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Mitsubishi Electric Corporation **Industrial** Robot

MELFA Technical News

BFP-A6079-0215E-*

January 2018

Subject: Precautions of replacement from RH-6SDH to RH-6FRH-D

Applicable to: RH-6SDH
RH-6FRH-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 **RH-6SDH** horizontal multiple-joint type robots with **RH-6FRH-D** robots.

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Precautions for the replacement of RH-6SDH with RH-6FRH.

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

The following shows the compatible models of robot arms and controllers for the replacement of RH-6SDH to RH-6FRH-D.

| Model | Controller | ⇒ | Model | Controller |
|---------|------------|---|-----------|------------|
| RH-6SDH | CR1DA-761 | | RH-6FRH-D | CR800-06HD |

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 | | | New models | | |
| Model | | RH-6SDH35xx/M/C | RH-6SDH45xx/M/C | RH-6SDH55xx/M/C | RH-6FRH35xx/M/C-D | RH-6FRH45xx/M/C-D | RH-6FRH55xx/M/C-D |
| Machine class | | None: Standard/M: Oil mist Note 4)C: Clean Note 5) | | | | | |
| Protection degree | | Standard: IP20/M: IP54/C: Class 10 (0.3µm) | | | Standard: IP20/M: IP65/C: ISO class 3 | | |
| Degree of freedom | | 4 | | | 4 | | |
| Installation style | | Floor type | | | | | |
| Structure | | Horizontal multiple-joint type | | | | | |
| Drive system | | AC servo motor | | | | | |
| Position detection method | | Absolute encoder | | | | | |
| Maximum load capacity (rating) | kg | 6 (2) | | | 6 (3) | | |
| Arm length | No. 1 arm | 125 | 225 | 325 | 125 | 225 | 325 |
| | No. 2 arm | 225 | | | | | |
| Maximum reach radius | mm | 350 | 450 | 550 | 350 | 450 | 550 |
| Operating range | J1 | 254 (±127) | | | 340 (±170) | | |
| | J2 | 274 (±137) | | | 290 (±145) | | |
| | J3 (Z) | xx = 20 : 200 / xx = 32 : 320 (standard) | | | xx=20 :200 / xx=34 :340 | | |
| | J4 (θ) | xx = 17 : 170 / xx = 27 : 270 (M specification/C specification) | | | | | |
| Maximum speed Note 6) | J1 | 375 | | | 400 | | |
| | J2 | 612 | | | 670 | | |
| | J3 (Z) | 1177 | | | 2400 | | |
| | J4 (θ) | 2411 | | | 2500 | | |
| Maximum composite speed Note 1) | mm/sec | 6473 | 7128 | 7782 | 6900 | 7600 | 8300 |
| Cycle time Note 2) | | 0.42 | | 0.43 | | 0.29 | |
| | X-Y composite | ±0.02 | | | ±0.010 | | |
| | J3 (Z) | | | | ±0.010 | | |
| Positioning repeatability | J3 (Z) | | | | ±0.01 | | |
| | J4 (θ) | ±0.02 | | | ±0.004 | | |
| | | | | | ±0.004 | | |
| Ambient temperature | °C | 0 to 40 | | | | | |
| Mass | kg | Approx. 20 | | Approx. 21 | | 36 | 37 |
| Tolerable amount of inertia (rating) | J4 (θ) kg, m2 | 0.04 (0.01) | | | 0.12 (0.01) | | |
| Tool wiring | | Hand: 8 input points/8 output points (forearm), 8 spare wires: AWG#24 (0.2mm ²) | | | Hand: 8 input points/8 output points (20 pins total) Serial signal cable for parallel I/O (2-pin + 2-pin power line) LAN × 1<100BASE-TX> (8-pin) Note 3) | | |
| Tool pneumatic piping | | Primary: φ6 × 2 Secondary: φ4 × 8 | | | | | |
| Machine cable | | 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) The value assumes composition of J1, J2, and J4.

Note 2) Value for a maximum load capacity of 2kg. 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 25mm and horizontal distance of 300mm.)

Note 3) Can also be used as a spare line (0.2sq 4-pair cable) for conventional models.

Note 4) Please contact a Mitsubishi Electric dealer since the environment resistance may not be secured depending on the characteristics of oil you use. Direct jet to the bellows is excluded.

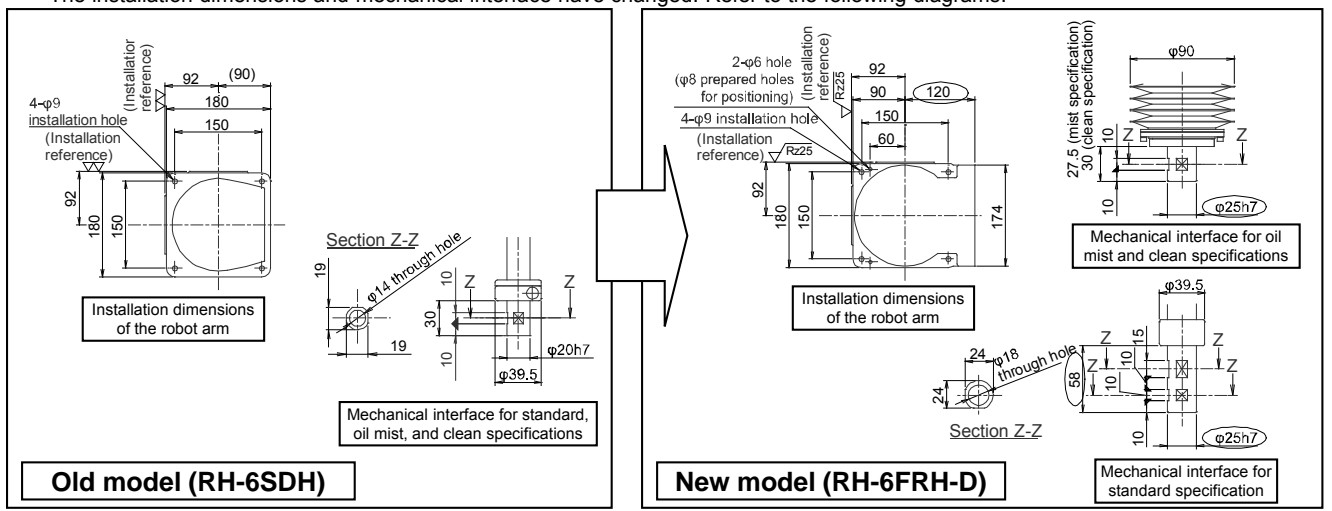
Note 5) Preservation of cleanliness levels depends on conditions of a downstream flow of 0.3m/s in the clean room and internal robot suctioning. A φ8-mm coupler for suctioning is provided at the back of the base.

Note 6) The value of when M/Tune2 (high-speed mode) is applied.

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

1) Robot arm installation dimensions and mechanical interface

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



2) Dimensions of the robot arm and diagram of the operating range

For the dimensions of the robot arm and diagram of the operating range, refer to the following.

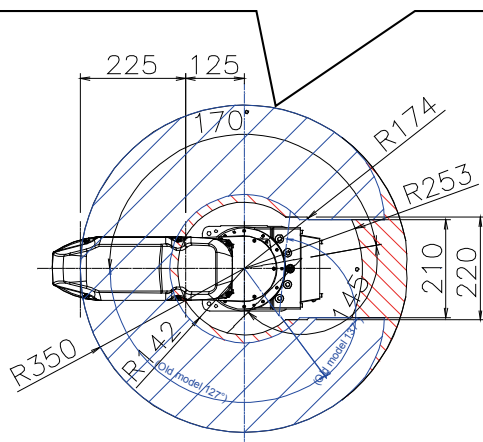
Operating range difference

RH-6FRH35xx-D:

(Shaded area with lines upward to the right + shaded area with lines downward to the right)

RH-6SDH35xx:

(Shaded area with lines upward to the right)



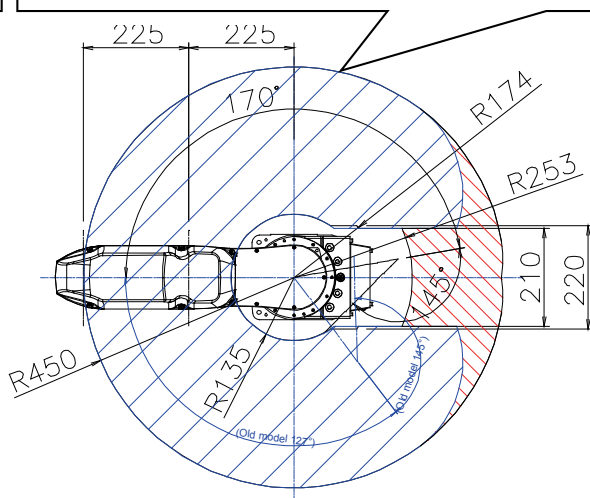
Operating range difference

RH-6FRH45xx-D:

(Shaded area with lines upward to the right + shaded area with lines downward to the right)

RH-6SDH45xx:

(Shaded area with lines upward to the right)



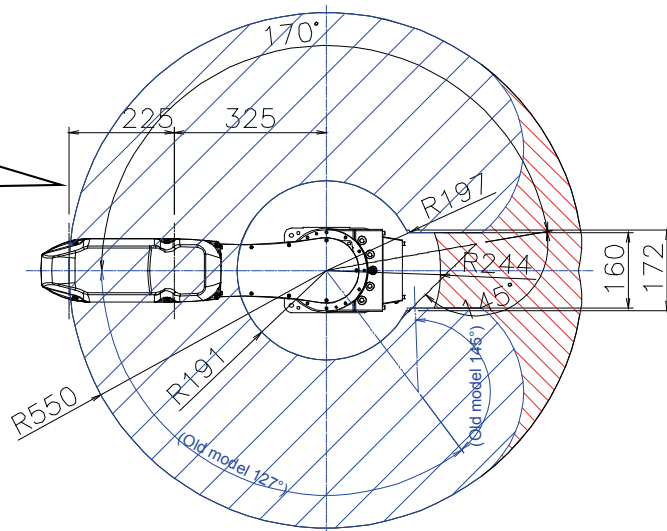
Operating range difference

RH-6FRH55xx-D:

(Shaded area with lines upward to the right + shaded area with lines downward to the right)

RH-6SDH55xx:

(Shaded area with lines upward to the right)



Overall height difference: 90mm

RH-6FRH5534: 938mm

RH-6SDH5532: 848mm

Overall height difference: 70mm

RH-6FRH5520: 798mm

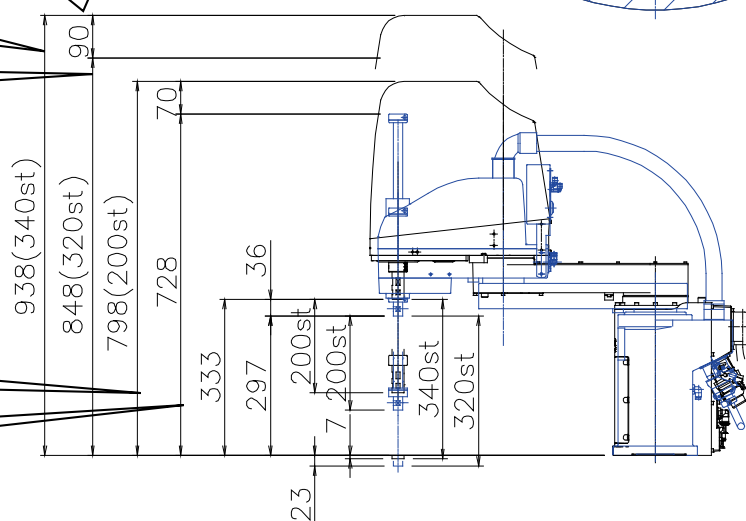
RH-6SDH5520: 728mm

RH-6FRH5534-D

RH-6SDH5532

RH-6FRH5520-D

RH-6SDH5520



Note that the height described above is for RH-6FRH55xx. The overall height of RH-6FRH35xx/6FRH45xx are the same as the above.

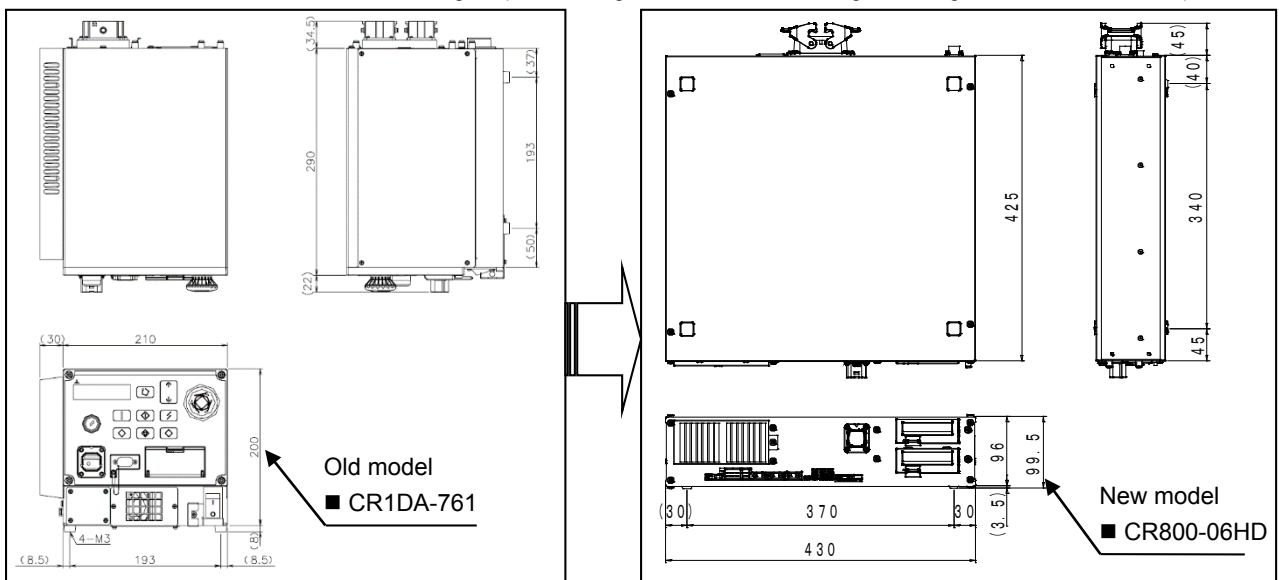
2.3 Specifications of the controller

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 model | New model | |
| | | RH-6SDH | RH-6FRH-D | |
| Controller model | | CR1DA-761 | CR800-06HD | |
| Routing control method | | PTP control, CP control | | |
| Number of control axis | | Simultaneously 4 | | |
| Programming language | | MELFA-BASIC V | MELFA-BASIC 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) | 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 8/output 8 (when using pneumatic hand interface: 8/8) | Input 8/output 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 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 10BASE-T/100BASE-TX | 1 (for T/B)/ 1 (for customer) 10BASE-T/100BASE-TX/1000BASE-T |
| USB | | port | 1 | 1 |
| Memory expansion slot | | SLOT | 1 | - |
| Expansion slot | | SLOT | 1 | 2 |
| Robot input/output link | | ch | 1 | 1 |
| Additional axis function | | ch | 1 (SSCNETIII) | 1 (SSCNETIII/H) |
| Encoder input | | ch | 2 | 2 |
| Input power supply | Voltage range | V | Single phase 180 to 253 VAC | Single phase 200 to 230 VAC |
| | Power capacity | kVA | 0.5 | 1 |
| 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] | | |
| Grounding | Ω | 100 or less (D class grounding) | | |

2.4 Outside dimensions of the controller

The controller's outside dimensions have changed. (Left drawing: RH-6SDH controller, right drawing: RH-6FRH-D controller)



2.5 Options

(1) Robot arm options comparison

| Item | Specifications | | Specifications and supplementary explanation | Compatibility |
|--|--|--|--|---------------|
| | Old model | New model | | |
| | RH-6SDH | RH-6FRH-D | | |
| Solenoid valve set | 1S-VD0□M-04 (Sink type) 1S-VD0□ME-04 (Source type) □: 1 to 4 | 1F-VD0□-01 (Sink type) 1F-VD0□E-01 (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-02 | 1F-GR60S-01 | The robot side has a connector, and the other side has output cables for unprocessed solenoid valve connection. | × |
| Hand input cable | 1S-HC35C-02 | 1F-HC35C-01 | The robot side has a connector, and the other side has input cables for unprocessed hand sensor connection. | × |
| Hand curl tube | 1E-ST0408C-300 | 1E-ST0408C-300 | φ4 × 8 pics, curl pneumatic tube for 4-set solenoid valve connection | ○ |
| Internal wiring/piping set for hand | - | 1F-HS408S-01 | 8 hand inputs, φ4 x 8 tip axis built-in wiring piping set (with fixed plate), for Z stroke of 200mm | - |
| | - | 1F-HS408S-02 | 8 hand inputs, φ4 x 8 tip axis built-in wiring piping set (with fixed plate), for Z stroke of 340mm | - |
| User external wiring/piping box | - | 1F-UT-BOX | Box for hand I/O wiring of 4-set solenoid valves and for external pullout of φ4 (8 pics) hand pipes | - |
| J1-axis operating range change | - | 1S-DH-01 | Stopper part for J1-axis operating range change | - |
| 2m machine cable (replacement type) | 1S-02UCBL-03 | - | Fixed type (Set of 2 cables for power supply and signals), 2m (Provided as substitute for standard 5m cables.) | - |
| Machine cable (replacement type) (fixed type) | - | 1F-□□UCBL-41 □□: 02, 10, 15, 20 | Fixed type: 2m, 10m, 15m, 20m | - |
| Machine cable (replacement type) (flexed type) | - | 1F-□□LUCBL-41 □□: 10, 15, 20 | Flexed type: 10m, 15m, 20m | - |
| Machine cable extension (Fixed type) | 1S-□□CBL-03 □□: 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-□□L CBL-03 □□: 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 | | CR1DA-761/CR800-D compatibility | Remarks |
|---------------------------------|--------------------------------------|--------------------------------------|---------------------------------|----------------------------|
| | Old models | New models | | |
| | CR1DA-761 | CR800-06HD | | |
| 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 |
| Additional axis interface | ☆ | ☆ | ☆ | |
| Ethernet interface | ☆ | ☆ | ☆ | |
| Tracking function | ☆ | ☆ | ☆ | |
| 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 | - | |
| 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 model | New model | | |
| | | RH-6SDH | RH-6FRH-D | | |
| Outside dimensions | Installation dimensions | Changed | | △1 | Only the base length (depth) is incompatible. |
| | Mechanical interface | Changed | | × | Incompatible (different shaft diameter) |
| | Operating range | Changed | | ○ | Compatible (expanded operating area) |
| Tooling | Hand wiring | Changed | | × | |
| | Hand piping | No change | | ○ | |
| | Backup wiring | Changed | | ○ | Built-in LAN cable, also available as backup wiring. |
| Maintenance | Backup battery | A6BAT | MR-BAT6V1 | × | |

○: Fully compatible, ×: Incompatible, △1: Only the base length (external depth dimension + 30mm) is incompatible.

3.2 Compatibility of the controller

| Category | Item | Specifications | | Compatibility | Remarks |
|-------------|-----------------------|----------------|----------------|---------------|---------|
| | | Old model | New model | | |
| | | CR1DA-761 | CR800-06HD | | |
| 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 | - | × | |

○: Fully compatible ×: Incompatible

Precautions of controller specifications

| Item | Specifications | |
|------------------------------|--|---|
| | Old models | FR series |
| | CR1DA-761 | CR800-06HD |
| 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 | Provided (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 model | FR series | |
| | CR1DA-761 | CR800-06HD | |
| 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 | |