

mitsubishi

Mitsubishi Industrial Robot

CR751-Q Controller

RV-4F-Q/7F-Q/13F-Q/20F-Q Series

Standard Specifications Manual

MELFA

BFP-A8973-E



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



WARNING

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.

 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.)

 CAUTION

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

 CAUTION

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

 CAUTION

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

 WARNING

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

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

 CAUTION

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

 CAUTION

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

 CAUTION

Never carry out modifications based on personal judgments, 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

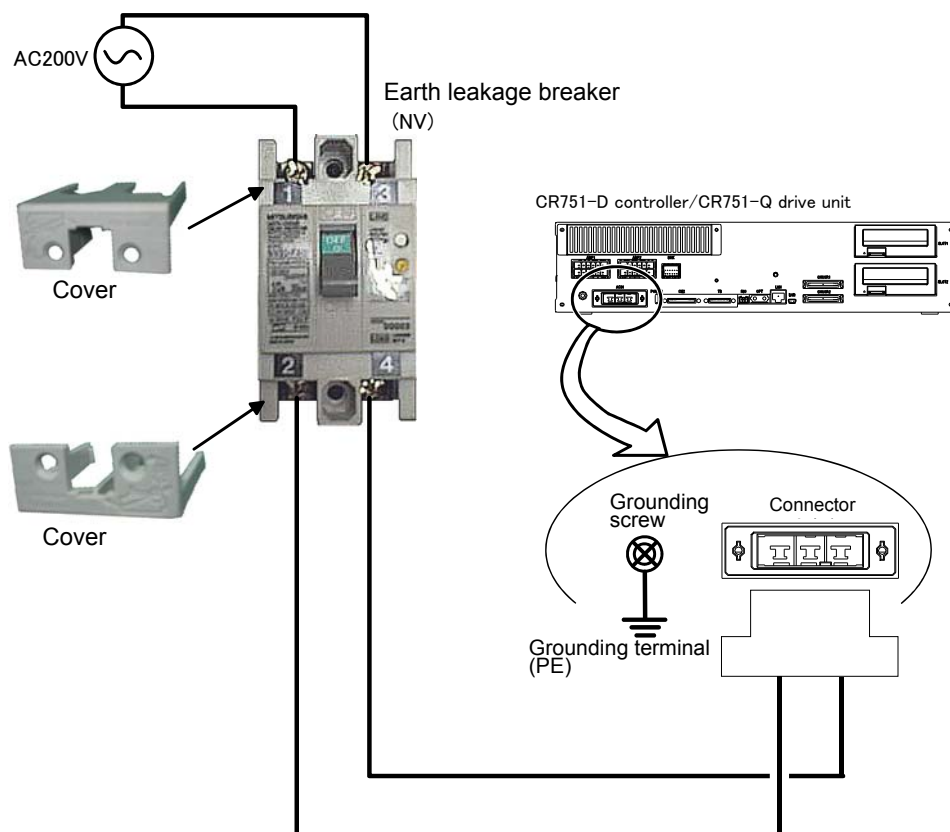
Do not turn off the main power to the robot controller while rewriting the internal information of the robot controller such as the program or parameters. If the main power to the robot controller is turned off while in automatic operation or rewriting the program or parameters, the internal information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

*CR751-D or CR751-Q controller

Notes of the basic component are shown.

⚠ 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.



■Revision history

Date of print	Specifications No.	Details of revisions
2013-03-11	BFP-A8973	<ul style="list-style-type: none"> • First print.
2013-04-04	BFP-A8973-A	<ul style="list-style-type: none"> • The diameter of A/B ports on the optional solenoid valve set for RV-13F/20F series were corrected. (formerly: $\phi 4$) • The values of "Allowable moment load" and "Allowable inertia" of RV-20F were corrected. • "Table 2-4: Position of center of gravity for loads (for loads with comparatively small volume): RV-20F" was added.
2013-07-19	BFP-A8973-B	<ul style="list-style-type: none"> • The length of the machine cable of a RV-13F series standard configuration equipment was added. • "Declaration of Incorporation" and "EC-Statement of Compliance" were updated. • "Table 2-28: Pin assign of hand input cable" was corrected. • The variations of an optional hand curl tube for RV-13F/13FL/20F were added. • "6.4 EMC installation guideline" was added. • Outside dimensions and operating range diagrams of RV-7FLL, RV-13F/20F and RV-13FL were changed. • "1.3 CE marking specifications" was added. • The outside dimension and shape of the optional solenoid valve set for RV-13F series was changed. • The color of wires of GR2 connector in "2.5.6 Wiring and piping system diagram for hand" was corrected. • The cautions of operating in a low temperature environment or after a prolonged stop in "6.3 Precautions for handling" were modified. • The caution about fumigation of wood packing was added to "6.3 Precautions for handling". • The caution about reduction gear of J1 to J3 axes of the RV-13F series was added. • The cable length of Forearm external wiring set/Base external wiring set were added.
2013-09-18	BFP-A8973-C	<ul style="list-style-type: none"> • "Fig.6-6: Limitations when connecting the relay etc. (CR751)" was corrected. (Error output → Emergency stop output, Contactor controleoutput for additional axes → Error output) • The drawings of mechanical interface of SH01 to SH05 of RV-13F/13FL/20F robot were added to "2.5.1 Wiring and piping for hand". • The outline drawing and attachments of the solenoid valve set for RV-4F/7F series are changed. • "1.2.1 How to identify the robot model" was modified. • "1.3 CE marking specifications" was corrected.
2014-01-08	BFP-A8973-D	<ul style="list-style-type: none"> • The descriptions of RV-4FJL were added. • The descriptions of clean and oil mist specifications of RV-7FLL were added. • The cable fixation plate was added to Fig.3-3 and Fig.3-4 (Outside dimensions of drive unit). • Conditions for the flexed type cables were corrected. • The description of "MELFA BASIC IV" was added to "Table 3-1: Specifications of controller". • The type name of the SSCNET III cable (5m) was corrected to MR-J3BUS5 M-A. • The outside dimensions of RV-13F series (RV-7FLL, RV-13F/FL, and RV-20F) were updated to Rev. B.
2014-03-31	BFP-A8973-E	<ul style="list-style-type: none"> • The grounding representation was corrected. • The shape of the left shoulder part of RV-4F/4FL and RV-7F/7FL were changed. • The types of the ACIN terminal were added.

■ Introduction

This series is a full-scale industrial vertical multi-joint type robot that is designed for use in machining processes and assembling. This series supports varied environments, offering a variety of specifications including clean specification, oil mist specification and long-arm specification.

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 9, "2 Robot arm"](#), the specifications related to the controller [Page 77, "3 Controller"](#), and software functions and a command list [Page 116, "4 Software"](#) separately.

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

*RV-4F-Q/RV-4FL-Q/RV-4FJL-Q (CR751-Q controller) series

Note) Indicates it as RV-4F series.

*RV-7F-Q/RV-7FL-Q (CR751-Q controller) series

Note) Indicates it as RV-7F series.

*RV-7FLL-Q (CR751-Q controller) series *1)

*RV-13F-Q/RV-13FL-Q (CR751-Q controller) series *1)

*RV-20F-Q (CR751-Q controller) series *1)

Note) *1) Indicates it as "RV-13F series" for a general name of these robots.

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- The specifications values are based on Mitsubishi standard testing methods.
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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 (CPU unit + Drive unit)
- (3) The connecting cable for the CPU unit and the drive unit
- (4) Machine cable
- (5) Robot arm installation bolts
- (6) Safety manual, CD-ROM (Instruction manual)
- (7) 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

RV - ◇ F J L ● - 1 Q ▲ - Sxx
 (a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

- (a). RV Indicates the vertical multiple-joint robot.
 Ex.)
 RV: Vertical multiple-joint type.
 RH: Horizontal multiple-joint type.
- (b). ◇ Indicates the maximum load.
 Ex)
 4: 4kg
 7: 7kg
 13: 13kg
 20: 20kg
- (c). F Indicates the F series.
- (d). J Indicates axis configuration.
 Ex)
 Omitted: 6-axis type
 J: 5-axis type (RV-4FJL only)
- (e). L Indicates long arm type.
 Ex)
 Omitted: Standard type
 L or LL: Long arm type
- (f). ● Indicates environment specification.
 Ex)
 Omitted: General specifications (IP40)
 M: Oil mist specifications (IP67)
 C: Clean specifications (ISO class3)
 Note) RV-7FLL has only general environment specification.
- (g). 1 Indicates the controller series.
 1: CR751 controller
- (h). Q Indicates the controller type.
 Q: iQ Platform
- (i). ▲ Technical standard of Conformity.
 Ex)
 Omitted: No conformity of technical standard.
 1: Conforms to the CE Marking
- (j). -Sxx Indicates a special model. In order, limit special specification.
 Ex)
 -SHxx: Indicates the internal wiring and piping specification.
 -Sxx: Indicates a special model.

1.2.2 Combination of the robot arm and the controller

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

Robot arm					Controller
Type name <small>Note1)</small>	Protection specification	Arm length <small>Note2)</small>	Internal wiring and piping specification (Mechanical I/F)	Axial constitution	
RV- □ F-1Q	Standard specification	Standard arm	-	6-axis type	CR751- □ VQ-0
RV-20F-1Q					CR751-20VQ-0
RV- □ FL-1Q		Long arm		5-axis type	CR751- □ VQ-0
RV-4FJL-1Q					CR751-04VJQ-0
RV-7FLL-1Q		Standard arm	equipped <small>Note3)</small>	6-axis type	CR751-07VLQ-0
RV- □ F-1Q-SH					CR751- □ VQ-0
RV-20F-1Q-SH				CR751-20VQ-0	
RV- □ FL-1Q-SH				CR751- □ VQ-0	
RV-4FJL-1Q-SH		Long arm		5-axis type	CR751-04VJQ-0
RV-7FLL-1Q-SH				6-axis type	CR751-07VLQ-0
RV- □ FM-1Q	Protection specification <small>Note4)</small>	Standard arm	-	6-axis type	CR751- □ VQ-0
RV-20FM-1Q					CR751-20VQ-0
RV- □ FLM-1Q		Long arm		5-axis type	CR751- □ VQ-0
RV-4FJLM-1Q					CR751-04VJQ-0
RV-7FLLM-1Q		Standard arm		6-axis type	CR751-07VLQ-0
RV- □ FC-1Q	CR751- □ VQ-0				
RV-20FC-1Q	CR751-20VQ-0				
RV- □ FLC-1Q	Long arm			5-axis type	CR751-04VJQ-0
RV-4FJLC-1Q		6-axis type		CR751-07VLQ-0	
RV-7FLLC-1Q	Clean specification <small>Note5)</small>	Long arm			

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

Note2) The RV-4FJL (5-axis type robot) is long arm type only.

Note3) The types of the internal wiring and piping specification models are shown in [Page 4, "1.2.3 Internal wiring and piping specification types"](#). This robot arm is a shipping special specification model. Check the delivery date.

Note4) This robot arm's protective structure is IP67. The protective structure of all the drive units is IP20 (open type). To protect a drive unit, use the optional controller protection box (IP54).

Note5) The protective structure of all the drive units is IP20 (open type). To use a drive units in a clean environment, install the drive units to a place that does not violate the cleanliness.

1.2.3 Internal wiring and piping specification types

The robot arm with in-wrist cables and piping is available. Before the robot arm is shipped from the factory, the tool cables/piping are built into the robot arm's wrist and pulled out from the side of the mechanical interface. This robot arm model eases wiring/piping tasks at the customer's side and improves the reliability against cable disconnections, etc. The following section shows the types. For wiring/piping system diagram for hand of each models, refer to [Page 46, "2.5.6 Wiring and piping system diagram for hand"](#).

(The unlisted robot arms do not have internal cables/pipes. However, they can use the hand input signals and devices such as a visual sensor.)

Table 1-2 : Internal wiring and piping specification types

Robot-arm type ^{Note1)} RV- □ F-1Q-SH** RV- □ FL-1Q-SH** RV-4FJL-1Q-SH** RV-7FLL-1Q-SH** RV-20F-1Q-SH**	Piping	Wiring (cable for the connection to each equipment)			Base section external wiring set ^{Note2)}
		Hand input signal	Vision sensor camera	Force sensor unit	
01	φ 4x4 ^{Note3)}	8 points	Not available		Not available
02	Not available	8 points	1	1	1F-HA01S-01
03	Not available	Not available	1	1	1F-HA02S-01
04	φ 4x2	8 points	–	1	1F-HA01S-01
05	φ 4x2	8 points	1	–	1F-HA01S-01

Note1) " □ " shows the load. 4kg: "4", 7kg: "7", 13kg: "13". The numeral in the table shows the applicable numeral to "**" of the type.

Example) When internal wiring/piping specification is "01" in the standard arm and load is 4 kg, the type name is RV-4F-1Q-SH01.

Note2) The corresponding base external wiring set is attached.

Note3) It can use as a secondary piping of the solenoid-valve set option.

1.3 CE marking specifications

The robot shown in the [Table 1-3](#) is the CE Marking specification.

Table 1-3 : Robot models with CE marking specifications

Robot type	Controller	External signal logic	Language setting
RV- □ F-1Q1-S15 RV- □ FL-1Q1-S15 RV- □ FM-1Q1-S15 RV- □ FLM-1Q1-S15 RV- □ FC-1Q1-S15 RV- □ FLC-1Q1-S15	CR751- □ VQ1-0-S15	Source type	English (ENG)
RV- □ F-1Q1-SH15xx RV- □ FL-1Q1-SH15xx	CR751- □ VQ1-0-S15xx		
RV-7FLL-1Q1-S15	CR751-07VLQ1-0-S15		
RV-20F-1Q1-S15 RV-20FM-1Q1-S15 RV-20FC-1Q1-S15	CR751-20VQ1-0-S15		
RV-20F-1Q1-SH15xx	CR751-20VQ1-0-S15xx		

Note 1) " □ " shows the load. 4kg: "04", 7kg: "07", 13kg: "13".

Note 2) "xx" shows the number of the special specification.

1.4 Contents of the structural equipment

1.4.1 Robot arm

The list of structural equipment is shown in below.

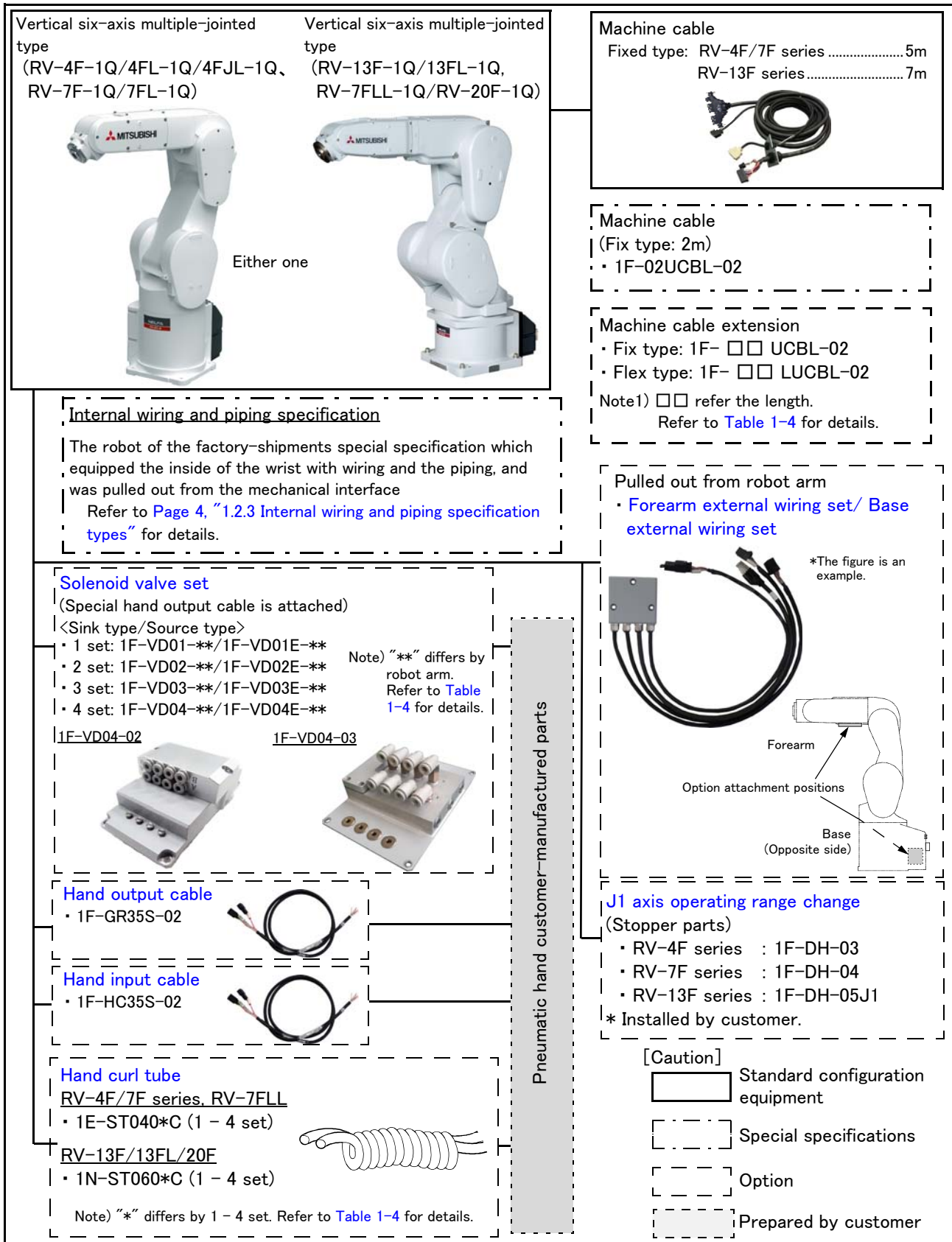


Fig.1-1 : Structural equipment (Robot arm)

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"](#).)

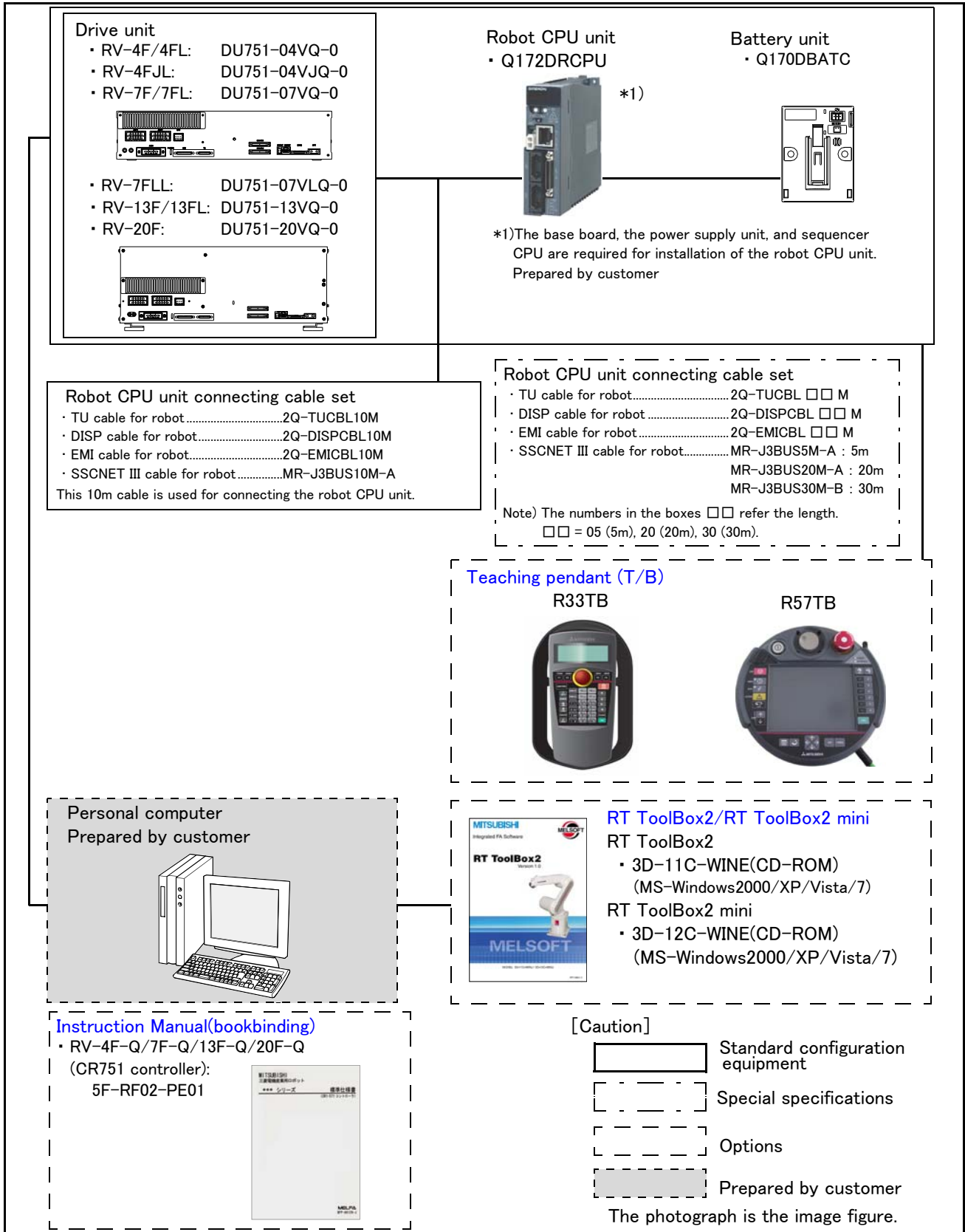


Fig.1-2 : Structural equipment

1.5 Contents of the Option equipment and special specification

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

Table 1-4 : The list of Option equipment and special specification

Item	Type	Specifications	Classification Note1)	Description
Internal wiring and piping specification (robot arm)	RV- □ F-1Q-SH01 RV- □ FL-1Q-SH01 RV-4FJL-1Q-SH01 RV-7FLL-1Q-SH01 RV-20F-1Q-SH01	Functions equipped inside of wrist: Air-hose $\phi 4 \times 4$, Eight hand input signals.	○	
	RV- □ F-1Q-SH02 RV- □ FL-1Q-SH02 RV-4FJL-1Q-SH02 RV-7FLL-1Q-SH02 RV-20F-1Q-SH02	Functions equipped inside of wrist: Eight hand input signals, connection cable for vision-sensor camera, connection cable for force sensor unit.	○	<ul style="list-style-type: none"> The connection with the force sensor unit uses the attached adapter cable in the force-sensor option. The force-sensor option does not support RV-4FJL. The corresponding base external wiring set is attached. The "□" indicates the load mass. ("4" for 4kg, "7" for 7kg, "13" for 13kg.)
	RV- □ F-1Q-SH03 RV- □ FL-1Q-SH03 RV-4FJL-1Q-SH03 RV-7FLL-1Q-SH03 RV-20F-1Q-SH03	Functions equipped inside of wrist: Connection cable for vision-sensor camera and force sensor unit.	○	
	RV- □ F-1Q-SH04 RV- □ FL-1Q-SH04 RV-4FJL-1Q-SH04 RV-7FLL-1Q-SH04 RV-20F-1Q-SH04	Functions equipped inside of wrist: Air-hose $\phi 4 \times 2$, Eight hand input signals, connection cable for force sensor unit.	○	
	RV- □ F-1Q-SH05 RV- □ FL-1Q-SH05 RV-4FJL-1Q-SH05 RV-7FLL-1Q-SH05 RV-20F-1Q-SH05	Functions equipped inside of wrist: Air-hose $\phi 4 \times 2$, Eight hand input signals, connection cable for vision-sensor camera.	○	
J1 axis operating range change	1F-DH-03	Stopper part for RV-4F series: Sets as the + side/- side each by the combination within 30, 73, 103 and 146.	○	This must be installed and setting the parameter by the customer. * Refer to Page 59 , "(2) J1 axis operating range change" for details.
	1F-DH-04	Stopper part for RV-7F series: Sets as the + side/- side each by the combination within 35, 77, 99 and 141.	○	
	1F-DH-05J1	Stopper part for RV-13F series: Sets as the + side/- side each by the combination within 30, 73, 103 and 146.	○	
Machine cable (Replaced to shorter cable)	1F-02UCBL-02	For fixing (Set of power and signal)	○ · □	2m (A 2m cable is supplied instead of the supplied standard cable.)
Extended machine cable	1F- □ □ UCBL-02	For fixing (Set of power and signal)	○	10, 15, 20m
	1F- □ □ LUCBL-02	For flexing (Set of power and signal)	○	10, 15, 20m
Solenoid valve set	1F-VD01-02/VD01E-02	1 set (Sink type)/(Source type)	○	The solenoid-valve set for the hand of the customer setup. Use for RV-4F/7F series and RV-7FLL.
	1F-VD02-02/VD02E-02	2 set (Sink type)/(Source type)	○	
	1F-VD03-02/VD03E-02	3 set (Sink type)/(Source type)	○	
	1F-VD04-02/VD04E-02	4 set (Sink type)/(Source type)	○	
	1F-VD01-03/VD01E-03	1 set (Sink type)/(Source type)	○	The solenoid-valve set for the hand of the customer setup. Use for RV-13F/13FL and RV-20F.
	1F-VD02-03/VD02E-03	2 set (Sink type)/(Source type)	○	
	1F-VD03-03/VD03E-03	3 set (Sink type)/(Source type)	○	
	1F-VD04-03/VD04E-03	4 set (Sink type)/(Source type)	○	
Hand input cable	1F-HC35S-02	Robot side: connector. Hand side: wire.	○	The cable is connected to the sensor by the customer.
Hand output cable	1F-GR35S-02	Robot side: connector. Hand side: wire	○	This cable can be used for the solenoid valve prepared by the customer.

Item	Type	Specifications	Classification Note1)	Description
Hand curl tube	1E-ST0402C	For solenoid valve 1set.: ϕ 4x2	○	Curl type air tube For RV-4F/7F series and RV-7FLL.
	1E-ST0404C	For solenoid valve 2set.: ϕ 4x4	○	
	1E-ST0406C	For solenoid valve 3set.: ϕ 4x6	○	
	1E-ST0408C	For solenoid valve 4set.: ϕ 4x8	○	
	1N-ST0602C	For solenoid valve 1set.: ϕ 6x2	○	Curl type air tube For RV-13F/13FL and RV-20F.
	1N-ST0604C	For solenoid valve 2set.: ϕ 6x4	○	
	1N-ST0606C	For solenoid valve 3set.: ϕ 6x6	○	
	1N-ST0608C	For solenoid valve 4set.: ϕ 6x8	○	
Forearm external wiring set	1F-HB01S-01	The following cables can be wired outside: hand input signals, force sensor and vision sensor.	○	Pulls out from forearm lower part.
	1F-HB02S-01	The following cables can be wired outside: force sensor and vision-sensor.	○	
Base external wiring set	1F-HA01S-01	The following cables can be wired outside: force sensor and vision-sensor.	○	Pulls out from base side.
	1F-HA02S-01	The following cables can be wired outside: force sensor and vision-sensor.	○	
Simple teaching pendant	R33TB	Cable length 7m	○	With 3-position enable switch IP65
	R33TB-15	Cable length 15m	○	
Highly efficient teaching pendant	R57TB	Cable length 7m	○	
	R57TB-15	Cable length 15m	○	
RT ToolBox2 (Personal computer Support software)	3D-11C-WINE	CD-ROM	○	MS-Windows2000/XP/Vista/7 (With the simulation function)
RT ToolBox2 mini (Personal computer Support software mini)	3D-12C-WINE	CD-ROM	○	MS-Windows2000/XP/Vista/7
Robot CPU unit connection cable set	2Q-RC-CBL □ □ M	Cable length 05, 20, 30m	□	This option include TU, DISP, EMI and SSCNET cables.
TU cable for robot	2Q-TUCBL □ M	Cable length 05, 20, 30m	□	For communication between robot CPU and DU.
DISP cable for robot	2Q-DISPCBL □ M	Cable length 05, 20, 30m	□	For communication between robot CPU and DU.
EMI cable for robot	2Q-EMICBL □ M	Cable length 05, 20, 30m	□	For a robot CPU emergency stop input.
SSCNET III cable for robot	MR-J3BUS □ M-A	Cable length 5, 20m	□	For the servo communication between robot CPU and DU .
	MR-J3BUS30M-B	Cable length 30m	□	
Instruction Manual	5F-RF02-PE01	RV-4F/7F/13F-Q series (CR751 drive unit)	○	

Note1) ○ : option, □ : special specifications.

2 Robot arm

2.1 Standard specifications

2.1.1 Basic specifications

(1) RV-4F/7F series

Table 2-1 : Standard specifications of robot (with no internal wiring and piping)

Item		Unit	Specifications				
Type			RV-4F	RV-4FL	RV-4FJL	RV-7F	RV-7FL
Environment			Omitted: Standard specification C: Clean specification M: Oil mist specification				
Degree of freedom			6		5	6	
Installation posture			On floor, hanging, (against wall ^{Note1)})				
Structure			Vertical, multiple-joint type				
Drive system			AC servo motor (brake provided on all axes)				
Position detection method			Absolute encoder				
Motor capacity	Waist (J1)	W	400			750	
	Shoulder (J2)		400			750	
	Elbow (J3)		100			400	
	Wrist twist (J4)		100		-	100	
	Wrist pitch (J5)		100				
	Wrist roll (J6)		50				
Operating range	Waist (J1)	Degree	±240				
	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)		±200		-	±200	
	Wrist pitch (J5)		±120				
	Wrist roll (J6)		±360				
Speed of motion	Waist (J1)	Degree/s	450	420		360	288
	Shoulder (J2)		450	336		401	321
	Elbow (J3)		300	250		450	360
	Wrist twist (J4)		540		-	337	
	Wrist pitch (J5)		623			450	
	Wrist roll (J6)		720				
Maximum reach radius (P point)		mm	514.5	648.7		713.4	907.7
Maximum resultant velocity ^{Note2)}		mm/sec	9,000			8,800	11,000
Load		kg(N)	4			7	
Pose repeatability ^{Note3)}		mm	±0.02				
Cycle time ^{Note4)}		sec	0.36			0.32	0.35
Ambient temperature ^{Note5)}		°C	0 to 40				
Mass		kg	39	41	39	65	67
Allowable moment load	Wrist twist (J4)	N・m	6.66		-	16.2	
	Wrist pitch (J5)		6.66			16.2	
	Wrist roll (J6)		3.90			6.86	
Allowable inertia	Wrist twist (J4)	kg・m ²	0.20		-	0.45	
	Wrist pitch (J5)		0.20			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 sensor etc.>				
Tool pneumatic pipes	Primary piping		φ6×2				
	Secondary piping		φ4×8				
Supply pressure		MPa	0.54				

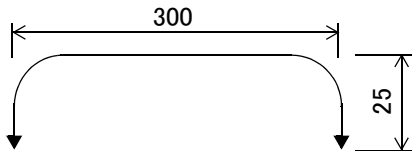
Item	Unit	Specifications
Protection specification ^{Note6)}		Standard specification: IP40 Clean specification: ISO class 3 ^{Note7)} Oil mist specification: IP67 ^{Note8)}
Painting color		Light gray (Equivalent to Munsell: 0.6B7.6/0.2)

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.

Note2) This is the value on the mechanical interface surface when all axes are combined.

Note3) The pose repeatability details are given in [Page 17, "2.2.1 Pose repeatability"](#)

Note4) The required time period to execute one cycle of the following operation pattern with 1kg 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 22, "2.2.6 Protection specifications"](#).

Note7) The details of the clean specifications are described in [Page 23, "2.2.7 Clean specifications"](#).

Note8) The protection performance cannot be ensured with some oil characteristics. Please contact the dealer.

Table 2-2 : Standard specifications of robot (with internal wiring and piping)

Item		Unit	Specifications				
Type			RV-4F-SH	RV-4FL-SH	RV-4FJL-SH	RV-7F-SH	RV-7FL-SH
Environment			Standard specification				
Degree of freedom			6		5	6	
Installation posture			On floor, hanging, (against wall ^{Note1)})				
Structure			Vertical, multiple-joint type				
Drive system			AC servo motor (brake provided on all axes)				
Position detection method			Absolute encoder				
Motor capacity	Waist (J1)	W	400			750	
	Shoulder (J2)		400			750	
	Elbow (J3)		100			400	
	Wrist twist (J4)		100	—	100		
	Wrist pitch (J5)		100				
	Wrist roll (J6)		50				
	Operating range		Waist (J1)	Degree	±240		
Shoulder (J2)		±120			-115 ~ 125	-110 ~ 130	
Elbow (J3)		0 to 161	0 to 164		0 to 156	0 to 162	
Wrist twist (J4)		±200			—	±200	
Wrist pitch (J5)		±120					
Wrist roll (J6)		±200 ^{Note2)}					
Speed of motion		Waist (J1)	Degree/s		450	420	
	Shoulder (J2)	450		336		401	321
	Elbow (J3)	300		250		450	360
	Wrist twist (J4)	540		337			
	Wrist pitch (J5)	623		450			
	Wrist roll (J6)	720		720			
	Maximum reach radius (P point)			mm	514.5	648.7	
Maximum resultant velocity ^{Note3)}		mm/sec	10,000	9,900		12,000	11,700
Load		kg(N)	4			7	
Pose repeatability ^{Note4)}		mm	±0.02				
Cycle time ^{Note5)}		sec	0.36			0.32	0.35
Ambient temperature ^{Note6)}		°C	0 to 40				
Mass		kg	40	42	40	66	68
Allowable moment load	Wrist twist (J4)	N・m	6.66		—	16.2	
	Wrist pitch (J5)		6.66		16.2		
	Wrist roll (J6)		3.90		6.86		
Allowable inertia	Wrist twist (J4)	kg・m ²	0.20		—	0.45	
	Wrist pitch (J5)		0.20		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 sensor etc.>				
Tool pneumatic pipes	Primary piping		φ6×2				
	Secondary piping		φ4×4: forearm section φ4×4: passes through in the wrist. ^{Note7)}				
Supply pressure		MPa	0.54				
Protection specification ^{Note8)}			Standard specification: IP40				
Painting color			Light gray (Equivalent to Munsell: 0.6B7.6/0.2)				

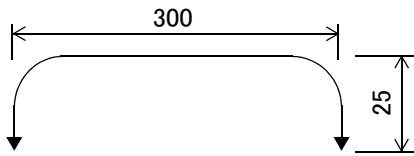
Note1) When used by mounting on the wall, a special specification that limits the operating range of the J1 axis will be used. Please give an order separately.

Note2) The operating range of the wrist roll is small compared to the model without internal cables/pipes.

Note3) This is the value on the mechanical interface surface when all axes are combined.

Note4) The pose repeatability details are given in [Page 17, "2.2.1 Pose repeatability"](#)

Note5) The required time period to execute one cycle of the following operation pattern with 1kg load. The cycle time may be longer depending on the required positioning accuracy for the workpiece and the operating position.



Note6) 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.)

Note7) The internal wiring and piping specification is $\phi 4 \times 4$.

Note8) The protection specification details are given in [Page 22, "2.2.6 Protection specifications"](#).

(2) RV-13F series

Table 2-3 : Standard specifications of robot (with no internal wiring and piping)

Item		Unit	Specifications			
Type			RV-13F	RV-13FL	RV-20F	RV-7FLL
Environment			Omitted: Standard specification C: Clean specification M: Oil mist specification			
Degree of freedom			6			
Installation posture			On floor, hanging (against wall ^{Note1)})			
Structure			Vertical, multiple-joint type			
Drive system			AC servo motor (brake provided on all axes)			
Position detection method			Absolute encoder			
Motor capacity	Waist (J1)	W	1500			
	Shoulder (J2)		1500			
	Elbow (J3)		750			
	Wrist twist (J4)		400			
	Wrist pitch (J5)		200		100	
	Wrist roll (J6)		100		50	
Operating range	Waist (J1)	Degree	±190			
	Shoulder (J2)		-90 to +150			
	Elbow (J3)		-10 to +157.5			
	Wrist twist (J4)		±200			
	Wrist pitch (J5)		±120			
	Wrist roll (J6)		±360			
Speed of motion	Waist (J1)	Degree/s	290	234	110	234
	Shoulder (J2)		234	164	110	164
	Elbow (J3)		312	219	110	219
	Wrist twist (J4)		375		124	375
	Wrist pitch (J5)		375		125	450
	Wrist roll (J6)		720		360	720
Maximum reach radius (P point)		mm	1,094	1,388	1,094	1,503
Maximum resultant velocity ^{Note2)}		mm/sec	10,450	9,700	4,200	15,300
Load Rating (Maximum)		kg	12(13)		15(20)	7(7)
Pose repeatability ^{Note3)}		mm	±0.05			±0.06
Cycle time ^{Note4)}		sec	0.53	0.68	0.70	0.63
Ambient temperature ^{Note5)}		°C	0 to 40			
Mass		kg	120	130	120	130
Allowable moment load	Wrist twist (J4)	N · m	19.3		49	16.2
	Wrist pitch (J5)		19.3		49	16.2
	Wrist roll (J6)		11			6.86
Allowable inertia	Wrist twist (J4)	kg · m ²	0.47		1.4	0.45
	Wrist pitch (J5)		0.47		1.4	0.45
	Wrist roll (J6)		0.14			0.1

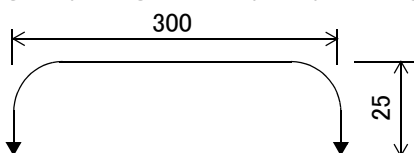
Item		Unit	Specifications	
Tool wiring	Hand input/output		Hand input eight points / hand output eight points	
	LAN cable		Equipped (eight cores) <100BASE-TX>	
	Wiring for user		Equipped (24 cores) <Force sensor etc.>	
Tool pneumatic pipes	Primary piping		$\phi 6 \times 2$	
	Secondary piping		$\phi 6 \times 8$	
Supply pressure		MPa	0.54	
Protection specification ^{Note6)}			Standard specification: IP40 Clean specification: ISO class 3 ^{Note7)} Oil mist specification: IP67 ^{Note8)}	IP40
Painting color			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.

Note2) This is the value on the mechanical interface surface when all axes are combined.

Note3) The pose repeatability details are given in [Page 17, "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 22, "2.2.6 Protection specifications"](#).

Note7) The details of the clean specifications are described in [Page 23, "2.2.7 Clean specifications"](#).

Note8) The protection performance cannot be ensured with some oil characteristics. Contact the dealer.

Table 2-4 : Standard specifications of robot (with internal wiring and piping)

Item		Unit	Specifications			
Type			RV-13F-SH	RV-13FL-SH	RV-20F-SH	RV-7FLL-SH
Environment			Standard specification			
Degree of freedom			6			
Installation posture			On floor, hanging (against wall ^{Note1)})			
Structure			Vertical, multiple-joint type			
Drive system			AC servo motor (brake provided on all axes)			
Position detection method			Absolute encoder			
Motor capacity	Waist (J1)	W	1500			
	Shoulder (J2)		1500			
	Elbow (J3)		750			
	Wrist twist (J4)		400			
	Wrist pitch (J5)		200		100	
	Wrist roll (J6)		100		50	
Operating range	Waist (J1)	Degree	±190			
	Shoulder (J2)		-90 to +150			
	Elbow (J3)		-10 to +157.5			
	Wrist twist (J4)		±200			
	Wrist pitch (J5)		±120			
	Wrist roll (J6)		±200 ^{Note2)}			
Speed of motion	Waist (J1)	Degree/s	290	234	110	234
	Shoulder (J2)		234	164	110	164
	Elbow (J3)		312	219	110	219
	Wrist twist (J4)		375		124	375
	Wrist pitch (J5)		375		125	450
	Wrist roll (J6)		720		360	720
Maximum reach radius (P point)		mm	1,094	1,388	1,094	1,503
Maximum resultant velocity ^{Note3)}		mm/sec	10,450	9,700	4,200	15,300
Load Rating (Maximum)		kg	12(13)		15(20)	7(7)
Pose repeatability ^{Note4)}		mm	±0.05			±0.06
Cycle time ^{Note5)}		sec	0.53	0.68	0.70	0.63
Ambient temperature ^{Note6)}		℃	0-40			
Mass		kg	120	130	120	130
Allowable moment load	Wrist twist (J4)	N・m	19.3		49	16.2
	Wrist pitch (J5)		19.3		49	16.2
	Wrist roll (J6)		11			6.86
Allowable inertia	Wrist twist (J4)	kg・m ²	0.47		1.4	0.45
	Wrist pitch (J5)		0.47		1.4	0.45
	Wrist roll (J6)		0.14			0.1
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 sensor etc.>			

Item		Unit	Specifications
Tool pneumatic pipes	Primary piping		$\phi 6 \times 2$
	Secondary piping		$\phi 4 \times 4$ ^{Note7)}
Supply pressure		MPa	0.54
Protection specification ^{Note8)}			Standard specification: IP40
Painting color			Light gray (Equivalent to Munsell: 0.6B7.6/0.2)

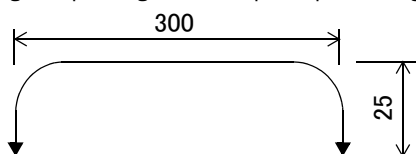
Note1) When used by mounting on the wall, a special specification that limits the operating range of the J1 axis will be used. Please give an order separately.

Note2) The operating range of the wrist roll is small compared to the model without internal cables/pipes.

Note3) This is the value on the mechanical interface surface when all axes are combined.

Note4) The pose repeatability details are given in [Page 17, "2.2.1 Pose repeatability"](#)

Note5) 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.



Note6) 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.)

Note7) The internal wiring and piping specification is $\phi 4 \times 4$.

Note8) The protection specification details are given in [Page 22, "2.2.6 Protection specifications"](#).

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 shown.

Table 2-5 : Value of each counter-force

Item	Unit	Value		
		RV-4F series	RV-7F series	RV-13F series
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 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 9, "2.1.1 Basic specifications"](#).
- (2) [Fig. 2-1](#), [Fig. 2-2](#), [Fig. 2-3](#) and [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 9, "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 overcurrent 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.

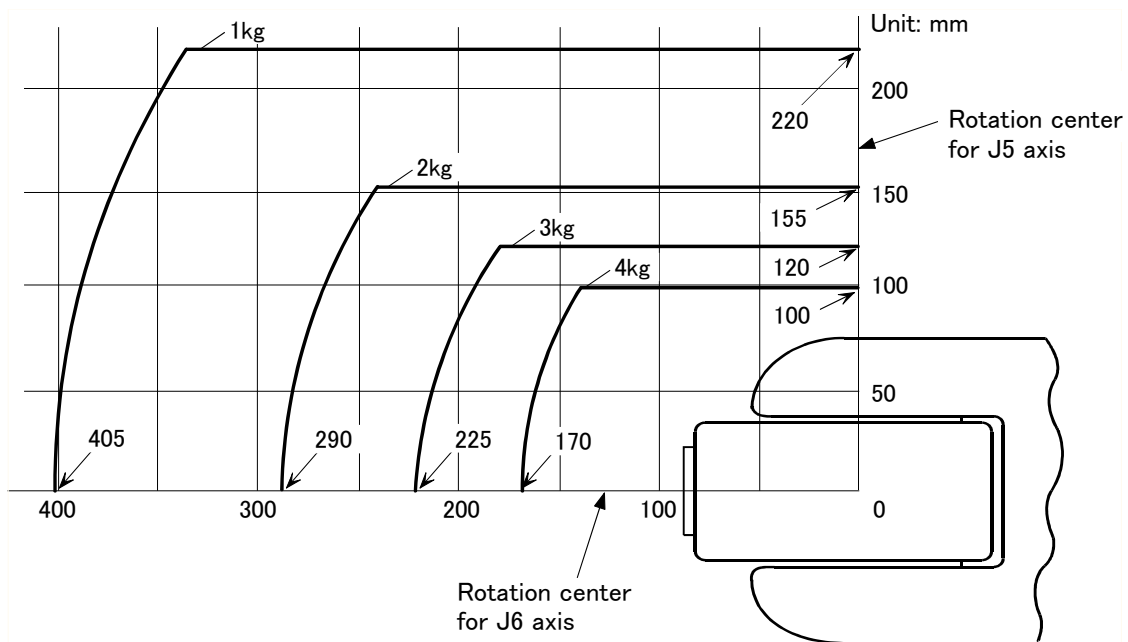


Fig.2-1 : Position of center of gravity for loads (for loads with comparatively small volume): RV-4F/4FL/4FJL

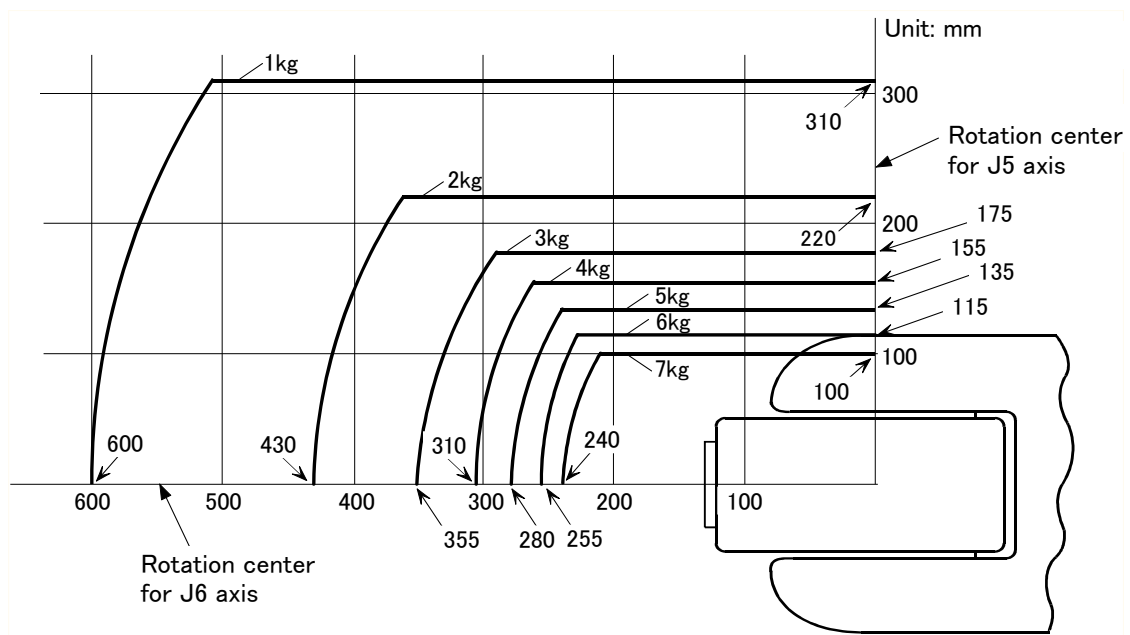


Fig.2-2 : Position of center of gravity for loads (for loads with comparatively small volume): RV-7F/7FL/7FLL

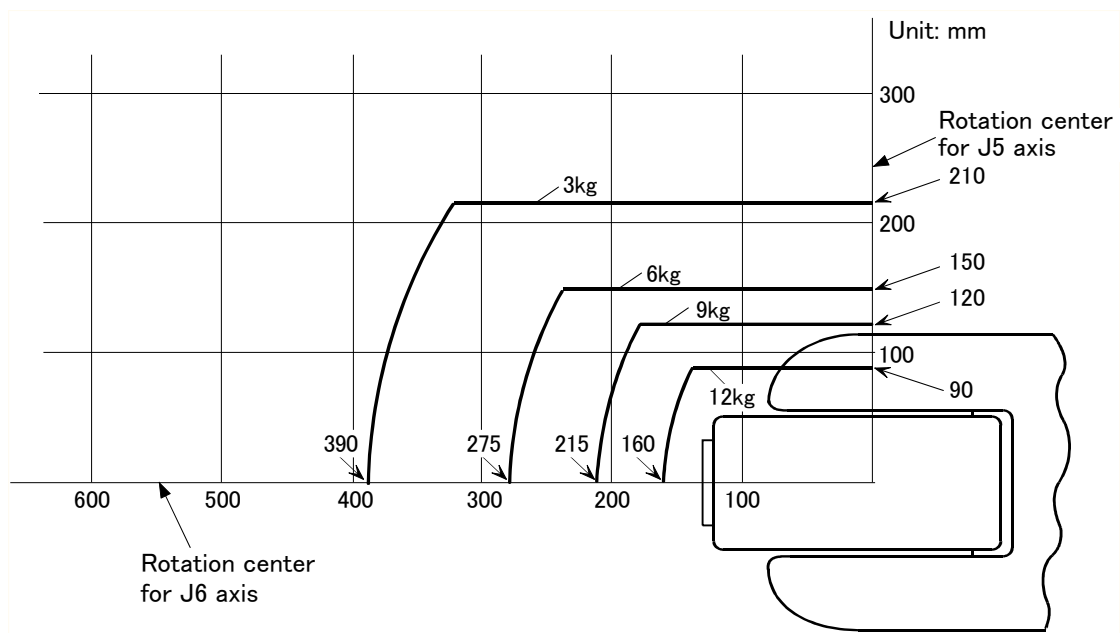


Fig.2-3 : Position of center of gravity for loads (for loads with comparatively small volume): RV-13F/13FL

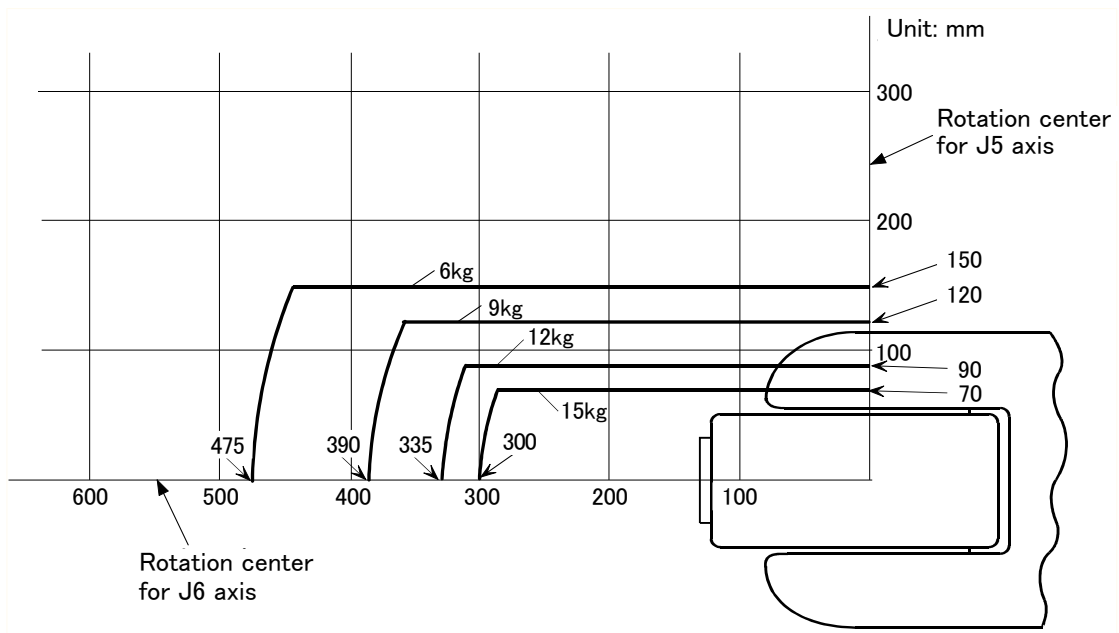


Fig.2-4 : Position of center of gravity for loads (for loads with comparatively small volume): RV-20F

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.

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 2-6.

Even oil mist environment can be used in addition to the general environment.

Table 2-6 : Protection specifications and applicable fields

Type	Protection specifications (IEC Standards value)	Classification	Applicable field	Remarks
RV-4F-1Q/4FL-1Q/4FJL-1Q RV-7F-1Q/7FL-1Q RV-7FLL-1Q RV-13F-1Q/13FL-1Q RV-20F-1Q	IP40	General environment specifications	General assembly Slightly dusty environment	
RV-4FM-1Q/4FLM-1Q/4FJLM-1Q RV-7FM-1Q/7FLM-1Q RV-7FLLM-1Q RV-13FM-1Q/13FLM-1Q RV-20FM-1Q	IP67	Oil mist specifications	Machine tool (cutting) Machine shop with heavy oil mist Dusty work shop	Note that if the cutting machine is using abrasive materials, the robot's life will be shortened.

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

The IEC standard is described by the following "Information" And, the corrosion of the rust etc. may occur to the robot with the liquids, such as the water and the oil.

【Information】

• The IEC IP40

The protection standard for approach in the dangerous spot in the tool. It indicates the protective structure that the proximity probe 2.5mm in diameter must not advance.

• The IEC IP67

Protection against water infiltration as specified in IP67 indicates a protective structure that is not harmfully affected, even if the test device dives underwater for the 30 minutes. The diving depth is shown below. When the height of the test device is less than 850 mm, the position of the lowest part is 1 m from the water surface.

When the height of the test device is 850 mm or more, the position of the highest part is 150 mm from the water surface.

(2) About the use with the bad environment

The robot arm with protection specification (oil mist specification) is made by order. This robot has protection methods that conform to IEC's IP67 standards (splashproof type). Recommended usage conditions.

1) The robot is designed for use in combination with machining device.

2) To ensure IP67 over the warranty period and further, the inside of the robot arm needs to be pressurized.

Use the provided $\phi 8$ joint (AIR PURGE) to supply dry air for pressurizing. The $\phi 8$ joint (AIR PURGE) can be found at the base rear part of the robot arm.

Table 2-7 : Specification of the dry air for pressurization

Item	Dew point	Pressure
Specification	The atmospheric pressure dew point is -20 degree or less.	0.01MPa or less

3) We are confirming examining with the cutting oil, and satisfying protection specification. Our warranty does not cover damages or failure resulting from the robot being operated in any environment where other cutting oils than those listed in the table are used (except cutting oils with respect to which the robot's compatibility with the protection specification is verified through our operability evaluation) or where the robot body may be directly splashed with water, oil or dust in quantities larger than stated in the protection specification.

- 4) Take measures so that the robot will not be exposed to water, oil and/or chips for a long period of time.

Also, entrained water droplets lead to the formation of rust on the robot, but would not usually affect the robot's ability to operate normally.

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 132, "6.2 Working environment"](#).

- 1) In surroundings that generate inflammable gases or corrosive gasses.
- 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.
- 4) Pressurization by the dry air exceeding the specification of [Table 2-7](#).

2.2.7 Clean specifications

(1) Types of clean specifications

The robot arm with clean specification is made by order. Please check the delivery schedule.

Table 2-8 : Clean specifications

Type	Degree of cleanliness	Internal suction	Remarks
RV-4FC-1Q/4FLC-1Q/ 4FJLC-1Q RV-7FC-1Q/7FLC-1Q RV-7FLLC-1Q RV-13FC-1Q/13FLC-1Q RV-20FC-1Q	ISO class3	Concentrated suction with vacuum generating valve. Use it in the clean room with the down flow (flow velocity 0.3 m/s above).	The use of a vacuum generating valve is recommended.

■ Precautions for use

- 1) A $\phi 8$ VACUUM coupling is provided in the base section of the robot arm for vacuum inside the robot arm.
(Refer to [Fig. 2-20](#)) When using the robot, connect this coupling with the vacuum generating valve (Refer to [Table 2-9](#)) and vacuum pump (furnished by the customer).
- 2) To suck in the robot arm, use the vacuum generator of the specification shown in following a) and b).
 - a) When using the vacuum generator

Table 2-9 : Specifications of vacuum generation valve (Confirmed in our company)

Type	Maker	Air pressure ^{Note1)}	Quantity
MEDT 14	KONEGAI CORPORATION	• Vacuum rate: 90.0 L/min(ANR)	1

Note1) It is the vacuum pump maker's written specification.

- b) When using the vacuum pump

Assure the vacuum flow rate of more than 30 L/min. And, secure the exhaust course from the pump not to affect the power supply and the cleanness for the vacuum pumps.

2.3 Names of each part of the robot

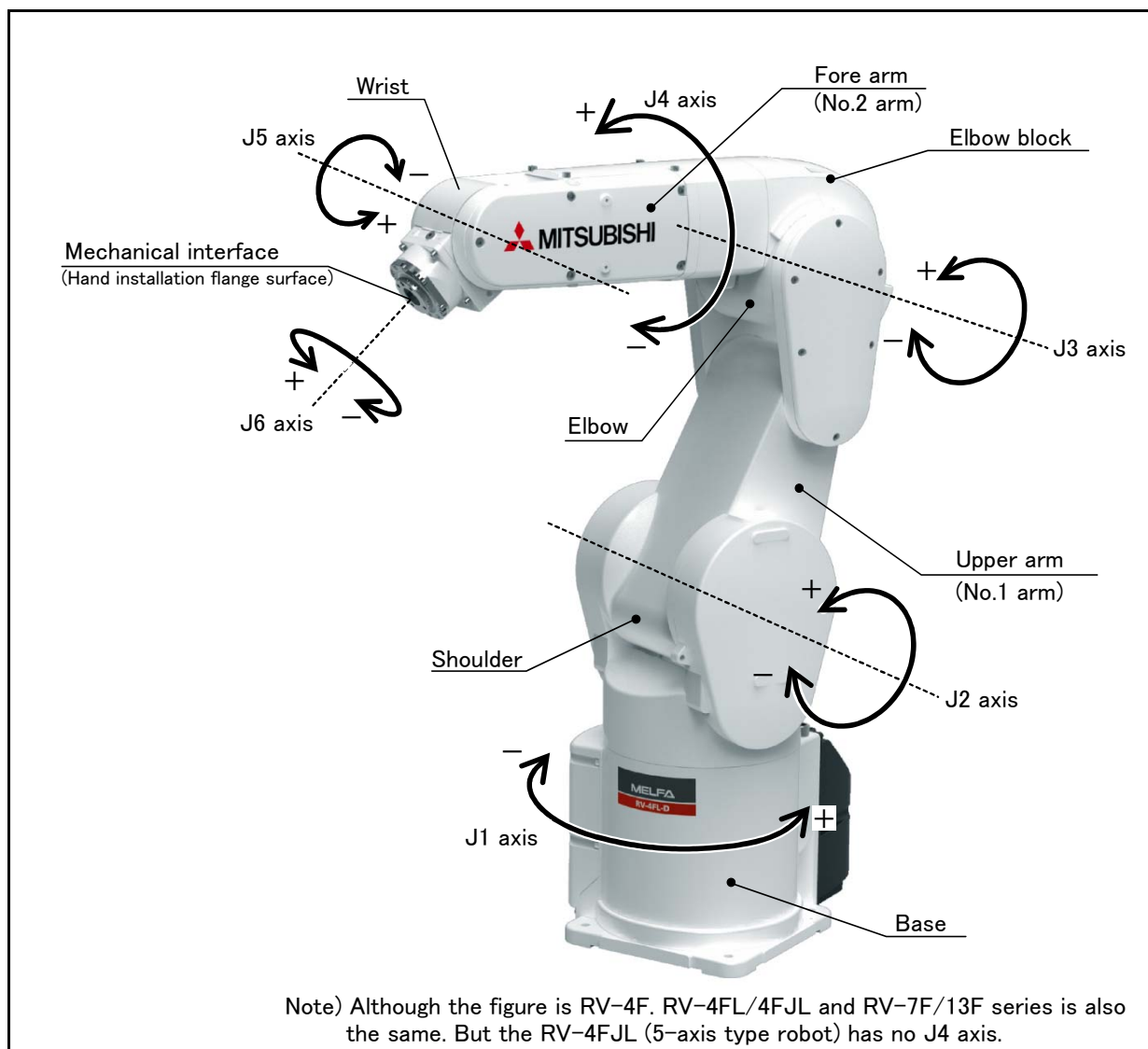


Fig.2-5 : Names of each part of the robot

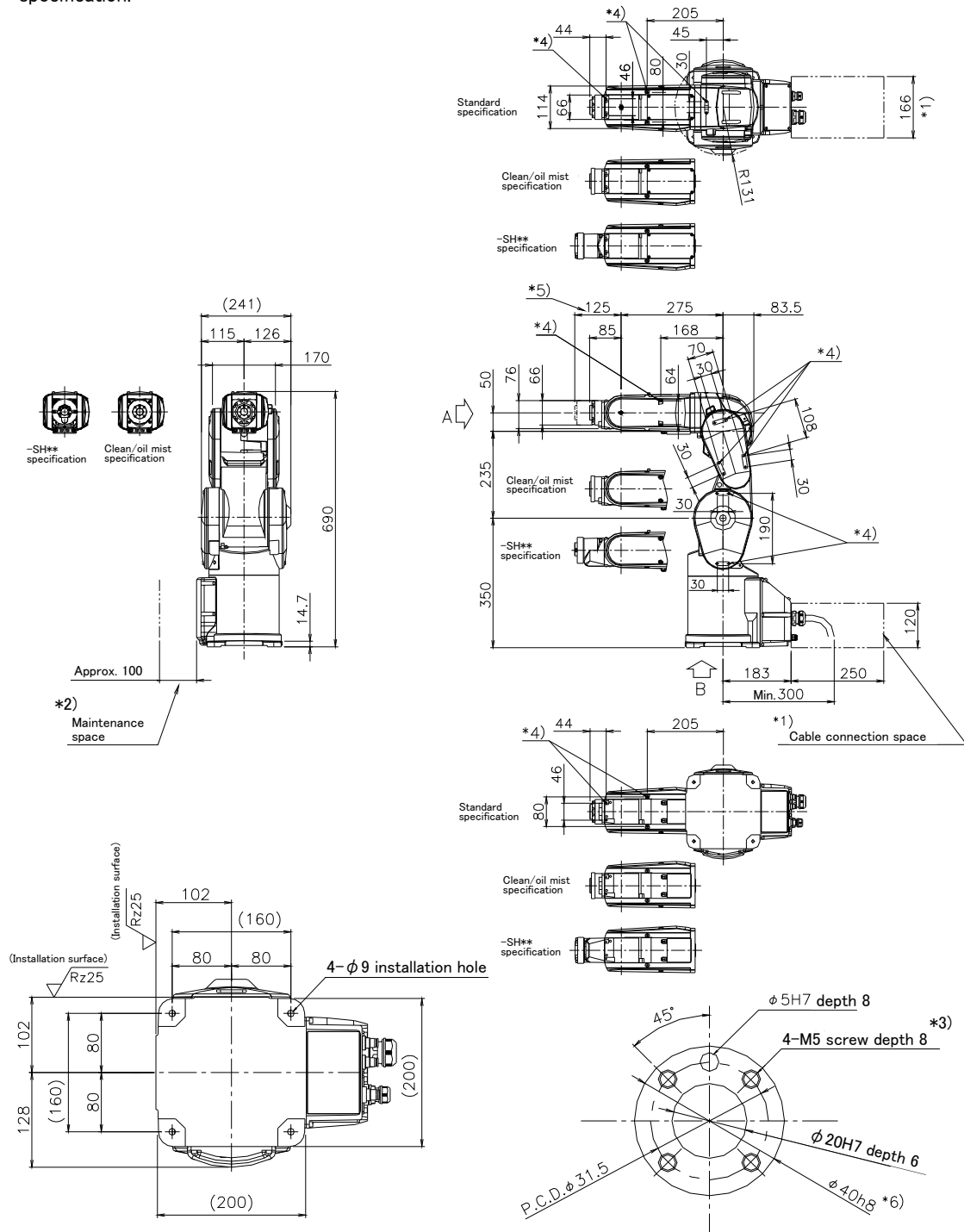
2.4 Outside dimensions • Operating range diagram

(1) RV-4F

Notes

Rev. B

1. *1) Ensure the cable connection space to connect machine cables.
2. *2) Ensure the maintenance space to take out the cover.
3. *3) The screw should go in to a depth of 7.5mm to 8mm.
4. *4) Screw hole (M4 depth 8) for securing the user cables/piping.
5. *5) The size of the internal wiring and piping specification model (-SHxx).
6. *6) The depth is 6mm for the normal specification, 3.5mm for the clean/oil mist specification and 6.5mm for -SH** specification.



View B bottom view drawing: Detail of installation dimension

View A: Detail of mechanical interface

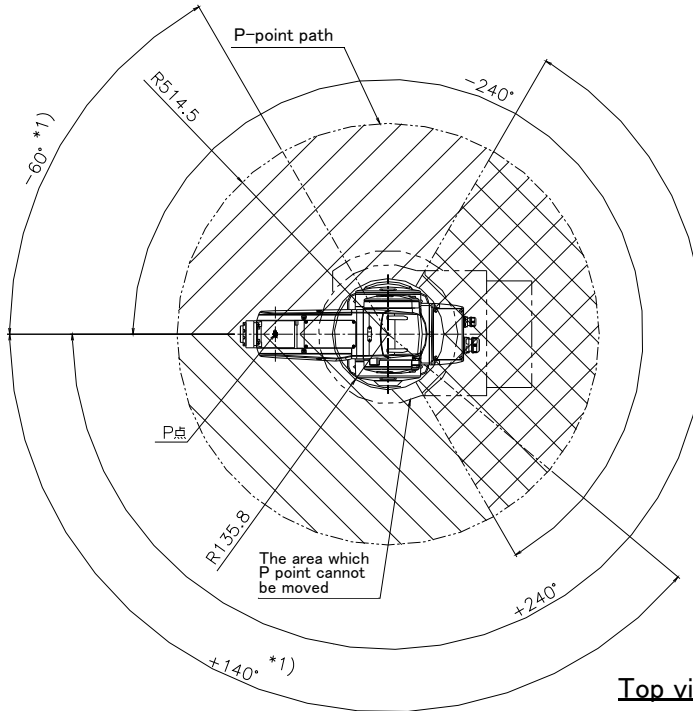
Note) Don't install the robot arm in the position where direct rays or the heat of lighting hits. The skin temperature of the robot arm may rise, and the error may occur.

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

Rev. B

Notes

- *1) Rear face operation limit: When the J axis angle is $-60^\circ \leq J1 \leq +140^\circ$, the J2 axis operation is limited to $-113^\circ \leq J2 \leq +120^\circ$.
- The following figure shows a robot at the position of: $J1=0^\circ$, $J2=0^\circ$, $J3=90^\circ$, $J4=0^\circ$, $J5=0^\circ$, and $J6=0^\circ$
- *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.



Operating range of each axis:

- $J1: \pm 240^\circ$
 $J2: \pm 120^\circ$
 $J3: 0^\circ \sim 161^\circ$
 $J4: \pm 200^\circ$
 $J5: \pm 120^\circ$
 $J6: \pm 360^\circ$
 $J6$ (-SH** specification): $\pm 200^\circ$

When Internal wiring and piping specification (-SH**)

Flange downward limit line

Control point (R point)

Control point of -SH** specification (R point)

P-point path

P-point

R136.8

R514.5

The boundary of the singular-point of flange downward

The area which P point cannot be moved

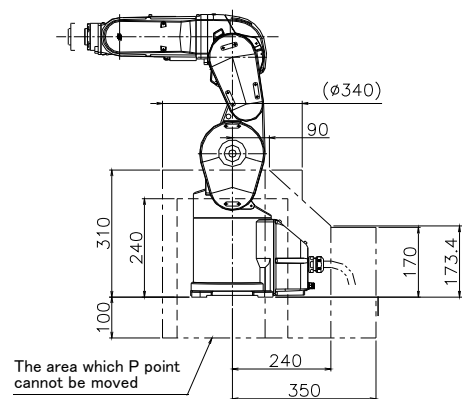
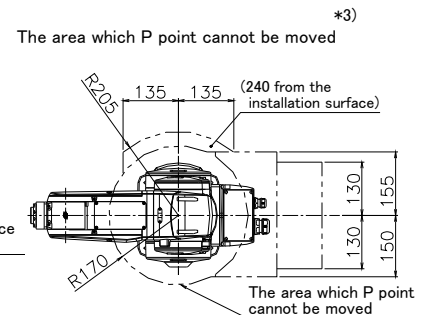
Side view

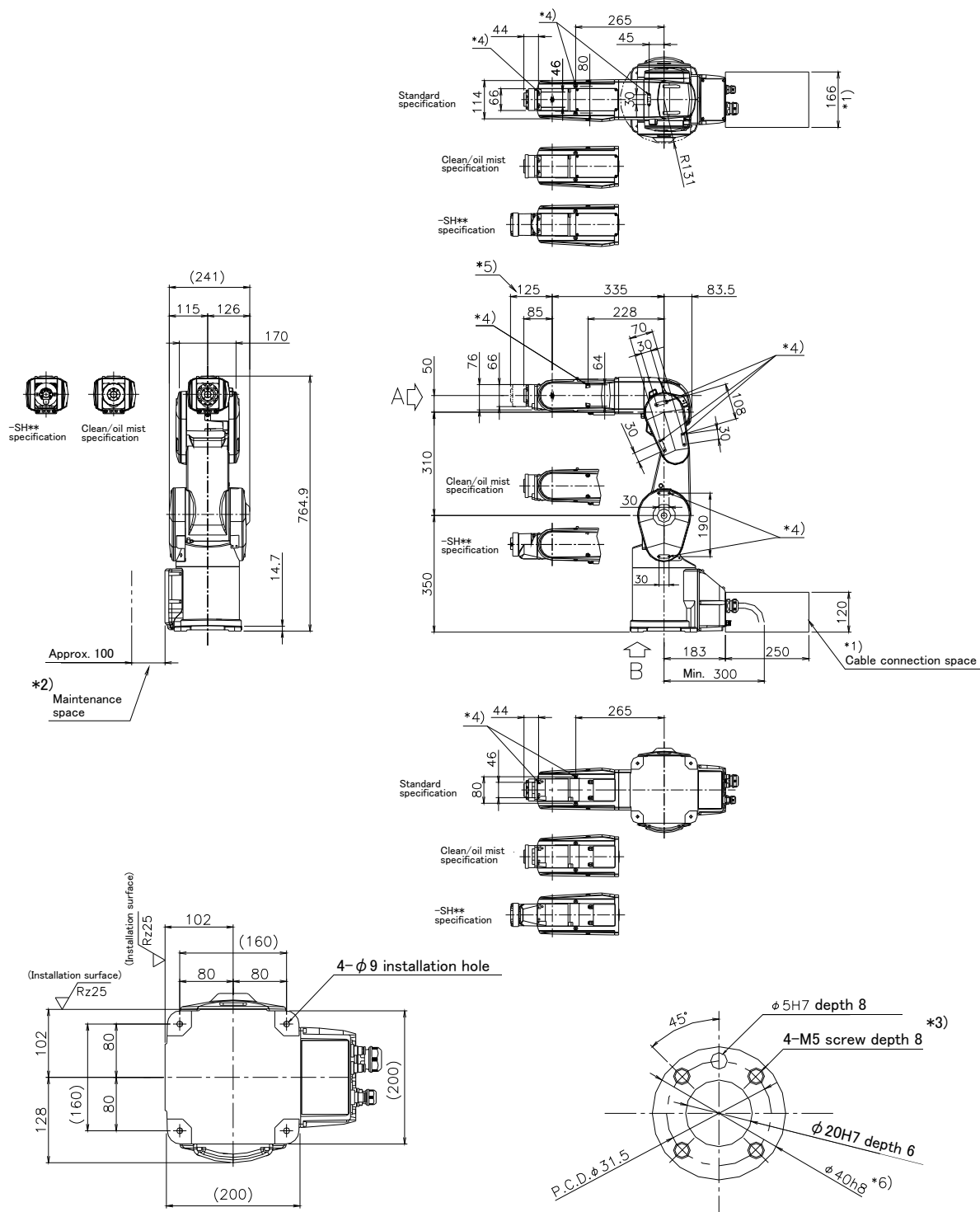
Fig.2-7 : Operating range diagram: RV-4F

(2) RV-4FL/4FJL

Notes

Rev. B

1. *1) Ensure the cable connection space to connect machine cables.
2. *2) Ensure the maintenance space to take out the cover.
3. *3) The screw should go in to a depth of 7.5mm to 8mm.
4. *4) Screw hole (M4 depth 8) for securing the user cables/piping.
5. *5) The size of the internal wiring and piping specification model (-SHxx).
6. *6) The depth is 6mm for the normal specification, 3.5mm for the clean/oil mist specification and 6.5mm for -SH** specification.



View B bottom view drawing: Detail of installation dimension

View A: Detail of mechanical interface

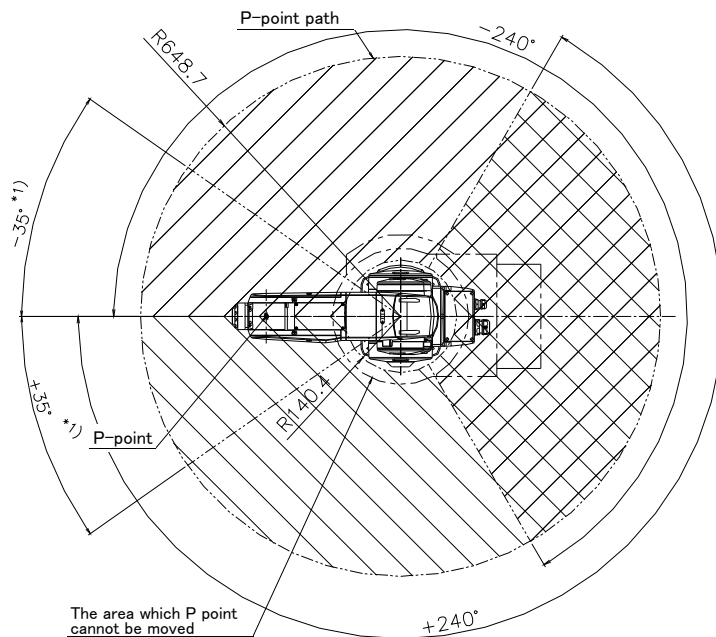
Note) Don't install the robot arm in the position where direct rays or the heat of lighting hits. The skin temperature of the robot arm may rise, and the error may occur.

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

Rev. B

Notes

- *1) Rear face operation limit: When the J axis angle is $-35^\circ \leq J1 \leq +35^\circ$, the J2 axis operation is limited to $-114^\circ \leq J2 \leq +120^\circ$.
- The following figure shows a robot at the position of:
J1=0°, J2=0°, J3=90°, J4=0°, J5=0°, and J6=0°
- *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.



Operating range of each axis:

- J1: $\pm 240^\circ$
 J2: $\pm 120^\circ$
 J3: $0^\circ \sim 164^\circ$
 J4: $\pm 200^\circ$
 J5: $\pm 120^\circ$
 J6: $\pm 360^\circ$
 J6 (-SH** specification): $\pm 200^\circ$

Top view

When Internal wiring and piping specification (-SH**)

Flange downward limit line

Control point (R point)

Control point of "-SH**" specification (R point)

P-point path

P-point

R140.4

R648.7

The boundary of the singular-point of flange downward
(Note)

(Note) RV-4FJL does not have this.

Side view

*1) Rear-face operating area

The area which P point cannot be moved *3)

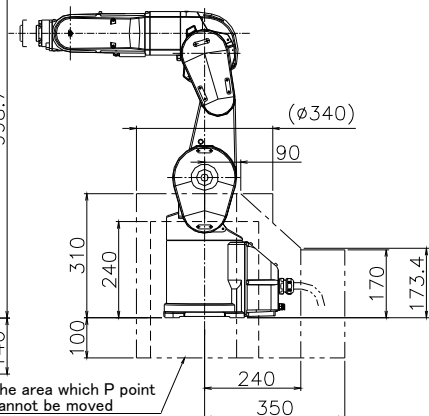
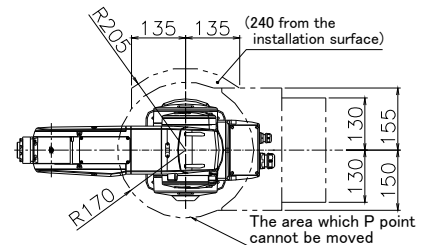


Fig.2-9 : Operating range diagram: RV-4FL/4FJL

(3) RV-7F

Notes

Rev. B

1. *1) Ensure the cable connection space to connect machine cables.
2. *2) Ensure the maintenance space to take out the cover.
3. *3) The screw should go in to a depth of 7.5mm to 8mm.
4. *4) Screw hole (M4 depth 8) for securing the user cables/piping.
5. *5) The size of the internal wiring and piping specification model (-SHxx).
6. *6) The depth is 6mm for the normal specification, 3.5mm for the clean/oil mist specification and 6.5mm for -SH** specification.

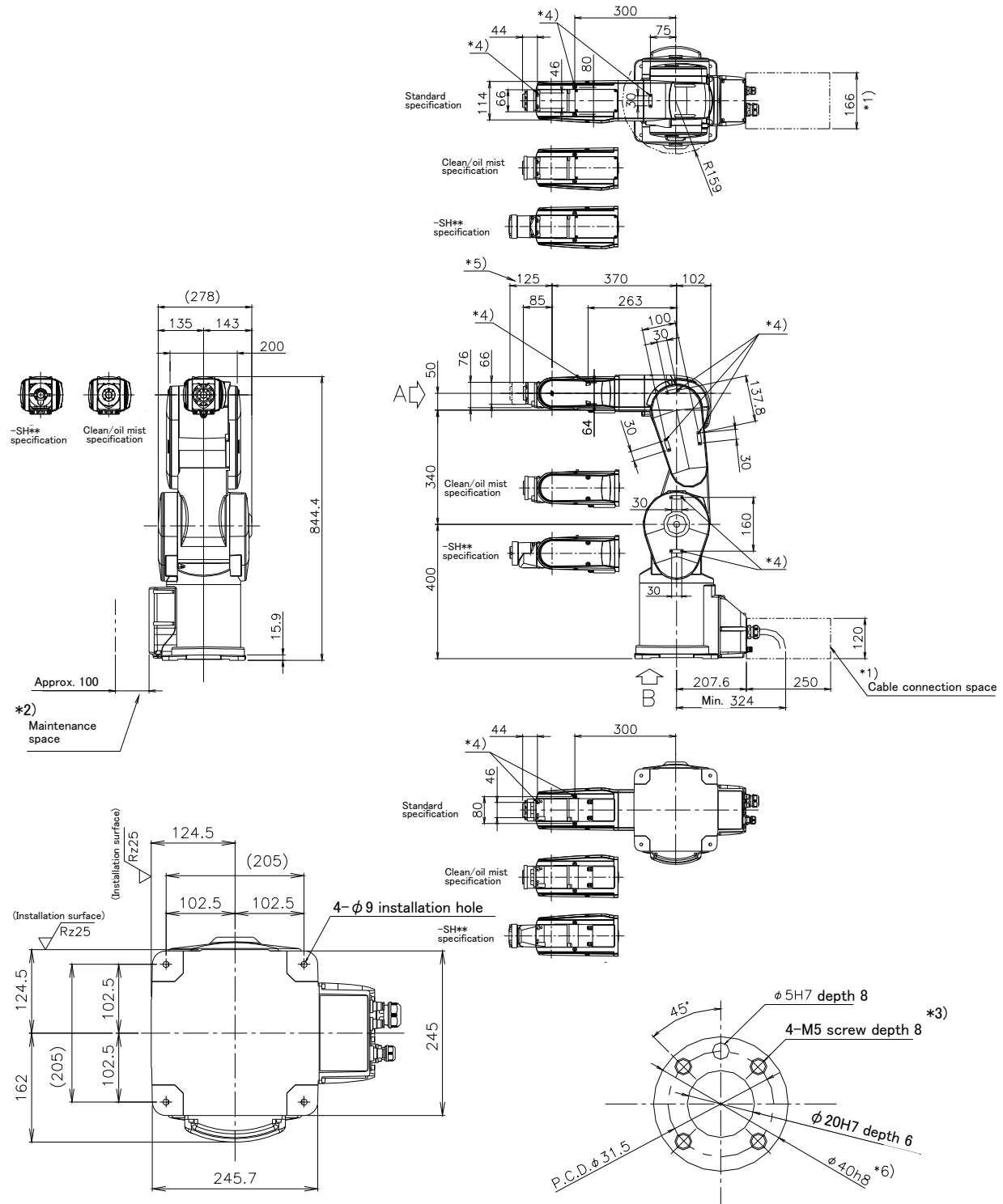
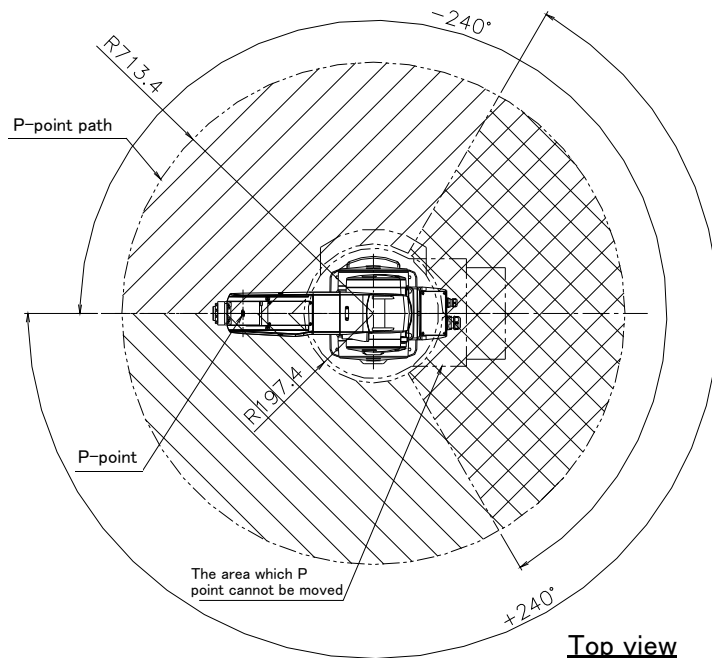


Fig.2-10 : Outside dimensions: RV-7F

Rev. B

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.

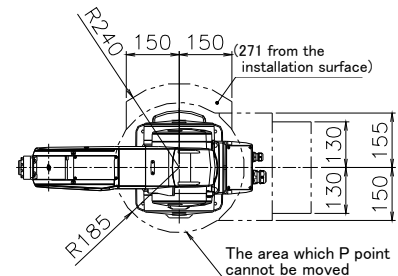


Operating range of each axis:

- J1: $\pm 240^\circ$
 J2: $-115^\circ \sim 125^\circ$
 J3: $0^\circ \sim 156^\circ$
 J4: $\pm 200^\circ$
 J5: $\pm 120^\circ$
 J6: $\pm 360^\circ$
 J6 (-SH** specification): $\pm 200^\circ$

*1)

The area which P point cannot be moved



When Internal wiring and piping specification (-SH**)

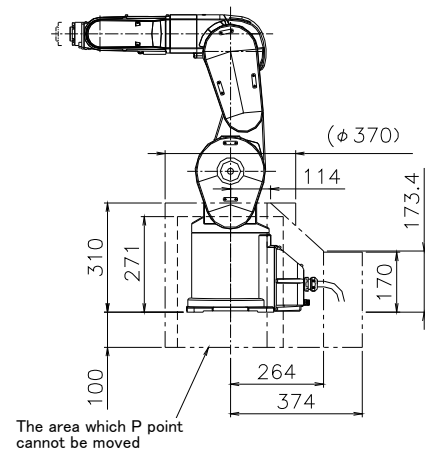
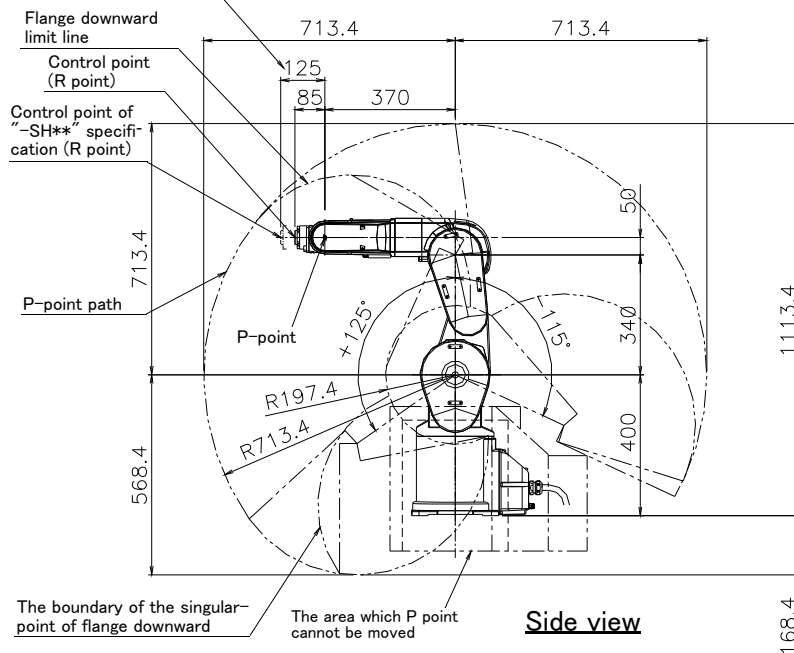


Fig.2-11 : Operating range diagram: RV-7F

Notes

Rev. B

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 $+145^\circ \leq J1 \leq +215^\circ$ or $-145^\circ \leq J1 \leq -215^\circ$, the J2 axis operation is limited to $-110^\circ \leq J2 \leq +120^\circ$.
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.

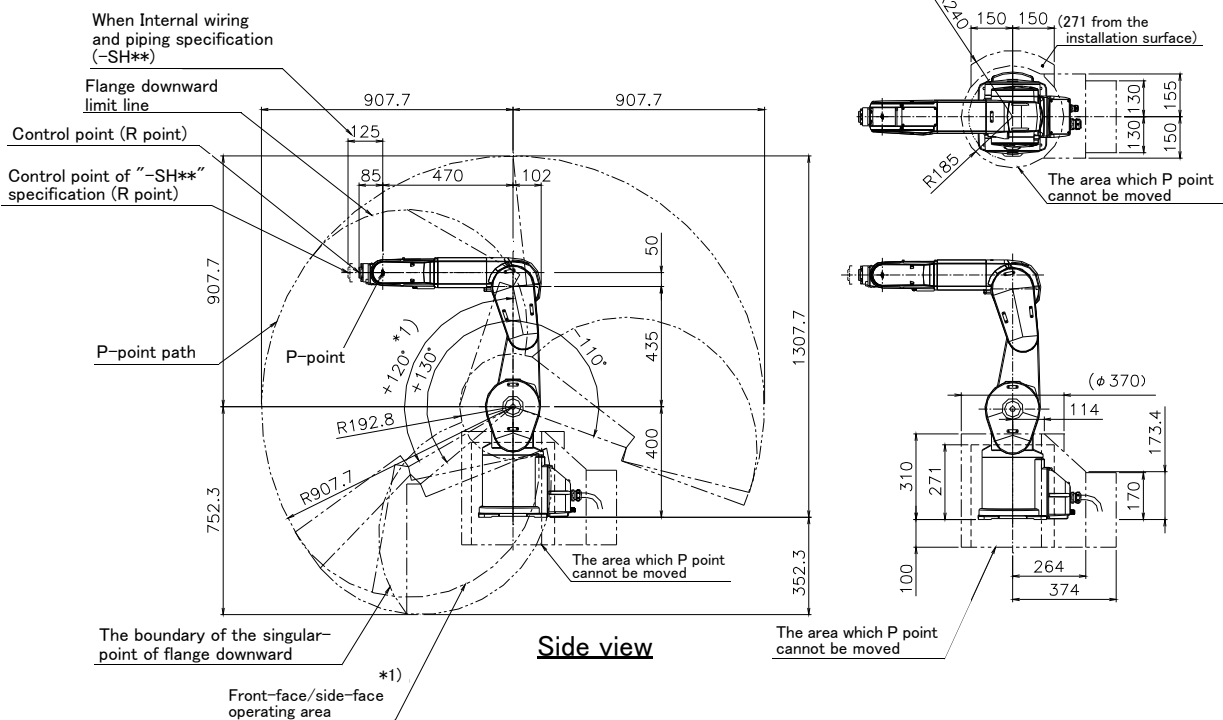
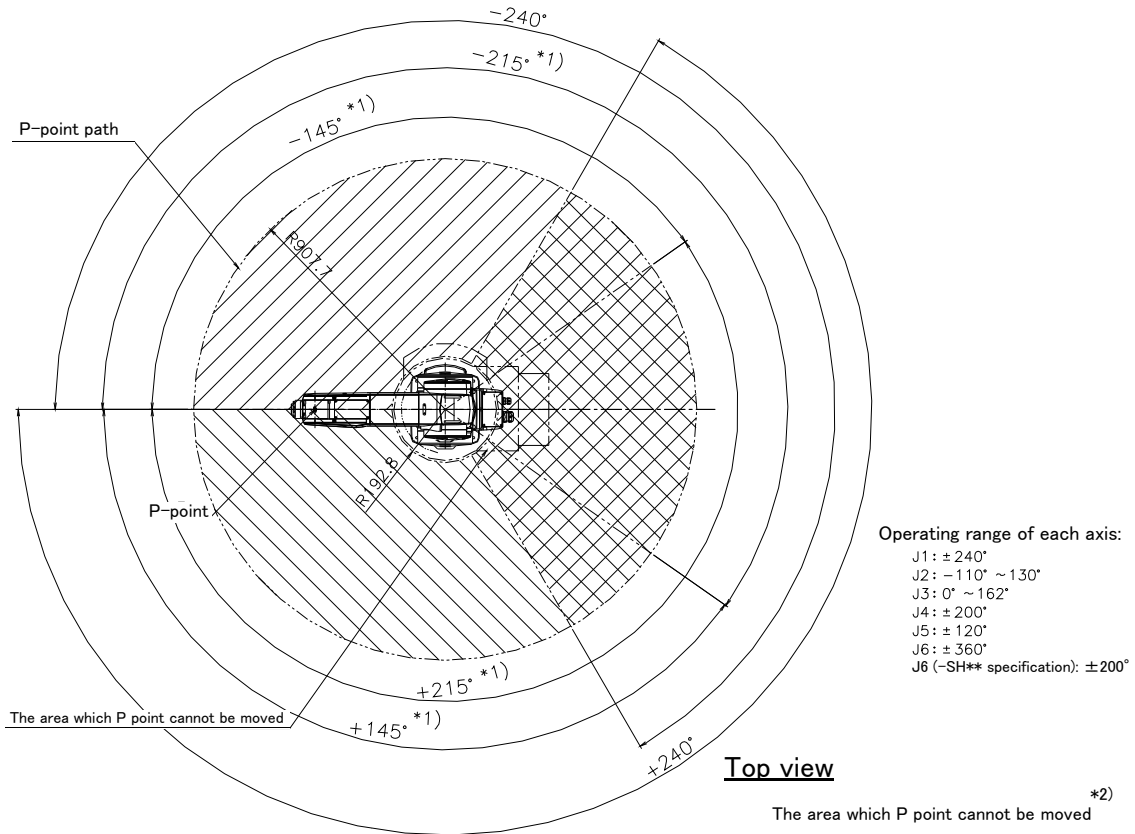
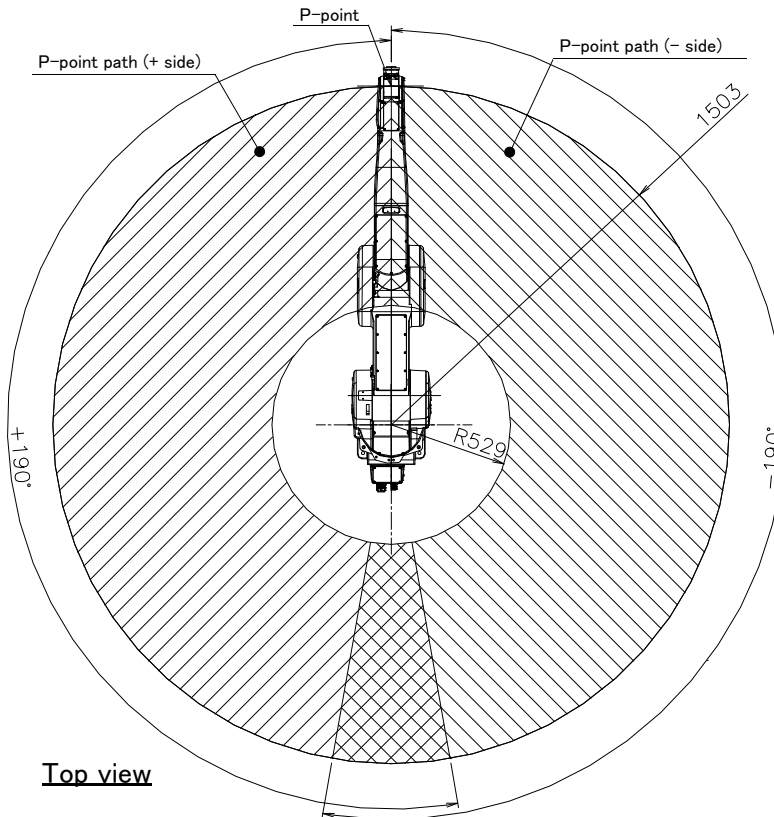


Fig.2-13 : Operating range diagram: RV-7FL

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 $+120^\circ \leq J1$ or $J1 \leq -120^\circ$, the J2 axis operation is limited to $-90^\circ \leq J2 \leq +130^\circ$.
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.

**Top view**

Operating range of each axis:

- J1 : $\pm 190^\circ$
 J2 : $-90^\circ \sim +150^\circ$
 J3 : $-10^\circ \sim +157.5^\circ$
 J4 : $\pm 200^\circ$
 J5 : $\pm 120^\circ$
 J6 : $\pm 360^\circ$
 J6 (-SH** specification): $\pm 200^\circ$

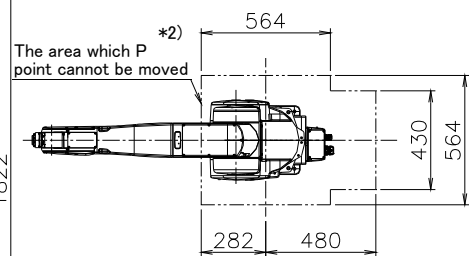
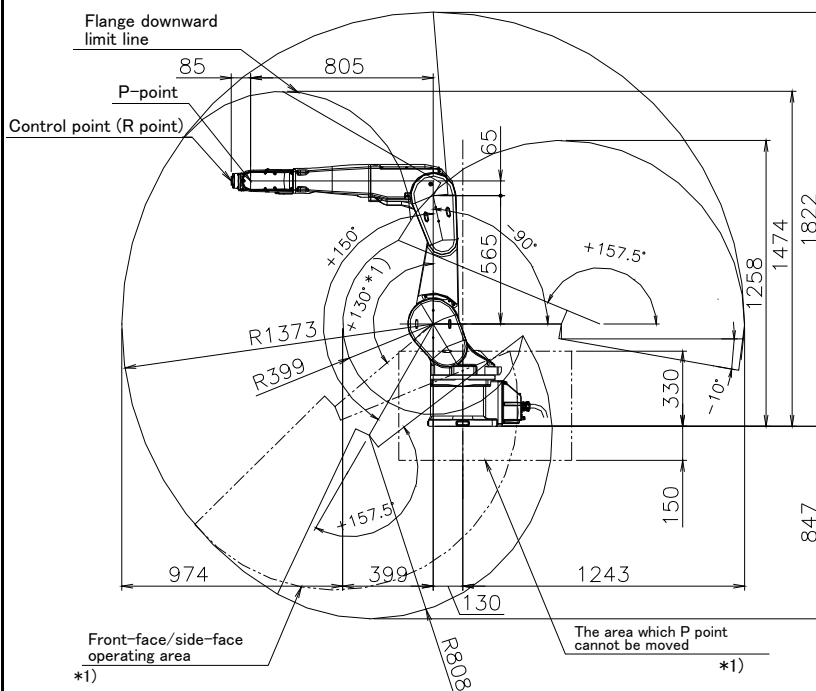
**Top view****Side view**

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

Rev. *

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 $+120^\circ \leq J1$ or $J1 \leq -130^\circ$, the J2 axis operation is limited to $-90^\circ \leq J2 \leq +130^\circ$.
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.

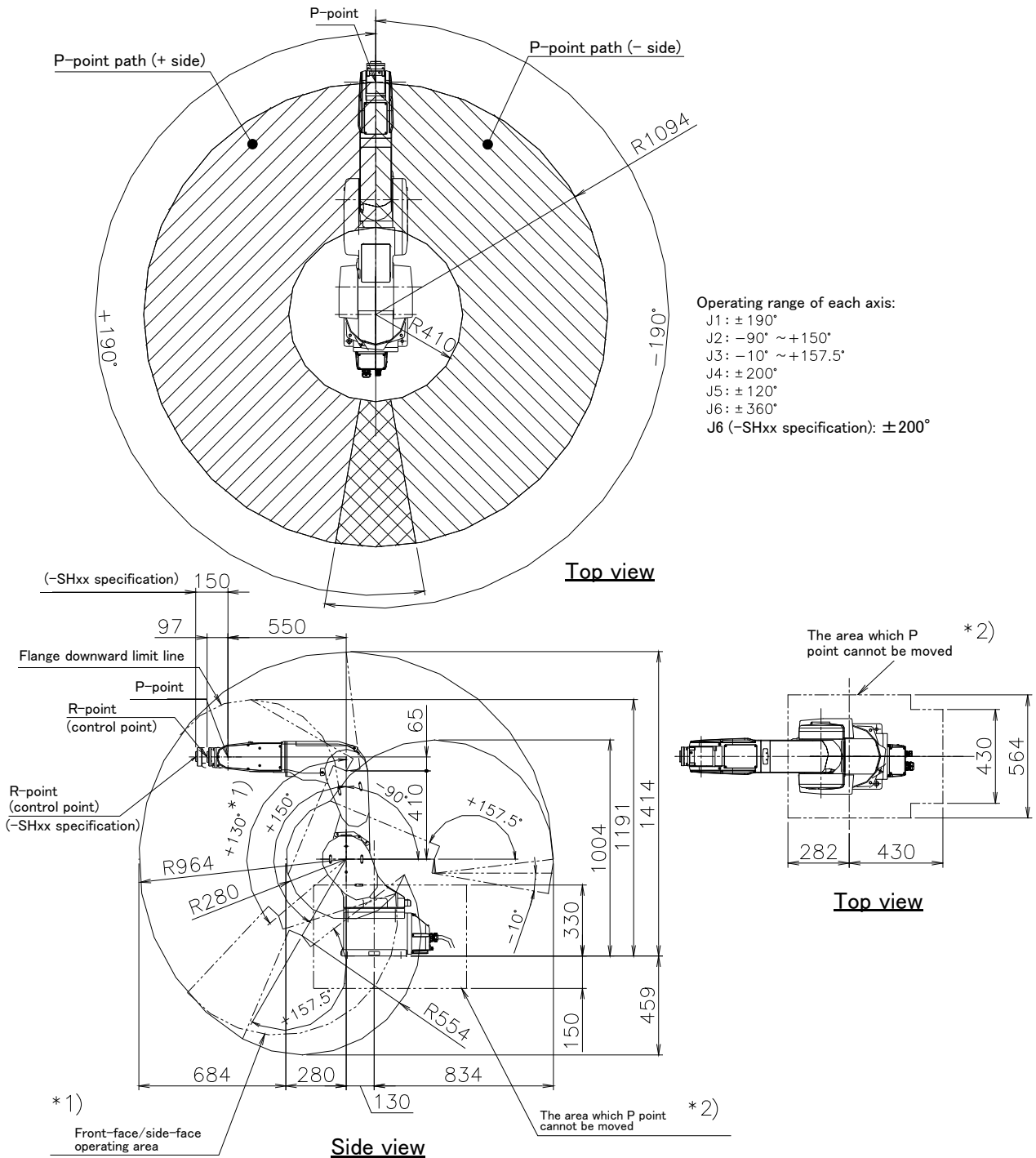


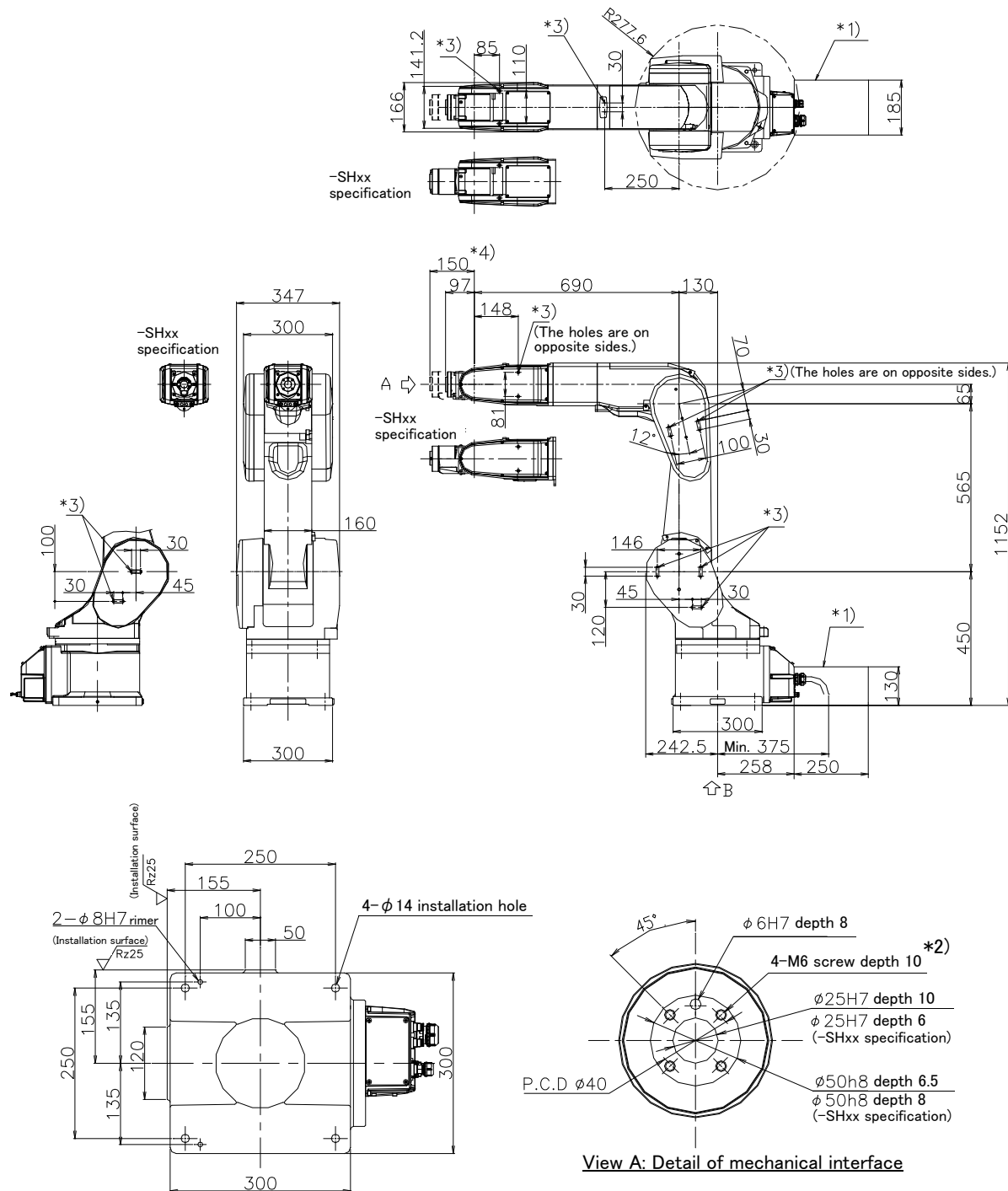
Fig.2-17 : Operating range diagram: RV-13F/20F

(7) RV-13FL

Notes

Rev. *

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 size of the internal wiring and piping specification model (-SHxx).



View B bottom view drawing: Detail of installation dimension

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

Rev. *

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 $+130^\circ \leq J1$ or $J1 \leq -140^\circ$, the J2 axis operation is limited to $-90^\circ \leq J2 \leq +130^\circ$.
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.

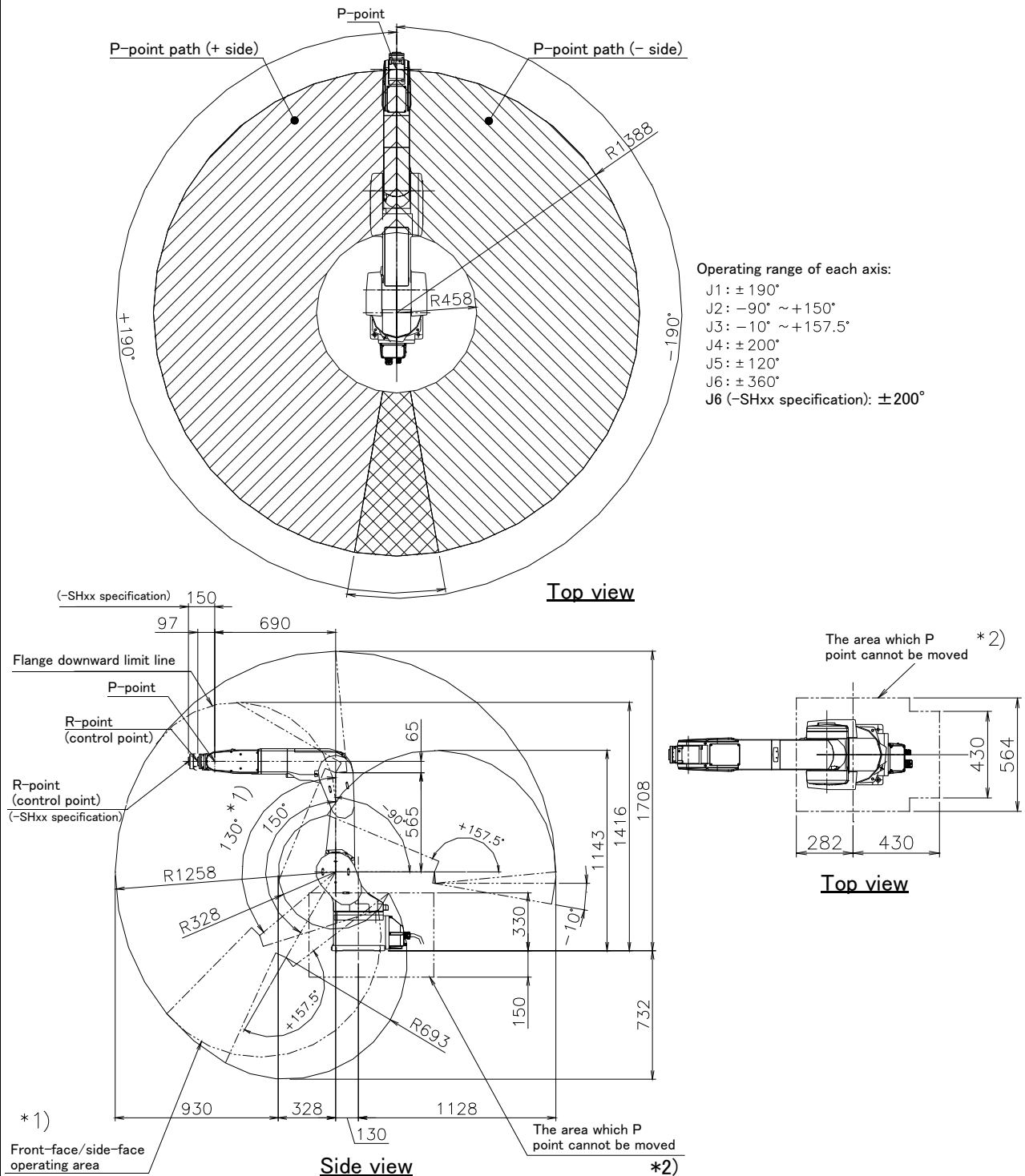


Fig.2-19 : Operating range diagram: RV-13FL

2.5 Tooling

2.5.1 Wiring and piping for hand

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

(1) Standard specification (with no internal wiring and piping)

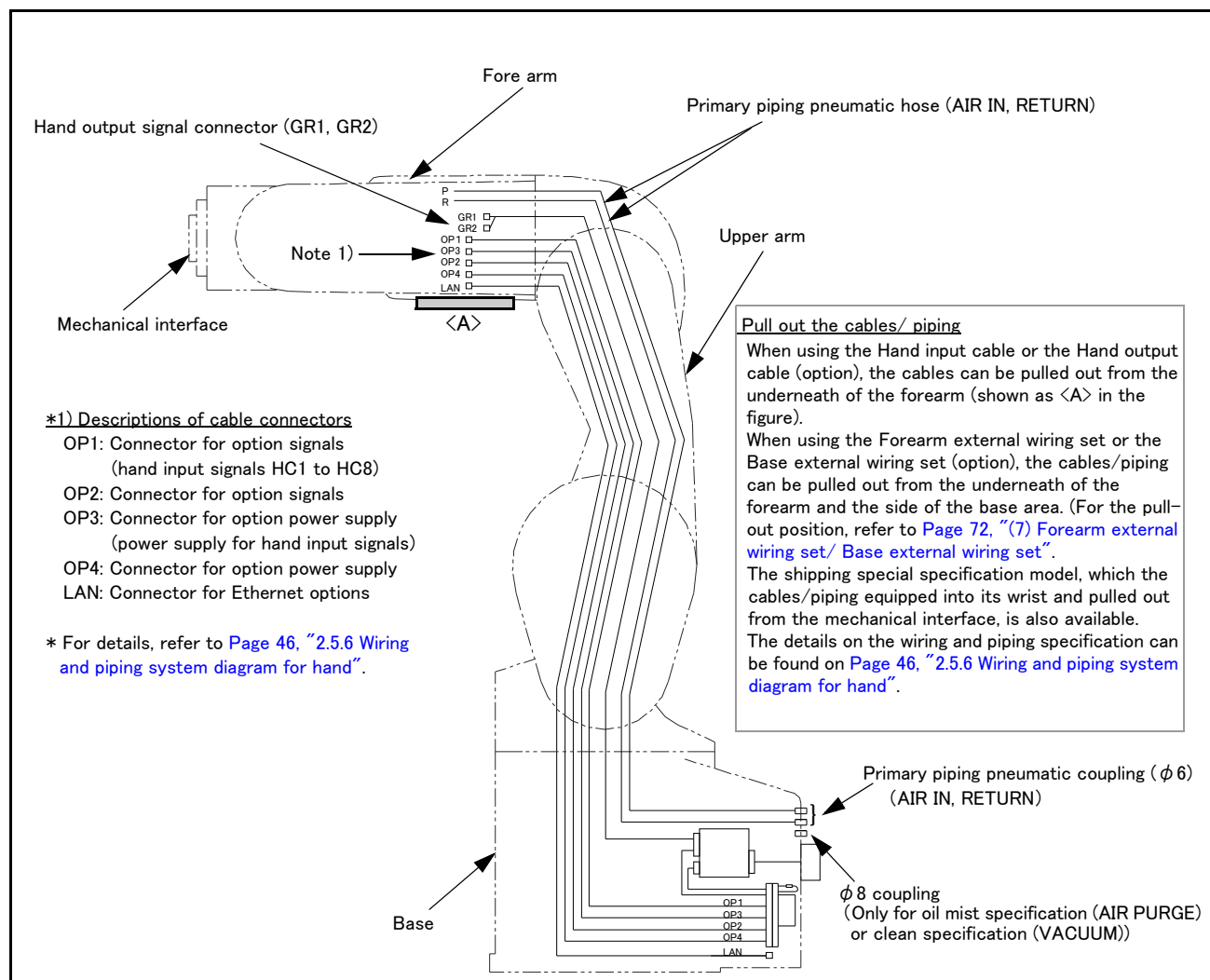


Fig.2-20 : Wiring and piping for hand

(2) Internal wiring and piping specification (SH01)

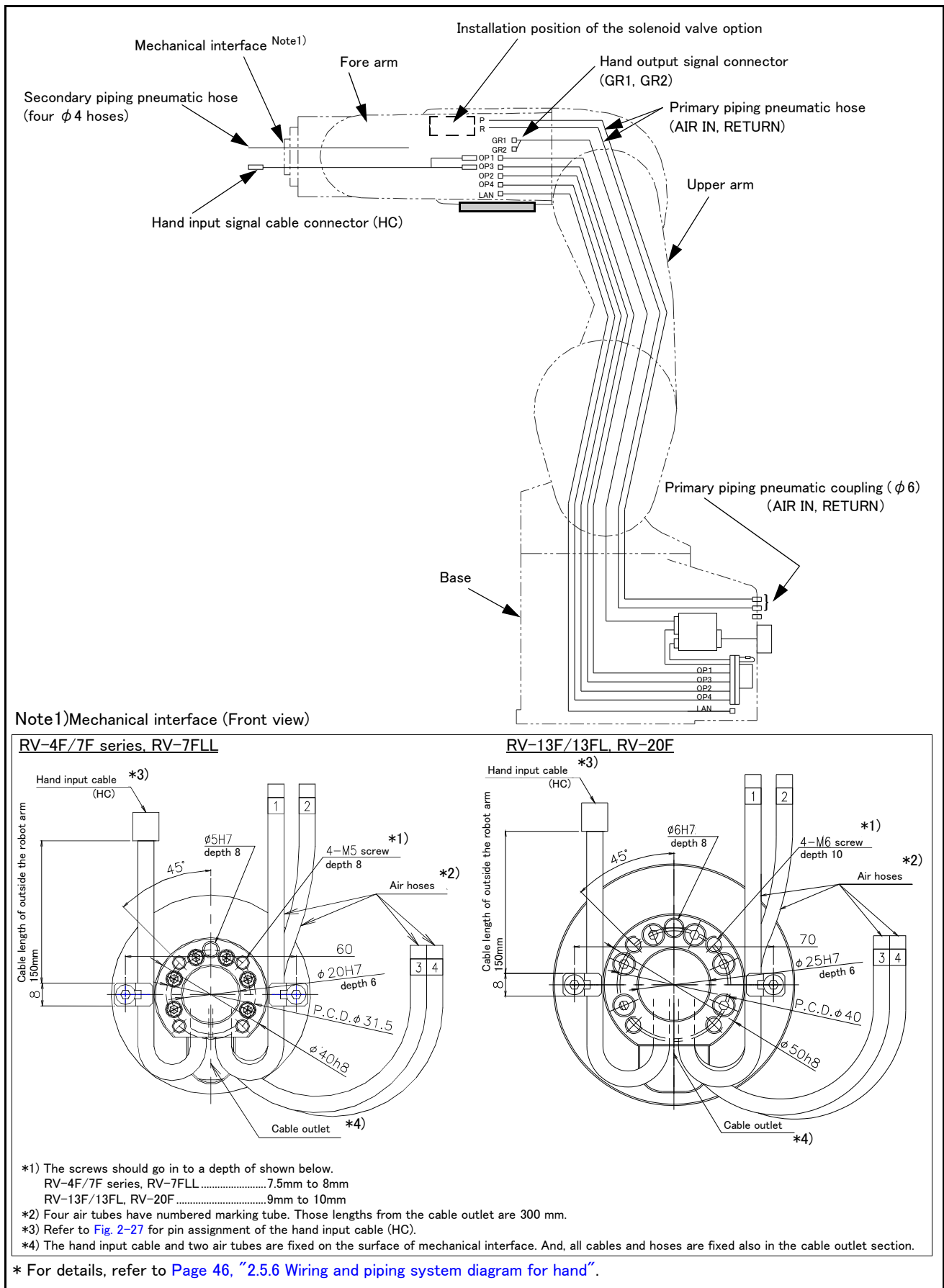
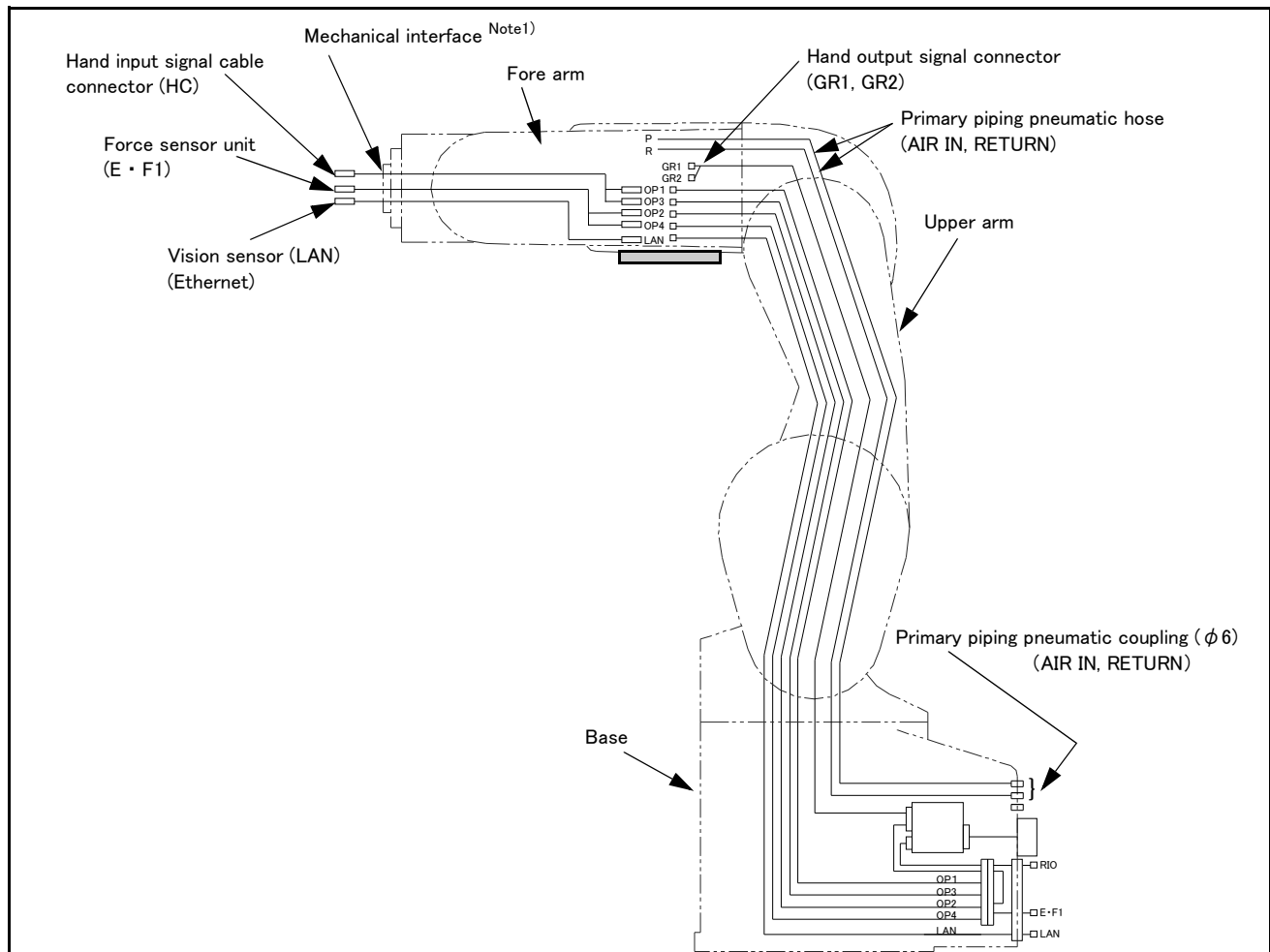


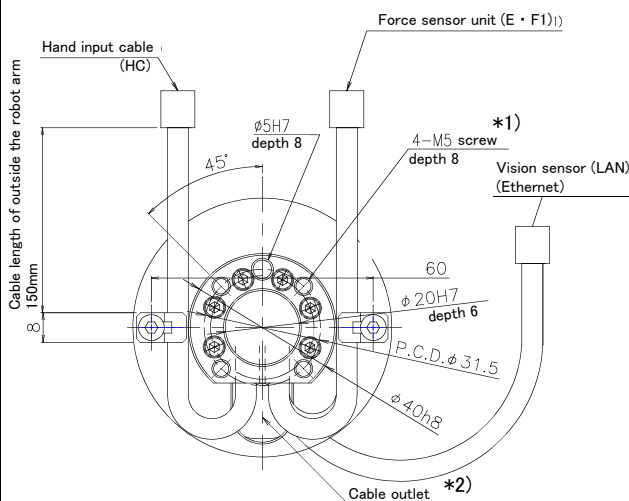
Fig.2-21 : Wiring and piping for hand (SH01)

(3) Internal wiring and piping specification (SH02)

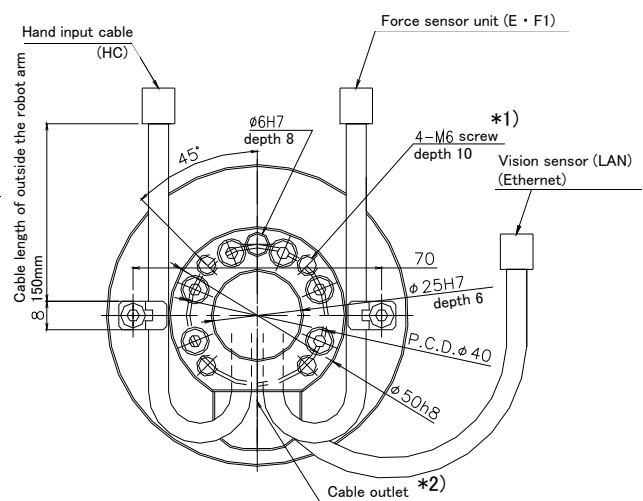


Note1) Mechanical interface (Front view)

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



RV-13F/13FL, RV-20F



*1) The screws should go in to a depth of shown below.

RV-4F/7F series, RV-7FLL 7.5mm to 8mm

RV-13F/13FL, RV-20F 9mm to 10mm

*2) The hand input cable and two air tubes are fixed on the surface of mechanical interface. And, all cables and hoses are fixed also in the cable outlet section.

* For details, refer to [Page 46, "2.5.6 Wiring and piping system diagram for hand"](#).

Fig.2-22 : Wiring and piping for hand (SH02)

(4) Internal wiring and piping specification (SH03)

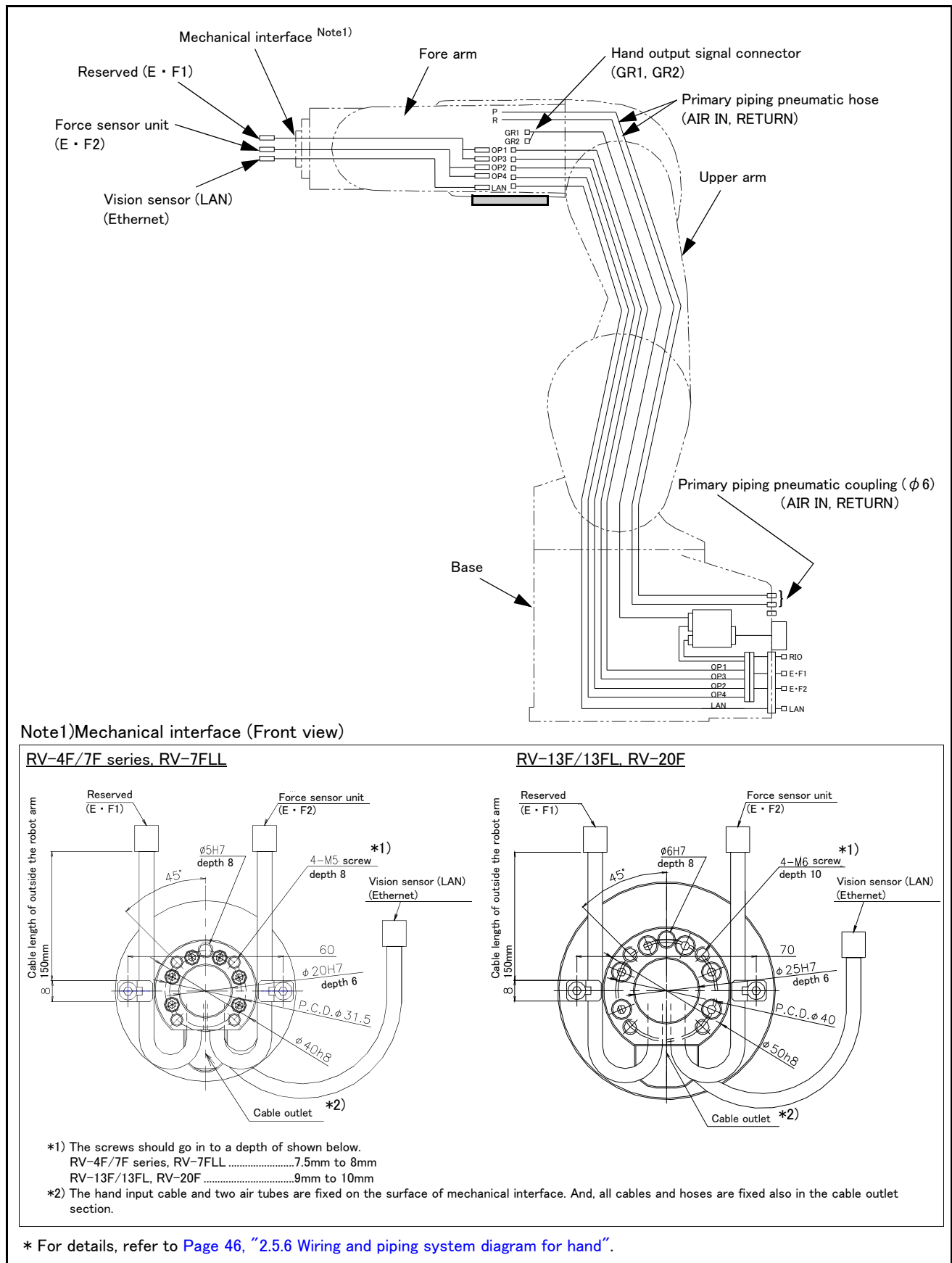


Fig.2-23 : Wiring and piping for hand (SH03)

(5) Internal wiring and piping specification (SH04)

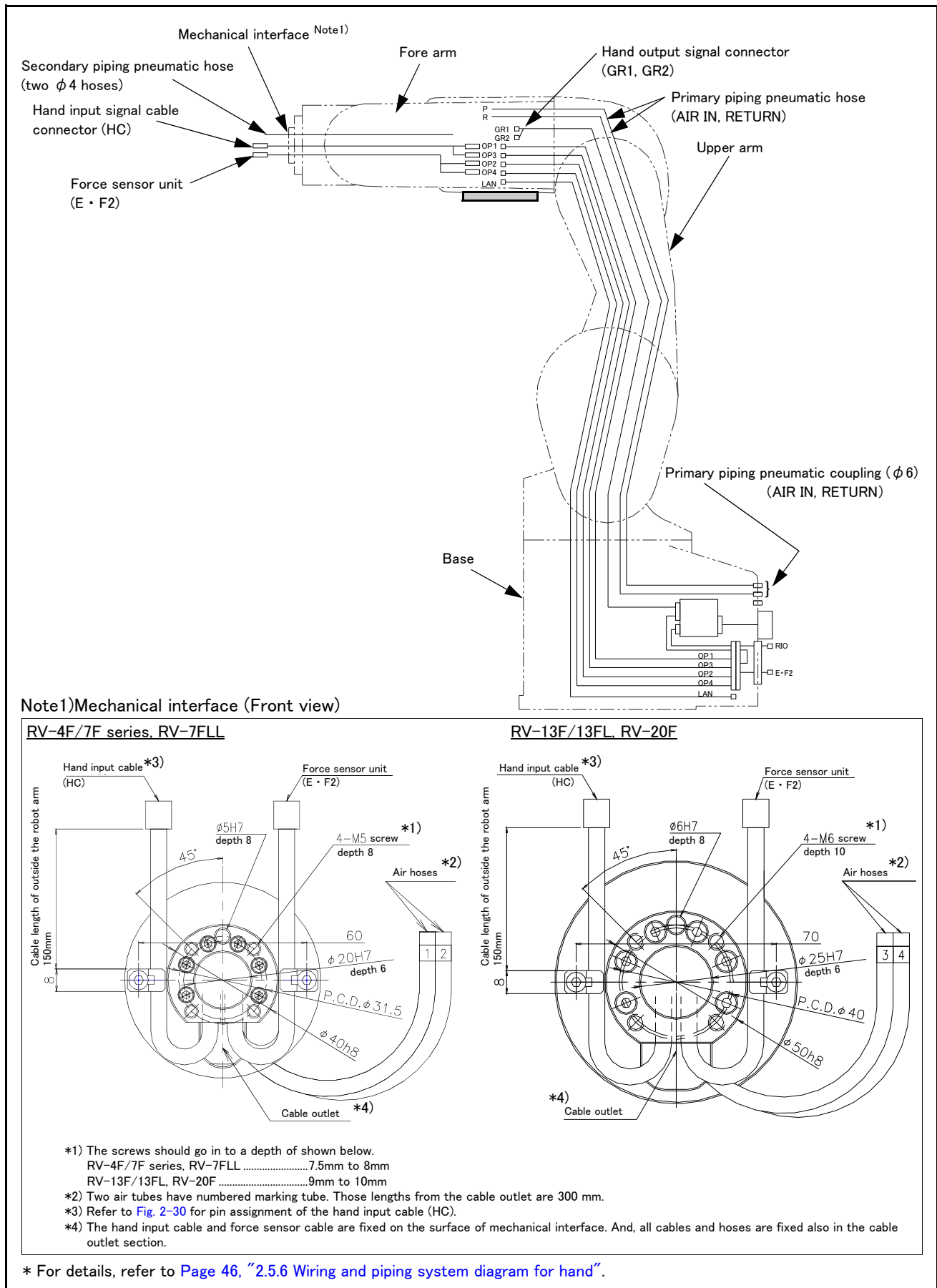
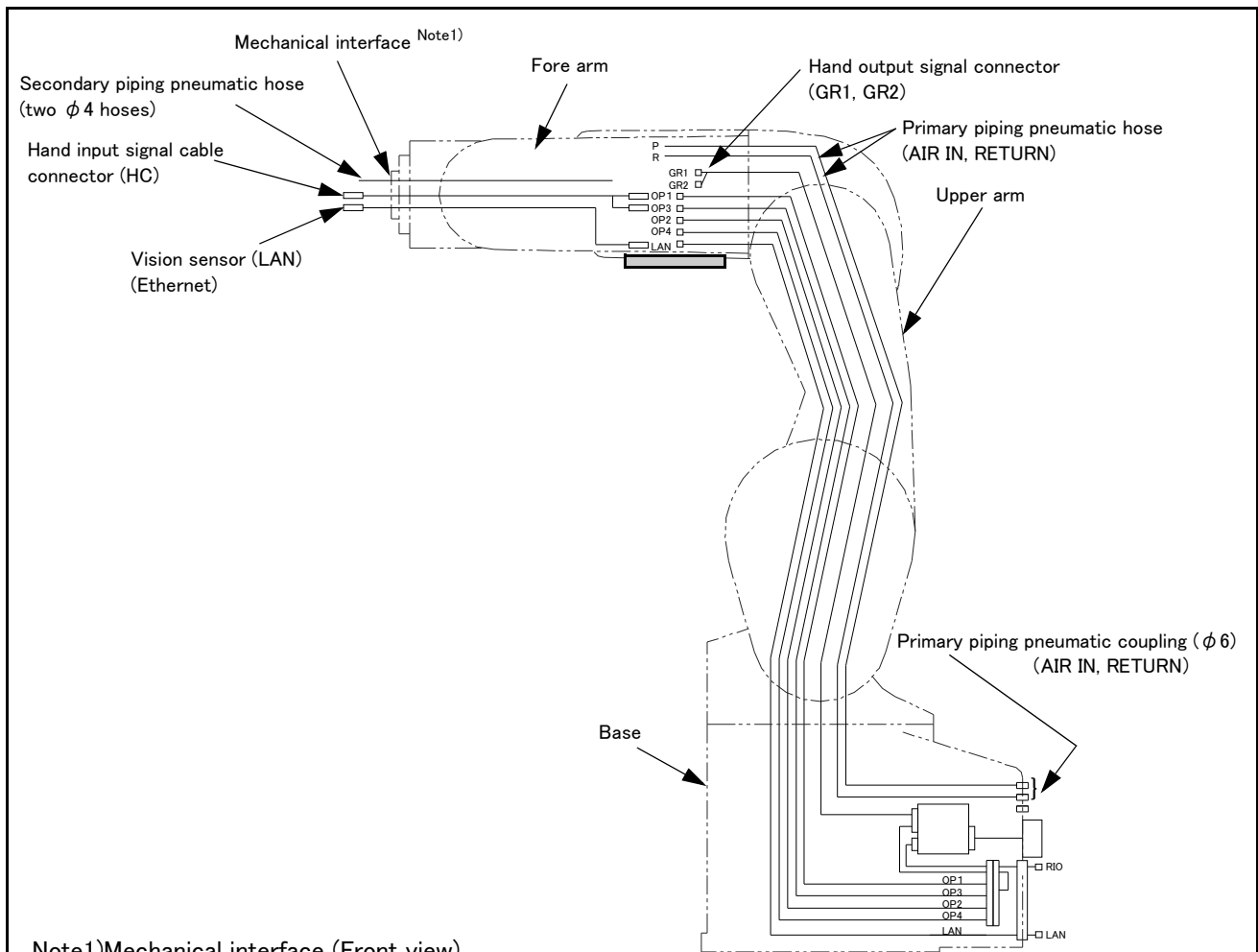


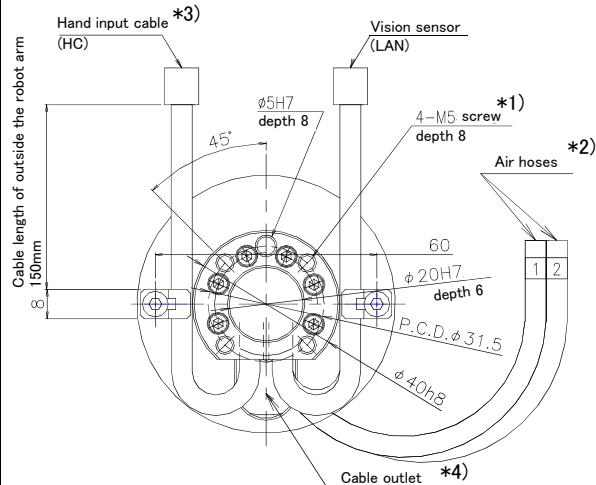
Fig.2-24 : Wiring and piping for hand (SH04)

(6) Internal wiring and piping specification (SH05)



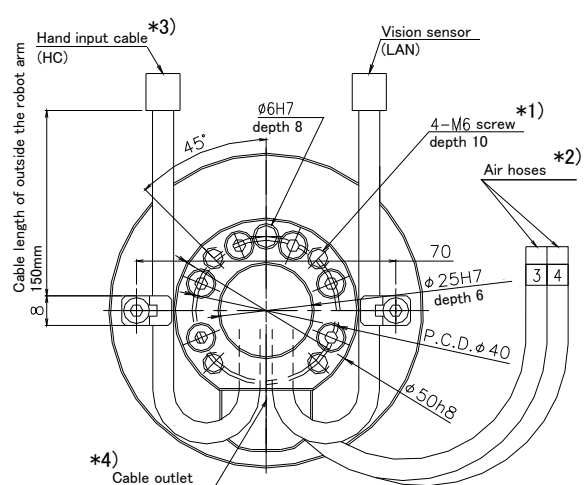
Note1) Mechanical interface (Front view)

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



- *1) The screws should go in to a depth of shown below.
RV-4F/7F series, RV-7FLL 7.5mm to 8mm
RV-13F/13FL, RV-20F 9mm to 10mm
- *2) Two air tubes have numbered marking tube. Those lengths from the cable outlet are 300 mm.
- *3) Refer to Fig. 2-31 for pin assignment of the hand input cable (HC).
- *4) The hand input cable and force sensor cable are fixed on the surface of mechanical interface. And, all cables and hoses are fixed also in the cable outlet section.

RV-13F/13FL, RV-20F



* For details, refer to Page 46, "2.5.6 Wiring and piping system diagram for hand".

Fig.2-25 : Wiring and piping for hand (SH05)

2.5.2 Internal air piping

(1) Standard type/Oil mist specifications

- 1) The robot has two $\phi 6$ urethane hoses from the pneumatic entrance on the base section to the shoulder cover. 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.
 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 $\phi 6$ pneumatic coupling bridge.
- 4) Refer to [Page 65, "\(3\) Solenoid valve set"](#) for details on the electronic valve set (optional).
- 5) Protection performance can be improved by pressurizing the inside of the robot arm. Since the joint (AIR PURGE) of $\phi 8$ is prepared at the rear of the base section, please supply the dry air for pressurization from this joint. Refer to [Page 22, "2.2.6 Protection specifications"](#) for the details of dry air.

(2) Clean type

- 1) The primary piping is the same piping as the standard type.
- 2) With the clean specification, a $\phi 8$ coupling is provided in the base section for suction inside the machine. For use, connect it to the suction port of the vacuum pump or the coupling on the "VACUUM" side of the vacuum generating valve. Moreover, to clean the exhaust from the vacuum pump or vacuum generator, use the exhaust filter (prepared by the customer).
- 3) Refer to [Page 23, "2.2.7 Clean specifications"](#) for details of the vacuum for suction.
- 4) Supply clean air to the vacuum generator.

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

- 1) 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-HC35C-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".)

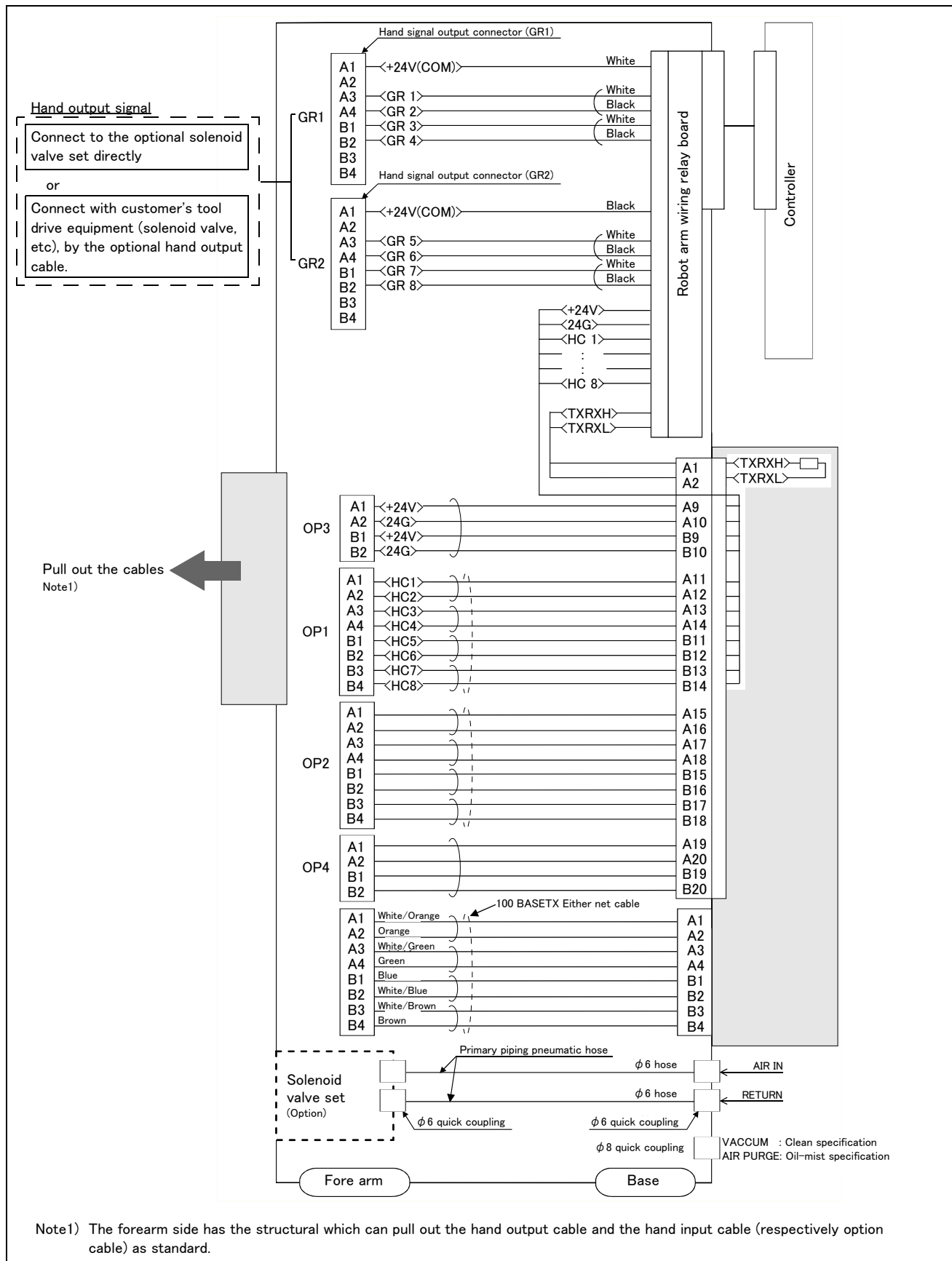
Table 2-10 : Ethernet cable specification

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.

(1) Standard specification (with no internal wiring and piping)



(2) Internal wiring and piping specification (SH01)

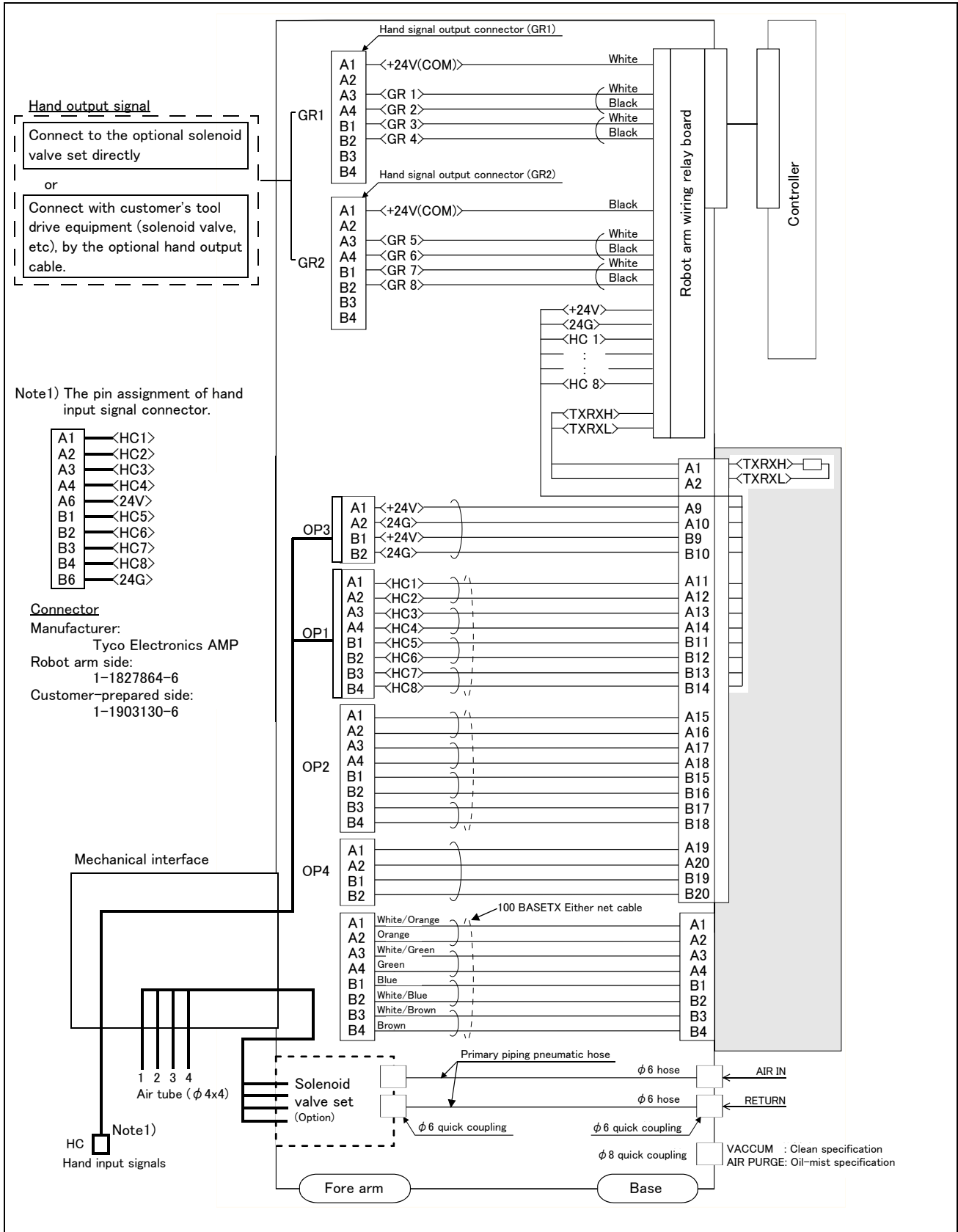


Fig.2-27 : Wiring and piping system diagram for hand and example the solenoid valve installation: SH01

(3) Internal wiring and piping specification (SH02)

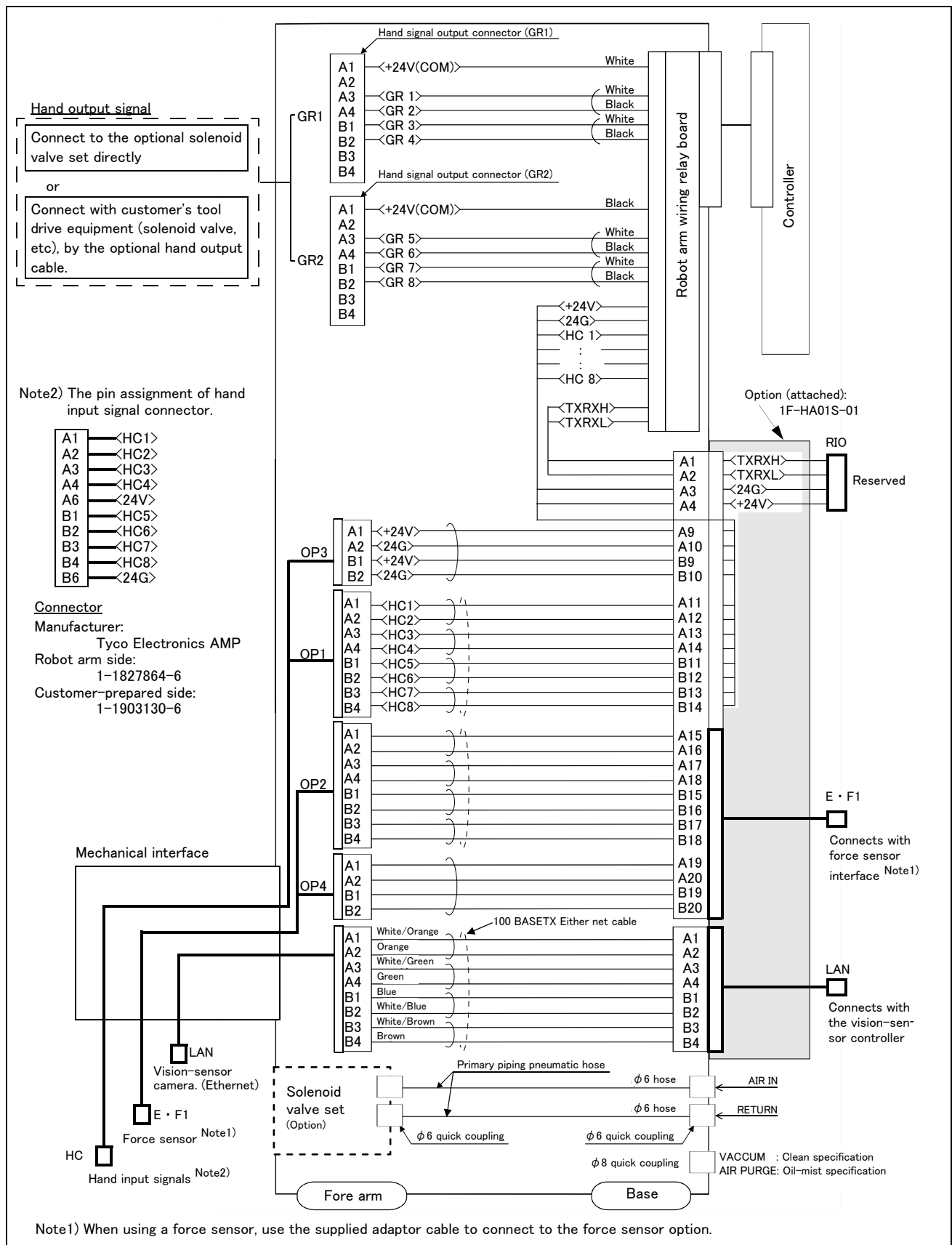


Fig.2-28 : Wiring and piping system diagram for hand and example the solenoid valve installation: SH02

(4) Internal wiring and piping specification (SH03)

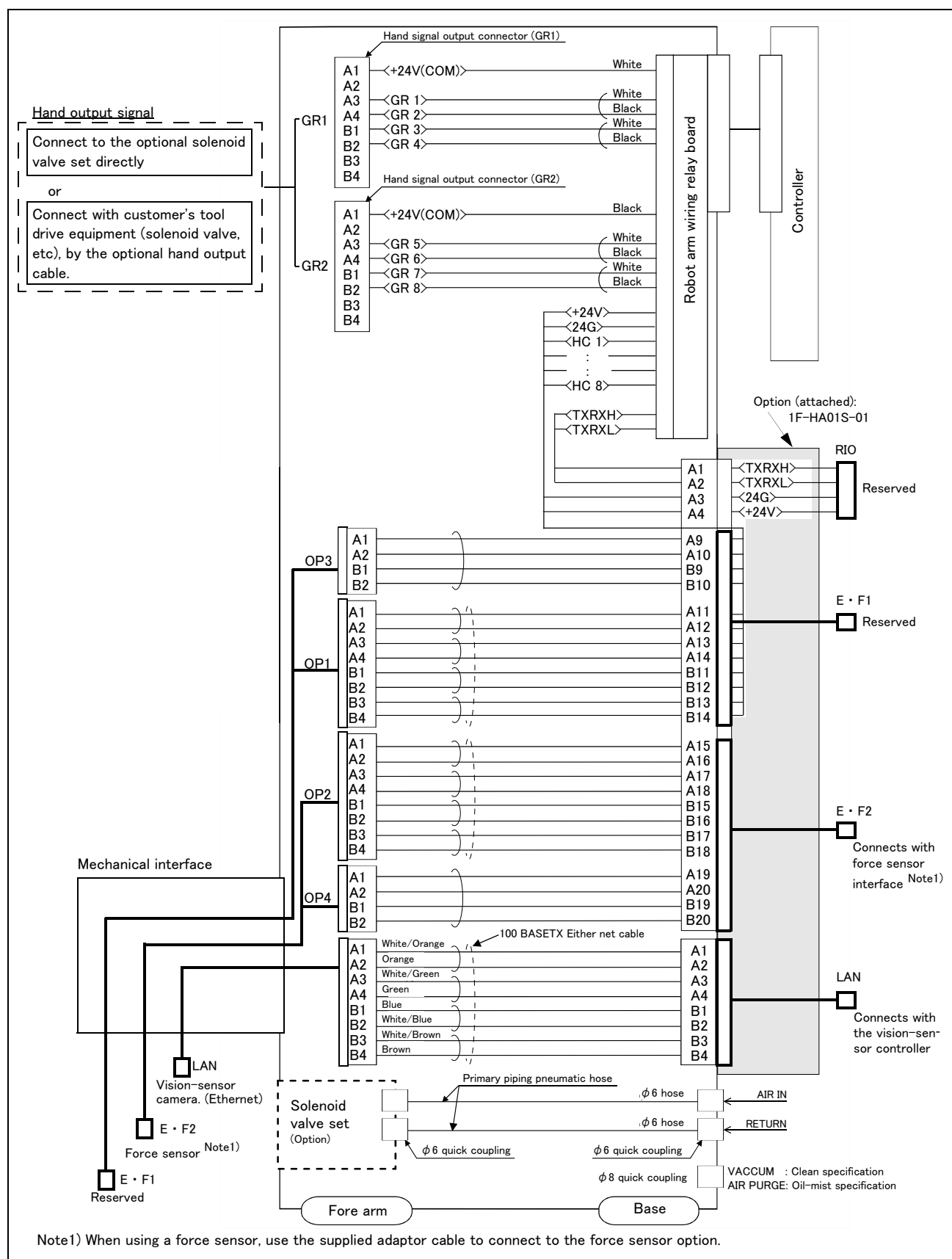


Fig.2-29 : Wiring and piping system diagram for hand and example the solenoid valve installation: SH03

(5) Internal wiring and piping specification (SH04)

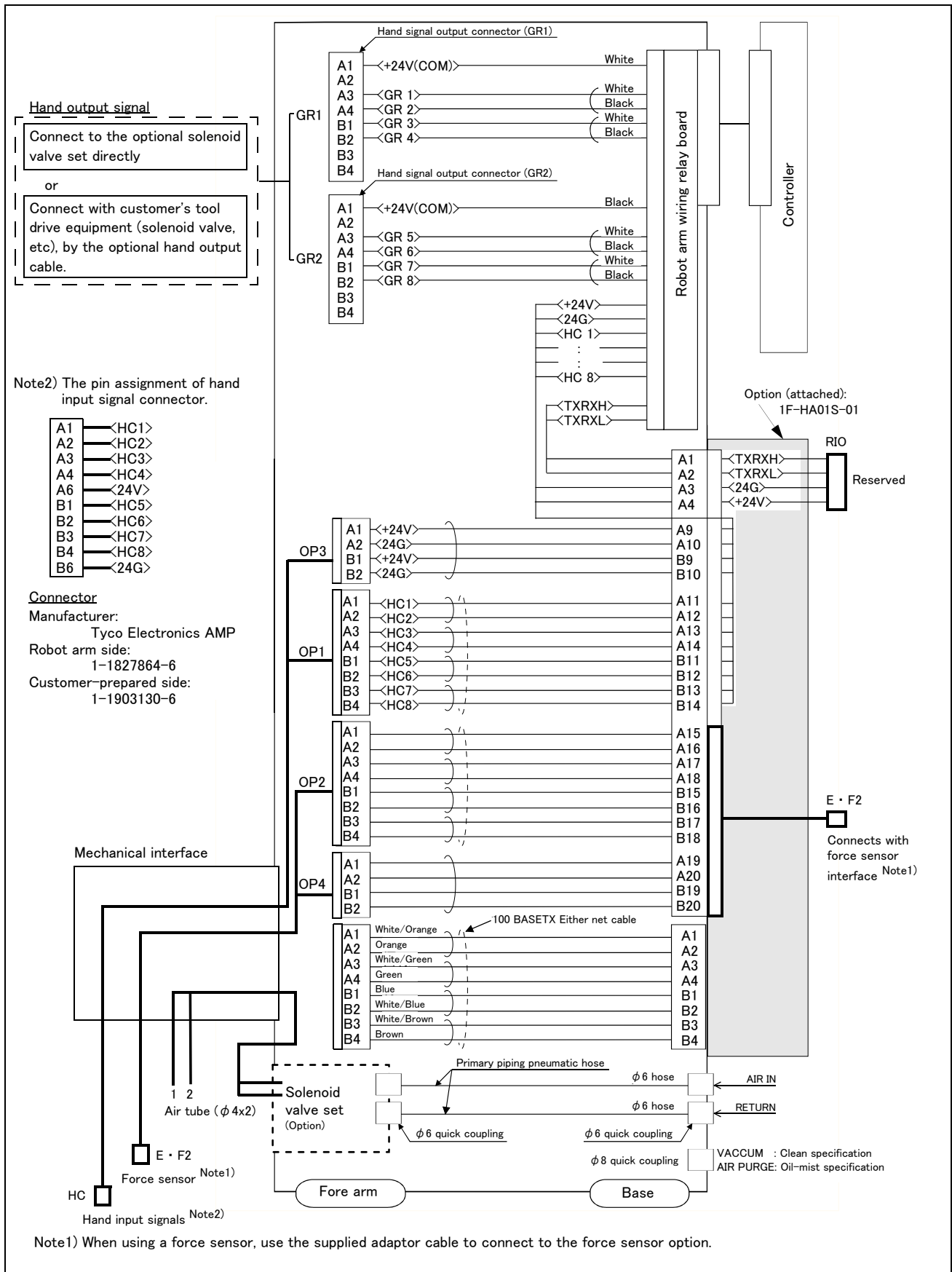


Fig.2-30 : Wiring and piping system diagram for hand and example the solenoid valve installation: SH04

(6) Internal wiring and piping specification (SH05)

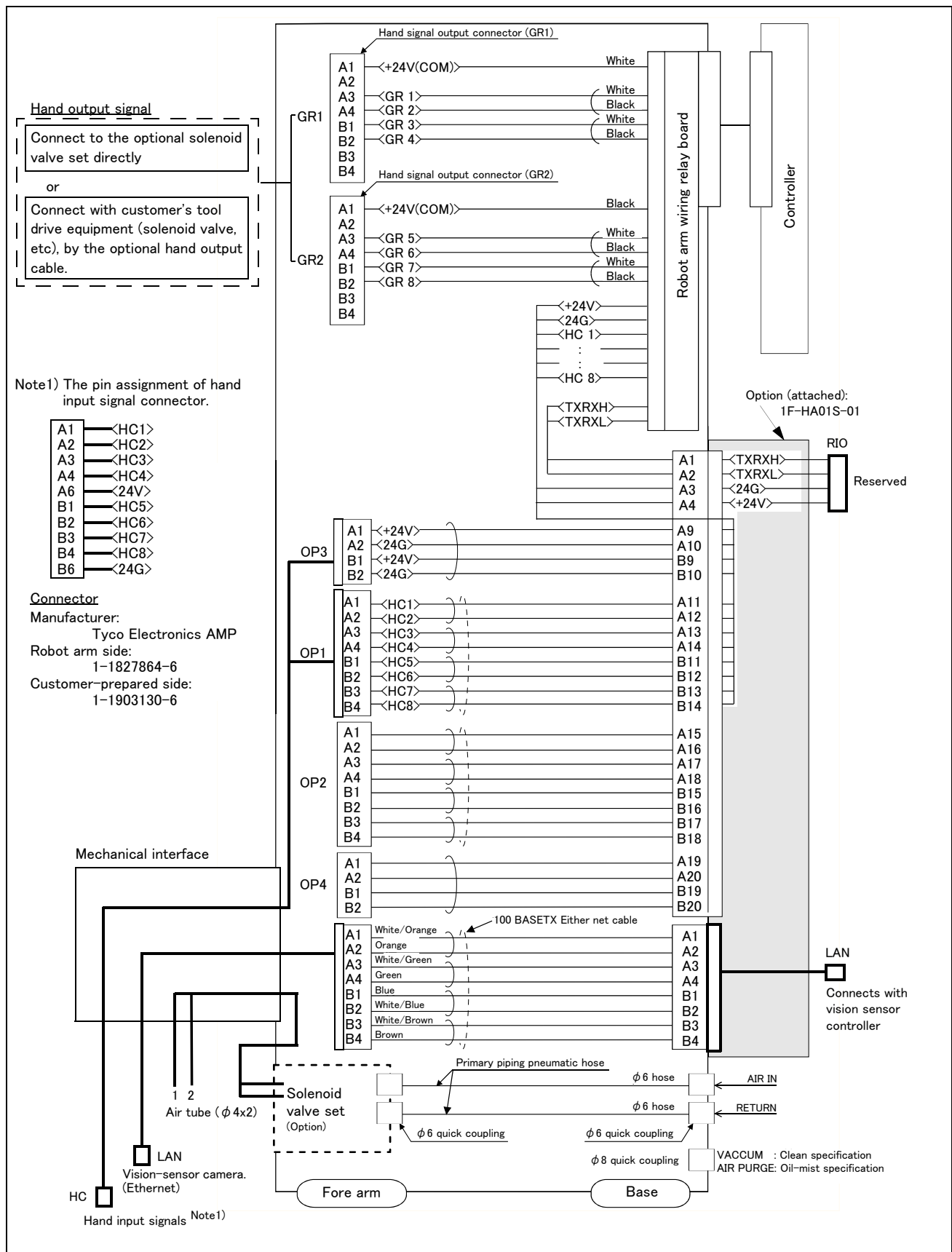


Fig.2-31 : Wiring and piping system diagram for hand and example the solenoid valve installation: SH05

2.5.7 Electrical specifications of hand input/output

Table 2-11 : Electrical specifications of input circuit

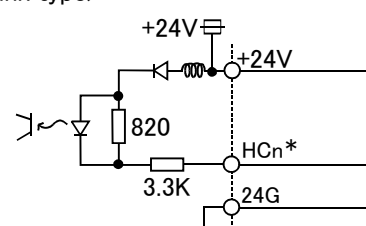
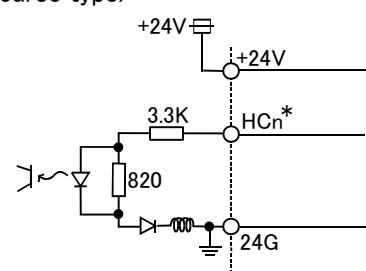
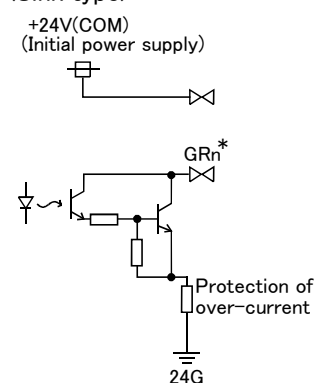
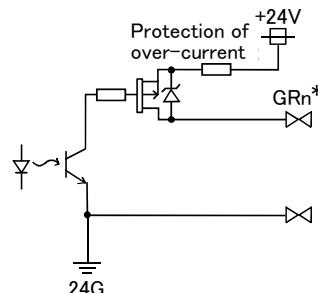
Item		Specifications	Internal circuit
Type		DC input	<p><Sink type></p>  <p><Source type></p>  <p>* HCn = HC1 to HC8</p>
No. of input points		8	
Insulation method		Photo-coupler insulation	
Rated input voltage		24VDC	
Rated input current		approx. 7mA	
Working voltage range		DC10.2 to 26.4V (ripple rate within 5%)	
ON voltage/ON current		8VDC or more/2mA or more	
OFF voltage/OFF current		4VDC or less/1mA or less	
Input resistance		Approx. 3.3kΩ	
Response time	OFF-ON	10ms or less (DC24V)	
	ON-OFF	10ms or less (DC24V)	

Table 2-12 : Electrical specifications of output circuit

Item		Specification	Internal circuit
Type		Transistor output	<p><Sink type></p>  <p><Source type></p>  <p>* GRn = GR1 to GR8</p>
No. of output points		8	
Insulation method		Photo coupler insulation	
Rated load voltage		DC24V	
Rated load voltage range		DC21.6 to 26.4VDC	
Max. current load		0.1A/ 1 point (100%)	
Current leak with power OFF		0.1mA or less	
Maximum voltage drop with power ON		DC0.9V(TYP.)	
Response time	OFF-ON	2ms or less (hardware response time)	
	ON-OFF	2 ms or less (resistance load) (hardware response time)	
Protects		Protects the over-current (0.9A)	

2.5.8 Air supply circuit example for the hand

Fig. 2-32 shows an example of pneumatic supply circuitry for the hand.

- (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. 2-32 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 when you use clean type robot.
- (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 the coupling or the hose surface.

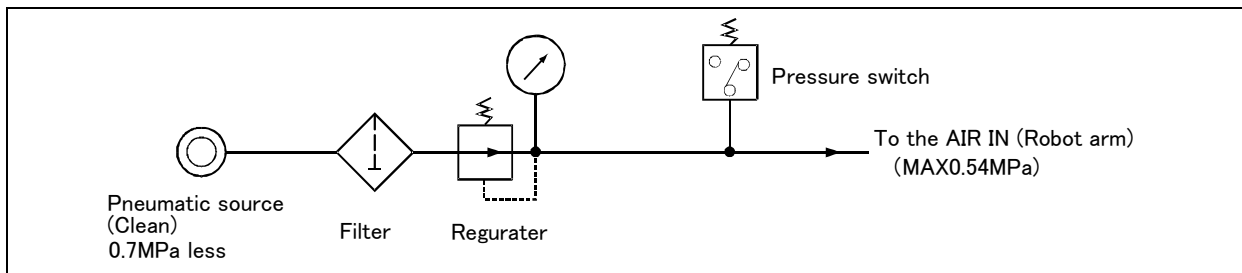


Fig.2-32 : Air supply circuit example for the hand

2.6 Shipping special specifications, options, and maintenance parts

2.6.1 Shipping special specifications

■ What are shipping 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.

(1) Machine cable

■ Order type: ● Fixed type 1F-02UCBL-02 (2m)

■ Outline



This cable is exchanged for the machine cable that was supplied as standard to shorten the distance between the controller and the robot arm.

■ Configuration

Table 2-13 : Configuration equipment and types

Part name		Type	Qty.	Mass(kg) ^{Note1)}	Remarks ^{Note2)}
Fixed	Set of signal and power cables	1F-02UCBL-02	1 set	2.6	2m
	Motor signal cable		(1 cable)	–	
	Motor power cable		(1 cable)	–	

Note1) Mass indicates one set.

Note2) Standard machine cable (for fixed type) is not attached.

[Caution] Orders made after purchasing a robot are treated as purchases of optional equipment. In this case, the machine cable that was supplied as standard is not reclaimed.

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: ● Fixed type 1F- □□ UCBL-02
 ● Flexed type 1F- □□ LUCBL-02 Note) The numbers in the boxes □□ refer the length.

■ Outline



The distance between the robot controller and the robot arm is extensible by this option. This cable is extended to the machine cable attached as standard.

A fixed type and flexible type are available.

The extended method is discriminated as follows.

Fixed type/Flexed type:

- Exchanges with the machine cable attached in the standards.

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

■ Configuration

Table 2-14 : Configuration equipment and types

Part name		Type ^{Note1)}	Qty.		Mass(kg) Note2)	Remarks
			Fixed	Flexed		
Fixed	Set of signal and power cables	1F- □□ UCBL-02	1 set	–	6.7(10m) 12(15m) 17(20m)	10m, 15m or 20m each
	Motor signal cable		(1 cable)	–		
	Motor power cable		(1 cable)	–		
Flexed	Set of signal and power cables	1F- □□ LUCBL-02	–	1 set	7(10m) 13(15m) 17(20m)	10m, 15m or 20m each
	Motor signal cable		–	(1 cable)		
	Motor power cable		–	(1 cable)		
Nylon clamp		NK-14N	–	2 pcs.	–	for motor signal cable
Nylon clamp		NK-18N	–	2 pcs.	–	for motor power cable
Silicon rubber			–	4 pcs.	–	

Note1) The numbers in the boxes □□ 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 2-15](#).

Table 2-15 : Conditions for the flexed type cables

Item		Specifications
Minimum flexed radius		100mm 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 silicone grease coating)
Environmental proof		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 7 and φ 1.7 x 1
	Motor power cable	φ 6.5 x 8 and φ 8.9 x 2

[Caution] The guidance of life count may greatly differ according to the usage state items related to [Table 2-15](#) and to the amount of silicon grease applied in the cableveyor.

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

[Caution] This option can be installed on clean-type, but its cleanliness 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

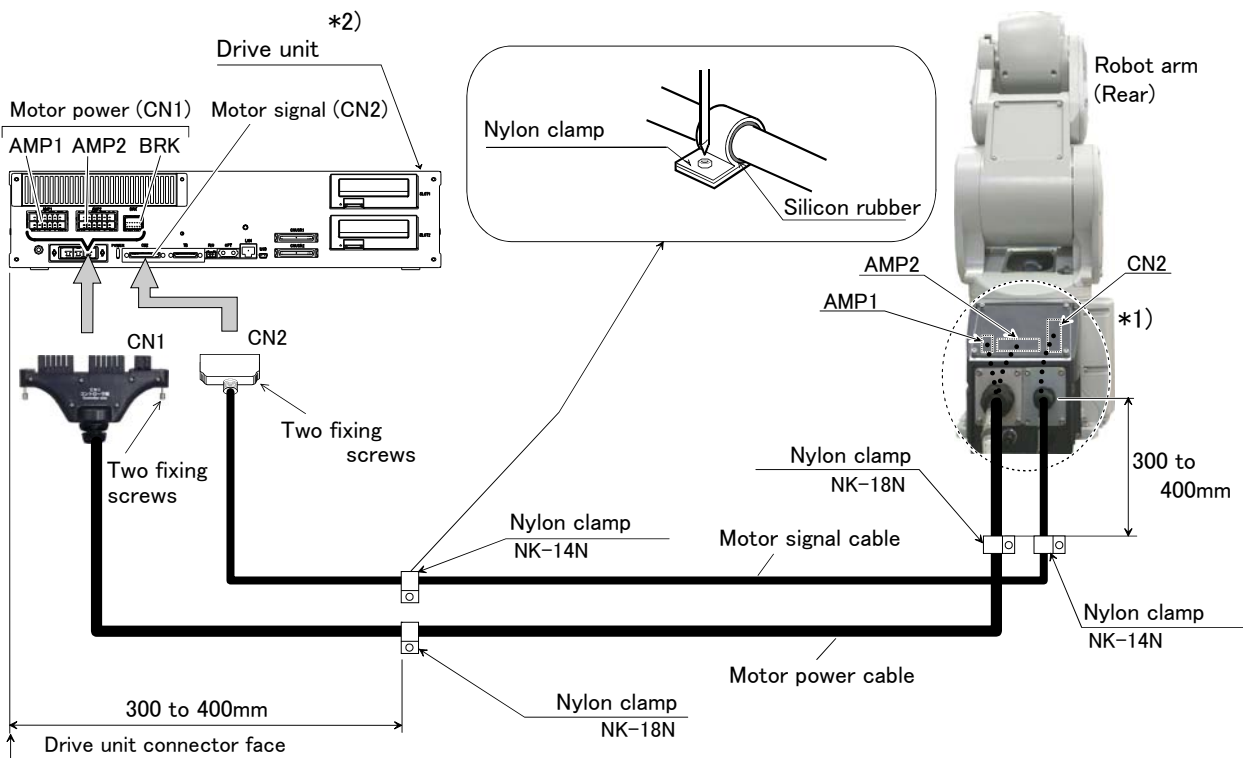
The configuration of the flexible cable is shown in Table 2-16. Refer to this table when selecting the cableveyor.

Table 2-16 : Cable configuration (Flexed type)

Item	Motor signal cable		Motor power cable	
No. of cores	AWG#24 (0.2mm ²)-4P	AWG#18 (0.75mm ²)	AWG#16 (1.25mm ²)-4C	AWG#18 (0.75mm ²)-3C
Finish dimensions	Approx. ϕ 6mm	Approx. ϕ 1.7mm	Approx. ϕ 8.9mm	Approx. ϕ 6.5mm
No. of cables used	7 cables	1 cable	2 cable	8 cable
No. in total	8 cables		10 cables	

■ Fixing the flexible cable

- (1) Connect the connector to the robot arm.
- (2) Wind the silicon rubber around the cable at a position 300 to 400 mm from the side of robot arm and drive unit as shown in Fig. 2-33, and fix with the nylon clamp to protect the cable from external stress.

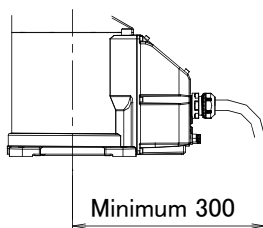


*1) Connect the robot arm side connector to the connector which is inside the CONBOX cover.

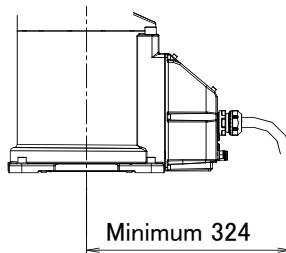
*2) Although the figure is CR750-D, the connection method is the same also in CR750-Q.

The bend size of cables are as follows.

<RV-4F series>



<RV-7F series>



<RV-7FLL/13F/20F series>

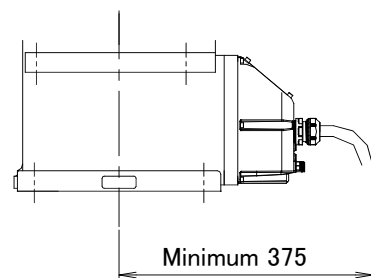


Fig.2-33 : Fixing the flexible cable

(2) J1 axis operating range change

- Order type RV-4F series: 1F-DH-03
 RV-7F series: 1F-DH-04
 RV-13F series: 1F-DH-05J1

■ Outline



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

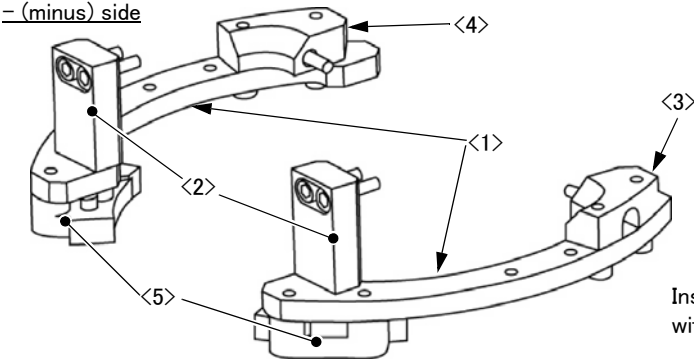
If the axis could interfere with the peripheral devices, etc., and the operating range need to be limited, use this.

■ Configuration

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

Table 2-17 : Configuration devices (RV-4F series)

No.	Part name	Qty.	Mass (kg)	Remarks
<1>	Stopper plate	2	1.1	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		- side
<5>	Variable stopper block	2		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



Install each parts to the upper arm lower part with attached screw.

Table 2-18 : Changeable angle (RV-4F series)

Item	Standard	Changeable angle (combination of + side/- side) (Unit: 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)}	–	Use		Disuse ^{Note3)}	
Parameter (MEJAR) setting value	–240	–30	–73	–103	–146

Note1) Symbol: “(a)” – “(d)” are related with the symbol of [Page 62 “Fig. 2-34: 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 2-18](#). The changeable angle shown in [Table 2-18](#) 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 2-18](#).
- 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)

Table 2-19 : Configuration devices

No.	Part name	Qty.	Mass (kg)	Remarks
<1>	Stopper plate	2	1.1	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		- 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

Diagram illustrating the installation of configuration devices on the upper and lower arms of the robot arm. The diagram shows the following components and their installation locations:

- <1> Stopper plate: Installed on both the upper and lower arms.
- <2> Fixing block A: Installed on the upper arm.
- <3> Fixing block B: Installed on the upper arm (+ side).
- <4> Fixing block C: Installed on the upper arm (- side).
- <5> Variable stopper block: Installed on both the upper and lower arms.

Install each parts to the upper arm lower part with attached screw.

Table 2-20 : Changeable angle (RV-7F series)

Item	Standard	Changeable angle (combination of + side/- side) (Unit: Degree)			
+ (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)}	-	Use		Disuse ^{Note3)}	
Parameter (MEJAR) setting value	-240	-35	-77	-99	-141

Note1) Symbol: “(a)” – “(d)” are related with the symbol of [Page 62 “Fig. 2-34: 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 2-20](#). The changeable angle shown in [Table 2-20](#) 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 2-20](#).

- 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)

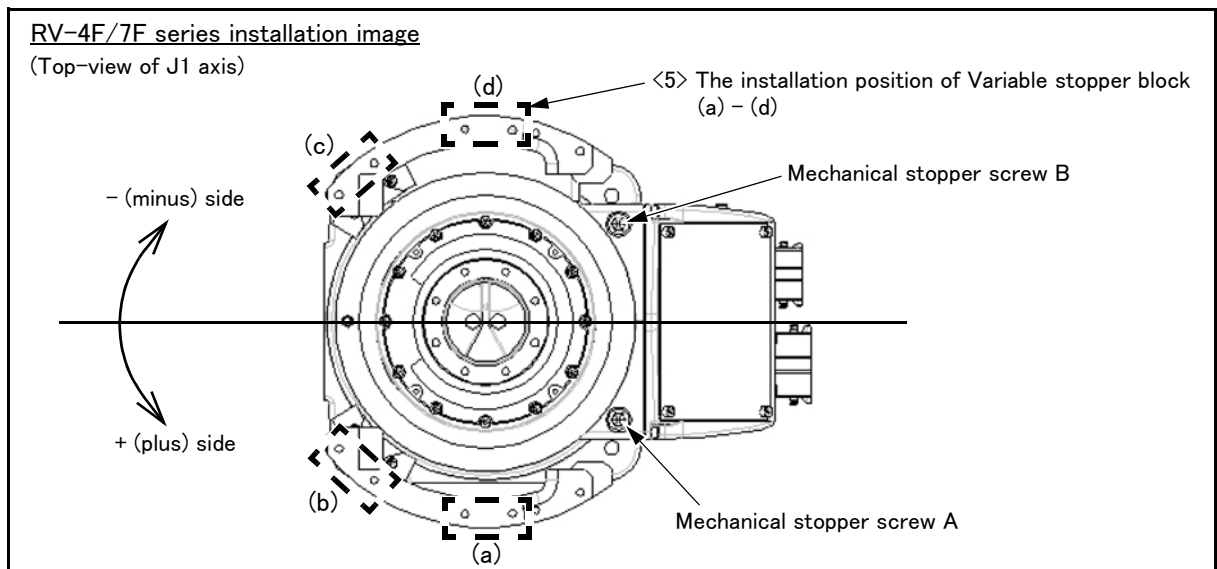


Fig.2-34 : Installation image of J1axis operating range change option (RV-4F/7F series)

[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.

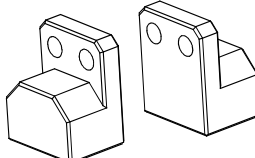
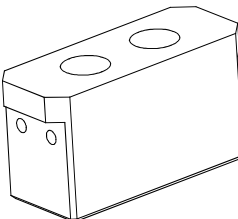
(4) RV-13F series (1F-DH-05J1)

Table 2-21 : Configuration devices

No.	Part name	Qty.	Mass (kg)	Remarks
<1>	Stopper Block J1	1	0.3	
<2>	Resin Stopper B	2		One piece each for + side/- side
<3>	Screw (M12 × 20)	2		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 2-22 : 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 2-22 is related with the symbol of “Fig. 2-35: Installation image of J1axis operating range change option (RV-13F series)”.

- 1) The changeable angle of RV-13F series is shown in Table 2-22. The changeable angle shown in Table 2-22 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 2-22.
- 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.

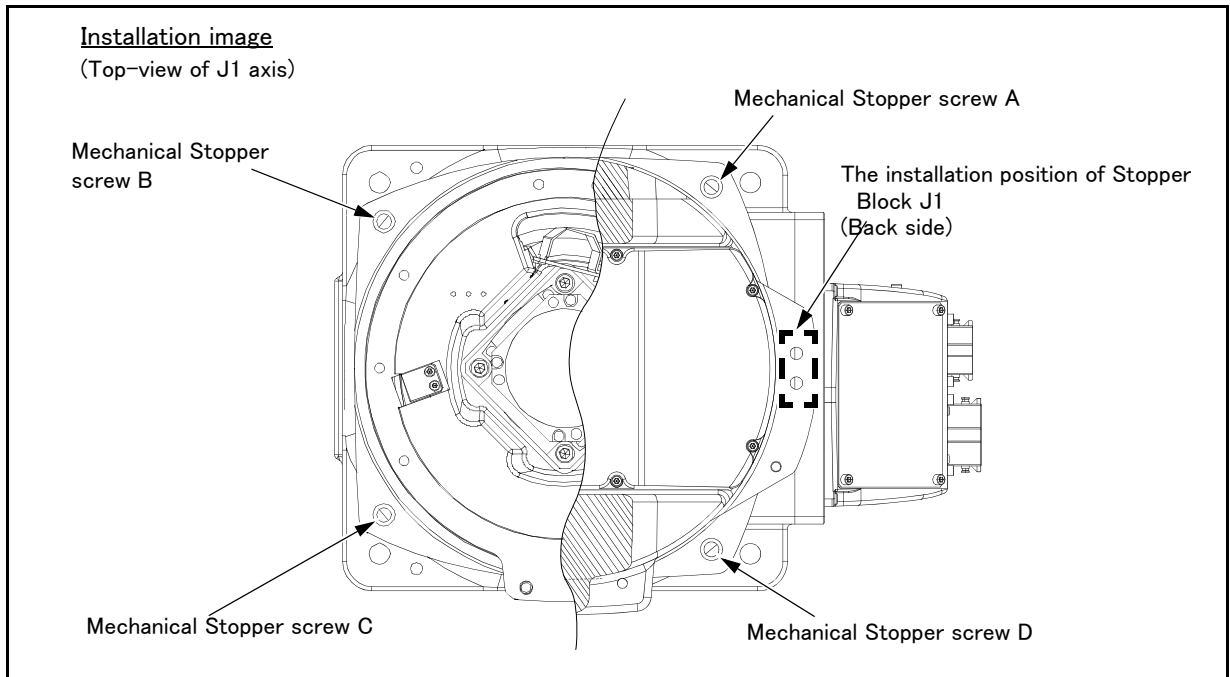


Fig.2-35 : Installation image of J1axis operating range change option (RV-13F series)

[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

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

· RV-4F/7F series and RV-7FLL “-02”

· RV-13F/13FL and RV-20F “-03”

■ Outline

1F-VD0*-02



1F-VD0*-03



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 2-23 : Configuration equipment

Part name	Type ^{Note1)}	Q'ty				Mass(kg) Note2)	Remark
		One set	Two sets	Three sets	Four sets		
Solenoid valve set (1 set)	1F-VD01-**/ 1F-VD01E-**	1 pc.	—	—	—	0.3	Hand output cable is already connected. Refer to Page 69 , “(5) Hand output cable”. 1F-VD0*-01: Sink type 1F-VD0*-01: Source type. Coupling size of A/B-port (output side of solenoid valve) · 1F-VD0*-02/1F-VD0*-E-02 : Φ 4 · 1F-VD0*-03/1F-VD0*-E-03 : Φ 6
Solenoid valve set (2 sets)	1F-VD02-**/ 1F-VD02E-**	—	1 pc.	—	—	0.4	
Solenoid valve set (3 sets)	1F-VD03-**/ 1F-VD03E-**	—	—	1 pc.	—	0.4	
Solenoid valve set (4 sets)	1F-VD04-**/ 1F-VD04E-**	—	—	—	1 pc.	0.5	

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

Note2) Mass indicates one set.

■ Specifications

Table 2-24 : 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

Note2)

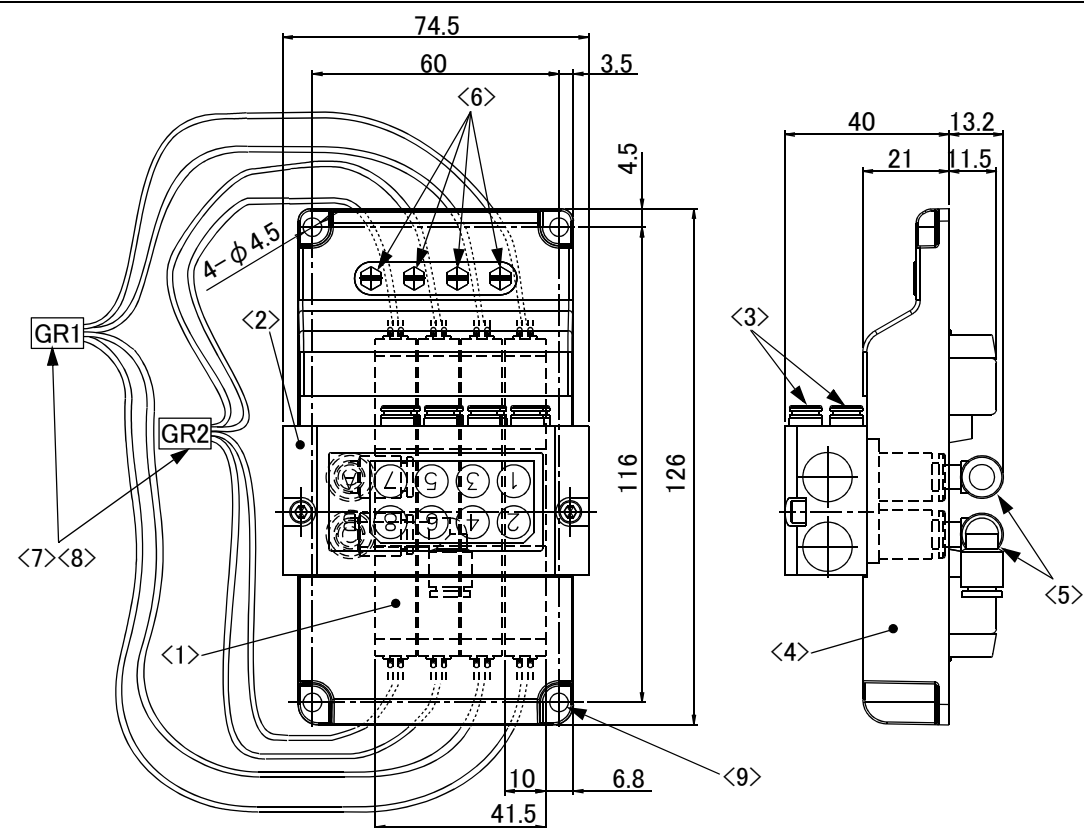


CAUTION

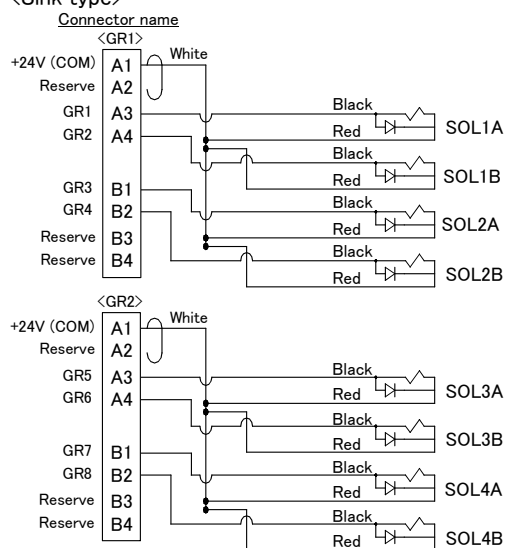
The air to be provided must be clean, i.e., filtered with a mist separator or air filter. Failing to do so may lead to malfunctions.

Table 2-25 : Solenoid specifications

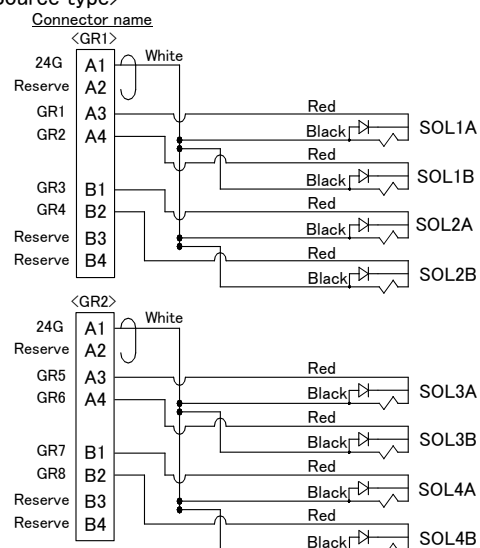
Item	Specifications
Method	Built-in fly-wheel diodes with surge protection
Coil rated voltage	DC24V ±10%
Power consumption	0.55W
Voltage protection circuit with power surge protection	Diode



<Sink type>



<Source type>



Part no.	Part name	1 sets	2 sets	3 sets	4 sets	Specifications
<1>	Solenoid valve	1	2	3	4	
<2>	Manifold block	1	1	1	1	
<3>	Quick coupling (Port A/B)	8	8	8	8	φ 4
<4>	Housing	1	1	1	1	
<5>	Quick coupling (Port P/R)	3	3	3	3	φ 6 (Attachment)
<6>	Plug	4	4	4	4	
<7>	Connector	1	1	2	2	1-1318115-4
<8>	Contact	3	5	8	10	1318112-1
<9>	Installation screw	4	4	4	4	M4 × 12

Fig.2-36 : Outline dimensional drawing (1F-VD0*-02/1F-VD0*-E-02)

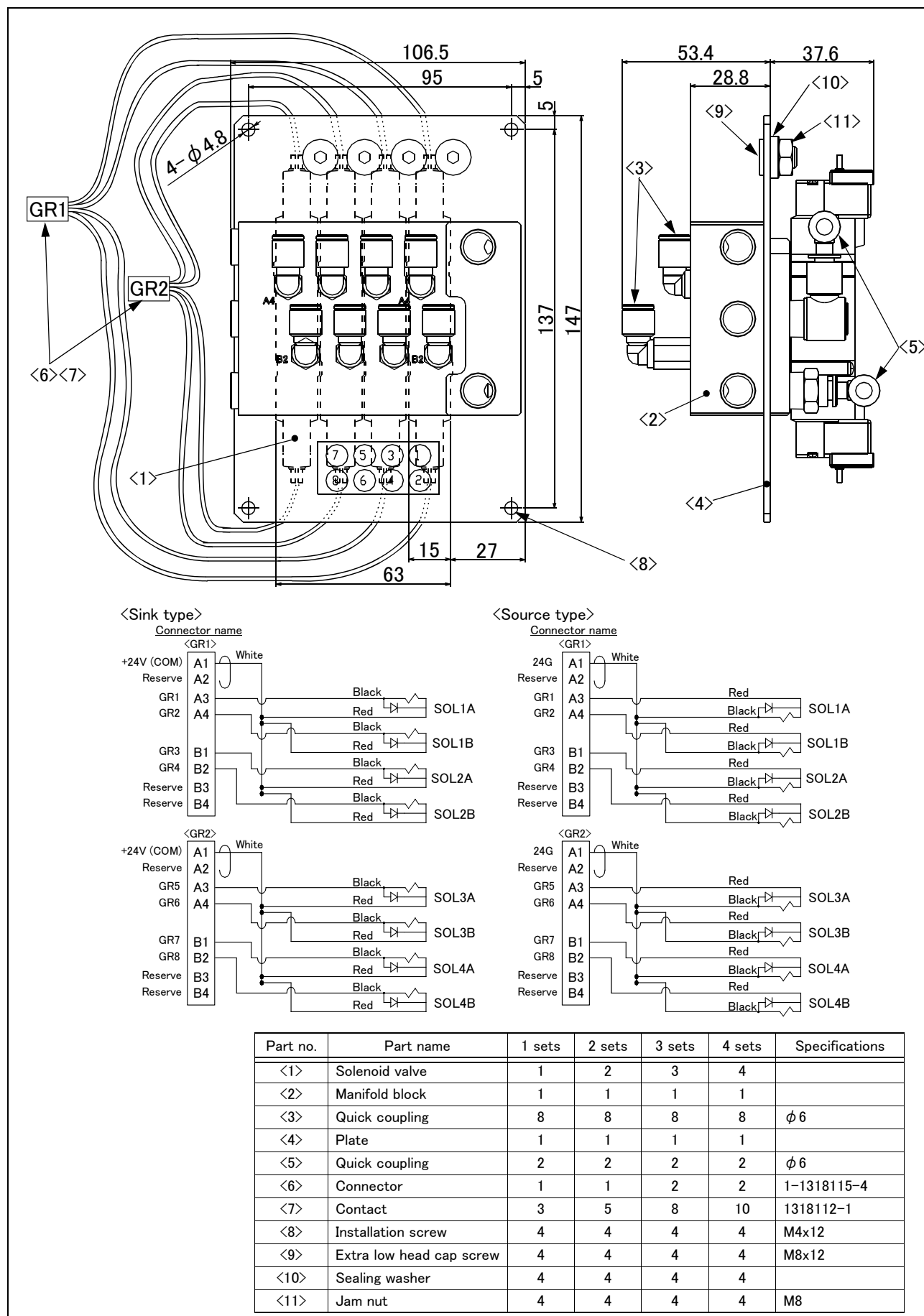


Fig.2-37 : Outline dimensional drawing (1F-VD0*-03/1F-VD0*E-03)

(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 2-26 : Configuration equipment

Part name	Type	Qty.	Mass (kg) ^{Note1)}	Remarks
Hand input cable	1F-HC35S-02	1 cable	0.2	

Note1) Mass indicates one set.

■ Specifications

Table 2-27 : 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 2-28](#).

Table 2-28 : Pin assign of hand input cable

Color	Connector ^{Note1)}	Pin number: names	Color	Connector ^{Note1)}	Pin number: names
Purple	OP1	A1: HC1	Yellow	OP3	A1: +24V
Brown		A2: HC2	Green		A2: 24G
Blue		A3: HC3	—		Reserved
Black		A4: HC4	—		Reserved
Red		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] This option can be installed on clean-type, but its cleanliness 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 2-29 : Configuration equipment

Part name	Type	Qty.	Mass (kg) ^{Note1)}	Remarks
Hand output cable	1F-GR35S-02	1 cable	0.1	

Note1) Mass indicates one set.

■ Specifications

Table 2-30 : 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 2-31](#).

Table 2-31 : Pin assign of hand output cable

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

[Caution] This option can be installed on clean-type, but its cleanliness is not under warranty.

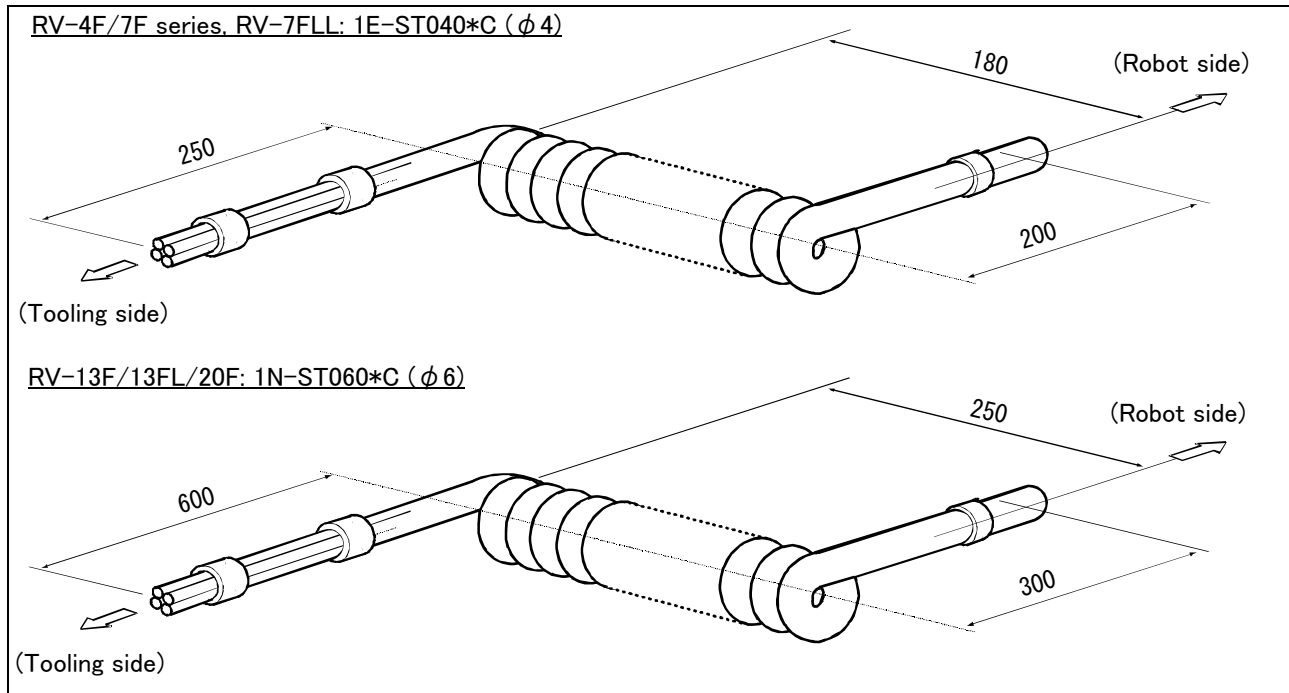


Fig.2-38 : Outline dimensional drawing

[Caution] This option can be installed on clean-type, but its cleanliness is not under warranty.

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

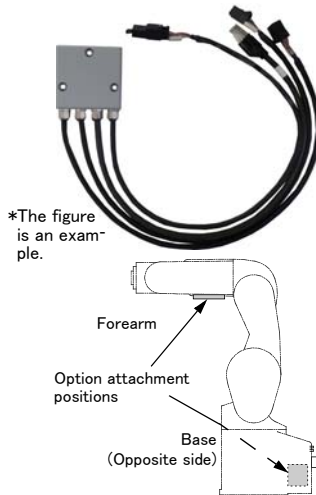
■ Order type

Forearm external wiring set: 1F-HB01S-01 (Hand input signals, force sensor and vision sensor)
1F-HB02S-01 (Force sensor and vision-sensor)

Base external wiring set: 1F-HA01S-01 (Force sensor and vision-sensor)
1F-HA02S-01 (Force sensor and vision-sensor)

Note) In the Internal wiring and piping specification, the corresponding base external wiring set is attached.

■ 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-HC35C-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 2-34 : Configuration equipment

Part name	Type	Qty.	Remarks
Forearm external wiring set	1F-HB01S-01	Either one pc.	
	1F-HB02S-01		
Base external wiring set	1F-HA01S-01	Either one pc.	
	1F-HA02S-01		

■ Specification

The kind of cable which can be pulled out for each option is shown in Table 2-35. 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 "the pairing (recommendation)" of the table. And, each wiring system figure is shown after the following page.

Table 2-35 : Internal wiring and piping specification types

Pairing (recommendation)	Option type	Cable length (mm) ^{Note1)}	Wiring (cable for the connection to each equipment)		
			Hand input signal ^{Note2)}	Vision sensor camera	Force sensor unit
1	1F-HB01S-01 (Forearm)	1,000	eight points	1	Either one unit
	1F-HA01S-01 (Base)	500	Not available	1	Either one unit
2	1F-HB02S-01 (Forearm)	1,000	Not available	1	1
	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 2-36.

Table 2-36 : 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	B4
Yellow	+24V	A6	Green	+24G(RG)	B6	-					

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

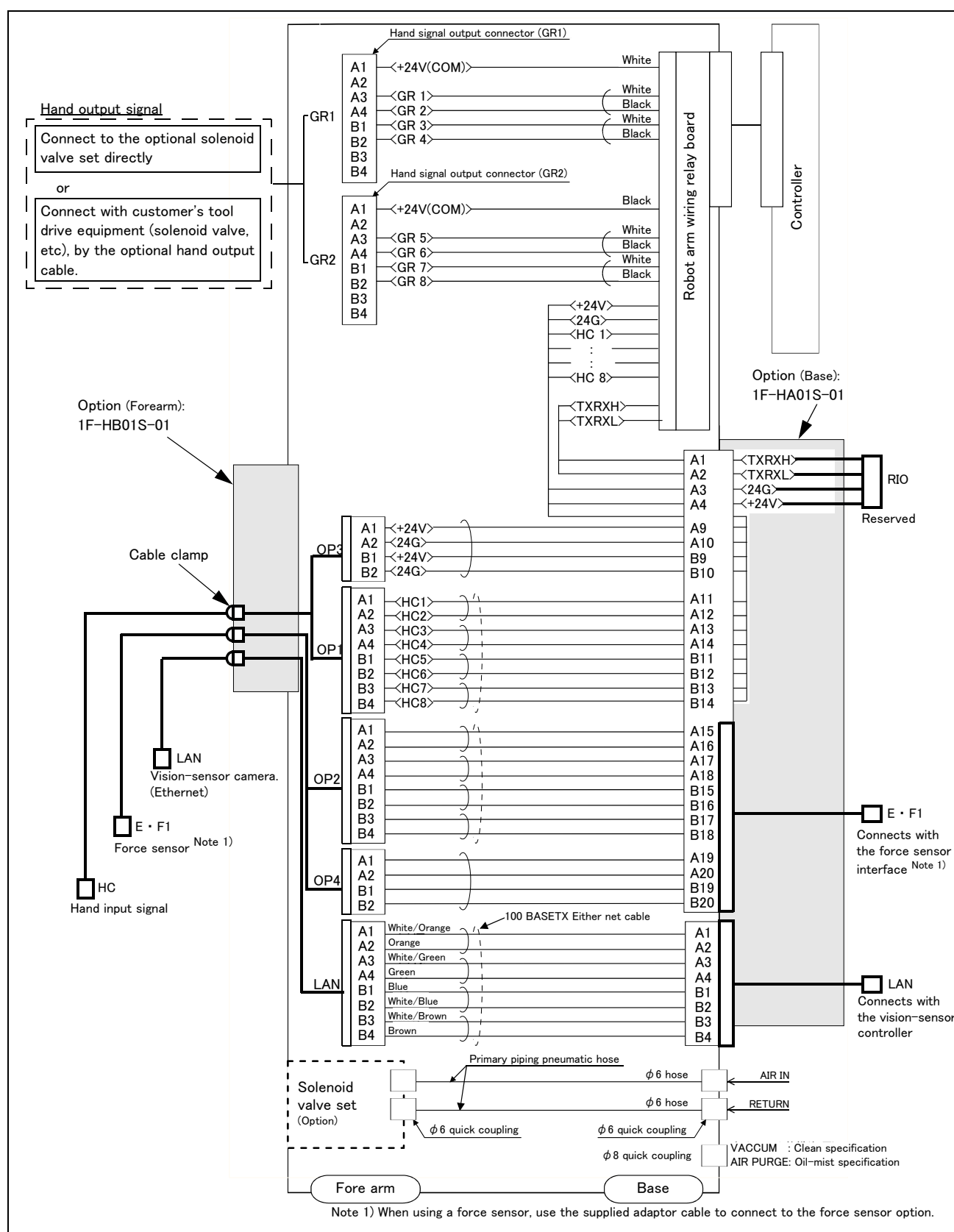


Fig.2-39 : Wiring system diagram (1F-H*01S-01)

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

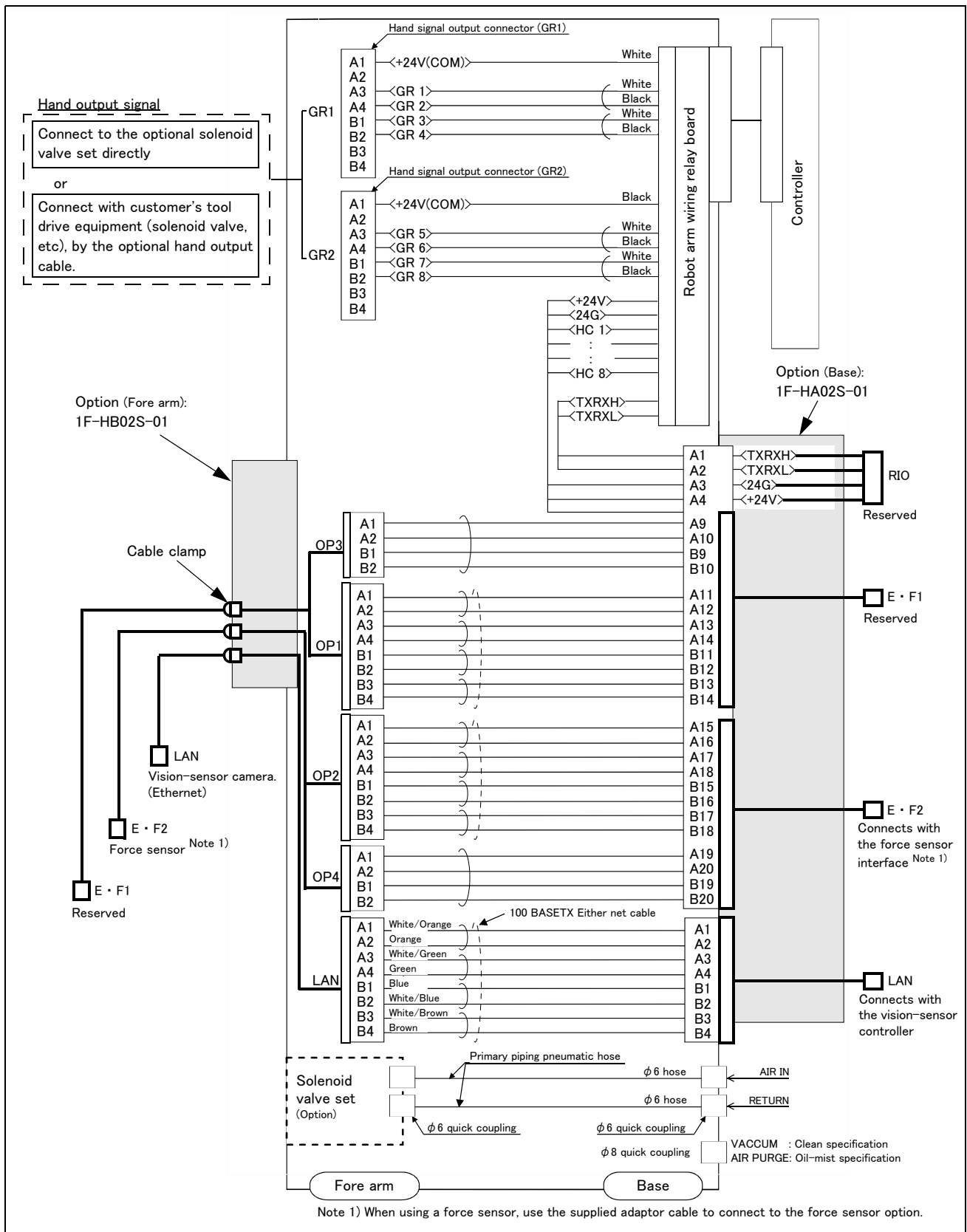


Fig.2-40 : Wiring system diagram (1F-H*02S-01)

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 body and 36,000 hours for the controller). (See Fig. 2-41.) For specific information about parts to be replaced and timing of overhaul, contact your local service representative.

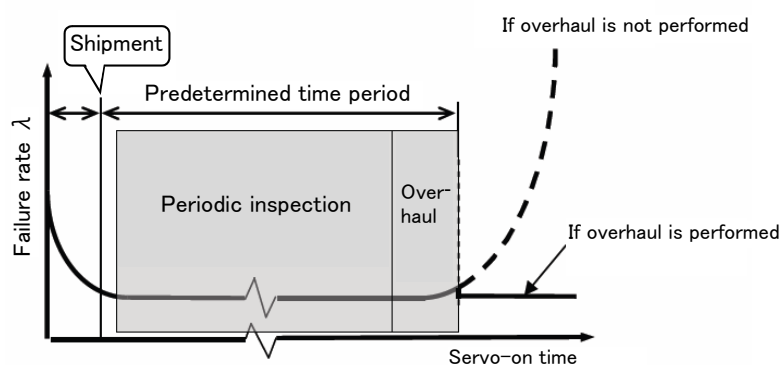


Fig.2-41 : Periodic inspection/overhaul periods

2.9 Maintenance parts

The consumable parts used in the robot arm are shown in [Table 2-37](#). 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 2-37 : 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.	

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

Use the robot CPU unit which consists of CR751-Q controllers, equipping the base unit of the sequencer of the MELSEC-Q series of our company. Specifications such as the power supply and outside dimension of the robot CPU unit are the same as the sequencer's specification. Refer to [Page 81 "Fig. 3-2"](#) (Names of each part), [Page 84 "Fig. 3-5"](#) and [Page 85 "Fig. 3-6"](#) (Outside dimensions)

Although the specification with which the robot CPU unit and the drive unit (box which mounts the servo amplifier for the robots, the safety circuit, etc.) were put together is shown in [Table 3-1](#), the specification of the drive unit is mainly described.

Table 3-1 : Specifications of controller

Item		Unit	Specification	Remarks
Type			CR751- □ VQ-0 CR751-04VJQ-0 CR751-07VLQ-0	" □ " in type name shows the load (04, 07, 13 or 20) of robot arm. CR751-04VJQ-0 controller is only for RV-4FJL. CR751-07VLQ-0 controller is only for RV-7FLL.
Number of control axis			Simultaneously 6	
Memory capacity	Programmed positions	point	13,000	
	No. of steps	step	26,000	
	Number of program		256	
Robot language			MELFA-BASIC IV, V	
Teaching method			Pose teaching method, MDI method ^{Note1)}	
External input and output	Input and output	point	0/0	Multi-CPU shared device Input 8192/Output 8192 (Max.)
	Dedicated input/output		Assign to the multi-CPU shared device.	
	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
Interface	RS-422	port	1	Only for T/B
	Ethernet	port	1	10BASE-T/100BASE-Tx
	Additional axis interface	Channel	1	SSCNET III (Connects with MR-J3-BS, MR-J4-B series)
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	
	Power capacity	kVA	RV-4F series : 1.0 RV-7F series : 2.0 RV-13F series : 3.0	Does not include rush current ^{Note3)}
	Power supply frequency	Hz	50/60	
Outline dimensions ^{Note4)}		mm	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
Mass		kg	RV-4F/7F series: Approx. 12 RV-13F series: Approx. 15	
Construction			Self-contained floor type, Opened type. Installation vertically or horizontally	IP20 ^{Note5)}

Item	Unit	Specification	Remarks
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.

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

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

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 82, "3.4 Outside dimensions/Installation dimensions"](#) for details.

Note5) This controller is standard specification. (Refer to [Page 78, "3.2 Protection specifications and operating supply"](#).)

Note6) The robot must be grounded by the customer.

Table 3-2 : Robot CPU unit standard specification

Item		Unit	Specification	Remarks
Type			Q172DRCPU	
Interface	Addition axis synchronization	port	1	
Power source	Power capacity (DC5V)	A	1.25	
Outline dimension		mm	98(W) x 27.4(D) x 119.3(H)	
Mass		kg	0.33	
Operating temperature range		°C	0 to 55	
Ambient humidity		%RH	5 to 95	Without dew drops

3.2 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.

【Information】

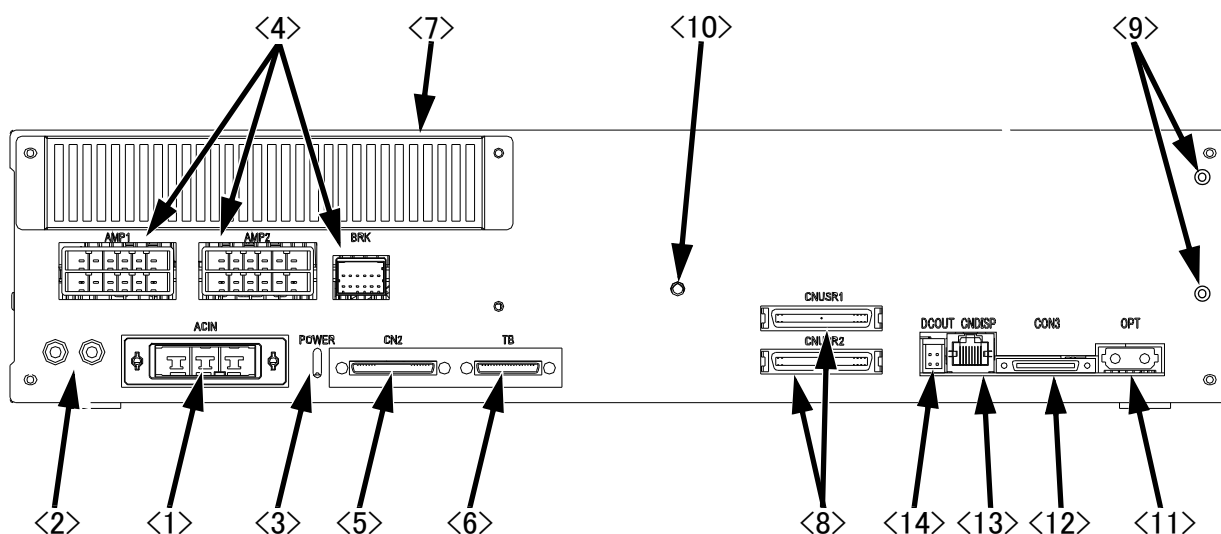
- The IEC IP20

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.

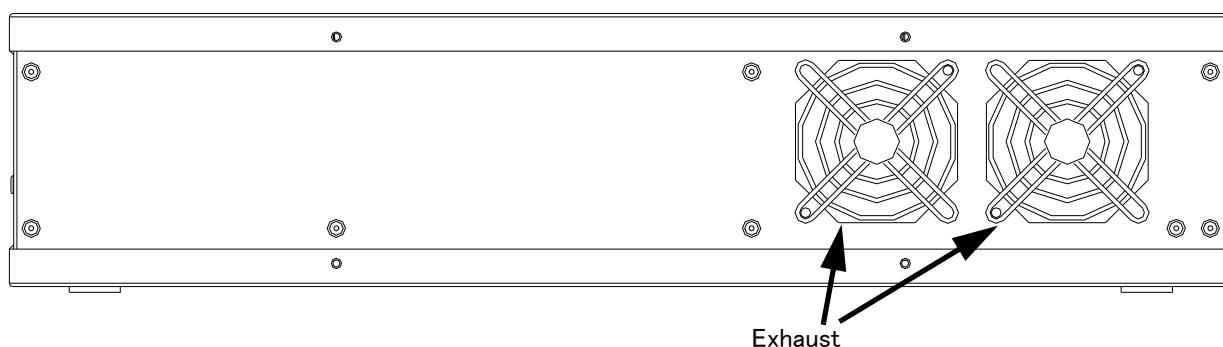
Refer to the section [Page 132, "6.2 Working environment"](#) for details on the working environment.

3.3 Names of each part

Drive unit (Front side)

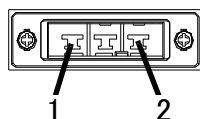


Controller (Rear side)



<1>: ACIN terminal

RV-4F series: Single phase



RV-7F/13F series: Single phase/Three phase

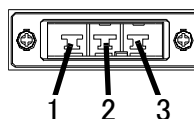


Fig.3-1 : Names of drive unit parts (CR751)

- <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)
 Note) When using the RV-4F series, connect the primary power supply to 1 and 2 terminal.
 When using the RV-7F/13F series, connect the primary power supply to 1, 2 and 3 terminal when using the three phase primary power supply, and connect the primary power supply to 1 and 3 terminal when using the single phase primary power supply.
- <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 power)
 AMP1, AMP2: Motor power, BRK: Motor brake
- <5> Machine cable connector (motor signal)
 CN2: Motor signal

- <6>T/B connection connector (TB)This is a dedicated connector for connecting the R33TB. When not using T/B, connect the attached dummy plug.
- <7>Filter coverThere is an air filter and battery inside this cover.
- <8>CNUSR connector.....The connector for input/ output connection dedicated for robot.
(CNUSR1、CNUSR2) (a plug connector attached)
- <9>Grounding terminal.....The grounding terminal for connecting cables of option card. (M3 screw x 2 places)
- <10>Power supply charge lamp (CRARGE)
The lamp is to ensure safe timing (prevent electric shocks) when removing the cover (users are not normally required to remove the cover).
This lamp is illuminated (red) when electrical energy accumulates on 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>OPT connector (OPT).....For SSCNETIII connection
- <12>CON3 connector (CON3).....For RS422 of T/B connection
- <13>CNDISP connector (CNDISP).....For LAN of T/B connection
- <14>DCOUT connector (DCOUT)For emergency stop

3.3.1 Names of each part of the robot CPU

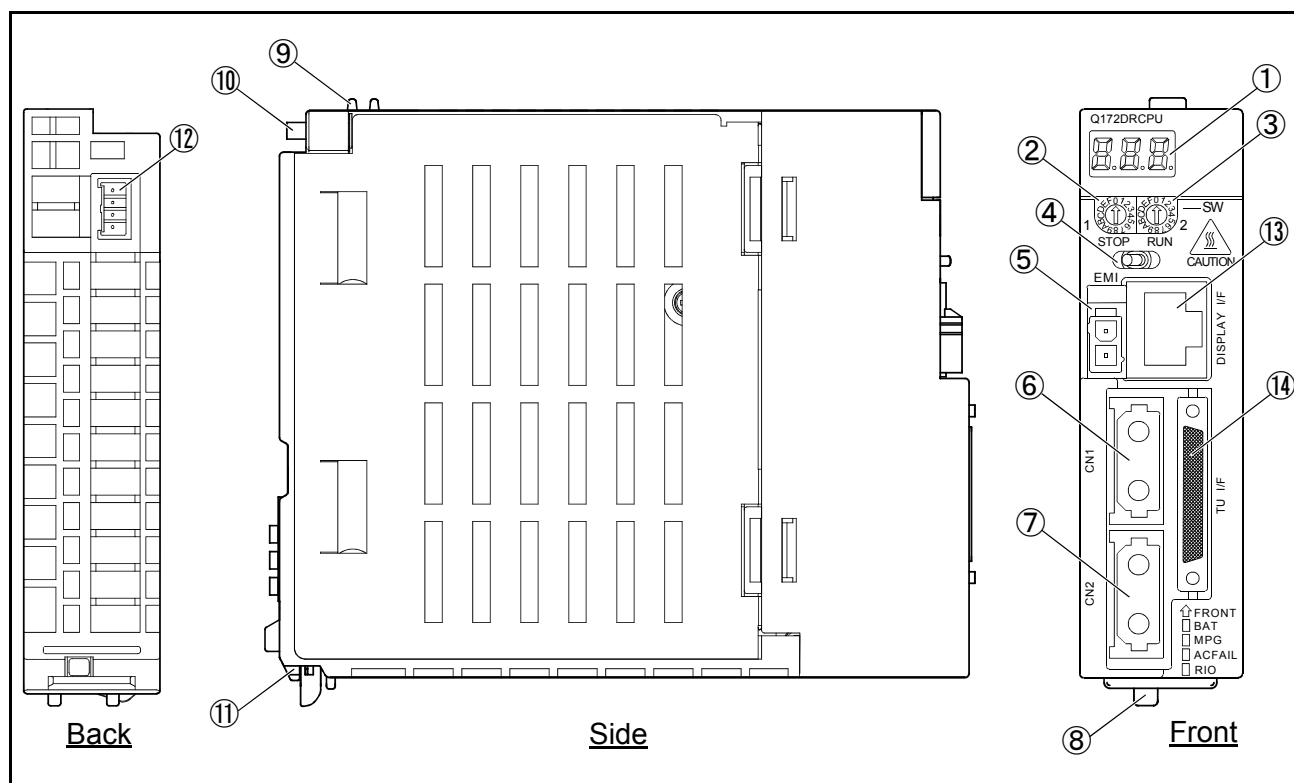


Fig.3-2 : Names of each part of the robot CPU

- ① Seven segments LED.....Indicates operational status and error information
- ② Rotary switch (SW1).....Set up operation mode. Always set it as "0."
- ③ Rotary switch (SW2).....Set up operation mode. Always set it as "0."
- ④ RUN/STOP switch.....Unused
- ⑤ Emergency stop input (EMI)*1) ..Connects with the connector (DCOUT) of the controller by the EMI cable for robot. (For the emergency stops)
- ⑥ CN1 connector*2)Connects with the connector (OPT) of the controller by the SSCNET III cable for robot. (For the robot-arm servo amplifier connection)
- ⑦ CN2 connector*2)Connect to the servo amplifier of the addition axis (Eight axes)
- ⑧ Lever for unit installation.....Use this lever, when installing the unit in the base unit.
- ⑨ Hook for unit fixing*3)The hook which fixes the unit to the base unit (For the support at installation)
- ⑩ Unit fixing screw.....The screw for fixing to the base unit (M3 × 13)
- ⑪ The projection for unit fixingThe projection for fixing to the base unit
- ⑫ Battery connector (BAT)*4)The connector for connection with battery holder unit Q170DBATC.
- ⑬ The connector for the networks (DISPLAY I/F)
Connects with the connector (CNDISP) of the controller by the DISP cable for robot. (For the LAN of T/B)
- ⑭ RS422 connector (TU I/F)Connects with the connector (CON3) of the controller by the TU cable for robot. (For the RS-422 of T/B)

*1) Please be sure to use the emergency stop input cable. The emergency stop cannot be canceled if it does not use. If it manufactures the emergency stop input cable in the customer, cable length should use 30m or less.

*2) Please store in the duct or fix the cable section near robot CPU with the bunch wire rod so that prudence of the cable is not applied to CN1 and CN2 connector section.

*3) It is equipment for the support when installing the unit in the basic base unit. Please be sure to fix the unit to the basic base unit with the attached fixing screw.

*4) Please be sure to use the external battery. Unless the battery cable is connected surely, the program in SRAM with a built-in robot CPU, the parameter, origin position data, etc. are not held.

3.4 Outside dimensions/Installation dimensions

3.4.1 Outside dimensions

(1) RV-4F/7F series

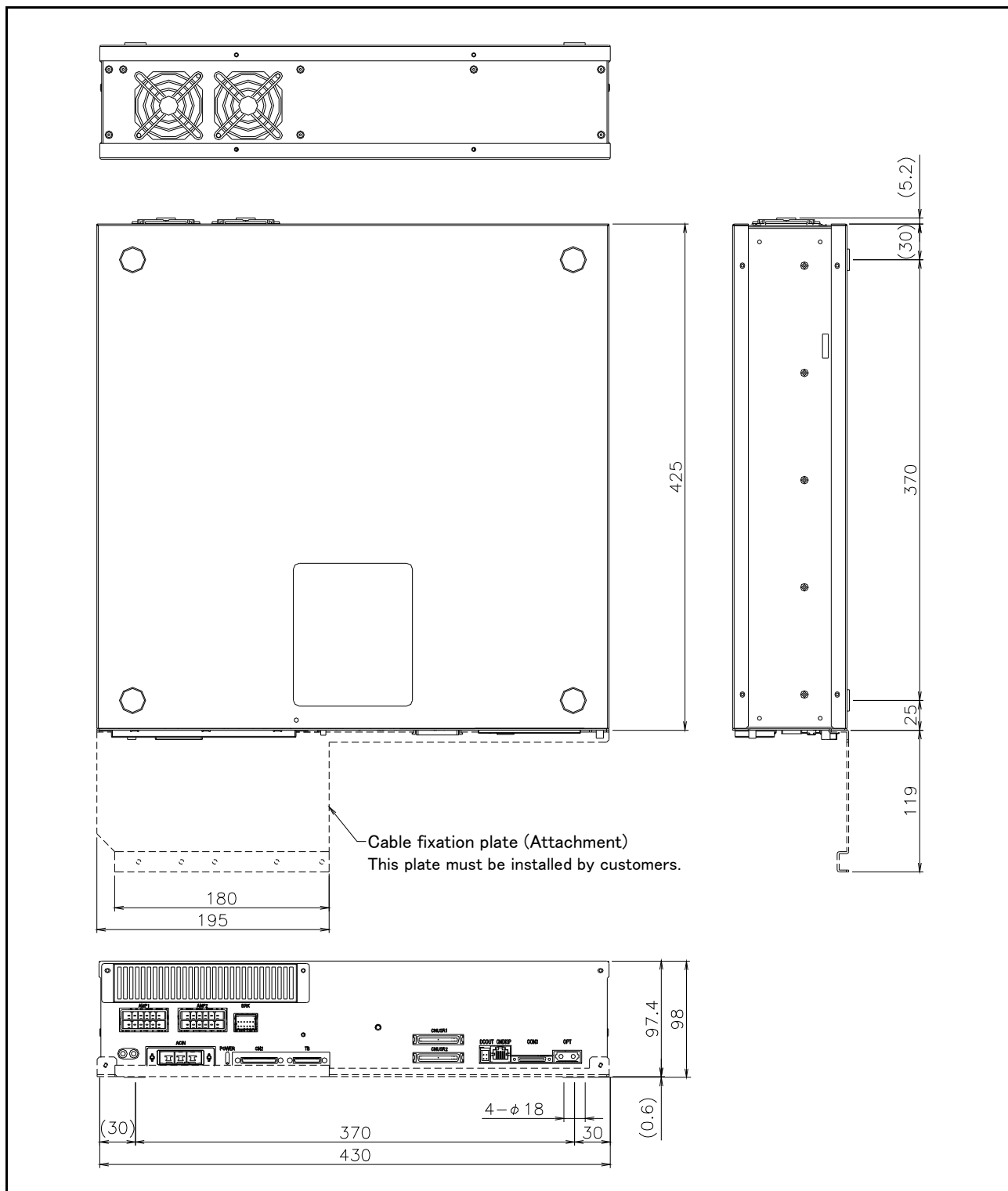


Fig.3-3 : Outside dimensions of drive unit (CR751: RV-4F/7F series)

(2) RV-13F series

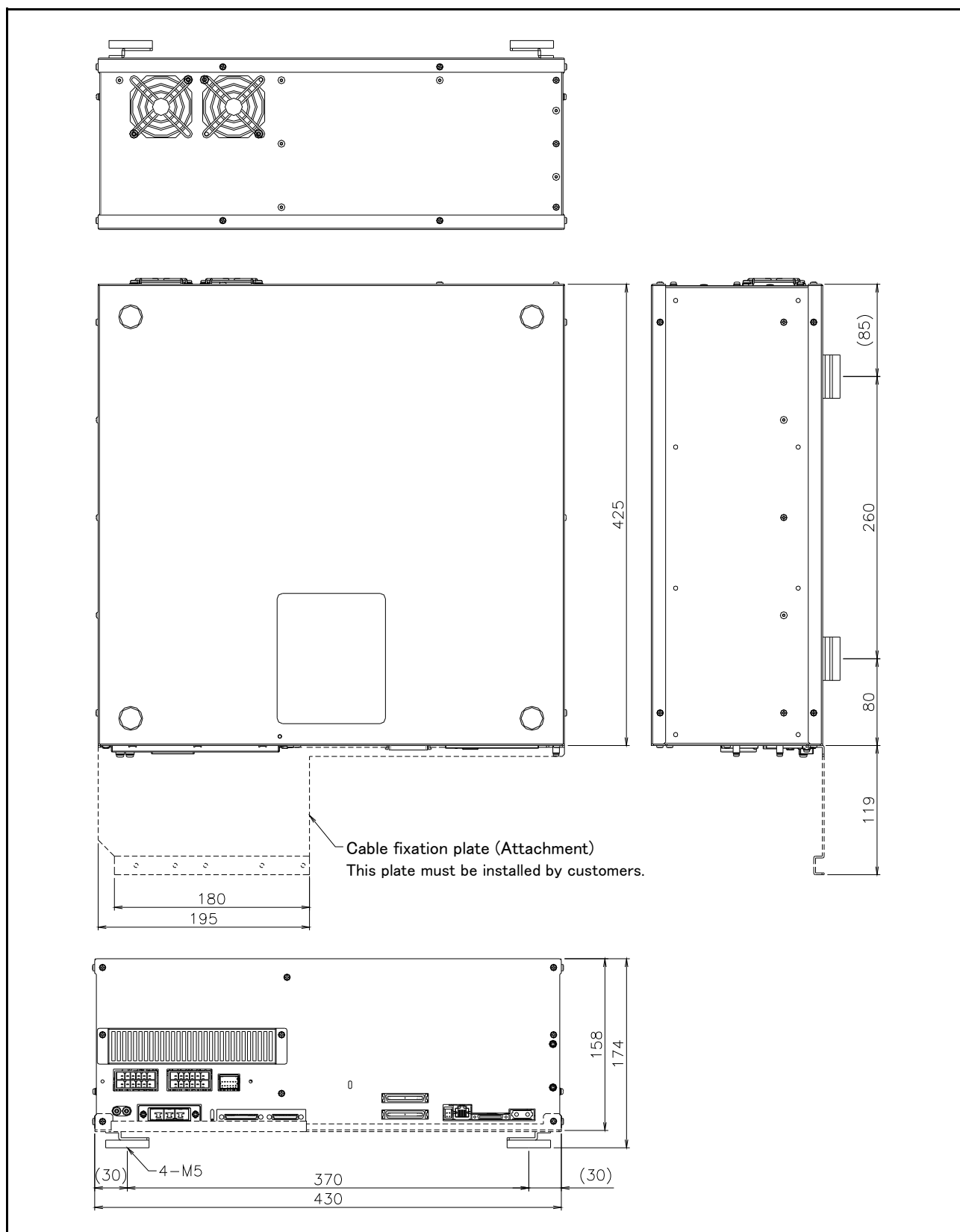


Fig.3-4 : Outside dimensions of drive unit (CR751: RV-13F series)

(3) Outside dimensions of robot CPU unit

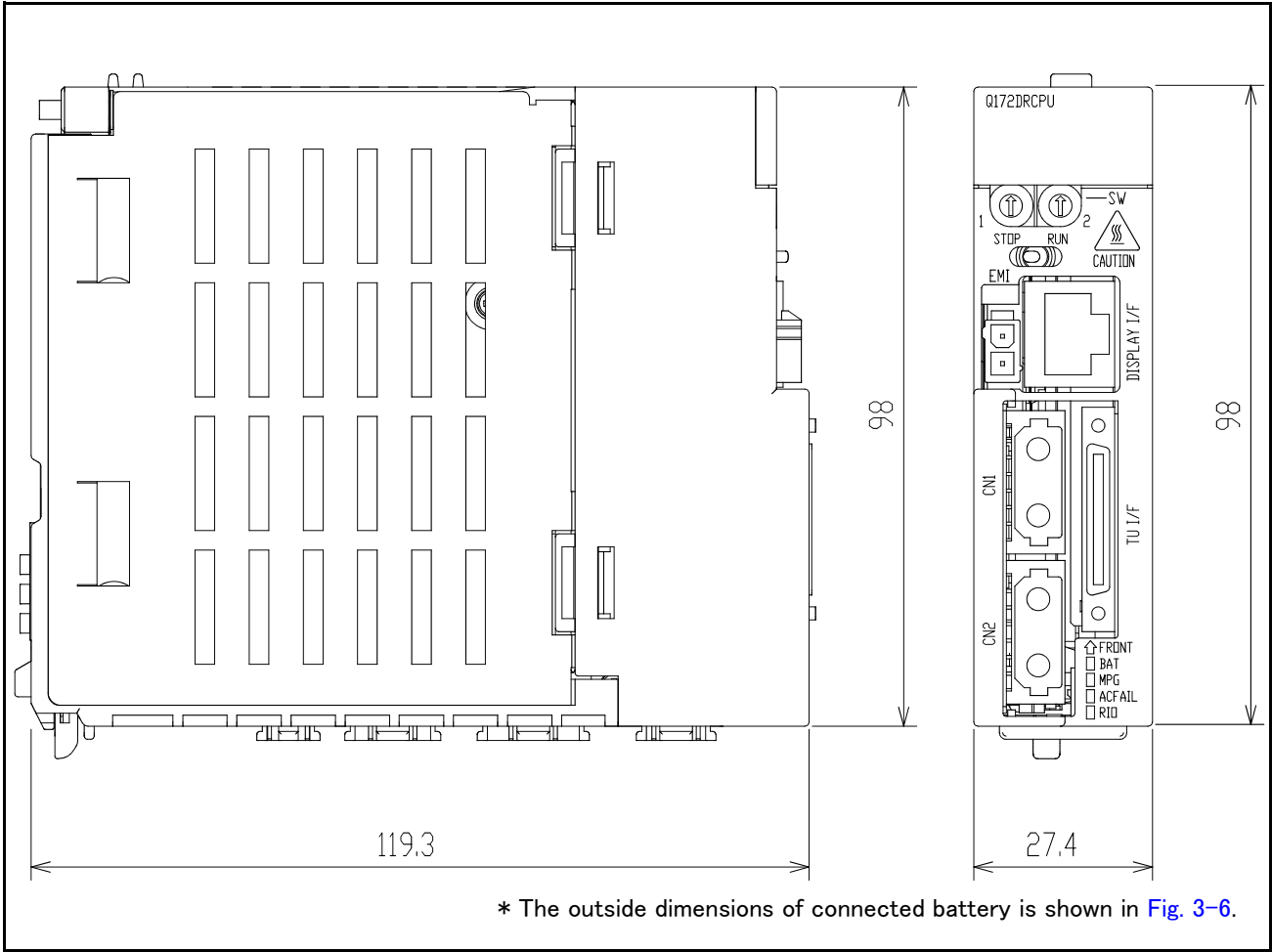


Fig.3-5 : Outside dimensions of robot CPU

(4) Battery unit outside dimension

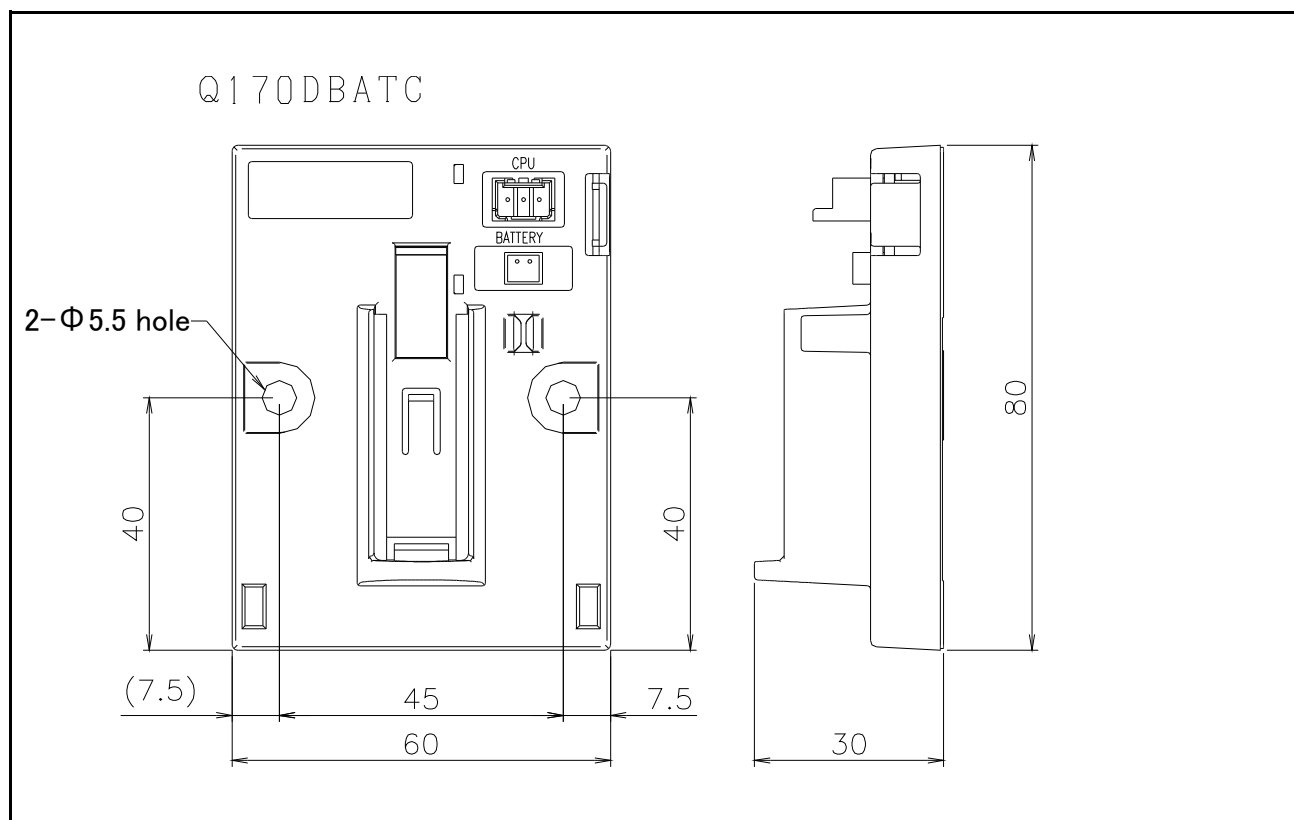
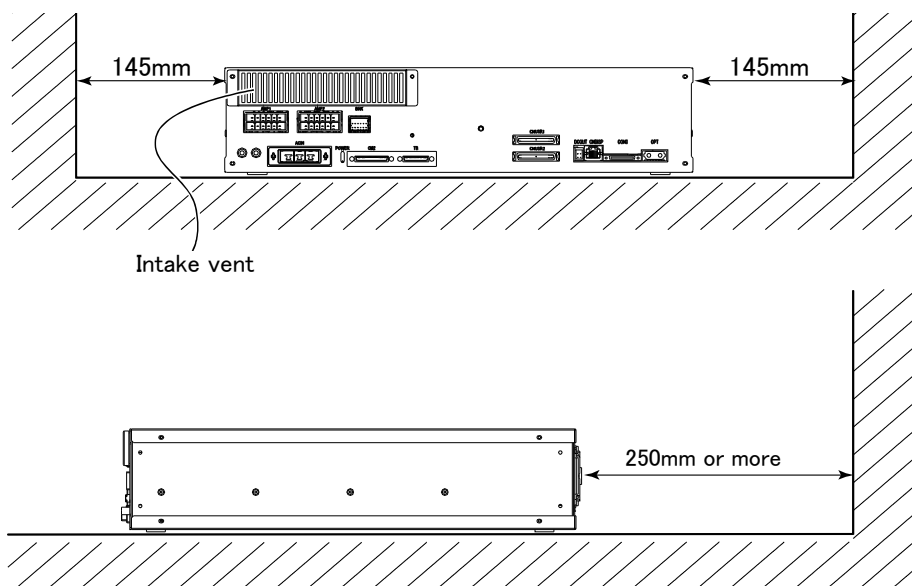


Fig.3-6 : Outside dimensions of battery unit

3.4.2 Installation dimensions

(1) RV-4F/7F series

<Placed horizontally>



<Placed vertically>

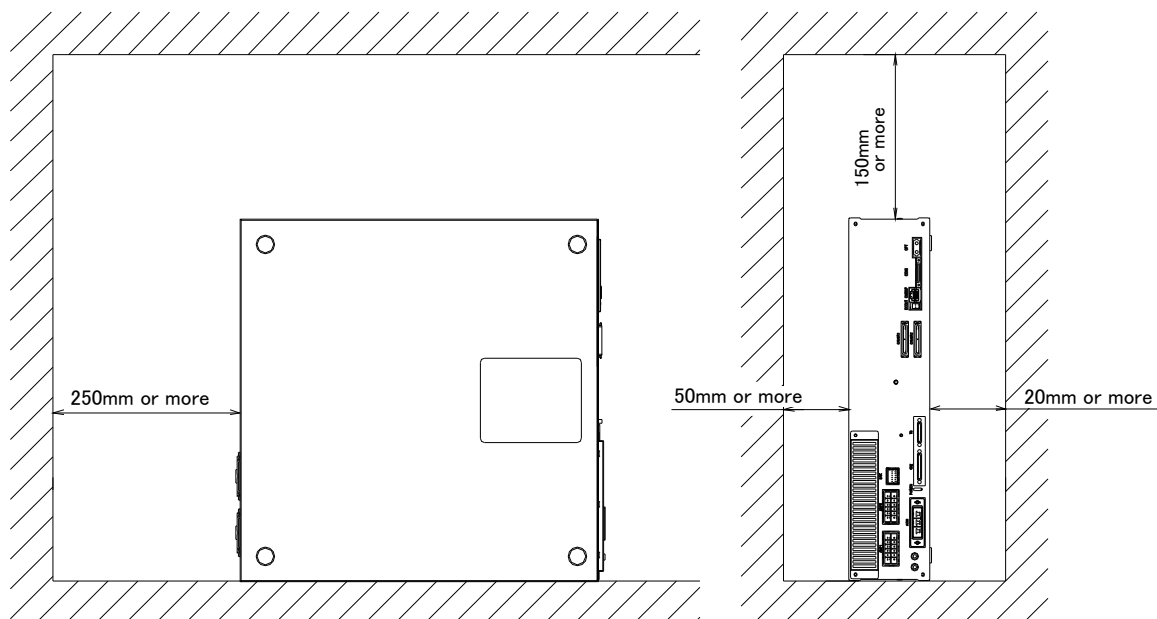


Fig.3-7 : Installation of controller (RV-4F/7F series)

CAUTION

Fixing installation section sure for prevention from the fall, when using the drive unit placing vertically. The reference figure of the metal plate for fixing is shown in [Fig. 3-8](#). 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 drive unit (side board thickness is 1.2mm) surely makes 6.8mm or less.

CAUTION

When storing the drive unit 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 drive unit in the position where direct rays or the heat of lighting hits. The skin temperature of the drive unit may rise, and the error may occur.

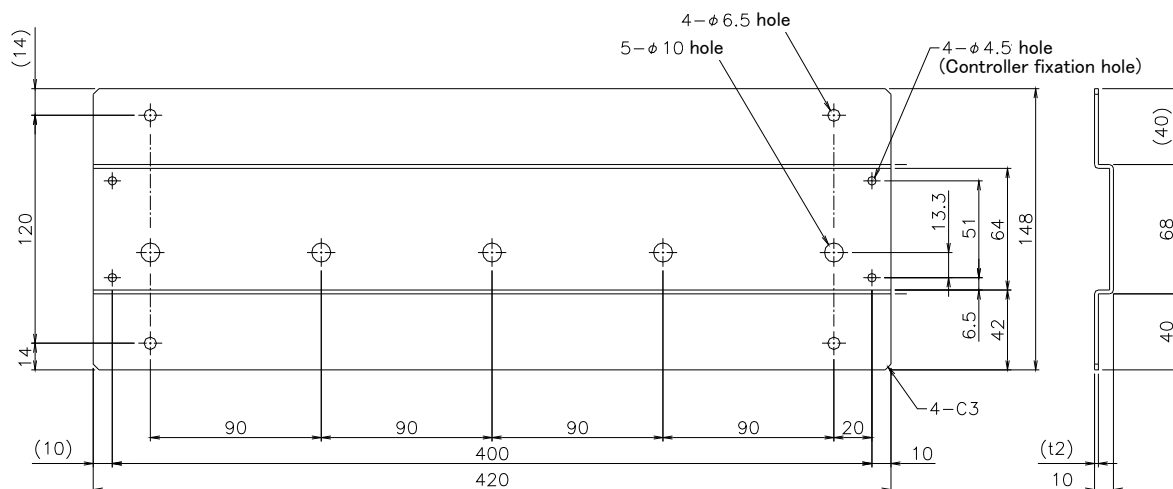
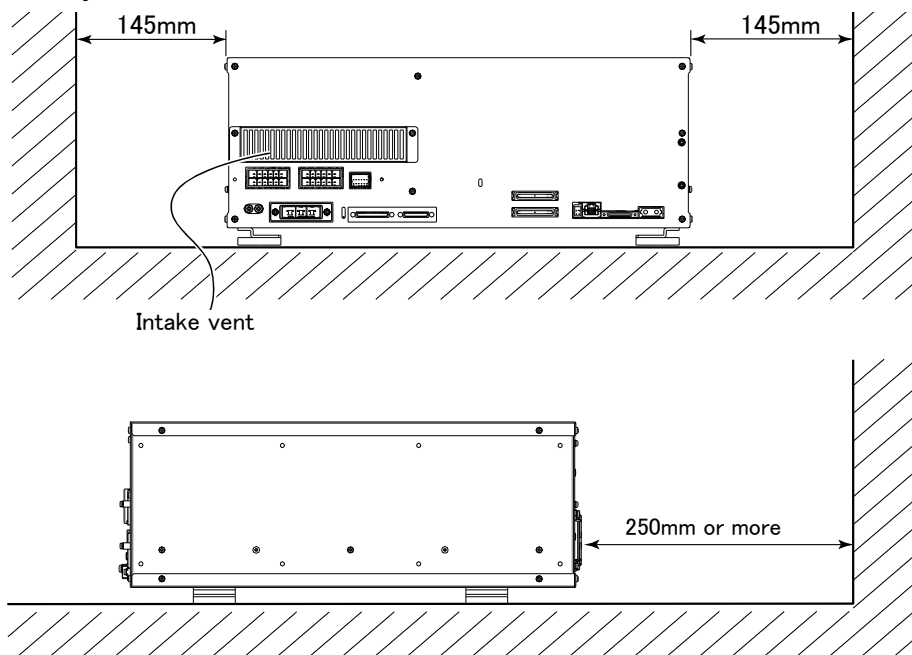


Fig.3-8 : Metal plate for fixation to placing vertically (Reference for RV-4F/7F series)

(2) RV-13F series

<Placed horizontally>



<Placed vertically>

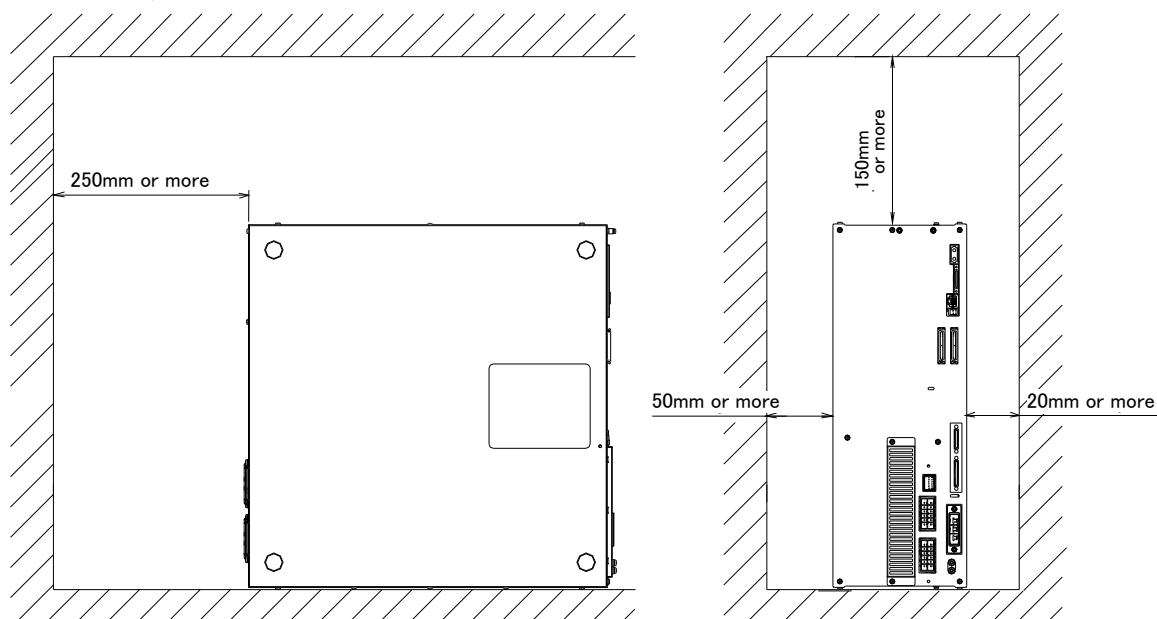


Fig.3-9 : Installation of controller (RV-13F series)

⚠ CAUTION

Fixing installation section sure for prevention from the fall, when using the drive unit placing vertically. The reference figure of the metal plate for fixing is shown in [Fig. 3-10](#). 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 drive unit (side board thickness is 1.2mm) surely makes 6.8mm or less.

⚠ CAUTION

When storing the drive unit 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 drive unit in the position where direct rays or the heat of lighting hits. The skin temperature of the drive unit may rise, and the error may occur.

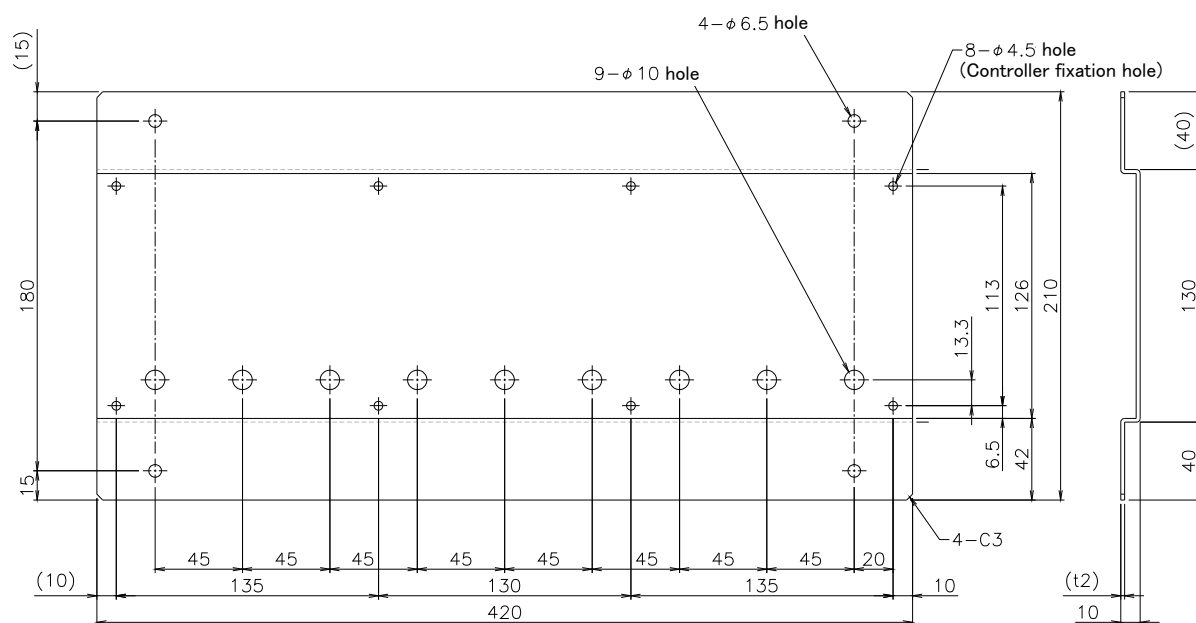


Fig.3-10 : Metal plate for fixation to placing vertically (Reference for RV-13F series)

(3) Robot CPU Unit installation dimensions

Because to improve ventilation and to make unit replacement easy, please secure the following distance between the upper and lower sides of the unit and the structure, etc.

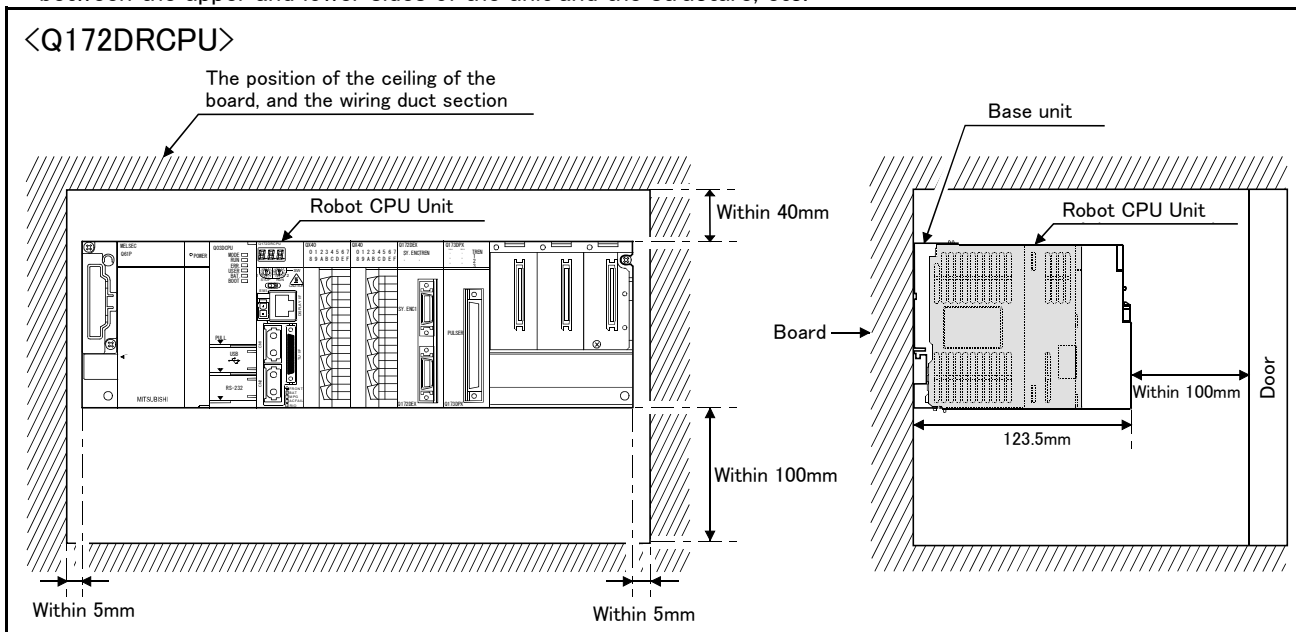


Fig.3-11 : Installation of robot CPU Unit

3.5 External input/output

3.5.1 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 95, "3.7 Emergency stop input and output etc."](#) and on [Page 125, "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).

3.6 Dedicated input/output

Show the main function of dedicated input/output in the [Table 3-3](#). 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 3-3 : Dedicated input/output list

Parameter name	Input Note1)			Output	
	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 operation 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.	E	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.	E	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.	E	Error occurring output 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.	E	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.	E	In machine lock output signal	Outputs the machine lock state.
SAFEPOS	Evasion point return input signal	Requests the evasion point return operation.	E	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.	E	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 name	Input Note1)			Output	
	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 input signal	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 name, override value., mechanism value.	L	Numeric value output (start No., end No.)	Used to output the program name, override value., mechanism No.
PRGOUT	Program No. output 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.	E	Line No. output signal	Outputs that the line No. is being output to the numeric value output signal.
OVRDOUT	Override value output request	Requests the override output.	E	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.	E	Error No. output signal	Outputs that the error No. is being output to the numeric value output signal.
JOGENA	Jog valid input signal	Validates jog operation with the external signals	E	Jog valid output signal	Outputs that the jog operation with external signals is valid.
JOGM	Jog mode input 2-bit	Designates the jog mode.	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	
HNDCTL1 : HNDCTL3	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 name	Input			Output	
	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 → 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.

3.7 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 3-4 : 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 99 , "3.7.2 Special stop input (SKIP)")
Input	Door switch	Servo-off. Dual line, normal close (Page 100 , "3.7.3 Door switch function")
Input	Enabling device	Servo-off. Dual line, normal close (Page 100 , "3.7.4 Enabling device function")
Output	Robot error output	Contact 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 107 , "3.10 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. 3-12](#).

3.7.1 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. 3-12](#).

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 125](#), "6.1.7 Examples of safety measures" Refer to it together

[Caution] The emergency stop circuit is duplicated inside the drive unit. 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
 - CR751 drive unit.....CNUSR1 connector "between 2 and 27" and "between 7 and 32".
 - b) Door switch
 - CR751 drive unit.....CNUSR1 connector "between 4 and 29" and "between 9 and 34".
 - c) Enabling device
 - CR751 drive unit.....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.



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.

⚠ CAUTION

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).

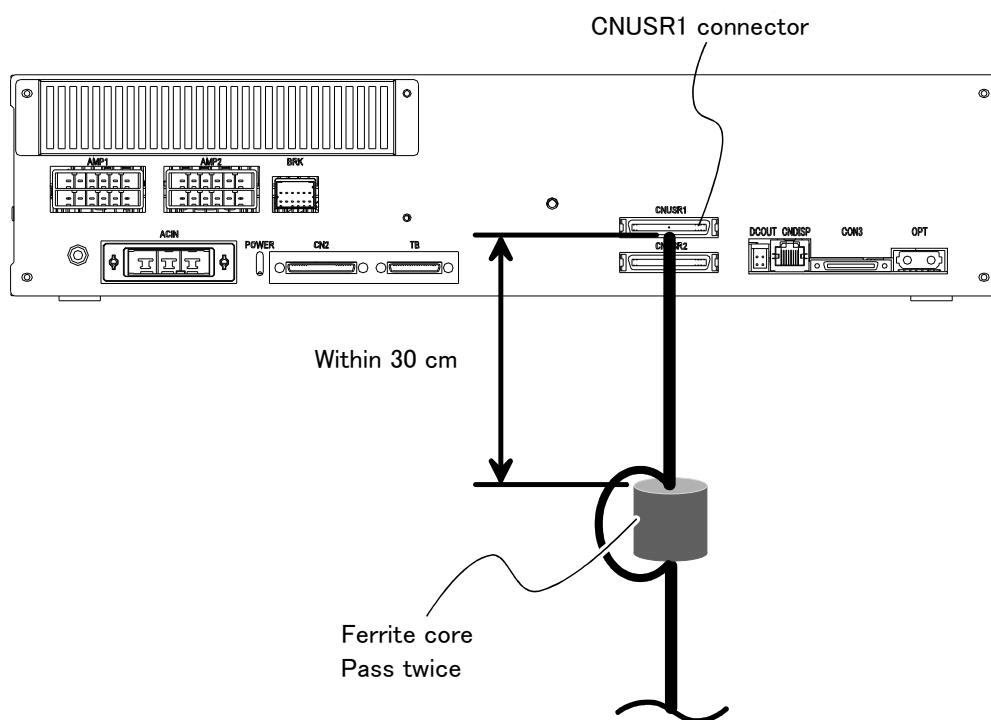


Fig.3-12 : Emergency stop cable connection (CR751)

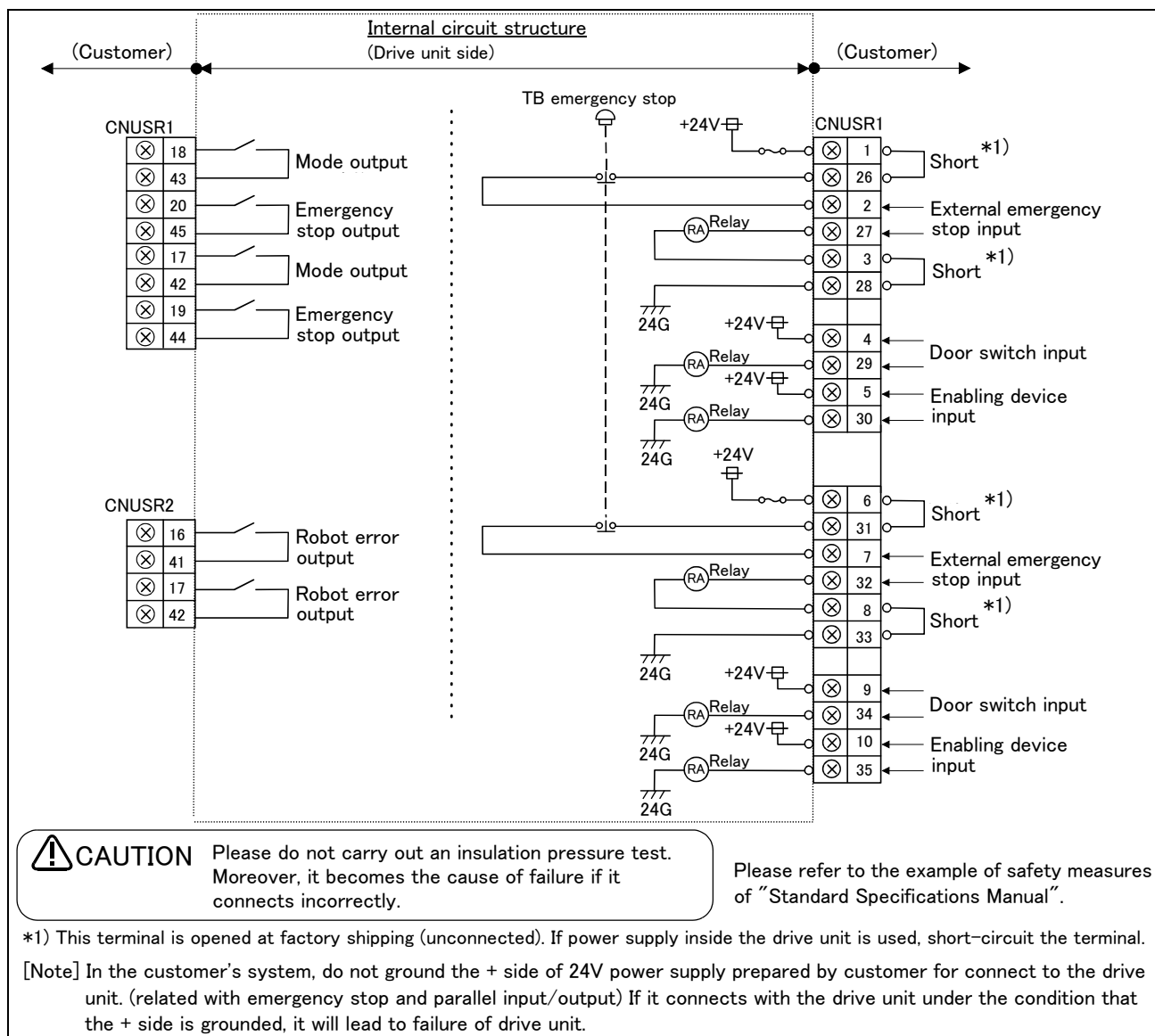


Fig.3-13 : External emergency stop connection (CR751)

CAUTION

Place the emergency stop switch in an easily operable position, and be sure to wire it to the emergency stop correctly by referencing [Page 125, "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.

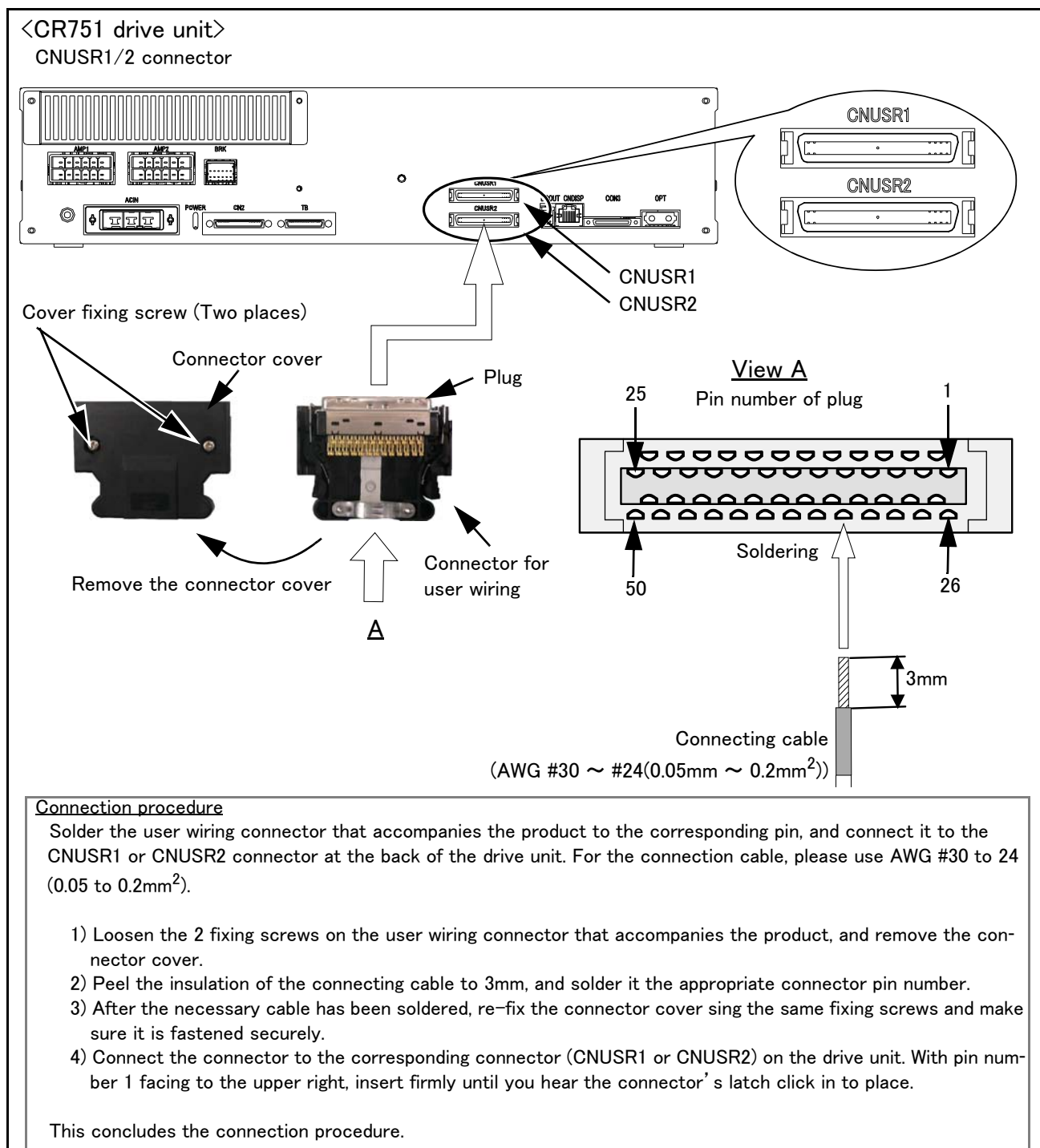


Fig.3-14 : Method of wiring for external emergency stop connection (CR751 (CNUSR1/2))

⚠ CAUTION

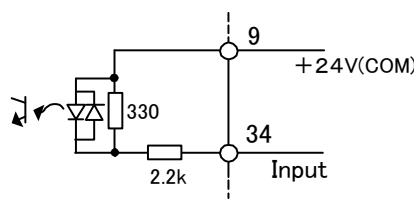
When soldering please take care to only connect to the specified pin number. Connecting to a different pin number or short-circuiting with another pin will result in the robot breaking down or malfunctioning.

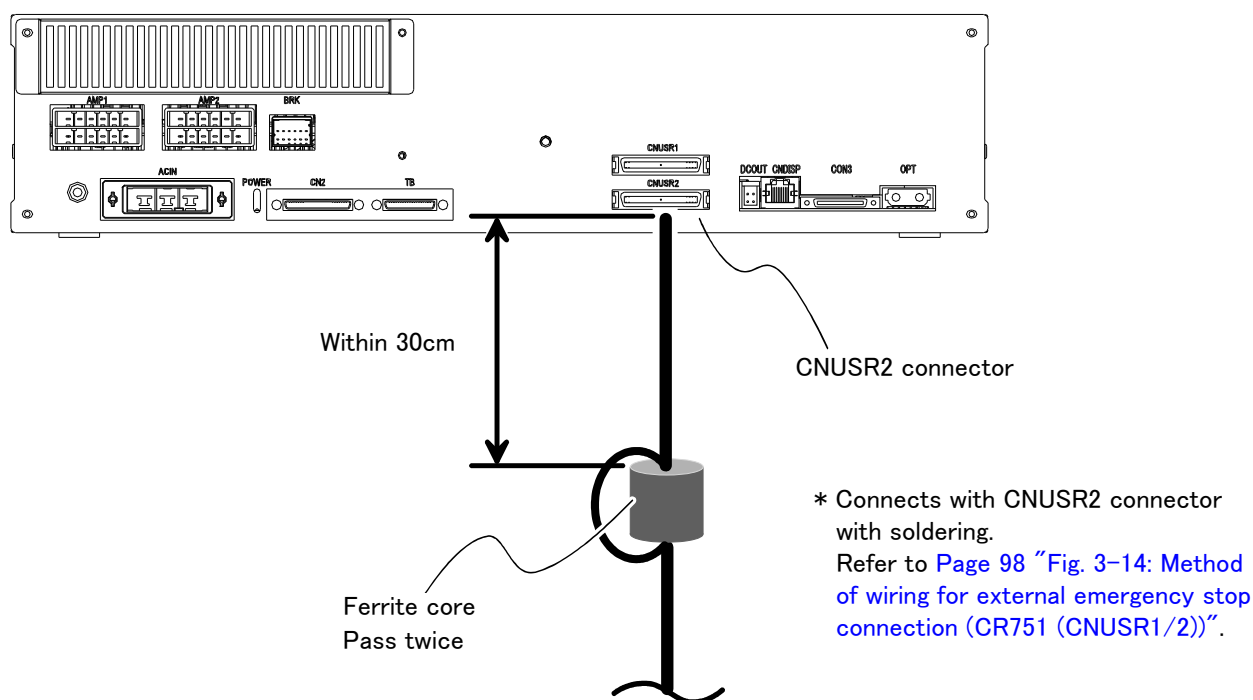
The connectors on the drive unit side are CNUSR1 (upper side) and CNUSR2 (lower side). Make sure that there is no mistake when connecting to the target connectors. Connecting incorrectly will result in the robot breaking down or malfunctioning.

3.7.2 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. 3-15.

Table 3-5 : Special stop input electric specification

Item		Specifications	Internal circuit
Type		DC input	
No. of input point		1	
Insulation method		Photo-coupler insulation	
Rated input voltage		DC24V	
Rated input current		Approx. 11mA	
Working voltage range		DC 21.6 ~ 26.4V (Ripple rate within 5%)	
ON voltage/ON current		DC 8V or more / 2mA or more	
OFF voltage/OFF current		DC 4V or less / 1mA or less	
Input resistance		Approx. 2.2 k Ω	
Response time	OFF \rightarrow ON	1ms or less	
	ON \rightarrow OFF	1ms or less	
Common method		1 point per common	
External wire connection method		Connector	



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.3-15 : Connection of the special-stop-input (CR751)

3.7.3 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 96 "Fig. 3-12: Emergency stop cable connection \(CR751\)"](#) and [Page 125, "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.

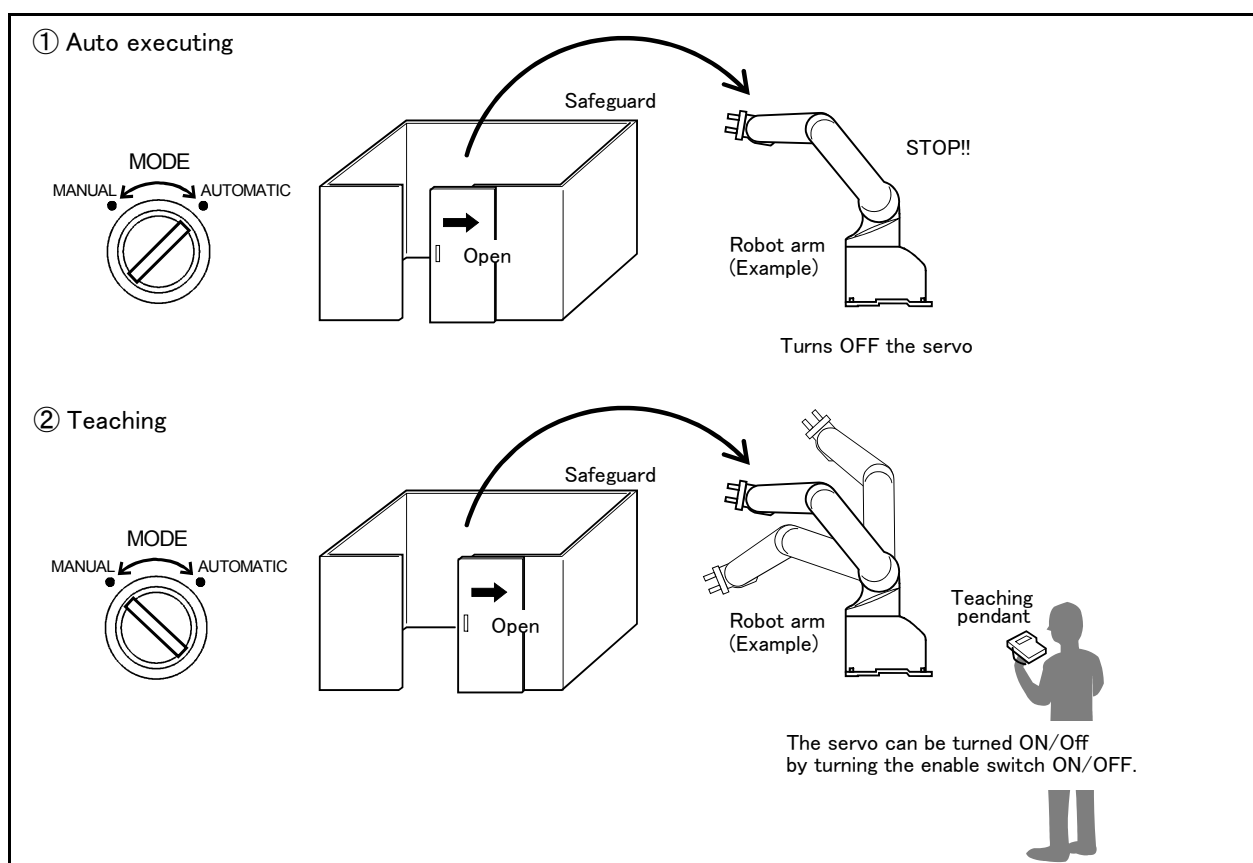


Fig.3-16 : Door switch function

3.7.4 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 3-6 : Various operations and necessary switch settings

No	Operation	Related switch settings ^{Note1)}					Description
		Mode of controller	T/B enable/disable	T/B enable switch	Enabling device input terminal	Door switch input terminal	
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 controller: [Page 102, “3.8 Mode changeover switch input”](#)
- T/B enable/disable:.....[Page 109, “\(1\) Teaching pendant \(T/B\)”](#)
- T/B enable switch:[Page 109, “\(1\) Teaching pendant \(T/B\)”](#)
- Enabling device input terminal:.....[Page 125, “6.1.7 Examples of safety measures”](#)
- Door switch input terminal:[Page 125, “6.1.7 Examples of safety measures”](#)

Note2) Jog operation, if door switch input is set for Close (Door Close), must be performed outside the safety barrier.

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.

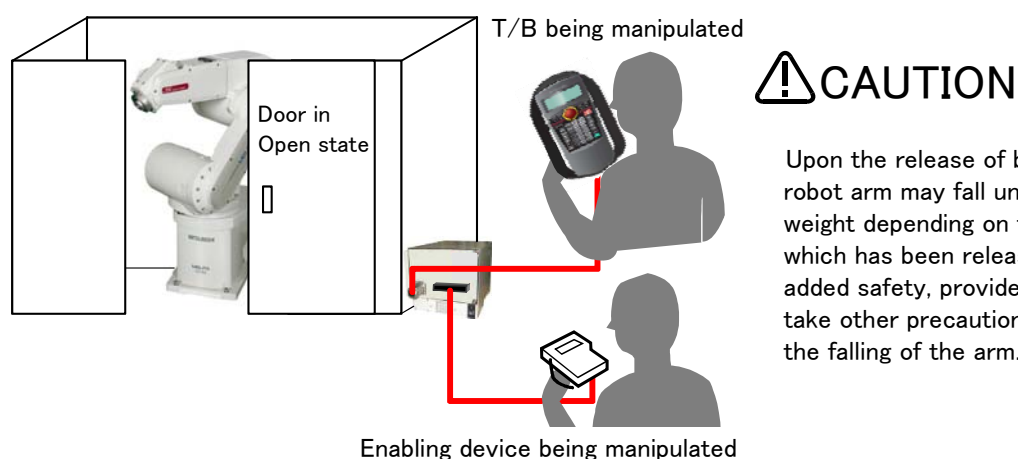


Fig.3-17 : Brake release operation

3.8 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)>

AUTOMATIC.....The 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.

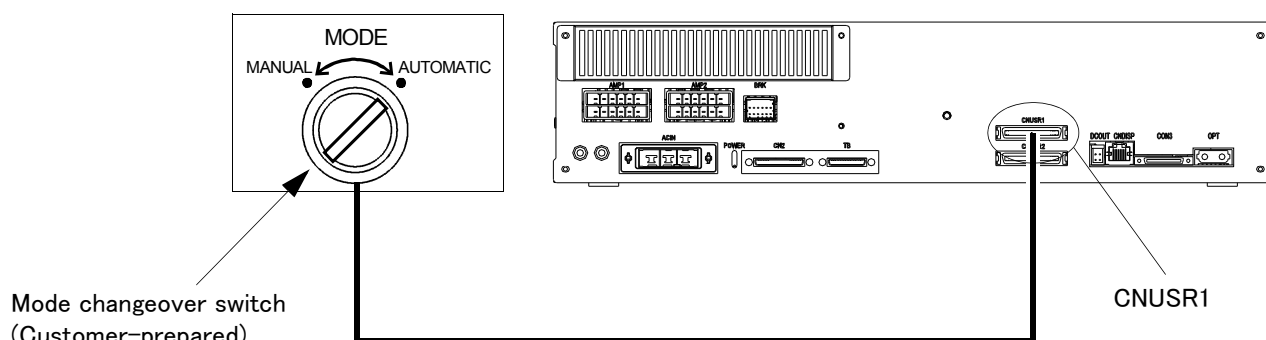


Fig.3-18 : Mode changeover switch image figure (CR751)

(1) Specification of the key switch interface

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

Table 3-7 : 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	Open	Close
24	Power supply +24V of pin number 49		
50	2nd line KEY input	Open	Close
25	Power supply +24V of pin number 50		

Note1) The mode changes by both opening or both closing between 30-5 pin and between 35-10 pin. Maintain the current mode except it.

[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 3-8 : Specification of the mode changeover switch input

Item	Specification	Remarks
Rated voltage	DC24V	Supply from the drive unit.
Current rating	Approx. 10mA	Select the switch or button which operates normally in 24V/10mA.
Input resistance	Approx. 2.2k Ω	
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

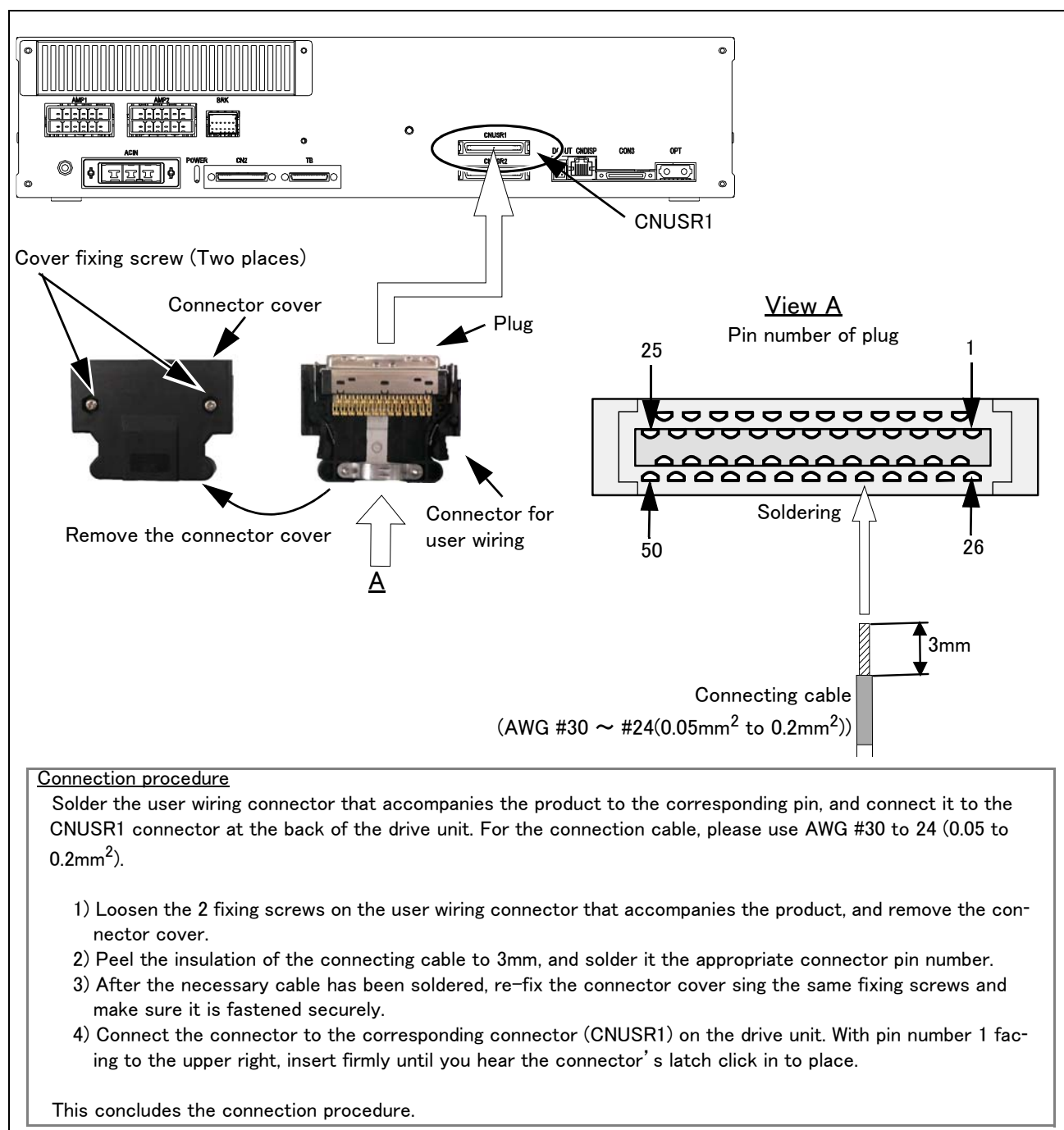


Fig.3-19 : Connection of the mode changeover switch input (CR751)

3.9 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.

3.9.1 Wiring of the Additional Axis Interface

Table 3-9 shows the connectors for additional axes inside the drive unit. Fig. 3-20 shows a connection example (configuration example).

Table 3-9 : Dedicated connectors inside the drive unit

Name	Connector name	Details
Connector for additional axes	CN2(Robot CPU) ^{Note1)}	The connector for connecting the general-purpose servo amplifier.

Note1) Since the CN1 connector is used for the robot arms, it cannot be used for the addition axis.

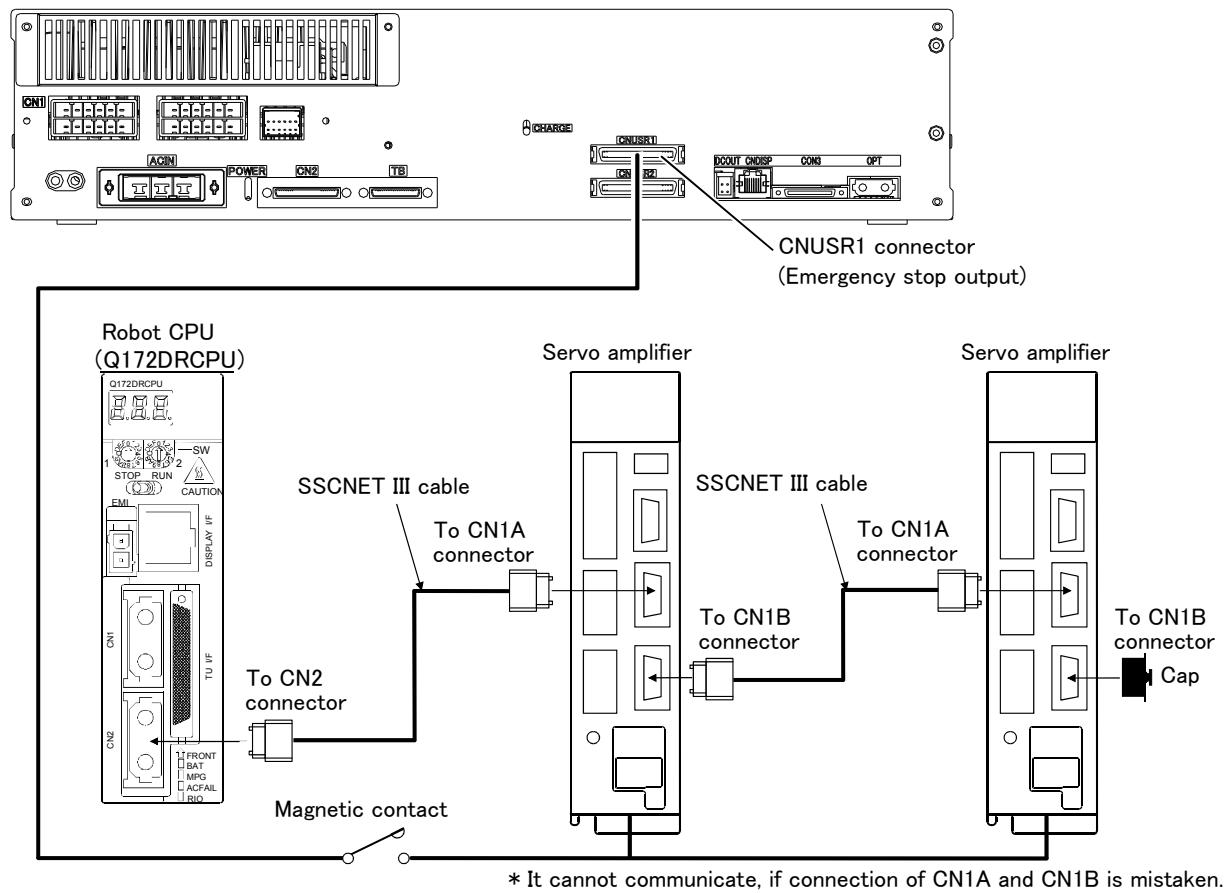


Fig.3-20 : Example of addition axis connection (CR751)

(1) Example of the installation of the noise filter

1) EMC filter (recommended)

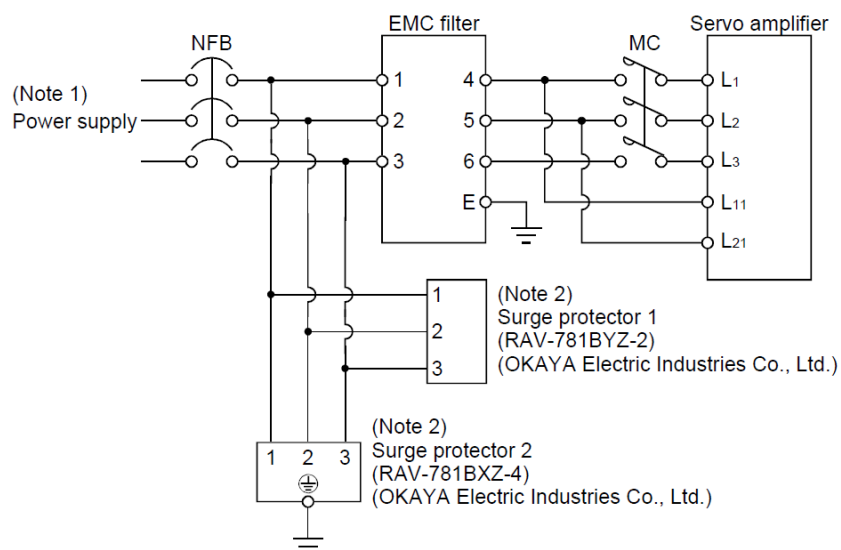
Please install the recommendation filter shown below according to the example of connection.

1) Combination with the servo amplifier

Servo amplifier	Recommended filter (Soshin Electric)		Mass [kg]([lb])
	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	5.5	6(13.23)
MR-J3-200B4 to MR-J3-700B4	TF3020C-TX		7.5(16.54)
MR-J3-11KB4	TF3030C-TX		12.5(27.56)
MR-J3-15KB4	TF3040C-TX		
MR-J3-22KB4	TF3060C-TX		

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.3-21 : 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.

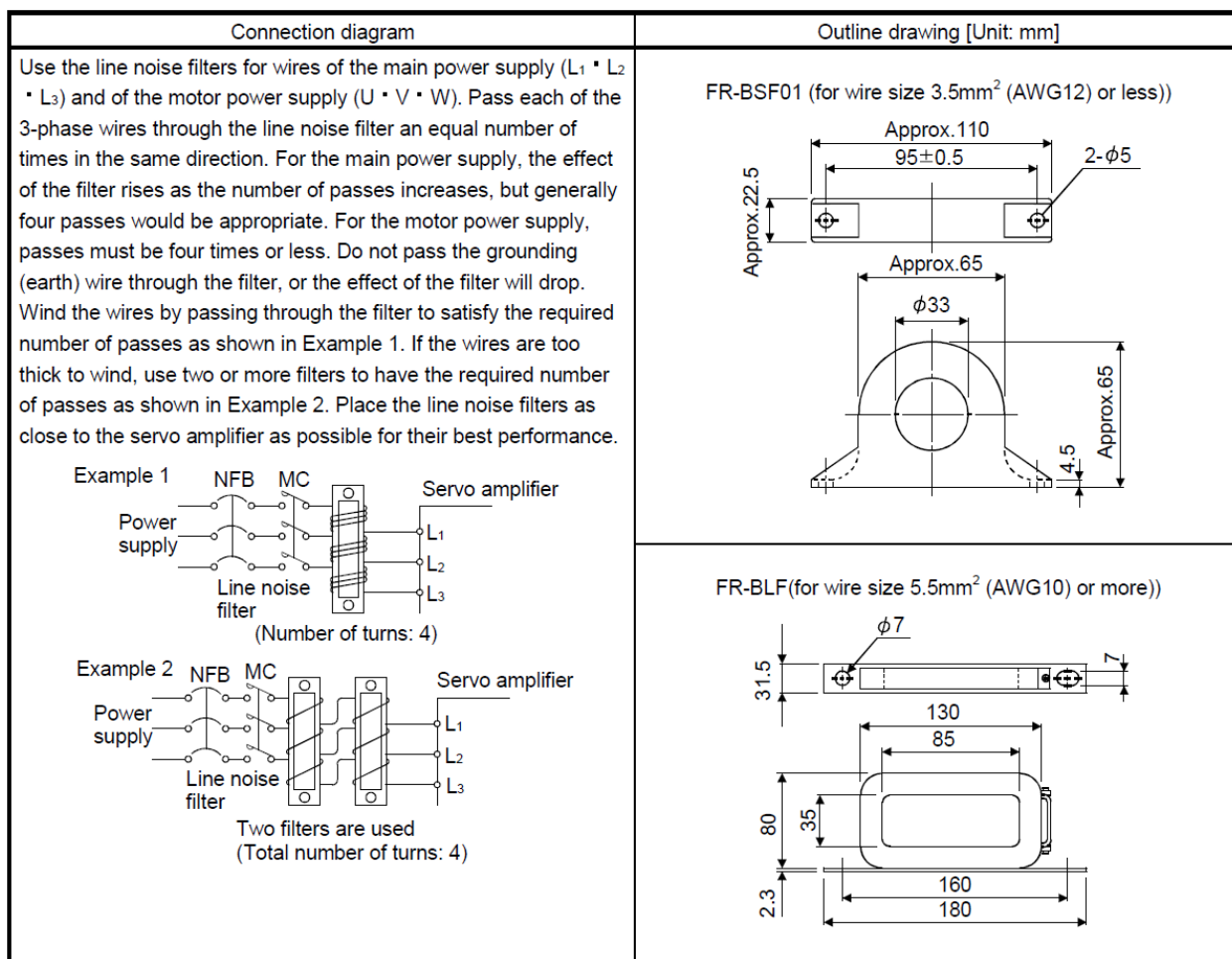


Fig.3-22 : Example of noise filter installation

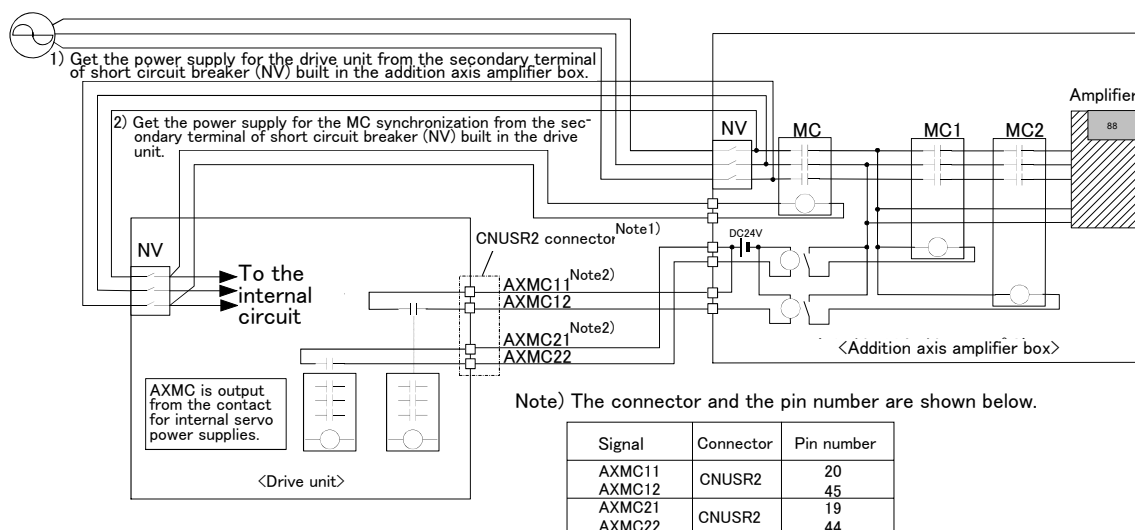
3.10 Magnet contactor control connector output (AXMC) for addition axes

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 drive unit 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 and an image of how to connect the controller connector are shown below. When you are using an additional axis, please perform appropriate circuit connections by referring to these drawings.

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

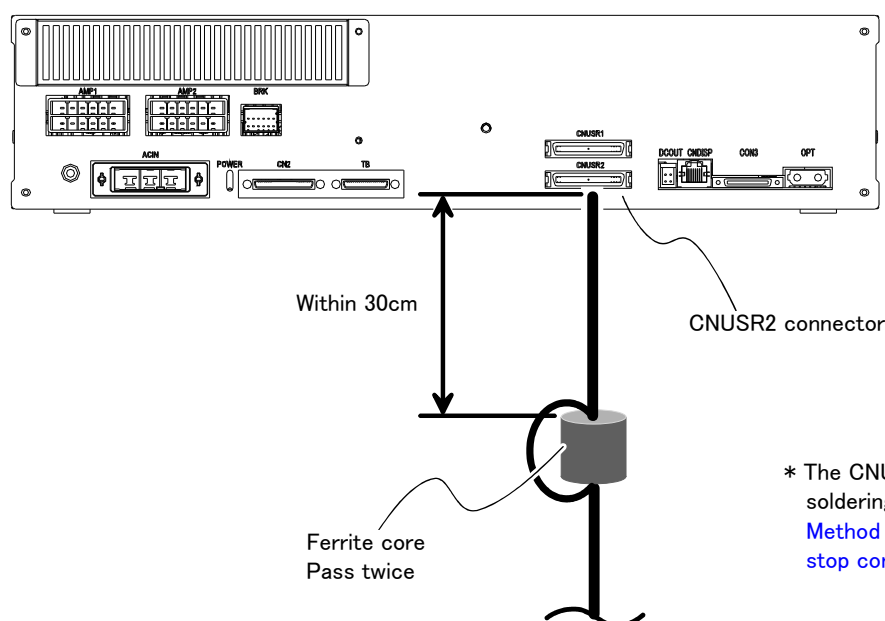
Note1) you use the addition axis function as a user mechanism who became independent of the robot arm, please do not connect this output signal. Servo-on of the user mechanism may be unable.



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.3-23 : Example of circuit for addition axes of Magnet contactor control output



* The CNUSR2 connector is connected by soldering. Refer to [Page 98 "Fig. 3-14: Method of wiring for external emergency stop connection \(CR751 \(CNUSR1/2\)\)"](#).

Fig.3-24 : AXMC terminal connector (CR751)

3.11 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 optionsA combination of single options and parts that together, form a set for serving some purpose.
2. Single optionsThat 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: 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 3-10 : Configuration device

Part name	Type	Qty.	Mass (kg) ^{Note1)}	Remarks
Teaching pendant	R33TB	Either one pc.	1.7	Cable length is 7m. Hand strap is attached.
	R33TB-15		2.8	Cable length is 15m. Hand strap is attached.

Note1) Mass indicates one set.

■ Specifications

Table 3-11 : 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 drive unit 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	

*1) <3-position enable switch>

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. *)

*) 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.

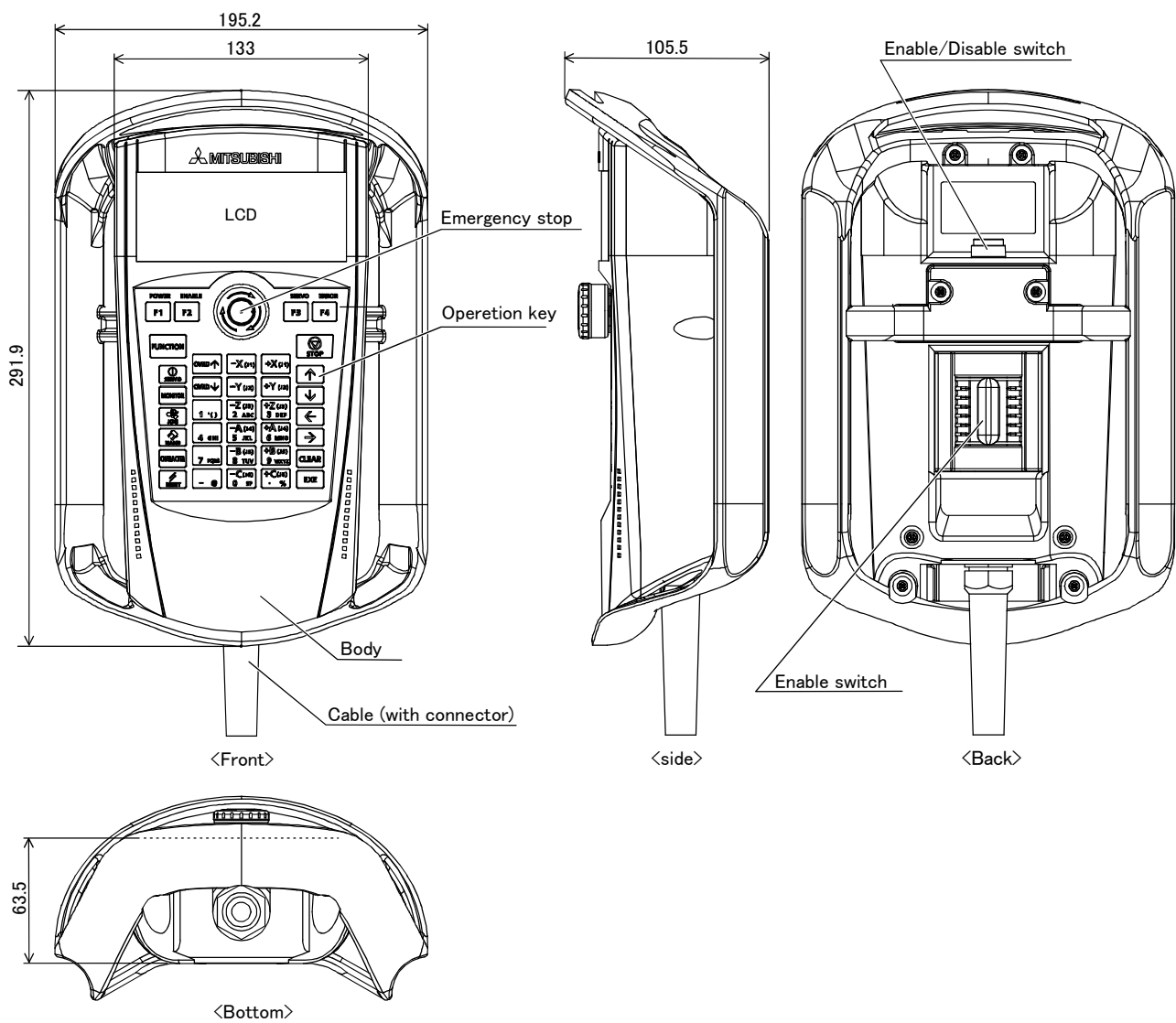


Fig.3-25 : Outside dimensions of teaching pendant

■ Installation method

The teaching pendant is connected to the T/B connector on the front of the drive unit.

■ Key layout and main functions



Fig.3-26 : Teaching pendant key layout and main functions

(2) RT ToolBox2/RT ToolBox2 mini

- Order type : ● RT ToolBox2
 *For windows CD-ROM : 3D-11C-WINE
 ● 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 3-12 : Product configuration

Part name	Type	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 3-13 : Functions

Function		Functional existence ^{Note1)}		Details
Compatible model		○	○	Personal computer running Microsoft Windows2000/XP/Vista/7. ^{Note2)}
Program editing functions	Editing functions	○	○	<ul style="list-style-type: none"> • 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 functions	○	○	<ul style="list-style-type: none"> • Program file control (list, copy, movement, delete, content comparison, name change, protect)
	Debugging functions	○	○	<ul style="list-style-type: none"> • Direct editing of program in controller • Confirmation of robot program operation (step execution, direct execution)
Simulation function		○	×	<ul style="list-style-type: none"> • Off-line simulation of robot program operation using CG (computer graphics) • Tact time calculation
Monitor functions		○	○	<ul style="list-style-type: none"> • 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		○	○	<ul style="list-style-type: none"> • 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.

○ : Function provided × : Function not provided

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

(3) Instruction Manual(bookbinding)

■ Order type: ● 5F-RF02-PE01RV-4F/7F/13F-Q series (CR751 drive unit)

■ Outline



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

■ Configuration

Table 3-14 : Product configuration

Name	Type	Mass (Kg) Note1)	Specifications
Instruction Manual	5F-RF02-PE01	2.6	The instructions manual set of RV-4F-Q series and RV-7F-Q series and RV-13F-Q series robot with CR751 drive unit.
Safety Manual	BFP-A8006	–	Items relating to safety in handling the robot
Standard Specifications	BFP-A8973	–	Specification of the robot arm and controller
Robot Arm Setup & Maintenance	BFP-A8935	–	Installation method of the robot arm, jog operation, and maintenance and inspection procedures
Controller Setup, Basic Operation and Maintenance	BFP-A8886	–	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.
Extended Function	BFP-A8787	–	Function of the Extended, operation method.

Note1) Mass indicates one set.

3.12 Maintenance parts

The consumable parts used in the controller are shown in [Table 3-15](#). 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 3-15 : Controller consumable parts list

No.	Name	Type ^{Note1)}	Qty.	Usage place	Supplier
1	Lithium battery	Q6BAT	1	The battery unit connected to the robot CPU unit	Mitsubishi Electric
2	Filter	BKOF A0773H41	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

Type	Class	Function	Input format (example)
Position and operation control	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 → passing point → start point (end point)) with 3-dimensional circular interpolation (360 degrees).	Mvc P1,P2,P1
		Moves along a designated arc (start point → passing point → 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 → 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
		Designates the acceleration/deceleration time as a percentage in respect to the predetermined maximum acceleration/deceleration. (1% unit)	Accel 50,80
		Automatically adjusts the acceleration/deceleration according to the parameter setting value.	Oadl ON
		Sets the hand and work conditions for automatic adjustment of the acceleration/deceleration.	Loadset 1,1
	Operation	Adds a process unconditionally to the operation.	Wth
		Adds a process conditionally to the operation.	WthIf
		Designates smooth operation.	Cnt 1,100,200
		Performance of movement is upgraded corresponding to the application.	MvTune 4
		Designates the positioning completion conditions with a No. of pulses.	Fine 200
		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 passage	Move to a specified position using linear interpolation passing through a singular point.	Mvs P1 Type 0,2

Type	Class	Function	Input format (example)
Program control	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	Defines the interrupt conditions and process.	Def Act 1, M1=1 GoTo *L100
		Enables/disables the interrupt.	Act 1=1
		Defines the start line of the program to be executed when an interrupt is generated from the communication line.	On Com(1) GoSub *L100
		Enables the interrupt from the communication line.	Com(1) On
		Disables the interrupt from the communication line.	Com(1) Off
		Stops the interrupt from the communication line.	Com(1) Stop
	Wait	Designates the wait time, and the output signal pulse output time. (0.01s unit)	Dly 0.5
		Waits until the variable becomes the designated value.	Wait M_In(1)=1
	Stop	Stops the program execution.	Hlt
		Generates an error. During program execution, continue, stop or servo OFF can be designated.	Error 9000
	End	Ends the program execution.	End
Hand	Hand open	Opens the designated hand.	HOpen 1
	Hand close	Closes the designated hand.	HClose 1
Input/output	Assignment	Defines the input/output variables.	Def IO PORT1=BIT,0
	Input	Retrieves the general-purpose input signal.	M1=M_In(1)
	Output	Calls out the general-purpose output signal.	M_Out(1)=0
Parallel execution	Mechanism designation	Acquires the mechanism with the designated mechanism No.	GetM 1
		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
		Returns the designated program's execution line to the head and enters the program selection enabled state.	XRst 3

Type	Class	Function	Input format (example)
Others	Definition	Defines the integer type or real number type variable.	Def Inte KAISUU
		Defines the character string variable.	Def Char MESSAGE
		Defines 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
	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	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.)
	AREA1ME : AREA32ME	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]

Parameter		Details
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.
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.
	GLEN232	Set the character length.
	CPRTY232	Set the parity.
	CSTOP232	Set the stop bit.
	CTERM232	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)
Multi CPU system setting	QMLTCPUN	At the multi CPU system, set the number of CPU units with which the standard base unit is equipped.
	QMLTCPUn	At the multi CPU system, set the number of points performing transmission and receipt between each CPU unit for the high speed communication function between multi CPU nos. 1 to 4.
	QMLTCPUS	At the CR750-Q/CR751-Q series controller, set the robot input signal offset for the multi CPU.
Select the function of singular point adjacent alarm	MESNGLSW	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		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	Overrun prevention 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	Teaching pendant	External input	Details
Emergency stop	○	○	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	○	○	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.

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
Input	External emergency stop <small>Note1)</small>	Connector (CNUSR1)	—	This servo power is shut off, and the robot stops immediately.	Externally installed emergency stop switch.
	Door switch		—		Door switch on safety protection fence. Stopping at high-level error occurrence.
	Enabling device input		—		The door switch of the safe protection fence
	Stop	Sequencer unit	STOP	The program execution is stopped, and the robot stops. The servo power is not shut off.	Enabling device. The safety switch during teaching work
	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.	The robot is stopped when a peripheral device fault occurs. The servo power is not shut off.
Output	Emergency stop output	Connector (CNUSR1)	—	Outputs the input signal of external emergency stop or emergency stop switch of T/B turned on.	Door switch on safety protection fence
	In servo ON	Sequencer unit	SRVON	The servo power ON/OFF state is output.	Display and warn the pilot lamp, the input signal of external emergency stop or the emergency stop switch of T/B turned on.
	Waiting		STOP	Outputs that the robot is temporarily stopped.	The servo power ON/OFF state is shown and alerted with the display lamps.
	In alarm	Connector (CNUSR2)	ERRRESET	Outputs when an alarm occurs in the robot.	The temporary stop 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 125, "6.1.7 Examples of safety measures"](#) for details.

And, refer to [Page 101, "\(3\) 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 years.

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 drive unit. 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 130, "\(1\) 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 drive unit, 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.

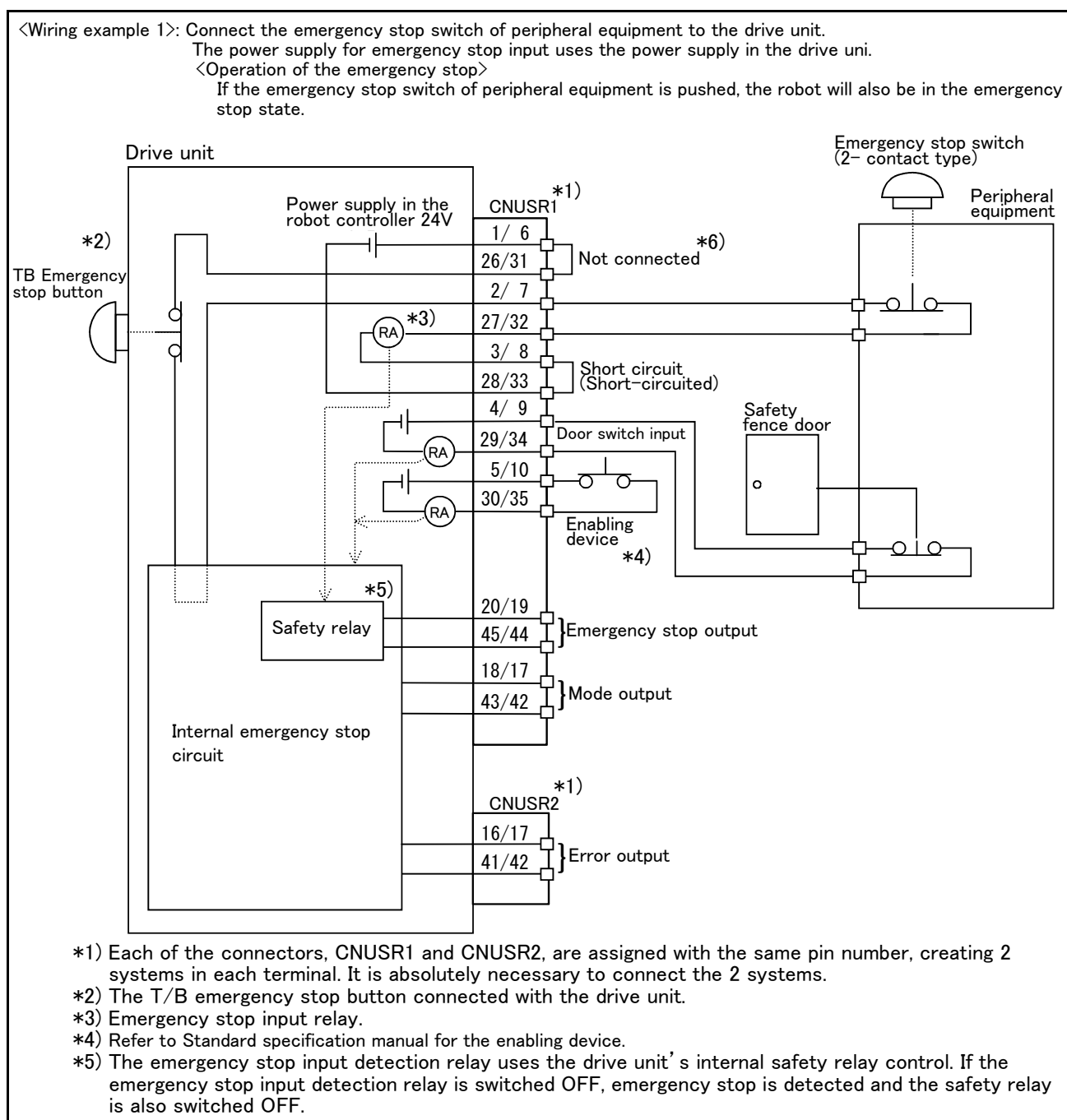


Fig.6-1 : Example of safety measures (CR751 wiring example 1)

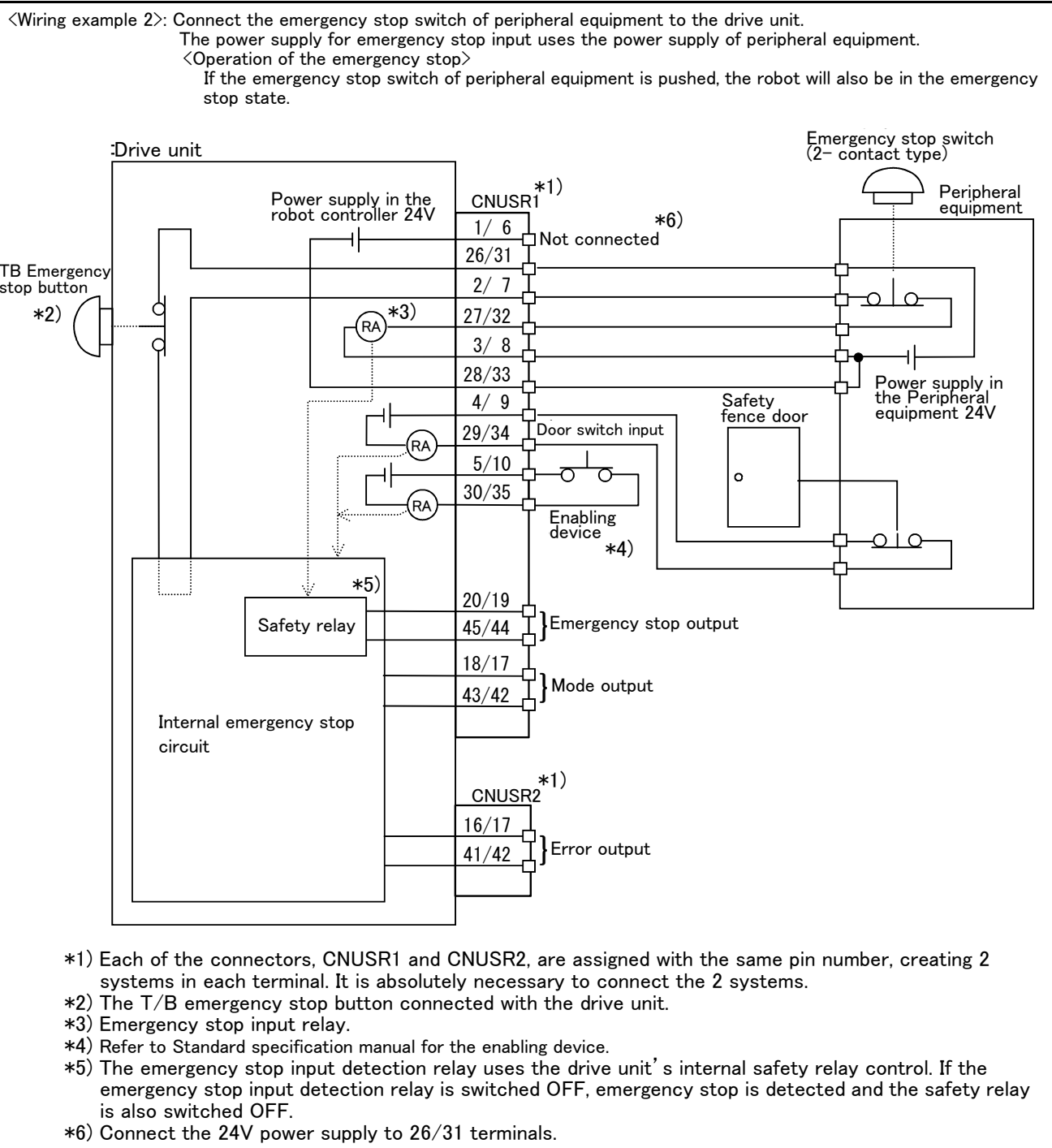
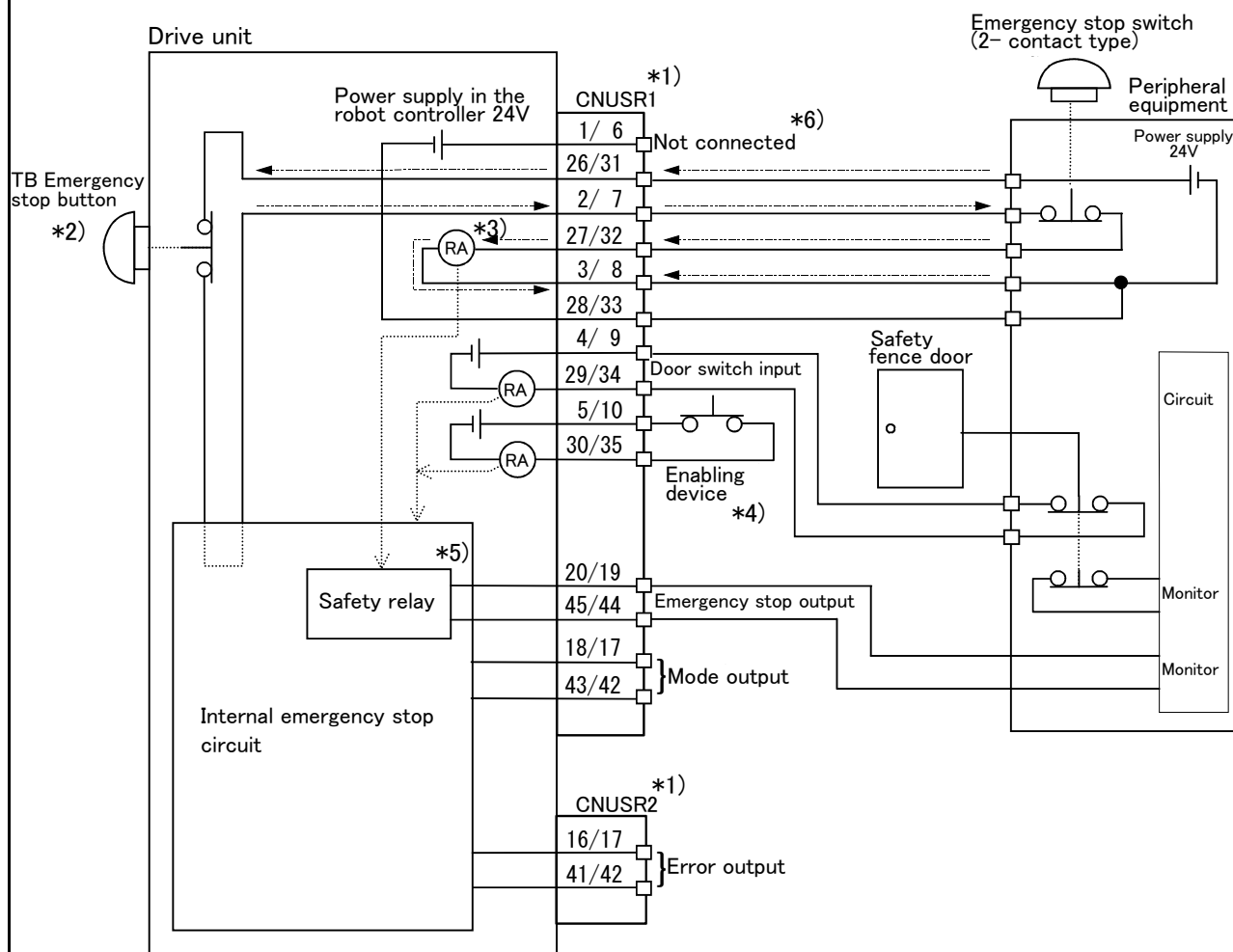


Fig.6-2 : Example of safety measures (CR751 wiring example 2)

<Wiring example 3>: Connect the emergency stop switch, door switch, and enabling device of peripheral equipment to the drive unit. The power supply for emergency stop input uses the power supply of peripheral equipment. Monitor the emergency stop state by the peripheral equipment side.

<Operation of the emergency stop>

If the emergency stop switch of peripheral equipment is pushed, the robot will also be in the emergency stop state. And, if the emergency stop switch of OP or T/B is pushed in the state of the power of drive unit OFF, peripheral equipment state can be the emergency stop also.



*1) Each terminal assigned with the respectively same pin number as connector: CNUSR1 and CNUSR2 and each is dual line. Always connect the two lines.

*2) The T/B emergency stop button connected with the drive unit.

*3) Emergency stop input relay.

*4) Refer to Standard specification manual for the enabling device.

*5) The emergency stop input detection relay uses the drive unit'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.6-3 : Example of safety measures (CR751 wiring example 3)

<Wiring example 4>: Connect the emergency stop switch of peripheral equipment, and the door switch to two drive units, and it interlocks. Connect the enabling device to the robot controller. The power supply for emergency stop input uses the power supply of peripheral equipment. Monitor the emergency stop state by the peripheral equipment side.

<Operation of the emergency stop>

If the emergency stop switch of peripheral equipment is pushed, the robot will also be in the emergency stop state. And, if the emergency stop switch of OP or T/B is pushed in the state of the power of drive unit OFF, peripheral equipment state can be the emergency stop also.

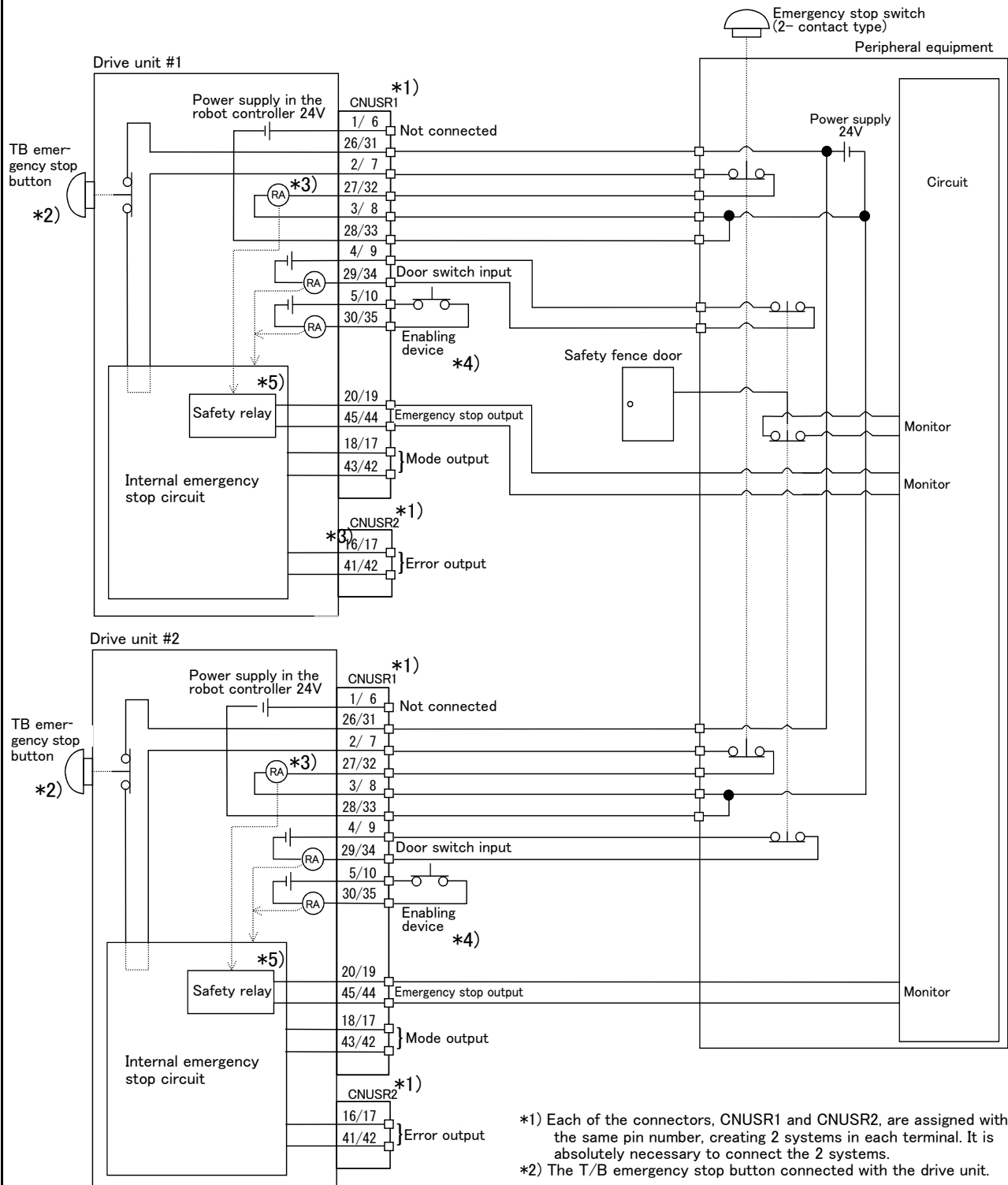
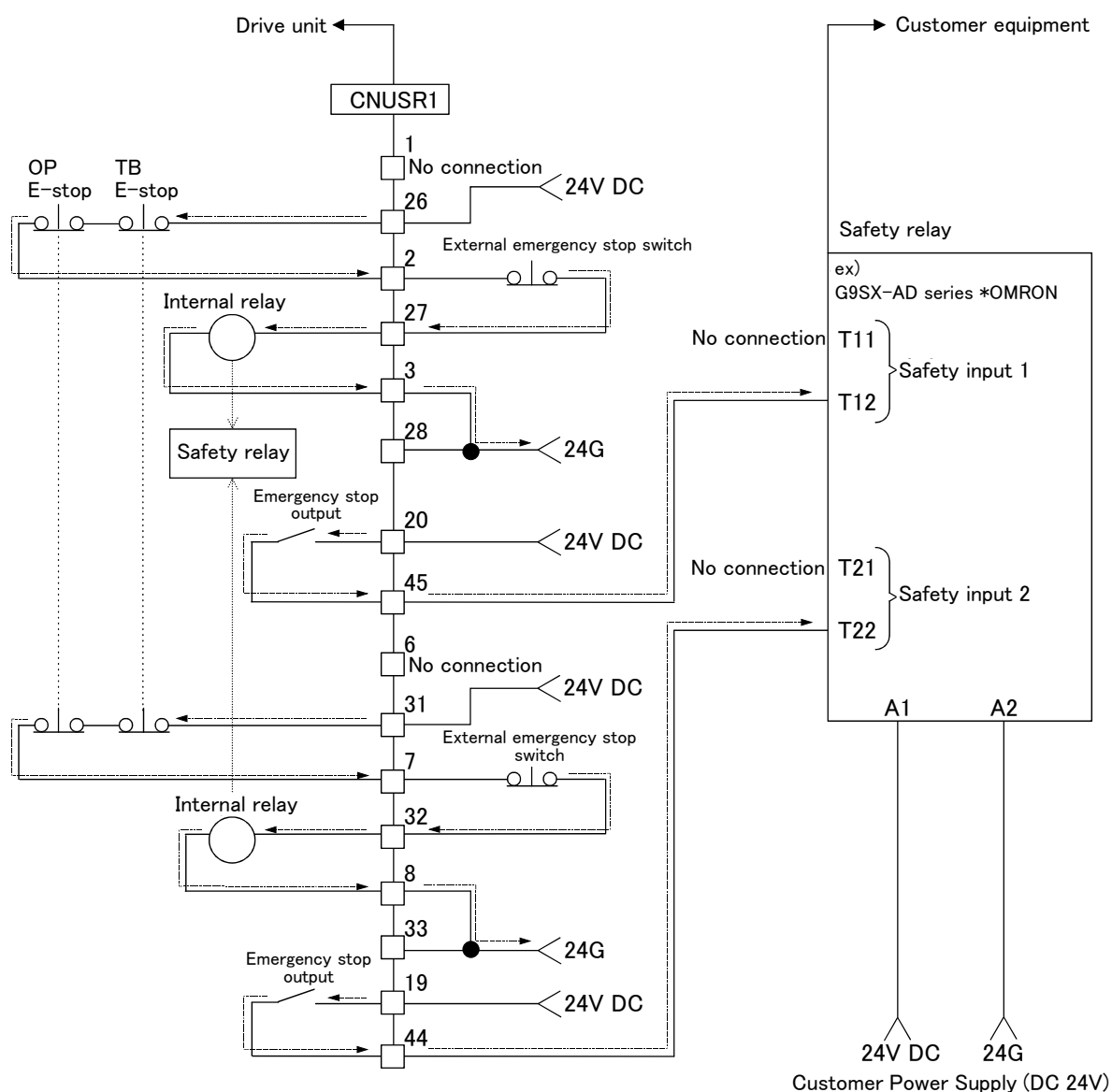


Fig.6-4 : Example of safety measures (CR751 wiring example 4)

<Wiring example 5>: Connect the drive unit to the safety relay
Use the drive unit's emergency stop button to input safety relay.



[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. Omron's G9S Series).
- 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.6-5 : Example of safety measures (CR751 wiring example 5)

(1) 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 drive unit 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 contact..... Prepare 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. 6-6)
- 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.

- CR751 drive unit CNUSR1/2 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.

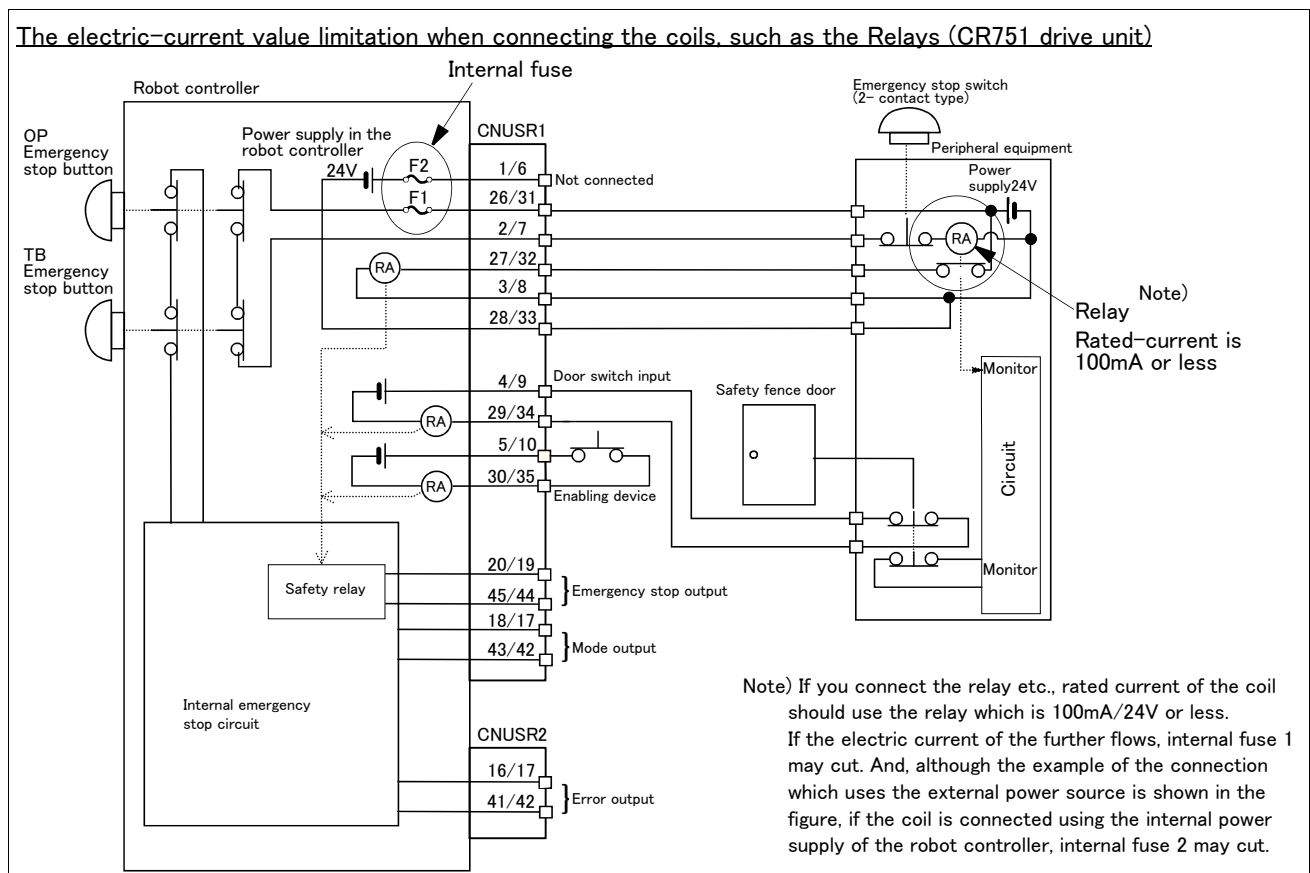
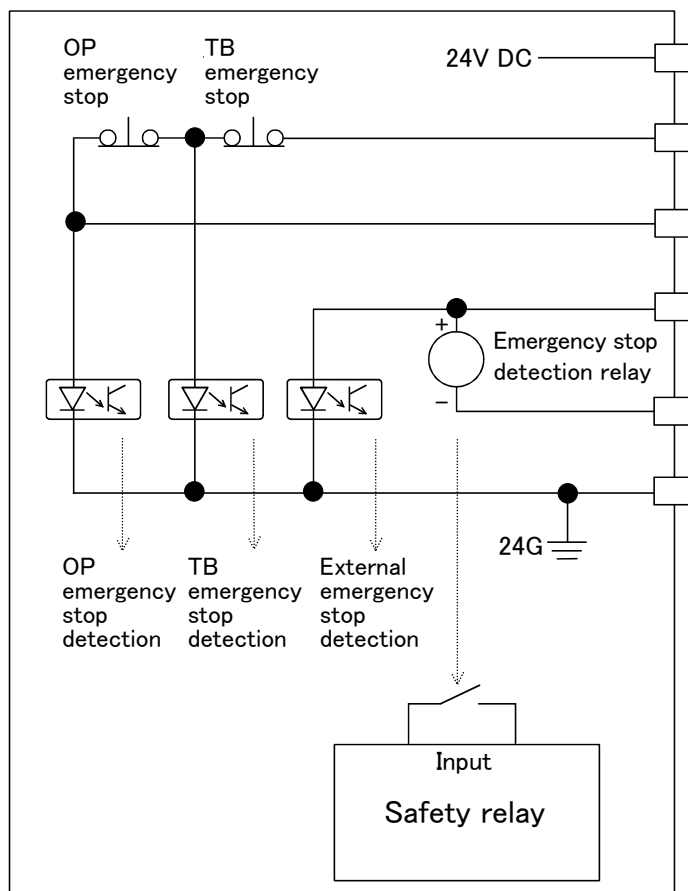


Fig.6-6 : Limitations when connecting the relay etc. (CR751)

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

[Supplementary explanation regarding emergency stop circuit]

The drive unit'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.



⚠ 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.

⚠ CAUTION

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.

CAUTION

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 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/s² or less during transportation and 5m/s² 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) The robot arm and controller must be grounded with 100 Ω or less (class D grounding) to secure the noise resistance and to prevent electric shocks.

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

- (6) The items described in these specifications are conditions for carrying out the periodic maintenance and inspections described in the instruction manual.
- (7) 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.
- (8) 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.
- (9) The hanging installation jig can be borrowed from the maker. Order to dealer when need.
- (10) 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.
- (11) 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.
- (12) 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.
- (13) 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 the axes collide with the mechanical stopper next or subsequent time.
- (14) 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.
- (15) 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.
- (16) Do not conduct an insulated voltage test. If conducted by mistake, it may result in a breakdown.
- (17) When the sequencer system becomes large too much, the robot's locus may deteriorate uncommonly. If this phenomenon occurs, inform to the dealer. And, when it turns out that the system is enlarged in advance, please inform our company.
- (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 trans-border transportation of lithium batteries by air, sea, and land. The lithium batteries (ER6, Q6BAT) used in Mitsubishi industrial robots contain less than 1 g of lithium and are not classified as dangerous goods. However, if the quantity of lithium batteries exceeds 24 batteries for storage, etc., they will be classified as Class 9: Miscellaneous dangerous substances and articles. Shipping less than 24 batteries is recommended to avoid having to carry out transport safety measures as the customer's consignor. Note that some transportation companies may request an indication that the batteries are not dangerous goods be included on the invoice. For shipping requirement details, please contact your transportation company.
- (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 EN62061:2005(Annex E)
	Electrical-conduction noise disturbance	The electromagnetism noise etc. which flow out of the power-supply line.	
Immunity (EMS)	Electrostatic discharge immunity test	The noise from the electrified human body.	
	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 disturbances 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.	

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

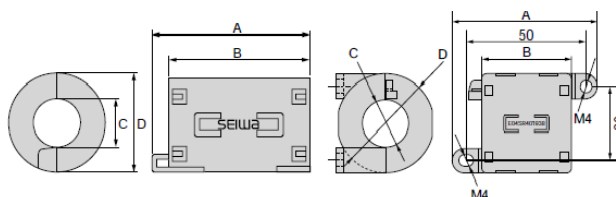
(1) Ferrite core

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.

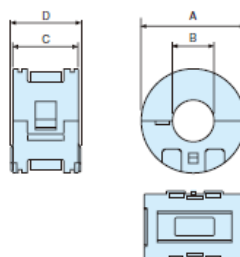
Maker: SEIWA ELECTRIC MFG. Co.,Ltd.

Type	Outside dimension (mm)				Diameter of the adaptation cable [max] (mm)
	A	B	C	D	
E04SR401938	61	38	19	40	19.0
E04SR301334	39	34	13	30	13.0



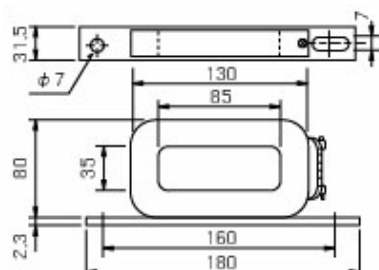
Maker: TAKACHI ELECTRONICS ENCLOSURE CO., LTD.

Type	Outside dimension (mm)				Diameter of the adaptation cable [max] (mm)
	A	B	C	D	
TFT-274015S	43.8	27.4	20.7	-	φ 26.5



(2) Line noise filter

Type : FR-BLF (Mitsubishi Electric Corp.)



7 Appendix

Appendix 1 : Specifications discussion material (RV-4F/7F series)

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased mode

Type ^{Note1)}				
<input type="checkbox"/> RV-4F-Q	<input type="checkbox"/> RV-4FL-Q	<input type="checkbox"/> RV-4FJL-Q	<input type="checkbox"/> RV-7F-Q	<input type="checkbox"/> RV-7FL-Q

Note1) Refer to the [Page 2, "1.2 Model type name of robot"](#) for the details of the robot arm type name.

■ Purchased mode

Item		Standard specifications	Shipping special specifications
Robot arm	Oil mist specification (IP67)	General environment specification (IP40)	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Clean specification (ISO class3)	General environment specification (IP40)	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Internal wiring and piping specification ^{Note1)}	Equipped to the forearm	<input type="checkbox"/> Not provided <input type="checkbox"/> -SH01 <input type="checkbox"/> -SH02 <input type="checkbox"/> -SH03 <input type="checkbox"/> -SH04 <input type="checkbox"/> -SH05
Machine cable		<input type="checkbox"/> 5m fixed type	<input type="checkbox"/> 2m fixed type: 1F-02UCBL-02
Controller	Robot CPU unit connecting cable set ^{Note2)}	<input type="checkbox"/> 10m	<input type="checkbox"/> Not provided <input type="checkbox"/> 5m <input type="checkbox"/> 20m <input type="checkbox"/> 30m: 2Q-RC-CBL <input type="checkbox"/> <input type="checkbox"/> M

Note1) The corresponding base external wiring set is attached.

Note2) The four type cables shown in below are contained. (Each cable length is the same.)

- 1)2Q-TUCBL ☐ ☐ M, 2)2Q-DISPCBL ☐ ☐ M, 3)2Q-EMICBL ☐ ☐ M,
4)MR-J3BUS ☐ ☐ M-A (5m, 20m) or MR-J3BUS ☐ ☐ M-B (30m)

■ Options (Installable after shipment)

Item		Type	Provision, and specifications when provided.
Robot arm	J1 axis operating range change	1F-DH-03	For RV-4F series: <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
		1F-DH-04	For RV-7F series: <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Machine cable extension	1F- <input type="checkbox"/> <input type="checkbox"/> UCBL-02	Fixed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
		1F- <input type="checkbox"/> <input type="checkbox"/> LUCBL-02	Flexed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
	Solenoid valve set	1F-VD0 <input type="checkbox"/> -02	<input type="checkbox"/> Not provide 1F-VD0 <input type="checkbox"/> -02 (Sink type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
		1F-VD0 <input type="checkbox"/> E-02	1F-VD0 <input type="checkbox"/> E-02 (Source type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
	Hand input cable	1F-HC35S-02	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Hand output cable	1F-GR35S-02	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Hand curl tube	1E-ST040 <input type="checkbox"/> C	<input type="checkbox"/> Not provided <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
Controller	Forearm external wiring set	1F-HB0 <input type="checkbox"/> S-01	<input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HB01S-01 <input type="checkbox"/> 1F-HB02S-01
	Base external wiring set	1F-HA0 <input type="checkbox"/> S-01	<input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HA01S-01 <input type="checkbox"/> 1F-HA02S-01
	Simple teaching pendant	R33TB- <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Highly efficient teaching pendant	R57TB- <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	RT ToolBox2	3D-11C-WINE	<input type="checkbox"/> Not provided <input type="checkbox"/> Windows2000/XP/Vista/7 English CD-ROM
	RT ToolBox2 mini	3D-12C-WINE	<input type="checkbox"/> Not provided <input type="checkbox"/> Windows2000/XP/Vista/7 English CD-ROM
	Network vision sensor	4D-2CG5***-PKG	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
Instructions manual		5F-RF02-PE01	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided () sets

■ Maintenance parts (Consumable parts)

Maintenance parts	<input type="checkbox"/> Backup batteries ER6 () pcs. <input type="checkbox"/> Backup batteries Q6BAT () pcs. <input type="checkbox"/> Grease () cans
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■ Robot selection check list

Work description	<input type="checkbox"/> Material handling <input type="checkbox"/> Assembly <input type="checkbox"/> Machining L/UL <input type="checkbox"/> Sealing <input type="checkbox"/> Testing and inspection <input type="checkbox"/> Other ()		
Workpiece mass () g	Hand mass () g	Atmosphere <input type="checkbox"/> General environment <input type="checkbox"/> Clean <input type="checkbox"/> Oil mist: Confirm oil proof <input type="checkbox"/> request (Oil name:) / <input type="checkbox"/> not request ^{Note1)} <input type="checkbox"/> Other ()	
Remarks			

Note1) Refer to [Page 22, "2.2.6 Protection specifications"](#) about oil resistance.

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

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased mode

Type ^{Note1)}
■ RV-7FLL-Q

Note1) Refer to the [Page 2, "1.2 Model type name of robot"](#) for the details of the robot arm type name.

■ Purchased mode

Item	Standard specifications	Shipping special specifications
Robot arm	Oil mist specification (IP67)	General environment specification (IP40) <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Clean specification (ISO class3)	General environment specification (IP40) <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Internal wiring and piping specification ^{Note1)}	Equipped to the forearm <input type="checkbox"/> Not provided <input type="checkbox"/> -SH01 <input type="checkbox"/> -SH02 <input type="checkbox"/> -SH03 <input type="checkbox"/> -SH04 <input type="checkbox"/> -SH05
Machine cable	<input type="checkbox"/> 5m fixed type	<input type="checkbox"/> 2m fixed type: 1F-02UCBL-02
Controller	Robot CPU unit connecting cable set ^{Note2)} <input type="checkbox"/> 10m	<input type="checkbox"/> Not provided <input type="checkbox"/> 5m <input type="checkbox"/> 20m <input type="checkbox"/> 30m: 2Q-RC-CBL <input type="checkbox"/> <input type="checkbox"/> M

Note1) The corresponding base external wiring set is attached.

Note2) The four type cables shown in below are contained. (Each cable length is the same.)

- 1)2Q-TUCBL ☐ ☐ M, 2)2Q-DISPCBL ☐ ☐ M, 3)2Q-EMICBL ☐ ☐ M,
4)MR-J3BUS ☐ ☐ M-A (5m, 20m) or MR-J3BUS ☐ ☐ M-B (30m)

■ Options (Installable after shipment)

Item	Type	Provision, and specifications when provided.
Robot arm	J1 axis operating range change	1F-DH-05J1 <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Machine cable extension	1F- <input type="checkbox"/> <input type="checkbox"/> UCBL-02 Fixed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
		1F- <input type="checkbox"/> <input type="checkbox"/> LUCBL-02 Flexed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
	Solenoid valve set	<input type="checkbox"/> Not provide 1F-VD0 <input type="checkbox"/> -02 (Sink type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set 1F-VD0 <input type="checkbox"/> E-02 (Source type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
	Hand input cable	1F-HC35S-02 <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Hand output cable	1F-GR35S-02 <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Hand curl tube	1E-ST040 <input type="checkbox"/> C <input type="checkbox"/> Not provided <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
	Forearm external wiring set	1F-HB0 <input type="checkbox"/> S-01 <input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HB01S-01 <input type="checkbox"/> 1F-HB02S-01
Controller	Base external wiring set	1F-HA0 <input type="checkbox"/> S-01 <input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HA01S-01 <input type="checkbox"/> 1F-HA02S-01
	Simple teaching pendant	R33TB- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Highly efficient teaching pendant	R57TB- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	RT ToolBox2	3D-11C-WINE <input type="checkbox"/> Not provided <input type="checkbox"/> Windows2000/XP/Vista/7 English CD-ROM
	RT ToolBox2 mini	3D-12C-WINE <input type="checkbox"/> Not provided <input type="checkbox"/> Windows2000/XP/Vista/7 English CD-ROM
	Network vision sensor	4D-2CG5***-PKG <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Instructions manual	5F-RF01-PE01 <input type="checkbox"/> Not provided <input type="checkbox"/> Provided () sets

■ Maintenance parts (Consumable parts)

Maintenance parts	<input type="checkbox"/> Backup batteries ER6 () pcs. <input type="checkbox"/> Backup batteries Q6BAT () pcs. <input type="checkbox"/> Grease () cans
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■ Robot selection check list

Work description	<input type="checkbox"/> Material handling <input type="checkbox"/> Assembly <input type="checkbox"/> Machining L/UL <input type="checkbox"/> Sealing <input type="checkbox"/> Testing and inspection <input type="checkbox"/> Other ()		
Workpiece mass () g	Hand mass () g	Atmosphere <input type="checkbox"/> General environment <input type="checkbox"/> Clean <input type="checkbox"/> Oil mist: Confirm oil proof <input type="checkbox"/> request (Oil name:) / <input type="checkbox"/> not request ^{Note1)} <input type="checkbox"/> Other ()	
Remarks			

Note1) Refer to [Page 22, "2.2.6 Protection specifications"](#) about oil resistance.

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

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased mode

Type ^{Note1)}	
<input type="checkbox"/> RV-13F-Q	<input type="checkbox"/> RV-13FL-Q

Note1) Refer to the [Page 2, "1.2 Model type name of robot"](#) for the details of the robot arm type name.

■ Purchased mode

Item		Standard specifications	Shipping special specifications
Robot arm	Oil mist specification (IP67)	General environment specification (IP40)	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Clean specification (ISO class3)	General environment specification (IP40)	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Internal wiring and piping specification ^{Note1)}	Equipped to the forearm	<input type="checkbox"/> Not provided <input type="checkbox"/> -SH01 <input type="checkbox"/> -SH02 <input type="checkbox"/> -SH03 <input type="checkbox"/> -SH04 <input type="checkbox"/> -SH05
Machine cable		<input type="checkbox"/> 7m fixed type	<input type="checkbox"/> 2m fixed type: 1F-02UCBL-02
Controller	Robot CPU unit connecting cable set ^{Note2)}	<input type="checkbox"/> 10m	<input type="checkbox"/> Not provided <input type="checkbox"/> 5m <input type="checkbox"/> 20m <input type="checkbox"/> 30m: 2Q-RC-CBL <input type="checkbox"/> M

Note1) The corresponding base external wiring set is attached.

Note2) The four type cables shown in below are contained. (Each cable length is the same.)

1)2Q-TUCBL ☐ M, 2)2Q-DISPCBL ☐ M, 3)2Q-EMICBL ☐ M,
4)MR-J3BUS ☐ M-A (5m, 20m) or MR-J3BUS ☐ M-B (30m)

■ Options (Installable after shipment)

Item		Type	Provision, and specifications when provided.
Robot arm	J1 axis operating range change	1F-DH-05J1	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Machine cable extension	1F- <input type="checkbox"/> UCBL-02	Fixed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
		1F- <input type="checkbox"/> LUCBL-02	Flexed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
	Solenoid valve set	1F-VD0 <input type="checkbox"/> -03 1F-VD0 <input type="checkbox"/> E-03	<input type="checkbox"/> Not provide 1F-VD0 <input type="checkbox"/> -03 (Sink type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set 1F-VD0 <input type="checkbox"/> E-03 (Source type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
	Hand input cable	1F-HC35S-02	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Hand output cable	1F-GR35S-02	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Hand curl tube	1N-ST060 <input type="checkbox"/> C	<input type="checkbox"/> Not provided <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
	Forearm external wiring set	1F-HB0 <input type="checkbox"/> S-01	<input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HB01S-01 <input type="checkbox"/> 1F-HB02S-01
Controller	Base external wiring set	1F-HA0 <input type="checkbox"/> S-01	<input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HA01S-01 <input type="checkbox"/> 1F-HA02S-01
	Simple teaching pendant	R33TB- <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Highly efficient teaching pendant	R57TB- <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	RT ToolBox2	3D-11C-WINE	<input type="checkbox"/> Not provided <input type="checkbox"/> Windows2000/XP/Vista/7 English CD-ROM
	RT ToolBox2 mini	3D-12C-WINE	<input type="checkbox"/> Not provided <input type="checkbox"/> Windows2000/XP/Vista/7 English CD-ROM
	Network vision sensor	4D-2CG5***-PKG	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Instructions manual	5F-RF01-PE01	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided () sets

■ Maintenance parts (Consumable parts)

Maintenance parts	<input type="checkbox"/> Backup batteries ER6 () pcs. <input type="checkbox"/> Backup batteries Q6BAT () pcs. <input type="checkbox"/> Grease () cans
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■ Robot selection check list

Work description				<input type="checkbox"/> Material handling		<input type="checkbox"/> Assembly		<input type="checkbox"/> Machining L/UL		<input type="checkbox"/> Sealing		<input type="checkbox"/> Testing and inspection		<input type="checkbox"/> Other ()	
Workpiece mass () g		Hand mass () g		Atmosphere <input type="checkbox"/> General environment <input type="checkbox"/> Clean <input type="checkbox"/> Oil mist: Confirm oil proof <input type="checkbox"/> request (Oil name:) / <input type="checkbox"/> not request ^{Note1)} <input type="checkbox"/> Other ()											
Remarks															

Note1) Refer to [Page 22, "2.2.6 Protection specifications"](#) about oil resistance.

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

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased mode

Type ^{Note1)}
■ RV-20F-Q

Note1) Refer to the [Page 2, "1.2 Model type name of robot"](#) for the details of the robot arm type name.

■ Purchased mode

Item	Standard specifications	Shipping special specifications
Robot arm	Oil mist specification (IP67)	General environment specification (IP40) <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Clean specification (ISO class3)	General environment specification (IP40) <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Internal wiring and piping specification ^{Note1)}	Equipped to the forearm <input type="checkbox"/> Not provided <input type="checkbox"/> -SH01 <input type="checkbox"/> -SH02 <input type="checkbox"/> -SH03 <input type="checkbox"/> -SH04 <input type="checkbox"/> -SH05
Machine cable	<input type="checkbox"/> 7m fixed type	<input type="checkbox"/> 2m fixed type: 1F-02UCBL-02
Controller	Robot CPU unit connecting cable set ^{Note2)} <input type="checkbox"/> 10m	<input type="checkbox"/> Not provided <input type="checkbox"/> 5m <input type="checkbox"/> 20m <input type="checkbox"/> 30m: 2Q-RC-CBL <input type="checkbox"/> M

Note1) The corresponding base external wiring set is attached.

Note2) The four type cables shown in below are contained. (Each cable length is the same.)

1)2Q-TUCBL ☐ M, 2)2Q-DISPCBL ☐ M, 3)2Q-EMICBL ☐ M,
4)MR-J3BUS ☐ M-A (5m, 20m) or MR-J3BUS ☐ M-B (30m)

■ Options (Installable after shipment)

Item	Type	Provision, and specifications when provided.
Robot arm	J1 axis operating range change	1F-DH-05J1 <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Machine cable extension	1F- <input type="checkbox"/> UCBL-02 Fixed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
		1F- <input type="checkbox"/> LUCBL-02 Flexed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
	Solenoid valve set	<input type="checkbox"/> Not provide 1F-VD0 <input type="checkbox"/> -03 (Sink type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set 1F-VD0 <input type="checkbox"/> E-03 (Source type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
	Hand input cable	1F-HC35S-02 <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Hand output cable	1F-GR35S-02 <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Hand curl tube	1N-ST060 <input type="checkbox"/> C <input type="checkbox"/> Not provided <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set
	Forearm external wiring set	1F-HB0 <input type="checkbox"/> S-01 <input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HB01S-01 <input type="checkbox"/> 1F-HB02S-01
Controller	Base external wiring set	1F-HA0 <input type="checkbox"/> S-01 <input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HA01S-01 <input type="checkbox"/> 1F-HA02S-01
	Simple teaching pendant	R33TB- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Highly efficient teaching pendant	R57TB- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	RT ToolBox2	3D-11C-WINE <input type="checkbox"/> Not provided <input type="checkbox"/> Windows2000/XP/Vista/7 English CD-ROM
	RT ToolBox2 mini	3D-12C-WINE <input type="checkbox"/> Not provided <input type="checkbox"/> Windows2000/XP/Vista/7 English CD-ROM
	Network vision sensor	4D-2CG5***-PKG <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Instructions manual	5F-RF01-PE01 <input type="checkbox"/> Not provided <input type="checkbox"/> Provided () sets

■ Maintenance parts (Consumable parts)

Maintenance parts	<input type="checkbox"/> Backup batteries ER6 () pcs. <input type="checkbox"/> Backup batteries Q6BAT () pcs. <input type="checkbox"/> Grease () cans
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■ Robot selection check list

Work description	<input type="checkbox"/> Material handling <input type="checkbox"/> Assembly <input type="checkbox"/> Machining L/UL <input type="checkbox"/> Sealing <input type="checkbox"/> Testing and inspection <input type="checkbox"/> Other ()		
Workpiece mass () g	Hand mass () g	Atmosphere <input type="checkbox"/> General environment <input type="checkbox"/> Clean <input type="checkbox"/> Oil mist: Confirm oil proof <input type="checkbox"/> request (Oil name:) / <input type="checkbox"/> not request ^{Note1)} <input type="checkbox"/> Other ()	
Remarks			

Note1) Refer to [Page 22, "2.2.6 Protection specifications"](#) about oil resistance.



Product Service

EC-Statement of Compliance

No. E6 13 05 25554 050

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: I

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.: 73542809



Date, 2013-05-28 (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.

Page 1 of 7

Attachment

Statement No.

E6 13 05 25554 050

Product Service

Nomenclature

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:

D :Stand alone type**Q** :iQ 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

Attachment

Statement No.

E6 13 05 25554 050

Product Service

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(3) **F** : **F** series robot(4) **H** : 4 joints

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

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

(6) Z stroke length specification:

35 : 350 mm arm**45** : 450 mm arm

(7) Dimension and Ambient specification:

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

[none] : Basic model(IP20)

(8) Type of Robot controller cabinet

[none] :CR750 controller

1 :CR751 controller

(9)Robot controller type:

D :Stand alone type**Q** :iQ 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

Attachment

Statement No.

E6 13 05 25554 050

Product Service

A3:RV-2Fseries 1.7kW

RV-x F x - x x x-Sxx

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

(1)**RV**: Vertical Robot

(2) Maximum Payload specification:

2 : 2kg(3) **F** : **F** series robot

(4) Robot Joint type

B : All axes have brake units.

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

(5) Type of Robot controller cabinet

[none] : CR750 controller

1 : CR751 controller

(6) Robot controller type:

D : Stand alone type**Q** : iQ platform type

(7) Standard:

0: normal type**1**: CE marking model**2**: CE marking and UL model

(8) Optional Specification:

1 : normal type**SM** : added cabinet box over Robot controller for oil mist resist**Sxx** : Mechanical option

Attachment

Statement No.

E6 13 05 25554 050

Product Service

A4:RV-4F,7Fseries 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:

4 : 4kg**7** : 7kg(3) **F** : **F** series robot

(4) Robot arm length:

L : Long arm model

[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

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

Attachment

Statement No.

E6 13 05 25554 050

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:

L : 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

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

Sxx :Mechanical option

Attachment

Statement No.

E6 13 05 25554 050



Product Service

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

CR750- xx x x x - x- x- Sxx

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

(1)**CR750**: CR750 controller

CR751: CR751 controller

(2) Maximum Payload specification:

03 : 3kg

06 : 6kg

12 : 12kg

20 : 20kg

02 : 2kg

04 : 4kg

07 : 7kg

13 : 13kg

(3) Robot type

H : Horizontal robot

V : Vertical robot

VL : for only RV-7FLL series

(4) Robot controller type

D :stand alone

Q :iQ platform type

(5) Standard

1 :CE marking model

2 :CE marking and UL model

(6) Operation Panel

[none] :No panel type

1 :Panel type

(7) Power input connector type

[none] :normal type

P2 :Added cable with a connector and a terminal

P3 :Added cable with a connector and a terminal block

(8) Optional Specification

[none] :normal

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

Sxx :mechanical option

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 sheet(P8).

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 Standards		Non-harmonized Standard
EMC(2004/108/EC)	EN61000-6-4:2007 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 Type B: Group safety standards B1: Safety aspects EN60204-1:2006, EN294:1992, EN349:1993 ISO13849-1:2006 (Category 3 and Performance level "d") Type C: Machine Safety standard ISO10218-1:2011	N/A

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): April 19, 2013

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


(signature)

[Tomoyuki Kobayashi]

Senior Manager
Robot Manufacturing Department
MITSUBISHI ELECTRIC Corporation Nagoya Works

Authorized representative in Europe
(The person authorized compiles the relevant Technical documentation)


(signature)

[Hartmut Putz]

FA Product Marketing Director FA Group
Gother St. 8 40880 Ratingen, Germany
MITSUBISHI Electric Europe B.V Germany

RH - xFH xx xx x - xxx - Sxx

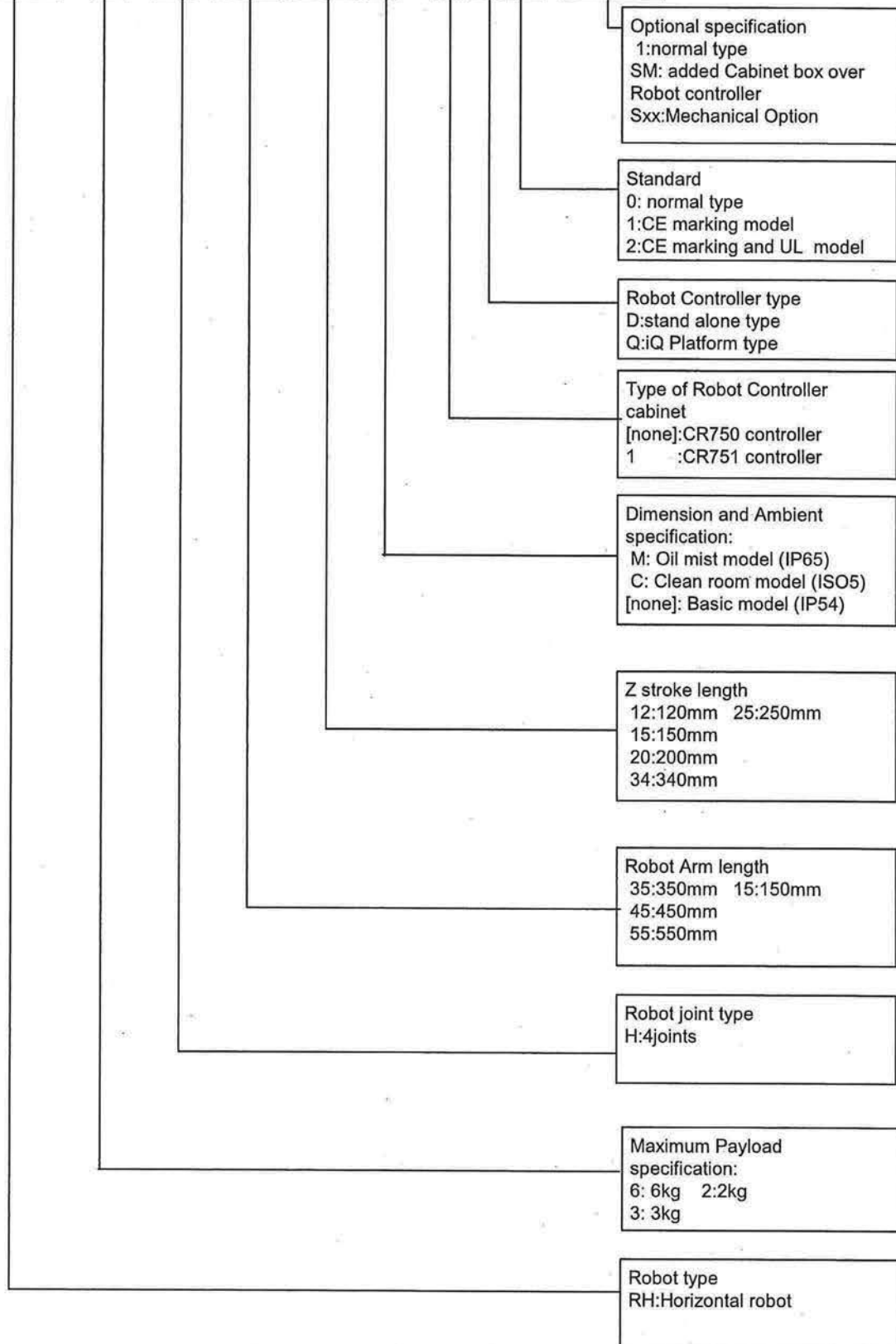


Fig.1-1 Nomenclature of F series robot of RH-6FH,3FH,2FH series

RH- xFH xx xx x - xxx- Sxx

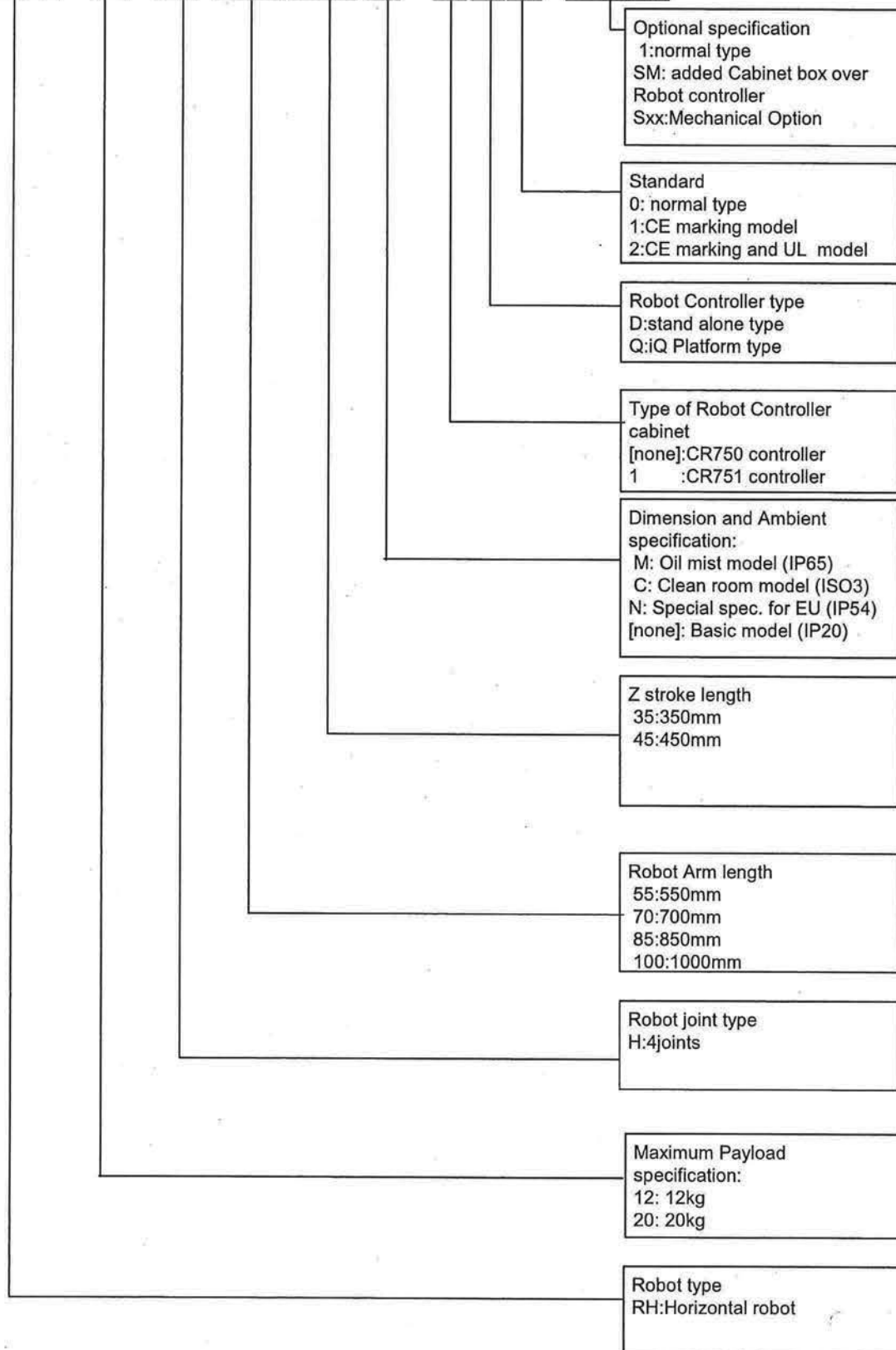


Fig.1-2 Nomenclature of F series robot of RH-12FH,20FH series

RV-xF x-xxx-Sxx

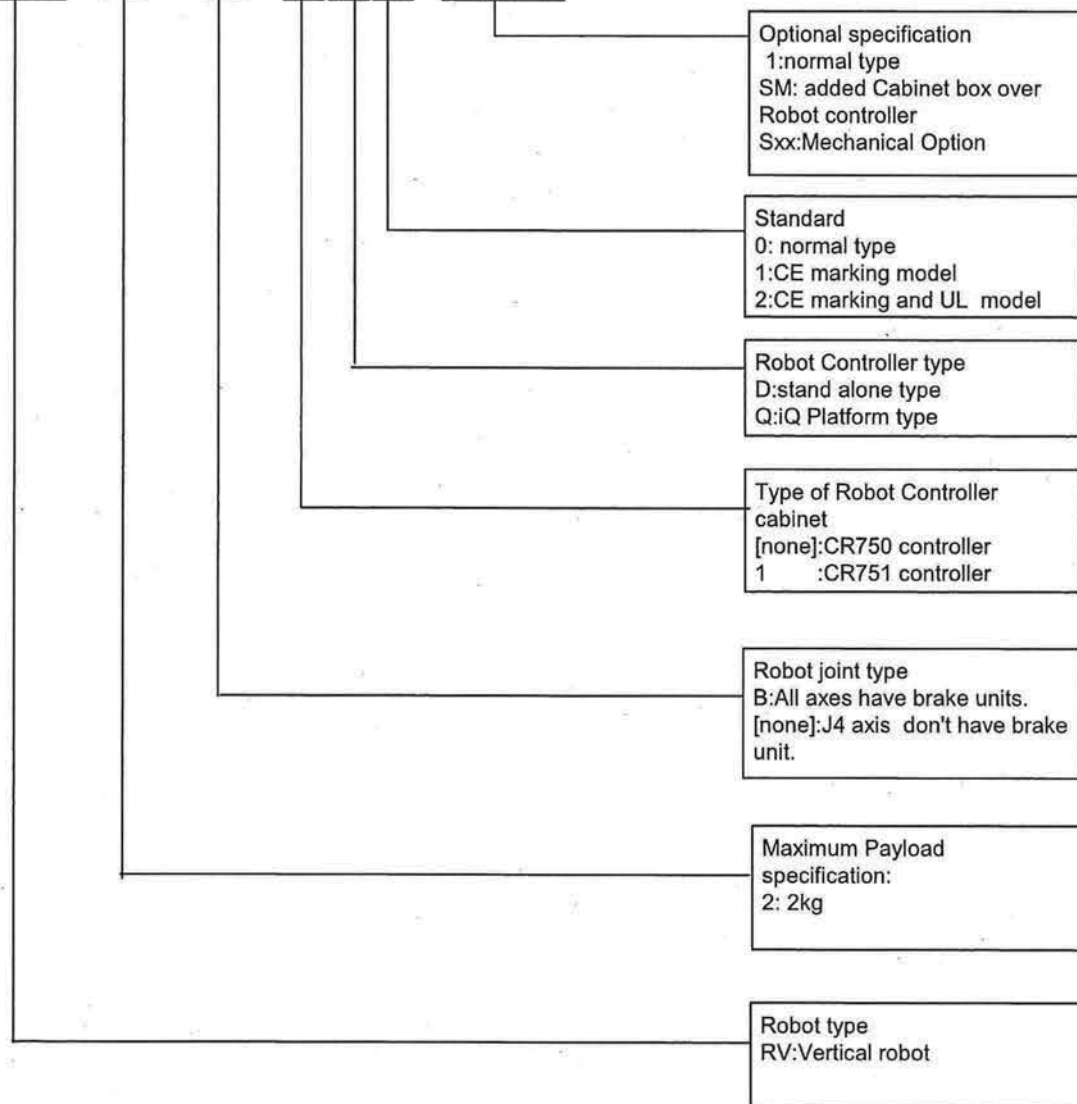


Fig.1-3 Nomenclature of F series robot of RV-2F series

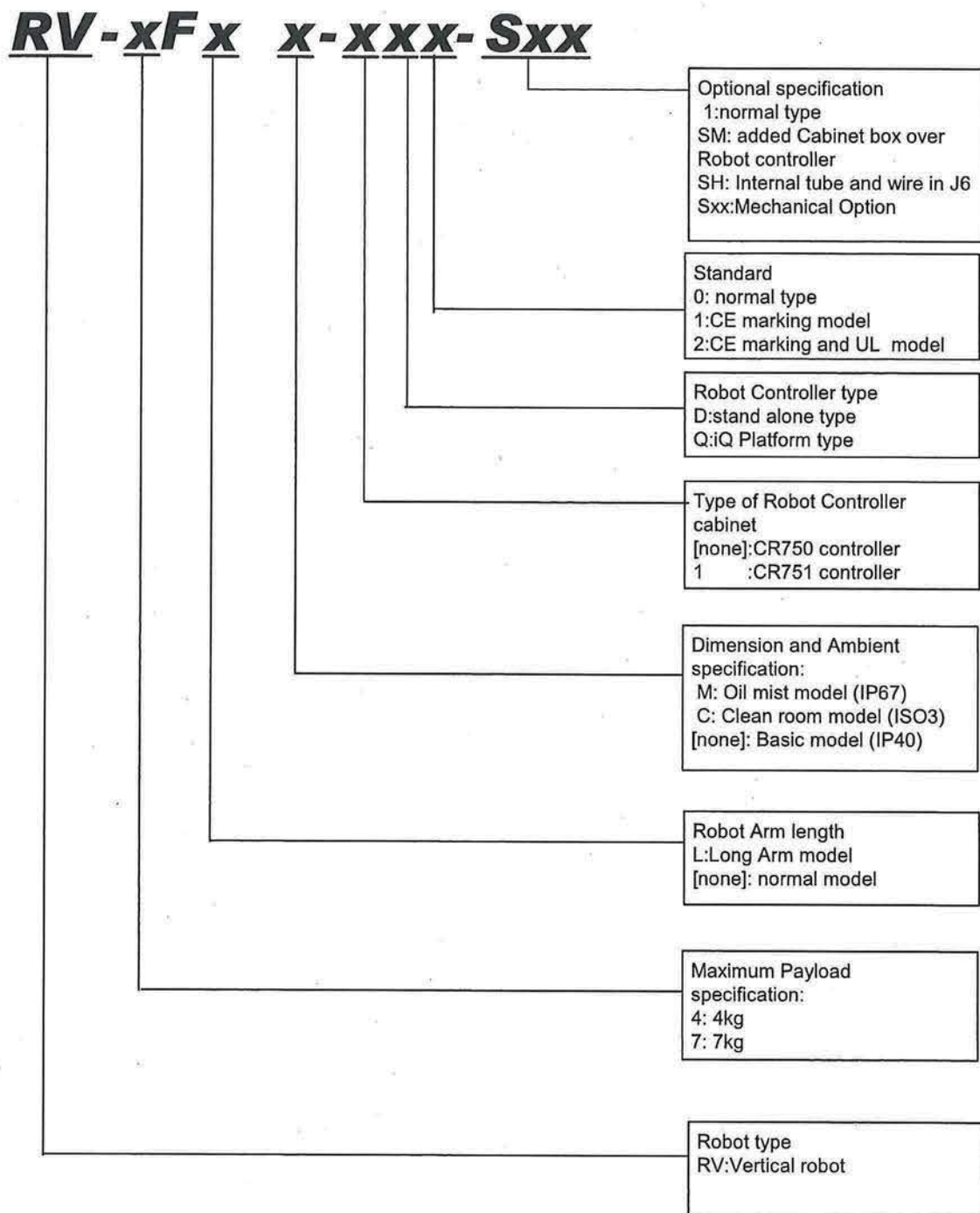


Fig.1-4 Nomenclature of F series robot of RV-4F,7F series

RV-xFx x-xxx-Sxx

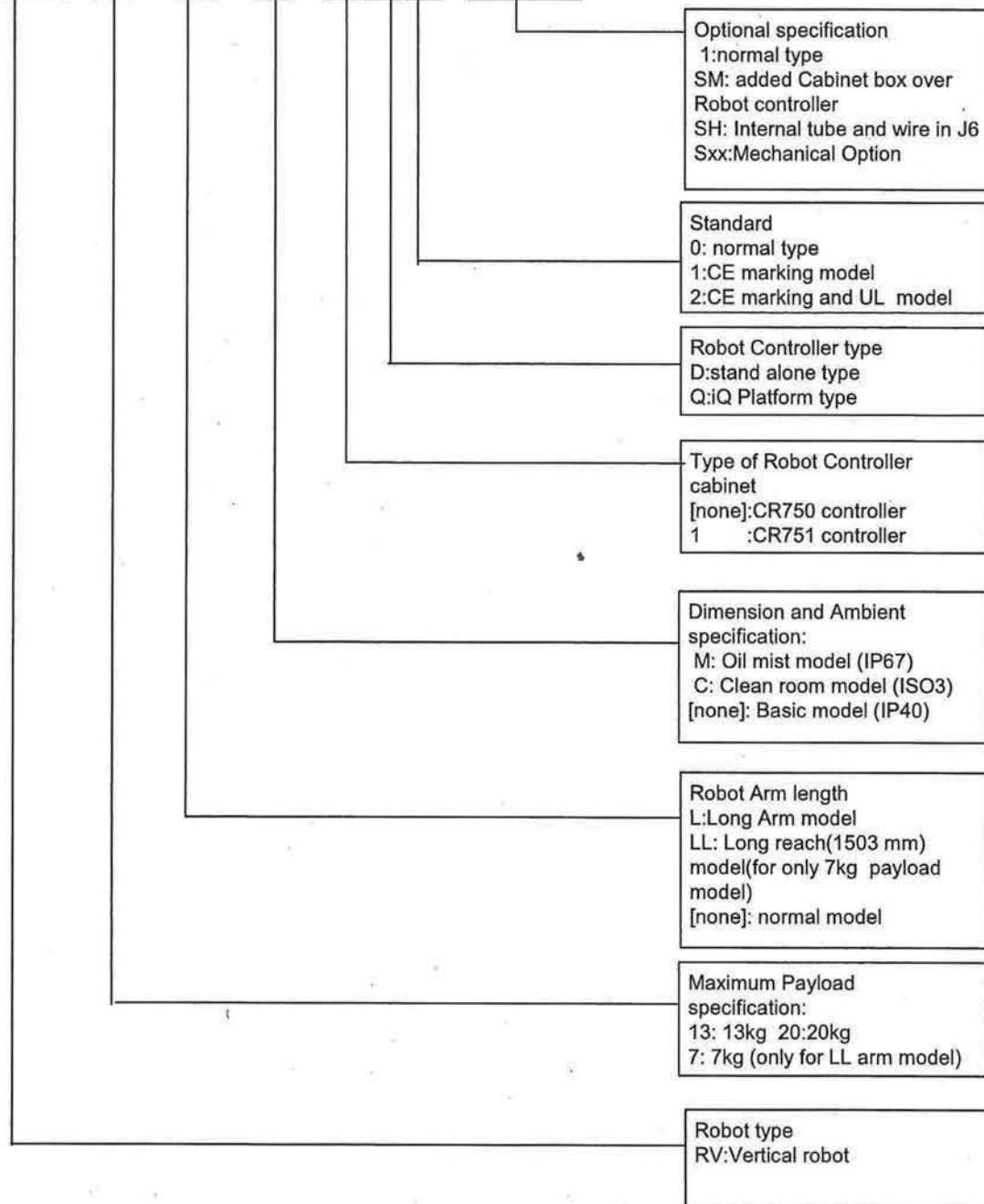


Fig.1-5 Nomenclature of F series robot of RV-13F,20F,7FLL series

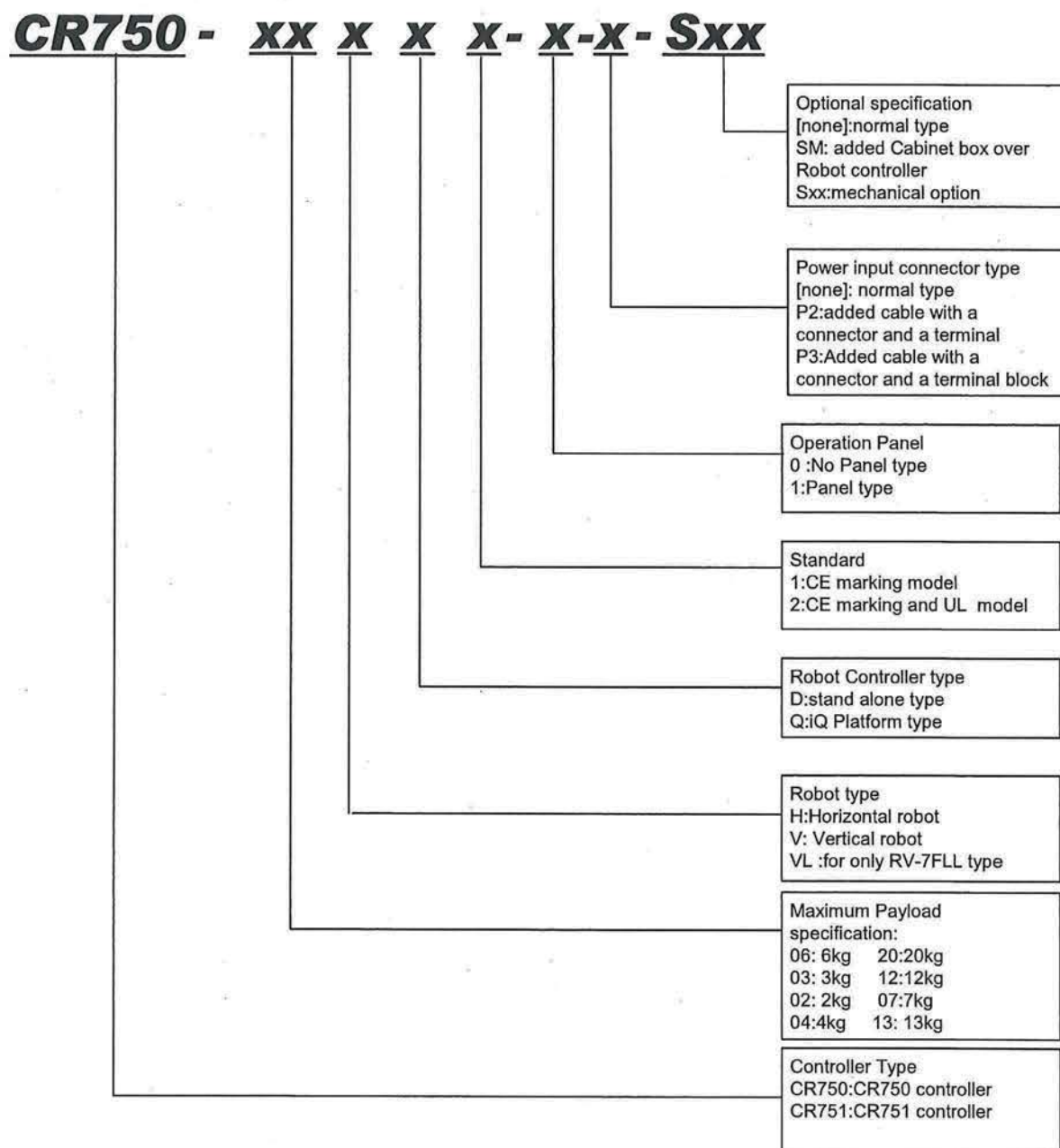


Fig.2-1 Nomenclature of F series robot controller

■ Details of serial number

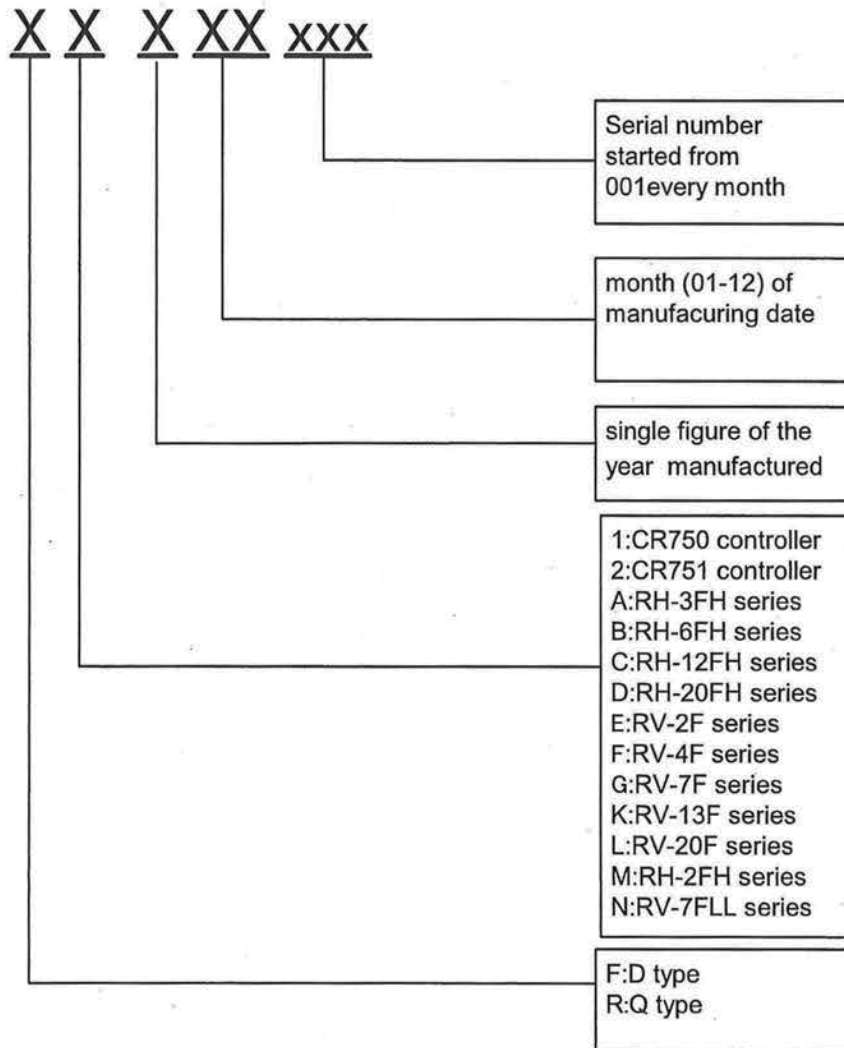


Fig.3.1 Nomenclature of serial number about F series Robot and robot controller

Revision history

Date	Specifications No.	Details of revisions	Rev.
April 16,2012		First print	*
May 25, 2012		Q type added	A
October 1,2012	Fig.1-2,1-3,1-4 added	RH-12/20FH-D series,RV-2F-D series,RV-4F/7F-D series added	B
November 1,2012	P1 P3-P7	Form changed RH-12/20FH-Q series,RV-2F-Q series,RV-4F/7F-Q series added "Details of serial No." added	C
April 15, 2013	P2,P6,P7,P8	RH-2FH series,RV-13F,20FH,7FLL series added	D

사용자안내문 User's Guide

기종별 Type of Equipment	사용자안내문 User's Guide
A 급 기기 (업무용 방송통신기자재) Class A Equipment (Industrial Broadcasting & Communication Equipment)	이 기기는 업무용(A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다. This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home.
B 급 기기 (가정용 방송통신기자재) Class B Equipment (For Home Use Broadcasting & Communication Equipment)	이 기기는 가정용(B 급) 전자파적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다. This equipment is home use (Class B) electromagnetic wave suitability equipment and to be used mainly at home and it can be used in all areas.



Authorised representative:

MITSUBISHI ELECTRIC EUROPE B.V. GERMANY

Gothaer Str. 8, 40880 Ratingen / P.O. Box 1548, 40835 Ratingen, Germany

HEADQUARTERS	
Mitsubishi Electric Europe B.V. Gothaer Straße 8 D-40880 Ratingen Phone: +49 (0)2102 / 486-0 Fax: +49 (0)2102 / 486-1120	EUROPE
Mitsubishi Electric Europe B.V. Radlická 751/113e Avenir Business Park CZ-158 00 Praha 5 Phone: +420 251 551 470 Fax: +420 251 551 471	CZECH REP.
Mitsubishi Electric Europe B.V. 25, Boulevard des Bouvets F-92741 Nanterre Cedex Phone: +33 (0)1 / 55 68 55 68 Fax: +33 (0)1 / 55 68 57 57	FRANCE
Mitsubishi Electric Europe B.V. Westgate Business Park, Ballymount IRL-Dublin 24 Phone: +353 (0)1 4198800 Fax: +353 (0)1 4198890	IRELAND
Mitsubishi Electric Europe B.V. Viale Colleoni 7 Palazzo Sirio I-20864 Agrate Brianza (MB) Phone: +39 039 / 60 53 1 Fax: +39 039 / 60 53 312	ITALY
Mitsubishi Electric Europe B.V. Nijverheidsweg 23a NL-3641RP Mijdrecht Phone: +31 (0) 297250350	NETHERLANDS
Mitsubishi Electric Europe B.V. ul. Krakowska 50 PL-32-083 Balice Phone: +48 (0) 12 630 47 00 Fax: +48 (0) 12 630 47 01	POLAND
Mitsubishi Electric Europe B.V. 52, bld. 3 Kosmodamianskaya nab 8 floor RU-115054 Moscow Phone: +7 495 / 721 2070 Fax: +7 495 / 721 2071	RUSSIA
Mitsubishi Electric Europe B.V. Carretera de Rubí 76-80 Apdo. 420 E-08190 Sant Cugat del Vallés (Barcelona) Phone: +34 (0) 93 / 5653131 Fax: +34 (0) 93 / 5891579	SPAIN
Mitsubishi Electric Europe B.V. (Scandinavia) Fjellievägen 8 SE-22736 Lund Phone: +46 (0) 8 625 10 00 Fax: +46 (0) 46 39 70 18	SWEDEN
Mitsubishi Electric Turkey Elektrik Ürünleri A.Ş. Fabrika Otomasyonu Merkezi Şerifali Mahallesi Nutuk Sokak No.5 TR-34775 Ümraniye-İSTANBUL Phone: +90 (0)216 / 526 39 90 Fax: +90 (0)216 / 526 39 95	TURKEY
Mitsubishi Electric Europe B.V. Travellers Lane UK-Hatfield, Herts. AL10 8XB Phone: +44 (0)1707 / 28 87 80 Fax: +44 (0)1707 / 27 86 95	UK
Mitsubishi Electric Europe B.V. Dubai Silicon Oasis United Arab Emirates - Dubai Phone: +971 4 3724716 Fax: +971 4 3724721	UAE
Mitsubishi Electric Corporation Tokyo Building 2-7-3 Marunouchi, Chiyoda-ku Tokyo 100-8310 Phone: +81 (3) 3218-2111 Fax: +81 (3) 3218-2185	JAPAN
Mitsubishi Electric Automation, Inc. 500 Corporate Woods Parkway Vernon Hills, IL 60061 Phone: +1 (847) 478-2100 Fax: +1 (847) 478-0328	USA
EUROPEAN REPRESENTATIVES	
GEVA Wiener Straße 89 A-2500 Baden Phone: +43 (0)2252 / 85 55 20 Fax: +43 (0)2252 / 488 60	AUSTRIA
OOO TECHNIKON Prospect Nezavisimosti 177-9 BY-220125 Minsk Phone: +375 (0)17 / 393 1177 Fax: +375 (0)17 / 393 0081	BELARUS
ESCO DRIVES Culliganlaan 3 BE-1831 Diegem Phone: +32 (0)2 / 717 64 60 Fax: +32 (0)2 / 717 64 61	BELGIUM
KONING & HARTMAN B.V. Woluwelaan 31 BE-1800 Vilvoorde Phone: +32 (0)2 / 257 02 40 Fax: +32 (0)2 / 257 02 49	BELGIUM
INEA RBT d.o.o. Stegne 11 SI-1000 Ljubljana Phone: +386 (0)1 / 513 8116 Fax: +386 (0)1 / 513 8170	BOSNIA AND HERZEGOVINA
AKHNATON 4, Andrei Ljapchev Blvd., PO Box 21 BG-1756 Sofia Phone: +359 (0)2 / 817 6000 Fax: +359 (0)2 / 97 44 06 1	BULGARIA
INEA CR Losinjska 4 a HR-10000 Zagreb Phone: +385 (0)1 / 36 940 - 01 / -02 / -03 Fax: +385 (0)1 / 36 940 - 03	CROATIA
AutoCont C. S. S.R.O. Kafkova 1853/3 CZ-702 00 Ostrava 2 Phone: +420 595 691 150 Fax: +420 595 691 199	CZECH REPUBLIC
Beijer Electronics A/S Lykkegardsvej 17 DK-4000 Roskilde Phone: +45 (0)46 / 75 76 66 Fax: +45 (0)46 / 75 56 26	DENMARK
HANS FØLSGAARD A/S Theilgaardsgade 1 DK-4600 Køge Phone: +45 4320 8600 Fax: +45 4396 8855	DENMARK
Beijer Electronics OY Vanha Nurmijärventie 62 FIN-01670 Vantaa Phone: +358 (0)207 / 463 500 Fax: +358 (0)207 / 463 501	FINLAND
PROVENDOR OY Teljänkatu 8 A3 FIN-28130 Pori Phone: +358 (0) 2 / 522 3300 Fax: +358 (0) 2 / 522 3322	FINLAND
UTECO A.B.E.E. 5, Mavrogenous Str. GR-18542 Piraeus Phone: +30 (0)211 / 1206-900 Fax: +30 (0)211 / 1206-999	GREECE
EUROPEAN REPRESENTATIVES	
AXICONT Automatika Kft. (Robot Center) Rokolya utca 1-13 HU-1131 Budapest Phone: +36 (0)1 / 412-0882 Fax: +36 (0)1 / 412-0883	HUNGARY
ALFATRIDE Ltd. 99, Paola Hill Malta-Paola PLA 1702 Phone: +356 (0)21 / 697 816 Fax: +356 (0)21 / 697 817	MALTA
HIFLEX AUTOM. B.V. Wolveverstraat 22 NL-2984 CD Ridderkerk Phone: +31 (0)180 / 46 60 04 Fax: +31 (0)180 / 44 23 55	NETHERLANDS
KONING & HARTMAN B.V. Haarlerbergweg 21-23 NL-1101 CH Amsterdam Phone: +31 (0)20 / 587 76 00 Fax: +31 (0)20 / 587 76 05	NETHERLANDS
Beijer Electronics AS Postboks 487 NO-3002 Drammen Phone: +47 (0)32 / 24 30 00 Fax: +47 (0)32 / 84 85 77	NORWAY
Fonseca S.A. R. João Francisco do Casal 87/89 PT-3801-997 Aveiro, Esqueira Phone: +351 (0)234 / 303 900 Fax: +351 (0)234 / 303 910	PORTUGAL
SIRIUS TRADING & SERVICES SRL Aleea Lacul Morii Nr. 3 RO-060841 Bucuresti, Sector 6 Phone: +40 (0)21 / 430 40 06 Fax: +40 (0)21 / 430 40 02	ROMANIA
INEA SR d.o.o. Ul. Karadjordjeva 12/217 SER-11300 Šmederevo Phone: +386 (026) 461 54 01	SERBIA
SIMAP SK (Západné Slovensko) Jána Derku 1671 SK-911 01 Trenčín Phone: +421 (0)32 743 04 72 Fax: +421 (0)32 743 75 20	SLOVAKIA
INEA RBT d.o.o. Stegne 11 SI-1000 Ljubljana Phone: +386 (0)1 / 513 8116 Fax: +386 (0)1 / 513 8170	SLOVENIA
Beijer Electronics Automation AB Box 426 SE-20124 Malmö Phone: +46 (0)40 / 35 86 00 Fax: +46 (0)40 / 93 23 01	SWEDEN
OOO "CSC-AUTOMATION" 4-B, M. Raskovoyi St. UA-02660 Kiev Phone: +380 (0)44 / 494 33 44 Fax: +380 (0)44 / 494-33-66	UKRAINE
MIDDLE EAST REPRESENTATIVE	
I.C. SYSTEMS Ltd. 23 Al-Saad-Al-Alee St. EG-Sarayut, Maadi, Cairo Phone: +20 (0) 2 / 235 98 548 Fax: +20 (0) 2 / 235 96 625	EGYPT
ILAN & GAVISH Ltd. 24 Shenkar St., Kiryat Ariet IL-49001 Petah-Tikva Phone: +972 (0)3 / 922 18 24 Fax: +972 (0)3 / 924 0761	ISRAEL
AFRICAN REPRESENTATIVE	
ADROIT TECHNOLOGIES 23 Waterford Office Park 189 Witkoppen Road ZA-Fourways Phone: +27 (0)11 / 658 8100 Fax: +27 (0)11 / 658 8101	SOUTH AFRICA