

Mitsubishi Industrial Robot

CR750-D/CR751-D Controller

RV-4/7/13/20FM-D-SE Series Standard Specifications Manual





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 special 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 a drop or reliability or faults. (Temperature, humidity, atmosphere, noise environment, etc.)

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

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

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

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.

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.

Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

WARNING

Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.

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 secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

∠ CAUTION

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.

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.

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.

Never carry out modifications based on personal judgments, or use 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 catching depending on the posture.

⚠ CAUTION

Do not stop the robot or apply 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. Moreover, it may interfere with the peripheral device by drop or move by inertia of the arm.

⚠ CAUTION

Do not turn off the main power to the robot controller while rewriting the internal information of the robot controller such as the program or parameters. If the main power to the robot controller is turned off while in automatic operation or rewriting the program or parameters, the internal information of the robot controller may be damaged.

⚠ 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 the operation rights are enabled or not.

⚠ 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. Eye discomfort may be felt if exposed to the light. (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 connector properties, and leading to malfunction.

A 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.

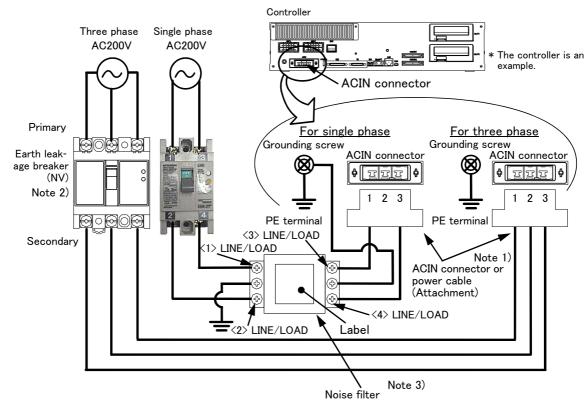
A CAUTION

Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

Notes of the basic component are shown.

A CAUTION

Please install the earth leakage breaker in the primary side supply power supply of the controller of CR751-D or CR751-Q because of leakage protection.



- Note 1) Crimping swage is recommended for connecting the attachment ACIN connector (soldering is also possible)
 Recommendation compression tools: 234171-1(Tyco Electronics)
- Note 2) The earth leakage breaker is the customer preparation. Always use the cover below.

 Recommendation: For single primary power supply NV30FAU-2P-10A-AC100-240V-30mA, (Cover: TCS-05FA2)

 For three primary power supply NV30FAU-3P-10A-AC100-240V-30mA, (Cover: TCS-05FA3)
- Note 3) If necessary, as shown in the figure, connects the noise filter between ACIN terminal blocks and primary power supply.

 (Recommended noise filter: SUP-EL20-ER6 *OKAYA ELECTRIC INDUSTRIES)
 - Please prepare the following: Leakage current breaker (with the terminal cover), cable for connecting the primary power supply (AWG #14 (2mm² or above), cables to ground the primary power supply (AWG #12 (3.5mm² or above).
 - The secondary power cable (with the ACIN connector) for single phase or three phase power is supplied with the product to match the specifications. When you build a cable suitable for your environment using the ACIN connector and the ACIN terminal supplied, prepare a secondary power cable (AWG #14 (2mm²) or above).
 - 2) Confirm that the primary power matches the specifications.
 - 3) Confirm that the primary power is OFF and that the earth leakage breaker power switch is OFF.
 - 4) Connect the secondary power cable.
 - a) When using the supplied power cable with the ACIN connector

Refer to the figure above and connect the cable from the secondary side of the earth leakage breaker.

b) When building a power cable using the ACIN connector and the ACIN terminals supplied

Connect the ACIN terminals with the secondary power cable (prepared by customers), and insert the ACIN terminals to the ACIN connector pins with the following numbers. Crimping caulking is recommended to connect the ACIN terminals.

For single phase: 1 and 3 For three phase: 1, 2, and 3

Refer to the figure above and connect the cable from the secondary side of the earth leakage breaker.

- 5) Connect this ACIN connector to the ACIN connector on the front of the controller.
- 6) Connect the grounding cable to the PE terminal. (M4 screw)
- 7) Connect the primary power cable to the primary side terminal of the earth leakage breaker.

■Revision history

Date of print	Specifications No.	Details of revisions
2014-08-20	BFP-A3322	• First print.
2014-12-24	BFP-A3322-A	 The type of the optional hand input cable was corrected. (error: 1F-HC35C-C02) Explanation of the maximum load was added. The models of the CE Marking specification were added. Correction of errors in the Specifications discussion materials. (Network vision sensor 4D-2CG5***-PKG was deleted.) The corporate logo mark of illustrations in this manual was changed. "6.4 EMC installation guideline" was added.
2015-02-10	BFP-A3322-B	The special hexagon flange bolts are also used for SE1502 model.
2015-11-18	BFP-A3322-C	 "Declaration of Incorporation" and "EC-Statement of Compliance" were updated. Shape of base section of RV-7F series robot was changed. Transportation precaution of the lithium battery was modified. List of parts and manufacturer of parallel I/O unit was corrected. Note1) in "Table3-6: Function of the key switch interface" was corrected.
2015-12-14	BFP-A3322-D	 The figures of "Position of center of gravity for loads" were modified. The explanation of the solenoid valve set for the chemical-resistant specification (SExx01) was added. Circuit diagrams in "3.6.1 Connection of the external emergency stop" and "6.1.7 Examples of safety measures" were modified.

■ Introduction

This series offers small-size industrial robots developed using Mitsubishi's latest technology. They are especially designed to handle and assemble mechanical parts. They are Mitsubishi's answer to the customer's need to achieve a compact manufacturing facility capable of highly flexible production, as necessitated by the diffusion of high-density product groups and the shorter product life cycles that have become common-place in recent years.

In order to support transportation and processing in food and pharmaceutical plants, we offer a product lineup with multiple-resistant specifications with improved corrosion resistance or washability of the robot arm. The products with chemical-resistant specifications (SExx01) and food machinery grade H1 grease specifications (SExx02) are available.

However, to comply with the target application, a work system having a well-balanced robot arm, peripheral devices or robot and hand section must be structured.

When creating these standard specifications, we have edited them so that the Mitsubishi robot's characteristics and specifications can be easily understood by users considering the implementation of robots. However, if there are any unclear points, please contact your nearest Mitsubishi branch or dealer.

Mitsubishi hopes that you will consider these standard specifications and use our robots.

Note that in this specification document the specifications related to the robot arm is described Page 11, "2 Robot arm", the specifications related to the controller Page 72, "3 Controller", and software functions and a command list Page 153, "4 Software" separately.

This document has indicated the specification of the following types robot.

Robot type	Series (generic name used in this document for robots listed in each row)
RV-4F-D, RV-4FL-D	RV-4F series
RV-7F-D RV-7FL-D	RV-7F series
RV-7FLL-D, RV-13F-D, RV-13FL-D, RV-20F-D	RV-13F series

· About CE Marking in the automization system

The Guidelines of the measures against EMC in the automization system manufactured by the customer is shown in Page 177, "6.4 EMC installation guideline".

Please refer to it and carry out the measures against EMC of the automization system of the customer.

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- The contents of this manual are subject to change without notice.
- The specifications values are based on Mitsubishi standard testing methods.
- The information contained in this document has been written to be accurate as much as possible. Please interpret that items not described in this document "cannot be performed." or "alarm may occur".
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1 General configuration

1.1 Structural equipment

Structural equipment consists of the following types.

1.1.1 Standard structural equipment

The following items are enclosed as a standard.

- (1) Robot arm
- (2) Controller
- (3) Machine cable
- (4) Robot arm installation bolts
- (5) Safety manual, CD-ROM (Instruction manual)
- (6) Guarantee card

1.1.2 Special specifications

For the special specifications, some standard configuration equipment and specifications have to be changed before factory shipping. Confirm the delivery date and specify the special specifications at the order.

1.1.3 Options

User can install options after their delivery.

1.1.4 Maintenance parts

Materials and parts for the maintenance use.

1.2 Model type name of robot

This robot has arranged the type name corresponding to load mass, arm length, and environment specification. Details are shown below, please select the robot suitable for the customer's use.

1.2.1 How to identify the robot model

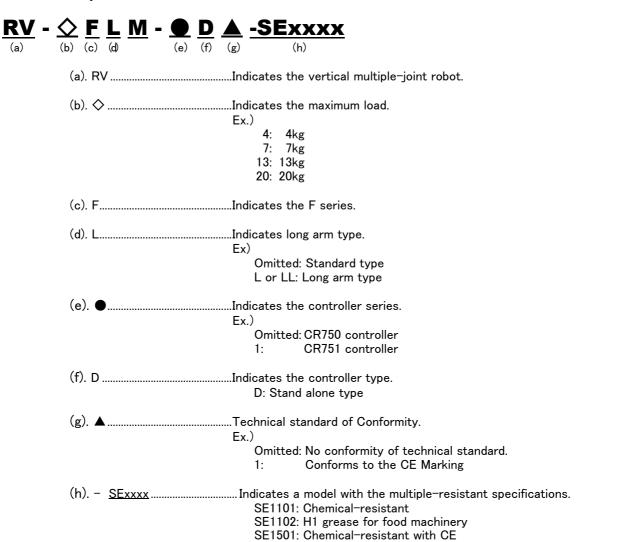


Table 1-1: Multiple-resistant correspondence table

Specification	Item	Chemical-resistant specifications (SExx01)	Food machinery grade H1 grease specifications (SExx02)
Α	Application of NSF H1 certified grease	0	0
В	Use of stainless steel at the end of the robot	0	0
С	Adoption of special hexagon flange bolts	0	O (- Note1))
D	Chemical-resistant body coating	0	-
E	Use of a chemical-resistant sealing material	0	-

SE1502: H1 grease for food machinery with CE

Note1) Not apply for SE1102.

1.2.2 Combination of the robot arm and the controller

(1) CR750 controller

Table 1-2: Combination of the robot arm and the CR750 controller

Robot arm				
Type name ^{Note1)}	Protection specification	Arm length	Internal wiring and piping specification (Mechanical I/F)	Controller
RV- ☐ FM-D-SE1101		Standard arm		CR750- ☐ VD-1-SE1101
RV-20FM-D-SE1101	Chemical-resistant speci- fications (SE1101) Note2)	Standard arm		CR750-20VD-1-SE1101
RV- ☐ FLM-D-SE1101		Long arm		CR750- ☐ VD-1-SE1101
RV-7FLLM-D-SE1101				CR750-07VLD-1-SE1101
RV- ☐ FM-D-SE1102	Food machinery grade H1 grease specifications (SE1102) Note2)	Standard arm	_	CR750- ☐ VD-1-SE1102
RV-20FM-D-SE1102				CR750-20VD-1-SE1102
RV- □ FLM-D-SE1102		Long arm		CR750- □ VD-1-SE1102
RV-7FLLM-D-SE1102	(CR750-07VLD-1-SE1102

Note1) The " \square " indicates the load mass."4" for 4kg, "7" for 7kg, "13" for 13kg. (" \square " of the controller type name is "04", "07" or "13".)

(2) CR751 controller

Table 1-3: Combination of the robot arm and the CR751 controller

Robot arm				
Type name ^{Note1)}	Protection specification	Arm length	Internal wiring and piping specification (Mechanical I/F)	Controller
RV- ☐ FM-1D-SE1101	Chemical-resistant speci- fications (SE1101) Note2)	Standard arm	-	CR751- □ VD-0-SE1101
RV-20FM-1D-SE1101		Standard arm		CR751-20VD-0-SE1101
RV- ☐ FLM-1D-SE1101		L and a sum		CR751- □ VD-0-SE1101
RV-7FLLM-1D-SE1101		Long arm		CR751-07VLD-0-SE1101
RV- ☐ FM-1D-SE1102	Food machinery grade H1 grease specifications (SE1102) Note2)	Standard arm		CR751- ☐ VD-0-SE1102
RV-20FM-1D-SE1102				CR751-20VD-0-SE1102
RV- ☐ FLM-1D-SE1102				CR751- □ VD-0-SE1102
RV-7FLLM-1D-SE1102		Long arm		CR751-07VLD-0-SE1102

Note1) The " \square " indicates the load mass."4" for 4kg, "7" for 7kg, "13" for 13kg. (" \square " of the controller type name is "04", "07" or "13".)

Note2) This robot arm's protective structure is IP65. The protective structure of all the controllers is IP20 (open type). To protect a controller, use the optional controller protection box (IP54). However, the controller is not chemical-resistant.

Note2) This robot arm's protective structure is IP65. The protective structure of all the controllers is IP20 (open type). To protect a controller, use the optional controller protection box (IP54). However, the controller is not chemical-resistant.

1.3 CE marking specifications

The robot shown in the Table 1-4 or Table 1-5 are the CE Marking specification.

(1) CR750 controller

Table 1-4: Robot models with CE marking specifications

Robot type Note1)	Controller	External signal logic	Language setting
RV- ☐ FM-D1-SE1501 RV- ☐ FLM-D1-SE1501	CR750- □ VD1-1-SE1501		
RV- ☐ FM-D1-SE1502 RV- ☐ FLM-D1-SE1502	CR750- □ VD1-1-SE1502		
RV-20FM-D1-SE1501	CR750-20VD1-1-SE1501	Source type	English (ENG)
RV-20FM-D1-SE1502	CR750-20VD1-1-SE1502		
RV-7FLLM-D1-SE1501	CR750-07VLD1-1-SE1501		
RV-7FLLM-D1-SE1502	CR750-07VLD1-1-SE1502		

Note1) The " \square " indicates the load mass."4" for 4kg, "7" for 7kg, "13" for 13kg. (" \square " of the controller type name is "04", "07" or "13".)

(2) CR751 controller

Table 1-5: Robot models with CE marking specifications

Robot type Note1)	Controller	External signal logic	Language setting
RV- ☐ FM-1D1-SE1501 RV- ☐ FLM-1D1-SE1501	CR751- □ VD1-0-SE1501		
RV- ☐ FM-1D1-SE1502 RV- ☐ FLM-1D1-SE1502	CR751- □ VD1-0-SE1502		
RV-20FM-1D1-SE1501	CR751-20VD1-0-SE1501	Source type	English (ENG)
RV-20FM-1D1-SE1502	CR751-20VD1-0-SE1502		
RV-7FLLM-1D1-SE1501	CR751-07VLD1-0-SE1501		
RV-7FLLM-1D1-SE1502	CR751-07VLD1-0-SE1502		

Note1) The " \square " indicates the load mass."4" for 4kg, "7" for 7kg, "13" for 13kg. (" \square " of the controller type name is "04", "07" or "13".)

1.4 Contents of the structural equipment

1.4.1 Robot arm

The list of structural equipment is shown in below.

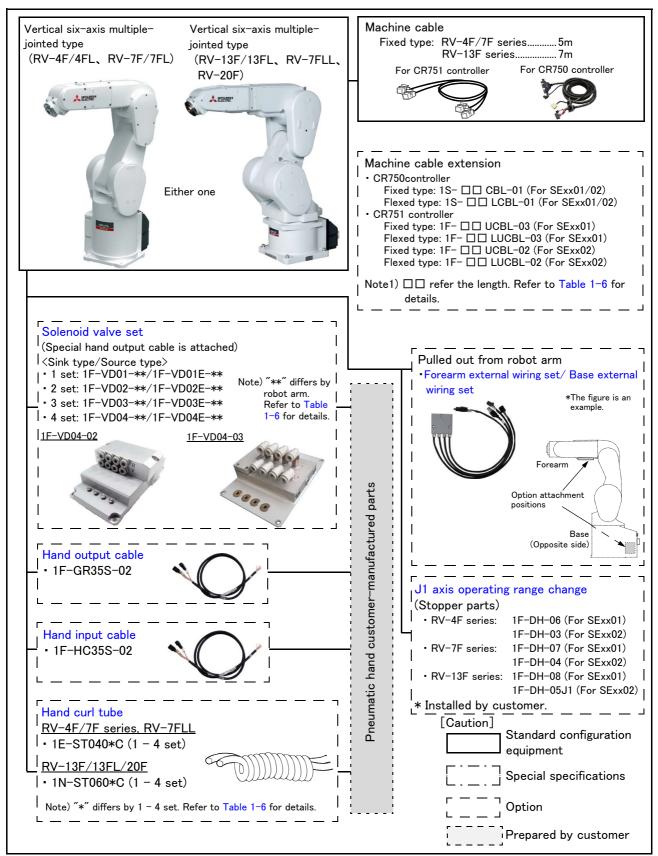


Fig.1-1: Structural equipment (Robot arm)

1.4.2 Controller

The devices shown below can be installed on the controller.

The controllers that can be connected differ depending on the specification of the robot. (Refer to Page 2, "1.2 Model type name of robot".)

(1) CR750controller

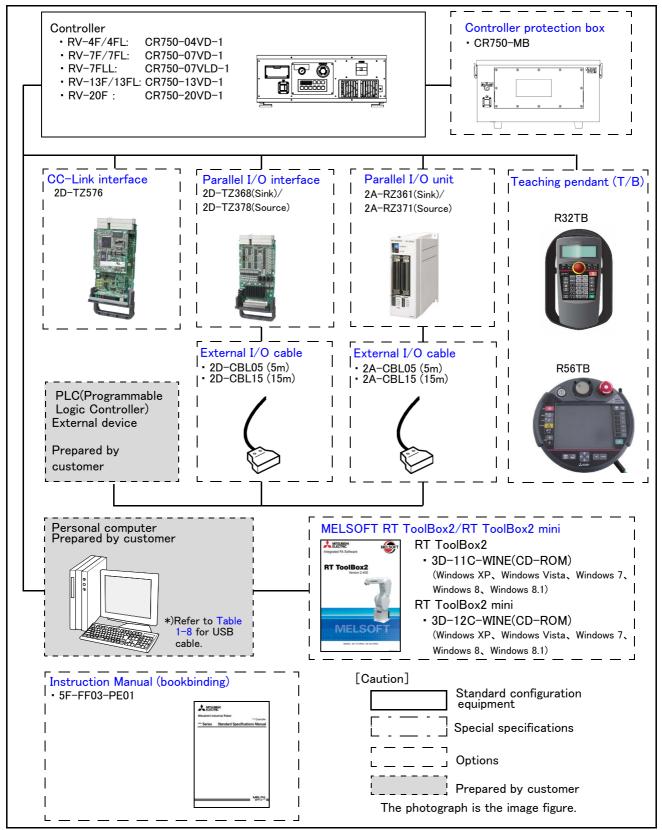


Fig.1-2: Structural equipment (CR750 controller)

(2) CR751 controller

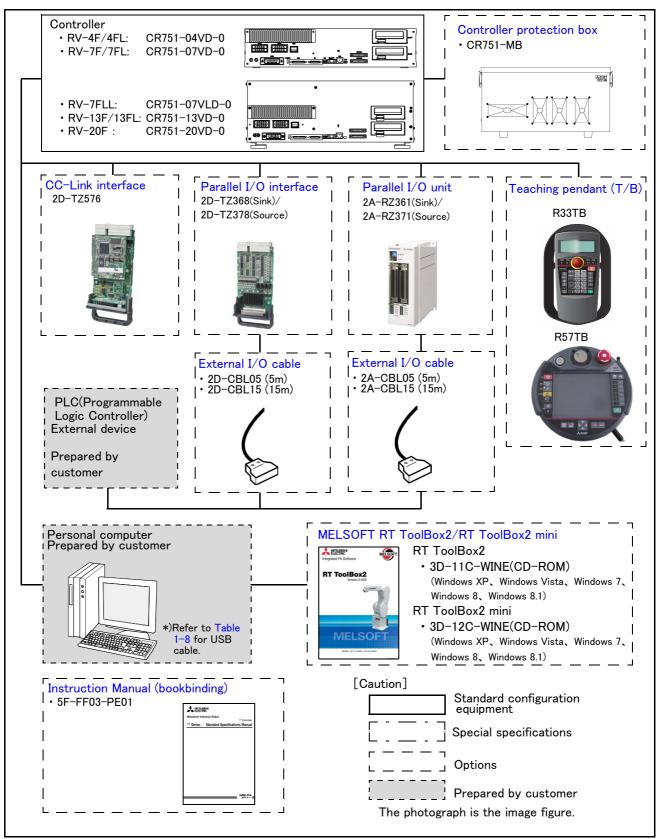


Fig.1-3: Structural equipment (CR751 controller)

1.5 Contents of the Option equipment and special specification

A list of all Optional equipment and special specifications are shown below.

Table 1-6 : The list of the robot arm option equipment and special specification

The same	Туре	San aliferations	Classification Note1)		Description
Item	Туре	Specifications	CR750 CR751		Description
J1 axis operating range change	1F-DH-06	Stopper part for RV-4F series: Sets as the + side/- side each by the combination within 30, 73, 103 and 146.	0	0	This must be installed and setting the parameter by the customer. For SExx01 (Chemical-resistant specifications).
	1F-DH-07	Stopper part for RV-7F series: Sets as the + side/- side each by the combination within 35, 77, 99 and 141.	0	0	* Refer to Page 50, "(2) J1 axis operating range change" for details.
	1F-DH-08	Stopper part for RV-13F series: Sets as the + side/- side each by the combination within 30, 73, 103 and 146.	0	0	
	1F-DH-03	Stopper part for RV-4F series: Sets as the + side/- side each by the combination within 30, 73, 103 and 146.	0	0	This must be installed and setting the parameter by the customer. For SExx02 (Food machinery grade H1 grease specifications).
	1F-DH-04	Stopper part for RV-7F series: Sets as the + side/- side each by the combination within 35, 77, 99 and 141.	0	0	* Refer to Page 50, "(2) J1 axis operating range change" for details.
	1F-DH-05J1	Stopper part for RV-13F series: Sets as the + side/- side each by the combination within 30, 73, 103 and 146.	0	0	
Extended machine cable (extension type)	1S- □□ CBL-01	For fixing (Set of power and signal) Extension type	0	-	" \(\sum \) " in type shows the length of the cables as follows.
	1S- □□ LCBL-01	For flexing (Set of power and signal) Extension type	0	_	05=5m, 10=10m, 15=15m For SExx01 (Chemical-resistant specifications)/SExx02(Food machinery grade H1 grease specifications).
Extended machine cable (direct type)	1F- □□ UCBL-03	For fixing (Set of power and signal) Extension type	_	0	"
	1F- □□ LUCBL-03	For flexing (Set of power and signal) Extension type	-	0	For SExx01 (Chemical-resistant specifications).
	1F- □□ UCBL-02	For fixing (Set of power and signal) Extension type	-	0	" \(\square\) " in type shows the length of the cables as follows.
	1F- □□ LUCBL-02	For flexing (Set of power and signal) Extension type	-	0	10=10m, 15=15m, 20=20m For SExx02 (Food machinery grade H1 grease specifications).
Solenoid valve set	1F-VD01-04/VD01E-04	1 set (Sink type)/(Source type)	0	0	The solenoid-valve set for the hand of
	1F-VD02-04/VD02E-04	2 set (Sink type)/(Source type)	0	0	the customer setup. Use for SExx01 (Chemical-resistant
	1F-VD03-04/VD03E-04	3 set (Sink type)/(Source type)	0	0	specifications) of the RV-4F/7F series and RV-7FLL.
	1F-VD04-04/VD04E-04	4 set (Sink type)/(Source type)	0	0	and IV /I EE.
	1F-VD01-05/VD01E-05	1 set (Sink type)/(Source type)	0	0	The solenoid-valve set for the hand of
	1F-VD02-05/VD02E-05	2 set (Sink type)/(Source type)	0	0	the customer setup. Use for SExx01 (Chemical-resistant
	1F-VD03-05/VD03E-05	3 set (Sink type)/(Source type)	0	0	specifications) of the RV-13F/13FL and RV-20F.
	1F-VD04-05/VD04E-05	4 set (Sink type)/(Source type)	0	0	11.0 201.
	1F-VD01-02/VD01E-02	1 set (Sink type)/(Source type)	0	0	The solenoid-valve set for the hand of
	1F-VD02-02/VD02E-02	2 set (Sink type)/(Source type)	0	0	the customer setup. Use for SExx02 (Food machinery grade
	1F-VD03-02/VD03E-02	3 set (Sink type)/(Source type)	0	0	H1 grease specifications) of the RV-4F/ 7F series and RV-7FLL.
	1F-VD04-02/VD04E-02	4 set (Sink type)/(Source type)	0	0	// Solies allu IVV /ITLL.
	1F-VD01-03/VD01E-03	1 set (Sink type)/(Source type)	0	0	The solenoid-valve set for the hand of
	1F-VD02-03/VD02E-03	2 set (Sink type)/(Source type)	0	0	the customer setup. Use for SExx02 (Food machinery grade
		3 set (Sink type)/(Source type)	0	0	H1 grease specifications) of the RV- 13F/13FL and RV-20F.
	1F-VD04-03/VD04E-03	4 set (Sink type)/(Source type)	0	0	

Item	Туре	Specifications	Classif Not		Description	
			CR750 CR751			
Hand input cable	1F-HC35S-02	Robot side: connector. Hand side: wire.	0	0	The cable is connected to the sensor by the customer.	
Hand output cable	1F-GR35S-02	Robot side: connector. Hand side: wire	0	0	This cable can be used for the solenoid valve prepared by the customer.	
Hand curl tube	1E-ST0402C	For solenoid valve 1set.: φ4x2	0	0	Curl type air tube	
	1E-ST0404C	For solenoid valve 2set.: ϕ 4x4	0	0	For RV-4F/7F series and RV-7FLL.	
	1E-ST0406C	For solenoid valve 3set.: ϕ 4x6	0	0		
	1E-ST0408C	For solenoid valve 4set.: ϕ 4x8	0	0		
	1N-ST0602C	For solenoid valve 1set.: ϕ 6x2	0	0	Curl type air tube	
	1N-ST0604C	For solenoid valve 2set.: ϕ 6x4	0	0	 For RV=13F/13FL and RV=20F.	
	1N-ST0606C	For solenoid valve 3set.: ϕ 6x6	0	0		
	1N-ST0608C	For solenoid valve 4set.: ϕ 6x8	0	0		
Forearm external wiring set	1F-HB01S-02	The following cables can be wired outside: hand input signals, force sensor and vision sensor.	0	0	Pulls out from forearm lower part. Use for SExx01 (Chemical-resistant specifications).	
	1F-HB02S-02	The following cables can be wired outside: force sensor and vision-sensor.	0	0		
	1F-HB01S-01	The following cables can be wired outside: hand input signals, force sensor and vision sensor.	0	0	Pulls out from forearm lower part. For SExx02 (Food machinery grade Higrease specifications).	
	1F-HB02S-01	The following cables can be wired outside: force sensor and vision-sensor.	0	0		
Base external wiring set	1F-HA01S-02	The following cables can be wired outside: force sensor and vision-sensor.	0	0	Pulls out from base side. Use for SExx01 (Chemical-resistant	
	1F-HA02S-02	The following cables can be wired outside: force sensor and vision-sensor.	0	0	specifications).	
	1F-HA01S-01	The following cables can be wired outside: force sensor and vision-sensor.	0	0	Pulls out from base side. For SExx02 (Food machinery grade H1	
	1F-HA02S-01	The following cables can be wired outside: force sensor and vision-sensor.	0	0	grease specifications).	

Note1) O : option, \square : special specifications.

Table 1-7: The list of the controller option equipment and special specification

Item	Туре	Specifications	Classification Note1)		Description	
			CR750 CR751			
Simple teaching pendant	R32TB	Cable length 7m	0	-	With 3-position enable switch	
	R32TB-15	Cable length 15m	0	-	IP65	
	R33TB	Cable length 7m	-	0		
	R33TB-15	Cable length 15m	_	0		
Highly efficient teaching	R56TB	Cable length 7m	0	-		
pendant	R56TB-15	Cable length 15m	0	-		
	R57TB	Cable length 7m	_	0		
	R57TB-15	Cable length 15m	_	0		
Parallel I/O Interface	2D-TZ378(Source type)	DO: 32 point DI: 32 point Insulated type output signal (0.1A/24V /point) Insulated type input signal (9mA/ 24V /point)	0	0	The card type external input-and-output. Interface. Install to the slot of controller.	
External I/O cable	2D-CBL05	5m	0	0	Use to connect the external peripheral	
(For Parallel I/O Interface)	2D-CBL15	15m	0	0	device to the parallel input/output interface.	
Parallel I/O Unit	2A-RZ371(Source type)	DO: 32 point/ DI: 32 point Insulated type output signal (0.1A/24V /point) Insulated type input signal (7mA/ 24V /point)	0	\circ	The unit for expansion the external input/output. Electrical isolated Type (100mA/Point)	
(For Parallel I/O Unit)	2A-CBL05	5m	0	0	Use to connect the external peripheral	
	2A-CBL15	15m	0	0	device to the parallel input/output unit	
CC-Link interface	2D-TZ576	Only Intelligent device station, Local station	0	0	For MELSEC PLC with CC-Link connection.	

Item	Туре	Specifications	Classification Note1)		Description
			CR750	CR751	
Controller protection box	CR750-MB	IP54	0	-	The controller protection box is used to
	CR751-MB		_		protect the controller from an oil mist or other operating environment.
RT ToolBox2 (Personal computer Sup- port software)	3D-11C-WINE	CD-ROM	0	0	Windows XP、Windows Vista、Windows 7、Windows 8、Windows 8.1 (With the simulation function)
RT ToolBox2 mini (Personal computer Sup- port software mini)	3D-12C-WINE	CD-ROM	0		Windows XP、Windows Vista、Windows 7、Windows 8、Windows 8.1
Instruction Manual	5F-FF03-PE01	RV-4F/7F/13F-D series multiple- resistant specification	0	0	

Note1) O : option, □ : special specifications.

[Reference]: The recommendation products of the USB cable are shown below

Table 1-8: Recommendation article of the USB cable

Name	Type name	Supplier
USB cable	KU-AMB530	SANWA SUPPLY INC.
(USB A type-USB mini B type)	USB-M53	ELECOM CO., LTD.
	GT09-C30USB-5P	MITSUBISHI ELECTRIC SYSTEM & SERVICE CO., LTD.
	MR-J3USBCBL3M	MITSUBISHI ELECTRIC CO., LTD.
USB adapter (USB B type-USB mini B type)	AD-USBBFTM5M	ELECOM CO., LTD.



Caution

Be careful to the USB cable to apply neither the static electricity nor the noise. Otherwise, it becomes the cause of malfunction.



Scaution

Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer.

The factor of the EA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

2 Robot arm

2.1 Standard specifications

2.1.1 Basic specifications

(1) RV-4F/7F series

Table 2-1: Standard specifications of robot

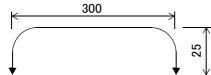
	Item	Unit		Specific	cations			
Туре			RV-4FM-SExx01 RV-4FLM-SExx01 RV-7FM-SExx01 RV-7FLM-SEX RV-4FM-SExx02 RV-4FLM-SExx02 RV-7FM-SExx02 RV-7FLM-SEX					
Environment				I Exx01: Chemical-resistant sp Exx02: Food machinery grade				
Degree of free	dom		6					
Installation po	osture			On floor, hanging, (a	gainst wall ^{Note1)})			
Structure				Vertical, multi				
Drive system				AC servo motor (brake	provided on all axes)			
Position detec	tion method			Absolute	encoder			
Motor capac-	Waist (J1)	W	4	100	7	750		
ty	Shoulder (J2)		4	100	7	750		
	Elbow (J3)		1	00	4	100		
	Wrist twist (J4)		1	00	1	100		
	Wrist pitch (J5)			10	0			
	Wrist roll (J6)			50)			
Operating	Waist (J1)	Degree		±2	40			
range	Shoulder (J2)		±	120	-115 to 125	-110 to 130		
	Elbow (J3)		0 to 161	0 to 164	0 to 156	0 to 162		
	Wrist twist (J4)			±2	00			
	Wrist pitch (J5)		±120					
	Wrist roll (J6)			±3	60			
Speed of	Waist (J1)	Degree/s	450	420	360	288		
motion	Shoulder (J2)		450	336	401	321		
	Elbow (J3)		300	250	450	360		
	Wrist twist (J4)		Ę	540	337			
	Wrist pitch (J5)		ϵ	323	450			
	Wrist roll (J6)			0				
	n radius (P point)	mm	514.5	648.7	713.4	907.7		
Maximum resu	Itant velocity ^{Note2)}	mm/sec	9,	000	11	,000		
Load		kg(N)		4		7		
Pose repeatab		mm		±0	.02			
Cycle time Note		sec	0	1.36	0.32 0.35			
Ambient temp	erature ^{Note5)}	°C		0 to	40	_		
Mass		kg	39	41	65	67		
Allowable	Wrist twist (J4)		6	5.66	16.2			
moment load	Wrist pitch (J5)	N·m	6	5.66	1	6.2		
	Wrist roll (J6)		3	.90	6	3.86		
Allowable	Wrist twist (J4)		0.20		0.45			
nertia	Wrist pitch (J5)	kg·m²	0.20		C	0.45		
	Wrist roll (J6)		0.10					
Tool wiring	Hand input/output		Hand input eight points / hand output eight points					
	LAN cable		Equipped (eight cores) <100BASE-TX>					
	Wiring for user		Equipped (24 cores) <force etc.="" sensor=""></force>					
Tool pneu-	Primary piping			φ6	× 2			
matic pipes	c pipes Secondary piping φ4×8							
Supply pressu	re	MPa		0.5	54			

Item	Unit	Specifications
Protection specification Note6) Note7)		Chemical-resistant specifications (SExx01)/Food machinery grade H1 grease specifications (SExx02): IP65
Painting color		Chemical-resistant specifications (SExx01): Gray (Coating agent's color) Food machinery grade H1 grease specifications (SExx02): Light gray (Equivalent to Munsell: 0.6B7.6/0.2)

- Note1) When used by mounting on the wall, a special specification that limits the operating range of the J1 axis will be used. Please give an order separately.
- Note3)
- This is the value on the mechanical interface surface when all axes are combined.

 The pose repeatability details are given in Page 15, "2.2.1 Pose repeatability"

 The required time period to execute one cycle of the following operation pattern with 1kg load. The cycle time may be Note4) longer depending on the required positioning accuracy for the workpiece and the operating position.



- Note5) Sets the robot's operating environmental temperature as parameter OLTMX. Corresponding to the environment, the continuous control action performance and the overload-protection function are optimized. (Refers to "Optimizing the overload level" described in "Chapter 5 Functions set with parameters" of separate instruction manual/ Detailed explanations of functions and operations for details.)
- Note6) The protection specification details are given in Page 20, "2.2.6 Protection specifications".
- Note7) The controller is not chemical-resistant. For installing the controller, avoid places where adhesion of chemicals may occur.

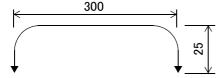
(2) RV-13F series

Table 2-2: Standard specifications of robot

	tem	Unit	S OI PODOL	Specific	cations			
Туре			RV-13FM-SExx01	RV-13FLM-SExx01	RV-20FM-SExx01	RV-7FLLM-SExx01		
. , , , .			RV-13FM-SExx02 RV-13FLM-SExx02 RV-20FM-SExx02 RV-7FLLM-S					
Environment			SExx01: Chemical-resistant specifications SExx02: Food machinery grade H1 grease specifications					
Degree of freed	lom			SEXXUZ. FOOD Machinery gr		iris		
Installation post				On floor, hanging (
Structure	cui o			Vertical, multi				
Drive system				AC servo motor (brake				
Position detect	ion method			Absolute	-			
Motor capac-	Waist (J1)	w		15				
ity	Shoulder (J2)	•		15				
	Elbow (J3)	=		75				
	Wrist twist (J4)	=	_	40				
	Wrist pitch (J5)	=		200	· ·	100		
	Wrist roll (J6)	=		100		50		
Operating	Waist (J1)	Degree		±1	190			
range	Shoulder (J2)	208.00	_	-90 to	+150			
	Elbow (J3)	=	_	-10 to				
	Wrist twist (J4)	=	_	±2				
	Wrist pitch (J5)	=	_	±1				
	Wrist roll (J6)	=						
Speed of	Waist (J1)	Degree/s	290	234	110	234		
motion	Shoulder (J2)		234	164	110	164		
	Elbow (J3)	=	312	219	110	219		
	Wrist twist (J4)	=	375		124	375		
	Wrist pitch (J5)	=		375 125				
	Wrist roll (J6)	=		720	360	450 720		
Maximum reach		mm	1,094	1,388	1,094	1,503		
Maximum result	tant velocity ^{Note2)}	mm/sec	10,450	9,700	4,200	15,300		
Load Rating (I		kg	12	2(13)	15(20)	7(7)		
Pose repeatabil		mm		±0.05	<u> </u>	±0.06		
Cycle time ^{Note4)}		sec	0.53	0.68	0.70	0.63		
Ambient temper		°C		0 to		l		
Mass		kg	120	130	120	130		
Allowable	Wrist twist (J4)	N·m		9.3	49	16.2		
moment load	Wrist pitch (J5)	1		9.3	49	16.2		
	Wrist roll (J6)	1		19.5		6.86		
Allowable	Wrist twist (J4)	kg·m²	0	1.47	1.4	0.45		
inertia	Wrist pitch (J5)	ng III	0.47		1.4	0.45		
	Wrist roll (J6)	1	0.14			0.1		
Tool wiring	Hand input/outpu	t	Hand input eight points / hand output eight points					
LAN cable			Equipped (eight cores) <100BASE-TX>					
Wiring for user			Equipped (24 cores) <force etc.="" sensor=""></force>					
Durana a dia tana			φ6×2					
Tool pneumatic pipes Secondary piping			φ6×8					
Supply pressure		MPa	0.54					
Protection spec Note6) Note7)		•	Chemical-resistant specifications (SExx01)/Food machinery grade H1 grease specifications (SExx02): IP65					
Painting color Chemical-resistant specifications (SExx01): Gray (Coating agent's color) Food machinery grade H1 grease specifications (SExx02): Light gray (Equivalent to Munsell: 0.6B7)					t to Munsell: 0.6R7.6/0.2)			

Note1) When used by mounting on the wall, a special specification that limits the operating range of the J1 axis will be used. Please give an order separately.

- Note2) This is the value on the mechanical interface surface when all axes are combined.
- Note3) The pose repeatability details are given in Page 15, "2.2.1 Pose repeatability"
- Note4) The required time period to execute one cycle of the following operation pattern with 5kg load. The cycle time may be longer depending on the required positioning accuracy for the workpiece and the operating position.



Note5) Sets the robot's operating environmental temperature as parameter OLTMX. Corresponding to the environment, the continuous control action performance and the overload-protection function are optimized. (Refers to "Optimizing the overload level" described in "Chapter 5 Functions set with parameters" of separate instruction manual/ Detailed explanations of functions and operations for details.)

Note6) The protection specification details are given in Page 20, "2.2.6 Protection specifications".

Note7) The controller is not chemical-resistant. For installing the controller, avoid places where adhesion of chemicals may occur.

2.1.2 The counter-force applied to the installation surface

The counter-force applied to the installation surface for the strength design of the robot installation surface is

Table 2-3: Value of each counter-force

		Value				
Item	Unit	RV-4F series	RV-7F series	RV-7FLL RV-13F series RV-20F		
Falls moment: M _L	N·m	410	900	2,060		
Torsion moment: M _T	N·m	400	900	2,060		
Horizontal translation force: F _H	N	700	1,000	1,750		
Vertical translation force: F _V	N	1,200	1,700	2,900		

2.2 Definition of specifications

The accuracy of pose repeatability mentioned in catalogs and in the specification manual is defined as follows.

2.2.1 Pose repeatability

For this robot, the pose repeatability is given in accordance with JIS B 8432 (Pose repeatability). Note that the value is based on 100 measurements (although 30 measurements are required according to JIS).

[Caution] The specified "pose repeatability" is not guaranteed to be satisfied under the following conditions.

- [1] Operation pattern factors
 - 1) When an operation that approaches from different directions and orientations are included in relation to the teaching position during repeated operations
 - 2) When the speed at teaching and the speed at execution are different
- [2] Load fluctuation factor
 - 1) When work is present/absent in repeated operations
- [3] Disturbance factor during operation
 - 1) Even if approaching from the same direction and orientation to the teaching position, when the power is turned OFF or a stop operation is performed halfway
- [4] Temperature factors
 - 1) When the operating environment temperature changes
 - 2) When accuracy is required before and after a warm-up operation
- [5] Factors due to differences in accuracy definition
 - 1) When accuracy is required between a position set by a numeric value in the robot's internal coordinate system and a position within the actual space
 - 2) When accuracy is required between a position generated by the pallet function and a position within the actual space

2.2.2 Rated load (mass capacity)

The robot's mass capacity is expressed solely in terms of mass, but even for tools and works of similar mass, eccentric loads will have some restrictions When designing the tooling or when selecting a robot, consider the following issues.

- (1) The tooling should have the value less or equal than the smaller of the tolerable inertia and the tolerable moment found in Page 11, "2.1.1 Basic specifications".
- (2) Fig. 2-1 to Fig. 2-4 shows the distribution dimensions for the center of gravity in the case where the volume of the load is relatively small. Use this figure as a reference when designing the tooling.
- (3) Even if the load is force, not the mass, design the tooling so that moment does not exceed the allowable moment. Refer to Page 11, "2.1 Standard specifications" for details of allowable moment value.

[Caution] The mass capacity is greatly influenced by the operating speed of the robot and the motion posture. Even if you are within the allowable range mentioned previously, an overload or generate an overcurrnt alarm could occur. In such cases, it will be necessary to change the time setting for acceleration/deceleration, the operating speed, and the motion posture.

[Caution] The overhang amount of the load, such as the mass capacity and the allowable moment of inertia defined in this section, are dynamic limit values determined by the capacity of the motor that drives axes or the capacity of the speed reducer. Therefore, it does not guarantee the accuracy on all areas of tooling. Guaranteed accuracy is measured from the center point of the mechanical interface surface. Please note that if the point of operation is kept away from the mechanical interface surface by long and low-rigid tooling, the positioning accuracy may deteriorate or may cause vibration.

[Caution] Even within the allowable range previously mentioned, an overload alarm may be generated if an ascending operation continues at a micro-low speed. In such a case, it is necessary to increase the ascending speed.

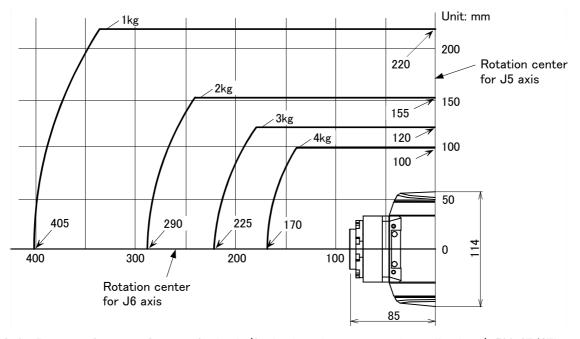


Fig.2-1: Position of center of gravity for loads (for loads with comparatively small volume): RV-4F/4FL

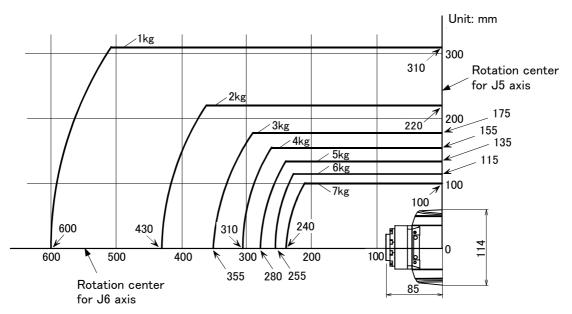


Fig.2-2: Position of center of gravity for loads (for loads with comparatively small volume): RV-7F/7FL/7FLL

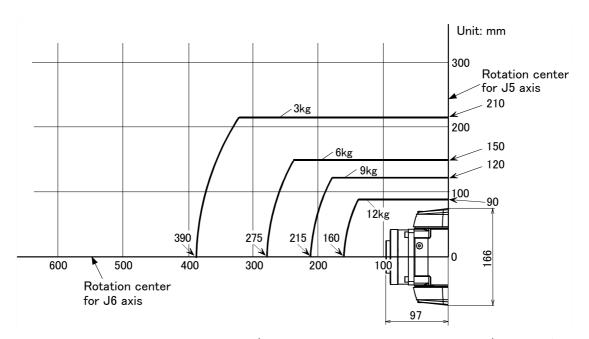


Fig.2-3: Position of center of gravity for loads (for loads with comparatively small volume): RV-13F/13FL

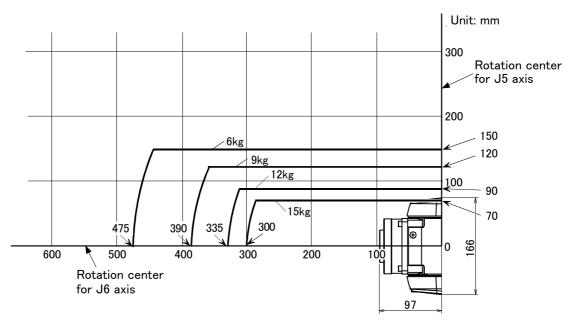


Fig.2-4: Position of center of gravity for loads (for loads with comparatively small volume): RV-20F

2.2.3 Relationships Among Mass Capacity, Speed, and Acceleration/Deceleration Speed

This robot automatically sets the optimum acceleration and deceleration speeds and maximum speed, according to the load capacity and size that have been set, and operates using these automatically set speeds.

To achieve that, it is necessary to correctly set the actual load data (mass and size of hand and work) to be used. However, vibration, overheating and errors such as excessive margin of error and overload may occur, depending on the robot operation pattern or ambient temperature.

In such a case, change the setting value to the +20% range.

If a setting is performed in such a way that it falls below the mounted load, the life span of the mechanism elements used in the robot may be shortened. In the case of a work requiring a high degree of accuracy, set up the load correctly and use the robot by lowering the ratios of the acceleration and deceleration speeds.

(1) Setting Load Capacity and Size (Hand Conditions)

Set up the capacity and size of the hand with the "HNDDAT*" parameter (optimum acceleration/deceleration setting parameter), and set up the capacity and size of the work with the "WRKDAT*" parameter. Numbers 0 to 8 can be used for the asterisk (*) part. Designate the "HNDDAT*" and "WRKDAT*" parameters to be used using the "LoadSet" command in a program.

For more details, refer to the separate "Instruction Manual/Detailed Explanation of Functions and Operations." It is the same meaning as "LoadSet 0.0" if not using the "LoadSet".

2.2.4 Vibrations at the Tip of the Arm during Low-Speed Operation of the Robot

Vibrations at the tip of the arm may increase substantially during the low-speed operation of the robot, depending on the combination of robot operation, hand mass and hand inertia. This problem occurs when the vibration count specific to the robot arm and the vibration count of the arm driving force are coming close to each other. These vibrations at the tip of the arm can be reduced by taking the following measures:

- 1) Lower the robot's operating speed by approximately 5% from high speed using the Ovrd command.
- 2) Change and move the teaching points of the robot.
- 3) Change the hand mass and hand inertia.

2.2.5 Collision detection

This series have the "collision detection function" which detects the abnormalities by the collision of the robot arm, however initial setting is in invalid condition.

The enable/disable of this function can be changed by parameter: COL and command: ColChk, this function is effective for protect of the robot and of the peripheral equipment.

The abnormalities are detected by the robot's kinetics model, presuming torque necessary for movement at any time. Therefore, the setting parameter (HNDDAT*, WRKDAT*) of the hand and the work piece conditions should be right. And, it may be detected as the collision in movement as speed and motor torque are changed rapidly. (for example, the movement near the place of the origin by linear interpolation, the reversal movement, the cold condition, the operation after long term stoppage)

In such a case, by adjusting the value of the setting parameter (COLLVL, COLLVLJG) of the collision detection level according to actual use environment, the sensitivity of collision detection can be optimized and the damage risk can be reduced further. And, in the operation after the low temperature or long term stoppage, please operate by accustoming at low speed (warm-up), or use the warm-up operation mode.

Refer to the separate instruction manual "Detailed explanations of functions and operations" for details of related parameter.

Table 2-4: Factory-shipments condition

	JOG operation	Automatic
RV-4F/7F/13F series	Invalid	Invalid

2.2.6 Protection specifications

(1) Types of protection specifications

The robot arm has protection specifications that comply with the IEC Standards. The protection specifications and applicable fields are shown in Table 2-5.

Table 2-5: Protection specifications and applicable fields

Туре	Protection specifications (IEC Standards value)	Classification	Applicable field
RV-4FM/4FLM-SExx01 RV-7FM/7FLM-SExx01 RV-7FLLM-SExx01 RV-13FM/13FLM-SExx01 RV-20FM-SExx01		Chemical-resistant specifications (SExx01)	Transportation and processing of medicine and food. Worksites that require chemical sterilization/cleaning of the robot arm.
RV-4FM/4FLM-SExx02 RV-7FM/7FLM-SExx02 RV-7FLLM-SExx02 RV-13FM/13FLM-SExx02 RV-20FM-SExx02	IP65	Food machinery grade H1 grease specifications (SExx02)	Transportation and processing of food. Worksites that require cleaning of the robot arm by wiping.



Do not use the controller in the sterilization/cleaning environment shown in Table 2-5. Avoid places where adhesion of chemicals may occur.

The IEC IP symbols define the degree of protection against solids and fluids, and do not indicate a protective structure against the entry of chemicals.

The IEC standard is described by the following "Information" The robots with food machinery grade H1 grease specifications (SExx02) may be corroded with rust due to liquids such as chemicals, water, or oil.

[Information]

• The IEC IP65

Protection against water infiltration as specified in IP65 indicates a protective structure that is not harmfully affected when $12.5 \pm 5\%$ liters of water is supplied from a test device at a position approx. 3m away in various directions and a water pressure of 30kPa at the nozzle section. The water is filled one minute per 1m2 of test device surface area for a total of three minutes.

(2) About using the robot in the sterilization environment

The multiple-resistant specification robot is made by order. This robot has protection methods that conform to IEC's IP65 standards (splashproof type). Recommended usage conditions.

- 1) Robots with multiple-resistant specifications are supposed to be used in applications such as transportation/processing systems in pharmaceutical and food plants.
- 2) In our company, chemical resistance of the robots is confirmed by the sterilization environment test with hydrogen peroxide gas*1) (for chemical-resistant specifications (SExx01) only). The robot arm may be adversely affected when used in the sterilization environment other than the above, or in direct contact with water or other liquids in excess of the amount indicated in the protection specifications. If you have any specific requests for surface treatment, materials, etc., contact your dealer.
- 3) Take measures to protect the robot arm against the sterilization environment other than the above or direct contact with water, oil, or cut chips in excess of the amount indicated in the protection specifications.
- 4) The packing gets deteriorated with the passage of time and must be replaced as required. If you find that the packing is torn or separated while removing/installing the cover, replace the packing. Failure to replace the packing permits chemicals, water or oil to enter the interior of the robot, possibly causing it to become inoperable. Packing required and liquid gasket used therewith are available from dealer.

Although the robot with food machinery grade H1 grease specifications (SExx02) may become rusty from water splashes, the operating performance of the robot is not disturbed.

The warranty is invalid for any faults that occur when the robot is used under the following conditions. Also, if the cover and/or other parts are damaged by interferences caused by the peripheral devices and the robot, the protection specification (seal performance, etc.) may be degraded. Therefore, please pay extra attention when handling the robot.

Refer to Page 175, "6.2 Working environment".

- 1) In surroundings that generate inflammable gases or corrosive gasses *2) .
- 2) Atmosphere of the mist containing polish liquid etc.
- 3) Atmosphere in which the water, the oil, and the dust exceeding protection specification fall on the robot arm directly.

^{*1) &}lt;Sterilization environment test> 6-h exposure in the environment of 120-ppm concentration of hydrogen peroxide gas X 14 times

^{*2)} Chemical resistance of the robots is confirmed by the sterilization environment test with hydrogen peroxide gas*1) for the models with chemical-resistant specifications (SExx01).

2.3 Names of each part of the robot

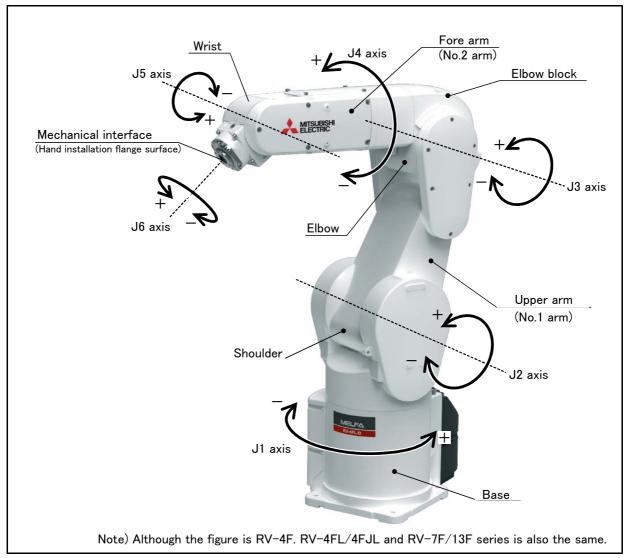


Fig.2-5: Names of each part of the robot

2.4 Outside dimensions • Operating range diagram

(1) RV-4F

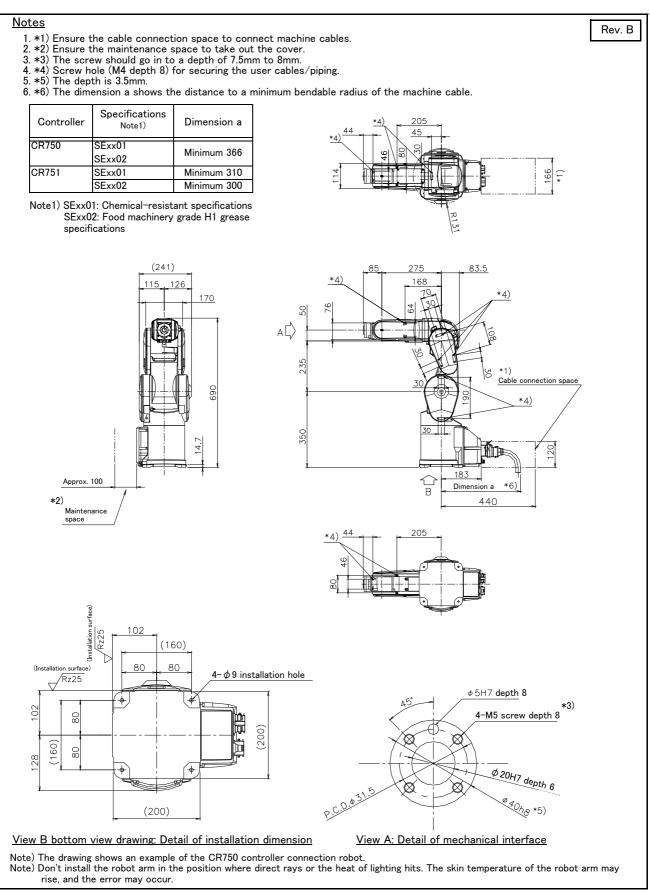


Fig.2-6: Outside dimensions: RV-4F

Rev. B

Notes

- 1. *1) Rear face operation limit: When the J axis angle is -60° <= J1 <= +140°, the J2 axis operation is limited to -113° <= J2 <= +120°.
- 2. The following figure shows a robot at the position of: J1=0°, J2=0°, J3=90°, J4=0°, J5=0°, and J6=0°
- 3. *3) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping,

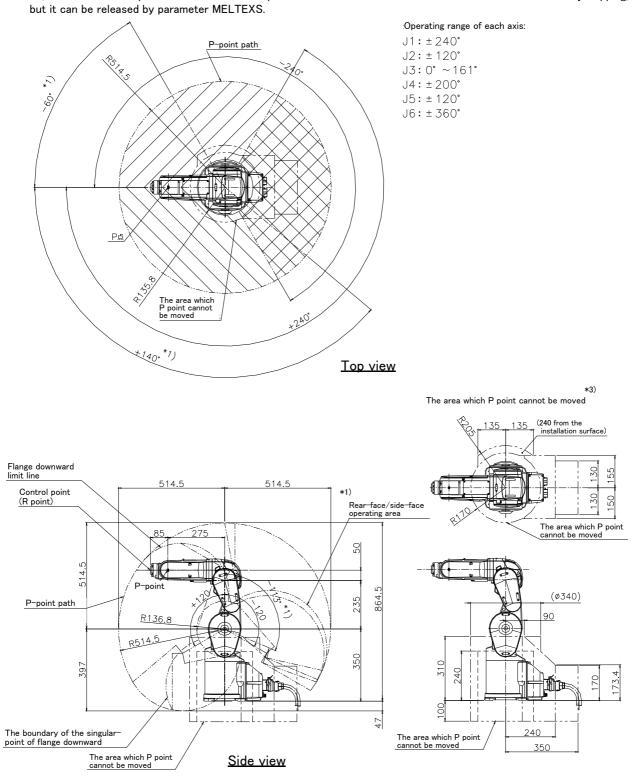


Fig.2-7: Operating range diagram: RV-4F

(2) RV-4FL

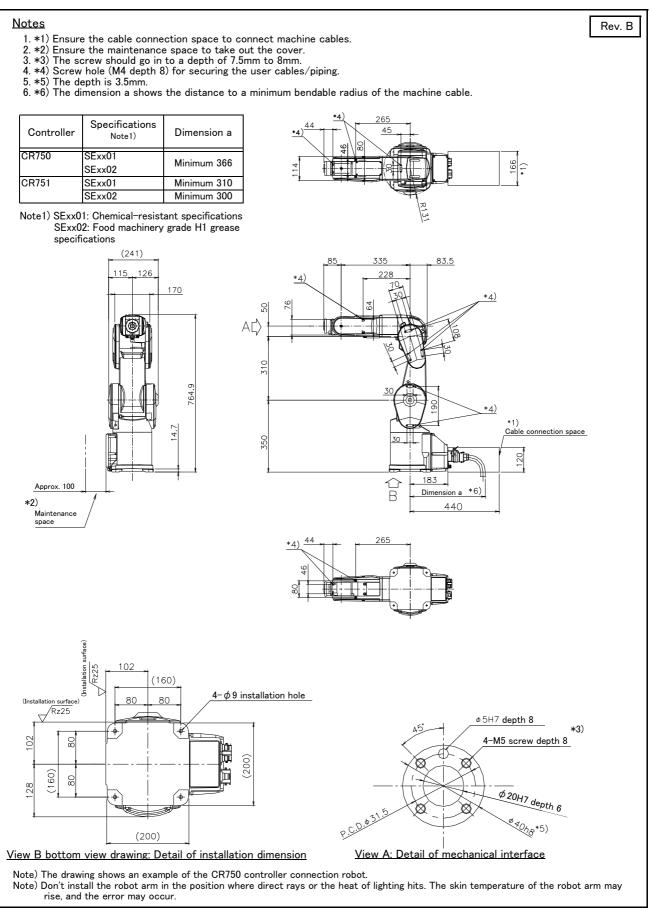


Fig.2-8: Outside dimensions: RV-4FL

Rev. B

<u>Notes</u>

- 1. *1) Rear face operation limit: When the J axis angle is −35° <= J1 <= +35°, the J2 axis operation is limited to −114° <= J2 <= +120°.
- 2. The following figure shows a robot at the position of: J1=0°, J2=0°, J3=90°, J4=0°, J5=0°, and J6=0°
- 3. *3) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping, but it can be released by parameter MELTEXS.

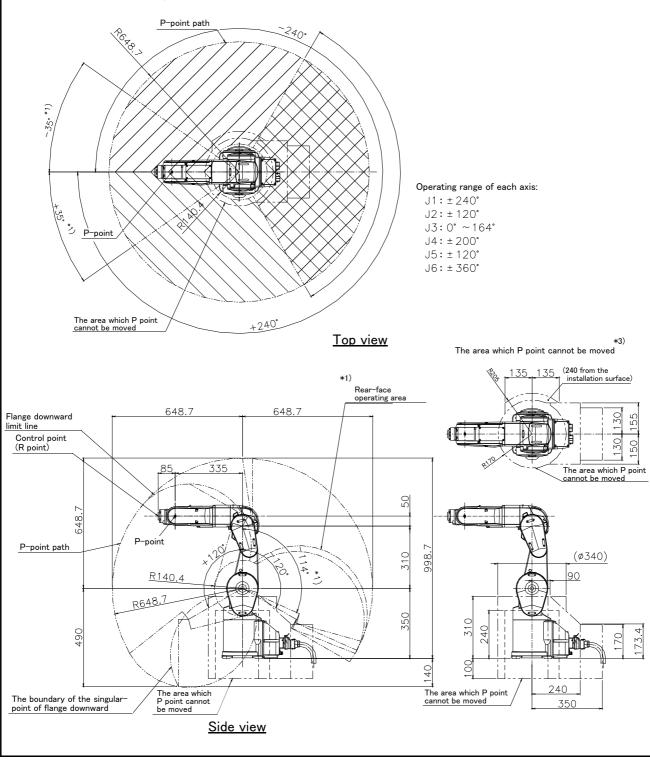


Fig.2-9: Operating range diagram: RV-4FL

(3) RV-7F

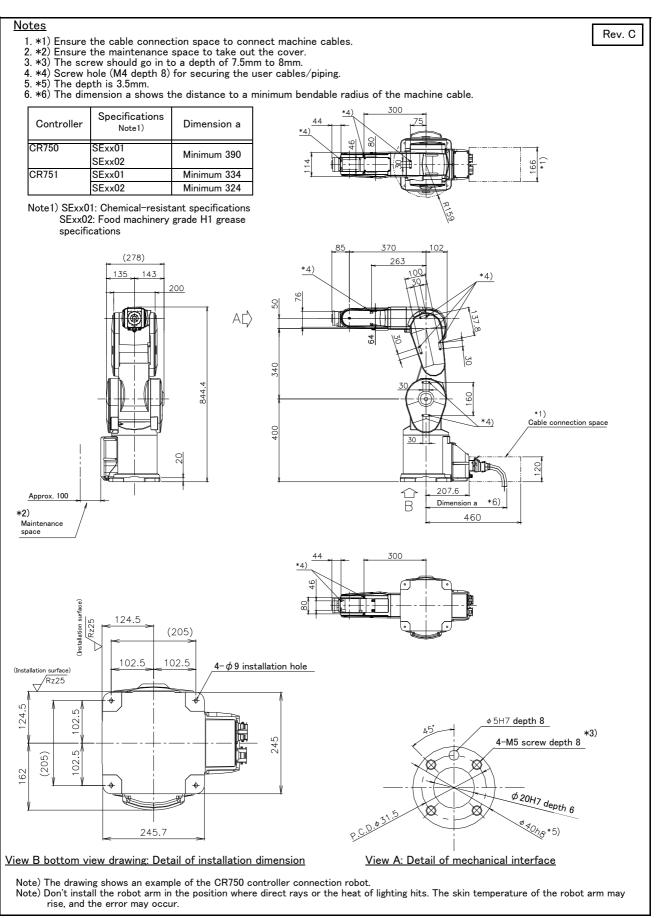


Fig.2-10: Outside dimensions: RV-7F

Rev. C **Notes** 1. The following figure shows a robot at the position of: J1=0°, J2=0°, J3=90°, J4=0°, J5=0°, and J6=0° 2. *1) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping, but it can be released by parameter MELTEXS. -240. P-point path Operating range of each axis: J1: ±240° J2: -115° ~125° J3: 0° ~156° J4: ± 200° P-point J5: ± 120° J6: ± 360° The area which P point cannot be moved Top view *1) The area which P point cannot be moved 150 (271 from the installation surface) Flange downward limit line 713.4 713.4 55 Control point (R point) 50 <u>3</u>70 The area which P point cannot be moved P-point path 340 P-point (φ370) R197.4 114 400 310 568. 264 The area which P point cannot be moved The boundary of the singular point of flange downward 374 Side view The area which P point cannot be moved

Fig.2-11: Operating range diagram: RV-7F

(4) RV-7FL

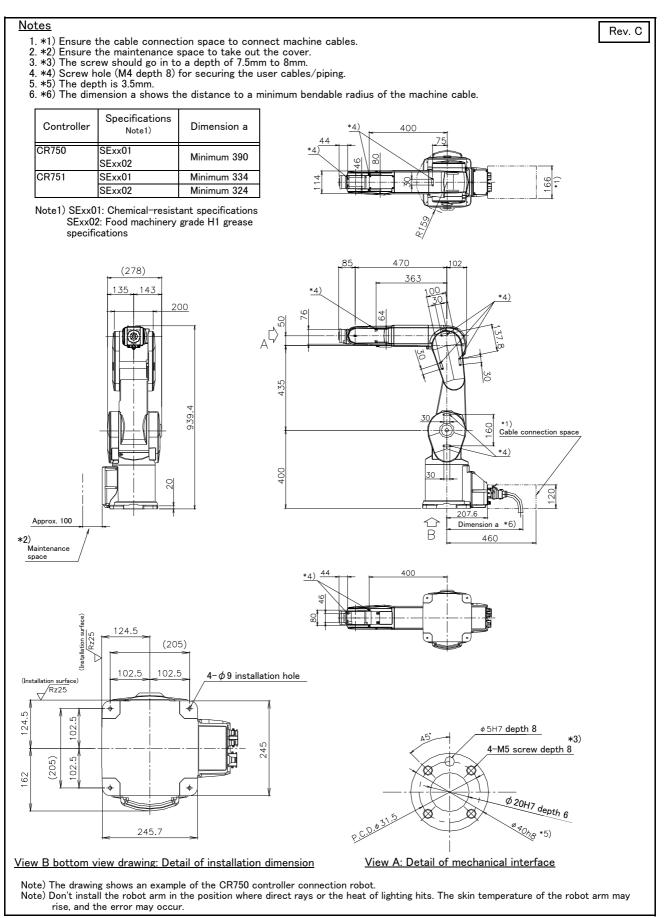


Fig.2-12: Outside dimensions: RV-7FL

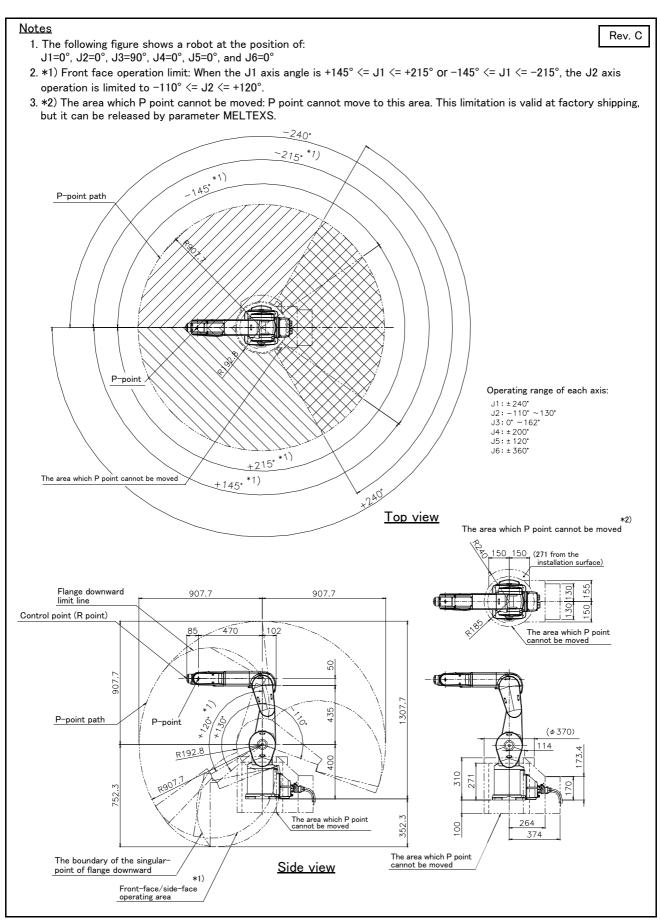


Fig.2-13: Operating range diagram: RV-7FL

(5) RV-7FLL

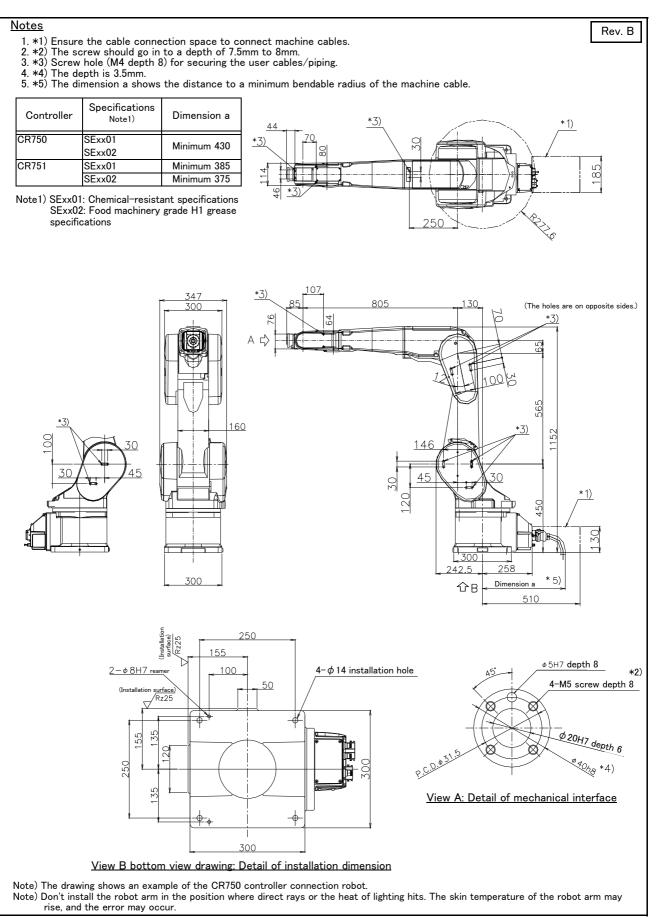


Fig.2-14: Outside dimensions: RV-7FLL

Notes Rev. * 1. The following figure shows a robot at the position of: J1=0°, J2=0°, J3=90°, J4=0°, J5=0°, and J6=0° 2. *1) Front face operation limit: When the J1 axis angle is +120° <= J1 or J1 <= -120°, the J2 axis operation is limited to -90° <= J2 <= +130°. 3. *2) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping, but it can be released by parameter MELTEXS. P-point path (- side) P-point path (+ side) Operating range of each axis: $J1: \pm 190^{\circ}$ J2: -90° ~+150° J3: -10° ~+157.5° J4: ± 200° J5: ± 120° J6: ± 360° Top view Flange downward limit line 564 85 805 The area which P P-point point cannot be moved Control point (R point) 564 1822 +157.5 480 R1373 Top view R399 .70. 50 974 1243 The area which P point cannot be moved Side view Front-face/side-face operating area *2)

Fig.2-15: Operating range diagram: RV-7FLL

(6) RV-13F/20F

Notes Rev. B 1. *1) Ensure the cable connection space to connect machine cables. 2. *2) The screw should go in to a depth of 9mm to 10mm. 3. *3) Screw hole (M4 depth 8) for securing the user cables/piping. 4. *4) The dimension a shows the distance to a minimum bendable radius of the machine cable. Specifications Controller Dimension a CR750 SExx01 *1) Minimum 430 SExx02 Minimum 385 CR751 SExx01 SExx02 Minimum 375 185. Note1) SExx01: Chemical-resistant specifications SExx02: Food machinery grade H1 grease specifications 347 550 *3)(The holes are on opposite sides.) 148 300 *3)(The holes are on opposite sides.) 10016 *3) <u>45</u> * 1) 20 300 242.5258 300 **企**B 510 155 100 4- ϕ 14 installation hole 2 − ϕ 8H7 rimer 50 /Rz25 ϕ 6H7 depth 8 *2) 4-M6 screw depth 10 55 ø25H7 **depth 10** 250 ø50h8 **depth 6.5** P.C.D Ø40 + View A: Detail of mechanical interface 300 View B bottom view drawing: Detail of installation dimension Note) The drawing shows an example of the CR750 controller connection robot.

Note) Don't install the robot arm in the position where direct rays or the heat of lighting hits. The skin temperature of the robot arm may rise, and the error may occur.

Fig.2-16: Outside dimensions: RV-13F/20F

Rev. A **Notes** 1. The following figure shows a robot at the position of: J1=0°, J2=0°, J3=90°, J4=0°, J5=0°, and J6=0° 2. *1) Front face operation limit: When the J1 axis angle is +120° <= J1 or J1 <= -130°, the J2 axis operation is limited to -90° <= J2 <= +130°. 3. *2) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping, but it can be released by parameter MELTEXS. P-point path (- side) P-point path (+ side) Operating range of each axis: +190° J1: ± 190° 190° J2: -90° ~+150° J3: -10° ~+157.5° J4: ± 200° J5: ± 120° J6: ± 360° Top view 550 The area which P *2) point cannot be moved Flange downward limit line P-point R-point 65 (control point) 564 * 157.5° 4 191 1004 28<u>2</u> 430 R964 Top view 459 50 280 684 834 130 *1) The area which P point *2) Front-face/side-face operating area Side view

Fig.2-17: Operating range diagram: RV-13F/20F

(7) RV-13FL

Notes Rev. B 1. *1) Ensure the cable connection space to connect machine cables. 2. *2) The screw should go in to a depth of 9mm to 10mm.
3. *3) Screw hole (M4 depth 8) for securing the user cables/piping. 4. *4) The dimension a shows the distance to a minimum bendable radius of the machine cable. Specifications Controller Dimension a Note1) CR750 SFxx01 Minimum 430 SExx02 CR751 Minimum 385 SExx01 SExx02 Minimum 375 Note1) SExx01: Chemical-resistant specifications SExx02: Food machinery grade H1 grease specifications 690 347 148 *3) (The holes are on opposite sides.) 300 (3) (The holes are on opposite sides.) 160 52 45 * 1) 450 300, 258 300 Dimension a *4) ûВ 510 250 155 $4-\phi$ 14 installation hole 100 2-φ8H7 rimer φ 6H7 **depth 8** 50 Rz25 4-M6 screw depth 10 ø25H7 depth 10 ø50h8 **depth 6.5** P.C.D Ø40 View A: Detail of mechanical interface 300 View B bottom view drawing: Detail of installation dimension Note) The drawing shows an example of the CR750 controller connection robot.

Note) Don't install the robot arm in the position where direct rays or the heat of lighting hits. The skin temperature of the robot arm may rise, and the error may occur.

Fig.2-18: Outside dimensions: RV-13FL

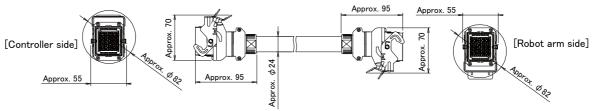
Rev. A **Notes** 1. The following figure shows a robot at the position of: J1=0°, J2=0°, J3=90°, J4=0°, J5=0°, and J6=0° 2. *1) Front face operation limit: When the J1 axis angle is +130° <= J1 or J1 <= -140°, the J2 axis operation is limited to -90° <= J2 <= +130°. 3. *2) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping, but it can be released by parameter MELTEXS. P-point path (+ side) P-point path (- side) Operating range of each axis: J1: ± 190° J2: -90° ~+150° J3: -10° ~+157.5° 190 190° J4: ±200° J5: ± 120° J6: ± 360° Top view 97 690 The area which P point cannot be moved Flange downward limit line P-point R-point (control point) 65 564 1416 430 R1258 Top view R328 Ô 150 930 1128 *1) Front-face/side-face The area which P 130 operating area point cannot be moved Side view *2)

Fig.2-19: Operating range diagram: RV-13FL

2.4.1 Outside dimensions of machine cables

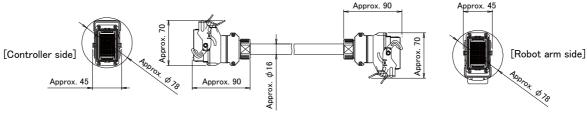
(1) Connection with the CR750 controller

1) Power cable



Note) If using an optional machine cable extension, refer to Page 45, "(1) Machine cable extension" in a diameter of the cable.

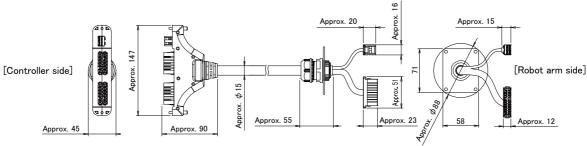
2) Signal cable



Note) If using an optional machine cable extension, refer to Page 45, "(1) Machine cable extension" in a diameter of the cable.

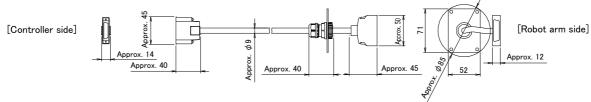
(2) Connection with the CR751 controller

1) Power cable



Note) If using an optional machine cable extension, refer to Page 45, "(1) Machine cable extension" in a diameter of the cable.

2) Signal cable



Note) If using an optional machine cable extension, refer to Page 45, "(1) Machine cable extension" in a diameter of the cable.

2.5 Tooling

2.5.1 Wiring and piping for hand

Shows the wiring and piping configuration for a standard-equipped hand.

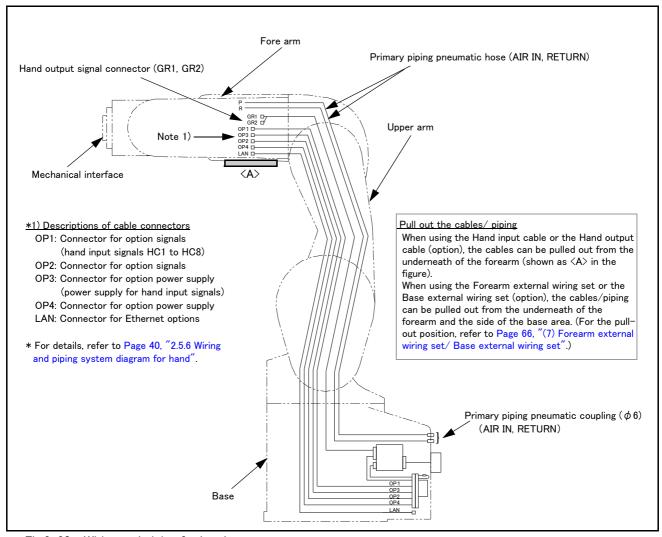


Fig.2-20: Wiring and piping for hand

2.5.2 Internal air piping

- 1) The robot has two ϕ 6 urethane hoses from the pneumatic entrance on the base section to the fore arm. One hose is the primary piping for the pneumatic equipment, and the other pipe is used for air exhaust.
- 2) The optional solenoid is provided with a maximum of eight couplings for the air hose. The diameter of the couplings are shown below.

```
For SExx01.....1F-VD0*-04 (Sink type)/1F-VD0*E-04 (Source type): \phi 4 1F-VD0*-05 (Sink type)/1F-VD0*E-05 (Source type): \phi 6 For SExx02.....1F-VD0*-02 (Sink type)/1F-VD0*E-02 (Source type): \phi 4 1F-VD0*-03 (Sink type)/1F-VD0*E-03 (Source type): \phi 6
```

- 3) The pneumatic inlet in the base section has a ϕ 6 pneumatic coupling bridge.
- 4) The solenoid valve set (optional) can be installed to the side on No.2 arm.
- 5) Refer to Page 56, "(3) Solenoid valve set" for details on the electronic valve set (optional).

2.5.3 Internal wiring for the hand output cable

1) The hand output primary cable extends from the connector PCB of the base section to the inside of the forearm. (AWG#24(0.2mm²) x 2 cores: 8 cables) The cable terminals have connector bridges for eight hand outputs. The connector names are GR1 and GR2.

To extend the wiring to the outside of the arm, a separate cable (optional "hand output cable 1F-GR35S-02") is required.

2.5.4 Internal wiring for the hand input cable

- The hand input cable extends from the connector PCB of the base section to the inside of the forearm. (AWG#24(0.2mm²) for eight points) The cable terminals have connector bridges for eight hand inputs. The connector names are OP1 and OP3.
- 2) The hand check signal of the pneumatic hand is input by connecting this connector. To extend the wiring to the outside of the arm, a separate cable (optional "hand input cable "1F-HC35S-02") is required.

2.5.5 Ethernet cable, option wiring cable

Ethernet cables, eight option signal cables, and four power supply cables internally run from the robot's base section up to the forearm area.

These cables can be also pulled out from the underneath of the forearm or from the side of the base area by using options. (Options "Forearm external wiring set" and "Base external wiring set".)

Table 2-6: Ethernet cable specification

Item	Specification
Communication speed	100BASE-TX
Size	AWG #26 (0.13mm ²) x four pair (total eight cores)
Externality of insulator	Approx. 0.98 mm

2.5.6 Wiring and piping system diagram for hand

Shows the wiring and piping configuration for a standard-equipped hand.

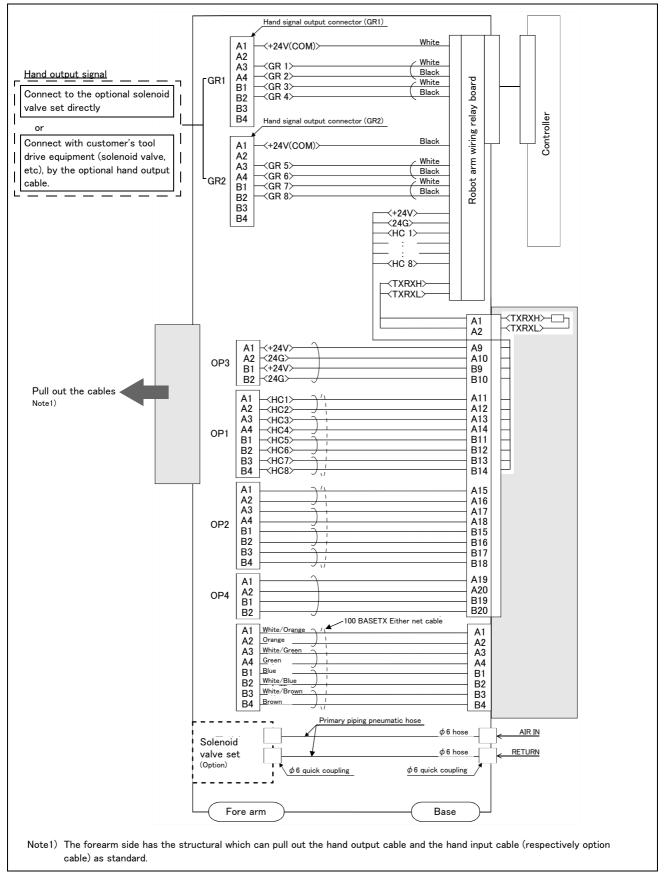


Fig.2-21: Wiring and piping system diagram for hand and example the solenoid valve installation

2.5.7 Electrical specifications of hand input/output

Table 2-7: Electrical specifications of input circuit

Item		Specifications	Internal circuit
Туре		DC input	<sink type=""></sink>
No. of input point	No. of input points 8		+24V ♀
Insulation method		Photo-coupler insulation	+24V
Rated input voltag	ge	24VDC	7 ***
Rated input curre	nt	approx. 7mA	│
Working voltage ra	ange	DC10.2 to 26.4V (ripple rate within 5%)	HCn*
ON voltage/ON c	urrent	8VDC or more/2mA or more	3.3K
OFF voltage/OFF	current	4VDC or less/1mA or less	
Input resistance		Approx. 3.3kΩ	<source type=""/>
Response time	OFF-ON	10ms or less (DC24V)	+24V -
	ON-OFF	10ms or less (DC24V)	+24V
S.V. S.V.			3.3K HCn* 820
			* HCn = HC1 to HC8

Table 2-8: Electrical specifications of output circuit

	Specification	Internal circuit
	Transistor output	⟨Sink type⟩
	8	+24V(COM)
	Photo coupler insulation	(Initial power supply) ——
	DC24V	L_{\bowtie}
е	DC21.6 to 26.4VDC	
	0.1A/ 1 point (100%)	GRn*
OFF	0.1mA or less] \$\dag{}
vith power ON	DC0.9V(TYP.)	
OFF-ON	2ms or less (hardware response time)	1
ON-OFF	2ms or less (resistance load) (hardware response time)	Protection of over-current
	Protects the over-current (0.9A)	
		24G
		<source type=""/>
		Protection of +24V over-current GRn* GRn* 24G * GRn = GR1 to GR8
		Transistor output 8 Photo coupler insulation DC24V e DC21.6 to 26.4VDC 0.1A/ 1 point (100%) OFF 0.1mA or less with power ON DC0.9V(TYP.) OFF-ON 2ms or less (hardware response time) ON-OFF 2ms or less (resistance load) (hardware response time)

2.5.8 Air supply circuit example for the hand

An example of pneumatic supply circuitry for the hand is shown below.

- (1) Place diodes parallel to the solenoid coil.
- (2) When the factory pneumatic pressure drops, as a result of the hand clamp strength weakening, there can be damage to the work. To prevent it, install a pressure switch to the source of the air as shown in Fig. 2-22 and use the circuit described so that the robot stops when pressure drops. Use a hand with a spring-pressure clamp, or a mechanical lock-type hand, that can be used in cases where the pressure switch becomes damaged.
- (3) The optional hand and solenoid valve are of an oilless type. If they are used, don't use any lubricator.
- (4) Supply clean air to the vacuum generation valve .
- (5) If the air supply temperature (primary piping) used for the tool etc. is lower than ambient air temperature, the dew condensation may occur on the coupling or the hose surface.

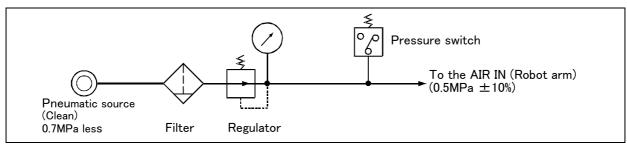


Fig.2-22: Air supply circuit example for the hand

2.5.9 About the Installation of Tooling Wiring and Piping

The customer is required to provide tooling wiring, piping and metal fixtures.

Screw holes are provided on the robot arm for the installation of tooling wiring, piping and metal fixtures. (Refer to the Page 23, "2.4 Outside dimensions • Operating range diagram".)

The length of wiring and piping and the installation position on the robot must be adjusted according to the work to be done by the robot. Please use the following example as reference.

<Precautions>

- · A hand input cable and a hand curl cable are available as optional accessories for your convenience.
- · After performing wiring and piping to the robot, operate the robot at low speed to make sure that each part does not interfere with the robot arm and the peripheral devices.
- Please be aware that dust may be generated from friction if wires and pipes come into contact with the robot arm when using it according to the clean specifications.
- ·If you install metal fixtures and a solenoid valve using the screw holes on the No.2 arm portion, add the mass of the metal fixtures and the solenoid valve to mass of a hand and set to parameter: HNDDAT. Moreover, Fix the parts, such as a solenoid valve, firmly to prevent the parts getting shaky during operation of a robot.

2.6 Shipping special specifications, options, and maintenance parts

2.6.1 Shipping special specifications

■ What are sipping special specifications?

Shipping special specifications are changed before shipping from the factory. Consequently, it is necessary to confirm the delivery date by the customer.

To make changes to the specifications after shipment, service work must be performed at the work site or the robot must be returned for service.

■ How to order

- (1) Confirm beforehand when the factory special specifications can be shipped, because they may not be immediately available.
- (2) Specify, before shipping from our company.
- (3) Specified method ····· Specify the part name, model, and robot model type.

2.7 Options

■ What are options?

There are a variety of options for the robot designed to make the setting up process easier for customer needs. customer installation is required for the options. Options come in two types: "set options" and "single options".

- 1. Set optionsA combination of single options and parts that together, from a set for serving some purpose.
- 2. Single optionsThat are configured from the fewest number of required units of a part. Please choose customer's purpose additionally.

(1) Machine cable extension

■ Order type:

CR750 controller.......Fixed type: 1S-□□ CBL-01 (For SExx01/SExx02)

Flexed type: 1S- \square LCBL-01 (For SExx01/SExx02)

● CR751 controller.....Fixed type: 1F- □□ UCBL-03 (For SExx01)

Flexed type: 1F- UCBL-03 (For SExx01)

Fixed type: 1F- UCBL-02 (For SExx02)

Flexed type: 1F- LUCBL-02 (For SExx02)

Note) \square refer the length.

Outline

<CR750 controller>

<CR751 controller>



The distance between the robot controller and the robot arm is extensible by this option.

A fixed type and flexible type are available.

The fix and flexible types are both configured of the motor signal cable and motor power cable.

The extension method is discriminated as follows depending on a controller.

• The cables for CR750 controller:

Adds to the machine cable attached in the standards.

The cables for CR751 controller:

Exchanges with the machine cable attached in the standards.

■ Configuration

Table 2-9: Configuration equipment and types

	Part name	Type ^{Note1)}	Q	ty.	Mass(kg)	Remarks	
	r ai t Haille	Туре	Fixed	Flexed	Note2)	Remarks	
'50 control	ler						
or SExx01	/SExx02						
Fixed	Set of signal and power cables	1S- □□ CBL-01	1 set	_	6.7(5m)	5m, 10m, or 15m each	
	Motor signal cable		(1 cable)	_	12(10m) 17(15m)		
	Motor power cable		(1 cable)	_	17(13111)		
Flexed	Set of signal and power cables	1S- 🗆 🗆 LCBL-01	-	1 set	7(5m)	5m, 10m, or 15m each	
	Motor signal cable		-	(1 cable)	13(10m) 17(15m)		
	Motor power cable		_	(1 cable)	17(13111)		
Nylon cla	amp	NK-14N	-	2 pcs.	-	for motor signal cable	
Nylon cla	amp	NK-18N	-	2 pcs.	-	for motor power cable	
Silicon ru	ubber		-	4 pcs.	-		
51 control	ler						
or SExx01							
Fixed	Set of signal and power cables	1F- □□ UCBL-03	1 set	_	6.7(10m)	10m, 15m, or 20m each	
	Motor signal cable		(1 cable)	_	12(15m) 17(20m)		
	Motor power cable		(1 cable)	_	17(2011)		
Flexed	Set of signal and power cables	1F- □□ LUCBL-03	-	1 set	7(10m)	10m, 15m, or 20m each	
	Motor signal cable		_	(1 cable)	13(15m) 17(20m)		
	Motor power cable		-	(1 cable)	17(2011)		
Nylon cla	amp	NK-14N	_	2 pcs.	-	for motor signal cable	
Nylon cla	amp	NK-18N	_	2 pcs.	-	for motor power cable	
Silicon ru	ubber		_	4 pcs.	-		

Part name		Type ^{Note1)}	Q	Qty.		Remarks
		туре	Fixed	Flexed	Note2)	Remarks
For SExx02						
Fixed	Set of signal and power cables	1F- 🗆 🗆 UCBL-02	1 set	-	6.7(10m)	10m, 15m, or 20m each
	Motor signal cable		(1 cable)	-	12(15m) 17(20m)	
Motor power cable			(1 cable)	-	17(2011)	
Flexed	Set of signal and power cables	1F- 🗆 LUCBL-02	_	1 set	7(10m)	10m, 15m, or 20m each
	Motor signal cable		_	(1 cable)	13(15m) 17(20m)	
	Motor power cable		_	(1 cable)	17(2011)	
Nylon clamp		NK-14N	_	2 pcs.	_	for motor signal cable
Nylon clamp		NK-18N	_	2 pcs.	_	for motor power cable
Silicon r	ubber		-	4 pcs.	-	

Note1) The numbers in the boxes $\square \square$ refer the length.

Note2) Mass indicates one set.

■ Specifications

The specifications for the fixed type cables are the same as those for standard cables. Shows usage conditions for flexed type cables in Table 2-10.

Table 2-10: Conditions for the flexed type cables

Iter	n	Specifications		
Cable		1S- 🗆 LCBL-01	1F- □□ LUCBL-02 1F- □□ LUCBL-03	
Minimum flexed radius		100mn	n or more	
Cableveyor, etc., occupation rate		50% or less		
Maximum movement speed		2,000mm/s or less		
Guidance of life count		7.5 million times (With	n silicone grease coating)	
Environmental proof		IP54	IP54 (except for the area approximately 500 mm from the end of the connector on the controller side)	
Cable configuration Motor signal cable		ϕ 6 x 5, ϕ 8.5 x 1, and ϕ 1.7 x 1	ϕ 6 x 7 and ϕ 1.7 x 1	
	Motor power cable	φ6.5 x 8 and φ8.9 x 2		

[Caution] The guidance of life count may greatly differ according to the usage state items related to Table 2–10 and to the amount of silicon grease applied in the cableveyor.

Recommendation grease: G-501 (Supplier: Shin-Etsu Chemical Co., Ltd.)

* The above-mentioned grease is not the food machinery grade H1 grease.

[Caution] The cleanliness of this option is not under warranty.

[Caution] When a cableveyor is used, partitions are required to avoid overlapping or riding up of the cables. Also, adjust the cable length to eliminate tension or excessive looseness, and fix it securely.

■ Cable configuration

The configuration of the flexible cable is shown in Table 2-11. Refer to this table when selecting the cableveyor.

Table 2-11 : Cable configuration (Flexed type)

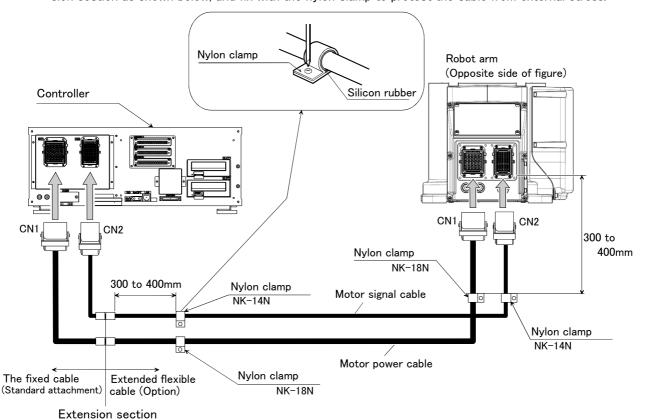
Item		Motor sign	al cable		Motor pow	ver cable	
CR750 controller							
No. of cores	AWG#24 (0.2mm ²)-4P	AW0 (0.2mm	G#24 n ²)-7P	AWG#18 (0.75mm ²)	AWG#16 (1.25mm ²)-4C	AWG#18 (0.75mm ²)-4C	
Finish dimensions	Approx. φ6mm	Approx.	ϕ 8.5mm	Approx. ϕ 1.7mm	Approx. <i>φ</i> 8.9mm	Approx. ϕ 6.5mm	
No.of cables used	5 cables	1 ca	able	1 cable	2 cable	8 cable	
No. in total		7 cab	les		10 cables		
R751 controller				,			
No. of cores	AWG#24 (0.2mm ²)-4l			AWG#18 (0.75mm ²)	AWG#16 (1.25mm ²)-4C	AWG#18 (0.75mm ²)-3C	
Finish dimensions	Approx. φ6n	ım App		orox. φ1.7mm	Approx. <i>φ</i> 8.9mm	Approx. φ 6.5mm	
No.of cables used	7 cables			1 cable	2 cable	8 cable	
No. in total		8 cab	oles		10 ca	bles	

■ Fixing the flexible cable

<CR750 controller>

- (1) Connect the connector to the robot arm.

 The connection method to a robot arm is the same as a standard machine cable. Please refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" and connect.
- (2) Wind the silicon rubber around the cable at a position 300 to 400 mm from the side of robot arm and extension section as shown below, and fix with the nylon clamp to protect the cable from external stress.





Cover the extension terminal area with the cover etc. so that it may not be easily touched to the latch lever.

The bend size of cables are as follows.

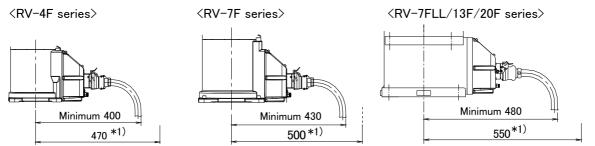
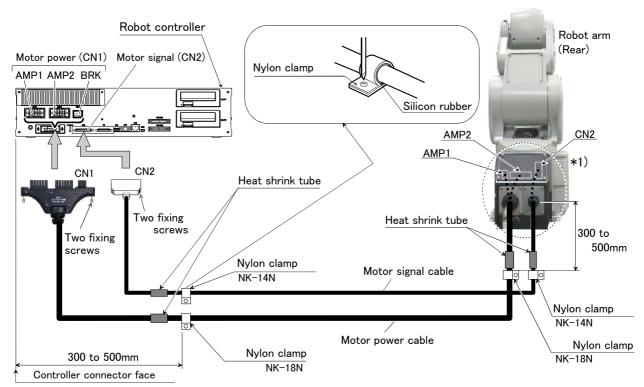


Fig.2-23: Fixing the flexible cable (CR750 controller)

*1) The connection space for a machine cable.

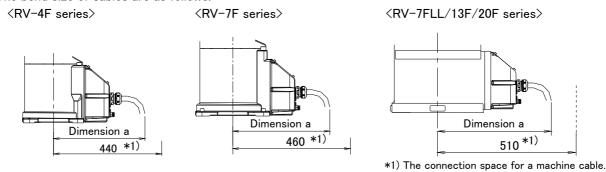
<CR751 controller>

- (1) Connect the connector to the robot arm.
 - The connection method to a robot arm is the same as a standard machine cable. Please refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" and connect.
- (2) For protection of wires from external stress, refer to following. Wrap the cable with the supplied silicon rubber and fix the cable with nylon clamps in the area between the heat shrink tubes on the robot and the controller sides (flexible cable area).



- *1) Connect the robot arm side connector to the connector which is inside the CONBOX cover.
- *2) The flexible cable area is the area between the heat shrink tubes on the robot and the controller sides.

The bend size of cables are as follows.



Model	RV-4F series		RV-7F series		RV-7FLL/13F/20F series	
Specification ^{Note1)}	SExx01	SExx02	SExx01	SExx02	SExx01	SExx02
Dimension a	Min. 310	Min. 300	Min. 310	Min. 300	Min. 310	Min. 300

Note1) SExx01: Chemical-resistant specifications. SExx02: Food machinery grade H1 grease specifications

Fig.2-24: Fixing the flexible cable (CR751 controller)

(2) J1 axis operating range change

Order type	RV-4F series	.1F-DH-06	(For SExx01)
		1F-DH-03	(For SExx02)
	RV-7F series	.1F-DH-07	(For SExx01)
		1F-DH-04	(For SExx02)
	RV-13F series	.1F-DH-08	(For SExx01)
		1F-DH-05J1	(For SExx02)

Outline



The operating range of J1 axis is limited by the robot arm's mechanical stopper and the controller parameters.

If the axis could interfere with the peripheral devices, etc., and the operating range need to be limited, use this.

■ Configuration

(1) RV-4F series (1F-DH-03, 1F-DH-06)

Table 2-12 : Configuration devices (RV-4F series)

No.	Part name	Qty.	Mass (kg)	Remarks
<1>	Stopper plate	2		One piece each for + side/- side
<2>	Fixing block A	2		One piece each for + side/- side
<3>	Fixing block B	1		+ side
<4>	Fixing block C	1	1.1	- side
<5>	Variable stopper block	2	1.1	One piece each for + side/- side
<6>	Screw (M10x20)	2		Use for mechanical stopper screw A and B
<7>	Screw (M6x25)	2		For fixing
<8>	Screw (M6x20)	16		For fixing

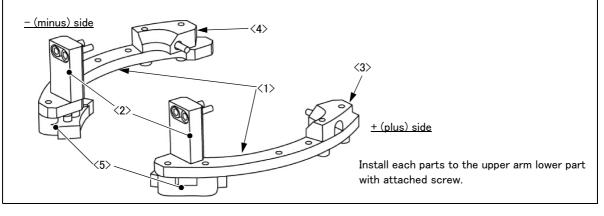


Table 2-13: Changeable angle (RV-4F series)

Item	Standard	Changeable	angle (combination	of + side/- side) (U	nit: Degree)
+ (plus) side	+240	+30	+73	+103	+146
Variable stopper block angle	-	+33	+76	+106	+149
Variable stopper block position Note1)	-	(a)	(b)	(a)	(b)
Mechanical stopper screw A Note2)	-	Use		Disuse Note3)	
Parameter (MEJAR) setting value	+240	+30	+73	+103	+146
- (minus) side	-240	-30	-73	-103	-146
Variable stopper block angle	_	-33	-76	-106	-149
Variable stopper block position Note1)	-	(d)	(c)	(d)	(c)
Mechanical stopper screw B Note2)	-	U	se	Disuse	Note3)
Parameter (MEJAR) setting value	-240	-30	-73	-103	-146

Note1) Symbol: "(a)" - "(d)" are related with the symbol of Page 53 "Fig. 2-25: Installation image of J1axis operating range change option (RV-4F/7F series)".

Note2) In the table, it means that "Disuse" does not install the screw, and "Use" does install the screw.

Note3) Mechanical stopper screw which is either one of the two is always necessary. For this reason, the combination enclosed by the thick line of the square in the table (both of + (plus) side and - (minus) side are 103 or 146) cannot be used.

Example) It cannot be used that set +146 as the plus side and set -103 as the minus side simultaneously. The other combination can be set up.

- 1) The changeable angle of RV-4F series is shown in Table 2-13. The changeable angle shown in Table 2-13 indicates the operation range by the software. The limit by the mechanical stopper is positioned three degrees outward from that angle, so take care when designing the layout.
- 2) The changeable angle can be set independently on the + (plus) side/ (minus) side, within the condition shown in Table 2-13.
- 3) The operating range is changed with robot arm settings and parameter settings. Refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" or "Instruction Manual/Detailed Explanation of Functions and Operations" for details.

(2) RV-7F series (1F-DH-04, 1F-DH-07)

Table 2-14: Configuration devices (RV-7F series)

No.	Part name	Qty.	Mass (kg)	Remarks				
<1>	Stopper plate	2		One piece each for + side/- side				
<2>	Fixing block A	2		One piece each for + side/- side				
<3>	Fixing block B	1		+ side				
<4>	Fixing block C	1	1.1	- side				
<5>	Variable stopper block	2		One piece each for + side/- side				
<6>	Screw (M12x25)	2		Use for mechanical stopper screw A and B				
<7>	Screw (M8x25)	14		For fixing				
<8>	Screw (M8x20)	4		For fixing				
– (n	- (minus) side							

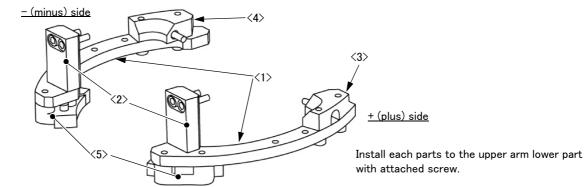


Table 2-15 : Changeable angle (RV-7F series)

Item	Standard	Changeable angle (combination of + side/- side) (Unit: De			
+ (plus) side	+240	+35	+77	+99	+141
Variable stopper block angle	-	+38	+80	+102	+144
Variable stopper block position Note1)	-	(a)	(b)	(a)	(b)
Mechanical stopper screw A Note2)	-	Use		Disuse Note3)	
Parameter (MEJAR) setting value	+240	+35	+77	+99	+141
- (minus) side	-240	-35	-77	-99	-141
Variable stopper block angle	-	-38	-80	-102	-144
Variable stopper block position Note1)	-	(d)	(c)	(d)	(c)
Mechanical stopper screw B Note2)	-	U	se	Disuse	Note3)
Parameter (MEJAR) setting value	-240	-35	-77	-99	-141

Note1) Symbol: "(a)" - "(d)" are related with the symbol of Page 53 "Fig. 2-25: Installation image of J1axis operating range change option (RV-4F/7F series)".

Note2) In the table, it means that "Disuse" does not install the screw, and "Use" does install the screw.

Note3) Mechanical stopper screw which is either one of the two is always necessary. For this reason, the combination enclosed by the thick line of the square in the table (both of + (plus) side and - (minus) side are 99 or 141) cannot be used.

Example) It cannot be used that set +141 as the plus side and set -99 as the minus side simultaneously. The other combination can be set up.

- 1) The changeable angle of RV-7F series is shown in Table 2-15. The changeable angle shown in Table 2-15 indicates the operation range by the software. The limit by the mechanical stopper is positioned three degrees outward from that angle, so take care when designing the layout.
- 2) The changeable angle can be set independently on the + (plus) side/ (minus) side, within the condition shown in Table 2-15.

- 3) The operating range is changed with robot arm settings and parameter settings. Refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" or "Instruction Manual/Detailed Explanation of Functions and Operations" for details.
- (3) Installation image (RV-4F/7F series)

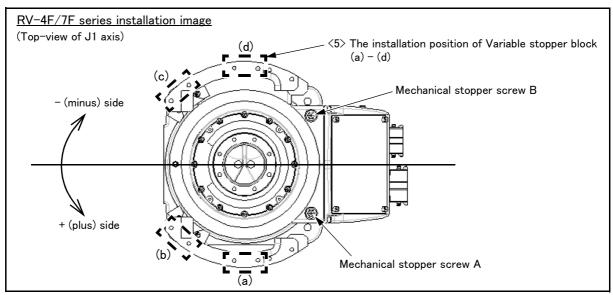


Fig.2-25: Installation image of J1axis operating range change option (RV-4F/7F series)

[Example] In the RV-7F series, when limiting the +side to +35 degree, and the -side to -141 degree, install as following.

Variable stopper block: Installs in the position of (a), and the position of (c).

Mechanical stopper screw A: Install.

Mechanical stopper screw B: Do not install.

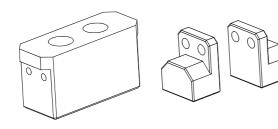
(4) RV-13F series (1F-DH-05J1, 1F-DH-08)

Table 2-16: Configuration devices (RV-13F series)

No.	Part name	Qty.	Mass (kg)	Remarks
<1>	Stopper Block J1	1		
<2>	Resin Stopper B	2		One piece each for + side/- side
<3>	Screw (M12 × 20)	2	0.3	Mechanical Stopper screw
<4>	Screw (M10 × 40)	2		For Stopper Block J1 fixing
<5>	Screw (M4 × 12)	4		For Resin Stopper B fixing

<1>Stopper Block J1

<2>Resin Stopper B



Install each parts to behind the J1 axis of robot arm with attached screw.

Table 2-17: Changeable angle (RV-13F series)

Item	Standard	Changeable angle		
+ (plus) side	+190	+30	+120	
Mechanical Stopper screw position Note1)	_	(A)	(B)	
Mechanical Stopper position	+193	+32.5	+122.5	
Parameter (MEJAR) setting value	+190	+30	+120	
+ (minus) side	-190	-30	-120	
Mechanical Stopper screw position ^{Note1)}	-	(D)	(C)	
Mechanical Stopper position	-193	-32.5	-122.5	
Parameter (MEJAR) setting value	-190	-30	-120	

Note1) Symbol: "(A)" - "(D)" in the Table 2-17 is related with the symbol of "Fig. 2-26: Installation image of J1axis operating range change option (RV-13F series)".

- 1) The changeable angle of RV-13F series is shown in Table 2-17. The changeable angle shown in Table 2-17 indicates the operation range by the software. The limit by the mechanical stopper is positioned three degrees outward from that angle, so take care when designing the layout.
- 2) The changeable angle can be set independently on the + (plus) side/ (minus) side, within the condition shown in Table 2-17.
- 3) The operating range is changed with robot arm settings and parameter settings. Refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" or "Instruction Manual/Detailed Explanation of Functions and Operations" for details.

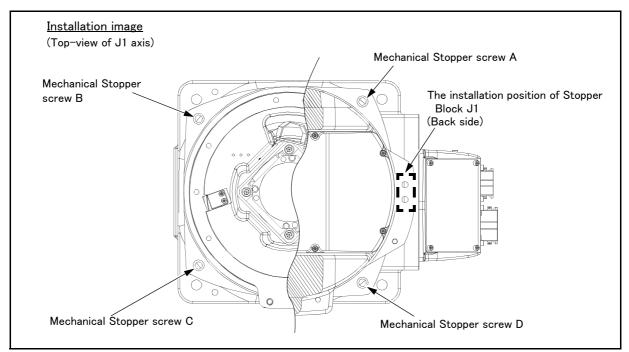


Fig.2-26: Installation image of J1axis operating range change option (RV-13F series)

[Example] In the RV-13F series, when limiting + side to +32.5 degree and - side to -122.5 degree, install the Mechanical Stopper screw in the position of (A) and (C).

(3) Solenoid valve set

1F-VD01-**(Sink type)/1F-VD01E-**(Source type) ■ Order type: One set:

> Two sets: 1F-VD02-**(Sink type)/1F-VD02E-**(Source type) Three sets: 1F-VD03-**(Sink type)/1F-VD03E-**(Source type) Four sets: 1F-VD04-**(Sink type)/1F-VD04E-**(Source type)

Note) "-**" differs by robot arm.

 \cdot RV-4F/7F series and RV-7FLL......."-04" (For SExx01), "-02" (For SExx02) \cdot RV-13F/13FL and RV-20F"-05" (For SExx01), "-03" (For SExx02)

Outline





The solenoid valve set is an option that is used for controlling toolings when various toolings, such as the hand, are installed at the end of the arm.

Also, for easy installation of this electromaagnetic set onto the robot, it comes equipped with a manifold, couplings, connectors, among other things.

■ Configuration

Table 2-18: Configuration equipment

		Q'ty		Mass(kg)			
Part name	Type ^{Note1)}	One	Two	Three	Four	Note2)	Remark
		set	sets	sets	sets		
Solenoid valve set (1 set)	1F-VD01-**/	1 no		_	_	0.3	Hand output cable is already connected.
	1F-VD01E-**	1 pc. —				0.5	Refer to Page 63, "(5) Hand output cable". 1F-VD0*-01: Sink type
Solenoid valve set (2 sets)	1F-VD02-**/		— 1 pc.	рс. —	_	- 0.4	1F-VD0*E-01: Sink type 1F-VD0*E-01: Source type. Coupling size of A/B-port (output side of sole-
	1F-VD02E-**	_					
Solenoid valve set (3 sets)	1F-VD03-**/			1	1	- 0.4	noid valve)
	1F-VD03E-**	_		1 pc.		0.4	· 1F-VD0*-02/1F-VD0*E-02 : Ф4 · 1F-VD0*-03/1F-VD0*E-03 : Ф6
Solenoid valve set (4 sets)	1F-VD04-**/			_	1 no	0.5	· 1F-VD0*-04/1F-VD0*E-04 : Ф4
	1F-VD04E-**				1 pc.	0.5	1F-VD0*-05/1F-VD0*E-05 : Ф6

Note1) "-**" differs by robot arm. (Refer to " ■ Order type above)

Note2) Mass indicates one set.

■ Specifications

Table 2-19: Valve specifications

Item	Specifications
Number of positions	2
Port	5 Note1)
Valve function	Double solenoid
Operating fluid	Clean air Note2)
Operating method	Internal pilot method
Effective sectional area (CV value)	1.1mm ² (0.06)
Oiling	Unnecessary
Operating pressure range	0.1 to 0.7MPa
Response time	22msec or less (at 0.5 MPa)
Max. operating frequency	5Hz
Ambient temperature	-10 to 50 °C (However, there must be no condensation.)

Note1) Couplings of unused solenoid valves must be blocked with plugs. If they are not blocked, supplied air will blow out from the couplings, lowering the air pressure of the solenoid valves being used and making them nonfunctional.

Recommended plugs: KQ2P-04 plug made by SMC (for 1F-VD0*-02/1F-VD0*E-02) KQ2P-06 plug made by SMC (for 1F-VD0*-03/1F-VD0*E-03) KQG2P-04 plug made by SMC (for 1F-VD0*-04/1F-VD0*E-04) KQG2P-06 plug made by SMC (for 1F-VD0*-05/1F-VD0*E-05)

Note2)



CAUTION The air to be provided must be clean, i.e., filtered with a mist separator or air filter. Failing to do so may lead to malfunctions.

Table 2-20 : Solenoid specifications

Item	Specifications
Method	Built-in fly-wheel diodes with surge protection
Coil rated voltage	DC24V ±10%
Power consumption	0.55W
Voltage protection circuit with power surge protection	Diode

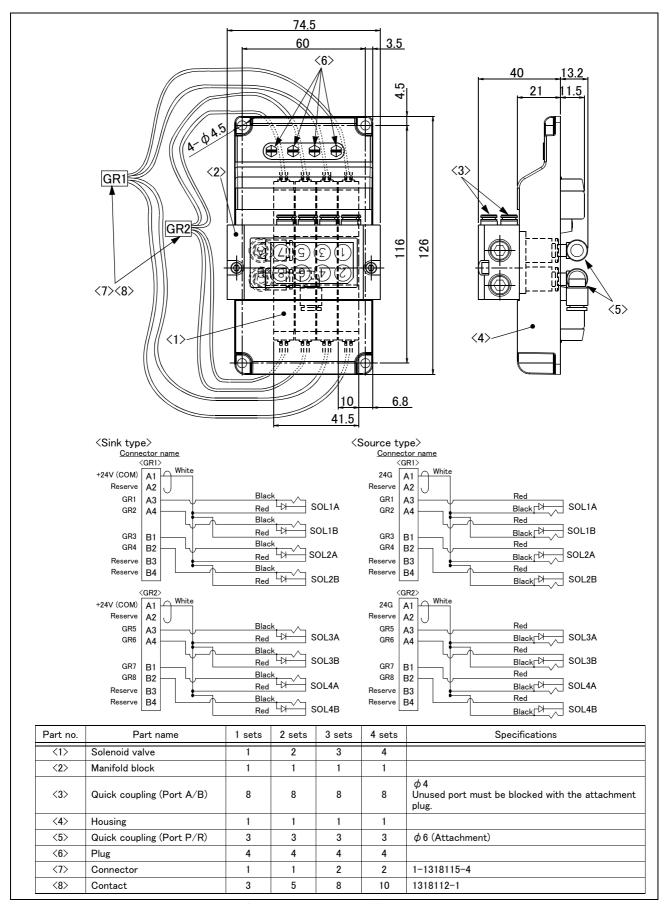


Fig.2-27: Outline dimensional drawing (1F-VD0*-02/1F-VD0*E-02)

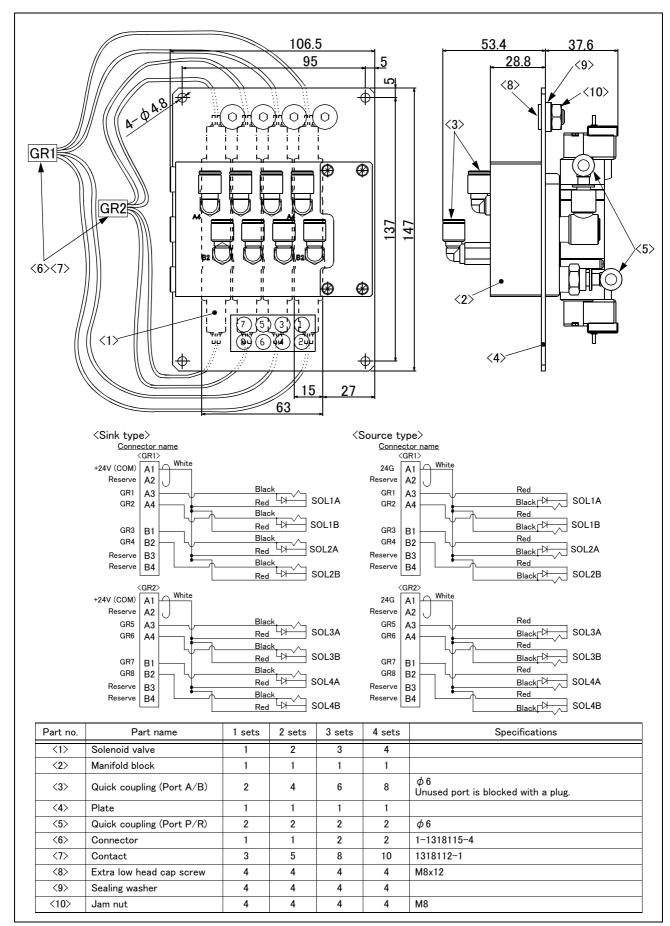


Fig.2-28: Outline dimensional drawing (1F-VD0*-03/1F-VD0*E-03)

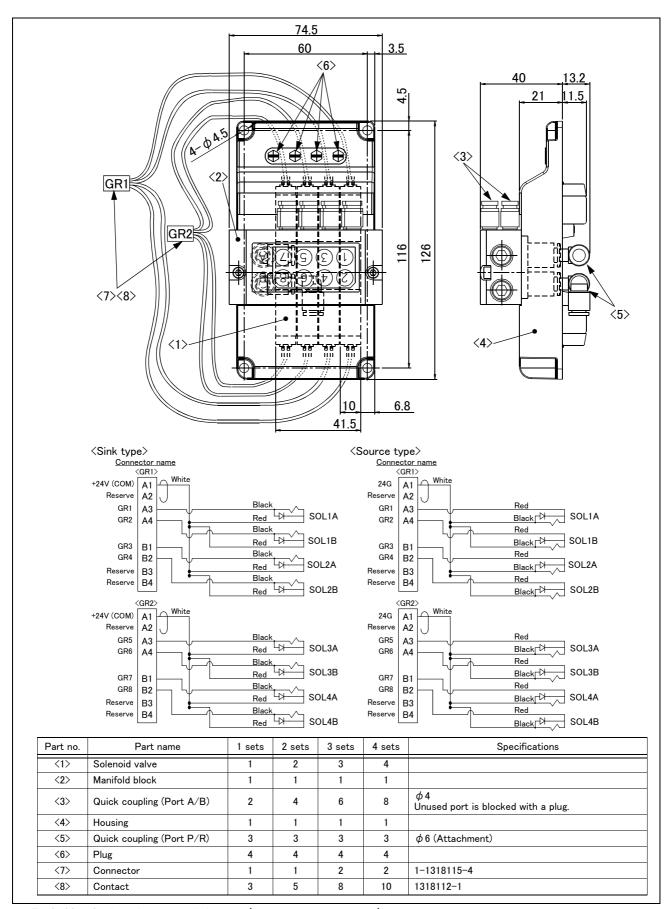


Fig.2-29: Outline dimensional drawing (1F-VD0*-04/1F-VD0*E-04)

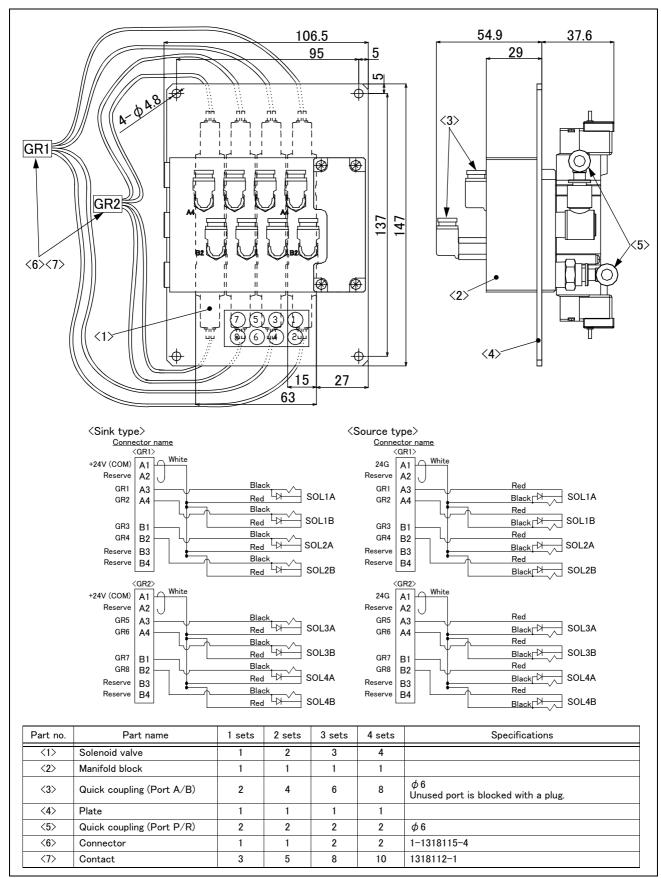


Fig.2-30 : Outline dimensional drawing (1F-VD0*-05/1F-VD0*E-05)

(4) Hand input cable

■ Order type: 1F-HC35S-02

Outline



The hand input cable is used for customer-designed pneumatic hands.

It is necessary to use this to receive the hand's open/close confirmation signals and grasping confirmation signals, at the controller.

One end of the cable connects to the connector for hand input signals, which is in the wrist section of the hand. The other end of the cable connected to the sensor inside the hand customer designed.

■ Configuration

Table 2-21: Configuration equipment

Part name	Туре	Qty.	Mass (kg) Note1)	Remarks
Hand input cable	1F-HC35S-02	1 cable	0.2	

Note1) Mass indicates one set.

■ Specifications

Table 2-22 : Specifications

Item	Specifications	Remarks
Size x cable core	AWG#24 (0.2 mm ²) × 10 cores	One-sided connector, one-sided cable bridging
Total length	1,000 mm	

Pin assign of the hand input cable is shown in Table 2-23.

Table 2-23: Pin assign of hand input cable

Color	Connector Note1)	Pin number: names	Color	Connector Note1)	Pin number: names	
Purple		A1: HC1	Yellow		A1: +24V	
Brown		A2: HC2	Green	OP3	A2: 24G	
Blue		A3: HC3	-	OP3	Reserved	
Black	OD1	A4: HC4	-		Reserved	
Red	OP1	B1: HC5		•		
White		B2: HC6				
Gray		B3: HC7				
Pink		B4: HC8				

Note1) The connector shows the connector name connected to the robot-arm side.

[Caution] The cleanliness of this option is not under warranty.

(5) Hand output cable

■ Order type: 1F-GR35S-02

Outline



The hand output cable (solenoid valve connection cable) is an option that is used when a solenoid valve other than one of the solenoid valve set options, is used. One end of the cable has a connector that connects to the input terminal inside the robot. The other end of the cable is connected.

■ Configuration

Table 2-24: Configuration equipment

Part name	Туре	Qty.	Mass (kg) Note1)	Remarks
Hand output cable	1F-GR35S-02	1 cable	0.1	

Note1) Mass indicates one set.

■ Specifications

Table 2-25: Specifications

Item	Specifications	Remarks
Size x Cable core	AWG#24(0.2 mm ²) x 10 cores	One side connector and one side cable connection
Total length	500 mm	

Pin assign of the hand output cable is shown in Table 2-26.

Table 2-26: Pin assign of hand output cable

Color	Connector	Pin number: names	Color	Connector	Pin number: names	
Yellow		A1: +24V	Green		A1: +24V	
_		A2: Reserved	-		A2: Reserved	
Purple		A3: GR1 (Hand output 1)	Red		A3: GR5 (Hand output 5)	
Brown	- GR1	A4: GR2 (Hand output 2)	White	GR2	A4: GR6 (Hand output 6)	
Blue		B1: GR3 (Hand output 3)	Gray	GRZ	B1: GR7 (Hand output 7)	
Black		B2: GR4 (Hand output 4) Pi		Pink		B2: GR8 (Hand output 8)
_		B3: Reserved	-		B3: Reserved	
_		B4: Reserved	-		B4: Reserved	

[Caution] The cleanliness of this option is not under warranty.

(6) Hand curl tube

■ Order type: RV-4F/7F series, RV-7FLL.....One set: 1E-ST0402C

Two sets: 1E-ST0404C Three sets: 1E-ST0406C

Four sets: 1E-ST0408C

RV-13F/13FL/20F.....One set: 1N-ST0602C

Two sets: 1N-ST0604C Three sets: 1N-ST0606C Four sets: 1N-ST0608C

Outline



The hand curl tube is a curl tube for the pneumatic hand.

■ Configuration

Table 2-27: Configuration equipment

	Part name	Туре	Qty.	Mass(kg) ^{Note1)}	Remarks					
Fo	For RV-4F/7F series, RV-7FLL									
	Hans curl tube (One set: 2 pcs.)	1E-ST0402C	1 pc.	0.1	ϕ 4 tube, 2pcs.					
	Hans curl tube (Two sets: 4 pcs.)	1E-ST0404C	1 pc.	0.1	ϕ 4 tube, 4pcs.					
	Hans curl tube (Three sets: 6 pcs.)	1E-ST0406C	1 pc.	0.1	ϕ 4 tube, 6pcs.					
	Hans curl tube (Four sets: 8 pcs.)	1E-ST0408C	1 pc.	0.1	ϕ 4 tube, 8pcs.					
Fo	r RV-13F/13FL/20F									
	Hans curl tube (One set: 2 pcs.)	1N-ST0602C	1 pc.	0.1	ϕ 6 tube, 2pcs.					
	Hans curl tube (Two sets: 4 pcs.)	1N-ST0604C	1 pc.	0.1	ϕ 6 tube, 4pcs.					
	Hans curl tube (Three sets: 6 pcs.)	1N-ST0606C	1 pc.	0.1	ϕ 6 tube, 6pcs.					
	Hans curl tube (Four sets: 8 pcs.)	1N-ST0608C	1 pc.	0.1	ϕ 6 tube, 8pcs.					

Note1) Mass indicates one set.

■ Specifications

Table 2-28 : Specifications

Item	Specifications			
Material	Urethane			
Size	1E-ST040*C : Outside diameter ϕ 4 × Inside diameter ϕ 2.5 1N-ST060*C : Outside diameter ϕ 6 × Inside diameter ϕ 4			

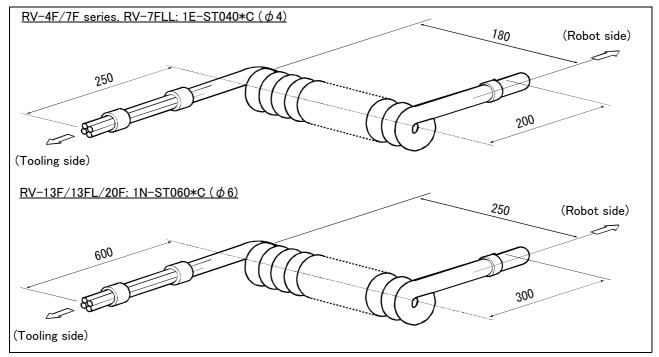


Fig.2-31: Outline dimensional drawing

[Caution] The cleanliness of this option is not under warranty.

(7) Forearm external wiring set/ Base external wiring set

Order type

Forearm external wiring set:

1F-HB01S-02 (Hand input signals, force sensor and vision sensor. For SExx01)

1F-HB01S-01 (Hand input signals, force sensor and vision sensor. For SExx02)

1F-HB02S-02 (Force sensor and vision-sensor. For SExx01)

1F-HB02S-01 (Force sensor and vision-sensor. For SExx02)

Base external wiring set:

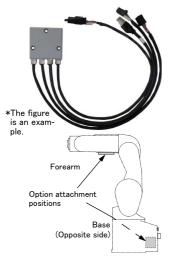
1F-HA01S-02 (Force sensor and vision-sensor. For SExx01)

1F-HA01S-01 (Force sensor and vision-sensor. For SExx02)

1F-HA02S-02 (Force sensor and vision-sensor. For SExx01)

1F-HA02S-01 (Force sensor and vision-sensor. For SExx02)

Outline



The Forearm external wiring set and the Base external wiring set are used to pull out the hand input signal cables and communication cables etc. from the underneath of the forearm and the side of the base.

This option consists of the cable clamp box and the cable for hand input signals or the cable for communication.

1) Hand input cable

The hand input cable of the option (equivalent of 1F-HC35S-02) is installed. Connect to the connectors OP1 and OP3 of the hand input cable, which is built into the forearm. Connect the user connection side of pulled-out cable to the tools etc, and input the signals.

2) Communication cable

Pulls out the cable which attached the connector for connecting with vision sensor etc.

The pulled out cables from the underneath of the forearm are connected with a vision sensor camera, or a force sensor. The pulled out cables from the side of the base are connected with a vision sensor controller, or a force sensor interface. (To connect to a force sensor, use the adaptor cable that is supplied in the force sensor option.)

■ Configuration

Table 2-29: Configuration equipment

Part name	Туре	Qty.	Remarks
Forearm external wiring set	1F-HB01S-02	Either one	For SExx01
	1F-HB02S-02	pc.	
	1F-HB01S-01	Either one	For SExx02
	1F-HB02S-01	pc.	
Base external wiring set	1F-HA01S-02	Either one	For SExx01
	1F-HA02S-02	pc.	
	1F-HA01S-01	Either one	For SExx02
	1F-HA02S-01	pc.	

■ Specification

The kind of cable which can be pulled out for each option is shown in Table 2-30. Because to pull out the cable of the same purpose also as the forearm side and the base side, you should use the option in pair shown in "the pairing (recommendation)" of the table. And, each wiring system figure is shown after the following page.

Table 2-30: Internal wiring and piping specification types

P	airing	0-1: 1	Cable length	Wiring (cable for the connection to each equipment)			
(recommendation)		Option type	(mm) Note1)	Hand input signal Note2)	Vision sensor camera	Force sensor unit	
For SExx01							
	-1	1F-HB01S-02 (Forearm)	1,000	eight points	1	Either one unit	
	'	1F-HA01S-02 (Base) 500		Not available	1	Either one unit	
	2	1F-HB02S-02 (Forearm) 1,000		Not available	1	1	
	2	1F-HA02S-02 (Base) 500		Not available	1	1	
F	or SExx02	•		•			
	-1	1F-HB01S-01 (Forearm)	1,000	eight points	1	Either one unit	
	'	1F-HA01S-01 (Base)	500	Not available	1	Either one unit	
	•	1F-HB02S-01 (Forearm)	1,000	Not available	1	1	
	2	1F-HA02S-01 (Base)	500	Not available	1	1	

Note1) The length from the cable clamp box to the connector.

Note2) Although the connector is attached to the customer wiring side of hand input cable, the connector can be cut, and connect to the tool of the customer preparation. The color and signal name of the wire are shown in Table 2-31.

Table 2-31: Color of the wire and signal name (hand input cable)

Color	Signal name	Connector (HC)	Color	Signal name	Connector (HC)	Color	Signal name	Connector (HC)	Color	Signal name	Connector (HC)
Violet	HC1	A1	Brown	HC2	A2	Blue	HC3	A3	Black	HC4	A4
Red	HC5	B1	White	HC6	B2	Gray	HC7	B3	Pink	HC8	В4
Yellow	+24V	A6	Green	+24G(RG)	B6			-	-		

1) Wiring system diagram (1F-H*01S-01/1F-H*01S-02: Hand input signals, force sensor and vision sensor)

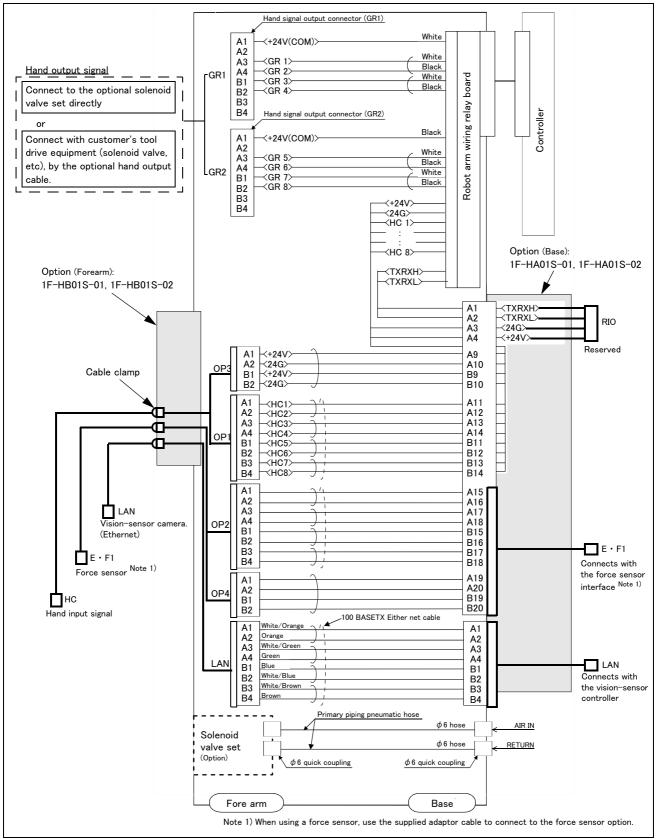


Fig.2-32: Wiring system diagram (1F-H*01S-01/1F-H*01S-02)

2)Wiring system diagram (1F-H*02S-01/1F-H*02S-02: Force sensor and vision-sensor)

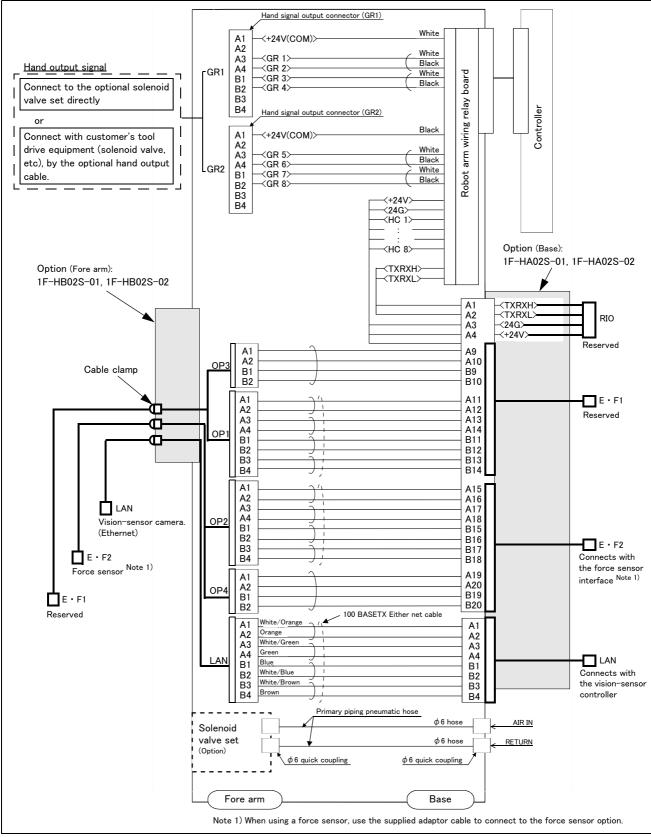


Fig.2-33: Wiring system diagram (1F-H*02S-01/1F-H*02S-02)

2.8 About Overhaul

Robots which have been in operation for an extended period 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. Overhaul interval for robots presumably varies with their operating conditions and thus with the degree of the equipment's wear and loss of performance. As a rule of thumb, however, it is recommended that overhaul be carried out before the total amount of servo-on time reaches the predetermined levels (24,000 hours for the robot arm and 36,000 hours for the controller). (See Fig. 2-34.) For specific information about parts to be replaced and timing of overhaul, contact your local service representative.

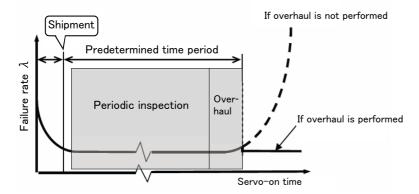


Fig.2-34: Periodic inspection/overhaul periods

2.9 Maintenance parts

The consumable parts used in the robot arm are shown in Table 2-32. Purchase these parts from the designated maker or 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.

Table 2-32 : Consumable part list

No.	Part name	Type Note1)	Usage place	Qty.	Supplier
1	Grease		Reduction gears of each axis	As needed	Mitsubishi Electric
2	Lithium battery	ER6	Inside the CONBOX cover	3 pcs.	MILSUDISTII ETECUTO

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

3 Controller

3.1 Standard specifications

3.1.1 Basic specifications

Table 3-1: Specifications of controller

	Item	Unit	Specification	Remarks
Туре			CR750- □ VD-1 CR751- □ VD-0 CR750-07VLD-1 CR751-07VLD-0	" in type name shows the load (4kg: "04", 7kg: "07", 13kg: "13", 20kg: "20") of robot arm. CR750-07VLD-1 and CR751-07VLD-0 controller are for RV-7FLL only.
Number of	control axis		Simultaneously 6	
Memory	Programmed positions	point	39,000	
capacity	No. of steps	step	78,000	
	Number of program		512	
Robot langu			MELFA-BASIC IV, V	
Teaching m	nethod		Pose teaching method, MDI method Note1)	
External input and	Input and output	point	0/0	Max. 256/256 by option
output	Dedicated input/output		Assigned with general-purpose input/output	The signal number of "STOP" input signals is fixing.
	Hand open/close input/output	point	8/8	Built-in
	Emergency stop input	point	1	Dual line
	Door switch input	point	1	Dual line
	Enabling device input	point	1	Dual line
	Emergency stop output	point	1	Dual line
	Mode output	point	1	Dual line
	Robot error output	point	1	Dual line
	Addition axis synchronization	point	1	Dual line
	Mode changeover switch input	point	1	Dual line (CR751 controller only)
Interface	RS-422	port	1	Only for T/B
	Ethernet	port	1	10BASE-T/100BASE-Tx
	USB	port	1	Ver.2.0 FullSpeed Only device function
	Additional axis interface	Channel	1	SSCNET III (Connects with MR-J3-BS, MR-J4-B series)
	Tracking interface	Channel	2	
	Option slot	slot	2	For option interface
Power source	Input voltage range	V	RV-4F series: Single phase AC180 to 253 RV-7F/13F series ^{Note2)} : Three phase AC180 to 253, or Single phase AC207 to 253	Refer to the table in " Introduction" for details of the robot type.
	Power capacity	kVA	RV-4F series : 1.0 RV-7F series : 2.0 RV-13F series : 3.0	Does not include rush current. Note3) Refer to the table in " Introduction" for details of the robot type.
Power supply frequency		Hz	50/60	
Outline dim	ensions ^{Note4)}	mm	CR750 controller 430(W) x 425(D) x 174(H) CR751 controller RV-4F/7F series: 430(W) x 425(D) x 98(H) RV-13F series: 430(W) x 425(D) x 174(H)	Excluding protrusions. Refer to the table in " Introduction" for details of the robot type.
Mass		kg	CR750 controller: Approx. 18	
		, ò	CR751 controller RV-4F/7F series: Approx. 12 RV-13F series: Approx. 15	Refer to the table in " Introduction" for details of the robot type.

Item	Unit	Specification	Remarks
Construction		Self-contained floor type, Opened type. Installation vertically or horizontally	IP20 Note5)
Operating temperature range	°C	0 to 40	
Ambient humidity	%RH	45 to 85	Without dew drops
Grounding	Ω	100 or less	100Ω or less (class D grounding) ^{Note6)}
Paint color		Dark gray	Equivalent to Munsell: 3.5PB3.2/0.8

Note1) Pose teaching method: The method to register the current position of the robot arm.

The method to register by inputting the numerical value Immediate. MDI method:

Note2) Both the three phase power supply and the single phase power supply can use this product according to voltage condi-

Note3) The power capacity is the rating value for normal operation. The power capacity does not include the rush current when the power is turned ON. The power capacity is a guideline and the actual operation is affected by the input power voltage. The short circuit breaker should use the following.

* Operate by the current leakage under the commercial frequency domain (50-60Hz). If sensitive to the high frequency ingredient, it will become the cause in which below the maximum leak current value carries out the trip.

Note4) Refer to Page 79, "3.3.1 Outside dimensions" for details.

Note5) This controller is standard specification. (Refer to Page 73, "3.1.2 Protection specifications and operating supply".)

Note6) The robot must be grounded by the customer.

3.1.2 Protection specifications and operating supply

A protection method complying with the IEC Standard IP20 (Opened type) is adopted for the controller. The IEC IP symbols refer only to the degree of protection between the solid and the fluids, and don't indicated that any special protection has been constructed for the prevention against oil and water.

The controller is not chemical-resistant. For installing the controller, avoid places where adhesion of chemicals may occur.

[Information]

• The IEC IP20

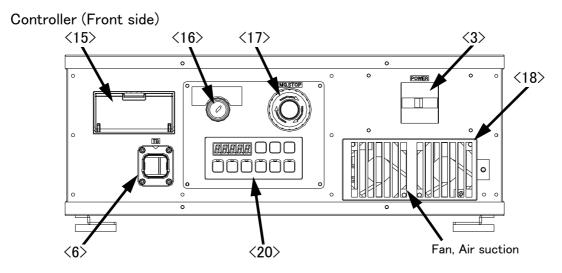
It indicates the protective structure that prevents an iron ball $12^{+0.05}_{0}$ mm diameter, which is being pressed with the power of 3.1 kg ± 10%, from going through the opening in the outer sheath of the supplied equipment.

Refer to the section Page 175, "6.2 Working environment" for details on the working environment.

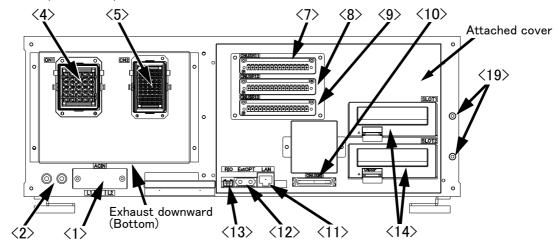
3.2 Names of each part

3.2.1 Controller

(1) CR750 controller



Controller (Rear side)



<1>: ACIN terminal



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

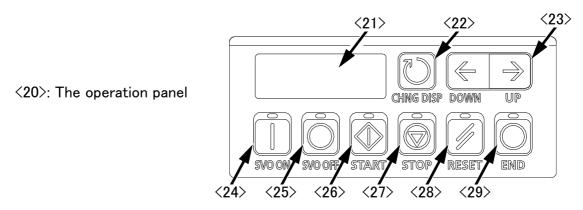


Fig.3-1: Names of controller parts (CR750)

<1> ACIN terminalThe terminal box for AC power source (single phase or three phase, AC200V) input. (Inner side of a cover)

There are two types of the terminal and the terminal differs depending on the model.

Model	Type of the terminal	
RV-4F/4FL series	Type A: For single phase L1 L2	
	Connect the primary power supply to L1 and L2 terminal.	
RV-7F/7FL series RV-7FLL series RV-13F/13FL series RV-20F series	Type B: For single phase/three phase L1 L2 L3	
	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.	

Refer to a separate manual "INSTRUCTION MANUAL/Controller setup, basic operation, and maintenance" for how to connect a power cable.

- basic operation, and maintenance—for now to connect a power cap <2> PE terminalThe screw for grounding of the cable. (M4 screw x 2 place)
- <3> Power switch......This turns the control power ON/OFF. (With earth leakage breaker function)
- <4> Machine cable connector (motor signal) (CN1)

Connect with the CN1 connector of the robot arm.

- <5> Machine cable connector (motor power) (CN2)
 - Connect with 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 Refer to a separate manual "INSTRUCTION MANUAL/Controller setup,

Refer to a separate manual "INSTRUCTION MANUAL/Controller setup basic operation, and maintenance" for the connection method and the further description of pin assign.

- <11> LAN connector (LAN).....For LAN connection
- <12> ExtOPT connector (ExtOPT) Connect the cable for addition axis control.
- <14> Option slot (SLOT1, SLOT2)....... Install the interface optional. (Install the cover, when not using.)
- <16> Mode key switch This key switch changes the robot's operation mode.
 - AUTOMATICOperations 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.)
 - MANUALWhen 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......This switch stops the robot in an emergency state. The servo turns OFF.
- 710 The series of the series o
- <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 x 2 places)
- <20> Operation panelThe 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.
- <23> UP/DOWN button......This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.

<24> SVO.ON button	This 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	This 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.

(2) CR751 controller

Controller (Front side)

All Andrews A

Controller (Rear side)

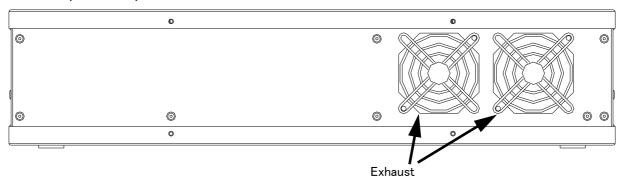


Fig.3-2: Names of controller parts (CR751)

<1> ACIN terminal	The connector for AC power source (single phase or single phase/three phase, AC200V) input. (a socket housing and a terminal are attached). Refer to a separate manual "INSTRUCTION MANUAL/Controller setup, basic operation, and maintenance" for how to connect a power cable.
<2> PE terminal	The screw for grounding of the cable. (M4 screw x 2 place)
<3> POWER lamp	Lamp of control power source
<4> Machine cable connector (motor p	ower)
	AMP1, AMP2: Motor power, BRK: Motor brake
<5> Machine cable connector (motor s	ignal)
	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.
	The connector for input/ output connection dedicated for robot. (a plug connector attached)
	Refer to a separate manual "INSTRUCTION MANUAL/Controller setup, basic operation, and maintenance" for the connection method and thefurther description of pin assign.
<9>Grounding terminal	The grounding terminal for connecting cables of option card. (M3 screw x 2 places)
<10>Power supply charge lamp (CRAR	GE)

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)......Connect the cable for addition axis control.

 $\verb|\label{localization}| $$<14>RIO connector (RIO).....Connect the extension parallel input/output unit.$

<15>Option slotInstall the interface optional. (Install the cover, when not using.)

(SLOT1, SLOT2)



Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

- 3.3 Outside dimensions/Installation dimensions
- 3.3.1 Outside dimensions
- (1) CR750 controller

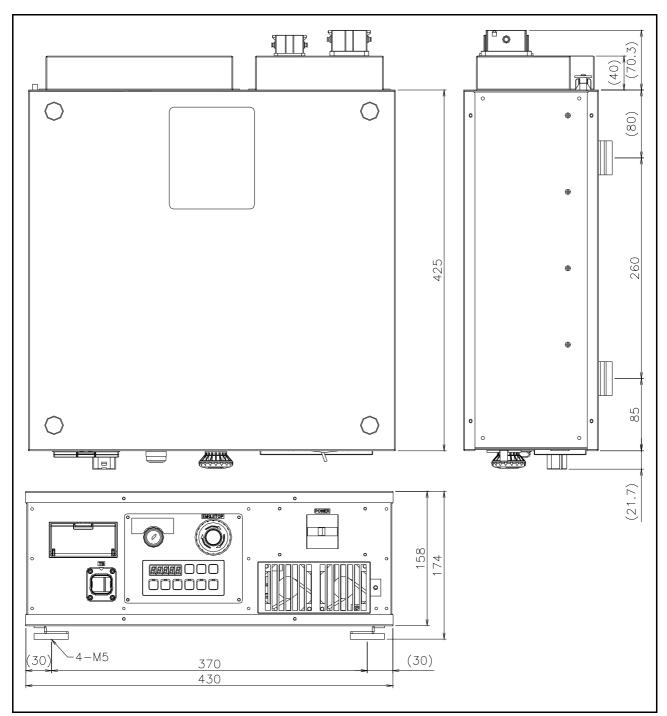


Fig.3-3: Outside dimensions of controller (CR750)

(2) CR751 controller

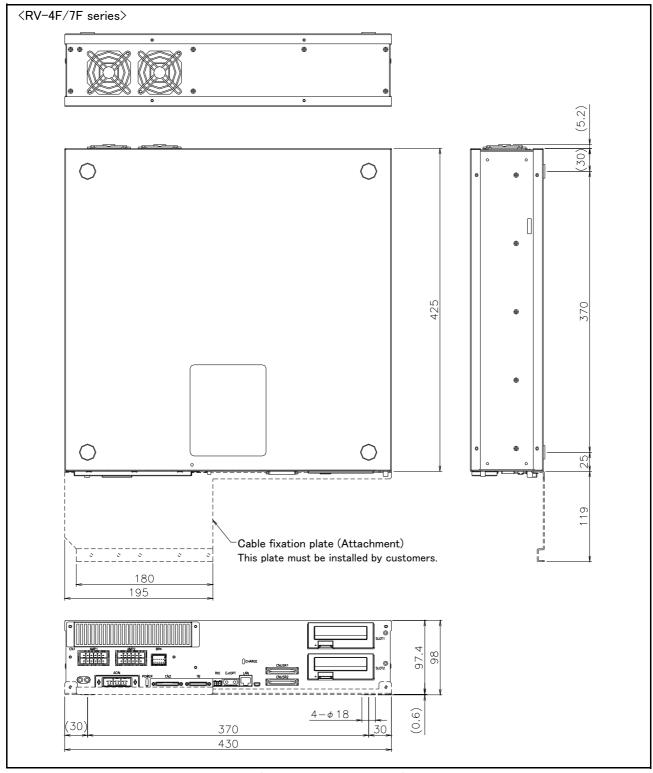


Fig.3-4 : Outside dimensions of controller (CR751: RV-4F/7F series)

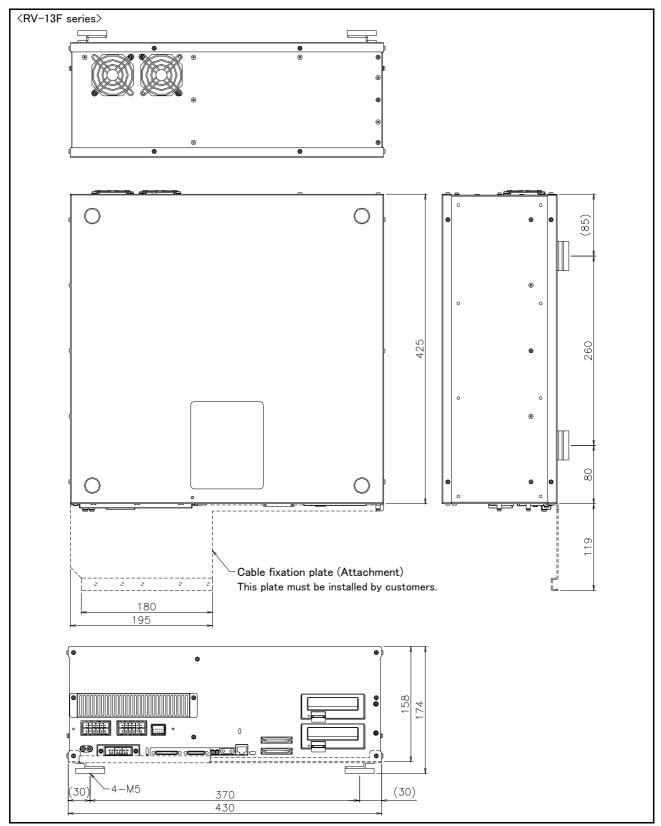
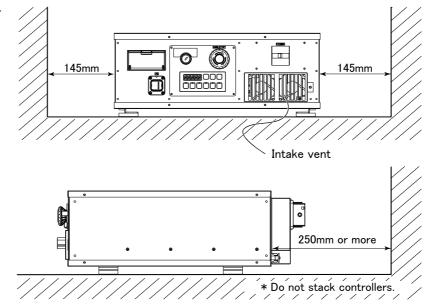


Fig.3-5 : Outside dimensions of controller (CR751: RV-13F series)

3.3.2 Installation dimensions

(1) CR750 controller

<Placed horizontally>



<Placed vertically>

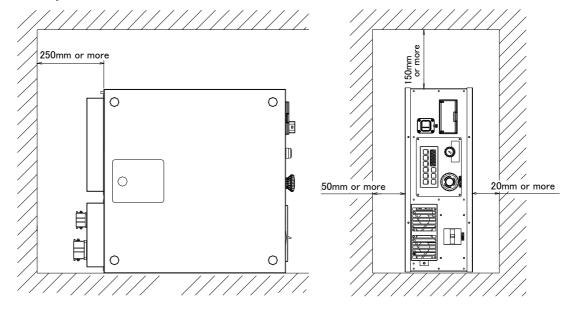


Fig.3-6: Installation of controller (CR750)

⚠CAUTION

Fixing installation section sure for prevention from the fall, when using the controller placing vertically. The reference figure of the metal plate for fixing is shown in Fig. 3-7. You should install the metal plate for fixation to the controller with M4 x 8 or the shorter screw. The screw projection length inside the controller (side board thickness is 1.2 mm) surely makes 6.8 mm or less.

ACAUTION

When storing the controller in a cabinet, etc., take special care to the heat radiating properties and ventilation properties so that the ambient temperature remains within the specification values. And, don't install the controller in the position where direct rays or the heat of lighting hits. The skin temperature of the controller may rise, and the error may occur.

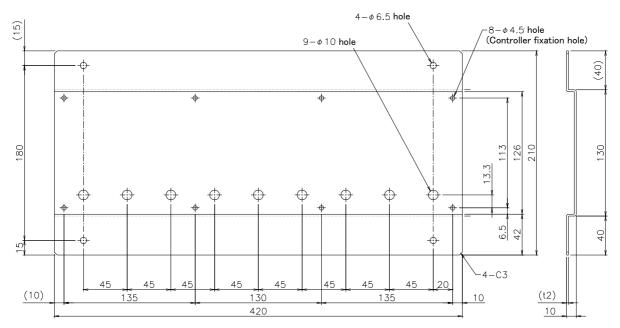
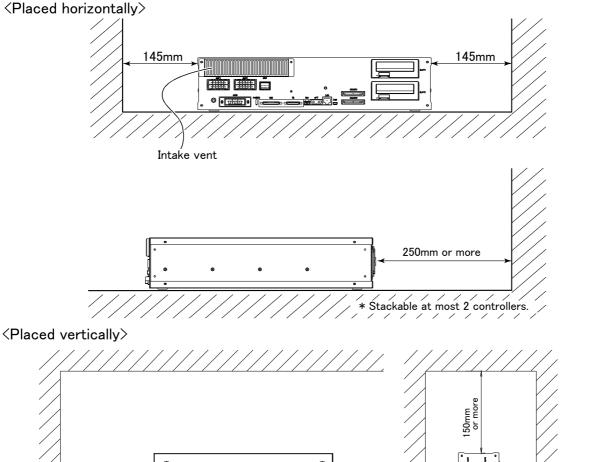


Fig.3-7: Metal plate for fixation to placing vertically (Reference for CR750)

(2) CR751 controller: RV-4F/7F series



0 0 20mm or more 250mm or more 50mm or more 0 0

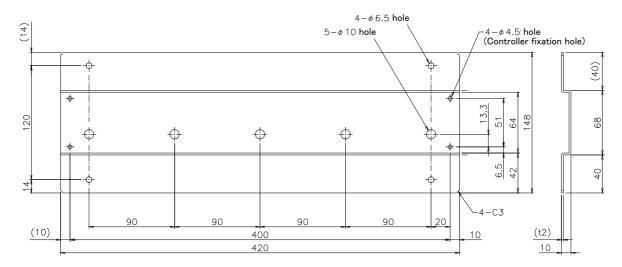
Fig.3-8: Installation of controller (CR751: RV-4F/7F series)

⚠CAUTION

Fixing installation section sure for prevention from the fall, when using the controller placing vertically. The reference figure of the metal plate for fixing is shown in Fig. 3-9. You should install the metal plate for fixation to the controller with M4 x 8 or the shorter screw. The screw projection length inside the controller (side board thickness is 1.2mm) surely makes 6.8mm or less.

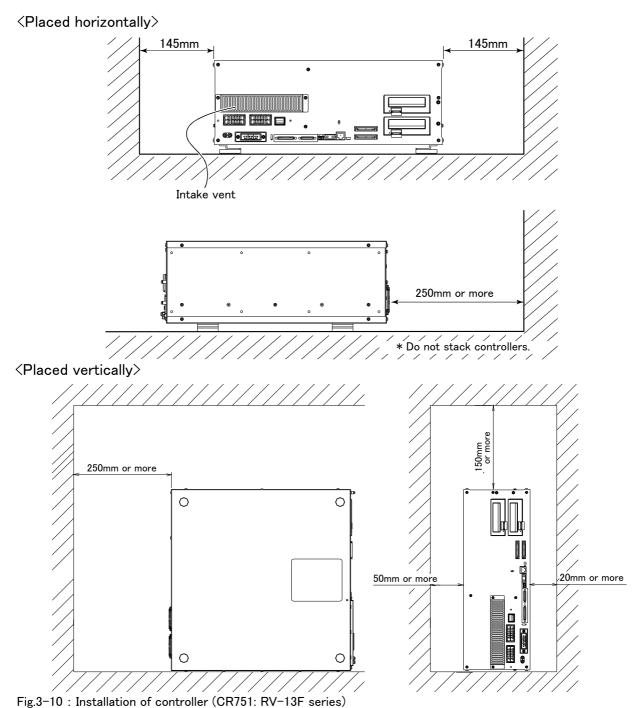
ACAUTION

When storing the controller in a cabinet, etc., take special care to the heat radiating properties and ventilation properties so that the ambient temperature remains within the specification values. And, don't install the controller in the position where direct rays or the heat of lighting hits. The skin temperature of the controller may rise, and the error may occur.



 $Fig. 3-9: Metal\ plate\ for\ fixation\ to\ placing\ vertically\ (Reference\ for\ CR751:\ RV-4F/7F\ series)$

(3) CR751 controller: RV-13F series



Fixing installation section sure for prevention from the fall, when using the controller placing vertically. The reference figure of the metal plate for fixing is shown in Fig. 3-11. You should install the metal plate for fixation to the controller with M4 x 8 or the shorter screw. The screw projection length inside the controller (side board thickness is 1.2mm) surely makes 6.8mm or less.



∆CAUTION

When storing the controller in a cabinet, etc., take special care to the heat radiating properties and ventilation properties so that the ambient temperature remains within the specification values. And, don't install the controller in the position where direct rays or the heat of lighting hits. The skin temperature of the controller may rise, and the error may occur.

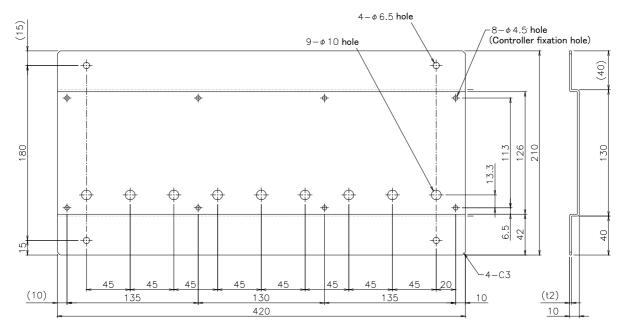


Fig.3-11: Metal plate for fixation to placing vertically (Reference for CR751: RV-13F series)

3.4 External input/output

3.4.1 Types

(1) Dedicated input/output	These inputs and outputs carry out the robot remote operation and
	status display.
(2) General-purpose input/output	These are inputs and outputs that the customer can program for
	peripheral device control.
(3) Hand input/output	These are inputs and outputs related to the hand that the customer can
	program.
(4)Emergency stop/Door switch input	The wiring for the safe security of the emergency stop etc. is shown in
	on Page 92, "3.6 Emergency stop input and output etc." and on Page
	162, "6.1.7 Examples of safety measures".

<For Reference>

Linking our GOT1000 Series (GT15) display equipment to the robot controller over the Ethernet permits you to control robot controller's input/output from a GOT (graphic operation terminal).

3.5 Dedicated input/output

Show the main function of dedicated input/output in the Table 3–2. Refer to attached instruction manual "Detailed explanations of functions and operations" in the product for the other functions. Each parameter indicated with the parameter name is used by designated the signal No., assigned in the order of input signal No. and output signal No.

Table 3-2: Dedicated input/output list

Parameter	Input				Output
name	Name	Function	Level	Name	Function
TEACHMD	None			Teaching mode output signal	Outputs that the teaching mode is entered.
ATTOPMD	None			Automatic mode output signal	Outputs that the automatic mode is entered.
ATEXTMD		None		Remote mode output signal	Outputs that the remote mode is entered.
RCREADY		None		Controller power ON complete signal	Outputs that external input signals can be received.
AUTOENA	Automatic opera- tion enabled input signal	Allows automatic operation.	L	Automatic operation enabled output signal	Outputs the automatic operation enabled state.
START	Start input signal	Starts all slots.	Е	Operating output signal	Outputs that the slot is operating.
STOP	Stop input signal	Stops all slots. The input signal No. is fixed to 0. Note) Use the emergency stop input for stop inputs related to safety.	L	Wait output signal	Outputs that the slot is temporarily stopped.
STOP2	Stop input signal	The program during operation is stopped. Unlike the STOP parameter, change of the signal number is possible. Notes) Specification is the same as the STOP parameter.	L	Wait output signal	Outputs that the slot is temporarily stopped. Notes) Specification is the same as the STOP parameter.
SLOTINIT	Program reset input signal	Resets the wait state.	Е	Program selection enabled output signal	Outputs that the slot is in the program selection enabled state.
ERRRESET	Error reset input signal	Resets the error state.	Е	Error occurring out- put signal	Outputs that an error has occurred.
CYCLE	Cycle stop input signal	Carries out cycle stop.	E	In cycle stop operation output signal	Outputs that the cycle stop is operating.
SRVOFF	Servo ON enabled input signal	Turns the servo OFF for all mechanisms.	L	Servo ON enabled output signal	Outputs servo-on disable status. (Echo back)
SRVON	Servo ON input signal	Turns the servo ON for all mechanisms.	Е	In servo ON output signal	Outputs the servo ON state.
IOENA	Operation rights input signal	Requests the operation rights for the external signal control.	L	Operation rights output signal	Outputs the operation rights valid state for the external signal control.
MELOCK	Machine lock input signal	Sets/resets the machine lock state for all mechanisms.	Е	In machine lock out- put signal	Outputs the machine lock state.
SAFEPOS	Evasion point return input signal	Requests the evasion point return operation.	Е	In evasion point return output signal	Outputs that the evasion point return is taking place.
OUTRESET	General-purpose output signal reset	Resets the general-purpose output signal.	Е		None
EMGERR		None		Emergency stop output signal	Outputs that an emergency stop has occurred.
S1START : S32START	Start input	Starts each slot.	E	In operation output	Outputs the operating state for each slot.

Parameter	Input			Output	
name	Name	Function	Level	Name	Function
S1STOP : S32STOP	Stop input	Stops each slot.	L	In wait output	Outputs that each slot is temporarily stopped.
PRGSEL	Program selection input signal Designates the setting value for the program No. with numeric value input signals.		E	None	
OVRDSEL	Override selection Designates the setting value for the override with the numeric value input signals.		E	None	
IODATA Note2)	Numeric value input (start No., end No.)	Used to designate the program Numeric value output Used to output the program		Used to output the program name, override value., mechanism No.	
PRGOUT	Program No. out- put request	Requests output of the program name.	E	Program No. output signal	Outputs that the program name is being output to the numeric value output signal.
LINEOUT	Line No. output request	Requests output of the line No.	Е	Line No. output signal	Outputs that the line No. is being output to the numeric value output signal.
OVRDOUT	Override value output request	·		Override value output signal	Outputs that the override value is being output to the numeric value output signal.
ERROUT	Error No. output request	Requests the error No. output.	Е	Error No. output sig- nal	Outputs that the error No. is being output to the numeric value output signal.
JOGENA	Jog valid input sig- nal Validates jog operation with the external signals		Е	Jog valid output sig- nal	Outputs that the jog operation with external signals is valid.
JOGM	Jog mode input 2- Designates the jog mode. lbit		L	Jog mode output 2- bit	Outputs the current jog mode.
JOG+	Jog feed + side for 8-axes Requests the + side jog operation.		L		None
JOG-	Jog feed – side for 8-axes Requests the – side jog operation.		L	None	
HNDCNTL1 : HNDCNTL3	None			Mechanism 1 hand output signal status : : Mechanism 3 hand output signal status	Mechanism 1: Outputs the status of general-purpose outputs 900 to 907. Mechanism 2: Outputs the status of general-purpose outputs 910 to 917. Mechanism 3: Outputs the status of general-purpose outputs 920 to 927.
HNDSTS1 : HNDSTS3	None			Mechanism 1 hand input signal status : : Mechanism 3 hand input signal status	Mechanism 1: Outputs the status of hand inputs 900 to 907. Mechanism 2: Outputs the status of hand inputs 910 to 917. Mechanism 3: Outputs the status of hand inputs 920 to 927.
HNDERR1 : HNDERR3	Mechanism 1 hand error input signal : Mechanism 3 hand error input signal Requests the hand error occurrence.		L	Mechanism 1 hand error output signal : Mechanism 3 hand error output signal	Outputs that a hand error is occurring.

Parameter	Input N			Output		
name	Name	Function	Level	Name	Function	
AIRERR1 : AIRERR3	Pneumatic pressure error 1 input signal : Pneumatic pressure error 3 input signal	Request the pneumatic pressure error occurrence.	L	Pneumatic pressure error 1 output signal. : Pneumatic pressure error 3 output signal.	Outputs that a pneumatic pressure error is occurring.	
M1PTEXC : M3PTEXC	None		L	Maintenance parts replacement time warning signal	Outputs that the maintenance parts have reached the replacement time.	
USERAREA Note3)	None			User-designated area 8-points	Outputs that the robot is in the user—designated area.	

Note1) The level indicates the signal level.

- L: Level signal → The designated function is validated when the signal is ON, and is invalidated when the signal is OFF.
- E: Edge signal ightarrow The designated function is validated when the signal changes from the OFF to ON state, and the function maintains the original state even when the signal then turns OFF.
- Note2) Four elements are set in the order of input signal start No., end No., output signal start No. and end No.
- Note3) Up to eight points can be set successively in order of start output signal No. and end output signal No.

3.6 Emergency stop input and output etc.

Do wiring of the external emergency stop, the special stop input, the door switch, and the enabling device from the "special input/output" terminal connector.

Table 3-3: Special input/output terminal

Item	Name	Function
Input	Emergency stop	Applies the emergency stop. Dual emergency line
Input	Special stop input	Applies the stop. (Refer to Page 100, "3.6.2 Special stop input (SKIP)")
Input	Door switch	Servo-off. Dual line, normal close (Page 102, "3.6.3 Door switch function")
Input	Enabling device	Servo-off. Dual line, normal close (Page 102, "3.6.4 Enabling device function")
Output	Robot error output	Contactor is opening during error occurrence.
Output	Emergency stop output	The point of contact opens under occurrence of emergency stop of external input signal, emergency stop of OP, emergency stop of T/B.
Output	Mode output	MANUAL mode: contactor is opening, AUTOMATIC mode: contactor is closing.
Output	Magnet contactor control connector output for addition axes	When an additional axis is used, the servo ON/OFF status of the additional axis can be synchronized with the robot arm. (Page 110, "3.9 Magnet contactor control connector output (AXMC) for addition axes")

^{*}At the time of the power supply OFF, the output point of contact is always open.

[Note] The contact capacity of each input/output terminal is DC24V/10mA - 100mA. Don't connect the equipment except for this range. The use exceeding contact capacity causes failure. In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Pin number assignment of each terminal and the circuit diagram are shown in Fig. 3-13 (CR750) or Fig. 3-17 (CR751).

3.6.1 Connection of the external emergency stop

The external emergency stop input and door switch input and enabling device input are opened at shipment as shown in Fig. 3-13 (CR750) or Fig. 3-17 (CR751).

Connect the external emergency stop switch and door switch with the following procedure.

And, the example of the connection and notes of the emergency stop are described in Page 162, "6.1.7 Examples of safety measures" Refer to it together

- [Caution] The emergency stop circuit is duplicated inside the controller. The emergency stop switch uses a double contact-type switch, so please be sure to fix both of the contacts to the connector pins as shown below in order to ensure the wiring is duplicated. An error will continue to occur in the event that only one of the pins is connected.
- 1) Please prepare the emergency stop switch, door switch and enabling device.
 - a) External emergency switch
 - CR750 controller CNUSR11 connector "between 3 and 4" and CNUSR12 Connector "between 3 and 4".
 - CR751 controller CNUSR1 connector "between 2 and 27" and "between 7 and 32".
 - b) Door switch
 - CR750 controller CNUSR11 connector "between 7 and 8" and CNUSR12 connector "between 7 and 8".
 - · CR751 controller CNUSR1 connector "between 4 and 29" and "between 9 and 34".
 - c) Enabling device
 - · CR750 controller CNUSR11 connector "between 9 and 10" and CNUSR12 connector "between 9 and 10".
 - CR751 controller CNUSR1 connector "between 5 and 30" and "between 10 and 35".
- [Caution] Be sure to use a shield cable for the emergency stop wiring cable. And when operating in an environment that is easily affected by noise, be sure to fix the attached ferrite core (model number: E04SR301334, manufacturer: Seiwa Electric Mfg. Co., Ltd.). Be sure to place the ferrite core more than 30 cm from the connecting terminal section.

/I\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

You should always connect doubly connection of the emergency stop, the door switch, and the enabling switch. In connection of only one side, if the relay of customer use should break down, it may not function correctly.

And, the output contacts from the robot controller (robot error output, emergency stop output, mode output, addition axis contactor control output) are dual contacts (synchronizes). You should connect surely by dual line with the customer's equipment as well as connection of the emergency stop and the door switch.

ACAUTION

Please make sure to wire the multiple emergency stop switches so that they each function independently. Check and make sure that the emergency stop doesn't only function under an AND condition (when multiple emergency stop switches are ON at the same time).

(1) CR750 controller

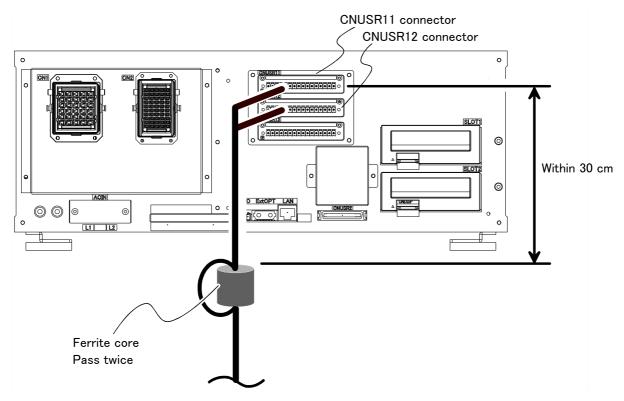
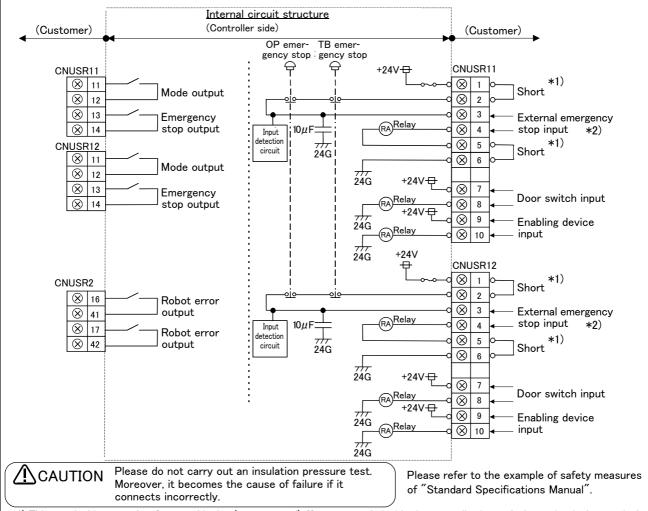


Fig.3-12: Emergency stop cable connection (CR750)



*1) This terminal is opened at factory shipping (unconnected). If power supply inside the controller is used, short-circuit the terminal. *2) This terminal can be used only for the external emergency stop input to the controller. The terminal cannot be used for the output

signal of OP emergency stop or TB emergency stop because the controller's internal circuit contains the input detection circuit and a capacitor.

(Do not use the terminal for other purposes such as monitoring the test pulse outputs, or a false detection may occur.)

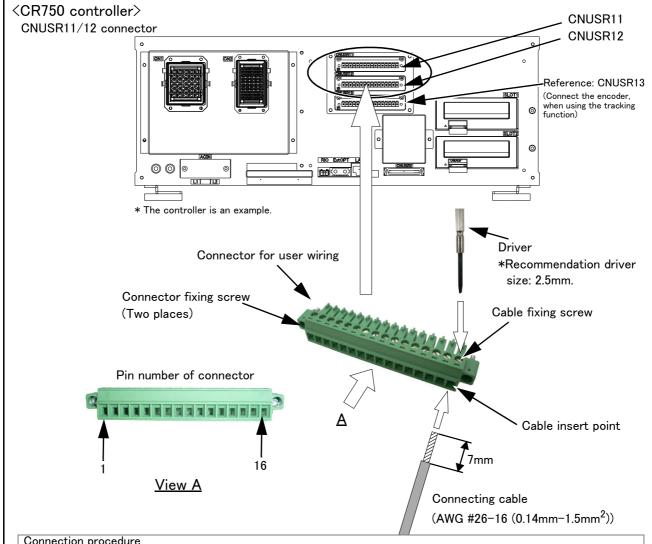
[Note] In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Fig.3-13: External emergency stop connection (CR750)



Place the emergency stop switch in an easily operable position, and be sure to wire it to the emergency stop correctly by referencing Page 162, "6.1.7 Examples of safety

This is a necessary measure in order to ensure safe operation so that the robot can be stopped immediately by pressing the emergency stop switch in the event that the robot malfunctions.



Connection procedure

Insert the connection cable into the appropriate pin of the user wiring connector that accompanies the product. Fix it securely with a screw and connect the connector to the CNUSR11/CNUSR12 connector at the back of the controller.

Please use an AWG #26 to 16 (0.14 to 1.5mm²) connector cable.

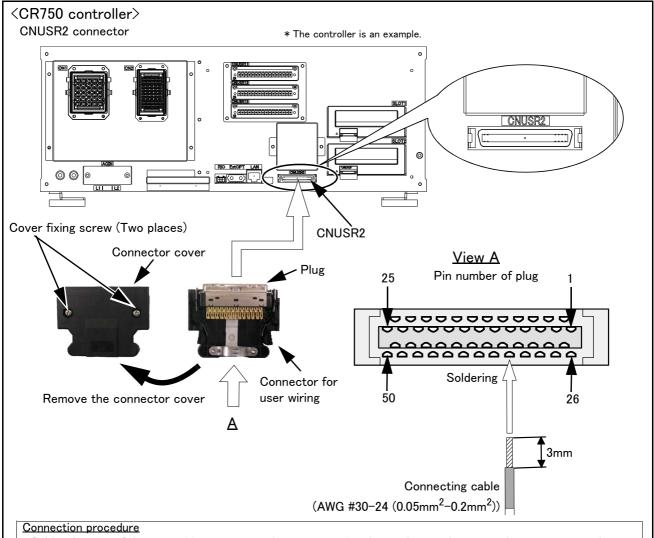
- 1) Prepare the user wiring connector that accompanies the product.
- 2) Loosen the cable fixing screw at the point where the cable is to be inserted. Please use a screwdriver head with a width of 2.5mm to loosen the screw.
- 3) Peel the insulation of the connecting cable to 7mm, and insert it into the cable slot of the corresponding con-
- 4) Be sure to fix the inserted cable securely by fastening a cable fixing screw. (tightening torque of 0.22 to 0.25Nm)
- 5) After the necessary cables save been fixed, connect the connector to the connector (CNUSR11/12) that corresponds with the controller. Connect so that the cable fixing screw is comes on top, and make sure to fix securely by fastening connector fixing screws in two places. A screwdriver head with a width of 2.5mm should be used to fix screws (tightening torque of 0.22 to 0.25Nm).

This concludes the connection procedure.

Fig.3-14: Method of wiring for external emergency stop connection (CR750 (CNUSR11/12))



Makes sure that there is no mistake when connecting to the target connectors. Connecting incorrectly will result in the robot breaking down or malfunctioning. The connector on the controller side that connects to the user wiring connector is CNUSR11 or CNUSR12. Be careful not to connect to CNUSR13 as the robot will not operate properly.



Solder the pins of the user wiring connector that accompanies the product, and connect the connector to the CNUSR2 connector at the back of the controller. For the connection cables, please use AWG #30 to 24 (0.05 to 0.2mm^2).

- 1) Loosen the two fixing screws on the user wiring connector that accompanies the product, and remove the con-
- 2) Peel the insulation of the connecting cable to 3mm, and solder it the appropriate connector pin number.
- 3) After the necessary cables have been soldered, re-fix the connector cover using the same fixing screws and make sure it is fastened securely.
- 4) Connect the connector to the corresponding connector (CNUSR2) on the controller. With pin number 1 facing to the upper right, insert firmly until you hear the connector's latch click in to place.

This concludes the connection procedure.

Fig.3-15: Method of wiring for external emergency stop connection (CR750 (CNUSR2))



When soldering please take care to only connect to the specified pin number. Connecting to a different pin number or short-circuiting with another pin will result in the robot breaking down or malfunctioning.

(2) CR751 controller

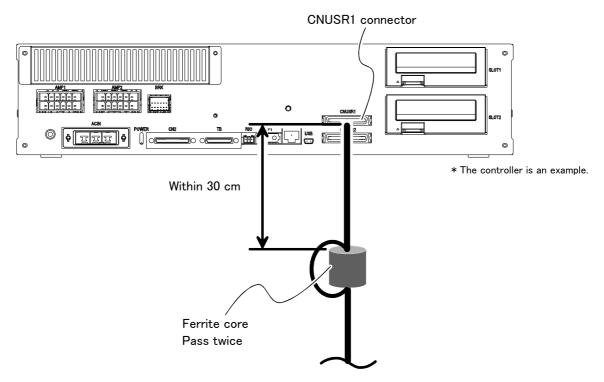
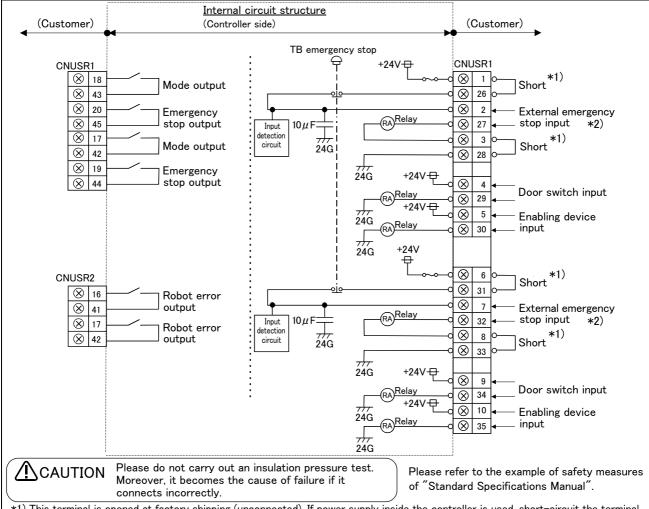


Fig.3-16 : Emergency stop cable connection (CR751)



- *1) This terminal is opened at factory shipping (unconnected). If power supply inside the controller is used, short-circuit the terminal.
- *2) This terminal can be used only for the external emergency stop input to the controller. The terminal cannot be used for the output signal of OP emergency stop or TB emergency stop because the controller's internal circuit contains the input detection circuit and a capacitor.

(Do not use the terminal for other purposes such as monitoring the test pulse outputs, or a false detection may occur.)

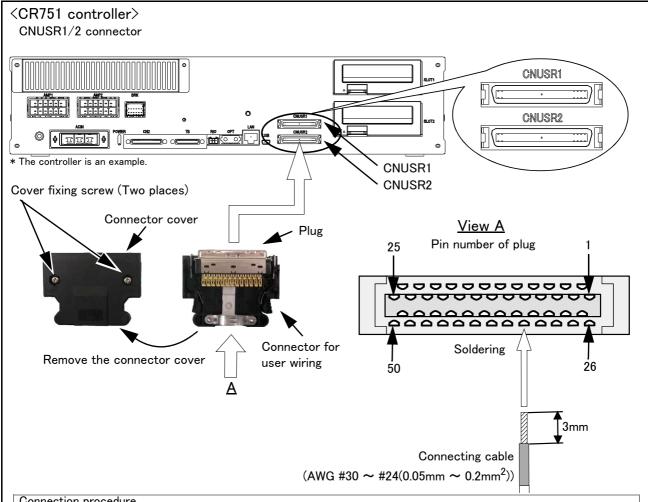
[Note] In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Fig.3-17: External emergency stop connection (CR751)



Place the emergency stop switch in an easily operable position, and be sure to wire it to the emergency stop correctly by referencing Page 162, "6.1.7 Examples of safety measures".

This is a necessary measure in order to ensure safe operation so that the robot can be stopped immediately by pressing the emergency stop switch in the event that the robot malfunctions.



Connection procedure

Solder the user wiring connector that accompanies the product to the corresponding pin, and connect it to the CNUSR1 or CNUSR2 connector at the back of the controller. For the connection cable, please use AWG #30 to 24 $(0.05 \text{ to } 0.2 \text{mm}^2).$

- 1) Loosen the 2 fixing screws on the user wiring connector that accompanies the product, and remove the con-
- 2) Peel the insulation of the connecting cable to 3mm, and solder it the appropriate connector pin number.
- 3) After the necessary cable has been soldered, re-fix the connector cover sing the same fixing screws and make sure it is fastened securely.
- 4) Connect the connector to the corresponding connector (CNUSR1 or CNUSR2) on the controller. With pin number 1 facing to the upper right, insert firmly until you hear the connector's latch click in to place.

This concludes the connection procedure.

Fig.3-18: Method of wiring for external emergency stop connection (CR751 (CNUSR1/2))



When soldering please take care to only connect to the specified pin number.

Connecting to a different pin number or short-circuiting with another pin will result in the robot breaking down or malfunctioning.

The connectors on the controller side are CNUSR1 (upper side) and CNUSR2 (lower side). Makes sure that there is no mistake when connecting to the target connectors. Connecting incorrectly will result in the robot breaking down or malfunctioning.

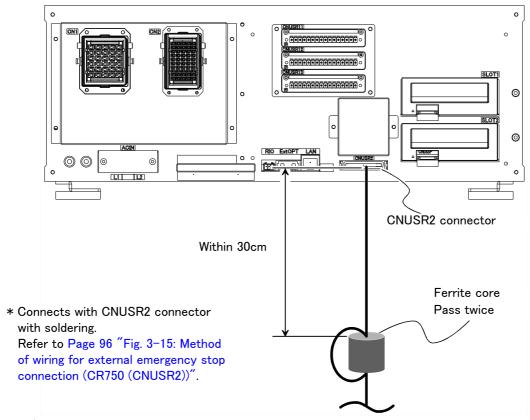
3.6.2 Special stop input (SKIP)

The skip is the input signal to stop the robot. The pin 9, 34 of the CNUSR2 connector shown in Fig. 3-19 (CR750) or Fig. 3-20 (CR751).

Table 3-4: Special stop input electric specification

Item		Specifications	Internal circuit			
Туре		DC input				
No. of input po	int	1				
Insulation met	hod	Photo-coupler insulation				
Rated input vo	ltage	DC24V	ı			
Rated input cu	rrent	Approx. 11mA	9 +24V(COM)			
Working voltag	e range	DC 21.6 ~ 26.4V (Ripple rate within 5%)	330 34 Input			
ON voltage/O	N current	DC 8V or more / 2mA or more				
OFF voltage/0	OFF current	DC 4V or less / 1mA or less	2.20			
Input resistand	ce	Approx. 2.2 k Ω				
Response	OFF → ON	1ms or less				
time	ON → OFF	1ms or less				
Common method		1 point per common				
External wire	connection method	Connector				

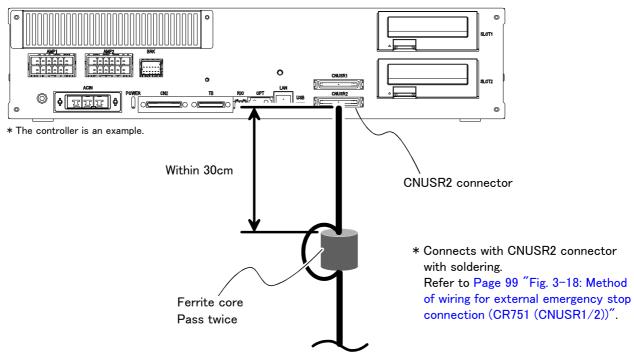
(1) CR750 controller



Note) In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Fig.3-19: Connection of the special-stop-input (CR750)

(2) CR751 controller



Note) In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Fig.3-20: Connection of the special-stop-input (CR751)

3.6.3 Door switch function

This function retrieves the status of the switch installed on the door of the safety fence, etc., and stops the robot when the door is opened. This differs from an emergency stop in that the servo turns OFF when the door is opened and an error does not occur. Follow the wiring example shown in Page 94 "Fig. 3-13: External emergency stop connection (CR750)" or Page 98 "Fig. 3-17: External emergency stop connection (CR751)", and Page 162, "6.1.7 Examples of safety measures". Those figure explains the wire is contact closes when the door is closed. Details of this function according to the robot status are shown below.

*During automatic operationWhen the door is opened, the servo turns OFF and the robot stops. An error occurs. The process of the restoration: Close the door, reset the alarm, turn on the servo, and restart

*During teaching...... Even when the door is opened, the servo can be turned ON and the robot moved using the teaching pendant.

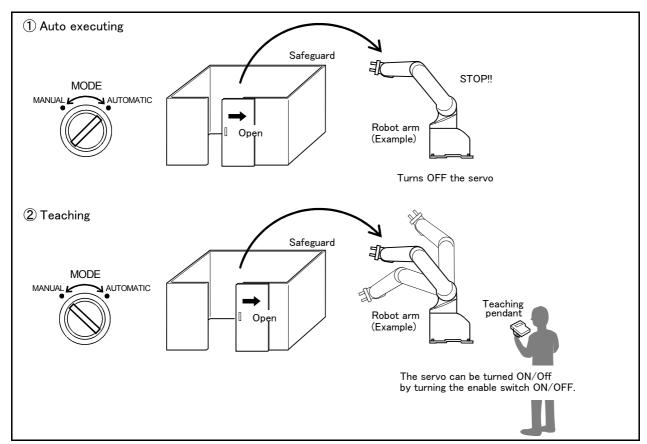


Fig.3-21: Door switch function

3.6.4 Enabling device function

When the abnormalities occur in teaching operations etc., the robot's servo power can be immediately cut only by switch operation of the enabling device*1) (servo-off), and the safety increases. To use the robot safely, please be sure to connect the enabling device.

(1) When door is opening

Please do teaching by two-person operations. One person has T/B, the other has enabling device. Turn on the servo power, in the condition that both of switches are pushed. (Enable switch of T/B and enabling device) Then the jog operation will be available. You can off the servo power only by releasing the switch of the enabling device. And, care that the servo-on and releasing the brake cannot be done in the condition that the switch of the enabling device is released.

(2) When door is closing

You can turn on the servo power by operation of only T/B. In this case perform jog operation outside the safeguard sure.

^{*1)} Recommendation products: HE1G-L20MB (IDEC)

(3) Automatic Operation/Jog Operation/Brake Release and Necessary Switch Settings The following is a description of various operations performed on the robot and switch settings that are required.

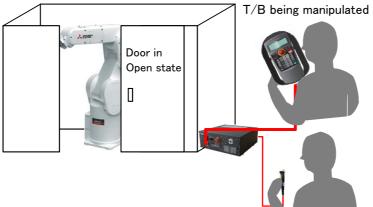
Table 3-5: Various operations and necessary switch settings

			Relate					
No	Operation	Mode of T/B controller enable/ disable		T/B enable switch	Enabling device input terminal	Door switch input terminal	Description	
1	Jog operation	Manual	Enable	ON	Close(ON)	_	If the enabling device input is set to Close (On), the state of door switch input does not matter.	
2	Jog operation Note2)	Manual	Enable	ON	Open(OFF)	Close (Door Close)	If the enabling device input is set to Open (Off), door switch input must be in a state of Close	
3	Brake release Note3)	Manual	Enable	ON	Close(ON)	_	Irrespective of the state of door switch input, enabling device input must be in a state of Close (On).	
4	Automatic operation	Automatic	Disable	_	_	Close (Door Close)	Door switch input must always be in a state of Close (Door Close).	

Note1) "-" in the table indicates that the state of switch concerned does not matter.

Refer to the following for operation of each switch.

- Mode of CR751 controller:Page 104, "3.7 Mode changeover switch input" · T/B enable/disable: Page 113, "(1) Teaching pendant (T/B)" · T/B enable switch: Page 113, "(1) Teaching pendant (T/B)"
- Note2) Jog operation, if door switch input is set for Close (Door Close), must be performed outside the safety bar-
- Note3) It is imperative that brake release operation be carried out by two persons. One person turns on the enabling device ("Close" on the enabling device input terminal) while the other manipulates the T/B. Brake release can be effected only when both of the enabling switch device and the T/B enable switch are placed in intermediate position (lightly gripped position). At this point, the state of door switch input does not matter.



Enabling device being manipulated

∕!\CAUTION

Upon the release of brake, the robot arm may fall under its own weight depending on the axis which has been released. For added safety, provide support or take other precaution to prevent the falling of the arm.

Fig.3-22: Brake release operation

3.7 Mode changeover switch input

Connect the key switch of customer prepared and change the right of robot's operation by switch operation. The key switch can be installed in the operation panel of customer preparation.

<Right of operation (mode)>

AUTOMATICThe operation from external equipment becomes available. Operation which needs the right of operation from T/B cannot be performed. It is necessary to set the parameter for the rights of operation to connection with external equipment. Refer to the separate volume, "Instruction Manual/Detailed Explanation of Functions and Operations" for detail.

MANUALWhen T/B is available, only the operation from T/B becomes available. Operation which needs the right of operation from external equipment cannot be performed.

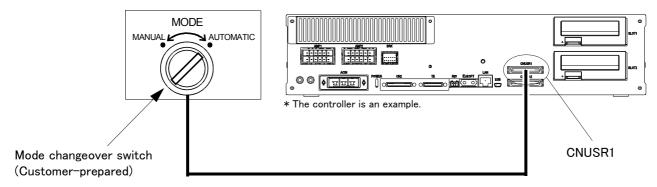


Fig.3-23: Mode changeover switch image figure (CR751)

(1) Specification of the key switch interface

The function and specification of the key switch interface are shown below.

Table 3-6: Function of the key switch interface

Pin number and	Function (Connector: CNUSR1)	Change mode ^{Note1)}		
Pin number	Function	MANUAL	AUTOMATIC	
49	1st line KEY input		Close	
24	Power supply +24V of pin number 49	Open		
50	50 2nd line KEY input			
25	Power supply +24V of pin number 50	Open	Close	

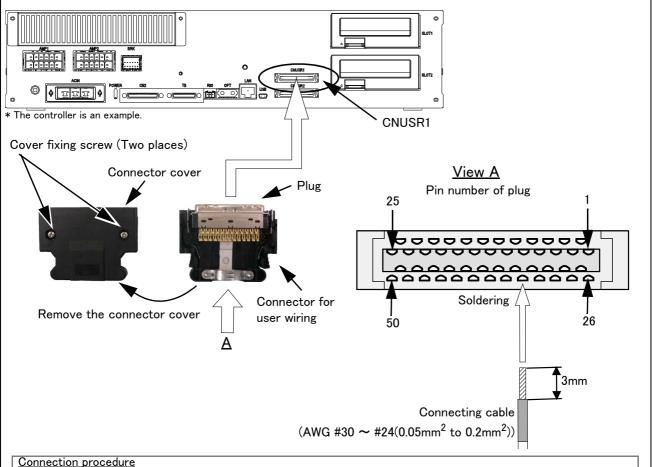
Note1) The mode changes by both opening or both closing between 49-24 pin and between 50-25 pin. When input states differ between two lines, error H0044 (OP Mode key line is faulty) will occur.

[Note] In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Table 3-7: Specification of the mode changeover switch input

Item	Specification	Remarks
Rated voltage	DC24V	Supply from the controller.
Current rating	Approx. 10mA	Select the switch or button which operates normally in 24V/10mA.
Input resistance	Approx. 2.2kΩ	
Response time (OFF->ON)	Approx. 15ms	Example: The response time the program starts, after pushing the run button.
Common method	1 point per common	
Connection method	Connector	
Conformity electric wire size	AWG#24 to #18	0.2 to 0.75mm ²
Maker/Type	-	Maker: PHOENIX CONTACT/ Type: FKC2.5/4-STF-5.0B

(2) Connection of the mode changeover switch input



Connection procedure

Solder the user wiring connector that accompanies the product to the corresponding pin, and connect it to the CNUSR1 connector at the back of the controller. For the connection cable, please use AWG #30 to 24 (0.05 to 0.2mm^2).

- 1) Loosen the 2 fixing screws on the user wiring connector that accompanies the product, and remove the connector cover.
- 2) Peel the insulation of the connecting cable to 3mm, and solder it the appropriate connector pin number.
- 3) After the necessary cable has been soldered, re-fix the connector cover sing the same fixing screws and make sure it is fastened securely.
- 4) Connect the connector to the corresponding connector (CNUSR1) on the controller. With pin number 1 facing to the upper right, insert firmly until you hear the connector's latch click in to place.

This concludes the connection procedure.

Fig.3-24: Connection of the mode changeover switch input (CR751)

3.8 Additional Axis Function

This controller is equipped with an additional axis interface for controlling an additional axis when a traveling axis or rotary table is added to the robot. A maximum of eight axes of servo motors can be controlled at the same time by connecting a general-purpose servo amplifier (MR-J3-B, MR-J4-B series) that supports Mitsubishi's SSCNET III. Refer to the separate "Additional axis interface Instruction Manual" for details on the additional axis function.

3.8.1 Wiring of the Additional Axis Interface

Table 3-8 shows the connectors for additional axes inside the controller. Fig. 3-25 (CR750) and Fig. 3-26 (CR751) shows a connection example (configuration example).

Table 3-8: Dedicated connectors inside the controller

Name	Connector name	Details	
Connector for additional axes	ExtOpt	The connector for connecting the general-purpose servo amplifier.	

(1) CR750 controller

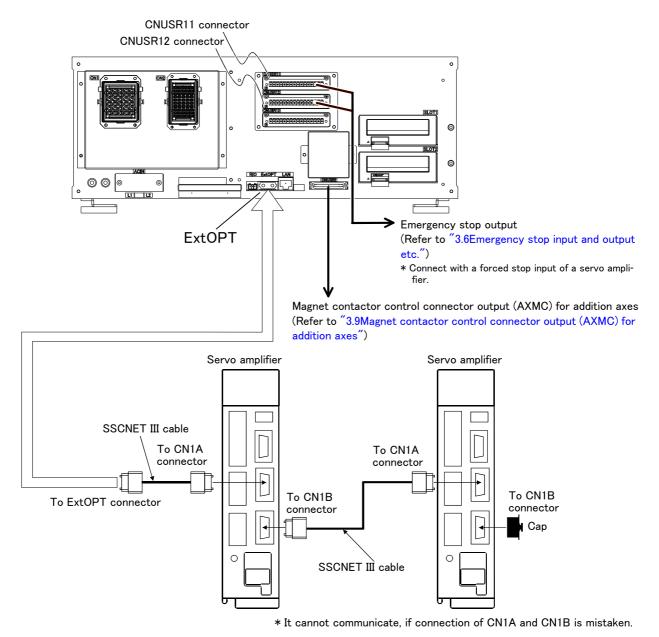
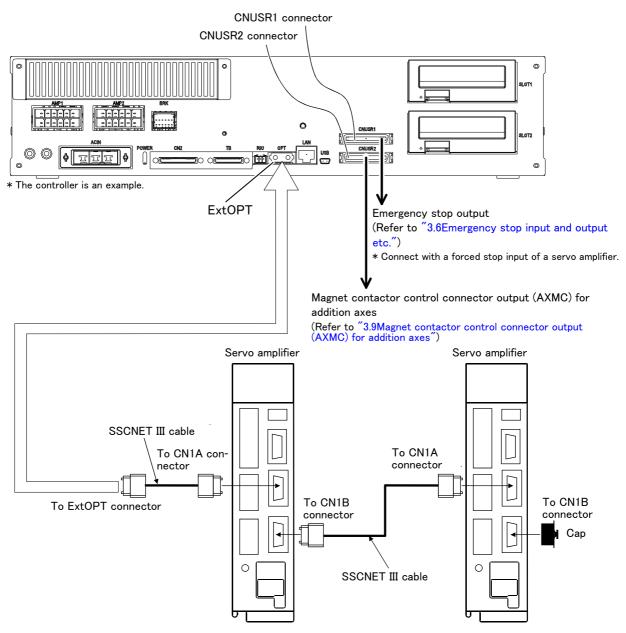


Fig.3-25: Example of addition axis connection (CR750)

(2) CR751 controller



* It cannot communicate, if connection of CN1A and CN1B is mistaken.

Fig.3-26: Example of addition axis connection (CR751)

- (3) Example of the installation of the noise filter
- 1) EMC filter (recommended)

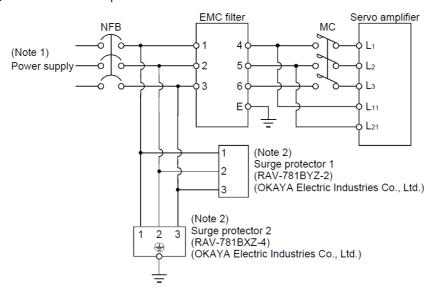
Please install the recommendation filter shown below according to the example of connection.

1) Combination with the servo amplifier

Servo amplifier	Recommended filt	er (Soshin Electric)	Mass [kg]([lb])	
Servo ampliner	Model	Leakage current [mA]		
MR-J3-10B to MR-J3-100B MR-J3-10B1 to MR-J3-40B1	(Note) HF3010A-UN	5	3 (6.61)	
MR-J3-250B • MR-J3-350B	(Note) HF3030A-UN		5.5 (12.13)	
MR-J3-500B • MR-J3-700B	(Note) HF3040A-UN	1.5	6.0 (13.23)	
MR-J3-11KB to MR-J3-22KB	(Note) HF3100A-UN	6.5	15 (33.07)	
MR-J3-60B4 • MR-J3-100B4	TF3005C-TX		0(42.02)	
MR-J3-200B4 to MR-J3-700B4	TF3020C-TX		6(13.23)	
MR-J3-11KB4	TF3030C-TX	5.5	7.5(16.54)	
MR-J3-15KB4	TF3040C-TX		12.5(27.56)	
MR-J3-22KB4	TF3060C-TX		12.5(27.56)	

Note. A surge protector is separately required to use any of these EMC filters.

2) Connection example



Note1) For 1-phase 200V to 230VAC power supply, connect the power supply to L1, L2 and leave L3 open. There is no L3 for 1-phase 100 to 120 VAC power supply.

Note2) The example is when a surge protector is connected.

Fig.3-27: Example of EMC noise filter installation

2) Line noise filter

This filter is effective in suppressing noises radiated from the power supply side and output side of the servo amplifier and also in suppressing high-frequency leakage current (zero-phase current) especially within 0.5MHz to 5MHz band.

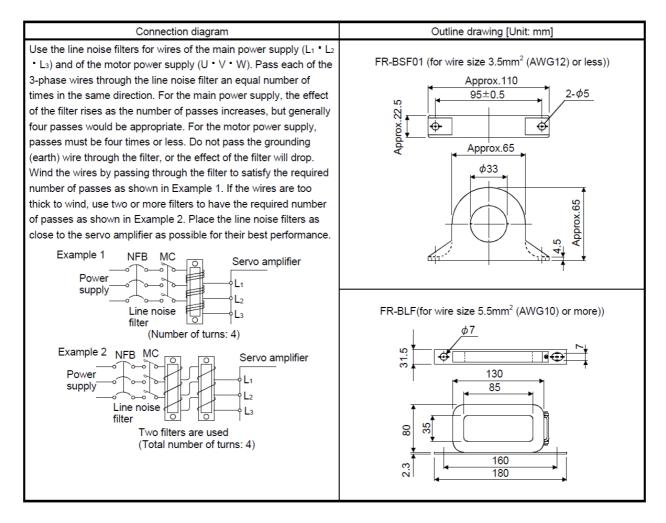


Fig.3-28: Example of noise filter installation

3.9 Magnet contactor control connector output (AXMC) for addition axes

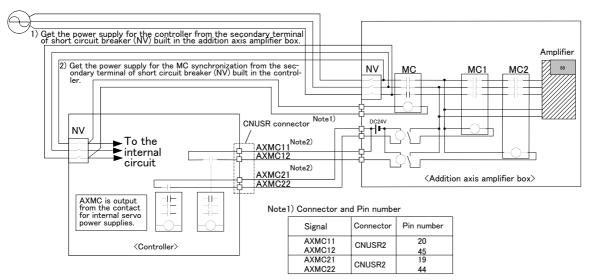
When an additional axis is used, the servo ON/OFF status of the additional axis can be synchronized with the servo ON/OFF status of the robot itself by using the output contact (AXMC) provided on the rear or inside of the controller and configuring a circuit so that the power to the servo amplifier for the additional axis can be turned off when this output is open.

An example circuit is shown Fig. 3-29. An image of how to connect the controller connector are shown Fig. 3-30 and Fig. 3-31.

When you are using an additional axis, please perform appropriate circuit connections by referring to these draw-

Refer to the separate "Additional axis interface Instruction Manual" for details on the additional axis function.

Note1) you use the addition axis function as a user mechanism who became independent of the robot arm, please do not connect this output signal. Servo-on of the user mechanism may be unable.



Note2) This output is opened, if the robot turns off the servo by occurrence of alarm etc. <Electric specification>
 DC24V/10mA to 100mA

[Note] In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Fig.3-29: Example of circuit for addition axes of Magnet contactor control output

(1) CR750 controller

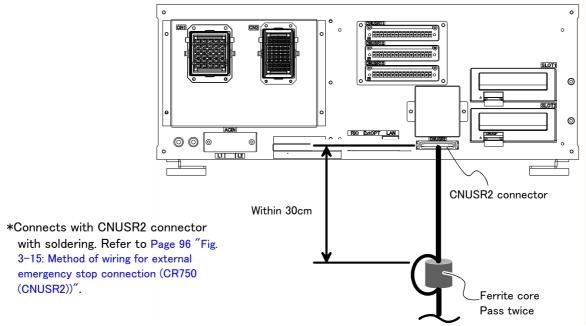


Fig.3-30: AXMC terminal connector (CR750)

(2) CR751 controller

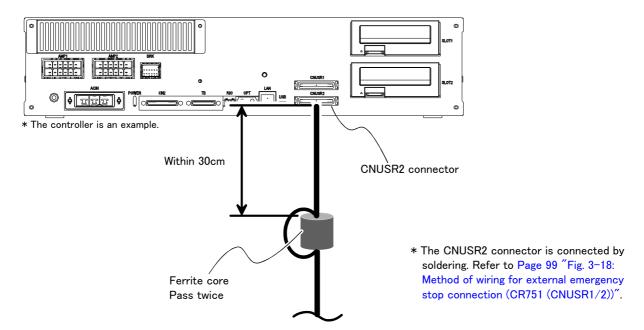


Fig.3-31: AXMC terminal connector (CR751)

3.10 Options

■ What are options?

There are a variety of options for the robot designed to make the setting up process easier for user needs. User installation is required for the options.

Options come in two types: "set options" and "single options".

- 1. Set options......A combination of single options and parts that together, form a set for serving some purpose.
- 2. Single options......That are configured from the fewest number of required units of a part. Please choose user's purpose additionally.

(1) Teaching pendant (T/B)

■ Order type: CR750 controller R32TB: Cable length 7m

■ R32TB-15: Cable length 15m

CR751 controller R33TB: Cable length 7m

■ R33TB-15: Cable length 15m

Outline



This is used to create, edit and control the program, teach the operation position and for jog feed, etc.

For safety proposes, a 3-position enable switch is mounted.*1)

■ Configuration

Table 3-9: Configuration device

Part name		Туре	Qty.	Mass (kg) Note1)	Remarks		
CR750 controller							
	Teaching pendant	R32TB	Fither and a	1.7	Cable length is 7m. Hand strap is attached.		
		R32TB-15 Either one pc.		2.8	Cable length is 15m. Hand strap is attached.		
CR	751 controller						
	Teaching pendant	R33TB	Eithau ana na	1.7	Cable length is 7m. Hand strap is attached.		
		R33TB-15	Either one pc.	2.8	Cable length is 15m. Hand strap is attached.		

Note1) Mass indicates one set.

Specifications

Table 3-10: Specifications

Items	Specifications	Remarks
Outline dimensions	195(W) x 292(H) x 106(D) (refer to outline drawing)	
Body color	Dark gray	
Mass	Approx. 0.9kg (only arm, excluding cable)	
Connection method	Connection with controller and connector.	
Interface	RS-422	
Display method	LCD method: 24 characters x 8 lines, LCD illumination: with backlight	At 8x8 font
Operation section	36 keys	

In ISO/10218 (1992) and JIS-B8433 (1993), this is defined as an "enable device". These standards specify that the robot operation using the teaching pendant is enabled only when the "enable device" is at a specified position. With the Mitsubishi Electric industrial robot, the above "enable device" is configured of an "Enable/Disable switch" and "Enable switch".

The 3-position enable switch has three statuses. The following modes are entered according to the switch state.

- a) "Not pressed"......The robot does not operate. *)
- b) "Pressed lightly" The robot can be operated and teaching is possible.
- c) "Pressed with force"......The robot does not operate. *)

^{*1) &}lt;3-position enable switch>

^{*)} Operations, such as program editing and status display, other than robot operation are possible.

Safety is secured as the servo power is turned OFF simultaneously with the input of the emergency stop.

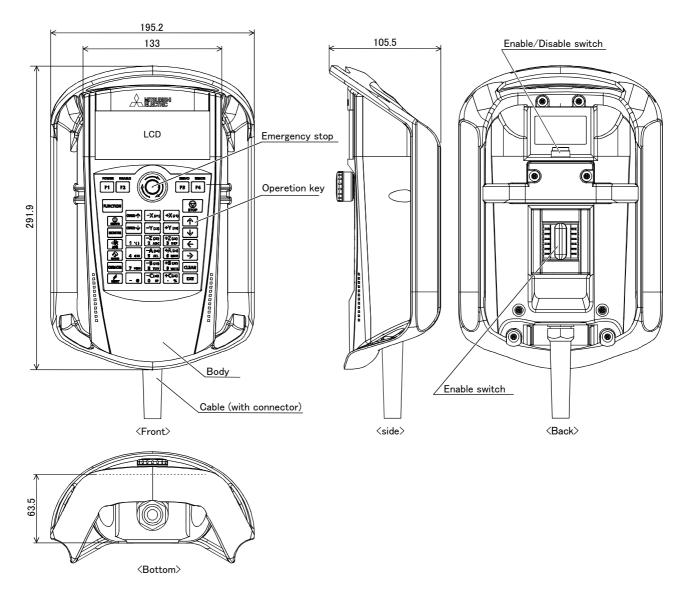


Fig.3-32: Outside dimensions of teaching pendant

■ Installation method

The teaching pendant is connected to the $\ensuremath{\mathsf{T/B}}$ connector on the front of the controller.

■ Key layout and main functions

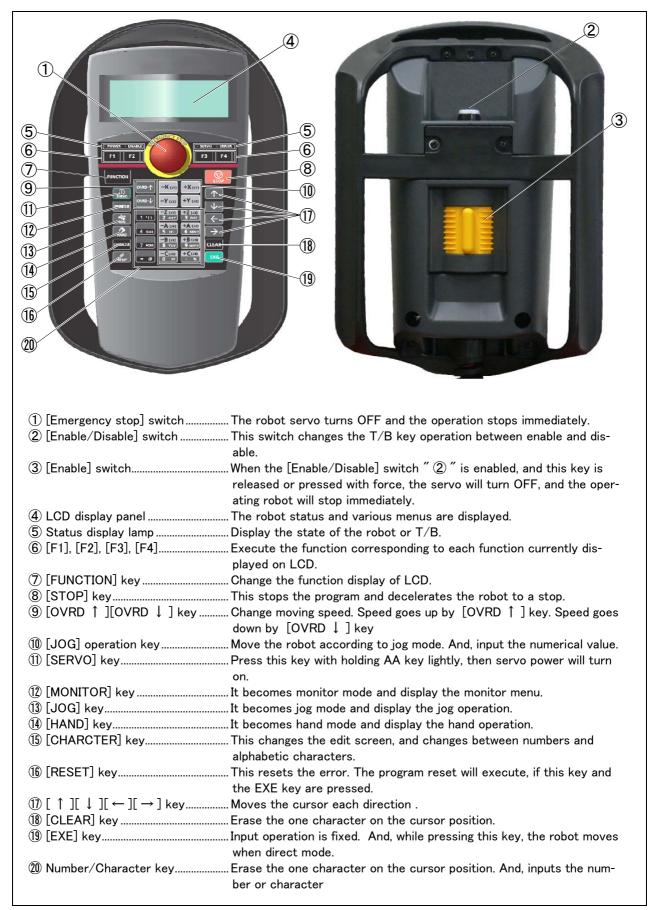


Fig.3-33: Teaching pendant key layout and main functions

(2) Parallel I/O interface

■ Order type : ● 2D-TZ368 (Sink type)/2D-TZ378 (Source type)

number 0 to 1)

Outline



This is used to expand the external inputs and outputs

• The connecting cable with external equipment is not attached. Since we are preparing the external input-and-output cable (2D-CBL05 or 2D-CBL15) as the option, please use. Notes)Although the combined use with the parallel input-and-output unit (2A-RZ361/2A-RZ371) of another option is also possible, please use the setup of the station number by the different number separately. The station number is automatically determined by the position of the option slot which installed this interface. (station

■ Configuration

Table 3-11: Configuration device

Part name	Туре	Qty.	Mass (kg) Note1)	Remarks	
Parallel I/O interface	2D-TZ368	Either one pc.	0.4	Input/output 32 points/32 points	
	2D-TZ378			2D-TZ368 is sink type. 2D-TZ378 is source type.	

Note1) Mass indicates one set.

■ Specifications

Table 3-12: Electrical specifications of input circuits

Item	Item		pecification	Internal circuit
Туре		DC input		<sink type=""></sink>
Number of input p	oints	32		+24V/+12V
Insulation method		Photo coupler insu	ulation	+24V/+12V (COM)
Rated input voltag	е	DC12V	DC24V	
Rated input currer	nt	Approx. 3mA	Approx.9mA	□
Working voltage ra	Working voltage range		uld be less than 5%)	2.7K
ON voltage/ON cu	ırrent	DC8V or more/2mA or more		(0)
OFF voltage/ OFF	current	DC4V or less/1mA or less		<source type=""/>
Input resistance		Approx. 2.7k Ω		2.7K Input
Response time	OFF-ON	10ms or less(DC24V)		7.07 1000
ON-OFF		10ms or less(DC24V)		
Common method		32 points per common		
External cable connection method		Connector		

Specification Internal circuit Item Type Transistor output <Sink type> No. of output points +24V/+12V Insulation method Photo-coupler insulation DC12V/DC24V Rated load voltage Output DC10.2 ~ 30V (peak voltage DC30V) Rated load voltage range Max. load current 0.1A/point (100%) Leakage current at OFF Within 0.1mA 24G/12G Max. voltage drop at ON DC0.9V(TYP.) Note1) OFF-ON 10ms or less(Resistance load) (hardware response time) Respons <Source type> e time ON-OFF 10ms or less(Resistance load) (hardware response time) +24V/+12V Fuse rating Fuse 1.6A(one per common) Replacement possible (max. 3) Common method 16 points per common (common terminal: 2points) External wire connection Connector method 24G/12G DC12/24V(DC10.2 ~ 30V) External Voltage power 60mA(TYP.DC24V per common)(base drive current) Current supply

Table 3-13: Electrical specifications for the output circuits

Note1) The maximum voltage drop value at signal ON.

Refer to it for the equipment connected to the output circuit.



Caution The protection fuse of the output circuit prevents the failure at the time of the load short circuit and incorrect connection. The load connected of the customer should be careful not to exceed maximum rating current. The internal transistor may be damaged if maximum rating current is exceeded.

■ Installation method

The expansion parallel input/output interface is installed in the controller. Refer to separate "Instruction Manual/ Controller setup, basic operation, and maintenance" for details on the installing method.

If it installs in the option SLOT of the controller, the station number will be assigned automatically.

SLOT1: station number 0 (0 to 31) SLOT2: station number 1 (32 to 63)



Caution If it uses together with parallel input-and-output unit 2A-RZ361/2A-RZ371, please do not overlap with the station number of the parallel input-and-output interface.

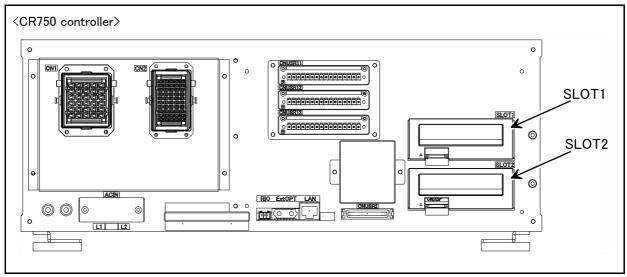


Fig.3-34: Parallel I/O interface installation position (CR750)

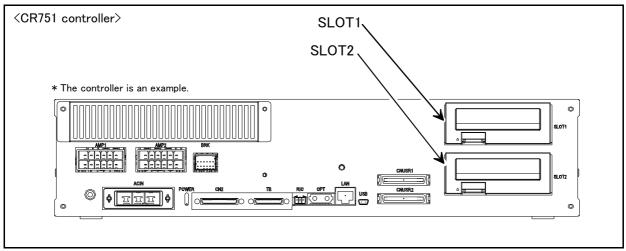


Fig.3-35 : Parallel I/O interface installation position (CR751)

■ Pin layout of connector

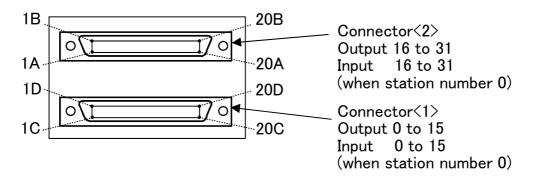


Fig.3-36: Pin layout of connector

■ Connector pin No. and signal assignment

The station number is fixed by the slot to install and the allocation range of the general-purpose input-and-output signal is fixed.

Table 3-14: The slot number and the station number

Slot number	Station	Range of the general-purpose input-and-output signal			
Slot Hulliber	number	Connector <1>	Connector <2>		
SLOT1	0	Input: 0 to 15 Output: 0 to 15	Input : 16 to 31 Output : 16 to 31		
SLOT2	1 Input : 32 to 47 Output : 32 to 47		Input : 48 to 63 Output : 48 to 63		

The connector pin number of the parallel input-and-output interface installed in SLOT1 and signal number allocation are shown in Table 3-15 and Table 3-16. If it installs in other slots, please interpret and utilize.

Table 3-15: Connector<1> pin assignment list and external I/O cable (2D-CBL**) color(SLOT1)

		Function name				Functio	
Pin No.	Line color	General-purpose	Dedicated/power supply, common	Pin No.	Line color	General-purpose	Dedicated/power supply, common
1C	Orange/Red a		24G/12G: For pins 5D- 20D	1D	Orange/Black a		+24V/+12V(COM): For pins 5D-20D
2C	Gray/Red a		COM: For pins 5C-20C ^{Note1)}	2D	Gray/Black a		Reserved
3C	White/Red a		Reserved	3D	White/Black a		Reserved
4C	Yellow/Red a		Reserved	4D	Yellow/Black a		Reserved
5C	Pink/Red a	General-purpose input 15		5D	Pink/Black a	General-purpose output 15	
6C	Orange/Red b	General-purpose input 14		6D	Orange/Black b	General-purpose output 14	
7C	Gray/Red b	General-purpose input 13		7D	Gray/Black b	General-purpose output 13	
8C	White/Red b	General-purpose input 12		8D	White/Black b	General-purpose output 12	
9C	Yellow/Red b	General-purpose input 11		9D	Yellow/Black b	General-purpose output 11	
10C	Pink/Red b	General-purpose input 10		10D	Pink/Black b	General-purpose output 10	
11C	Orange/Red C	General-purpose input 9		11D	Orange/Black c	General-purpose output 9	
12C	Gray/Red c	General-purpose input 8		12D	Gray/Black c	General-purpose output 8	
13C	White/Red c	General-purpose input 7		13D	White/Black c	General-purpose output 7	
14C	Yellow/Red c	General-purpose input 6		14D	Yellow/Black c	General-purpose output 6	
15C	Pink/Red c	General-purpose input 5	Operation rights input signal Note2)	15D	Pink/Black c	General-purpose output 5	
100			_	100	a (D) I I		
16C	Orange/Red d	General-purpose input 4	Servo ON input signal Note2)	16D	Orange/Black d	General-purpose output 4	
17C	Gray/Red d	General-purpose input 3	Start input ^{Note2)}	17D	Gray/Black d	General-purpose output 3	Operation rights output signal Note2)
18C	White/Red d	General-purpose input 2	Error reset input signal Note2)	18D	White/Black d	General-purpose output 2	Error occurring output signal Note2)
19C	Yellow/Red d	General-purpose input 1	Servo OFF input signal Note2)	19D	Yellow/Black d	General-purpose output 1	In servo ON output signal ^{Note2)}
20C	Pink/Red d	General-purpose input 0	Stop input ^{Note3)}	20D	Pink/Black d	General-purpose output 0	Operating output Note2)

Note1) Sink type: $\pm 24V/\pm 12V(COM)$, Source type: $\pm 24G/12G$ Note2) The dedicated signal is assigned at shipping. It can change with the parameter.

Note3) The dedicated input signal (STOP) is assigned at shipping. The signal number is fixing.

Table 3-16 : Connector<2> pin assignment list and external I/O cable (2D-CBL**) color(SLOT1)

Pin		Function name		Pin		Function name		
No.	Line color	General-purpose	Dedicated/power supply, common	No.	Line color	General-purpose	Dedicated/power supply, common	
1A	Orange/Red a		24G/12G: For pins 5B-	1B	Orange/Black a		+24V/+12V(COM): For	
			20B				pins 5B-20B	
2A	Gray/Red a		COM: For pins 5A- 20A ^{Note1)}	2B	Gray/Black a		Reserved	
3A	White/Red a		Reserved	3B	White/Black a		Reserved	
4A	Yellow/Red a		Reserved	4B	Yellow/Black a		Reserved	
5A	Pink/Red a	General-purpose input 31		5B	Pink/Black a	General-purpose output 31		
6A	Orange/Red b	General-purpose input 30		6B	Orange/Black b	General-purpose output 30		
7A	Gray/Red b	General-purpose input 29		7B	Gray/Black b	General-purpose output 29		
8A	White/Red b	General-purpose input 28		8B	White/Black b	General-purpose output 28		
9A	Yellow/Red b	General-purpose input 27		9B	Yellow/Black b	General-purpose output 27		
10A	Pink/Red b	General-purpose input 26		10B	Pink/Black b	General-purpose output 26		
11A	Orange/Red c	General-purpose input 25		11B	Orange/Black c	General-purpose output 25		
12A	Gray/Red c	General-purpose input 24		12B	Gray/Black c	General-purpose output 24		
13A	White/Red c	General-purpose input 23		13B	White/Black c	General-purpose output 23		
14A	Yellow/Red c	General-purpose input 22		14B	Yellow/Black c	General-purpose output 22		
15A	Pink/Red c	General-purpose input 21		15B	Pink/Black c	General-purpose output 21		
16A	Orange/Red d	General-purpose input 20		16B	Orange/Black d	General-purpose output 20		
17A	Gray/Red d	General-purpose input 29		17B	Gray/Black d	General-purpose output 19		
18A	White/Red d	General-purpose input 18		18B	White/Black d	General-purpose output 18		
19A	Yellow/Red d	General-purpose input 17		19B	Yellow/Black d	General-purpose output 17		
20A	Pink/Red d	General-purpose input 16		20B	Pink/Black d	General-purpose output 16		

Note1) Sink type: +24V/+12V(COM), Source type: 24G/12G

<Reference> The example of connection with our PLC

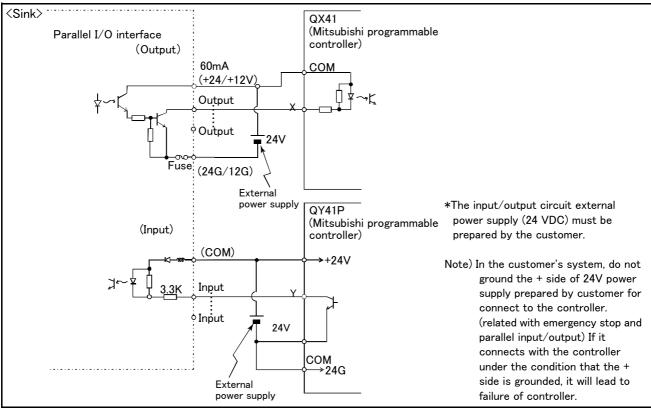


Table 3-17: Connection with a Mitsubishi PLC (Example of sink type)

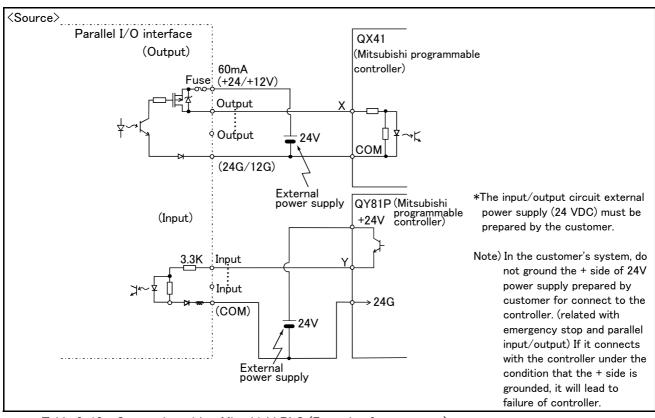


Table 3-18: Connection with a Mitsubishi PLC (Example of source type)

(3) External I/O cable

■ Order type : ● 2D-CBL □□ Note) The numbers in the boxes □□ refer to the length. (05: 5m, 15: 15m)

Outline



This is the dedicated cable used to connect an external peripheral device to the connector on the parallel I/O interface. For parallel I/O unit is another option 2A-CBL.**. One end matches the connector on the parallel input/output unit, and the other end is free. Connect the peripheral device's input/output signal using the free end. One cable correspond to the input 16 points and output 16 points.

Two cables are needed to connection of (input 32 points and output 32 points) with built-in standard.

■ Configuration

Table 3-19: Configuration device

Part name	Туре	Qty.	Mass (kg) Note1)	Remarks
External I/O cable	2D-CBL □□	1 pc.	0.7(5m) 1.84(15m)	5m or 15m

Note1) Mass indicates one set.

■ Specifications

Table 3-20: Specifications

Items	Specifications
Number of cables x cable size	AWG #28 x 20P (40 pairs)
Total length	5m, 15m

■ Connector pin numbers and cable colors

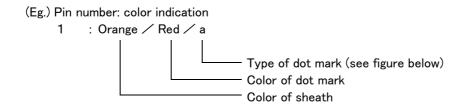
Table 3-21: Connector pin numbers and cable colors

Pin no.	Cable colors	Pin no.	Cable colors	Pin no.	Cable colors	Pin no.	Cable colors
1A/C	Orange/Red a	11A/C	Orange/Red c	1B/D	Orange/Black a	11B/D	Orange/Black c
2A/C	Gray/Red a	12A/C	Gray/Red c	2B/D	Gray/Black a	12B/D	Gray/Black c
3A/C	White/Red a	13A/C	White/Red c	3B/D	White/Black a	13B/D	White/Black c
4A/C	Yellow/Red a	14A/C	Yellow/Red c	4B/D	Yellow/Black a	14B/D	Yellow/Black c
5A/C	Pink/Red a	15A/C	Pink/Red c	5B/D	Pink/Black a	15B/D	Pink/Black c
6A/C	Orange/Red b	16A/C	Orange/Red d	6B/D	Orange/Black b	16B/D	Orange/Black d
7A/C	Gray/Red b	17A/C	Gray/Red d	7B/D	Gray/Black b	17B/D	Gray/Black d
8A/C	White/Red b	18A/C	White/Red d	8B/D	White/Black b	18B/D	White/Black d
9A/C	Yellow/Red b	19A/C	Yellow/Red d	9B/D	Yellow/Black b	19B/D	Yellow/Black d
10A/C	Pink/Red b	20A/C	Pink/Red d	10B/D	Pink/Black b	20B/D	Pink/Black d

Notes) Pin number of connector $\langle 1 \rangle$ are 1C, 2C,20C, 1D, 2D,20D, connector $\langle 2 \rangle$ are 1A, 2A,20A, 1B, 2B,20B.

■ Connections and outside dimensions

The sheath of each signal cable (40 lines) is color indicated and marked with dots. Refer to the cable color specifications in "Table 3-32: Connector pin numbers and cable colors" when making the connections.



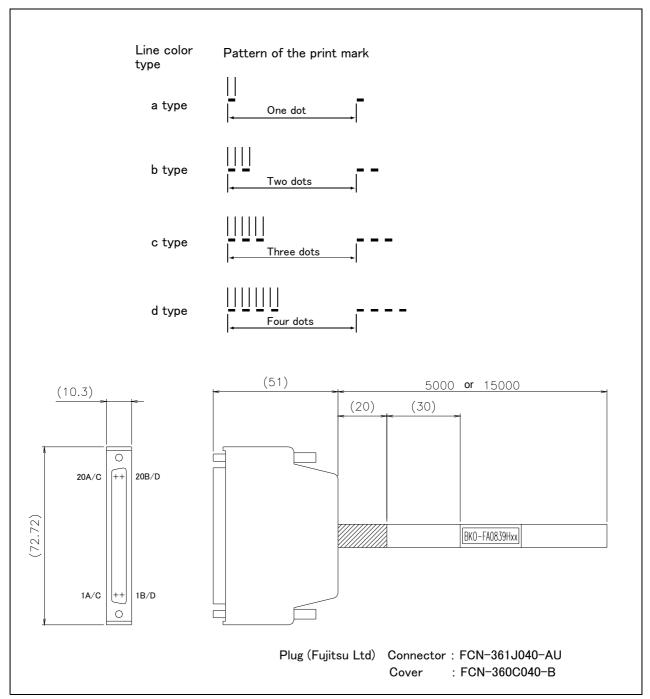


Fig.3-37: Connections and outside dimensions

(4) Parallel I/O unit

■ Order type: 2A-RZ361(Sink type)

2A-RZ371(Source type)

Outline



This is used to expand the external inputs and outputs. One one equal with this unit is built into the control unit among controllers the standard.

- The connection cable is not included. Prepare the optional external input/output cable (2A-CBL05 or 2A-CBL15).
- Use 2A-RZ361 if the external input/output signal logic is of the sink type and 2A-RZ371 for source type signal logic.

Notes) Although the combined use with the parallel I/O interface (2D-TZ368) of another option is also possible, please use the setup of the station number by the different number separately. The station number is automatically fixed by the position of the option slot which installed the parallel I/O interface in 0-1.

■ Configuration

Table 3-22: Configuration device

Part name	Туре	Qty.	Mass (kg) Note1)	Remarks
Parallel I/O unit	2A-RZ361	Either one	0.7	Input/output 32 points/32 points
	2A-RZ371	pc.	0.7	2A-RZ361 is the sink type. 2A-RZ371 is the source type.
Robot I/O link connection connector	NETcable-1	2 sets	-	Connector with pins. The cable must be prepared and wired by the customer.
Power connection connector	DCcable-2	1 set	-	Connector with pins. The cable must be prepared and wired by the customer.
Terminator	R-TM	1 pc.	-	100Ω(1/4W)

Note1) Mass indicates one set.

■ Specifications

- 1) The parallel I/O interface (2D-TZ368) of another option, and the a maximum of eight pieces in all. (One station occupies one unit.)
- 2) The power supply (24V) must be prepared by the customer and connected with the power connection cable (DCcable-2)

A separate 24V power supply is required for the input/output circuit wiring.

Table 3-23: Electrical specifications of input circuits

Item		;	Specification	Internal circuit	
Туре		DC input		⟨Sink type⟩	
Number of input poir	its	32		+24V/+12V	
Insulation method		Photo coupler insulati	on	(COM)	
Rated input voltage		12VDC	24VDC	7	
Rated input current		Approx 3mA	Approx 7mA	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	
Working voltage rang	е	10.2 to 26.4VDC(Ripp	le factor should be less than 5%.)	Input	
ON voltage/ON curr	ent	8VDC or more/ 2mA	or more	3.3K	
OFF voltage/ OFF c	urrent	4VDC or less/ 1mA or less		Source type>	
Input resistance		Approx. 3.3kΩ			
Response time	OFF-ON	10ms or less (24VDC)		3.3K Input	
	ON-OFF	10ms or less (24VDC)			
Common method		8 points per common		│ ノペマ 以820	
External cable conne	ction method	Connector			
				24G/12G	

Item Specification Internal circuit <Sink type> Туре Transistor output No. of output points Insulation method Photo-coupler insulation +24V/+12V 12VDC/24VDC Rated load voltage Output 10.2 to 30VDC(peak voltage 30VDC) Rated load voltage range Max. load current 0.1A/point (100%) Leakage current at OFF 0.1mA or less 24G/12G 0.9VDC(TYP.) Note1) Max. voltage drop at ON Fuse 2ms or less OFF-ON (hardware response time) Response time <Source type> 2ms or less ON-OFF (Resistance load) (hardware response time) Fuse +24V/+12V Fuse 3.2A (one per common) Replacement not possible Fuse rating Output Common method 8 points per common (common terminal: 4 points) External wire connection Connector method 24G/12G 12VDC/24VDC(10.2 to 30VDC) Voltage External power supply Current 60mA (TYP. 24VDC per common) (base drive current)

Table 3-24: Electrical specifications for the output circuits

Note1) The maximum voltage drop value at signal ON.

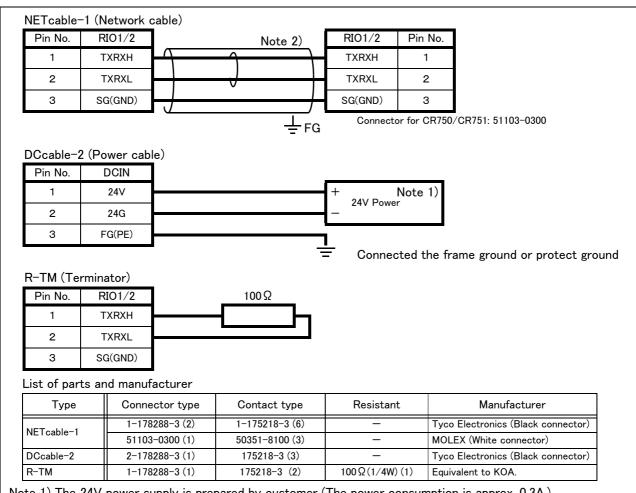
Refer to it for the equipment connected to the output circuit.



The output circuit protective fuses prevent failure in case of load short-circuit and improper connections. Please do not connect loads that cause the current to exceed the maximum rated current. If the maximum rated current is exceeded, the internal transistors may be damaged.



Inputs the power supply for control (DCcable-2) then inputs the controller's power supply.



Note 1) The 24V power supply is prepared by customer (The power consumption is approx. 0.3A.)

In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Note 2) The cable for general purpose can be used to the network cable. However, use the twisted shield cable of AWG#22(0.3mm²) or more.

Fig.3-38: Specifications for the connection cable

■ Installation method

The expansion parallel input/output unit is installed outside of the controller. Connect with the network connection cable (NETcable-1) from the RIO connector in the rear/into of the controller.(Terminator is connected at the time of shipment)

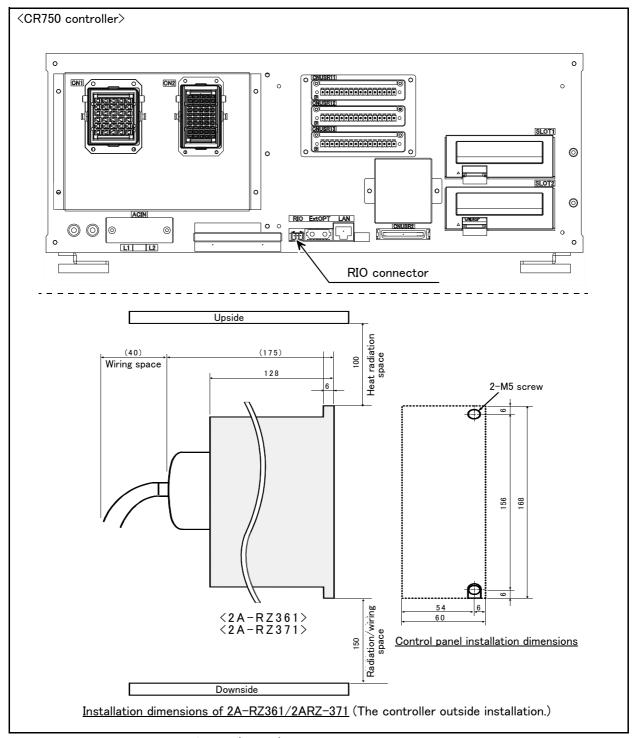


Fig.3-39: Installing the parallel I/O unit (CR750)

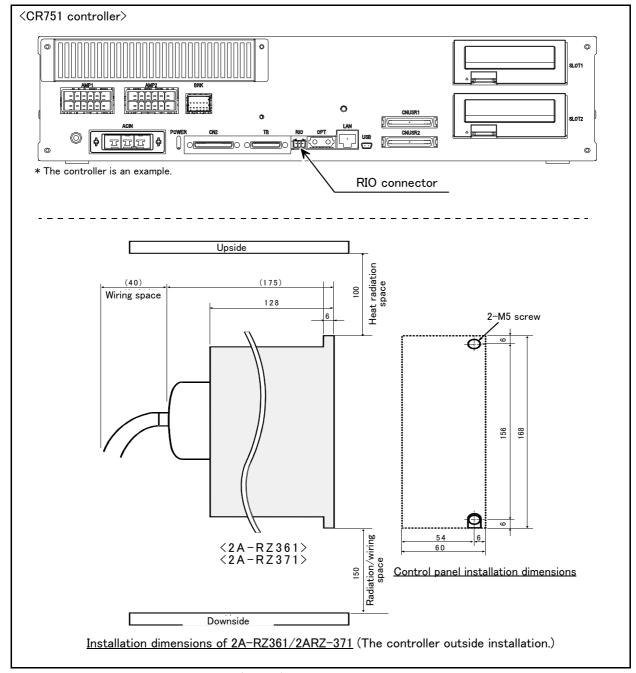


Fig.3-40 : Installing the parallel I/O unit (CR751)

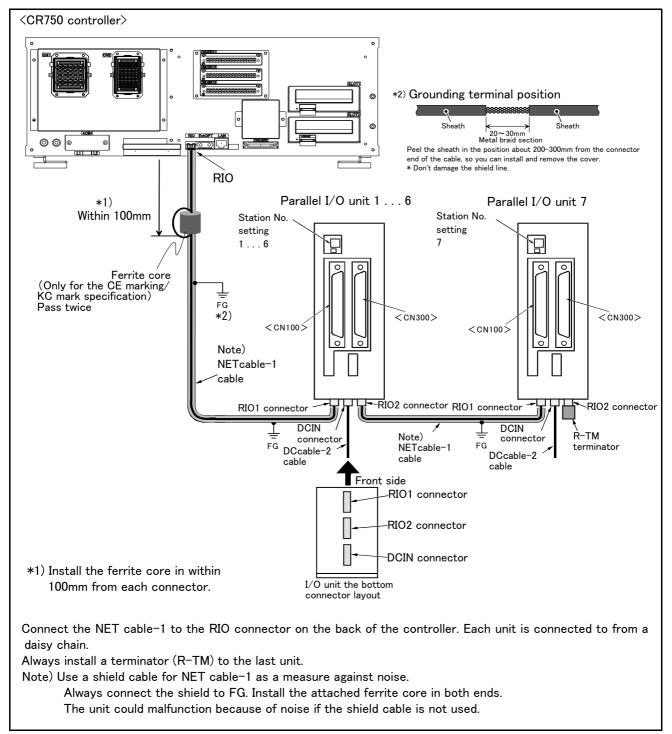


Fig.3-41: Connection method of expansion parallel I/O unit (CR750)

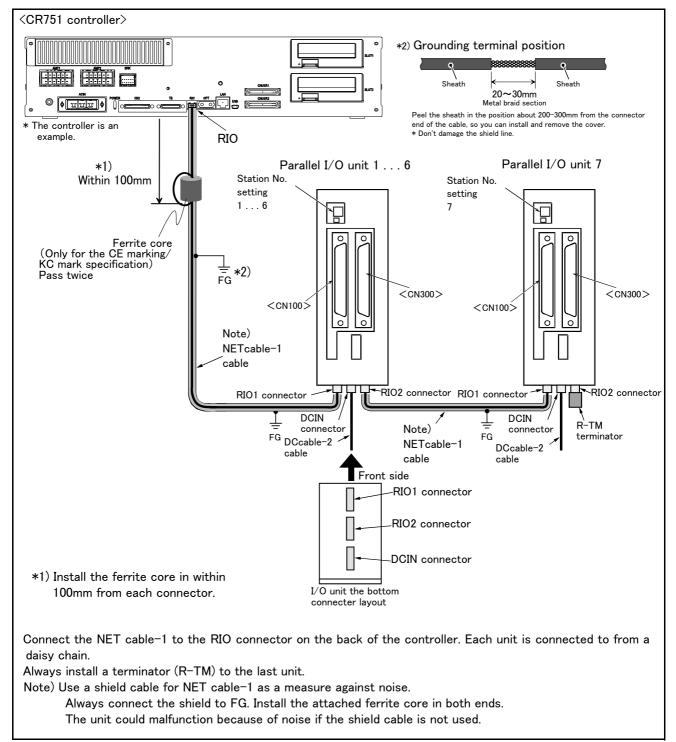
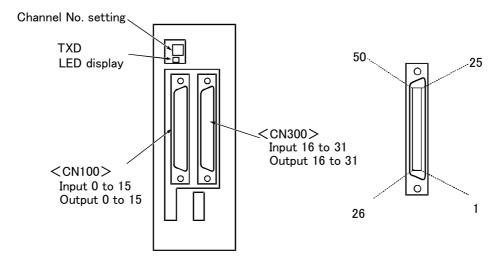


Fig.3-42: Connection method of expansion parallel I/O unit (CR751)

■ Pin arrangement of the connector



*2A-RZ361/2 A-RZ371 are 32/32 input-and-output units. (One-station occupancy)

Fig.3-43 : Pin arrangement of the parallel I/O unit

■ Assignment of pin number and signal

The assignment range of the general-purpose input-and-output signal is fixed by the setup of the station number.

Table 3-25: Assignment of pin number and signal

Unit Number	Station number	CN100	CN300
1st set	0	Input: 0 to 15 Output: 0 to 15	Input : 16 to 31 Output : 16 to 31
2nd set	1	Input: 32 to 47 Output: 32 to 47	Input : 48 to 63 Output : 48 to 63
3rd set	2	Input : 64 to 79 Output : 64 to 79	Input : 80 to 95 Output : 80 to 95
4th set	3	Input : 96 to 111 Output : 96 to 111	Input: 112 to 127 Output: 112 to 127
5th set	4	Input : 128 to 143 Output : 128 to 143	Input : 144 to 159 Output : 144 to 159
6th set	5	Input : 160 to 175 Output : 160 to 175	Input : 176 to 191 Output : 176 to 191
7th set	6	Input : 192 to 207 Output : 192 to 207	Input : 208 to 223 Output : 208 to 223
8th set	7	Input : 224 to 239 Output : 224 to 239	Input : 240 to 255 Output : 240 to 255

The connector pin number of the parallel I/O unit of the station number 0 and signal number assignment are shown in Table 3-26 and Table 3-27. If it is set as other station number, please interpret and utilize.

■ Parallel I/O interface (First expansion unit)

Table 3-26 : Connector CN100pin No. and signal assignment list (2A-CBL □□)

Pin	20.00	Function name		Pin		Function name	
No.	Line color	General-purpose	Dedicated/power supply, common	No.	No. Line color	General-purpose	Dedicated/power supply, common
1	Orange/Red A		FG	26	Orange/Blue A		FG
2	Gray/Red A		0V:For pins 4−7, 10−13	27	Gray/Blue A		0V:For pins 29-32, 35-38
3	White/Red A		12V/24V:For pins 4-7	28	White/Blue A		12V/24V:For pins 29-32
4	Yellow/Red A	General-purpose output 0	Operating output Note1)	29	Yellow/Blue A	General-purpose output 4	
5	Pink/Red A	General-purpose output 1	In servo ON output signal Note1)	30	Pink/Blue A	General-purpose output 5	
6	Orange/Red B	General-purpose output 2	Error occurring output signal Note1)	31	Orange/Blue B	General-purpose output 6	
7	Gray/Red B	General-purpose output 3	Operation rights output signal Note1)	32	Gray/Blue B	General-purpose output 7	
8	White/Red B		0V:For pins 4-7, 10-13	33	White/Blue B		0V:For pins 29-32, 35-38
9	Yellow/Red B		12V/24V:For pins 10-13	34	Yellow/Blue B		12V/24V:For pins 35-38
10	Pink/Red B	General-purpose output 8		35	Pink/Blue B	General-purpose output 12	
11	Orange/Red C	General-purpose output 9		36	Orange/Blue C	General-purpose output 13	
12	Gray/Red C	General-purpose output 10		37	Gray/Blue C	General-purpose output 14	
13	White/Red C	General-purpose output 11		38	White/Blue C	General-purpose output 15	
14	Yellow/Red C		COM0:For pins 15-22 Note2)	39	Yellow/Blue C		COM1:For pins 40-47 Note2)
15	Pink/Red C	General-purpose input 0	Stop input ^{Note3)}	40	Pink/Blue C	General-purpose input 8	
16	Orange/Red D	General-purpose input 1	Servo OFF input signal Note1)	41	Orange/Blue D	General-purpose input 9	
17	Gray/Red D	General-purpose input 2	Error reset input signal Note1)	42	Gray/Blue D	General-purpose input 10	
18	White/Red D	General-purpose input 3	Start input Note1)	43	White/Blue D	General-purpose input 11	
19	Yellow/Red D	General-purpose input 4	Servo ON input signal Note1)	44	Yellow/Blue D	General-purpose input 12	
20	Pink/Red D	General-purpose input 5	Operation rights input sig- nal ^{Note1)}	45	Pink/Blue D	General-purpose input 13	
21	Orange/Red E	General-purpose input 6		46	Orange/Blue E	General-purpose input 14	
22	Gray/Red E	General-purpose input 7		47	Gray/Blue E	General-purpose input 15	
23	White/Red E		Reserved	48	White/Blue E		Reserved
24	Yellow/Red E		Reserved	49	Yellow/Blue E		Reserved
25	Pink/Red E		Reserved	50	Pink/Blue E		Reserved

Note1) The dedicated signal is assigned at shipping. It can change with the parameter. Note2) Sink type:12V/24V(COM), Source type:0V(COM) Note3) The dedicated input signal (STOP) is assigned at shipping. The signal number is fixing.

Table 3-27 : Connector CN300pin No. and signal assignment list (2A-CBL □ □)

Pin			on name	Pin		Functio	n name
No.	Line color	General-purpose	Dedicated/power supply, common	No.	Line color	General-purpose	Dedicated/power supply, common
1	Orange/Red A		FG	26	Orange/Blue A		FG
2	Gray/Red A		0V:For pins 4−7, 10−13	27	Gray/Blue A		0V:For pins 29-32, 35-38
3	White/Red A		12V/24V:For pins 4-7	28	White/Blue A		12V/24V:For pins 29-32
4	Yellow/Red A	General-purpose output 16		29	Yellow/Blue A	General-purpose output 20	
5	Pink/Red A	General-purpose output 17		30	Pink/Blue A	General-purpose output 21	
6	Orange/Red B	General-purpose output 18		31	Orange/Blue B	General-purpose output 22	
7	Gray/Red B	General-purpose output 19		32	Gray/Blue B	General-purpose output 23	
8	White/Red B		0V:For pins 4−7, 10−13	33	White/Blue B		0V:For pins 29-32, 35-38
9	Yellow/Red B		12V/24V:For pins 10-13	34	Yellow/Blue B		12V/24V:For pins 35-38
10	Pink/Red B	General-purpose output 24		35	Pink/Blue B	General-purpose output 28	
11	Orange/Red C	General-purpose output 25		36	Orange/Blue C	General-purpose output 29	
12	Gray/Red C	General-purpose output 26		37	Gray/Blue C	General-purpose output 30	
13	White/Red C	General-purpose output 27		38	White/Blue C	General-purpose output 31	
14	Yellow/Red C		COM0:For pins 15-22 ^{Note1)}	39	Yellow/Blue C		COM1:For pins 40-47 Note1)
15	Pink/Red C	General-purpose input 16		40	Pink/Blue C	General-purpose input 24	
16	Orange/Red D	General-purpose input 17		41	Orange/Blue D	General-purpose input 25	
17	Gray/Red D	General-purpose input 18		42	Gray/Blue D	General-purpose input 26	
18	White/Red D	General-purpose input 19		43	White/Blue D	General-purpose input 27	
19	Yellow/Red D	General-purpose input 20		44	Yellow/Blue D	General-purpose input 28	
20	Pink/Red D	General-purpose input 21		45	Pink/Blue D	General-purpose input 29	
21	Orange/Red E	General-purpose input 22		46	Orange/Blue E	General-purpose input 30	
22	Gray/Red E	General-purpose input 23		47	Gray/Blue E	General-purpose input 31	
23	White/Red E		Reserved	48	White/Blue E		Reserved
24	Yellow/Red E		Reserved	49	Yellow/Blue E		Reserved
25	Pink/Red E		Reserved	50	Pink/Blue E		Reserved

Note1) Sink type:12V/24V(COM),Source type:0V(COM)

<Reference> The example of connection with our PLC

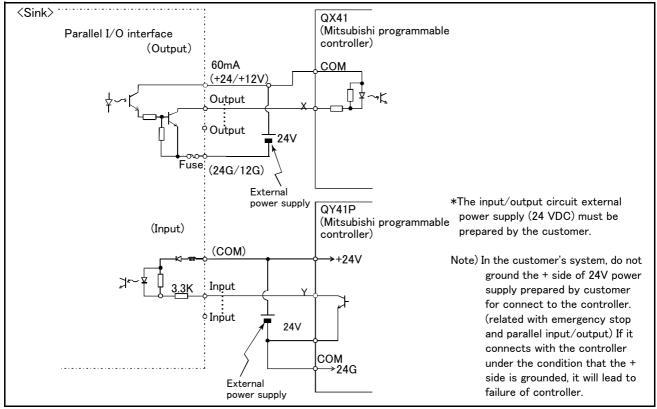


Table 3-28: Connection with a Mitsubishi PLC (Example of sink type)

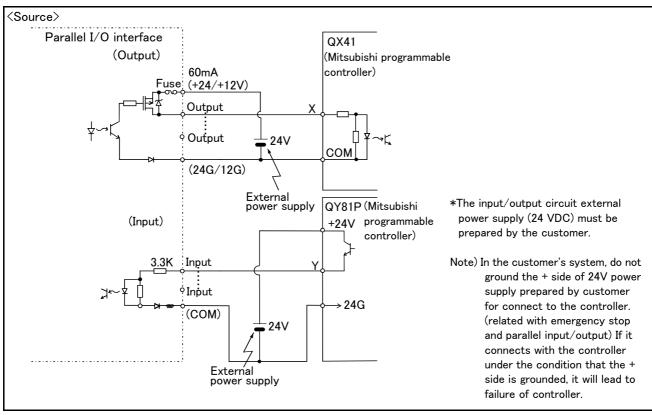


Table 3-29: Connection with a Mitsubishi PLC (Example of source type)

(5) External I/O cable

■ Order type: 2A-CBL □□ Note) The numbers in the boxes □□ refer to the length. (05: 5m、15: 15m)

Outline



This is the dedicated cable used to connect an external peripheral device to the connector on the parallel input/output unit.

One end matches the connector on the parallel input/output unit, and the other end is free. Connect the peripheral device's input/output signal using the free end.

One cable correspond to the input 16 points and output 16 points.

Two cables are needed to connection of (input 32 points and output 32 points) with built-in standard.

■ Configuration

Table 3-30 : Configuration device

Part name	Туре	Qty.	Mass(kg) ^{Note1)}	Remarks	
External I/O cable	2A-CBL □□	1pc.	0.7(5m) 1.84(15m)	5m or 15m	

Note1) Mass indicates one set.

■ Specifications

Table 3-31: Specifications

Items	Specifications			
Number of cables x cable size	50 pairs x AWG #28			
Total length	5m or 15m			

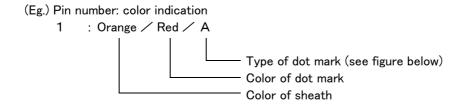
■ Connector pin numbers and cable colors

Table 3-32: Connector pin numbers and cable colors

Pin no.	Cable colors	Pin no.	Cable colors	Pin no.	Cable colors	Pin no.	Cable colors	Pin no.	Cable colors
1	Orange/Red A	11	Orange/Red C	21	Orange/Red E	31	Orange/Blue B	41	Orange/Blue D
2	Gray/Red A	12	Gray/Red C	22	Gray/Red E	32	Gray/Blue B	42	Gray/Blue D
3	White/Red A	13	White/Red C	23	White/Red E	33	White/Blue B	43	White/Blue D
4	Yellow/Red A	14	Yellow/Red C	24	Yellow/Red E	34	Yellow/Blue B	44	Yellow/Blue D
5	Pink/Red A	15	Pink/Red C	25	Pink/Red E	35	Pink/Blue B	45	Pink/Blue D
6	Orange/Red B	16	Orange/Red D	26	Orange/Blue A	36	Orange/Blue C	46	Orange/Blue E
7	Gray/Red B	17	Gray/Red D	27	Gray/Blue A	37	Gray/Blue C	47	Gray/Blue E
8	White/Red B	18	White/Red D	28	White/Blue A	38	White/Blue C	48	White/Blue E
9	Yellow/Red B	19	Yellow/Red D	29	Yellow/Blue A	39	Yellow/Blue C	49	Yellow/Blue E
10	Pink/Red B	20	Pink/Red D	30	Pink/Blue A	40	Pink/Blue C	50	Pink/Blue E

■ Connections and outside dimensions

The sheath of each signal cable (50 lines) is color indicated and marked with dots. Refer to the cable color specifications in "Table 3-32: Connector pin numbers and cable colors" when making the connections.



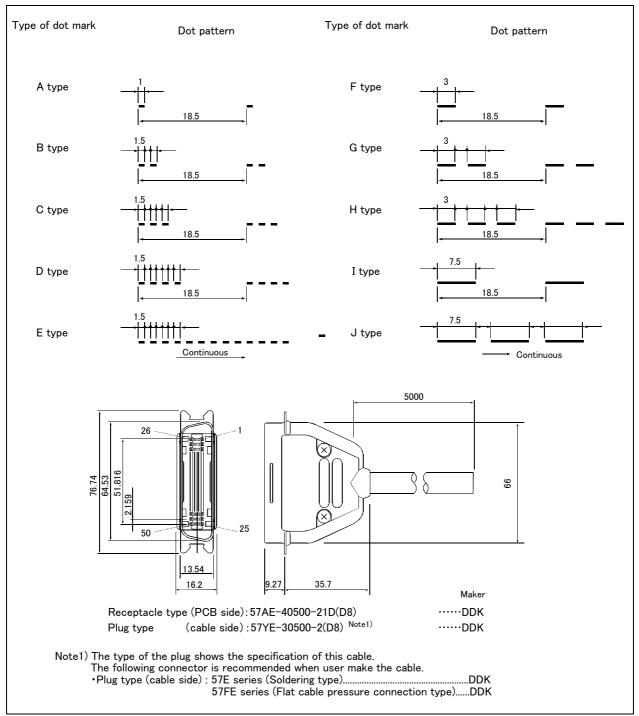


Fig.3-44: Connections and outside dimensions

(6) CC-Link interface

■ Order type: ● 2D-TZ576

■ Outline



The CC-Link interface is the optioninterface to not only add bit data to the robot controller. but also to add CC-Link field network function that allows cyclic transmission of word data.

■ Configuration

Table 3-33 : Configuration device

Part name	Туре	Qty.	Mass(kg) ^{Note1)}	Remarks
CC-Link interface	TZ576	1	0.6	
Manual	BFP-A8701	1	-	
Ferrite core	E04SR301334	2	-	
Cable clamp	AL4	2	-	Be sure to install this for noise countermeasure.
	AL5	2	-	

Note1) Mass indicates one set.

Table 3-34: Procured by the customer

Part name	Туре	Qty.	Remarks	
	QJ61BT11(Q series)			
	QJ61BT11N(Q series)			
	AJ61QBT11(QnA series)		FX series products are not supported.	
Master station	A1SJ61QBT11(QnAS series)	1		
	AJ61BT11(A series)			
	A1SJ61BT11(AnS series)			
	A80BD-J61BT11(personal computer board)			
Communication cable	-	1	Shielded 3-core twisted cable This cable may be manufactured by the customer.	
Terminal resistor	-	1	110 Ω or 130 Ω is recommended.	

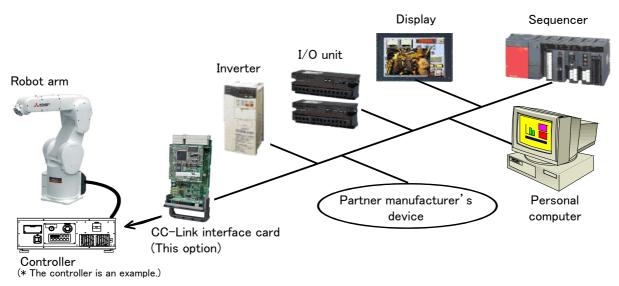


Fig.3-45: Example of CC-Link Product Configuration

■ Specifications

Table 3-35 : Specifications

	Item		Specifications				Remarks
Communica	ation function		Bit data	and word da	ita can be tr	ansmitted.	Word data are used by the registers.
Station typ	е		Int	elligent devi	ice station ^N	ote1)	
Support sta	ation			Local	station		No master station function
The version	n correspondin	g to CC-Link		V	er.2		The extended cyclic setup is possible.
Mountable	option slot			Slo	t 1, 2		
Number of	mountable CC	-Link interface cards			1		Multiple CC-Link interface cards cannot be inserted.
Number of	stations			1 to 64	stations		When four stations are occupied, continuous station numbers are used. The station numbers are set by a DIP switch.
Transmissio	on speed		101	M/5M/2.5M	/625K/156K	bps	This is set by the rotary SW.
Station nur	nber			1 t	o 64		When two or more stations are occupied,
Number of	occupied stati	ons		1/2	2/3/4		continuous station numbers are used.
Extended c	yclic setup			1/2	2/4/8		
Maximum li	nk point	Remote I/O (RX, RY).		Each 8	96 points		The two last cannot be used.
		Remote register (RWr, RWw)		Each 12	8 register		16 bits/register
Extended c	yclic setup	_	1 fold setup	2 fold setup	3 fold setup	4 fold setup	
Link point per set	When one station is	Remote I/O (RX, RY).	32 point	32 point	64 point	128 point	
oc	occupied	Remote register (RWw)	4 word	8 word	16 word	32 word	
		Remote register (RWr)	4 word	8 word	16 word	32 word	
	When two stations is	Remote I/O (RX, RY).	64 point	96 point	192 point	384 point	
	occupied	Remote register (RWw)	8 word	16 word	32 word	64 word	
		Remote register (RWr)	8 word	16 word	32 word	64 word	
	When three stations is	Remote I/O (RX, RY).	96 point	160 point	320 point	640 point	
	occupied	Remote register (RWw)	12 word	24 word	48 word	96 word	
		Remote register (RWr)	12 word	24 word	48 word	96 word	
	When four stations is	Remote I/O (RX, RY).	128 point	224 point	448 point	896 point	
	occupied	Remote register (RWw)	16 word	32 word	64 word	128 word	
		Remote register (RWr)	16 word	32 word	64 word	128 word	
Number of	the maximum	occupancy station		4 st	ations		
The I/O first number of the robot controller.		No. 6000 The number corresponding to the station number by the setup of the parameter "CCFIX."					

Note1) The CC-Link interface supports neither the transient transmission function nor the FX series.

■ Functions

(1) Communication function

• The number of usable points is 896 points maximum for bit control and 128 points maximum for word control.

(2) Easy setup

- The CC-Link interface card can be set by a rotary switch or DIP switch.
- •No separate space is required to mount the CC-Link interface card as it is embedded in the robot controller (can only be mounted into slot 2).
- Easy wiring since only four terminals need to be connected.
- Dedicated commands have been added to MELFA-BASIC V (robot programming language); thus, no complex interface programming is required.

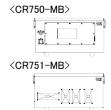
(3) High-speed response

- The link scan time when connecting 64 stations is approximately 7.2 ms, achieving superior high-speed response performance.
- A transmission speed can be selected from 10M, 5M, 2.5M, 625K and 156K bps according to the transmission distance.

(7) Controller protection box

■ Order type: CR750 controller.....CR750-MB CR751 controllerCR751-MB

Outline



By putting the controller in this box, the controller can be protected from oil mist environment.

Use this option, when the controller is installed where environment is oil mist such as machine shop etc.

This option is not chemical-resistant. For installing the option, avoid places where adhesion of chemicals may occur.

■ Configuration

Table 3-36 : Configuration equipment and types

Part name	Type	Qty.	Mass (Kg) ^{Note1)}	Remarks
R750 controller	•		•	
Controller protection box	CR750-MB	1		
Internal power cable		3		For connection between the power supply relay terminal and controller inside this box
Internal earth cable		1		For connection between the grounding terminal and controller inside this box
Label for serial number		1	22	
Transparent seal		1	7	
Cable tie	T50L	4	7	
Screw for fixing of the controller mounting plate	M4x8	4		
Instruction Manual	BFP-A8896	1	_	
R751 controller		•	•	
Controller protection box	CR751-MB	1		
Internal power cable		2		For connection between the power supply relay terminal and controller inside this box
Internal earth cable		1		For connection between the grounding terminal and controller inside this box
Label for serial number		1	21	
Transparent seal		1		
Cable tie	T50L	4		
Screw for fixing of the controller mounting plate	M4x8	4		
Instruction Manual	BFP-A8997	1	-	

Note1) Mass indicates one set.

■ Specifications

Table 3-37 : Specifications

Item	Unit	Specifications	Remarks
CR750 controller			
Outside dimension	mm	500(W) × 725(D) × 250(H)	Excluding protrusions
Mass	Kg	22	
Construction		Self-contained floor type	IP54
Grounding	Ω	100 or less (class D grounding)	
Paint color		Dark gray	Equivalent to Munsell: 3.5PB3.2/0.8
CR751 controller			
Outside dimension	mm	500(W) × 725(D) × 250(H)	Excluding protrusions
Mass	Kg	21	
Construction		Self-contained floor type	IP54
Grounding	Ω	100 or less (class D grounding)	
Paint color		Dark gray	Equivalent to Munsell: 3.5PB3.2/0.8

- (1) The robot must be grounded by the customer.
- (2) The cable for primary power supply connection and the grounding cable are customer preparations.

■ Outside dimension

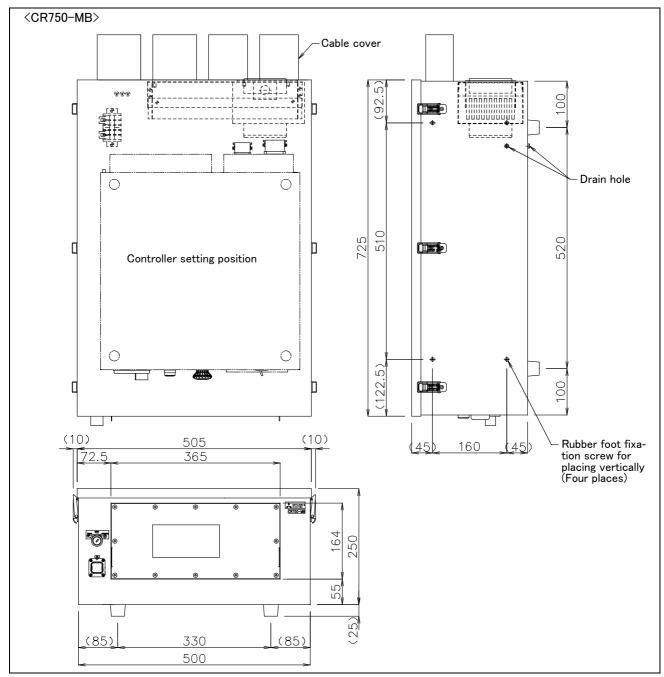


Fig.3-46: Outside dimension of CR750-MB

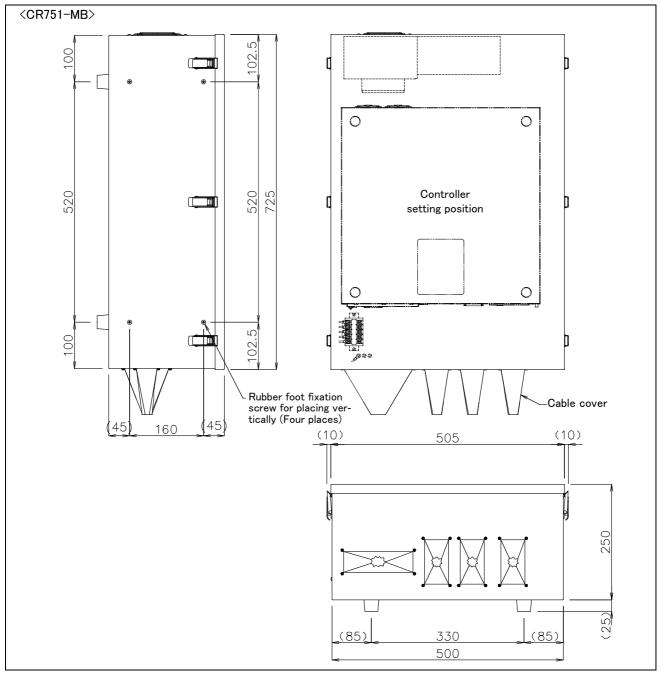


Fig.3-47 : Outside dimension of CR751-MB

■ Names of each part

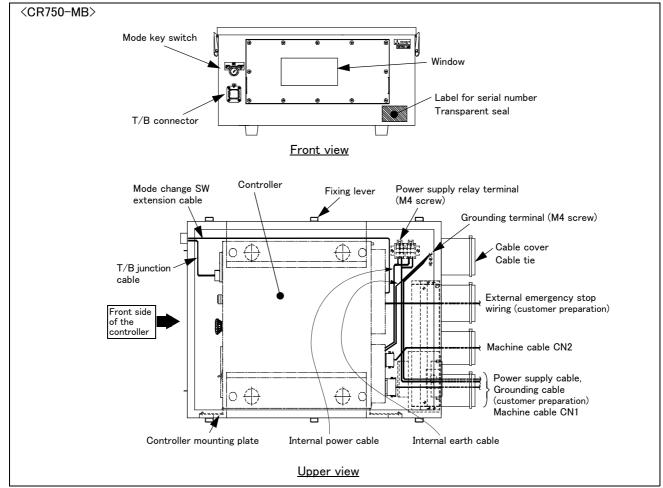


Fig.3-48: Names of each part (CR750-MB)

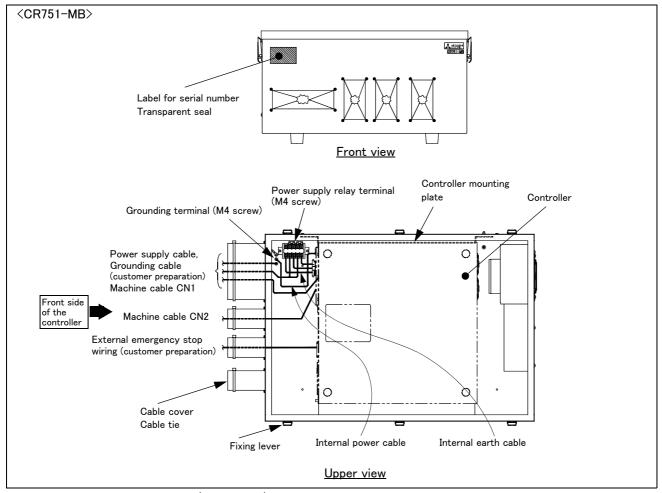


Fig.3-49: Names of each part (CR751-MB)

■ Wiring system diagram

<CR750-MB> Single phase: RV-4F series Controller protection box Internal power cable Terminal Controller (L1) Power supply cable (L2) Grounding cable CN1 CN2 FG CNUSR 11/12 AC fan FG FG FG Internal earth cable Grounding terminal Single phase/Three phase: RV-7F/13F series Controller protection box Internal power cable Terminal Note1) Controller (L1) (L2) Power supply cable (L2) (L3) Grounding cable CN2 (L3) CNUSR AC fan FG FG FG Internal earth cable Grounding terminal Note1) When using the controller for the three phases with the single-phase power supply, connect the primary power supply to L1 and L2 electric terminal of the protection box so that the power supply may be supplied to the heat-exchanger AC fan of the protection box. Connects with L1 and L3 electric terminal to the ACIN terminal block of the controller. Refer to the separate manual "Controller setup, basic operation, and maintenance" for detail of connecting the power cable and the grounding cable.

Fig.3-50: Wiring system diagram (CR750-MB)

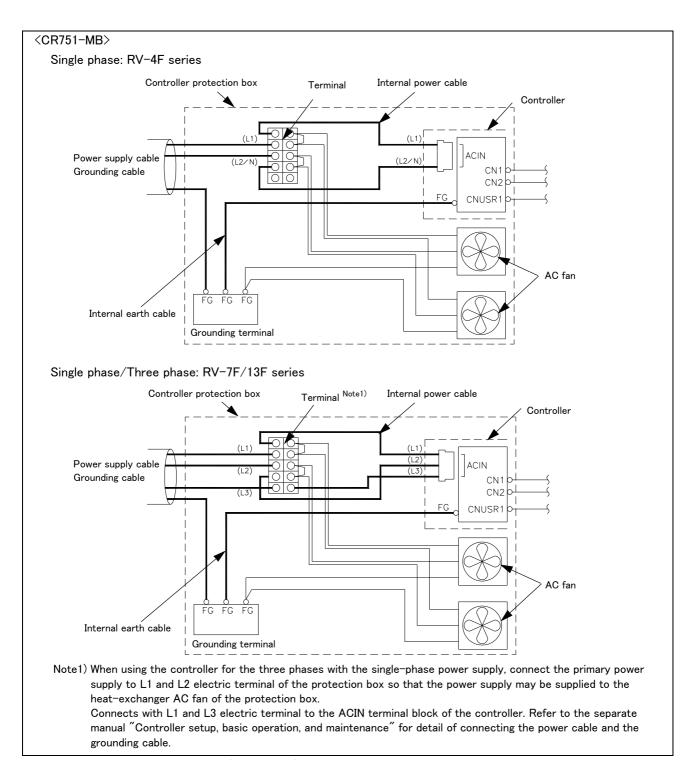


Fig.3-51: Wiring system diagram (CR751-MB)

■ Installation dimensions

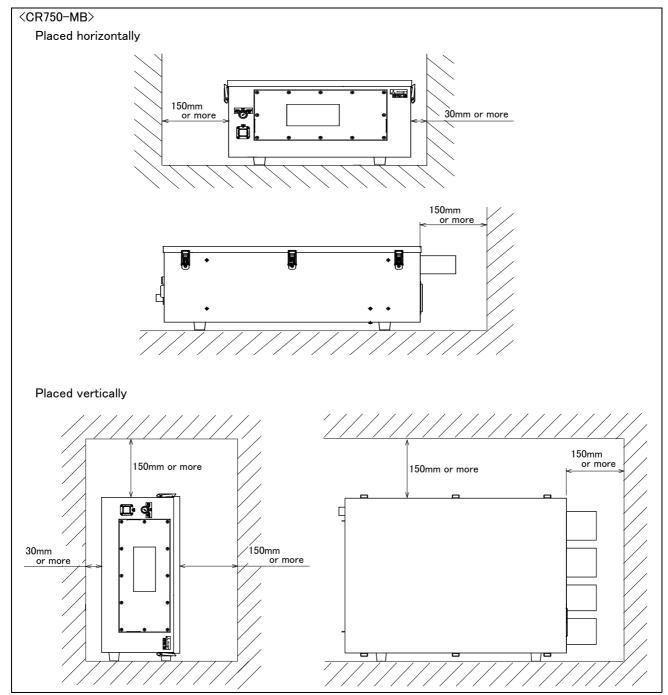


Fig.3-52: Installation dimensions (CR750-MB)

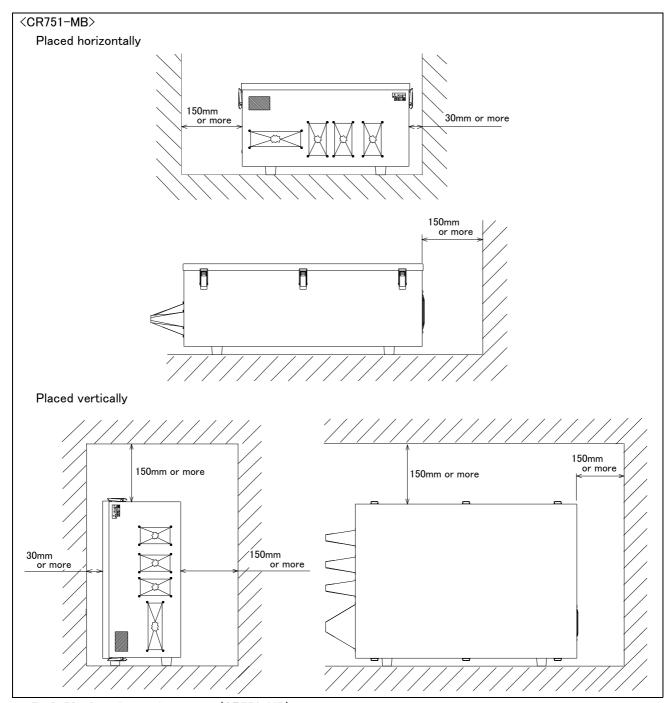


Fig.3-53: Installation dimensions (CR751-MB)

(8) MELSOFT RT ToolBox2/RT ToolBox2 mini

■ Order type : ● MELSOFT RT ToolBox2

*For windows CD-ROM : 3D-11C-WINE

● MELSOFT RT ToolBox2 mini

*For windows CD-ROM : 3D-12C-WINE

Outline



This is handy software that fully uses the personal computer functions. It can be used in various stages from the robot specifications study (tact study, etc.) to the design support (creation and editing of programs), start up support (execution, control and debugging of program), and maintenance.

The "personal computer support software" which supports these function fully, and the "personal computer support software mini" which does not have the simulation function are available.

■ Configuration

Table 3-38: Product configuration

Part name	Туре	Medium	Mass (kg) ^{Note1)}	Remarks
RT ToolBox2	3D-11C-WINE	CD-ROM	0.2	
RT ToolBox2 mini	3D-12C-WINE	CD-ROM	0.2	

Note1) Mass indicates one set.

■ Features

(1) Simple operation with guidance method and menu method

The Windows standard is used for windows operation, so the controller initialization and startup operations can be carried out easily by following the instructions given on the screen. Even a beginner can easily carry out the series of operations from program creation to execution.

(2) Increased work efficiency with ample support functions

The work efficiency is greatly improved with the multi-window method that carries out multiple steps and displays in parallel. The renumbering function, and copy, search, syntax check and step execution are especially sufficient, and are extremely useful when editing or debugging the program.

With the simulation function support, the program can be debugged and the tact checked before starting the machine at the site. This allows the on-site startup work efficiently to be greatly improved.

- (3) The maintenance forecast function increases the efficiency of maintenance work. Analyze the load condition while the robot is actually operating. Based on this analysis, calculate the time for maintenance, such as lubrication and belt replacement. By utilizing this information, the line stop time as well as the maintenance costs can be reduced.
- (4) The position recovery support function increases the recovery efficiency in the event of origin position displacement. This function compensates the origin settings and position data by just reproducing several previous teaching points when hand and/or arm displacement occurs, when replacing the motor and the belts, or when reloading the robot. This function can reduce the time required for recovery.

■ Functions

Table 3-39 : Functions

Fun	ction	Functiona	Il existence ^{Note1)}	Details		
Compatible mode	ıl	0	0	Personal computer running Windows XP, Windows Vista, Windows 7, Windows 8, or Windows 8.1. Note2)		
Program editing functions	Editing functions	0	0	MELFA BASIC V language compatible Multiple editing screen simultaneously display Command input, comment writing Position data editing File operation (writing to controller, floppy disk, personal computer) Search and replace function (using characters, line Nos., labels) Copy, cut, paste, insert (per character, line), undo (per command statement, position conversion) Line No. automatic generation, renumbering Batch syntax check Command template Position conversion batch editing Position variable template Print, print preview		
	Control func- tions	0	0	Program file control (list, copy, movement, delete, content comparison, name change, protect)		
	Debugging functions	0	0	Direct editing of program in controller Confirmation of robot program operation (step execution, direct execution)		
Simulation function		0	×	Off-line simulation of robot program operation using CG (computer graphics) Tact time calculation		
Monitor functions			0	Robot operation monitor (robot operation state, stop signal, error monitor, program monitor (execution program, variables), general-purpose input/output signals (forced output possible), dedicated input/output signals, operation confirmation (operation range, current position, hand, etc.) Operation monitor (working time statistics, production information, robot version) Servo monitor (load)		
Maintenance function		0	0	Parameter setting Batch, divided backup		
				RT ToolBox2 mini (3D-12C-WINE) - RT ToolBox2 (3D-11C-WINE)		

Note1) The functions included with the RT ToolBox2 and the RT ToolBox2 mini are shown below.

O: Function provided X: Function not provided

Note2) Recommend corresponding to CE Marking, an FCC standard, and a VCCI standard.

(9) Instruction Manual (bookbinding)

■ Order type: ● 5F-FF03-PE01.....RV-4F/7F/13F/20F-D series multiple-resistant specification

Outline



This is a printed version of the CD-ROM (instruction manual) supplied with this product.

■ Configuration

Table 3-40 : Product configuration

Name	Туре	Mass (Kg) Note1)	Specifications	
truction Manual	5F-FF03-PE01	2.6	The instructions manual set of RV-4F/7F/13F-D series multiple-resistant specification robot	
Safety Manual	BFP-A8006	-	Items relating to safety in handling the robot	
Standard Specifications	BFP-A3322	-	Specification of the robot arm and controller	
Robot Arm Setup & Maintenance	BFP-A3324	-	Installation method of the robot arm, jog operation, and maintenance and inspection procedures	
Controller Setup, Basic Operation and Maintenance	BFP-A8867	-	Installation method of the controller, basic operation, and maintenance and inspection procedures	
Detailed Explanation of Functions and Operations	BFP-A8869	-	Functions of the controller and T/B, operation method, and explanation of MELFA-BASIC V	
Troubleshooting	BFP-A8871	-	Causes of errors occurred and their countermeasures	
Additional axis function	BFP-A8663	-	Function of the additional axis, operation method.	
Tracking Function Manual	BFP-A8664	-	Function of the Tracking, operation method.	
GOT Direct Connection Extended Function	BFP-A8849	-	Explains of data configuration of shared memory, monitoring, and operating procedures, between the GOT and controller.	

Note1) Mass indicates one set.

3.11 Maintenance parts

The consumable parts used in the controller are shown in Table 3–41. Purchase these parts from your 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 your dealer.

Table 3-41: Controller consumable parts list

No.	Name	Type Note1)	Qty.	Usage place	Supplier
1	Lithium battery	Q6BAT	1	CR750 controller: Inside of the interface cover CR751 controller: Inside of the filter cover	Mitsubishi Electric
2	Filter	CR750 controller: BKOFA0773H42 CR751 controller: BKOFA0773H41	1	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.

4 Software

4.1 List of commands

The available new functions in MELFA-BASIC V are given in Table 4-1.

Table 4-1: List of MELFA-BASIC V commands

Туре	Class	Function	Input format (example)
	Joint interpolation	Moves to the designated position with joint interpolation.	Mov P1
	Linear interpolation	Moves to the designated position with linear interpolation.	Mvs P1
	Circular interpolation	Moves along a designated arc (start point \rightarrow passing point \rightarrow start point (end point)) with 3-dimensional circular interpolation (360 degrees).	Mvc P1,P2,P1
		Moves along a designated arc (start point \rightarrow passing point \rightarrow end point) with 3-dimensional circular interpolation.	Mvr P1,P2,P3
		Moves along the arc on the opposite side of a designated arc (start point → reference point → end point) with 3-dimensional circular interpolation.	Mvr2 P1,P9,P3
		Moves along a set arc (start point \rightarrow end point) with 3-dimensional circular interpolation.	Mvr3 P1,P9,P3
	Speed designation	Designates the speed for various interpolation operations with a percentage (0.1% unit).	Ovrd 100
		Designate the speed for joint interpolation operation with a percentage (0.1% unit).	JOvrd 100
		Designates the speed for linear and circular interpolation with a numerical value (mm/s unit).	Spd 123.5
0		Designates the acceleration/deceleration time as a percentage in respect to the predetermined maximum acceleration/deceleration. (1% unit)	Accel 50,80
contr		Automatically adjusts the acceleration/deceleration according to the parameter setting value.	Oadl ON
Position and operation control		Sets the hand and work conditions for automatic adjustment of the acceleration/deceleration.	Loadset 1,1
ber	Operation	Adds a process unconditionally to the operation.	Wth
ō		Adds a process conditionally to the operation.	WthIf
an		Designates smooth operation.	Cnt 1,100,200
o		Performance of movement is upgraded corresponding to the application.	MvTune 4
siti		Designates the positioning completion conditions with a No. of pulses.	Fine 200
Po		Designates the positioning completion conditions with a distance in a straight line	Fine 1, P
		Designates the positioning completion conditions with a joint interpolation.	Fine 0.5, J, 2
		Turns the servo power ON/OFF for all axes.	Servo OFF
		Limits the operation of each axis so that the designated torque is not exceeded.	Torq 4,10
	Position control	Designates the base conversion data.	Base P1
		Designates the tool conversion data.	Tool P1
	Float control	The robot arm rigidity is lowered and softened. (XYZ coordinate system)	Cmp Pos ,&B00000011
		The robot arm rigidity is lowered and softened. (JOINT coordinate system)	Cmp Jnt ,&B00000011
		The robot arm rigidity is lowered and softened. (TOOL coordinate system)	Cmp Tool ,&B00000011
		The robot arm rigidity is returned to the normal state.	Cmp Off
		The robot arm rigidity is designated.	CmpG 1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0
	Pallet	Defines the pallet.	Def Plt 1,P1,P2,P3,P4,5,3,1
		Operates the pallet grid point position.	Plt 1,M1
	Singular point pas- sage	Move to a specified position using linear interpolation passing through a singular point.	Mvs P1 Type 0,2

Class	Function	Input format (example)
Branching	Branches unconditionally to the designated place.	GoTo 120
	Branches according to the designated conditions.	If M1=1 Then GoTo *L100
		Else GoTo 20
		End If
	Repeats until the designated end conditions are satisfied.	For M1=1 TO 10
		Next M1
	Repeats while the designated conditions are satisfied.	While M1<10
		WEnd
	Branches corresponding to the designated expression value.	On M1 GoTo *La1, *Lb2, *Lc3
	Executes program block corresponding to the designated expression value	Select Case 1
		Break Case 2
		Break End Select
	Moves the program process to the next line.	Skip
Collision detection	Set to enable/disable the collision detection.	ColChk ON/OFF
	Set the detection level of the collision detection.	ColLvl 100,80,,,,,
Subroutine	Executes the designated subroutine. (Within program)	GoSub *L200
	Returns from the subroutine.	Return
	Executes the designated program.	CallP "P10",M1,P1
	Defines the program argument executed with the CALLP command.	FPrm M10,P10
	Executes the subroutine corresponding to the designated expression value	On M1 GoSub *La1, *Lb2, *Lc3
Interrupt		Def Act 1, M1=1 GoTo *L100
,		Act 1=1
	Defines the start line of the program to be executed when an interrupt is	On Com(1) GoSub *L100
		Com(1) On
		Com(1) Off
	*	Com(1) Stop
Wait	Designates the wait time, and the output signal pulse output time. (0.01s	Dly 0.5
		M-:+ M I-/1)-1
C+		Wait M_In(1)=1
Groh		Hlt
		Error 9000
Fnd		End
	. 5	HOpen 1
· · · · · · · · · · · · · · · · · · ·		HClose 1
	-	
		Def IO PORT1=BIT,0
		M1=M_In(1)
Output	Calls out the general-purpose output signal.	M_Out(1) =0
Mechanism designa-	Acquires the mechanism with the designated mechanism No.	GetM 1
tion	Releases the mechanism with the designated mechanism No.	RelM 1
Selection	Selects the designated program for the designated slot.	XLoad 2,"P102"
Start/stop	Carries out parallel execution of the designated program.	XRun 3,"100",0
	Stops parallel execution of the designated program.	XStp 3
	Branching Branching Collision detection Subroutine Interrupt Wait Stop End Hand open Hand close Assignment Input Output Mechanism designation	Branching Branches unconditionally to the designated place. Branches according to the designated conditions. Repeats until the designated end conditions are satisfied. Repeats while the designated conditions are satisfied. Branches corresponding to the designated expression value. Executes program block corresponding to the designated expression value. Set to enable/disable the collision detection. Set the detection level of the collision detection. Set the detection level of the collision detection. Set the detection level of the collision detection. Executes the designated subroutine. (Within program) Returns from the subroutine. Executes the designated program. Defines the program argument executed with the CALLP command. Executes the subroutine corresponding to the designated expression value. Interrupt Defines the interrupt conditions and process. Enables/disables the interrupt. Defines the interrupt from the communication line. Disables the interrupt from the communication line. Disables the interrupt from the communication line. Designates the wait time, and the output signal pulse output time. (0.01s unit) Wait unit) the variable becomes the designated value. Stop Stops the program execution. Generates an error. During program execution, continue, stop or servo OFF can be designated. End Ends the program execution. Hand open Opens the designated hand. Hand open Opens the designated hand. Assignment Defines the input/ output variables. Retrieves the general-purpose output signal. Mechanism designation Acquires the mechanism with the designated mechanism No. Releases the mechanism with the designated mechanism No.

Туре	Class	Function	Input format (example)
	Definition	Defines the integer type or real number type variable.	Def Inte KAISUU
		Defines the character string variable.	Def Char MESSAGE
		efines the layout variable. (Up to 3-dimensional possible)	Dim PDATA(2,3)
		Defines the joint variable.	Def Jnt TAIHI
		Defines the position variable.	Def Pos TORU
		Defines the function.	Def FN TASU(A,B)=A+B
Others	Clear	Clears the general-purpose output signal, variables in program, variables between programs, etc.	Clr 1
	File	Opens a file.	Open "COM1:" AS #1
		Closes a file.	Close #1
		Inputs data from a file.	Input# 1,M1
		Outputs data to a file.	Print# 1,M1
	Comment	Describes a comment.	Rem "ABC"
	Label	Indicates the branching destination.	*SUB1

4.2 List of parameters

Show the main parameter in the Table 4-2.

Table 4-2: List of parameters

Parameter		Details		
Standard tool coordinates. MEXTL		Set the default value for the tool data. Unit: mm or deg.		
Standard base coordinates	MEXBS	Set the relation of the world coordinate system and robot coordinate system. Unit: mm or deg.		
XYZ operation range	MEPAR	Designate the overrun limit value for the world coordinate system.		
JOINT operation range	MEJAR	Set the overrun limit value for each joint axis.		
Free plane limit		This is the overrun limit set with the free plane. Create a plane with the three coordinates x1, y1, z1 to x3, y3, z3, and set the outer side of the plane as the outside operation range (error). The following three types of parameters are used.		
	SFC1P : SFC8P	Eight types of free plane limits can be set in SFC1P to SFC8P. There are nine elements, set in the order of x1, y1, z1, x2, y2, z2, x3, y3, z3.		
	SFC1ME : SFC8ME	Designate which mechanism to use eight types of set free plane limits. The mechanism No. to use is set with 1 to 3.		
	SFC1AT : SFC8AT	Set the validity of the eight types of set free plane limits. (Valid 1/Valid 2/invalid = 1/-1/0)		
User-defined area		An area (cube) defined with two XYZ coordinate points can be designated and that area set as the outside operation range. Furthermore, a signal can be output when the axis enters that area. Up to 32 types of area can be designated.		
	AREA1CS : AREA32CS	Specify the coordinate system of the user definition area *. 0: Base coordinate system (conventional compatibility) 1: Robot coordinate system		
	AREA1P1 : AREA32P1	Designated the 1st point of the area. There are eight elements, set in the order of x, y, z, a, b, c, L1, L2. (L1 and L2 are the additional axes.)		
AREA1P2 : AREA32P2 AREA1ME : AREA32ME		Designated the 2nd point of the area. There are eight elements, set in the order of x, y, z, a, b, c, L1, L2. (L1 and L2 are the additional axes.)		
		Designate which mechanism to use the 32 types of set area. The mechanism No. to use is set with 1 to 3.		
	AREA1AT : AREA32AT	Designate the area check type. (Invalid/zone/interference = 0/1/2) Zone: The dedicated output signal USRAREA turns ON. Interference: An error occurs		
Automatic return setting	RETPATH	Set to restart the program after returning to the interrupt position when resuming operation after an interruption.		
Buzzer ON/OFF	BZR	Designate whether to the turn buzzer ON or OFF.		
Jog setting	JOGJSP	Designate the joint jog and step operation speed. (Set dimension H/L amount, max. override.)		
	JOGPSP	Designate the linear jog and step operation speed. (Set dimension H/L amount, max. override.)		
Jog speed limit value	JOGSPMX	Limit the operation speed during the teaching mode. Max. 250[mm/s]		
Hand type HANDTYPE		Set the hand type of the single/double solenoid, and the signal No. (Single/double = S/D) Set the signal No. after the hand type. Example) D900		
Stop input B contact designation	INB	Change the dedicated input (stop) to either of normal open or normal close.		

Parameter		Details	
User-designated origin	USERORG	Designate the user-designated origin position.	
Program selection memory	SLOTON	Select the program selected previously when initializing the slot. The non-selected state will be entered when not set.	
Communication setting	CBAU232	Set the baud rate.	
	CLEN232	Set the character length.	
	CPRTY232	Set the parity.	
	CSTOP232	Set the stop bit.	
CTERM		Set the end code.	
Slot table	SLT1 : SLT32	Make settings (program name, operation type, order of priority, etc.) for each slot during slot initialization.	
No. of multi-tasks	TASKMAX	Designate the No. of programs to be executed simultaneously. (Max. 32)	
Select the function of singular point adjacent alarm W		Designate the valid/invalid of the singular point adjacent alarm. (Invalid/Valid = 0/1) When this parameter is set up "VALID", this warning sound is buzzing even if parameter: BZR (buzzer ON/OFF) is set up "OFF".	
Display language. LNG		Change the language to display on the LCD display of teaching pendant.	

5 Instruction Manual

5.1 The details of each instruction manuals

The contents and purposes of the documents enclosed with this product are shown below. Use these documents according to the application.

Instruction manuals enclosed in dashed lines in the list below are for optional products.

For special specifications, a separate instruction manual describing the special section may be enclosed.

Safety Manual

Explains the common precautions and safety measures to be taken for robot handling, system design and manufacture to ensure safety of the operators involved with the robot.

Standard **Specifications**

Explains the product's standard specifications, factory-set special specifications, option configuration and maintenance parts, etc. Precautions for safety and technology, when incorporating the robot, are also explained.

Robot Arm Setup & Maintenance

Explains the procedures required to operate the robot arm (unpacking, transportation, installation, confirmation of operation), and the maintenance and inspection procedures.

Controller Setup, Basic Operation and Maintenance

Explains the procedures required to operate the controller (unpacking, transportation, installation, confirmation of operation), basic operation from creating the program to automatic operation, and the maintenance and inspection procedures.

Detailed Explanation of Functions and Operations

Explains details on the functions and operations such as each function and operation, commands used in the program, connection with the external input/output device, and parameters, etc.

Troubleshooting

Explains the causes and remedies to be taken when an error occurs. Explanations are given for each error No.

Additional axis function

Explains the specifications, functions and operations of the additional axis control.

Tracking Function Manual

Explains the control function and specifications of conveyor tracking

Extended Function Instruction Manual

Explains the detailed description of data configuration of shared memory, monitoring, and operating procedures, about the PLC(CR750-Q/CR751-Q controller) and the GOT(CR750-D/CR751-D controller).

6 Safety

6.1 Safety

Measures to be taken regarding safety of the industrial robot are specified in the "Labor Safety and Sanitation Rules". Always follow these rules when using the robot to ensure safety.

6.1.1 Self-diagnosis stop functions

This robot has the self-diagnosis stop functions shown in Table 6-1 and the stop functions shown in Table 6-2 for safe use.

Table 6-1 : Self-diagnosis stop functions

No.	Function		Details	Remarks		
1	Overload protection function		•		Activates when the total servo current time exceeds the specified value.	The drive circuit is shut off. The robot stops, and an alarm displays.
2	Overcurrent diagnosis function		<u> </u>		Activates when an overcurrent flows to the motor circuit.	The drive circuit is shut off. The robot stops, and an alarm displays.
3	Encoder disconnection diagnosis function				Activates when the encoder cable is disconnected.	The drive circuit is shut off. The robot stops, and an alarm displays.
4	Deflection over diagnosis function		_		Activates when an error occurs between the command value and actual position, and the error exceeds the specified amount.	The drive circuit is shut off. The robot stops, and an alarm displays.
5	AC power voltage drop diagnosis function		Activates when the AC power voltage drops below the specified value.	The drive circuit is shut off. The robot stops, and an alarm displays.		
6	CPU error detection function		Activates when an error occurs in the CPU.	The drive circuit is shut off. The robot stops, and an alarm displays.		
7	function	Software limit detection	This is the limit provided by the software to enable operation only in the operation range.	The drive circuit is shut off. The robot stops, and an alarm displays.		
		Mechanical stopper	This is the mechanical stopper provided outside the software.	The robot mechanically stops, and function 1 or 2 activates.		

Table 6-2: List of stop functions

Stop function	Operation panel Note1)	Teaching pendant	External input	Details	
Emergency stop	0	0	0	This is the stop with the highest degree of emergency. The servo power is shut off, and the mechanical brakes (all axes) activate to stop the robot. To recover, reset the alarm, and turn the servo ON with the servo ON command.	
Stop	0	0	0	This is a stop operation with a high degree of emergency. The robot immediately decelerates and stops. Note that the servo power is not shut off. Use this when using the collision evasion sensor, etc.	

Note1) Only CR750 controller has operation panel.

6.1.2 External input/output signals that can be used for safety protection measures

Table 6-3: External input/output signals that can be used for safety protection measures

	Signal	Connection point	Parameter	Functions	Usage method
	External emer- gency stop Note1)	Connector (CR750 controller: CNSUSR11/12) (CR751 controller: CNSUSR1)	-	This servo power is shut off, and the robot stops immediately.	Externally installed emergency stop switch. Door switch on safety protection fence. Stopping at high-level error occurrence.
	Door switch		-		The door switch of the safe protection fence
±.	Enabling device input		-		Enabling device. The safety switch during teaching work
Input	Stop	Parallel I/O unit or interface	STOP	The program execution is stopped, and the robot stops. The servo power is not shut off.	The robot is stopped when a peripheral device fault occurs. The servo power is not shut off.
	Servo OFF		SRVOFF	The servo power can be shut off.	The robot is stopped when a peripheral device fault occurs. The servo power is not shut off.
	Automatic operation enable		AUTOENA	Disables automatic operation when inactive.	Door switch on safety protection fence
	Emergency stop output	Connector (CR750 controller: CNSUSR11/12) (CR751 controller: CNSUSR1)	-	Outputs the input signal of external emergency stop or emergency stop switch of T/B turned on.	Display and warn the pilot lamp, the input signal of external emergency stop or the emergency stop switch of T/B turned on.
Output	In servo ON	Parallel I/O unit or interface	SRVON	The servo power ON/OFF state is output.	The servo power ON/OFF state is shown and alerted with the display lamps.
o	Waiting		STOP	Outputs that the robot is temporarily stopped.	The temporary stop state is shown and alerted with the display lamps.
	In alarm	Connector (CR750/CR751 controller: CNUSR2)	ERRRESET -	Outputs when an alarm occurs in the robot.	The alarm state is shown and alerted with the display lamps.

Note1) The external emergency stop input is prepared as a normal close for safety proposes. Thus, if the emergency stop input circuit is opened when the robot is started up, the robot will not operate. Refer to Page 162, "6.1.7 Examples of safety measures" for details.

And, refer to Page 103, "(3) Automatic Operation/Jog Operation/Brake Release and Necessary Switch Settings" for the function of the door switch input and the enabling device input.

6.1.3 Precautions for using robot

The safety measures for using the robot are specified in the "Labor Safety and Sanitation Rules". An outline of the rules is given below.

(1) Robot installation

- Secure sufficient work space required to safely perform work such as teaching and maintenance related to the robot.
- Install the controller outside the robot's motion space. (If a safety fence is provided, install outside the fence.)
- Install the controller where the entire robot operation can be viewed.
- Install display lamps, etc., to indicate the robot's operation state.
- Securely fix the robot arm onto the fixing table with the designated bolts.

(2) Prevention of contact with operator

- Install a safety fence or enclosure so that the operator cannot easily enter the robot's motion space.
- Install an interlock function that will stop the robot if the safety fence or enclosure door is opened.

(3) Work procedures

- Create and observe work procedures for the robot teaching, operation, inspection and emergencies.
- Create hand signals to be followed when several operators are working together.
- Create displays such as "Teaching in Progress" and "Inspection in Progress" to be put up when an operator is
 in the robot's motion space so that other operators will not operate the operation panel (controller, control
 panel).

(4) Training

• Train the operators about the operations, maintenance and safety required for the robot work.

- Only trained and registered operators must operate the robot.
 Participation in the "Special training for industrial robots" sponsored by the Labor Safety and Sanitation Committee, etc., is recommended for safety training.
- (5) Daily inspection and periodic inspection
 - · Always inspect the robot before starting daily operations and confirm that there are no abnormalities.
 - Set the periodic inspection standards in view of the robot's ambient environment and operation frequency, and perform periodic inspections.
 - Make records when periodic inspections and repairs have been done, and store the records for three or more vears.

6.1.4 Safety measures for automatic operation

- (1) Install safety fences so that operators will not enter the operation area during operation and indicate that automatic operation is in progress with lamps, etc.
- (2) Create signals to be given when starting operation, assign a person to give the signal, and make sure that the operator follows the signals.

6.1.5 Safety measures for teaching

Observe the following measures when teaching, etc., in the robot's operation range.

- (1) Specify and follow items such as procedures related to teaching work, etc.
- (2) Take measures so that operation can be stopped immediately in case of trouble, and measures so that operation can be restarted.
- (3) Take measures with the robot start switch, etc., to indicate that teaching work is being done.
- (4) Always inspect that stop functions such as the emergency stop device before starting the work.
- (5) Immediately stop the work when trouble occurs, and correct the trouble.
- (6) Take measures so that the work supervisor can immediately stop the robot operation when trouble occurs.
- (7) The teaching operator must have completed special training regarding safety. (Training regarding industrial robots and work methods, etc.)
- (8) Create signals to be used when several operators are working together.

6.1.6 Safety measures for maintenance and inspections, etc.

Turn the power OFF and take measures to prevent operators other than the relevant operator from pressing the start switch when performing inspections, repairs, adjustments, cleaning or oiling.

If operation is required, take measures to prevent hazards caused by unintentional or mistaken operations.

- (1) Specify and follow items such as procedures related to maintenance work, etc.
- (2) Take measures so that operation can be stopped immediately in case of trouble, and measures so that operation can be restarted.
- (3) Take measures with the robot start switch, etc., to indicate that work is being done.
- (4) Take measures so that the work supervisor can immediately stop the robot operation when trouble occurs.
- (5) The operator must have completed special training regarding safety. (Training regarding industrial robots and work methods, etc.)
- (6) Create signals to be used when several operators are working together.

6.1.7 Examples of safety measures

Two emergency-stop input circuits are prepared on the user wiring terminal block of the controller. Create a circuit as shown below for safety measures. In addition, the figure shows the normal state which is not in the emergency stop state.

[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 172, "(3) External emergency stop connection [supplementary explanation]".

- [Note] In the emergency-stop related wiring by the customer, if the coil (is not the contact points) of the relay prepared by the customer is connected to the controller, please be sure to implement the measure against the noise by the customer in the coil section. And, please also take the lifetime of noise suppression parts into consideration.
 - · Electric specification of the emergency-stop-related output terminal: 100mA/24V or less
 - In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

(1) CR750 controller

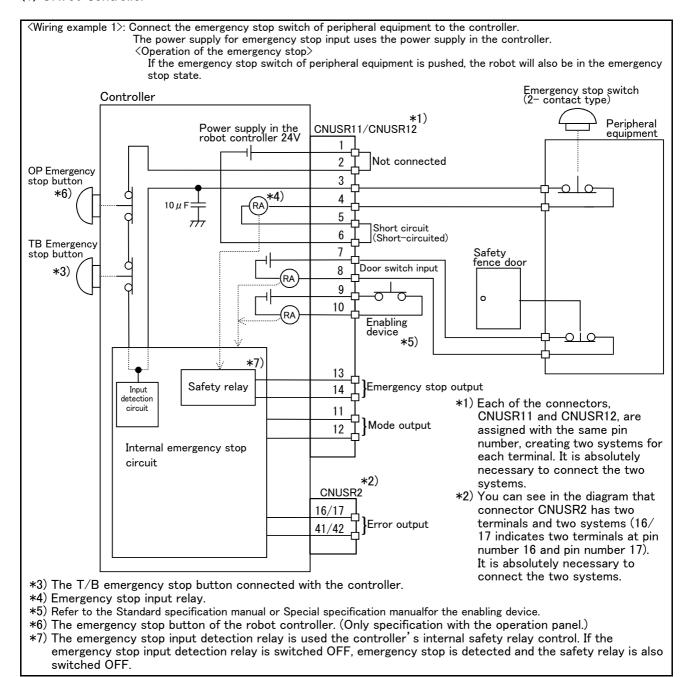


Fig.6-1: Example of safety measures (CR750 wiring example 1)

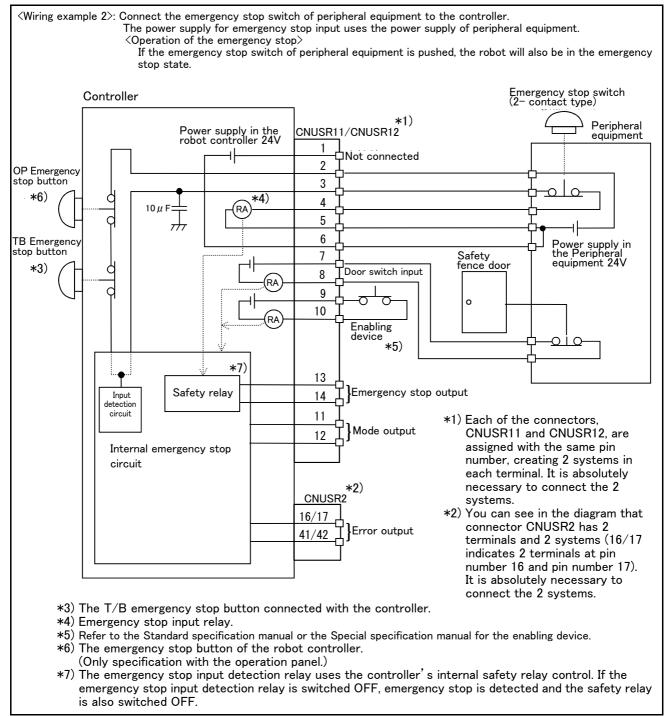
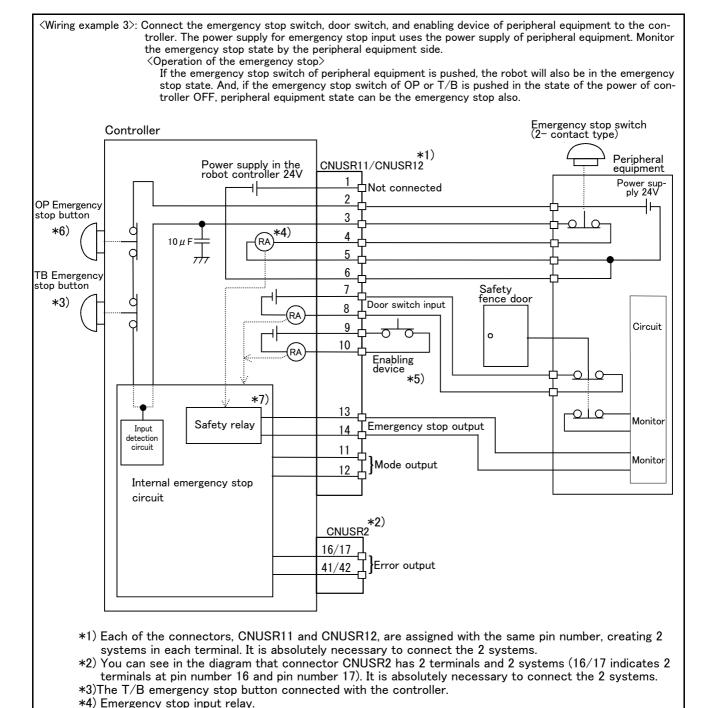


Fig.6-2: Example of safety measures (CR750 wiring example 2)



*5) Refer to the Standard specification manual or the Special specification manual for the enabling device.

*7) The emergency stop input detection relay uses the controller's internal safety relay control. If the

emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay

Fig.6-3: Example of safety measures (CR750 wiring example 3)

is also switched OFF.

*6) The emergency stop button of the robot controller. (Only specification with the operation panel.)

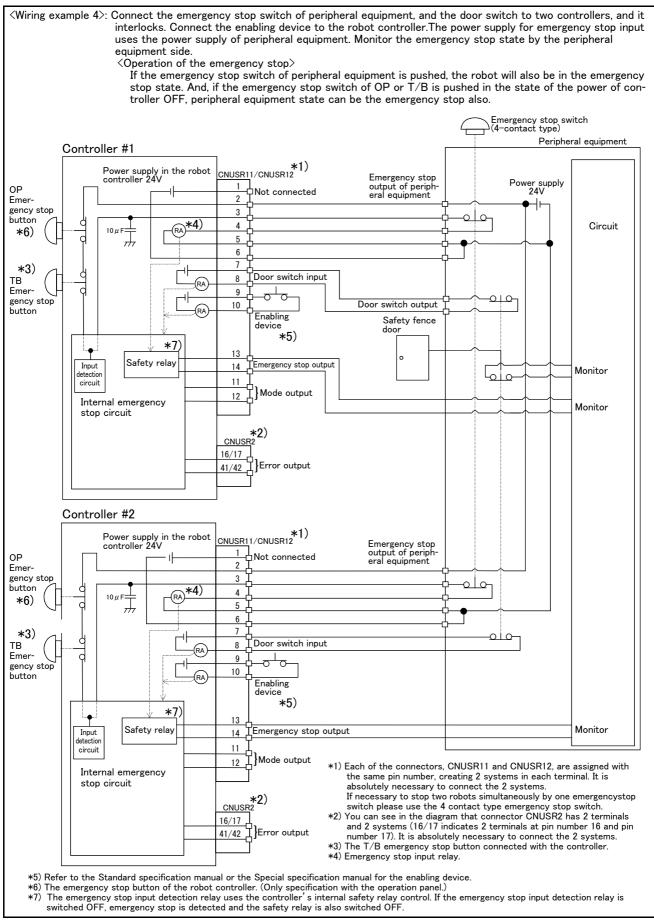
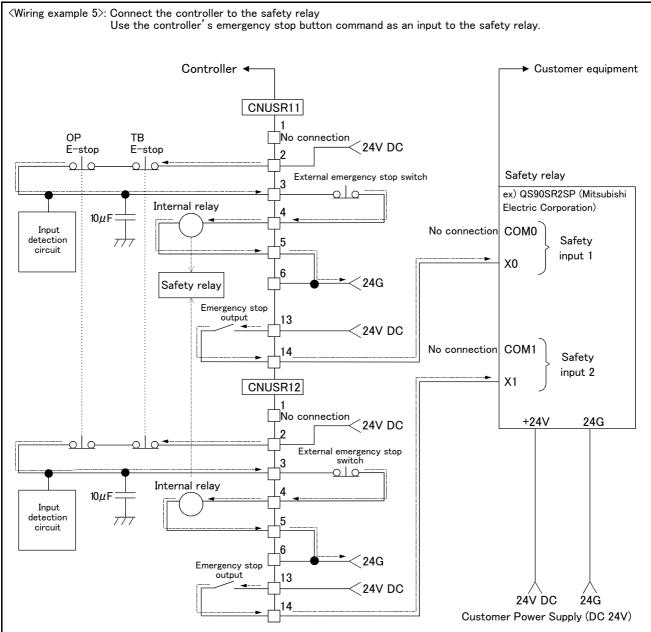


Fig.6-4: Example of safety measures (CR750 wiring example 4)



- [Caution]
 - 1) This product has category 3 functionality and therefore the robot's whole unit cannot be set to category 4.
 - 2) The controller's internal circuit has polarity. Please adhere to the polarity as detailed in the wiring examples, particularly for emergency stop button output when using user equipment. Connect the positive side of the user equipment (24V DC) to the terminal 2 of CNUSR11/12, then connect the emergency stop button (or contact points) in the user equipment to across the terminals 3 and 4 of CNUSR11/12, and ultimately connect the negative side (24G).
 - 3) When installing a safety relay to use it as an input point of the controller's emergency stop button command, use a safety relay that is activated by an input from one of the two systems (i.e. QS90SR2SP (Manufacture: Mitsubishi Electric Corporation)).
 - 4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
 - 5) When connecting emergency stop button output to an external safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly, this function will not operate correctly. Please connect the terminal 13 of CNUSR11/12 to 24V.

Fig.6-5: Example of safety measures (CR750 wiring example 5)

(2) CR751 controller

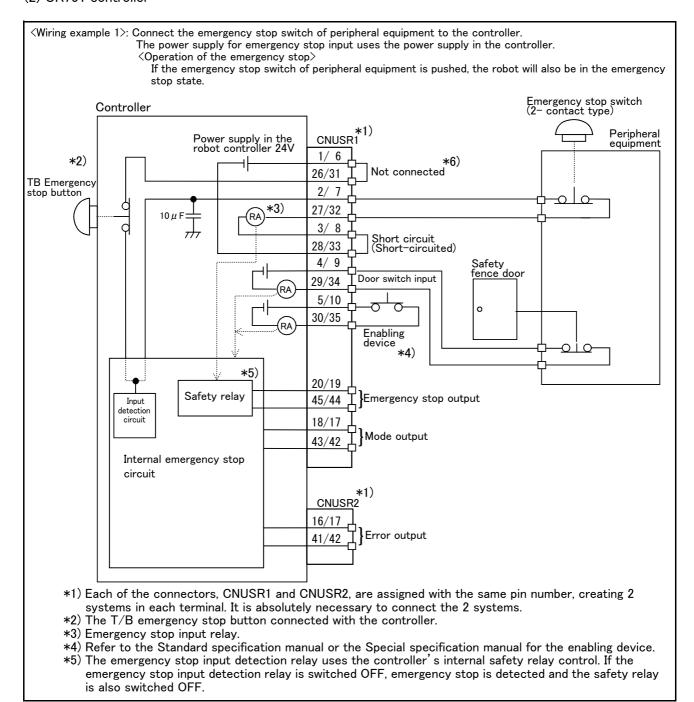
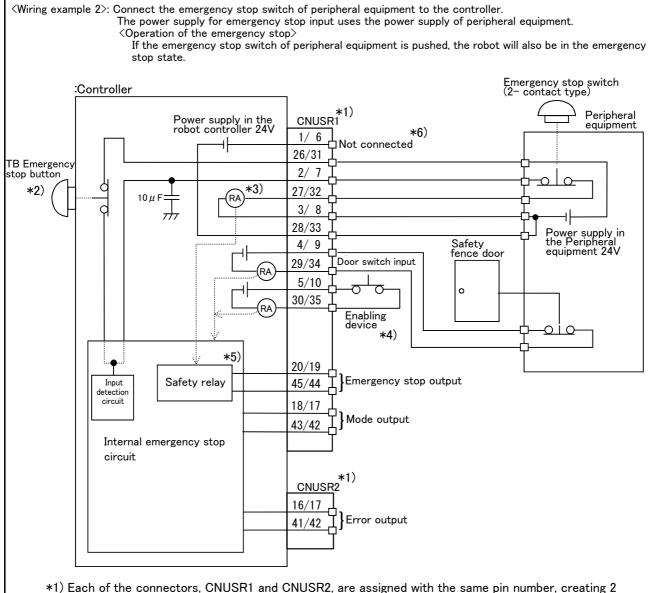


Fig.6-6: Example of safety measures (CR751 wiring example 1)



- *1) Each of the connectors, CNUSR1 and CNUSR2, are assigned with the same pin number, creating 2 systems in each terminal. It is absolutely necessary to connect the 2 systems.
- *2) The T/B emergency stop button connected with the controller.
- *3) Emergency stop input relay.
- *4) Refer to the Standard specification manual or the Special specification manual for the enabling device.
- *5) The emergency stop input detection relay uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
- *6) Connect the 24V power supply to 26/31 terminals.

Fig.6-7: Example of safety measures (CR751 wiring example 2)

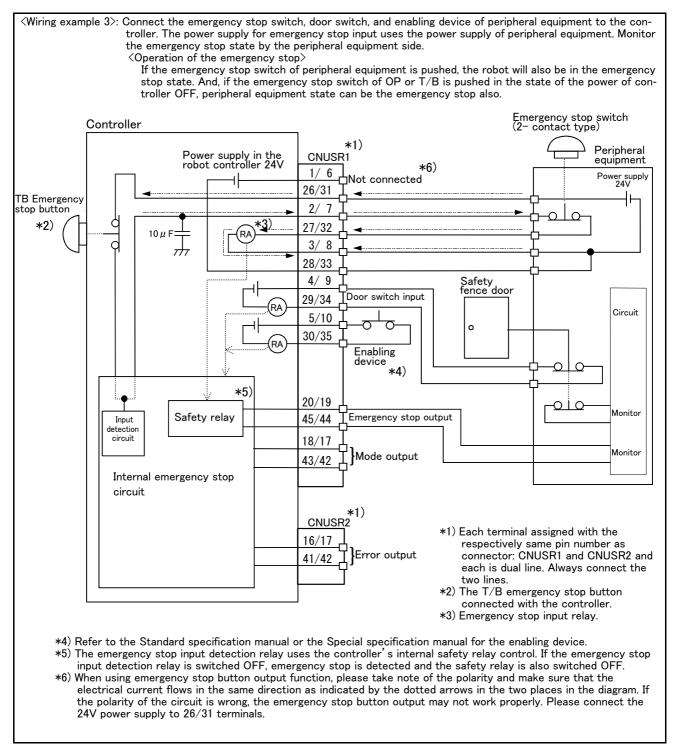


Fig.6-8: Example of safety measures (CR751 wiring example 3)

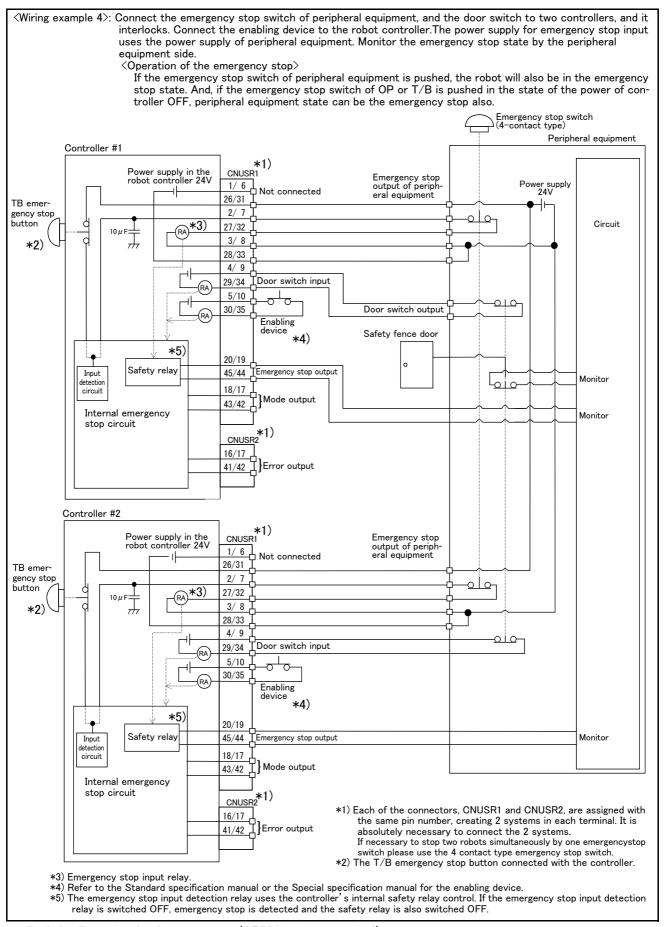
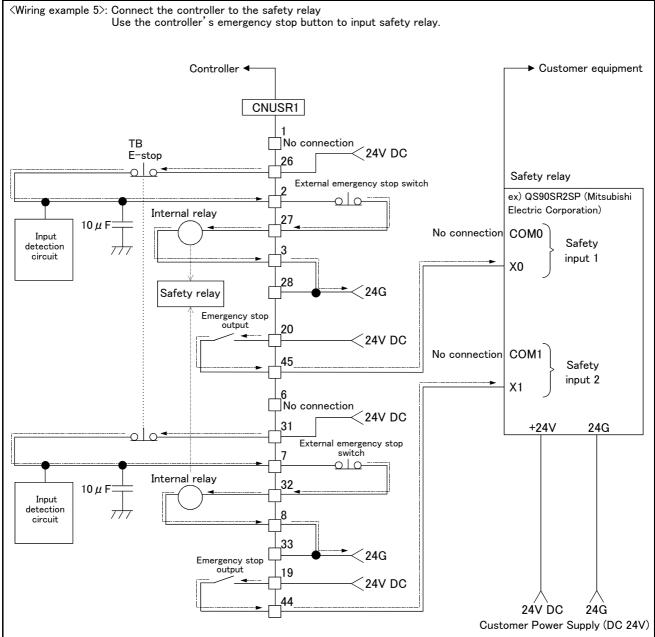


Fig.6-9: Example of safety measures (CR751 wiring example 4)



[Caution]

- 1) This product has category 3 functionality and therefore the robot's whole unit cannot be set to category 4.
- 2) The controller's internal circuit has polarity. Please adhere to the polarity as detailed in the wiring examples, particularly for emergency stop button output when using user equipment. Connect the positive side of the user equipment (24V DC) to the two terminals 26/31, then connect the emergency stop button (or contact points) in the user equipment to the 2-27 and 7-32 terminals, and ultimately connect to the negative side (24G).
- 3) Setup a safety relay on the user equipment, and when using to input the emergency stop button on the controller, please only use a safety relay that functions when connecting the input to the one end of the 2 systems (i.e. QS90SR2SP (Manufacture: Mitsubishi Electric Corporation)).
- 4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
- 5) When connecting emergency stop button output to an exterior safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly this function will not operate correctly. Please connect 20/19 terminal to 24V.

Fig.6-10: Example of safety measures (CR751 wiring example 5)

- (3) External emergency stop connection [supplementary explanation]
 - (1) Use a 2-contact type switch for all switches.
 - (2) Install a limit switch on the safety fence's door. With a constantly open contact (normal open), wire to the door switch input terminal so that the switch turns ON (is conducted) when the door is closed, and turns OFF (is opened) when the door is open.
 - (3) Use a manual-return type of normal close which have two lines for the emergency stop button.
 - (4) Classify the faults into minor faults (faults that are easily restored and that do not have a great effect) and major faults (faults that cause the entire system to stop immediately, and that require care in restoration), and wire accordingly.

[Caution] The emergency stop input (terminal block) on the user wiring in the controller can be used for safety measures as shown in figure above. Note that there are limits to the No. of switch contacts, capacity and cable length, so refer to the following and install.

- Switch contactPrepare a 2-contact type.*1)
- Switch contact capacity......Use a normal open contact that operates with a switch contact capacity of approx. 1mA to 100mA/24V. *1)

If you connect the relay etc., rated current of the coil should use the relay which is 100mA/24V or less. (Refer to Fig. 6-12, Fig. 6-11)

Cable length......The length of the wire between the switch and terminal block must be max. 15m or less. Please use the shield line, in case of the cable may receive the noise etc. by other equipment, such as servo amplifier.

And, since the ferrite core is attached as noise measures parts, please utilize.

The size of the wire that fits to use is shown below.

- CR750 controller...... CNUSR11/12/13 connector: AWG #26 to #16 (0.14mm² to 1.5mm²)
- CR750 controller...... CNUSR2 connector: AWG #30 to #24 (0.05mm² to 0.2mm²)

Electric specification of the emergency stop related output circuit is 100mA/24V or less. Don't connect the equipment except for this range.

^{*1)} The minimum load electric current of the switch is more than 5mA/24V.

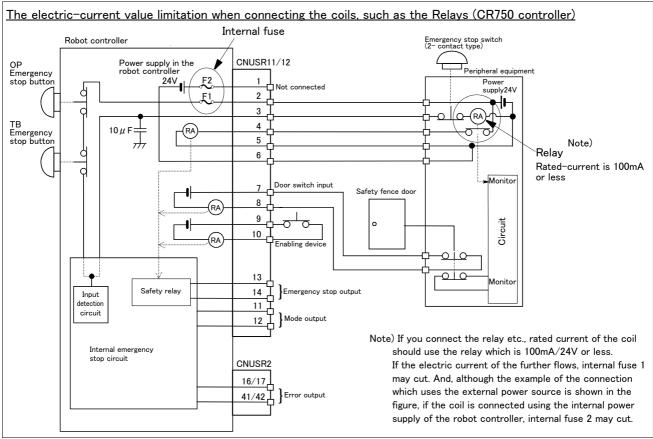


Fig.6-11: Limitations when connecting the relay etc. (CR750)

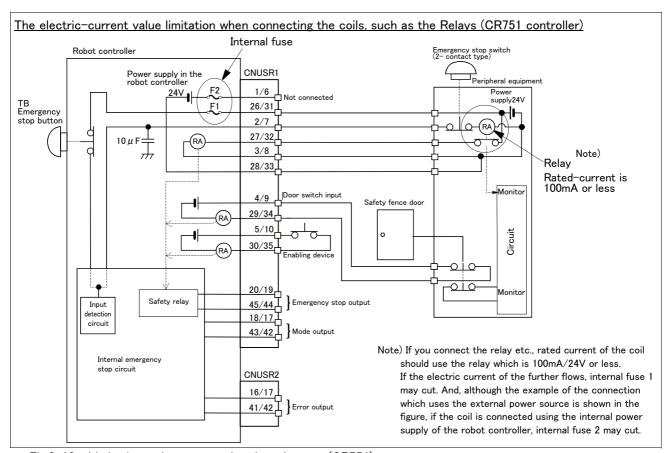


Fig.6-12: Limitations when connecting the relay etc. (CR751)

[Supplementary explanation regarding emergency stop circuit]

The controller's internal circuit is as shown in the below diagram. Be sure to build a circuit that properly shuts off the emergency stop detection relay when the emergency stop button is pressed.

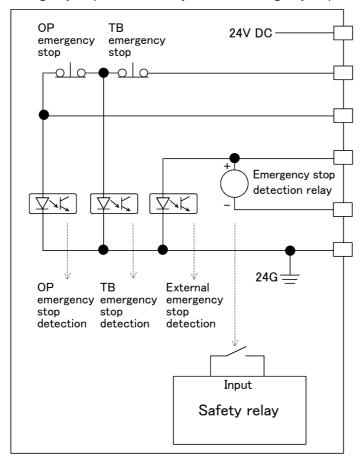


Fig.6-13: Internal circuit of controller

∴ CAUTION

Be sure to perform wiring correctly. If there are mistakes in the wiring, the robot may not stop when the emergency stop button is pressed and there will be a risk of damage or personal injury occurring.

After wiring, be sure to press each of the installed emergency stop switches and check whether the emergency stop circuit works properly.



Be sure to duplicate connection of the emergency stop, door switch and enabling switch. If not duplicated, these functions may fail due to a broken relay used by customer, etc.

6.2 Working environment

Avoid installation in the following places as the equipment's life and operation will be affected by the ambient environment conditions. When using in the following conditions, the customer must pay special attention to the preventive measures.

(1) Power supply

- · Where the voltage fluctuation will exceed the input voltage range.
- Where a momentary power failure exceeding 20ms may occur.
- Where the power capacity cannot be sufficiently secured.



Please use the controller with an input power supply voltage fluctuation rate of 10% or less. In the case of 200 VAC input, for example, if the controller is used with 180 VAC during the day and 220 VAC during the night, turn the servo off once and then on again. If this is not performed, an excessive regeneration or overvoltage error may occur.

(2) Noise

• Where a surge voltage exceeding 1000V, 1 μ s may be applied on the primary voltage. Near large inverters, high output frequency oscillator, large contactors and welding machines. Static noise may enter the lines when this product is used near radios or televisions. Keep the robot away from these items.

(3) Temperature and humidity

- Where the atmospheric temperature exceeds 40 degree, lower than 0 degree.
- Where the relative humidity exceeds 85%, lower than 45%, and where dew may condense.
- · Where the robot will be subject to direct sunlight or near heat generating sources such as heaters.

(4) Vibration

• Where excessive vibration or impact may be applied. (Use in an environment of 34m/s^2 or less during transportation and 5m/s^2 or less during operation.)

(5) Installation environment

- · Where strong electric fields or magnetic fields are generated.
- Where the installation surface is rough. (Avoid installing the robot on a bumpy or inclined floor.)
- · Where there is heavy powder dust and oil mist present.

6.3 Precautions for handling

- (1) This robot has brakes on all axes. The precision of the robot may drop, looseness may occur and the reduction gears may be damaged if the robot is moved with force with the brakes applied.
- (2) Avoid moving the robot arm by hand. When unavoidable, gradually move the arm. If moved suddenly, the accuracy may drop due to an excessive backlash, or the backed up data may be destroyed.
- (3) Note that depending on the posture, even when within the movement range, the wrist section could interfere with the base section. Take care to prevent interference during jog. *1)
- (4) The robot arm consists of precision parts such as bearing. Lubricants such as grease are also applied on the moving parts to keep the mechanical accuracy. In a cold start under low temperature or in the first start after being stored for one month or longer, lubricants may not be spread enough. Such condition may lower the positioning accuracy, cause servo and overload alarms, and early wearing of the moving parts. To avoid such situation, perform warm—up operation of the machine at a low speed (at about 20% of normal operation speed). Move the robot arm from the lower to the upper limit of the movable range with the 30 degree joint angle or more for about 10 minutes. After that, speed up the operation gradually.
 - Please use the warm-up operation. (About the details of the warm-up operation, refer to "INSTRUCTION MANUAL/Detailed explanations of functions and operations".)
- (5) In the environment where hygiene management is required, clean the robot arm before use. Chemical-resistant specifications (SExx01) corresponds to the sterilization and cleaning by chemicals. And Food machinery grade

^{*1)} Jog operation refers to operating the robot manually using the teaching pendant.

- H1 grease specifications (SExx02) corresponds to wiping. (Refer to Page 20, "2.2.6 Protection specifications" in detail.)
- (6) The robot arm and controller must be grounded with $100\,\Omega$ or less (class D grounding) to secure the noise resistance and to prevent electric shocks.
- (7) The items described in these specifications are conditions for carrying out the periodic maintenance and inspections described in the instruction manual.
- (8) When using the robot arm on a mobile axis or elevating table, the machine cables enclosed as standard configuration may break due to the fixed installation specifications. In this case, use "the machine cable extension (for flexed)" factory shipment special specifications or options.
- (9) If this robot interferes with the workpiece or peripheral devices during operation, the position may deviate, etc. Take care to prevent interference with the workpiece or peripheral devices during operation.
- (10) The hanging installation jig can be borrowed from the maker. Order to dealer when need.
- (11) Do not attach a tape or a label to the robot arm and the controller. If a tape or a label with strong adhesive power, such as a packaging tape, is attached to the coated surfaces of the robot arm and controller, the coated surface may be damaged when such tape or label is peeled off.
- (12) If the robot is operated with a heavy load and at a high speed, the surface of the robot arm gets very hot. It would not result in burns, however, it may cause secondary accidents if touched carelessly.
- (13) Do not shut down the input power supply to stop the robot. If the power supply is frequently shut down during a heavy load or high-speed operation, the speed reducer may be damaged, backlash may occur, and the program data may be destroyed.
- (14) If the J1, J2 and J3 axes collide with the mechanical stopper during the automatic operation of the robot, it is necessary to replace the resin part of the mechanical stopper unit. For the replacement of the resin parts, please contact Mitsubishi or Mitsubishi's dealer.

 If the resin part is not replaced, the mechanism unit and the speed reducer may be damaged significantly when
 - If the resin part is not replaced, the mechanism unit and the speed reducer may be damaged significantly when the axes collide with the mechanical stopper next or subsequent time.
- (15) During the robot's automatic operation, a break is applied to the robot arm when the input power supply is shut down by a power failure, for instance. When a break is applied, the arm may deviate from the operation path predetermined by automatic operation and, as a result, it may interfere with the mechanical stopper depending on the operation at shutdown. In such a case, take an appropriate measure in advance to prevent any dangerous situation from occurring due to the interference between the arm and peripheral devices. Example) Installing a UPS (uninterruptible power supply unit) to the primary power source in order to reduce interference.
- (16) The J1 to J3 axes of the RV-13F series generate loud noise during high-speed operation because of their reduction gear structure, but it does not affect the robot's function, performance, and a life.
- (17) Do not conduct an insulated voltage test. If conducted by mistake, it may result in a breakdown.
- (18) Fretting may occur on the axis which moving angle or moving distance move minutely, or not moves. Fretting is that the required oil film becomes hard to be formed if the moving angle is small, and wear occurs. The axis which not moved is moving slightly by vibration etc. To make no fretting recommends to move these axes about once every day the 30 degree or more, or the 20mm or more.
- (19) The United Nations' Recommendations on the Transport of Dangerous Goods must be observed for transborder transportation of lithium batteries by air, sea, and land. The lithium batteries (ER6, Q6BAT) used in Mitsubishi industrial robots contain lithium and fall under the definition.
 - When the lithium batteries are shipped for storage, etc., they will be classified as Class 9: Miscellaneous dangerous substances and articles. Please contact your transportation company and must provide appropriate transport safety measures as the customer's consignor.
- (20) If the air supply temperature (primary piping) used for the tool etc. is lower than ambient air temperature, the dew condensation may occur on the coupling or the hose surface.
- (21) When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

6.4 EMC installation guideline

6.4.1 Outlines

The EMC directive is coerced from January 1, 1996, and it is necessary to attach the CE mark which shows that the product is in conformity to directive.

Since the industrial robot is the component of the automation system, it considers that the EMC directive is not the target product of the direct. However, because it is one of the main components, introduces the method and components of the measures for conforming the automation system to the EMC directive.

And also we are carrying out the qualification test about the conformity of the EMC directive under the environment based on the contents of this document. However, the noise level is changed by the kind of equipment to be used, the layout, the construction of the controlling board, the course of wiring, etc. Therefore, please confirm by the customer eventually.

6.4.2 EMC directive

The Mitsubishi Electric industrial robot follows the European EMC directive. This technical standard regulates the following two items.

- (1) Emission (EMI : Electromagnetic Interference) The capacity not to generate the disturbance noise which has a bad influence outside.
- (2) Immunity (EMS: Electromagnetic Susceptibility)........ The capacity which does not malfunction for the disturbance noise from the outside.

Each contents are shown below.

Item	Name	Contents	Testing technical- standard number		
Emission (EMI)	Radiative noise disturbance	The electromagnetic noise etc. which are emitted to environs.	EN61000-6-2 : 2005 EN61000-6-4 : 2007		
	Electrical-conduction noise disturbance	The electromagnetism noise etc. which flow out of the power-supply line.	EN62061:2005(Annex E)		
Immunity	Electrostatic discharge immunity test	The noise from the electrified human body.			
(EMS)	Radiated, radio-frequency, electromagnetic field immunity test susceptibility test	The electromagnetism noise from the transceiver, the broadcasting station, etc.			
	Electrical fast transient burst immunity test	The relay noise or the electromagnetism noise etc. which are caused in power-supply ON/OFF.			
	Immunity to conducted distrurbances induced radio-frequency fields	The electromagnetism noise etc. which flow in through the power source wire and the grounding wire.			
	Power frequency magnetic field immunity test	The electromagnetism noise with a power supply frequency of 50/60 Hz etc.			
	Voltage dips, short interruptions and voltage variations immunity test	The noise in the variation of the source voltage of the power dispatching, etc.			
	Surge immunity test	The electromagnetism noise by the thunderbolt, etc.	c.		

6.4.3 EMC measures

There are mainly following items in the EMC measures.

- (1) Store into the sealed metal board.
- (2) Grounding all the conductor that have floated electrically (makes the impedance low).
- (3) Wiring so that the power source wire and signal wire are separated.
- (4) Use the shield cable for the cable which wired outside of the metal board.
- (5) Install the noise filter.

To suppress the noise emitted out of the board, be careful of the following item.

- (1) Ensure grounding of the equipment.
- (2) Use the shield cable.
- (3) Separate the metal board electrically. Narrows the distance/hole.

The strength of electromagnetic noise emitted to environment is changed a lot by the shielding efficiency of cable and the distance of metal board, so it should be careful.

6.4.4 Component parts for EMC measures

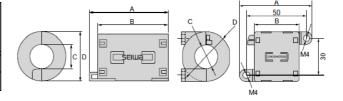
(1) Ferrite core

The ferrite core is mounted by the plastics case as one. It can attach by the one-touch, without cutting the cable. This has the effect in the common-mode noise. The measures against the noise are made not influential in the quality of the signal.

There are the following as an example.

Maker: SEIWA ELECTRIC MFG. Co.,Ltd.

T	Out	side dim	ension (r	mm)	Diameter of the
Туре	Α	В	С	D	adaptation cable [max] (mm)
E04SR401938	61	38	19	40	19.0
E04SR301334	39	34	13	30	13.0



Maker: TAKACHI ELECTRONICS ENCLOSURE CO., LTD.

Market: 17 mg term Eller i termes Eliteles ett.										
T	Out	side dim	Diameter of the							
Туре	Α	В	С	D	adaptation cable [max] (mm)					
TFT-274015S	43.8	27.4	20.7	_	φ 26.5					

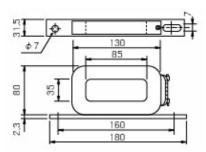






(2) Line noise filter

Type: FR-BLF (Mitsubishi Electric Corp.)



7 Appendix

Cor	npany name	ation			Name		
	lress				Telephone		
Dur	hased model	<u> </u>					
uit	Item			Tyne	Note1)		Controller ^{Note2}
Che	mical-resistant	☐ RV-4FM-D-SEx	x01 □ RV-4FLM-0		□ RV-7FM-D-SExx(01 □ RV-7FLM-D-SExx01	CR750-0*VD-
spe	cifications xx01)	□ RV-4FM-1D-SE	_		□ RV-7FM-1D-SExx		CR751-0*VD-
Foo	d machinery	□ RV-4FM-D-SEx	x02 □ RV-4FLM-D	SExx02	□ RV-7FM-D-SExx(02 □ RV-7FLM-D-SExx02	CR750-0*VD-
spe	le H1grease cifications xx02)	□ RV-4FM-1D-SE	xx02 □ RV-4FLM-1	D-SExx02	□ RV-7FM-1D-SExx	k02 □ RV-7FLM-1D-SExx02	CR751-0*VD-0
Vote	(2) "*" in the (2)		I type name of robot' ne maximum load of				
		Item		Stand	lard specification	Special shipping spe	cifications
Rob	ot arm	CE Markin	g specification	Not confe directive.	orming with EMC	□ Not provided □ -S15	
Opti	ons (Installab	ole after shipme	nt)				
	Ite	m	Туре		Provision	ded.	
	J1 axis operating range change		1F-DH-06	For	SExx01 of the RV-4	F series: Not provided 🛛 F	Provided
						Provided	
						Provided	
			1F-DH-04 For SExx02 of the RV-7F series: ☐ Not provided ☐ F				Provided
	Machine cable	extension	1S- ☐ CBL-01 Fixed type (For CR750, SExx01/02): ☐ Not provide ☐ 5				
			1S- □ LCBL-01 Flexed type (For CR750, SExx01/02): □ Not provide □				
			1F- UCBL-03		Fixed type (For CR751, SExx01): Not provide 10m 15m 20		
			1F- □□ LUCBL-03 Flexed type (For CR751, SExx01): □ Not provide □ 10m				
arm			1F- □□ UCBL-02 Fixed type (For CR751, SExx02): □ Not provide □ 10m 1F- □□ LUCBL-02 Flexed type (For CR751, SExx02) □ Not provide □ 10m				
Robota	Solenoid valve	set	1F-VD0 □ -04 1F-VD0 □ E-04	For 1	SExx01 F−VD0 □ −04 (Sink	☐ Not provide] 3set □ 4set
			1F-VD0 □ -02 1F-VD0 □ E-02	1	SExx02 F−VD0 □ −02 (Sink : F−VD0 □ E−02 (Sou	Not provide type): 1set 2set rce type): 1set 2set 2	
	Hand input cab	ole	1F-HC35S-02		lot provided Pro	vided	
	Hand output ca	able	1F-GR35S-02		lot provided 🛮 Pro	vided	
	Hand curl tube	·	1E-ST040 □ C		lot provided 🛚 1se	t □ 2set □ 3set □ 4set	
	Forearm extern	nal wiring set	1F-HB0 □ S-02	For	SExx01: ☐ Not prov	ided □ 1F-HB01S-02 □ 1F	F-HB02S-02
			1F-HB0 □ S-01		SExx02: ☐ Not prov		-HB02S-01
	Base external	wiring set	1F-HA0 □ S-02		SExx01: Not provi		-HA02S-02
			1F-HA0 □ S-01		SExx02: ☐ Not prov		-HA02S-01
Controller	Simple teaching		R32TB- □ □ R33TB- □ □		R33TB (CR750 controller): ☐ 7m ☐ 15r CR751 controller): ☐ 7m ☐ 15r	n
Contr	Highly efficient	teaching pendant	R56TB- □ □ R57TB- □ □	□N		CR750 controller): ☐ 7m ☐ 15r CR751 controller): ☐ 7m ☐ 15r	

	aru		1F- □□ LUCBL-02	Flexed type (For CR751, SExx02) ☐ Not provide ☐ 10m ☐ 15m ☐ 20m				
-	Solenoid valve se	t	1F-VD0 □ -04 1F-VD0 □ E-04	For SExx01				
			1F-VD0 □ -02 1F-VD0 □ E-02	For SExx02				
	Hand input cable		1F-HC35S-02	□ Not provided □ Provided				
	Hand output cabl	е	1F-GR35S-02	□ Not provided □ Provided				
	Hand curl tube		1E-ST040 □ C	□ Not provided □ 1set □ 2set □ 3set □ 4set				
	Forearm external	Forearm external wiring set	1F-HB0 □ S-02	For SExx01: ☐ Not provided ☐ 1F-HB01S-02 ☐ 1F-HB02S-02				
			1F-HB0 □ S-01	For SExx02: ☐ Not provided ☐ 1F-HB01S-01 ☐ 1F-HB02S-01				
	Base external wir	ing set	1F-HA0 □ S-02	For SExx01: ☐ Not provided ☐ 1F-HA01S-02 ☐ 1F-HA02S-02				
			1F-HA0 □ S-01	For SExx02: ☐ Not provided ☐ 1F-HA01S-01 ☐ 1F-HA02S-01				
=	Simple teaching p	pendant	R32TB- □ □ R33TB- □ □	□ Not provided R32TB (CR750 controller): □ 7m □ 15m R33TB (CR751 controller): □ 7m □ 15m				
Controller	Highly efficient te	eaching pendant	R56TB- □ □ R57TB- □ □	□ Not provided R56TB (CR750 controller): □ 7m □ 15m R57TB (CR751 controller): □ 7m □ 15m				
	Parallel I/O inter	face	2D-TZ368/ 2D-TZ378	□ Not provided 2D-TZ368(Sink type)/ □ -1pc. □ -2pc. 2D-TZ378(Source type)/ □ -1pc. □ -2pc.				
	External I/O cabl (For parallel I/O i	-	2D−CBL □□ (2D−TZ368/TZ378)	□ Not provided □ 5m-()pc. □ 15m-()pc.				
	Parallel I/O unit		2A-RZ361/ 2A-RZ371	□ Not provided □ 2A-RZ361(Sink type)/() unit □ 2A-RZ371(Source type)/() unit				
	External I/O cabl (For Parallel I/O	-	2A-CBL □□ (2A-RZ361/RZ371)	□ Not provided □ 5m-()pc. □ 15m-()pc.				
	CC-Link interface	е	2D-TZ576	□ Not provided □ Provided				
	Controller protec	tion box	CR750-MB	For CR750 controller: ☐ Not provided ☐ Provided				
			CR751-MB	For CR751 controller: ☐ Not provided ☐ Provided				
	RT ToolBox2		3D-11C-WINE	□ Not provided □ Windows XP/Vista/7/8/8.1 English CD-ROM				
	RT ToolBox2 min	i	3D-12C-WINE	□ Not provided □ Windows XP/Vista/7/8/8.1 English CD-ROM				
	Instructions manu	ual	5F-FF03-PE01	□ Not provided □ Provided () sets				
_								
nr	div-170 Specifie	ations disque	cian matarial (DV-11	-//E corine				

Maintenance pa	arts (Consuma	e parts)			
Maintenance pa	arts 🗆 Backup	tteries ER6() pcs. □ Backup b	atteries Q6BAT () p	pcs. 🛘 Grease () cans
Robot selection	n check list				
Work description	☐ Material handli	☐ Assembly ☐ Machining L/UL	☐ Sealing ☐ Testing ar	nd inspection 🛮 Othe	r()
Workpiece mass	Hand mass	tmosphere 🗆 Chemicals (Contact y	our dealer.) 🗌 Water [☐ Other()
()g	()g	emarks:			

Appendix 2 : Specifications discussion material (RV-7FLL)

Con	npany name					Name		
Add	ress					Telephone		
urc	hased model							
		Item				Type ^{Note1)}		Controller
Che	mical-resistant s	pecifications (SEx	x01)		∃ RV	-7FLLM-D-SExx01		CR750-07VLD-1
		,				-7FLLM-1D-SExx01		CR751-07VLD-0
Foo	d machinery grad	e H1 grease			□ RV	-7FLLM-D-SExx02		CR750-07VLD-1
Food machinery grade H1 grease specifications (SExx02)						-7FLLM-1D-SExx02		CR751-07VLD-0
lote	1) Refer to the F	Page 2 "12 Model	type na	me of robot"	for t	he details of the robot ar	rm tvp	e name
	ping special s		-71				,,	
	1 0 1	Item				Standard specification		Special shipping specifications
Robo	ot arm	CE Markin	g specif	cation		conforming with EMC		Not provided □ -S15
nti	one (Inetallah)	le after shipme	nt)		uire	cuve.		
pu	Iten			Tuno		Provioion	a and	specifications when provided.
			15_00	Type		For SExx01: Not prov	-	·
	J1 axis operating range change			1F-DH-08 1F-DH-05J1		For SExx02: Not prov		
	Machine cable e	extension	<u> </u>					
	Macrillo cable 6	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1S-			Fixed type (For CR750, SExx01/02): Not provide 5m 10m 15m Flexed type (For CR750, SExx01/02): Not provide 5m 10m 15m		
			1F- UCBL-03			Fixed type (For CR751, SExx01/02): Not provide 10m 15m 20m		
			1F- DD LUCBL-03			Flexed type (For CR751, SExx01): Not provide 10m 15m 20m		
			1F- 🗆 🗆 UCBL-02					: ☐ Not provide ☐ 10m ☐ 15m ☐ 20m
arm			1F- 🗆 LUCBL-02		2	Flexed type (For CR751, SExx02): ☐ Not provide ☐ 10m ☐ 15m ☐ 20m		
Kobot	1		1F-VD0 □ -04 1F-VD0 □ E-04		For SExx01			
				1F-VD0 □ -02 1F-VD0 □ E-02		For SExx02		
	Hand input cabl	e	1F-HC	35S-02		☐ Not provided ☐ Pro		
	Hand output cal	ble	1F-GR35S-02		☐ Not provided ☐ Pro	ovided		
	Hand curl tube		1E-ST	1E-ST040 □ C		□ Not provided □ 1set □ 2set □ 3set □ 4set		
	Forearm extern	al wiring set	1F-HB	1F-HB0 □ S-02		For SExx01: ☐ Not provided ☐ 1F-HB01S-02 ☐ 1F-HB02S-02		
			1F-HB	1F-HB0 □ S-01		For SExx02: ☐ Not provided ☐ 1F-HB01S-01 ☐ 1F-HB02S-01		
	Base external w	iring set	1F-HA	0 □ S-02		For SExx01: ☐ Not provided ☐ 1F-HA01S-02 ☐ 1F-HA02S-02		
				1F-HA0 □ S-01		For SExx02: ☐ Not provided ☐ 1F-HA01S-01 ☐ 1F-HA02S-01		
Controller	Simple teaching	pendant	R32TB R33TB			□ Not provided R32TB (CR750): □ 7m □ 15m R33TB (CR751): □ 7m □ 15m		
Sol		teaching pendant	R56TB R57TB			R57TB	(CR75	0): □ 7m □ 15m 1): □ 7m □ 15m
	Parallel I/O inte		2D-TZ 2D-TZ	378		2D-	TZ378	(Sink type)/
	External I/O ca (For parallel I/C	interface)		368/TZ378)		□ Not provided □ 5m)pc. □ 15m-()pc.
	Parallel I/O unit		2A-RZ 2A-RZ	371			A-RZ	861(Sink type)/() unit 871(Source type)/() unit
	External I/O ca (For Parallel I/O	unit)		361/RZ371)		□ Not provided □ 5m)pc. □ 15m-()pc.
	CC-Link interface		2D-TZ			☐ Not provided ☐ Pro		
	Controller protection box		CR750			CR750 : ☐ Not provided		
			CR751			CR751 : ☐ Not provided ☐ Provided		
	RT ToolBox2			C-WINE		·		XP/Vista/7/8/8.1 English CD-ROM
	RT ToolBox2 m			C-WINE		•		XP/Vista/7/8/8.1 English CD-ROM
			5F-FF	F-FF03-PE01			() sets	

_	-			
	Robot	selection	check	liet

ĺ	Work description	☐ Material handl	ing ☐ Assembly ☐ Machining L/UL ☐ Sealing ☐ Testing and inspection ☐ Other (
I	Workpiece mass	Hand mass	Atmosphere ☐ Chemicals (Contact your dealer.) ☐ Water ☐ Other()
l	()g	()g	Remarks:	

Appendix 3: Specifications discussion material (RV-13F/13FL)

Co	mpany name				Name					
Add	dress				Teleph	one				
ur	chased model				I					
	Ite	m			Туре	Note1)		Controller		
Che	emical-resistant s	pecifications	☐ RV-13FM-D-5	SExx(M-D-SExx01	CR750-13VD-1		
(SE	xx01)		☐ RV-13FM-1D-	-SExx	k01	□ RV-13FL	M-1D-SExx01	CR751-13VD-0		
Foc	od machinery grad	e H1 grease	☐ RV-13FM-D-	SExx()2	□ RV-13FL	M-D-SExx02	CR750-13VD-1		
specifications (SExx02)			☐ RV-13FM-1D-	-SExx	<02	□ RV-13FL	M-1D-SExx02	CR751-13VD-0		
	e1)Refer to the oping special s	=	el type name of robot	″ for	the details o	f the robot a	rm type name.			
		Item		5	Standard spe	cification	Special ship	ping specifications		
Rob	oot arm	CE Markin	g specification		conforming v ctive.	vith EMC	☐ Not provided ☐	I -S15		
pt	ions (I nstallabl	e after shipme	nt)							
	Item	า	Type			Provision,	and specifications wh	nen provided.		
	J1 axis operatin	ig range change	1F-DH-08		For SExx01:	☐ Not provi	ded 🗌 Provided			
		1			For SExx02:	☐ Not provi	ded ☐ Provided			
	Machine cable e	extension	1S- 🗆 🗆 CBL-01		Fixed type (F	or CR750, SE	xx01/02): ☐ Not provi	ide 🗆 5m 🗆 10m 🗆 15		
			1S- □□ LCBL-01		Flexed type (For CR750, S	Exx01/02): 🗌 Not prov	vide □ 5m □ 10m □ 1		
				1F- 🗆 UCBL-03		Fixed type (For CR751, SExx01): ☐ Not provide ☐ 10m ☐ 15m ☐ 20m				
				1F- □□ LUCBL-03		Flexed type (For CR751, SExx01): ☐ Not provide ☐ 10m ☐ 15m ☐ 20m				
E			1F- □□ UCBL-02		Fixed type (F	or CR751, SE	xx02): Not provide	□ 10m □ 15m □ 20m		
arm			1F- 🗆 🗆 LUCBL-0	2	Flexed type (For CR751, S	Exx02) 🗌 Not provide	□ 10m □ 15m □ 20n		
Robot	Solenoid valve s	Solenoid valve set			For SExx01					
			1F-VD0 □ -03 1F-VD0 □ E-03		For SExx02					
	Hand input cable	е	1F-HC35S-02		□ Not provided □ Provided					
	Hand output cal	ble	1F-GR35S-02		□ Not provided □ Provided					
	Hand curl tube		1N-ST060 □ C	N-ST060 □ C □ Not provided □ 1set □ 2set □ 3se						
	Forearm externa	al wiring set	1F-HB0 □ S-02		For SExx01: Not provided 1F-HB01S-02 1F-HB02S-02					
			1F-HB0 □ S-01		For SExx02: Not provided 1F-HB01S-01 1F-HB02S-01					
	Base external w	viring set	1F-HA0 □ S-02		For SExx01: ☐ Not provided ☐ 1F-HA01S-02 ☐ 1F-HA02S-02 For SExx02: ☐ Not provided ☐ 1F-HA01S-01 ☐ 1F-HA02S-01					
			1F-HA0 🗆 S-01							
Controller	Simple teaching		R32TB- 🗆 🗆		□ Not provided R32TB (CR750): □ 7m □ 15m R33TB (CR751): □ 7m □ 15m					
ဒိ	3 ,	teaching pendant	R56TB-		□ Not provid	R57TB (CR750):	1		
	Parallel I/O inte		2D-TZ368/ 2D-TZ378 2D-CBL □□		□ Not provi	2D-T	Z368(Sink type)/			
	(For parallel I/O unit	interface)	(2D-TZ368/TZ378) 2A-RZ361/		□ Not provi		-RZ361(Sink type)/() unit		
	External I/O cal		2A-RZ371 2A-CBL 🗆 🗆		□ Not provi	□ 2A	-RZ371(Source type)			
	(For Parallel I/C		(2A-RZ361/RZ371)				, ,ро. 🗀 топт (,po.		
	CC-Link interfa	ce	2D-TZ576		☐ Not provi	ided 🗆 Prov	vided			
	Controller prote	ection box	CR750-MB		CR750 : □	Not provided	☐ Provided			
			CR751-MB		CR751 : □ I	Not provided	☐ Provided			
	RT ToolBox2		3D-11C-WINE		☐ Not provi	ded 🗆 Wind	ows XP/Vista/7/8/8.	1 English CD-ROM		
	RT ToolBox2 m	ini	3D-12C-WINE		☐ Not provi	ded 🗆 Wind	ows XP/Vista/7/8/8.	1 English CD-ROM		
	Instructions ma	nual	5F-FF03-PE01		□ Not provided □ Provided () sets					

_				
	Robot	selection	check	list

Work description	☐ Material handl	ing ☐ Assembly ☐ Machining L/UL ☐ Sealing ☐ Testing and inspection ☐ Other ()
Workpiece mass	Hand mass	Atmosphere	
()g	()g	Remarks:	

Appendix 4 : Specifications discussion material (RV-20F)

Company name				Name				
Address						Telephone		
urc	chased model					l .	-	
						Type Note1)	Controller	
					⊒ RV	-20FM-D-SExx01	CR750-20VD-1	
				[□ RV	-20FM-1D-SExx01	CR751-20VD-0	
				[□ RV	-20FM-D-SExx02	CR750-20VD-1	
specifications (SExx02)			☐ RV-20FM-1D-SExx02			CR751-20VD-0		
	e1) Refer to the ping special s	_	l type n	ame of robot	" for	the details of the robot a	rm type name.	
Item						Standard specification	Special shipping specifications	
Rob	ot arm	CE Markin	g specif	•		t conforming with EMC Not provided -S15 ective.		
pti	ons (Installabl	e after shipme	nt)					
	Item			Туре		Provision, and specifications when provided.		
	J1 axis operating range change		1F-DH	F-DH-08		For SExx01: ☐ Not provided ☐ Provided		
	,		1F-DH	1F-DH-05J1		For SExx02: ☐ Not provided ☐ Provided		
	Machine cable e	extension	1S- 🗆 🗆 CBL-01		Fixed type (For CR750, SExx01/02): Not provide 5m 10m 15			
			1S- 🗆 🗆 LCBL-01			Flexed type (For CR750, SExx01/02): Not provide 5m 10m 15		
			1F- □□ UCBL-03		Fixed type (For CR751, SExx01): ☐ Not provide ☐ 10m ☐ 15m ☐ 20m			
			1F- □□ LUCBL-03		Flexed type (For CR751, SExx01): ☐ Not provide ☐ 10m ☐ 15m ☐ 20n			
E			1F- □□ UCBL-02		Fixed type (For CR751, SExx02): ☐ Not provide ☐ 10m ☐ 15m ☐ 20m			
arm			1F- 🗆 LUCBL-02		Flexed type (For CR751, SExx02) ☐ Not provide ☐ 10m ☐ 15m ☐ 20n			
Kobot	Solenoid valve set		1F-VD0 □ -05 1F-VD0 □ E-05		For SExx01			
			1F-VD0 □ -03 1F-VD0 □ E-03			For SExx02		
	Hand input cable		1F-HC35S-02		□ Not provided □ Provided			
	Hand output cal	ole	1F-GR35S-02		□ Not provided □ Provided			
	Hand curl tube		1N-ST060 □ C		□ Not provided □ 1set □ 2set □ 3set □ 4set			
	Forearm externa	al wiring set	1F-HB0 □ S-02		For SExx01: ☐ Not provided ☐ 1F-HB01S-02 ☐ 1F-HB02S-02			
			1F-HB0 □ S-01		For SExx02: ☐ Not provided ☐ 1F-HB01S-01 ☐ 1F-HB02S-01			
	Base external w	iring set	1F-HA0 □ S-02		For SExx01: Not provided			
			1F-HA0 □ S-01			For SExx02: Not provided 1F-HA01S-01 1F-HA02S-01		
Controller	Simple teaching pendant		R32TB- □ □ R33TB- □ □		□ Not provided R32TB (CR750): □ 7m □ 15m R33TB (CR751): □ 7m □ 15m			
Š		teaching pendant	R56TB- □ □ R57TB- □ □		□ Not provided R56TB (CR750): □ 7m □ 15m R57TB (CR751): □ 7m □ 15m			
	Parallel I/O inte		2D-TZ 2D-TZ	378		□ Not provided 2D-TZ368(Sink type)/ □ -1pc. □ -2pc. 2D-TZ378(Source type)/ □ -1pc. □ -2pc.		
	External I/O cable (For parallel I/O interface)		2D−CBL □□ (2D−TZ368/TZ378)		□ Not provided □ 5m-()pc. □ 15m-()pc.			
	Parallel I/O unit		2A-RZ361/ 2A-RZ371 2A-CBL 🗆 🗆		□ Not provided □ 2A-RZ361(Sink type)/() unit □ 2A-RZ371(Source type)/() unit □ Not provided □ 5m-()pc. □ 15m-()pc.			
	External I/O cable (For Parallel I/O unit)		(2A-RZ361/RZ371)		д тос ргочиса д от С урс. д тот С урс.			
	CC-Link interface		2D-TZ576		□ Not provided □ Provided			
	Controller protection box		CR750-MB			CR750 : ☐ Not provided ☐ Provided		
			CR751-MB		CR751 : ☐ Not provided ☐ Provided			
	RT ToolBox2		3D-11C-WINE		□ Not provided □ Windows XP/Vista/7/8/8.1 English CD-ROM			
	RT ToolBox2 mini		3D-12C-WINE			□ Not provided □ Windows XP/Vista/7/8/8.1 English CD-ROM		
	Instructions manual		5F-FF03-PE01 ☐ Not provided ☐ Provided () sets					

_				
	Robot	selection	check	list

Work description	☐ Material handli	ing □ Assembly □ Machining L/UL □ Sealing □ Testing and inspection □ Other ()	
Workpiece mass	Hand mass	Atmosphere	
()g	()g	Remarks:	



EC-Statement of Compliance

No. E6 15 02 25554 053

Holder of Certificate: Mitsubishi Electric Corporation

Tokyo BILD., 2-7-3 Marunouchi,

Chiyoda-ku Tokyo

100-8310 JAPAN

Name of Object:

Industrial, Scientific and Medical

equipment

Industrial Robot

Model(s):

F series

(See Attachment for Nomenclature)

Description of

Object:

Rated Voltage:

230 VAC

Rated Power:

1.7 kW

Protection Class: 1

Tested according to:

EN 61000-6-4/A1:2011

EN 61000-6-2:2005

This EC-Statement of Compliance is issued according to the Directive 2004/108/EC relating to electromagnetic compatibility. It confirms that the listed apparatus complies with such aspects of the essential requirements of the EMC directive as specified by the manufacturer or his authorized representative in the European Community and applies only to the sample and its technical documentation submitted to TÜV SÜD Product Service GmbH for testing and certification. See also notes overleaf.

Technical report no.:

73552066

Date, 2015-02-10 (Johann Roidt)



TÜV SÜD Product Service GmbH is Notified Body to the Directive 2004/108/EC of the European Parliament and of the council with the identification number 0123.

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Statement No.

E6 15 02 25554 053



Product Service

A: Model name of **F** series Robot description is shown as follows. A1:RH-3FH,RH6FH,RH-2FH series 1.7kW

RH-x FH xx xx x - x x x-Sxx

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)

(1)RH: Horizontal Robot

(2) Maximum Payload specification:

3 : 3kg **2** : 2kg

6 : 6kg

(3) **F** : **F** series robot

(4)**H** :4 joints

(5) Robot Arm length(No1 and No2 arm) specification:

35 : 350 mm arm **15** : 150 mm arm

45 : 450 mm arm **55** : 550 mm arm

(6) Z stroke length specification:

12 : 120 mm arm **25** : 250 mm arm

15 : 150 mm arm 20 : 200 mm arm 34 : 340 mm arm

(7) Dimension and Ambient specification:

M : Oil mist model(IP65)C : Clean room model(ISO5)

[none] : Basic model(IP54)

(8) Type of Robot controller cabinet

[none] :CR750 controller

1 :CR751 controller

(9)Robot controller type:

Stand alone typeiQ platform type

(10)Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(11)Optional Specification:

1 :normal type

SM :added cabinet box over Robot controller for oil mist resist

Sxx :Mechanical option

Statement No.

E6 15 02 25554 053



A2:RH-12FH,RH-20FHseries 1.7kW

RH-x FH xx xx x - x x x-Sxx

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)

(1)RH: Horizontal Robot

(2) Maximum Payload specification:

12 : 12kg 20 : 20kg

: F series robot (3) **F**

(4)**H** :4 joints

(5) Robot Arm length(No1 and No2 arm) specification:

: 550 mm arm 55 70 : 700 mm arm 85 ; 850 mm arm 100 : 1000 mm arm

(6) Z stroke length specification:

35 : 350 mm arm : 450 mm arm 45

(7) Dimension and Ambient specification:

: Oil mist model(IP65) : Clean room model(ISO3) C : Special spec. For EU(IP54) N

[none]: Basic model(IP20)

(8) Type of Robot controller cabinet

[none] :CR750 controller :CR751 controller 1 (9)Robot controller type:

:Stand alone type :iQ platform type Q

(10)Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(11)Optional Specification:

1 :normal type

:added cabinet box over Robot controller for oil mist resist SM

Statement No.

E6 15 02 25554 053



Product Service

A3:RV-2Fseries 1.7kW

RV-x F x x - x x x-Sxx

(1) (2) (3) (4)(5) (6)(7) (8) (9)

(1) RV: Vertical Robot

(2) Maximum Payload specification:

2 : 2kg

: F series robot (3) **F**

(4)Robot Joint type

:All axes have brake units.

[none] :J4 axis doesn't have brake unit.

(5)Robot Arm length

: Long Arm model [none] : normal model

(6) Type of Robot controller cabinet

[none] :CR750 controller :CR751 controller

(7)Robot controller type:

:Stand alone type :iQ platform type

(8)Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(9)Optional Specification:

1 :normal type

:added cabinet box over Robot controller for oil mist resist SM

CERTIFICATE

Attachment

Statement No.

E6 15 02 25554 053



Product Service

A4:RV-4F,7Fseries 1.7kW

RV - x F x x x - x x x - Sxx

(1) (2) (3) (4)(5) (6)

(10)(7) (8) (9)

(1)RV: Vertical Robot

(2) Maximum Payload specification:

: 4kg 7 : 7kg

: F series robot (3) **F**

(4) Robot axes:

: 5 axes model [none]: normal model

(5) Robot arm length:

: Long arm model [none]: normal model

(6) Dimension and Ambient specification:

: Oil mist model(IP67) M : Clean room model(ISO3) C

[none] : Basic model(IP40)

(7) Type of Robot controller cabinet

:CR750 controller [none] :CR751 controller (8)Robot controller type:

:Stand alone type D

:iQ platform type Q

(9)Standard:

0: normal type 1:CE marking model

2:CE marking and UL model

(10)Optional Specification:

:normal type 1

:added cabinet box over Robot controller for oil mist resist SM

:Internal tube and wires are extended to J6 axis. SH

ZERTIFIKAT + CERTIFICATE

Attachment

Statement No.

E6 15 02 25554 053



Product Service

A5:RV-13F,20F,7FLLseries 1.7kW

RV-x F x x - x x x - Sxx

(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1) RV: Vertical Robot

(2) Maximum Payload specification:

13

: 13kg

20

: 20kg

7

: 7kg

(3) F

: F series robot

(4) Robot arm length:

: Long arm model

LL

: Long reach(1503mm) model (for onlyRV-7FLL series)

[none]: normal model

(5) Dimension and Ambient specification:

M

: Oil mist model(IP67)

C

: Clean room model(ISO3)

[none] : Basic model(IP40)

(6) Type of Robot controller cabinet

[none]

:CR750 controller

:CR751 controller

(7)Robot controller type:

D

:Stand alone type

Q

:iQ platform type

(8)Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(9)Optional Specification:

1

:normal type

SM

:added cabinet box over Robot controller for oil mist resist

SH Sxx :Internal tube and wires are extended to J6 axis. :Mechanical option

Statement No.

E6 15 02 25554 053



Product Service

A6:RH-1FHR,RH-3FHR series 1.7kW

RH-x F HR xx xx x - x x x - Sxx

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)

: 750 mm arm

(1)RH: Horizontal Robot

(2) Maximum Payload specification:

: 1kg

3 : 3kg

55

; **F** series robot (3) **F**

:4 joints ,reverse mount model (4)**HR**

(5) Robot Arm length(No1 and No2 arm) specification:

75 : 350 mm arm

: 550 mm arm

(6) Z stroke length specification:

: 120 mm arm 12 : 150 mm arm 15

(7) Dimension and Ambient specification:

W : Water proof model : Oil mist model M

: Clean room model(ISO5)

[none] : Basic model(IP54)

(8) Type of Robot controller cabinet

[none] :CR750 controller :CR751 controller (9)Robot controller type:

:Stand alone type D Q :iQ platform type

(10)Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(11)Optional Specification:

:normal type 1

:added cabinet box over Robot controller for oil mist resist SM

Statement No.

E6 15 02 25554 053



Product Service

B: Model name of **F** series Robot controller description is shown as follows.

CR750- $xx \times x \times x - x - x - Sxx$

(2) (3) (4) (5) (6) (7) (1)

(1)CR750: CR750 controller

CR751: CR751 controller (2) Maximum Payload specification:

01 : 1kg

03 : 3kg

06 : 6kg

12 : 12kg

20 : 20kg

02

: 2kg

04 : 4kg

07 : 7kg

13 : 13kg

(3) Robot type

Н : Horizontal robot

: Horizontal robot(reverse mount) HR

V : Vertical robot

VJ : 5 axes Vertical robot

: for only RV-7FLL series VL

(4)Robot controller type

:stand alone D

Q :iQ platform type

(5)Standard

:CE marking model

:CE marking and UL model

(6)Operation Panel

:No panel type [none]

:Panel type

(7)Power input connector type

[none] :normal type

:Added cable with a connector and a terminal P2

:Added cable with a connector and a terminal block P3

(8)Optional Specification

[none] :normal

:Added Cabinet box over robot controller for oil mist resist SM



EC DECLARATION OF CONFORMITY (According to EMC Directive) EC DECLARATION OF INCORPORATION (According to Machinery Directive)

We.

Manufacturer:

MITSUBISHI ELECTRIC Corporation Nagoya Works

Address

1-14 Yada-Minami 5-Chome Higashi-Ku, Nagoya 461-8670, Japan

(Place of Declare):

Declare under our sole responsibility that the Product

Description:

Industrial Robot

Type of Model:

F series

Notice:

Details of Serial number are as per attached Nomenclature.

Restrictive use:

For industrial environment only

Conforms with the essential requirements of the EMC Directive 2004/108/EC and the Machinery Directive 2006/42/EC, based on the following specifications applied:

EU Harmonized Standar	Non-harmonized Standard			
EMC(2004/108/EC)	EN 61000-6-4:2007+A1:2011 EN61000-6-2:2005	N/A		
Machinery (2006/42/EC)	Type A:Fundamental safety standards EN ISO12100-1:2003 EN ISO12100-2:2003 EN 1050:1997	N/A		
4. T. A.	Type B:Group safety standards B1:Safety aspects EN60204-1:2006, ISO 13857:2008, ISO 13854:1996			
	IEC61326-3-1:2008 ISO13849-1:2006 (Category 3 and Performance level "d") Type C:Machine Safety standard			
K 2 2 2	ISO10218-1:2011			

and therefore complies with the essential requirements and provisions of the EMC Directive and the Machinery Directive.

< Partly completed Machinery>

This product meets the specification and/or the performance by correct installing. So it must not be used until being installed into the final machinery of the customer.

Issue Date (Date of Declaration):

Feb 23 20/5-

The identity and signature of the person empowered to bind the manufacturer or his authorized representative.

(signature

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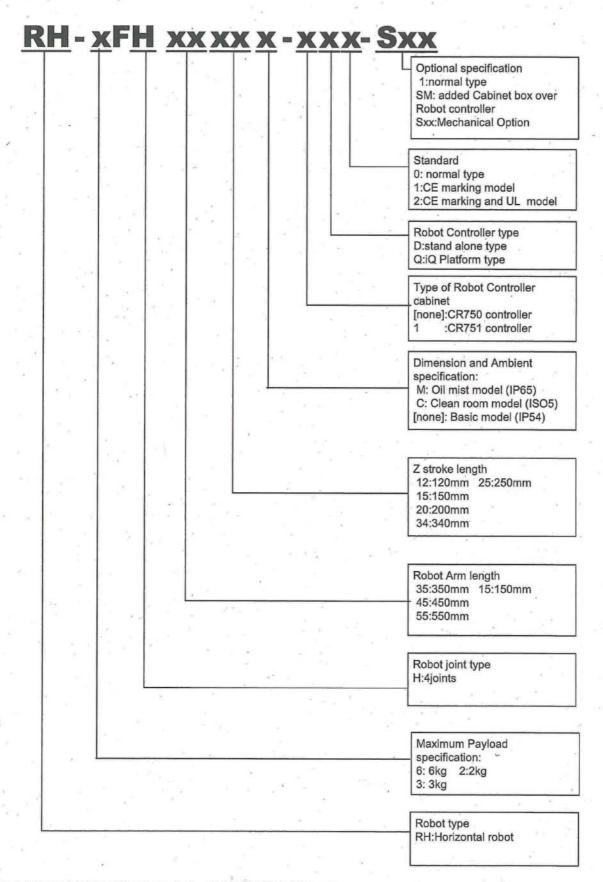


Fig.1-1 Nomenclature of F series robot of RH-6FH,3FH ,2FH series

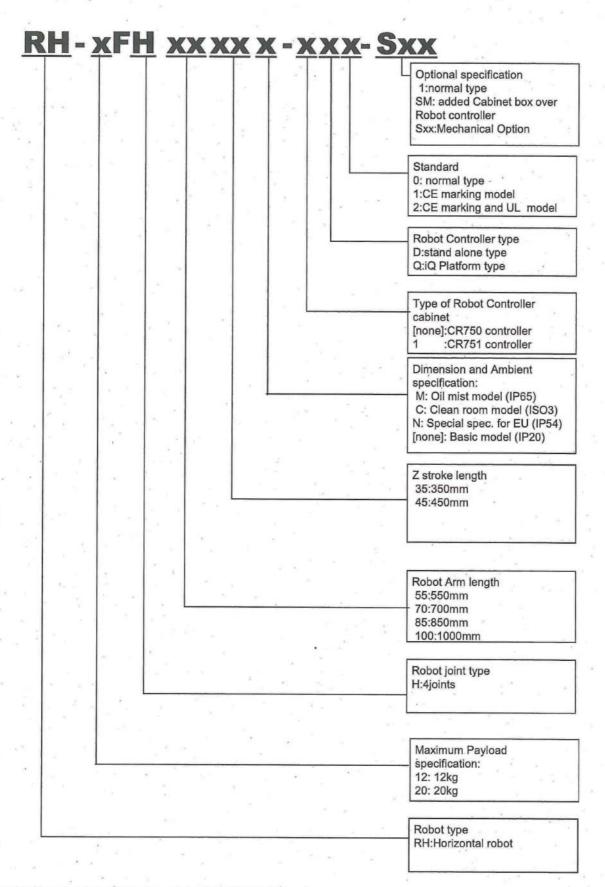


Fig.1-2 Nomenclature of F series robot of RH-12FH,20FH series

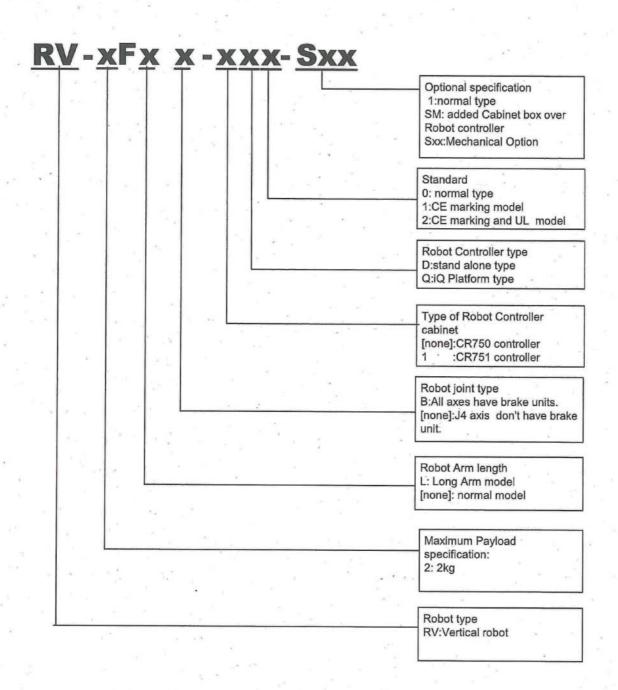


Fig.1-3 Nomenclature of F series robot of RV-2F series

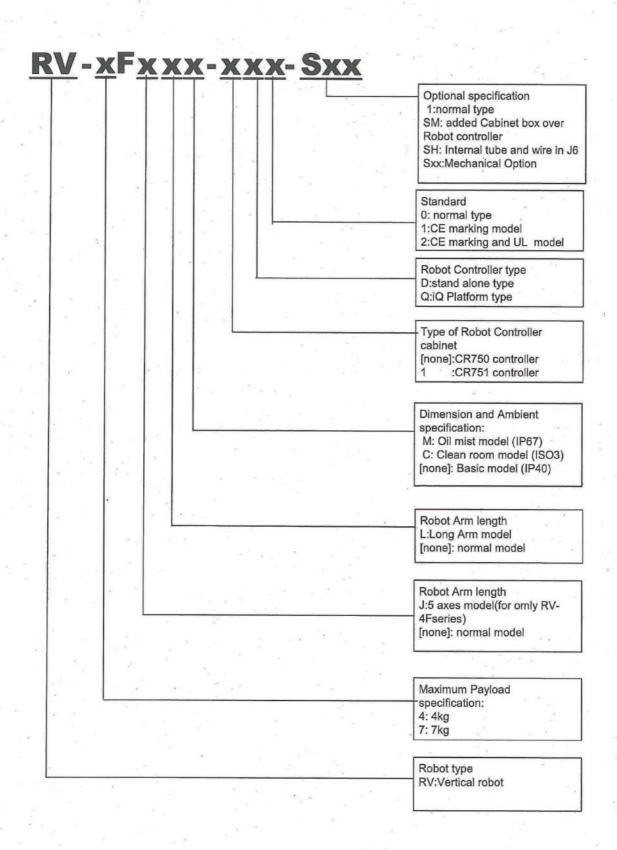


Fig.1-4 Nomenclature of F series robot of RV-4F,7F series

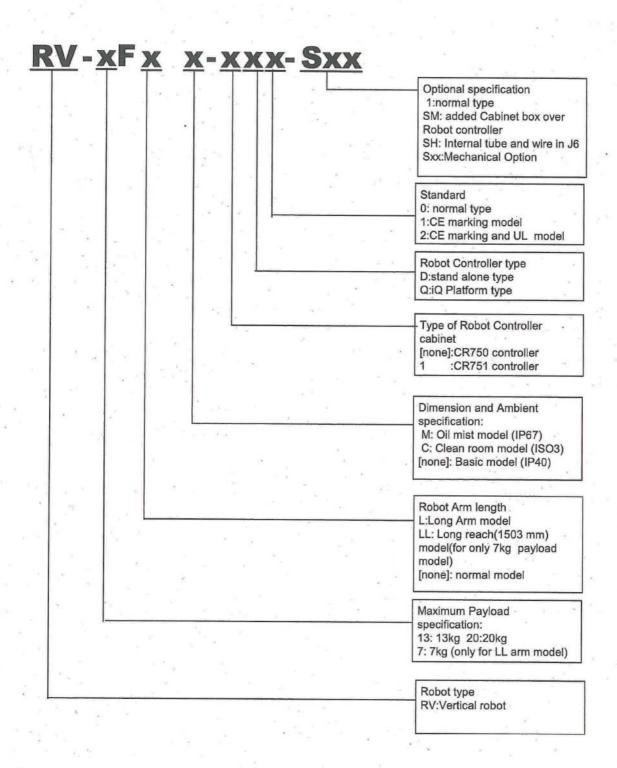


Fig.1-5 Nomenclature of F series robot of RV-13F,20F,7FLL series

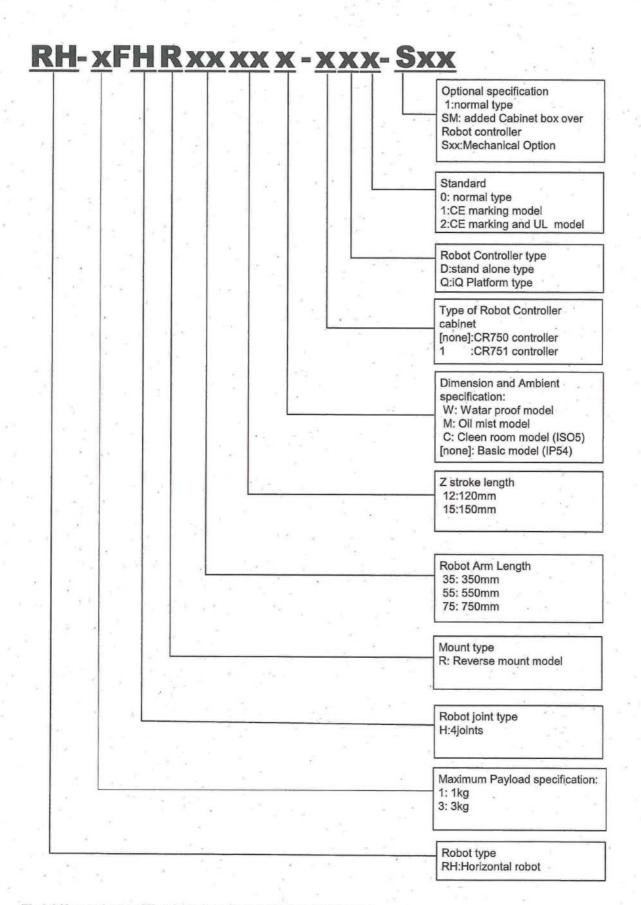


Fig.1-6 Nomenclature of F series robot of RH-1FHR, RH-3FHR series

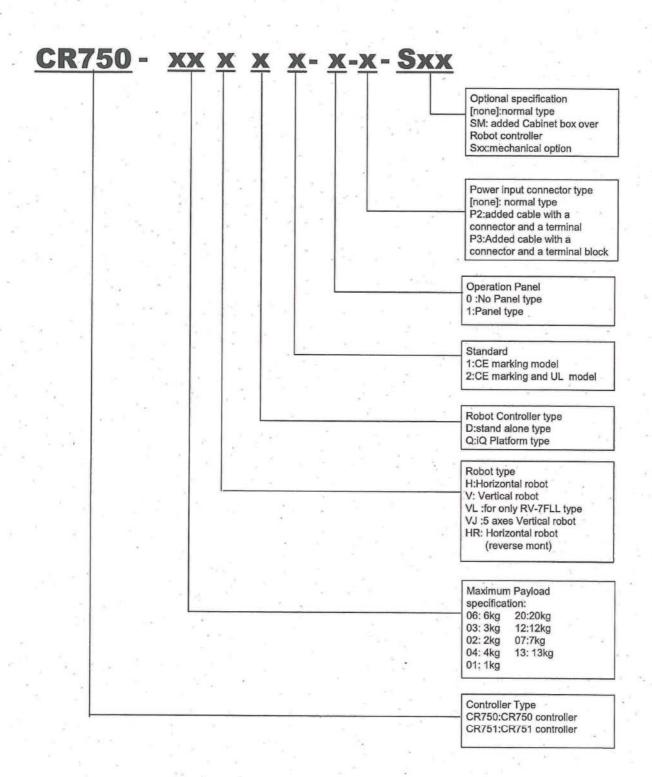


Fig.2-1 Nomenclature of F series robot controller

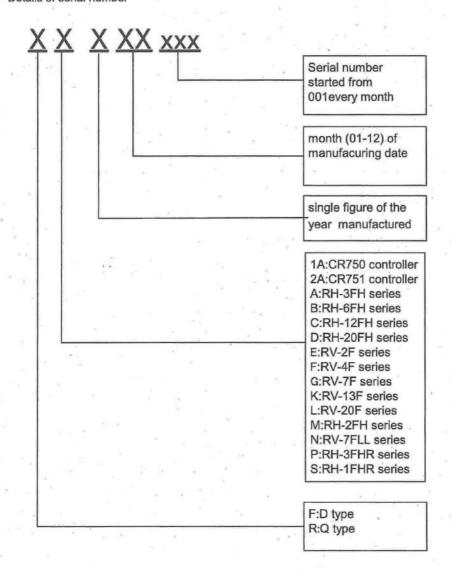


Fig.3.1 Nomenclature of serial number about F series Robot and robot controller

Revision history

Date	Specifications No.	Details of revisions	Rev.
April 16,2012		First print	*
May 25, 2012		Q type are added.	Α
Oct 1, 2012	Fig.1-2,1-3,1-4 added	RH-12/20FH-D series,RV-2F-D series,RV-4F/7F-D series are added.	В
Nov 1,2012	P1 P3-P7	Form is changed. RH-12/20FH-Q series,RV-2F-Q series,RV-4F/7F-Q series are added "Details of serial No." is added	С
Apr 15, 2013	P2,P6,P7,P8	RH-2FH series,RV-13F,20FH,7FLL series are added	D
Mar 12,2014	P1 P5	Standards are updated. "J"option added (RV-4FJseries added)	
Apr 24, 2014	P1	Standards are updated.	_
Jul 9 2014	P7	RH-3FHR series and RH-1FHR series are added.	1
Feb.3,2015	3,2015 P1 Standards are updated. P4 Nomenclature of RV-2F series update(added RV-2FL series added)		G

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