MITSUBISHI ELECTRIC

Mitsubishi Electric Industrial Robot

MELFA

Robot Seminar Textbook <Robot Maintenance FR/F Series>

MELFA

BFP-A3616-A

MELFA Robot Seminar Curriculum <Robot Maintenance FR/F Series>

Item	Place	Time
Opening Greetings Orientation Industrial robot safety (video) (1) Configuration and connection of the devices (2) Maintenance and inspection of the robot arm Type and schedule of the inspection and maintenance Inspection items Robot arm structure Installing/removing the cover	Lecture room	60 min.
Break		15 min.
(2) Maintenance and inspection of the robot arm Inspection, replacement, and adjustment of the timing belt Lubrication	Lecture room, training room	90 min.
Lunch	Lecture room	(60 min.)
(2) Maintenance and inspection of the robot arm Replacing the backup battery Replacing the packing Overhaul and maintenance parts (3) Resetting the origin Origin data input method Jig method ABS origin method User origin method	Training room	100 min.
Break		20 min.
(4) Maintenance and inspection of the robot controller Type and schedule of the inspection and maintenance Inspection items Inspection, cleaning, and replacement of the filter Replacing the fuse Backup and restore End	Training room	90 min.

⚠ Safety Precautions

Always read the following precautions and the separate "Safety Manual" before starting use of the robot to learn the required measures to be taken.

⚠CAUTION All teaching work must be carried out by an operator who has received relevant training.
(This also applies to maintenance work with the power source turned ON.)
→Enforcement of safety training

⚠CAUTION For teaching work, prepare a work plan related to the methods and procedures of operating the robot, and to the measures to be taken when an error occurs or when restarting. Carry out work following this plan.
(This also applies to maintenance work with the power source turned ON.)
→Preparation of work plan

⚠WARNING Prepare a device that allows operation to be stopped immediately during teaching work.
(This also applies to maintenance work with the power source turned ON.)
→Setting of emergency stop switch

⚠CAUTION During teaching work, place a sign indicating that teaching work is in progress on the start switch, etc.
(This also applies to maintenance work with the power source turned ON.)
→Indication of teaching work in progress

⚠DANGER Provide a fence or enclosure during operation to prevent contact of the operator and robot.
→Installation of safety fence

⚠CAUTION Establish a set signaling method to the related operators for starting work, and follow this method.
→Signaling of operation start

⚠CAUTION As a principle, turn the power OFF during maintenance work. Place a sign indicating that maintenance work is in progress on the start switch, etc.
→Indication of maintenance work in progress

⚠CAUTION Before starting work, inspect the robot, emergency stop switch and other related devices, etc., and confirm that there are no errors.
→Inspection before starting work

The points of the precautions given in the separate "Safety Manual" are given below.
Refer to the actual "Safety Manual" for details.

⚠DANGER When automatic operation of the robot is performed using multiple control devices (GOT, programmable controller, push-button switch), the interlocking of operation rights of the devices, etc. must be designed by the customer.

⚠CAUTION Use the robot within the environment given in the specifications. Failure to do so could lead to faults or reduce reliability.
(Temperature, humidity, atmosphere, noise environment, etc.)

⚠CAUTION Transport the robot with the designated transportation posture. Transporting the robot in a non-designated posture could lead to personal injuries or faults from the robot falling over.

⚠CAUTION Always use the robot installed on a secure table. Use of an instable posture could lead to positional deviation and vibration.

⚠CAUTION Route the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.

⚠CAUTION Do not apply excessive force on the connector or excessively bend the cable. Failure to observe this could lead to contact defects or wire breakage.

⚠CAUTION Make sure that the workpiece weight, including the hand, does not exceed the rated load or tolerable torque. Exceeding these values could lead to alarms or faults.

⚠WARNING Ensure that the hand and tool are installed properly and that the workpiece is securely held in place. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

⚠WARNING Ensure the robot and controller are grounded (earthed) properly. Failure to observe this could lead to malfunctions caused by noise or to electric shock.

⚠CAUTION Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.

⚠WARNING When carrying out teaching work in the robot's movement range, always ensure the instructor has priority over control of the robot. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

⚠CAUTION Keep the jog speed as low as possible, and always watch the robot. Failure to do so could lead to interference with the workpiece or peripheral devices.

⚠CAUTION After editing the program, always confirm the operation with step operation before starting automatic operation. Failure to do so could lead to interference with peripheral devices because of programming mistakes, etc.

⚠CAUTION Make sure that if the safety fence entrance door is opened during automatic operation, the door is locked or that the robot will automatically stop. Failure to do so could lead to personal injuries.

⚠CAUTION Never carry out modifications based on personal judgments, non-designated maintenance parts. Failure to observe this could lead to faults or failures.

⚠WARNING When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers getting caught in the robot depending on its posture.

⚠CAUTION Do not stop the robot or carry out an emergency stop by turning the robot controller's main power OFF. If the robot controller main power is turned OFF during automatic operation, the robot accuracy could be adversely affected. Also a falling or coasting robot arm could collide with peripheral devices.

⚠CAUTION Do not turn OFF the robot controller's main power while rewriting the robot controller's internal information, such as programs and parameters. Turning OFF the robot controller's main power during automatic operation or program/parameter writing could erase internal information from the robot controller.

⚠DANGER Do not connect the Handy GOT when using the GOT direct connection function of this product. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether operation rights are enabled or not.

⚠DANGER Do not connect the Handy GOT to a programmable controller when using an iQ Platform compatible product with the CR800-R controller. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether operation rights are enabled or not.

⚠DANGER Do not remove the SSCNET III cable while power is supplied to the multiple CPU system or the servo amplifier. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables of the Motion CPU or the servo amplifier. Looking directly at this light may irritate the eyes.
(Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)

⚠DANGER Do not remove the SSCNET III cable while power is supplied to the controller.
Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables. Looking directly at this light may irritate the eyes.
(Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)

⚠DANGER Attach the cap to the SSCNET III connector after disconnecting the SSCNET III cable.
If the cap is not attached, dirt or dust may adhere to the connector pins, resulting in deterioration or malfunction of the connector.

⚠CAUTION Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in errors, such as the emergency stop not being released. In order to prevent errors occurring, please be sure to check that all functions (such as the teaching box emergency stop, customer emergency stop, and door switch) are working properly after the wiring setup is completed.

⚠CAUTION Commercially available devices (computers, LAN hubs, etc.) which connect to the controller's USB ports may not be suitable for FA environments due to incompatibility with our products, or temperature and noise tolerances.
When using commercially available devices, taking precautions against EMI (Electro Magnetic Interference) such as the addition of a ferrite core may be required. Please confirm with the customer that everything works correctly. Mitsubishi Electric cannot guarantee compatibility or carry out the maintenance of commercially available devices.

⚠CAUTION To maintain the safety of the robot system against unauthorized access from external devices via the network, take appropriate measures.
To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.

■Revision history

Date	Manual number	Revisions
2018-08-31	BFP-A3616	・First edition
2018-10-11	BFP-A3616-A	･5.2 Jig method 5.2.1 RV-FR, RV-F series (2) J2 axis origin setting 6.table RV-2FR series position was modified. (3) J3 axis origin setting 6.table Robot models were modified. ･4.6.3 Timing belt tension RV-4Frseries J6 Tension for new belt installation was modified. .2 Jig method 5.2.1 RV-FR, RV-F series ･Appendix 5.2 List of maintenance jigs (image) Installation pin φ8 was deleted. ･Appendix 5.4 List of maintenance jigs Installation pin φ8 was deleted.

■ Introduction 1
1. Importance of Production Maintenance 3
1.1 Importance of Maintenance 3
1.2 Maintenance System 4
1.3 Maintenance Plan 5
1.4 Management of Maintenance Documents 6
1.5 Maintenance Record 6
1.6 Types of Malfunction 7
2. Related Laws 8
A. Laws and Standards for Ensuring Safety 8
■Industrial Safety and Health Act 8
■Ordinance on Industrial Safety and Health 8
B. Special Safety and Health Training Curriculum (Ministry of Health, Labor and Welfare Ministerial Notification No. 49) 9
C. Matters excluded from industrial robots 9
D. Matters to be noted during inspection 10
■Ordinance on Industrial Safety and Health 10
3 Connecting Devices (FR Series) 11
3.1 Device configuration 11
(1) Standalone type 11
(2) iQ Platform compatible type 11
3.2 Connection with the controller 12
3.2.1 CR800 controller (FR series R type) 12
(1) Connection between the robot CPU system and the controller (FR series R type) 12
(2) Connecting the machine cables 13
(3) Connection of controller and machine cable 16
(4) Removing the machine cable 16
3.3 Controller names and functions of each part 17
3.3.1 CR800 controller 17
3.4 Installing and removing the teaching pendant (T/B) 19
3.4.1 CR800 controller 19
4 Maintenance and Inspection (Robot) 21
4.1 Type of inspection and maintenance works 21
4.2 Inspection items 22
4.2.1 Daily inspection items 22
4.2.2 Periodic inspection 23
(1) Inspection item 23
(2) Schedule 24
4.3 Maintenance and inspection procedures 25
4.4 Robot arm structure 26
(1) RV-2FR, RV-2F series 26
(2) RV-4/7FR, RV-4/7F series 27
(3) RV-13/20FR, RV-13/20F series 28
(4) RH-3FRH, RH-3FH series 29
(5) RH-6/12/20FRH, RH-6/12/20FH series 30
(6) RH-3FRHR, RH-3FR series (Hanging type) 31
4.5 Installing/removing the cover 33
(1) RV-2FR, RV-2F series 33
(2) RV-4/7FR, RV-4/7F series 35
(3) RV-13/20FR, RV-13/20F series 37
(4) RH-FRH, RH-FH series 39
(5) RH-3FRHR, RH-3FHR series (Celling type) 41
4.6 Inspection replacement of timing belt 43
4.6.1 Timing belt replacement period 44
4.6.2 Timing belt tension measurement 45
4.6.3 Timing belt tension 46
4.6.4 Amount of movement of each axis during the timing belt tension measurement 49
4.6.5 Inspection replacement of timing belt 51

(1) RV-2FR, RV-2F series 51
(2) RV-4/7FR, RV-4/7F series 75
(3) RV-13/20FR, RV-13/20F series 91
(4) RH-3FRH, RH-3FH series 99
(5) RH-6/12/20FRH, RH-6/12/20FH series 103
(6) RH-3FRHR, RH-3FHR series (Celling type) 107
4.7 Lubrication 112
(1) RV-2FR, RV-2F series 113
(2) RV-4/7FR, RV-4/7F series 115
(3) RV-13/20FR, RV-13/20F series 119
(4) RH-FRH, RH-FH series 121
(5) RH-3FRHR, RH-3FHR series (Celling type) 125
4.8 Replacing the backup battery (FR series) 127
(1) RV-2FR series 128
(2) RV-4/7/13/20FR series 129
(3) RH-FRH series 130
(4) RH-3FRHR series (Hanging type) 131
4.9 Packing replacement (RH-FRH and RH-FH series, Celling type) 132
4.10 Overhaul 136
4.11 Maintenance parts (FR series) 137
(1) RV-FR series 137
(2) RH-FRH series 141
(3) RH-3FRHR series (Celling type) 144
5 Resetting the Origin 145
5.1 Setting the origin with the origin data input method 146
(1) Confirming the origin data 146
(2) Selecting the origin setting method 147
(3) Inputting the origin data 148
(4) Installing the cover 149
5.2 Jig method 150
5.2.1 RV-FR, RV-F series 150
(1) J1 axis origin setting 150
(2) J2 axis origin setting 153
(3) J3 axis origin setting 156
(4) J4 axis origin setting (6-axis type robot only) 159
(5) J5 axis and J6 axis origin setting 162
5.2.2 RH-FRH, RH-FH series 166
(1) J1 axis origin setting 166
(2) J2 axis origin setting 168
(3) J3 and J4 axis origin setting 170
5.3 ABS origin method 173
(1) RV-2FR, RV-2F series 173
(2) RV-4/7FR, RV-4/7F series 174
(3) RV-13/20FR, RV-13/20F series 175
(4) RH-3/6/12/20FRH, RH-3/6/12/20FH series 176
(5) RH-3FRHR, RH-3FHR series (Celling type) 177
(6) Origin setting procedure 178
5.4 User origin method 179
5.5 Recording the origin data 180
6 Maintenance and Inspection (CR800 Controller) 181
6.1 Maintenance and inspection intervals 181
6.2 Inspection items 182
6.2.1 Daily inspection items 182
6.2.2 Periodic inspections 182
6.3 Maintenance and inspection procedures 183
6.3.1 Inspection, cleaning, and replacement of the filter 183
6.3.2 Fuse replacement 184

(1) Brake fuse 184
(2) Hand fuse 185
(3) CPU board (DQ171n) fuse 185
(4) Converter fuse 186
6.4 Backing up/restoring the controller data 187
6.4.1 Backup (robot → personal computer) 187
(1) For RT ToolBox3 187
(2) For RT ToolBox2 187
6.4.2 Restore (personal computer → robot) 188
(1) For RT ToolBox3 188
(2) For RT ToolBox2 188
6.5 Maintenance parts 189
(1) Consumable controller parts 189
(2) Spare controller parts 189
Appendix1 Device Connection (F Series) 191
Appendix1.1 Device configuration 191
(1) Standalone type 191
(2) iQ Platform compatible type 191
Appendix 1.2 Connection with the controller 192
Appendix 1.2.1 CR750/CR751 controller, drive unit 192
(1) Connection of robot CPU unit and drive unit (F series and Q type) 192
(2) Connection with the device connection cable 195
Appendix 1.3 Controller Names and functions 200
1.3.1 CR750/CR751 controller 200
(1) CR750 controller 200
(2) CR751 controller 203
1.3.2 CR750/CR751 drive unit 204
(1) CR750 drive unit 204
(2) CR751 controller 207
Appendix 1.4 Installing and removing the teaching box 208
Appendix 1.4.1 CR750/CR751 controller, drive unit 208
(1) CR750 controller, drive unit 208
(2) CR751 controller, drive unit 209
Appendix 2 Maintenance and Inspection (F Series Robot) 211
Appendix 2.1 Backup battery replacement 211
(1) RV-2F series 212
(2) RV-4/7/13/20F series 213
(3) RH-FH series 214
(4) RH-3FHR series (Celling type) 215
Appendix 2.2 Maintenance parts (F series) 216
(1) RV-F series 216
(2) RH-FH series 220
(3) RH-3FHR series (Celling type) 223
Appendix 3 Maintenance and Inspection (CR750/CR751 Controller, Drive Unit) 225
Appendix 3.1 Inspection schedule 225
Appendix 3.2 Inspection items 226
Appendix 3.2.1 Daily inspection items 226
Appendix 3.2.2 Periodic inspection 226
Appendix 3.3 Maintenance and inspection procedures 227
Appendix 3.3.1 Replacing the battery 227
(1) CR750 controller 228
(2) CR751 controller 229
(3) Robot CPU unit (F series Q type) 230
Appendix 3.3.2 Inspection, cleaning, and replacement of the filter 231
(1) CR750 controller 231
(2) CR751 controller 232
(3) CR750 drive unit 233

(4) CR751 drive unit....234
Appendix 3.3.3 Fuse replacement....235
(1) Hand fuse, brake fuse, power supply line fuse....235
(2) Fuse (F8)....237
(1) Backup (robot → personal computer)....239
(2) Restore (personal computer → robot)....240
Appendix 3.4 Maintenance parts....241
(1) CR750/CR751 controller....241
(a) Consumable controller parts....241
(b) Spare controller parts....241
(2) CR750/CR751 drive unit....242
(a) Consumable drive unit parts....242
(b) Spare drive unit parts....242
Appendix 4 Replacing the Bellows....243
(1) RH-FRH, RH-F series....243
(2) RH-3FRHR, RH-3FHR series (Celling type)....245
Appendix 5 Maintenance Tool....247
Appendix 5.1 List of maintenance tool (image)....247
Appendix 5.2 List of maintenance jigs (image)....250
Appendix 5.3 List of maintenance tools....251
Appendix 5.4 List of maintenance jigs....252
Appendix 6 Troubleshooting....253
Appendix 6.1 List of error codes....253
Appendix 6.2 Troubles and measures....333

■ Introduction

The FR Series and F Series robots are available in the following two types:

- **First edition iQ Platform compatible type**
- **First edition Standalone type**

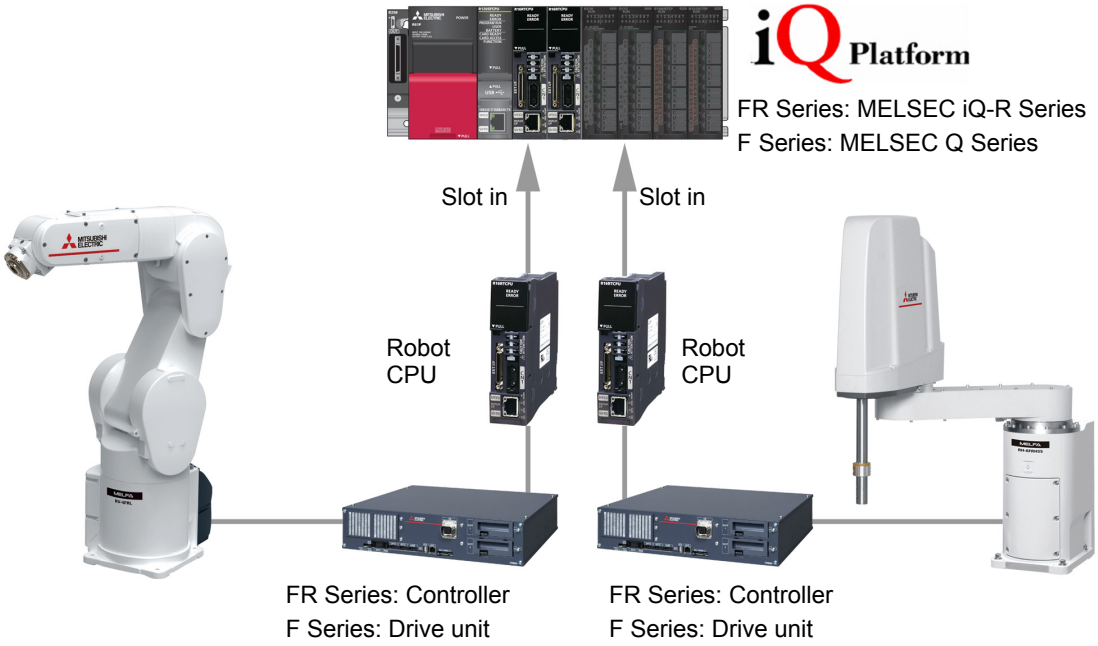
This textbook explains the FR Series and F Series with iQ Platform compatible type and stand alone type.

In the following pages, refer to the following symbols, and read the page for the robot you are using.

Symbol	FR Series		F Series	
	iQ Platform compatible (R type)	Standalone (D type)	iQ Platform compatible (Q type)	Standalone (D type)
COMMON	○	○	○	○
FR series	○	○		
F series			○	○

iQ Platform compatible type (FR Series R type/F Series Q type)

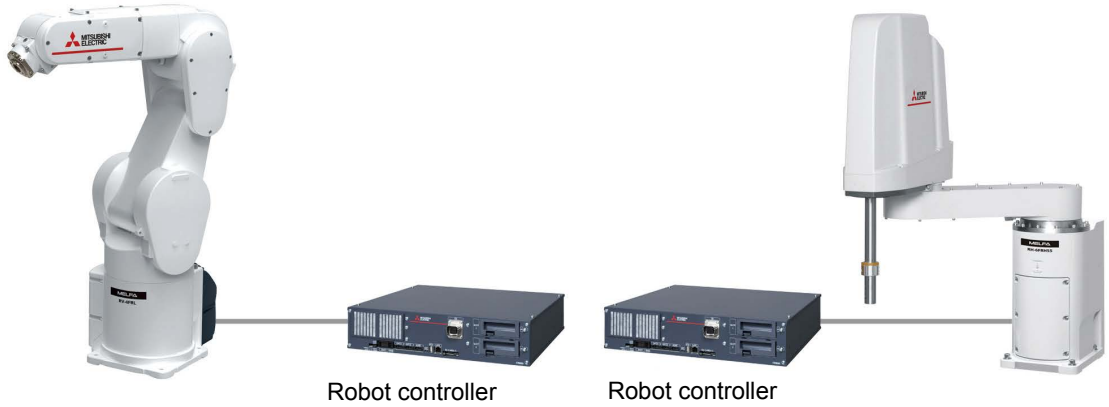
This controller is compatible with "iQ Platform" that integrates each type of controller andHMI, engineering environment, and network seamlessly. With the multi-CPU configuration, compatibility with FA devices is enhanced, and elaborate control and information management can be performed quickly and easily.



Standalone type (FR Series D type/F Series D type)

Cells can be built by using the robot controller as the main controller.

This type of robot is equipped with various types of interface as standard, and enables users to build the best system for their application.

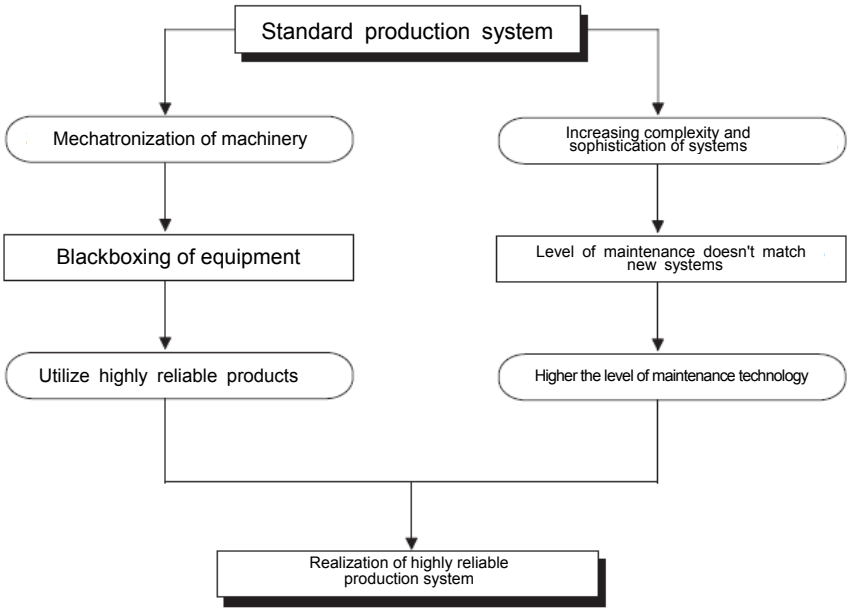


1. Importance of Production Maintenance

If the production system stops due to a malfunction or power failure, a loss proportional to the stop time occurs. Therefore, it is necessary to design the equipment system so as to prevent the production system stopping due to malfunction or power failure.
Even if the production system stops, the important issue is how quickly the system will be restored.
Therefore, organization with maintenance staff is established in each factory to improve the operation rate of the production system.

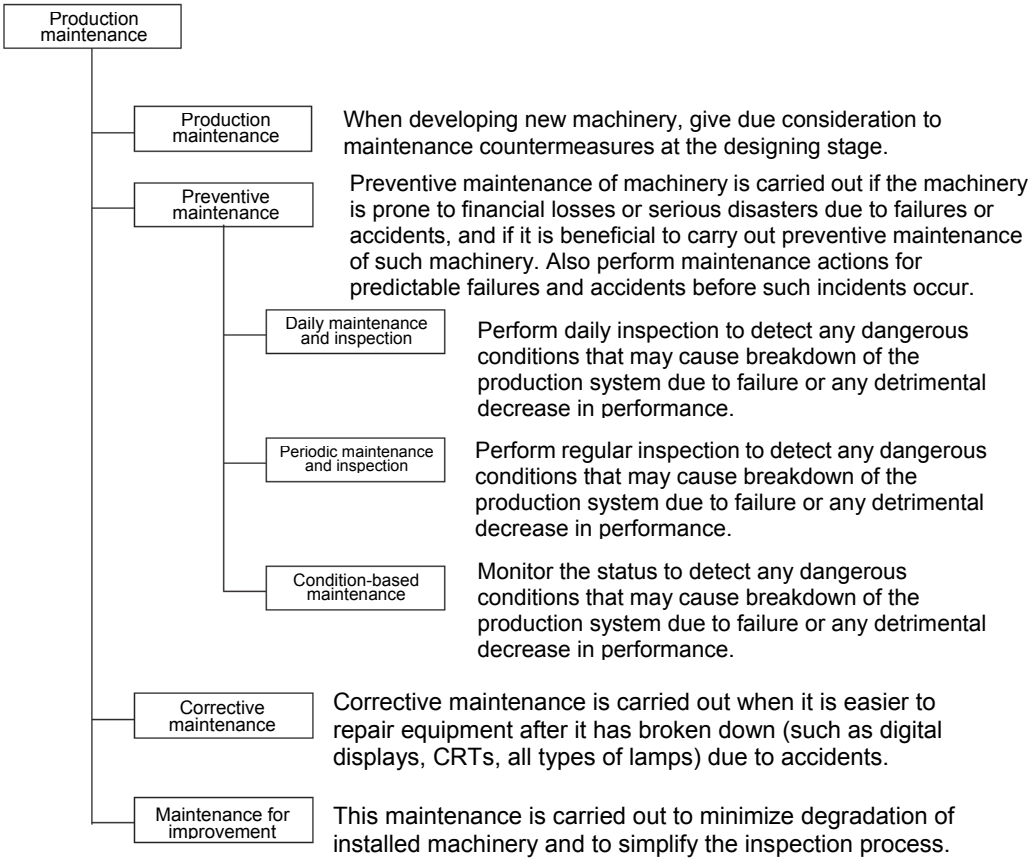
1.1 Importance of Maintenance

The mechatronization of machinery and increasing complexity and sophistication of systems is facilitating the blackboxing of equipment. As such, the current level of maintenance does not match the level needed for new systems, and it is becoming increasingly difficult to improve the productions rates of the latest production systems.
Therefore, highly reliable products and a high level of maintenance technology is urgently required.



1.2 Maintenance System

In order to achieve a highly reliable production system, it is important to have an established maintenance system in place. The following shows an outline of a maintenance system.



1.3 Maintenance Plan

In production systems, the recovery time can be long, and improvements in system availability cannot be expected if repairs are considered only after a malfunction occurs. Therefore, a maintenance plan is developed from when a production system is implemented, and efficient maintenance is conducted.
In order to quickly restore the system after a malfunction occurs, it is necessary to systematically execute the contents of the following table.

Table 1.1 Daily and periodic inspection

Plan item	Description	
Maintenance training	Information about industrial robots	・Fundamental knowledge of principle, function, performance, etc., of industrial robots ・Characteristics of industrial robots ・Location of industrial robot ・Introductory status of industrial robots (Usages in own department, etc.) ・Description of installed (introduced) machine type (type, function, performance, characteristics, etc., of industrial robots used)
	Maintenance scope & maintenance technology	・Knowledge about maintenance of industrial robots (Characteristics of industrial robots from maintenance perspective, maintenance items of industrial robots) ・Precautions for maintenance of industrial robots (Handling method, key points of maintenance, etc.)
	Training	・Functions related to maintenance of industrial robots ・Functions related to maintenance of peripheral equipment (Troubleshooting function, etc.) ・Practical training for troubleshooting (Operation of peripheral equipment, replacement of hardware)
Maintenance time	Specify the target type, etc., of preventive maintenance and corrective maintenance, and determine the implementation timing.	
Maintenance equipment	Spare parts, components, measuring instruments, measurement equipment, etc., for maintenance	
Maintenance procedure	Prepare the manuals, etc., and clearly define the implementation method and a description.	
Maintenance staff	Determine staff procurement, positions, assigned areas, etc.	
Maintenance method improvement	Study to improve maintenance methods, etc.	
Understanding industrial robot manufacturer service and support system	After service	・Service base (location, address, person in charge, etc.) ・Service area (target, handling area, etc.) ・Service time (Start/end time, turnaround time, emergencies, etc.) ・Service period (free service period, handling at the time of paid service, etc.) ・Spare parts supply period (repair after discontinuing production, supply period, etc.) ・Measures against discontinued production (contents of discontinuance declaration, repair period, etc.) ・Time required for repair (standard delivery, shortest/longest deliveries)
	Technical support	・Support base (location, address, person in charge, etc.) ・Support area (Target equipment type, hardware/software, system) ・Support method (telephone, FAX, visit, school, actual machine operation) ・Manual (manual effective for maintenance)

1.4 Management of Maintenance Documents

In order to quickly restore after a malfunction occurs, it is necessary to organize and manage the documents described in the following table.

Table 1.2 Maintenance-related documents to manage

Item	Document name	Description
System-specific documents	System and control specifications documents	Documents describing the functions and operations of a target system and control (Sequence and timing of operation, operation condition, and operation procedure)
	Electrical wiring diagrams	Schematic diagrams (Power supply circuit, motor circuit, control circuit, operating circuit, display circuit, etc.) Connection diagrams between equipment and panel (cable layout diagram, grounding wire layout diagram)
	Equipment layout diagrams	Layout diagrams for electrical equipment in the panel, terminal block line number layout drawings, connection assignment tables for connector pins (For identifying models and line numbers for each equipment)
	Lists of hardware used	Lists of electrical equipment used in the system (Model names and specifications of all the electrical equipment including the modules constituting the industrial robot, peripheral equipment, electrical components in the cabinet, I/O equipments, software packages, etc.)
	Controlled system installation guides/maintenance and inspection instructions	For handling (operation), maintenance, and inspection of controlled systems
General documents	Catalogs of hardware used	Identifies configuration and manufacturer of equipment models
	Instruction manuals of hardware used	For troubleshooting hardware and software

1.5 Maintenance Record

After recovery following a malfunction, it is necessary to manage the maintenance record as follows for future reference.

Table 1.3 Maintenance record to manage

Item	Description
Occurrence status of failure, malfunction	Name of device/equipment, phenomenon, environment
System stop time	Time of occurrence, stop time
Impact due to occurrence	Amount of loss, loss time, other impacts
Cause	Method of cause investigation, cause including presumption
Recovery method	Recovery methods such as replacement, repairs
Measures against re-occurrence	Prevention methods against re-occurrence of similar malfunctions, and lessons learned
Failure record	Record of source of failure, countermeasures, etc.
Name of person in charge	

1.6 Types of Malfunction

In general, the malfunction modes in a complicated system can be classified in three levels of initial malfunctions, random malfunctions, and wear-out malfunctions, as shown in Figure 1.1. An initial malfunction is considered a malfunction that is removed during the manufacturing process or through inspection by the manufacturer. A random malfunction is an unexpected malfunction that cannot be anticipated and can occur anytime before the wear-out progresses during the life of the equipment. It is difficult to take technical measures against random malfunctions, and at this point, only measures based on statistical handling can be implemented.
A wear-out malfunction occurs near the end of the usable life as a result of deterioration or abrasion, and increase rapidly over time. The number of years before replacement is indicated by point tb in Figure 1.1, at which point preventive maintenance is achieved by replacing specific parts with new parts.

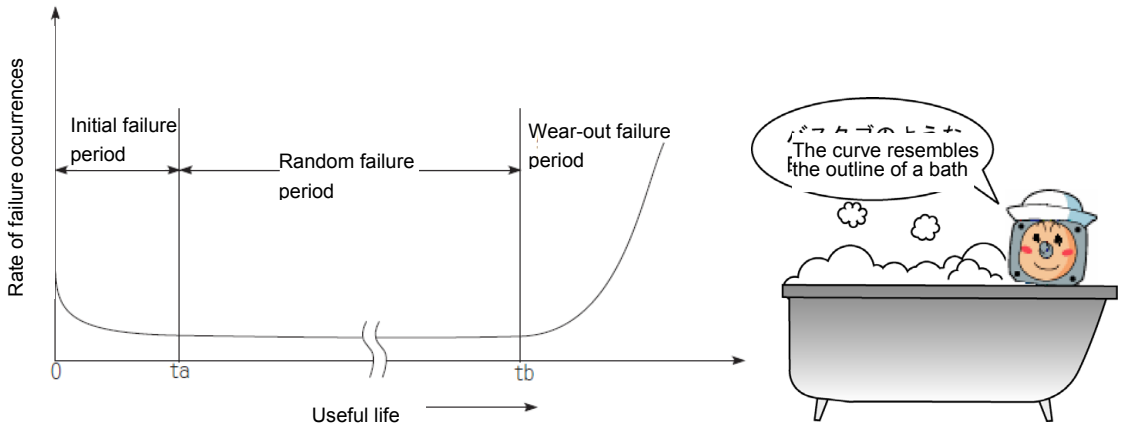


Figure 1.1 Bath tub curve

2. Related Laws

Work using a robot is designated as " Hazardous work ".

A. Laws and Standards for Ensuring Safety

1 Manufacturer side: (Ministry of Economy, Trade and Industry) JIS "B8433" Manipulating Industrial Robots - Safety

2 User side: (Ministry of Health, Labor and Welfare) Industrial Safety and Health Act, Ordinance on Industrial Safety and Health

■Industrial Safety and Health Act

Chapter VI Measures in Placing Workers
(Safety and Health Education)

Article 59 The employer shall, when a new worker is employed, give the said worker education for safety and/or health concerning work operations in which the worker is to be engaged, as provided for by the Ordinance of the Ministry of Health, Labour and Welfare.

(2) The provisions of the preceding paragraph shall apply mutatis mutandis when the contents of the operations have been changed.

(3) The employer shall, when a worker is to be placed in the dangerous or harmful operations provided for by the Ordinance of the Ministry of Health, Labour and Welfare, give the worker the special education for safety and/or health concerning the said operations, as provided for by the Ordinance of the Ministry of Health, Labour and Welfare.

■Ordinance on Industrial Safety and Health

Part 1 General Rules
Chapter IV Safety and Health Education
(Work Necessitating Special Education)

Article 36 Dangerous or harmful work prescribed by the Ordinance of the Ministry of Health, Labour and Welfare set forth in paragraph (3) of Article 59 of the Act shall be as follows:

(xxxi) Work pertaining to instruction, etc. (meaning setting, altering or confirming the motion sequence, position or velocity of a manipulator for an industrial robot (a machine which is composed of manipulators and memory devices (including variable sequence control units and fixed sequence control units, the same shall apply in this item.) and capable automatically to perform the motions of manipulators such as telescopic, bending/stretching, raising/lowering, right/left, revolving motions, and their combines motions based on the information in the memory device, excluding the one research and development or others provided by the Minister of Health, Labour and Welfare), excluding those carried out while the power source of the said industrial robot is cut off, the same shall apply in this item.) for the said industrial robot within its movable range (meaning the maximum movable range in which manipulators and other moving parts of the said industrial robot are capable of moving based on the information in the memory device, hereinafter the same shall apply.) and pertaining to the operation of the apparatus for the said instruction, etc. carried out by a co-worker at outside of the movable range in cooperation with the worker who carries out the instruction, etc., within the movable range;

(xxxii) Work relating to inspection, repair or adjust (excluding those corresponding to instruction, etc.), or the confirmation of the result of these actions (hereinafter referred to as "inspection, etc." in this item) (limited to those carried out while the said industrial robot is in operation, the same shall apply in this item.), or relating to the operation of apparatus pertaining to the said inspection, etc. carried out by a co-worker at outside of the movable range in cooperation with the worker who carries out the instruction, etc. within the movable range;

B. Special Safety and Health Training Curriculum (Ministry of Health, Labor and Welfare Ministerial Notification No. 49)

The following two articles have been added to Article 17.

Special training related to the teaching of industrial robots, etc.

Article 18

(1) Special training related to operations listed in the Safety and Health Provisions Article 36-31 shall be carried out with classroom training and practical training.

(2) The above mentioned classroom training shall follow the courses listed below. The scope listed below shall be covered for the specified time.

(3) For the practical training in Section 1, the following courses shall be conducted for the specified time or longer.

Course	Scope	Time
Basics of Industrial Robots	Types of industrial robots, and functions and handling methods of each part	2 hours
Basics of Industrial Robot Operations such as Teaching	Operation methods, such as teaching, risks of operations such as teaching, coupling with related machines, etc.	4 hours
Related Laws	Laws, ordinances and related articles in Safety and Health Provisions	1 hour

1. How to operate an industrial robot 1 hour
2. How to teach an industrial robot, etc. 2 hours

Special training related to inspection of industrial robots, etc.

Article 19

(1) Special training related to the operations listed in Safety and Health Provisions Article 36-32 shall be carried out with classroom training and practical training.

(2) The above mentioned classroom training shall follow the courses listed below. The scope listed below shall be covered for the specified time.

(3) For the practical training in Section 1, the following courses shall be conducted for the specified time or longer.

Course	Scope	Time
Basics of Industrial Robots	Types of industrial robots, control methods, drive methods, structure, function and handling of each part, types and characteristics of control parts	4 hours
Basics of Industrial Robot Inspections, etc.	Inspection, etc., methods, risks in inspection work, etc., coupling with related machines, etc.	4 hours
Related Laws	Laws, ordinances and related articles in Safety and Health Provisions	1 hour

1. How to operate an industrial robot 1 hour
2. How to inspect an industrial robot, etc. 3 hours

C. Matters excluded from industrial robots

1. Machine having a drive motor with a rated output of 80 watts or less (if machine has two or more drive motor, the motor with the larger rated output)
2. Machine that repeats a simple operation of manipulator extension, vertical movement, left/right movement or turning based on information from a fixed sequence control unit.
3. In addition to the machine listed in item 2 above, machine approved by the manager of the Ministry of Health, Labor and Welfare's Labor Standards Bureau as a machine having a structure and performance that will not pose a risk to the operator even if the said machine is touched.

D. Matters to be noted during inspection

■Ordinance on Industrial Safety and Health

Section 9 Industrial Robot

(Inspection, etc.)

Article 150-5 The employer shall, when carrying out the work inspecting, repairing, adjusting (excluding those for teaching, etc.), cleaning or lubrication, or confirmation of these results for an industrial robot within its movement range, take measures of stopping the operation of the industrial robot, locking the start switch while carrying out the said work, posting a sign on a start switch of the said industrial robot to indicate the work is in progress in order to prevent the persons other than the worker who engages in the operation from operating the said start switch. However, this shall not apply to the case where the work has to be carried out during operation of the industrial robot, and when taking the following measures for preventing dangers due to an unexpected activation or an operational error of the industrial robot.

1 To establish rules as to the following matters and to have workers carry out work by the said rules:

(a) Method and procedure for the operation of the industrial robot.

(b) Method for exchanging signals among the workers where the work has to be carried out by more than one worker.

(c) Measures in an emergency.

(d) Measures for resuming the operation of the robot after the emergency stop.

(e) Other measures necessary for preventing dangers occurring due to unexpected activation or erroneous operation of the robot

2 To take measures for enabling workers who engage in the work or a person who oversees the said workers to immediately stop the operation of the industrial robot in an emergency.

3 To take measures for preventing a person other than the workers who engage in work from touching the selector switch for changing the operating conditions of the robot during work such as posting a sign to indicate that the work are currently in progress to the said selector switch, etc.

3 Connecting Devices (FR Series)

3.1 Device configuration

(1) Standalone type

Robot arm

Device connection cable

・ For CR800 controller

Controller

・ CR800-D

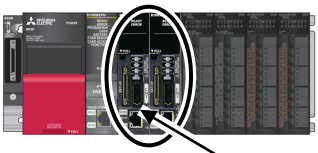
(2) iQ Platform compatible type

Robot arm

Device connection cable

・ For CR800 controller

PLC unit (MELSEC iQ-R Series)



Controller

Cable

Robot CPU unit Note1)

R16RTCPU

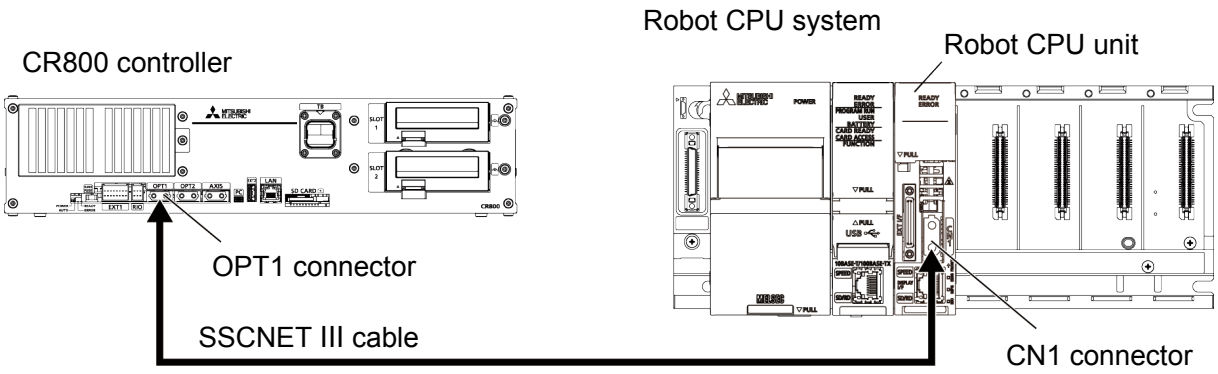
・ CR800 controller

Note1) The same type of robot CPU module is used for both robot arm types.
The CPU is mounted on the PLC unit (base board, power module, PLC CPU required) prepared by the user.

3.2 Connection with the controller

3.2.1 CR800 controller (FR series R type)

(1) Connection between the robot CPU system and the controller (FR series R type)



■CPU unit connection cable types

Only one type of connection cable is available (robot dedicated).

Connects the robot CPU unit and robot controller.

(1) SSCNET III cable…For servo amplifier control

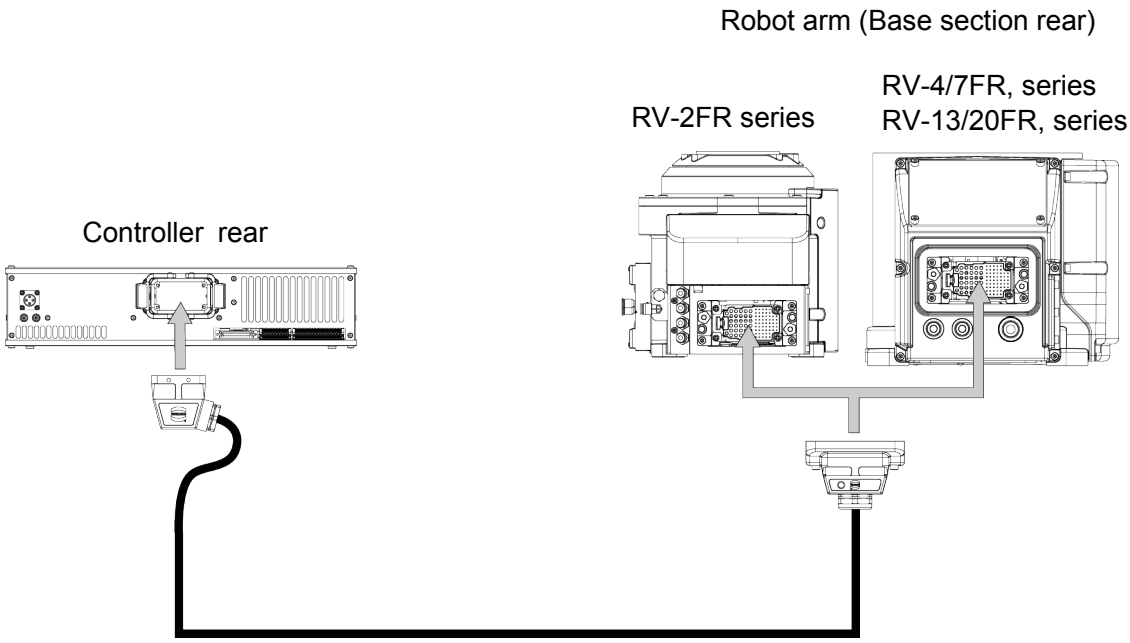
⚠CAUTION

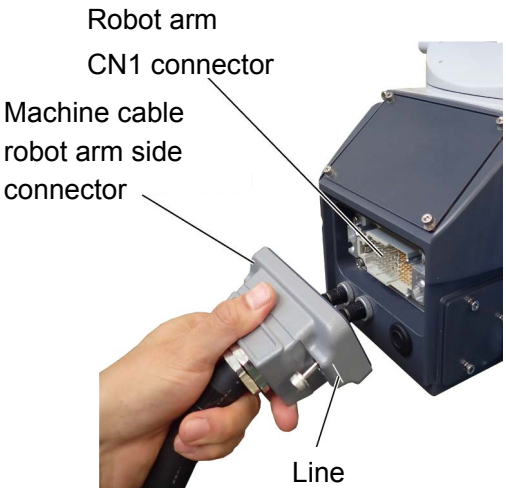
1) If the cap is not installed in the SSCNET III connector after removing the SSCNET III cable, there is a possibility that the characteristic may deteriorate and malfunction by adhesion of garbage and the dust
2) Don't remove the SSCNET III cable, when the power supply of the robot CPU system or servo amplifier is turned on. Don't face squarely the light emitted from motion CPU or the tip of the SSCNET III connector of servo amplifier, and the SSCNET III cable. If light hits to the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNET III is equivalent to the class 1 specified to JISC6802 and IEC60825-1.)
3) Install the SSCNET III cable in the larger radius than minimum flexed radius shown in the following sure.

Type	Minimum flexed radius [mm]
MR-J3BUS10M-A	Reinforcement skin section: 50 Code section: 25

(2) Connecting the machine cables

(a) RV-FR series





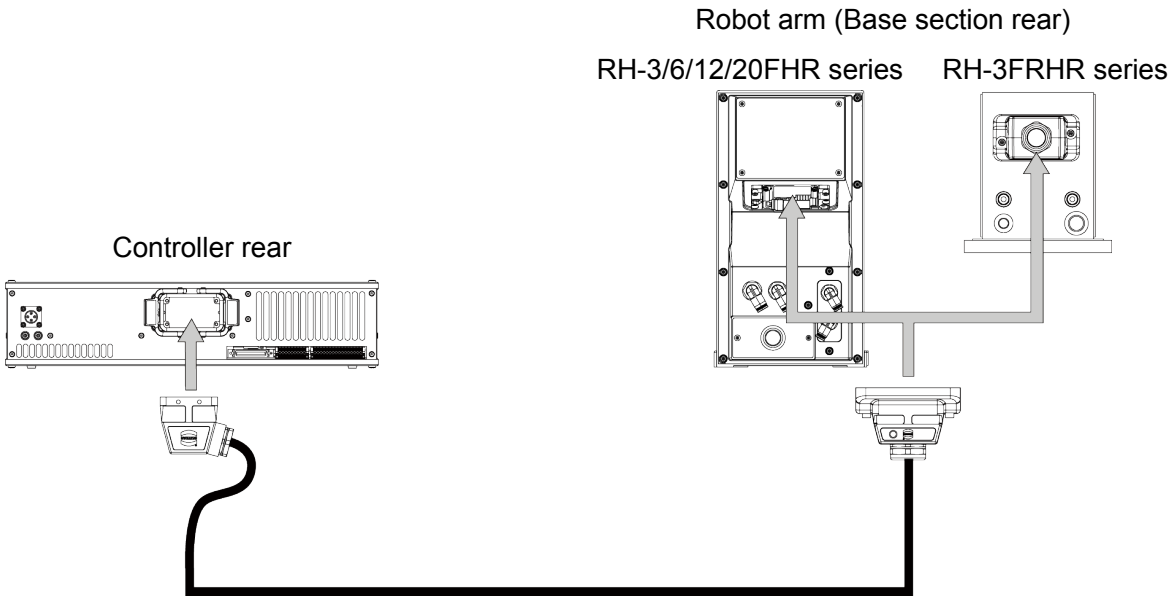
1) Make sure that the power of the controller is turned OFF.
2) Connect the machine cable to CN1 connector on the robot arm.

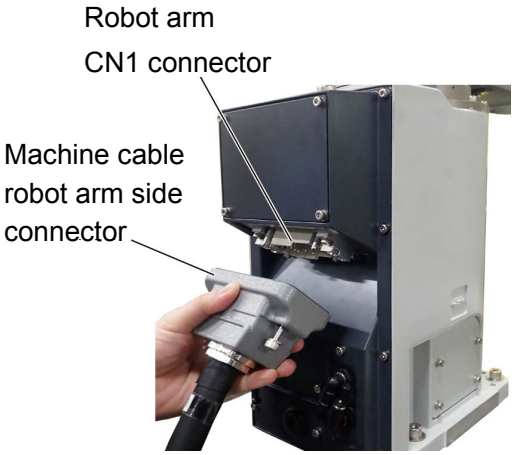
Note) The same connection method is also applicable to other models with the same-shaped connector.

- For RV-2FR series, insert the connector until the connector edge is aligned with the CONBOX surface and tighten two bolts.
- For RV-4FR/7FR series, insert the connector until the line of the connector is aligned with the CONBOX surface and tighten two bolts.
  (Screw fixing torque: 3.6 to 4.4 N·m)

⚠CAUTION Be careful not to get your hand pinched.

(b) RH-FRH series

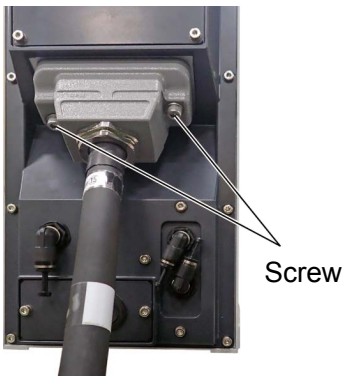




1) Make sure that the power of the controller is turned OFF.
2) Connect the machine cable to CN1 connector on the robot arm.

Note) The same connection method is also applicable to other models with the same-shaped connector.

・Insert the connector until the line of the connector is aligned with the CONBOX surface and tighten two bolts.
(Screw fixing torque: 3.6 to 4.4 N･m)



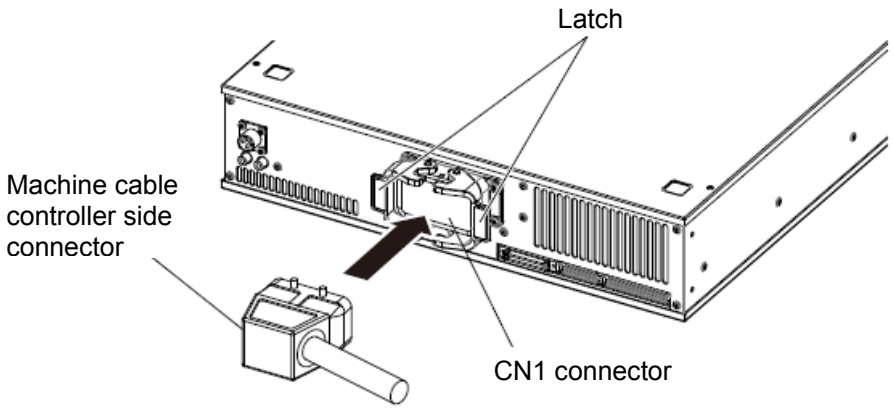
⚠**CAUTION** Be careful not to get your hand pinched.

⚠CAUTION

1) The machine cable connectors are dedicated for the controller side and robot arm side, so take special care when connecting.
2) When installing or removing the connector, to the connector of the other party in parallel, install or remove.
3) If the cable is pulled with force or bent excessively, wires could break or the connector could be damaged.
4) Connect the machine cable at the place without the effect of the dust or oil mist. Please keep the dust and oil mist from being applied to of the robot arm connector section, in the condition that the machine cable is removed.
   Before disconnecting the machine cable, wipe off dust and oil mist around the connector.
5) Please be careful not to catch the hand at installation and removal. To disconnect the machine cable, hold the connector part and pull out the cable.

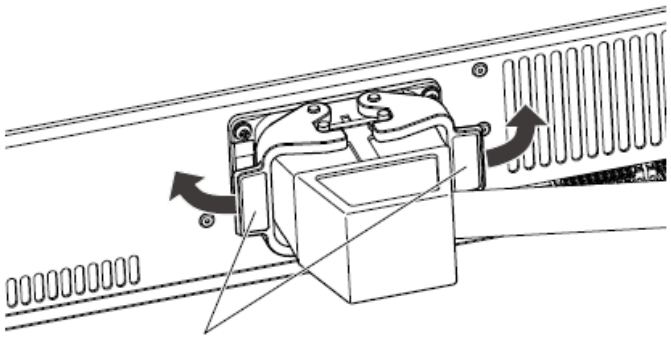
(3) Connection of controller and machine cable

1) Make sure that the power of the controller is turned OFF.
2) Connect the controller side connector of the machine cable to CN1 connector on the rear side of the controller.
3) To secure the inserted connector, close the latches of the CN1 connector.

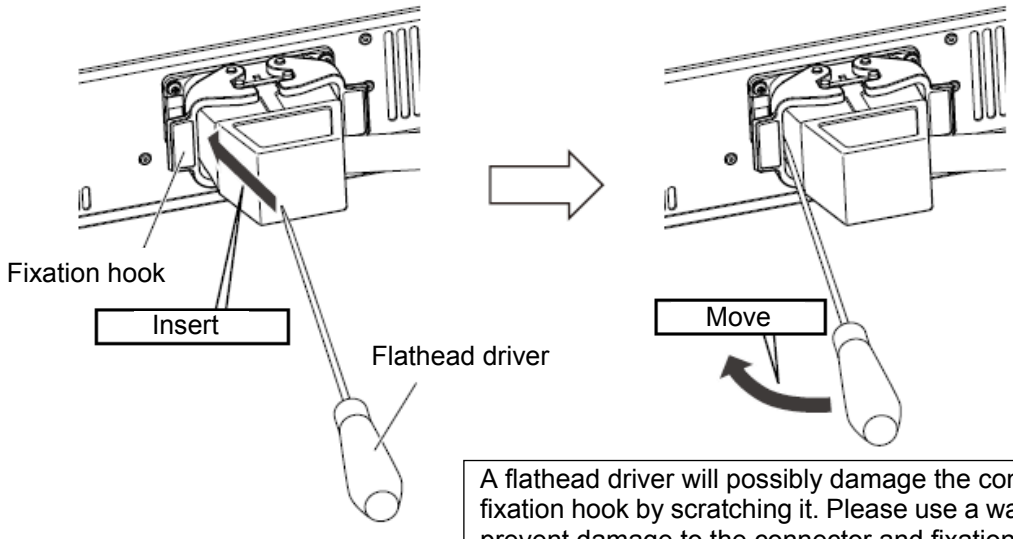


(4) Removing the machine cable

When removing the machine cable from a controller, push the fixation hook of the machine cable connector and unlock the connector.



If the fixation hook is too stuck to release the connector, use a flathead screwdriver to release the connector as shown below.

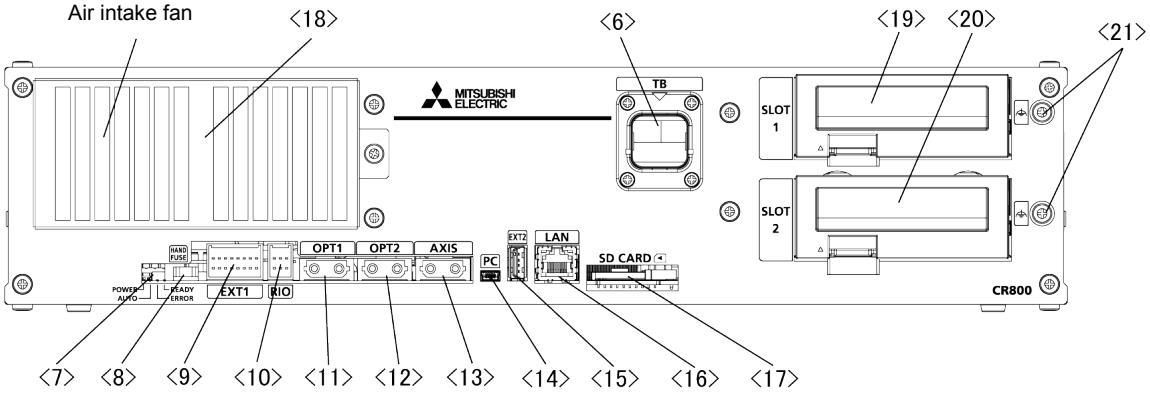


A flathead driver will possibly damage the connector and fixation hook by scratching it. Please use a waste cloth to prevent damage to the connector and fixation hook.

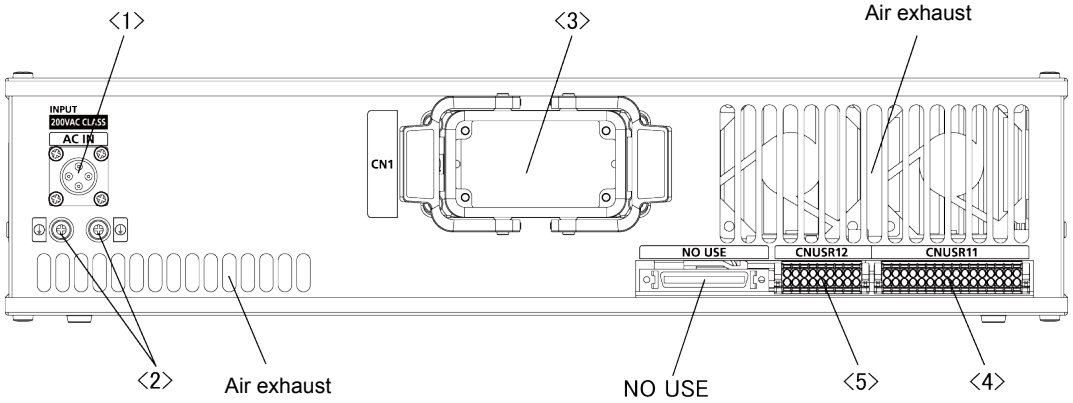
3.3 Controller names and functions of each part

3.3.1 CR800 controller

Controller front



Controller rear



<1> ACIN connector.....Supplied ACIN cable connector (input voltage: AC200V). (*1)

<2> PE terminals .....Terminals for grounding (M4 screw × 2).

<3> CN1 cable.....Machine cable connector.

<4> <5> CNUSR connector ....Robot I/O cable connectors.
<4>: CNUSR11, <5>: CNUSR12

<6> TB connector .....Dedicated connector for connecting T/B.

<7> LED.....Four LEDs indicating the controller status.（*2）

<8> HAND FUSE.....Fuse for the hand.

<9> EXT1 .....Connector for function extension.

<10> RIO .....Parallel I/O extension connector.

<11> OPT1 .....Connector for communication with another controller or the robot CPU.

<12> OPT2 .....Connector for communication with another controller.

<13> AXIS.....Connector for additional axis connection.

<14> PC.....Connector for communication with a personal computer.

<15> EXT2.....Connector for function extension.

<16> LAN .....Connector for Ethernet communication.

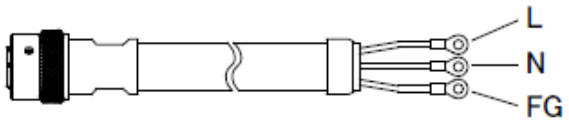
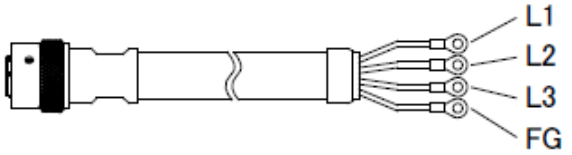
<17> SD CARD .....SD memory card slot.

<18> Filter cover .....Dustproof dust filter cover. An air filter is provided inside the filter cover.

<19> <20> Option slot.....Option card slots (must be covered when not used).
<19> SLOT1, <20> SLOT2

<21> FG terminal.....Option card cable terminals for grounding (M4 screw × 2).

(*1) ACIN cable

Number of phases	ACIN cable	
Single phase	Terminal: M5, cable length: 3m	
Three phase	Terminal: M5, cable length: 3m	

(*2) LED

LED	Details	State
POWER	Indicates the control power status.	On: Control power ON Off: Control power OFF
AUTO	Indicates the controller mode.	On: AUTOMATIC mode Off: MANUAL mode
ERROR	Indicates the error status.	On: Error occurred. Rapid flashing: High-level error occurred. Off: Normal operation
READY	Indicates the operation status.	On: ON (ready) Slow flashing: During operation Rapid flashing: Operation suspended.

Pick Up !

What are the operation rights?

Even when multiple devices, such as a T/B and personal computer, are connected to the controller, the operation at one time is limited to one device. This limited device (has the operation rights)

◇◆◇What operations require operation rights?◇◆◇

Operations that start the robot, such as program start and alarm reset, and operations that can cause the robot to start require operation rights. Conversely, operations that stop the robot, such as stopping and servo OFF, can be used without operation rights for safety purposes.

3.4 Installing and removing the teaching pendant (T/B)

3.4.1 CR800 controller

Installing and removing the T/B, with turning off the controller power.

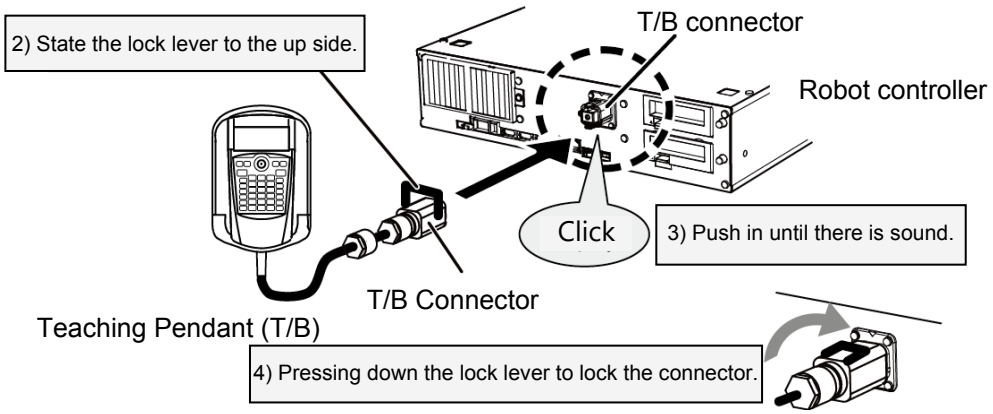
If the T/B is installed or removed with the control source ON, the emergency stop alarm will occur.

However, the T/B can be removed from the controller without occurrence of alarm by pulling out the T/B connector within five seconds while the 3-position enable switch of the T/B is being pulled up lightly (position 2).

⚠CAUTION Please do not pull the cable of T/B strongly or do not bend it too much. It becomes the breaking of a wire of the cable and the cause of breakage of the connector. Please installing and removing so that stress does not start the cable with the connector itself.

(a) Installing the T/B

1) Check that the controller's power supply is OFF.
2) Use as the upper surface the lock lever.
3) Push in until there is sound.
4) Pressing down the lock lever to lock the connector as shown below.



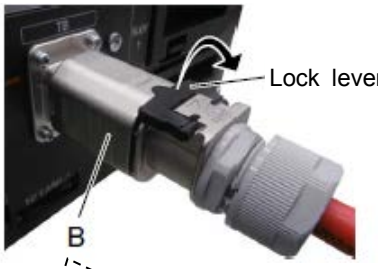
(b) Removing the T/B

■In MANUAL mode

1) Check that the controller's power supply is OFF.
2) Raise the lock lever at the upper part of the connector, and pull the connector (the case (B)) by holding it. (Refer to the right figure.)

■In AUTOMATIC mode

1) Pull up the 3-position enable switch of the T/B lightly (position 2).
2) Pull out the T/B connector within five seconds after above 1). Raise the lock lever at the upper part of the connector, and pull the connector (the case (B)) by holding it. (Refer to the right figure.)



How to remove the T/B connection connector

Release the lock (raise the lock lever), slide the case (B) to the front to remove the latch, and then pull out the connector.

<< MEMO >> * Please use this page for your memo.

4 Maintenance and Inspection (Robot)

The maintenance and inspection procedures to be carried out to use the robot for a long time without trouble are described in this chapter. The types and replacement methods of consumable parts are also explained.

4.1 Type of inspection and maintenance works

Maintenance and inspection are divided into inspections carried out daily, and periodic inspections carried out at set intervals. Always carry these out to prevent unforeseen trouble, to maintain the product for a long time, and to ensure safety.
The following table shows the types of inspection and maintenance.

■Type of inspection and maintenance works

No.	Type of inspection and maintenance works		Description	Operating time Note1)
1	Daily inspection		Inspection work to be performed every day before starting operation for the safe use of the robot.	-
2	Periodic inspection	Monthly inspection	Inspection and maintenance work to be performed every month.	Every 300 hr
3		6-month inspection	Inspection and maintenance work to be performed every 6 months.	Every 1,800 hr
4		2-year inspection	Inspection and maintenance work to be performed every 2 years.	Every 7,200 hr
5		Battery replacement	Replacement of the backup battery of the robot. Replace the battery every year regardless of the operating hours.	-
6		Lubrication	Lubrication of each axis of the robot. Refer to "4.7 Lubrication" for the lubrication schedule.	-

Note1) The operating hours assume the robot operation of 15 hours per day for 20 days per month. When the robot operates for 8 hours per day, the operating hours per month become about a half of the one under the above conditions. Monthly inspection is required every two months. To check the periodic inspection schedule and calculate the operating hours, refer to "4.2.2 (2) Schedule".

4.2 Inspection items

The inspection items for the robot arm are shown below.

Inspect the controller as well referring to "6 Maintenance and Inspection (CR800 Controller)" and "Appendix 3 Maintenance and Inspection (CR750/CR751 Controller and Drive Unit)".

4.2.1 Daily inspection items

The following table shows the procedure and inspection items for daily inspection. If you notice any abnormalities, take appropriate measures.

Procedure	Inspection item (details)	Remedies
Before turning power ON (Check the following items before turning the power ON.)		
1	Are any of the robot installation bolts loose? (Visual)	Securely tighten the bolts.
2	Are any of the cover tightening screws loose? (Visual)	Securely tighten the screws.
3	Are any of the hand installation bolts loose? (Visual)	Securely tighten the bolts.
4	Is the power supply cable securely connected? (Visual)	Securely connect.
5	Is the machine cable between the robot and controller securely connected? (Visual)	Securely connect.
6	Are there any cracks, foreign contamination or obstacles on the robot and controller cover?	Replace with a new part, or take remedial measures.
7	Are there any abnormalities with the pneumatic system? Are there any air leaks, drain clogging or hose damage? Is the air source normal? (Visual)	Drain the drainage, and remedy the air leaks (replace the part).
8	Are there any cracks or foreign matter on the bellows? (Only for clean/oil mist/waterproof specification) (When the bellow option is used) (Observe visually)	Replace it with a new bellows.
After turning the power ON (Turn the power ON while monitoring the robot.)		
1	Is there any abnormal motion or abnormal noise when the power is turned ON?	Follow the troubleshooting section.
During operation (try running with an original program)		
1	Check whether the movement points are deviated? Check the following points if there is any deviation. 1. Are any installation bolts loose? 2. Are any hand installation section bolts loose. 3. Are the positions of the jigs other than the robot deviated? 4. If the positional deviation cannot be corrected, refer to "Troubleshooting", check and remedy.	Follow the troubleshooting section.
2	Is there any abnormal motion or abnormal noise? (Visual)	Follow the troubleshooting section.

4.2.2 Periodic inspection

The inspection items and timings for the robot arm are shown below.

(1) Inspection item

Perform the periodic inspection in the following table.

Periodic inspection items (details)

Inspection item (details)	Remedies
Monthly inspection	
Are any of the bolts or screws on the robot arm loose?	Securely tighten the bolts.
Are any of the connector fixing screws or terminal block terminal screws loose?	Securely tighten the screws.
6-month inspection	
Has the dust accumulated in the bellows? (Only for clean/oil mist/waterproof specification. For the environment with much dust.)	Remove the bellows and clean the inside. (For how to remove the bellows, refer to "Appendix 4 Replacing the Bellows".)
2-year inspection[Note1)]	
Is the friction at the timing belt teeth severe?	If the teeth are missing or severe friction is found, replace the timing belt.
Is the timing belt tension value more than the guideline value? Does any position mismatch occur?	When the tension value becomes less than the guideline value, the timing belt must be replaced.
Battery replacemenet	
Replace the backup battery in the robot arm. Replace the battery every year regardless of the operating hours.	Replace it referring to "4.8 Replacing the backup battery (FR series)" and "Appendix 2.1 Backup battery replacement".
Lubrication	
Check the lubrication schedule for each axis, and perform lubrication. The lubrication schedule differs according to the model.	Lubricate it referring to "4.7 Lubrication".
Is enough grease applied on the shaft? (RH-FRH series and RH-3FRHR series) (The guideline for greasing is every 2000 km.)	

Note1) When the robot is operated 24 hours a day or with a heavy load, it is recommended to be inspected every 6 months (1,800 hr).

(2) Schedule

The following shows the schedule for the periodic inspection works. Perform the periodic inspection works as appropriate according to the following table.

Operating time Note1)	Inspection schedule		Type of periodic inspection works Note2)				
	15 hours per day	8 hours per day	Monthly inspection	6-month inspection	2-month inspection	Battery replacement	Lubricatio
300 hr	1 month	2 months	○			Every year Note3)	As appropriate Note4)
600 hr	2 months	4 months	○				
900 hr	3 months	6 months	○				
1,200 hr	4 months	8 months	○				
1,500 hr	5 months	10 months	○				
1,800 hr	6 months	12 months	○	○			
:	:			:			
3,600 hr	12 months	24 months	○	○			
:	:			:			
7,200 hr	24 months	48 months	○	○	○		
:	:			:			
10,800 hr	36 months	72 months	○	○			

Note1) The following shows examples of calculation of the operating hours.

- Operating hours when the robot operates 15 hours per day for 20 days per month for three months:
  15 hr/day × 20 days/month × 3 months = 900 hr
- Operating hours when the robot operates 8 hours per day for 20 days per month for three months:
  8 hr/day × 20 days/month × 3 months = 480 hr ... Approx. 500 hr

Note2) The item marked with the circle (○) is to be performed. According to the operating hours, inspect "(1) Inspection items".

Note3) Replace the battery every year regardless of the operating hours.

Note4) Check the lubrication interval described in "4.7 Lubrication".

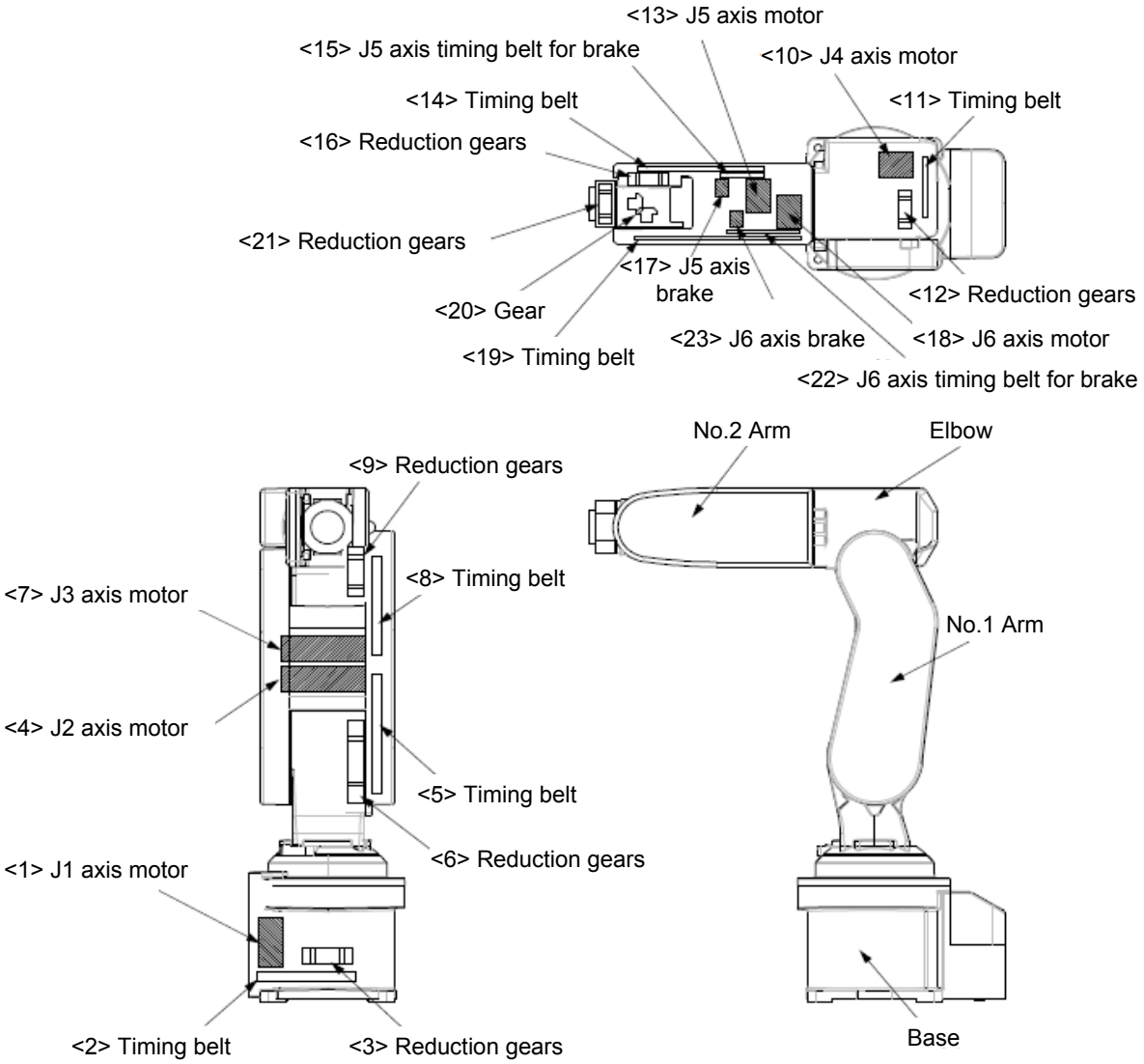
4.3 Maintenance and inspection procedures

The procedures for carrying out the periodic maintenance and inspection are described in this section.
(Never disassemble, the parts not described in this manual.)
The maintenance parts that require the customer to perform the maintenance and inspection are described in "4.11 Maintenance parts (FR series)" and "Appendix 2.2 Maintenance parts (F series)" of this manual.

⚠CAUTION The origin of the machine system could deviate when this work is carried out.
Review of the position data and re-teaching will be required.

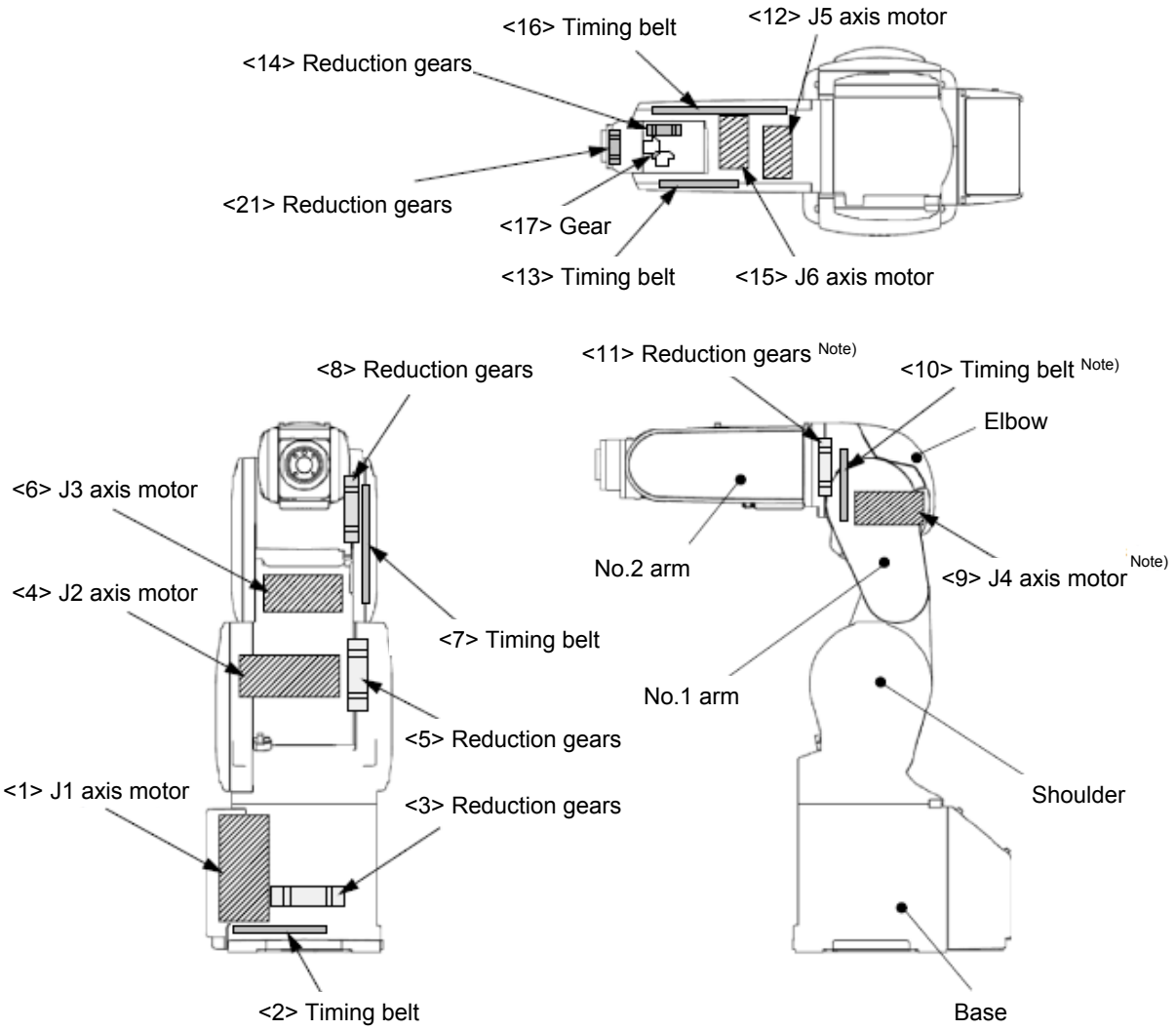
4.4 Robot arm structure

(1) RV-2FR, RV-2F series



Axis	Drive method
J1	The rotation of the J1 axis motor <1> arranged in the base is conveyed to the reduction gears <3> via the timing belt <2>. RV-2FR/2FRL, 2F/2FL: Brakes are not mounted. RV-2FRB/2FRLB, 2FB/2FLB: Non-excitation magnetic brakes are mounted in the J1 axis motor <1>.
J2	The rotation of the J2 axis motor <4> arranged in the No.1 arm is conveyed to the reduction gears <6> via the timing belt <5>. Non-excitation magnetic brakes are mounted in the J2 axis motor <4>.
J3	The rotation of the J3 axis motor <7> arranged in the No.1 arm is conveyed to the reduction gears <9> via the timing belt <8>. Non-excitation magnetic brakes are mounted in the J3 axis motor <7>.
J4	The rotation of the J4 axis motor <10> arranged in the elbow is conveyed to the reduction gears <12> via the timing belt <11>. RV-2FR/2FRL, 2F/2FL: Brakes are not mounted. RV-2FRB/2FRLB, 2FB/2FLB: Non-excitation magnetic brakes are mounted in the J4 axis motor <10>.
J5	The rotation of the J5 axis motor <13> arranged in the No.2 arm is conveyed to the reduction gears <16> via the timing belt <14>. Non-excitation magnetic brakes <17> are mounted via the J5 axis timing belt for brake <15>.
J6	RV-2FR/2FRL, 2F/2FL: The rotation of the J6 axis motor <18> arranged in the No.2 arm is conveyed to the reduction gears <21> via the timing belt <19> and gear <20>. Brakes are not mounted. RV-2FRB/2FRLB, 2FB/2FLB: The rotation of the J6 axis motor <18> arranged in the No.2 arm is conveyed to the reduction gears <21> via the timing belt <19> and gear <20>. Non-excitation magnetic brakes <23> are mounted via the J6 axis timing belt for brake <22>.

(2) RV-4/7FR, RV-4/7F series

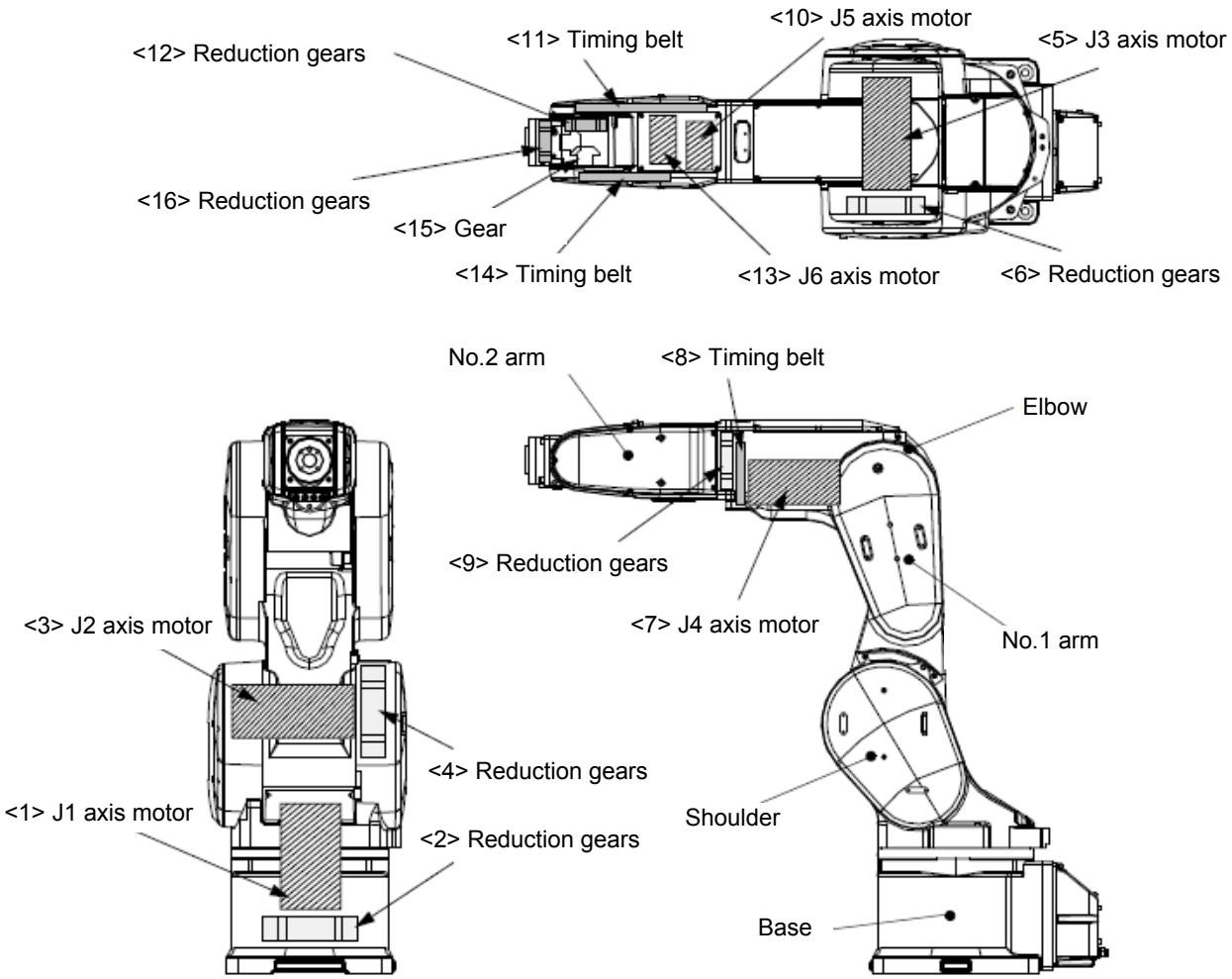


Non-excitation magnetic brakes are mounted in all axes's motor.

Axis	Drive method
J1	The rotation of the J1 axis motor <1> arranged in the base is conveyed to the reduction gears <3> via the timing belt <2>.
J2	The J2 axis rotation is driven by the J2 axis motor <4> and reduction gears <5>.
J3	The rotation of the J3 axis motor <6> arranged in the No.1 arm is conveyed to the reduction gears <8> via the timing belt <7>.
J4	The rotation of the J4 axis motor <9> arranged in the elbow is conveyed to the reduction gears <11> via the timing belt <10> to rotate the J4 axis. Note) Since the RV-4FRJL is 5-axis type robot, it has no J4 axis.
J5	The rotation of the J5 axis motor <12> arranged in the No.2 arm is conveyed to the reduction gears <14> via the timing belt <16>.
J6	The rotation of the J6 axis motor <15> arranged in the No.2 arm is conveyed to the reduction gears <21> via the timing belt <13> and gear <17>.

Note) The robots of the 5-axis specifications model (RV-4FRJL and RV-4FJL) have no J4 axis.

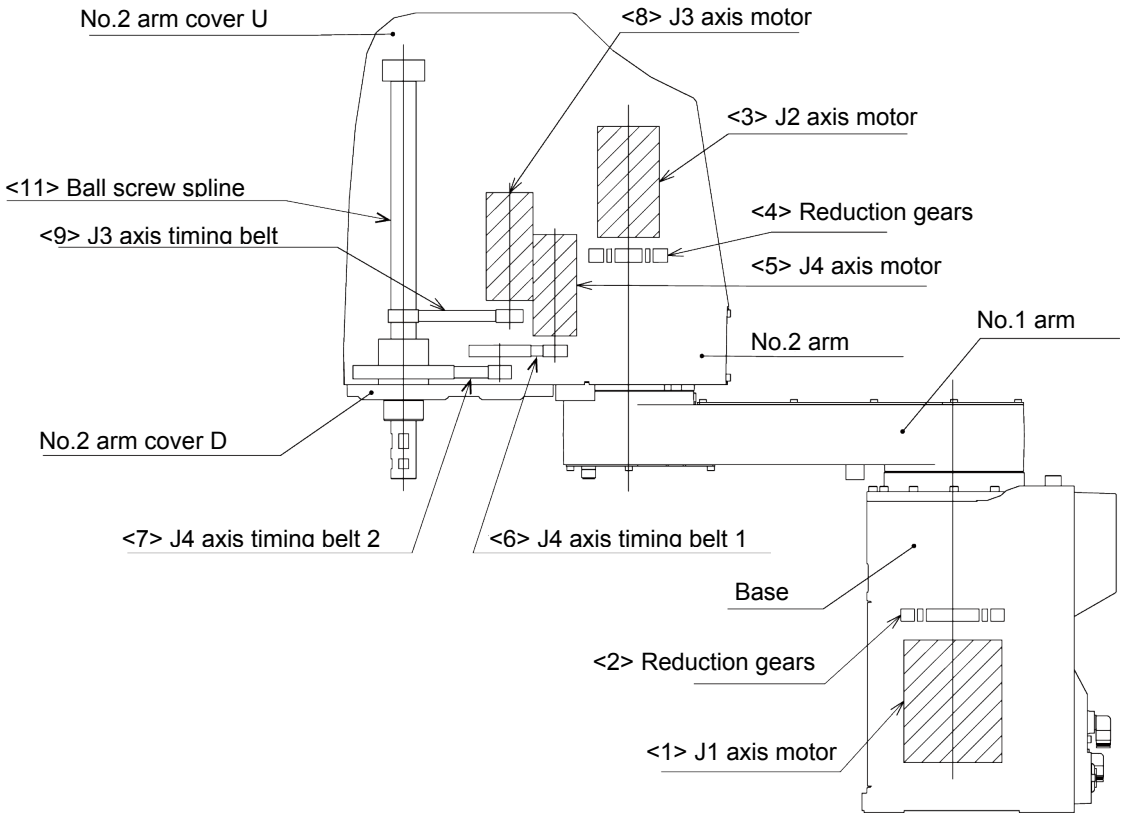
(3) RV-13/20FR, RV-13/20F series



Non-excitation magnetic brakes are mounted in all axes's motor.

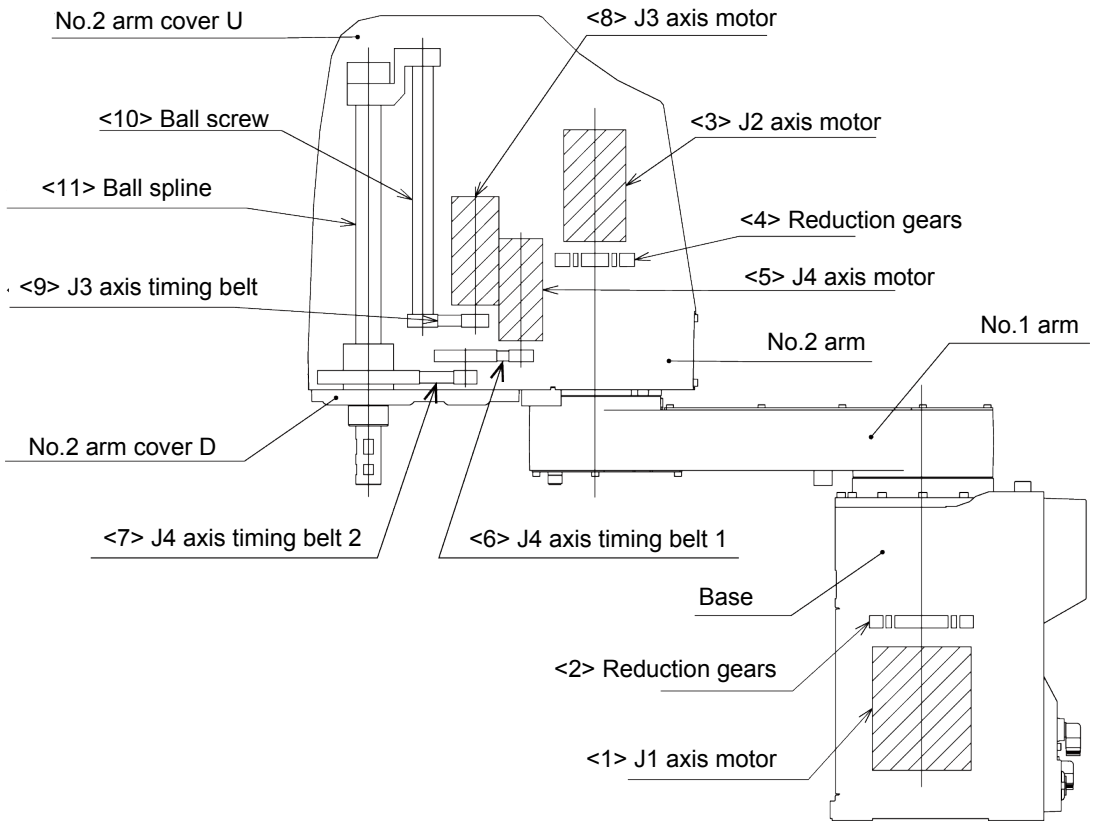
Axis	Drive method
J1	The J1 axis rotation is driven by the J1 axis motor <1> and reduction gears <2>.
J2	The J2 axis rotation is driven by the J2 axis motor <3> and reduction gears <4>.
J3	The J3 axis rotation is driven by the J2 axis motor <5> and reduction gears <6>.
J4	The rotation of the J4 axis motor <7> arranged in the elbow is conveyed to the reduction gears <9> via the timing belt <8>.
J5	The rotation of the J5 axis motor <10> arranged in the No.2 arm is conveyed to the reduction gears <12> via the timing belt <11>.
J6	The rotation of the J6 axis motor <13> arranged in the No.2 arm is conveyed to the reduction gears <16> via the timing belt <14> and gear <15>.

(4) RH-3FRH, RH-3FH series



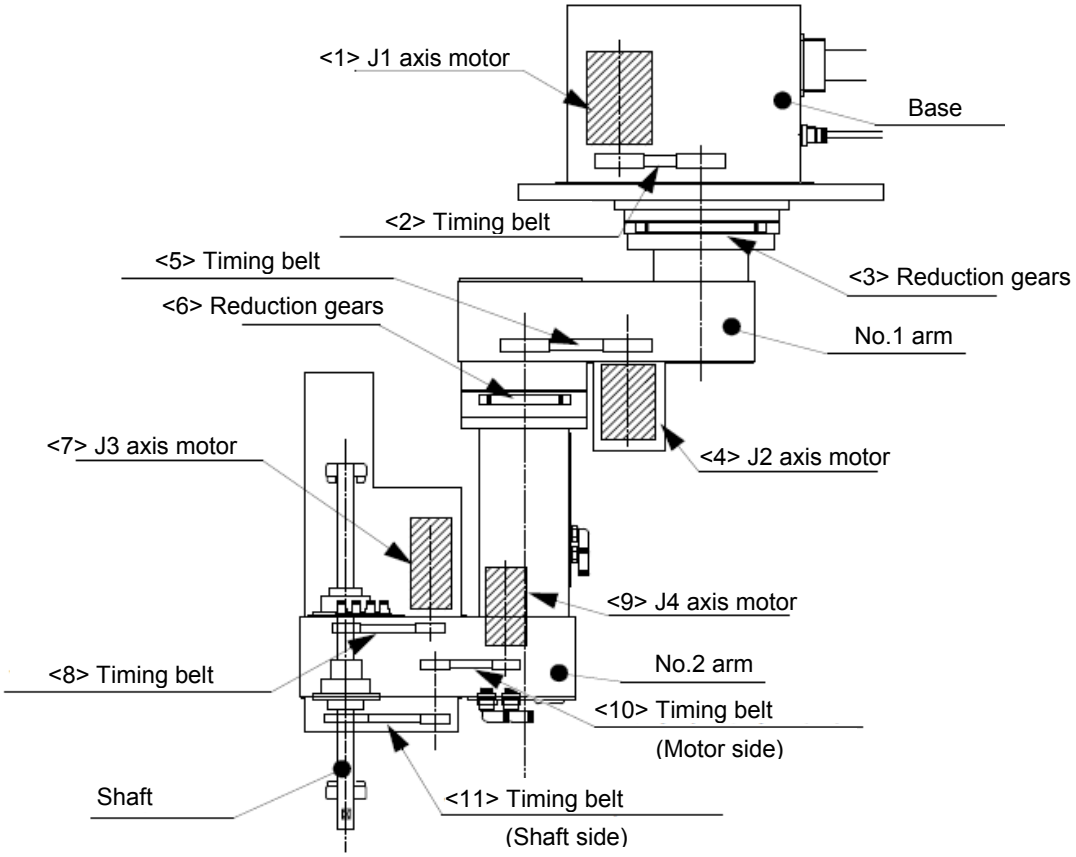
Axis	Drive method
J1	The J1 axis rotation is driven by the J1 axis motor <1> and reduction gears <2>. Brakes are not mounted.
J2	The J2 axis rotation is driven by the J2 axis motor <3> and reduction gears <4> in the No. 2 arm. Brakes are not mounted.
J3	The rotation of the J3 axis motor <8> arranged in the No.2 arm is conveyed to the ball screw spline <11> via the J3 axis timing belt <9>. Non-excitation magnetic brakes are mounted in the J3 axis motor <8>.
J4	The rotation of the J4 axis motor <5> arranged in the No.2 arm is conveyed to the ball screw spline <11> via the J4 axis timing belt 1 <6> and J4 axis timing belt 2 <7> to rotate the J4 axis. Brakes are not mounted.

(5) RH-6/12/20FRH, RH-6/12/20FH series



Axis	Drive method
J1	The J1 axis rotation is driven by the J1 axis motor <1> and reduction gears <2>. Brakes are not mounted.
J2	The J2 axis rotation is driven by the J2 axis motor <3> and reduction gears <4> in the No. 2 arm. Brakes are not mounted.
J3	The rotation of the J3 axis motor <8> arranged in the No.2 arm is conveyed to the ball screw <10> via the J3-axis timing belt <9> to rotate the J3 axis. Non-excitation magnetic brakes are mounted in the J3 axis motor <8>.
J4	The rotation of the J4 axis motor <5> arranged in the No.2 arm is conveyed to the ball spline <11> via the J4 axis timing belt 1 <6> and the J4 axis timing belt 2 <7> to rotate the J4 axis. Brakes are not mounted.

(6) RH-3FRHR, RH-3FR series (Hanging type)



Axis	Drive method
J1	The rotation of the J1 axis motor <1> arranged in the base is conveyed to the reduction gears <3> via the timing belt <2> to rotate the J1 axis. Brakes are not mounted.
J2	The rotation of the J2 axis motor <4> arranged in the No.1 arm is conveyed to the reduction gears <6> via the timing belt <5> to rotate the J2 axis. Brakes are not mounted.
J3	The rotation of the J3 axis motor <7> arranged in the No.2 arm is conveyed to the shaft via the timing belt <8> to rotate the J3 axis. Non-excitation magnetic brakes are mounted in the J3 axis motor <7>.
J4	The rotation of the J4 axis motor <9> arranged in the No.2 arm is conveyed to the shaft via the timing belt (motor side) <10> and the timing belt (shaft side) <11> to rotate the J4 axis. Brakes are not mounted.

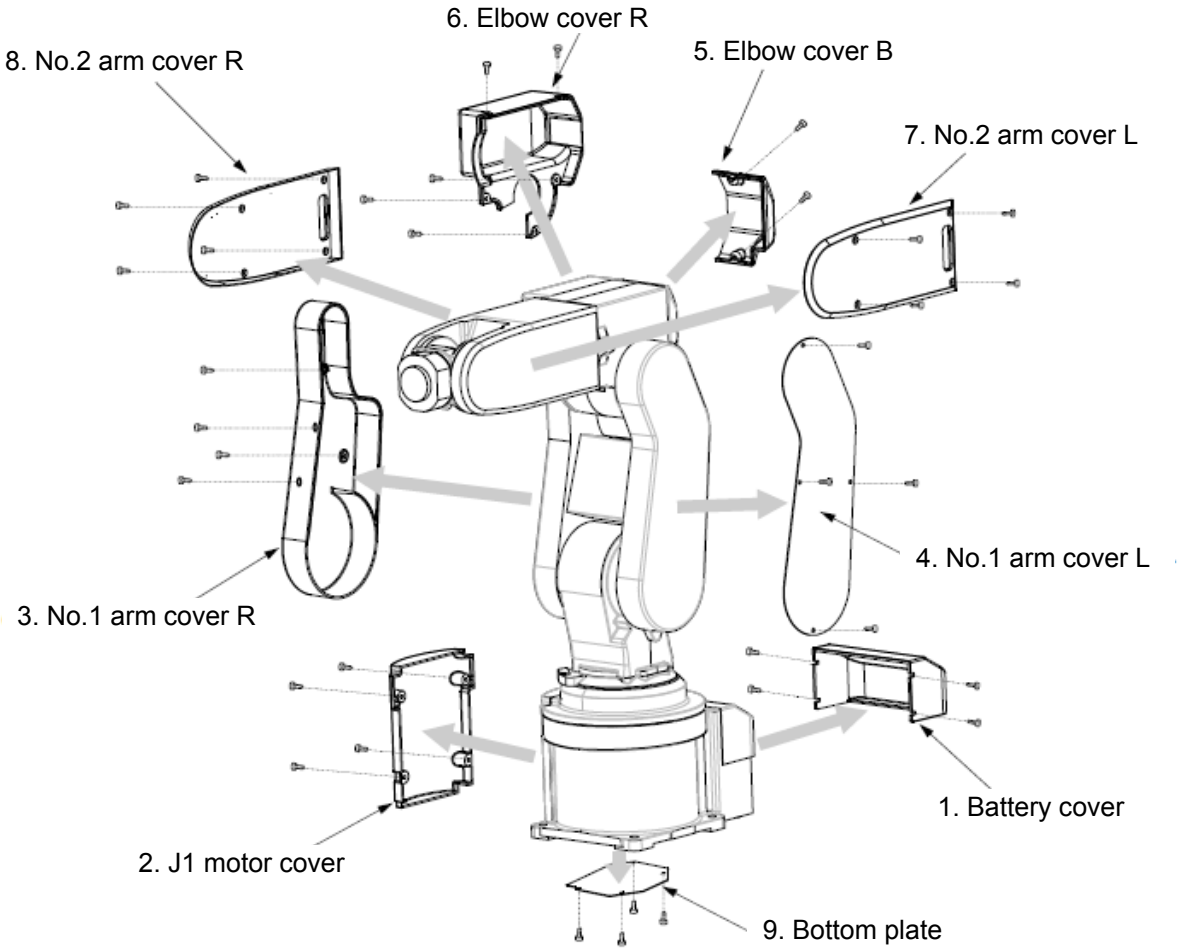
<< MEMO >> * Please use this page for your memo.

4.5 Installing/removing the cover

⚠WARNING Always install/remove the cover with the controller control power turned OFF.
Failure to do so could lead to physical damage or personal injury should the robot start moving due to incorrect operations.

(1) RV-2FR, RV-2F series

1) Refer to the figure below and remove the covers.
2) When the covers are hard to remove, change the posture of the robot with the jog operation and remove the covers.
3) When attaching the cover after maintenance and inspection, use the detaching procedure in reverse. Tighten the screws with the torque shown in the right table.



Cover names and installation screw list (RV-2FR, RV-2F series)

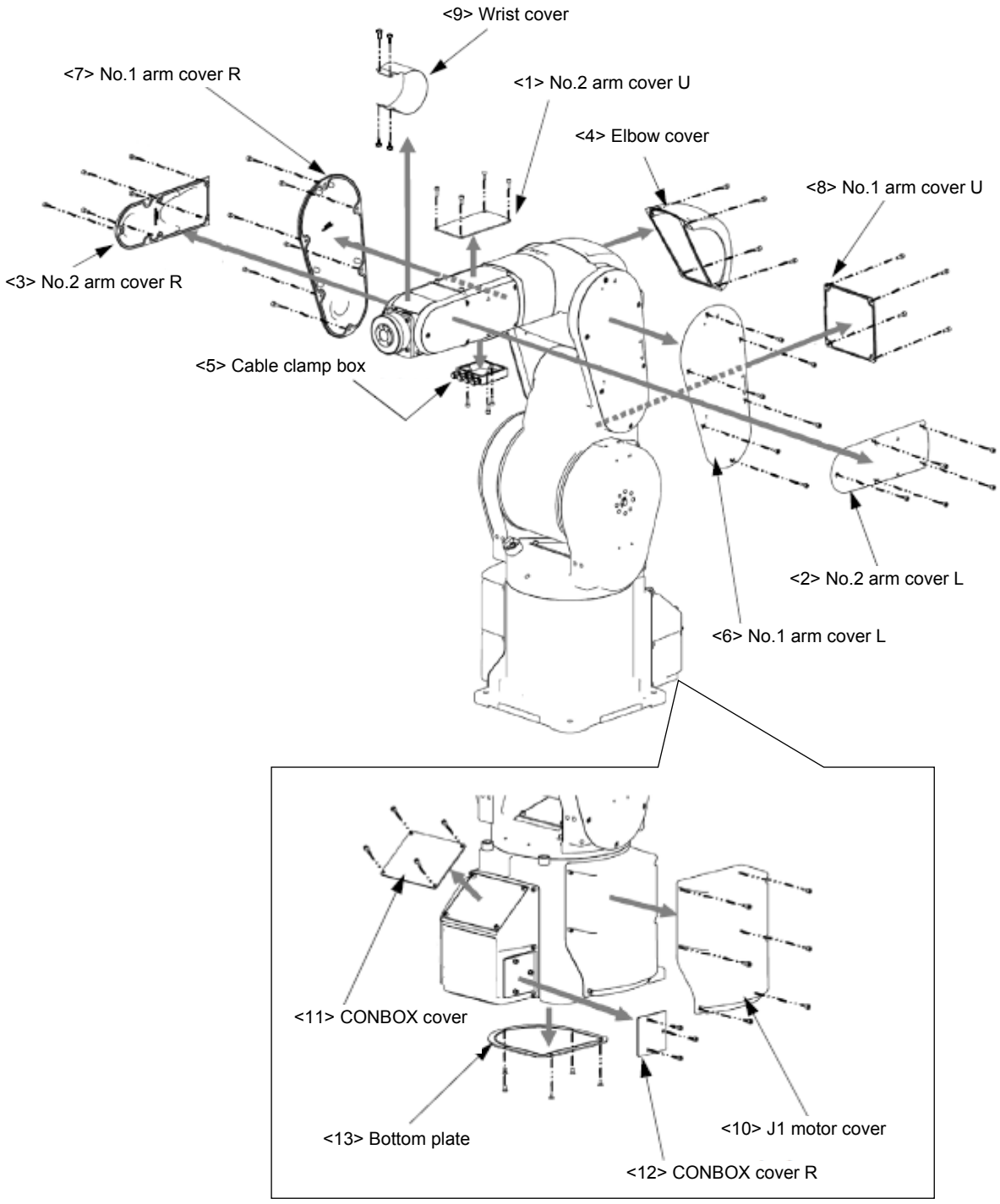
(* The numbers correspond to the figure.)

No	Cover names	Installation screw Note1)	Qty	Remarks
<1>	Battery cover	Bind screw M3	4	
<2>	J1 motor cover	Bind screw M3	4	
<3>	No. 1 arm cover R	Bind screw M3	4	
<4>	No. 1 arm cover L	Low head safety socket M3	4	Nickel-plated screw.
<5>	Elbow cover B	Bind screw M3	2	
<6>	Elbow cover R	Bind screw M3	5	
<7>	No. 2 arm cover L	Bind screw M3	4	
<8>	No. 2 arm cover R	Bind screw M3	4	
<9>	Bottom plate	Low head safety socket M3	4	Nickel-plated screw.

Note1) The tightening torque of each screw are shown below.
M3 screw: 0.608 to 0.824 N·m

(2) RV-4/7FR, RV-4/7F series

1) Refer to the figure below and remove the covers.
2) When the covers are hard to be removed, change the posture of the robot with the jog operation and remove the covers.
3) When removing the wrist cover, move the J5 axis to the position of +90 degrees with the jog operation.
4) When attaching the cover after maintenance and inspection, use the detaching procedure in reverse. Tightening the screws with the torque shown in the right table.



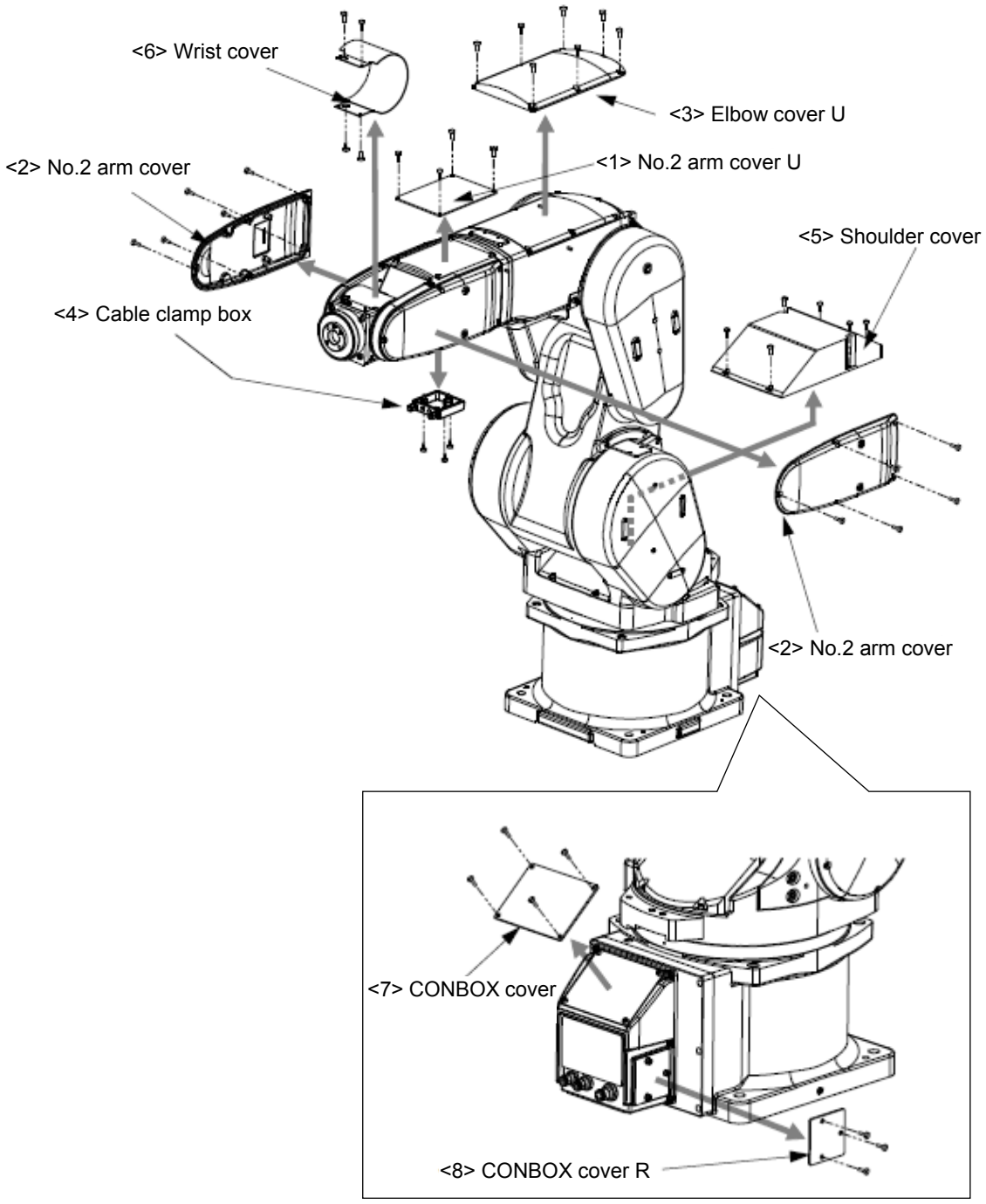
Cover names and installation screw list (RV-4FR/7FR, RV-4F/7F series)
(* The numbers correspond to the figure.)

No.	Cover names	Installation screws Note1)	Qty	Remarks
<1>	No.2 arm cover U	Hexagon socket head cap screw, M4 × 12	4	
<2>	No.2 arm cover L	Hexagon socket head cap screw, M4 × 12	5	
<3>	No.2 arm cover R	Hexagon socket head cap screw, M4 × 12	5	
<4>	Elbow cover	Hexagon socket head cap screw, M4 × 12	4	
<5>	Cable clamp box	Hexagon socket head cap screw, M4 × 20	3	Only protection specification has seal washer M4
<6>	No.1 arm cover L	Hexagon socket head cap screw, M4 × 12	5	RV-4FR/7FR series. RV-4F/7F series.
			6	RV-4FRL/4FRJL/7FRL series. RV-4FL/4FJL/7FL series.
<7>	No.1 arm cover R	Hexagon socket head cap screw, M4 × 12	5	RV-4FR/7FR series. RV-4F/7F series.
			6	RV-4FRL/4FRJL/7FRL series. RV-4FL/4FJL/7FL series.
<8>	No.1 arm cover U	Hexagon socket head cap screw, M4 × 8	4	RV-4FR/7FR series. RV-4F/7F series.
			6	RV-4FRL/4FRJL/7FRL series. RV-4FL/4FJL/7FL series.
<9>	Wrist cover	Low head cap screw, M3 × 8	4	
<10>	J1 motor cover	Hexagon socket head cap screw, M4 × 12	6	
<11>	CONBOX cover	Hexagon socket head cap screw, M4 × 8	4	
<12>	CONBOX cover R	Hexagon socket head cap screw, M4 × 20	3	Only protection specification has seal washer M4
<13>	Bottom plate	Flat head screw, M4 × 8	5	

Note1) The tightening torque of each screw are shown below.
M3 screw: 0.608 - 0.824 N·m
M4 screw: 1.39 - 1.89 N·m

(3) RV-13/20FR, RV-13/20F series

1) Refer to the figure below and remove the covers.
2) When the covers are hard to be removed, change the posture of the robot with the jog operation and remove the covers.
3) When removing the wrist cover, move the J5 axis to the position of +90 degrees with the jog operation.
4) When attaching the cover after maintenance and inspection, use the detaching procedure in reverse. Tightening the screws with the torque shown in the right table.



Cover names and installation screw list (RV-13FR/20FR, RV-13F/20F series)
(* The numbers correspond to the figure.)

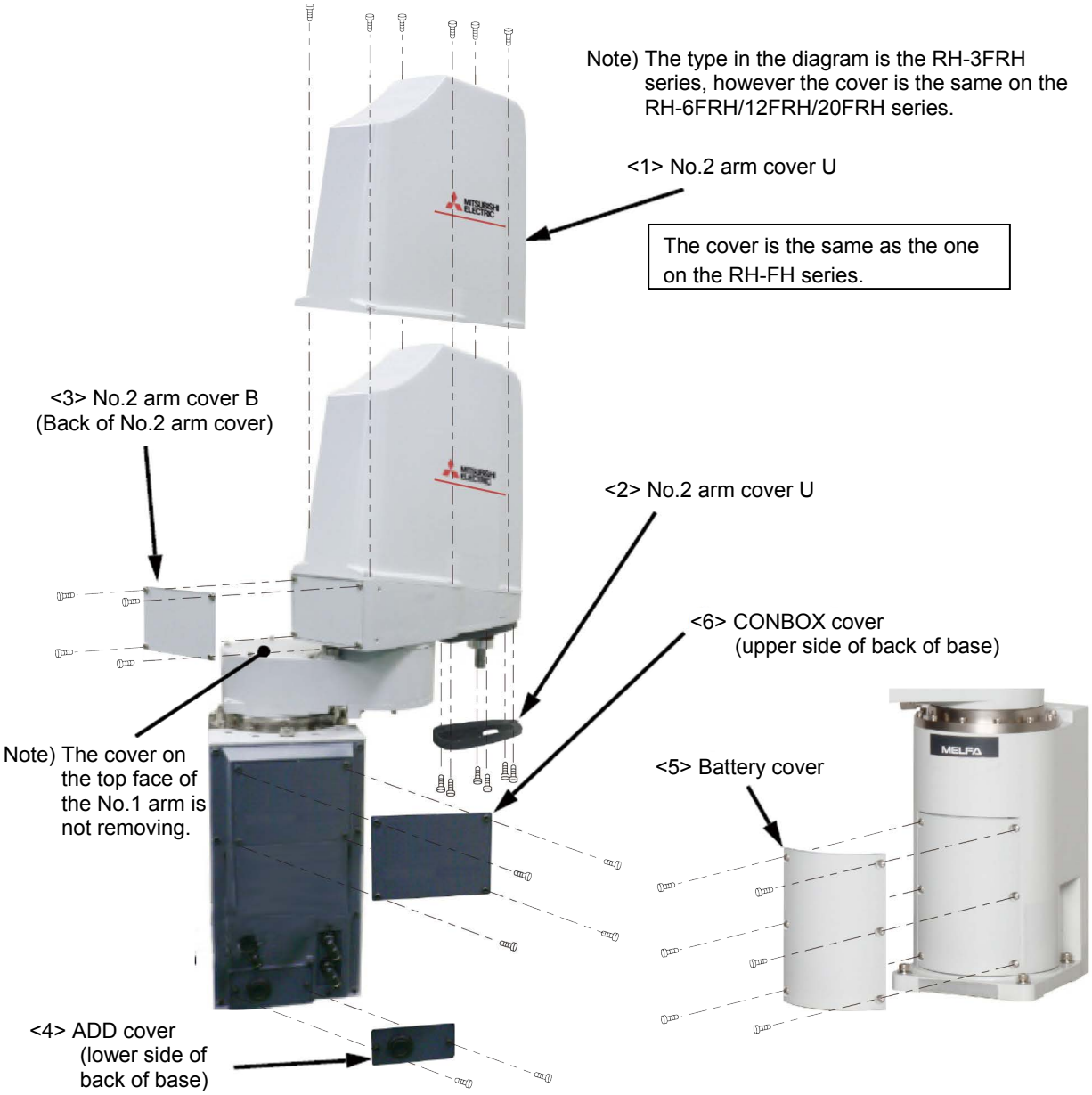
No.	Cover names	Installation screws Note1)	Qty	Remarks
<1>	No.2 arm cover U	Hexagon socket head cap screw, M4 × 12	4	
<2>	No.2 arm cover	Hexagon socket head cap screw, M4 × 12	5/one side	
<3>	Elbow cover U	Hexagon socket head cap screw, M4 × 12	7	
<4>	Cable clamp box	Hexagon socket head cap screw, M4 × 16	3	Only protection specification has seal washer M4
<5>	Shoulder cover	Hexagon socket head cap screw, M4 × 12	6	
<6>	Wrist cover	Low head cap screw, M3 × 8	4	For RV-7FRLL
		Hexagon socket head cap screw, M3 × 8	4	For RV-13FR/13FRL/20FR For RV-13FR/13FL/20F
<7>	CONBOX cover	Hexagon socket head cap screw, M4 × 8	4	
<8>	CONBOX cover R	Hexagon socket head cap screw, M4 × 20	3	Only protection specification has seal washer M4

Note1) The tightening torque of each screws are shown below.
M3 screw: 0.608 - 0.824 N·m
M4 screw: 1.39 - 1.89 N·m

(4) RH-FRH, RH-FH series

1) Refer to the figure below and remove the covers.

2) When attaching the cover after maintenance and inspection, use the detaching procedure in reverse. Tightening the screws with the torque shown in the right table.



⚠CAUTION Check that the packing is not torn or separated while installing or removing the cover. If you keep using the robot with the torn or separated packing, oil mist or the like may get into the robot, resulting in malfunction of the robot.

Cover name and installation screw list (RH-3FRH/6FRH/12FRH/20FRH series)
(* The numbers correspond to the figure.)

No.	Cover names	Installation screws Note1)	Qty	Remarks
<1>	No.2 arm cover U	Truss head screw, M4 × 10	6	RH-3FRH/6FRH series.
		Truss head screw, M4 × 10	8	RH-12FRH series, RH-20FRH85** series.
		Truss head screw, M4 × 10	10	RH-20FRH100** series.
<2>	No.2 arm cover D	Truss head screw, M4 × 10	6	
<3>	No.2 arm cover B	Hexagon socket head cap screw, M4 × 8	4	
<4>	ADD cover	Hexagon socket head cap screw, M4 × 8	2	
<5>	Battery cover	Truss head screw, M4 × 10	6	
<6>	CONBOX cover	Hexagon socket head cap screw, M4 × 8	4	

Note1) The tightening torque of each screw is shown below: 1.39 – 1.89 N·m

[Note] Sealant is applied to the installation surface of cover in the oil mist and clean specification models. Be sure to replace the sealant if it has been dislocated and bent or crushed and does not return to its original shape. Moreover, in the case of oil mist and clean specification models, it is necessary to remove the bellows.

(5) RH-3FRHR, RH-3FHR series (Celling type)

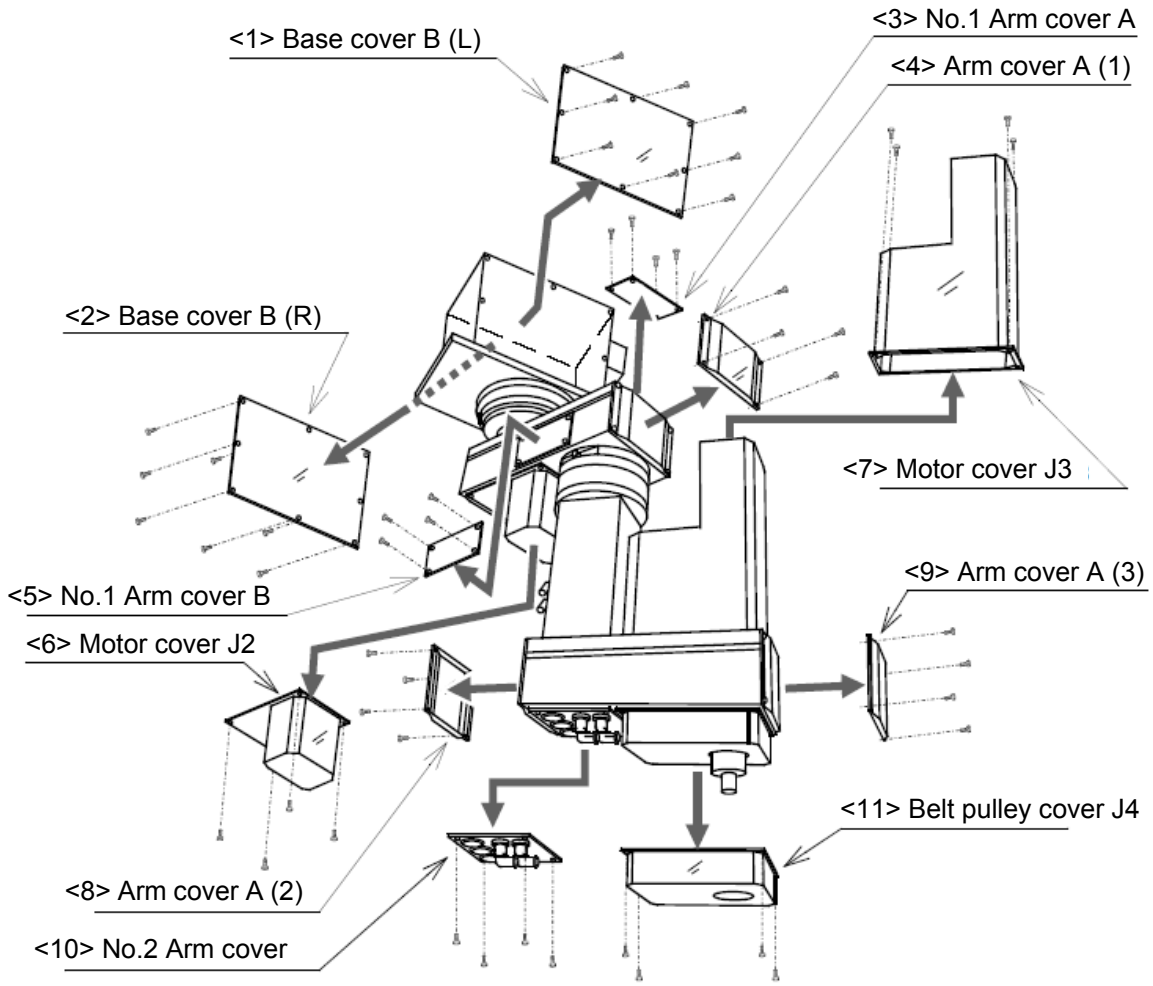
[Note] When you remove the cover, do not remove the screws other than the ones shown in the figure below and the table on the right.

1) Refer to the figure below and remove the covers.

2) Depending on the posture of the robot, some covers are hard to be removed. In such a case, change the posture of the robot with the jog operation to remove the covers.

3) When attaching the cover after maintenance and inspection, use the detaching procedure in reverse. Tightening the screws with the torque shown in the right table.

[Note] Please wipe off the grease which splashed from the ball screw spline at the time of maintenance inspection.



Cover name and installation screw list (RH-3FRHR, RH-3FHR series) (Hanging type)
(* The numbers correspond to the figure.)

General environment specification

No.	Cover names	Installation screws Note1)	Qty	Remarks
<1>	Base cover B (L)	Low head hexagon socket screw, M4 × 8	8	
<2>	Base cover B (R)	Low head hexagon socket screw, M4 × 8	8	
<3>	No. 1 arm cover A	Low head hexagon socket screw, M4 × 8	4	
<4>	Arm cover A (1)	Low head hexagon socket screw, M4 × 8	4	
<5>	No. 1 arm cover B	Low head hexagon socket screw, M4 × 8	4	
<6>	Motor cover J2	Low head hexagon socket screw, M4 × 8	4	
<7>	Motor cover J3	Low head hexagon socket screw, M4 × 8	4	
<8>	Arm cover A (2)	Low head hexagon socket screw, M4 × 8	4	
<9>	Arm cover A (3)	Low head hexagon socket screw, M4 × 8	4	
<10>	No. 2 arm cover	Low head hexagon socket screw, M4 × 8	4	
<11>	Belt pulley cover J4	Low head hexagon socket screw, M4 × 8	4	

Note1) Bolting torque of each fixing screw is 1.39 to 1.89 N·m.

Clean/Waterproof specification

No.	Cover names	Installation screws Note1)	Qty	Remarks
<1>	Base cover B (L)	SUS hexagon socket screw, M4 × 10	8	With seal washer.
<2>	Base cover B (R)	SUS hexagon socket screw, M4 × 10	8	With seal washer.
<3>	No. 1 arm cover A	SUS hexagon socket screw, M4 × 10	8	With seal washer.
<4>	Arm cover A (1)	SUS hexagon socket screw, M4 × 10	8	With seal washer.
<5>	No. 1 arm cover B	SUS hexagon socket screw, M4 × 10	8	With seal washer.
<6>	Motor cover J2	SUS hexagon socket screw, M4 × 10	8	With seal washer.
<7>	Motor cover J3	SUS hexagon socket screw, M4 × 10	8	With seal washer.
<8>	Arm cover A (2)	SUS hexagon socket screw, M4 × 8	8	
<9>	Arm cover A (3)	SUS hexagon socket screw, M4 × 8	8	
<10>	No. 2 arm cover	SUS hexagon socket screw, M4 × 10	8	With seal washer.
<11>	Belt pulley cover J4	SUS hexagon socket screw, M4 × 10	8	With seal washer.

Note1) Bolting torque of each fixing screw is 1.39 to 1.89 N·m.

4.6 Inspection replacement of timing belt

This robot uses a timing belt for the drive conveyance system. Compared to gears and chains, the timing belt does not require lubrication and has a low noise. However, if the belt usage method and tension adjustment are inadequate, the life could drop and noise could be generated. Depending on the robot working conditions, elongation will occur gradually over a long time. Thus, the tension must be confirmed during the periodic inspection.
Please prepare the sound wave type belt tension gauge in inspection of the timing belt. Refer to the "4.6.3 Timing belt tension" for the tension of the timing belt.

The recommendation gauge
Manufacture: Gates Unitta Asia Company
Type: U-508

⚠CAUTION It is possible for the customer to replace the timing belt, but precise adjustment is needed to prevent malfunction of the relevant parts. To ask for replacement of the timing belt, contact the dealer.

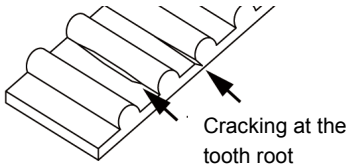
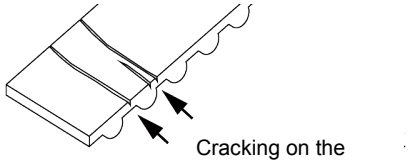
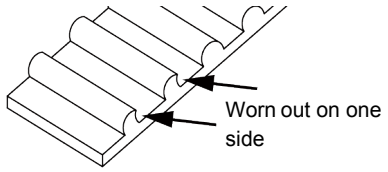
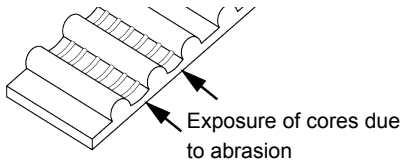
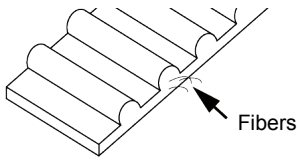
⚠CAUTION When the timing belt has to be removed for repair or some other reason, measure the tension before removing the belt. When the belt is reinstalled, the tension must be the same as the one measured before removal. Otherwise, the life of the belt and the relevant parts may be shortened.

4.6.1 Timing belt replacement period

The timing belt life is greatly affected by the robot working conditions, so a set time cannot be given. However, if the following symptoms occur, replace the belt.

1) The belt tension value becomes less than the guideline value.
2) A position mismatch or gear teeth skipping occurs.
3) The belt is damaged as shown in the following table.

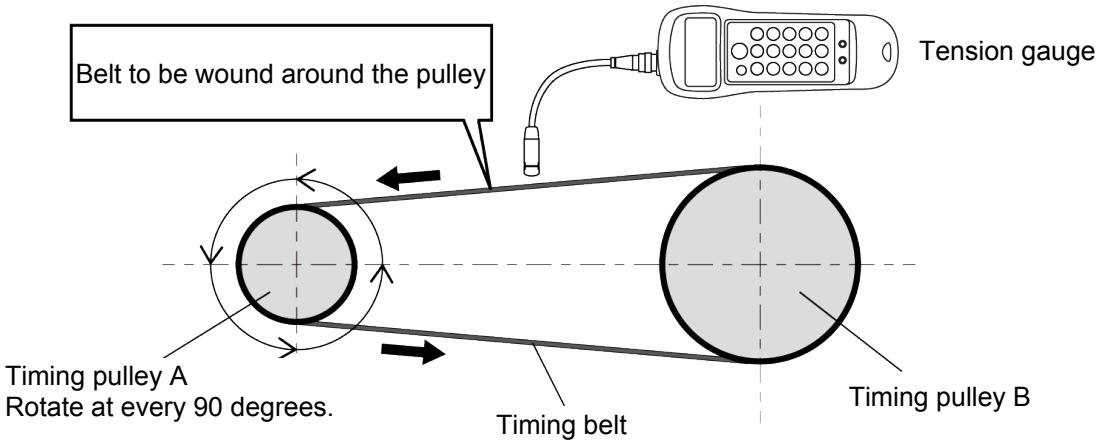
Typical damage conditions of the timing belt

Damage condition	Appearance	Cause
Gear tooth crack		Overload
Backside crack		Deterioration of rubber due heat to or ozone
Worn teeth		Overload Excessive or insufficient tension
Tooth bottom abrasion and exposure of cores		Excessive tension
The following is not belt damage.		
Fibers coming out of the side of the belt		Manufacturing related factor. This is not belt damage.

⚠CAUTION Due to the manufacturing of the timing belt, initial wear will occur. Wear chips may accumulate in the cover after approx. 300 hr of operating the robot, but this is not a fault. When the belt is replaced, the machine system origin may deviate. After the replacement, ensure to reset the origin.

4.6.2 Timing belt tension measurement

Rotate the timing pulley A to one direction while visually checking its position, and measure the belt tension every 90 degrees, four times in total. The average of the four measurements is used as the timing belt tension value.
The timing belt must be pulled tight before the tension is measured. For this purpose, rotate timing pulley A 90 degrees before measurement. Measure the tension of the belt to be pulled by the movement of timing pulley A.
When the temperature of the robot arm is high, the timing belt tension is increased. To ensure reliability of the measurement, take measurements at least 30 minutes after the robot stops its movement.
Low ambient temperature may make accurate measurements using a tension gauge impossible. In this case, perform the automatic operation or jog operation at measuring target axis for a few minutes, then measure the tension of the belt.



[Timing belt tension measurement procedure]

1) Turn on the controller's power supply.
2) Rotate the timing pulley A to one direction in jog operation while visually checking its position, and measure the belt tension at every 90 degrees, four times in total (for one turn of the timing pulley A).
   (Reference: Amount of movement of each axis when the timing pulley A is rotated 90 degrees "4.6.4 Amount of movement of each axis during the timing belt tension measurement")
3) Take an average of the four measurements to determine the timing belt tension value.
   During inspection of the timing belt, check that the belt tension exceeds the replacement guideline value in "4.6.3 Timing belt tension". When the belt tension value becomes less than the guideline value, the belt must be replaced immediately.

4.6.3 Timing belt tension

The following table shows the preset values of the sonic belt tension gauge, the tension value for new belt installation, and the tension value as the replacement guideline.

a) Belt tension (RV-FR series)

Axis	Belt type	Preset value			Tension for new belt installation (N)	Replacement guideline tension (N)
		M (g/m)	W (mm/R)	S (mm)		
RV-2FR series						
J1	210-3GT-6	2.5	6	61	26 to 32	15
J2	324-3GT-6	2.5	6	88	26 to 32	15
J3	303-3GT-6	2.5	6	103	26 to 32	15
J4	186-3GT-4	2.5	4	52	18 to 22	10
J5	336-3GT-4	2.5	4	131	18 to 22	10
J5 (brake)	174-3GT-4	2.5	4	42	- Note1)	10
J6	345-3GT-4	2.5	4	131	18 to 22	10
J6 (brake)	174-3GT-4	2.5	4	42	- Note1)	10
RV-2FRL series						
J1	210-3GT-6	2.5	6	61	26 to 32	15
J2	324-3GT-6	2.5	6	88	26 to 32	15
J3	324-3GT-6	2.5	6	106	26 to 32	15
J4	186-3GT-4	2.5	4	52	18 to 22	10
J5	336-3GT-4	2.5	4	131	18 to 22	10
J5 (brake)	174-3GT-4	2.5	4	42	- Note1)	10
J6	345-3GT-4	2.5	4	131	18 to 22	10
J6 (brake)	174-3GT-4	2.5	4	42	- Note1)	10
RV-4FR series						
J1	315-EV3GT-12	2.5	12	85.5	79.7 to 97.4	30
J3	369-EV3GT-6	2.5	6	118.4	39.2 to 47.9	15
J4 Note2)	240-EV3GT-6	2.5	6	56.4	39.2 to 47.9	15
J5	393-EV3GT-4	2.5	4	149.8	27.0 to 33.0	10
J6	270-EV3GT-4	2.5	4	96.0	27.0 to 33.0	10
RV-7FR series						
J1	405-EV5GT-20	4.0	20	107.5	96 to 118	70
J3	501-3GT-9	2.5	9	178.5	59.4 to 72.6	22
J4	237-EV3GT-6	2.5	6	54.9	39.2 to 47.9	15
J5	408-EV3GT-6	2.5	6	150.0	39.2 to 47.9	15
J6	270-EV3GT-4	2.5	4	96.0	27.0 to 33.0	10
RV-7FRLL						
J4	252-EV3GT-9	2.5	9	60.0	59.4 to 72.6	22
J5	408-EV3GT-6	2.5	6	150.0	39.2 to 47.9	15
J6	270-EV3GT-4	2.5	4	96.0	27.0 to 33.0	10

Axis	Belt type	Preset value			Tension for new belt installation (N)	Replacement guideline tension (N)
		M (g/m)	W (mm/R)	S (mm)		
RV-13FR/13FRL, RV-20FR series						
J4	252-EV3GT-9	2.5	9	60.0	59.4 to 72.6	22
J5	495-EV3GT-9	2.5	9	181.0	59.4 to 72.6	22
J6	330-EV3GT-6	2.5	6	111.0	39.2 to 47.9	15

Note1) The tension of the brake timing belt is automatically adjusted by work of spring installed on the motor plate.
Note2) RV-4FRJL (5-axis type robot) has no J4 axis.

b) Belt tension (RH-FRH, RH-FH series)

Axis	Belt type	Preset value			Tension for new belt installation (N)	Replacement guideline tension (N)
		M (g/m)	W (mm/R)	S (mm)		
RH-3FRH, RH-3FH series						
J3	309-EV3GT-6	2.5	6	96	39 to 48	15
J4 (motor side)	336-EV3GT-6	2.5	6	64	39 to 48	15
J4 (shaft side)	282-EV3GT-12	2.5	12	74	80 to 97	30
RH-6FRH, RH-6FH series						
J3	264-EV3GT-9	2.5	9	82	59 to 79	22
J4 (motor side)	315-EV3GT-6	2.5	6	64	39 to 48	15
J4 (shaft side)	363-EV3GT-12	2.5	12	95	80 to 97	30
RH-12FRH, RH-12FH series						
J3	288-EV3GT-12	2.5	12	71	83 to 101	30
J4 (motor side)	417-EV3GT-9	2.5	9	99	60 to 73	22
J4 (shaft side)	456-EV3GT-20	2.5	20	121	138 to 151	49
RH-20FRH series, RH-20FH series						
J3	303-EV3GT-12	2.5	12	71	83 to 101	30
J4 (motor side)	417-EV3GT-9	2.5	9	99	60 to 73	22
J4 (shaft side)	456-EV3GT-20	2.5	20	121	138 to 151	49

c) Belt tension (RH-3FRHR, RH-3FHR series) (Hanging type)

Axis	Belt type	Preset value			Tension for new belt installation (N)	Replacement guideline tension (N)
		M (g/m)	W (mm/R)	S (mm)		
RH-3FRHR, RH-3FHR series (Hanging type)						
J1	340-5GT-20	4.0	20	84	171 to 209	69
J2	363-3GT-12	2.5	12	103	80 to 97	30
J3	297-3GT-9	2.5	9.0	77	31.1 to 38	22
J4 (motor side)	345-3GT-6	2.5	6.0	69	39.8 to 45.4	15
J4 (shaft side)	312-3GT-12	2.5	12	82	43.6 to 52.8	30

4.6.4 Amount of movement of each axis during the timing belt tension measurement

The following tables shows the amount of movement of each axis when the timing pulley A is rotated 90 degrees.

a) Amount of movement of each axis during the tension measurement (RV-FR series)

Model	Amount of movement					
	J1 axis	J2 axis	J3 axis	J4 axis	J5 axis	J6 axis
RV-2FR series	0.8°	0.4°	0.8°	1.1°	1.1°	1.8°
RV-4FR series	1.1°	0.9°	0.6°	1.4 Note1)	1.6°	1.8°
RV-7FR	1.1°	1.1°	1.1°	0.8°	1.1°	1.8°
RV-7FRL	0.9°	0.9°	0.9°	0.8°	1.1°	1.8°
RV-7FRLL	-	-	-	1.9°	1.1°	1.8°
RV-13FR/13FRL	-	-	-	0.9°	0.9°	1.8°
RV-20FR series	-	-	-	0.6°	0.6°	1.8°

Note1) RV-4FRJL, RV-4FJL (5-axis type robot) has no J4 axis.

b) Amount of movement of each axis during the tension measurement (RH-FRH, RH-FH series)

Model	Amount of movement				
	J1 axis	J2 axis	J3 axis	J4 axis (Timing belt A)	J4 axis (Timing belt B)
RH-3FRH, RH-3FH series	-	-	4 mm	8.4°	36.0°
RH-6FRH, RH-6FH series	-	-	6.3 mm	6.2°	24.1°
RH-12FRH, RH-12FH series	-	-	6 mm	6.0°	25.5°

c) Amount of movement of each axis during the tension measurement (RH-3FRHR, RH-3FHR series (Hanging type))

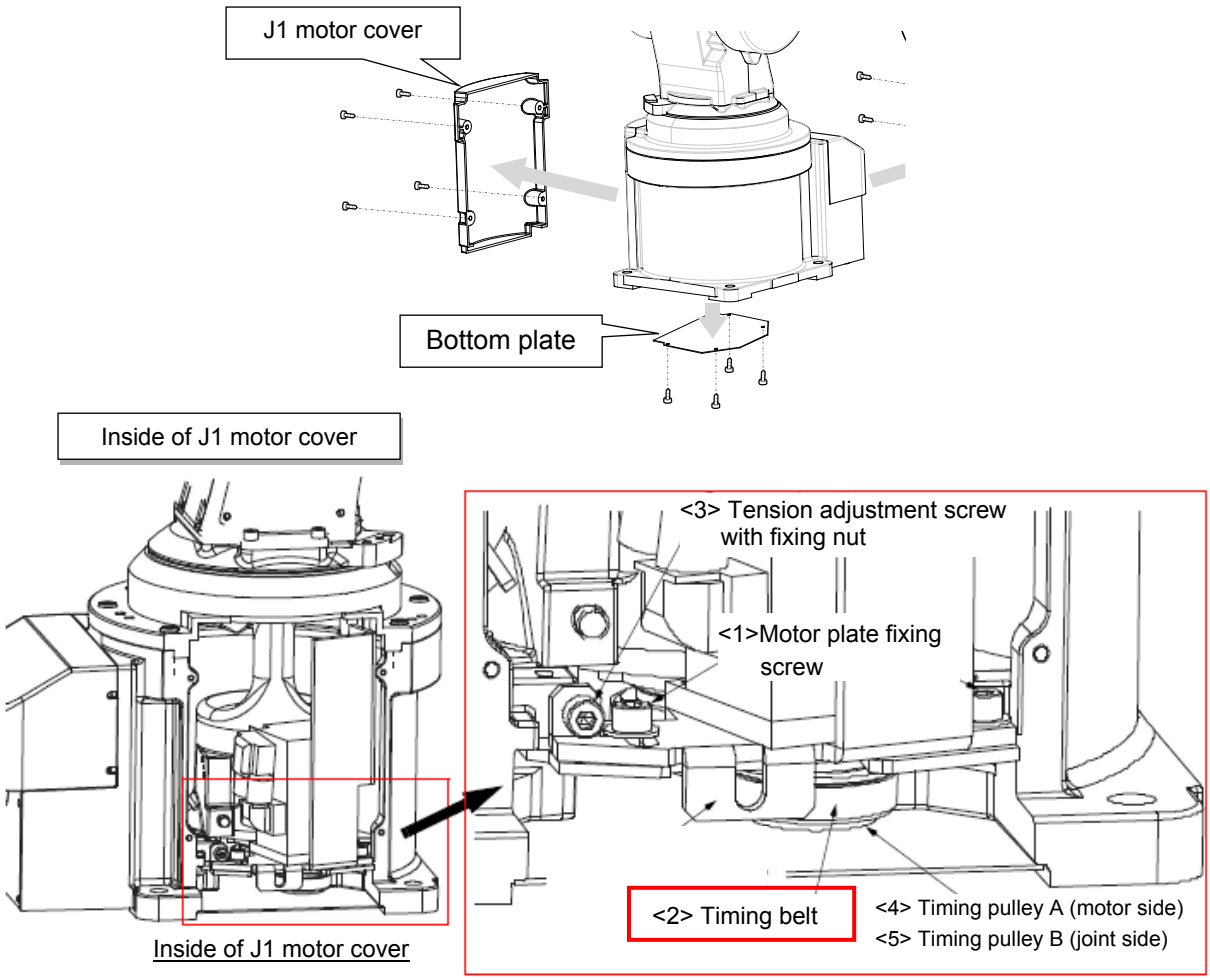
Model	Amount of movement				
	J1 axis	J2 axis	J3 axis	J4 axis (Timing belt A)	J4 axis (Timing belt B)
RH-3FRHR, RH-3FHR series (Hanging type)	1.8°	1.8°	4 mm	8.4°	36.0°

<< MEMO >> * Please use this page for your memo.

4.6.5 Inspection replacement of timing belt

(1) RV-2FR, RV-2F series

(a) J1-axis timing belt



■Inspecting the J1 axis timing belt

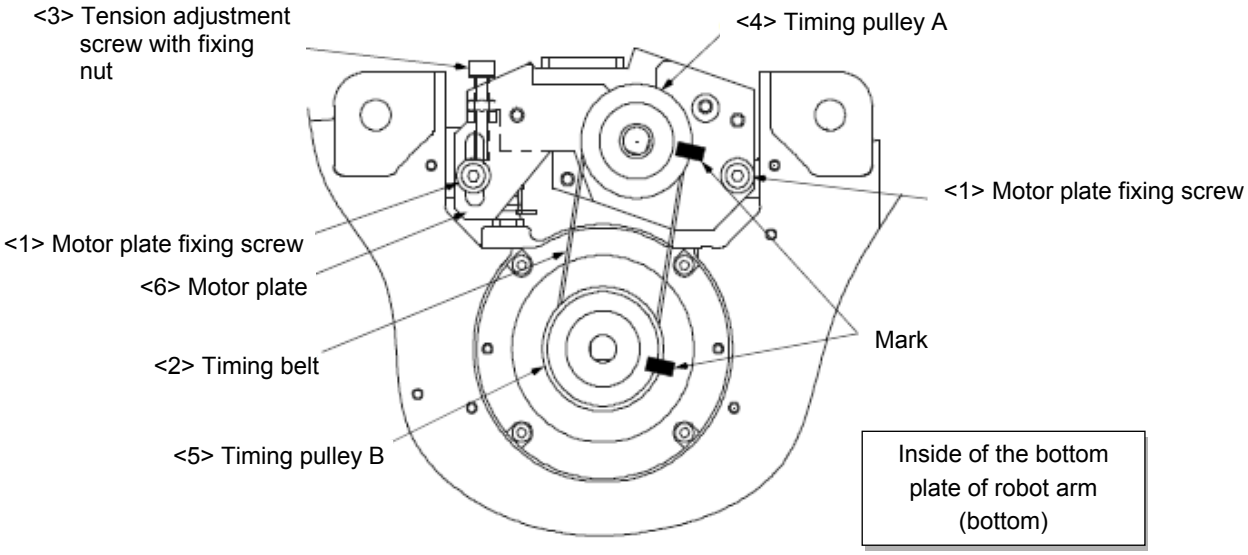
RV-2FR, RV-2F series: Inspection of J1-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the J1 motor cover.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the J1 motor cover securely as before and finish inspection.

■Replacing the J1 axis timing belt

Timing belt replacement of the J1 axis removes the bottom plate in the robot-arm bottom, and replace the belt from the robot's bottom. For this reason, it is necessary to remove the robot arm from the installation surface and to place it sideways. Remove the machine cable or piping, etc. corresponding to the usage condition, and put the robot on the floor sideways.

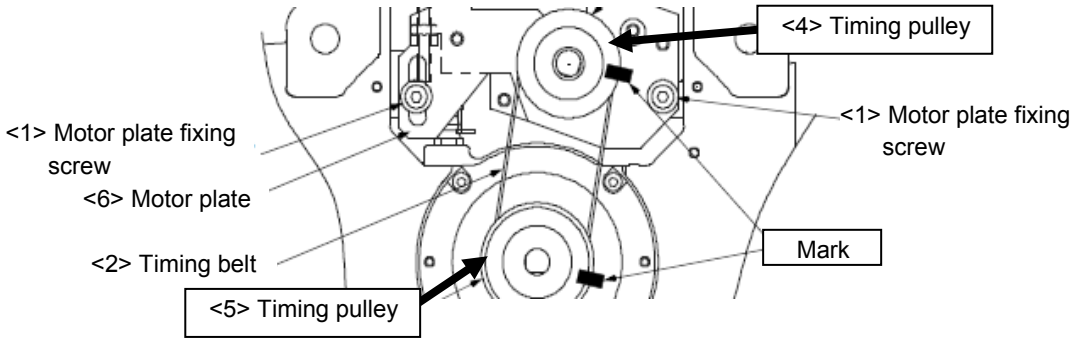
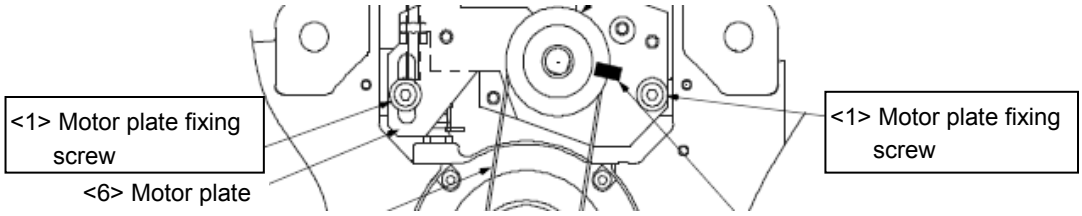
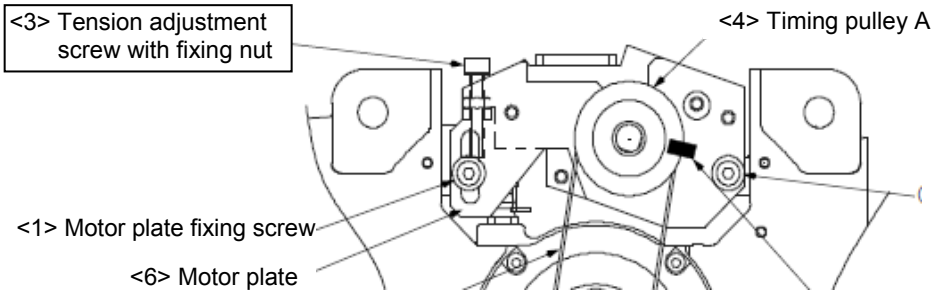
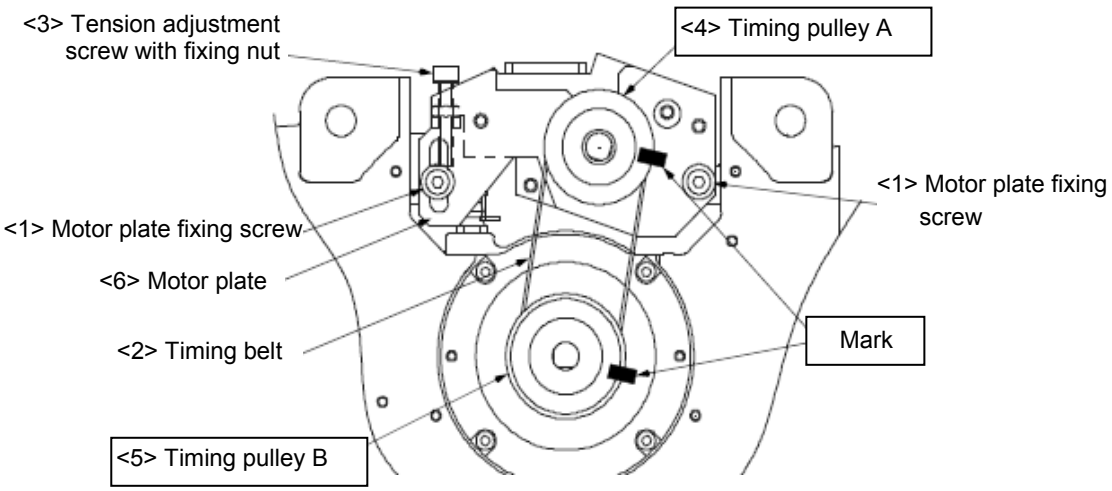
⚠CAUTION Perform the following items when removing and laying the robot arm so as not to damage the resin cover.

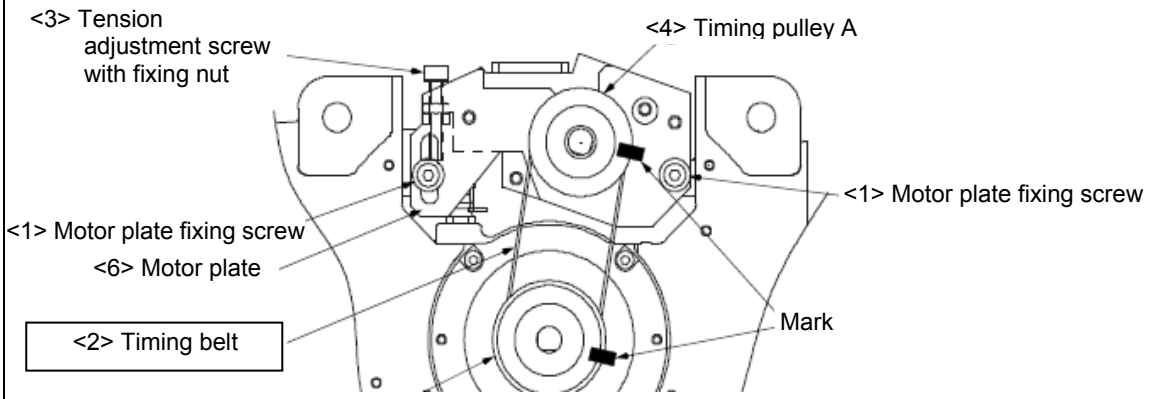
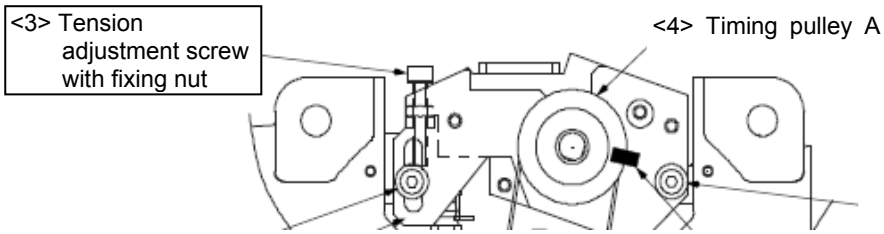
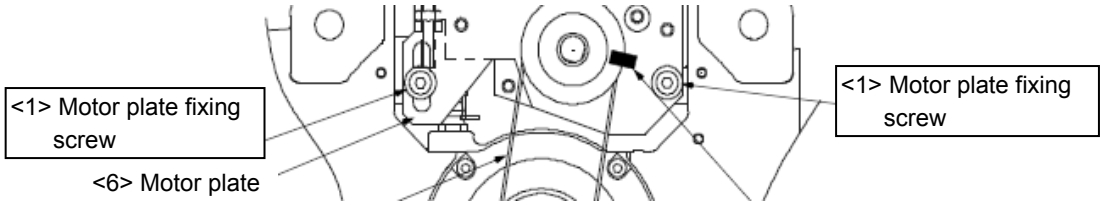
- Lay the robot arm so that the J1 motor cover faces upward.
- To turn the No.1 arm cover upward, turn the J1 axis to the front with the jog operation beforehand. (Joint angle is approximately 0 degree.)
- Do not hold the resin cover when transporting and holding the robot arm.
- Topple the robot arm slowly so that a shock may not be given.



[Note] Make sure that the pulleys do not move while replacing the belt.
If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-2FR, RV-2F series: Replacement of J1-axis timing belt	
1	Turn the J1 axis to the front using jog operation beforehand. (joint angle is near 0 degrees)
2	Turn off the robot controller.
3	Remove the machine cable or piping, etc. corresponding to the usage condition.
4	Place the robot on the floor sideways. (Turn J1 motor cover upward, and place sideways slowly so that a shock may not be given to the robot arm.)
5	Remove the J1 motor cover and the bottom plate. (Refer to "4.5 Installing/removing the cover".)

RV-2FR, RV-2F series: Replacement of J1-axis timing belt	
6	Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in following figure so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate. 
7	Lightly loosen the motor plate fixing screw <1>. (two pc.) (Do not loosen too much.) 
8	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
9	Copy the marks onto the new timing belt. (Make sure that both belts are tense when making the marks.)
10	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-2FR, RV-2F series: Replacement of J1-axis timing belt	
11	Turn the tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) (Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension".) 
12	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
13	Moreover, also fasten two motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 N·m). Note4) 
14	Install the J1 motor cover and the bottom plate securely as before and finish adjustment.
15	Reinstall the robot arm just as before.
16	Reset the origin position. (Refer to "5 Resetting the Origin".)
17	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

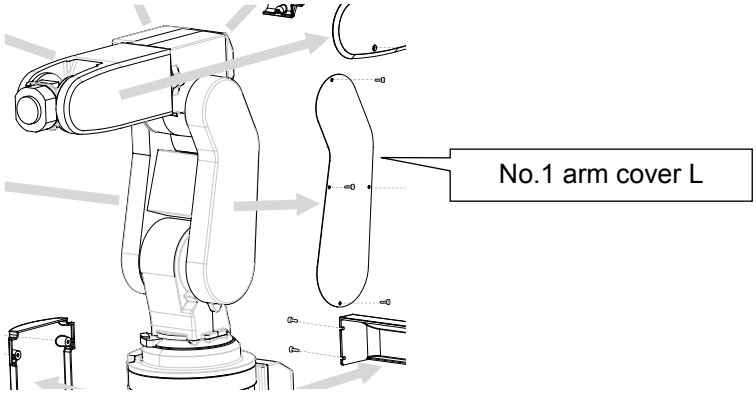
Note2) Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

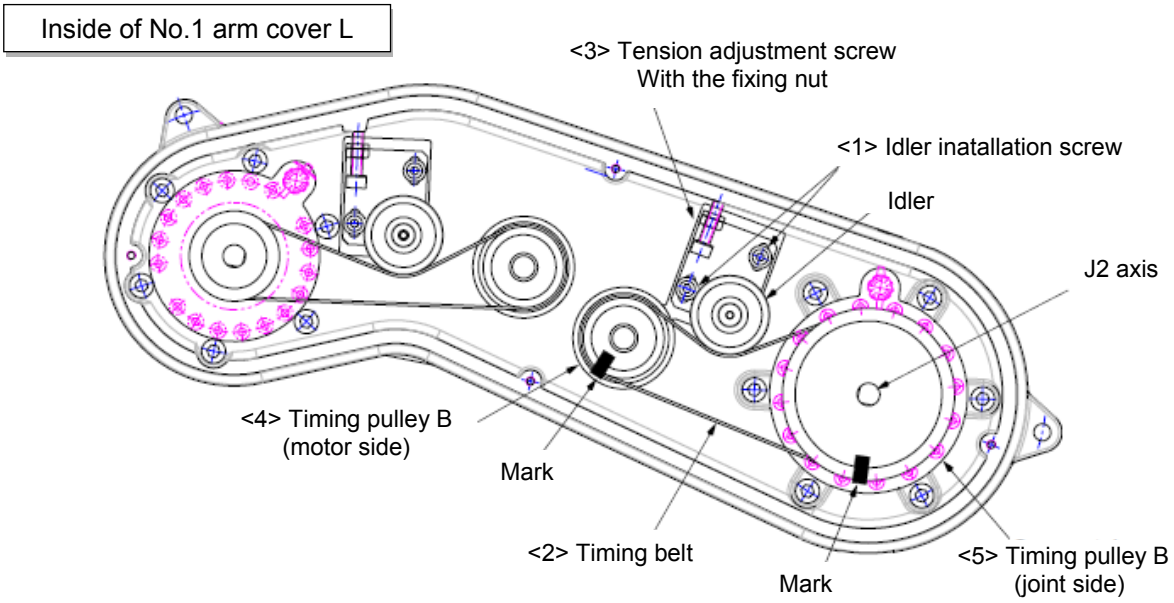
Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

Note4) Improper tightening can cause the belt to loosen with vibration.

Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(b) J2-axis timing belt



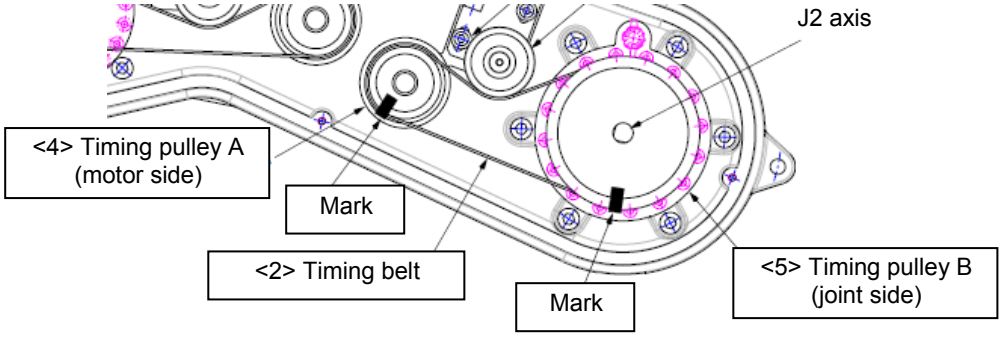
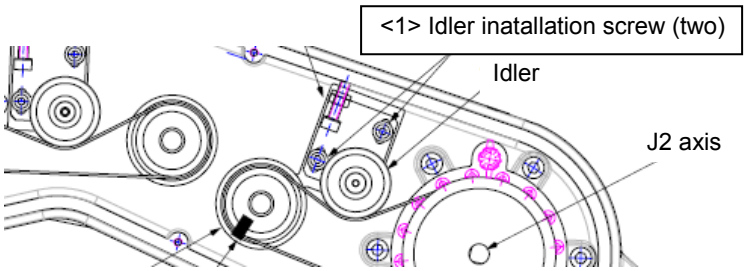
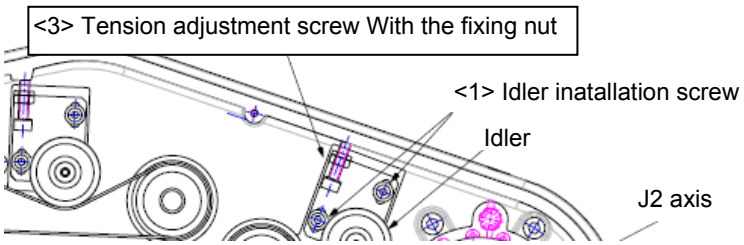
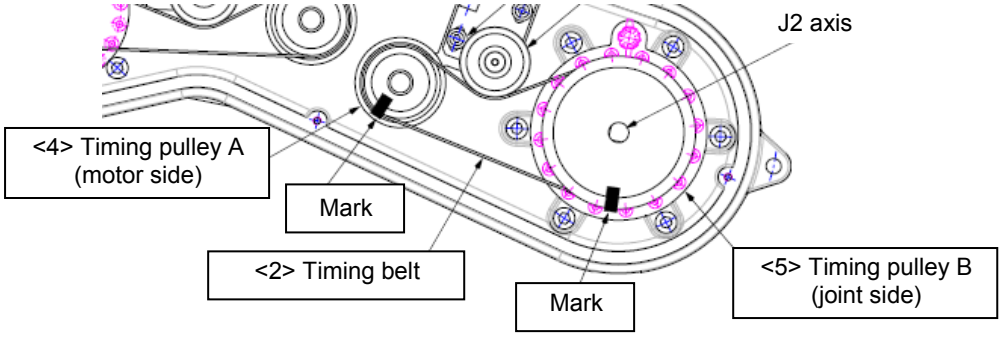


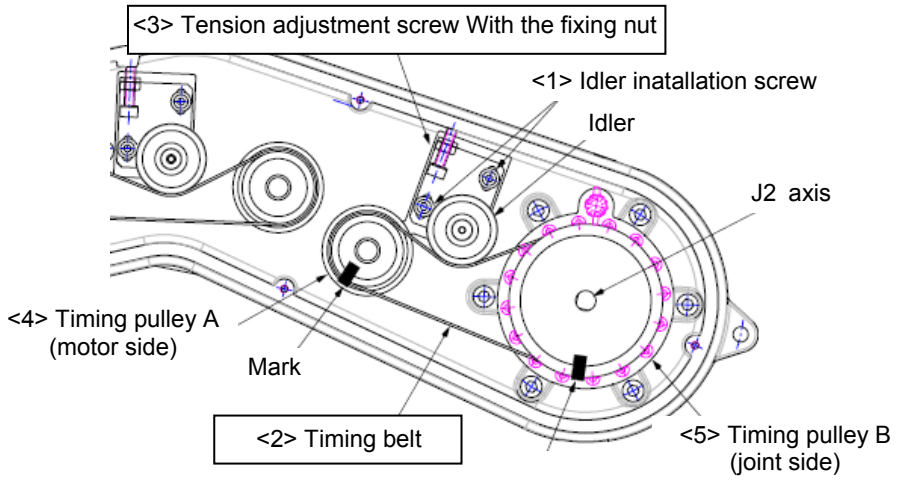
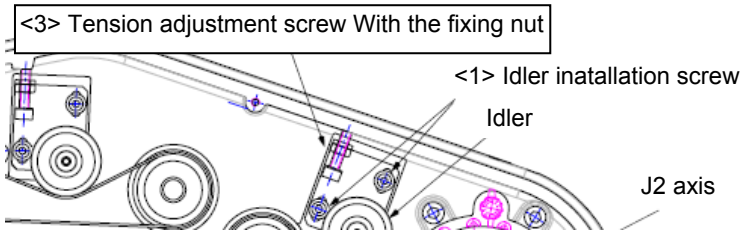
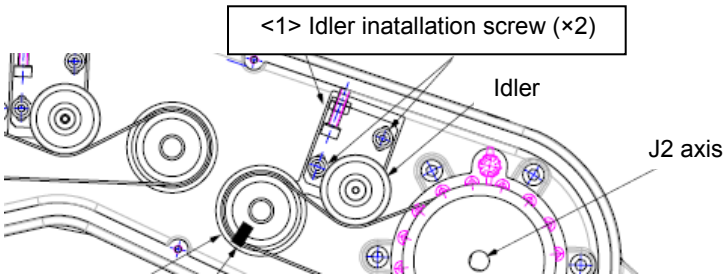
■Inspecting the J2 axis timing belt

RV-2FR, RV-2F series: Inspection of J2-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 1 arm cover L.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 1 arm cover L securely as before and finish inspection.

■Replacing the J2 axis timing belt

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-2FR, RV-2F series: Replacement of J2-axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 1 arm cover L.
2	Make marks on the timing belt <2> and timing pulleys A <4> and B <5> with a felt-tip pen as shown in following figure so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate. 
3	Lightly loosen the two idler installation screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. (Make sure that both belts are tense when making the marks.)
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-2FR, RV-2F series: Replacement of J2-axis timing belt	
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) (Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension".) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten two idler installation screws <1> certainly (M3 screw: tightening torque is 1.96 N·m). Note4) 
10	Install the No. 1 arm cover L securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

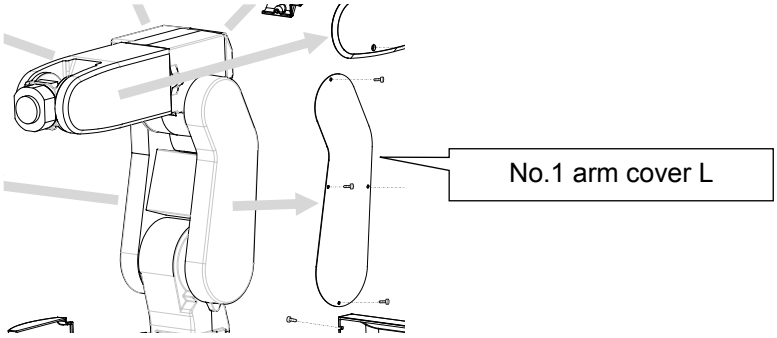
Note2) Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

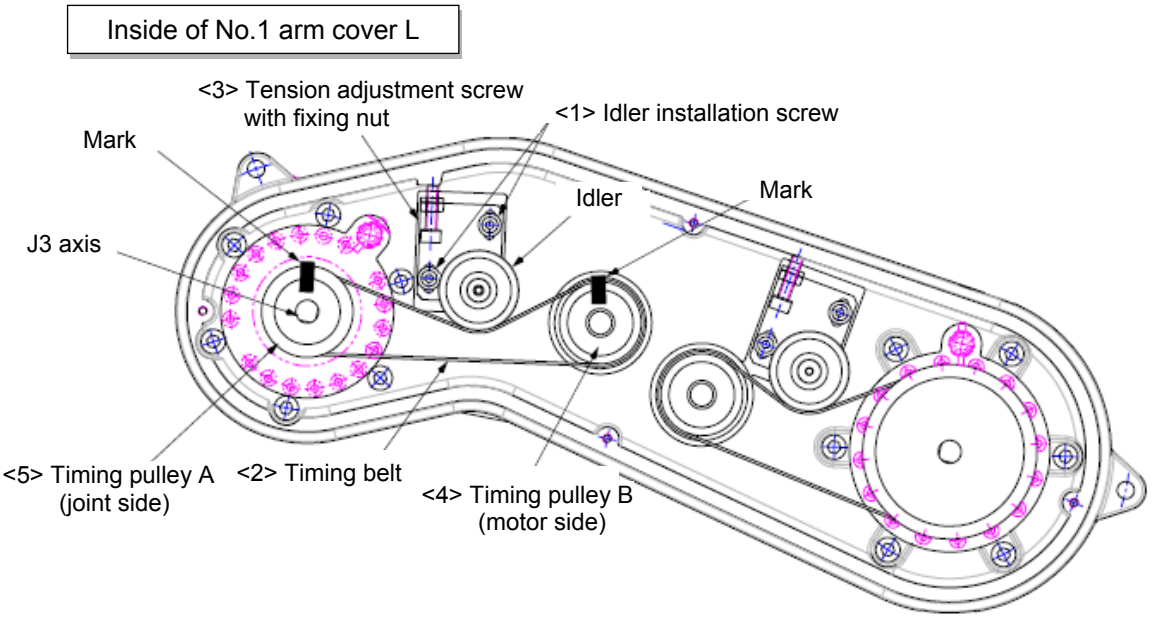
Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

Note4) Improper tightening can cause the belt to loosen with vibration.

Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(c) J3-axis timing belt





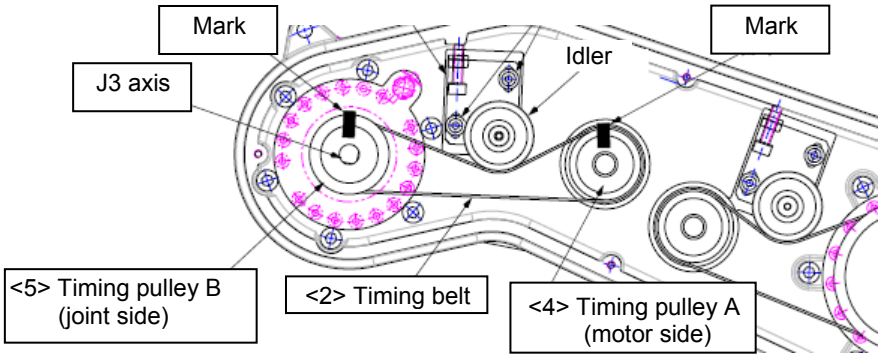
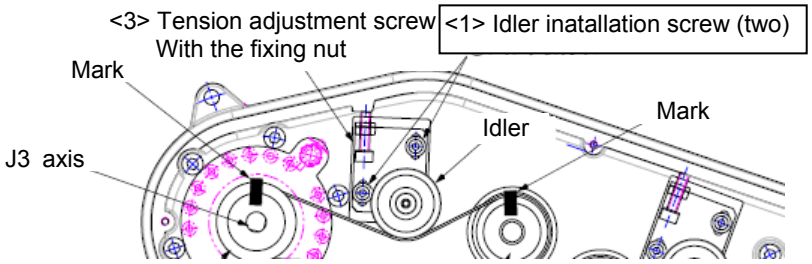
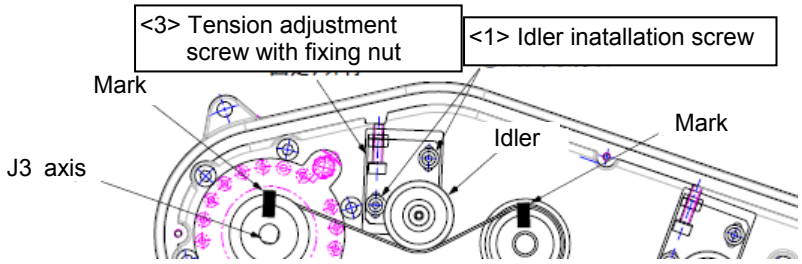
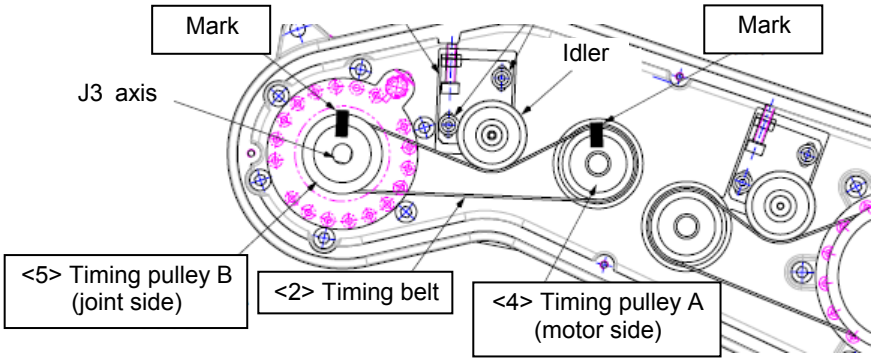
■Inspecting the J3 axis timing belt

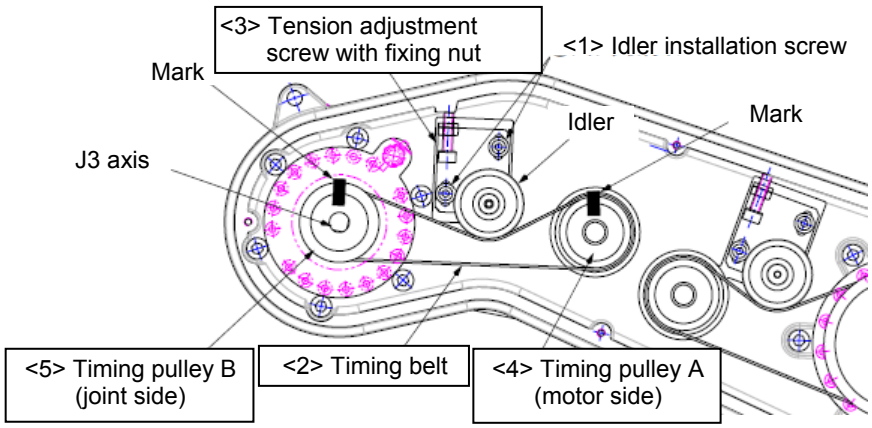
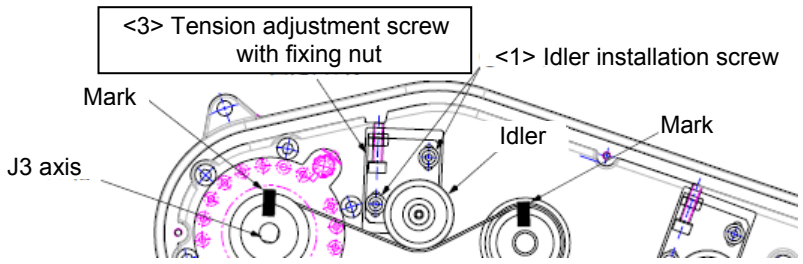
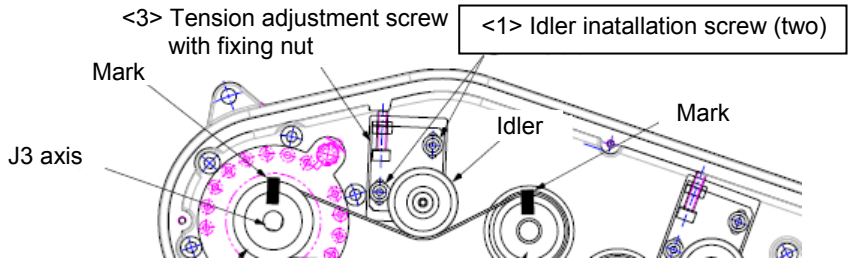
RV-2FR, RV-2F series: Inspection of J3-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 1 arm cover L.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 1 arm cover L securely as before and finish inspection.

■Replacing the J3 axis timing belt

[Note] Make sure that the pulleys do not move while replacing the belt.

If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-2FR, RV-2F series: Replacement of J3-axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 1 arm cover L.
2	Make marks on the timing belt <2> and timing pulleys A <4> and B <5> with a felt-tip pen as shown in following figure so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate. 
3	Lightly loosen the two idler installation screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. (Make sure that both belts are tense when making the marks.)
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-2FR, RV-2F series: Replacement of J3-axis timing belt	
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) (Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension".) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten two idler installation screws <1> certainly (M3 screw: tightening torque is 1.96 N·m). Note4) 
10	Install the No. 1 arm cover L securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

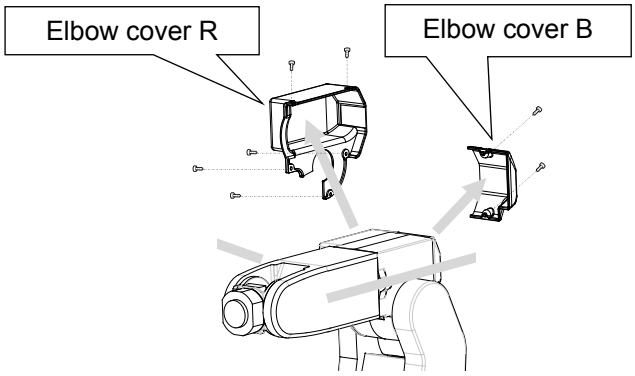
Note2) Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

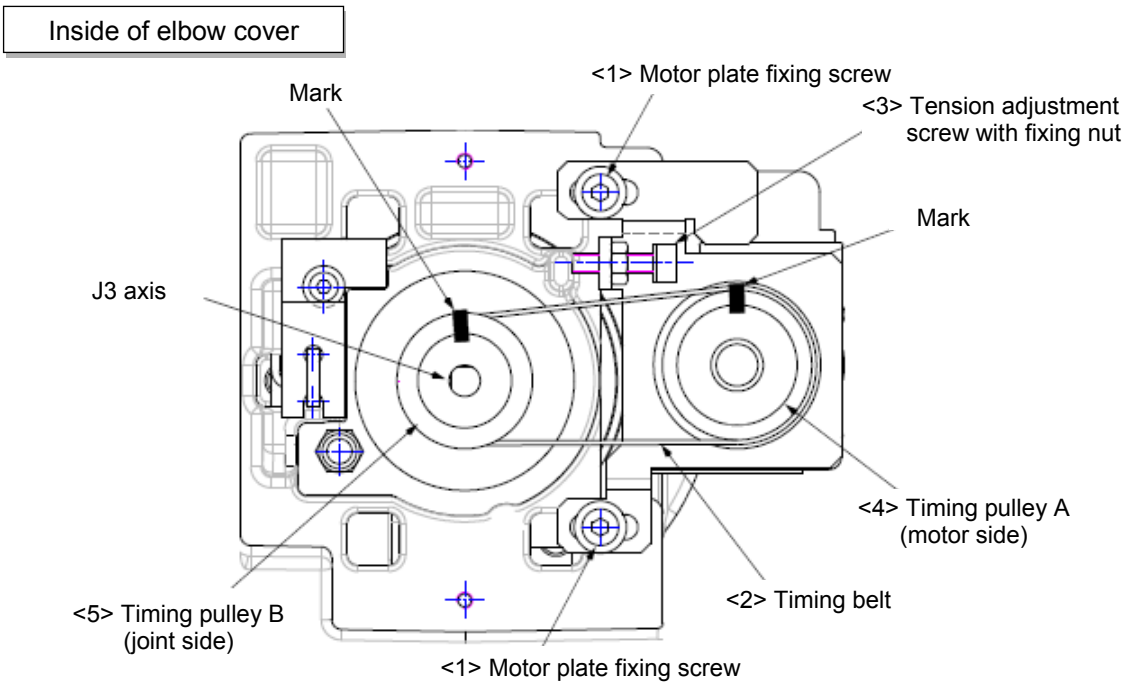
Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

Note4) Improper tightening can cause the belt to loosen with vibration.

Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(d) J4-axis timing belt



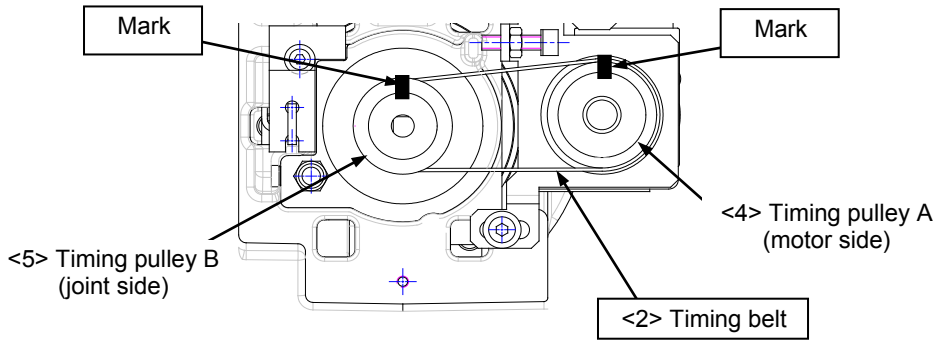
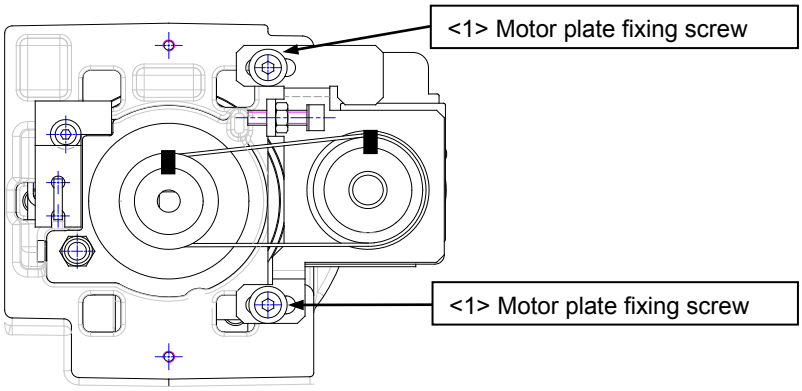
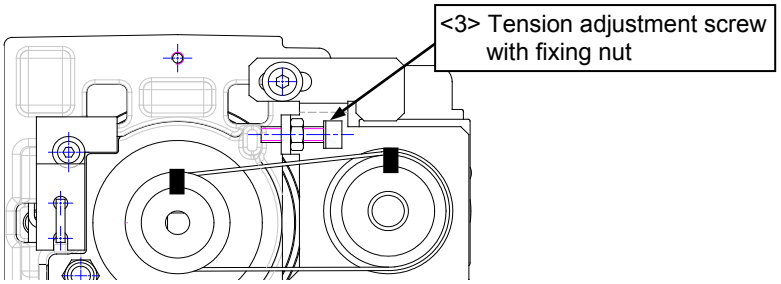
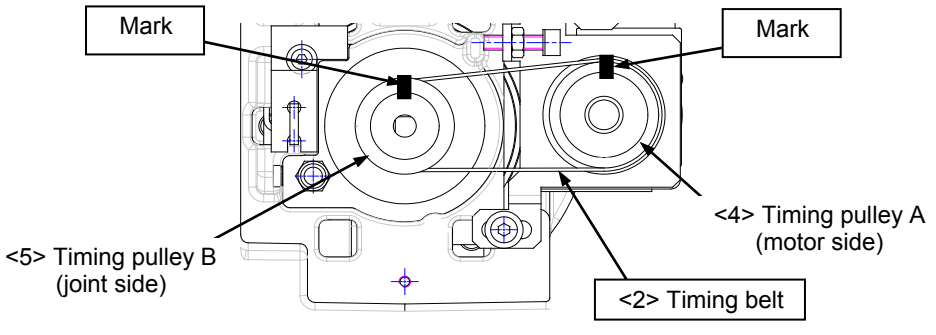


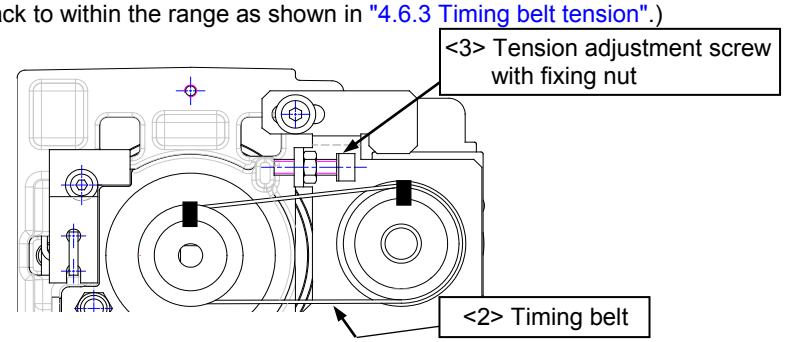
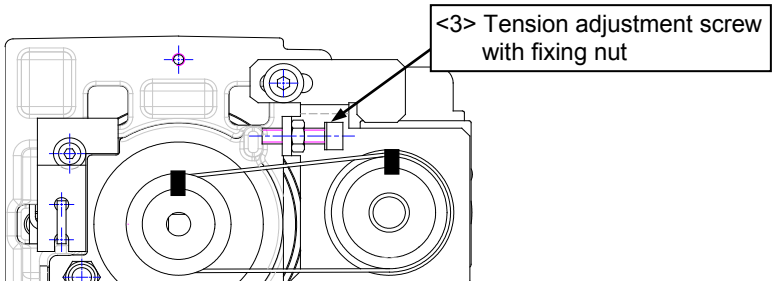
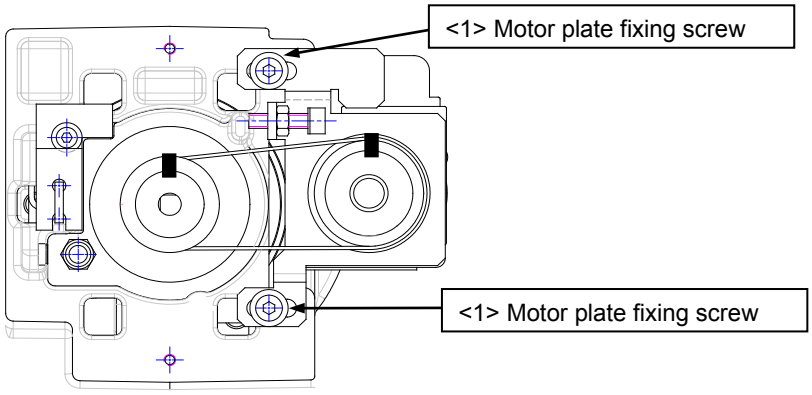
■Inspecting the J4 axis timing belt

RV-2FR, RV-2F series: Inspection of J4-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the elbow cover B and elbow cover R.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the elbow cover B and elbow cover R securely as before and finish inspection.

■Replacing the J4 axis timing belt

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-2FR, RV-2F series: Replacement of J4-axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the elbow cover B and elbow cover R.
2	Make marks on the timing belt <2> and timing pulleys A <4> and B <5> with a felt-tip pen as shown in the following figure so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate. 
3	Lightly loosen the two motor plate fixing screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. (Make sure that both belts are tense when making the marks.)
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-2FR, RV-2F series: Replacement of J4-axis timing belt	
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) (Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension".) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten two motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 N·m). Note4) 
10	Install the elbow cover B and elbow cover R securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

Note2) Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

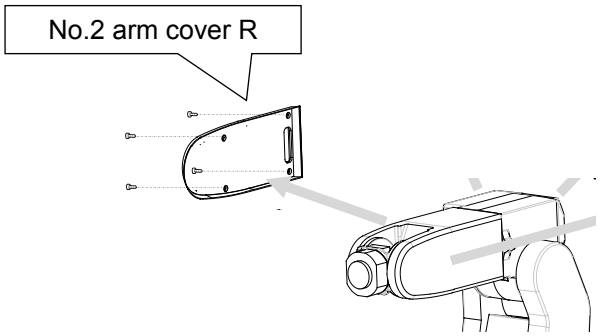
Note4) Improper tightening can cause the belt to loosen with vibration.

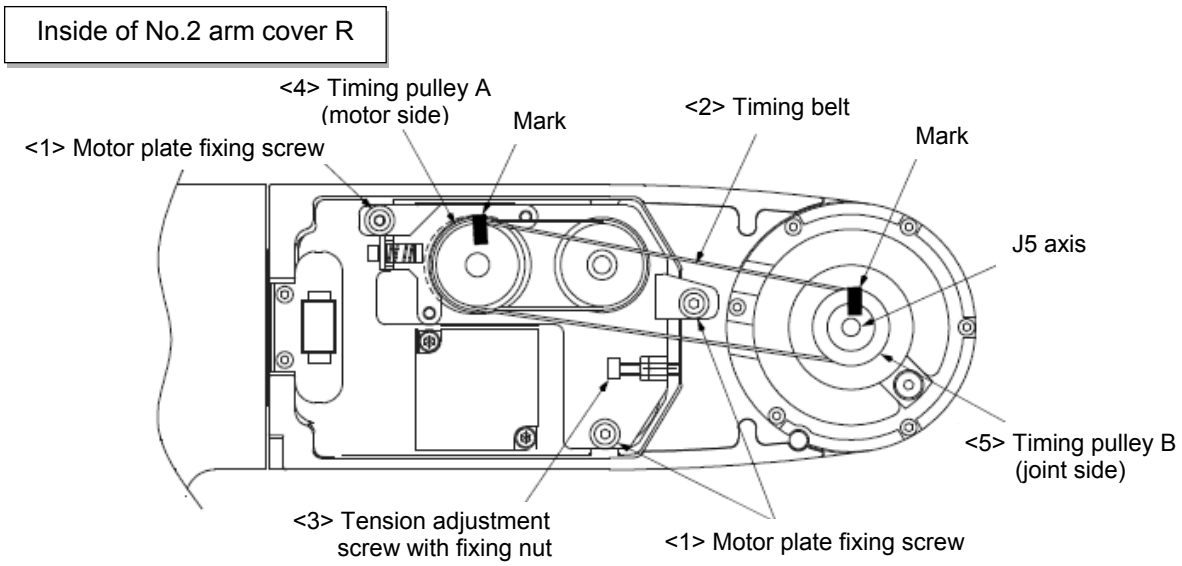
Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(e) J5 axis timing belt and brake timing belt

The J5 axis has the timing belt rotating the J5 axis and the brake timing belt conveying the brake. The inspection and replacement method of each belt is shown below.

(e-1) Inspection, maintenance and replacement of J5-axis timing belt



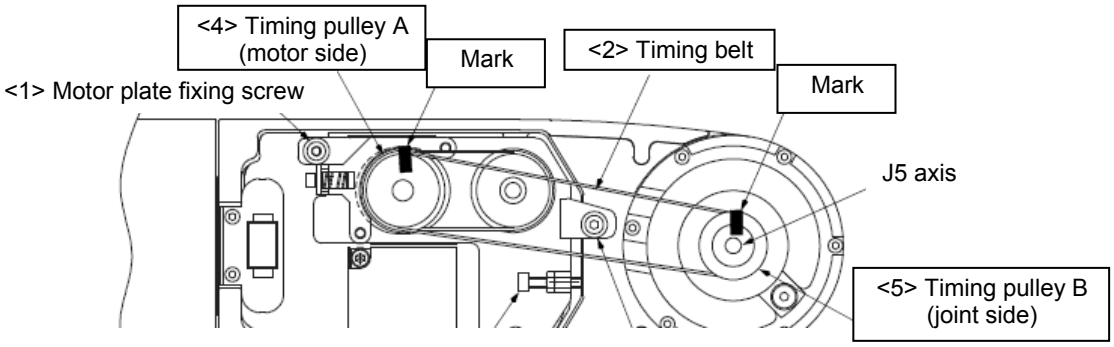
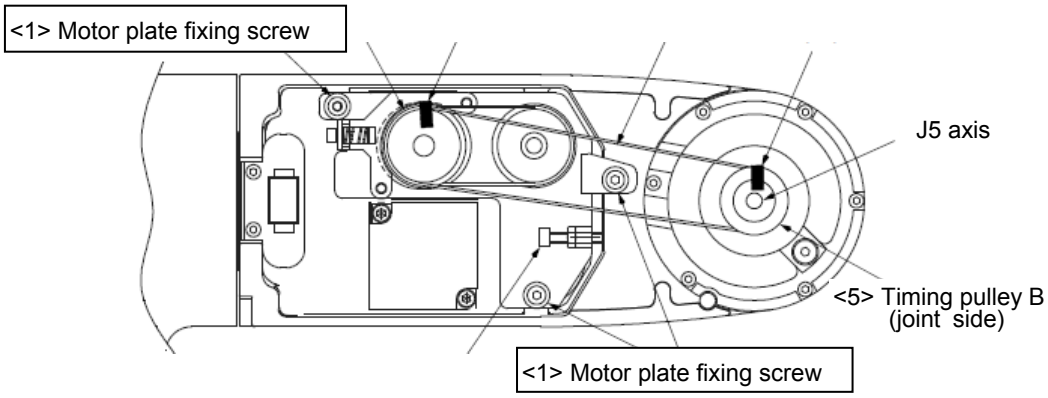
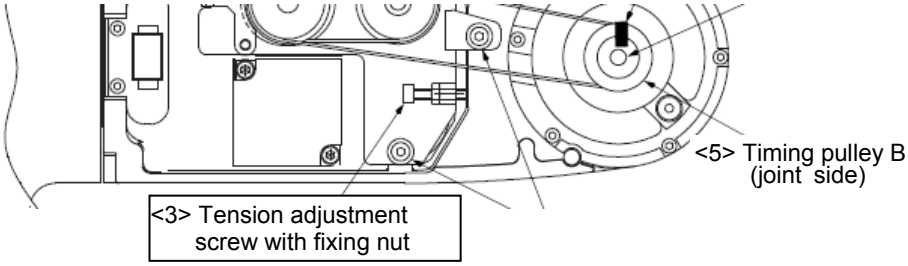
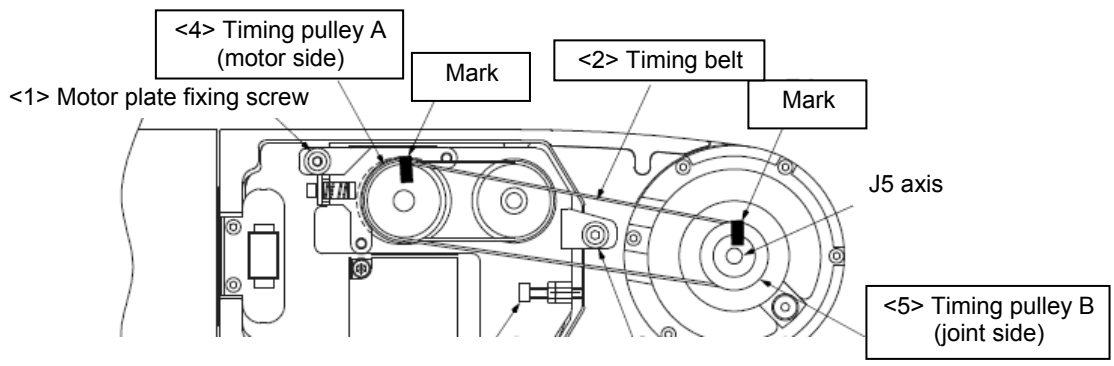


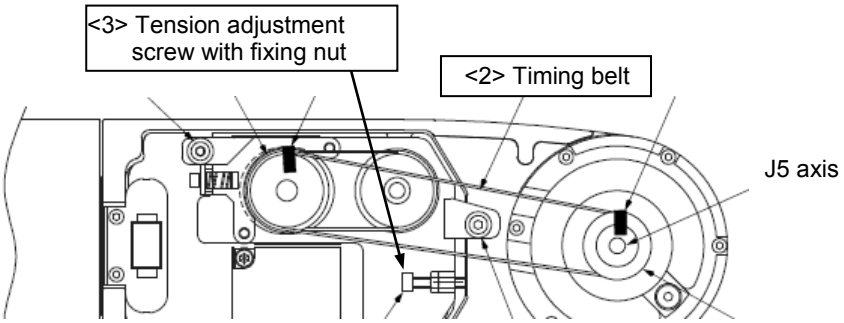
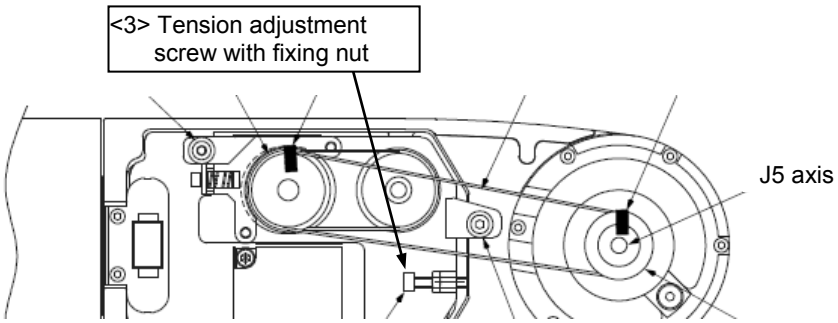
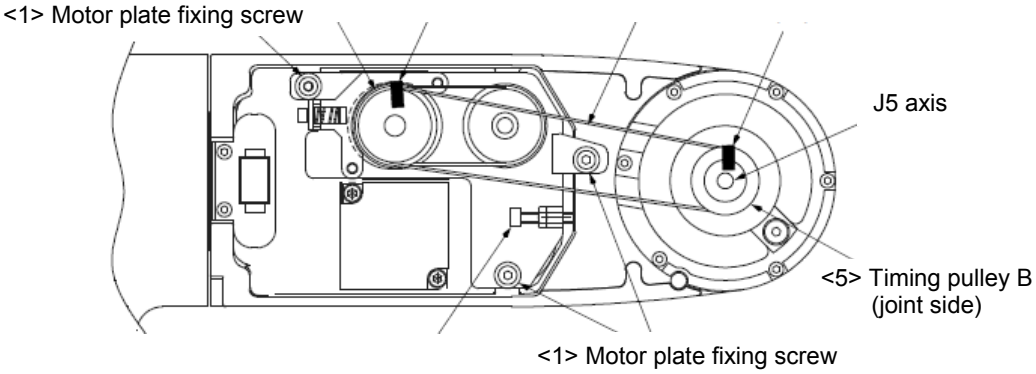
■Inspecting the J5 axis timing belt

RV-2FR, RV-2F series: Inspection of J5-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 2 arm cover R securely as before and finish inspection.

■Replacing the J5 axis timing belt

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-2FR, RV-2F series: Replacement of J5-axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R.
2	Make marks on the timing belt <2> and timing pulleys A <4> and B <5> with a felt-tip pen as shown in following figure so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate. 
3	Lightly loosen the three motor plate fixing screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. (Make sure that both belts are tense when making the marks.)
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-2FR, RV-2F series: Replacement of J5-axis timing belt	
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) (Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension".) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten the three motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 N·m). Note4) 
10	Install the No. 2 arm cover R securely as before and finish inspection.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

Note2) Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

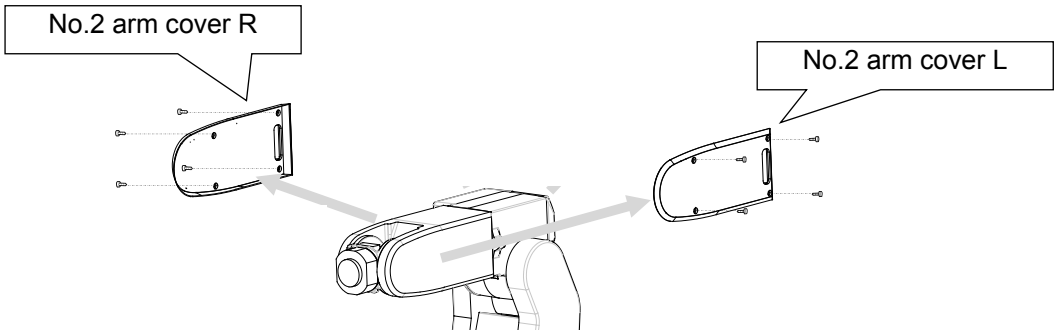
Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

Note4) Improper tightening can cause the belt to loosen with vibration.

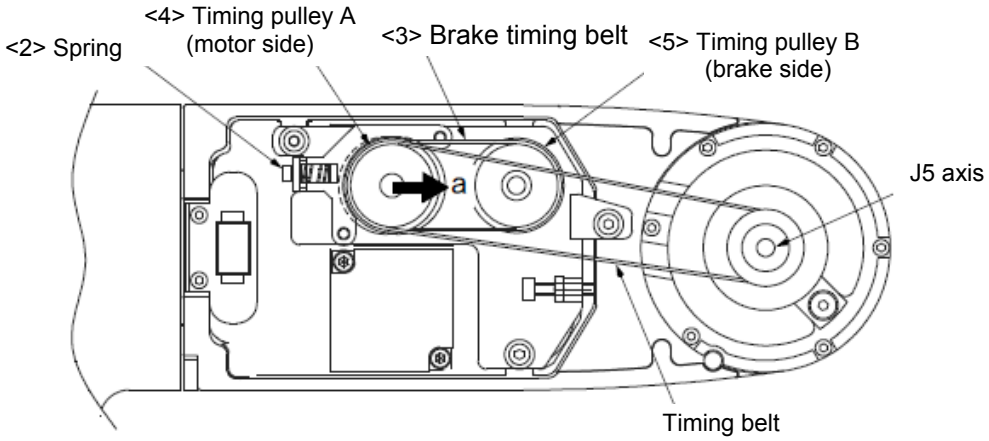
Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(e-2) Inspection and replacement of J5 axis brake timing belt

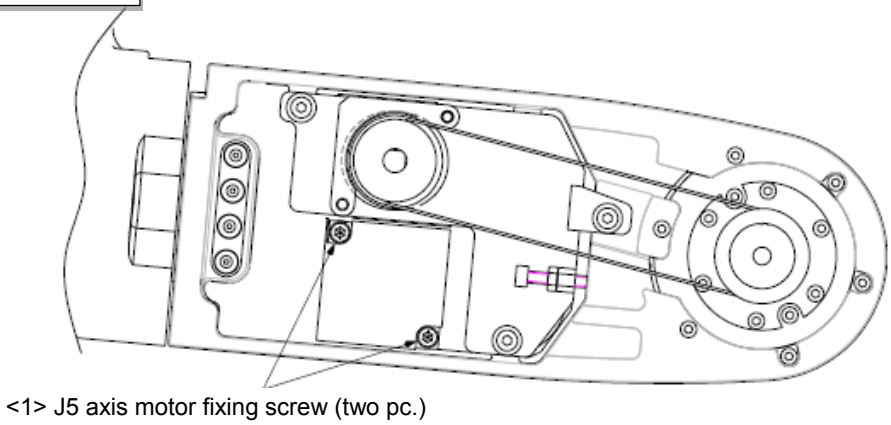
To replace the J5 axis brake timing belt, remove the J5 axis timing belt. Measure the tension before removing the J5 axis timing belt, and reinstall the belt so that the tension must be the same as the one measured before removal.



Inside of No.2 arm cover R



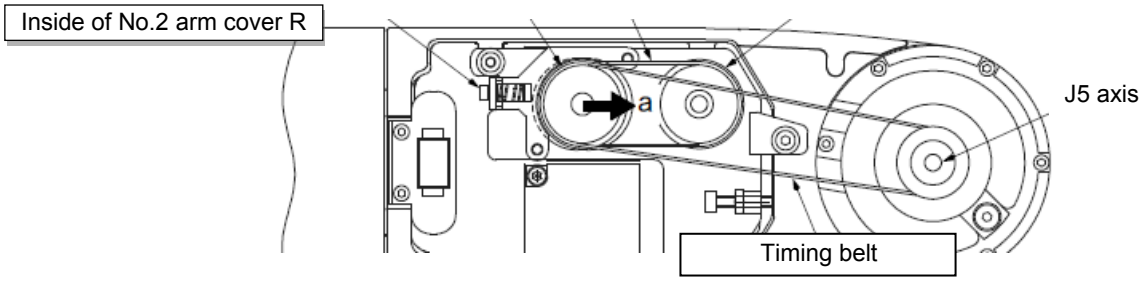
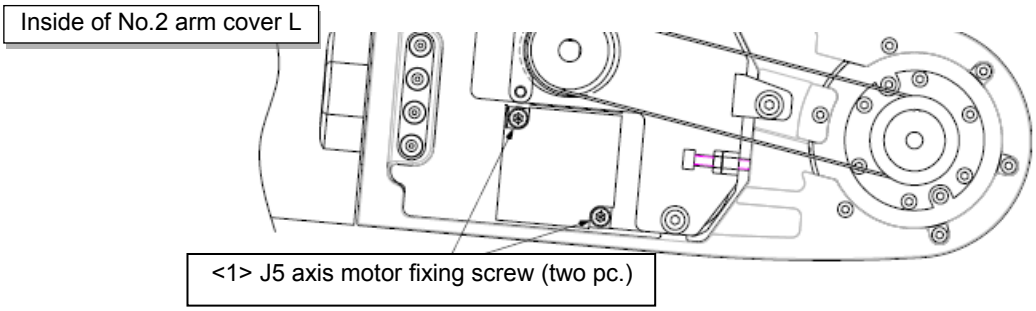
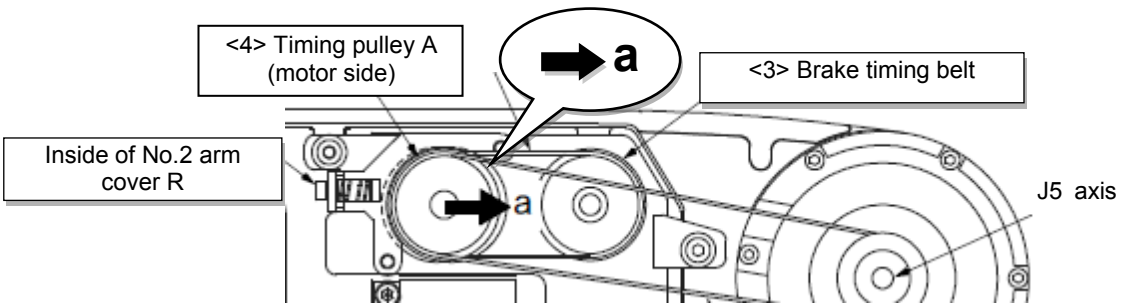
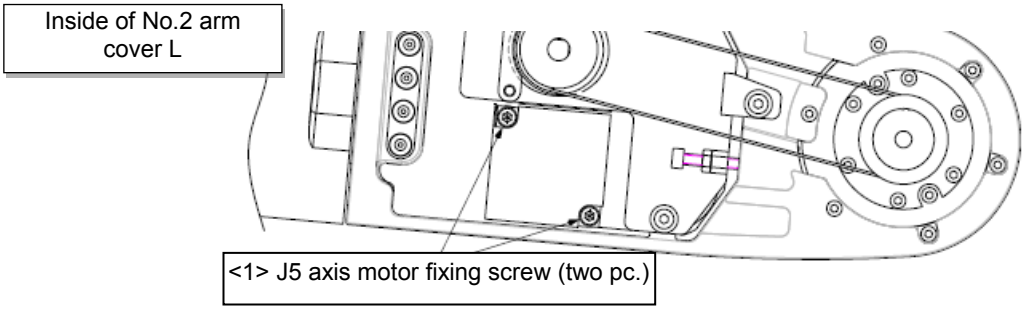
Inside of No.2 arm cover L



■Inspecting the J5 axis brake timing belt

RV-2FR, RV-2F series: Inspection of J5-axis brake timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R and L.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 2 arm cover R and L securely as before and finish inspection.

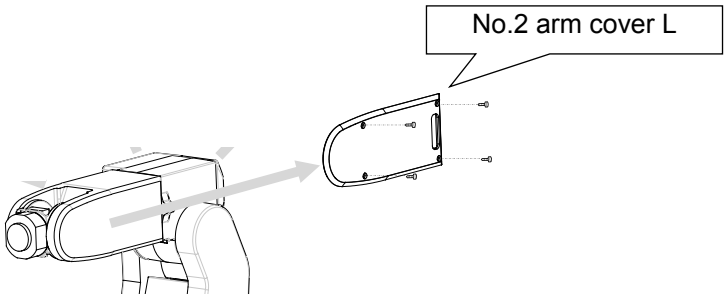
■Replacing the J5 axis brake timing belt

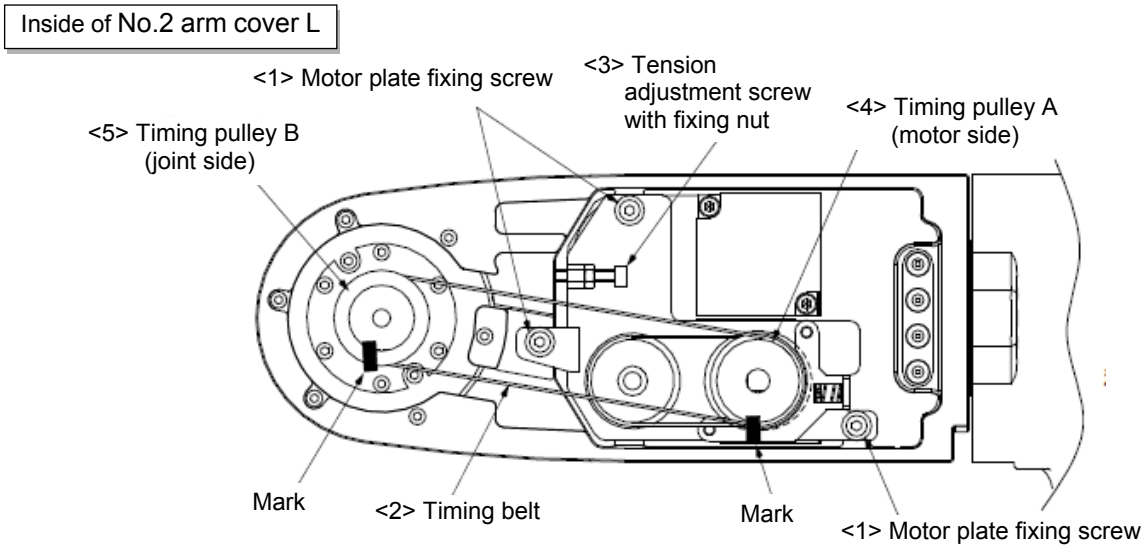
RV-2FR, RV-2F series: Replacement of J5-axis brake timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R and L.
2	Remove J5 axis timing belt with referring to "(e-1) Inspection, maintenance and replacement the J5 axis timing belt". 
3	Loosen the two motor fixing screws <1>. (Do not loosen too much.) 
4	Move motor side timing belt pulley (4) in the direction of the arrow "a" of following figure, and remove the brake timing belt. 
5	Install the new brake timing belt. The operations of matching the position for brake timing belt is unnecessary.
6	After replacement, securely tighten the two motor installation screws <1> (M4 screw: tightening torque is 4.51 N·m). (Tension is automatically adjusted by the spring.) Improper tightening can cause the belt to loosen with vibration. 
7	Install J5 axis timing belt with reference to "(e-1) Inspection, maintenance and replacement the J5 axis timing belt", and adjust tension.

(f) J6-axis timing belt and brake timing belt

In the RV-2FRB/2FRLB, the J6 axis has the timing belt rotating the J6 axis and the brake timing belt conveying the brake. Also inspection and replacement the brake timing belt simultaneously.

(f-1) Inspection, maintenance and replacement of J6-axis timing belt





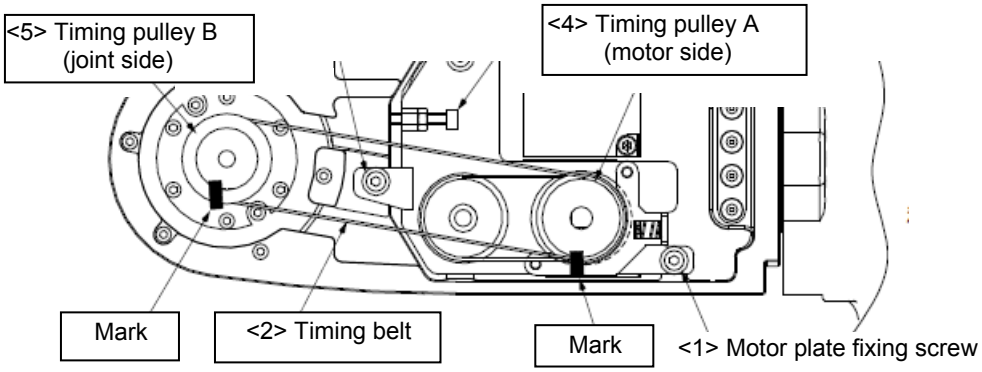
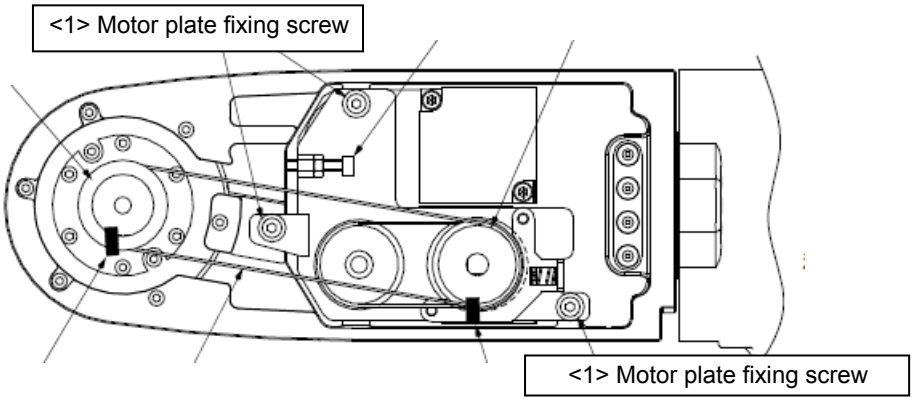
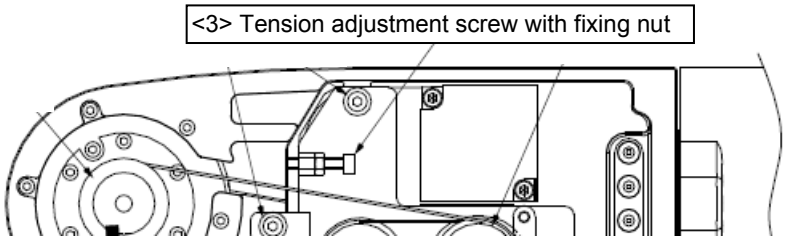
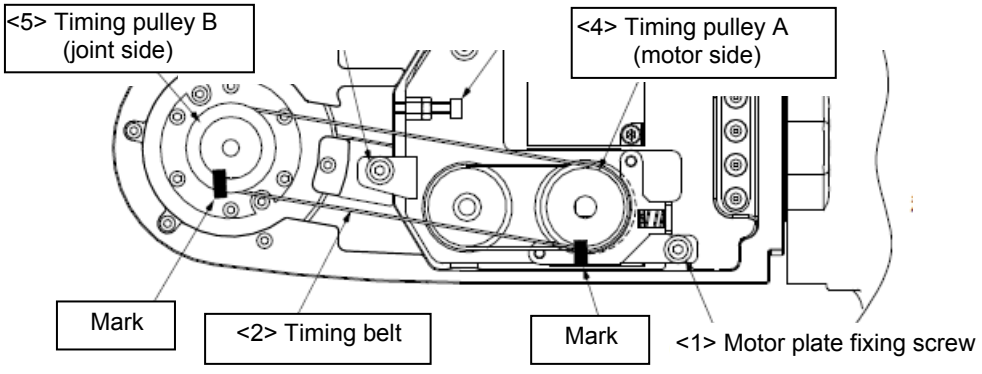
Note) The figure shows RV-2FRB/2FRLB.

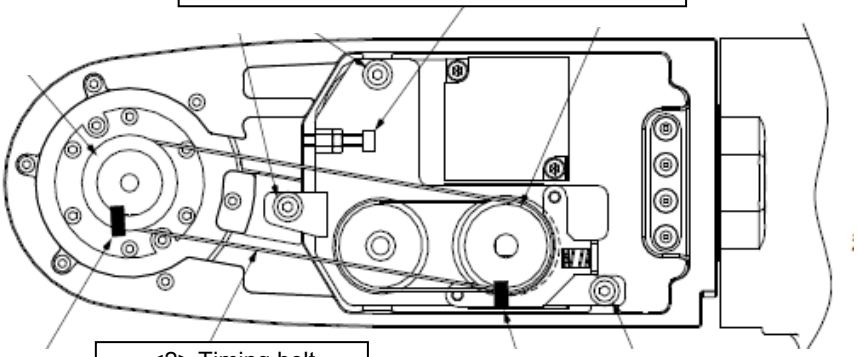
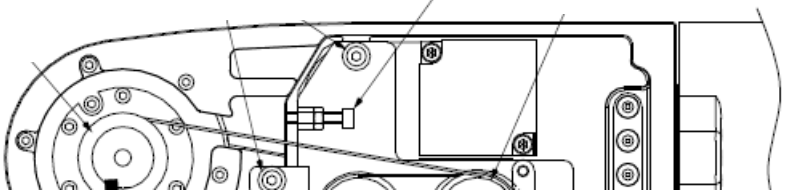
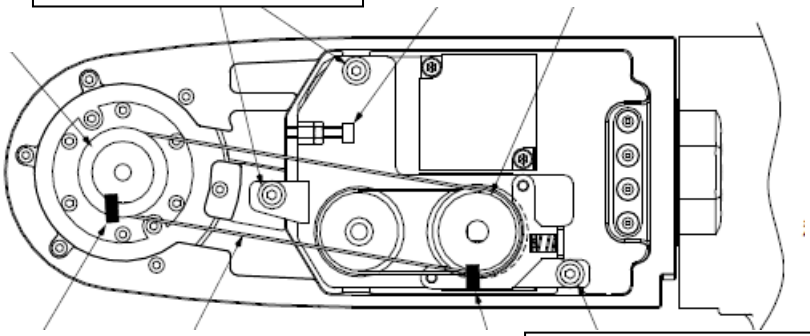
■Inspecting the J6 axis timing belt

RV-2FR, RV-2F series: Inspection of J6-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover L.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 2 arm cover L securely as before and finish inspection.

■Replacing the J6 axis timing belt

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-2FR, RV-2F series: Replacement of J6-axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover L.
2	Make marks on the timing belt <2> and timing pulleys A <4> and B <5> with a felt-tip pen as shown in following figure so that the engagement of the timing belt <2> and timing pulleys <4> and <5> does not deviate. 
3	Lightly loosen the three motor plate fixing screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-2FR, RV-2F series: Replacement of J6-axis timing belt	
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) (Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension".) <3> Tension adjustment screw with fixing nut  <2> Timing belt
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. <3> Tension adjustment screw with fixing nut 
9	Moreover, also fasten the three motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 N·m). Note4) <1> Motor plate fixing screw  <1> Motor plate fixing screw
10	Install the No. 2 arm cover L securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

Note2) Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

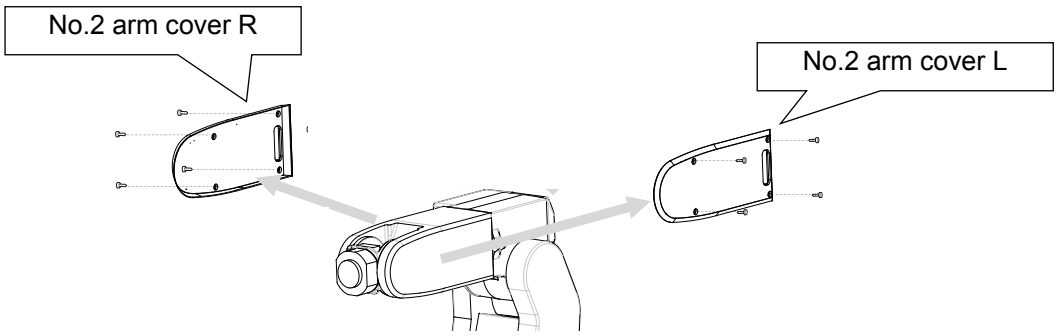
Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

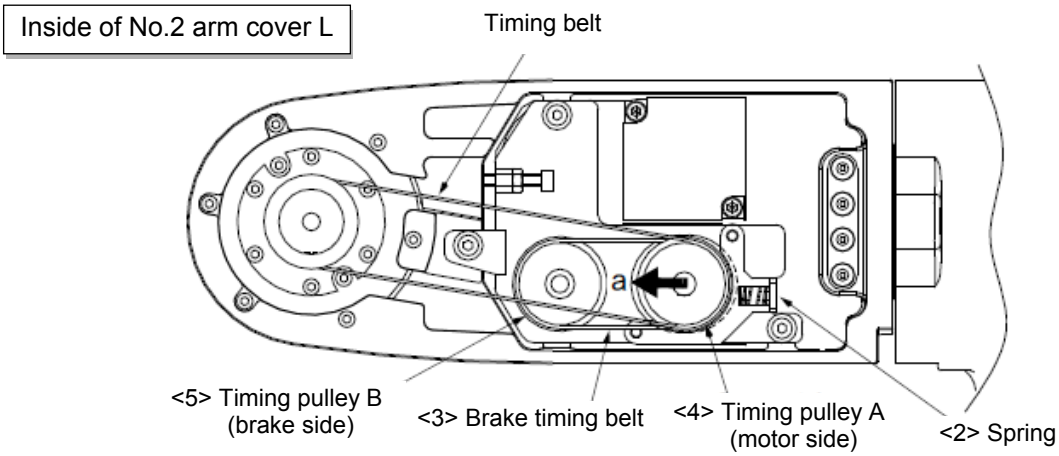
Note4) Improper tightening can cause the belt to loosen with vibration.

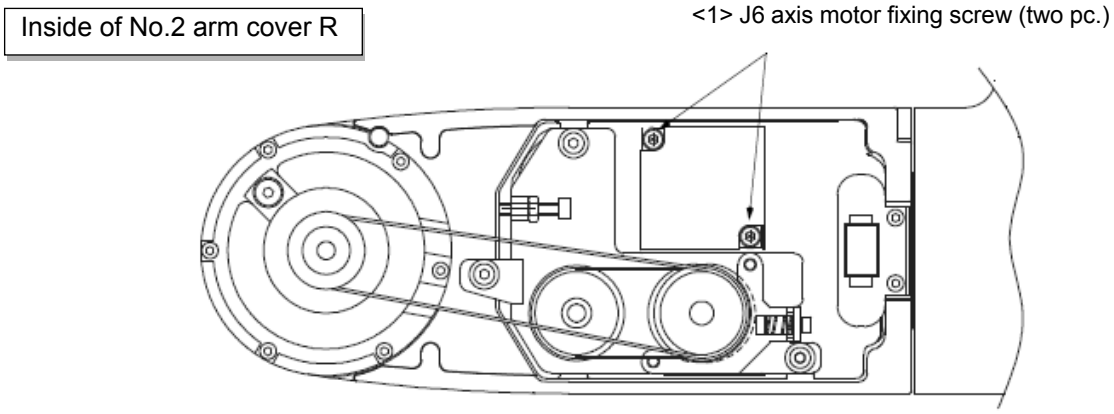
Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(f-2) Inspection and replacement of J6 axis brake timing belt

To replace the J6 axis brake timing belt, remove the J6 axis timing belt. Measure the tension before removing the J6 axis timing belt, and reinstall the belt so that the tension must be the same as the one measured before removal.



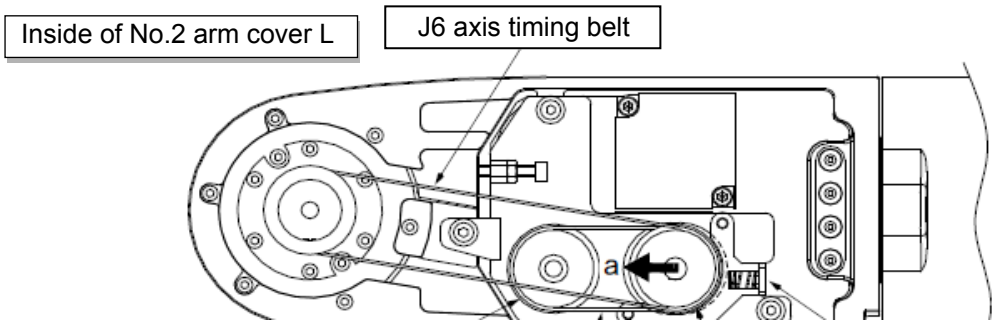
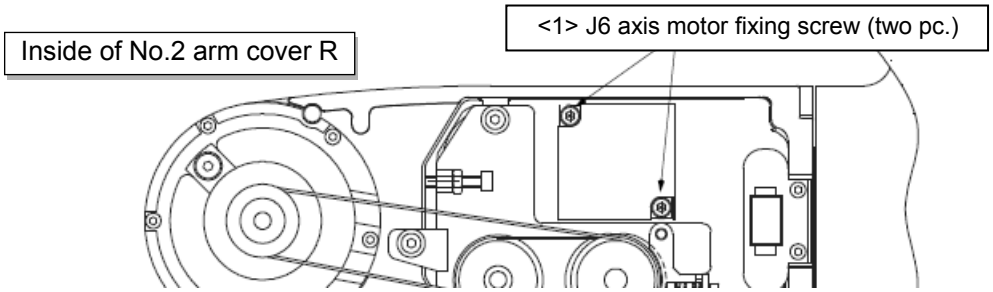
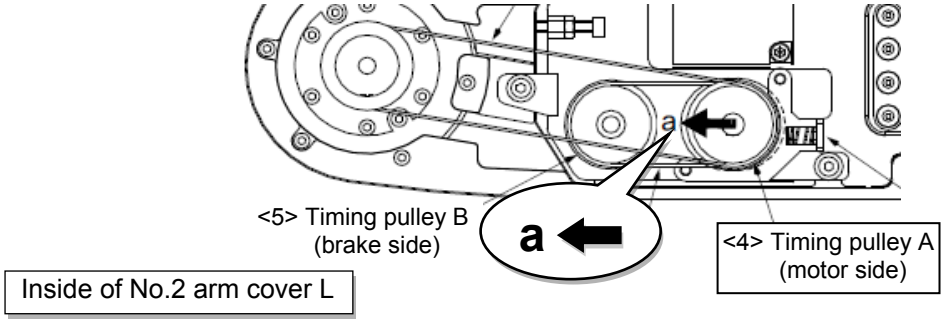
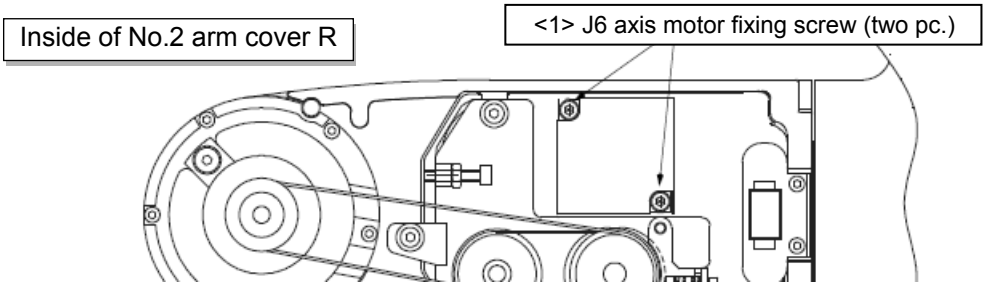




■Inspecting the J6 axis brake timing belt

RV-2FR, RV-2F series: Inspection of J6-axis brake timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R and L.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 2 arm cover R and L securely as before and finish inspection.

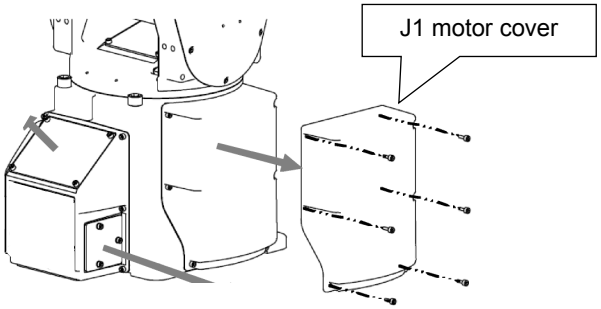
■Replacing the J6 axis brake timing belt

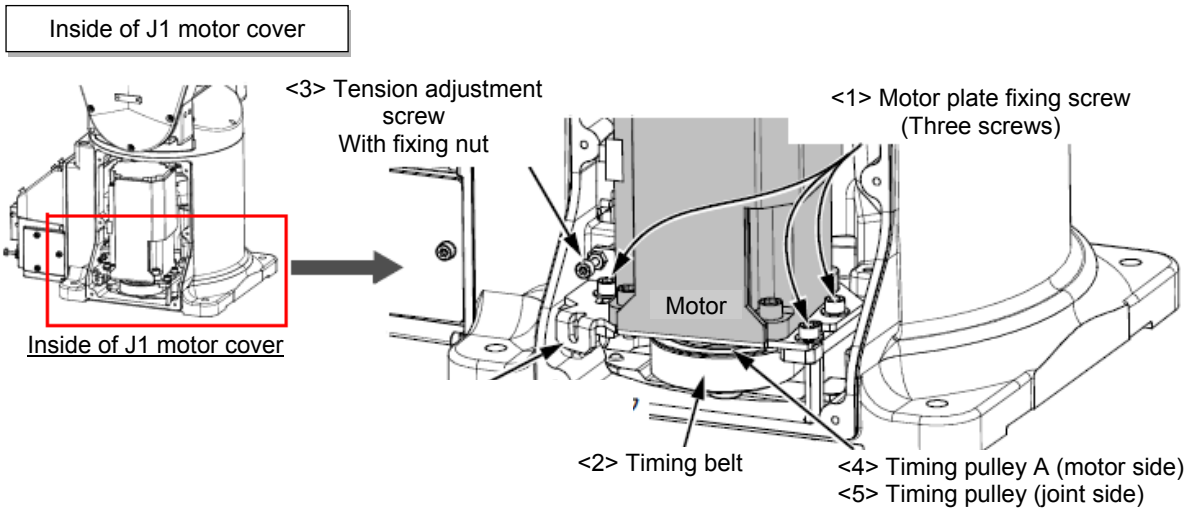
RV-2FR, RV-2F series: Replacement of J6-axis brake timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R and L.
2	Remove J6 axis timing belt with referring to "(f-1) Inspection, maintenance and replacement the J6 axis timing belt". 
3	Loosen the two motor fixing screws <1>. (two pc.) (Do not loosen too much.) 
4	Move motor side timing belt pulley (4) in the direction of the arrow "a" of following figure, and remove the brake timing belt. 
5	Install the new brake timing belt. The operations of matching the position for brake timing belt is unnecessary.
6	After replacement, securely tighten the two motor installation screws <1> (M4 screw: tightening torque is 4.51 N·m). (Tension is automatically adjusted by the work of the spring.) Improper tightening can cause the belt to loosen with vibration. 
7	Install J6 axis timing belt with reference to "(f-1) Inspection, maintenance and replacement the J6 axis timing belt", and adjust tension.

<< MEMO >> * Please use this page for your memo.

(2) RV-4/7FR, RV-4/7F series

(a) J1-axis timing belt



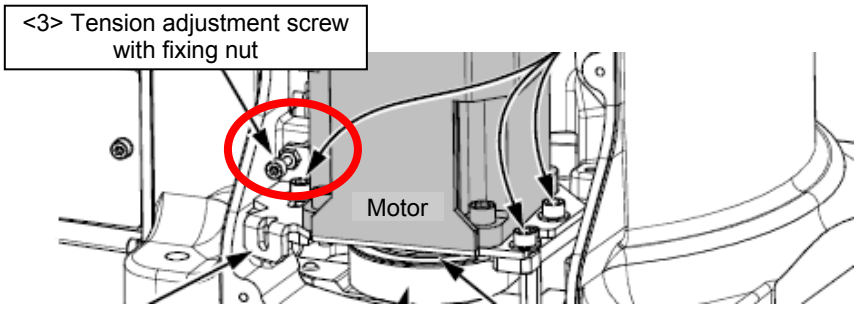
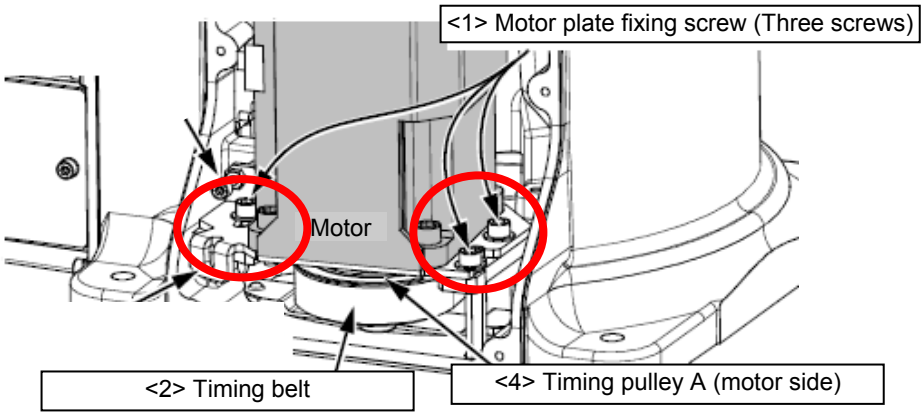
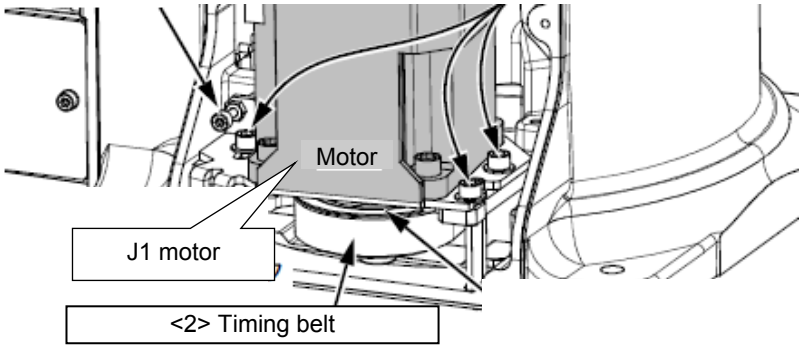
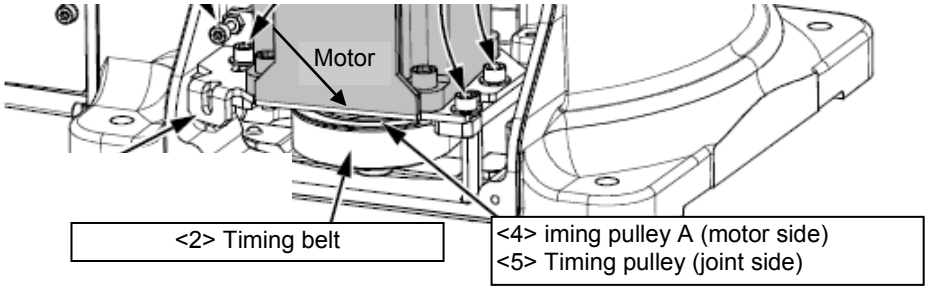


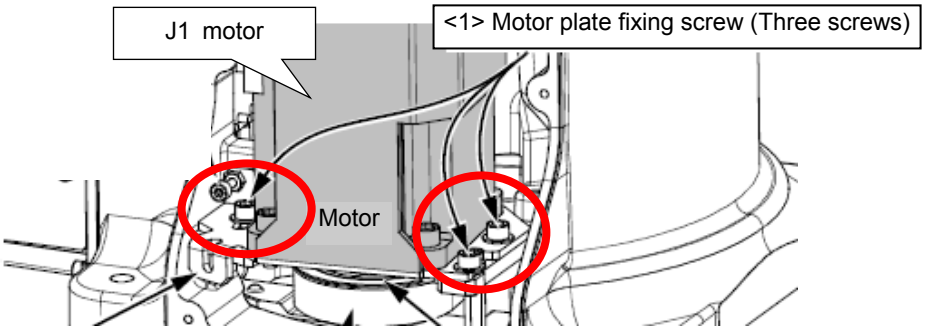
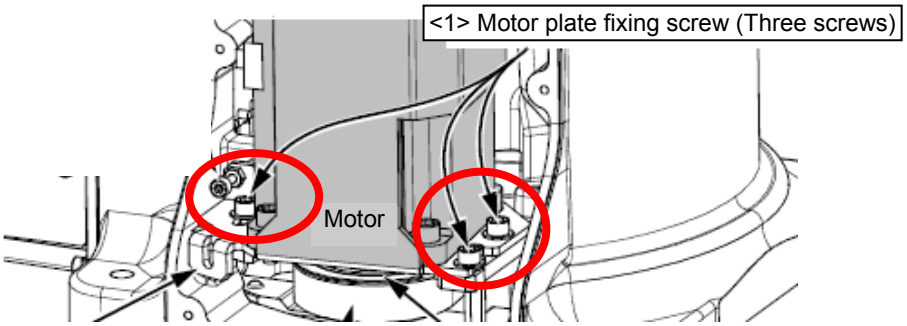
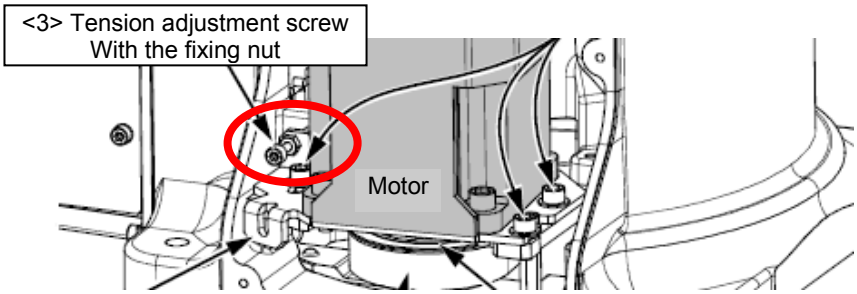
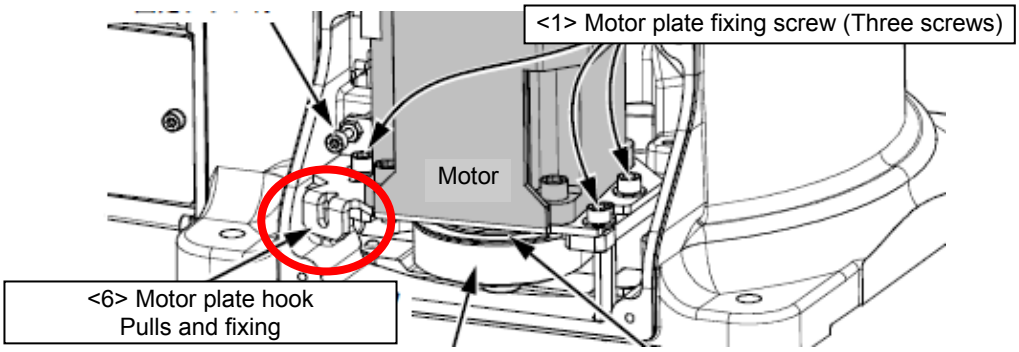
■Inspecting the J1 axis timing belt

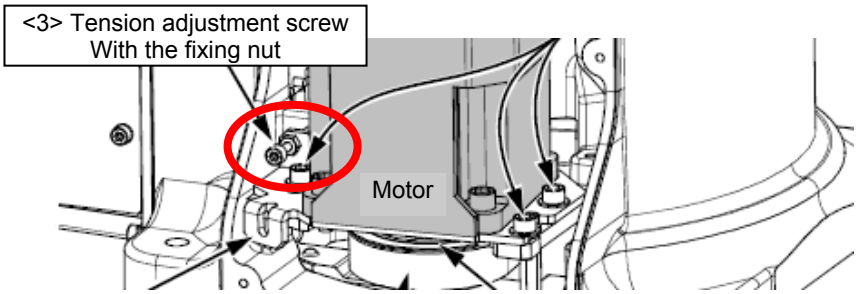
RV-4FR/7FR, RV-4F/7F series: Inspection of J1-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the J1 motor cover.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the J1 motor cover securely as before and finish inspection.

■Replacing the J1 axis timing belt

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-4FR/7FR series: Replacement of J1-axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the J1 motor cover.
2	Loosen the nut of the tension adjustment screw <3>, and loosen the tension adjustment screw <3>. 
3	Remove the three motor plate fixing screws <1>, and remove the timing belt <2> from the timing pulley A <4>. 
4	Remove the J1 axis motor, and remove the timing belt <2>. 
5	Install the new timing belt to the timing pulley B <5> and timing pulley A <4>. 

RV-4FR/7FR series: Replacement of J1-axis timing belt	
6	Install the J1 axis motor to the original position by the motor plate fixing screws <1>. 
7	Lightly loosen the three motor plate fixing screws <1>. (Do not loosen too much.) 
8	Loosen the nut fixing tension adjustment screw <3>. And lightly loosen tension adjustment screw <3>. 
9	Refer to the following Note1) and tighten the three motor plate fixing screws <1> while pulling the motor plate hook <6>. Note2) Certainly fix the three motor plate fixing screws <1>.  ・The tension of J1 axis timing belt is adjusted with this method. Check that the belt tension meets the value in "4.6.3 Timing belt tension". ・Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement". ・If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

RV-4FR/7FR series: Replacement of J1-axis timing belt	
10	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
11	Install the J1 motor cover securely as before.
12	Reset the origin position. (Refer to "5 Resetting the Origin".)
13	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note3)

Note1) Motor plate hook <6> pulling force

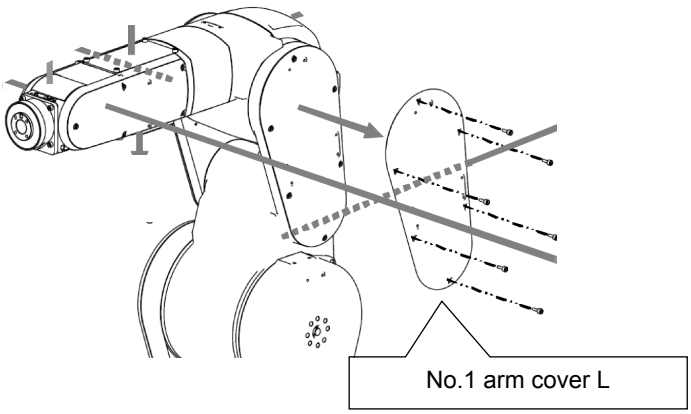
Model	Hook pulling force [N]		Motor plate fixing screw Size: Tightening torque
	Existing belt	New belt	
RV-4FR series	53 to 65	80 to 98	M4: 4.51 N·m
RV-7FR series	64 to 78	91 to 112	M5: 9.31 N·m

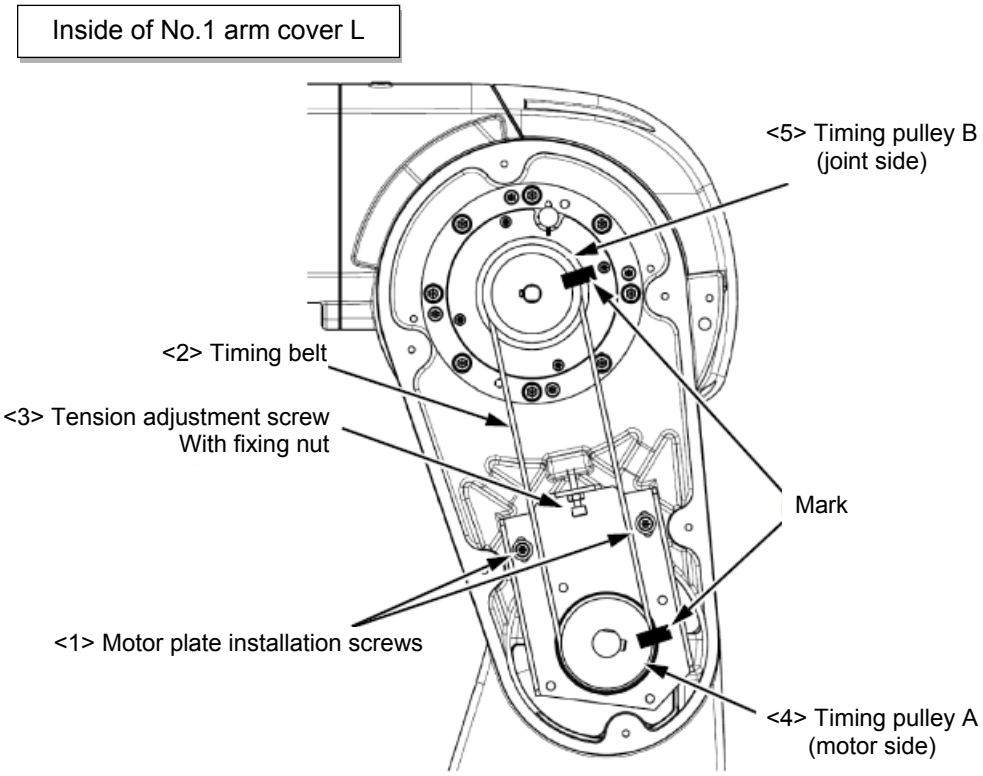
※ For the RV-7F series, the width of the timing belt of J1 axis differs according to manufacturing date.
Pull the hook with an appropriate tension in accordance with the belt width (following table).

Model		Hook pulling force [N]	
		Existing belt	New belt
RV-7FR series(※)	Belt width: 15 mm	65 to 79	107 to 131
	Belt width: 20 mm	67 to 78	91 to 112

Note2) Improper tightening can cause the belt to loosen with vibration.
Note3) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(b) J3-axis timing belt





■Inspecting the J1 axis timing belt

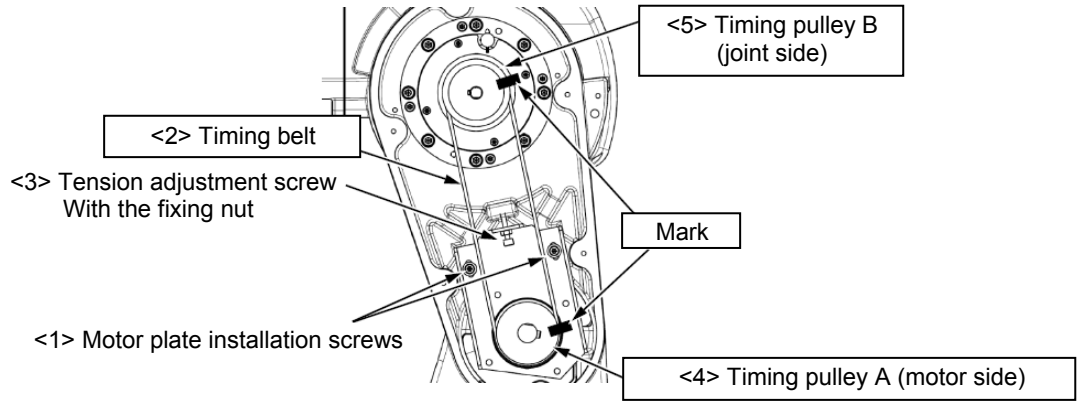
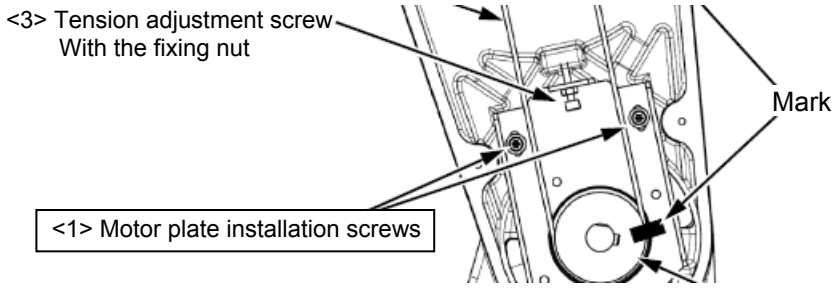
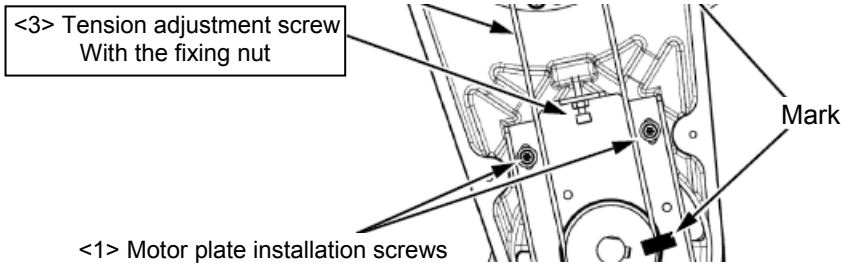
RV-4FR/7FR, RV-4F/7F series: Inspection of J3-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 1 arm cover L.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 1 arm cover L securely as before and finish inspection.

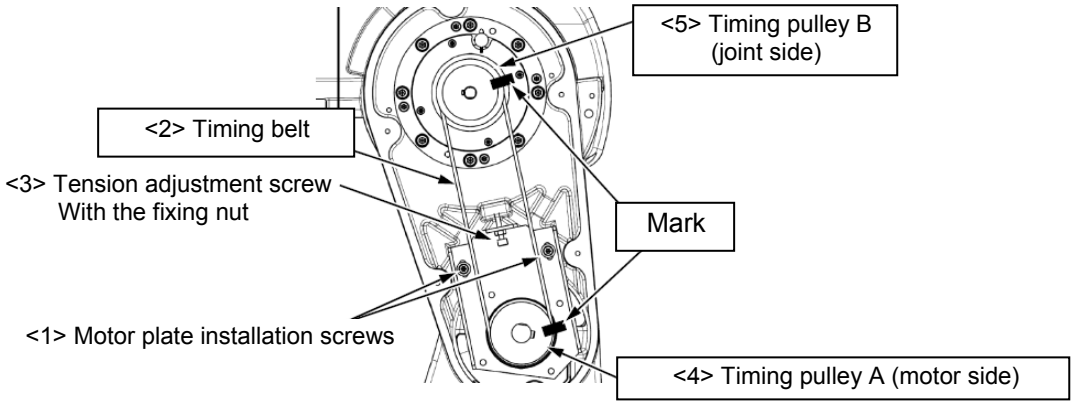
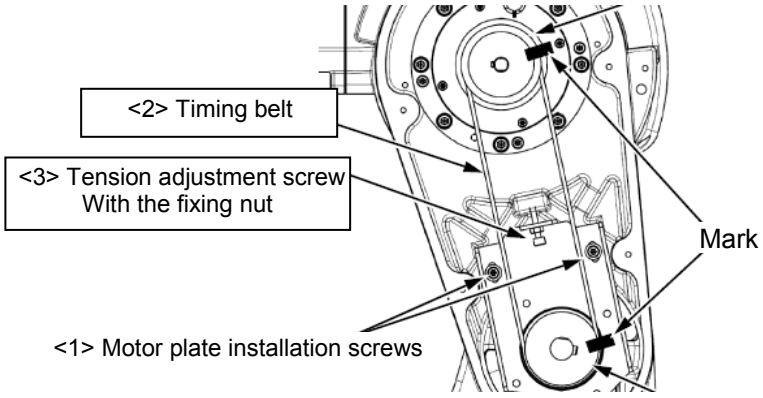
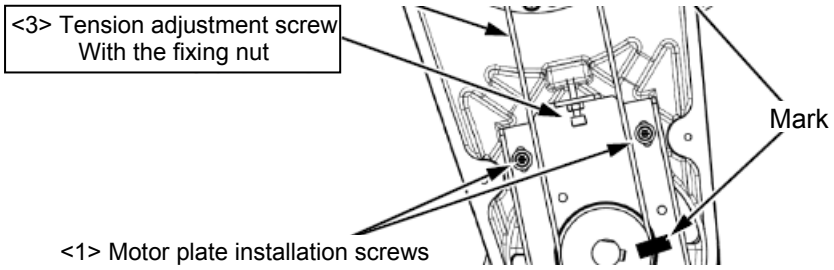
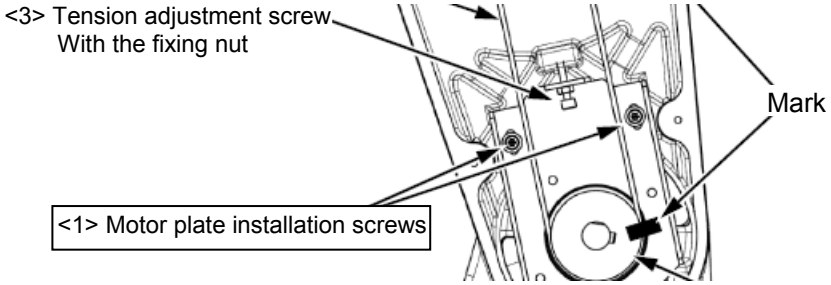
■Replacing the J3 axis timing belt (RV-4FR series)

⚠CAUTION If the timing belt of the J3 axis is removed, the forearm will drop by the self-weight. And, if the positional relation between the timing pulley A <4> and B <5> deviated, it will become the cause of the position deviation.

For the safety before replacing the timing belts, hit the J3 axis against mechanical stopper with releasing brake.

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-4FR/7FR, RV-4F/7F series: Replacement of J3-axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 1 arm cover L.
2	Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen. 
3	Lightly loosen the two motor plate installation screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.

RV-4FR/7FR, RV-4F/7F series: Replacement of J3-axis timing belt	
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten the two motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 N·m). Note4) 
10	Install the No. 1 arm cover L securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

Note2) Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension".

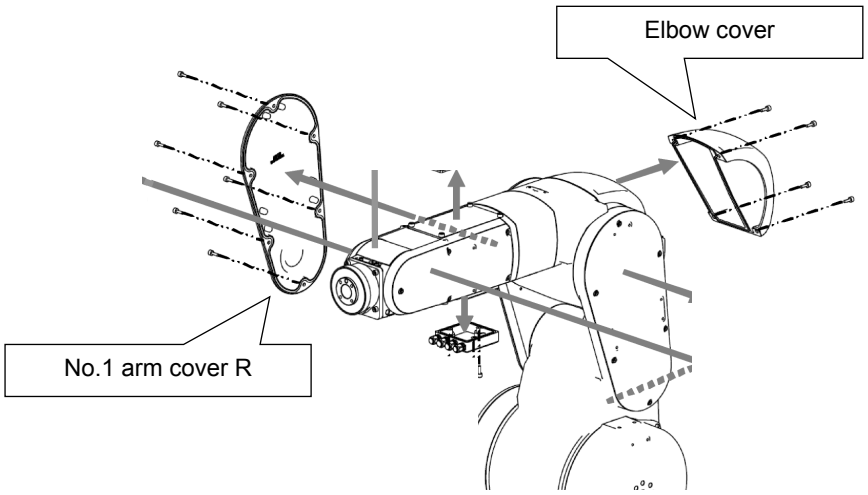
Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

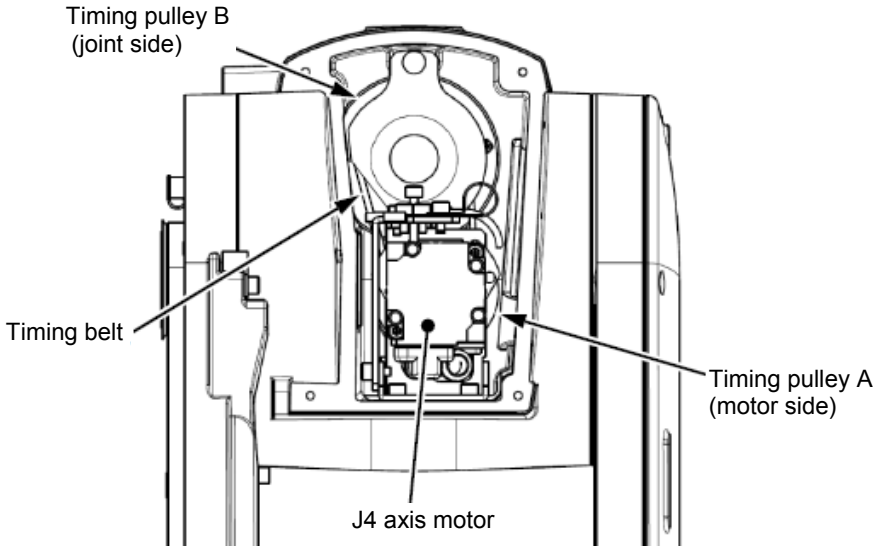
Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

Note4) Improper tightening can cause the belt to loosen with vibration.

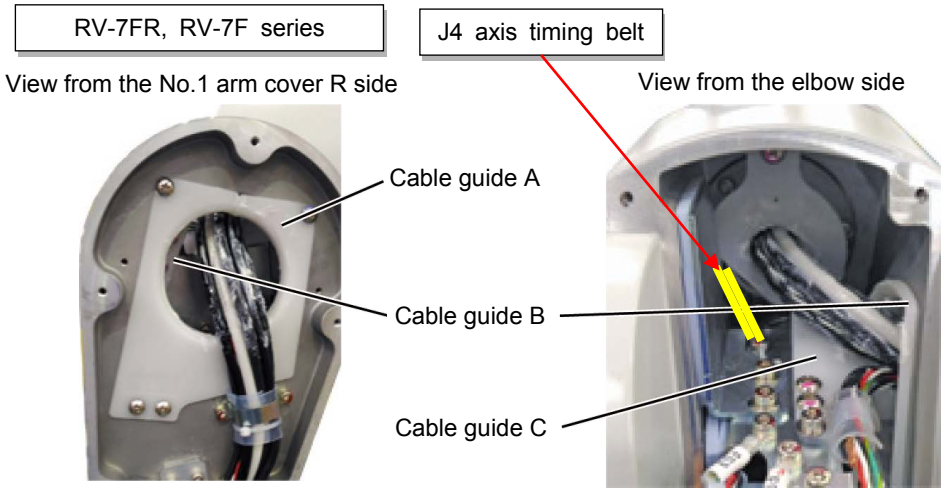
Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(c) J4-axis timing belt (6-axes type)





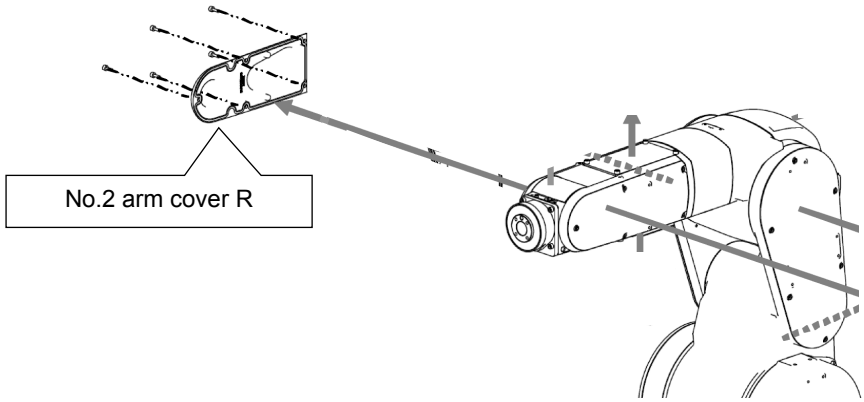
■Inspecting the J4 axis timing belt

RV-4FR/7FR, RV-4F/7F series: Replacement of J4-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the elbow cover and No.1 arm cover R.
3	In RV-7FR, RV-7F series, remove the cable guide A, B, and C. 
4	Silicon grease is applied to the contact surface of each cable guide to reduce friction or wear caused by movement of the cables. Do not wipe off the silicon grease.
5	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
6	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
7	In RV-7FR, RV-7F series, install the cable guide A, B, and C securely as before.
8	Install the elbow cover and No.1 arm cover R securely as before and finish inspection.

■Replacing the J4 axis timing belt

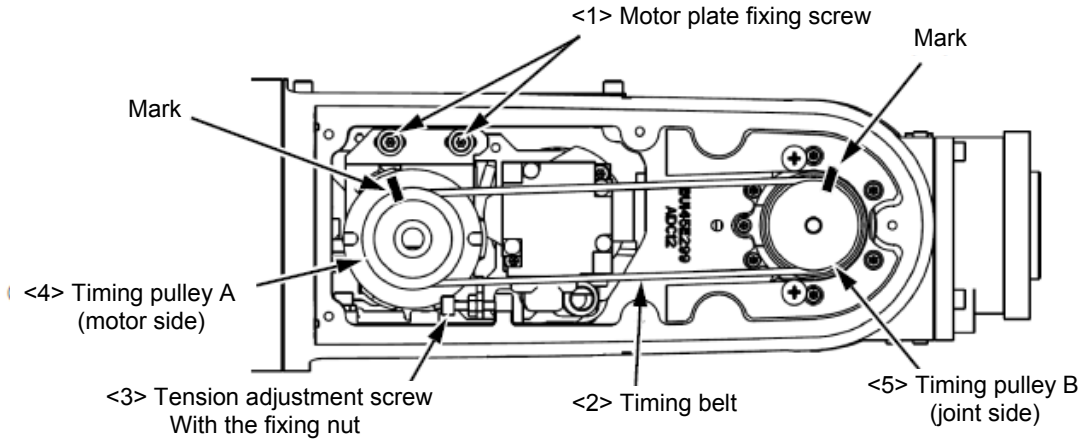
For the replacement of the J4 axis timing belt, contact the dealer.

(d) J5-axis timing belt



Inside of No.2 arm cover R

RV-4/7FR, RV-4/7F series, RV-7FRLL, RV-7FLL



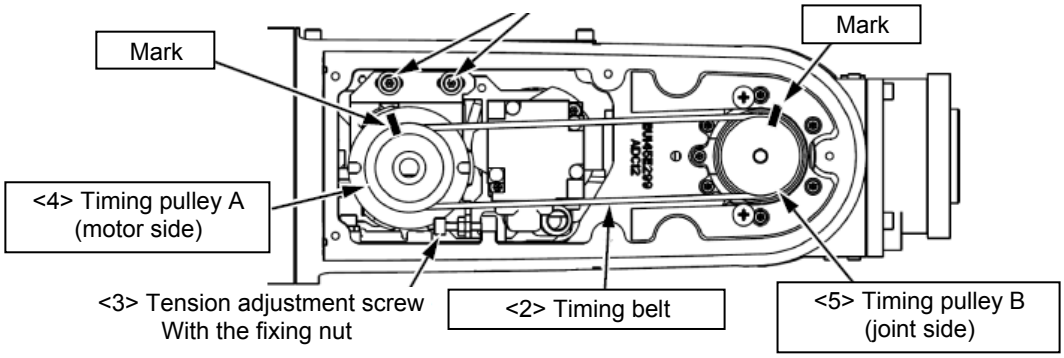
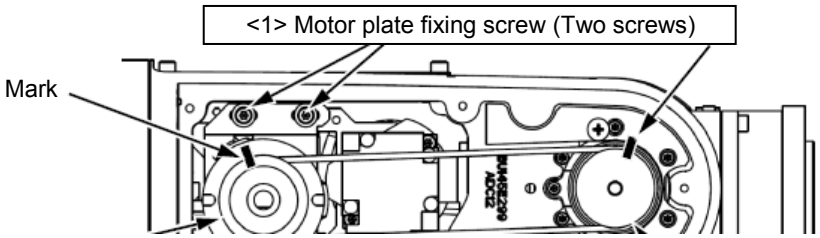
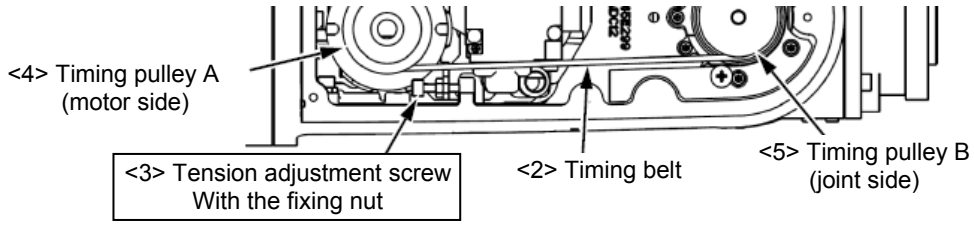
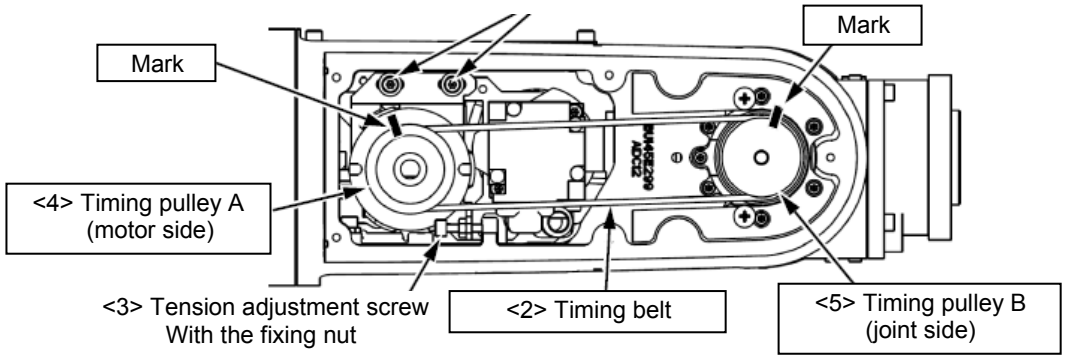
■Inspecting the J5 axis timing belt

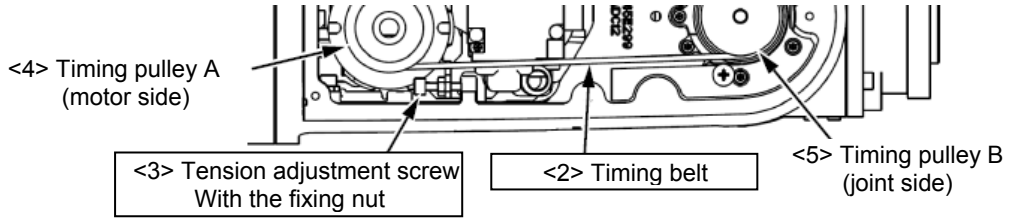
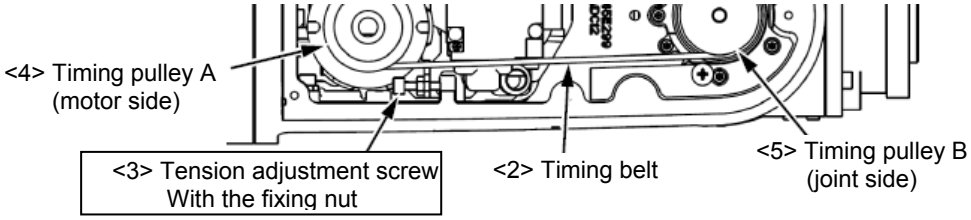
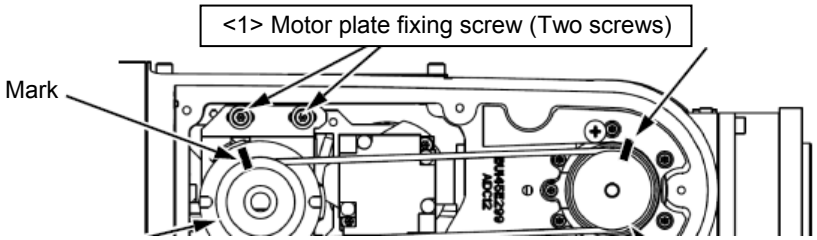
RV-4/7FR, RV-4/7F series, RV-7FRLL, RV-7FLL: Inspection of J5-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 2 arm cover R securely as before and finish inspection.

■Replacing the J5 axis timing belt

⚠CAUTION If the timing belt of the J5 axis is removed, the forearm will drop by the self-weight. (faces in the downward) And, if the positional relation between the timing pulley A <4> and B <5> deviated, it will become the cause of the position deviation. For the safety before replacing the timing belt, move the J5 axis so that it may face in the downward by jog operation.

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-4/7FR, RV-4/7F series, RV-7FRLL, RV-7FLL: Replacing the J5 axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R.
2	Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in the figure below. 
3	Lightly loosen the following motor plate fixing screw <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-4/7FR, RV-4/7F series, RV-7FRLL, RV-7FLL: Replacing the J5 axis timing belt	
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten the motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 N·m). Note4) 
10	Install the No. 2 arm cover R securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

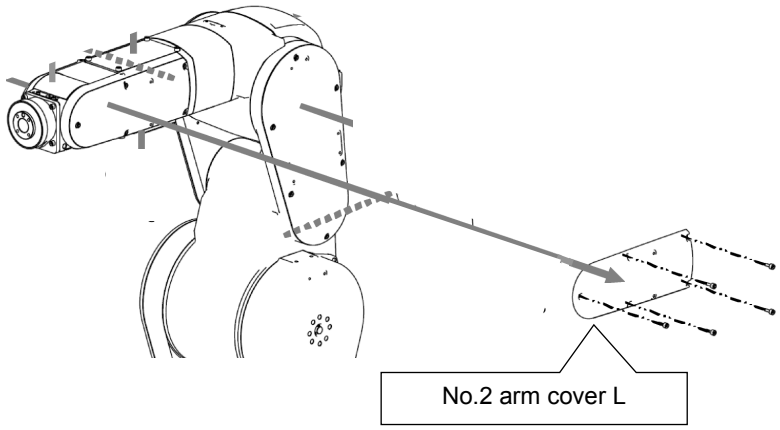
Note2) Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension". Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

Note4) Improper tightening can cause the belt to loosen with vibration.

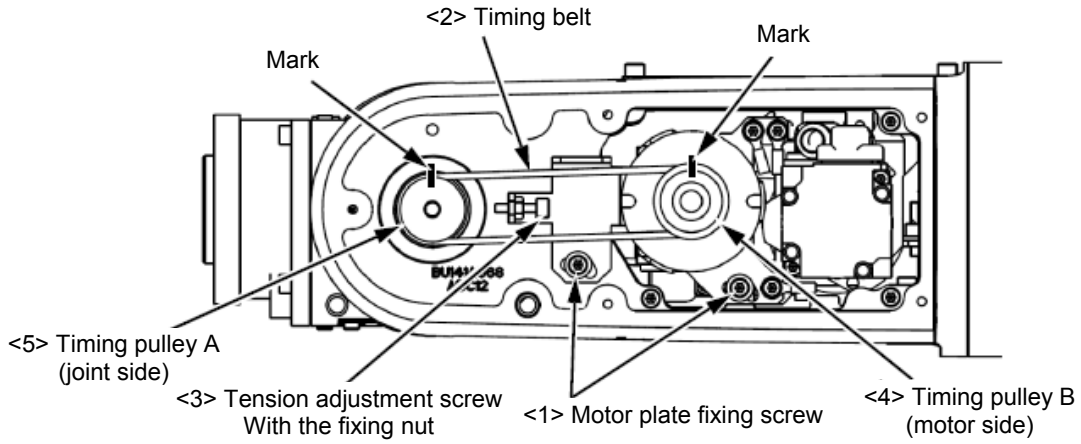
Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(e) J6-axis timing belt



Inside of No.2 arm cover L

RV-4/7FR, RV-4/7F series, RV-7FRLL, RV-7FLL

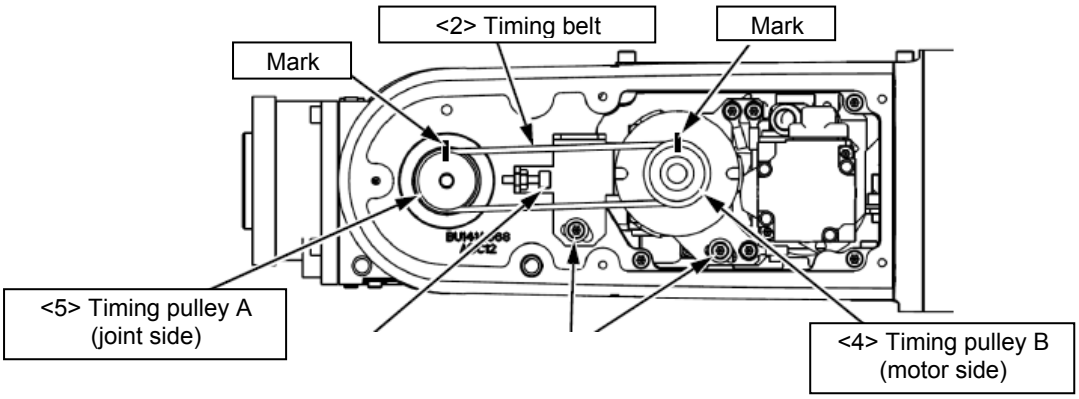
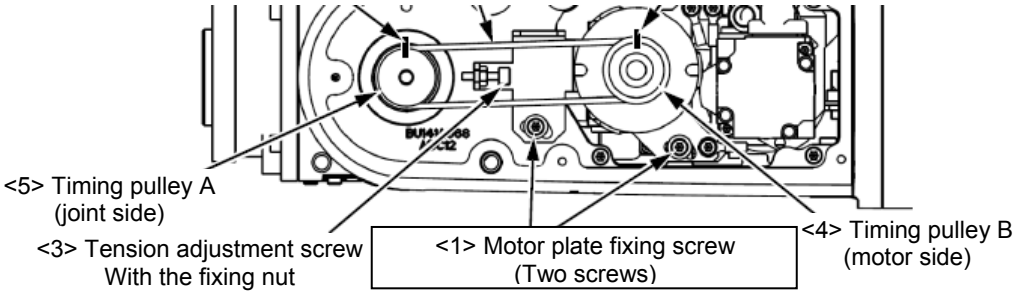
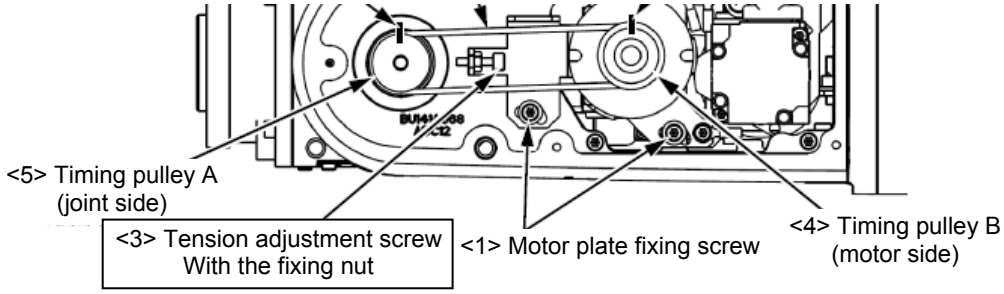
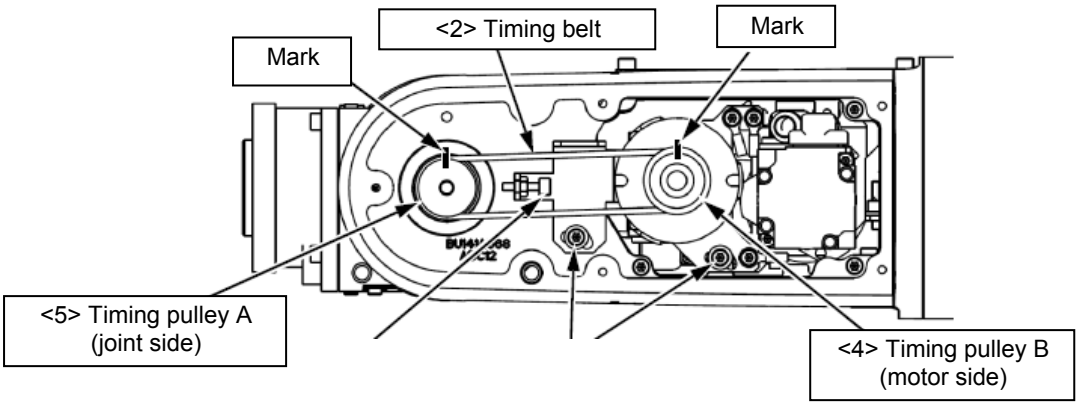


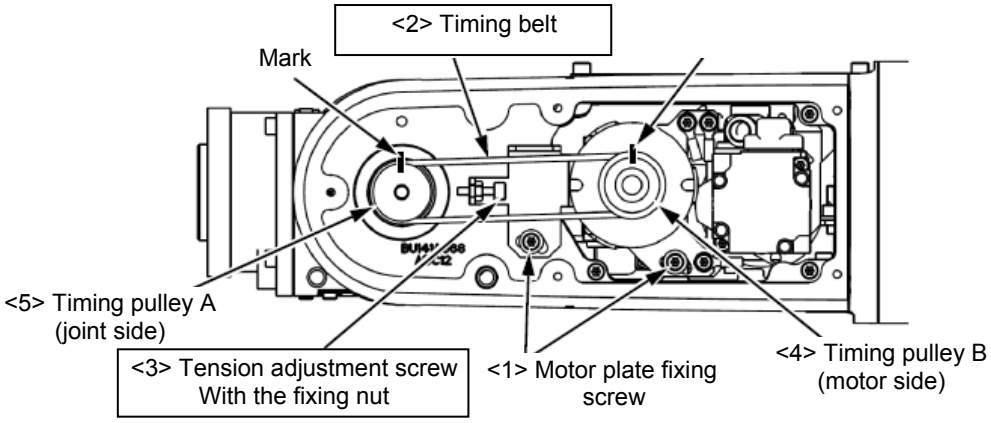
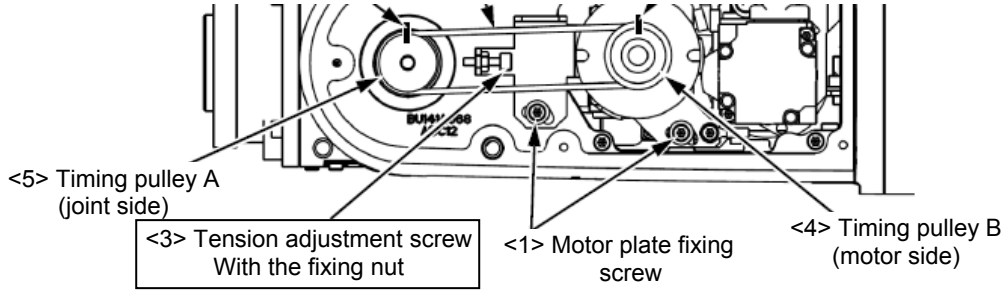
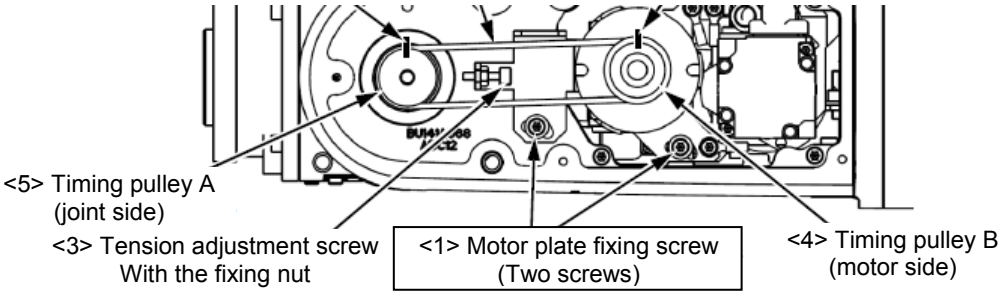
■Inspecting the J6 axis timing belt

RV-4/7FR, RV-4/7F series, RV-7FRLL, RV-7FLL: Inspection of J6-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover L.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 2 arm cover L securely as before and finish inspection.

■Replacing the J6 axis timing belt

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-4FR/7FR, RV-4F/7F series, RV-7FRLL, RV-7FLL: Replacing the J6 axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover L.
2	Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen. 
3	Lightly loosen the two motor plate fixing screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-4FR/7FR, RV-4F/7F series, RV-7FRLL, RV-7FLL: Replacing the J6 axis timing belt	
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten the two motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 Nm). Note4) 
10	Install the No. 2 arm cover L securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

Note2) Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension". Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

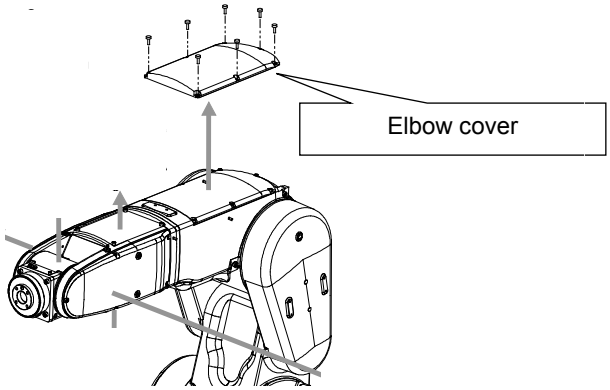
Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

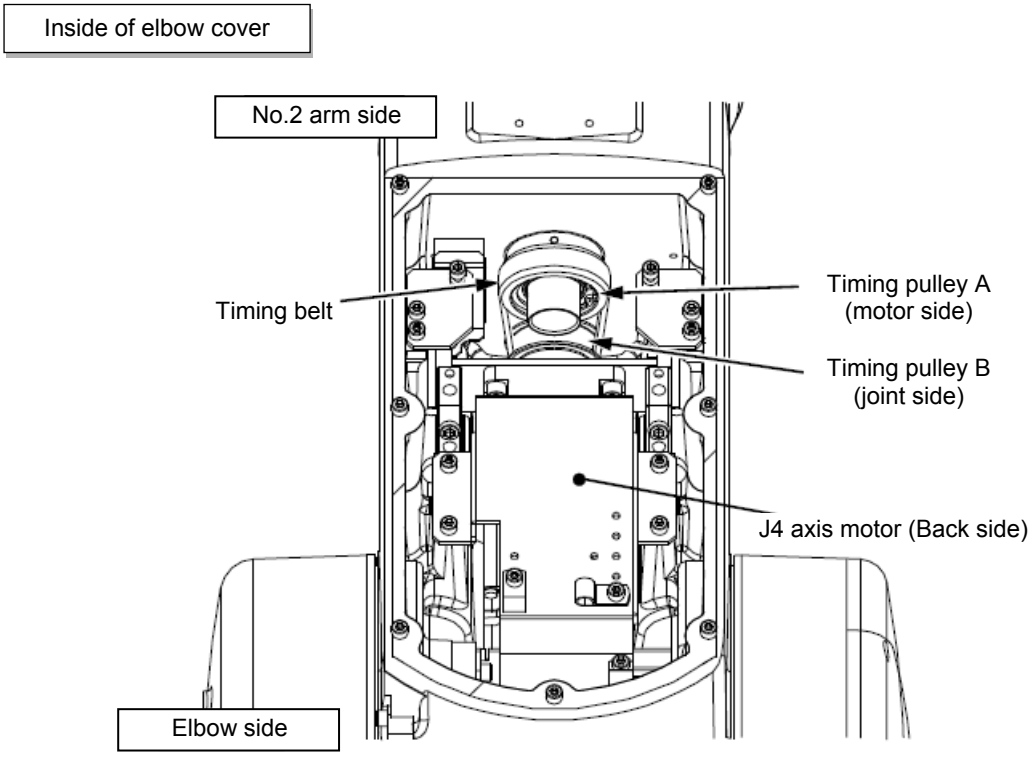
Note4) Improper tightening can cause the belt to loosen with vibration.

Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(3) RV-13/20FR, RV-13/20F series

(a) J4-axis timing belt





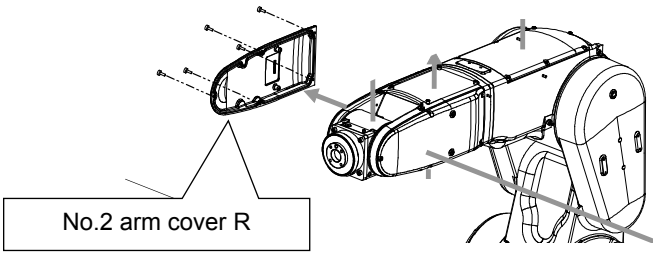
■Inspecting the J4 axis timing belt

RV-13/20FR, RV-13/20F series: Inspection of J4-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the elbow cover.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the elbow cover securely as before and finish inspection.

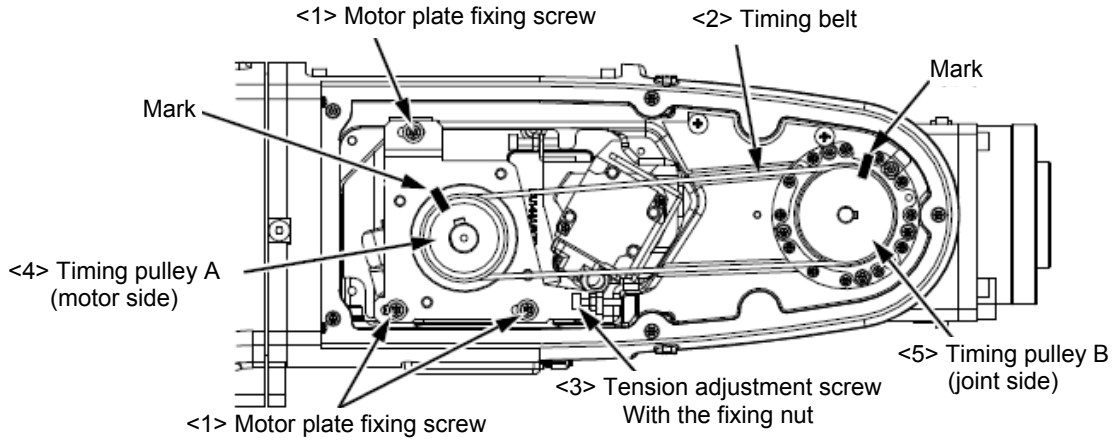
■Replacing the J4 axis timing belt

For the replacement of the J4 axis timing belt, contact the dealer.

(b) J5-axis timing belt



Inside of No.2 arm cover R



* For the RV-7FRLL and RV-7FLL, refer to "(2) RV-4/7FR, RV-4/7F series (d) J5-axis timing belt".

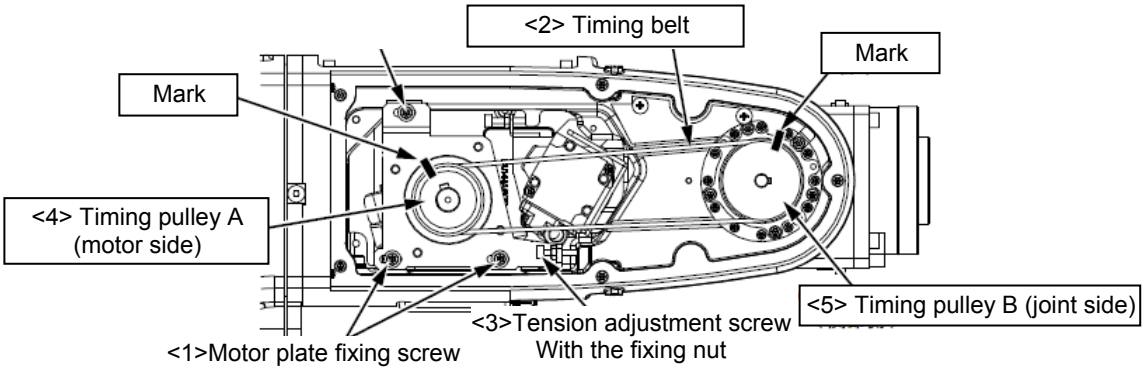
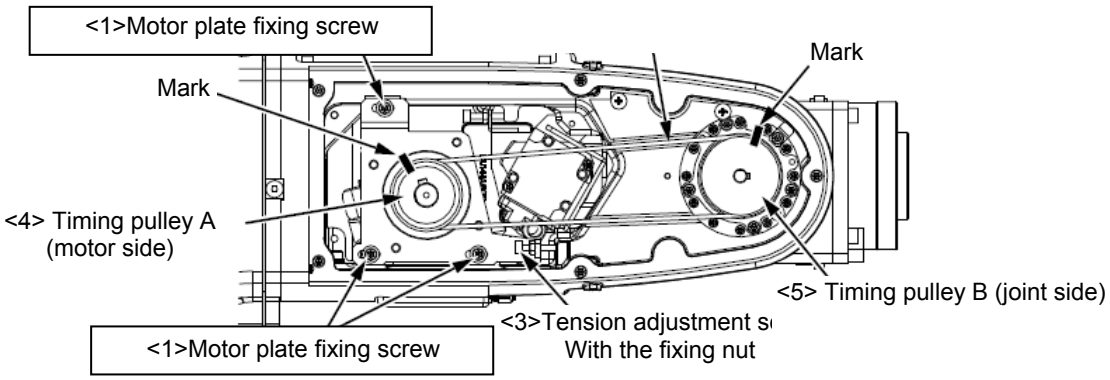
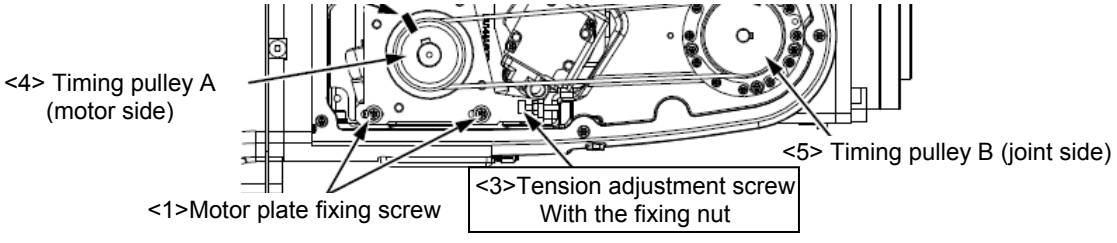
■Inspecting the J5 axis timing belt

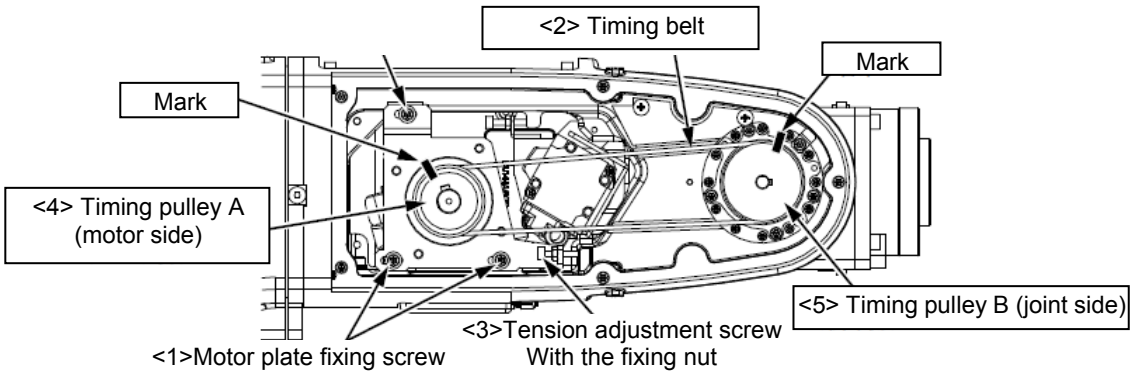
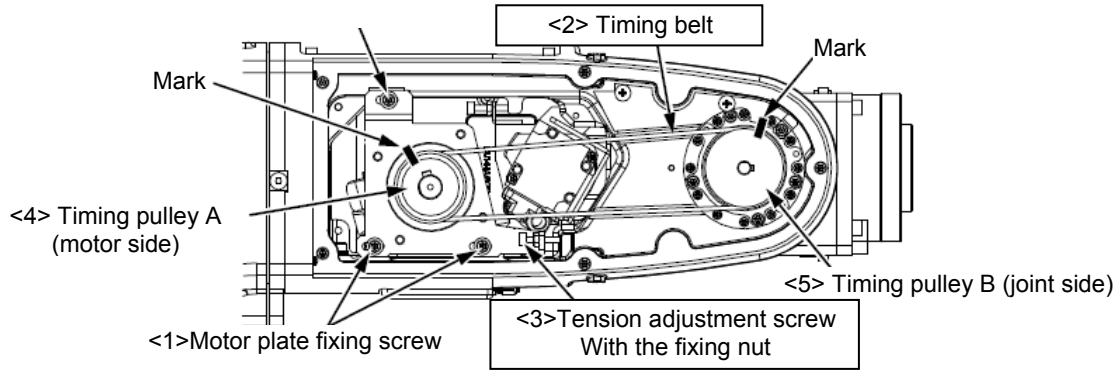
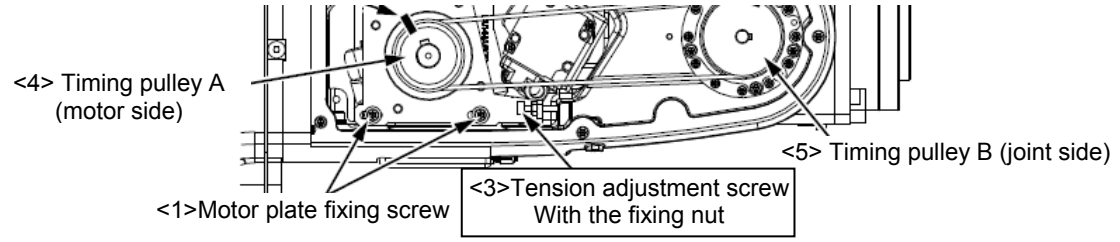
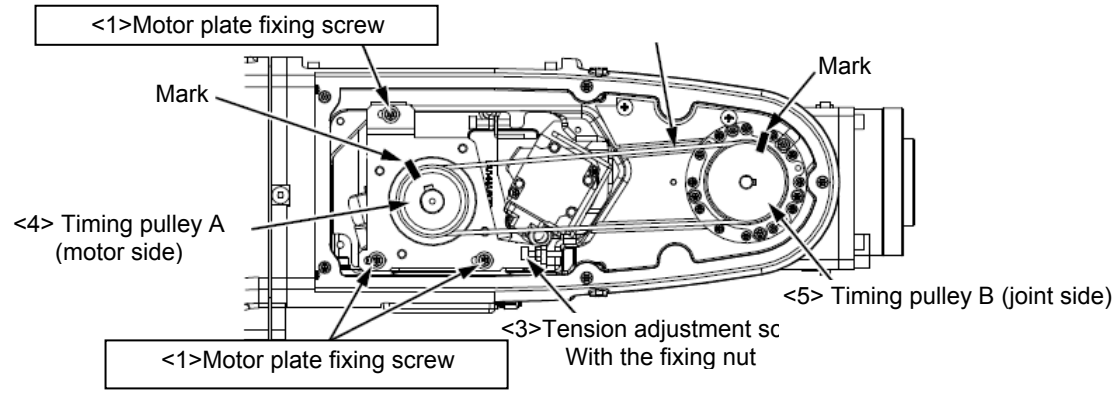
RV-13/20FR, RV-13/20F series: Inspection of J5-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 2 arm cover R securely as before and finish inspection.

■Replacing the J5 axis timing belt

⚠CAUTION If the timing belt of the J5 axis is removed, the forearm will drop by the self-weight. (faces in the downward) And, if the positional relation between the timing pulley A <4> and B <5> deviated, it will become the cause of the position deviation. For the safety before replacing the timing belt, move the J3 axis so that it may face in the downward by jog operation.

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-13/20FR, RV-13/20F series: Replacing the J5 axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover R.
2	Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen as shown in the figure below. 
3	Lightly loosen the three motor plate fixing screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.

RV-13/20FR, RV-13/20F series: Replacing the J5 axis timing belt	
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten the three motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 Nm). Note4) 
10	Install the No. 2 arm cover R securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

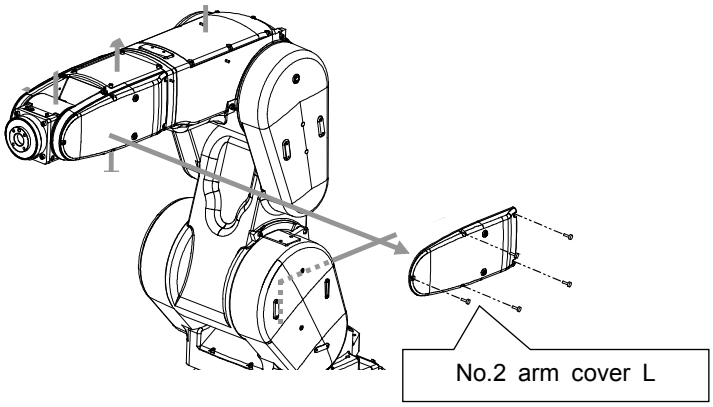
Note2) Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension". Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

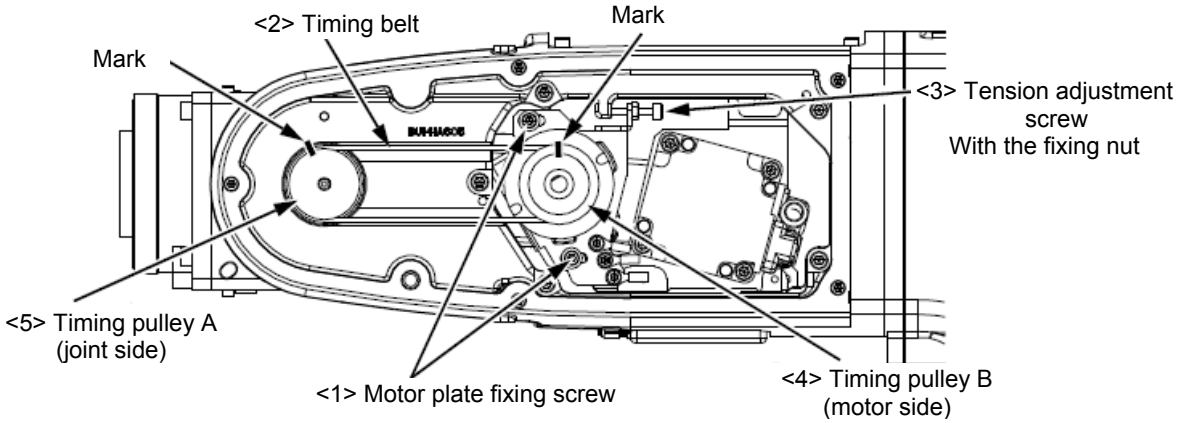
Note4) Improper tightening can cause the belt to loosen with vibration.

Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

(c) J6-axis timing belt



Inside of No.2 arm cover L



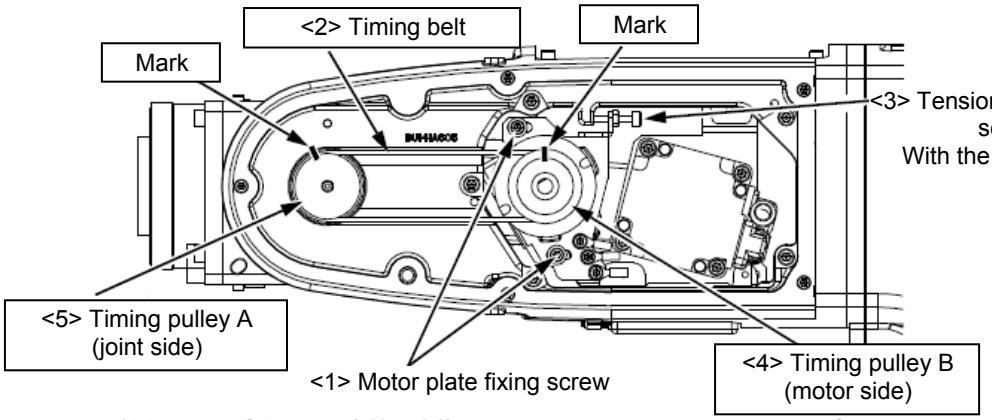
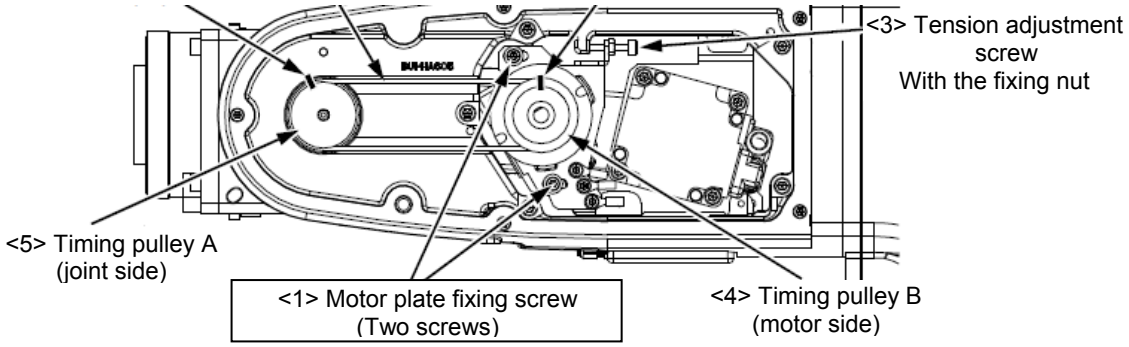
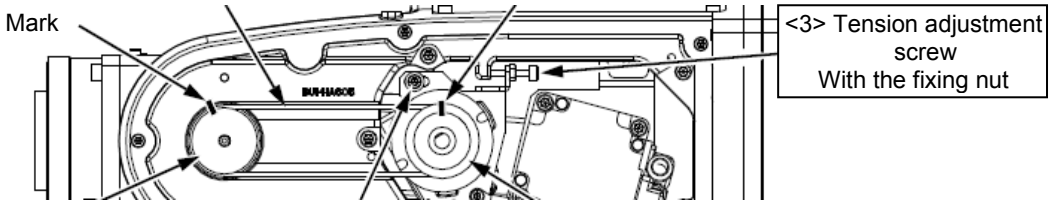
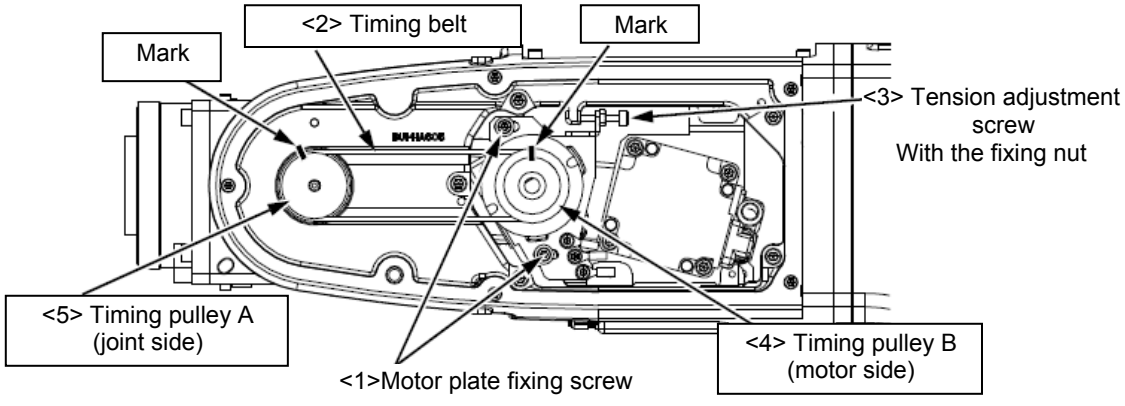
* For the RV-7FRLL and RV-7FLL, refer to "(2) RV-4/7FR, RV-4/7F series (d) J5-axis timing belt".

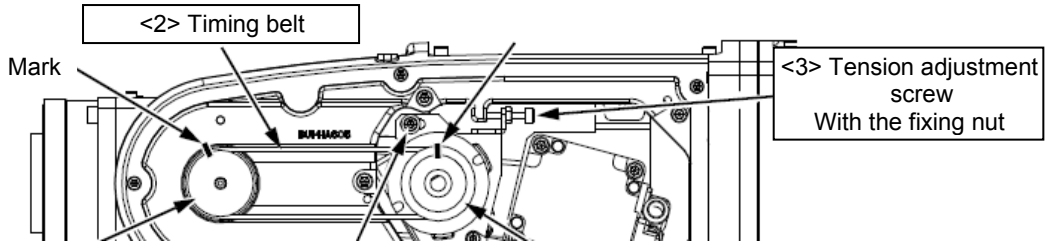
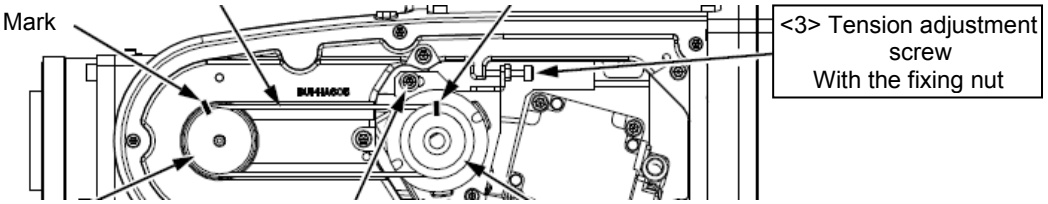
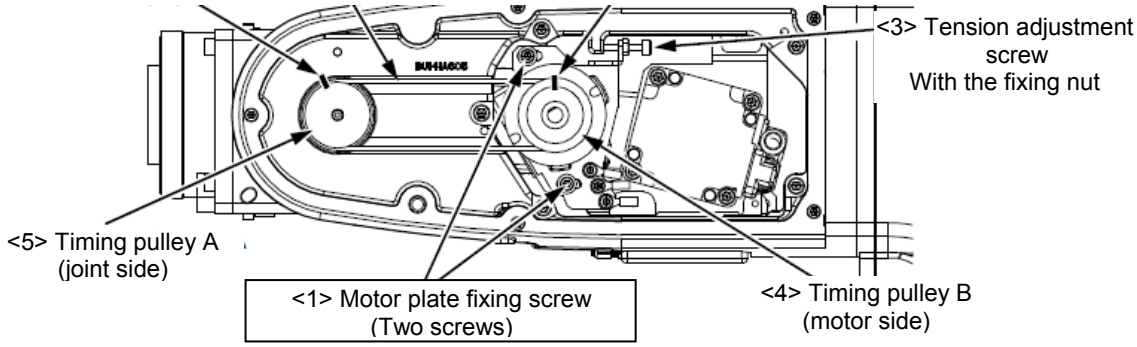
■Inspecting the J6 axis timing belt

RV-13/20FR, RV-13/20F series: Inspection of J6-axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover L.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <2>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No. 2 arm cover L securely as before and finish inspection.

■Replacing the J6 axis timing belt

[Note] Make sure that the pulleys do not move while replacing the belt. If the timing pulley A <4> and the timing pulley B <5> position relation deviates, the position could deviate.

RV-13/20FR, RV-13/20F series: Replacing the J6 axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No. 2 arm cover L.
2	Make marks on the timing belt <2> and timing pulleys <4> and <5> with a felt-tip pen. 
3	Lightly loosen the two motor plate fixing screws <1>. (Do not loosen too much.) 
4	Loosen the nut fixing tension adjustment screw <3>. Loosen the tension adjustment screw <3>, and remove the old belt. 
5	Copy the marks onto the new timing belt. Make sure that both belts are tense when making the marks.
6	Align the new timing belt with the marks on the timing pulleys <4> and <5>, and install. 

RV-13/20FR, RV-13/20F series: Replacing the J6 axis timing belt	
7	Turn tension adjustment screw <3> Note1), and adjust the tension of timing belt <2>. Note2) Note3) 
8	After adjustment fastens the fixing nut of tension adjustment screw <3>, and certainly fixes tension adjustment screw <3>. 
9	Moreover, also fasten the two motor plate fixing screws <1> certainly (M4 screw: tightening torque is 4.51 N·m). Note4) 
10	Install the No. 2 arm cover L securely as before.
11	Reset the origin position. (Refer to "5 Resetting the Origin".)
12	When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

Note2) Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension". Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".

Note3) If the belt is loosened too much when adjusting the tension causing it to come off the timing pulleys <4> and <5>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

Note4) Improper tightening can cause the belt to loosen with vibration.

Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

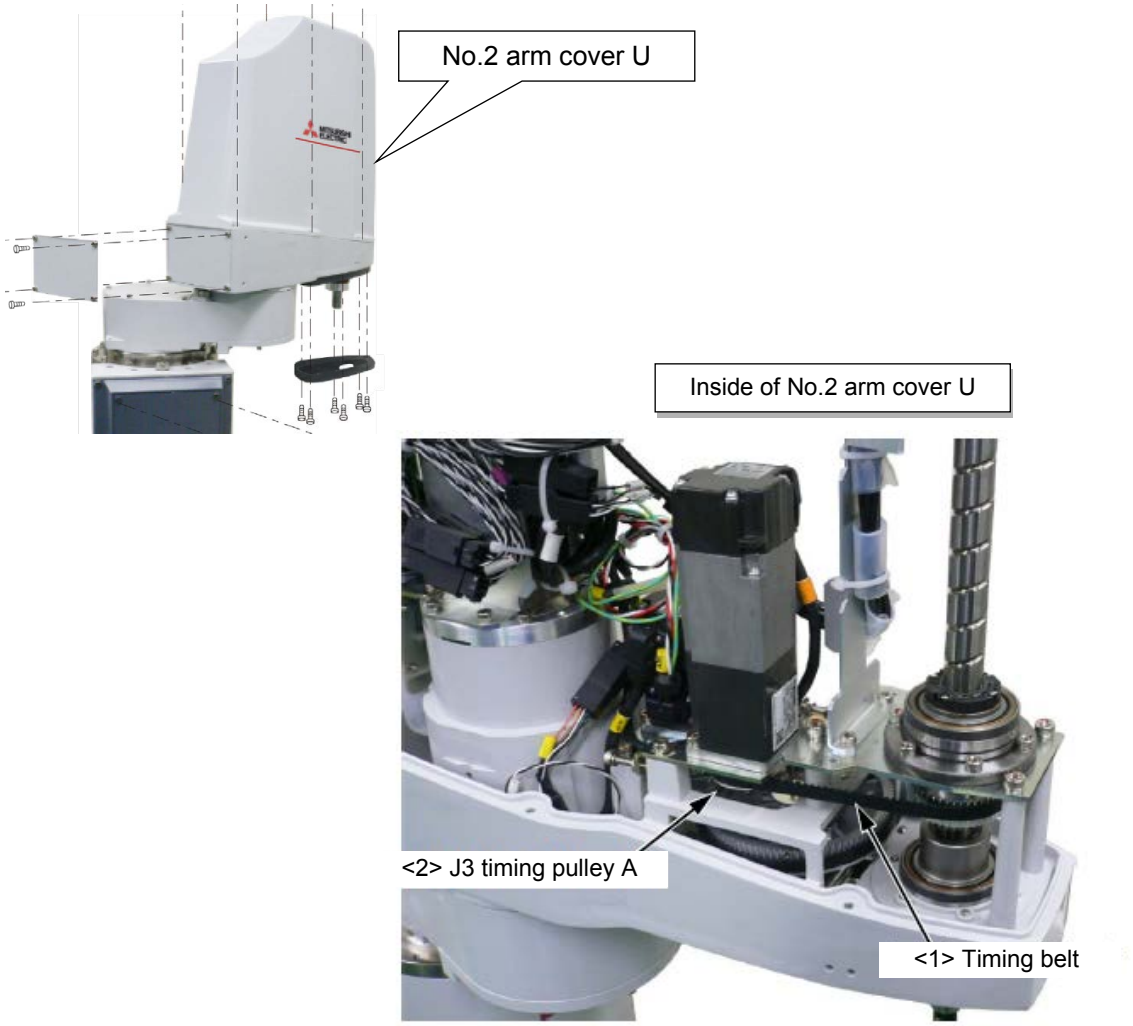
(4) RH-3FRH, RH-3FH series

(a) J3-axis timing belt

■Inspecting the J3 axis timing belt

The section related to the J3 axis timing belt of the RH-3FRH and RH-3FH series is shown in the figure below.

The picture is the image which removed the No.2 arm cover.



RH-3FRH, RH-3FH series: Inspecting the J3 axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No.2 arm cover U.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <1>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No.2 arm cover U securely as before and finish inspection.

■Replacing the J3 axis timing belt

The procedure for replacing the J3 axis timing belt of the RH-3FRH series is shown below.

The diagram shows an image of the removed No. 2 arm cover U.

After replacing the J3 axis timing belt the resetting the origin of J3 and J4 axis is necessary.

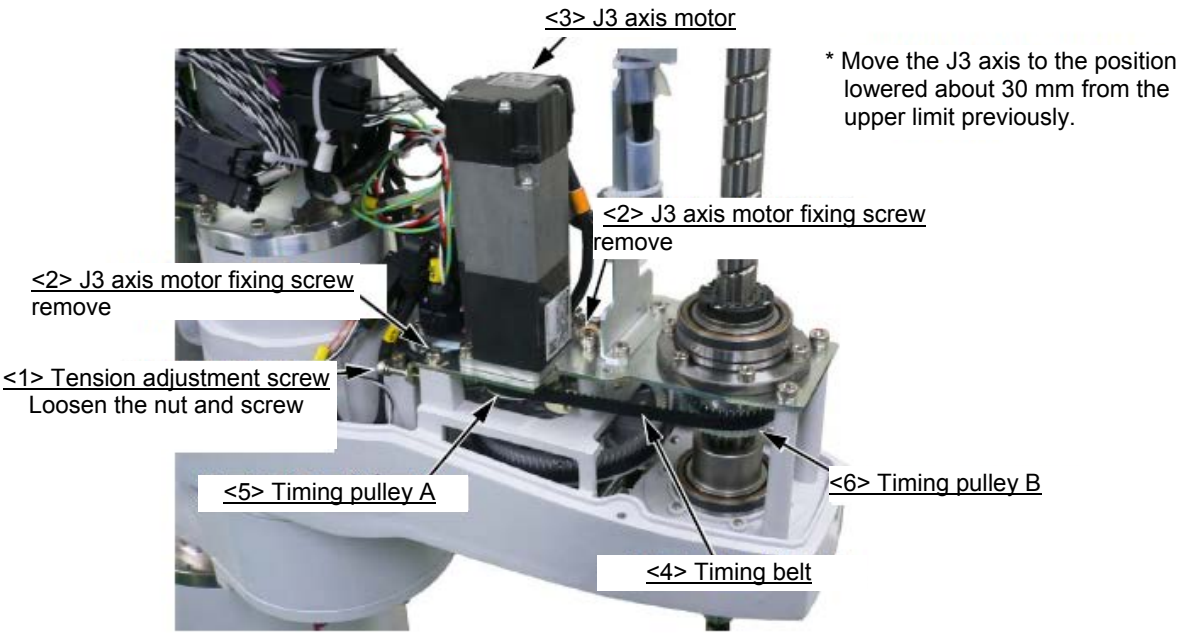
RH-3FRH, RH-3FH series: Replacing the J3 axis timing belt

(1) Move the J3 axis to the position lowered about 30 mm from the upper limit by jog operation.
(This position makes the space for removing the belt.)

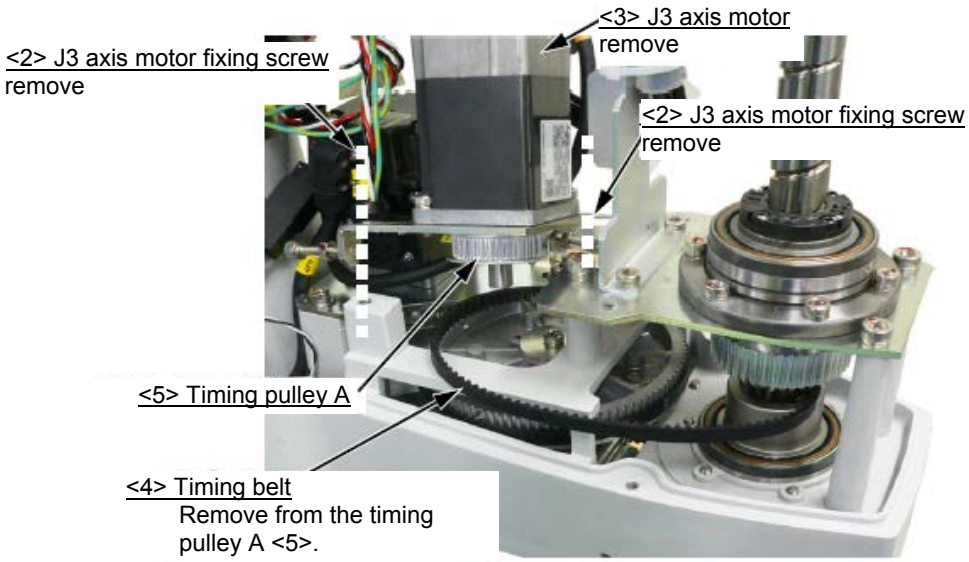
(2) Turn the controller's power supply OFF.

(3) Refer to "4.5 Installing/removing the cover", and remove the No.2 arm cover U.

(4) Loosen the nut of tension adjustment screw <1>, and loosen the tension adjustment screw <1>.



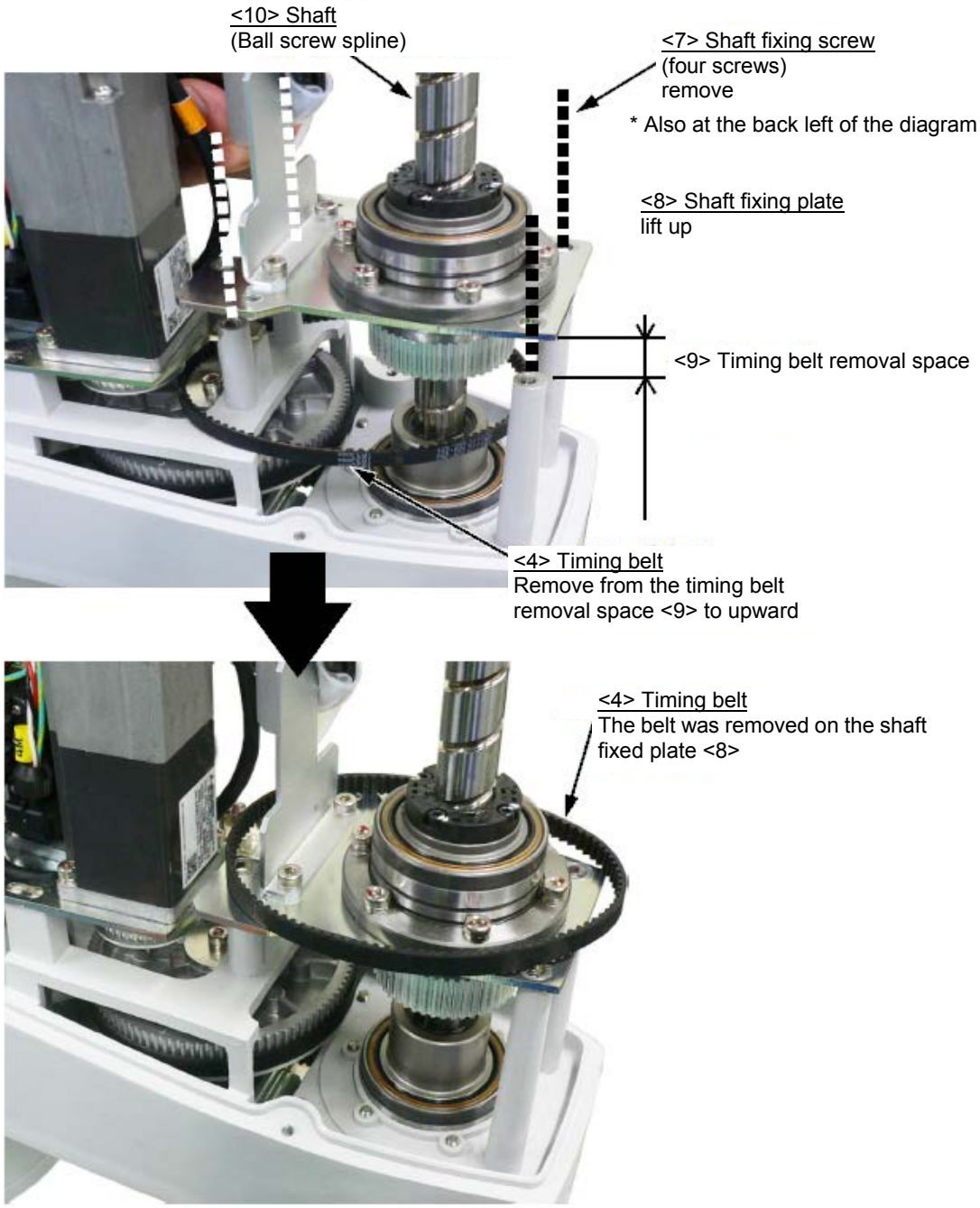
(5) Remove two fixing screws <2>, remove the J3 axis motor <3>, remove the timing belt <4> from the timing pulley A <5>.



RH-3FRH, RH-3FH series: Replacing the J3 axis timing belt

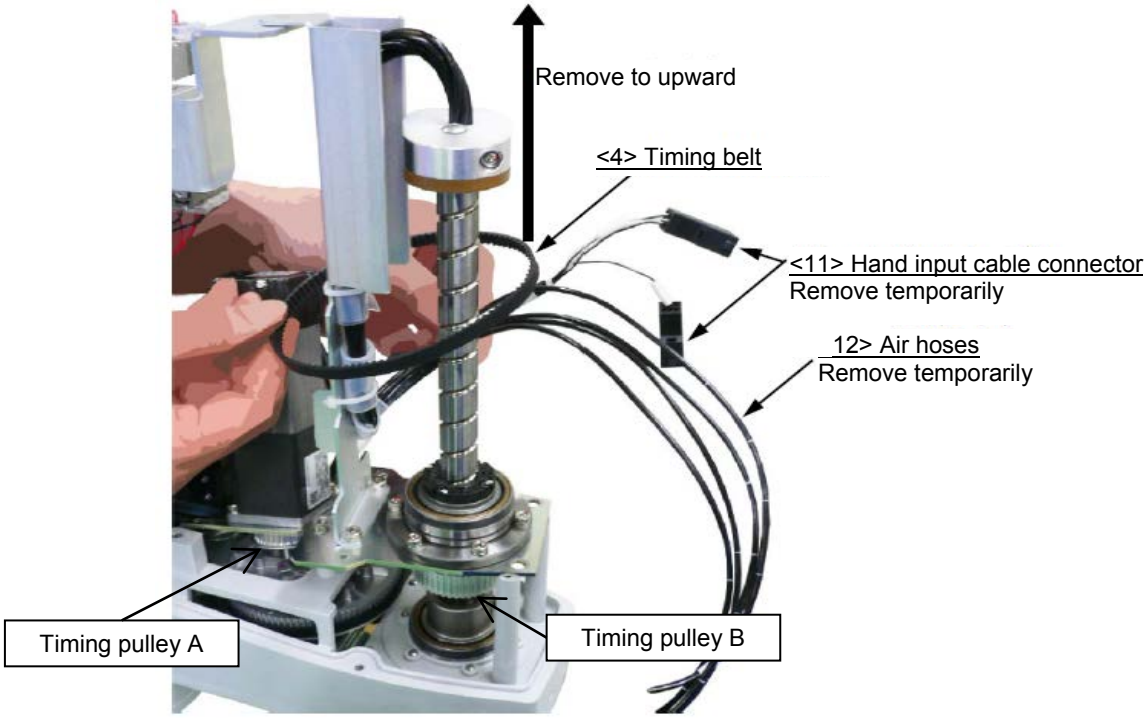
(6) Remove the timing belt <4> from the shaft to upward.
Remove the fixing screw <7> of shaft fixing plates and lift up the shaft fixing plate <8>.
When using the optional hand internal wiring and piping set remove the fixing screws fixed to the top.
Remove the timing belt <4> from the timing belt removal space <9> created under the shaft fixing plate <8> by lift up.

(7) Remove the timing belt <4> from the timing belt removal space <9> created under the shaft fixing plate <8> by lift up.



RH-3FRH, RH-3FH series: Replacing the J3 axis timing belt

(8) Remove the timing belt <4> from the top of the shaft
If using the optional hand internal wiring and piping set, temporarily remove the hand input cable connector <11> and air hoses <12> of solenoid valve side. And remove the timing belt to upward.



(9) Install the new timing belt in reverse procedure of removal.
Install the new belt to the timing pulley (on the motor) <5> and timing pulley B <6> securely.
Fix the shaft fixing plate <8> by fastening the original fixing screws securely. (M5 screw: tightening torque is 9.31 Nm)

(10) If using the hand input cables <11> and air hoses <12>, connect them as before.

(11) Install the J3 axis motor <3> by tightening lightly the J3 axis motor fixing screw <2> (two screws).

(12) The nut which is fixing tension adjustment screw <1> is loosened, turn tension adjustment screw <1>, and adjust the tension of timing belt <4>. Note1)
Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension". Note2)

(13) Fasten the two J3 axis motor fixing screws <2> certainly (M4 screw: tightening torque is 4.51 N·m).

(14) Moreover, also fasten the nut of tension adjustment screw <1> certainly. Note3)

(15) Install the No.2 arm cover U securely as before.

(16) Reset the origin of J3 and J4 axis with referring to the "5 Resetting the Origin"

(17) When the maintenance forecast function is valid, reset the accumulation data about the belt. Note4)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

Note2) Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".
If the belt is loosened too much when adjusting the tension causing it to come off the timing pulley A <5> and the timing pulley B <6>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

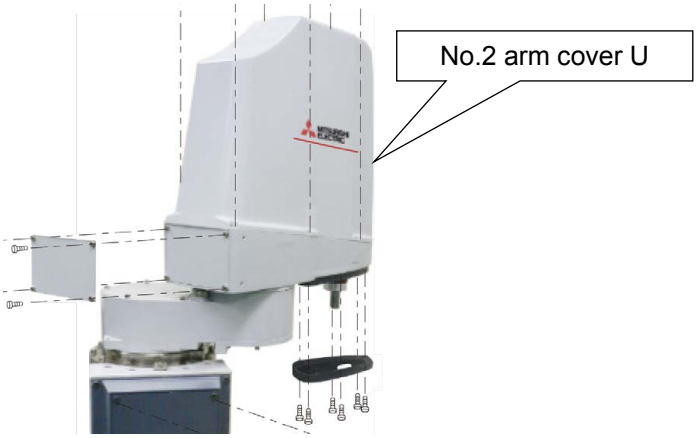
Note3) Improper tightening can cause the belt to loosen with vibration.

Note4) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

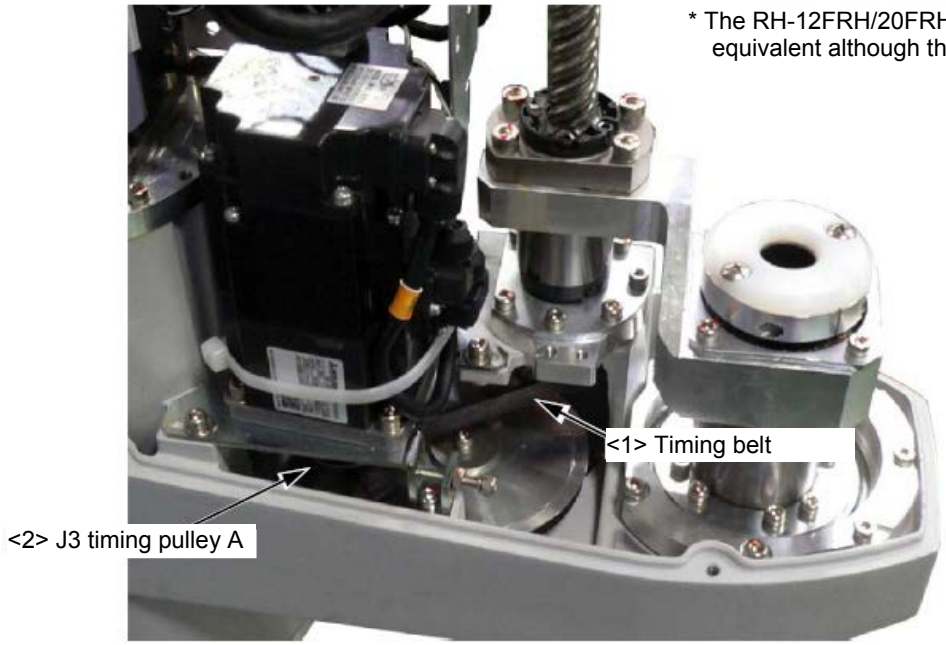
(5) RH-6/12/20FRH, RH-6/12/20FH series

(a) J3-axis timing belt

The section related to J3 axis timing belt of RH-6/12/20FRH, RH-6/12/20FH series is shown in figure below.
The picture is the image which removed the No.2 arm cover.



Inside of No.2 arm cover U



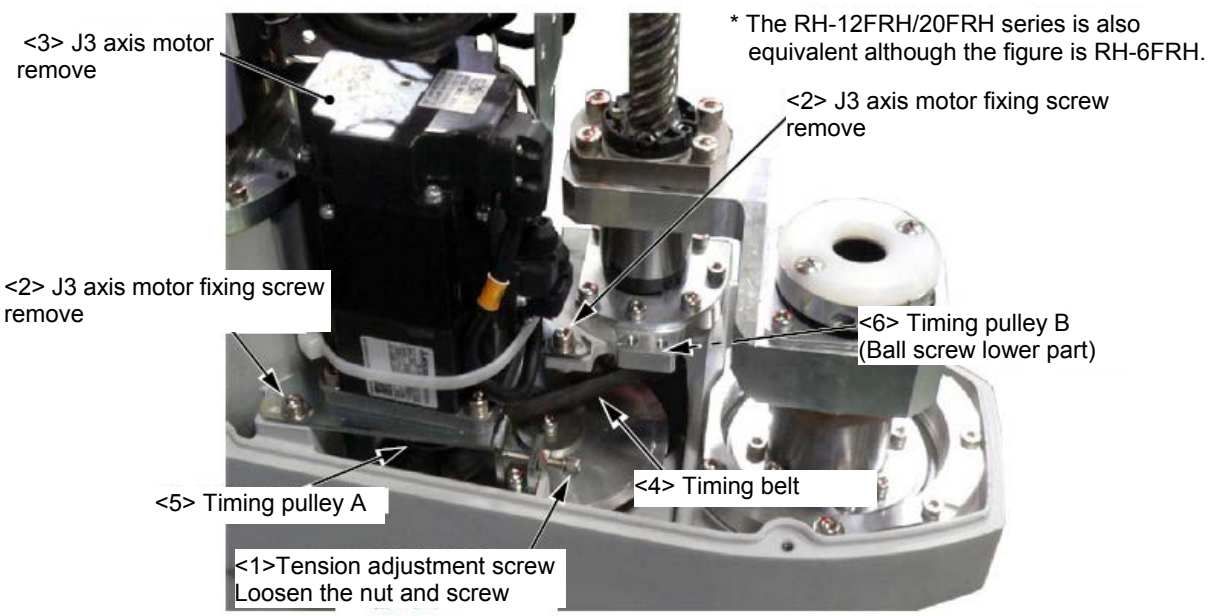
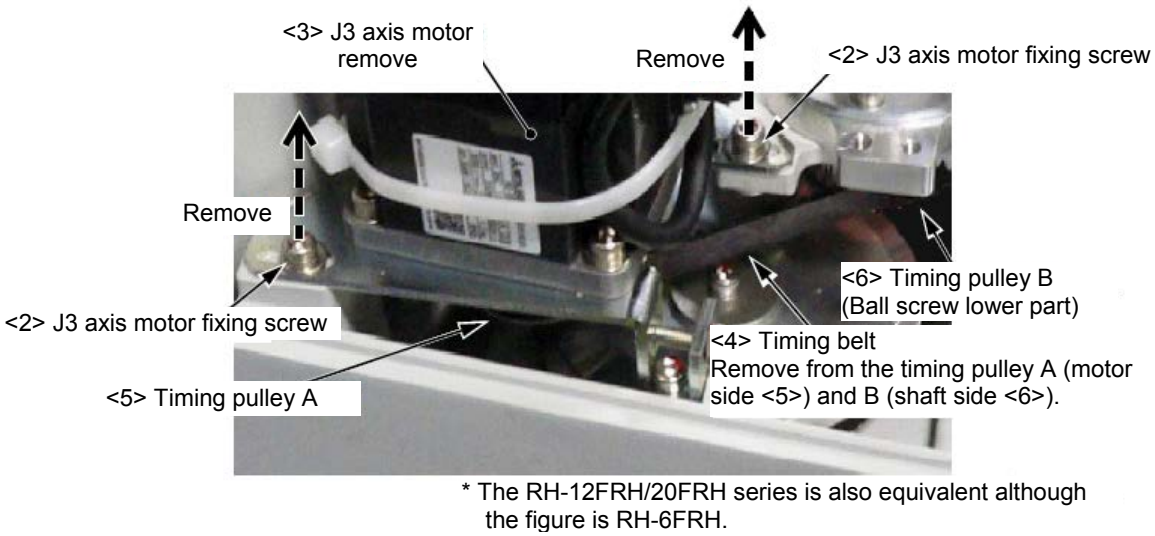
* The RH-12FRH/20FRH series is also equivalent although the figure is RH-6FRH.

■Inspecting the J3 axis timing belt

RH-6/12/20FRH, RH-6/12/20FH series: Inspecting the J3 axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No.2 arm cover U.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <1>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No.2 arm cover U securely as before and finish inspection.

■Replacing the J3 axis timing belt

The procedure for replacing the J3 axis timing belt of the RH-6FRH/12FRH/20FRH series is shown below.
The diagram shows an image of the removed No. 2 arm cover U.
After replacing the J3 axis timing belt the resetting the origin of J3 and J4 axis is necessary.

RH-6/12/20FRH, RH-6/12/20FH series: Replacing the J3 axis timing belt
(1) Refer to "4.5 Installing/removing the cover", and remove the No.2 arm cover U.
(2) Loosen the nut of tension adjustment screw <1>, and loosen the tension adjustment screw <1>. 
(3) Remove two fixing screws <2>, and remove the J3 axis motor <3>. (4) Remove the timing belt <4> from the timing pulley A <5> and B <6>.    * The RH-12FRH/20FRH series is also equivalent although the figure is RH-6FRH.
(5) Install surely the new belt to the timing pulley A <5> and timing pulley B <6>, and fix the J3 axis motor <3> with J3 axis motor fixing screw <2>. Confirms having related the timing belt <4> to the timing pulley A <5> and the timing pulley B <6> securely.
(6) Lightly loosen J3 motor installation screws <2> (Be careful not to overly loosen the screws.).
(7) The nut which is fixing tension adjustment screw <1> is loosened, turn tension adjustment screw <1>, and adjust the tension of timing belt <4>. Note1) Adjust the belt tension slack to within the range as shown in "4.6.3 Timing belt tension".

RH-6/12/20FRH, RH-6/12/20FH series: Replacing the J3 axis timing belt
(8) Install surely the new belt to the timing pulley A <5> and timing pulley B <6>, and fix the J3 axis motor <3> with J3 axis motor fixing screw <2>. Confirms having related the timing belt <4> to the timing pulley A <5> and the timing pulley B <6> securely. Note2)
(9) Fasten the two J3 axis motor fixing screws <2> certainly with the following torque. Note3)
(10) Moreover, also fasten the nut of tension adjustment screw <1> certainly. Note4)
(11) Install No.2 arm cover U securely as before.
(12) Reset the origin of J3 and J4 axis with referring to the "5 Resetting the Origin".
(13) When the maintenance forecast function is valid, reset the accumulation data about the belt. Note5)

Note1) When the screw is turned to the right, the belt will be stretched, and when turned to the left, will loosen.

Note2) Before the tension measurement, rotate the timing pulley at least three times in each direction so that the timing belt fits in the pulley. Check the tension measurement method in "4.6.2 Timing belt tension measurement".
If the belt is loosened too much when adjusting the tension causing it to come off the timing pulley A <5> and the timing pulley B <6>, or if the belt and pulley teeth engagement is deviated, the machine system's origin will deviate.

Note3) J3 axis motor fixing screws Tightening torque

Model	Screw size: tightening torque
RH-3FRH series	M4: 4.51 N·m
RH-6FRH/12FRH/20FRH series	M5: 9.31 N·m

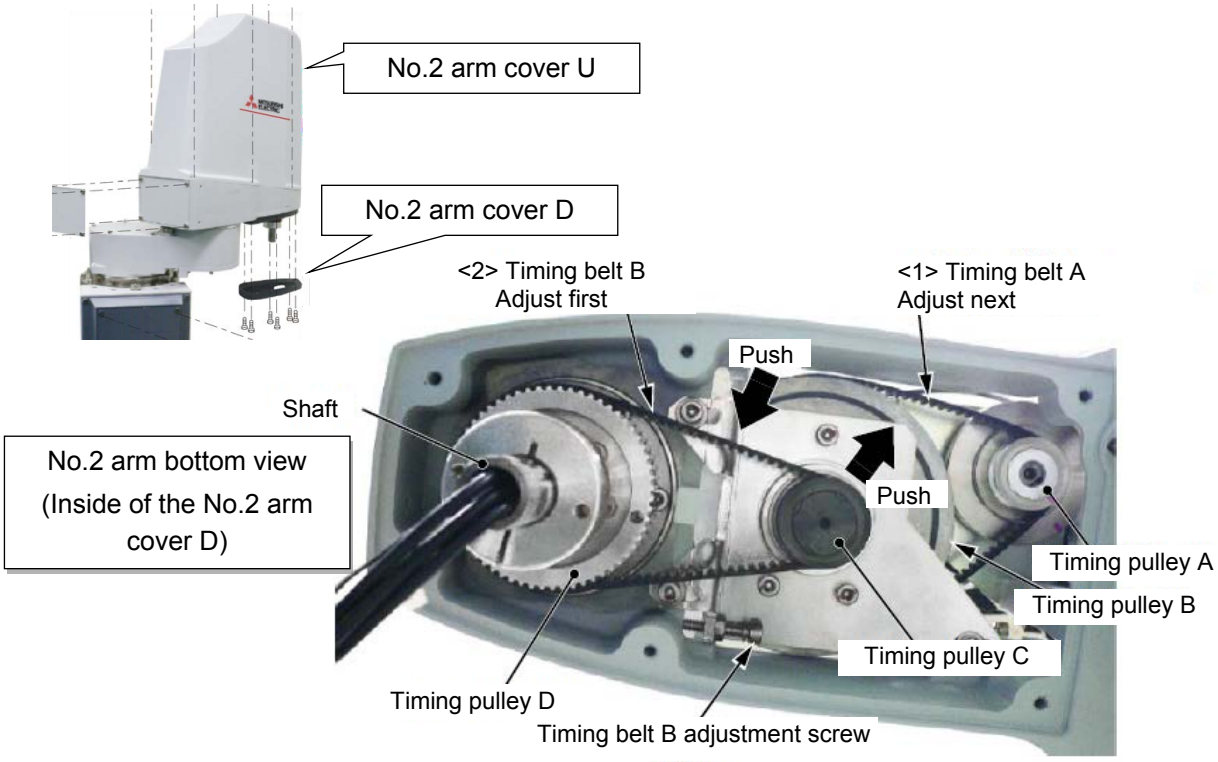
Note4) Improper tightening can cause the belt to loosen with vibration.

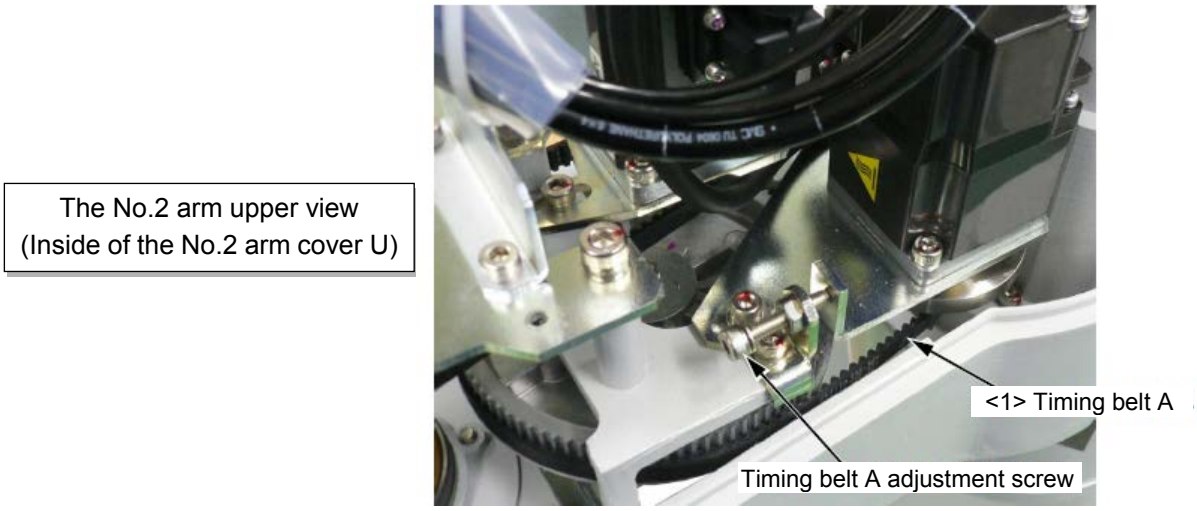
Note5) Reset by the dedicated screen or parameter MFBRST of RT ToolBox3.

The replacement of the timing belt of the RH-6FRH/12FRH/20FRH is complete.

(b) J4-axis timing belt

As shown in figure below, the J4 axis timing belt consists of two timing belts: timing belt A <1> and timing belt B <2>.





■Inspecting the J4 axis timing belt

RH-6/12/20FRH, RH-6/12/20FH series: Inspecting the J4 axis timing belt	
1	Refer to "4.5 Installing/removing the cover", and remove the No.2 arm cover U and No.2 cover D.
2	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt.
3	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
4	Install the No.2 arm cover U and No.2 arm cover D securely as before and finish inspection.

■Replacing the J4 axis timing belt

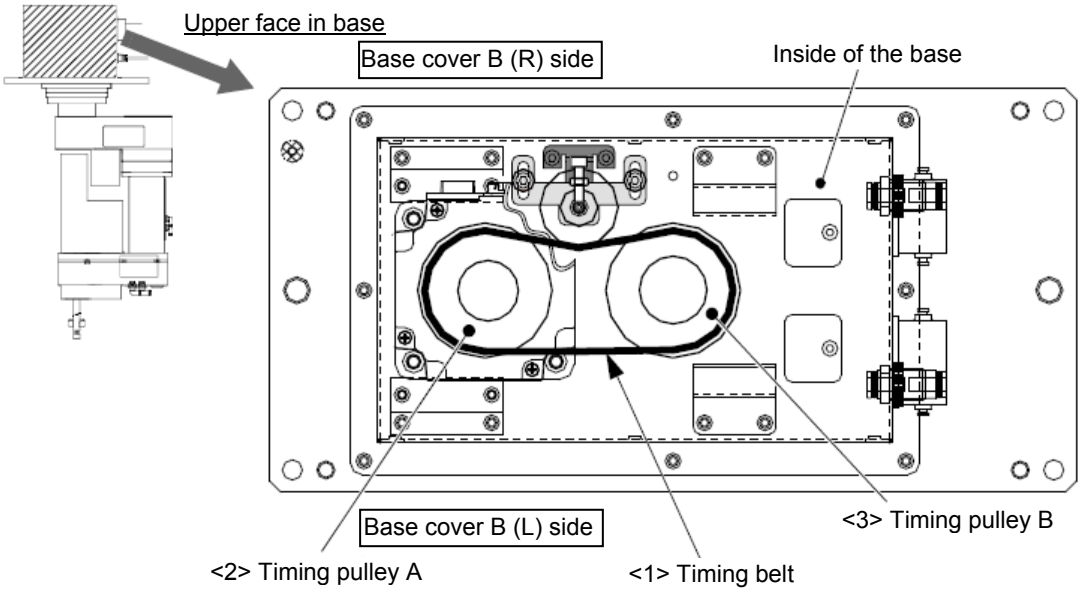
For the replacement of the J4 axis timing belt, contact the dealer.

(6) RH-3FRHR, RH-3FHR series (Celling type)

(a) J1-axis timing belt

■Inspecting the J1 axis timing belt

The following figure is the reference for the inspection of the J1 axis timing belt of the RH-3FRHR and RH-3FHR series (hanging type).



Note) The figure shows the timing belt structure section in the base portion.
Remove and confirm both base cover B (L) and (R).

RH-3FRHR, RH-3FHR series (Hanging type): Inspection of J1 axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the base cover B (R) and (L).
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <1>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the base cover B (R) and (L) securely as before and finish inspection.

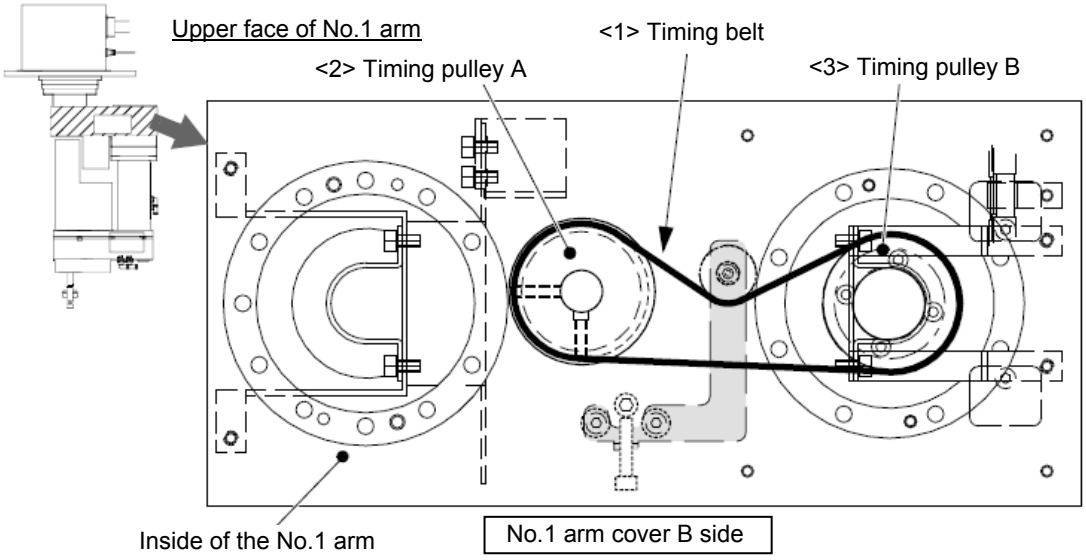
■Replacing the J1 axis timing belt

For the replacement of the J1 axis timing belt, contact the dealer.

(b) J2-axis timing belt

■Inspecting the J2 axis timing belt

The following figure is the reference for the inspection of the J2 axis timing belt of the RH-3FRHR and RH-3FHR series (hanging type).



Note) The figure shows the timing belt structure section in the No.1 arm portion.
Remove and confirm both No.1 arm cover B.

RH-3FRHR, RH-3FHR series (Hanging type): Inspection of J2 axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No.1 arm cover B.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <1>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the No.1 arm cover B securely as before and finish inspection.

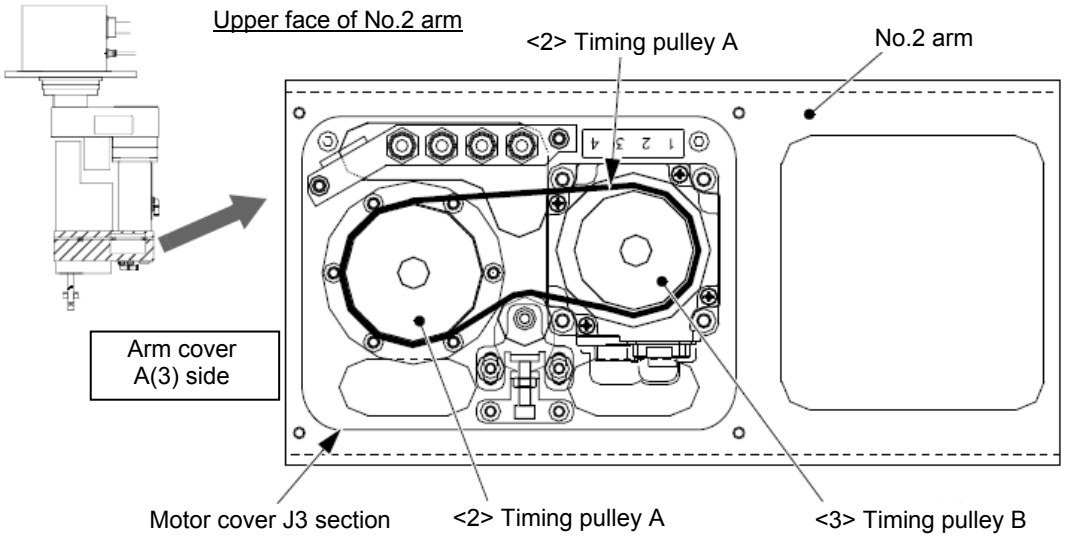
■Replacing the J2 axis timing belt

For the replacement of the J2 axis timing belt, contact the dealer.

(c) J3-axis timing belt

■Inspecting the J3 axis timing belt

The following figure is the reference for the inspection of the J3 axis timing belt of the RH-3FRHR and RH-3FHR series (hanging type).



Note) The figure shows the timing belt structure section inside the No.2 arm.
Remove and confirm the motor cover J3 and the arm cover A(3).

RH-3FRHR, RH-3FHR series (Hanging type): Inspection of J3 axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the motor cover J3 and arm cover A(3).
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <1>.
4	Refer to "4.6.2 Timing belt tension measurement", and confirm the belt tension.
5	Install the motor cover J3 and arm cover A(3) securely as before and finish inspection.

■Replacing the J3 axis timing belt

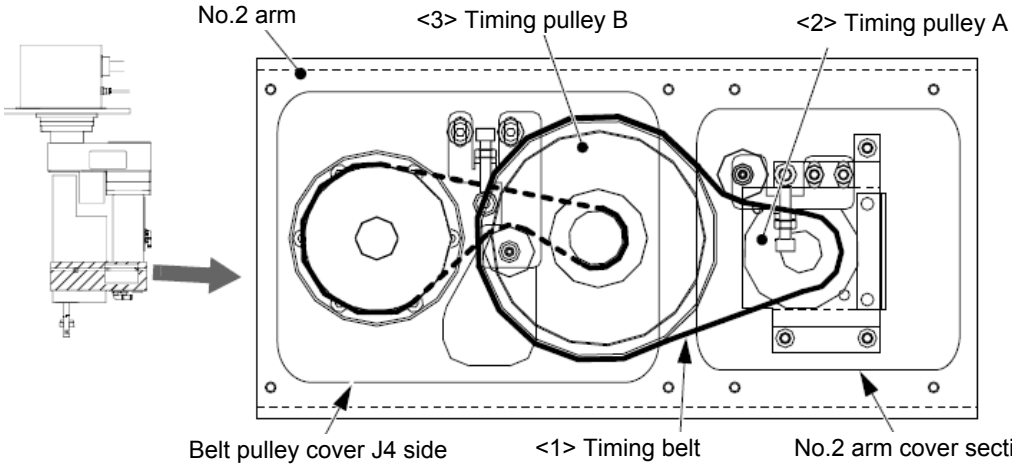
For the replacement of the J3 axis timing belt, contact the dealer.

(d) J4-axis timing belt

■Inspecting the J4 axis timing belt

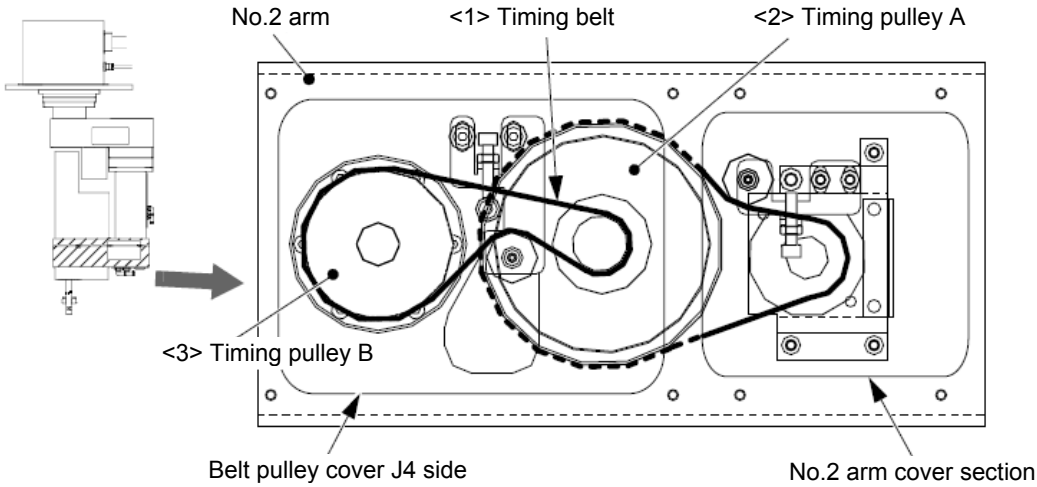
The following figure is the reference for the inspection of the J4 axis timing belt of the RH-3FRHR and RH-3FHR series (hanging type). There are the two belts of the motor side and the shaft side, in the J4 axis. Perform inspection of two belts simultaneously.

Motor side (Inside figure of No.2 arm)



Note) The figure shows the timing belt structure section (motor side) inside the No.2 arm. Remove and confirm the No.2 arm cover and the belt pulley cover J4.

Shaft side (Bottom view of No.2 arm)



Note) The figure shows the timing belt structure section (shaft side) inside the No.2 arm. Remove and confirm the No.2 arm cover and the belt pulley cover J4.

RH-3FRHR, RH-3FHR series (Hanging type): Inspection of J4 axis timing belt	
1	Confirm that the controller power is OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the No.2 arm cover and the belt pulley cover J4.
3	Visually confirm that the symptoms indicated in "4.6.1 Timing belt replacement period" have not occurred with the timing belt <1>.
4	Check the tension of two timing belts <1>. (Refer to "4.6.2 Timing belt tension measurement".)
5	Install the No.2 arm cover and the belt pulley cover J4 securely as before and finish inspection.

■Replacing the J4 axis timing belt

For the replacement of the J4 axis timing belt, contact the dealer.

4.7 Lubrication

Grease (lubrication oil) is used for the reduction gears of the robot. Grease has various functions such as suppressing the wear of the reduction gears, reducing friction heat, and preventing burning.

Grease will deteriorate when the robot is used for a long term depending on the load condition during the operation (operation speed, operation frequency, and heat generation condition). The deteriorated grease cannot achieve the original performance and affects the life of the robot.

Thus, grease needs to be replaced regularly.

The following describes the lubrication position, lubrication specifications, and lubrication method for each model. Please note the following precautions.

[Note about lubrication specification (common to all models)]

- The brand name of the grease in the lubrication specification table is the grease put in at shipping.
- The lubrication interval is a cumulative value of the operation at the maximum speed. If the operation has been suspended, or if the designated speed is slow, the lubrication time can be lengthened in proportion.
- Depending on the robot operation state, the lubrication interval will fluctuate, so determine the time according to the state so that the grease does not run out.
- Because excessive lubrication leads to the grease leak, avoid it. And the number of times of lubrication limits to 3 times. The maintenance after it needs the overhaul work which replaces internal grease.
- When the specified time limit (24,000 Hr) is due, the overhaul work to replace internal grease is required. If the overhaul cannot be conducted at the specified timing, lubricate them at the lubrication interval in the table.
- By the maintenance forecast function of RT ToolBox3 (option) computes the guide of the lubrication hours put together with the customer's operation status.

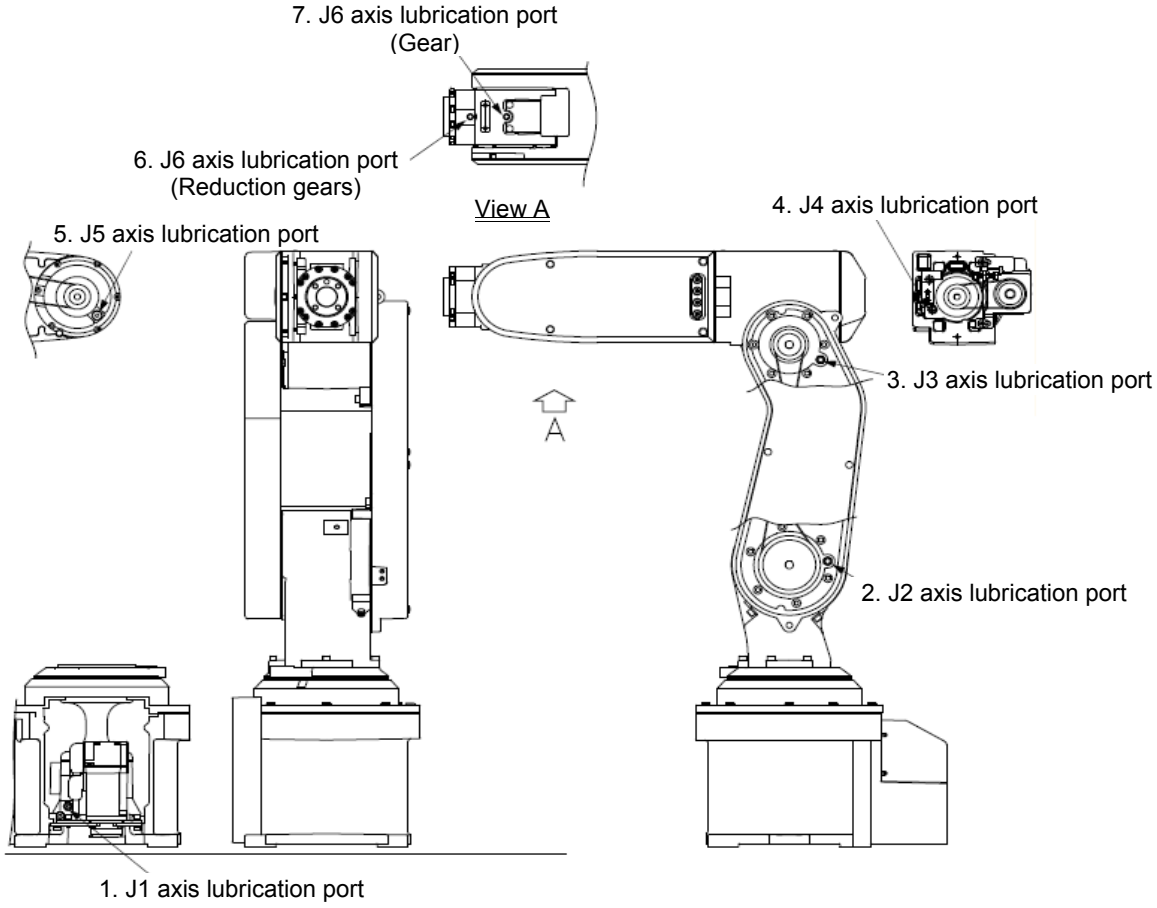
[Note about lubrication (common to all models)]

- Use manual grease gun, and inject grease with pressure 0.03 Mpa or less.
- Do not use the grease gun, which derived by the factory air presser to avoid injecting by too high pressure.
- A grease gun that fits the grease nipple is required.
  Recommended grease gun: CH-400 (dedicated for the cartridge) (Manufacture: Yamada Corporation Inc.,)
- When a grease can is used, the following hand grease gun for hand packing is recommended.
  Recommended grease gun: KH-120 (amount: 140 ml)
  (Manufacturer: Yamada Corporation)
- The KH-120 comes with a short nozzle (HSP-1) as standard. If this short nozzle does not reach the desired areas, depending on the robot model and installation location, it may be useful to use a long nozzle (HSP-2).
  (CH-400 has a long nozzle as standard equipment.)

(1) RV-2FR, RV-2F series

■Lubrication position

The position of the grease nipple and lubrication specifications of each axis are shown below.
Refer to the "4.5 Installing/removing the cover" for the method of removing and installing the cover.



■Lubrication specifications (The numbers correspond to the figure.)

No.	Parts to be lubricated	Oiling method	Lubrication oil (manufacturer)	Lubrication interval	Lubrication amount	Cover to remove
1	J1 axis reduction gears	Grease nipple WA-610	Grease Harmonic grease SK-1A (Harmonic Drive Systems Inc.)	6,000 Hr	3cc (2.8 g)	J1 motor cover
2	J2 axis reduction gears				2.5cc (2.3 g)	No1. Arm cover plate
3	J3 axis reduction gears				2.5cc (2.3 g)	
4	J4 axis reduction gears				0.5cc (0.5 g)	Elbow cover B
5	J5 axis reduction gears				0.5cc (0.5 g)	-
6	J6 axis reduction gears				0.5cc (0.5 g)	-
7	J6 axis gear				1.4cc (1.3 g)	-

■Lubrication method

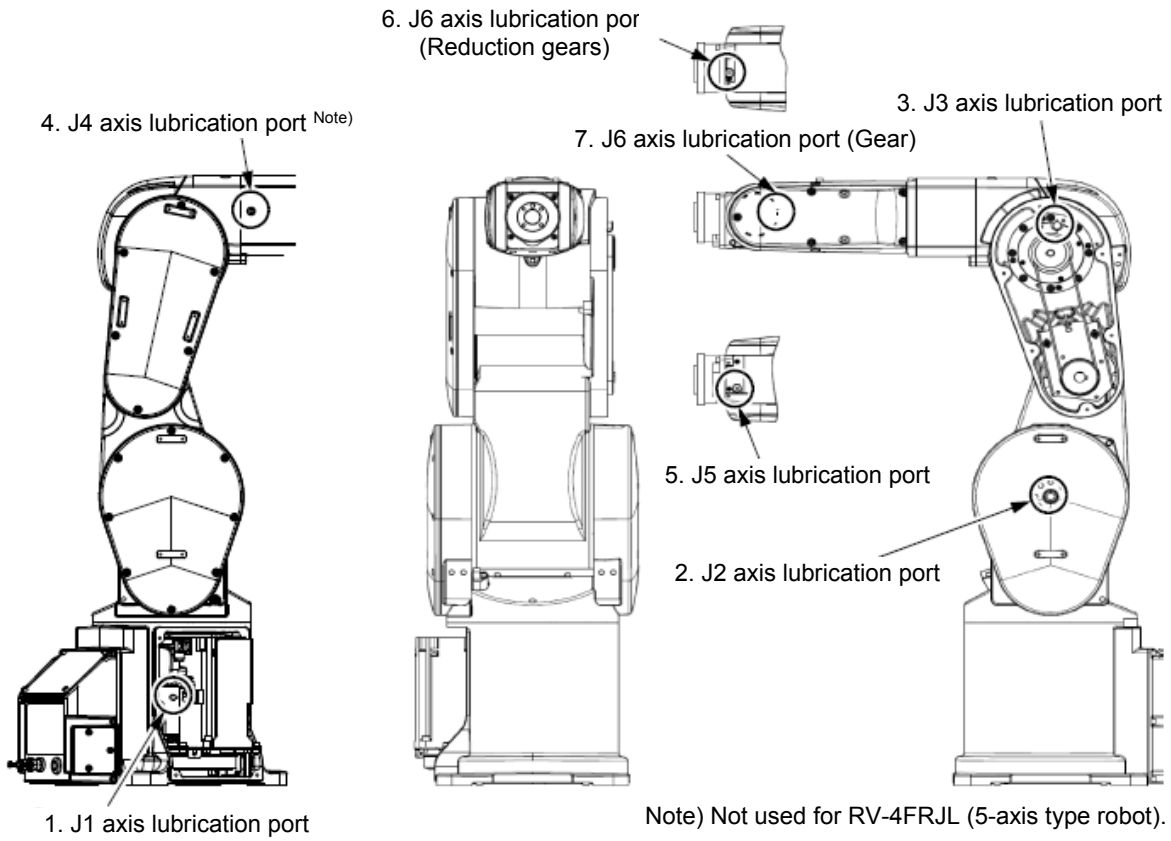
RV-2FR, RV-2F series Lubrication method	
1	Set the robot to the posture shown in "Figure: Lubrication position (RV-2FR, RV-2F series)".
2	Refer to "4.5 Installing/removing the cover", and remove the covers.
3	Please protect the timing belt with the cloth etc. so that the grease does not take for the timing belt at the time of oil supply.
4	J5 axis lubrication port <5>, the J6 axis lubrication port <6> (reduction gears), and the J6 axis lubrication port <7> (gear) should remove the bolt, and should install the attached grease nipple. Securely tighten the grease nipple by 4.7 N·m to 6.3 N·m.
5	Insert the grease shown in table left using a grease gun from the lubrication grease nipple.
6	J5 axis lubrication port <5>, the J6 axis lubrication port <6> (reduction gears), and the J6 axis lubrication port <7> (gear) should remove the grease nipple, and should install the original bolt. Securely tighten the bolt by 4.7 N·m to 6.3 N·m.
7	Replace the covers with the removal procedure in reverse.
8	If the maintenance forecast function is enable, please reset the accumulated data about grease. (Carries out the resetting operation by RT ToolBox3 (option) or parameter MFGRST.)

(2) RV-4/7FR, RV-4/7F series

■Lubrication positions

The following shows the positions of the grease nipple, lubrication positions, and lubrication specifications of each axis.

Refer to the "4.5 Installing/removing the cover" for the method of removing and installing the cover.



■Lubrication specifications (The numbers correspond to the figure.)

No.	Parts to be lubricated Note1)	Oiling method	Lubrication oil (manufacturer)	Lubrication interval	Lubrication amount	Cover to remove
RV-4FR, RV-4F series						
1	J1 axis reduction gears	Grease nipple WA-610	4B No.2 (Harmonic Drive Systems Inc.)	24,000 Hr	8 g	J1 motor cover
2	J2 axis reduction gears				8 g	
3	J3 axis reduction gears				4 g	No.1 arm cover L
4	J4 axis reduction gears Note2)				4 g	
5	J5 axis reduction gears				2 g	
6	J6 axis reduction gears				2 g	
7	J6 axis gears				1.3 g	Wrist cover
RV-7FR, RV-7F series						
1	J1 axis reduction gears	Grease nipple WA-610	4B No.2 (Harmonic Drive Systems Inc.)	24,000 Hr	12 g	J1 motor cover
2	J2 axis reduction gears				12 g	
3	J3 axis reduction gears				8 g	No.1 arm cover L
4	J4 axis reduction gears				4 g	
5	J5 axis reduction gears				2 g	
6	J6 axis reduction gears				2 g	
7	J6 axis gears				1.3 g	Wrist cover

Note1) When the screw is installed in the illustrated lubrication point, install the attached grease nipple and supply the grease.

Note2) Since RV-4FRJL and RV-4FJL are 5-axis type robots, they have no J4 axis reduction gears.

■Lubrication method (RV-4FR, RV-4F series)

RV-4FR, RV-4F series Lubrication method	
1	Set the robot to the posture shown in "Figure: Lubrication position (RV-4/7FR, RV-4/7F series)".
2	Refer to "4.5 Installing/removing the cover", and remove the covers.
3	Please protect the timing belt with the cloth etc. so that the grease does not take for the timing belt at the time of oil supply.
4	Remove the following screws, and install the attached grease nipples. J3 axis lubrication port <3>, J4 axis lubrication port <4>, J5 axis lubrication port <5>, J6 axis lubrication port <6> (reduction gears) and J6 axis lubrication port <7> (gear). Securely tighten the grease nipple by 4.7 N·m to 6.3 N·m * RV-4FRJL does not use the J4 axis lubrication port <4>.
5	Insert the grease shown in table of the lubrication specifications using a grease gun from the lubrication grease nipple.
6	Remove the grease nipples installed above and install the original screws. Tighten the screws by 4.7 N·m - 6.3 N·m.
7	Replace the covers with the removal procedure in reverse.
8	If the maintenance forecast function is enable, please reset the accumulated data about grease. Note1)

Note1) Carries out the resetting operation by RT ToolBox3 (option) or parameter MFGRST.

■Lubrication method (RV-7FR, RV-7F series)

RV-7FR, RV-7F series Lubrication method	
1	Set the robot to the posture shown in "Figure: Lubrication position (RV-4/7FR, RV-4/7F series)".
2	Refer to "4.5 Installing/removing the cover", and remove the covers.
3	Please protect the timing belt with the cloth etc. so that the grease does not take for the timing belt at the time of oil supply.
4	Remove the following screws, and install the attached grease nipples. J4 axis lubrication port <4>, J5 axis lubrication port <5>, J6 axis lubrication port <6> (reduction gears) and J6 axis lubrication port <7> (gear). Securely tighten the grease nipple by 4.7 N·m to 6.3 N·m
5	Insert the grease shown in table of the lubrication specifications using a grease gun from the lubrication grease nipple.
6	Remove the grease nipples installed above and install the original screws. Tighten the screws by 4.7 N·m - 6.3 N·m.
7	Replace the covers with the removal procedure in reverse.
8	If the maintenance forecast function is enable, please reset the accumulated data about grease. Note1)

Note1) Carries out the resetting operation by RT ToolBox3 (option) or parameter MFGRST.

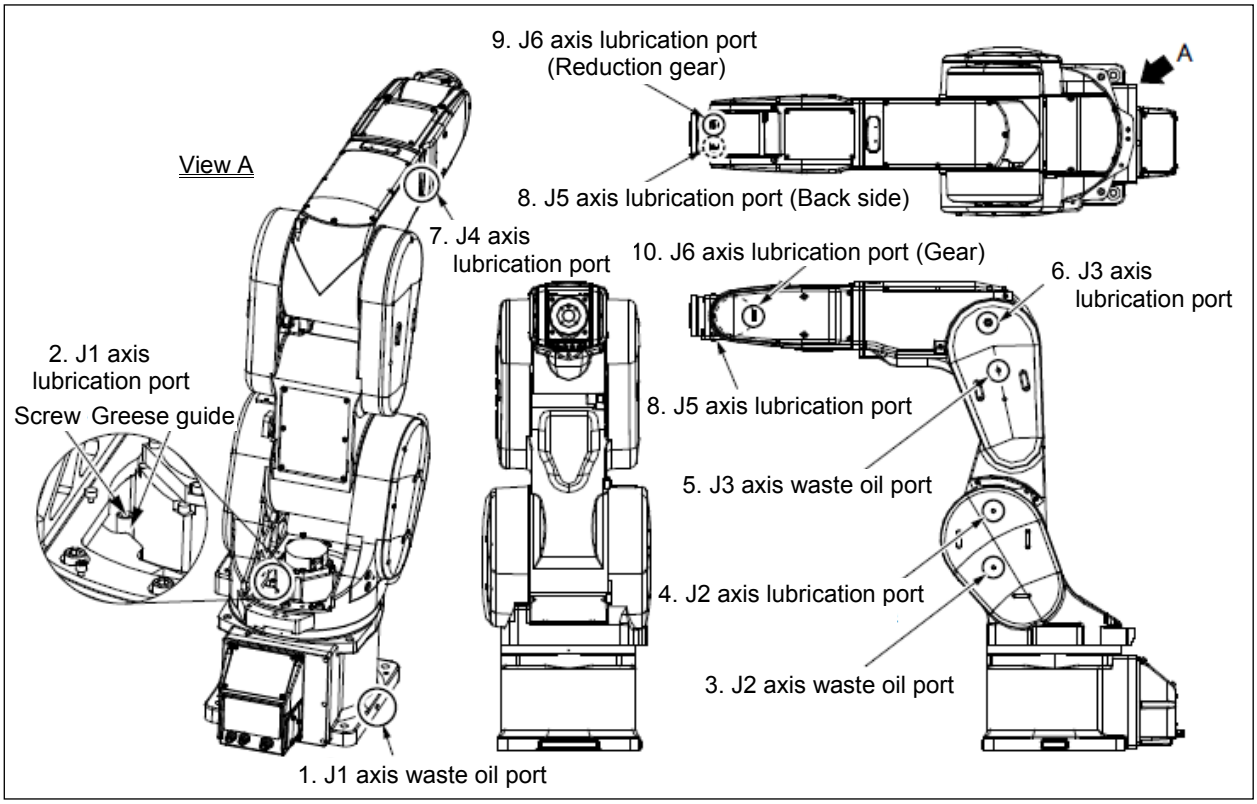
<< MEMO >> * Please use this page for your memo.

(3) RV-13/20FR, RV-13/20F series

■Lubrication positions

The following shows the positions of the grease nipple, lubrication positions, and lubrication specifications of each axis.

Refer to the "4.5 Installing/removing the cover" for the method of removing and installing the cover.

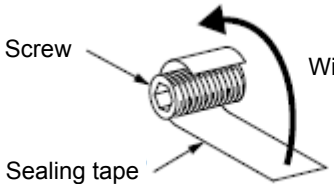


■Lubrication specifications (The numbers correspond to the figure.)

No.	Parts to be lubricated Note1)	Oiling method	Lubrication oil (manufacturer)	Lubrication interval	Lubrication amount	Cover to remove
RV-13/20FR, RV-13/20F series (including the RV-7FLL and RV-7FRLL)						
2	J1 axis reduction gears	Grease nipple WA-110	VIGO GREASE (Nabtesco Co., Ltd.)	20,000 Hr	255 g	Shoulder cover
4	J2 axis reduction gears				251 g	
6	J3 axis reduction gears				150 g	
7	J4 axis reduction gears	Grease nipple WA-610	4B No.2 (Harmonic Drive Systems Inc.)	24,000 Hr	7 g	
8	J5 axis reduction gears				3 g	
9	J6 axis reduction gears				2 g	
10	J6 axis gears				1.5 g	Wrist cover

Note1) When the screw is installed in the illustrated lubrication point, install the attached grease nipple and supply the grease.

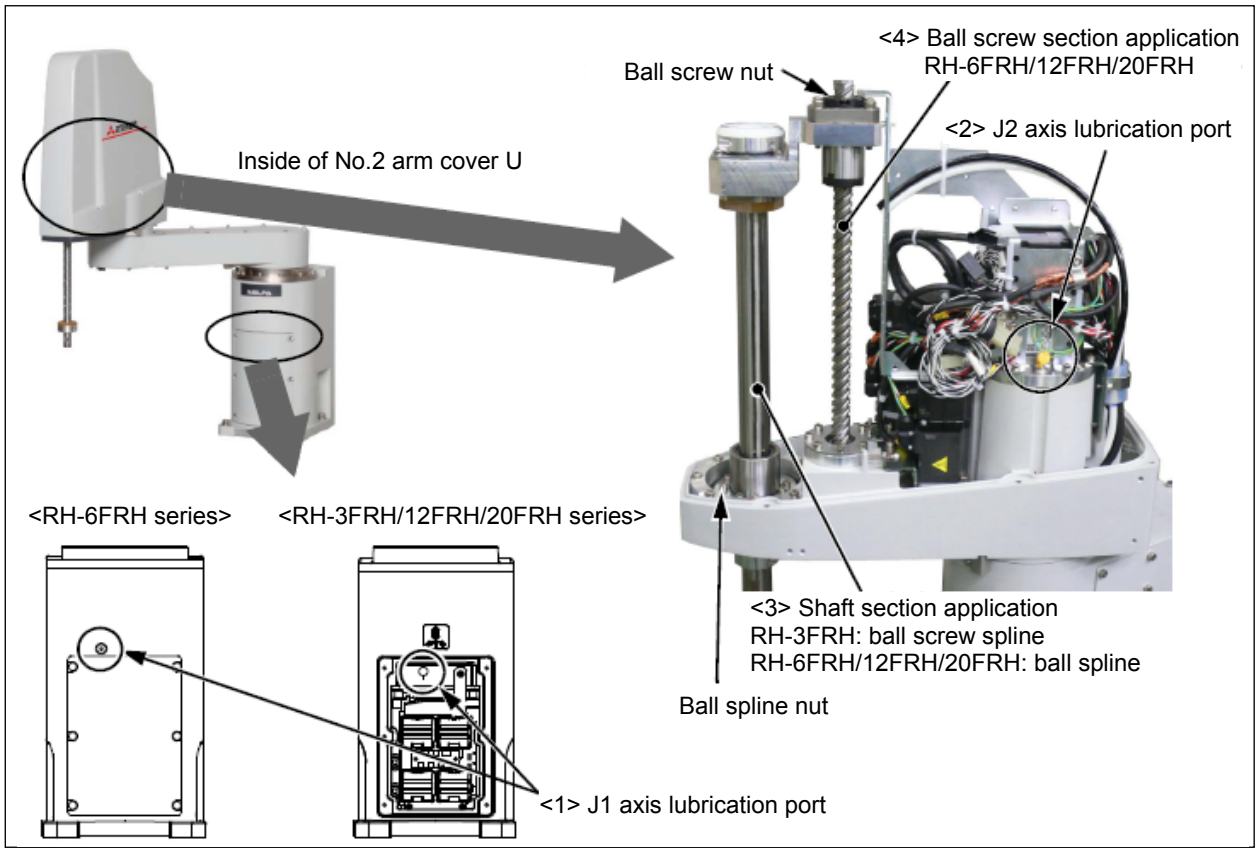
■Lubrication method

RV-13/20FR, RV-13/20F series Lubrication method	
1	Set the robot to the posture shown in "Figure: Lubrication position (RV-13/20FR, RV-13/20F series)".
2	Refer to "4.5 Installing/removing the cover", and remove the covers.
3	Please protect the timing belt with the cloth etc. so that the grease does not take for the timing belt at the time of oil supply.
4	Removes J1 axis waste oil screw <1>, the J2 axis waste oil screw <3>, and the J3 axis waste oil screw <5>. Because the oil appears from the screw hole, please wipe off with the rag etc.
5	Remove the screw of from J1 axis lubrication port <2> to the J6 axis lubrication port (gear) <7>, and install the attached grease nipple. Securely tighten the grease nipple by 4.7 N·m to 6.3 N·m
6	Insert the grease shown in table of the lubrication specifications using a grease gun from the lubrication grease nipple.
7	In the RV-13FR series, wind thread sealing tape two or three times around the thread of the screws removed from waste oil portion (1), (3), and (5) (refer to the image below). Then tighten the screws by 7.1 N·m to 8.5 N·m.  Winding directions of the sealing tape on the screw. Recommended sealing tape: NITOFLON Pipe Seal No.95 (JIS), manufacture: NITTO DENKO
8	Remove the grease nipples installed above and install the original screws. 1) In lubrication portion of from (7) to (10), tighten the screw by 4.7 N·m - 6.3 N·m. 2) In lubrication portion (2), (4), and (6), wind thread sealing tape two or three times around the thread of the screws (see 7)). (Recommended sealing tape: NITOFLON Pipe Seal No.95 (JIS), manufacture: NITTO DENKO) 3) Tighten the screw of lubrication portion (2) to the end surface of grease guide. 4) Tighten the screw of lubrication portion (4) and (6) by 7.1 N·m to 8.5 N·m.
9	Replace the covers with the removal procedure in reverse.
10	If the maintenance forecast function is enable, please reset the accumulated data about grease. Note1)

Note1) Carries out the resetting operation by RT ToolBox3 (option) or parameter MFGRST.

(4) RH-FRH, RH-FH series

■Lubrication positions



■Lubrication specifications (The numbers correspond to the figure.)

No.	Parts to be lubricated	Oiling method	Lubrication oil (manufacturer)	Lubrication interval	Lubrication amount	Cover to remove
RH-3FRH, SRH-3FH series						
<1>	J1 axis reduction gears	Grease nipple WA-610 (Only addition)	4B No.2 (Harmonic Drive Systems Inc.)	24,000 Hr	12 g	Battery cover
<2>	J2 axis reduction gears	Grease nipple WB-610 (Only addition)		24,000 Hr	8 g	No.2 arm cover U
<3>	Shaft (ball screw spline)	Wipe the old grease, and applies	Multemp PS2 (KYODO YUSHI CO., LTD.)	Every 2,000 km movement	1 g	
RH-6FRH, RH-6FH series						
<1>	J1 axis reduction gears Note1)	Grease nipple WA-610 (Only addition)	4B No.2 (Harmonic Drive Systems Inc.)	24,000 Hr	12 g	
<2>	J2 axis reduction gears	Grease nipple WB-610 (Only addition)		24,000 Hr	8 g	No.2 arm cover U
<3>	Shaft (ball screw spline)	Wipe the old grease, and applies	Multemp PS2 (KYODO YUSHI CO., LTD.)	Every 2,000 km movement	1 g	
<4>	Shaft (ball screw)				1 g	

No.	Parts to be lubricated	Oiling method	Lubrication oil (manufacturer)	Lubrication interval	Lubrication amount	Cover to remove
RH-12FRH/20FRH, RH-12FH/20FH series						
<1>	J1 axis reduction gears	Grease nipple WA-610 (Only addition)	4B No.2 (Harmonic Drive Systems Inc.)	24,000 Hr	16 g	Battery cover
<2>	J2 axis reduction gears	Grease nipple WB-610 (Only addition)		24,000 Hr	12 g	No.2 arm cover U
<3>	Shaft (ball screw spline)	Wipe the old grease, and applies	Multemp PS2 (KYODO YUSHI CO., LTD.)	Every 2,000 km movement	1 g	
<4>	Shaft (ball screw)				1 g	

Note1) Remove the screw from lubrication point and install the supplied grease nipple for supplying grease.

■Lubrication method to the J1, J2 axis

RH-FRH, RH-FH series Lubrication method to the J1, J2 axis	
1	Turn the controller's power supply OFF.
2	Refer to "4.5 Installing/removing the cover", and remove the covers.
3	In RH-6FRH series, remove the screw from the J1 axis lubrication port, and install the attached grease nipple. Securely tighten the grease nipple by 4.7 N·m to 6.3 N·m.
4	Insert the grease shown in table of the lubrication specifications using a grease gun from the lubrication grease nipple. Note1)
5	In RH-6FRH series, removes the grease nipple installed above and installs the original screw. Securely tighten the screw by 4.7 N·m to 6.3 N·m.
6	Install the removed cover as before. Note2)
7	If the maintenance forecast function is enable, please reset the accumulated data about grease. Note3)

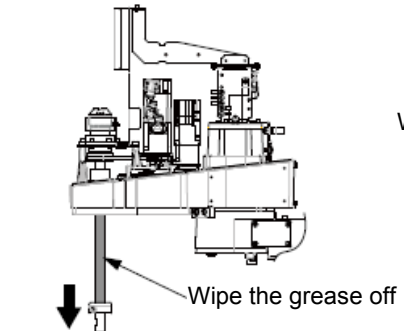
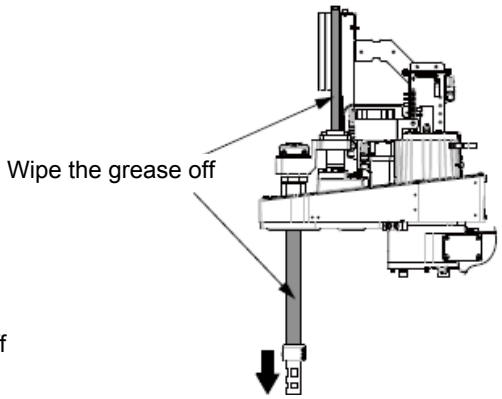
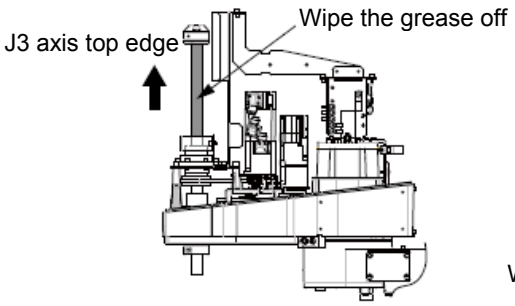
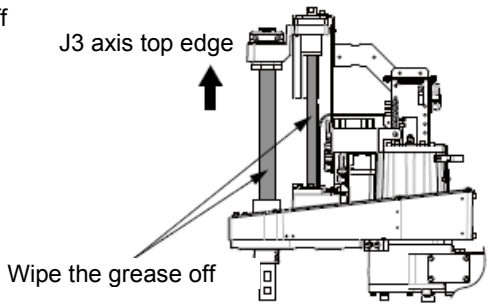
Note1) Add only the specified amount of grease. Adding excess grease may cause grease to leak.

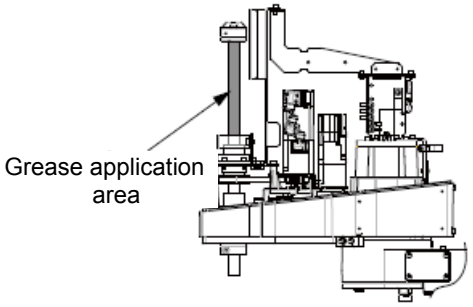
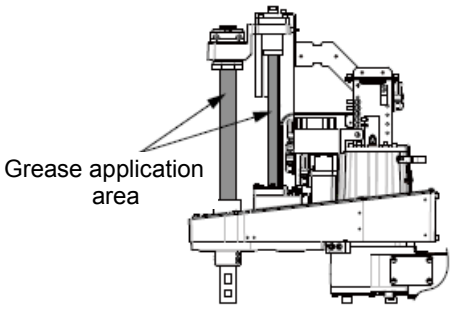
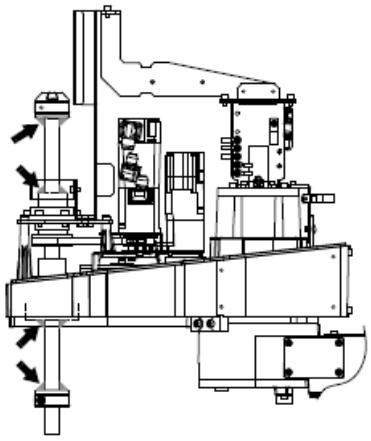
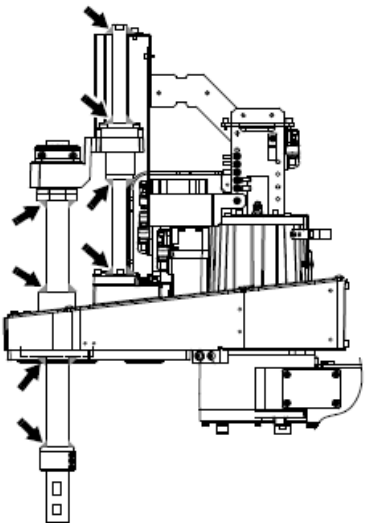
Note2) Sealant is applied to the installation surface of the cover in the oil mist and clean specification models. Be sure to replace the sealant if it has been dislocated and bent or crushed and does not return to its original shape.

Note3) Carries out the resetting operation by RT ToolBox3 (option) or parameter MFGRST.

The lubricating to the J1 and J2 axes is completed.

■Lubrication method to the shaft

RH-FRH, RH-FH series Lubrication method to the shaft	
1	Move the J3 axis to the bottom end with a jog operation.
2	Turn the controller's power supply OFF.
3	Refer to "4.5 Installing/removing the cover", remove the No. 2 arm cover U.
4	For the oil mist and clean specifications model, remove the bellows. (Refer to "Appendix 4 Replacing the Bellows".) Note 1)
5	Wipe the old grease off the shaft. Wipe off the grease inside the No. 2 arm cover-U and the bracket attached vertically to the shaft fixing area.  RH-3FRH series  RH-6FRH/12FRH/20FRH series
6	Power on the controller.
7	Move the J3 axis to the top end with a jog operation.
8	Then shut off the controller's power supply again.
9	Wipe off the old grease beneath the ball spline nut and the ball screw nut on the shaft.  RH-3FRH series  RH-6FRH/12FRH/20FRH series

RH-FRH, RH-FH series Lubrication method to the shaft	
10	Apply the specified amount of grease to the shaft. Fill the shaft grooves with the grease. Also, apply thegrease lightly to the areas other than the grooves on the shaft surface to prevent rusting.  RH-3FRH series  RH-6FRH/12FRH/20FRH series
11	Turn on the controller's power supply.
12	Turn on the controller's power supply. Move the J3 axis up and down for several times using the jog operation to distribute the grease inside the ball spline nut and the ball screw nut.
13	Move the J3 axis to a position around the center of the stroke using the jog operation.
14	Turn the controller's power supply OFF.
15	Wipe off the grease adhering around the shaft ends or the nuts of the ball spline and the ball screw (indicated with the arrows below). Note2)  RH-3FRH series  RH-6FRH/12FRH/20FRH series
16	Install the No.2 arm cover U as before.
17	Install the bellows as before in the oil mist and clean specification. Note3)

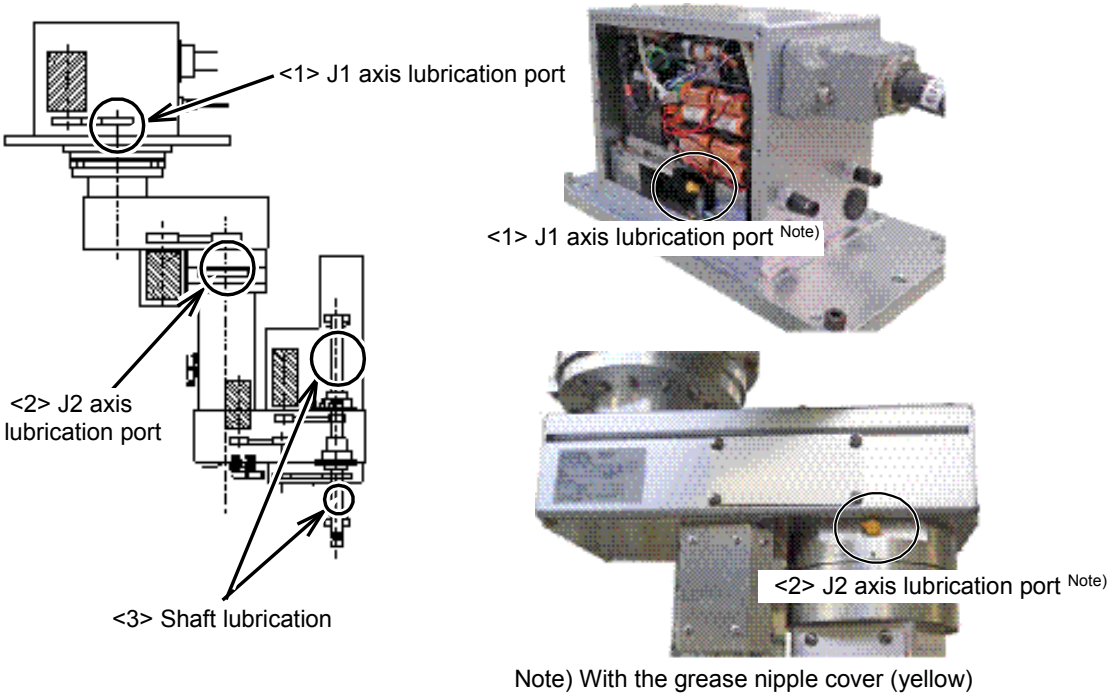
Note1) Replace the bellows in a place where there is no risk of contamination by dust and oil mist. If it must be replaced in a dust-filled area, be sure to remove as much dust as possible in advance before replacing it.

Note2) When the ball spline and the ball screw are moved with extra grease on them, a large amount of grease is scattered inside the arm. The grease may reach the timing belt inside the No.2 arm, causing the timing belt to deteriorate early.

Note3) Sealant is applied to the installation surface of cover in the oil mist and clean specification models. Be sure to replace the sealant if it has been dislocated and bent or crushed and does not return to its original shape.

(5) RH-3FRHR, RH-3FHR series (Celling type)

■Lubrication positions



Note) With the grease nipple cover (yellow)

■Lubrication specifications (The numbers correspond to the figure.)

No.	Parts to be lubricated	Oiling method	Lubrication oil (manufacturer)	Lubrication interval	Lubrication amount	Cover to remove
<1>	J1 axis reduction gears	Grease nipple WC-610 (Only addition)	Grease Harmonic grease SK-1A (Harmonic Drive Systems Inc.)	6,000 Hr	4.1 g	Base cover B (L)
<2>	J2 axis reduction gears			6,000 Hr	1.8 g	-
<3>	Shaft (General environment/ Clean specification)	Wipe the old grease, and apply new grease	Marutenpu PS No.2 (KYODO YUSHI CO.,LTD.)	Every 2,000 km movement	1 g	Motor cover J3
<4>	Shaft (Waterproof specification)		NOK Klubersynth UH1 14-222 (NOK CORPORATION)			

■Lubrication method to the J1, J2 axis

RH-3FRHR, RH-3FRH series Lubrication method to the J1, J2 axis	
1	Move the robot to the posture in which it can supply the grease easy. The positions of lubrication ports are shown in "Figure: Lubrication position (RH-3FRHR series)".
2	Refer to "4.5 Installing/removing the cover", and remove the covers.
3	Insert the grease shown in "Table: Lubrication specifications" using a grease gun from the lubrication grease nipple. Note 1)
4	If grease has adhered to the J1 axis, wipe it off. Note 2)
5	Install the removed cover as before.
6	If the maintenance forecast function is enable, please reset the accumulated data about grease. Note3)

Note1) Add only the specified amount of grease. Adding excess grease may cause grease to leak.

Note2) The J1 axis grease lubrication port is positioned near the timing belt. If grease has adhered to the belt, wipe it off, although the belt is resistant to grease.

Note3) Carries out the resetting operation by RT ToolBox3 (option) or parameter MFGRST.

The lubricating to J1 and J2 axes is completed.

■Lubrication method to the shaft

RH-3FRHR, RH-3FRH series Lubrication method to the shaft	
1	Refer to "4.5 Installing/removing the cover", and remove the motor cover J3.
2	Wipe the old grease off the shaft. At this time, wipe off the grease that has been scattered inside the motor cover J3 and the bracket attached vertically to the shaft fastening area.
3	Apply the specified amount of grease to the shaft. Insert the grease shown in "Table: Lubrication specifications" using a grease gun from the lubrication grease nipple. Note 1)
4	If the grease is adhered to the J1 axis, wipe it off. Note 2)
5	Install the covers with the removal procedure in reverse.

Note1) If too much grease is applied, grease may get scattered all over inside of the No. 2 arm. If the grease reaches the timing belt inside the No. 2 arm, the timing belt may deteriorate prematurely.

Note2) The J1 axis grease lubrication port is positioned near the timing belt. If the grease is adhered to the belt, wipe it off, although the belt is resistant to grease.

The applying grease to shaft is completed.

4.8 Replacing the backup battery (FR series)

* For the F series, refer to "Appendix 2 Maintenance and Inspection (F Series Robot) Replacing the backup battery".

An absolute encoder is used for the position detector, so while power of controller is turned off the position must be saved by the backup battery. These batteries are installed when the robot is shipped from the factory, but as these are consumable parts, they must be replaced periodically by the customer.

The guideline for replacing the battery is one year, but this will differ according to the robot's usage. There exists the kinds of the errors about the battery shown in table below. If error occurs, please exchange the battery of the robot arm.

■The error about the battery

Error number	Description	Measure
7510	Encoder battery voltage low	Replace the battery as soon as possible.
7500	No encoder battery voltage	
112n Note1)	Encoder ABS position data lost	The backup data cannot be guaranteed if this error occurs.

Note1) "n" indicates the axis number.

Replace the battery referring to the replacement procedure of the robot arm battery shown below. About the purchase of the battery, refers to "4.11 Maintenance parts (FR series)".

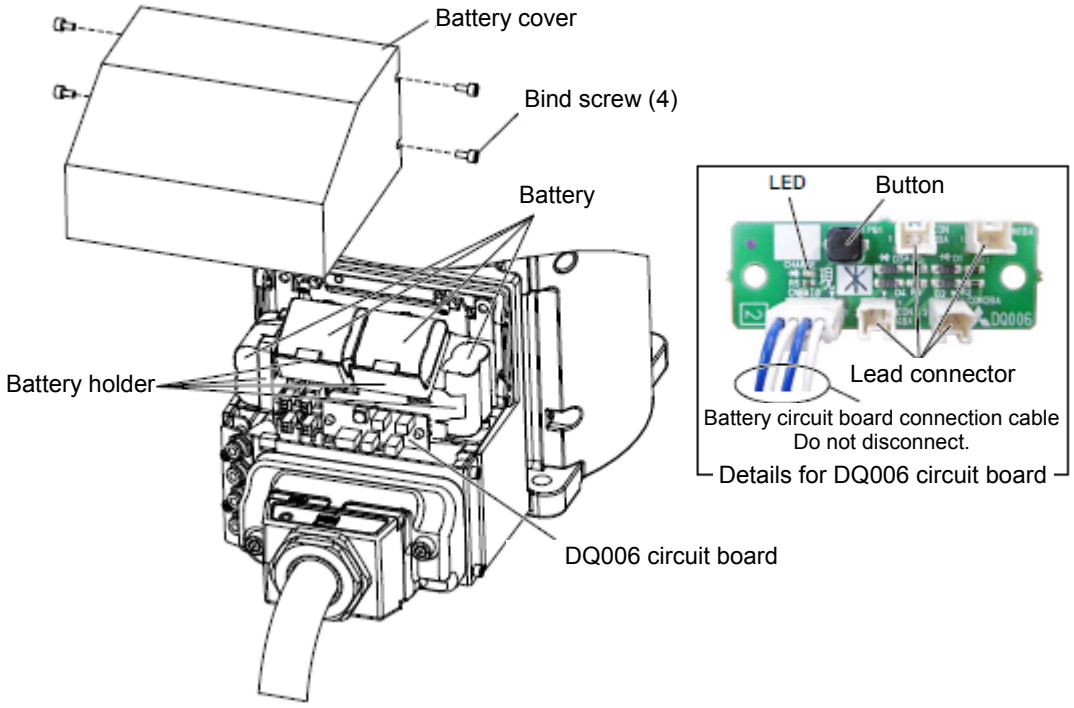
⚠CAUTION If error 7500 or 112n (n indicates the axis number) occurs, the program data and other data in the controller is lost and it becomes necessary to load the data such as program and origin data again.

The battery circuit board connection cable is used to supply power from the backup battery to the encoder. The cable must be connected while replacing the battery or operating usually. Thus, if the cable connection is incomplete, the encoder position data will be lost, and resetting the origin is necessary.

Before replacing the backup battery, check that the capacitor is fully charged. If the robot has been used for over 36,000 hours, the battery life is gradually shortened due to deterioration of the capacitor.

Replace the batteries one by one. If all batteries are removed, the encoder data will be lost, and resetting the origin is necessary.

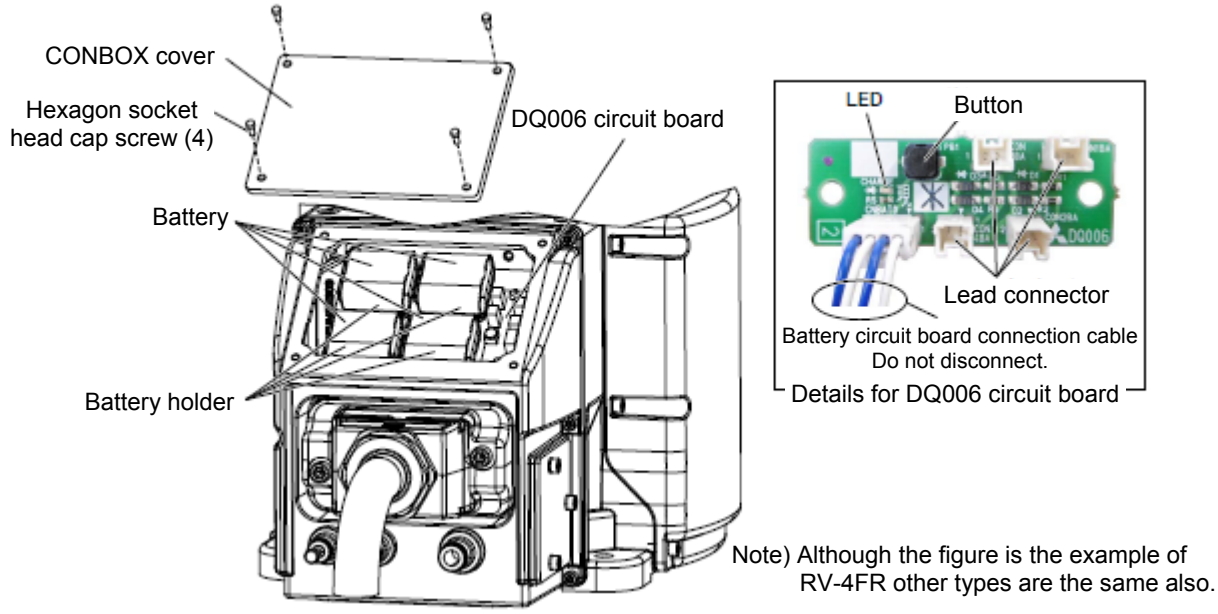
(1) RV-2FR series



RV-2FR series Backup battery replacement procedure	
1	Turn the controller control power OFF.
2	Remove the battery cover, referring to "4.5 Installing/removing the cover".
3	Press the button on the DQ006 circuit board and check that the LED on the same circuit board turns on. When the LED lights, the capacitor is fully charged. If the LED does not turn on when the button is pressed, the capacitor needs to be charged. Turn on the controller and charge the capacitor for approximately 30 minutes.
4	Replace the battery within 15 minutes after checking that the LED turns on.
5	Replaces the backup battery one by one. The battery holder is located inside the battery cover. Remove the old battery from the holder, and disconnect the lead connector.
6	Insert the new battery into the holder, and connect the lead connector. Replace all batteries with new ones at the same time.
7	All the batteries should be checked that it has been exchanged newly. If the old battery is contained, generating heat and damaging may occur.
8	Install the battery cover as before. Be careful so that the cable may not be inserted.

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again. Refer to "5 Resetting the Origin" and reset the origin using the ABS origin method.

(2) RV-4/7/13/20FR series

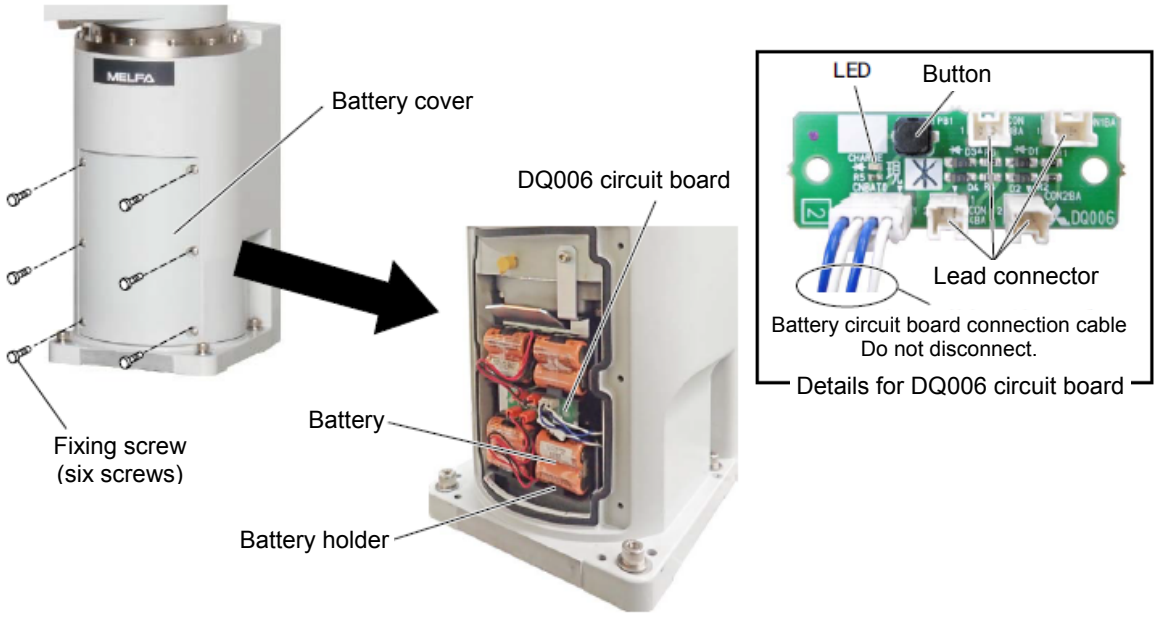


Note) Although the figure is the example of RV-4FR other types are the same also.

RV-4/7/13/20FR series Backup battery replacement procedure	
1	Turn the controller control power OFF.
2	Remove the CONBOX cover, referring to "4.5 Installing/removing the cover".
3	Check that the capacitor is fully charged. Press the button on the DQ006 circuit board and check that the LED on the same circuit board turns on. When the LED lights, the capacitor is fully charged. * If the LED does not turn on when the button is pressed, the capacitor needs to be charged. Turn on the controller and charge the capacitor for approximately 30 minutes.
4	Replace the battery within 15 minutes after checking that the LED turns on.
5	Replaces the backup battery one by one. The battery holder is located inside the CONBOX cover. Remove the old battery from the holder, and disconnect the lead connector.
6	Insert the new battery into the holder, and connect the lead connector. Replace all batteries with new ones at the same time.
7	All the batteries should be checked that it has been exchanged newly. * If the old battery is contained, generating heat and damaging may occur.
8	Install the CONBOX cover as before. * Be careful so that the cable may not be inserted.

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again. Refer to "5 Resetting the Origin" and reset the origin using the ABS origin method.

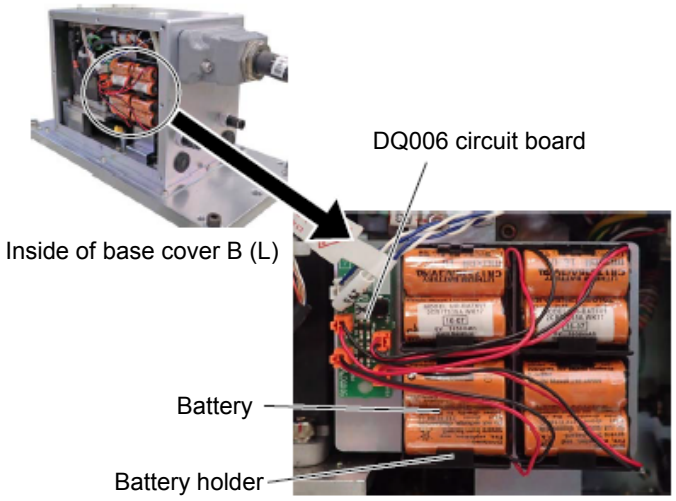
(3) RH-FRH series

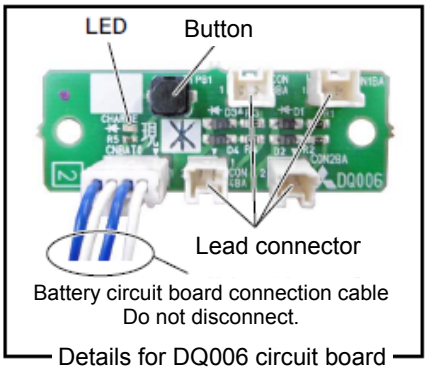


RH-FRH series Backup battery replacement procedure	
1	Turn the controller control power OFF.
2	Remove the battery cover, referring to "4.5 Installing/removing the cover".
3	Check that the capacitor is fully charged. Press the button on the DQ006 circuit board and check that the LED on the same circuit board turns on. When the LED lights, the capacitor is fully charged. * If the LED does not turn on when the button is pressed, the capacitor needs to be charged. Turn on the controller and charge the capacitor for approximately 30 minutes.
4	Replace the battery within 15 minutes after checking that the LED turns on.
5	Replaces the backup battery one by one. The battery holder is located inside the battery cover. Remove the old battery from the holder, and disconnect the lead connector.
6	Insert the new battery into the holder, and connect the lead connector. Replace all batteries with new ones at the same time.
7	All the batteries should be checked that it has been exchanged newly. * If the old battery is contained, generating heat and damaging may occur.
8	Install the battery cover as before. * Be careful so that the cable may not be inserted.

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again. Refer to "5 Resetting the Origin" and reset the origin using the ABS origin method.

(4) RH-3FRHR series (Hanging type)





RH-3FRHR series Backup battery replacement procedure	
1	Turn the controller control power OFF.
2	Remove the base cover B (L), referring to "4.5 Installing/removing the cover".
3	Check that the capacitor is fully charged. Press the button on the DQ006 circuit board and check that the LED on the same circuit board turns on. When the LED lights, the capacitor is fully charged. * If the LED does not turn on when the button is pressed, the capacitor needs to be charged. Turn on the controller and charge the capacitor for approximately 30 minutes.
4	Replace the battery within 15 minutes after checking that the LED turns on.
5	Replaces the backup battery one by one. The battery holder is located inside the battery cover. Remove the old battery from the holder, and disconnect the lead connector.
6	Insert the new battery into the holder, and connect the lead connector. Replace all batteries with new ones at the same time.
7	All the batteries should be checked that it has been exchanged newly. * If the old battery is contained, generating heat and damaging may occur.
8	Install the base cover B (L) as before. * Be careful so that the cable may not be inserted.

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again. Refer to "5 Resetting the Origin" and reset the origin using the ABS origin method.

4.9 Packing replacement (RH-FRH and RH-FH series, Celling type)

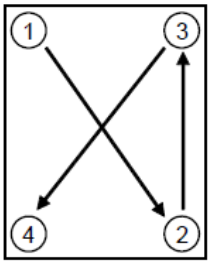
The packing gets deteriorated with the passage of time and must be replaced as required. Table below provides guidelines for replacing the packing. Replace the packing in accordance with the instructions given below. If the packing is not replaced in a timely manner, water or oil will be allowed to intrude the robot, possibly making it inoperative.

■Packing replacement guideline

Service environment	Whether or not robot is pressurized	When packing must be replaced
General environment	Not pressurized	When signs of cracking or peeling are noted in the packing.
Clean room	Not pressurized	
Waterproof environment	Not pressurized	
Oil mist	Pressurized	
	Not pressurized	When the cover mounted on the robot is removed/put back in place

■Packing replacement instructions

Packing replacement instructions	
1	Remove the old packing.
2	Clean and degrease the surface on which it has been placed.
3	Stick the packing according to the shape of the sticking surface. * Note that the packing does not slide. The packing has the double sided tape. Refer to figures "Example of sticking packing (Good Example)" and "Sticking the cord-like packing". ("Example of sticking packing (Bad Example)" shows the packing that slides.)
4	To stick multiple packings to one position on the cover, refer to the following procedure. * The length of the packing is designed so that the ends of the packings overlap. Refer to figure "Examples of packing overlaps". a) Stick packing in line with form of the sticking surface. Finally, cut packing so that adjoining pieces have a 1mm overlap at the end. b) Apply liquid gasket to the cut edges. Note1) c) Stick so that the gap may not be made to each other's packing.
6	Install the cover after the 6 hours pass after sticking packing. Note2)
7	Confirm that packing is stuck correctly and install the cover. · When tightening the bolts fixing the cover, avoid tightening them to a specified torque at a time. · Tighten the bolt in the order shown in the right figure "Example of order which tighten bolts" as much as possible. Note 3)



Example of order which tighten bolts

Note1) Designated liquid gasket: 1212 (Manufacturer: Three Bond)

Note2) For gasket hardening, do not install the cover immediately after sticking the packing.

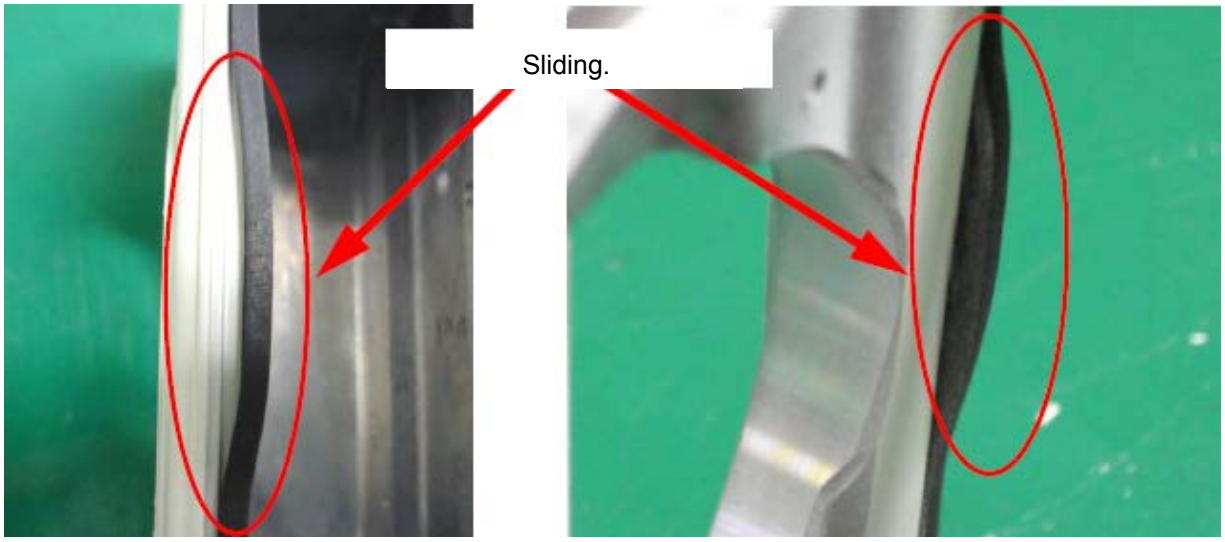
Note3) For the torque for tightening the fixing bolt of each cover, refer to "4.5 Installing/removing the cover".

⚠**CAUTION** Stick the packing securely, pressing down with the finger. If sticking is insufficient, when the cover is installed, packing slides by the pressure, and there is a possibility that it may become impossible to secure protection performance.

■Example of sticking packing

Good example

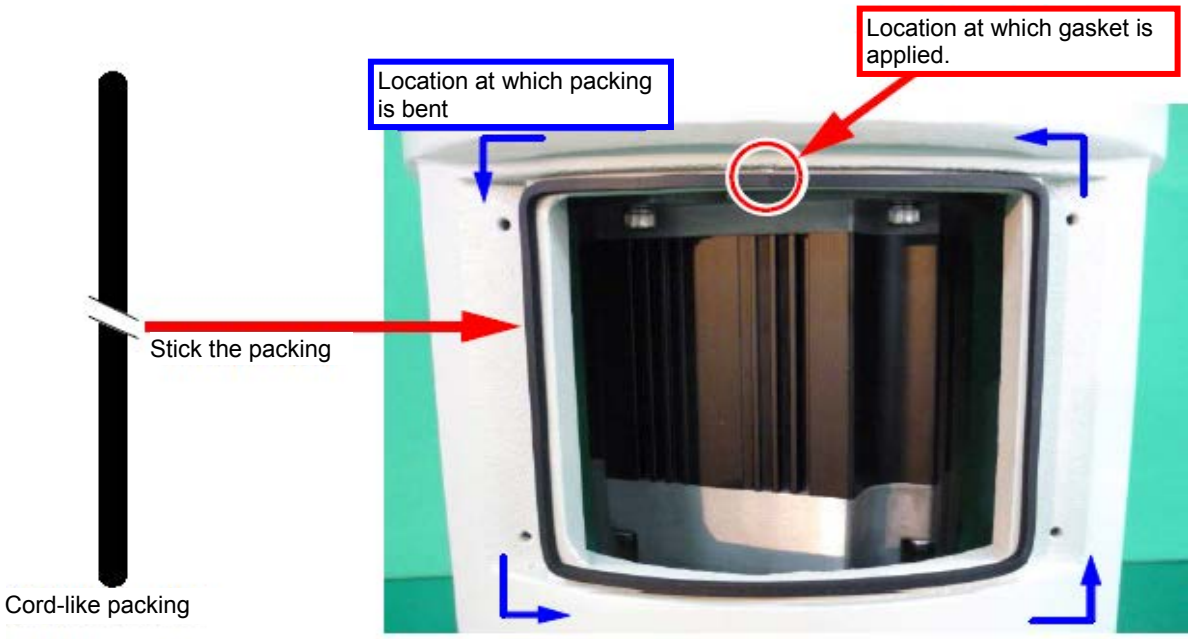
Bad example



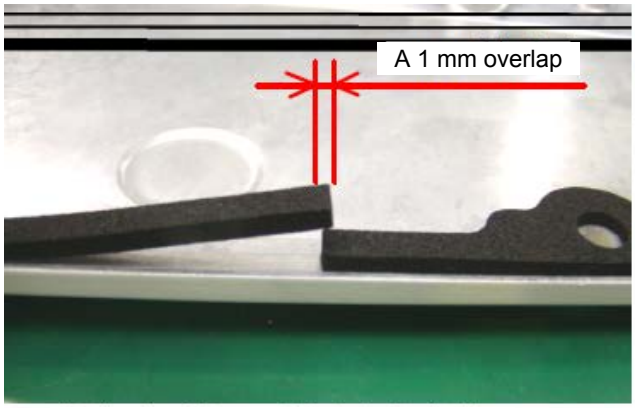
■Sticking the cord-like packing

Some of the packings to be used are cord-like.

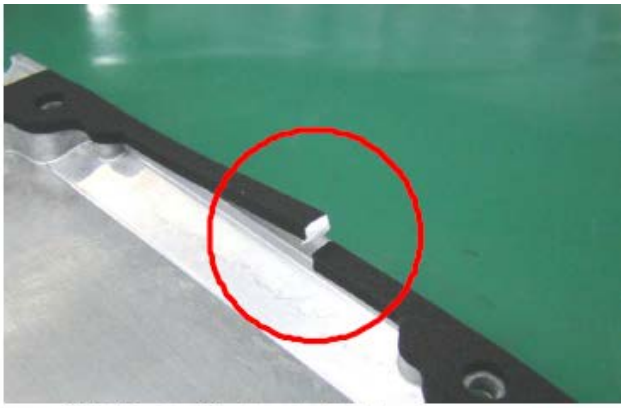
Stick such packings by bending in line with the form.



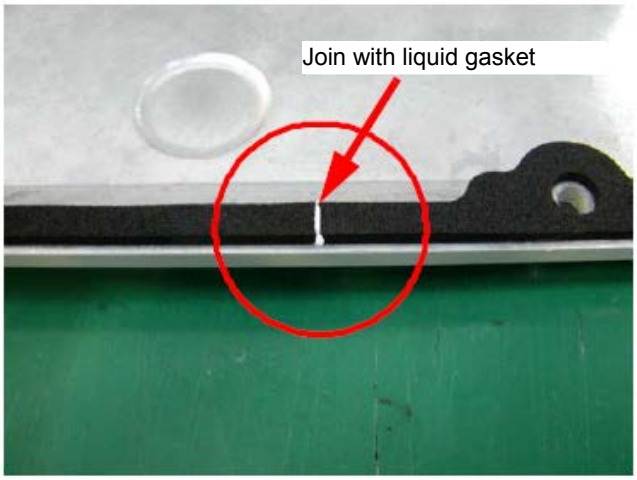
■Examples of packing overlaps



[1] Cut the packing so that there is a 1 mm overlap at the end.



[2] Apply liquid gasket to the cut edges.



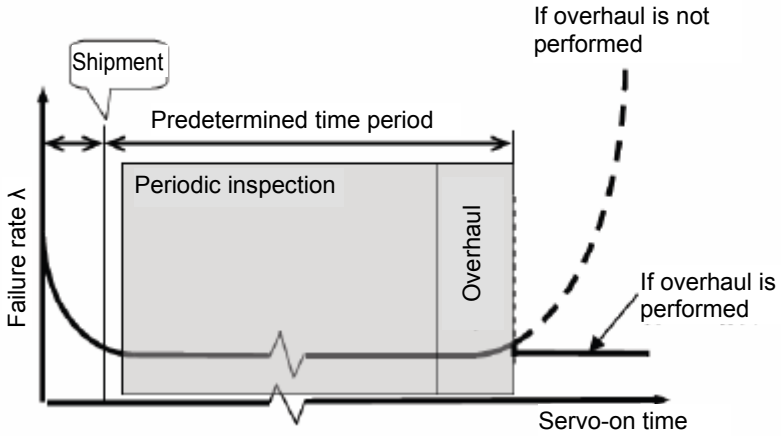
[3] Stick the packing so that there is no gap between the adjacent pieces.

4.10 Overhaul

Robots which have been in operation for an extended periods of time can suffer from wear and other forms of deterioration. In regard to such robots, we define overhaul as an operation to replace parts running out of specified service life or other parts which have been damaged, so that the robots may be put back in shape for continued use.

As a rule of thumb, it is recommended that overhaul be carried out before the total amount of servo-on time reaches the specified time (24,000 hours for the robot arm and 36,000 hours for the controller). (See figure below.)

However, the degree of the equipment's wear and deterioration presumably varies depending on their operating conditions. Especially for operation with high load and frequency, the maintenance cycle may be shorter.



4.11 Maintenance parts (FR series)

The following table shows the consumable parts that must be replaced periodically and spare parts that may be required during repairs. Purchase these parts from the dealer when required.

* For the maintenance parts of the F series, refer to "Appendix 2.2 Maintenance parts (F series)".

[Note] Some Mitsubishi-designated parts differ from the maker's standard parts. Thus, confirm the part name, robot arm and controller serial No. and purchase the parts from the dealer.

(1) RV-FR series

a) Consumable part list

No.	Part name	Usage place	Q'ty	Description	Supplier
RV-2FR series					
1	Timing belt	J1 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
2		J2 axis	1		
3		J3 axis	1		
4		J4 axis	1		
5		J5 axis	1		
6		For J5 axis brakes	1		
7		J6 axis	1		
8		For J6 axis brakes Note1)	1		
9	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	
10	Lithium battery (Battery: MR-BAT6V1)	Base section	4	"4.8 Replacing the backup battery"	
RV-4FR/7FR series					
11	Timing belt	J1 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
12		J3 axis	1		
13		J4 axis	1		
14		J5 axis	1		
15		J6 axis	1		
16	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	
17	Lithium battery (Battery: MR-BAT6V1)	Base section	4	"4.8 Replacing the backup battery"	
RV-13/20FR series					
18	Timing belt	J4 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
19		J5 axis	1		
20		J6 axis	1		
21	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	
22	Lithium battery (Battery: MR-BAT6V1)	Base section	4	"4.8 Replacing the backup battery"	

Note1) Only for the RV-2FRB

b) Spare parts list

No.	Part name	Usage place	Q'ty	Supplier
RV-2FR series (common)				
1	AC servo motor	J1, J2, J3 axis	3	Mitsubishi Electric
2		J4, J5, J6 axis	3	
RV-2FR/2FRB (Standard arm type)				
3	Reduction gears	J1 axis	1	Mitsubishi Electric
4		J2 axis	1	
5		J3 axis	1	
6		J4, J5 axis	2	
7		J6 axis	1	
RV-2FRL/2FRLB (Long arm type)				
8	Reduction gears	J1 axis	1	Mitsubishi Electric
9		J2 axis	1	
10		J3 axis	1	
11		J4, J5 axis	2	
12		J6 axis	1	
RV-4FR series (common)				
1	AC servo motor	J1, J2 axis	2	Mitsubishi Electric
2		J3 axis	1	
3		J4, J5 axis	2	
4		J6 axis	1	
RV-4FR (Standard arm type)				
5	Reduction gears	J1, J2 axis	2	Mitsubishi Electric
6		J3 axis	1	
7		J4 axis	1	
8		J5 axis	1	
9		J6 axis	1	
RV-4FRL (Long arm type)				
10	Reduction gears	J1 axis	1	Mitsubishi Electric
11		J2, J3 axis	2	
12		J4 axis	1	
13		J5 axis	1	
14		J6 axis	1	
RV-4FRJL (Long arm type)				
15	Reduction gears	J1 axis	1	Mitsubishi Electric
16		J2, J3 axis	2	
17		J5 axis	1	
18		J6 axis	1	

No.	Part name	Usage place	Q'ty	Supplier
RV-7FR series (common)				
1	AC servo motor	J1, J2 axis	2	Mitsubishi Electric
2		J3 axis	1	
3		J4, J5 axis	2	
4		J6 axis	1	
RV-7FR (Standard arm type)				
5	Reduction gears	J1, J2 axis	2	Mitsubishi Electric
6		J3 axis	1	
7		J4 axis	1	
8		J5 axis	1	
9		J6 axis	1	
RV-7FRL (Long arm type)				
10	Reduction gears	J1, J2 axis	2	Mitsubishi Electric
11		J3 axis	1	
12		J4 axis	1	
13		J5 axis	1	
14		J6 axis	1	
RV-7FRLL (Long arm type)				
15	AC servo motor	J1, J2 axis	2	Mitsubishi Electric
16		J3 axis	1	
17		J4 axis	1	
18		J5 axis	1	
19		J6 axis	1	
20	Reduction gears	J1 axis	1	
21		J2 axis	1	
22		J3 axis	1	
23		J4 axis	1	
24		J5 axis	1	
25		J6 axis	1	

No.	Part name	Usage place	Q'ty	Supplier
RV-13FR/20FR (common)				
1	AC servo motor	J1, J2 axis	2	Mitsubishi Electric
2		J3 axis	1	
3		J4 axis	1	
4		J5 axis	1	
5		J6 axis	1	
RV-13FR/RV-20FR (Standard arm type)				
1	Reduction gears	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5		J5 axis	1	
6		J6 axis	1	
RV-13FLR (Long arm type)				
7	Reduction gears	J1 axis	1	Mitsubishi Electric
8		J2 axis	1	
9		J3 axis	1	
10		J4 axis	1	
11		J5 axis	1	
12		J6 axis	1	

(2) RH-FRH series

a) Consumable part list

No.	Part name	Usage place	Q'ty	Description	Supplier
RH-3FRH/6FRH/12FRH/20FRH series common					
1	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	Mitsubishi Electric
2		Shaft	A small amount		
3	Lithium battery (Battery: MR-BAT6V1)	Base section	4	"4.8 Replacing the backup battery"	
4	Liquefied gasket	Packing Note1)	A small amount	"4.9 Packing Replacement Procedure"	
RH-3FRH series					
5	Timing belt	J3 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
6		J4 axis motor side	1		
7		J4 axis shaft side	1		
RH-6FRH series					
8	Timing belt	J3 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
9		J4 axis motor side	1		
10		J4 axis shaft side	1		
RH-12FRH series					
11	Timing belt	J3 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
12		J4 axis motor side	1		
13		J4 axis shaft side	1		
RH-20FRH series					
14	Timing belt	J3 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
15		J4 axis motor side	1		
16		J4 axis shaft side	1		

Note1) The liquefied gasket is necessary for the place which uses two or more packings to connect.

b) Spare parts list

No.	Part name	Usage place	Q'ty	Supplier
RH-3FRH series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis (general environment and oil mist specification)	1	
8		J3 axis (clean specification)	1	
9	Bellows	J3 axis (oil mist specification)	1	
10		J3 axis (clean specification)	1	
11	Liquid gasket	Bellows (clean specification)	A small amount	
RH-6FRH series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis (general environment specification)	1	
8		J3 axis (clean/oil mist specification)	1	
9	Ball screw	J3 axis (general environment/clean/oil mist specification)	1	
10	Bellows	J3 axis (oil mist specification)	1	
11		J3 axis (clean specification)	1	
12	Liquid gasket	Bellows (clean specification)	A small amount	

No.	Part name	Usage place	Q'ty	Supplier
RH-6FRH series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis (general environment specification)	1	
8		J3 axis (clean/oil mist specification)	1	
9	Ball screw	J3 axis (general environment/clean/oil mist specification)	1	
10	Bellows	J3 axis (oil mist specification)	1	
11		J3 axis (clean specification)	1	
12	Liquid gasket	Bellows (clean specification)	A small amount	
RH-20FRH series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis (general environment specification)	1	
8		J3 axis (clean/oil mist specification)	1	
9	Ball screw	J3 axis (general environment/clean/oil mist specification)	1	
10	Bellows	J3 axis (oil mist specification)	1	
11		J3 axis (clean specification)	1	
12	Liquid gasket	Bellows (clean specification)	A small amount	

(3) RH-3FRHR series (Celling type)

a) Consumable parts list

No.	Part name	Usage place	Q'ty	Description	Supplier
RH-3FRHR series					
1	Timing belt	J1 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
2		J2 axis	1		
3		J3 axis	1		
4		J4 axis motor side	1		
5		J4 axis shaft side	1		
6	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	
7	Lithium battery (Battery: MR-BAT6V1)	Base section	4	"4.8 Replacing the backup battery"	

b) Spare parts list

No.	Part name	Usage place	Q'ty	Supplier
RH-3FRHR series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis (general environment specification)	1	
8		J3 axis (clean specification)	1	
9		J3 axis (waterproof specification)	1	
10	Bellows	J3 axis (clean/waterproof specification)	1	

5 Resetting the Origin

The origin is set so that the robot can be used with a high accuracy. The origin is set so that the robot can be used with a high accuracy. Setting is required if the motor is replaced or an encoder error occurs.

The origin setting methods and when each origin setting method is required are shown in table below.

■Origin setting method

No	Method	Explanation	Cases when setting the origin is required	Remarks
1	Origin data input method	The origin data set as the default is input from the T/B.	CR75*series When the data is lost due to flat battery of the robot controller (when C7500 occurs) CR800 series When the encoder data is lost due to flat battery of the robot arm	The setting method is explained in "5.1 Setting the origin with the origin data input method".
2	Jig method	The origin posture is set with the calibration jig installed.	When a structural part of the robot (motor, reduction gear, timing belt, etc.) is replaced When deviation occurred by a collision.	The setting method is explained in "5.2 Jig method".
3	ABS origin method	This method is used when the encoder backup data lost in the cause such as battery cutting.	When the encoder data is lost due to flat battery of the robot arm (when H112n occurs)	Before using this method, the origin must be set with the other method with same encoder. The setting method is explained in "5.3 ABS origin method".
4	User origin method	A randomly designated position is set as the origin posture.	When an arbitrary position is set as the origin	Before using this method, the origin must be set with the other method. The setting method is explained in "5.4 User origin method".

[Remarks]
- The origin is set using the jig method (No.2) at factory default.
- The origin data is inherent to the serial number of each robot arm.
- The ABS origin method is used to restore the previous data by aligning the triangular marks to each other for each axis to set the lost origin data.
  (Although the setting position is confirmed visually, deviations within a half rotation of the motor can be compensated.)

[Caution]
- The ABS origin method cannot be used when the robot arm mechanically deviates (for example caused by replacement of the reduction gear, motor, or timing belt).
- After the origin setting is completed, move the robot arm to the position where the ABS marks align each other, and check that the displayed joint coordinates of the position are correct.
  For the details of the ABS mark position and the joint coordinates, refer to "5.3 ABS origin method".

5.1 Setting the origin with the origin data input method

(1) Confirming the origin data

The origin data to be input is noted in the origin data sheet. (See figure below.)

Origin data label (an example) 6-axis robot

●Origin data history table (Origin Data History) Serial No.ES804008

Date	Default	. . .	. . .	. . .
D	V!%S29			
J1	06DTYY			
J2	2?HL9X			
J3	1CP55V			
J4	T6!M$Y			
J5	Z2IJ%Z			
J6	A12%Z0			
Method	J	J・A・U	J・A・U	J・A・U

(O: O(Alphabet), 0: Zero)

Note) Meanings of symbols in method column
J: Jig method
A: ABS origin method
U: User origin method

Origin data label (an example) 4-axis robot

●Origin data history table (Origin Data History) Serial No.ES804008

Date	Default	. . .	. . .	. . .
D	V!%S29			
J1	06DTYY			
J2	2?HL9X			
J3	1CP55V			
J4	T6!M$Y			
J5				
J6				
Method	J	J・A・U	J・A・U	J・A・U

(O: O(Alphabet), 0: Zero)

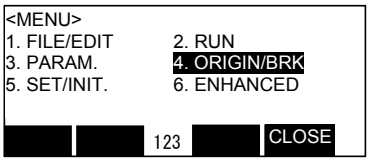
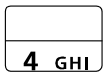
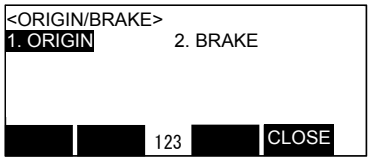
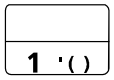
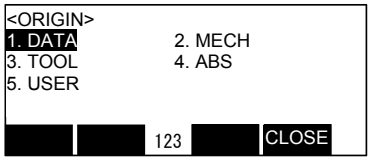
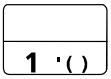
The origin data history table is attached on the back of the following covers.

Model	Cover
RV-2FR, RV-2F series	J1 motor cover
RV-4/7/13/20FR, RV-4/7/13/20F series	CONBOX cover
RH-3/6/12/20FRH, RH-3/6/12/20FH series	Battery cover
RH-3FRHR, RH-3FHR series (Hanging type)	Base cover B (L)

・Referring to "4.5 Installing/removing the cover", remove the cover above and confirm the value.
・The value given in the default setting column is the origin settings set with the jig method before shipment.
・Note that the 5-axis type robot does not have a J4 axis.
* The origin data to input is found on also the robot examination report sheet.

⚠WARNING Always install/remove the cover with the controller control power turned OFF. Failure to do so could lead to physical damage or personal injury should the robot start moving due to incorrect operations.

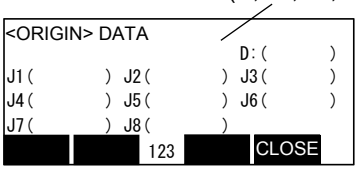
(2) Selecting the origin setting method

Selecting the origin setting method			
1	<Menu screen>  	 	Press the [4] key on the menu screen, and display the ORIGIN/BRAKE screen.
2	<ORIGIN/BRAKE screen>  	 	Press the [1] key on the ORIGIN/BRAKE screen, and display the origin setting method selection screen.
3	<ORIGIN screen>  	 	Press the [1] key on the origin setting method selection screen, and select the data input method.
4	<ORIGIN screen> 		Display the origin data input screen

(3) Inputting the origin data

T/B screen

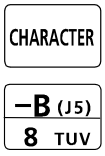
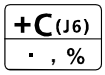
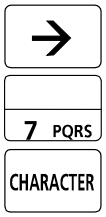
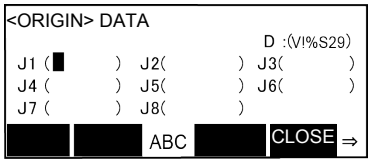
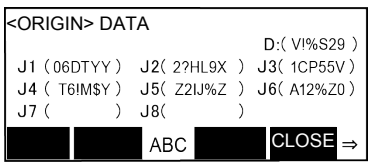
Origin data label
(D, J1, J2, J3, J4, J5, J6, J7, J8)



Correspondence of origin data label and axis

Input the value confirmed in section "5.1 (1) Confirming the origin data". The correspondence of the origin data label value and axis to be input is shown in figure.
(For the 5-axis type robot, the J4 axis is meaningless.)

The method for inputting the origin data is explained below. Input the D value "V!%S29" as an example.

Origin setting method Inputting the origin data			
1	<ORIGIN screen> 		Confirm that the cursor is at the "D" position on the T/B display screen. Input the D value "V!%S29".
2			Inputting "V" Press the [CHARACTER] key and set to the character input mode. (Condition that "ABC" was displayed under the screen) Press the [TUV] key three times. "V" will be set.
3			Inputting "!" Press the [, %] key four times. "!" will be set.
4			Press the [→] key once and move the cursor. Then, press the [%] key once to display "%". Press the [PQRS] key to input "S". Press the [CHARACTER] key and set to the numeral input mode. (Condition that "123" was displayed under the screen) Press the [2] key (input "2"), and press the [9] key (input "9"). "V!%S29" will appear at the "D" data on the teaching pendant screen.
5			Press the [↓] key, and move the cursor to the J1 input position. Input the J1, J2, J3, J4, J5 and J6 value in the same manner as above. (Note that the J4 axis is not required for the 5-axis type.)
6			After inputting all of the values, press the [EXE] key. The origin setting confirmation screen will appear.

Origin setting method Inputting the origin data			
7	<ORIGIN> DATA CHANGE TO ORIGIN. OK? Yes ABC No	F1	Press [F1] (Yes) to end the origin setting

(4) Installing the cover

Return the cover removed in section "5.1 (1) Confirming the origin data" to its original position.

The setting of the origin with the origin data input method is complete.

⚠WARNING Removing and installing the cover by always turning off the controller power.
Failure to do so could lead to the robot moving because of incorrect operations, or to physical damage or personal injury.

If the origin input data is incorrect

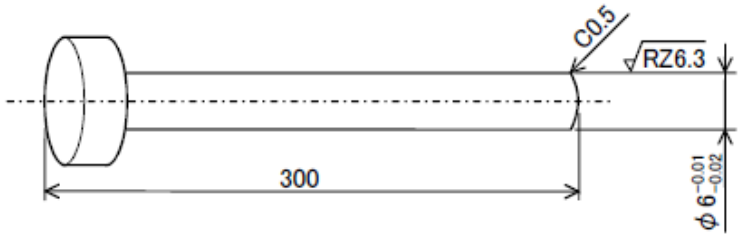
If the origin input data is incorrect, the alarm No. 1760 (origin setting data illegal) will occur when origin data input. In this case, reconfirm the value input for the origin data.

5.2 Jig method

The origin is set for each axis using origin jig in this method.

5.2.1 RV-FR, RV-F series

The reference figure of the origin setting tool is shown in figure below.



(1) First, set each axis to the origin position. There are two positioning methods: manual setting by releasing the brake and jog feeding. The following describes the positioning by releasing the brake.

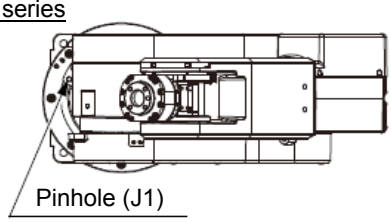
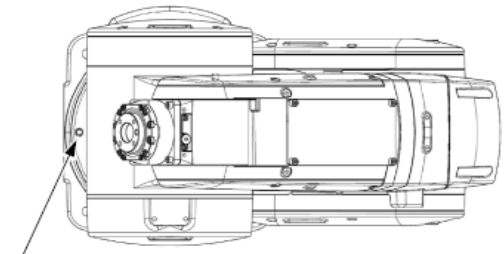
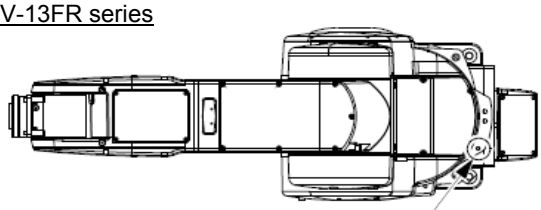
(2) After the positioning, set the origin with the origin setting operation.

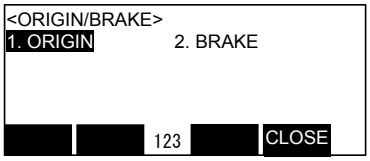
⚠CAUTION In the following procedure, the brake is released for the axis with brake to move the arm with both hands. When the brake is released, the arm may fall by its own weight depending on the posture of the robot.
To ensure safety, take appropriate measures such as supporting the axis to avoid the free fall.

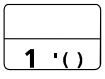
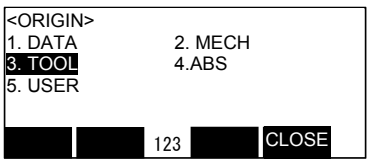
This operation is carried out with the teaching pendant. Set the mode of the controller to "MANUAL", and set the [ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant.
Do the following operations, pressing down the enabling switch of T/B lightly.

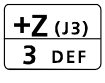
(1) J1 axis origin setting

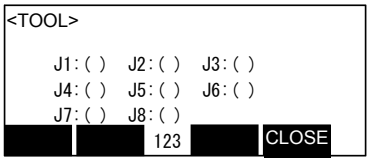
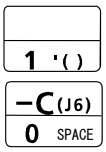
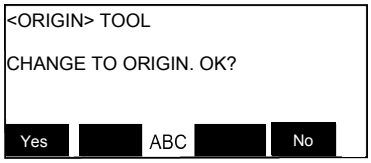
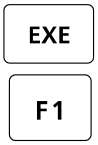
RV-FR, RV-F series J1 axis origin setting			
1	<MENU screen> <MENU> 1. FILE/EDIT 2. RUN 3. PARAM. 4. ORIGIN/BRK 5. SET/INIT. 6. ENHANCED 123 CLOSE	4 GHI	Press the [4] key on the menu screen, and display the Origin/Brake selection screen.
2	<ORIGIN/BRAKE screen> <ORIGIN/BRAKE> 1. ORIGIN 2. BRAKE 123 CLOSE	−Z (J3) 2 ABC	The type which does not have the brake in the J1 axis should go to "5)". Press the [2] key, and display the Brake release selection screen.
3	<BRAKE screen> <BRAKE> J1:( ) J2:(0) J3:(0) J4:(0) J5:(0) J6:(0) J7:(0) J8:(0) REL. 123 CLOSE	1 '( ) −C (J6) 0 SPACE	Release the brake of the J1 axis. Move the cursor to ( ) of J1, and press the [1] key. Set "0" to other axes.
4	<BRAKE screen> <BRAKE> J1:( ) J2:(0) J3:(0) J4:(0) J5:(0) J6:(0) J7:(0) J8:(0) REL. 123 CLOSE	F1	Confirm the axis for which the brakes are to be released. Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

<table>
<tr><td colspan="4">RV-FR, RV-F series J1 axis origin setting</td></tr>
<tr><td>5</td><td colspan="2">RV-2FR series
 
Pinhole (J1)
Diagram of the robot viewed from the top
RV-4FR/7FR series
 
Pinhole (J1)
Diagram of the robot viewed from the top
RV-13FR series
 
Pinhole (J1)
Diagram of the robot viewed from the top</td><td>Move the J1 axis slowly with both hands to the position around ±0°. Align the pinhole of the lower part of the shoulder and the pinhole at the base section, feed through the origin jig (φ6) into the pinholes and fasten.
For the type that does not have a brake in the J1 axis, go to procedure 7.</td></tr>
<tr><td>6</td><td><BRAKE screen>

</td><td>Detach the [F1] key and work the brake.
Press the [F4] key and return to the origin / brake screen.</td></tr>
<tr><td>7</td><td><ORIGIN/BRAKE screen>
 

 
</td><td>Press the [1] key, and display the Origin setting selection screen.</td></tr>
<tr><td>8</td><td><ORIGIN screen>
 

 
</td><td>Press the [3] key, and display the Tool selection screen.</td></tr>
</table>

RV-FR, RV-F series J1 axis origin setting			
9	<ORIGIN screen> 		Press the [↑] to [→] keys to move the cursor to ( ) of J1, and press the [1] key. Set "0" to other axes.
10	<ORIGIN screen> 		Press the [EXE] key, and display Confirmation screen. Press the [F1] key, and the origin position is set up.
11	<ORIGIN screen> 		Setting of the origin is completed. Refer to "5.5 Recording the origin data", and record the origin data on the origin data seal.

Release the brake

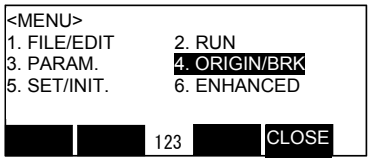
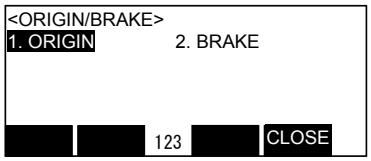
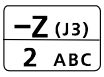
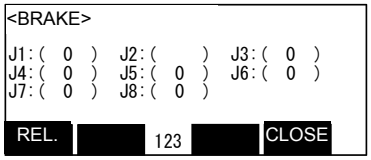
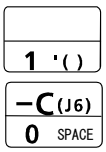
The brakes can be released only for the axis for which a "1" is displayed on the screen. If the brakes are not to be released, press the [0] key and display a "0".

If the [F1] key on the teaching pendant or the enabling switch is detached while the brakes are released, the brakes will be work immediately.

Select the axis of origin setting

The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

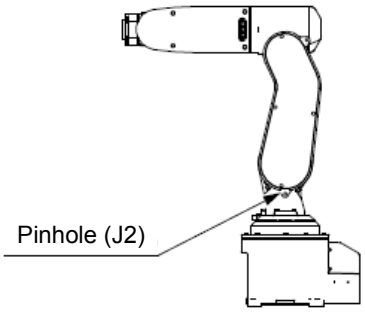
(2) J2 axis origin setting

RV-FR, RV-F series J2 axis origin setting			
1	<MENU screen>  	 	Press the [4] key on the menu screen, and display the Origin/Brake selection screen.
2	<ORIGIN/BRAKE screen>  	 	Press the [2] key, and display the Brake release selection screen.
3	<BRAKE screen>  	 	Release the brake of the J2 axis. Press the [↑] to [→] keys to move the cursor to ( ) of J2, and press the [1] key. Set "0" to other axes.
4	<BRAKE screen> 		Confirm the axis for which the brakes are to be released. One worker must securely support the upper arm with both hands.
5	<BRAKE screen> 	 	Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key. Note) In the RV-13FR series, brake is released in an off-and-on way, because to drop J2 axis slowly.

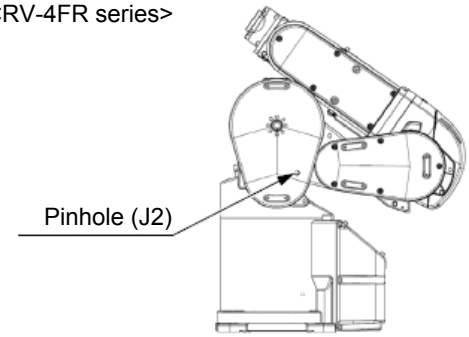
RV-FR, RV-F series J2 axis origin setting

6

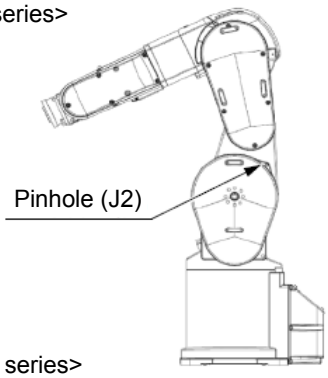
<RV-2FR series>



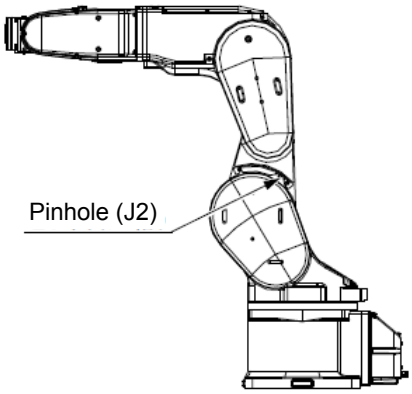
<RV-4FR series>



<RV-7FR series>



<RV-13FR series>



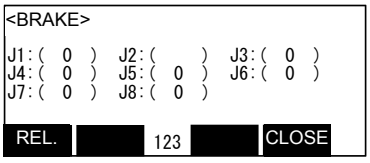
Move the J2 axis slowly with both hands to the following position and align the pinhole of the No.1 arm and the pinhole at the shoulder.

Feed through the J2 axis origin jig (φ6) into the aligned pinholes and fasten.

Robot model	Position
RV-2FR series	Around ±0°
RV-4FR series	Around -107°
RV-7FR/13FR series	Around ±0°

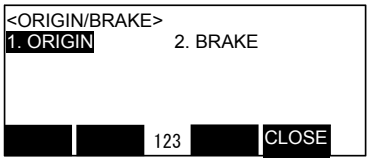
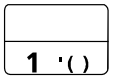
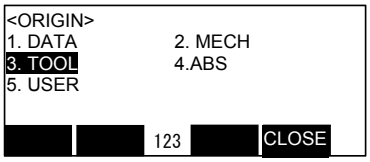
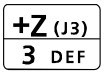
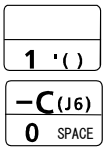
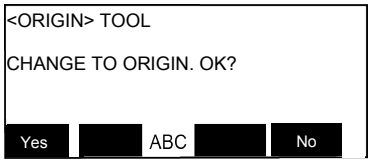
7

<BRAKE screen>

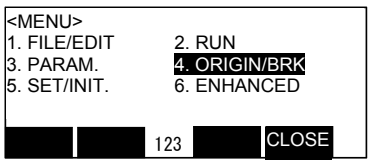
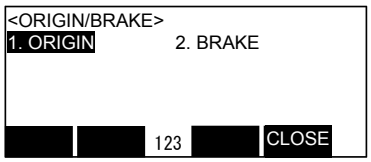
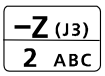
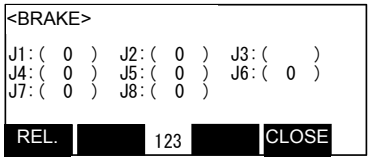
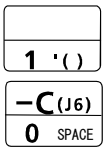
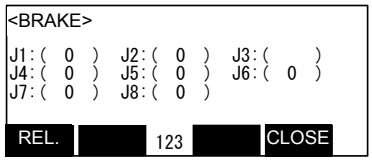


Detach the [F1] key and work the brake.

Press the [F4] key and return to the origin / brake screen.

RV-FR, RV-F series J2 axis origin setting			
8	<ORIGIN/BRAKE screen>  	 	Press the [1] key, and display the Origin setting selection screen
9	<ORIGIN screen>  	 	Press the [3] key, and display the Tool selection screen.
10	<ORIGIN screen> 	 	Move the cursor to ( ) of J2, and press the [1] key. Set "0" to other axes.
11	<ORIGIN screen>  	 	Press the [EXE] key, and display the Confirmation screen.
12	<ORIGIN screen> 	 	Press the [F1] key, and the origin position is set up. Refer to "5.5 Recording the origin data", and record the origin data on the origin data seal.

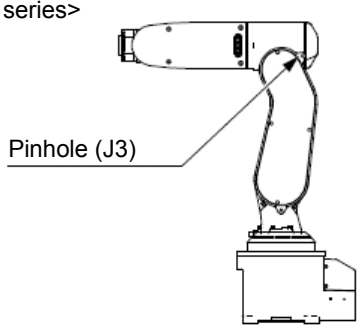
(3) J3 axis origin setting

RV-FR, RV-F series J3 axis origin setting			
1	<MENU screen>  	 	Press the [4] key on the menu screen, and display the Origin/Brake selection screen.
2	<ORIGIN/BRAKE screen>  	 	Press the [2] key, and display the Brake release selection screen.
3	<BRAKE screen>  	 	Release the brake of the J3 axis. Move the cursor to ( ) of J3, and press the [1] key. Set "0" to other axes.
4	<BRAKE screen>  		Confirm the axis for which the brakes are to be released. One worker must securely support the upper arm with both hands.
5	<BRAKE screen> 	 	Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key. Note) In the RV-13FR series, brake is released in an off-and-on way, because to drop J2 axis slowly.

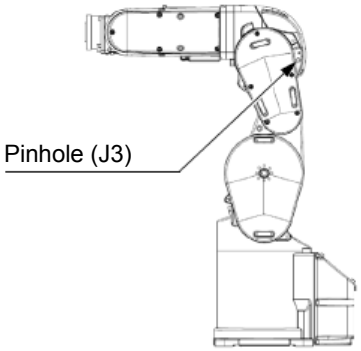
RV-FR, RV-F series J3 axis origin setting

6

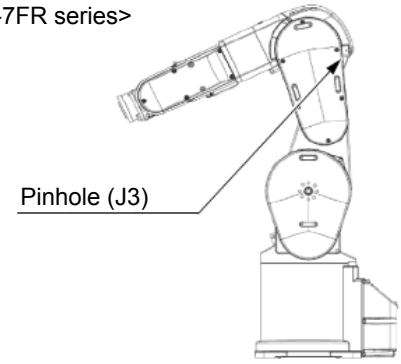
<RV-2FR series>



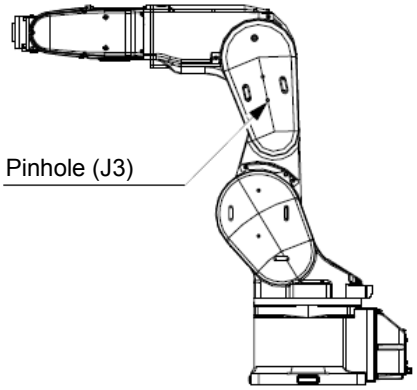
<RV-4FR series>



<RV-7FR series>



<RV-13FR series>



Move the J3 axis slowly with both hands to the following position and align the pinhole of the No.1 arm and the pinhole at the elbow.

Feed through the J3 axis origin jig (φ6) into the aligned pinholes and fasten.

Robot model	Position
RV-2FR/4FR series	Around +90°
RV-7FR series	Around +115°
RV-13FR series	Around +90°

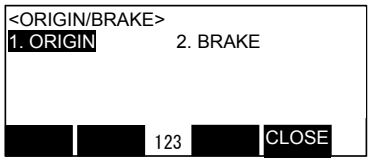
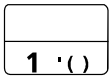
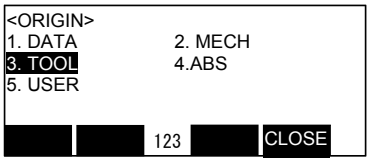
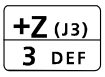
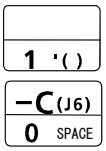
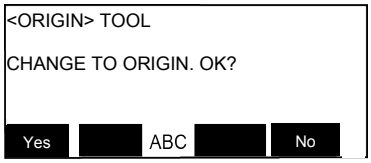
7

<BRAKE screen>

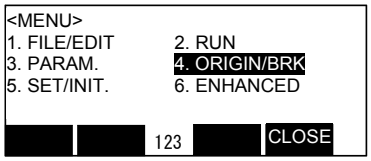
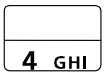
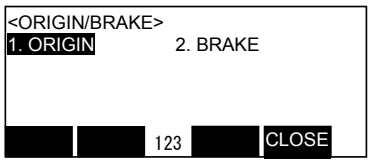
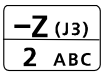
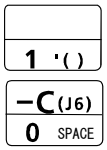
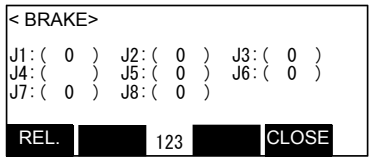
F4

Detach the [F1] key and work the brake.

Press the [F4] key and return to the origin / brake screen.

RV-FR, RV-F series J3 axis origin setting			
8	<ORIGIN/BRAKE screen>  	 	Press the [1] key, and display the Origin setting selection screen.
9	<ORIGIN screen>  	 	Press the [3] key, and display the Tool selection screen.
10	<ORIGIN screen> 	 	Move the cursor to ( ) of J3, and press the [1] key. Set "0" to other axes.
11	<ORIGIN screen>  	 	Press the [EXE] key, and display the Confirmation screen.
12	<ORIGIN screen> 	 	Press the [F1] key, and the origin position is set up. Refer to "5.5 Recording the origin data", and record the origin data on the origin data seal.

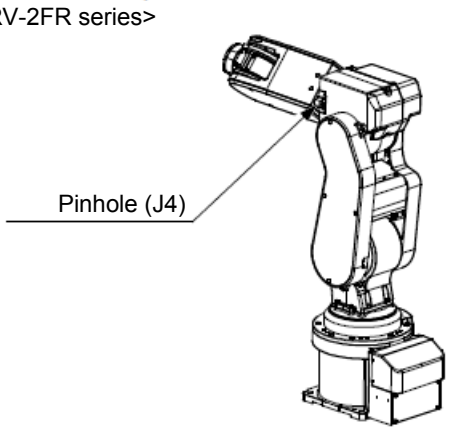
(4) J4 axis origin setting (6-axis type robot only)

RV-FR, RV-F series J4 axis origin setting (6-axis type robot only)			
1	<MENU screen>  	 	Press the [4] key on the menu screen, and display the Origin/Brake selection screen.
2	<ORIGIN/BRAKE screen>  	 	For the type that does not have a brake in the J4 axis, go to procedure 6. Press the [2] key, and display the Brake release selection screen.
3	<BRAKE screen> 	 	Release the brake of the J4 axis. Move the cursor to ( ) of J4, and press the [1] key. Set "0" to other axes.
4	<BRAKE screen>  		Confirm the axis for which the brakes are to be released. One worker must securely support the upper arm with both hands.
5	<BRAKE screen> 	 	Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

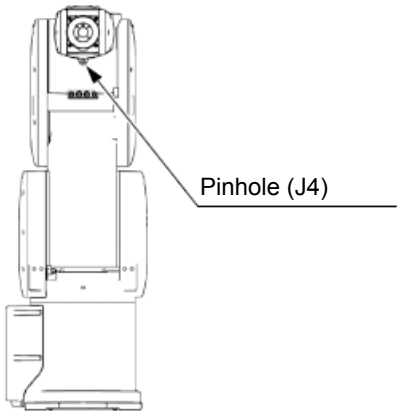
RV-FR, RV-F series J4 axis origin setting (6-axis type robot only)

6

<RV-2FR series>



<RV-4FR/7FR/13FR series>



Move the J4 axis slowly with both hands to the following position and align the pinhole of the No.2 arm and the pinhole at the elbow.
Feed through the J4 axis origin jig (φ6) into the aligned pinholes and fasten.

Robot model	Position
RV-2FR series	Around -50°
RV-4FR/7FR/13FR series	Around ±0°

For the type that does not have a brake in the J4 axis, go to procedure 8.

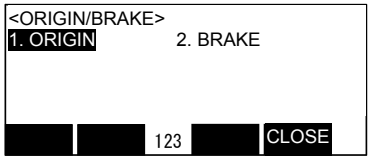
7

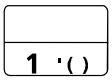
<BRAKE screen>

Detach the [F1] key and work the brake.
Press the [F4] key and return to the origin / brake screen.

8

<ORIGIN/BRAKE screen>

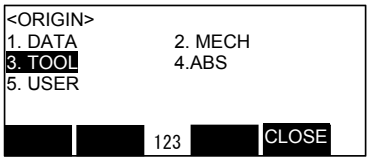


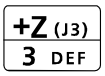


Press the [1] key, and display the Origin setting selection screen.

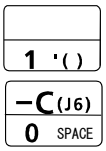
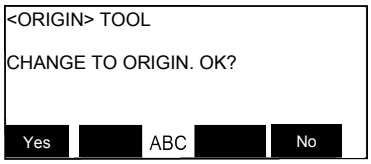
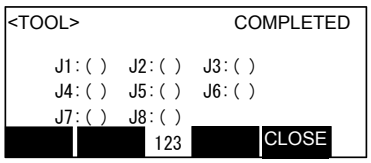
9

<ORIGIN screen>





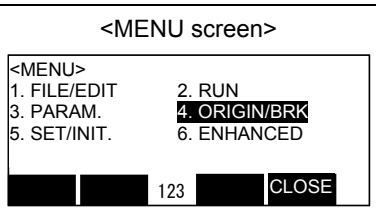
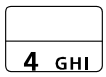
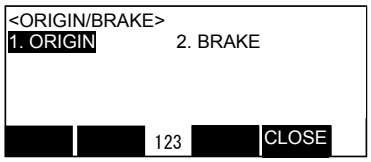
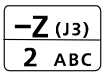
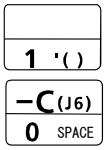
Press the [3] key, and display the Tool selection screen.

RV-FR, RV-F series J4 axis origin setting (6-axis type robot only)			
10	<ORIGIN screen> 		Move the cursor to ( ) of J4, and press the [1] key. Set "0" to other axes.
11	<ORIGIN screen> 		Press the [F1] key, and the origin position is set up.
12	<ORIGIN screen> 		Press the [F1] key, and the origin position is set up. Refer to "5.5 Recording the origin data", and record the origin data on the origin data seal.

(5) J5 axis and J6 axis origin setting

Always perform origin setting of the J5 axis and the J6 axis simultaneously. First, set the J5 axis posture.

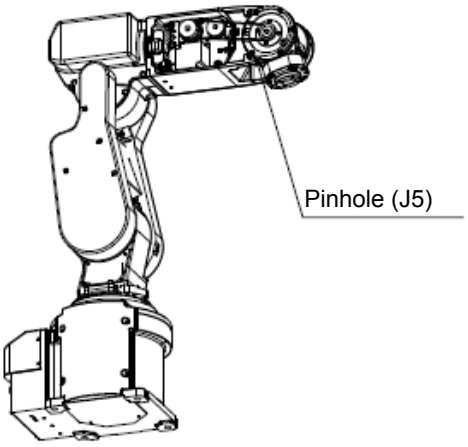
■Origin setting of J5 axis

<table>
<tr><th colspan="4">RV-FR, RV-F series J5 axis origin setting</th></tr>
<tr><td>1</td><td colspan="3">Remove the following cover. The pin hole is inside the cover.
<table>
<tr><th>Robot model</th><th>Cover</th></tr>
<tr><td>RV-2FR series</td><td>No.2 arm cover R</td></tr>
<tr><td>RV-4FR/7FR/13FR series</td><td>No.2 arm cover L</td></tr>
</table></td></tr>
<tr><td>2</td><td> 
</td><td> 
</td><td>Press the [4] key on the menu screen, and display the Origin/BRK selection screen.</td></tr>
<tr><td>3</td><td> 
</td><td> 
</td><td>Press the [2] key, and display the Brake release selection screen.</td></tr>
<tr><td>4</td><td>
</td><td> 
</td><td>Brake release of the J5 axis.
Press the [Arrow] key, move the cursor to the J5 axis and press the [1] key. Set [0] to other axes.</td></tr>
<tr><td>5</td><td>
</td><td></td><td>Confirm the axis for which the brakes are to be released.
The one person needs to support the list part securely with both hands.</td></tr>
<tr><td>6</td><td>
</td><td>
</td><td>Pressing the [F1] key is kept with the enabling switch of T/B pressed down.
The brake is released while pressing the key.</td></tr>
</table>

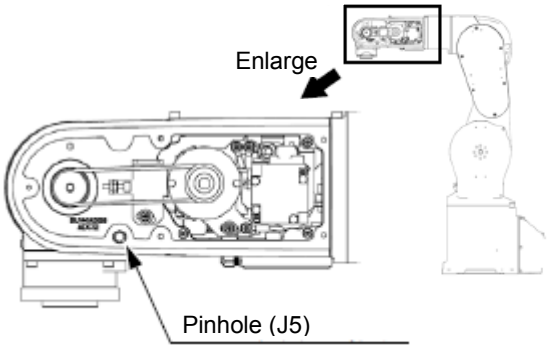
RV-FR, RV-F series J5 axis origin setting

7

<RV-2FR series>



<RV-4FR/7FR/13FR series>



Move the J5 axis slowly with both hands to the following position and align the pinhole of the No.2 arm and the pinhole at the wrist.
Feed through the J5 axis origin jig (φ6) into the aligned pinholes and fasten.

Robot model	Position
RV-2FR series	Around +75°
RV-4FR/7FR series	Around +90°
RV-13FR/20FR series	

8

<BRAKE screen>

Detach the [F1] key and work the brake.

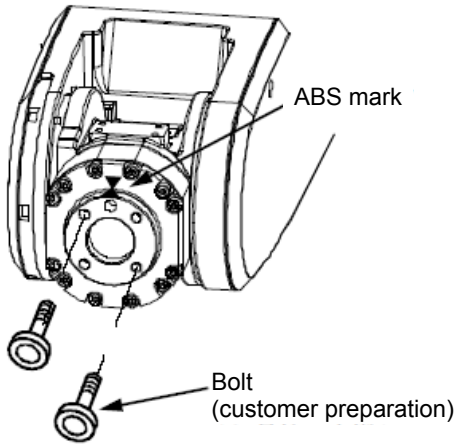
Next, set the J6 axis posture.

■J6 axis origin setting

RV-FR series J6 axis origin setting

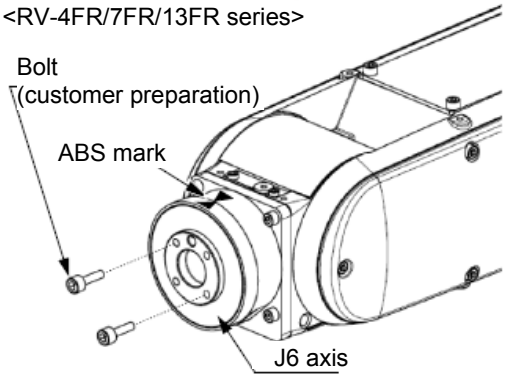
9

<RV-2FR series>



⚠CAUTION The J6-axis does not have a mechanical stopper. When setting the origin position do not rotate the axis more than the motion range (±200 deg.).

<RV-4FR/7FR/13FR series>



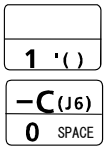
⚠CAUTION The J6 axis of internal wiring and piping specification type have mechanical stopper, but the standard specification type is without mechanical stopper. Please do not move to the position exceeding the operating range (+/-360 degree)

Install the following bolt (customer preparation) in the diagonal position at the J6 axis.

Robot model	Bolt
RV-2FR/4FR/7FR series, RV-7FRLL	M5, 2 pcs.
RV-13FR/20FR series	M6, 2 pcs,

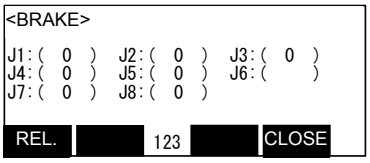
The type which has the brake in the J6 axis releases the brake.
For the type that does not have a brake in the J4 axis, go to procedure 13.

Press the [Arrow] key, move the cursor to the J6 axis and press the [1] key. Set [0] to other axes.



10

<BRAKE screen>



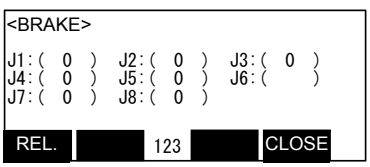
F1

Confirm the axis for which the brakes are to be released.

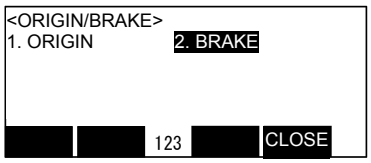
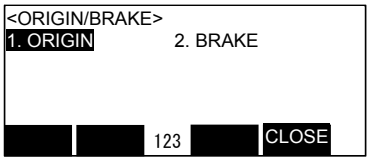
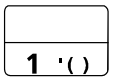
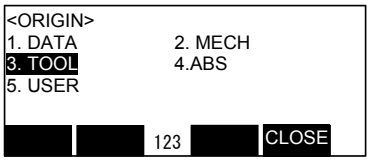
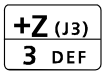
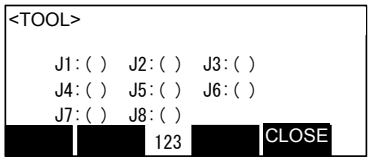
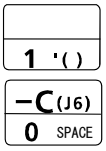
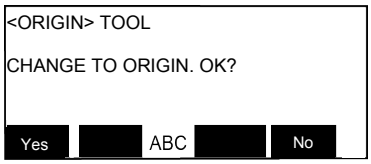
Pressing the [F1] key is kept with the enabling switch of T/B pressed down. The brake is released while pressing the key.

11

<BRAKE screen>



Hold the bolts with hands, rotate them slowly and align the ABS mark of the J6 axis with the ABS mark of the wrist area.
If the ABS mark is aligned detach the [F1] key and work the brake.

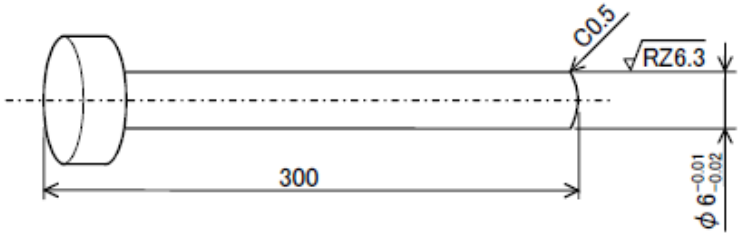
RV-FR series J6 axis origin setting			
13	<ORIGIN/BRAKE screen>  	 	Press the [F4] key and return to the origin / brake screen.
14	<ORIGIN screen>  	 	After aligning the both ABS marks, press the [1] key, and display the Origin setting selection screen.
15	<ORIGIN screen>  	 	Press the [3] key , and display the Tool selection screen.
16	<ORIGIN screen>  	 	Press the [Arrow] key, move the cursor, and set "1" to the J5 axis and J6 axis. Set [0] to other axes.
17	<ORIGIN screen>  	 	Press the [EXE] key , and display Confirmation screen.
18	<ORIGIN screen> 	 	Press the [F1] key , and the origin position is set up. Refer to "5.5 Recording the origin data", and record the origin data on the origin data seal.

The origin settings are completed by the jig method.

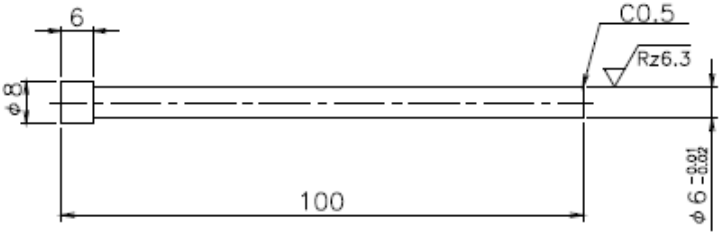
5.2.2 RH-FRH, RH-FH series

The reference figure of the origin setting tool is shown in figure below.

RH-FRH, RH-FH series



RH-3FRHR, RH-3FHR series
(Hanging type)



⚠CAUTION In the following procedure, the J3 axis brake is released to move its shaft with both hands.
When the brake is released, the J3 axis falls by its own weight.
To ensure safety, take appropriate measures such as supporting the axis to avoid the free fall.

⚠CAUTION If [F1] key or enable switch of T/B is released, the brakes will be work immediately.

Release the brake

The brakes can be released only for the axis for which a "1" is displayed on the screen. If the brakes are not to be released, press the [0] key and display a "0". If the [F1] key on the teaching pendant or the enabling switch is detached while the brakes are released, the brakes will be work immediately.

Select the axis of origin setting

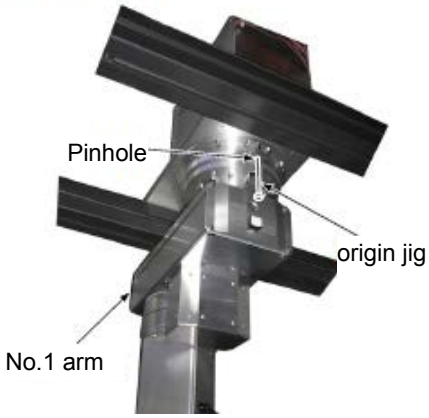
The origin is set only for the axis for which a "1" is displayed on the screen. If the origin is not to be set, press the [0] key and display a "0".

This operation is carried out with the teaching pendant. Set the mode of the controller to "MANUAL", and set the [ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant. Do the following operations, pressing down the enable switch of T/B lightly.

* The origin setting can be performed for the target axis only instead of for all axes. Go to steps for the target axis to set the origin.

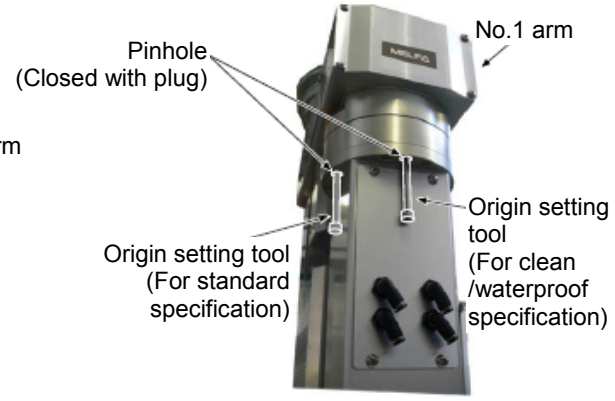
(1) J1 axis origin setting

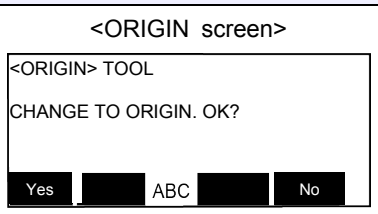
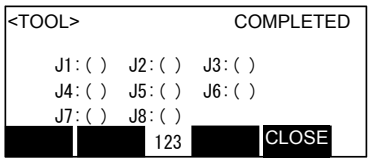
RH-FRH, RH-FH series J1 axis origin setting			
1	<MENU screens> <MENU> 1. FILE/EDIT 2. RUN 3. PARAM. 4. ORIGIN/BRK 5. SET/INIT. 6. ENHANCED 123 CLOSE	4 GHI	Press the [4] key on the menu screen, and display the Origin/Break selection screen.

RH-FRH, RH-FH series J1 axis origin setting			
2	Move the J1 axis slowly toward the front using both hands. Align the pinhole of the No.1 arm and the pinhole at the base section, feed through the origin jig into the pinholes and fasten. For the RH-3FRHR and RH-3FHR series (hanging type), insert the origin jig by 35 mm. <RH-3FRH/6FRH/12FRH/20FRH series> <RH-3FRHR series>  		
3	<ORIGIN/BRAKE screen> <ORIGIN/BRAKE> 1. ORIGIN 2. BRAKE 123 CLOSE	1 '( )	Press the [1] key, and display the Origin setting selection screen.
4	<ORIGIN screen> <ORIGIN> 1. DATA 2. MECH 3. TOOL 4.ABS 5. USER 123 CLOSE	+Z (J3) 3 DEF	Press the [3] key, and display the Tool selection screen.
5	<ORIGIN screen> <TOOL> J1:( ) J2:( ) J3:( ) J4:( ) J5:( ) J6:( ) J7:( ) J8:( ) 123 CLOSE	1 '( ) −C (J6) 0 SPACE	Move the cursor to ( ) of J1, and press the [1] key. Set "0" to other axes.
6	<ORIGIN screen> <ORIGIN> TOOL CHANGE TO ORIGIN. OK? Yes ABC No	EXE	Press the [EXE] key, and display Confirmation screen.
7	<ORIGIN screen> <TOOL> COMPLETED J1:( ) J2:( ) J3:( ) J4:( ) J5:( ) J6:( ) J7:( ) J8:( ) 123 CLOSE	F1	Press the [F1] key, and the origin position is set up. Refer to "5.5 Recording the origin data", and record the origin data on the origin data seal.

(2) J2 axis origin setting

RH-FRH, RH-FH series J2 axis origin setting

1	<MENU screen> <MENU> 1. FILE/EDIT 2. RUN 3. PARAM. 4. ORIGIN/BRK 5. SET/INIT. 6. ENHANCED 123 CLOSE	4 GHI	Press the [4] key on the menu screen, and display the Origin/Break selection screen.
2	Move the J2 axis slowly with both hands to the position around ±0°. And align the pinholes of the No. 1 and No. 2 arms, feed through the origin jig into the pinholes and fasten. Note) RH-3FRH/6FRH, RH-3FH/6FH series robot which have 350mm arm length have to be rotated in the direction of +90 degrees. For the RH-3FRHR and RH-3FHR series (hanging type), set the origin after removing the plug from the pinhole with a hexagon wrench. The origin jig should be inserted by 65 mm. Note) If the origin setting jig cannot be inserted by 65 mm, move the J2 axis to the mechanical stopper once, and then move it to the point approximately ± 0 degree. <RH-3FRH/6FRH/12FRH/20FRH series> <RH-3FRHR series>  		
3	<ORIGIN/BRAKE screen> <ORIGIN/BRAKE> 1. ORIGIN 2. BRAKE 123 CLOSE	1 '( )	Press the [1] key, and display the Origin setting selection screen.
4	<ORIGIN screen> <ORIGIN> 1. DATA 2. MECH 3. TOOL 4.ABS 5. USER 123 CLOSE	+Z (J3) 3 DEF	Press the [3] key, and display the Tool selection screen.
5	<ORIGIN screen> <BRAKE> J1:(0) J2:( ) J3:(0) J4:(0) J5:(0) J6:(0) J7:(0) J8:(0) REL. 123 CLOSE	1 '( ) −C (J6) 0 SPACE	Move the cursor to ( ) of J2, and press the [1] key. Set "0" to other axes.

<table>
<tr><td colspan="4">RH-FRH, RH-FH series J2 axis origin setting</td></tr>
<tr><td>6</td><td> 
</td><td>EXE</td><td>Press the [EXE] key, and display Confirmation screen.</td></tr>
<tr><td>7</td><td> 
</td><td>F1</td><td>Press the [F1] key, and the origin position is set up.

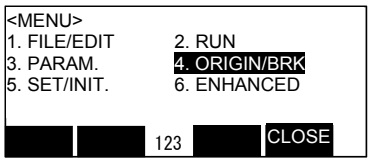
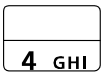
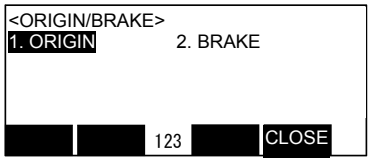
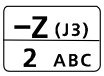
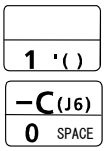
Refer to "5.5 Recording the origin data", and record the origin data on the origin data seal.</td></tr>
<tr><td colspan="4">[Note] For the RH-3FRHR and RH-3FHR series (celling type), always reinstall the plug into the pinhole after setting the origin.
Wrap sealing tape around the plug to fix it in place securely.</td></tr>
</table>

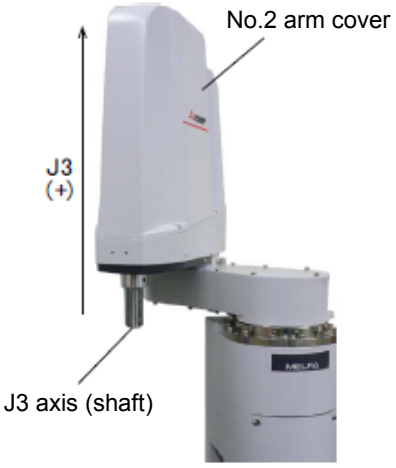
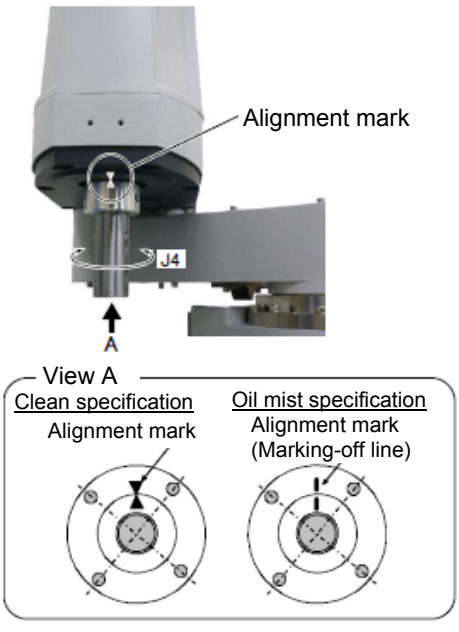
(3) J3 and J4 axis origin setting

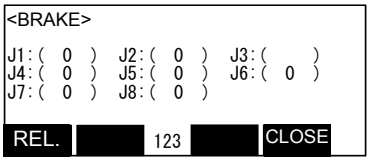
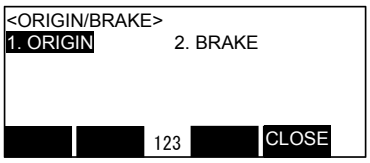
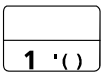
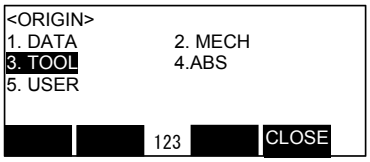
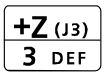
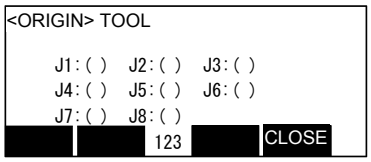
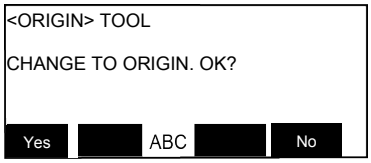
Always perform origin setting of the J3 axis and the J4 axis simultaneously.

In the RH-3FRH and RH-3FH series, if the wiring and piping are passed in the shaft, remove the No.2 arm cover U and set the origin.

Note) If origin setting is carried out with the No.2 arm cover U installed, the origin may not be set up correctly because the wiring and the piping interfere with the No.2 arm cover U.

RH-FRH, RH-FH series J3 and J4 axis origin setting			
1	In the RH-3FRH, RH-3FH series, if the wiring and piping is passed in the shaft, removes the No.2 arm cover U referring the "4.5 Installing/removing the cover". It is not necessary to remove the cover if wiring and piping is not passed, or if using the other robot.		
2	<MENU screen> 		Press the [4] key on the menu screen, and display the Origin/Break selection screen.
3	<ORIGIN/BRAKE screen> 		Press the [2] key, and display the Brake release selection screen.
4	<BRAKE screen> 		Release the brake of the J3 axis. Move the cursor to ( ) of J3, and press the [1] key. Set "0" to other axes.
5	<BRAKE screen> 		Confirm the axis for which the brakes are to be released.

RH-FRH, RH-FH series J3 and J4 axis origin setting	
6	Pressing the [F1] key is kept with the enabling switch of T/B pressed down. * The brake is released while pressing the key. Note) In RH-3FRH/6FRH/12FRH/20FRH, RH-3FH/6FH/12FH/20FH series, the brake of the axis shown below repeats release/lock at the interval in each about 200ms for dropping the J3 axis slowly. F1 With both hands, slowly move the J3 axis in + (plus) direction, and contact the axis against the mechanical stopper. Match the alignment mark of J4 axis in this condition next. Go to the following procedure continuously. <RH-3FRH/6FRH/12FRH/20FRH series>  <RH-3FRHR series>
7	Hold the J4 axis with your hand and rotate it slowly to match the alignment marks. Move the J4 axis with maintaining the condition that the releasing brake of the J3 axis and the J3 axis contact to the mechanical stopper. Note) If the J3 axis has slid, move the J3 axis against the mechanical stopper, and contact again. <RH-3FRH/6FRH/12FRH/20FRH series>  <RH-3FRHR series> General environment specification Clean specification Waterproof specification

RH-FRH, RH-FH series J3 and J4 axis origin setting			
8	<BRAKE screen> 		Detach the [F1] key and work the brake. Press the [F4] key and return to the origin / brake screen.
9	<BRAKE screen> 		Press the [1] key, and display the Origin setting selection screen.
10	<ORIGIN screen> 		Press the [3] key, and display the Tool selection screen.
11	<ORIGIN screen> 		Move the cursor to ( ) of J3 and J4, and press the [1] key. Set "0" to other axes. Press the [EXE] key, and display the Confirmation screen.
12	<ORIGIN screen> 		Press the [F1] key, and the origin position is set up. When No.2 arm cover U was removed, installs as before. Refer to "5.5 Recording the origin data", and record the origin data on the origin data seal.

5.3 ABS origin method

When the origin setting of the robot is performed for the first time, record the angular position of the origin within one rotation of the encoder as the offset value. If the origin setting is performed according to the ABS origin method, this value is used to suppress variations in the origin setting operations and to reproduce the initial origin position accurately.

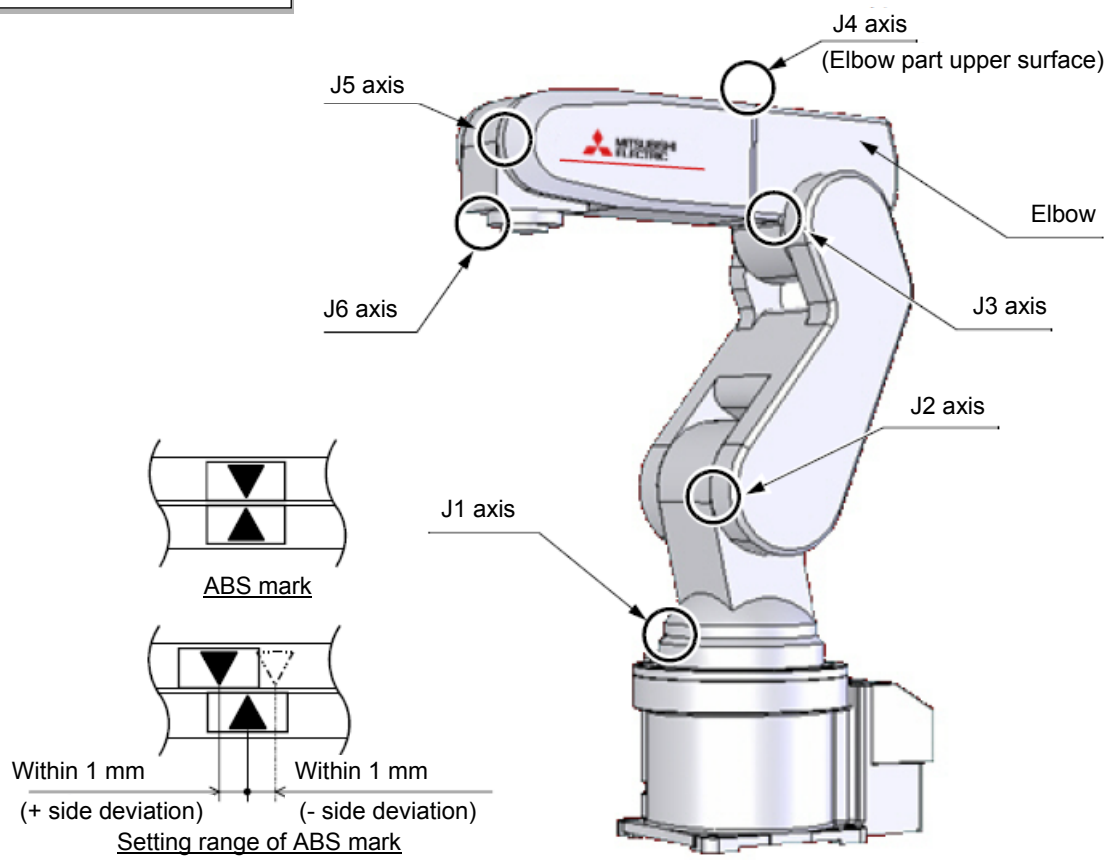
This operation is carried out with the teaching pendant. Set the mode of the controller to "MANUAL", and set the [ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant.

First, align the ABS mark arrow of the axis for which the origin is to be set with the jog operation. This can be set for all axes simultaneously or each axis independently. To align the ABS marks, view the robot from the front. The deviation between the end points of the two triangular marks must be 1 mm or less.

The positions of the ABS marks are shown below.

(1) RV-2FR, RV-2F series

ABS mark positions



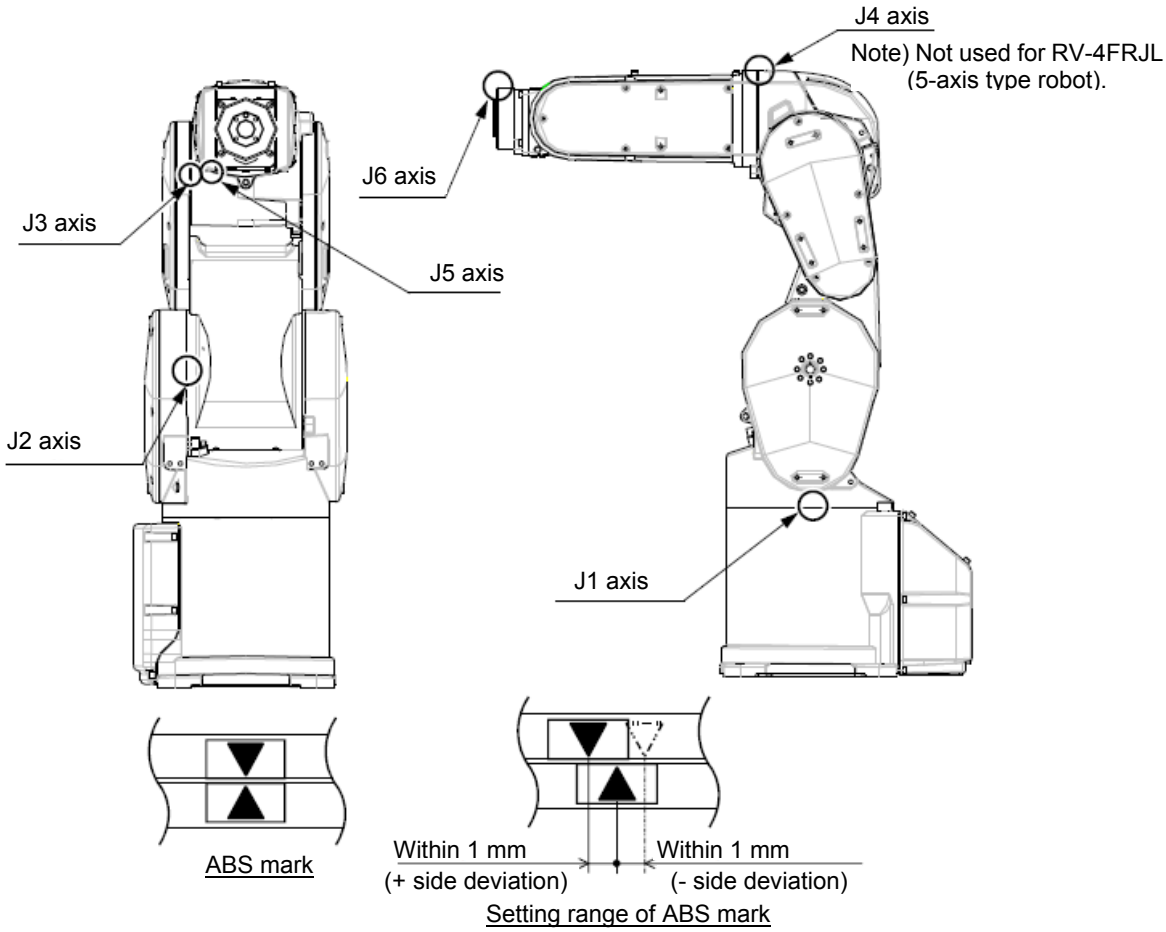
The angles of each axis which sets up the ABS origin are shown below.

Model	J1 axis	J2 axis	J3 axis	J4 axis	J5 axis	J6 axis
RV-2FR series RV-2F series	0°	0°	90°	-50°	75°	0°

(2) RV-4/7FR, RV-4/7F series

Note) For the attachment position of the ABS marks of the J1 axis, J2 axis, and J3 axis of the RV-7FRLL, refer to figure (3) that describes the RV-13FR/20FR series.

ABS mark positions

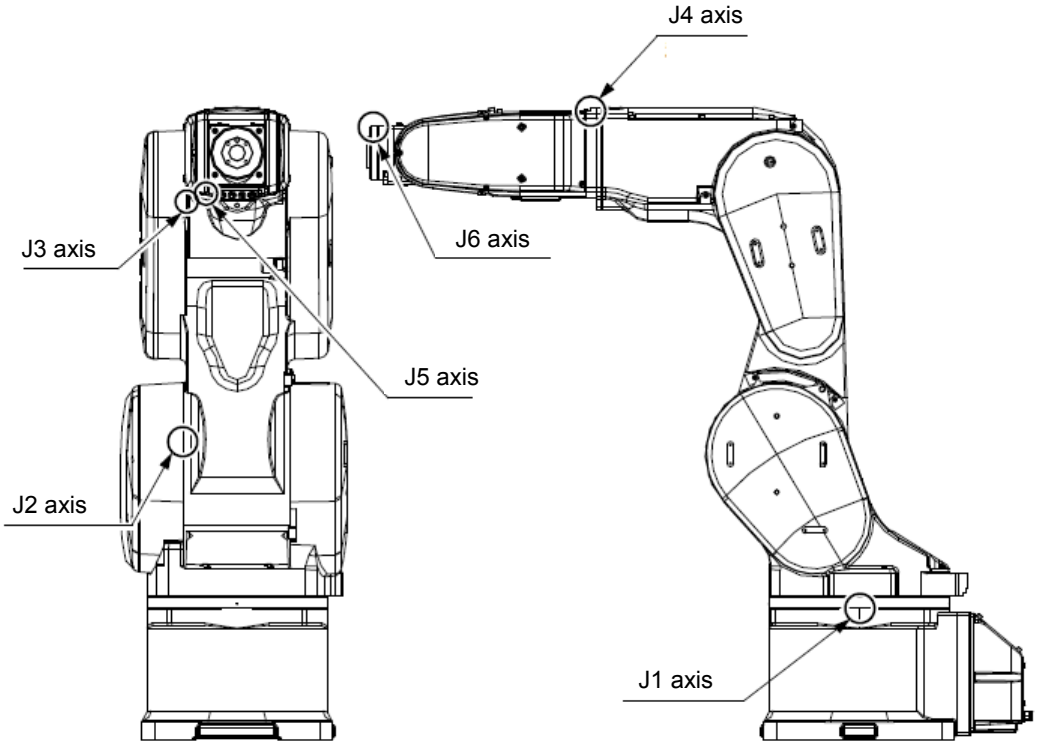


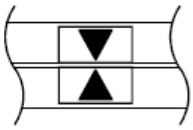
The angles of each axis which sets up the ABS origin are shown below.

Model	J1 axis	J2 axis	J3 axis	J4 axis	J5 axis	J6 axis
RV-4FR series RV-4F series	0°	-107°	90°	0°	90°	0°
RV-7FR series RV-7F series	0°	0°	115°	0°	90°	0°
RV-7FRLL series RV-7FLL series	0°	0°	90°	0°	90°	0°

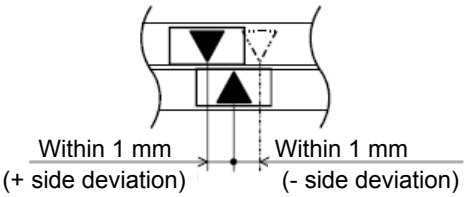
(3) RV-13/20FR, RV-13/20F series

ABS mark positions





ABS mark

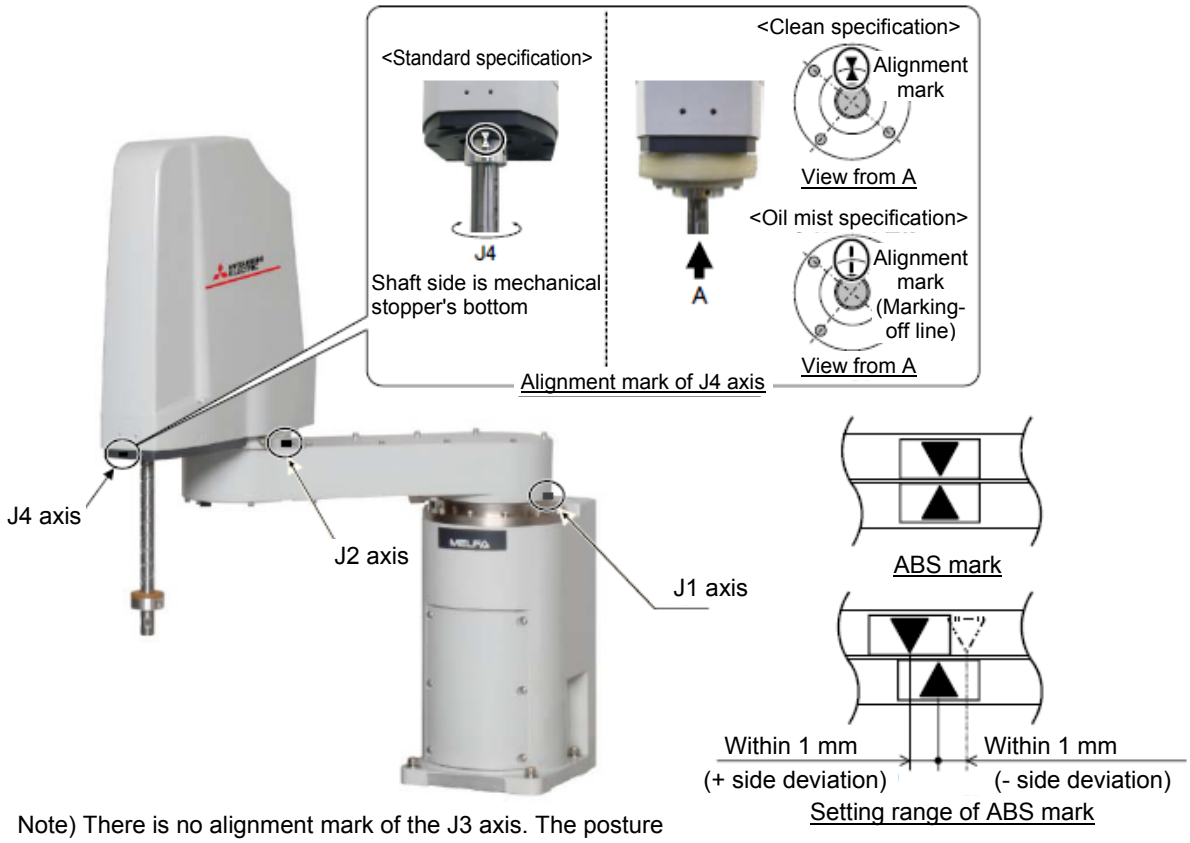


Setting range of ABS mark

The angles of each axis which sets up the ABS origin are shown below.

Model	J1 axis	J2 axis	J3 axis	J4 axis	J5 axis	J6 axis
RV-13/20FR series RV-13/20F series	0°	0°	90°	0°	90°	0°

(4) RH-3/6/12/20FRH, RH-3/6/12/20FH series

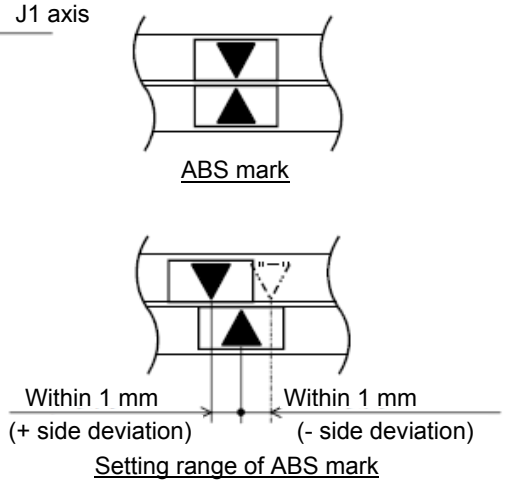


Note) There is no alignment mark of the J3 axis. The posture to be set is the same with the jig method.

Refer to "5.2.2 (3) J3 and J4 axis origin setting".

The angles of each axis which sets up the ABS origin are shown below.

Model	J1 axis	J2 axis	J3 axis	J4 axis
RH-3FRH3515, RH-3FH3515	0°	103.5°	383.4 mm	0°
RH-3FRH3512C, RH-3FH3512C	0°	103.5°	341.9 mm	0°
RH-3FRH4515/5515, RH-3FH4515/5515	0°	0°	383.4 mm	0°
RH-3FRH4512C/5512C, RH-3FH4512C/5512C	0°	0°	341.9 mm	0°
RH-6FRH35** (Excluded RH-6FRH3534C/M) RH-6FH35** (Excluded RH-6FRH3534C/M)	0°	103.5°	336 mm	0°
RH-6FRH3534C/M, RH-6FH3534C/M	0°	103.5°	300 mm	0°
RH-6FRH45**/55** (Excluded RH-6FRH4534C/M, RH-6FRH5534C/M) RH-6FH45**/55** (Excluded RH-6FRH4534C/M, RH-6FRH5534C/M)	0°	0°	336 mm	0°
RH-6FRH4534C/M、RH-6FRH5534C/M RH-6FH4534C/M、RH-6FH5534C/M	0°	0°	300 mm	0°
RH-12FRH55**/70**/80**(C/M) RH-12FH55**/70**/80**(C/M)	0°	0°	350.5 mm	0°
RH-20FRH85**/100**(C/M) RH-20FH85**/100**(C/M)	0°	0°	342.5 mm	0°



Setting range of ABS mark

General environment type

Clean/Waterproof type

Alignment mark of J4 axis (View A)

Note) There is no alignment mark on the J3 axis. The posture to be set is the same with the jig method. Refer to "4.2.2 (3) J3 and J4 axis origin setting".

(5) RH-3FRHR, RH-3FHR series (Celling type)

The angles of each axis which sets up the ABS origin are shown below.

Model	J1 axis	J2 axis	J3 axis	J4 axis
RH-3FRHR3515, RH-3FHR3515	0°	103.5°	-569.5 mm	0°
RH-3FRHR3512C/W, RH-3FHR3512C/W	0°	103.5°	-609 mm	0°

(6) Origin setting procedure

Do the following operations with pressing the enabling switch of T/B lightly.

ABS origin setting method Origin setting procedure			
1	<MENU screen> <MENU> 1. FILE/EDIT 2. RUN 3. PARAM. 4. ORIGIN/BRK 5. SET/INIT. 6. ENHANCED 123 CLOSE	4 GHI	Press the [4] key on the menu screen, and display the Origin/Brake selection screen.
2	<ORIGIN/BRAKE screen> <ORIGIN/BRAKE> 1. ORIGIN 2. BRAKE 123 CLOSE	1 '( )	Press the [1] key, and display the Origin setting selection screen.
3	<ORIGIN screen> <ORIGIN> 1. DATA 2. MECH 3. TOOL 4.ABS 5. USER 123 CLOSE	4 GHI	Press the [4] key, and select the ABS method.
4	<ORIGIN screen> <ABS> J1 : ( ) J2 : (1) J3 : (1) J4 : (1) J5 : (1) J6 : (1) J7 : ( ) J8 : ( ) 123 CLOSE	1 '( )	Move the cursor to ( ) of the axis to be set its origin, and input "1".
6	<ORIGIN screen> <ORIGIN> TOOL CHANGE TO ORIGIN. OK? Yes ABC No	EXE	Press the [EXE] key, and display Confirmation screen. Note) Always perform the origin setting for the J5 axis and J6 axis simultaneously.
7	<ORIGIN screen> <ABS> COMPLETED J1 : ( ) J2 : (1) J3 : (1) J4 : (1) J5 : (1) J6 : (1) J7 : ( ) J8 : ( ) 123 CLOSE	F1	Press the [F1] key, and the origin position is set up.

The origin settings are completed.

⚠CAUTION After setting the origin, if the joint coordinates of the ABS mark position deviate from the coordinates of the ABS origin by 1.5° or more, align the end points of the ABS marks and set the origin using the ABS origin method again.

If the ABS mark of the axis other than the J6 axis is peeled off, align the pinholes used to set the origin with the jig method. The joint coordinates are the same between the ABS origin method and the jig method.

5.4 User origin method

⚠CAUTION Before setting the origin with the user origin method, set the origin with the other method. (Refer to table "Origin setting method" in "5 Resetting the Origin".)

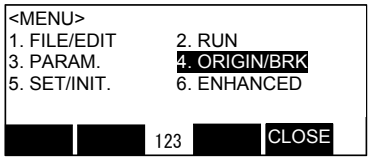
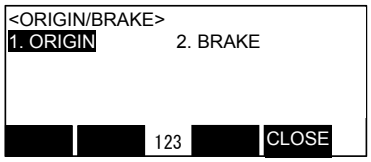
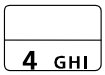
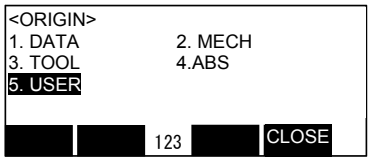
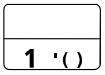
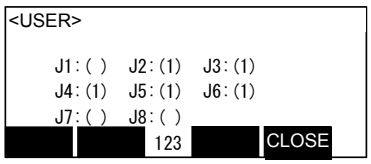
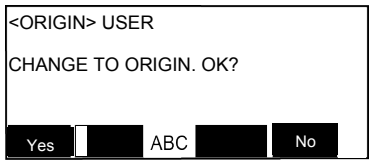
This operation is carried out with the teaching pendant.

Set the [ENABLE] switch on the teaching pendant to "ENABLE" to enable the teaching pendant.

* When setting the origin with the user origin method

· For the first time ·····Perform the operations in order from step 1.

· For the second time and later ···Move the robot arm to the user origin position with the jog operation, and accurately position all axes. Then, perform the operations in order from step 4.

User origin method Origin setting procedure			
1	Determine the user origin position. Move the robot to the position to be set as the origin with jog operation. [CAUTION] Choose the user origin position as the position where it doesn't move by the gravity. This position is left as a guideline to position all axes with jog operation when setting the origin again with this method.		
2	Enter the JOINT jog mode, and display the joint coordinates on the teaching pendant screen. Record the value of the axis for which the origin is to be set.		
3	Input the value recorded in the "user designated origin parameter (USERORG)".		
4	<MENU screen>  		Next, set the origin. Display the menu screen.
5	<ORIGIN/BRAKE screen>  	 	Press the [1] key, and display the Origin setting selection screen.
6	<ORIGIN screen>  	 	Press the [1] key, and display the Origin setting selection screen.
7	<ORIGIN screen>  	 	Input "1" into the axis to origin setting. Press the [EXE] key, and display Confirmation screen.
8	<ORIGIN screen>  	 	Press the [F1] key, and the origin position is set up.

The origin settings are completed by the user origin method.

5.5 Recording the origin data

Confirm the origin data on the teaching pendant screen (origin data input screen).
The origin data label is enclosed with the following cover. Refer to "5.1 Setting the origin with the origin data input method".

Robot model	Cover
RV-2FR, RV-2F series	J1 motor cover
RV-4/7/13/20FR, RV-4/7/13/20F series	CONBOX cover
RH-3/6/12/20FRH, RH-3/6/12/20FH series	Battery cover
RH-3FRHR, RH-3FHR series (Hanging type)	Base cover B (L)

The teaching pendant operation method and the cover removal method for confirming the origin data is the same as the methods for setting the origin with the origin data input method. Refer to "5.1 Setting the origin with the origin data input method", and write the origin data displayed on the teaching pendant onto the origin label.

(1) Confirming the origin data label
Remove the cover.
Refer to "4.5 Installing/removing the cover", and remove the cover.

(2) Confirming the origin data
Confirm the value displayed on the teaching pendant's Origin Data Input screen.
Refer to "5.1 Setting the origin with the origin data input method", "(3) Inputting the origin data", and display the Origin Data Input screen on the teaching pendant display screen.

(3) Recording the origin data
Write the origin data displayed on the teaching pendant to the origin data label.

(4) Installing the cover
Install the cover removed in step "(1) Confirming the origin data label" above.
Refer to "4.5 Installing/removing the cover", and replace the cover.

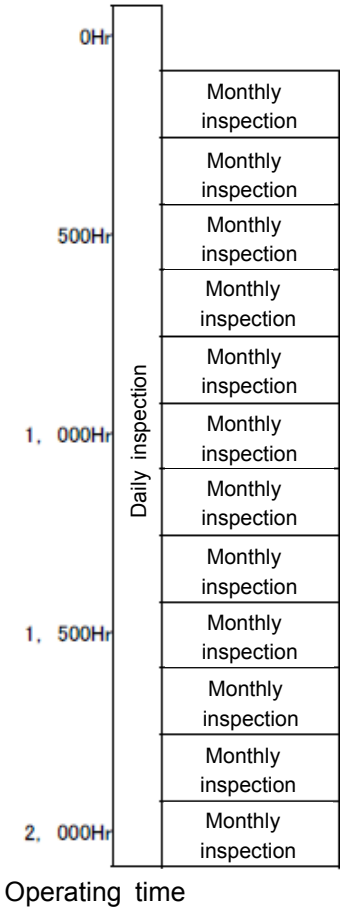
The recording of the origin data is completed.

6 Maintenance and Inspection (CR800 Controller)

The maintenance and inspection procedures to be carried out to use the robot for a long time without trouble are described in this chapter. The types and replacement methods of consumable parts are also explained.

6.1 Maintenance and inspection intervals

Maintenance and inspection are divided into the inspections carried out daily, and the periodic inspections carry out at set intervals. Always carry these out to prevent unforeseen trouble, to maintain the product for a long time, and to secure safety.



<Guideline for inspection period>

For one shift

8 Hr/day x 20 days/month x 12 months = approx. 1800 Hr
10 Hr/day x 20 days/month x 12 months = approx. 2400 Hr

For two shifts

15 Hr/day x 20 days/month x 12 months = approx. 3600 Hr

[Caution] According to the schedule on the above, when using the double shift, you should make the inspections at half the regular intervals.

6.2 Inspection items

The controller inspection items are shown below.
Inspect the robot arm while referring to section "Chapter 4 Maintenance and Inspection (Robot)".

6.2.1 Daily inspection items

Perform daily inspections with the following procedure.

Procedure	Inspection items (details)	Remedies
Before turning the power ON (Check the following inspection items before turning the power ON.)		
1	Is the power cable securely connected? (Visual)	Connect securely.
2	Are the machine cables between the robot arm and controller securely connected? (Visual)	Securely connect.
3	Is the controller cover cracked, has any foreign matter adhered, or is there any interference?	Replace with a new part, or take remedial measures.
After turning the power ON (Turn the power ON while monitoring the robot.)		
1	Is there any abnormal movement or noise when the power was turned ON?	Refer to the Troubleshooting section and remedy.
During operation (Try moving with an original program.)		
1	Check that the operation point is not deviated. If deviated, check the following items. 1) Are any of the installation bolts loose? 2) Are the bolts at the hand installation section loose? 3) Has the position of the jigs, other than the robot, deviated? 4) If the positional deviation cannot be eliminated, refer to "Troubleshooting", and remedy.	Refer to the Troubleshooting section and remedy.
2	Is there any abnormal movement or noise? (Visual)	Refer to the Troubleshooting section and remedy.

6.2.2 Periodic inspections

Perform the periodic inspections with the following procedure.

Procedure	Inspection items (details)	Remedies
Monthly inspection items		
1	Are any of the connector fixing screws or terminal block terminal screws loose?	Securely tighten the screws.
2	Is the controller filter dirty? (Visual)	Clean or replace with a new part. Inspect, clean and replace the filter by refer to "6.3.1 Inspection, cleaning, and replacement of the filter".

6.3 Maintenance and inspection procedures

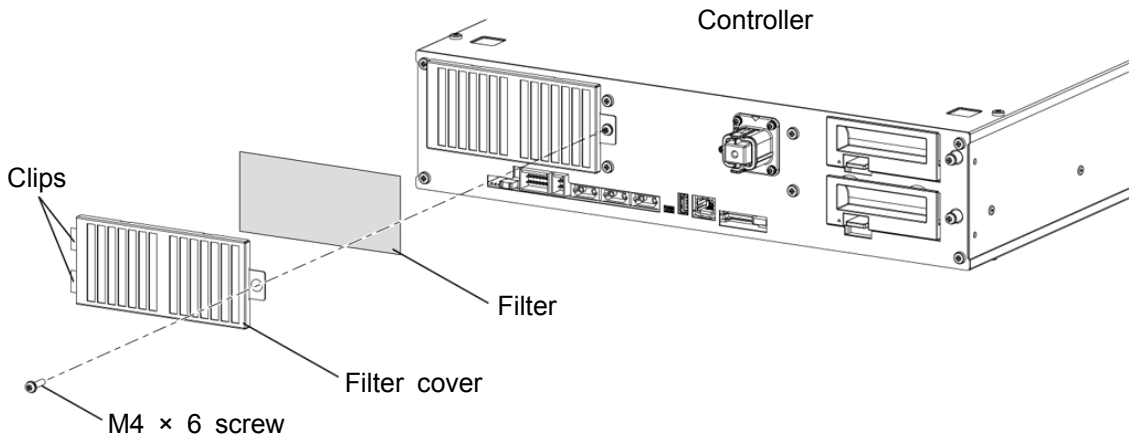
The procedures for performing periodic maintenance and inspection are described below.
(Never disassemble any of the parts not described in this textbook.)

The maintenance and inspection for the maintenance parts performed by the customer are described in "Section 6.5 Maintenance parts". Contact your dealer for these parts as necessary.

* For the maintenance and inspection of the CR750/CR751 series controller and drive unit, refer to "Appendix 3 Maintenance and Inspection (CR750/CR751 Controller, Drive Unit)".

6.3.1 Inspection, cleaning, and replacement of the filter

The following shows the procedure for cleaning and replacing the filter of the CR800 controller.

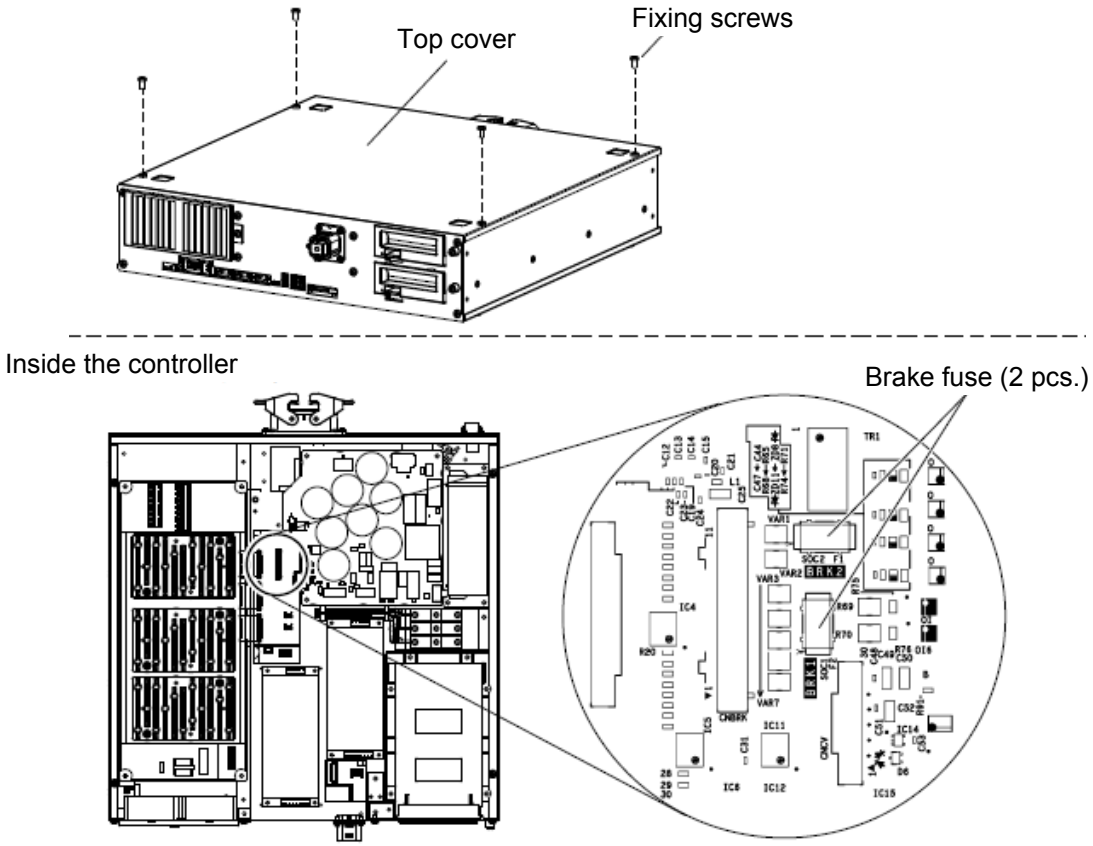


CR800 controller Filter inspection, cleaning, and replacement	
1	Turn off the controller power.
2	Loosen one M4 × 6 screw and remove the filter cover at the front of the controller. Release the clips on the left side of the filter cover which is inserted in the front of the controller.
3	Remove the filter from the filter cover and remove dust and other dirt on it. * If the filter is particularly dirty, handwash it with detergent diluted with water and then dry fully before attaching. If the surface of the washed filter is fluffy, replace it with a new filter.
4	Attach the cleaned filter (or a new filter).
5	Install the filter cover to the controller with one M4 × 6 screw.

The inspection, cleaning, and replace of the controller filter is completed.

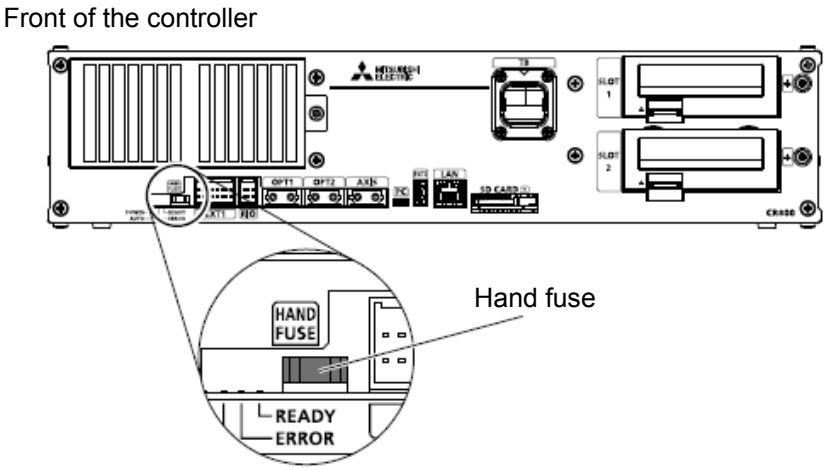
6.3.2 Fuse replacement

(1) Brake fuse



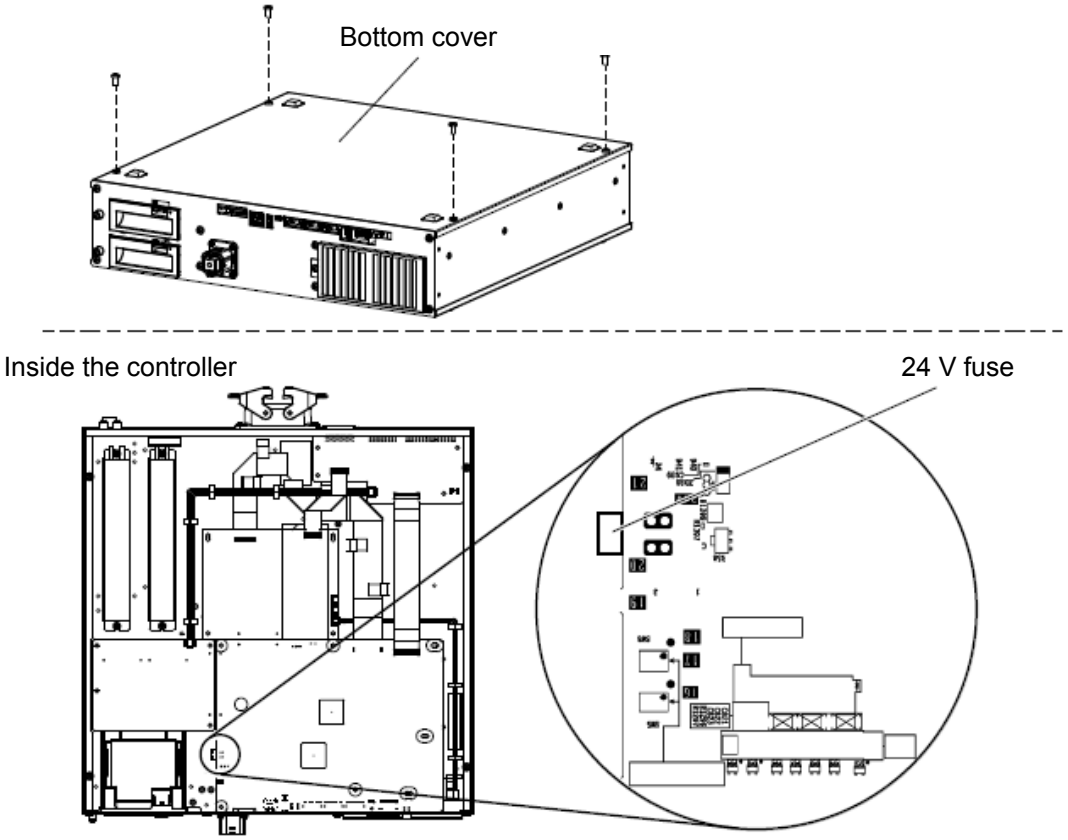
CR800 controller Brake fuse replacement	
1	Turn off the controller power.
2	Remove four top plate fixing screws (M4 × 8) and remove the top plate.
3	Replace two fuses "LM20" of the servo CPU board (DQ865n).

(2) Hand fuse



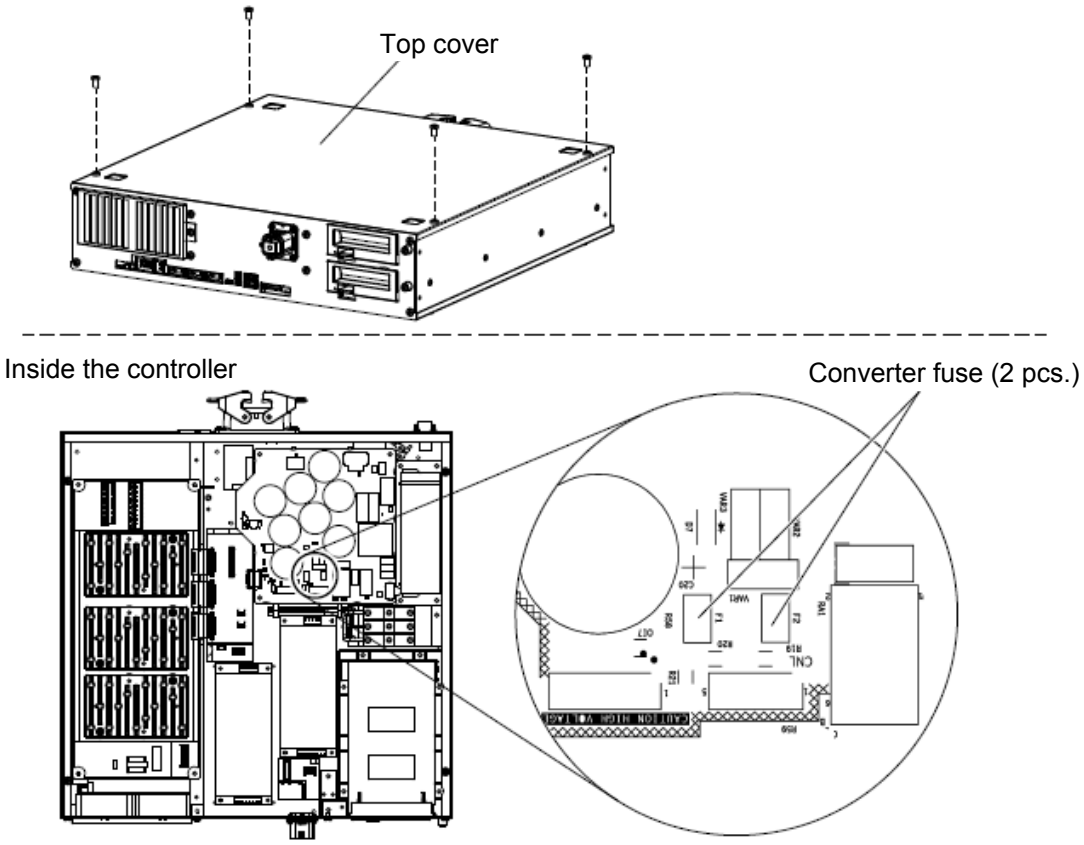
CR800 controller Hand fuse replacement	
1	Turn off the controller power.
2	Replace the Hand fuse (LM16).

(3) CPU board (DQ171n) fuse



CR800 controller Replacement of the CPU board (DQ171n) fuse	
1	Turn off the controller power.
2	Remove four top plate fixing screws (M4 × 8) and remove the top plate.
3	Replace the fuse "LM40" on the CPU board (DQ171n).

(4) Converter fuse



CR800 controller Converter fuse replacement	
1	Turn off the controller power.
2	Remove four top plate fixing screws (M4 × 8) and remove the top plate.
3	Replace two fuses of the converter board (DQ801n).

6.4 Backing up/restoring the controller data

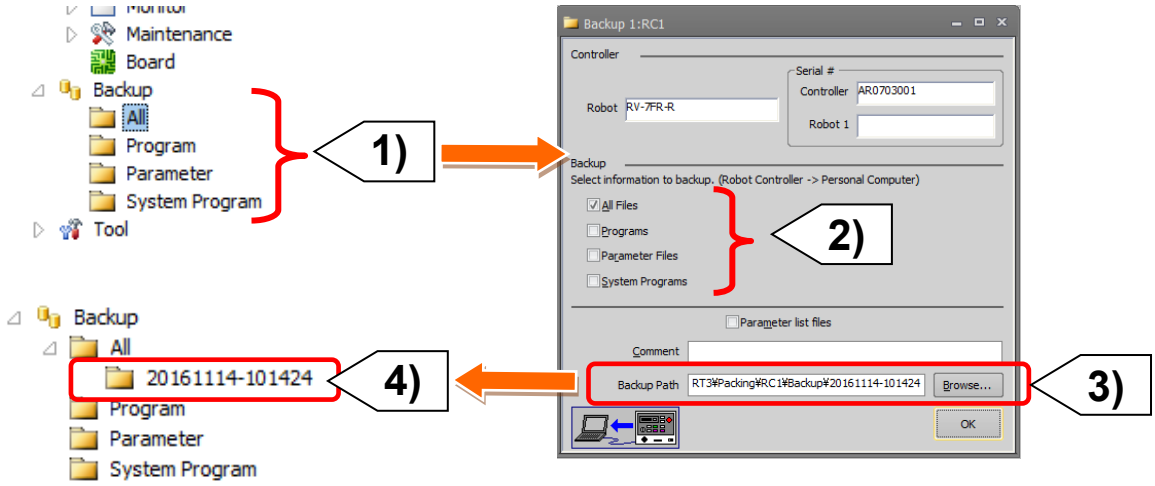
Backup or restore data with the robot controller connected to RT ToolBox3.

6.4.1 Backup (robot → personal computer)

Save the information in the robot controller to a file in a personal computer.

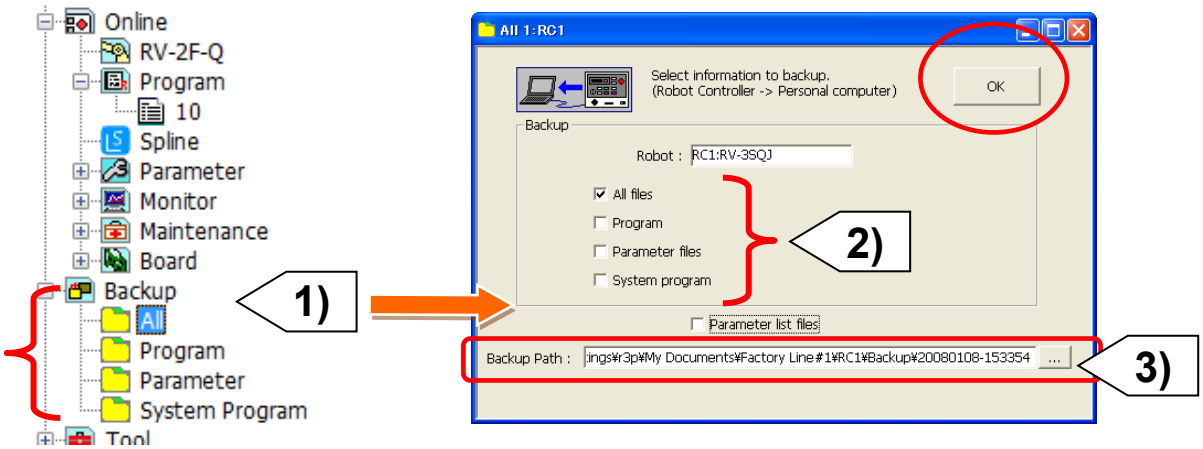
(1) For RT ToolBox3

1) Expand [Online] → [Backup] in the project tree. Double-click the item to be backed up from the four types of backup methods displayed in the project tree.
2) The backup method can be changed by selecting a check box in the Backup window.
3) Specify the backup destination, and click "OK".
4) The Confirmation window is displayed, and the backup starts.
5) When the backup has completed, the backup data is displayed under [Backup] in the project tree.



(2) For RT ToolBox2

1) Expand [Online] → [Backup] in the project tree, and double-click the items to be backed up.
2) The backup method can be changed by selecting the check box in the window.
3) Specify the backup destination, and click "OK".
4) The Confirmation window is displayed, and the backup starts.
5) When the backup has completed, the backup data is displayed under [Backup] in the project tree.

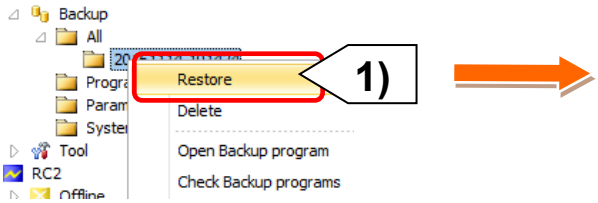


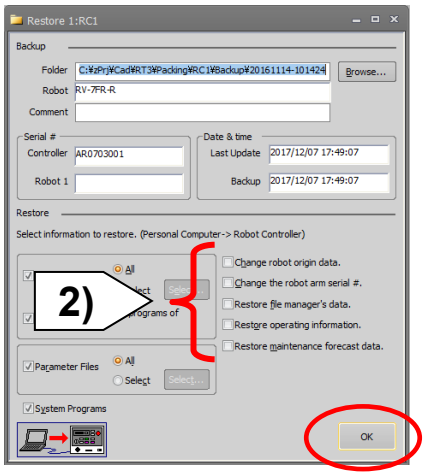
6.4.2 Restore (personal computer → robot)

Transfer information backed up on the personal computer to the robot controller.

(1) For RT ToolBox3

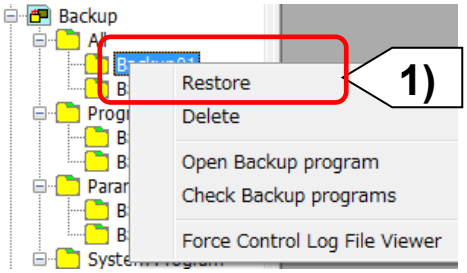
1) Expand [Backup] in the project tree. Select the data to be restored, right-click and select "Restore".
2) Specify the restoration method, and click "OK".

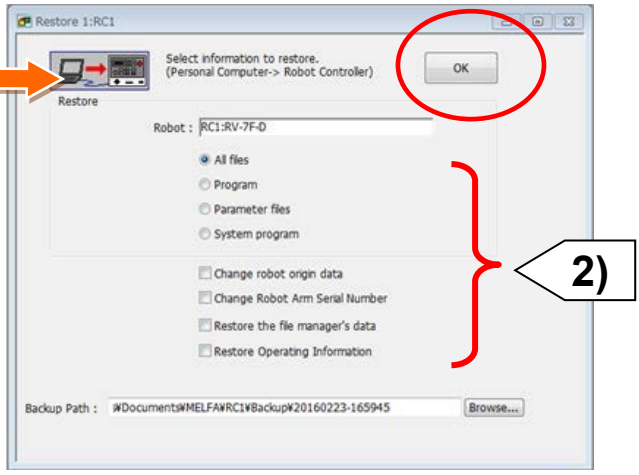




(2) For RT ToolBox2

1) Expand [Backup] in the project tree, select the items to be restored, and select "Restore" from the right-click menu.
2) Specify the restoration method, and click "OK".





6.5 Maintenance parts

This section describes the consumable parts that need to be replaced periodically and spare parts that may be necessary for repairs.

Purchase these parts from the dealer when required. Some Mitsubishi-designated parts differ from the maker's standard parts. Thus, confirm the part name, robot arm and controller serial No. and purchase the parts from the dealer.

(1) Consumable controller parts

No.	Part name	Type Note1)	Qty.	Section	Supplier
1	Filter	BKOFA0773H42	1	Inside the filter cover	Mitsubishi Electric

Note1) Confirm the robot arm serial No., and contact the dealer or service branch of Mitsubishi Electric Co., for the type.

(2) Spare controller parts

No.	Part name	Type Note1)	Qty.	Section	Supplier
1	1.6A fuse	LM16	1	Hand fuse (front of the controller)	Mitsubishi Electric

Note1) Confirm the robot arm serial No., and contact the dealer or service branch of Mitsubishi Electric Co., for the type.

<< MEMO >> * Please use this page for your memo.

Appendix1 Device Connection (F Series)

Appendix1.1 Device configuration

(1) Standalone type

Robot arm

Device connection cable

• For CR750 controller

• For CR751 controller

Controller

• CR750-D

• CR751-D

• CR760-D

(2) iQ Platform compatible type

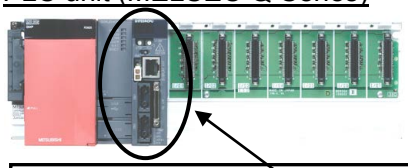
Robot arm

Device connection cable

• For CR750 drive unit

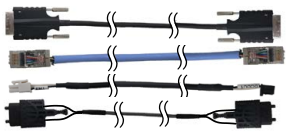
• For CR751 drive unit

PLC unit (MELSEC Q Series)



Controller

Cable



Robot CPU unit Note 1)
Q172DRCPU

Battery unit

Note 2) Do not remove the battery unit.

Drive unit

• For CR750 drive unit

• For CR760 drive unit

• For CR751 drive unit

Note 1) The same type of robot CPU module is used for both robot arm types.
The CPU is mounted on the PLC unit (base board, power module, PLC CPU required) prepared by the user.

Appendix 1.2 Connection with the controller

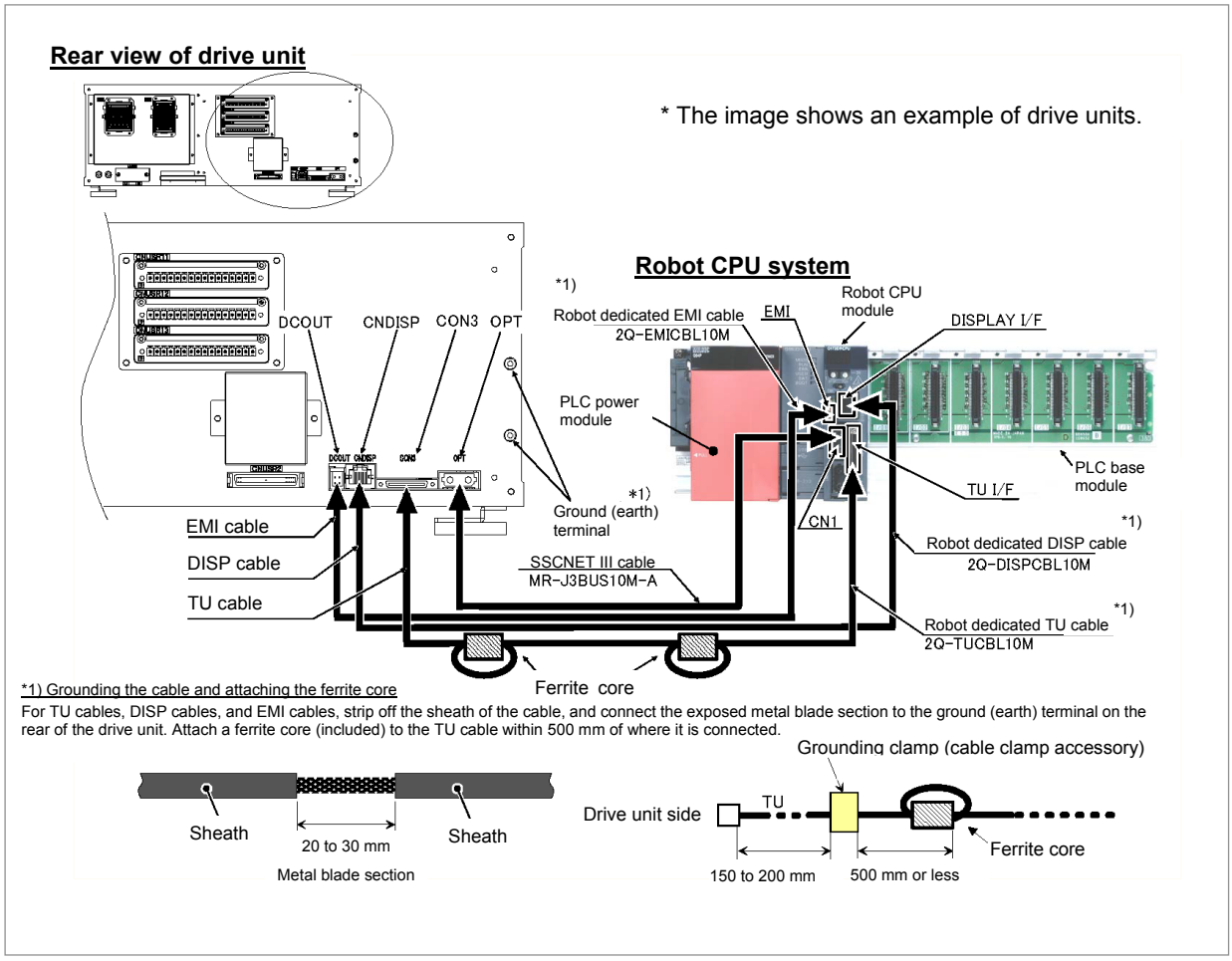
Appendix 1.2.1 CR750/CR751 controller, drive unit

(1) Connection of robot CPU unit and drive unit (F series and Q type)

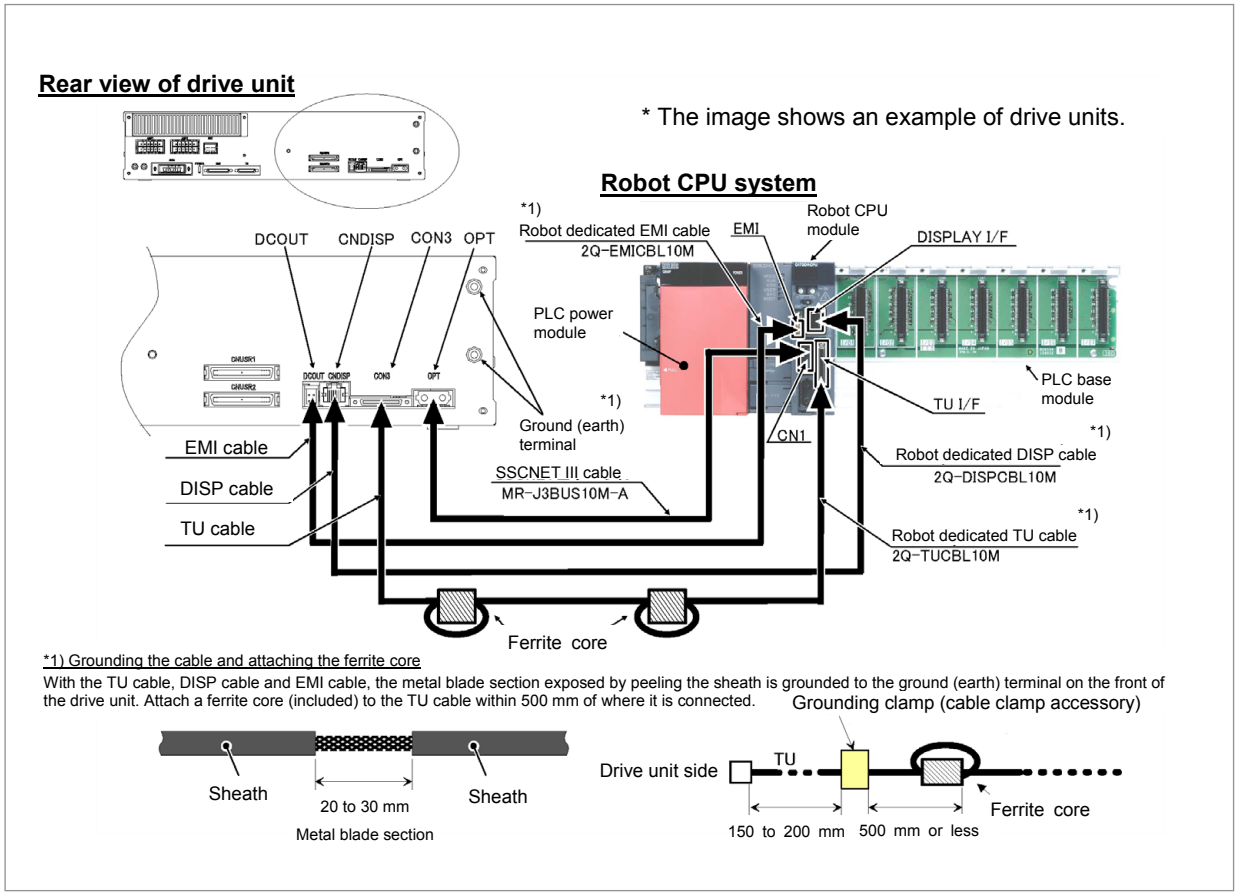
The following connection cables are provided (robot). These cables connect the robot CPU unit and drive unit.

(1)	TU cable	For T/B and operation panel signals
(2)	DISP cable	For T/B data transmission
(3)	EMI cable	For emergency stop signal
(4)	SSCNET III cable	For servo amplifier control

a) Connection of robot CPU unit and CR750 drive unit



b) Connection of robot CPU unit and CR751 drive unit



⚠CAUTION

1) After removing the SSCNET III cable, attach the lid to the connector.
   If dirt or dust is observed, the feature may deteriorate and malfunctions may be caused.
2) Do not remove the SSCNET III cable while the power is supplied to the multiple CPU system or servo amplifier. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables of the Motion CPU or the servo amplifier. Eye discomfort may be caused if exposed to the light. (SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC 60825-1 (domestic standards in Japan).)
3) When connecting the TU cable, DISP cable, and EMI cable for the robot, peel a part of the cable sheath to prevent effect from the noise, and connect the metal blade part (braided part) to the earth of the drive unit.
   For the drive unit side, fix the cable to the cable clamp at the front using the supplied cable clamp.
   For the robot CPU system side, fix the cable to the earth clamp prepared by the customer. (The customers are required to prepare the cable clamp.)
   When fixing the cable with the cable clamp closed, the cable fixing may be loose depending on the shape of the clamp. In that case, slightly squeeze the clamp with a nipper to ensure the contact with the shield part.
   When peeling the cable sheath, be careful not to cut the cable inside.
4) Always install the SSCNET III cable with the following minimum bend radius or more.
   Model: MR-J3BUS*M-A.....Reinforced cable part: 50 mm, Cord part: 25 mm
   Model: MR-J3BUS30M-B.....Reinforced cable part: 50 mm, Cord part: 30 mm
   ("*" in the model name indicates the cable length.)

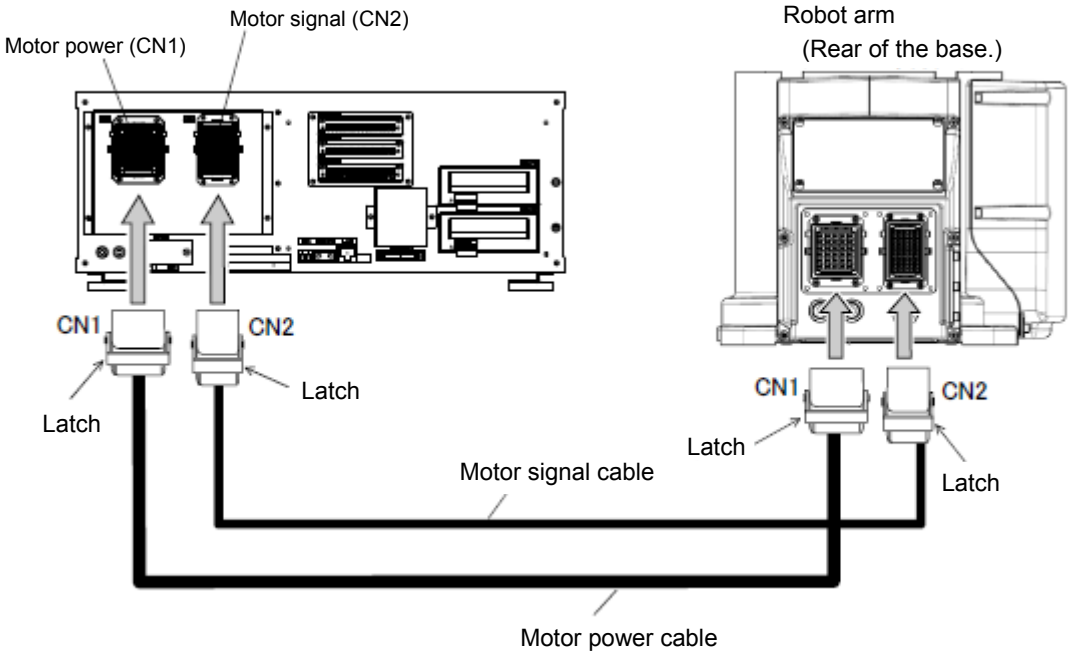
<< MEMO >> * Please use this page for your memo.

(2) Connection with the device connection cable

a) CR750 controller, drive unit

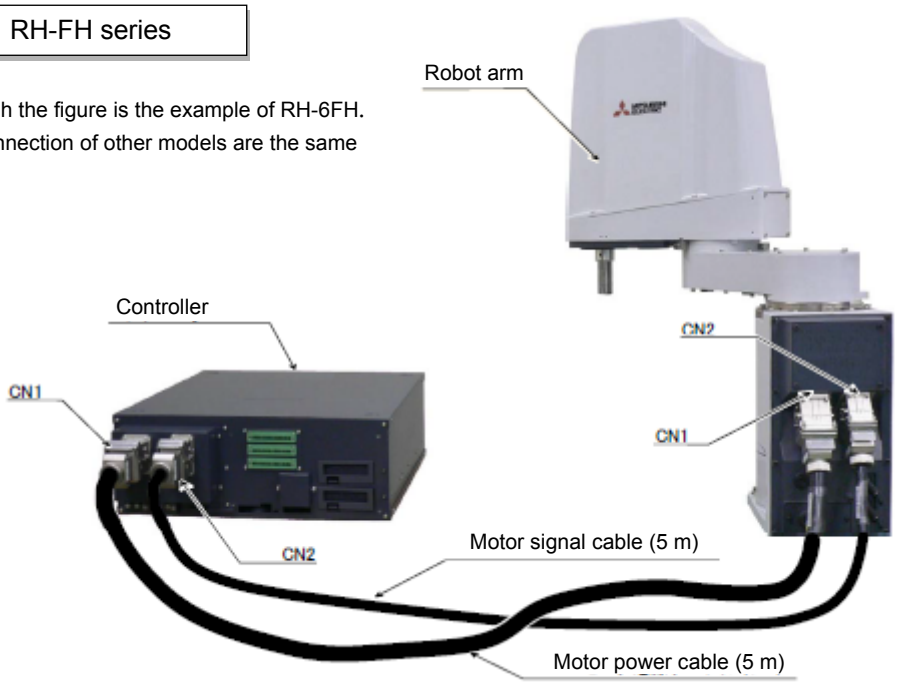
RV-F series

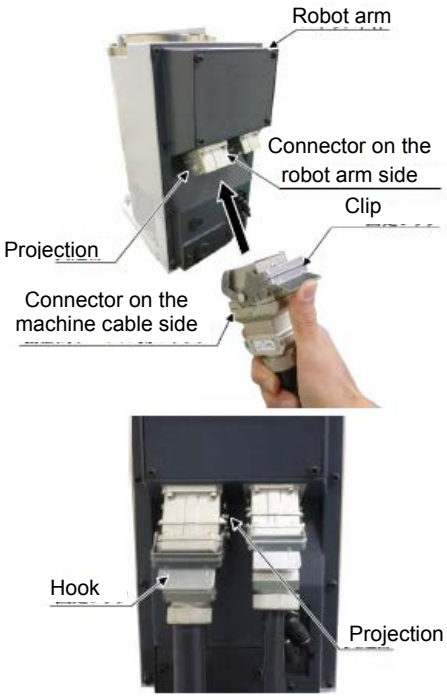
Although the figure is the example of RV-4F.
The connection of other models are the same



RH-FH series

Although the figure is the example of RH-6FH.
The connection of other models are the same





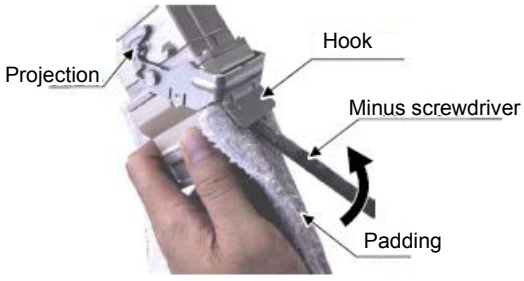
1) Check that the controller power is off.
2) Connect the controller side connector of the device connection cable to the CN1 connector at the back of the controller.
3) After connecting the connector, insert the hook attached to the connector on the machine cable side to the rear of the projection of the robot arm connector to fix securely in place.

Note) The connection methods are the same for other models with the same connector shape as RH-6FH that is shown in the left figure.

⚠CAUTION <<Caution for connection with the device connection cable>>

- When installing or removing the connector, to the connector of the other party in parallel, install or remove. If load strong against one side is applied, the connector pin may be damaged and it may not be connected securely.
- The machine cable connectors are dedicated for the controller side and robot arm side, so take special care when connecting.
- Take special care to the leading of the connection cable. If the cable is pulled with force or bent excessively, wires could break or the connector could be damaged.
- Connect the machine cable at the place without the effect of the dust or oil mist.
  Please keep the dust and oil mist from being applied to of the robot-arm connector section, in the condition that the machine cable is removed. Since it becomes the cause of failure.

[Removing the device connection cable]



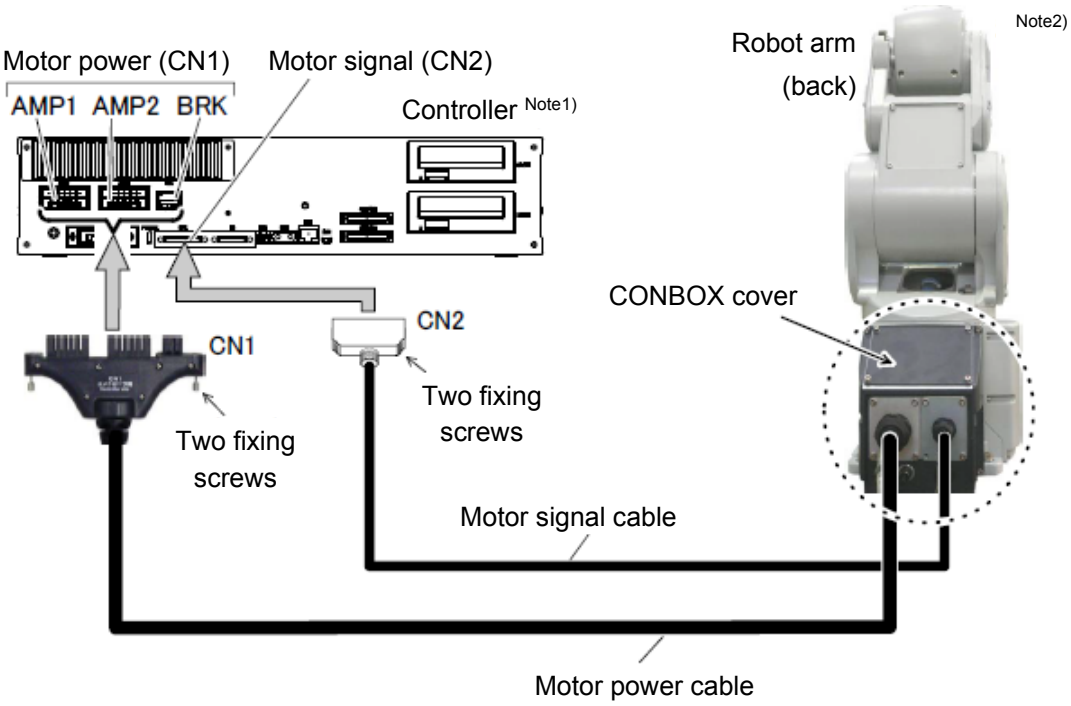
To remove the cable, insert a minus screwdriver under the clip while using a cloth as padding, and remove the cable by lifting the hook.

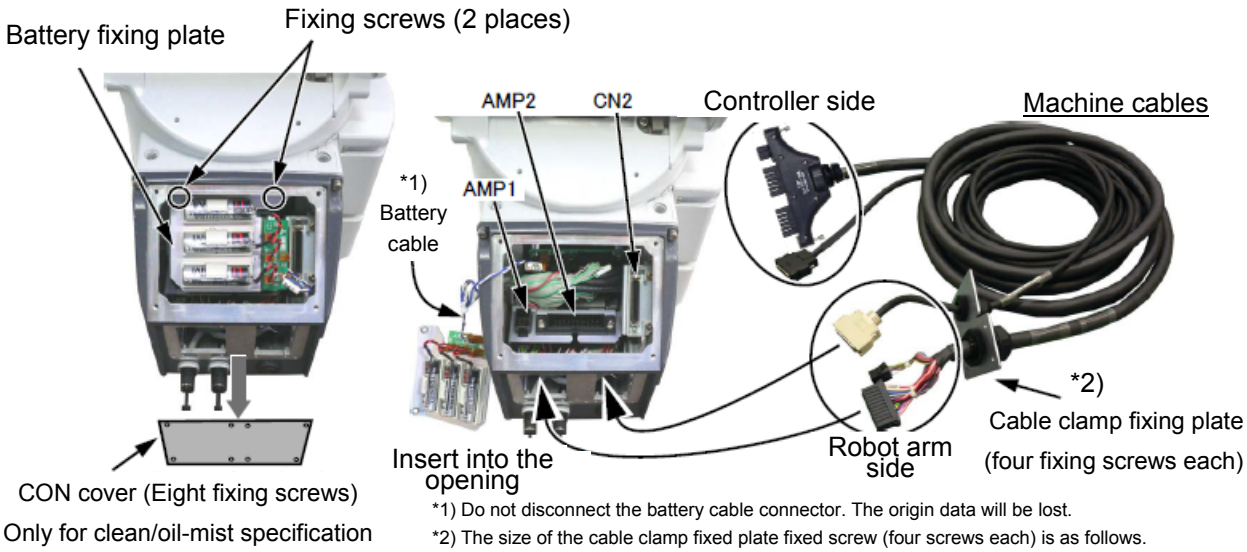
* Install and remove the cables in parallel with the connector of the other side.

b) CR751 controller, drive unit

RV-F series

The robot side figure is an example for RV-4F.
The connection of other models are the same.





*1) Do not disconnect the battery cable connector. The origin data will be lost.
*2) The size of the cable clamp fixed plate fixed screw (four screws each) is as follows.
Standard specification: M4x12
Clean/oil-mist specification: M4x16

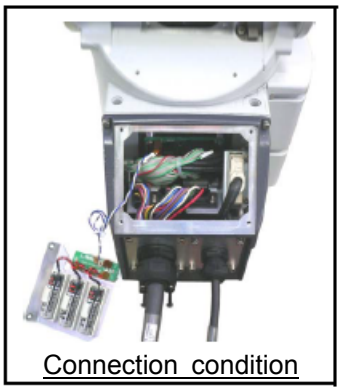


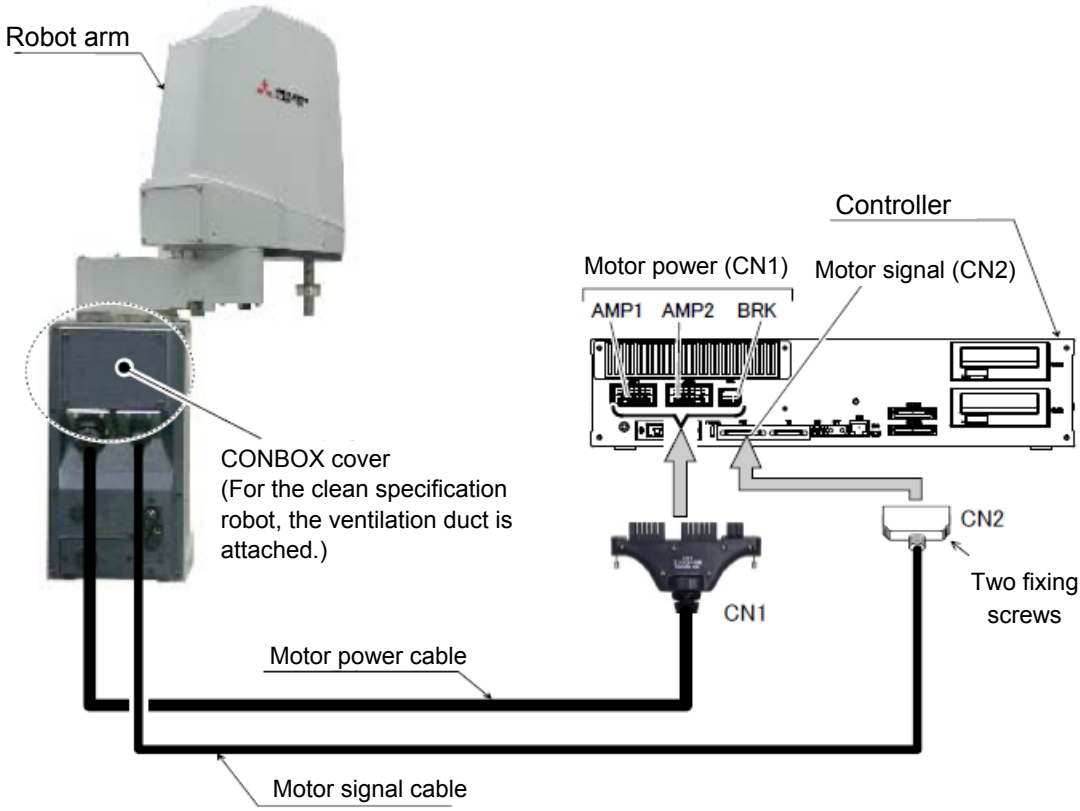
Table 2-4: Boxing posture for each model (reference) Unit: degree

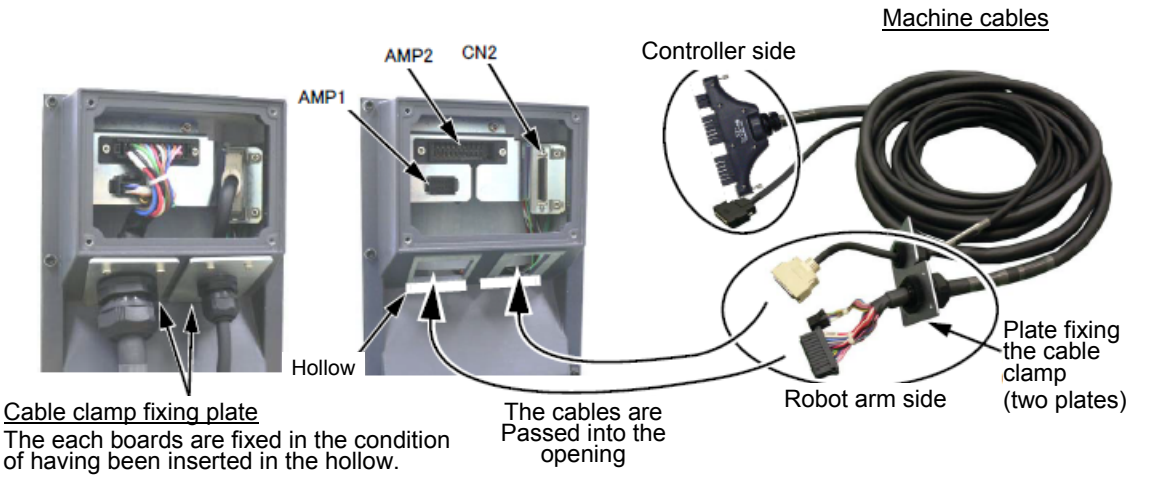
Axis	RV-4F	RV-4FL RV-4FJL	RV-7F	RV-7FL	RV-7FLL, RV-13F/FL RV-20F
J1	90	90	90	90	0
J2	-122	-121	-116	-115	-93
J3	162	165	158	164	160
J4	0	0 Note 1)	0	0	0
J5	45	41	48	41	23
J6	0	0	0	0	0

Note 1) The RV-4FJL (5-axis type robot) does not have the J4 axis.

RH-FH series

The robot side figure is an example for RH-6FH.
The connection of other models are the same.





CR751 controller Connection with the device connection cable	
1	Turn off the power switch of the controller.
2	Remove the CONBOX cover at the back of the base. For the clean/oil mist specification model, remove the CON cover and eight fixing screws. (An opening for the connector is inside.)
3	Remove two fixing screws of the battery fixing plate in the CONBOX cover and remove the battery fixing plate. Note) Do not disconnect the connector of the battery cable. The robot origin data will be lost.
4	Lead the robot side connector of the device connection cable from the opening at the back of the robot base, and connect it to the corresponding connector. Securely connect the connector (AMP1, AMP2, CN2).
5	Fix the cable clamp fixing plate installed to the device connection cable with the supplied fixing screws. (Securely fix two cables with four screws each.)
6	Securely fix the battery fixing plate as before. Be careful that the cable does not get caught.
7	Securely install the CONBOX cover as before. Be careful that the cable does not get caught.
8	Connect the device connection cable to the corresponding connector at the front of the controller. Securely connect the connector CN1 (AMP1, AMP2, BRK) and CN2. Securely tighten two fixing screws. Tighten the CN2 fixing screw with 0.06 to 0.07 N·m.

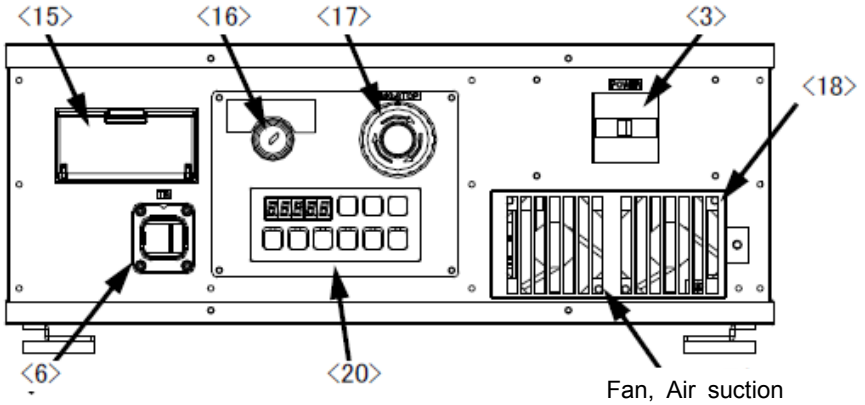
Appendix 1.3 Controller Names and functions

1.3.1 CR750/CR751 controller

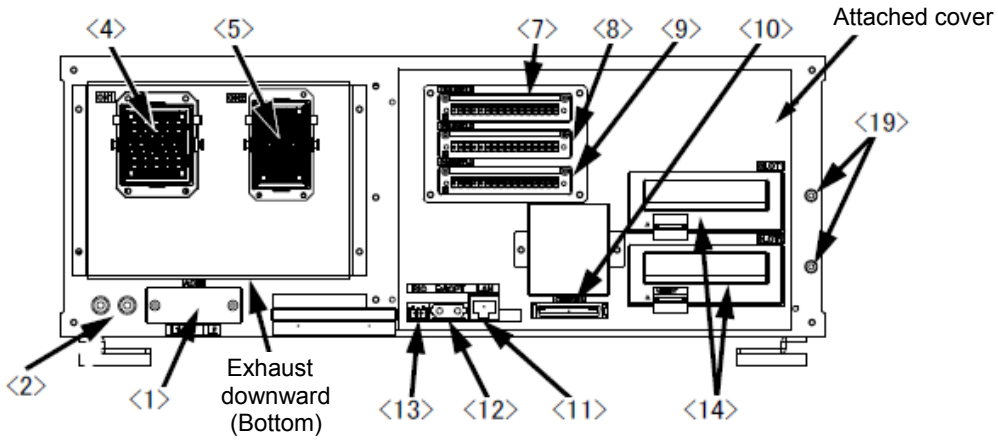
(1) CR750 controller

Front of the controller

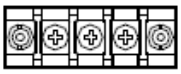
* The controller is an example.



Back of the controller

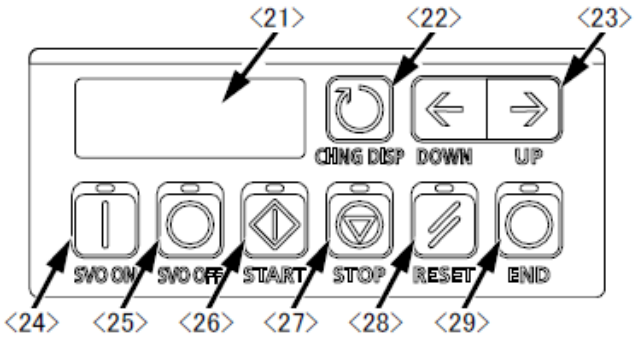


〈1〉 : ACIN terminal



There are three types of terminal (Type A, B, and C).
Refer to next page for details.

〈20〉 : The operation panel



<1> ACIN terminal..... The terminal box for AC power source (single phase or single phase/three phase, AC 200 V) input. (Inner side of a cover)
Two types of terminal are available. The type to be used depends on the model. (*1)

<2> PE terminal ..... The screw for grounding of the cable. (M4 screw × 2 place)

<3> Power switch..... This turns the control power ON/OFF

<4> Machine cable connector (motor signal) (CN1)
Connect with the CN1 connector of the robot arm.

<5> Machine cable connector (motor power) (CN2)
Connect to the CN2 connector of the robot arm.

<6> T/B connection connector (TB).... This is a dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.

<7><8><9><10> CNUSR connector... The connector for input/ output connection dedicated for robot. (a plug connector attached)
<7>: CNUSR11, <8>: CNUSR12, <9>: CNUSR13, <10>:CNUSR2

<11> LAN connector (LAN)..... For LAN connection

<12> ExtOPT connector (ExtOPT) ..... Connect the cable for addition axis control.

<13> RIO connector (RIO)..... Connect the extension parallel input/output unit.

<14> Option slot..... Install the interface optional. (Install the cover, when not using.) (SLOT1, SLOT2)

<15> Interface cover ..... USB interface and battery are mounted.

<16> Mode key switch ..... Changes the robot's operation mode.

AUTOMATIC..... Operations from the controller or external equipment are valid. Operations for which the operation mode must be at the external device or T/B are not possible. (Exclude the start of automatic operation.)

MANUAL..... When the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device or controller are not possible.

<17> Emergency stop switch..... Stops the robot in an emergency state. The servo turns OFF.

<18> Filter cover ..... There is an air filter inside the cover.

<19> Grounding terminal ..... The grounding terminal for connecting cables of option card. (M3 screw × 2 places)

<20> Operation panel ..... The operation panel for servo ON/OFF, START/STOP the program etc.

<21> Display panel (STATUS.NUMBER)
The alarm No., program No., override value (%), etc., are displayed.

<22> CHNGDISP button ..... This button changes the details displayed on the display panel in the order of "Override" → "Program No." → "Line No.".

<23> UP/DOWN button..... This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.

<24> SVO.ON button ..... Turns ON the servo power. (The servo turns ON.)

<25> SVO.OFF button ..... This turns OFF the servo power. (The servo turns OFF.)

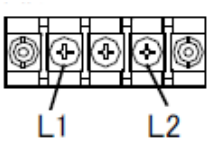
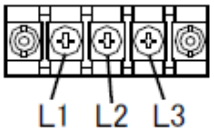
<26> START button ..... Executes the program and operates the robot. The program is run continuously.

<27> STOP button ..... This stops the robot immediately. The servo does not turn OFF.

<28> RESET button ..... This resets the error. This also resets the program's halted state and resets the program.

<29> END button..... This stops the program being executed at the last line or END statement.

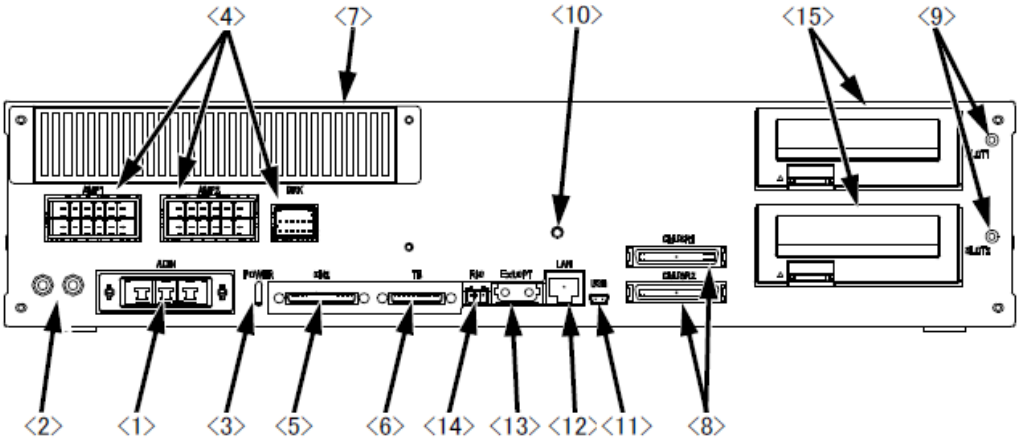
(*1) Type of ACIN terminal block

Type of terminal	Model	Type of terminal
Type A: For single phase	RV-2F series RV-4F/4FL series RH-3FH series RH-6FH series RH-3FHR series	 Connect the primary power supply to L1 and N terminal.
Type B: For single phase/three phase	RV-7F/7FL series RV-7FLL series RV-13F/13FL series RV-20F series RH-12FH series RH-20FH series	When using the three phase primary power supply, connect to L1, L2, and L3 terminal. When using the single phase primary power supply, connect to L1 and L3 terminal. 

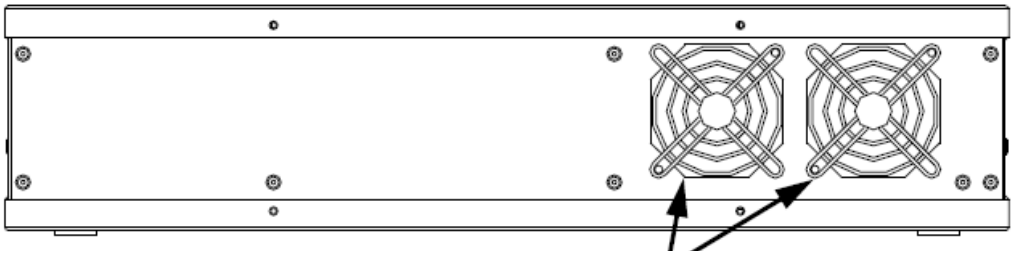
(2) CR751 controller

Front of the controller

* The controller in the figure is an example.



Back of the controller



Exhaust

<1> ACIN connector..... The connector for AC power source (single phase, AC 200 V) input (a socket housing and a terminal are attached)

<2> PE terminal..... The screw for grounding of the cable. (M4 screw × 2 place)

<3> POWER lamp..... Lamp of control power source

<4> Machine cable connector (motor power)
AMP1, AMP2: Motor power, BRK: Motor brake

<5> Machine cable connector (motor signal)
CN2: Motor signal

<6> T/B connection connector (TB). ... This is a dedicated connector for connecting the R33TB. When not using T/B, connect the attached dummy plug.

<7> Filter cover ..... There is an air filter and buttery inside this cover.

<8> CNUSR connector ..... The connector for input/ output connection dedicated for robot. (a plug connector attached)

<9> Grounding terminal ..... The grounding terminal for connecting cables of option card. (M3 screw × 2 places)

<10> Power supply charge lamp (CHARGE)
The lamp is to ensure safe timing (prevent electric shocks) when removing the cover (users are not normally required to remove the cover). This lamp is illuminated (red) when electrical energy accumulates on the controller's power supply circuit board due to the robot's servo being ON. After turning the control power OFF and allowing a few minutes to pass, the lamp will go out.

<11> USB connecting connector (USB)
..... For USB connection

<12> LAN connector (LAN)..... For LAN connection

<13> ExtOPT connector (ExtOPT) ..... For additional axis connection.

<14> RIO connector (RIO) ..... For parallel I/O extension connection.

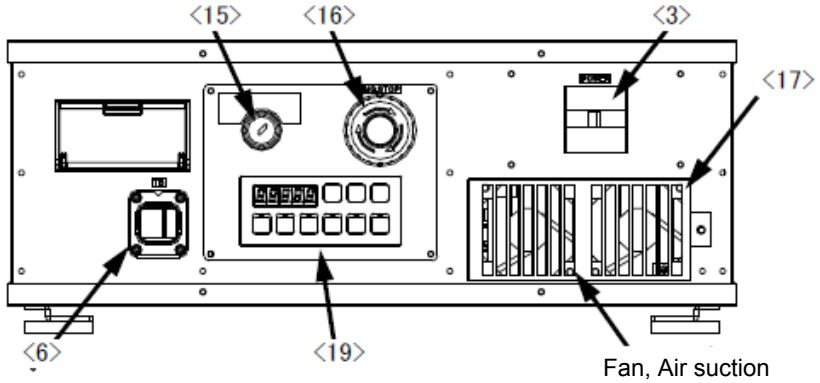
<15> Option slot ..... Slot for installing option cards. (Install the cover when not used.) (SLOT1, SLOT2)

1.3.2 CR750/CR751 drive unit

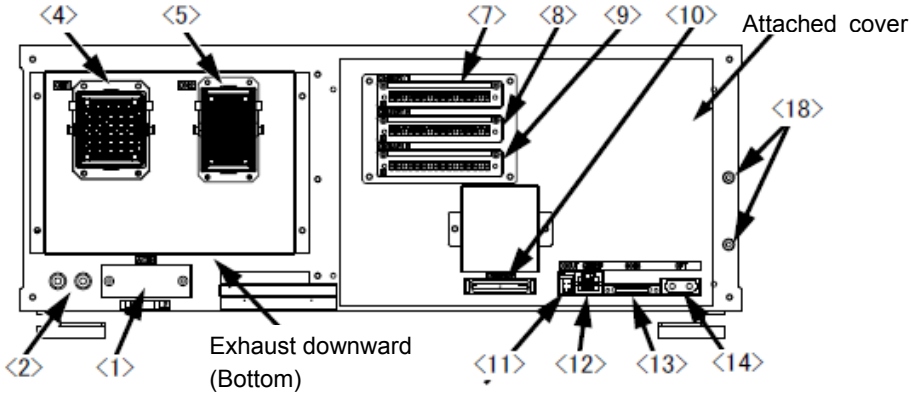
(1) CR750 drive unit

Drive unit (Front side)

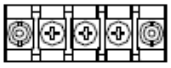
* The drive unit is an example.



Drive unit (Rear side)

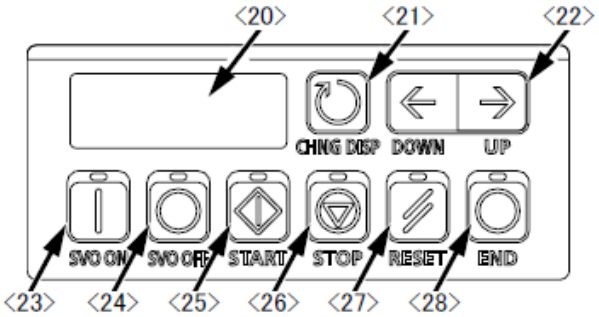


<1> : ACIN terminal



There are three types (Type A, B, and C) of the terminals.
Refer to next page for details.

<19> : The operation panel



<1> ACIN terminal..... The terminal box for AC power source (single phase or single phase/three phase, AC 200 V) input. (Inner side of the cover)
Two types of terminal are available. The type to be used depends on the model. (*1)

<2> PE terminal ..... The screw for grounding (earthing) the cable. (M4 screw × 2 place)

<3> Power switch..... This turns the control power ON/OFF

<4> Machine cable connector (motor signal) (CN1)
Connects with the CN1 connector of the robot arm.

<5> Machine cable connector (motor power) (CN2)
Connects with the CN2 connector of the robot arm.

<6> T/B connection connector (TB).... A dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.

<7><8><9><10> CNUSR connector... The connector for input/ output connection dedicated for robot. (a plug connector attached)
<7>: CNUSR11, <8>: CNUSR12, <9>: CNUSR13, <10>: CNUSR2
Note) <9>: CNUSR13 connector is not used in this controller.

<11> DCOUT connector (DCOUT)..... For emergency stop

<12> CNDISP connector (CNDISP) ... For LAN of T/B connection

<13> CON3 connector (CON3)..... For RS422 of T/B connection

<14> OPT connector (OPT)..... For SSCNETIII connection

<15> Mode switch..... This key switch changes the robot's operation mode.

AUTOMATIC..... Operations from the controller or external equipment are valid. Operations for which the operation mode must be at the external device or T/B are not possible. (Exclude the start of automatic operation.)

MANUAL..... When the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device or controller are not possible.

<16> Emergency stop switch..... This switch stops the robot in an emergency state. The servo turns OFF.

<17> Filter cover ..... There is an air filter inside the cover.

<18> Grounding terminal ..... The grounding terminal for connecting cables of option card. (M3 screw × 2 places)

<19> Operation panel ..... The operation panel for servo ON/OFF, START/STOP the program etc.

<20> Display panel (STATUS.NUMBER)
The alarm No., program No., override value (%), etc., are displayed.

<21> CHNGDISP button..... This switches the display contents of the display panel in the order of "Override" → "Line No." → "Program No." → "User information"→ "Manufacturer information".

<22> UP/DOWN button..... This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.

<23> SVO.ON button..... This turns ON the servo power. (The servo turns ON.)

<24> SVO.OFF button ..... This turns OFF the servo power. (The servo turns OFF.)

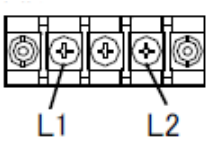
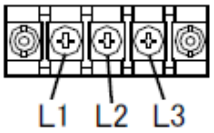
<25> START button ..... This executes the program and operates the robot. The program is run continuously.

<26> STOP button ..... This stops the robot immediately. The servo does not turn OFF.

<27> RESET button..... This resets the error. This also resets the program's halted state and resets the program.

<28> END button ..... This stops the program being executed at the last line or END statement.

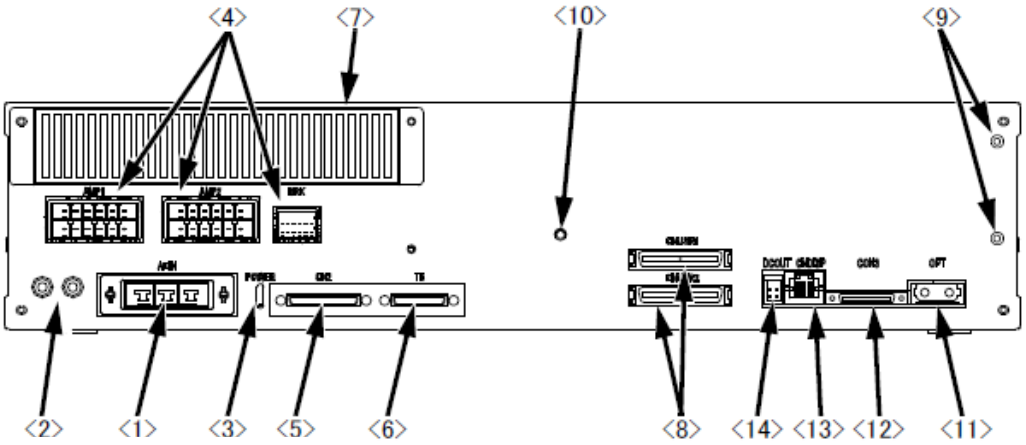
(*1) Type of ACIN terminal block

Type of terminal	Model	Type of terminal
Type A: Single-phase	RV-2F series RV-4F/4FL series RH-3FH series RH-6FH series RH-3FHR series	 Connect the primary power supply to L1 and L2 terminal.
Type B: Single-phase/three-phase	RV-7F/7FL series RV-7FLL series RV-13F/13FL series RV-20F series RH-12FH series RH-20FH series	When using the three phase primary power supply, connect to L1, L2, and L3 terminal. When using the single phase primary power supply, connect to L1 and L3 terminal. 

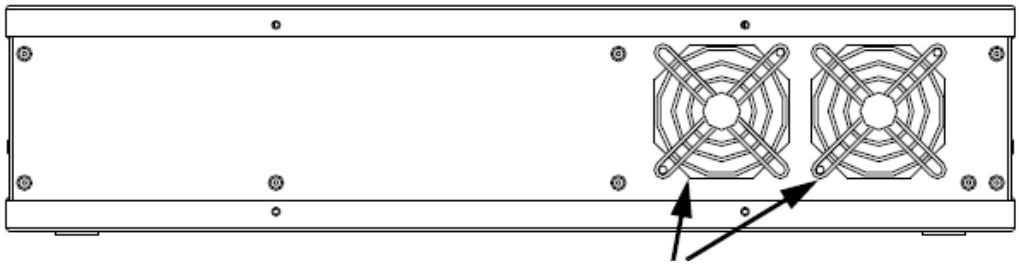
(2) CR751 controller

Controller (Front side)

* The controller is an example.



Controller (Rear side)



<1> ACIN connector..... The connector for AC power source (single phase, AC 200 V) input (a socket housing and a terminal are attached)

<2> PE terminal ..... The screw for grounding of the cable. (M4 screw × 2 place)

<3> POWER lamp..... Lamp of control power source

<4> Machine cable connector (motor power)
AMP1, AMP2: Motor power, BRK: Motor brake

<5> Machine cable connector (motor signal)
CN2: Motor signal

<6> T/B connection connector (TB).... This is a dedicated connector for connecting the R33TB. When not using T/B, connect the attached dummy plug.

<7> Filter cover ..... There is an air filter and buttery inside this cover.

<8> CNUSR connector ..... The connector for input/ output connection dedicated for robot. (CNUSR1, CNUSR2) (a plug connector attached) Refer to Page 32, "(2) CR751 controller" for the connection method and the further description of pin assign.

<9> Grounding terminal ..... The grounding terminal for connecting cables of option card. (M3 screw × 2 places)

<10> Power supply charge lamp (CRARGE)
The lamp is to ensure safe timing (prevent electric shocks) when removing the cover (users are not normally required to remove the cover). This lamp is illuminated (red) when electrical energy accumulates on thecontroller's power supply circuit board due to the robot's servo being ON. After turning the control power OFF and allowing a few minutes to pass, the lamp will go out.

<11> OPT connector (OPT)..... For SSCNETIII connection

<12> CON3 connector (CON3) ..... For T/B RS422

<13> CNDISP connector (CNDISP) .. For T/B LAN

<14> DCOUT connector (DCOUT) ... For emergency stop

Appendix 1.4 Installing and removing the teaching box

Appendix 1.4.1 CR750/CR751 controller, drive unit

Installing and removing the T/B, with turning off the drive unit power.

If T/B is Installed and removed in the state of control source ON, emergency stop alarm will be occurred.

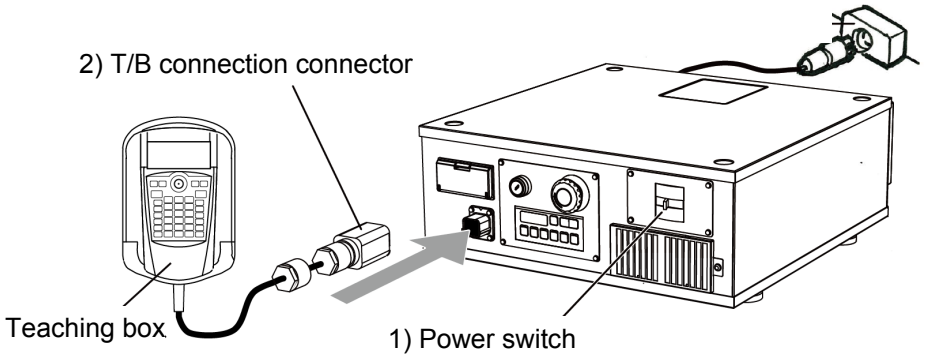
If you use the robot wherein T/B is removed, install the dummy connector of attachment for the product instead of T/B. Take out and insert the dummy connector with the connector itself.

⚠CAUTION Pulling the cable of the T/B hard or bending excessively may break the cable or damage the connector. Hold the connector to reduce the stress on the cable when installing and removing the T/B.

(1) CR750 controller, drive unit

(a) Installing the T/B

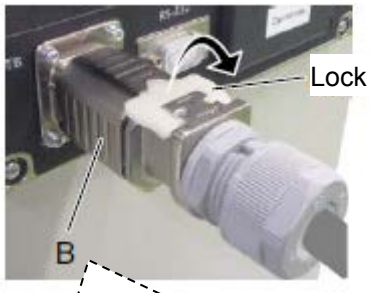
1) Check that the controller power is off.
2) Raise the lock lever.
3) Insert the connector until it clicks.
4) Lower the lock lever and fix the connector.



(b) Removing the T/B

1) Check that the controller power is off.
2) Raise the lock lever at the upper part of the connector, and pull the connector by holding it.
   (Refer to the right figure.)

* When using the robot without installing the T/B, install a dummy connector.

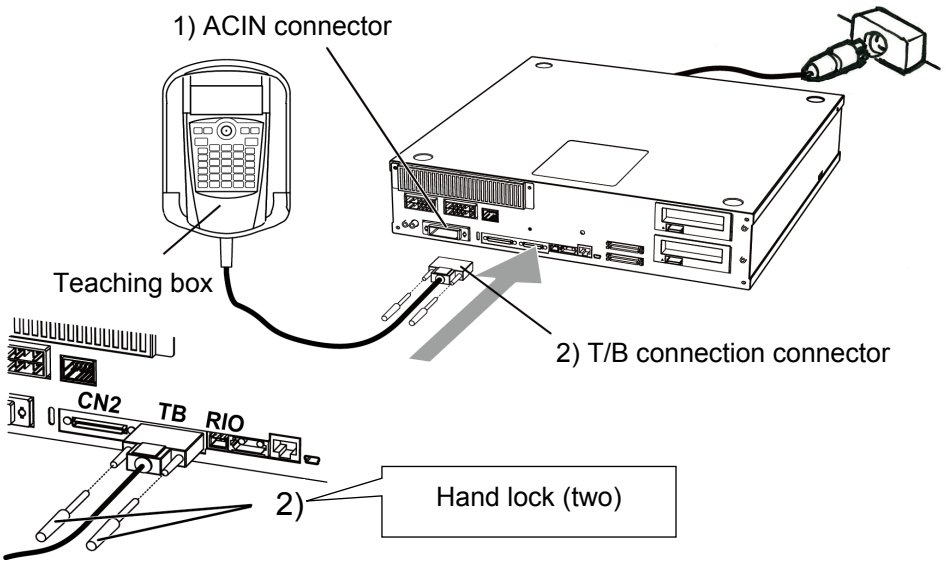


How to remove the T/B connection connector
Release the lock (raise the lock lever), slide the case (B) to the front to remove the latch, and then pull out the connector.

(2) CR751 controller, drive unit

(a) Installing the T/B

1) Check that the controller power is OFF.
2) Connect the T/B connection connector to the T/B connector of the controller.
Securely fix the connectors by tightening two hand locks as shown in the following figure.



(2) Removing the T/B

1) Check that the controller power is OFF.
2) Loosen two hand locks of the connector, and pull the connector by holding it.

* When using the robot without installing the T/B, install a dummy connector.

<< MEMO >> * Please use this page for your memo.

Appendix 2 Maintenance and Inspection (F Series Robot)

Appendix 2.1 Backup battery replacement

* For the FR series, refer to "Section 4.8 Replacing the backup battery (FR series)".

Since the absolute encoder is used for position detection, the encoder position data is stored with the backup battery at power shutoff. The battery is installed at the factory shipment. Since it is a consumable part, periodic replacement by the customer is required.

A lithium battery is used for the battery. The guideline for the battery replacement is one year, but this will differ according to the robot usage. The following table shows the error types of the battery. When an error occurs, replace the battery of the robot controller (robot CPU unit) and robot arm.

■The error about the battery

Item	Error number	Description	Measure
Controller	7520	The battery consumption time was exceeded	Replace the battery
	7510	Battery voltage low	
	7500	No battery voltage	Backup data cannot be guaranteed if this error occurs.
Robot arm	7520	The battery consumption time was exceeded	Replace the battery
	133n Note1)	Encoder battery voltage low	
	112n Note1)	Encoder ABS position data lost	The backup data cannot be guaranteed if this error occurs.

Note1) "n" indicates the axis number

Refer to the following robot arm battery replacement procedure to replace the battery. For information regarding purchasing a battery, refer to "Section 4.11 Maintenance parts".

⚠CAUTION

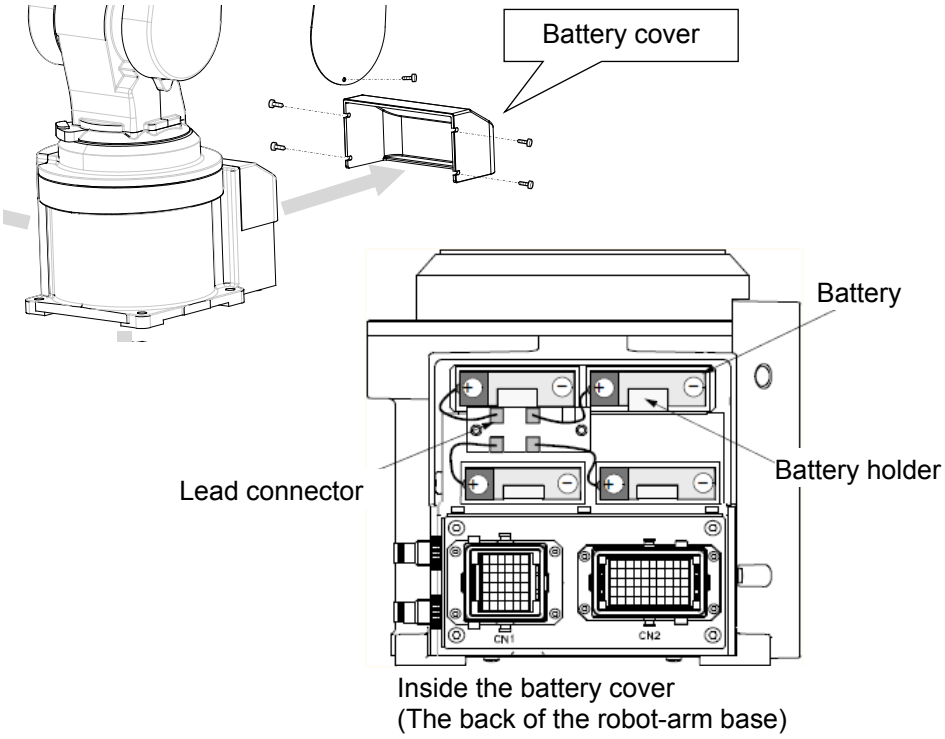
When error 7500 or 112n (n indicates the axis number) occurs, the origin needs to be set again.
(The backup data cannot be guaranteed.)

The battery board connection cable is for supplying the power to the encoder from the backup battery. The connection cable needs to be securely connected during operation and at replacement. When the cable is not connected properly, the power is not supplied to the encoder, position data is lost, and the origin needs to be set again.

Before replacing the backup battery, check that the capacitor is fully charged. When the backup battery is used for 36,000 hours or more, the retention time gradually decreases due to the deterioration of the capacitor.

Always replace one battery at a time. When all the backup battery is removed simultaneously, the position data of the encoder is lost and origin needs to be set again.

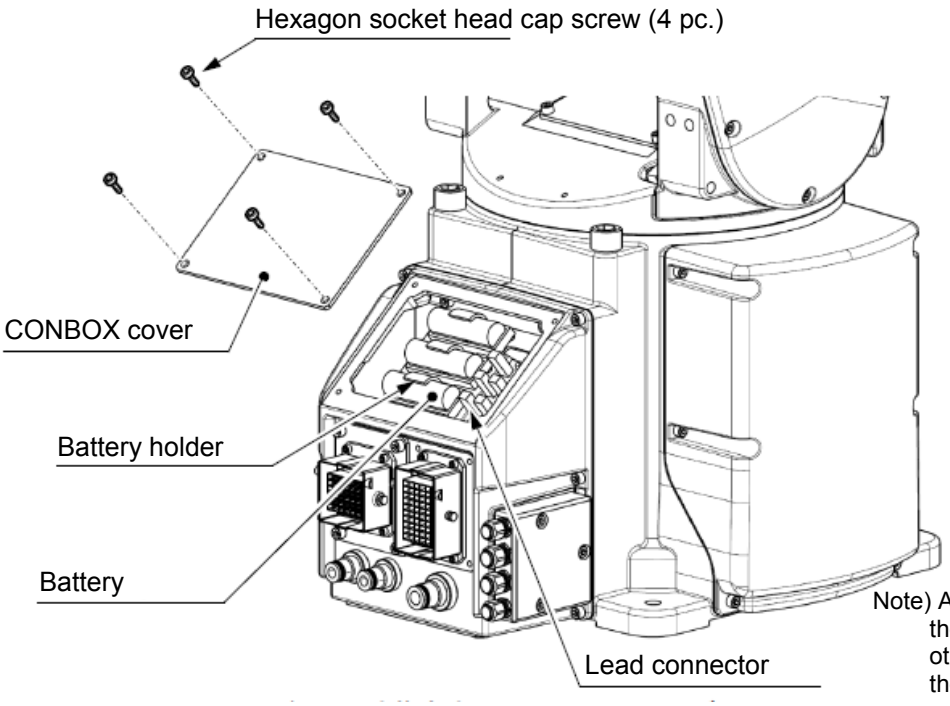
(1) RV-2F series



RV-2F series Backup battery replacement procedure	
1	Turn off the controller power.
2	Remove the battery cover from the robot arm. (Refer to "Section 4.5 Installing/removing the cover".)
3	Replace one battery at a time. Remove the old battery from the battery holder inside the battery cover, and disconnect the lead connector.
4	Install the new battery to the holder, and connect the battery to the lead connector. Replace all the old batteries with the new batteries.
5	Check that all the backup batteries are replaced with the new batteries. * If any old battery remains, it may generate heat and cause damage.
6	Reinstall the battery cover. * Be careful that the cables do not get caught.
7	Initialize the battery consumption time. (Always initialize the battery usage time at battery replacement.)

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again.
Set it with the ABS method referring to "Chapter 5 Resetting the Origin".

(2) RV-4/7/13/20F series

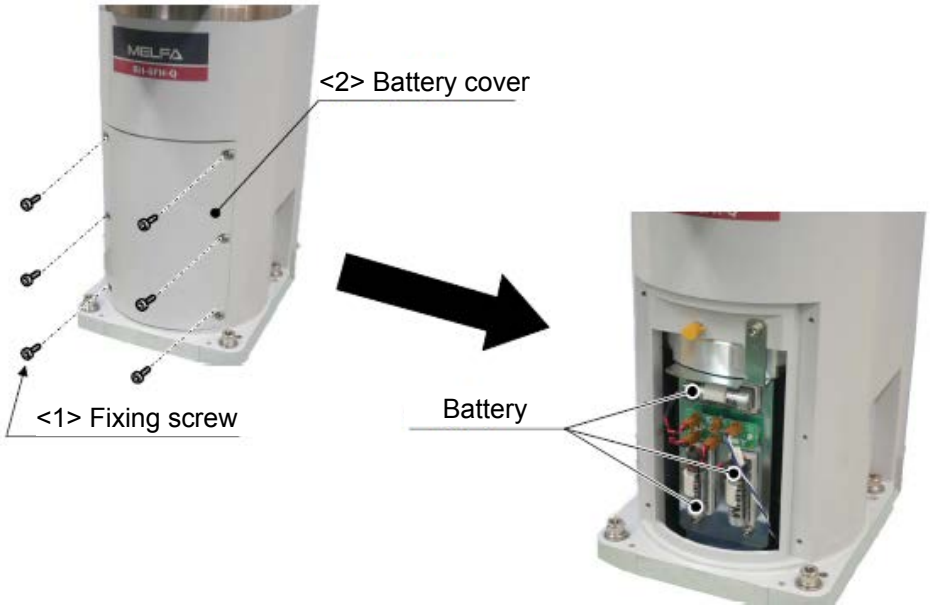


Note) Although the figure is the example of RV-4F other types are the same also.

RV-4/7/13/20F series Backup battery replacement procedure	
1	Turn off the controller power.
2	Remove the CONBOX cover from the robot arm. (Refer to "Section 4.5 Installing/removing the cover".)
3	Replace one battery at a time. Remove the old battery from the battery holder inside the CONBOX cover, and disconnect the lead connector.
4	Install the new battery to the holder, and connect the battery to the lead connector. Replace all the old batteries with the new batteries.
5	Check that all the backup batteries are replaced with the new batteries. * If any old battery remains, it may generate heat and cause damage.
6	Install the CONBOX cover as before. * Be careful that the cables do not get caught.
7	Initialize the battery consumption time. (Always initialize the battery usage time at battery replacement.)

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again. Set it with the ABS method referring to "Chapter 5 Resetting the Origin".

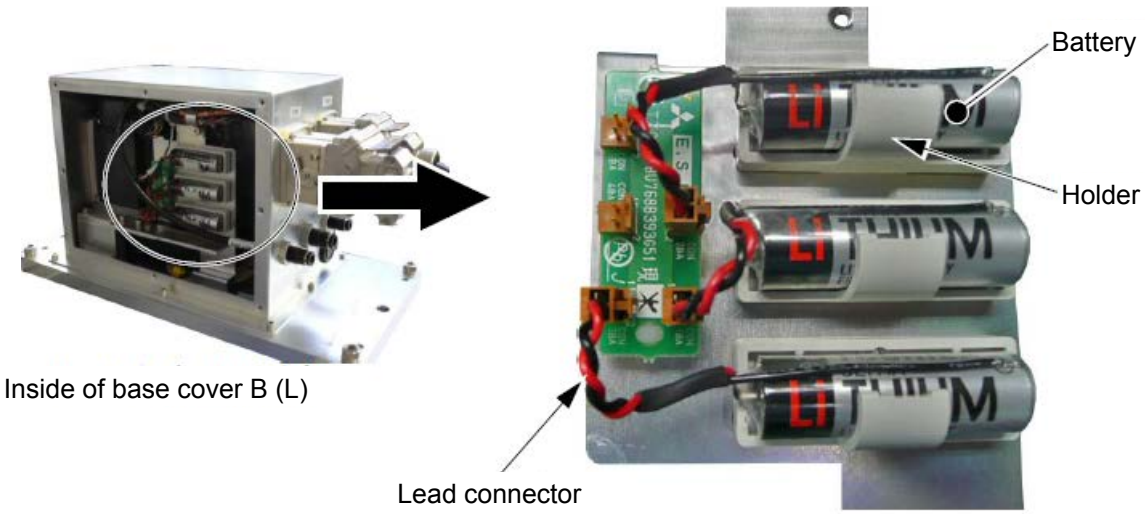
(3) RH-FH series



RH-FH series Backup battery replacement procedure	
1	Turn off the controller power.
2	Remove <1> installation screws (six screws) on the battery cover, and then remove <2> battery cover.
3	Replace one battery at a time. Remove the old battery from the battery holder inside the battery cover, and disconnect the lead connector.
4	Install the new battery to the holder, and connect the battery to the lead connector. Replace all the old batteries with the new batteries.
5	Check that all the backup batteries are replaced with the new batteries. * If any old battery remains, it may generate heat and cause damage.
6	Reinstall <2> battery cover. * Be careful that the cables do not get caught.
7	Initialize the battery consumption time. (Always initialize the battery usage time at battery replacement.)

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again.
Set it with the ABS method referring to "Chapter 5 Resetting the Origin".

(4) RH-3FHR series (Celling type)



RH-3FHR series (hanging type) Backup battery replacement procedure	
1	Turn off the controller power.
2	Remove the base cover B (L) from the robot arm. (Refer to "Section 4.5 Installing/removing the cover".)
3	Replace one battery at a time. Remove the old battery from the battery holder inside the base cover B (L), and disconnect the lead connector.
4	Install the new battery to the holder, and connect the battery to the lead connector. Replace all the old batteries with the new batteries.
5	Check that all the backup batteries are replaced with the new batteries. * If any old battery remains, it may generate heat and cause damage.
7	Install the base cover B (L) as before. * Be careful that the cables do not get caught.
8	Initialize the battery usage time. (Always initialize the battery usage time at battery replacement.)

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again.
Set it with the ABS method referring to "Chapter 5 Resetting the Origin".

Appendix 2.2 Maintenance parts (F series)

This section describes the consumable parts that need to be replaced periodically and spare parts that may be necessary for repairs.
Purchase these parts from the dealer when required.
* For the maintenance parts of the FR series, refer to "4.11 Maintenance parts (FR series)".

[Caution]: Some Mitsubishi-designated parts differ from the maker's standard parts. Thus, confirm the part name, robot arm and controller serial No. and purchase the parts from the dealer.

(1) RV-F series

a) Consumable part list

No.	Part name	Usage	Q'ty	Reference	Supplier
RV-2F series					
1	Timing belt	J1 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
2		J2 axis	1		
3		J3 axis	1		
4		J4 axis	1		
5		J5 axis	1		
6		For J5 axis brakes	1		
7		J6 axis	1		
8		For J6 axis brakes Note1)	1		
9	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	
10	Lithium battery (Battery: ER6)	Inside the battery cover	4	"4.8 Replacing the backup battery"	
RV-4F/7F/13F/20F series					
11	Timing belt	J1 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
12		J3 axis	1		
13		J4 axis	1		
14		J5 axis	1		
15		J6 axis	1		
16	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	
17	Lithium battery (Battery: ER6)	Base	4	"4.8 Replacing the backup battery"	

Note1) Only for the RV-2FRB

b) Spare parts list

No.	Part name	Usage	Q'ty	Supplier
RV-2F series (common)				
1	AC servo motor	J1, J2, J3 axis	3	Mitsubishi Electric
2		J4, J5, J6 axis	3	
RV-2F/2FB (Standard arm type)				
3	Reduction gears	J1 axis	1	Mitsubishi Electric
4		J2 axis	1	
5		J3 axis	1	
6		J4, J5 axis	2	
7		J6 axis	1	
RV-2FL/2FLB (Long arm type)				
8	Reduction gears	J1 axis	1	Mitsubishi Electric
9		J2 axis	1	
10		J3 axis	1	
11		J4, J5 axis	2	
12		J6 axis	1	
RV-4F series (common)				
1	AC servo motor	J1, J2 axis	2	Mitsubishi Electric
2		J3 axis	1	
3		J4, J5 axis	2	
4		J6 axis	1	
RV-4F (Standard arm type)				
5	Reduction gears	J1, J2 axis	2	Mitsubishi Electric
6		J3 axis	1	
7		J4 axis	1	
8		J5 axis	1	
9		J6 axis	1	
RV-4FL (Long arm type)				
10	Reduction gears	J1 axis	1	Mitsubishi Electric
11		J2, J3 axis	2	
12		J4 axis	1	
13		J5 axis	1	
14		J6 axis	1	
RV-4FJL (Long arm type)				
15	Reduction gears	J1 axis	1	Mitsubishi Electric
16		J2, J3 axis	2	
17		J5 axis	1	
18		J6 axis	1	

F series

No.	Part name	Usage	Q'ty	Supplier
RV-7F series (common)				
1	AC servo motor	J1, J2 axis	2	Mitsubishi Electric
2		J3 axis	1	
3		J4, J5 axis	2	
4		J6 axis	1	
RV-7F (Standard arm type)				
5	Reduction gears	J1, J2 axis	2	Mitsubishi Electric
6		J3 axis	1	
7		J4 axis	1	
8		J5 axis	1	
9		J6 axis	1	
RV-7FL (Long arm type)				
10	Reduction gears	J1, 2 axis	2	Mitsubishi Electric
11		J3 axis	1	
12		J4 axis	1	
13		J5 axis	1	
14		J6 axis	1	
RV-7FLL (Long arm type)				
15	AC servo motor	J1, J2 axis	2	Mitsubishi Electric
16		J3 axis	1	
17		J4 axis	1	
18		J5 axis	1	
19		J6 axis	1	
20	Reduction gears	J1 axis	1	
21		J2 axis	1	
22		J3 axis	1	
23		J4 axis	1	
24		J5 axis	1	
25		J6 axis	1	
RV-13F/20F (common)				
1	AC servo motor	J1, J2 axis	2	Mitsubishi Electric
2		J3 axis	1	
3		J4 axis	1	
4		J5 axis	1	
5		J6 axis	1	

No.	Part name	Usage	Q'ty	Supplier
RV-13F/RV-20F (Standard arm type)				
1	Reduction gears	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5		J5 axis	1	
6		J6 axis	1	
RV-13FL (Long arm type)				
7	Reduction gears	J1 axis	1	Mitsubishi Electric
8		J2 axis	1	
9		J3 axis	1	
10		J4 axis	1	
11		J5 axis	1	
12		J6 axis	1	

(2) RH-FH series

a) Consumable part list

No.	Part name	Usage	Q'ty	Reference	Supplier
RV-FH series (common)					
1	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	Mitsubishi Electric
2		Shaft	A small amount		
3	Lithium battery (Battery: ER6)	Inside the battery cover	3	"4.8 Replacing the backup battery"	
4	Liquefied gasket	Packing Note1)	A small amount	"4.5 Installing/removing the cover"	
RH-3FH series					
5	Timing belt	J3 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
6		J4 axis motor side	1		
7		J4 axis shaft side	1		
RH-6FH series					
8	Timing belt	J3 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
9		J4 axis motor side	1		
10		J4 axis shaft side	1		
RH-12FH series					
11	Timing belt	J3 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
12		J4 axis motor side	1		
13		J4 axis shaft side	1		
RH-20FH series					
14	Timing belt	J3 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
15		J4 axis motor side	1		
16		J4 axis shaft side	1		

Note1) The liquefied gasket is necessary for the place which uses two or more packings to connect.

b) Spare parts list

No.	Names	Usage	Q'ty	Supplier
RH-3FH series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J axis	1	
7	Ball screw spline	J3 axis (general environment specification)	1	
8		J3 axis (general environment specification)	1	
9	Bellows	J3 axis (oil mist specification)	1	
10		J3 axis (clean specification)	1	
11	Liquid gasket	Bellows (clean specification)	A small amount	
RH-6FH series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball spline	J3 axis (general environment specification)	1	
8		J3 axis (clean and oil mist specification)	1	
9	Ball screw	J3 axis (general environment, clean and oil mist specification)	1	
10	Bellows	J3 axis (oil mist specification)	1	
11		J3 axis (clean specification)	1	
12	Liquid gasket	Bellows (clean specification)	A small amount	

F series

No.	Names	Usage	Q'ty	Supplier
RH-12FH series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis (general environment specification)	1	
8		J3 axis (clean and oil mist specification)	1	
9	Ball screw	J3 axis (general environment, clean and oil mist specification)	1	
10	Bellows	J3 axis (oil mist specification)	1	
11		J3 axis (clean specification)	1	
12	Liquid gasket	Bellows (clean specification)	A small amount	
RH-20FH series				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis (general environment specification)	1	
8		J3 axis (clean and oil mist specification)	1	
9	Ball screw	J3 axis (general environment, clean and oil mist specification)	1	
10	Bellows	J3 axis (oil mist specification)	1	
11		J3 axis (clean specification)	1	
12	Liquid gasket	Bellows (clean specification)	A small amount	

(3) RH-3FHR series (Celling type)

a) Consumable part list

No.	Part name	Usage	Q'ty	Reference	Supplier
RH-3FHR series (hanging type)					
1	Timing belt	J1 axis	1	"4.6 Inspection replacement of timing belt"	Mitsubishi Electric
2		J2 axis	1		
3		J3 axis	1		
4		J4 axis motor side	1		
5		J4 axis shaft side	1		
6	Grease	Reduction gears of each axis	A small amount	"4.7 Lubrication"	
7	Lithium battery (Battery: ER6)	Inside base cover B (L)	4	"4.8 Replacing the backup battery"	

b) Spare parts list

No.	Part name	Usage	Q'ty	Reference
RH-3FHR series (hanging type)				
1	AC servo motor	J1 axis	1	Mitsubishi Electric
2		J2 axis	1	
3		J3 axis	1	
4		J4 axis	1	
5	Reduction gears	J1 axis	1	
6		J2 axis	1	
7	Ball screw spline	J3 axis	1	

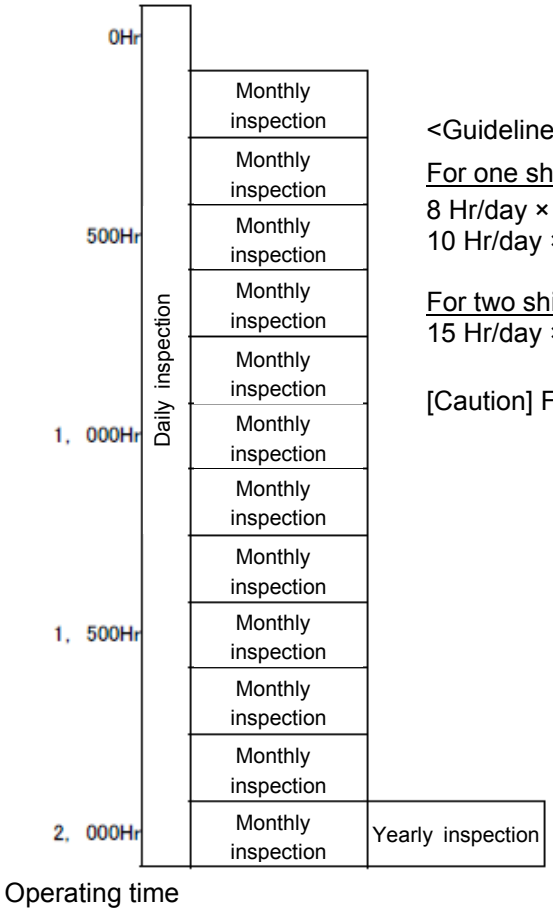
<< MEMO >> * Please use this page for your memo.

Appendix 3 Maintenance and Inspection (CR750/CR751 Controller, Drive Unit)

The maintenance and inspection procedures to be carried out to use the robot for a long time without trouble are described in this chapter. The types and replacement methods of consumable parts are also explained.

Appendix 3.1 Inspection schedule

For the maintenance and inspection, perform a daily inspection and periodic inspection. Always perform maintenance and inspection to prevent malfunctions, increase the product life, and ensure safety.



<Guideline for inspection period>

For one shift

8 Hr/day × 20 days/month × 12 months = approx. 1800 Hr
10 Hr/day × 20 days/month × 12 months = approx. 2400 Hr

For two shifts

15 Hr/day × 20 days/month × 12 months = approx. 3600 Hr

[Caution] For two shifts, perform the yearly inspection half a year.

Appendix 3.2 Inspection items

The inspection items for the robot arm are shown below.
Inspect the robot arm, referring to "Chapter 4 Maintenance and Inspection (Robot)" and "Appendix 1 Maintenance and Inspection (F Series Robot)".

Appendix 3.2.1 Daily inspection items

Perform the daily inspections with the following procedure.

Procedure	Inspection item (details)	Remedies
Before turning power ON (Check the following items before turning the power ON.)		
1	Is the power supply cable securely connected? (Visual)	Securely connect.
2	Is the machine cable between the robot and controller securely connected? (Visual)	Securely connect.
3	Are there any cracks, foreign matters, or obstacles on the cover?	Replace with a new part, or take remedial measures.
After turning the power ON (Turn the power ON while monitoring the robot.)		
1	Is there any abnormal motion or abnormal noise when the power is turned ON?	Follow the troubleshooting section.
During operation (try running with an original program)		
1	Check whether the movement points are deviated? Check the following points if there is any deviation. 1. Are any installation bolts loose? 2. Are any hand installation section bolts loose. 3. Are the positions of the jigs other than the robot deviated? 4. If the positional deviation cannot be corrected, refer to "Troubleshooting", check and remedy.	Follow the troubleshooting section.
2	Is there any abnormal motion or abnormal noise? (Visual)	Follow the troubleshooting section.

Appendix 3.2.2 Periodic inspection

Perform periodic inspections with the following procedure.

Procedure	Inspection item (details)	Remedies
Monthly inspection items		
1	Are any of the bolts or screws on the robot arm loose?	Securely tighten the screws.
2	Is the filter of the controller clean? (Observe visually)	Clean or replace it with a new filter. Inspect, clean, and replace the filter referring to "Appendix 3.3.2 Inspection, cleaning, and replacement of the filter".
Yearly inspection items		
1	Replace the backup battery of the controller.	Replace the backup battery referring to "Appendix 3.3.1 Replacing the battery".

Appendix 3.3 Maintenance and inspection procedures

The procedures for performing periodic maintenance and inspection are described below.
(Never disassemble any of the parts not described in this textbook.)

The maintenance and inspection for the maintenance parts performed by the customer are described in "Section 4.11 Maintenance parts". Contact your dealer for these parts as necessary.

* For the maintenance and inspection of the CR800 series controller, refer to "Chapter 6 Maintenance and Inspection (CR800 Series Controller)".

Appendix 3.3.1 Replacing the battery

The programs stored in the robot controller and robot CPU unit are stored by the backup battery while the power is shut off.
The backup battery is used for the robot arm to store the encoder position data.
The battery is installed at the factory shipment. Since it is a consumable part, periodic replacement by the customer is required.

■The error about the battery

Item	Error number	Description	Measure
Controller	7520	The battery consumption time was exceeded	Replace the battery
	7510	Battery voltage low	
	7500	No battery voltage	The backup data cannot be guaranteed if this error occurs.
Robot arm	7520	The battery consumption time was exceeded	Replace the battery
	133n Note1)	Encoder battery voltage low	
	112n Note1)	Encoder ABS position data lost	The backup data cannot be guaranteed if this error occurs.

Note1) "n" indicates the axis number

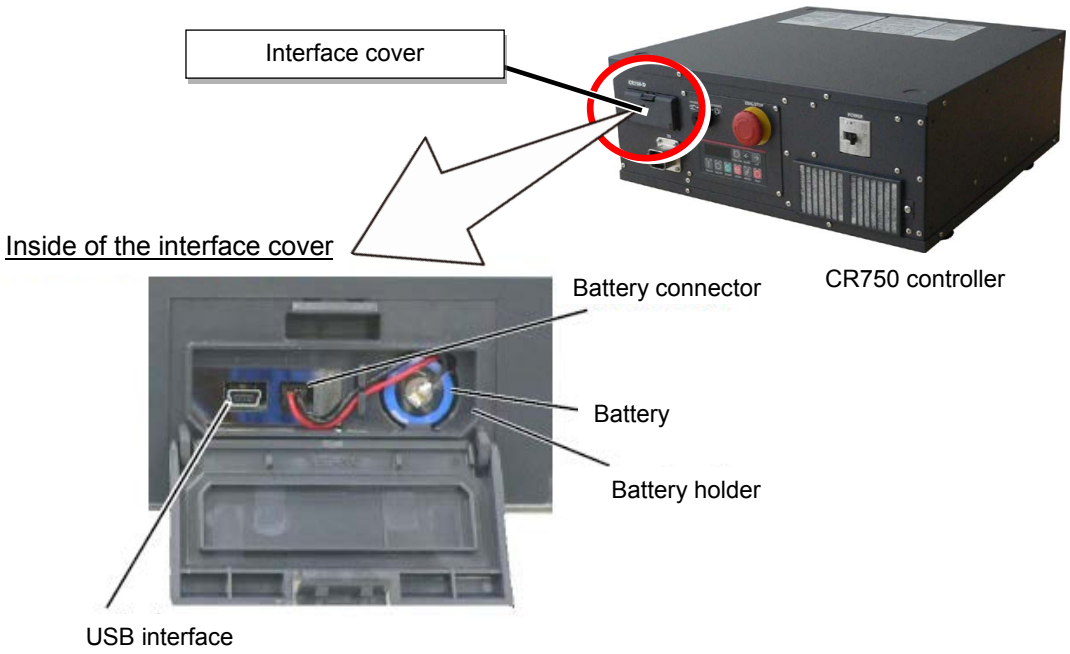
⚠CAUTION

When error 7500 or 112n (n indicates the axis number) occurs, the backup data cannot be guaranteed. In this case, the origin needs to be set again.

When replacing the battery of the robot controller and robot CPU unit, connect the new battery within three minutes of removing the old battery. If the battery is not connected within three minutes, the origin and program needs to be set and created again.

* In case the data is lost, it is recommended to back up the data in batch with RT ToolBox (optional personal computer support software).

(1) CR750 controller

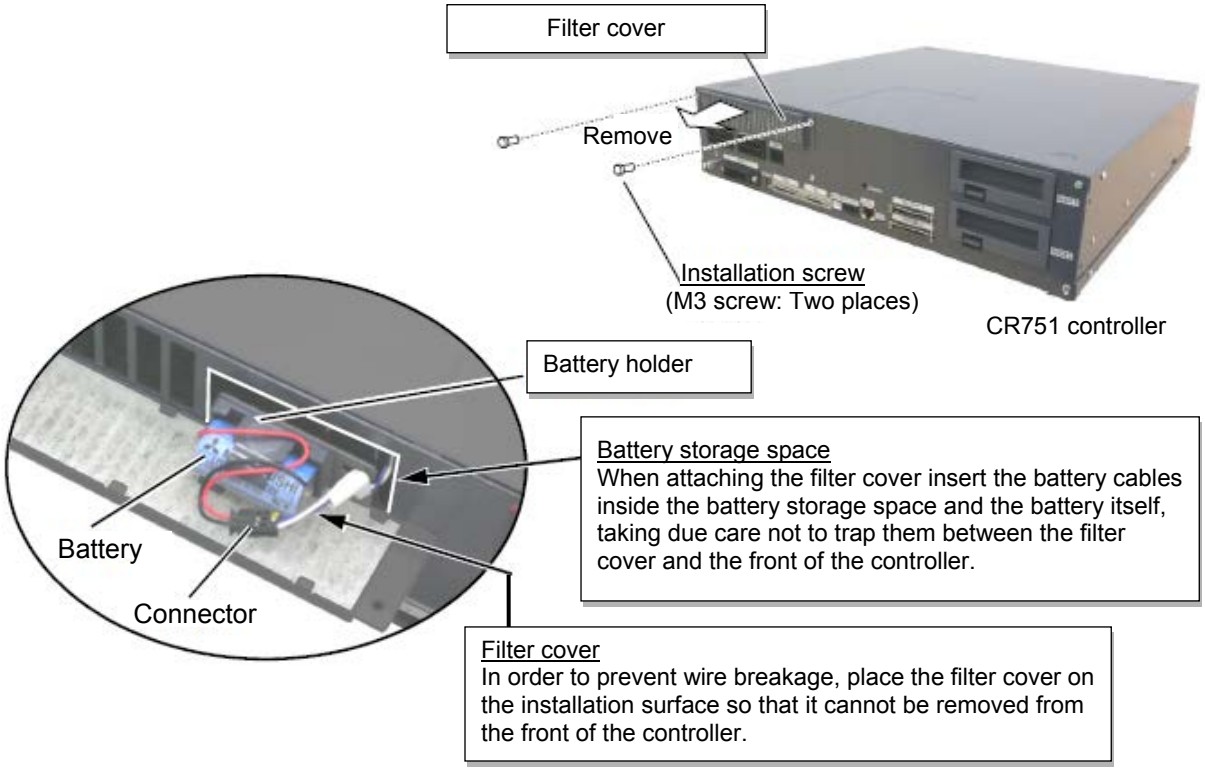


CR750 controller Battery replacement procedure	
1	Turn the controller power ON once. (For approx. one minute.)
2	Turn off the power of the controller.
3	Open the interface cover at the front of the controller. The battery is in the interface cover.
4	Pick and pull up the connector of the old battery and remove from battery holder.
5	Fix the new battery into the battery holder. Install so that the lead may come out to the front.
6	Connect the connector of the new battery cable. Connect so that the red lead may become left-hand side. * Complete the work within 3 minutes of removing the old battery.
7	Close the interface cover of the operation panel.
8	Turn on the power of the controller.
9	Initialize the battery usage time. * Always initialize the battery usage time at battery replacement.

[Caution] Note that when error 7500 or 112n (n indicates the axis number) occurs, the backup data cannot be guaranteed. In this case, the origin and programs need to be set and created again.

This completes the replacement of the controller battery.

(2) CR751 controller

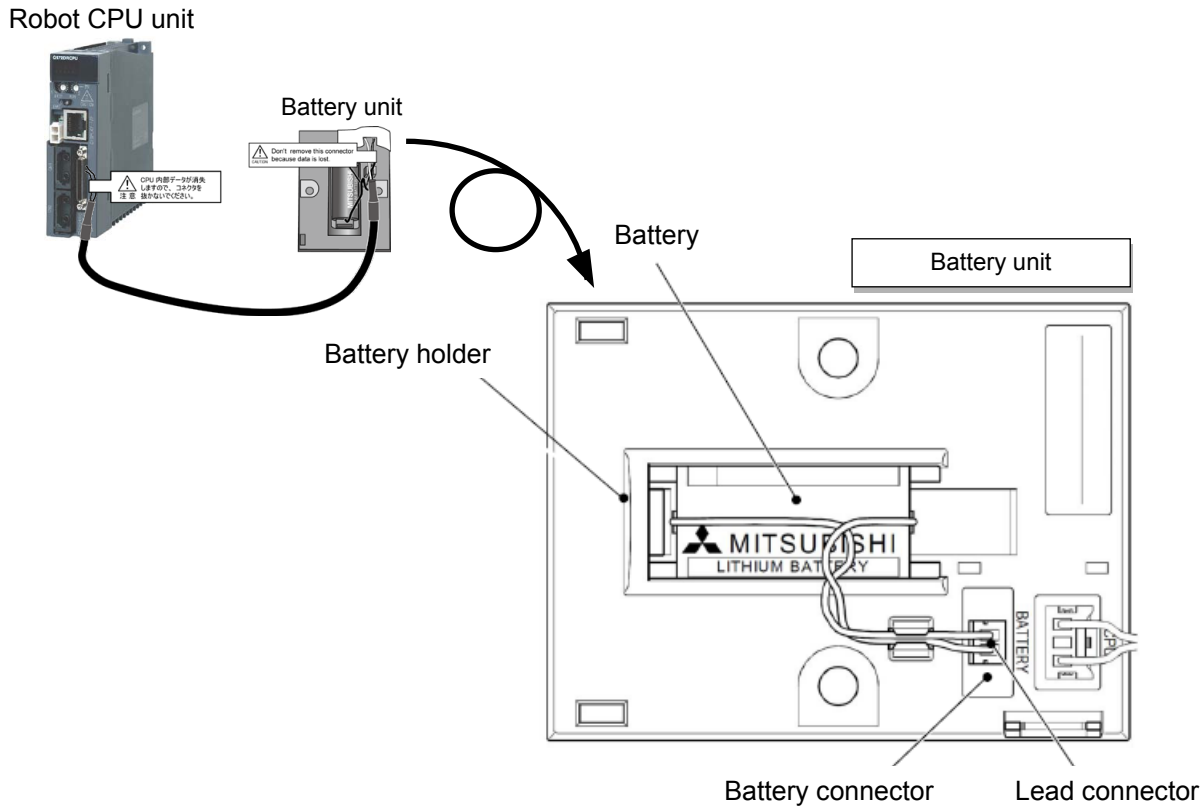


CR751 controller Battery replacement procedure	
1	Turn the controller power ON once. (For approx. one minute.)
2	Turn off the power of the controller.
3	Open the filter cover at the front of the controller. The battery is fixed inside the filter cover.
4	Pick and pull up the connector of the old battery and remove from battery holder.
5	Place the filter cover on the installation surface so that it cannot be removed from the front of the controller.
6	Fix new batteries into the battery holder. Connect the cable of the battery to the connector.
7	Connect the connector of the new battery cable. * Connect the new battery within three minutes after removing the old battery.
8	Check that the filter is not off the cover, and reinstall the filter cover at the front of the controller. * Be careful that the battery cable does not get caught.
9	Turn on the power of the controller.
10	Initialize the battery usage time. * Always initialize the battery usage time at battery replacement.

[Caution] Note that when error 7500 or 112n (n indicates the axis number) occurs, the backup data cannot be guaranteed. In this case, the origin and programs need to be set and created again.

This completes the replacement of the controller battery.

(3) Robot CPU unit (F series Q type)



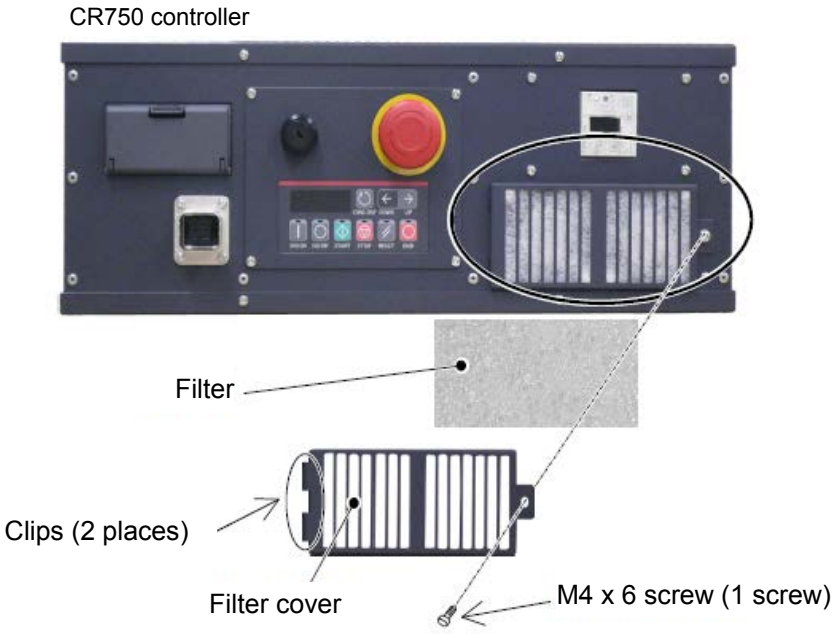
Robot CPU unit Battery replacement procedure	
1	Turn on the robot CPU system power supply for 10 minutes or longer.
2	Turn off the robot CPU system power supply.
3	Disconnect the lead connector from the battery connector. Remove the old battery from its holder.
6	Install a new battery into the holder in the correct direction. Connect the lead connector to the connector (BATTERY). * Complete the work within 3 minutes of removing the old battery.
8	Turn on the robot CPU system power supply.
9	Initialize the battery usage time. * Always initialize the battery usage time at battery replacement.

[Caution] Note that when error 7500 or 112n (n indicates the axis number) occurs, the backup data cannot be guaranteed. In this case, the origin and programs need to be set and created again.

This completes the replacement of the battery.

Appendix 3.3.2 Inspection, cleaning, and replacement of the filter

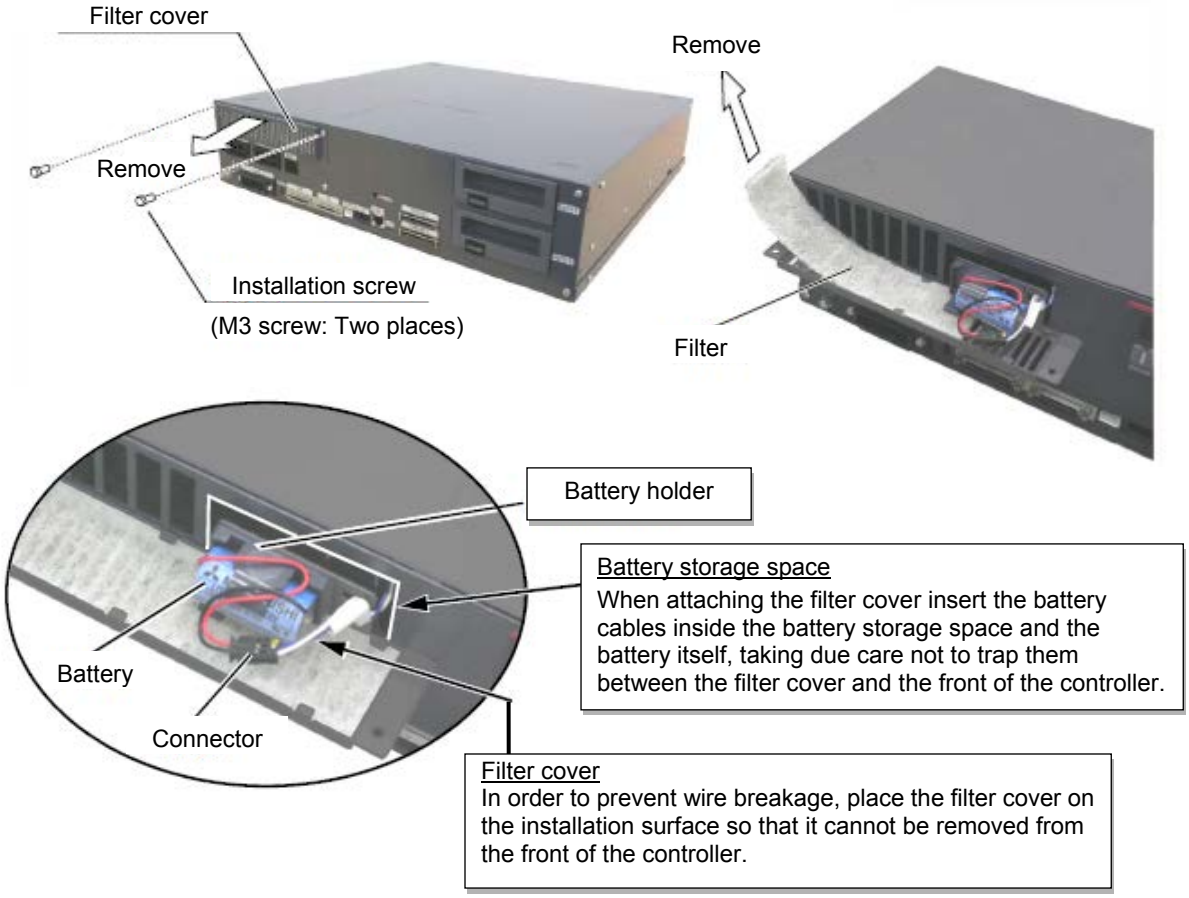
(1) CR750 controller



CR750 controller Filter inspection, cleaning, and replacement	
1	Turn off the power of the controller.
2	Loosen the M4 x 6 screws and remove the filter cover from the front of the controller. Release the clip on the left side of the filter cover as it is inserted in the front face of the controller.
3	Remove the filter from the filter cover and remove dust and other dirt that has built up on it. * If the filter is particularly dirty then wash it in water and detergent and then dry fully before re-fixing. In the event that the surface of the washed filter has become fluffy, please replace it with a new filter.
4	Attach the cleaned filter (or a new filter) to the controller.
5	Install the filter cover to the controller with one M4 × 6 screw.

This completes the inspection, cleaning and replace of the filter for the controller.

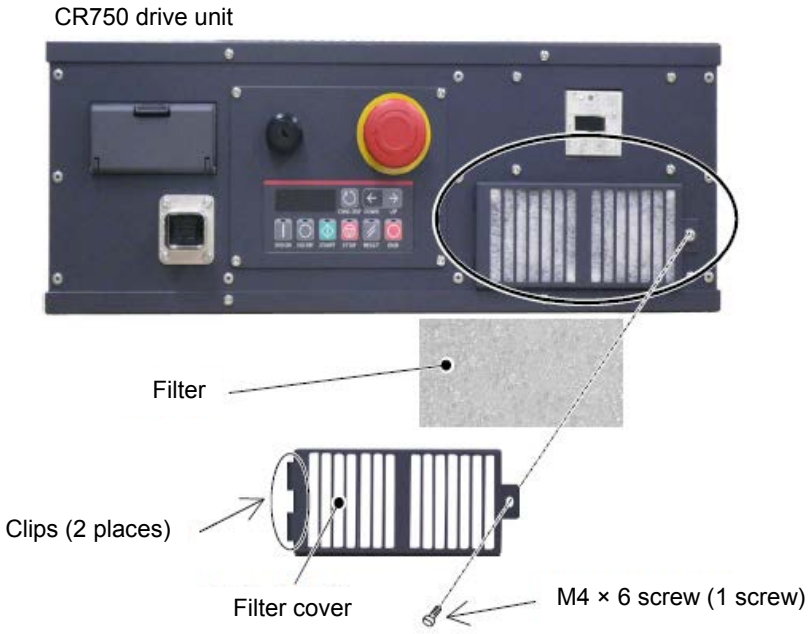
(2) CR751 controller



CR751 controller Filter inspection, cleaning, and replacement	
1	Turn off the power of the controller.
2	Loosen the M3 screws and remove the filter cover from the front of the controller.
3	Remove the filter from the filter cover and remove dust and other dirt that has built up on it. * If the filter is particularly dirty then wash it in water and detergent and then dry fully before re-fixing. In the event that the surface of the washed filter has become fluffy, please replace it with a new filter.
4	Attach the cleaned or new filter to the filter plate
5	Check that the filter is not off the cover.
6	Securely install the battery cover at the front of the controller with two M3 screws. * Be careful that the battery cable does not get caught.

This completes the inspection, cleaning and replace of the filter for the controller.

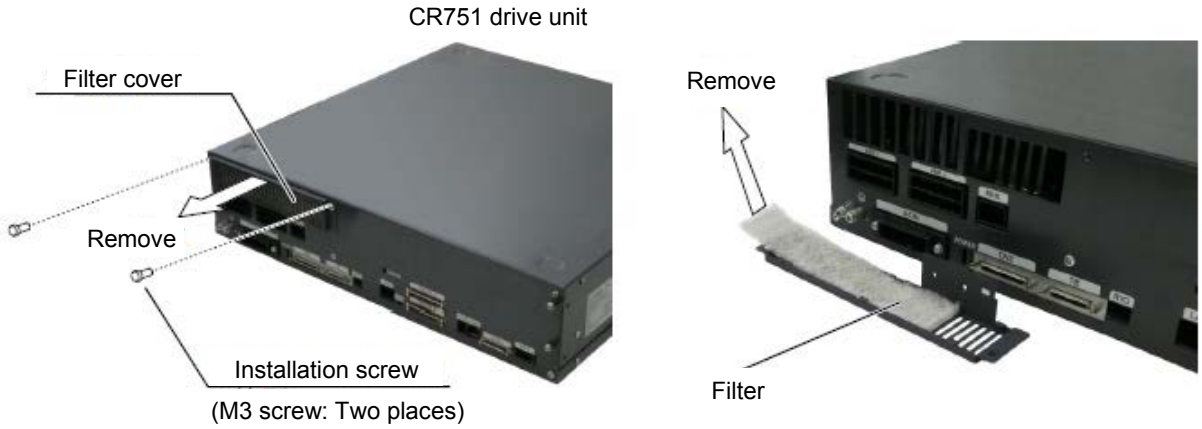
(3) CR750 drive unit



CR750 drive unit Inspection, cleaning, and replacement	
1	Turn off the power of the drive unit.
2	Loosen the M4 × 6 screws and remove the filter cover from the front of the drive unit. Remove the claw on the left side of the filter cover which is inserted in the front of the controller.
3	Remove the filter from the filter cover and remove dust and other dirt that has built up on it. * If the filter is particularly dirty then wash it in water and detergent and then dry fully before re-fixing. In the event that the surface of the washed filter has become fluffy, please replace it with a new filter.
4	Attach the filter to the drive unit.
5	Install the filter cover to the controller with one M4 × 6 screw.

This completes the inspection, cleaning and replace of the filter for the drive unit.

(4) CR751 drive unit



CR751 drive unit Inspection, cleaning, and replacement	
1	Turn off the power of the drive unit.
2	Loosen the M3 screws and remove the filter cover from the front of the drive unit.
3	Remove the filter from the filter cover and remove dust and other dirt that has built up on it. * If the filter is particularly dirty then wash it in water and detergent and then dry fully before re-fixing. In the event that the surface of the washed filter has become fluffy, please replace it with a new filter.
4	Attach the cleaned or new filter to the filter plate.
5	Check that the filter is not off the cover.
6	Securely install the filter cover at the front of the drive unit with two M3 screws. * Be careful that the battery cable does not get caught.

This completes the inspection, cleaning and replace of the filter for the drive unit.

Appendix 3.3.3 Fuse replacement

(1) Hand fuse, brake fuse, power supply line fuse

(a) Fuse positions

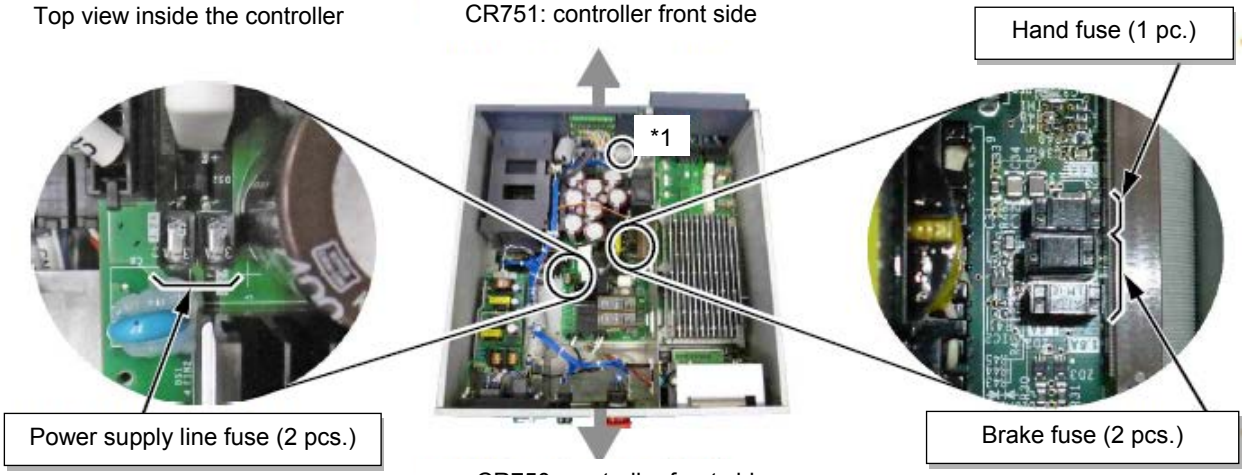
Remove the six top cover fixing screws (M3 × 6), and remove the top cover.

Top cover fixing screws
- CR751 controller: Two screws each at right and left and the rear.
- CR750 controller: Two screws each at right and left and the front.

Note) For the CR750 and CR751, the fuses to be replaced are in the same positions.

Top view inside the controller

CR751: controller front side



CR750: controller front side

CR750/CR751 controller Hand fuse, brake fuse, and power supply line fuse replacement	
1	Turn off the power of the controller.
2	Remove six top plate fixing screws (M3 × 6), and remove the top plate. Top plate fixing screw: CR750 controller: Two screws each at the side and front CR751 controller: Two screws each at the side and back
3	Replace the fuse of the converter board (YZ801n). (Refer to the above figure.)

The part number and model of the fuse to be replaced depend on the robot type and controller serial number that is used.
Replace the fuse with an applicable one referring to the fuse compatibility table.

Note) The fuse part numbers vary according to the sub-number n of the converter circuit board (YZ801n) mounted inside the controller. The sub-number of the converter circuit board is marked on the area indicated by "*1" in the figure shown above.

Ex.) Sub-number is "A" (YZ801A) ..... Hand fuse: F3, Brake fuse: F1 and F2
Sub-number is "B" or later (YZ801B or later) ..... Hand fuse: F5, Brake fuse: F3 and F4, Power supply line fuse: F1 and F2

(b) Table of applicable fuses

■Hand fuse

Robot series	Controller's serial number	Converter circuit board	Power supply line fuse	
			Part number	Model
RH-3/6/12/20FH series, RV-2/4/7F series	F1xxxxxx/F2xxxxxx/R1xxxxxx/R2xxxxxx	YZ801A	F3	LM16
	F1Axxxxxx/F2Axxxxxx/R1Axxxxxx/ R2Axxxxxx	YZ801B or later	F5	LM16
RV-13/20F series, RV-7FLL series	F1xxxxxx/F2xxxxxx/R1xxxxxx/R2xxxxxx	YZ801A	F3	LM16
	F1Axxxxxx/F2Axxxxxx/R1Axxxxxx/ R2Axxxxxx	YZ801B or later	F5	LM16

■Brake fuse

Robot series	Controller's serial number	Converter circuit board	Power supply line fuse	
			Part number	Model
RH-3/6/12/20FH series, RV-2/4/7F series	F1xxxxxx/F2xxxxxx/R1xxxxxx/R2xxxxxx	YZ801A	F1, F2	LM16
	F1Axxxxxx/F2Axxxxxx/R1Axxxxxx/ R2Axxxxxx	YZ801B or later	F3, F4	LM16
RV-13/20F series, RV-7FLL series	F1xxxxxx/F2xxxxxx/R1xxxxxx/R2xxxxxx	YZ801A	F1, F2	LM32
	F1Axxxxxx/F2Axxxxxx/R1Axxxxxx/ R2Axxxxxx	YZ801B or later	F3, F4	LM32

■Power supply line fuse

Robot series	Controller's serial number	Converter circuit board	Power supply line fuse	
			Part number	Model
RH-3/6/12/20FH series, RV-2/4/7F series	F1xxxxxx/F2xxxxxx/R1xxxxxx/R2xxxxxx	YZ801A	−	−
	F1Axxxxxx/F2Axxxxxx/R1Axxxxxx/ R2Axxxxxx	YZ801B or later	F1, F2	HM32
RV-13/20F series, RV-7FLL series	F1xxxxxx/F2xxxxxx/R1xxxxxx/R2xxxxxx	YZ801A	−	−
	F1Axxxxxx/F2Axxxxxx/R1Axxxxxx/ R2Axxxxxx	YZ801B or later	F1, F2	HM32

(2) Fuse (F8)

(a) Fuse positions

Remove the six top cover fixing screws (M3 × 6), and remove the top cover.

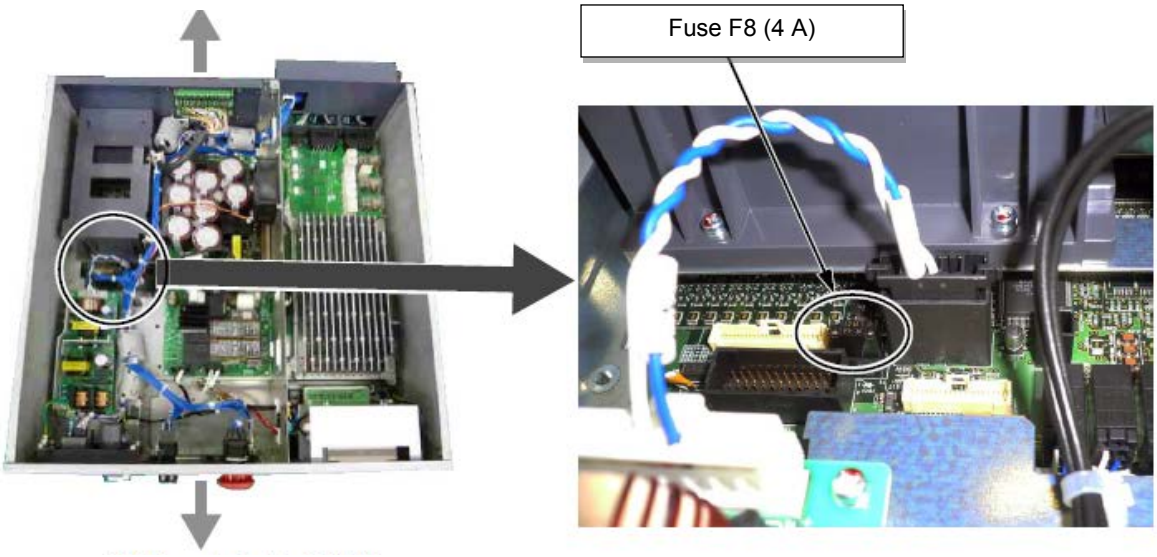
Top cover fixing screws
• CR751 controller: Two screws each at right and left and the rear.
• CR750 controller: Two screws each at right and left and the front.

For the CR750 and CR751, the fuses to be replaced are in the same positions.

Top view inside the controller

Model: LM40
Note) Display "large 4 A" on surface of the fuse.

CR751: controller front side



CR750: controller front side

CR750/CR751 controller Fuse (F8) replacement	
1	Turn off the power of the controller.
2	Remove six top plate fixing screws (M3 × 6), and remove the top plate. Top plate fixing screw: CR750 controller: Two screws each at the side and front CR751 controller: Two screws each at the side and back
3	Replace the fuse (F8) of the base board (YZ311). (Refer to the above figure.)

<< MEMO >> * Please use this page for your memo.

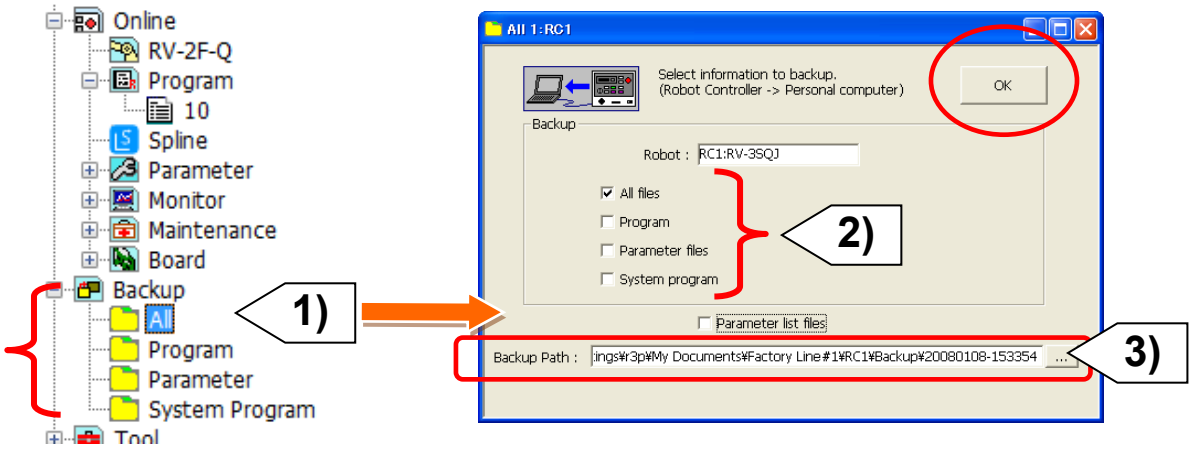
Appendix 3.3.4 Backing up/restoring the controller data

Backup or restore data with the robot controller connected to RT ToolBox2.

(1) Backup (robot → personal computer)

Save the information in the robot controller to a file in a personal computer with RT ToolBox2.

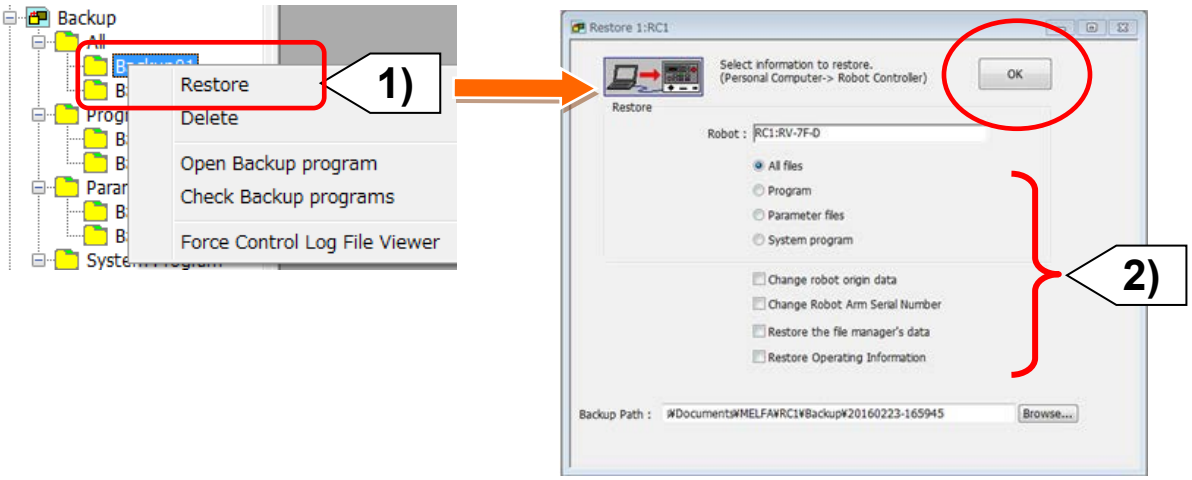
1) Expand [Online] → [Backup] in the project tree, and double-click the items to be backed up.
2) The backup method can be changed by selecting the check box in the window.
3) Specify the backup destination, and click "OK".
4) The Confirmation window is displayed, and the backup starts.
5) When the backup has completed, the backup data is displayed under [Backup] in the project tree.



(2) Restore (personal computer → robot)

Transfer information back up on the personal computer to the robot controller.

1) Expand [Backup] in the project tree, select the items to be restored, and select "Restore" from the right-click menu.
2) Specify the restoration method, and click "OK".



Appendix 3.4 Maintenance parts

This section describes the consumable parts that need to be replaced periodically and spare parts that may be necessary for repairs.

When these parts are needed, purchase them from the designated dealer.
Some Mitsubishi-designated parts differ from the maker's standard parts. Thus, confirm the part name, robot arm and controller serial No. and purchase the parts from the dealer.

(1) CR750/CR751 controller

(a) Consumable controller parts

No.	Part name	Type Note1)	Qty.	Usage	Supplier
1	Lithium battery	Q6BAT	1	CR750 controller: Inside the interface cover	Mitsubishi Electric
				CR751 controller: Inside the filter cover	
2	Filter	BKOFA0773H42	1	CR750 controller: Inside the filter cover	
		BKOFA0773H41	1	CR751 controller: Inside the filter cover	

Note1) Confirm the robot arm serial No., and contact the dealer or service branch of Mitsubishi Electric Co., for the type.

(b) Spare controller parts

No.	Part name	Type Note1)	Qty.	Usage	Supplier
1	1.6 A fuse	LM16	1		Mitsubishi Electric
2	3.2 A fuse	HM32	1		
3	4 A fuse	LM40	1		
4	3.2 A fuse	LM32	1		
5	7.5 A fuse	GP75	1		

Note1) Confirm the robot arm serial No., and contact the dealer or service branch of Mitsubishi Electric Co., for the type.

(2) CR750/CR751 drive unit

(a) Consumable drive unit parts

No.	Part name	Type Note1)	Qty.	Usage	Supplier
1	Lithium battery	Q6BAT	1	Inside the battery unit which connected to robot CPU unit.	Mitsubishi Electric
2	Filter	BKOFA0773H42	1	CR750 drive unit: Inside the filter cover	
		BKOFA0773H41	1	CR751 drive unit: Inside the filter cover.	

Note1) Confirm the robot arm serial No., and contact the dealer or service branch of Mitsubishi Electric Co., for the type.

(b) Spare drive unit parts

No.	Part name	Type Note1)	Qty.	Usage	Supplier
1	1.6 A fuse	LM16	1		Mitsubishi Electric
2	3.2 A fuse	HM32	1		
3	4 A fuse	LM40	1		
4	3.2 A fuse	LM32	1		
5	7.5 A fuse	GP75	1		

Note1) Confirm the robot arm serial No., and contact the dealer or service branch of Mitsubishi Electric Co., for the type.

Appendix 4 Replacing the Bellows

The following shows how to replace the bellows of the clean, oil mist, or waterproof specification robot.

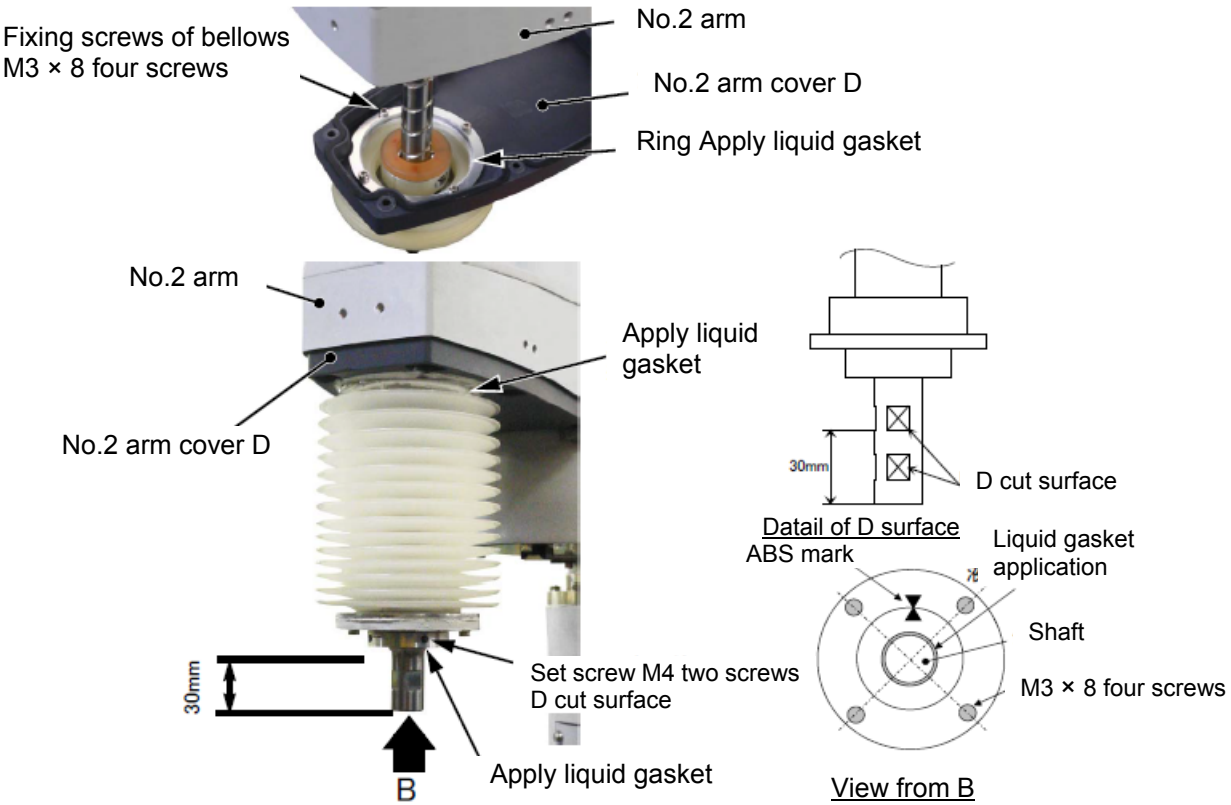
⚠CAUTION Replace the bellows in a place where there is no risk of contamination by dust and oil mist. If it must be replaced in a dust-filled area, be sure to remove as much dust as possible in advance before replacing it.

(1) RH-FRH, RH-F series

■Clean specification

RH-3FRH/6FRH/12FRH/20FRH series clean specification model Bellows replacement	
1	Turn off the controller's power supply.
2	Remove the No.2 arm cover U and No.2 arm cover D. (Refer to "Section 4.5 Installing/removing the cover".)
3	Loosen the two fixing (M4) screws of bellows, and remove the bellows to downward together with No.2 arm cover D.
4	Remove the four fixing screws which fix the bellows to the No.2 arm cover D, and removes the ring, then the bellows can be removed from No.2 arm cover D.
5	Fix the new bellows to the No. 2 arm cover D in the same way (screw tightening torque: 0.8 N·m). Fill the gap between the No. 2 arm cover D and the bellows with a seal such as a liquid gasket.
6	Install the No. 2 arm cover D as before.
7	Fix the bellows to shaft with adjusting the position of the bellows's bottom to 30 mm from end of shaft. Align two set screws (M4) to the D cut surface and fix them securely.
8	Fill the gap between the bellows fixing section and the shaft with a seal such as a liquid gasket.
9	Sticks the attached ABS mark on the lower part of bellows. Makes the J4 axis into the position of 0 degree by jog operation etc., and match the ABS mark sticker with ABS mark on the shaft, and stick it.

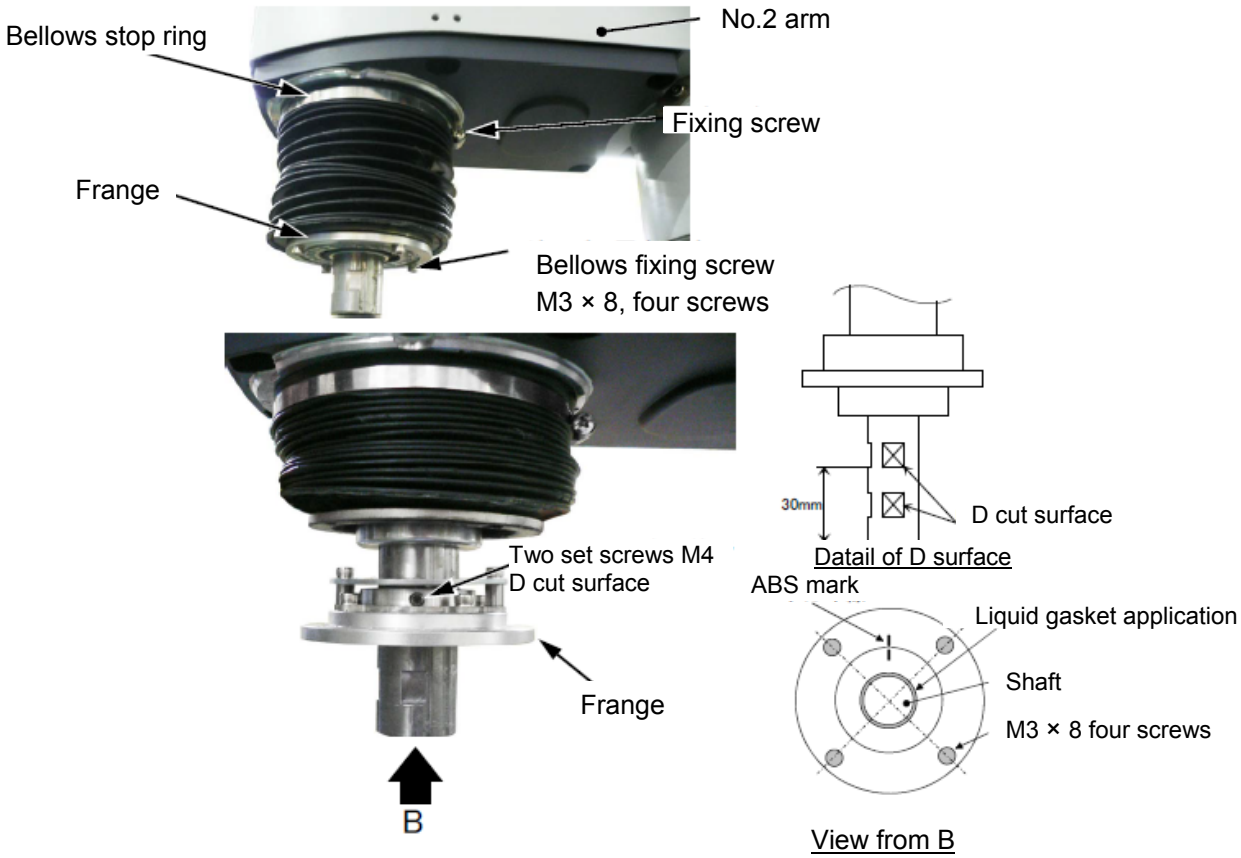
[Caution] When installing the No. 2 arm cover D to the No. 2 arm, please check the condition of the seal. In the event that the sealing material has been removed or has been bent or broken to the extent that it cannot be return to the original form, be sure to replace the sealing material. Please inform the dealer, if exchange is necessary.



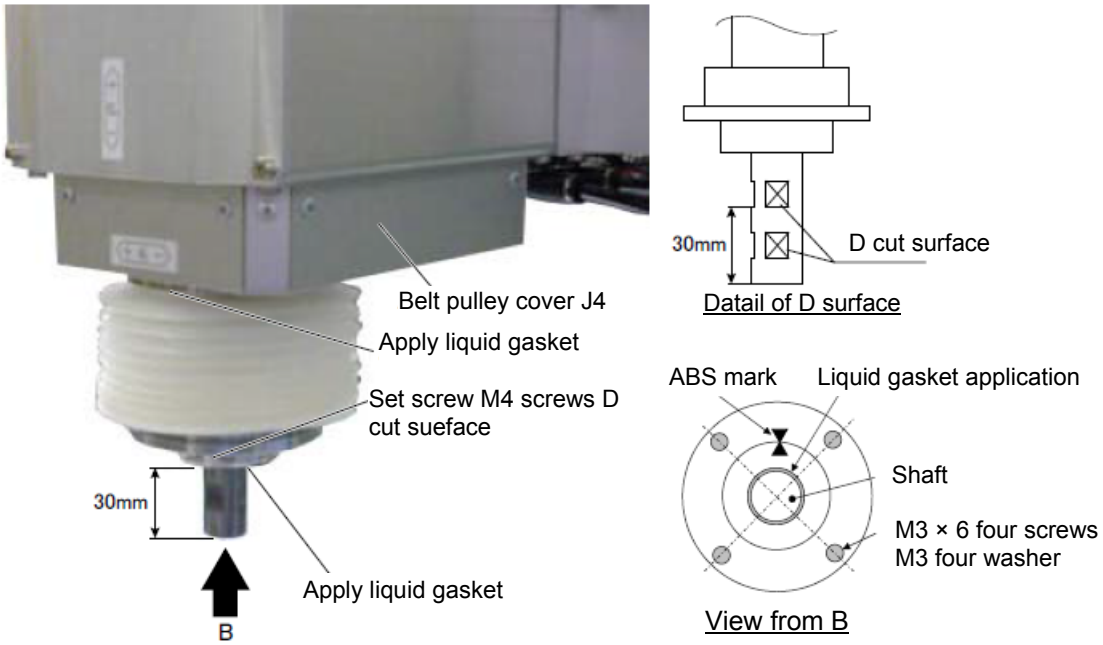
■Oil mist specification

RH-3FRH/6FRH/12FRH/20FRH series oil mist specification model bellows replacement	
1	Previously, move the J3 axis to upper end position by jog operation. This position is necessary to set the ABS mark (marking-off line) of J4 axis after.
2	Turn off the controller's power supply.
3	Remove the four screws (M3 × 8) which fix the lower part of bellows to the frange.
4	Lift the bellows, and loosen the two set screws, and remove the flange.
5	Loosens the fixing screw of the bellows stop ring which is fixing the upper part of bellows, and remove bellows.
6	Installs new bellows.
7	Install the flange in the position of 30 mm from the shaft lower end as before. Align two set screws (M4) to the D cut surface and fix them securely.
8	Fixes the bellows lower part to the frange as before. Fixes the four bellows fixing screws (M3 × 8) securely.
9	Makes the J4 axis into the position of 0 degree by jog operation etc., and match the ABS mark (marking-off line) with ABS mark (marking-off line) on the shaft. In the condition that each other's ABS mark has matched, fixes the bellows upper part.
10	Fixes the fixing screw of the bellows stop ring as before, and fixes the upper part of bellows securely.

[Caution] The fixing screw should fix the bellows stop ring in the position used as the inner side. (refer to figure) If that is not right, the fixing screw may interfere with the No.1 arm. And, you should confirm that the stop ring has covered the perimeter of bellows surely. If the fixation is not enough, the protection performance may drop.



(2) RH-3FRHR, RH-3FHR series (Celling type)



■Clean/waterproof specification

RH-3FRHR, RH-3FHR series (hanging type) clean/waterproof specification model bellows replacement	
1	Turn off the controller's power supply.
2	Remove the pulley cover J4. (Refer to "Section 4.5 Installing/removing the cover".)
3	Loosen the two fixing (M4) screws of bellows, and remove the bellows to downward together with belt pulley cover J4.
4	Remove the four fixing screws which fix the bellows to the belt pulley cover J4, and removes the ring, then the bellows can be removed from belt pulley cover J4.
5	Fix the new bellows to the belt pulley cover J4 in the same way (screw tightening torque: 0.8 N·m). Fill the gap between the belt pulley cover J4 and the bellows with a seal such as a liquid gasket.
6	Install the belt pulley cover J4 as before.
7	Fix the bellows to shaft with adjusting the position of the bellows's bottom to 30 mm from end of shaft. Align two set screws (M4) to the D cut surface and fix them securely.
8	Fill the gap between the bellows fixing section and the shaft with a seal such as a liquid gasket.
9	Sticks the attached ABS mark on the lower part of bellows. Makes the J4 axis into the position of 0 degree by jog operation etc., and match the ABS mark sticker with ABS mark on the shaft, and stick it.

[Caution] When installing the No. 2 arm cover D to the No. 2 arm, please check the condition of the sealing. In the event that the sealing material has been removed or has been bent or broken to the extent that it cannot be return to the original form, be sure to replace the sealing material. Please inform the dealer, if exchange is necessary.

<< MEMO >> * Please use this page for your memo.

Appendix 5 Maintenance Tool

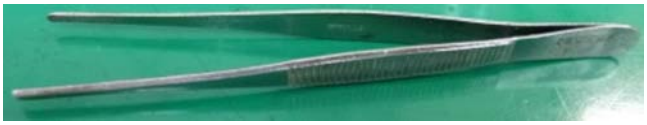
Appendix 5.1 List of maintenance tool (image)

The following table shows the list of tools used for the maintenance and inspection.

No.	Name	Appearance
1	Hexagon socket screw keys set	
2	Torque driver	
3, 4	Torque wrench	
5, 6	Bits	
7	Bit adaptor	
8, 9	Phillips-head screw driver	
10	Flathead screw driver	

No.	Name	Appearance
11	Plier	
12	Nippers	
13	Tube cutter	
14	Open ended spanners	
15	Tape measure	
16, 17	Tap	
18	Tap handle	

No.	Name	Appearance
19	Precise minus driver	
20	Tension meter	
21	Multimeters	
22, 23	T-shaped wrench	
24	Electroscope	
25	Grease gun	

No.	Name	Appearance
26, 27	Spatula	
28	Magnet pick-up tool	
29	Straightedge	
30	Tweezers	
31	Light	

Appendix 5.2 List of maintenance jigs (image)

No.	Name	Appearance
1	Installation pin	
2	Marker pen: pink, red, black	

Appendix 5.3 List of maintenance tools

No.	Part name	Recommendation		Q'ty	Application	Remarks
		Type	Manufacture			
1	Hexagon socket screw keys set (M1.5 to M12)	Appropriate		1	Assembly/ Disassembly	
2	Torque driver (Range 40 – 200 cNm)	N20LTDK	NAKAMURA MFG.CO.,LTD.	1	Assembly	
3	Torque wrench (Range 2 - 6 Nm)	N60QLK	NAKAMURA MFG.CO.,LTD.	1	Assembly	M3
4	Torque wrench (Range 4 – 12 Nm)	N120QLK	NAKAMURA MFG.CO.,LTD.	2	Assembly	M4, M5
5	Bits: width across flat 2.5 mm, Length over 150 mm	Appropriate		1	Assembly	M3
6	Bits: width across flat 3 mm, Length over 150 mm	Appropriate		1	Assembly	M4
7	Bit adaptor	784B/1	WERA	2	Assembly	
8	Phillips-head screw driver No.1	Appropriate		3	Assembly	
9	Phillips-head screw driver No.2	Appropriate		1	Assembly/ Disassembly	
10	Flathead screwdriver	Appropriate		2	Disassembly	
11	Plier	Appropriate		1	Assembly/ Disassembly	
12	Nippers	Appropriate		1	Disassembly	
13	Tube cutter	Appropriate		1	Assembly	
14	Spanner set: width across flat 5.5 to 19 mm	Appropriate		1	Assembly/ Disassembly	
15	Tape measure 2 m	Appropriate		1	Assembly	
16	Tap: M3	Appropriate		1	For repairing	
17	Tap: M4	Appropriate		1	For repairing	
18	Tap handle	Appropriate		1	For repairing	
19	Precise minus driver: width 2.5 mm	Appropriate		1		
20	Tension meter	U-507	Gates Unitta Asia Company	1		For adjusting belt tension
21	Multimeters	Appropriate		1		
22	T-shaped wrench: width across flat 2.5 mm, Length 200 mm	Appropriate		1		M3
23	T-shaped wrench: width across flat 3 mm, Length 350 mm	Appropriate		1		M4
24	Electroscope	Appropriate		1		
25	Grease gun	KH-120 or 35 or 32	Yamada Corporation	◎		
26	Spatula, small	Appropriate		◎		For grease application
27	Spatula, Long	Appropriate		◎		For grease application

No.	Part name	Recommendation		Q'ty	Application	Remarks
		Type	Manufacture			
28	Magnet pick-up tool	Appropriate		1		
29	Straightedge: The degree 150 mm	Appropriate		1		
30	Tweezers	Appropriate		1		
31	Light	Appropriate		1		

Appendix 5.4 List of maintenance jigs

No.	Part name	Recommendation		Q'ty	Remarks
		Type	Manufacture		
1	Installation pin: φ6	Refer to "Appendix 5.2 List of maintenance jigs (image)".		1	For the origin setting
2	Marker pen: pink, red, black	Appropriate		1 each	For bolt tightening confirmation

Appendix 6 Troubleshooting

Appendix 6.1 List of error codes

(1) Error No.

When an error occurs, ERROR LED at the front of the controller will turn on or blink.

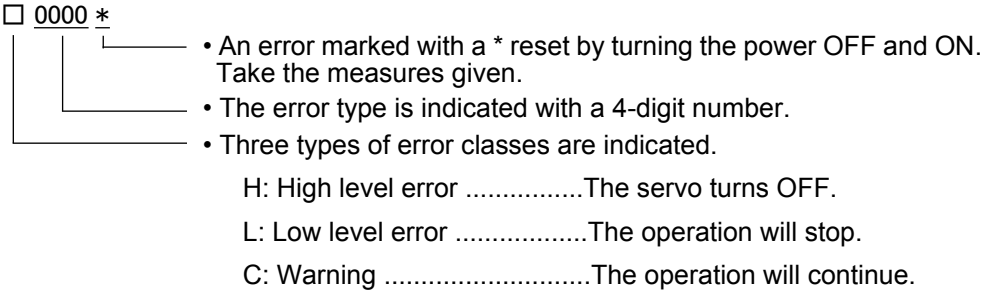
ERROR LED status	Details
On	Low-level error, or warning occurred.
Flashing	High-level error occurred.
Off	Normal operation.

The four-digit error number (number except the one character of the head.) is displayed on LCD of T/B.
Example: In the case of C0010, display the display and the error message for "0010."
In addition, the alarm rings at 0.5-second intervals while an error is occurring. When resetting the power supply, if the interval between turn-on and turn-off of a controller is too short, the alarm rings at 0.1-second intervals.

The following table describes the message, cause, and measure for the error number that occurred.
Also, a detailed message will be displayed on the Error History screen of the T/B, depending on the error No. of the error occurred. Check by displaying the Error History screen after resetting the error.

If the error recurs even after the measures in the table are taken, contact your service provider.

[Note] The following describes the meaning of the error number in the following table.



• The axis No. may be indicated at the last digit of the error No.
Example) H0931 No. 1 axis motor overcurrent.

(2) Cause and measures against the error

"n" at the end of the error No. in this list indicates the axis number (1 to 8).

Error No.	Error cause and measures	
H0001	Error message	Fail safe error (SRVOFF)
	Cause	The system may be abnormal.
	Measures	Turn the power OFF and ON once. If it comes back, contact to your service provider.
H0002	Error message	Fail safe error (STOP)
	Cause	The system may be abnormal.
	Measures	Turn the power OFF and ON once. If it comes back, contact to your service provider.

Error No.	Error cause and measures	
H0003	Error message	The system is abnormal
	Cause	The problem of the system is the cause.
	Measures	If it comes back, contact to your service provider.
H0004 *	Error message	CPU Watch dog error
	Cause	CPU was not normally treatable.
	Measures	It is necessary to change some parts when not improvement. If it comes back, contact to your service provider. * The "CPU" part in each message varies according to the CPU in which an error is detected. RCPU_main, CCPU_main, RCPU_sub, CCPU_sub, CPU_main, CPU_sub, FPGA, RCPU_PLD, CCPU_PLD
H0006 *	Error message	CPU process error
	Cause	CPU was not normally treatable.
	Measures	It is necessary to change some parts when not improvement. * The "CPU" part in each message varies according to the CPU in which an error is detected. RCPU_main, CCPU_main, RCPU_sub, CCPU_sub, CPU_main, CPU_sub, FPGA
H0008 *	Error message	CPU synchronization error
	Cause	CPU synchronization was failed.
	Measures	Turn the power OFF and ON once.
H0009 *	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Version UP (ALL)
	Cause	Version UP (ALL)
	Measures	Turn the power OFF and power ON once.
	Error message	Version UP (MAIN)
	Cause	Version UP (MAIN)
	Measures	Turn the power OFF and power ON once.
	Error message	Version UP (SERVO)
	Cause	Version UP (SERVO)
	Measures	Turn the power OFF and power ON once.
	Error message	The servo s/w was written
	Cause	The servo s/w was written.
	Measures	Please release an error by reset operation * This error can be reset without turning on the power supply again.
	Error message	Rewriting failed servo(Er.*)
	Cause	Servo S/W couldn't be read.
	Measures	When it occurs, contact your service provider. * The number (1 to 7) which indicates the cause of the error is shown in "*" in the error message.
C0010	Error message	Illegal Version (file)
	Cause	The version is inconsistent.
	Measures	The file has been automatically initialized. The program is being deleted.
C0011	Error message	Illeagal Version (system data)
	Cause	The version is inconsistent.
	Measures	The file has been automatically initialized. Turn the power OFF and ON once.

Error No.	Error cause and measures	
C0012	Error message	Initialize (error log)
	Cause	The error log has been initialized because of version mismatch or the error log file is abnormal.
	Measures	Reset the alarm, and continue the operation.
C0013 *	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Illeagal file
	Cause	Data including programs may have been damaged.
	Measures	Contact your service provider as the initialization operation is required.
	Error message	Illegal system SD card
	Cause	File Crash.
	Measures	File Initial operation.
H0014 *	Error message	System error (illegal MECHA)
	Cause	A character string cannot exceed 14 characters.
	Measures	Re-input the correct name.
H0015 *	Error message	Illeagal Version (file)
	Cause	Illeagal Version (file)
	Measures	Contact the manufacturer.
L0016 *	Error message	Turn the power OFF and ON once
	Cause	The time from turning the power OFF to turning the power ON again is too short.
	Measures	Give more time before turning the power ON again after turning the power OFF.
H0020 *	Error message	System Error (same name is Backup data.)
	Cause	The data of the system backup area is abnormal.
	Measures	Please consult your service provider.
H0021 *	Error message	System Error (Backup data is Count over.)
	Cause	The control region is overflowing.
	Measures	Please consult your service provider.
H0022 *	Error message	System Error (Backup data is no area.)
	Cause	The region is too small.
	Measures	Please consult your service provider.
H0028 *	Error message	Memory error (ECC)
	Cause	2 bit error of ECC was detected (***)
	Measures	Turn the power OFF and ON once * The part where an error is detected is shown in "***" in the message. nvSRAM, FROM, RCPU_DRAM, RCPU_L2C, CCPU_DRAM, CCPU_L2C, R_nvSRAM, R_DRAM, R_L2C
C0029	Error message	Memory error (ECC)
	Cause	1 bit error of ECC was detected (***)
	Measures	When it frequently occurs, contact your service provider * The part where an error is detected is shown in "***" in the message. nvSRAM, FROM, RCPU_DRAM, RCPU_L2C, CCPU_DRAM, CCPU_L2C, R_nvSRAM, R_DRAM, R_L2C
L0030	Error message	Hand error. LS release
	Cause	This is a user setting error.
	Measures	Reset the error after removing the cause.

Error No.	Error cause and measures	
L0031	Error message	Air pressure error
	Cause	This is a user setting error.
	Measures	Reset the error after releasing the cause.
C0032	Error message	HIOTYPE parameter not set
	Cause	HIOTYPE parameter needs to be changed.
	Measures	Please set the HIOTYPE parameter. (0: Sink/1: Source)
H0039	Error message	Door Switch Signal line is faulty
	Cause	The one point of contact in 2 points of contact of the door switch has broken. Or wiring is not the double lines.
	Measures	Turn off the power supply. Confirm whether there is any problem in wiring of the switch. And, please confirm whether it is wiring of the double line. Refer to the "Examples of safety measures" given in separate "Standard Specifications Manual" for door switch wiring. Turn on the power supply again after checking.
H0040	Error message	Door Switch Signal is Input
	Cause	The door switch is open.
	Measures	Confirm whether the door switch input signal is connected correctly. And close the door connected to the input signal of door switch.
H0041 *	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Comm. error (Remote I/O #1)
	Cause	Communication line is illegal.
	Measures	In CR800-R controller, confirm that the remote I/O cable between the CPU and the controller is grounded and connected correctly.
	Error message	The CRC error of remote I/O channel 1 occurs
	Cause	An error was found in the communication line for remote I/O channel 1.
	Measures	In CR800-R controller, confirm that the remote I/O cable between the CPU and the controller is grounded and connected correctly.
H0042 *	Error message	Comm. error (Remote I/O #2)
	Cause	Communication line is illegal.
	Measures	Checks the remote I/O cable connection in the CR750-Q/CR751-Q controller.
H0044 *	Error message	Comm. error (Remote I/O #4)
	Cause	Communication line is illegal.
	Measures	Check the cable or power supply.
H0045 *	Error message	Comm. error (Remote I/O #5)
	Cause	Communication line is illegal.
	Measures	Check the cable or power supply.
H0046	Error message	Faulty wiring (Mode sel. switch)
	Cause	The state of doubled wiring is not matching (Mode sel. switch).
	Measures	Turn off the power and confirm whether wiring of the switch is right. Wiring needs to be doubled. Refer to the separate manual, "Standard Specifications Manual" for wiring of the mode selector switch.
H0047	Error message	OCL detect
	Cause	OCL detect
	Measures	Please check the line (O/P Emergency Stop).

Error No.	Error cause and measures	
H0048	Error message	Faulty line (Mode Selector switch)
	Cause	The state of doubled line is not matching (Mode Selector switch).
	Measures	Please check the line (Mode Selector switch).
H0049	Error message	Faulty Line (T/B Enable Switch)
	Cause	The state of doubled line is not matching (T/B Enable Switch).
	Measures	Please check the line (T/B Enable Switch).
H0050	Error message	EMG signal is input (external)
	Cause	The external emergency stop is being input. If the emergency stop of T/B turns on, this error may occur simultaneously.
	Measures	Release the external emergency stop signal.
H0051	Error message	Wiring of the external emergency stop is abnormal
	Cause	If the emergency stop of T/B turns on, this error may occur simultaneously.
	Measures	Turn OFF the power supply. Confirm whether there is any problem in wiring of the external emergency stop switch. And, please confirm whether it is wiring of the dual line. Refer to the "Examples of safety measures" given in separate "Standard Specifications Manual" for external emergency stop switch wiring. Turn on the power supply again after checking.
H0053	Error message	EMG signal is input (Add.Axis2)
	Cause	The external emergency stop to addition axis amplifier is inputting.
	Measures	Check the emergency stop of Additional Axis servo amp. Or the EM1 (forced outage) line of the addition axis may be open. Please confirm connection. In addition, the External Emergency Stop 1 and 2 are separated. The "External Emergency Stop 1" is for I/F card, and the "External Emergency Stop 2" is for main device of the amplifier.
H0054	Error message	Faulty wiring (External EMG power)
	Cause	The state of doubled wiring is not matching (External EMG).
	Measures	Please check the wiring (External Emergency Stop).
H0061	Error message	EMG line is faulty (O.Panel)
	Cause	The emergency stop line isn't stable.
	Measures	Confirm whether there is any problem in wiring of the external emergency stop switch. And, please confirm whether it is wiring of the double line. Refer to the "Examples of safety measures" given in separate "Standard Specifications Manual" for external emergency stop switch wiring. Turn on the power supply again after checking.
H0070	Error message	EMG signal is input (T.Box)
	Cause	EMG signal is input. (T.Box) Or when using the UL specification, the brake release switch is turning ON.
	Measures	Cancel the T/B emergency stop. Check the emergency stop switch of teaching pendant. Or when using the UL specification, turn OFF the brake release switch. If the alarm cannot be canceled, check the fuse of the safe unit (TZ348). If the fuse broke off, exchange new fuse.

Error No.	Error cause and measures	
H0071	Error message	EMG line is faulty (T.Box)
	Cause	The emergency stop line isn't stable.
	Measures	Confirm whether there is any problem in wiring of the external emergency stop switch. And, please confirm whether it is wiring of the double line. Refer to the "Examples of safety measures" given in separate "Standard Specifications Manual" for external emergency stop switch wiring. Turn on the power supply again after checking.
H0074	Error message	Faulty line (T/B Enable/Disable)
	Cause	The state of doubled line is not matching (T/B Enable/Disable).
	Measures	Confirm whether T/B is connected correctly. If it comes back, contact to yourservice provider.
H0075	Error message	TB communication error
	Cause	Communication between the RC and TB was cut off.
	Measures	If it comes back, contact your service provider.
H0077 *	Error message	Electric double layer overvolt
	Cause	A power supply of a substrate in the robot is broken.
	Measures	Turn the power OFF and contact your service provider.
H0083 *	Error message	Fuse is blown (hand)
	Cause	The pneumatic hand's power fuse has broken. Possibly the power supply line of the hand input/output signal short-circuited.
	Measures	Confirm that the hand input/output cables shown below are connected correctly with no short circuit caused by biting of the cables. · Hand input cables (HC1 to HC8) and cables connected to them. · Hand output cables (GR1 to GR8) and cables connected to them. Exchange the fuse. If the error recurs after replacing the fuse, contact the manufacturer.
H0086	Error message	Hand module overcurrent
	Cause	The motorized hand's motor or circuit board has broken.
	Measures	Exchange the motorized hand's motor or circuit board.
H0090	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Fuse is blown (brake)
	Cause	A brake failure or a ground fault of brake cable may have caused the error.
	Measures	There are two brake fuses inside the robot controller. Replace both fuses. When an error occurs even the fuses are replaced, please contact your supplier.
	Error message	Fuse is blown (T/B)
	Cause	The cable may be disconnected or ground fault.
	Measures	Confirm whether there is any problem in cable. Turn on the power supply again after checking. If it comes back, contact to your dealer.
L0091	Error message	Can't access the Special signal
	Cause	The dedicated output signal is assigned to the specified signal. This signal cannot be used in duplicate.
	Measures	Confirm whether the same dedicated output number is assigned to the separate dedicated output signal. Change the output No., or change the dedicated output assignment parameter.

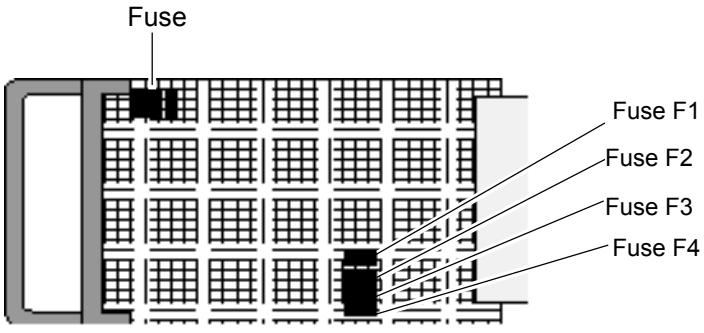
Error No.	Error cause and measures	
L0092	Error message	This signal is used in the electric hand
	Cause	The output signal for the electric hand cannot be used.
	Measures	When the multifunctional electric hand is connected, the output signal used in the multifunctional electric hand cannot be output with the program. Change the output signal number to be used in the program.
H0095	Error message	Brake release switch is turning on
	Cause	Cannot execute while brake release switch is turning on.
	Measures	Please check the brake release switch and turn it off.
H0097 *	Error message	Abnormal MC status
	Cause	The duplex magnetic contactor status signal status is not consistent.
	Measures	The status of the duplex system for the magnetic contactor (MC) is not consistent. After turning OFF the power, turn ON the power again to reset the error. If the same error recurs, contact the manufacturer.
H0098 *	Error message	Abnormal SR status
	Cause	The duplex safety relay status signal status is not consistent.
	Measures	The status of the duplex system for the safety relay (SR) is not consistent. After turning OFF the power, turn ON the power again to reset the error. If the same error recurs, contact the manufacturer.
H0099 *	Error message	S/W ver. is illegal (**)
	Cause	Servo software with an old version is installed.
	Measures	Change to the correct version of software is necessary. Contact your service provider. * The correct version of servo software is shown in (**). * The error message and "software" of the cause are changed as follows according to the software in which an error occurs. CCPU main system, OS, RCPU sub system, CCPU sub system, servo S/W, FPGA OS, sub system, FPGA system, boot
H0100 *	Error message	Temperature in RC is too high
	Cause	The intake fan is not operating, or the fan filter is clogged.
	Measures	Check the operation of the intake fan, or clean or replace the fan filter if necessary. Confirms that the environmental temperature is the specification range. When it comes back, contact to the dealer.
L0101	Error message	Temperature in RC is too high
	Cause	The intake fan is not operating, or the fan filter is clogged.
	Measures	Check the operation of the intake fan, or clean or replace the fan filter if necessary. Confirms that the environmental temperature is the specification range. When it comes back, contact to the dealer.
C0102	Error message	Temperature in RC is too high
	Cause	The intake fan is not operating, or the fan filter is clogged.
	Measures	Check the operation of the intake fan, or clean or replace the fan filter if necessary. Confirms that the environmental temperature is the specification range. When it comes back, contact to the dealer.
H0103 *	Error message	Temp. in robot CPU is too high
	Cause	Ambient temperature of robot CPU becomes high.
	Measures	Please lower ambient temperature to the specification range.
L0104	Error message	Temp. in robot CPU is too high
	Cause	Ambient temperature of robot CPU becomes high.
	Measures	Please lower ambient temperature to the specification range.

Error No.	Error cause and measures	
C0105	Error message	Temp. in robot CPU is too high
	Cause	Ambient temperature of robot CPU becomes high.
	Measures	Please lower ambient temperature to the specification range.
H0117 *	Error message	12V power supply error (brake)
	Cause	The output of the power supply deviated from the specified range
	Measures	Turn the power OFF and contact your service provider
C0120 *	Error message	Instantaneous power failure
	Cause	The power was OFF for 20msec or more.
	Measures	Check the power supply connection and power supply state.
H0130 *	Error message	The initialization connection error of system remote I/O
	Cause	Communication line of System Remote I/O is illegal.
	Measures	Confirm whether the communication cable is grounded correctly or connection correctly. In CR800-R controller, turn on the switch of the controller, then of the robot CPU when turning the power ON.
C0150	Error message	Undefined robot serial number
	Cause	Undefined robot serial number.
	Measures	Input the robot serial number Refer to separate manual: "Controller setup, basic operation, and maintenance" for the setting method.
C0151	Error message	Undefined robot serial number
	Cause	Undefined robot serial number.
	Measures	Input the robot serial number.
C0152	Error message	Unmatched robot serial number
	Cause	Robot arm that connection was replaced.
	Measures	Please confirm the connected robot body is not replaced. If this error occurs after purchasing the robot arm or changing robot arm and controller combination, please input the serial number. Refer to "Input the serial number" in separate manual: "Controller setup, basic operation, and maintenance" for the setting method.

<table>
<tr><th>Error No.</th><th colspan="2">Error cause and measures</th></tr>
<tr><td rowspan="4">H016m
(m=1 to 3)</td><td>Error message</td><td>Cannot use PIO I/F and Unit</td></tr>
<tr><td>Cause</td><td>The I/O Channel number of PIO interface and PIO unit overlaps.</td></tr>
<tr><td>Measures</td><td>Select either of Parallel I/O interface or Parallel I/O unit.</td></tr>
<tr><td>Details</td><td>The same station number cannot be assigned with the Parallel I/O interface. The Parallel I/O interface for Slot m (m=1 to 3) and Parallel I/O unit for station 0 to 2 are overlapped. If they are overlapped and assigned, this error occurs at power on.

When using the Parallel I/O interface and Parallel I/O unit at the same time, set a different station number.

For the Parallel I/O interface, change the mounting slot of the option slot where it does not overlap.

For the Parallel I/O unit, change the station number of the rotary switch where it does not overlap.
<table>
<tr><th>Station</th><th>I/O number</th><th>Parallel I/O interface mounting slot</th><th>Parallel I/O unit station number rotary switch</th></tr>
<tr><td>0</td><td>0 to 31</td><td>Option slot 1</td><td>0</td></tr>
<tr><td>1</td><td>32 to 63</td><td>Option slot 2</td><td>1</td></tr>
<tr><td>2</td><td>64 to 95</td><td>Option slot 3</td><td>2</td></tr>
<tr><td>3</td><td>96 to 127</td><td></td><td>3</td></tr>
<tr><td>4</td><td>128 to 159</td><td></td><td>4</td></tr>
<tr><td>5</td><td>160 to 191</td><td></td><td>5</td></tr>
<tr><td>6</td><td>192 to 223</td><td></td><td>6</td></tr>
<tr><td>7</td><td>224 to 255</td><td></td><td>7</td></tr>
</table>
* Overlap warning</td></tr>
<tr><td rowspan="3">H017m
(m=1 to 2)</td><td>Error message</td><td>Parallel I/O interface H/W error (option slot Slot m (m=1 - 2))</td></tr>
<tr><td>Cause</td><td>The parallel-input/output card broke or the external power source for the parallel input/outputs was cut off.</td></tr>
<tr><td>Measures</td><td>If it comes back, exchange the Parallel I/O interface card.</td></tr>
<tr><td rowspan="4">H018m
(m=1 to 2)</td><td>Error message</td><td>Fuse is blown (PIO) (Slot m-Fn)</td></tr>
<tr><td>Cause</td><td>Fuse is blown. (Parallel I/O interface)</td></tr>
<tr><td>Measures</td><td>Change fuse. (Parallel I/O interface)</td></tr>
<tr><td>Details</td><td>The electric fuse Fn (n= 1 - 4) of the parallel input output interface installed to the option slot m (m= 1 - 2) is open.
Removes the cause by which the fuse open and replaces the fuse.
 
</td></tr>
</table>

Error No.	Error cause and measures	
H0210 *	Error message	Power supply error (***)
	Cause	The power supply output voltage is out of the specified range.
	Measures	The output voltage of the power supply in the robot controller is the specified value or higher/lower. After turning OFF the power, turn ON the power again to reset the error. If the same error recurs, contact the manufacturer. * The part where an error is detected is shown in "***" in the message. 24 V, 5 V, 3.3 V, 2.5 V, 1.8 V, RCPU 1.5 V, CCPU 1.5 V, 1.2 V, RCPU 1.15 V, CCPU 1.15 V, 1.1 V, Ether 1 V, ServoM 1 V, ServoS 1 V
H0211 *	Error message	Power supply error (***)
	Cause	The power supply output voltage is out of the specified range.
	Measures	The output voltage of the power supply in the robot controller is the specified value or higher/lower. After turning OFF the power, turn ON the power again to reset the error. If the same error recurs, contact the manufacturer. * The part where an error is detected is shown in "***" in the message. 24 V, 5 V, 3.3 V, 2.5 V, 1.8 V, RCPU 1.5 V, CCPU 1.5 V, 1.2 V, RCPU 1.15 V, CCPU 1.15 V, 1.1 V, Ether 1 V, ServoM 1 V, ServoS 1 V
H0212 *	Error message	Power supply error
	Cause	The output of the power supply deviated from the specified range.
	Measures	Turn the power OFF and ON once. After turning OFF the power, turn ON the power again to reset the error. If the same error recurs, contact the manufacturer.
H0213 *	Error message	Power supply error
	Cause	The output of the power supply deviated from the specified range.
	Measures	Turn the power OFF and ON once. After turning OFF the power, turn ON the power again to reset the error. If the same error recurs, contact the manufacturer.
H0220 *	Error message	Memory fault (main CPU)
	Cause	A memory fault is detected.
	Measures	A fault (inconsistent data between writing/reading, broken retention data) is detected for the memory (DRAM) to which the main CPU has access. After turning OFF the power, turn ON the power again to reset the error. If the same error recurs, contact the manufacturer.
H0230 *	Error message	Safety parameter error (xxxxx)
	Cause	Detect errors in safety parameter value.
	Measures	The safety parameter setting is not correct. Check the parameter setting shown in the "(xxxxx)" part of the error message, and set an appropriate value.
H0231 *	Error message	Parameter CRC error (xxxxx)
	Cause	Detect CRC errors in safety parameter value.
	Measures	Please check the safety parameter settings and write parameters.
C0240 *	Error message	Setting mismatch of safety function
	Cause	The safety function is disabled.
	Measures	Safety logic settings is set but safety function is disabled. Delete Safety Logic settings or Enable Safety Function.
H0241 *	Error message	Fault in Safety Communication
	Cause	Detect a fault in safety communication.
	Measures	Turn the power OFF and ON once. If the same error recurs, contact the manufacturer.
H0242 *	Error message	Fault in Safety Data
	Cause	Detect a fault in safety data.
	Measures	Turn the power OFF and ON once. If the same error recurs, contact the manufacturer.

Error No.	Error cause and measures	
H0243	Error message	XXX function is not available
	Cause	The Safety Function is not supported by this robot.
	Measures	Disable the safety function.
H0260 *	Error message	EMG circuit diagnosis error
	Cause	Voltage diagnosis error.
	Measures	Turn the power OFF and ON once.
H0270 *	Error message	Voltage diagnosis error
	Cause	Voltage diagnosis error.
	Measures	Turn the power OFF and ON once.
H0280 *	Error message	STO circuit diagnosis error
	Cause	STO citcuit error.
	Measures	Turn the power OFF and ON once.
H0290 *	Error message	PLD control error
	Cause	PLD control error.
	Measures	Turn the power OFF and ON once.
H0310	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Mecha board access error
	Cause	Failed in access to a Mecha board.
	Measures	Please confirm the connection with Mecha board.
	Error message	Mecha board buffer access error
	Cause	Cannot store more than 100 of the data to send/receive buffer.
	Measures	Please confirm the communication with Mecha board.
H0311 *	Error message	RemoteI/O unit config error
	Cause	The multiple RemoteI/O units which do not support are connected.
	Measures	Please confirm the constitution of RemoteI/O unit. When extended safety unit is connected, restart the unit.
H0315	Error message	Can't access the D-device area
	Cause	This area cannot be used in duplicate.
	Measures	Please change the D-device start number in parameter DDEVVLn.
H0316	Error message	The D-device area is out of range
	Cause	An area corresponding to the variable type can't be allocated.
	Measures	Please change the D-device start number in parameter DDEVVLn.
H0317	Error message	The D-device variable duplication
	Cause	Cannot be doubly allotted to one variable.
	Measures	Please change the variable name in parameter DDEVVLn.
C043n (n indicates the axis number (1 to 8).)	Error message	Servo amplifier motor overheat
	Cause	The motor or encoder’s thermal protector activated.
	Measures	Reduce the speed and acceleration of the robot.
C049n * (n indicates the fan number (1 to 8).)	Error message	Alarm of fan in the robot
	Cause	Fan in the robot might be out of order.
	Measures	Please exchange the fan in the robot.

Error No.	Error cause and measures	
H050n * (n indicates the axis number (1 to 8).)	Error message	Servo axis setting error
	Cause	The setting of the axis number selection switch is illegal.
	Measures	Confirm the setting of the axis selection switch.
H0510 *	Error message	The converter setting is illegal
	Cause	The external emergency-stop input power was detected except external emergency-stop mode.
	Measures	Setting is wrong. When it comes back, contact to the dealer.
H0520 *	Error message	Robot axis setting illegal
	Cause	The setting of the servo axis used by the mechanism is duplicated with another mechanism's axis.
	Measures	Correctly set.
H053n * (n indicates the axis number (1 to 8).)	Error message	Servo sys. error (memory)
	Cause	The servo amplifier memory IC's check sum is illegal.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H054n * (n indicates the axis number (1 to 8).)	Error message	Servo sys. error (over run)
	Cause	The servo amplifier software data process did not end within the specified time.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H055n * (n indicates the axis number (1 to 8).)	Error message	Servo sys. error (mag. pole pos)
	Cause	An error was detected in the magnetic pole position detection signal of the detector.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H056n * (n indicates the axis number (1 to 8).)	Error message	Servo sys. error (A/D)
	Cause	An error was found in the servo amplifier's A/D converter during initialization.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H057n * (n indicates the axis number (1 to 8).)	Error message	Encoder error (EEPROM)
	Cause	An error was detected in EEPROM data of the serial pulse encoder.
	Measures	Turn the power OFF and ON once. Also, carefully check whether there is no deviation in the operating position of the robot. If it is deviated, set the origin position (OP) again. For more information about the operating procedure, refer to the separate volume, "Instruction Manual/Robot Arm Setup to Maintenance." If it comes back, contact your service provider.
H058n * (n indicates the axis number (1 to 8).)	Error message	Encoder error (LED)
	Cause	The LED of the serial pulse encoder has been deteriorated.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H059n * (n indicates the axis number (1 to 8).)	Error message	Encoder error (position data)
	Cause	An error was detected in the position data within a single rotation of the encoder.
	Measures	Turn the power OFF and ON once. Also, carefully check whether there is no deviation in the operating position of the robot. If it is deviated, set the origin position (OP) again. For more information about the operating procedure, refer to the separate volume, "Instruction Manual/Robot Arm Setup to Maintenance." If it comes back, contact your service provider.

Error No.	Error cause and measures	
H060n * (n indicates the axis number (1 to 8).)	Error message	Encoder no-signal detection 1
	Cause	An error was detected in the operating input of the detector mounted on the edge of the motor.
	Measures	Turn the power OFF and ON once. Also, carefully check whether there is no deviation in the operating position of the robot. If it is deviated, set the origin position (OP) again. For more information about the operating procedure, refer to the separate volume, "Instruction Manual/Robot Arm Setup to Maintenance." If it comes back, contact your service provider.
H061n * (n indicates the axis number (1 to 8).)	Error message	Encoder no-signal detection 2
	Cause	An error was detected in the operating input of the detector mounted on the edge of the machine.
	Measures	Turn the power OFF and ON once. Also, carefully check whether there is no deviation in the operating position of the robot. If it is deviated, set the origin position (OP) again. For more information about the operating procedure, refer to the separate volume, "Instruction Manual/Robot Arm Setup to Maintenance." If it comes back, contact your service provider.
H062n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier LSI error
	Cause	An operation error was detected in the LSI of the servo amplifier.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H063n * (n indicates the axis number (1 to 8).)	Error message	Unused axis servo error
	Cause	A power module error occurred in an axis which not use the movement control.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H064n * (n indicates the axis number (1 to 8).)	Error message	System error (ABS CPU)
	Cause	An error in the CPU of the absolute position linear scale was detected.
	Measures	Turn the power OFF and ON once. Also, carefully check whether there is no deviation in the operating position of the robot. If it is deviated, set the origin position (OP) again. For more information about the operating procedure, refer to the separate volume, "Instruction Manual/Robot Arm Setup to Maintenance." If it comes back, contact your service provider.
H065n * (n indicates the axis number (1 to 8).)	Error message	Absolute position error
	Cause	An error was detected in the absolute position detection circuit within the absolute position linear scale.
	Measures	Turn the power OFF and ON once. Also, carefully check whether there is no deviation in the operating position of the robot. If it is deviated, set the origin position (OP) again. For more information about the operating procedure, refer to the separate volume, "Instruction Manual/Robot Arm Setup to Maintenance." If it comes back, contact your service provider.
H066n * (n indicates the axis number (1 to 8).)	Error message	Incremental position error
	Cause	An error was detected in the relative position detection circuit within the absolute position linear scale.
	Measures	Turn the power OFF and ON once. Also, carefully check whether there is no deviation in the operating position of the robot. If it is deviated, set the origin position (OP) again. For more information about the operating procedure, refer to the separate volume, "Instruction Manual/Robot Arm Setup to Maintenance." If it comes back, contact your service provider.

Error No.	Error cause and measures	
H067n * (n indicates the axis number (1 to 8).)	Error message	Encoder CPU error
	Cause	An error was detected in the CPU of the position detector.
	Measures	Turn the power OFF and ON once. Also, carefully check whether there is no deviation in the operating position of the robot. If it is deviated, set the origin position (OP) again. For more information about the operating procedure, refer to the separate volume, "Instruction Manual/Robot Arm Setup to Maintenance." If it comes back, contact your service provider.
H068n * (n indicates the axis number (1 to 8).)	Error message	Encoder LED error
	Cause	Deterioration of the position detector's LED was detected.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0690 *	Error message	Regeneration circuit error
	Cause	A regenerative transistor or resistor error was detected. This error may also occur when the power supply voltage is high.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0700 *	Error message	P.S. external contactor fusing
	Cause	The contactor was turned ON even though READY is OFF.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0710 *	Error message	Servo amp. relay error
	Cause	The relay on servo cpu card did not turn ON.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0711 *	Error message	Discharge resistance relay error
	Cause	Discharge resistance circuit on converter is state-of-discharge.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0712 *	Error message	Converter fuse fusing
	Cause	Fuse of a converter fused for a ground fault or short circuit.
	Measures	Please exchange a fuse of a converter. Investigate and correct the ground fault or short circuit portion in the wiring made by the customer. Then, replace the 3.2 A fuse inside the controller. For details, refer to "Place where a converter fuse replacement is required". (On details of the 3.2 A fuse, contact the manufacturer.) If no improvement is made after carrying out the above measures, please contact the manufacturer.
H0713 *	Error message	Encoder power supply fuse trip
	Cause	Encoder power supply fuse tripped by ground fault, short circuit.
	Measures	Turn the power OFF, wait a while, and then turn ON again.
H0720 *	Error message	Power supply watch dog
	Cause	The converter software process did not end within the specified time.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0730 *	Error message	Power supply rush relay fusing
	Cause	The rush resistance short-circuit relay did not turn OFF.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.

Error No.	Error cause and measures	
H0740 *	Error message	Power supply main circuit error
	Cause	The charge operation of the main circuit capacitor is not normal. Connection of the external emergency stop has the mistake.
	Measures	Turn the power OFF and ON once. Confirm that the power supply voltage is in the specification value and the connection of the external emergency stop is correct. If it comes back, confirm the time of occurrence of this error being "servo ON/OFF", or being "power supply OFF/ON", and contact your service provider.
H0742	Error message	Power supply main circuit error
	Cause	A main circuit voltage has decreased because of a failure of the Safety relay on a converter card.
	Measures	Turn the power OFF and ON once. Confirm whether there is any problem in wiring of the external emergency stop switch. Refer to the "Examples of safety measures" given in separate "Standard Specifications Manual" for external emergency stop switch wiring. If it comes back, contact to your service provider.
H0743 *	Error message	Power supply main circuit error3
	Cause	A main circuit voltage has decreased because of contactor fail.
	Measures	Turns off the power once and turns on on the power supply again. Confirm power supply voltage and the connection of the external emergency stop. When it comes back, contact to the dealer.
H0750 *	Error message	Power supply memory error
	Cause	An error in the memory circuit of converter or AD converter was detected.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0760 *	Error message	Power supply error
	Cause	An error was detected in the data comm. with the power supply.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0770 *	Error message	Power supply process error
	Cause	An error occurred in the process cycle of power supply.
	Measures	Turn the power OFF and ON once. Check that there is not a source of noise. If it comes back, contact your service provider.
H078n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier watch dog
	Cause	The servo amplifier software process is not operating correctly.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H079n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier board error
	Cause	An error was detected in the servo amplifier's PCB.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H080n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier clock error
	Cause	An error was detected in the servo amplifier's clock.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.

Error No.	Error cause and measures	
H081n * (n indicates the axis number (1 to 8).)	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Servo amplifier under voltage
	Cause	The PN bus voltage dropped to 200 V or less. Momentary power failure may have occurred.
	Measures	Check the primary voltage.
	Error message	Voltage error at accel/decel
	Cause	A motor control error was detected due to an input voltage drop.
	Measures	Turn the power OFF and ON once. Check the primary voltage.
H0820 * H082n * (n indicates the axis number (1 to 8).)	Error message	Motor ground fault
	Cause	A motor ground fault was detected. A connection or conductance error may have occurred in the motor cable.
	Measures	Turn the power OFF and ON once. Check connection and continuity of motor cable.
H083n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier overvoltage
	Cause	The PN bus voltage rose to 400 V or more.
	Measures	Check the primary power supply voltage. Turn the power OFF and ON once.
H0840 *	Error message	Instantaneous power failure (SRV)
	Cause	A power shutdown status of 50 msec or longer has occurred.
	Measures	Check the power voltage. Turn the power OFF and ON once.
H0850 *	Error message	Power supply voltage incorrect
	Cause	The input power (L1, L2, L3) has an open phase, the voltage is not within the specifications, or the 100 V/200 V specifications changeover setting is incorrect.
	Measures	Check the power connection, power state or the setting.
H0860	Error message	Power supply overvoltage
	Cause	The voltage across the converter's L+ and L- exceeded 410 V.
	Measures	Check the power supply connection and power supply state.
H0870 *	Error message	Power module overheat (Fan Stop)
	Cause	A cooling fan stopped, and overheat occurred.
	Measures	Check the rotation of fan, and the connector connected to a fan.
H0880 * H088n * (n indicates the axis number (1 to 8).)	Error message	Power module overheat
	Cause	Overheating of the power module regenerative resistor was detected.
	Measures	Turn the controller power OFF, wait a while, and then turn ON again. If it comes back, contact your service provider.
H089n (n indicates the axis number (1 to 8).)	Error message	Servo amplifier motor overheat
	Cause	The position detector's thermal protector activated.
	Measures	Turn the controller power OFF, wait a while, and then turn ON again. Decrease the acceleration/deceleration time of the operation speed, for instance. Refer to "Detailed explanation of command words"/"Accel (Accelerate)," "Ovrd (Override)" and "Spd (Speed)," or "Detailed explanation of Robot Status Variable"/"M_SetAdl," "M_LdfAct" and "Functions set with parameters"/"JADL (Optimum acceleration/deceleration adjustment rate)" of the Separate Volume, "INSTRUCTION MANUAL/Detailed Explanation of Functions and Operations."

Error No.	Error cause and measures	
H090n * (n indicates the axis number (1 to 8).)	Error message	Absolute position overspeed
	Cause	It moved 45 mm/sec or faster with the absolute position linear scale during initialization.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H091n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier overspeed
	Cause	A speed exceeding the motor's tolerable speed was detected.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H0920 * H092n * (n indicates the axis number (1 to 8).)	Error message	Power module overcurrent
	Cause	A servo amplifier or power supply overcurrent was detected.
	Measures	Confirms the connection of the machine cable and the locomotion-axis cable. If it comes back, contact your service provider.
H093n * (n indicates the axis number (1 to 8).)	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Motor overcurrent
	Cause	An excessive current flowed to the motor, or the A/D converter output is abnormal. An abnormality may have occurred in the connection of the motor's power line.
	Measures	Turn the power OFF and ON once. Confirms the connection of the machine cable and the locomotion-axis cable etc. If it comes back, contact your service provider.
	Error message	Motor overcurrent (Grounding)
	Cause	The motor power cable is in contact with ground.
	Measures	Turn the power OFF and ON once. Confirms the connection of the machine cable and the locomotion-axis cable etc. If it comes back, contact your service provider.
H094n (n indicates the axis number (1 to 8).)	Error message	Overload (over weight 1)
	Cause	Operation tight for a motor (operation with high duty) was performed more than fixed time.
	Measures	Decrease the acceleration/deceleration time of the operation speed, for instance. Refer to "Detailed explanation of command words"/"Accel (Accelerate)," "Ovrd (Override)" and "Spd (Speed)," or "Detailed explanation of Robot Status Variable"/"M_SetAdl," "M_LdfAct" and "Functions set with parameters"/"JADL (Optimum acceleration/deceleration adjustment rate)" of the Separate Volume, "INSTRUCTION MANUAL/Detailed Explanation of Functions and Operations." Confirms that conveyance conditions (hand mass, work-piece mass) are less than specification values. When it comes back, contact to the dealer.
H095n (n indicates the axis number (1 to 8).)	Error message	Overload (over weight 2)
	Cause	The maximum output current continued for more than one second.
	Measures	Check the load weight and the robot pressing, etc. Confirms that conveyance conditions (hand mass, work-piece mass) are less than specification values. When it comes back, contact to the dealer.

Error No.	Error cause and measures	
H096n (n indicates the axis number (1 to 8).)	Error message	Excessive error 1
	Cause	The position error exceeded at servo ON. Moreover, this error may occur during the emergency-stop deceleration.
	Measures	• Check the load weight and press, etc. Confirms the connection of the machine cable and the locomotion-axis cable etc. If the surrounding temperature is low, or starting after stopping operation for an extended period of time, perform running-in operation at low speed or use the warm-up operation mode. • When hand offset is long and acceleration-and-deceleration control is fixed or tracking is active in RH-20FRH series. please reduce the acceleration and deceleration speeds (Accel command) and movement speed (Ovrd command). Refer to separate "Instruction Manual/Detailed Explanation of Functions and Operations" for details of each command. (This error may occur during the emergency-stop deceleration.) • While operation is performed in the compliance mode of the joint coordinate system, if the Excessive error 1 (H096n) occurs, increase the set value of parameter CMPJCLL to suppress this error. Refer to "Detailed explanation of command words"/"Cmp Jnt (Compliance Joint)" and "Movement parameter"/"CMPJCLL (Current Limit Level for Cmp Jnt)" given in separate "INSTRUCTION MANUAL/ Detailed explanation of functions and operations".
H097n (n indicates the axis number (1 to 8).)	Error message	Excessive error 2
	Cause	The position error exceeded at servo OFF.
	Measures	Check the moving robot arm by something power. When it comes back, contact to the dealer.
H098n (n indicates the axis number (1 to 8).)	Error message	Excessive error 3
	Cause	Abnormal motor power line connection.
	Measures	Check the connection of motor power line. When the excessive error 1 was detected, the current of the motor is off.
H101n (n indicates the axis number (1 to 8).)	Error message	Collision detection
	Cause	A collision was detected.
	Measures	1) If the robot has stopped by interference with peripheral equipment, move the arm to part from peripheral equipment using jog operation. Depending on the level of collision, the collision detection error may occur again. In that case, turn on the servo power again and do jog operation. If it still recurs, release the brake and move the arm by hand. 2) If this error occurs without having collided, please adjust the collision detection level. If collision is detected incorrectly during automatic operation, enlarge the setting value of the parameter (COLLVL) corresponding to axis. If collision is detected incorrectly during jog operation, enlarge the setting value of the parameter (COLLVLJG) corresponding to axis. However, since the detection level drops by enlarging the set value, don't enlarge too much. And, the incorrect detection can be reduced when setup value of parameter (HNDDATn, WRKDATn) is correct. 3) If the speed excessive error has occurred at the same time, the torque alteration by rapid speed change may be detected as a collision state. Remove other causes of the error and confirm movement again. 4) In case of operation under the environment of low temperature or after the long term stoppage, the collision detection error may occur by viscous transmutation of the grease used. In such a case, operate by accustoming at low speed (warm-up), or use the warm-up operation mode.
H102n (n indicates the axis number (1 to 8).)	Error message	Servo AMP over-regeneration
	Cause	The additional axis exceeded the regenerative performance limit.
	Measures	Check the regenerative capacity and parameters for the additional axis. If it comes back, contact your service provider. Regeneration resistance may be disconnected.

Error No.	Error cause and measures	
H1030 *	Error message	Power supply over-regeneration
	Cause	The converter's regenerative performance limit was exceeded.
	Measures	Wait at least 15 minutes in the power ON state, and then turn the power OFF and ON. If it comes back, contact your service provider. Regeneration resistance may be disconnected.
H104n * (n indicates the axis number (1 to 8).)	Error message	Encoder init communication error
	Cause	An abnormality may have occurred in the position detector cable connection.
	Measures	1) Turn the power OFF and ON once. If it comes back, contact your service provider. 2) When instantaneous power failure errors occur simultaneously, turn on the power supply again.
H107n * (n indicates the axis number (1 to 8).)	Error message	Encoder communication error
	Cause	Communication between the encoder and detector was cut off.
	Measures	Confirms the signal cable of the machine cable and the locomotion-axis cable etc. If it comes back, contact your service provider.
H108n * (n indicates the axis number (1 to 8).)	Error message	Servo AMP communication error
	Cause	An abnormality may have occurred in the communication cable connection.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider. CR800-R: Check the connection between the robot CPU system and the controller.
H1090 * H109n * (n indicates the axis number (1 to 8).)	Error message	Servo AMP initialization error
	Cause	An abnormality may have occurred in the servo axis settings (parameters, rotary switches).
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider. CR800-R: Check the connection between the robot CPU system and the robot controller. And when turning the power ON, turn on the switch of the robot controller, then of the robot CPU. Using the additional axis: Confirms the axis setting switch, cable connection with robot controller, setting parameter, condition of power supply of additional axis amplifier, type of additional axis amplifier etc. When applying a power supply, turn on the additional axis amplifier first, then turn on the controller.
H1100 *	Error message	Servo com. receive error
	Cause	Abnormality occurred in data reception from a servo amplifier.
	Measures	Check the communication cable connection and conductivity.
H1110 *	Error message	Servo communication timeout
	Cause	Data from a servo amplifier is not received.
	Measures	Check the communication cable connection and conductivity.
H111n (n indicates the axis number (1 to 8).)	Error message	SRV-AMP comm. error
	Cause	A communication error was detected between the servo amplifier and robot controller.
	Measures	Check the communication cable connection and conductivity. If it comes back, contact your service provider.

Error No.	Error cause and measures	
H112n * (n indicates the axis number (1 to 8).)	Error message	Encoder ABS position data lost
	Cause	The absolute position data in the position detector was lost. The voltage of the robot-arm or additional axis's backup battery may be dropping.
	Measures	Please set up the origin by ABS method after replacing the batteries. (Since position data can be perfectly restored if the origin is set up by the ABS method, re-teaching is unnecessary.) Refer to separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" for ABS method. If the voltage of robot battery is low, reset the error, and set up the origin by ABS method. Then, the robot can be operated without replacing the battery. However, this error occurs again when the controller is returned on. It is recommended to replace the battery at the earliest opportunity.
H113n * (n indicates the axis number (1 to 8).)	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Encoder per rotation data error
	Cause	An error was detected in the position detector's one rotation data.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
	Error message	Encoder data scattered
	Cause	Position deviation by scattered encoder data occurred.
	Measures	Turns off the power supply once and turns on again. Check that there is not a source of excessive vibration. If it comes back, contact your service provider.
H114n * (n indicates the axis number (1 to 8).)	Error message	SRV-AMP Comm. data error (CRC)
	Cause	A CRC error was detected in the data from servo amplifier.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
H115n * (n indicates the axis number (1 to 8).)	Error message	Large command position
	Cause	The command position from the RC is abnormally large.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
H116n * (n indicates the axis number (1 to 8).)	Error message	SRV-AMP Comm. error (frame)
	Cause	An error was detected in the communication frame from servo amplifier.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
H117n * (n indicates the axis number (1 to 8).)	Error message	SRV-AMP Comm. error (info)
	Cause	An error was detected in the communication information data sent from the robot controller.
	Measures	Check the communication cable connection and conductivity. If it comes back, contact your service provider.
H118n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier feedback error 1
	Cause	Pulses skipped in the position detector's feedback signal.
	Measures	Check the detector cable connection and conductivity. If it comes back, contact your service provider.
H119n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier feedback error 2
	Cause	Displacement occurred in the feedback amounts between the detectors on the motor edge and on the machine edge.
	Measures	Check the detector cable connection and conductivity. If it comes back, contact your service provider.

Error No.	Error cause and measures	
H1200 *	Error message	SRV-AMP Comm. data error (CRC)
	Cause	A CRC error was detected in the communication data from the servo amplifier.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
H121n * (n indicates the axis number (1 to 8).)	Error message	SRV-AMP Comm. data error (ID)
	Cause	A data ID error was detected in the communication data from the servo amplifier.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
H122n * (n indicates the axis number (1 to 8).)	Error message	SRV-AMP Comm. data error (axis No)
	Cause	An axis No. error was detected in the communication data from the servo amplifier.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
H123n * (n indicates the axis number (1 to 8).)	Error message	SRV-AMP Comm. data error (SubID)
	Cause	A Sub ID error was detected in the communication data from the servo amplifier.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
H1240 *	Error message	SRV-AMP Comm. data error (frame)
	Cause	An No. of received frames error was detected in the communication data from the servo amplifier.
	Measures	Turns off the power supply once and turns on again. If it comes back, contact your service provider.
H125n * (n indicates the axis number (1 to 8).)	Error message	Servo amplifier parameter error
	Cause	An error was detected in the servo parameter.
	Measures	Confirms whether the type displayed on the rated name plate of controller and T/B is the same. If different, restores the type data (backup data). If it comes back, contact your service provider.
C126n (n indicates the axis number (1 to 8).)	Error message	Encoder communication error
	Cause	Initial communication could not be established with the low-speed serial type absolute position linear scale.
	Measures	Check the detector cable connection and conductivity. If it comes back, contact your service provider.
C127n (n indicates the axis number (1 to 8).)	Error message	Encoder communication error
	Cause	The serial data of absolute position was abnormally transmitted.
	Measures	Check the detector cable connection and conductivity. Moreover, confirms carefully that the moving position of the robot has not deviated, and if it has deviated, sets up the origin again. Refer to separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" for operation method. If it comes back, contact your service provider.
C128n (n indicates the axis number (1 to 8).)	Error message	Encoder serial format error
	Cause	Absolute position serial data format was incorrect.
	Measures	Check the detector cable connection and conductivity. Moreover, confirms carefully that the moving position of the robot has not deviated, and if it has deviated, sets up the origin again. Refer to separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" for operation method. If it comes back, contact your service provider.

Error No.	Error cause and measures	
C129n (n indicates the axis number (1 to 8).)	Error message	Absolute position fluctuation
	Cause	The absolute position data fluctuated when the power was turned ON.
	Measures	Check whether the axis moved due to arm dropping or external force when the power was turned ON.
C130n (n indicates the axis number (1 to 8).)	Error message	Servo AMP MP scale F/B error
	Cause	Excessive displacement was detected in the feedback amounts between the detector and the MP scale.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
C131n (n indicates the axis number (1 to 8).)	Error message	Servo AMP MP scale offset error
	Cause	Excessive displacement was detected in the feedback amounts between the detector and the MP scale.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
C132n (n indicates the axis number (1 to 8).)	Error message	Multi-rotation data error
	Cause	An error was detected in the position detector's multi-rotation data.
	Measures	When the power supply is turned on next time, the current position data may not be correctly detected. Please re-turn on the controller power supply and set up the origin by ABS method. Refer to separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" for ABS method. (Even if this warning occurs, unless the controller is re-turned on, it can operate perfectly. However, when re-turning on the controller, the position gap may occur. Please be sure to set up the origin by ABS method after re-turning on the controller power supply. Current position data returns to the normal position before error occurrence.) When it comes back, contact to the dealer.
C133n (n indicates the axis number (1 to 8).)	Error message	Encoder battery voltage low
	Cause	The battery voltage supplied to the position detector dropped.
	Measures	Replace the backup battery. For more information about the replacement procedure, refer to the separate volumes, "Instruction Manual/Robot Arm Setup to Maintenance". Even if this warning occurs, unless the controller is re-turned on, it can operate perfectly. However, if the battery consumption is intense, the Encoder ABS position data lost error (H112n) may occur when the controller is re-turned on. It is recommended to replace the battery at the earliest opportunity.
C134n (n indicates the axis number (1 to 8).)	Error message	Over-regeneration warning
	Cause	The regenerative level of the additional axis has risen to 80% or more.
	Measures	Check the regenerative capacity and parameters for the additional axis. If it comes back, contact your service provider. Regeneration resistance may be disconnected.
C135n (n indicates the axis number (1 to 8).)	Error message	Overload warning
	Cause	The overload level reached 95% or more.
	Measures	Check the load weight and the robot for collisions, etc.
H136n * (n indicates the axis number (1 to 8).)	Error message	Absolute position counter error
	Cause	The counter of absolute position is illegal.
	Measures	Confirm whether the connection of encoder cable and the battery voltage of arm is falling.
C137n (n indicates the axis number (1 to 8).)	Error message	Illegal parameter (servo)
	Cause	A parameter was set exceeding the setting range.
	Measures	The parameter has not been changed. Reset the correct value. If it comes back, contact your service provider.

Error No.	Error cause and measures	
C138n (n indicates the axis number (1 to 8).)	Error message	Removing control axis (servo)
	Cause	An instruction to remove the axis was issued by the controller.
	Measures	Cancel the instruction of removing axis.
H1390	Error message	Emergency stop (Servo amplifier)
	Cause	The emergency stop command has been input from the RC.
	Measures	Release the emergency stop state.
H1410 *	Error message	Instantaneous power interruption
	Cause	The power was momentarily interrupted.
	Measures	Check power specification, and wiring of power and external emergency stop. If it comes back, contact your service provider.
C1420	Error message	Over-regeneration warning
	Cause	The regeneration level reached 80% or more.
	Measures	Lower the robot's movement speed. If it comes back, contact your service provider. Regeneration resistance may be disconnected.
C1430	Error message	Servo amplifier main circuit OFF
	Cause	The servo turned ON while the main circuit power was OFF.
	Measures	Turn the main circuit power ON.
H144n * (n indicates the axis number (1 to 8).)	Error message	System.4 error (servo 2)
	Cause	Trouble occurred in the current processing processor.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H1450 *	Error message	Instantaneous power interruption
	Cause	The power was momentarily interrupted at the power supply.
	Measures	Check power specification, and wiring of power and external emergency stop. If it comes back, contact your service provider.
H1460 *	Error message	Power supply overcurrent
	Cause	Overcurrent in the power module in the power supply.
	Measures	Check the AC power line. If it comes back, contact your service provider.
H1470 *	Error message	Frequency error
	Cause	AC frequency is out of range.
	Measures	Check the AC power line frequency. If it comes back, contact your service provider.
H148n * (n indicates the axis number (1 to 8).)	Error message	Power supply parameter error
	Cause	Illegal at the power supply parameter.
	Measures	Turn the power OFF and ON once. If it comes back, contact your service provider.
H1490 *	Error message	Power supply Power module overheat
	Cause	The temperature protection function of the power module operated.
	Measures	Clean up or replaces the air filters. When it comes back, contact to the dealer.
H1491	Error message	Illegal converter thermal servo AMP
	Cause	Overheating of servo AMP converter.
	Measures	Turn the power OFF, wait a while, and then turn ON again.

Error No.	Error cause and measures	
H1492 *	Error message	Power supply converter overheat
	Cause	Overheating of the converter was detected.
	Measures	Turn the power OFF, wait a while, and then turn ON again.
H1493 *	Error message	Rush resistance overheat
	Cause	Overheating of the rush resistance was detected.
	Measures	Turn the power OFF, wait a while, and then turn ON again.
H1494 *	Error message	Discharge resistance overheat
	Cause	Overheating of the discharge resistance was detected.
	Measures	Turn the power OFF, wait a while, and then turn ON again.
H150n * (n indicates the axis number (1 to 8).)	Error message	Motor combination error
	Cause	The servo motor which does not correspond to addition axis servo amplifier is connected.
	Measures	Confirm the specifications of servo amplifier and the motor.
H151n * (n indicates the axis number (1 to 8).)	Error message	SRV-AMP USB comm. error
	Cause	A communication error was detected between the servo amp and PC.
	Measures	Check the communication cable connection and conductivity.
H152n * (n indicates the axis number (1 to 8).)	Error message	Servo motor output watt over
	Cause	The output wattage of the servo motor exceeded ratings.
	Measures	Lower the rotation speed of the servo motor.
H154n * (n indicates the axis number (1 to 8).)	Error message	Communication error between units
	Cause	The transmission data between servo amplifier units is illegal.
	Measures	Check the communication cable connection and conductivity.
H1550 *	Error message	Emergency stop is a breakdown
	Cause	The external emergency stop input is illegal.
	Measures	Turn the power OFF and ON once. When it comes back, contact to the dealer.
H156n (n indicates the axis number (1 to 8).)	Error message	Excessive error 4
	Cause	The axis moved while executing servo ON processing.
	Measures	If it comes back, contact your service provider.
H157n (n indicates the axis number (1 to 8).)	Error message	Non-registered servo error (This error may be caused by the error on the amplifier for additional axis.)
	Cause	A non-registered servo alarm occurred.
	Measures	Confirms the code by LED of servo additional axis amplifier, and refer to the instruction manual of servo amplifier. If the alarm cannot be reset, turn the power OFF and ON. If it comes back, contact your service provider.
C158n (n indicates the axis number (1 to 8).)	Error message	Non-registered servo warning (This caution may be caused by the warning on the amplifier for additional axis.)
	Cause	A non-registered servo warning occurred.
	Measures	Confirms the code by LED of servo additional axis amplifier, and refer to the instruction manual of servo amplifier. If the alarm cannot be reset, turn the power OFF and ON. If it comes back, contact your service provider.

Error No.	Error cause and measures	
H1600 *	Error message	Mechanism un-setting
	Cause	The mechanism is not set up.
	Measures	Set up one or more of mechanism. If this alarm occur after the restoring the data of controller check the restored data. If it comes back, contact your service provider.
H1601 *	Error message	Unmatched robot model
	Cause	Robot arm that connection is not correct.
	Measures	Please confirm the connected robot arm.
H1610 *	Error message	System error (illegal MEMECH)
	Cause	The mechanism module name is illegal or not registered.
	Measures	Correctly set. If it comes back, contact your service provider. If it comes back, contact your service provider.
C1620	Error message	Illegal robot No.
	Cause	When specifying the mechanism number by the external communications protocol, the mechanism number not existing was specified.
	Measures	Specify the existing mechanism number.
C1630	Error message	Cannot servo ON (during error)
	Cause	The servo cannot be turned ON during a servo error.
	Measures	Reset the servo error before turning the servo ON.
C1640	Error message	Cannot servo ON (DEADMAN OFF)
	Cause	The servo cannot be turned ON while the enable switch is OFF.
	Measures	Turn the enable switch ON before turning the servo ON.
C1650	Error message	Cannot servo ON (brake OFF)
	Cause	The servo cannot be turned ON when there is an axis with the brakes released.
	Measures	Lock the brakes for all axes before turning the servo ON.
C1660	Error message	Cannot servo ON (SRVON process)
	Cause	The servo cannot be turned ON during the servo ON process.
	Measures	Operate it after servo ON process is finished.
C1670	Error message	Cannot servo ON (SRVOFF process)
	Cause	The servo OFF process is being carried out.
	Measures	Operate it after servo OFF process is finished.
H1680	Error message	Cannot servo ON (timeout)
	Cause	The servo did not turn ON within the specified time.
	Measures	If it comes back, confirm that power supply voltage is in the specification value, and connection of the external emergency stop is correct. And, when using the addition axis, confirm that the power supply voltage to the servo amplifier of addition axes is in the specification value and connection of AXMC is correct. If it comes back, contact your service provider.
H1681	Error message	Unexpected servo OFF
	Cause	The servo turned OFF unexpectedly.
	Measures	Confirm that primary power supply voltage is in the specification value and wiring of the external emergency stop line is correct. When using the additional axis, confirms whether the alarm occur on the additional axis. If it comes back, contact your service provider.

Error No.	Error cause and measures	
H1682	Error message	Servo ON Timeout (Safety relay)
	Cause	main circuit voltage did not rise because of a failure of the Safety relay on a converter card.
	Measures	Turn the power OFF and ON once. Confirm that wiring of the external emergency stop line is correct. Confirm whether there is any problem in wiring of the external emergency stop switch. Refer to the "Examplesof safety measures" given in separate "Standard Specifications Manual" for external emergency stop switch wiring. Please confirm whether in use of addition axis, there is any failure in the servo amplifier for addition axes. If it comes back, contact to your service provider.
H1683	Error message	Servo ON Timeout (Contactor)
	Cause	A main circuit voltage did not rise because of contactor welded.
	Measures	Turns off the power supply once and turns on again. Confirm that primary power supply voltage is in the specification value and wiring of the external emergency stop line is correct. When it comes back, contact to the dealer.
C1690	Error message	Cannot brake operation (DEADMAN)
	Cause	The servo cannot be turned ON while the enable switch is OFF.
	Measures	Turn the enable switch ON before turning the servo ON.
C1700	Error message	Cannot brake operation (EMG)
	Cause	The brakes cannot be released while the emergency stop is input.
	Measures	Release the emergency stop state before operating.
C1710	Error message	Cannot brake operation (SRVON)
	Cause	The brakes cannot be operated during servo ON.
	Measures	Turn the servo OFF before operating.
C1720	Error message	Cannot brake operation (BRK OFF)
	Cause	The brakes cannot be released during the brake release process.
	Measures	Operate it after brake is released.
C1730	Error message	Cannot brake operation (BRK ON)
	Cause	The brakes cannot be locked during the brake lock process.
	Measures	Operate it after brake is locked.
C1740	Error message	Servo parameter change failure
	Cause	Other parameters cannot be changed during the parameter change process.
	Measures	Carry out the parameter change process again.
C1750	Error message	Servo parameter change failure
	Cause	Changes of the servo parameter failed.
	Measures	Carry out the parameter change process again.
C1760	Error message	Illegal origin data
	Cause	The origin setting data is not correct.
	Measures	Set the correct origin setting data. Confirm mistakes such as "1 (one)" and "I (alphabet)", or "O (alphabet)" and "0 (zero)", etc.
C1761	Error message	Illegal origin data in robot arm
	Cause	The origin data is illegal in robot arm.
	Measures	Setting the origin.

Error No.	Error cause and measures	
C1770	Error message	Origin setting incomplete
	Cause	The origin is not set.
	Measures	Re-execute after setting the origin.
C1780	Error message	Cannot set origin (illegal axis)
	Cause	The origin was not set simultaneously for the interference axis.
	Measures	Set the origin simultaneously for the interference axis. For example, the J3 axis and the J4 axis of the RH type robot. Please refer to the section of origin setting of separate manual: "ROBOT ARM SETUP & MAINTENANCE" for details.
C1781	Error message	Cannot set origin (SRVON)
	Cause	The origin was set during servo ON.
	Measures	Turn the servo OFF before setting the origin.
H179n * (n indicates the axis number (1 to 8).)	Error message	Illegal parameter (MEJAR)
	Cause	The parameter (MEAJAR) setting is illegal. Or the setting value of the parameter related to addition axis control have exceeded the controllable operating range.
	Measures	The useful range of the operating range setting parameter (MEAJAR) is -131072.00 to +131072.00. Correct, if the set value is over the range. Or confirm the setting value of the parameter related to addition axis control.
H1800 *	Error message	Illegal parameter (MEMAR)
	Cause	The ABS operation range setting parameter MEMAR setting is incorrect. (Minus side value is larger than "0", or plus side value is smaller than "0")
	Measures	Set the value of the parameter "MEMAR" within the limits.
H1810 *	Error message	Illegal parameter (USERORG)
	Cause	The user origin setting parameter USERORG setting is incorrect.
	Measures	Correct the parameter USERORG.
L182n (n indicates the axis number (1 to 8).)	Error message	Pos. data disagree. Check origin
	Cause	Position data changed during power off.
	Measures	Check the origin, re-install if shifting. Re-set up the origin only for the axis which deviated by the ABS method. Refer to separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" for ABS method.
L1830	Error message	JRC. Exseeds the Pos. limit
	Cause	The JRC instruction exceeding the operation range was executed.
	Measures	Check the current position and the operating range.
L184n (n indicates the axis number (1 to 8).)	Error message	JRC Qtt. Setting Too Large
	Cause	The movement amount setting of the JRC is excessive.
	Measures	Correct the JRCQTT parameter.
C1850	Error message	Instantaneous power failure
	Cause	There was the momentary power failure.
	Measures	Check the power supply connection and power supply state.
L1860	Error message	Illegal parameter (TLC)
	Cause	The setting of the TLC parameter that sets the approach direction was incorrect.
	Measures	Correct the TLC parameter. (=X/Y/Z)

Error No.	Error cause and measures	
L1864	Error message	FTP parameter setting error (**) Note) "**" is substituted with the "parameter name".
	Cause	The FTP communication parameter setting lies outside the range.
	Measures	Check the setting and correct.
H188n * (n indicates the axis number (1 to 8).)	Error message	Jn addition axis amplifier cooling fan stop.
	Cause	The cooling fan of the addition axis amplifier of Jn axis may be out of order.
	Measures	Please replace the cooling fan of addition axis amplifier. * Please also refer to the instruction manual of the servo amplifier of usage.
C189n * (n indicates the axis number (1 to 8).)	Error message	Jn addition axis amplifier cooling fan rev fall
	Cause	The cooling fan of the addition axis amplifier of Jn axis may be out of order.
	Measures	Please replace the cooling fan of addition axis amplifier. * Please also refer to the instruction manual of the servo amplifier of usage.
C1940	Error message	Agitating fan stopped
	Cause	The fan for agitating inside the robot controller has stopped.
	Measures	Confirm rotation of the target cooling fan, and if out of order, replace them. For the fan installation position, refer to "Fan installation place of robot controller".
H195n	Error message	Additional axis AMP error xx
	Cause	Alarm of the addition axis servo amplifier was detected.
	Measures	Refer to the instruction manuals of addition axis servo amplifier for the details of alarm. "xx" of the error message corresponds to the alarm number of addition axis servo amplifier (MR-J4- □ B). (The error reset methods differ for each alarm number of addition axis servo amplifier.)
C196n	Error message	Additional axis AMP Warning xx
	Cause	Warning of the addition axis servo amplifier was detected.
	Measures	Refer to the instruction manuals of addition axis servo amplifier for the details of warning. "xx" of the error message corresponds to the warning number of addition axis servo amplifier (MR-J4- □B).
C1970	Error message	Agitating fan stopped (robot)
	Cause	The agitating fan in the robot stopped.
	Measures	Confirm the rotation of the agitating fan. * According to the type of the stopped fan, "inside the robot arm" and "inside the robot base" are shown separately.
L2000	Error message	The servo is OFF
	Cause	Because servo is turned off, the robot can't move.
	Measures	Turn the servo ON and then restart.
L2010	Error message	Pulse output was not possible
	Cause	There is an error in the pulse output designation.
	Measures	Correct the program.
L2020	Error message	Reading external position data
	Cause	A command that cannot be executed while reading the external commands was executed.
	Measures	Correct the program.
L2030	Error message	JOG operation cannot be accepted
	Cause	The JOG operation request was issued when the JOG operation request could not be accepted.
	Measures	Changes the JOG mode after the JOG operation.

Error No.	Error cause and measures	
H2031 *	Error message	"Illegal parameter (JOGTSJ,JOGJSP)"
	Cause	The parameter JOGTSJ, JOGJSP settings are not correct. [JOGPSP], [JOGJSP] = (element 1, element2) = (constant high, constant low)
	Measures	Set the set dimension to 5 or less.
H2040	Error message	Teaching position is not correct
	Cause	Change the teaching position.
	Measures	The work coordinates were not able to be calculated from the teaching position. The cause is the following content. 1. Two points are the same position. 2. Three points line up on the straight line. Confirm and correct the teaching position.
L2041	Error message	Can't calculate frame transformation coordinates
	Cause	The position data that defines the coordinate system used with frame transformation are on the same point or arranged on a straight line so the coordinate system could not be calculated.
	Measures	Change the position data to appropriate positions so the coordinate system can be calculated.
L2042	Error message	Frame transformation coordinates are not set
	Cause	Frame transformation was attempted even though the coordinate system for frame transformation was not set.
	Measures	Set the coordinate system or cancel frame transformation. Check that the MvSpl command argument <Frame transformation> designation is correct.
L2050	Error message	CPU processing time exceeds
	Cause	Because the function made effective is many at the same time
	Measures	The CPU processing time exceeded the limiting value. Please take measures of either of following. 1) If interference avoidance function is activated, changes some cylinder models into the sphere model, or reduces the number of the models for checking . 2) Invalidate some functions of following. Interference avoidance, User definition area, Free plane limit, Collision detection, Compliance, Tracking, Force sense 3) Reduces the Interrupt definition function currently used by the program.
H2090	Error message	In interference zone n (n indicates the zone number (1 to 32).)
	Cause	Movement outside the user-defined area "n" range was attempted.
	Measures	Adjust the position.
H211n (n indicates the plane number (1 to 8).)	Error message	Free plane n overrun
	Cause	Movement outside the plane defined with free plane "n" was attempted.
	Measures	Adjust the position.
H2129	Error message	Free plane limit data illegal
	Cause	The free plane data setting value is illegal.
	Measures	The two points are the same in the three points of parameter: SFCnp. The value of parameter: SFCnAT is except "0, 1, -1".
H213n (n indicates the plane number (1 to 8).)	Error message	Jn Speed is excessive (command)
	Cause	The speed instruction value of n axis exceeded the permissible value. When moving by the linear interpolation (or circle interpolation), needs to rotate the motor at the big speed depending on the pose. If the specified speed is large, the speed instruction value to the motor may exceed the permissible value.
	Measures	Please lower moving speed by the Ovrd command and Spd command or change the movement position.

Error No.	Error cause and measures	
H214n (n indicates the plane number (1 to 8).)	Error message	Jn +ABS limit over
	Cause	The axis "n" + ABS limit was exceeded.
	Measures	Referring to "Operation to Temporarily Reset an Error that Cannot Be Canceled" in the separate volume, "Instruction Manual/Detailed Explanation of Functions and Operations", reset the error and move the axis "n" within the operation range using JOG operation.
H215n (n indicates the plane number (1 to 8).)	Error message	Jn -ABS limit over
	Cause	The axis "n" - ABS limit was exceeded.
	Measures	Referring to "Operation to Temporarily Reset an Error that Cannot Be Canceled" in the separate volume, "Instruction Manual/Detailed Explanation of Functions and Operations", reset the error and move the axis "n" within the operation range using JOG operation.
H216n (n indicates the plane number (1 to 8).)	Error message	Jn (+) angle exceeds the limit
	Cause	The axis "n" + Joint limit was exceeded. When the teach mode, numerical "0" is set to n.
	Measures	Adjust the position.
H217n (n indicates the plane number (1 to 8).)	Error message	Jn (-) angle exceeds the limit
	Cause	The axis "n" - Joint limit was exceeded. When the teach mode, numerical "0" is set to n.
	Measures	Adjust the position.
H2181	Error message	X(+) data exceeds the limit
	Cause	The X axis + XYZ limit was exceeded.
	Measures	Adjust the position.
H2182	Error message	Y(+) data exceeds the limit
	Cause	The Yaxis + XYZ limit was exceeded.
	Measures	Adjust the position.
H2183	Error message	Z(+) data exceeds the limit
	Cause	The Z axis + XYZ limit was exceeded.
	Measures	Adjust the position.
H2191	Error message	X(-) data exceeds the limit
	Cause	X(-) data exceeds the limit.
	Measures	Adjust the position.
H2192	Error message	Y(-) data exceeds the limit
	Cause	Y(-) data exceeds the limit.
	Measures	Adjust the position.
H2193	Error message	Z(-) data exceeds the limit
	Cause	Z(-) data exceeds the limit.
	Measures	Adjust the position.

Error No.	Error cause and measures	
H220m (m indicates The monitoring plane number (1 to 8).)	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	SLP (ROBOT position error: CMD Plane)
	Cause	SLP detected the robot position CMD over the monitoring plane.
	Measures	Please confirm the robot movement or related parameter setting.
	Error message	SLP (ROBOT position error: FB Plane)
	Cause	SLP detected the robot position FB over the monitoring plane.
	Measures	Please confirm the robot movement or related parameter setting.
	Error message	SLP (ROBOT position error: CMD Area)
	Cause	SLP detected the robot position CMD over the monitoring area.
	Measures	Please confirm the robot movement or related parameter setting.
	Error message	SLP (ROBOT position error: FB Area)
	Cause	SLP detected the robot position FB over the monitoring area.
	Measures	Please confirm the robot movement or related parameter setting.
H221n (n indicates the axis number (1 to 8).)	Error message	STR (ROBOT torque error)
	Cause	Safety Torque Range monitoring detected over the torque limit.
	Measures	A feedback torque in excess of the predetermined allowable torque width is detected by the torque width monitoring function.
H222m * (m indicates the DSI number (1 to 8).)	Error message	DSI inconsistency
	Cause	The duplex DSI status is not consistent.
	Measures	The duplex DSI signal ON/OFF status is not consistent. Check the following for the DSI. • DSI wiring • Duplex signal ON/OFF status • ON/OFF status switching timing (The error occurs when the ON/OFF status remains inconsistent between the duplex signals for about 0.1 seconds or more.)
H2230 *	Error message	Mismatch of Dual Safety Output
	Cause	State of the redundant wiring do not match (Dual Safty Output).
	Measures	Turn the power OFF and ON once. If the same error recurs, contact the manufacturer.
H2231 *	Error message	Mismatch of Dual Safety Output Feedback
	Cause	State of Dual Safty Output and the feeedback do not match.
	Measures	Turn the power OFF and ON once. If the same error recurs, contact the manufacturer.
H2240 *	Error message	Origin data change
	Cause	The origin data is changed during execution of the position monitoring function.
	Measures	The error occurs when the origin data is changed by setting the origin during execution of the position monitoring function. After turning OFF the power, turn ON the power again to reset the error.

Error No.	Error cause and measures	
C2250	Error message	Safety function execution disabled (No origin setting)
	Cause	The safety function cannot be executed because the origin is not set.
	Measures	The safety monitoring function is not activated when the origin is not set. Set the origin.
H2260 *	Error message	Safety function execution disabled (No extended safety unit)
	Cause	The extended safety unit of the robot safety option is not connected.
	Measures	To use the safety monitoring function, it is necessary to connect the extended safety unit of the robot safety option to the controller. Connect the extended safety unit. If the error occurs even if the extended safety unit is connected, the extended safety unit may be faulty. Contact your service provider.
H2261 *	Error message	Extended safety unit's No. error
	Cause	The extended safety unit’s station No. is illegal.
	Measures	Set the extended safety unit’s station No. to 2.
H2270	Error message	Cannot servo ON (SS1/STO active)
	Cause	The servo cannot be turned ON while SS1/STO is active.
	Measures	Disable SS1 before turning the servo ON.
H2280	Error message	SS1 deceleration time exceeded
	Cause	The robot didn't stop within deceleration time from SS1 enabled.
	Measures	Please confirm the robot movement and the load, stop speed parameter (SFSPZERO) setting.
H2281	Error message	SS2 deceleration time exceeded
	Cause	The robot didn't stop within deceleration time from SS2 enabled.
	Measures	Please confirm the robot movement and the load, stop speed parameter (SFSPZERO) setting.
H2282	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	SOS (Position error)
	Cause	Detect the change of position FB on SOS.
	Measures	An error that the position FB has changed on SOS due to external force was detected. Eliminate the cause of the external force or perform the risk assessment. Then modify the value of the parameter "SOSTLRNC" to extend the acceptable range of SOS.
	Error message	SOS (Speed error)
	Cause	Detect FB speed over on SOS.
	Measures	Please check external force or related parameter settings.
	Error message	SOS (Position command error)
	Cause	Detect the change of position CMD on SOS.
	Measures	Please confirm the robot movement or related parameter setting.
	Error message	SOS (Speed command error)
	Cause	Detect CMD speed over on SOS.
	Measures	Please confirm the robot movement or related parameter setting.

Error No.	Error cause and measures	
H230n (n indicates the axis number (1 to 8).)	Error message	SLS (Joint Speed Error)
	Cause	Speed monitor detected the speed over.
	Measures	A speed feedback exceeding the limit speed is detected by the speed monitoring function. Check the robot movement or the monitoring speed setting. Or else, check the delay time (parameterSLSDLY) setting.
H231n (n indicates the direction in which an error is detected, 1:Composite speed, 2: X+, 3: X-, 4: Y+, 5: Y-, 6: Z+, 7: Z-)	Error message	SLS (XYZ Speed Error)
	Cause	Speed monitor detected the speed over.
	Measures	A speed feedback exceeding the limit speed is detected by the speed monitoring function. Check the robot movement or the monitoring speed setting. Or else, check the delay time (parameterSLSDLY) setting.
H2320	Error message	SF robot control error
	Cause	The robot motion command and the feedback are inconsistent.
	Measures	The robot position command and the feedback position are inconsistent. Check the details of the robot movement, the terminal load setting, or interference with the peripheral equipment.
H2370 *	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	SF (Process error)
	Cause	The Safety Function is not normally executed.
	Measures	Turn the power OFF and ON once. If the same error recurs, contact the manufacturer.
	Error message	SF (Process Counter error)
	Cause	The Safety Function of servo CPU is not normally executed.
	Measures	Turn the power OFF and ON once. If the same error recurs, contact the manufacturer.
L240n (n: Robot CPU No.)	Error message	Collision avoidance detect (*) Note) "(*)": shows the detected model. (the the lower digit of the parameter for the model registry)
	Cause	A collision avoidance was detected.
	Measures	Release the collision avoidance state.
L241n (n: Robot CPU No.)	Error message	Collision avoidance detect (*) Note) "(*)": shows the detected model. (the the lower digit of the parameter for the model registry)
	Cause	A collision avoidance was detected.
	Measures	Release the collision avoidance state.
L2420	Error message	Collision avoidance comm. error.
	Cause	Collision avoidance comm. error.
	Measures	Check the robot controller.

Error No.	Error cause and measures	
L2421	Error message	A lot of colli. avoidance models
	Cause	A lot of collision avoidance models.
	Measures	Reduce the collision avoidance models.
L2430	Error message	Collision avoidance re-detect
	Cause	Collision avoidance was already detected.
	Measures	Move the robot arm from the interference area and resume the operation.
L2500	Error message	Tracking encoder data error
	Cause	An error was detected in the data of tracking encoder.
	Measures	1) The conveyor rotates at the fixed velocity. 2) The connection of the encoder. 3) The earth of the earth wire.
L2510	Error message	Tracking parameter reverses
	Cause	Tracking parameter [EXCRGM*] Setting value reverses.
	Measures	Check the parameter [EXCRGM*] value.
L2520	Error message	Tracking parameter is range over
	Cause	Tracking parameter [TRBUF] Setting value is range over. Setting range: element 1 = 1 - 8, element 2 = 1 - 64
	Measures	Check the parameter [TRUBF] value.
L2530	Error message	There is no area where data is written
	Cause	There is no area where data is written.
	Measures	Please read the data by using TrRd.
L2540	Error message	There is no read data
	Cause	There is no read data.
	Measures	Please use TrRd after executing TrWrt.
L2560	Error message	Ilegal parameter of Tracking
	Cause	The value of the parameter: EXTENC is outside the range. setting range: 1 - 8.
	Measures	Please check the value of parameter.
L2580	Error message	No workpiece in the tracking area
	Cause	There is no workpiece in the tracking buffer or “TrkMv On” command is executed. Before the workpiece enters to the tracking area.
	Measures	Execute “TrkMv On” command when the workpiece is in the tracking area.
L2601	Error message	Start pos. exseeds the limit
	Cause	The start position is outside the operation range.
	Measures	Adjust the position.
L2602	Error message	DSTN pos. exseeds the limit
	Cause	The target position is outside the operation range.
	Measures	Adjust the position.

Error No.	Error cause and measures	
L2603	Error message	Med pos. data exseeds the limit
	Cause	The intermediate position is outside the operation range.
	Measures	Adjust the position.
L2610	Error message	Spline interpolation error (Spline file)
	Cause	An error related to the spline file occurred.
	Measures	Refer to the error details No. and check the details of the occurring error. Then take actions for those error details.
	Error message	Can't open spline file
	Cause	The spline file corresponding to the spline No. designated with the MvSpl command could not be opened.
	Measures	Check that the spline No. designation is correct, and that the target spline file is saved in the controller.
	Error message	Spline file is broken
	Cause	The spline file contents did not match the checksum.
	Measures	Open the target spline file and check the contents. Then, save the file again to recreate the spline file. Write the new file to the controller again.
	Error message	Spline file is not supported
	Cause	The designated spline file cannot be used with the current controller.
	Measures	Check the spline file and controller versions. It may be necessary to upgrade the software version.
	Error message	Can't change spline file
	Cause	The target spline file is currently being used for spline interpolation (file is open).
	Measures	A spline file currently being used for spline interpolation (file is open) cannot be exported to the controller, deleted or renamed. Carry these out after spline interpolation ends.
	Error message	Can't get data
	Cause	The spline file is closed so the data cannot be retrieved.
	Measures	Reset the program, and then execute the MvSpl command again.
	Error message	The setting of Ex-T is illegal
	Cause	The setting of Ex-T is illegal.
	Measures	Please confirm the number and the content of the file.
	Error message	Cannot make the spline file
	Cause	The specified spline file is opened already.
	Measures	Please confirm the specified number.

Error No.	Error cause and measures	
L2611	Error message	Spline interpolation error (path point)
	Cause	An error related to the path point registered in the spline file has occurred.
	Measures	Refer to the error details No. and check the details of the occurring error. Then take actions for those error details.
	Error message	Path points are too close (nnnn)
	Cause	The distance between path points is too short, or the speed command in respect to the path point distance is too high.
	Measures	"nnnn" in the error message indicates the path point No. causing the error. Review this path point's position, or review the spline interpolation command speed.
	Error message	The posture variation is too large (nnnn)
	Cause	The variation in posture between path points is too large. (The posture variation angle exceeds 150 degrees.)
	Measures	"nnnn" in the error message indicates the path point No. causing the error. Review the posture so that the posture variation amount for this path point is smaller, or add a path point to reduce the posture variation amount in the single block.
	Error message	Path point's configuration flag is incorrect (nnnn)
	Cause	A different path point is registered for the configuration flag value.
	Measures	"nnnn" in the error message indicates the path point No. causing the error. Review this path point's position, and change it so it is the same configuration flag as the other path points.
	Error message	Path point is not registered
	Cause	The Specified path point is not registered.
	Measures	Please confirm the number and the content of the file.
	Error message	Cannot open the path point file.
	Cause	The specified path point file does not exist.
	Measures	Please confirm the file name and existence of the file.
	Error message	The format of file is different
	Cause	The format of file is different.
	Measures	Please confirm the format of the file.
	Error message	The number of point is illegal
	Cause	The number of path point is illegal.
	Measures	Please confirm the file and the content of the file.

Error No.	Error cause and measures	
L2612	Error message	Spline interpolation error (Execution error)
	Cause	An error related to the spline interpolation execution conditions occurred.
	Measures	Refer to the error details No. and check the details of the occurring error. Then take actions for those error details.
	Error message	This robot does not support spline interpolation
	Cause	Spline interpolation was attempted with a robot that does not support spline interpolation.
	Measures	Use a different movement command than spline interpolation.
	Error message	Can't execute with these start conditions
	Cause	Spline interpolation was attempted with a robot program in a slot having the start conditions ALWAYS•ERROR.
	Measures	Spline interpolation cannot be executed with a slot having the start conditions ALWAYS•ERROR. Delete spline interpolation or change the start conditions to START.
	Error message	Another spline interpolation is being executed
	Cause	Multiple spline interpolations cannot be executed simultaneously.
	Measures	Check whether spline interpolation was attempted with a different robot during spline interpolation, or whether spline interpolation was directly attempted while spline interpolation was halted.
	Error message	Can't execute step return
	Cause	Step return was attempted in respect to spline interpolation.
	Measures	Spline interpolation does not support the step return operation. Do not attempt step return.

Error No.	Error cause and measures	
L2613	Error message	Spline interpolation error (interpolation process)
	Cause	An error occurred during the spline interpolation process.
	Measures	Refer to the error details No. and check the details of the occurring error. Then take actions for those error details.
	Error message	Not enough path points
	Cause	There are less than four path points registered in the spline file.
	Measures	At least four path points are required to execute spline interpolation. Use a spline file in which four or more path points are registered.
	Error message	Not enough arc designated points (nnnn)
	Cause	Three consecutive path points are not designated for the spline interpolation arc.
	Measures	The number of points in the arc containing the path point No. "nnnn" displayed in the error message is insufficient. To generate an arc, an arc for three consecutive path points must be designated. This error occurs if there are only two consecutive points. Add another path point in the arc designation to move with an arc path.
	Error message	Block data calculation error (ssssssss)
	Cause	An error occurred in the process to calculate the data related to the spline interpolation block.
	Measures	The details of the error differ according to "ssssssss" in the error message. • Reg.Pt.: The information on the number of path points saved in the spline file does not match the number of path points actually registered. Open the spline file in the Spline File Edit screen once, save it again and export it to the controller. • Cir.Arc: The arc could not be generated. Check that the path points for the arc designation are not arranged on a straight line. • Frm.Cnv.: The frame transformation calculation failed. Review the path point positions. • Blk.Stp.: Generation of the data for the block stopped, and spline interpolation could not be executed. Reset the program. • PtoJ.: The joint angle cannot be calculated at the position. Review the path point positions.
	Error message	Block data does not exist
	Cause	The load in the process for the controller during spline interpolation was large, and the data for the spline interpolation block could not be generated in time.
	Measures	Check whether the load in the spline interpolation execution process can be reduced in the following ways. • Stop simultaneous execution of functions related to movement such as the collision detection function or visual control function. • Review the multi-tasks and reduce the number of slots executed simultaneously. • Reduce the dedicated output signal assignments. • Reduce the spline interpolation command speed.
	Error message	Spline interpolation command calculation error (nnnn)
	Cause	An error occurred in the process for calculating the spline interpolation position commands.
	Measures	Review the position of path point No. "nnnn" indicated in the error message or the MvSpl command argument’s setting value. Check that the cancel angle is set correctly. (Does the spline curve bend suddenly?)

Error No.	Error cause and measures	
L2614	Error message	Spline interpolation error (other functions)
	Cause	A function that cannot be used with the spline interpolation was executed.
	Measures	Refer to the error details No. and check the details of the occurring error. Then take actions for those error details.
	Error message	Tracking function is enabled
	Cause	The tracking function was enabled when attempting spline interpolation.
	Measures	Spline interpolation and tracking function cannot be executed simultaneously. Disable the tracking function before executing spline interpolation.
	Error message	Can't change tool/base setting
	Cause	The tool/base setting was changed during spline interpolation execution.
	Measures	The tool/base setting cannot be changed during spline interpolation (including when halted). Change the settings after spline interpolation ends.
	Error message	Can't execute Jrc command
	Cause	The Jrc command was executed during spline interpolation.
	Measures	The Jrc command cannot be executed during spline interpolation (including when halted). Execute the command after spline interpolation ends.
L2615	Error message	Spline interpolation error (exceeds setting range)
	Cause	A setting value related to spline interpolation exceeds the setting range.
	Measures	Refer to the error details No. and check the details of the occurring error. Then take actions for those error details.
	Error message	M_SplVar setting value exceeds setting range
	Cause	A value exceeding the range was substituted into M_SplVar.
	Measures	Substitute a value within the setting range (0 to 32767).
	Error message	M_SplVar setting range exceeds setting range (nnnn)
	Cause	A value exceeding the setting range is set in the spline file.
	Measures	Change the setting for the path point No. "nnnn" indicated in the error message so it is within the range (–1 to 32767).
	Error message	Tolerance setting value exceeds range (nnnn)
	Cause	The tolerance designation in the spline file exceeds the range.
	Measures	Change the tolerance designation for the path point No. "nnnn" indicated in the error message so it is within the range (0 to 100).
	Error message	Output signal exceeds range (nnnn)
	Cause	The head No. for the signal output in the spline file exceeds the range.
	Measures	Change the head No. of the signal output for the path point No. "nnnn" indicated in the error message so it is within the range (–1 to 32767).
	Error message	Interpolation setting information exceeds range
	Cause	Data with value exceeding the range was found in the spline file interpolation setting information.
	Measures	Open the target spline file and check the contents. Then, save the file again to recreate the spline file. Write the new file to the controller again.
	Error message	Header information exceeds range
	Cause	Data with value exceeding the range was found in the spline file header information.
	Measures	Open the target spline file and check the contents. Then, save the file again to recreate the spline file. Write the new file to the controller again.

Error No.	Error cause and measures	
L2621	Error message	Tracking function is enabled
	Cause	The tracking function and Ex-T control function cannot be enabled simultaneously.
	Measures	When using the Ex-T control function, disable the tracking function.
L2622	Error message	Singular point passage function is enabled
	Cause	The singular point passage function and Ex-T control function cannot be enabled simultaneously.
	Measures	When using the Ex-T control function, disable the singular point passage function.
H264n (n indicates the axis number (1 to 8))	Error message	Add axis FLS signal is input
	Cause	Add axis FLS signal is input.
	Measures	Release the brake and move the arm by hand. Or, referring to "Operation to Temporarily Reset an Error that Cannot Be Canceled" in the separate volume "Instruction Manual/Detailed Explanation of Functions and Operations", reset the error and move the axis "n" within the operation range using JOG operation.
H265n (n indicates the axis number (1 to 8))	Error message	Add axis RLS signal is input
	Cause	Add axis RLS signal is input.
	Measures	Release the brake and move the arm by hand. Or, referring to "Operation to Temporarily Reset an Error that Cannot Be Canceled" in the separate volume "Instruction Manual/Detailed Explanation of Functions and Operations", reset the error and move the axis "n" within the operation range using JOG operation.

Error No.	Error cause and measures	
L2660	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Error concerning axis coop
	Cause	The error concerning the axis coop occurred.
	Measures	Please Confirm the content by a detail number of the error.
	Error message	Illegal robot No. (axis trk)
	Cause	The designated robot No. is illegal.
	Measures	Set the correct robot No.
	Error message	Illegal axis No. (axis trk)
	Cause	The designated axis No. is illegal.
	Measures	Set the correct axis No.
	Error message	Illegal unit system (axis trk)
	Cause	A rotary axis is designated.
	Measures	Please designate a linear drive axis.
	Error message	Origin unsetting (axis trk)
	Cause	Axis tracking cannot be executed because of origin unsetting.
	Measures	Please set the origin and turn the power OFF and ON.
	Error message	Illegal robot No. (base coop)
	Cause	The designated robot No. is illegal.
	Measures	Set the correct robot No.
	Error message	Illegal axis No. (base coop)
	Cause	The designated axis No. is illegal.
	Measures	Set the correct axis No.
	Error message	Illegal unit system (base coop)
	Cause	A rotary axis is designated.
	Measures	Please designate a linear drive axis.
	Error message	Origin unsetting (base coop)
	Cause	Base coop cannot be executed because of origin unsetting.
	Measures	Please set the origin and turn the power OFF and ON.

Error No.	Error cause and measures	
L2661	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Error concerning axis coop (combi.)
	Cause	The function cannot be used at the same time with the axis coop.
	Measures	Please confirm the content by a detailed number of the error.
	Error message	Cannot be used (axis trk)
	Cause	A synchronous addition axis control is effective.
	Measures	Invalidate a synchronous addition axis control.
	Error message	Cannot be used (base coop)
	Cause	Tracking function is effective.
	Measures	Invalidate the tracking function.
	Error message	Cannot be used (base coop)
	Cause	A synchronous addition axis control is effective.
	Measures	Invalidate a synchronous addition axis control.
	Error message	Jrc cannot be executed
	Cause	The base coop is executing.
	Measures	Please do not use Jrc command.
	Error message	Interpolation cannot be executed
	Cause	An addition axis is going to move.
	Measures	Please do not move an addition axis.
	Error message	Cannot be used (base coop)
	Cause	Interference avoidance function is effective.
	Measures	Invalidate the interference avoidance function.
L2662	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Work setting cannot be changed
	Cause	The additional axis tracking is executing.
	Measures	Please change after the work coop is invalid.
	Error message	This work cannot use
	Cause	The setting is not done (axis trk).
	Measures	Please confirm a set valuse and then execute.
H2663	Error message	Origin data was changed
	Cause	Origin data was changed about the base cooperation target axis.
	Measures	Turn the power OFF and ON once.
L2700	Error message	Cmp error (different mode)
	Cause	The designated mode is different from the current mode.
	Measures	Execute Cmp Off and then designate.
C2710	Error message	Cmp error (displacement)
	Cause	The displacement magnitude of the compliance operation exceeded the specified value.
	Measures	Correct the program, position or other item so that the displacement magnitude can be reduced.

Error No.	Error cause and measures	
H2720	Error message	Cmp error (joint angle)
	Cause	Cmp Command exceeds the limit of a joint angle.
	Measures	Adjust the position data or reduce the displacement.
C272n (n indicates the axis number (1 to 8).)	Error message	Cmp error (Jn joint angle)
	Cause	Cmp Command exceeds the limit of joint angle of joint "n" axis.
	Measures	Change the position data or reduce displacement.
C273n (n indicates the axis number (1 to 8).)	Error message	Cmp error (Jn axis speed)
	Cause	Cmp Command exceeds the limit of speed of joint "n" axis.
	Measures	Change the position data or slow down.
C2740	Error message	Cmp error (coordinates conv.)
	Cause	An error was detected in the coordinates conversion of Cmp command.
	Measures	Adjust the position data.
L2750	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Cannot execute while tracking
	Cause	Cannot execute while tracking.
	Measures	Execute Trk Off and then execute.
	Error message	Unable to disable force sense control. (Tracking being performed)
	Cause	Unable to disable force sense control while tracking function being executed.
	Measures	Try again after disabling the tracking function.
H2760	Error message	The force sense control offset limit was reached
	Cause	The robot attempted to move beyond the force sense control offset limit.
	Measures	Check whether there is a problem with robot movement while force sense control is enabled. (The offset limit is the value set in parameter FSCORMX.)
H2770	Error message	Outside offset position movement range (**) Note) "**" is substituted with "±Jn" (n is axis No.)
	Cause	The position after force sense control offset lies outside the range. The robot may have been moved near the movement range limit.
	Measures	Review the movement position or force sense control settings, and ensure that the offset position does not exceed the movement range.
H2780	Error message	Offset position speed over (**) Note) "**" is substituted with "Jn" (n is axis No.)
	Cause	The speed of movement to the position after offsetting with force sense control exceeded the speed limit. The movement speed may be too fast, or the robot may have been moved at the singular point adjacent.
	Measures	Review the movement speed and movement position, or the force sense control settings.
L2800	Error message	Illegal position data
	Cause	This may occur for a position to which the robot cannot reach.
	Measures	Adjust the position.
L2801	Error message	Illegal position data (start)
	Cause	This may occur for a starting position to which the robot cannot reach.
	Measures	Adjust the position.

Error No.	Error cause and measures	
L2802	Error message	Illegal position data (dstn)
	Cause	This may occur for a ending position to which the robot cannot reach.
	Measures	Adjust the position.
L2803	Error message	Illegal assisting position data (intmed)
	Cause	The intermediate path at the straight line interpolation and the route at circle interpolation are the position which the robot cannot move.
	Measures	Confirm the error occurrence line and confirm that there is no position which the robot cannot move. And please correct the data of starting position, midway position, or ending position.
L2810	Error message	Posture flag is disagree
	Cause	The structure flag of the start point and end point don't match.
	Measures	Adjust the position data.
H2820	Error message	Illegal Accel ratio
	Cause	This occurs when the acceleration/deceleration ratio is too small.
	Measures	Adjust the acceleration/deceleration ratio to a larger value.
H2830	Error message	System error (ipol posture type)
	Cause	The Type argument of the Mov instruction was set to -1 or a similar value.
	Measures	Change the Type argument of the Mov instruction to a correct value (0, 1, etc).
H2840	Error message	System error (ipol parameters)
	Cause	The parameter may have been damaged.
	Measures	If it comes back, contact your service provider.
H2850	Error message	System error (ipol norm)
	Cause	The norm is illegal. A problem occurred in internal computation processing.
	Measures	If it comes back, contact your service provider.
H2860	Error message	System error (ipol type)
	Cause	An illegal interpolation process method is being used. A problem occurred in internal computation processing.
	Measures	If it comes back, contact your service provider.
H2870	Error message	System error (ipol data undef)
	Cause	The interpolation position data has not been defined. A problem occurred in internal computation processing.
	Measures	If it comes back, contact your service provider.
H2880 *	Error message	System error (ipol data area)
	Cause	The memory is insufficient for the inside operation.
	Measures	If it comes back, contact your service provider.
H2890	Error message	System error (undefined err)
	Cause	An undefined error number was generated in internal computation processing.
	Measures	If it comes back, contact your service provider.
L2900	Error message	System ERROR M00 to M04
	Cause	An error occurred in the internal processing.
	Measures	If it comes back, contact your service provider.

Error No.	Error cause and measures	
L3100	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Processor Call Stack over
	Cause	Too many function calls or local variables.
	Measures	Correct the program and re-execute.
	Error message	System ERROR (Call Stack)
	Cause	Processor Call Stack defect.
	Measures	Possible problem with execution sequence of Function command.
L3110	One of the errors below is detected. Please take measures corresponding to an error message. Refer to the separate manual, “Instruction Manual/Detailed Explanation of Functions and Operations” or “Instruction Manual/Force Sensor Function” in details.	
	Error message	Arg. value range over
	Cause	Arg. value is outside range.
	Measures	Please confirm the range of the argument and set a correct value.
	Error message	The force sense control command argument lies outside the range
	Cause	A value outside the range was set for the force sense control command argument.
	Measures	Check the argument range and set a correct value.
	Error message	The force sense control status variable argument lies outside the range
	Cause	A value outside the range was set for the force sense control status variable argument.
	Measures	Check the argument range and set a correct value.
	Error message	The force sense control related argument lies outside the range
	Cause	A value outside the range was set for the force sense control related argument.
	Measures	Check the argument range and set a correct value.
	Error message	The Mo trigger No. lies outside the range
	Cause	A value outside the range was set for the Mo trigger No.
	Measures	Check the setting range and set a correct value.
	Error message	Def MoTrg command argument error
	Cause	An unusable variable or different mechanical No. was set.
	Measures	Set a usable variable or same mechanical No.
L3120	Error message	No. of arg. is over
	Cause	No. of argument is over.
	Measures	Please confirm the range of the argument and set a correct value.
L3130	Error message	COM file is already opened
	Cause	Opening of a file already opened was attempted.
	Measures	Check the file No. and re-execute.
L3140	Error message	Can't open COM file
	Cause	The file cannot be opened.
	Measures	Check the file No. and re-execute.
L3141	Error message	The NVOpen command is not executed
	Cause	No NVOpen command was executed before execution of a command communicating with the vision sensor.
	Measures	Revise the robot program to execute the NVOpen command.

Error No.	Error cause and measures	
L3142	Error message	The communication line can not be opened
	Cause	The line for communication with the vision sensor can not be opened.
	Measures	Check the communication cable or the communications parameters.
L3150	Error message	Cannot Print (INPUT mode)
	Cause	The file open mode is INPUT, so writing is not possible.
	Measures	Check the file No. and open mode, and re-execute.
L3170	Error message	Cannot Input (OUTPUT mode)
	Cause	The file open mode is OUTPUT, so writing is not possible.
	Measures	Check the file No. and open mode, and re-execute.
L3180	Error message	System error (array range over)
	Cause	System error (array range over).
	Measures	If it comes back, contact your service provider.
L3200	Error message	This file is read only
	Cause	The file cannot be read.
	Measures	Check the contents of the file.
L3210	Error message	This variable is write protected
	Cause	Writing of this variable is prohibited.
	Measures	Check the variable protection setting.
L3220	Error message	Nesting over
	Cause	A nest-over error occurred in If of the If instruction or For of the For instruction.
	Measures	Correct the program and re-execute.
L3230	Error message	For Next statements unmatch
	Cause	The No. of For and Next statements do not match.
	Measures	Correct the program and re-execute.
L3240	Error message	Nesting over (For, While)
	Cause	Nesting over (For, While).
	Measures	Correct the program and re-execute.
L3250	Error message	While WEnd statements unmatch
	Cause	The No. of While and WEnd statements do not match.
	Measures	Correct the program and re-execute.
L3251	Error message	Number of jump destination exceeds 32
	Cause	The number of branches defined exceeded 32.
	Measures	Correct the program and re-execute.
L3252	Error message	If EndIf statements unmatch
	Cause	If EndIf statements unmatch.
	Measures	Correct the program and re-execute.
L3253	Error message	Nesting over (If, EndIf)
	Cause	Nesting over (If, EndIf).
	Measures	Correct the program and re-execute.
L3254	Error message	Select - End Select statements unmatch
	Cause	Select - End Select statements unmatch.
	Measures	Correct the program and re-execute.

Error No.	Error cause and measures	
L3255	Error message	If Else statements unmatch
	Cause	If Else statements unmatch.
	Measures	Correct the program and re-execute.
L3256	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Function definition error
	Cause	The error concerning the function definition occurred.
	Measures	Please confirm the content by a detailed number of the error.
	Error message	Function definitions exceeds max.
	Cause	The number of function definitions exceeds 256.
	Measures	Correct the program and re-execute.
	Error message	Function statement is incorrect
	Cause	Function statement position is incorrect.
	Measures	Correct the program and re-execute.
	Error message	Function FEnd statemets unmatch
	Cause	Function FEnd statemets unmatch.
	Measures	Correct the program and re-execute.
	Error message	Undefined function
	Cause	The called function or the assigned function is undefined.
	Measures	Please confirm the function procedure name.
	Error message	Function Main called
	Cause	Function Main called.
	Measures	Function Main cannot be called.
	Error message	Function Main does not exist
	Cause	Programs that there is no Function Main cannot be executed.
	Measures	Please add Function Main (parameterless) to the program.
	Error message	Local var. in function was used
	Cause	A local variable in the function procedure was used.
	Measures	Local variables in a function procedure cannot be used.

Error No.	Error cause and measures	
L3257	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Include declaration error
	Cause	The error concerning the include declaration occurred.
	Measures	Please confirm the content by a detailed number of the error.
	Error message	Include declaration exceeds max
	Cause	The number of include declarations exceeds 64.
	Measures	Correct the program and re-execute.
	Error message	Include statement is incorrect
	Cause	Include statement position is incorrect.
	Measures	Correct the program and re-execute.
L3258	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Preprocessor error
	Cause	The error concerning the preprocessor occurred.
	Measures	Please confirm the content by a detailed number of the error.
	Error message	Preprocessor run line exceeds max
	Cause	Preprocessor execution line exceeds 100 lines.
	Measures	Correct the program and re-execute.
	Error message	Preprocessor run error
	Cause	Commands that can not execute by the preprocessor are included.
	Measures	Correct the program and re-execute.
L3260	Error message	Cannot exec for all slots
	Cause	Execution with all slots designated is not possible.
	Measures	Designate an individual slot and try again.
L3270	Error message	The command size is exceeded
	Cause	The command size is exceeded.
	Measures	Specify within single-byte 256 characters.
L3280	Error message	Cannot execute without GetM
	Cause	The command you attempted to execute cannot be executed without GetM. Or, a non-existing mechanical number was specified.
	Measures	Execute it after executing the RelM and GetM commands in another task slot.
L3281	Error message	Cannot execute during RUN
	Cause	Cannot execute during operation.
	Measures	Cannot execute during operation.
L3282	Error message	"Can't RUN (not select, attribute)"
	Cause	The program is not selected or the attribute is illegal.
	Measures	Load the program into the specified task slot. Or, change the program attributes.
L3285	Error message	Cannot execute (RUN or WAI)
	Cause	can't execute in the state of stopping or executing.
	Measures	Reset the program (cancel the abort status).

Error No.	Error cause and measures	
L3286	Error message	Program is empty
	Cause	Execution of an empty program was attempted.
	Measures	Make the program or select the correct program.
L3287	Error message	Cannot execute (ERROR ALWAYS)
	Cause	This command cannot be used when the start conditions are ERROR and ALWAYS.
	Measures	Correct the program.
L3288	Error message	Cannot execute while editing
	Cause	That program cannot be executed because it is being edited.
	Measures	Finish editing the program first, and then start it.
L3289	Error message	Program does not exist (SLT*)
	Cause	The program designated in the slot table does not exist.
	Measures	Correct the slot parameter.
L3290	Error message	System slot cannot be executed
	Cause	The system slot cannot be executed.
	Measures	Check whether another slot (user slot) is being operated.
L3300	Error message	User slot cannot be executed
	Cause	A user slot cannot be executed.
	Measures	Check whether the system slot is being operated.
L3310	Error message	Cannot execute XRun (Runing)
	Cause	XRun is not possible as the designated slot is operating.
	Measures	Stop the specification slot, and execute.
L3320	Error message	Cannnot execute XRun (empty)
	Cause	XRun is not possible as the program has not been selected.
	Measures	Specify program name to the argument or execute XLoad.
L3330	Error message	Cannnot execute XStp (empty)
	Cause	XStp is not possible as the program has not been selected.
	Measures	Correct the program, and execute.
L3340	Error message	Cannnot execute XRst (empty)
	Cause	XRst is not possible as the program has not been selected.
	Measures	Resetting is possible in the state of waiting only.
L3350	Error message	Cannnot execute XRst (Running)
	Cause	Xrst is not possible as the program is executing.
	Measures	Stop execution, and do it.
L3360	Error message	Cannnot execute XLoad (not PSA)
	Cause	XLoad cannot be executed when the program cannot be selected.
	Measures	Execute XRst, and do it.
L3361	Error message	Can not load the program (SLT*)
	Cause	A non-existing program was specified in the slot parameter (SLTn).
	Measures	A non-existing program was specified in the slot parameter (SLTn).

Error No.	Error cause and measures	
L3370	Error message	Cannnot execute XClr (empty)
	Cause	XClr is not possible as the program has not been selected.
	Measures	XClr can only be executed to enable program selection.
L3380	Error message	Cannnot execute XClr (not PSA)
	Cause	Program selection is not enabled.
	Measures	Execute XClr after resetting the program (canceling the abort status).
L3390	Error message	Cannot use arc pallet
	Cause	Cannot use arc pallet.
	Measures	Change to another method.
L3400	Error message	System error (PROC stack over)
	Cause	System error. (Processor stack overflow)
	Measures	If it comes back, contact your service provider.
L3500	Error message	Illegal format input (Input)
	Cause	The type of the variable specified by Input and the type of the received data do not match.
	Measures	Check the format.
L3501	Error message	Illegal Receive data (EBREAD)
	Cause	Type is different (receive data and specified variable).
	Measures	Please confirm specified tag data of the vision.
L3600	Error message	Jump destination does not exist
	Cause	No jump destination was found for the Def Act, On Com and On GoTo commands.
	Measures	Check the jump destination.
L3601	Error message	Jump destination is incorrect
	Cause	Jumping into program control block is prohibited.
	Measures	Correct the program and re-execute.
L3700	Error message	Undefined variable
	Cause	It was attempted to reference a variable that has not been initialized.
	Measures	Define a variable, enter an initial value, and then use it.
L3710	Error message	Nesting over (CallP)
	Cause	Program Call is used more than the limitation.
	Measures	Reduce the call count of CallP (nesting).
L3720	Error message	RC NX statements unmatch
	Cause	RC NX statements unmatch.
	Measures	Match the numbers of RC and NX.
L3750	Error message	Illegal positions (Def Plt)
	Cause	Multi rotation flag (FL2 J1/J4 axis) is different.
	Measures	Specify position to become the same multi rotation flag.
L3760	Error message	Illegal positions (Def Plt)
	Cause	J1 or J4 axis is greatly changed (Def Plt).
	Measures	Specify positions to be not different greatly.

Error No.	Error cause and measures	
L3770	Error message	This is an undefined Mo trigger
	Cause	An attempt was made to use an undefined Mo trigger.
	Measures	Define the specified Mo trigger before use.
L3780	Error message	Cannot use the MELFA Smart Plus
	Cause	The MELFA Smart Plus card or MELFA Smart Plus card pack is not installed in the controller. When the MELFA Smart Plus card is installed, the setting of the parameter SMART+1 may be set incorrectly.
	Measures	Install the MELFA Smart Plus card or MELFA Smart Plus card pack. Set the parameter SMART+1 correctly.
L3781	Error message	Cannot use the MELFA Smart Plus
	Cause	The MELFA Smart Plus card or MELFA Smart Plus card pack is not installed in the controller. When the MELFA Smart Plus card is installed, the setting of the parameter SMART+1 may be set incorrectly.
	Measures	Install the MELFA Smart Plus card or MELFA Smart Plus card pack. Set the parameter SMART+1 correctly.
L3810	Error message	Different argument type
	Cause	The type of an argument in an arithmetic operation, monadic operation, comparison operation or each function is different.
	Measures	Designate the correct argument.
L3820	Error message	Undefined intermediate code
	Cause	A program or system status variable may have been damaged.
	Measures	Restore using the backup data. If the backup data is not available, it is necessary to create a program again.
L3821	Error message	A compilation error occurred
	Cause	There is an error in the input syntax.
	Measures	Check the error number in the error message.
L3830	Error message	Cannot execute GetM
	Cause	GET of the mechanisms is not possible.
	Measures	Check whether the designated mechanisms are being used with a different slot.
L3840	Error message	Return without GoSub
	Cause	Return was executed without using GoSub.
	Measures	Check the program.
L3850	Error message	Undefined PLT
	Cause	The Def Plt command was not executed.
	Measures	Use it after defining a pallet with the Def Plt command.
L3860	Error message	Illegal position data defined
	Cause	There is an error in the position data.
	Measures	Check the position data definition.

Error No.	Error cause and measures	
L3870	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Illegal mecha No. (****) Note) "****" is substituted with the "robot status variable".
	Cause	The designated mecha No. is an invalid value.
	Measures	Please set a correct mecha No.
	Error message	The force sense control status variable mechanical No. is an invalid value
	Cause	An invalid variable was set for the force sense control status variable mechanical No.
	Measures	Set a correct mechanical No.
	Error message	The mechanical No. specified with the Def MoTrg command is an invalid value
	Cause	The mechanical No. specified with the Def MoTrg command is an invalid value.
	Measures	Set a correct mechanical No.
L3880	Error message	Illegal slot No.
	Cause	The task slot number specified in the argument of the system status variables was invalid.
	Measures	Input the correct slot No.
L3890	Error message	System error (make MCODE)
	Cause	An error has occurred when creating an operation instruction. The program may have been damaged.
	Measures	Restore using the backup data. If the backup data is not available, it is necessary to create a program again.
L3900	Error message	JRC Command is disable
	Cause	The JRCEXE parameter is disabled, so it cannot be used.
	Measures	Change the JRCEXE parameter, and then execute.
L3910	Error message	Cannnot execute (JRC 0)
	Cause	JRC 0 can not execute for robot arm axis.
	Measures	Correctly set.
L3930	Error message	This command cannot be executed
	Cause	Collision detection is effective.
	Measures	Repeal collision detection (execute ColChk Off).
L3940	Error message	ColChk cannot be executed
	Cause	An exclusive function is performing with ColChk.
	Measures	Repeal the corresponding function.
L3950	Error message	NOERR cannot be executed
	Cause	Interruption using M_ColSts is invalid.
	Measures	Define interruption using M_ColSts and confirm it.
L3960	Error message	This Act No. cannot be repealed
	Cause	NOERR of collision detection is performed.
	Measures	Repeal this interruption after canceling NOERR.
L3970	Error message	ColChk cannot be performed
	Cause	Collision detection serves as prohibition of use.
	Measures	Change parameter COL into use permission.

Error No.	Error cause and measures	
L3980	Error message	Load mode cannot be specified
	Cause	Prec command is executed.
	Measures	Repeal high accuracy mode (execute Prec Off).
L3982	Error message	Cannot be used (singular point)
	Cause 1	This robot does not correspond to the singular point function.
	Measures 1	Check the argument of Type specification.
	Cause 2	Cmp command is executed.
	Measures 2	Invalidate a compliance mode (execute Cmp Off).
	Cause 3	A synchronous addition axis control is effective.
	Measures 3	Invalidate a synchronous addition axis control.
	Cause 4	Tracking mode is effective.
	Measures 4	Invalidate a tracking mode (execute Trk Off).
	Cause 5	Pre-fetch execution is effective.
	Measures 5	Invalidate a pre-fetch execution.
	Cause 6	This robot is a setting of the multi mechanism.
	Measures 6	Do not use the function of passage singular point.
	Cause 7	ColChk On command is executed.
	Measures 7	Invalidate a collision detection (execute ColChk Off).
H3983	Error message	Cannot execute Cnt movement
	Cause	A structural flag or the angle of the joint is not corresponding.
	Measures	It surely positions it by Dly command etc.
L3984	Error message	Cannot be passsed (singularity)
	Cause	Robot passes position which is very near the singular point.
	Measures	Adjust the teaching position.
H3985	Error message	Cannot be passsed (singularity)
	Cause	Robot passes position which is very near the singular point.
	Measures	Adjust the teaching position.

Error No.	Error cause and measures	
L3986	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Unable to enable force sense control (Sensor)
	Cause	Unable to execute because the force sensor is not connected.
	Measures	Connect the force sensor, or delete the command that cause the error.
	Error message	Unable to enable force sense control. (Cmp command)
	Cause	It is not possible to enable force sense control function while the compliance control function is enabled.
	Measures	The force sense control function and compliance control function cannot be enabled simultaneously. If using the force sense control function, disable the compliance control function.
	Error message	Unable to execute the Cmp command (Force sense control)
	Cause	It is not possible to enable the compliance control function while the force sense control function is enabled.
	Measures	The force sense control function and compliance control function cannot be enabled simultaneously. If using the compliance control function, disable the force sense control function.
	Error message	Unable to enable the collision detection function (Force sense control)
	Cause	It is not possible to enable the collision detection function while force sense control function is enabled.
	Measures	The force sense control function and collision detection function cannot be enabled simultaneously. If using the collision detection function, disable the force sense control function.
	Error message	Unable to enable force sense control (Initialization)
	Cause	It is not possible to perform initialization when starting force sense control.
	Measures	Check the parameter settings.
	Error message	This is the singular point adjacent area (Force sense control)
	Cause	It is not possible to move the singular point adjacent area while the force sense control function is enabled.
	Measures	If moving the singular point adjacent area, disable the force sense control function.
	Error message	The force sense control status is different
	Cause	The force sense control enabled/disabled status when resuming program operation differs from that during program operation.
	Measures	Set the force sense control enabled/disabled status to the correct status. (This occurs only once when resuming program operation.)
	Error message	This function cannot be used
	Cause	This model is not compatible with the executed force sense control function.
	Measures	Do not use this force sense control function. Contact the maker for details on the latest compatibility status.
	Error message	Unable to change tool conversion data (Force sense control)
	Cause	It is not possible to change tool conversion data while the force sense control function is enabled.
	Measures	If changing tool conversion data, disable the force sense control function.
	Error message	Unable to change base conversion data (Force sense control)
	Cause	It is not possible to change base conversion data while the force sense control function is enabled.
	Measures	If changing base conversion data, disable the force sense control function.

Error No.	Error cause and measures	
	Error message	Unable to execute the Jrc command (Force sense control)
	Cause	It is not possible to execute the Jrc command while the force sense control function is enabled.
	Measures	To execute the Jrc command, disable the force sense control function.
	Error message	Disable force sense control
	Cause	JOG operation cannot be performed on your model while the force sense control function is enabled.
	Measures	Disable the force sense control function.
	Error message	Unable to perform offset cancel (Force sense control)
	Cause	It is not possible to perform offset cancel while the force sense control function is enabled.
	Measures	If performing offset cancel, disable the force sense control function.
L3987	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Force sense control is disabled
	Cause	Force sense control is disabled, and so unable to execute the command.
	Measures	Enable the force sense control function.
	Error message	Force sense control is enabled
	Cause	It is not possible to enable force sense control again while already enabled.
	Measures	First disable the force sense control function, and then enable again.
	Error message	Unable to execute the FsGChg command
	Cause	It is not possible to execute the FsGChg command when force control gain change is not complete.
	Measures	Review the program so that the FsGChg command is executed after force control gain change is complete.
	Error message	Unable to output log file
	Cause	FTP processing was not properly performed.
	Measures	Check the FTP related parameter setting. Check the Ethernet cable connection. Check the FTP server settings at the computer.
	Error message	The specified log file does not exist
	Cause	The log file for the No. specified with the FsOutLog command does not exist.
	Measures	Check whether the log file No. is incorrect.
	Error message	Unable to change the force sense status variable
	Cause	The status variable setting is currently being used by the force sense control function and so cannot be changed.
	Measures	If changing the setting, disable the force sense control function.
	Error message	Force sense log commands executed simultaneously
	Cause	It is not possible to create/output another file while creating (FsLog Off command) or outputting .(FsOutLog command) a force sense log file.
	Measures	Process after force sense log file creation/output is complete.
	Error message	Unable to create log file
	Cause	Unable to create a force sense log file.
	Measures	Check the amount of available record space in the robot controller.
	Error message	Unable to execute the Fsc ON command

Error No.	Error cause and measures	
	Cause	It is not possible to execute the Fsc On command while changing the force control gain.
	Measures	Execute the Fsc On command after force control gain change is complete.
	Error message	Unable to perform log data related processing
	Cause	It is not possible to execute FsLog On command file while recording force sense control log data.
	Measures	Execute the FsLog On command after log data recording is complete.
	Error message	Force sense control is enabled
	Cause	The parameter setting is currently being used by the force sense control function and so cannot be changed.
	Measures	If changing the parameter, disable the force sense control function once.
	Error message	Unable to enable the Mo trigger
	Cause	The Mo trigger for the FsCtrg command executed first is enabled.
	Measures	Execute after changing the control characteristics.
	Error message	Mo trigger timeout
	Cause	The Mo trigger did not turn ON within the specified time.
	Measures	Review the Mo trigger conditions and robot program.
	Error message	Unable to execute the FsCTrg command
	Cause	The control characteristics is currently being changed. The Mo trigger for the FsCTrg command executed first is enabled.
	Measures	Execute after changing the control characteristics.
	Error message	Unable to specify the control characteristics change
	Cause	The control characteristics change has been set with another command.
	Measures	Change the program so that the command is not executed at the same time as another command.
H3988	Error message	Unable to create a position command
	Cause	It is not possible to convert linear position data to joint angle after offsetting with force control. The position after offsetting lies outside the movement range or is a singular point.
	Measures	Review the movement and, settings so that adjacents outside the movement range and singular point adjacents are avoided.
L3990	Error message	ColChk cannot be used
	Cause	This robot is a setting of the multi mechanism.
	Measures	Change parameter COL into use prohibition.
L3991	Error message	Mainte.Forecast cannot be used
	Cause	This robot is a setting of the multi mechanism.
	Measures	Invalidate the maintenance forecast.
L3995	Error message	Can't use SQ Direct and ALWENA
	Cause	SQ Direct function (parameter: IQMEM valid setting) can't be used Xrun, Xload, Xstp, Xrst, Servo and Reset Error command with always running program (parameter: ALWENA=1).
	Measures	Change ALWENA parameter to 0.
L4000	Error message	System error (time out)
	Cause	There is a problem in the program's exclusive process.
	Measures	If it comes back, contact your service provider.

Error No.	Error cause and measures	
L4100	Error message	No. of registered file is full
	Cause	The No. of program has been exceeded.
	Measures	Delete any unnecessary programs.
L4110	Error message	Memory area is full
	Cause	The program and data have exceeded the capacity. Capacity of a program execution area is insufficient.
	Measures	Delete any unnecessary programs or data.
L4120	Error message	Too long program name
	Cause	The program name is a maximum of 12 characters with 3 extension characters.
	Measures	Set the program name to within 12 characters and 3 extension characters.
L4130	Error message	Illegal program name
	Cause	An illegal character was used in the program name.
	Measures	Only numbers and alphabetic characters can be used.
L4140	Error message	The program was not found
	Cause	The designated program was not found.
	Measures	Designate a different program, or create the designated program.
L4150	Error message	Program is faulty
	Cause	Power shutdown may have occurred during the write operation.
	Measures	The file may have been damaged. Delete the file.
L4160	Error message	Not a robot program
	Cause	The designated program is not a robot program.
	Measures	Designate a different program.
L4170	Error message	The program is being edited
	Cause	The program is being edited.
	Measures	Close the program being edited.
L4180	Error message	Program is running
	Cause	The program is running.
	Measures	Stop the program.
L4190	Error message	The program is selected
	Cause	The program is preparing to execute. The user base program is selected. Or the program to be executed is used with a different slot.
	Measures	Reset the program.
L4200	Error message	Cannot write to file
	Cause	Write operation is prohibited, or the file capacity is insufficient.
	Measures	1. Enable file writing. 2. Delete unnecessary files.
L4210	Error message	Too long statement
	Cause	The command statement length is limited to 240 characters.
	Measures	Delete the No. of characters in the command statement to within 240 characters.
L4220	Error message	Syntax error
	Cause	There is an error in the syntax of the input command statement.
	Measures	Re-input in the correct syntax after checking the contents.

Error No.	Error cause and measures	
L4230	Error message	The line No. does not exist
	Cause	There is no specified line number.
	Measures	Check the contents, and reinput the correct line No.
L4240	Error message	The statement is write protected
	Cause	The command statement is write protected.
	Measures	Cancel the write protection.
L4250	Error message	No more lines or variables
	Cause	Reading of lines and variables exceeding the registered ones.
	Measures	Check the programs.
L4300	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Too long variable name
	Cause	The variable name length is limited to 16 characters.
	Measures	Shorten the variable name to within 16 characters.
	Error message	Too long variable/function name
	Cause	The variable/function name length is limited to 32 characters.
	Measures	Shorten the variable/function name to within 32 characters.
L4310	Error message	Illegal character is used
	Cause	A character other than A to Z or 0 to 9 was used.
	Measures	Use the character which can be used.
L4320	Error message	The variable is write protected
	Cause	The variable is write protected.
	Measures	1. Use a writable variable. 2. Cancel the write protection.
L4330	Error message	The variable is read protected
	Cause	The variable is read protected.
	Measures	1. Use a writable variable. 2. Cancel the write protection.
L4340	Error message	The variable is not defined
	Cause	The variable has not been defined.
	Measures	Define the variable.
L4341	Error message	The user external variable is not defined.
	Cause	The user external variable has not been defined.
	Measures	Define the user external variable.
L4350	Error message	Duplicate definition (Val.)
	Cause	Variables already defined cannot be redefined with the Dim or Def statements.
	Measures	1. Change the variable name and define. 2. Delete the defined variable.
L4360	Error message	Same variable used (65535 times)
	Cause	Example: 1 P1=P1+P2 references P1 twice and P2 once.
	Measures	Change the program to reduce the No. of times the same variable is used.

Error No.	Error cause and measures	
L4370	Error message	Error in the array element
	Cause	1. The array elements exceeds the define range. 2. The specified variable is not an array.
	Measures	1. Correct the number of array elements within one to the maximum elements. 2. Do not specify array elements.
L4380	Error message	Cannot delete variables (used)
	Cause	Variables used in a command statement cannot be deleted.
	Measures	Delete the command statement using the variable.
L4390	Error message	Variable type combination error
	Cause	The type of the user-defined external variable is different.
	Measures	Match the variable types.
L4400	Error message	Program is faulty
	Cause	The content of the program is abnormal.
	Measures	Delete the program.
L4420	Error message	Line No exceeds 32767
	Cause	The new line No. or line gap is large.
	Measures	Do not use line No. exceeding 32767.
L4430	Error message	Not found the string searched
	Cause	The character string searched for was not found.
	Measures	Check the program.
L4440	Error message	Duplicate definition (label)
	Cause	A label already defined cannot be redefined.
	Measures	1. Change the label name. 2. Delete the defined label line.
L4460	Error message	Argument value range over
	Cause	Argument value range over.
	Measures	Confirm the argument range, and correct the value.
L4470	Error message	Line No can't be used
	Cause	Line No can't be used.
	Measures	Please use the label.
L4800	Error message	System error (System base prog)
	Cause	The base program for the system could not be opened. Or, the system base program name was not specified correctly in the parameter.
	Measures	If it comes back, contact your service provider.
L4810	Error message	The global variable defined by user is not available
	Cause	The parameter "PRGUSR" is not correct.
	Measures	To use user-defined external variables, it is necessary to set the name of the program describing only variable definitions in the PRGUSR parameter.
L4811 *	Error message	The global variable redefined
	Cause	A system global variable is defined in user global.
	Measures	Correct the program.

Error No.	Error cause and measures	
L4820	Error message	No editing program
	Cause	The program was closed while editing. For example, the program being edited is closed when a key switch enable/disable operation is performed via the T/B during online editing on a PC.
	Measures	Try editing the program again.
L4900	Error message	System error (Prog Hndl)
	Cause	The program name used by internal processing is not normal.
	Measures	If it comes back, contact your service provider.
L4910	Error message	Robot Language is mismatched
	Cause	The parameter RLNG is mismatched. (2: MELFA-BASIC V, 3: MELFA-BASIC VI)
	Measures	Re-set RLNG or select an other program.
L4922	Error message	Unsupported program version
	Cause	This program was created with the new version.
	Measures	This program cannot be opened with this robot.
L4930	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	CavChk cannot be executed (*)
	Cause	Collision avoidance serves as prohibition of use.
	Measures	Change parameter CAV into use permission.
	Error message	The collision avoidance cannot be enabled for the specified robot.
	Cause	The collision avoidance setting for the specified robot is disabled.
	Measures	When the parameter CAV (collision avoidance enable/disable setting) of the specified robot is disabled, the collision avoidance function cannot be used. Check the setting value of the specified robot and enable the collision avoidance.
	Error message	CavChk cannot be used
	Cause	This robot does not correspond to collision avoidance.
	Measures	Delete CavChk command.
L4931	Error message	Cmp command cannot be executed
	Cause	Collision avoidance is effective.
	Measures	Repeal collision avoidance (execute CavChk Off).
L4932	Error message	Trk command cannot be executed
	Cause	Collision avoidance is effective.
	Measures	Repeal collision avoidance (execute CavChk Off).
L4933	Error message	CavChk cannot be executed
	Cause	Cmp command is executed.
	Measures	Repeal compliance mode (execute Cnp Off).
L4934	Error message	CavChk cannot be executed
	Cause	Trk command is executed.
	Measures	Repeal tracking mode (execute Trk Off).
L4935	Error message	NOERR cannot be executed
	Cause	Interruption using M_CavSts is invalid.
	Measures	Define interruption using M_CavSts and confirm it.
L4936	Error message	This ACT No. cannot be repealed
	Cause	NoErr of collision avoidance is performed.
	Measures	Repeal this interruption after canceling NoErr.

Error No.	Error cause and measures	
L4937	Error message	A user free area size is lack
	Cause	The size of a user free area is smaller than that of 2K.
	Measures	Please set 2K or more to the size of a user free area.
L4938	Error message	This robot does not correspond to collision avoidance
	Cause	This robot does not correspond to collision avoidance.
	Measures	Parameter CAV returns disapproval.
L4939	Error message	CAV version of Robot No. n is old
	Cause	Software version of Robot No. n is old.
	Measures	Interference avoidance function cannot be used because the software version of interference avoidance of the robot-n is old. Software version upgrade is required. Contact the maker.
L4941	Error message	MvSpl command cannot be executed
	Cause	Collision avoidance is effective.
	Measures	The spline interpolation function and collision avoidance function cannot be enabled simultaneously. If using the spline interpolation function, disable the collision avoidance function.
L4950	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Error in a function syntax
	Cause	Error in the definition of a function procedure.
	Measures	Correct the definition of the function procedure.
	Error message	Error in a parameter
	Cause	Error in a parameter of the function.
	Measures	Correct the parameter of the function.
	Error message	Error in a parameter
	Cause	The elements exceeds the range.
	Measures	Correct the array element.
H5000	Error message	TB Enable key is ON
	Cause	The TB Enable key was ON in the AUTO mode.
	Measures	OFF the TB Enable key, or enter the TEACH mode.
L5010	Error message	AUTOENA signal is OFF
	Cause	The automatic operation possible signal is OFF.
	Measures	Turn the automatic operation possible signal ON, or enter the teach mode.
L5100	Error message	No program is selected
	Cause	A program is not selected for the designated slot.
	Measures	Select a program for the designated slot.
L5110	Error message	Continuous RUN is not possible
	Cause	A different program name has been designated.
	Measures	Designate the correct program name.
L5120	Error message	Cannot select program (not PSA)
	Cause	The specified slot is not in the program selection state.
	Measures	Reset the program.

Error No.	Error cause and measures	
L5130	Error message	Cannot execute servo on
	Cause	A servo OFF process is taking place.
	Measures	Wait for the servo to turn OFF before turning the servo ON.
L5140	Error message	Cannot read the file
	Cause	Reading is being carried out, or editing is being carried out.
	Measures	Close the file being edited, or read after the reading is completed.
L5150	Error message	The origin has not been set
	Cause	The origin has not been set.
	Measures	Refer to the chapters of “Setting the origin” and “Resetting the origin” which are described in the separate volumes “ROBOT ARM SETUP & MAINTENANCE”. And set the origin.
L5200 *	Error message	Parameter error (TASKMAX)
	Cause	The TASKMAX parameter setting value has been exceeded (initial value: 8, maximum value: 32).
	Measures	Reduce the number of multi tasks, or change the TASKMAX parameter.
L5210 *	Error message	Parameter error (MECHAMAX)
	Cause	The No. of multi mechanisms has exceeded the limit.
	Measures	Reduce the No. of multi mechanisms.
L5400	Error message	All robot cannot be designated
	Cause	All mechanisms cannot be specified.
	Measures	Specify an independent mechanism number.
L5410	Error message	Non-existent mode
	Cause	It has been changed to a mode other than Auto/Teach.
	Measures	Contact the maker.
L5420	Error message	Illegal slot No.
	Cause	A task slot number other than 1 through TASKMAX (parameter) is specified.
	Measures	Designate the correct task slot.
L5430	Error message	Illegal robot No.
	Cause	The mechanism designation is illegal.
	Measures	Designate the correct mechanism.
L5600	Error message	Cannot execute during an error
	Cause	Cannot execute during an error.
	Measures	Reset the error.
C5610	Error message	Cannot execute during STOP ON
	Cause	Cannot execute during stop signal input.
	Measures	Turn the stop signal OFF and execute.
L5620	Error message	Cannot execute during CSTOP ON
	Cause	Cannot execute during cycle stop signal input.
	Measures	Turn the cycle stop signal OFF.
L5630	Error message	Cannot execute during SRVOFF ON
	Cause	Cannot execute during servo OFF signal input.
	Measures	Turn the servo OFF signal OFF.

Error No.	Error cause and measures	
L5640	Error message	Cannot execute during RUN
	Cause	Cannot execute during operation.
	Measures	Stop the operation, and then execute.
L5650	Error message	Cannot execute during STOP
	Cause	Cannot execute during stop operation.
	Measures	Complete the stop, and then execute.
L5660	Error message	Edit during RUN (include ALWAYS)
	Cause	Editing cannot be performed while in operation (including continuous execution).
	Measures	Stop the program, and then execute.
C5670	Error message	Cannot execute during wait
	Cause	Cannot execute during wait.
	Measures	Execute Program Reset.
L5990	Error message	System error (Illegal command)
	Cause	Not exist command was executed.
	Measures	Execute the correct command.
L6010	Error message	Illegal command
	Cause	This may have occurred because data was sent before the communication line was opened via a data link, or an unregistered communication command was sent due to the mismatch between the versions of the controller and support software.
	Measures	Send after the communication line is opened. Or, match the versions.
L6011	Error message	Cannot connect to CR800
	Cause	Cannot connect to CR800.
	Measures	Please connect to CPU unit.
L6020	Error message	The Operation is disable
	Cause	The operation rights have not been acquired.
	Measures	Acquire the operation rights.
L6030	Error message	The editing operation is disable
	Cause	The editing operation rights have not been acquired.
	Measures	Acquire the editing operation rights.
L6040	Error message	System error (illegal device No)
	Cause	A non-registered device No. was set.
	Measures	Set a valid device.
C6050	Error message	The file cannot be opened
	Cause	The block file cannot be opened.
	Measures	Check the file, and designate the correct file.
C6060	Error message	The mode is not TEACH
	Cause	Carry out parameter writing in the teach mode.
	Measures	Change to the teaching mode, and then execute.
C6070	Error message	The time cannot be set
	Cause	The time setting can only be executed when the program is stopped and the servo is OFF.
	Measures	Stop the program and turn the servo OFF, and then set the time.

Error No.	Error cause and measures	
C6080	Error message	Com mesg is too long
	Cause	The character string of a communication text exceeded the maximum number allowed.
	Measures	Verify the number of characters in a comment in various settings such as parameters.
C6090	Error message	Can not power reset of robot
	Cause	Can not power reset of robot.
	Measures	Can not power reset of robot.
C6500	Error message	Not opened COM line
	Cause	Open was not executed by the program.
	Measures	Execute Open, and then send PRN.
H6530 *	Error message	COMDEV parameter is illegal
	Cause	Illegal parameter (COMDEV).
	Measures	Correct COMDEV parameter.
L6600	Error message	Signal number is out of range.
	Cause	The designated signal No. has not been defined. 1) 257 to 799 2) 808 to 899 3) 8048 to 8999 4) 9005 to 9999 5) 18192 to 32767
	Measures	Change the signal No. to the correct No.
L6610	Error message	Cannot output (hand input)
	Cause	The hand input signal cannot be written.
	Measures	Use the correct output signal.
L6620	Error message	Cannot write (special Input)
	Cause	The input signal cannot be written into the robot dedicated area.
	Measures	Use an actual signal.
L6630	Error message	Input signal cannot be written
	Cause	This is the actual signal input mode.
	Measures	Set a pseudo-input signal.
L6632	Error message	Cannot write to the TREN input signal
	Cause	Writing to the TREN input signal (No. 810 to 817) was being performed in the actual signal input mode (not in pseudo-input mode).
	Measures	Input the signal to the actual TREN input.
H6640 *	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Illegal param (special signal)
	Cause	The parameter setting is illegal.
	Measures	Correct the changed parameter.
	Error message	Illegal setting of the dedicated signal parameter SFMODE
	Cause	The setting of the dedicated signal parameter SFMODE (safety mode output) is illegal.
	Measures	An error (output bit width of the output signal is less than 3 bits) exists in the dedicated output SFMODE setting. Correct the parameter setting.

Error No.	Error cause and measures	
L6641	Error message	Duplicate setting (special IN)
	Cause	The parameter setting is illegal.
	Measures	Correct the parameter of the dedicated input signal you changed.
L6642 *	Error message	STOP is fixed signal No. 0
	Cause	The parameter setting is illegal.
	Measures	Set the parameter STOP (input) to 0.
L6643	Error message	Illegal parameter (special Sig.)
	Cause	The parameter setting is illegal.
	Measures	Make the ending number larger than the starting number.
L6650 *	Error message	Duplicate setting (special OUT)
	Cause	The parameter setting is illegal.
	Measures	Correct the parameters.
L6651 *	Error message	Duplicate setting (HANDTYPE)
	Cause	The parameter setting is illegal.
	Measures	Correct the parameter.
L6660	Error message	Cannot output (SPECIAL OUT)
	Cause	The program setting is illegal.
	Measures	Correct the program.
L6670	Error message	Illegal OUT reset pattern
	Cause	The parameters are not defined in sets of 8 characters.
	Measures	Correct the parameters.
L6800 *	Error message	"Cancel pseudo-input mode, PW OFF"
	Cause	If pseudo input was canceled, it is necessary to turn the power ON again in order to prevent the erroneous operation of the robot by external input signals.
	Measures	Turn the power OFF and then ON once. It switches to an external input signal.
C6900	Error message	Pseudo-input signal mode
	Cause	Set with the parameters.
	Measures	To set a real signal, reset the parameter and then turn the power ON again.
C7000	Error message	Copy source file was not found
	Cause	The copy source file was not found.
	Measures	Input the correct file name.
C7010	Error message	Delete target file was not found
	Cause	The delete target file was not found.
	Measures	Input the correct file name.
C7020	Error message	Rename target file was not found
	Cause	The rename target file was not found.
	Measures	Input the correct file name.
H7030 *	Error message	System error (param size over)
	Cause	The change capacity is too large.
	Measures	Contact the maker.

Error No.	Error cause and measures	
C7040	Error message	Parameter changes prohibited
	Cause	Changing this parameter is prohibited as it is a dangerous parameter.
	Measures	Contact the maker.
H7050	Error message	File is illegal
	Cause	This file is damaged.
	Measures	Contact to the dealer.
H7060 *	Error message	System error (RAM area full)
	Cause	The capacity has been exceeded.
	Measures	Contact the maker.
C7070	Error message	Memory area is full
	Cause	The program and data have already exceeded the capacity.
	Measures	Delete any unnecessary programs or data.
L7071	Error message	Not enough memory area for CTN
	Cause	Continue function needs more than 100K bytes memory area.
	Measures	Delete any unnecessary programs.
C7080	Error message	Can not read parameter
	Cause	Non-existent parameter or illegal password.
	Measures	1. Input the correct parameter name. 2. Input the correct password
C7081	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Can not write parameter
	Cause	Non-existent parameter or illegal password.
	Measures	1. Input the correct parameter name. 2. Input the correct password.
	Error message	Illegal CRC during parameter writing
	Cause	The parameter CRC value is illegal.
	Measures	An error is detected in the CRC check in the writing process of a parameter related to the safety monitoring function. Check the communication environment between the robot controller and the personal computer, and perform the writing operation again.
C7090	Error message	Parameter comment illgal
	Cause	The number of parameter comment characters exceeded the limit.
	Measures	Operation will not be affected, so continue the operation.
L7099	Error message	Can not read parameter"xxx" "xxx": Parameter name.
	Cause	The parameter doesn't exist.
	Measures	Please confirm the parameter name.
H7300 *	Error message	Loading the parameter file
	Cause	It is necessary to turn the power ON again to reflect the parameters.
	Measures	Turn the power OFF and ON once.
C7310	Error message	Changed variables weren't saved
	Cause	The power was OFF during program execution.
	Measures	Don't turn the power OFF during program execution.

Error No.	Error cause and measures	
L7311	Error message	The power was OFF during file saving
	Cause	The power was OFF during file saving.
	Measures	Don't turn the power OFF during file saving.
L7332	Error message	Can't change to RAM mode in CTN mode
	Cause	Can't change to RAM mode in continue mode.
	Measures	Please change to RAM mode and perform again.
L7340	Error message	Contine function cannot be used in DRAM mode
	Cause	Contine function cannot be used in DRAM mode.
	Measures	Please change to RAM mode and perform again.
L7341	Error message	Can't change to DRAM mode in CTN mode
	Cause	Can't change to DRAM mode in CTN mode.
	Measures	Please change to RAM mode and perform again.
L7342	Error message	Global extension cannot be used in DRAM mode
	Cause	Global extension cannot be used in DRAM mode.
	Measures	Please change to RAM mode and perform again.
L7343	Error message	Can't change to DRAM mode in PRGGBL mode
	Cause	Can't change to DRAM mode in PRGGBL mode.
	Measures	Please change to RAM mode and perform again.
L7370	Error message	The password is 8 to 32 characters
	Cause	The password is 8 to 32 characters.
	Measures	Please input the password 8 to 32 characters.
L7371	Error message	Only alphanumeric character
	Cause	It input it excluding the alphanumeric character.
	Measures	Please input the password in the alphanumeric character.
L7372	Error message	The password is unmatch
	Cause	The password is unmatch.
	Measures	Please input the password again.
L7373	Error message	Password lock to the programs
	Cause	Password lock to the programs.
	Measures	Please release password.
L7374	Error message	Password lock to the parameter
	Cause	Password lock to the parameter.
	Measures	Please release password.
L7375	Error message	Password lock to the files
	Cause	Password lock to the files.
	Measures	Please release password.
L7378	Error message	Change password
	Cause	The password has not been changed from the initial value.
	Measures	The password to change functional safety related parameters has not been changed from the initial value. Change the password to new one, and perform parameter setting. The factory default password is “MELFASafetyPSWD”.

Error No.	Error cause and measures	
C7500	Error message	No battery voltage (robot)
	Cause	The battery is spent.
	Measures	Replace the battery and set the origin. For more information about the replacement procedure, refer to the separate volumes, "Instruction Manual/Robot Arm Setup to Maintenance".
C7510	Error message	Battery voltage low (robot)
	Cause	The battery will be spent soon.
	Measures	Replace the battery. For more information about the replacement procedure, refer to the separate volumes, "Instruction Manual/Robot Arm Setup to Maintenance".
C753n (n indicates the axis number (1 to 6).)	Error message	Replenishment time of grease
	Cause	It seems that grease reached longevity.
	Measures	Replenish grease.
C754n (n indicates the axis number (1 to 6).)	Error message	Exchange time of the belt
	Cause	It seems that the belt reached longevity.
	Measures	Execute the check and the exchange of the belt.
H7600 *	Error message	Mechanism number of additional axis is illegal
	Cause	The value of AXMENO (mechanism No. used) parameter is illegal.
	Measures	On the mechanical additional axis, change "0" to a value which is smaller than set to AXUNUM (number of mechanisms used).
H7601 *	Error message	Axis number of additional axis is illegal
	Cause	The value of AXJNO (setting axis No.) is illegal.
	Measures	Change the value of this parameter from 1 to 3. Change the value of this parameter to a order from 1.
H7602 *	Error message	Axis numbers of additional axis are overlap
	Cause	As the parameter value of AXJNO (setting axis No.), the same value is set at two or more elements.
	Measures	Change the values of the element Nos. which set the same values at this pa-rameter AXMENO, to all different values.
H7603 *	Error message	Unit of additional axis is illegal
	Cause	The value of AXUNT (unit axis) parameter is illegal.
	Measures	Change the values of all elements of this parameter to "0" or "1".
H7604 *	Error message	Acceleration time of additional axis is illegal
	Cause	The value of AXACC (acceleration time) parameter is illegal.
	Measures	Change the values of all elements of this parameter to positive real numbers.
H7605 *	Error message	Deceleration time of additional axis is illegal
	Cause	The value of AXDEC (deceleration time) parameter is illegal.
	Measures	Change the values of all elements of this parameter to positive real numbers.
H7606 *	Error message	Gear ratio numerator of additional axis is illegal
	Cause	The value of AXGRTN (total speed ratio numerator) parameter is illegal.
	Measures	Change the values of all elements of this parameter to positive integers.
H7607 *	Error message	Gear ratio denominator of additional axis is illegal
	Cause	The value of AXGRTD (total speed ratio denominator) parameter is illegal.
	Measures	Change the values of all elements of this parameter to positive integers.

Error No.	Error cause and measures	
H7609 *	Error message	Motor rated speed of additional axis is illegal
	Cause	The value of AXMREV (rated speed) parameter is illegal.
	Measures	Change the values of all elements of this parameter to positive integers.
H7610 *	Error message	Motor maximum speed of additional axis is illegal
	Cause	The value of AXJMX (maximum speed) parameter is illegal.
	Measures	Change the values of all elements of this parameter to positive integers.
H7611 *	Error message	Encoder pulse of additional axis is illegal
	Cause	The value of AXENCR (encoder resolution) parameter is illegal.
	Measures	Change the values of all elements of this parameter to positive integers.
H7612 *	Error message	JOG smoothening time constant of additional axis is illegal
	Cause	The value of AXJOGTS (JOG smoothening time constant) parameter is illegal.
	Measures	Change the values of all elements of this parameter to 0 or positive real number.
H7613 *	Error message	Turn OFF the power supply once, and turn ON it again
	Cause	It is necessary to turn OFF the power supply once.
	Measures	Turn OFF the power supply of the controller, and turn it ON again.
H7650	Error message	The force sensor quantity setting is incorrect
	Cause	Only 1 force sensor can be used for a single robot.
	Measures	Check the parameter (AXJNO, AXMENO) settings to see whether multiple force sensors have been set.
H7651 *	Error message	Force sense I/F unit initialization error
	Cause	The force sense I/F unit was not recognized, and therefore it was not possible to successfully complete initialization.
	Measures	Check the force sense I/F unit wiring and whether the power supply is ON.
H7652 *	Error message	Force sense I/F unit revision illegal
	Cause	This force sense I/F unit revision is not supported.
	Measures	Contact the maker.
H766n (n indicates the sensor axis.)	Error message	The force sensor data exceeded the tolerance value
	Cause	The force acting on the force sensor exceeded the set tolerance value.
	Measures	Check whether too large a force is acting on the force sensor. Check whether an appropriate value has been set for parameter FSLMTMX. Refer to the section “Force Sensor Tolerance” in separate manual, "Instruction Manual/Force Sense Function" for details on the error recovery method.
H7700 *	Error message	CC-Link card is illegal (Error Code)
	Cause	CC-Link card is illegal.
	Measures	Please exchange the CC-Link card. When it comes back, contact to the dealer.
H7710 *	Error message	Cannot set a CC-Link master station
	Cause	A master station is already set by the rotary switch.
	Measures	Set the rotary switch to other than 0.
H7720 *	Error message	Two CC-Link interface cards are mounted
	Cause	Mount one card in slot 2.
	Measures	It is not allowed to install two cards. Install only one card.
L7730	Error message	CC-Link data link error (local station connection error)
	Cause	There is a line error or the master station's parameter settings are invalid.
	Measures	Review the line and parameters.

Error No.	Error cause and measures	
L7750	Error message	A (CC-Link) cable is not connected or parameters do not match
	Cause	A cable is not connected or parameters do not match.
	Measures	Reset the power and start again.
H7760 *	Error message	CC-Link initialization error
	Cause	The master station's parameters do not match.
	Measures	Correct the parameters, and then start again.
L7780	Error message	A CC-Link register number is outside the range
	Cause	A register number entered is outside the allowable range.
	Measures	Enter the correct value.
L7781	Error message	A signal number for CC-Link was specified
	Cause	A signal number for CC-Link was specified.
	Measures	Install a CC-Link interface card.
H7810	Error message	MONPORT/SLMPPORT parameter error
	Cause	The element of MONPORT(1/2) and SLMPPORT overlap.
	Measures	Please set not to overlap to another port number.
H7820	Error message	Mxt Scommand timeout
	Cause	The setting time of the MXTTOUT parameter has been exceeded.
	Measures	Make the MXTTOUT parameter value larger.
H7830	Error message	"Ethernet card is not installed, or command disable"
	Cause	Ethernet card is not installed, or command disable.
	Measures	Install Ethernet interface card.
H7840	Error message	Mxt command Illegal received data
	Cause	The command argument and the data type do not match.
	Measures	Check the command and the data you are sending.
H7860	Error message	SLMP error
	Cause	An error related to SLMP has occurred.
	Measures	Please confirm the content by a detailed number of the error.
H7861	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	SLMP parameter error
	Cause	Illegal parameter.
	Measures	Correct parameter.
	Error message	SLMP SLMPPORT parameter error
	Cause	Overlap with server port number of NETPORT.
	Measures	Please set not to overlap to another port number.
	Error message	SLMP SLMPPORT parameter error
	Cause	Overlap with element of NETPORT(1) or MONPORT(1/2).
	Measures	Please set not to overlap to another port number.

Error No.	Error cause and measures	
H8140	Error message	Multifunctional electric hand 1 remote I/O communication line error
	Cause	A CRC error or connection error occurred in the multifunctional electric hand remote I/O communication.
	Measures	Check the communication cable or power of the connected device.
L8141	Error message	Multifunctional electric hand 1 alarm occurrence
	Cause	Either of the following alarms occurred in the multifunctional electric hand. Motor overload, motor overcurrent, encoder Z-phase deviation, power voltage drop, position deviation over, feedback error 1, 2, and 3, voltage error, system error 1 and 2.
	Measures	After eliminating the alarm cause referring to the instruction manual of the multifunctional electric hand, perform the error reset operation for the robot. When the error is not cleared even the error reset operation is performed, restart the robot.
L8142	Error message	Multifunctional electric hand 1 error occurrence
	Cause	Either of the following errors occurred in the multifunctional electric hand. Software limit over, home position return incompletion, driving power off, executed movement command during interlock, input execution command during operation, input command during data writing, Z-phase not found at home position return, FCS check error, data input range over, actuator type mismatch, internal communication error.
	Measures	After eliminating the error cause referring to the instruction manual of the multifunctional electric hand, perform the error reset operation for the robot. When the error is not cleared even the error reset operation is performed, restart the robot. The example for checking the completion state of the home position return by the program is described in "Precautions for operation" of the separate "INSTRUCTION MANUAL Detailed explanations of functions and operations".
L8143	Error message	Multifunctional electric hand 1 not connected
	Cause	The multifunctional electric hand is not connected.
	Measures	Check the connection of the remote I/O communication cable or the station number setting.
L8144	Error message	Multifunctional electric hand 1 model selection not completed
	Cause	The model selection for the multifunctional electric hand is not completed.
	Measures	Set the robot parameter, actuator type (EHnTYPE).
L8145	Error message	Multifunctional electric hand 1 home position return not completed
	Cause	Home position return of the multifunctional electric hand 1 is not completed.
	Measures	Execute the home position return. The example for checking the completion state of the home position return by the program is described in "Precautions for operation" of the separate "INSTRUCTION MANUAL Detailed explanations of functions and operations".
L8146	Error message	Multifunctional electric hand 1 response timeout
	Cause	The multifunctional electric hand does not respond.
	Measures	Check the connection status of the cable and the status of multifunctional electric hand, and restart the controller.
L8147	Error message	Multifunction electric hand 1 operation command duplication
	Cause	The operation command of the multifunctional electric hand is duplicated.
	Measures	Correct the program not to execute the operation command in duplicate.

Error No.	Error cause and measures	
L8148	Error message	Multifunctional electric hand 1 point registration duplication
	Cause	The point data registration duplicated by the multi-task program setting and the operation of T/B and RT ToolBox3.
	Measures	Correct the program or review the operation procedure.
L8149	Error message	Multifunctional electric hand 1 system error 3
	Cause	A system error occurred in the multifunctional electric hand.
	Measures	Execute the home position return after the error reset. When the error cannot reset, turn off and on the power. When the error occurs again, contact your supplier.
H8150	Error message	Multifunctional electric hand 2 remote I/O communication line error
	Cause	A CRC error or connection error occurred in the multifunctional electric hand remote I/O communication.
	Measures	Check the communication cable or power of the connected device.
L8151	Error message	Multifunctional electric hand 2 alarm occurrence
	Cause	Either of the following alarms occurred in the multifunctional electric hand. Motor overload, motor overcurrent, encoder Z-phase deviation, power voltage drop, position deviation over, feedback error 1, 2, and 3, voltage error, system error 1 and 2.
	Measures	After eliminating the alarm cause referring to the instruction manual of the multifunctional electric hand, perform the error reset operation for the robot. When the error is not cleared even the error reset operation is performed, restart the robot.
L8152	Error message	Multifunctional electric hand 2 error occurrence
	Cause	Either of the following errors occurred in the multifunctional electric hand. Software limit over, home position return incompletion, driving power off, executed movement command during interlock, input execution command during operation, input command during data writing, Z-phase not found at home position return, FCS check error, data input range over, actuator type mismatch, internal communication error.
	Measures	After eliminating the error cause referring to the instruction manual of the multifunctional electric hand, perform the error reset operation for the robot. When the error is not cleared even the error reset operation is performed, restart the robot. The example for checking the completion state of the home position return by the program is described in "Precautions for operation" of the separate "INSTRUCTION MANUAL Detailed explanations of functions and operations".
L8153	Error message	Multifunctional electric hand 2 not connected
	Cause	The multifunctional electric hand is not connected.
	Measures	Check the connection of the remote I/O communication cable or the station number setting.
L8154	Error message	Multifunctional electric hand 2 model selection not completed
	Cause	The model selection for the multifunctional electric hand is not completed.
	Measures	Set the robot parameter, actuator type (EHnTYPE).
L8155	Error message	Multifunctional electric hand 2 home position return not completed
	Cause	Home position return of the multifunctional electric hand 1 is not completed.
	Measures	Execute the home position return. The example for checking the completion state of the home position return by the program is described in "Precautions for operation" of the separate "INSTRUCTION MANUAL Detailed explanations of functions and operations".

Error No.	Error cause and measures	
L8156	Error message	Multifunctional electric hand 2 response timeout
	Cause	The multifunctional electric hand does not respond.
	Measures	Check the connection status of the cable and the status of multifunctional electric hand, and restart the controller.
L8157	Error message	Multifunction electric hand 2 operation command duplication
	Cause	The operation command of the multifunctional electric hand is duplicated.
	Measures	Correct the program not to execute the operation command in duplicate.
L8158	Error message	Multifunctional electric hand 2 point registration duplication
	Cause	The point data registration duplicated by the multi-task program setting and the operation of T/B and RT ToolBox3.
	Measures	Correct the program or review the operation procedure.
L8159	Error message	Multifunctional electric hand 2 system error 3
	Cause	A system error occurred in the multifunctional electric hand.
	Measures	Execute the home position return after the error reset. When the error cannot reset, turn off and on the power. When the error occurs again, contact your supplier.
H8160	Error message	Multifunctional electric hand 3 remote I/O communication line error
	Cause	A CRC error or connection error occurred in the multifunctional electric hand remote I/O communication.
	Measures	Check the communication cable or power of the connected device.
L8161	Error message	Multifunctional electric hand 3 alarm occurrence
	Cause	Either of the following alarms occurred in the multifunctional electric hand. Motor overload, motor overcurrent, encoder Z-phase deviation, power voltage drop, position deviation over, feedback error 1, 2, and 3, voltage error, system error 1 and 2.
	Measures	After eliminating the alarm cause referring to the instruction manual of the multifunctional electric hand, perform the error reset operation for the robot. When the error is not cleared even the error reset operation is performed, restart the robot.
L8162	Error message	Multifunctional electric hand 3 error occurrence
	Cause	Either of the following errors occurred in the multifunctional electric hand. Software limit over, home position return incompletion, driving power off, executed movement command during interlock, input execution command during operation, input command during data writing, Z-phase not found at home position return, FCS check error, data input range over, actuator type mismatch, internal communication error.
	Measures	After eliminating the error cause referring to the instruction manual of the multifunctional electric hand, perform the error reset operation for the robot. When the error is not cleared even the error reset operation is performed, restart the robot. The example for checking the completion state of the home position return by the program is described in "Precautions for operation" of the separate "INSTRUCTION MANUAL Detailed explanations of functions and operations".
L8163	Error message	Multifunctional electric hand 3 not connected
	Cause	The multifunctional electric hand is not connected.
	Measures	Check the connection of the remote I/O communication cable or the station number setting.
L8164	Error message	Multifunctional electric hand 3 model selection not completed
	Cause	The model selection for the multifunctional electric hand is not completed.
	Measures	Set the robot parameter, actuator type (EHnTYPE).

Error No.	Error cause and measures	
L8165	Error message	Multifunctional electric hand 3 home position return not completed
	Cause	Home position return of the multifunctional electric hand 1 is not completed.
	Measures	Execute the home position return. The example for checking the completion state of the home position return by the program is described in "Precautions for operation" of the separate "INSTRUCTION MANUAL Detailed explanations of functions and operations".
L8166	Error message	Multifunctional electric hand 3 response timeout
	Cause	The multifunctional electric hand does not respond.
	Measures	Check the connection status of the cable and the status of multifunctional electric hand, and restart the controller.
L8167	Error message	Multifunction electric hand 3 operation command duplication
	Cause	The operation command of the multifunctional electric hand is duplicated.
	Measures	Correct the program not to execute the operation command in duplicate.
L8168	Error message	Multifunctional electric hand 3 point registration duplication
	Cause	The point data registration duplicated by the multi-task program setting and the operation of T/B and RT ToolBox3.
	Measures	Correct the program or review the operation procedure.
L8169	Error message	Multifunctional electric hand 3 system error 3
	Cause	A system error occurred in the multifunctional electric hand.
	Measures	Execute the home position return after the error reset. When the error cannot reset, turn off and on the power. When the error occurs again, contact your supplier.
L8300	Error message	There are a lot of GETPOS define
	Cause	GETPOS function are up to 8.
	Measures	Please use the same Act No. or reset an unnecessary program.
L8310	Error message	GETPOS undefined
	Cause	GETPOS undefined.
	Measures	Please define GETPOS.
H8320	Error message	System Error (GETPOS)
	Cause	Internal data of GETPOS is illegal.
	Measures	Turn the power OFF and ON once.
H8400	Error message	CTN data is illegal (Prec)
	Cause	CTN data is illegal. It changed to Prec Off.
	Measures	Try to set be a Prec mode again.
L8600	Error message	The vision is a unconnection
	Cause	The vision is a unconnection.
	Measures	Please check Com No. and Parameter.
L8601	Error message	The vision can't be logged on
	Cause	The parameter of the user-name or the password is abnormal.
	Measures	Please set the parameter correctly.
L8602	Error message	Password is abnormal
	Cause	The password of the user-name is not corresponding.
	Measures	Please set the password correctly.

Error No.	Error cause and measures	
L8603	Error message	Parameter is abnormal
	Cause	The parameter of the user-name or the password is abnormal.
	Measures	Please set the parameter correctly.
L8610	Error message	The communication is abnormal
	Cause	The communication was cut.
	Measures	Please check the communications cable.
L8620	Error message	The vision number is abnormal
	Cause	The number is not designated by NVOpen.
	Measures	Please check NVOpen command.
L8621	Error message	Vision program name is abnormal
	Cause	The vision program name has exceeded 15 characters.
	Measures	Please make the program name within 15 characters.
L8622	Error message	There is no vision program
	Cause	There is no specified vision program.
	Measures	Please check the vision program name.
L8623	Error message	SKIP number is already used
	Cause	SKIP number is already used.
	Measures	Please confirm the SKIP number.
L8630	Error message	The recognition cell is illegal
	Cause	There is no value on the cell.
	Measures	Please check the recognition cell.
L8631	Error message	The cell is outside the range
	Cause	The range of the cell is exceeded.
	Measures	Please check the range of the cell.
L8632	Error message	The vision is a time-out
	Cause	There is no response from the vision.
	Measures	Please check the time-out time.
L8633	Error message	The vision is a time-out (NVTRG)
	Cause	There is no response from the vision (NVTRG).
	Measures	Please decrease the load of the network.
L8634	Error message	There is a comma within the range of the cell
	Cause	There is a comma within the range of the cell.
	Measures	Please check the range of the cell.
L8635	Error message	There is no comma within the range of the cell
	Cause	There is no comma within the range of the cell.
	Measures	Please check the range of the cell.
L8636	Error message	Vision Tag name is abnormal
	Cause	There is no specified vision tag in the vision program.
	Measures	Please correct the vision tag name.

Error No.	Error cause and measures	
L8640	Error message	The image trigger is abnormal
	Cause	The trigger setting of the vision sensor is abnormal.
	Measures	Please check the trigger setting.
L8650	Error message	Please make the vision online
	Cause	The vision sensor is off-line.
	Measures	Please make vision sensor online.
L8660	Error message	There is no authority
	Cause	The authority of the user-name is not a full access.
	Measures	Please check user name.
L8670	Error message	Can not restart
	Cause	It started without resetting it.
	Measures	Please reset the program.
L8680	Error message	Unknown code was received (code no.)
	Cause	Status code of unregistration was received from vision sensor. (Status cord which is not registered with robot controller was received.)
	Measures	The status code received from vision sensor is displayed to the code no.. When the code no. is not the numerical value, there is a possibility which received abnormal data. Please check the communication state, the communication setting, and the command argument.
L8700 (CR800-R only)	Error message	Multi CPU system self-check error
	Cause	Illegal parameter of multi CPU system and CPU is abnormal,etc.
	Measures	Confirm details and measures of the error with GX Developer etc.
L8710	Error message	PC I/O module parameter(m) error. (m): Target parameter numbers 1-4. (correspond to QXYUNIT 1-4)
	Cause	An illegal setting of the PC I/O module was detected.
	Measures	Please check the value of parameter.
L8720	Error message	Fuse is blown.(PC I/O module (m)). (m): Target parameter numbers 1-4. (correspond to QXYUNIT 1-4)
	Cause	Fuse is blown.(PC I/O module)
	Measures	Please refer to the manual of PC I/O module.
L8730	Error message	I/O module (m) remove error. (m): Target parameter numbers 1-4. (correspond to QXYUNIT 1-4)
	Cause	PC I/O module was removed.
	Measures	Please mount PC I/O module.
H8740	Error message	CR800 init communication error
	Cause	Initial communication with the CR800 was not possible.
	Measures	Check the communication cable connection.
H8741	Error message	CPU unit init communication error
	Cause	Initial communication with the CPU unit was not possible.
	Measures	Check the communication cable connection.
H8751	Error message	CR800 communication error
	Cause	Communication from the CR800 was cut off.
	Measures	Check the communication cable connection.

Error No.	Error cause and measures	
H8752	Error message	CPU unit communication error
	Cause	Communication from the CPU unit was cut off.
	Measures	Check the communication cable connection.
H8760	Error message	PLC CPU parameters are not set
	Cause	Fixed Scan Communication Area is not set in the PLC CPU.
	Measures	Please set the Fixed Scan Communication Area in the PLC CPU.
H8761	Error message	CPU number setting is illegal
	Cause	The setting of CPU number is different.
	Measures	Please check PLC's multi CPU setting and QMLTCPUN parameter.
H8770	Error message	CR800 communication error
	Cause	Communication error was detected from CR800.
	Measures	Check the communication cable connection.
H8780	Error message	CPU unit communication error
	Cause	Communication error was detected from the CPU unit.
	Measures	Check the communication cable connection.
H8790	Error message	CR800 error reset error
	Cause	Can not reset CR800 error.
	Measures	Check the communication cable connection.

Error No.	Error cause and measures	
H8800 *	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	ASIC communication error
	Cause	A failure was detected in the communication within the controller. The internal temperature of the controller may be high. For the CR800-R controller, the following conditions may also be the cause. • The power on timing may be incorrect. • The cable between the controller and the robot CPU may have a fault.
	Measures	Confirm that the controller filter has no clogging and the ambient temperature is 40 °C or less. If the error persists after taking above measures, contact the manufacturer. For the CR800-R controller, turn on the switch of the controller, then of the robot CPU. Check the cable connection between the robot CPU and the controller.
	Error message	ASIC CRC error
	Cause	A failure was detected in the communication within the controller. The internal temperature of the controller may be high. For the CR800-R controller, the following conditions may also be the cause. • The power on timing may be incorrect. • The cable between the controller and the robot CPU may have a fault.
	Measures	Confirm that the controller filter has no clogging and the ambient temperature is 40 °C or less. If the error persists after taking above measures, contact the manufacturer. For the CR800-R controller, turn on the switch of the controller, then of the robot CPU. Check the cable connection between the robot CPU and the controller.
	Error message	ASIC short frame error
	Cause	A failure was detected in the communication within the controller. The internal temperature of the controller may be high. For the CR800-R controller, the following conditions may also be the cause. • The power on timing may be incorrect. • The cable between the controller and the robot CPU may have a fault.
	Measures	Confirm that the controller filter has no clogging and the ambient temperature is 40 °C or less. If the error persists after taking above measures, contact the manufacturer. For the CR800-R controller, turn on the switch of the controller, then of the robot CPU. Check the cable connection between the robot CPU and the controller.
	Error message	ASIC overrunning error
	Cause	A failure was detected in the communication within the controller. The internal temperature of the controller may be high. For the CR800-R controller, the following conditions may also be the cause. • The power on timing may be incorrect. • The cable between the controller and the robot CPU may have a fault.
	Measures	Confirm that the controller filter has no clogging and the ambient temperature is 40 °C or less. If the error persists after taking above measures, contact the manufacturer. For the CR800-R controller, turn on the switch of the controller, then of the robot CPU. Check the cable connection between the robot CPU and the controller.
	Error message	ASIC connector connection error
	Cause	A failure was detected in the communication within the controller. The internal temperature of the controller may be high. For the CR800-R controller, the following conditions may also be the cause. • The power on timing may be incorrect. • The cable between the controller and the robot CPU may have a fault.
	Measures	Confirm that the controller filter has no clogging and the ambient temperature is 40 °C or less. If the error persists after taking above measures, contact the manufacturer. For the CR800-R controller, turn on the switch of the controller, then of the robot CPU. Check the cable connection between the robot CPU and the controller.
	Error message	ASIC 0byte transmission

Error No.	Error cause and measures	
	Cause	A failure was detected in the communication within the controller. The internal temperature of the controller may be high. For the CR800-R controller, the following conditions may also be the cause. • The power on timing may be incorrect. • The cable between the controller and the robot CPU may have a fault.
	Measures	Confirm that the controller filter has no clogging and the ambient temperature is 40 °C or less. If the error persists after taking above measures, contact the manufacturer. For the CR800-R controller, turn on the switch of the controller, then of the robot CPU. Check the cable connection between the robot CPU and the controller.
H8810	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Communication error
	Cause	Error occurred by the data transmission to the servo.
	Measures	Check the communication cable connection. Check that there is not a source of noise.
	Error message	Illegal ID
	Cause	ID of the com. data with the servo is not corresponding.
	Measures	Turn the power OFF and ON once.
H8820	Error message	Communication timeout
	Cause	The communication with the servo became a timeout.
	Measures	Turn the power OFF and ON once.
H8830	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Amplifier unconnection
	Cause	The servo amplifier cannot be detected.
	Measures	Check the cable connection and the power supply of amp.
	Error message	Servo axis setting error
	Cause	The axis setting is not correct.
	Measures	Check the servo axis settings (parameters, rotary switches).
	Error message	Uncorrespondence amplifier
	Cause	Uncorrespondence amplifier is connected.
	Measures	Remove the uncorrespondence amplifier.
	Error message	Uncorrespondence protocol
	Cause	The communication protocol which does not correspond.
	Measures	Remove the uncorrespondence amplifier.
	Error message	Illegal motor ID
	Cause	Uncorrespondence motor is connected.
	Measures	Remove the uncorrespondence motor.
	Error message	Parameter setting failure
	Cause	A set value of the servo parameter is illegal.
	Measures	Change to a correct value.
	Error message	Illegal amp. number
	Cause	The number of connected amplifiers is not suitable.
	Measures	Check the number of connected amplifiers.

Error No.	Error cause and measures	
H887n	One of the errors below is detected. Please take measures corresponding to an error message.	
	Error message	Transient processing error
	Cause	Illegal demand data was transmitted.
	Measures	Turn the power OFF and ON once. If it comes back, contact to your service provider.
	Error message	Transient processing timeout
	Cause	There is no response to the demand from servo.
	Measures	Turn the power OFF and ON once. If it comes back, contact to your service provider.
H8920	Error message	Sensor I/F unit error (**) Note) "**" is substituted with the "sensor I/F unit error No." (2 hexadecimal digits)
	Cause	An error occurred at the force sensor interface unit.
	Measures	Refer to "Force sense interface unit errors" according to the error No. in the error message.
C8921	Error message	Sensor I/F unit warning (**) Note) "**" is substituted with the "sensor I/F unit warning No." (2 hexadecimal digits)
	Cause	A warning occurred at the force sensor interface unit.
	Measures	Refer to "Force sense interface unit errors" according to the error No. in the error message.
H9000 to H9099	Error message	User High level error
	Cause	A high-level alarm was issued from the robot program.
	Measures	Check the program.
L9100 to L9199	Error message	User Low level error
	Cause	A low-level alarm was issued from the robot program.
	Measures	Check the program.
C9200 to C9299	Error message	User Caution level error
	Cause	A warning was issued from the robot program.
	Measures	Check the program.

Appendix 6.2 Troubles and measures

No.	Issue	
1	An unusual noise can be heard (from the robot arm).	
	Cause	• Unusual noises can be caused by friction between movable parts, deformed parts, foreign matters getting inside, and defects in belt tension. An unusual noise is also made from the fan and the cover bolts became loosened.
	Measures	• Identify the particular point from where the unusual noise is being made, and where necessary treat the problem by replacing parts, etc. • When operating at slow speeds, a rattling sound can be heard from the brakes, but this is not unusual. However, if the noise gets louder as the speed gets higher, contact the manufacturer.
2	An unusual noise can be heard (from RC)	
	Cause	• A noise is made as the internally mounted fan and its casing resonate. • A noise is made by the fan catching internal wiring.
	Measures	• Check the state of the cover fastening. • Check to see whether or not the fan is interfering with cables, etc. If no improvement is made after carrying out the above measures, please contact the manufacturer.
3	The tip of the robot is vibrating.	
	Cause	• The load conditions exceed the specified values (mass, inertia) • The load condition settings are not suitable (HNDDAT and WRKDAT settings are not consistent with the load) • The tip is being used near a singular point. • Acceleration or deceleration is too sudden. • The installation stand is not rigid enough. • Vibrations from nearby equipment are being felt.
	Measures	• Check the load conditions and the parameter settings. Please also try to adjust the acceleration/deceleration time, the speed, and the teaching point where necessary. • Check the condition of the unit's installation (including external vibrations). If no improvement is made after carrying out the above measures, please contact the manufacturer.
4	The servo-on cannot be performed	
	Cause	• A servo OFF signal (SRVOFF) is being input from an external source. • The operating right is not given. (IOENA parameters settings/exclusive input and output). • An error is occurring. • TB operation error (enabling switch, activate/deactivate)
	Measures	• Check for a servo OFF signal and check the operation rights. • Check how to operate the TB. Check that the 3 position enabling switch is set to the middle position. • If an error message is occurring please cancel it. If no improvement is made after carrying out the above measures, please contact the manufacturer.

No.	Issue	
5	In automatic drive mode the system does not start up even if a startup signal is input. The robot stops during automatic drive.	
	Cause	• A stop signal (STOP/STOP2/SKIP) is being input from an external source. • The operating right is not given. (IOENA parameters settings/exclusive input and output). • An error is occurring. • A start signal (START) has not been input. • The slot attribute settings are not set to START. • The program's operation commands have not been executed.
	Measures	• Check for a stop/startup signals and check the operation rights. • Check the attributes of the program. • With the robot stopped, check the status of the operation program's execution. • If an error message is occurring please cancel it. In no improvement is made after carrying out the above measures, please contact the manufacturer.
6	The position becomes offset during automatic drive. The position becomes offset after moving the equipment.	
	Cause	• Program error (arithmetic processing, etc.). • Teaching operation error. • Peripheral equipment is offset. • There is a setting error in the origin position data. • The origin position data has been lost (battery life, etc.). • Origin positions are offset (the arm was moved while the power supply was OFF, etc.) • Connecting parts have come loose. • Belt teeth have been skipped. • Increased backlash from the reduction gear.
	Measures	• Check the positioning data in the area where the positioning has become offset. • Check the peripheral equipment and the robot's connecting parts (hand, robot installation section, etc.) • Check the remaining time on the robot battery's life. • Check the position of the origin positions. • Check the condition of the belt. • Check whether there is any nearby interference, etc. If no improvement is made after carrying out the above measures, please contact the manufacturer.
7	The leakage current breaker trips when the controller's primary power switch is turned ON. The leakage current breaker trips when the servo is switched on.	
	Cause	• Incorrect breaker selection (current capacity/drive purpose, etc.). • Leakage current due to electrically conductive foreign matters (oil/moisture) getting inside. • Earthing due to cable wear.
	Measures	• Check the specification of the breaker. • Check whether or not electrically conductive foreign matters have got inside the robot's body or inside the controller. • Check whether or not the cable is damaged.

No.	Issue	
8	Oil is leaking from the robot's body	
	Cause	• Deterioration in the reducer oil seal. • Too much grease was applied. • A grease other than the specified grease was applied. • Excess grease left on the unit when grease was applied. • Foreign materials have stuck to the oil seal (dust, etc.).
	Measures	• Check the amount of grease that should be applied and the name and product number of the grease. • Take measures to make sure that dust, etc. does not adhere to joints. • After applying grease wipe off any grease that is protruding.
9	Breaker trips/overcurrent error occurs (cutting oil gets inside the robot body)	
	Cause	• Deterioration in the packing. • Scaling on the packing. • Using a highly permeable cutting oil. • An environment that exceeds the IP functionality.
	Measures	• In a mist environment, pull off and replace the packing every time the cover is removed. • If a highly permeable cutting fluid is being used, or in an environment that exceeds the IP functionality, purge the air and take measures on the jacket. * Cutting oil that has got inside the arm must be thoroughly cleaned away or the components inside the arm are at risk of rotting.
10	The hand does not move properly (air hand)	
	Cause	• An air leak/break in the piping. • The solenoid bulb has failed. • Wire breakage on the hand signal line. • Hand signal line short circuit • The hand IF card has failed or has been inserted incorrectly. • Sink/source setting error. • Hand connecting wire error • Insufficient air pressure. • A foreign material has got stuck in the air hose. • Faulty connection in the cables that run between devices.
	Measures	• Carry out a check on the air hose, joints, air pressure, and connecting wire. • Check the condition of the hand input/output signal. • Check whether or not the controller's sink/source settings and wiring are consistent with each other. • Check the condition of the connections on the cables that run between devices. In the event that no improvement is made after carrying out the above measures, please contact the manufacturer.

No.	Issue	
11	The hand does not move properly The hand operation screen is not displayed on the TB (Electric operated hand)	
	Cause	• Wire breakage on the hand signal line. • The electronic hand controller (manufactured by TAIYO Ltd.) has failed. • Faulty connection in the cables that run between devices. • The software version on the TB and robot controller is not compatible with the electric operated hand. • The user is trying to use the electric operated hand on a model that is not compatible with the electric operated hand.
	Measures	• Check the connections. • Check the condition of the hand input/output signal. • Check the mating condition of the cables that run between devices. • Check whether the software version is compatible or not. • Check the model compatibility. If no improvement is made after carrying out the above measures, please contact the manufacturer.
12	The hand does not move properly The hand operation screen is not displayed on the TB (Multi hand)	
	Cause	• An air leak/break in the piping. • The solenoid valve has failed. • Wire breakage on the hand signal line. • The multi hand dedicated circuit has failed. • Insufficient air pressure. • A foreign material has got stuck in the air hose. • Faulty connection in the cables that run between devices. • Wire breakage on the hand signal line. • The software version on the TB and robot controller is not compatible with the multi hand. • The user is trying to use the multi hand on a model that is not compatible with the multi hand.
	Measures	• A check on the air hose, joints, air pressure, and connections. • Check the condition of the hand input/output signal. • Check the connections. • Check the mating condition of the cables that run between devices. • Check whether the software version is compatible or not. • Check the model compatibility. If no improvement is made after carrying out the above measures, please contact the manufacturer.
13	Brake is not working properly	
	Cause	[Occurs only when operating manually] • T/B operation error. [Occurs when operating manually and automatically] • Faulty connection of the cables that run between devices. • Brake failure.
	Measures	[Occurs only when operating manually] • Check the T/B operation (operation buttons, 3 position enabling switch, etc.). [Occurs when operating manually and automatically] • Check the mating of the cables that run between devices. If no improvement is made after carrying out the above measures, please contact the manufacturer.

No.	Issue	
14	The communication fault occurs by the equipment connected to the Ethernet cable inside the robot arm.	
	Cause	• The Ethernet cable is not connected surely. • There are the device etc. which cause the noise and the noise has applied to the Ethernet cable.
	Measures	• Confirm that the Ethernet cable is connected surely. • If the effect by the noise can be considered, find out the noise source and remove the noise. Moreover, adds the grounding and ferrite core of the Ethernet cable if needed. Recommendation ferrite core: E04SR301334 (SEIWA ELECTRIC MFG. Co.,Ltd.)
15	The T/B does not display anything.	
	Cause	• The fuse installed in the controller may have blown out. For the fuse blowout, there may be a ground fault or short circuit in the T/B cable. • The T/B might be out of order.
	Measures	• Investigate and correct the ground fault or short circuit portion in the wiring made by the customer. If no improvement is made after carrying out the above measures, please contact the manufacturer.

<< MEMO >> * Please use this page for your memo.

This manual is published in October 2018. Specifications are subject to change without notice. Printed in October 2018 (1810) MEE