



Mitsubishi Industrial Robot

CR750-Q/CR751-Q/CR760-Q Controller

**RV-4F-Q/7F-Q/13F-Q/20F-Q/35F-Q/50F-Q/
70F-Q Series**

Standard Specifications Manual

MELFA
BFP-A8933-X

Safety Precautions

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

CAUTION

All teaching work must be carried out by an operator who has received special training. (This also applies to maintenance work with the power source turned ON.)

Enforcement of safety training

CAUTION

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

Preparation of work plan

WARNING

Prepare a device that allows operation to be stopped immediately during teaching work. (This also applies to maintenance work with the power source turned ON.)

Setting of emergency stop switch

CAUTION

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

Indication of teaching work in progress

DANGER

Provide a fence or enclosure during operation to prevent contact of the operator and robot.

Installation of safety fence

CAUTION

Establish a set signaling method to the related operators for starting work, and follow this method.

Signaling of operation start

CAUTION

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

Indication of maintenance work in progress

CAUTION

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

Inspection before starting work

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

DANGER

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

CAUTION

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

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.

DANGER

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

DANGER

Do not connect the Handy GOT to a programmable controller when using an iQ Platform compatible product with the CR7xx-Q controller. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.

DANGER

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

DANGER

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

DANGER

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

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

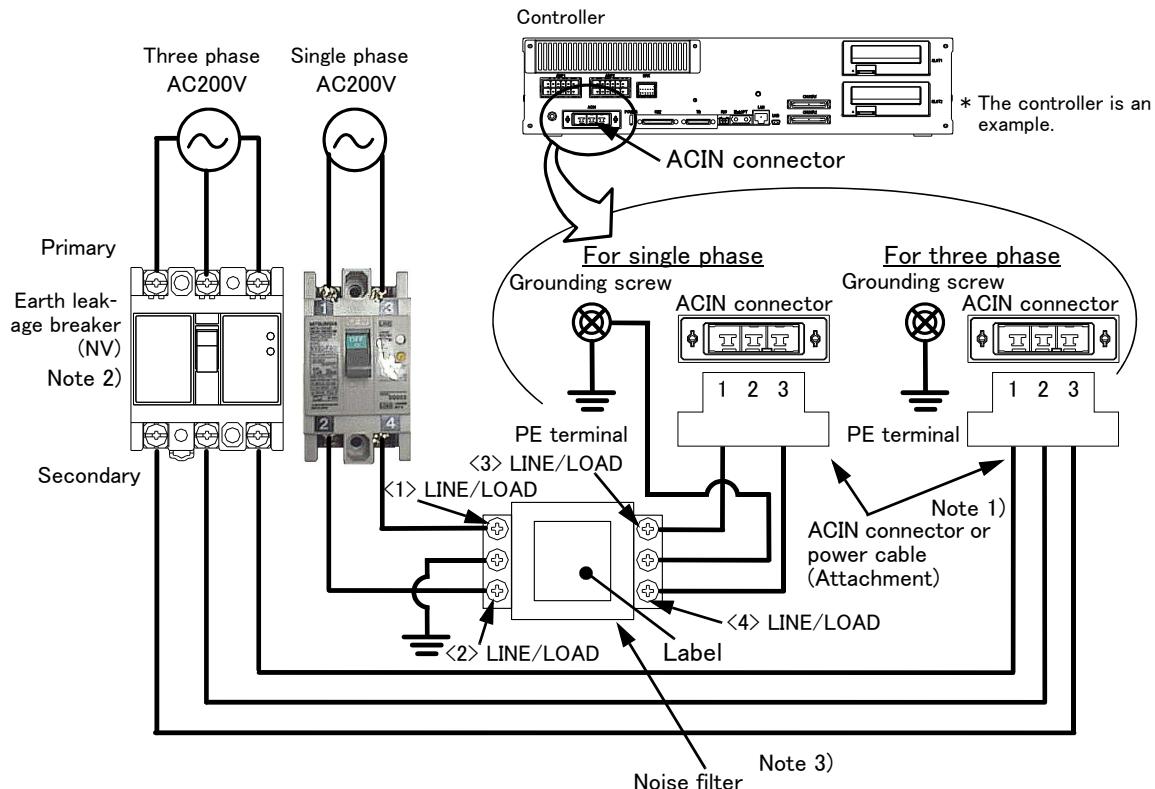
Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures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

*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.



Note 1) Crimping swage is recommended for connecting the attachment ACIN connector (soldering is also possible)
Recommendation compression tools: 234171-1(Tyco Electronics)

Note 2) The earth leakage breaker is the customer preparation. Always use the cover below.

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

For three primary power supply NV30FAU-3P-10A-AC100-240V-30mA, (Cover: TCS-05FA3)

Note 3) If necessary, as shown in the figure, connects the noise filter between ACIN terminal blocks and primary power supply.
(Recommended noise filter: SUP-EL20-ER6 *OKAYA ELECTRIC INDUSTRIES)

- 1) Please prepare the following: Leakage current breaker (with the terminal cover), cable for connecting the primary power supply (AWG #14 (2mm² or above), cables to ground the primary power supply (AWG #12 (3.5mm² or above).
The secondary power cable (with the ACIN connector) for single phase or three phase power is supplied with the product to match the specifications. When you build a cable suitable for your environment using the ACIN connector and the ACIN terminal supplied, prepare a secondary power cable (AWG #14 (2mm²) or above).
- 2) Confirm that the primary power matches the specifications.
- 3) Confirm that the primary power is OFF and that the earth leakage breaker power switch is OFF.
- 4) Connect the secondary power cable.
 - a) When using the supplied power cable with the ACIN connector
Refer to the figure above and connect the cable from the secondary side of the earth leakage breaker.
 - b) When building a power cable using the ACIN connector and the ACIN terminals supplied
Connect the ACIN terminals with the secondary power cable (prepared by customers), and insert the ACIN terminals to the ACIN connector pins with the following numbers. Crimping caULKING is recommended to connect the ACIN terminals.
For single phase: 1 and 3
For three phase: 1, 2, and 3
Refer to the figure above and connect the cable from the secondary side of the earth leakage breaker.
- 5) Connect this ACIN connector to the ACIN connector on the front of the controller.
- 6) Connect the grounding cable to the PE terminal. (M4 screw)
- 7) Connect the primary power cable to the primary side terminal of the earth leakage breaker.

■ Revision history

Date of print	Specifications No.	Details of revisions
2012-10-09	BFP-A8933	<ul style="list-style-type: none"> ▪ First print.
2012-10-18	BFP-A8933-A	<ul style="list-style-type: none"> ▪ The user's guide of KC mark was added.
2012-11-20	BFP-A8933-B	<ul style="list-style-type: none"> ▪ "1.3 CE marking specifications" was added. ▪ The statement about trademark registration was added. ▪ The notes of "set the Optimization of overload detection level parameter OLTMX" were added. (Environmental temperature in the table of Standard specifications of robot) ▪ The notes about the input-output connected to the controller were added. (do not ground the + side of 24V power supply prepared by customer) ▪ "Declaration of Incorporation" was added. ▪ "Fig. 2-18: Outline dimensional drawing" was added.
2012-12-05	BFP-A8933-C	<ul style="list-style-type: none"> ▪ The terminal name to connect when using the three phase specification by the single phase power supply was added. ▪ EC-Statement of Compliance was added.
2013-01-17	BFP-A8933-D	<ul style="list-style-type: none"> ▪ Note of the external emergency stop were added (opens the connector terminal at factory shipping). ▪ J1 axis operating range change (option) was added. ▪ The connector name and pin assignment were added to Wiring and piping system diagram for hand. ▪ The description of SH04 and SH05 of Internal wiring and piping specification types was added. ▪ "Table 2-23: Pin assign of hand input cable" and "Table 2-26: Pin assign of hand output cable" were added. ▪ The specification description of CR750-MB was added. ▪ The outside dimensions and operating ranges of RV-4F/4FL, RV-7F/7FL were changed.
2013-03-22	BFP-A8933-E	<ul style="list-style-type: none"> ▪ The specification description of RV-7FLL, RV-13F and RV-20F were added. ▪ The metal plate which fixes CR750 controller vertically was changed. (upward compatibility) ▪ "Table 3-2: Robot CPU unit standard specification" was added. ▪ The mass of the controller was shown which was divided by each robot type. ▪ The type name of "J1 axis operating range change" for RV-7F series was corrected. (formerly: 1F-DH-04)
2013-04-04	BFP-A8933-F	<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-A8933-G	<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. ▪ The values of RV-4F series in "Table 2-5: Value of each counter-force" were corrected. ▪ 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-A8933-H	<ul style="list-style-type: none"> ▪ "Fig.6-6: Limitations when connecting the relay etc. (CR750)" was corrected. (Error output → Emergency stop output, Contactor control output 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.

Date of print	Specifications No.	Details of revisions
2014-01-08	BFP-A8933-J	<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. • 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-A8933-K	<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.
2014-08-20	BFP-A8933-M	<ul style="list-style-type: none"> • The cover and corporate logo mark of this manual was changed. • The statement about trademark registration was modified. • The explanation of CR751 drive unit was added. • A connection space for a machine cable was added. • The description about screw holes using for tooling wiring and piping was added. • The number of a quick coupling of a solenoid valve for RV-13F series was corrected. • A safety relay in "example of safety measures (wiring example 5)" both CR750 and CR751 controller were changed. • "Declaration of Incorporation" and "EC-Statement of Compliance" were updated.
2014-12-17	BFP-A8933-N	<ul style="list-style-type: none"> • The type of the optional hand input cable was corrected. (error: 1F-HC35C-C02) • Explanation of the maximum load was added. • Correction of errors in the Specifications discussion materials. (Network vision sensor: 4D-2CG5***-PKG was deleted.) • The corporate logo mark of illustrations in this manual was changed.
2015-10-29	BFP-A8933-P	<ul style="list-style-type: none"> • "Declaration of Incorporation" and "EC-Statement of Compliance" were updated. • Shape of base section of RV-7F series robot was changed. • Transportation precaution of the lithium battery was modified. • Note1) in "Table3-6: Function of the key switch interface" was corrected. • The explanation of RV-50F series (RV-35F, RV-50F, RV-70F) were added.
2015-11-30	BFP-A8933-R	<ul style="list-style-type: none"> • "Fig.2-23 : Outside dimensions: RV-50F" was corrected.
2015-12-14	BFP-A8933-S	<ul style="list-style-type: none"> • The figures of "Position of center of gravity for loads" were modified. • Errors in "(3) Solenoid valve set" were corrected. • Circuit diagrams in "3.6.1 Connection of the external emergency stop" and "6.1.7 Examples of safety measures" were modified.
2016-04-07	BFP-A8933-T	<ul style="list-style-type: none"> • The name of robot CPU unit was corrected. (error: R760CPU unit) • The number of the ferrite cores attach to the emergency stop line of CR760 controller was corrected. • Windows10 was supported by RT ToolBox2. • "EC DECLARATION OF CONFORMITY" pages were deleted.
2016-09-23	BFP-A8933-U	<ul style="list-style-type: none"> • CE marking specification of RV-50F series (RV-35F, RV-50F, RV-70F) were added. • Type name of 1F-□□LCBL-21 cable in "(1) Machine cable extension" was corrected. • Allowable moment load in "Table 2-5 : Standard specifications of RV-50F series robot" was corrected. • Notes 3 and 4 were added to "Fig.2-23 : Outside dimensions: RV-50F". • Note 6 was added to "Table 2-5 : Standard specifications of RV-50F series robot".
2016-10-27	BFP-A8933-V	<ul style="list-style-type: none"> • Series name was modified. (formerly RV-50F series) • "Table 2-5 : Standard specifications of RV-35F/50F/70F series robot" was corrected. • "Fig.2-24 : Operating range diagram: RV-35F/50F/70F series" was modified.
2017-05-22	BFP-A8933-W	<ul style="list-style-type: none"> • The optional J2 axis motor cover was added. • Contact information of the authorized representative was updated.
2017-09-25	BFP-A8933-X	<ul style="list-style-type: none"> • "2.9 About Overhaul" was modified. • Connection method of three-phase power supply in CE marking specification was supplemented. • Figures of internal wiring and piping specification were corrected. (Fig. 2-29, Fig. 2-36, Fig. 2-37)

■ 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 16, "2 Robot arm"](#), the specifications related to the controller [Page 109, "3 Controller"](#), and software functions and a command list [Page 183, "4 Software"](#) separately.

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

Robot type	Series (generic name used in this document for robots listed in each row)
RV-4F-Q, RV-4FL-Q, RV-4FJL-Q	RV-4F series
RV-7F-Q, RV-7FL-Q	RV-7F series
RV-7FLL-Q, RV-13F-Q, RV-13FL-Q, RV-20F-Q	RV-13F series
RV-35F-Q, RV-50F-Q, RV-70F-Q	RV-35F/50F/70F series

• About CE Marking in the automation system

The Guidelines of the measures against EMC in the automation system manufactured by the customer is shown in [Page 213, "6.4 EMC installation guideline"](#).

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

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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

(1) RV-4F/7F/13F series

RV - ◇ F J L O - ● 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). O 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). ● 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.

(2) RV-35F/50F/70F series

RV - ◇ F O - Q ▲ -Sxx

(a) (b) (c) (d) (e) (f) (g)

(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)

35 : 35kg

50 : 50kg

70 : 70kg

(c). F Indicates the F series.

(d). O Indicates environment specification.
Ex)

Omitted: General specifications (Robot arm: IP54, Wrist portion:
IP67)

M: Oil mist specifications (Robot arm/Wrist portion: IP67)

(e). Q Indicates the controller type.
Q: iQ Platform

(f). ▲ Technical standard of Conformity.
Ex)

Omitted: No conformity of technical standard.

1: Conforms to the CE marking

(g). -Sxx Indicates a special model. In order, limit special specification.

1.2.2 Combination of the robot arm and the controller

(1) CR750 controller

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

Robot arm					Controller		
Type name Note1)	Protection specification	Arm length Note2)	Internal wiring and piping specification (Mechanical I/F)	Axial constitution			
RV- □ F-Q	Standard specification	Standard arm	-	6-axis type	CR750- □ VQ-1		
RV-20F-Q					CR750-20VQ-1		
RV- □ FL-Q		Long arm			CR750- □ VQ-1		
RV-4FJL-Q		5-axis type		CR750-04VJQ-1			
RV-7FLL-Q		Standard arm	equipped Note3)	6-axis type	CR750-07VLQ-1		
RV- □ F-Q-SH					CR750- □ VQ-1		
RV-20F-Q-SH		Long arm		6-axis type	CR750-20VQ-1		
RV- □ FL-Q-SH					CR750- □ VQ-1		
RV-4FJL-Q-SH	Protection specification Note4)	Standard arm		5-axis type	CR750-04VJQ-1		
RV-7FLL-Q-SH					CR750-07VLQ-1		
RV- □ FM-Q		Long arm	-	6-axis type	CR750- □ VQ-1		
RV-20FM-Q					CR750-20VQ-1		
RV- □ FLM-Q		Standard arm		5-axis type	CR750- □ VQ-1		
RV-4FJLM-Q					CR750-04VJQ-1		
RV-7FLLM-Q		Long arm		6-axis type	CR750-07VLQ-1		
RV- □ FC-Q	Clean specification Note5)	Standard arm			CR750- □ VQ-1		
RV-20FC-Q					CR750-20VQ-1		
RV- □ FLC-Q		Long arm		5-axis type	CR750- □ VQ-1		
RV-4FJLC-Q					CR750-04VJQ-1		
RV-7FLLC-Q				6-axis type	CR750-07VLQ-1		

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 6, "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.

(2) CR751 controller

Table 1-2 : Combination of the robot arm and the CR751 controller

Robot arm					Controller		
Type name Note1)	Protection specification	Arm length Note2)	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			CR751- □ VQ-0		
RV-4FJL-1Q					CR751-04VJQ-0		
RV-7FLL-1Q		Standard arm	equipped Note3)	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					CR751-07VLQ-0		
RV- □ FM-1Q	Protection specification Note4)	Standard arm	-	6-axis type	CR751- □ VQ-0		
RV-20FM-1Q					CR751-20VQ-0		
RV- □ FLM-1Q		Long arm			CR751- □ VQ-0		
RV-4FJLM-1Q		5-axis type		CR751-04VJQ-0			
RV-7FLLM-1Q				CR751-07VLQ-0			
RV- □ FC-1Q	Clean specification Note5)	Standard arm	-	6-axis type	CR751- □ VQ-0		
RV-20FC-1Q					CR751-20VQ-0		
RV- □ FLC-1Q		Long arm			CR751- □ VQ-0		
RV-4FJLC-1Q		5-axis type		CR751-04VJQ-0			
RV-7FLLC-1Q				CR751-07VLQ-0			

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 6, "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.

(3) CR760 controller

Table 1-3 : Combination of the robot arm and the CR760 controller

Robot arm		Controller
Type name Note1)	Protection specification	
RV- □ F-Q	Standard specification	CR760- □ VQ-1
RV- □ FM-Q	Protection specification Note2)	

Note1) The " □ " indicates the load mass."35" for 35kg, "50" for 50kg, "70" for 70kg. (" □ " of the controller type name is "35", "50" or "70".)

Note2) This robot arm's protective structure is IP65. The protective structure of all the drive units is IP54 (enclose type).

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 63, "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 1-4 : Internal wiring and piping specification types

Special model number Note1)	Piping	Wiring (cable for the connection to each equipment)			Base section external wiring set Note2)
		Hand input signal	Vision sensor camera	Force sensor unit	
-SH01	Φ 4x4 Note3)	8 points	Not available		Not available
-SH02	Not available	8 points	1	1	1F-HA01S-01
-SH03	Not available	Not available	1	1	1F-HA02S-01
-SH04	Φ 4x2	8 points	-	1	1F-HA01S-01
-SH05	Φ 4x2	8 points	1	-	1F-HA01S-01

Note1) In order to confirm a special model number, see at the end of a type name of a robot.

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 [Table 1-5](#), [Table 1-6](#) or [Table 1-7](#) are the CE marking/KC mark specification.

(1) CR750 controller

Table 1-5 : Robot models with CE marking specifications

Robot type	Controller	External signal logic	Language setting
RV- □ F-Q1-S15 RV- □ FL-Q1-S15 RV- □ FM-Q1-S15 RV- □ FLM-Q1-S15 RV- □ FC-Q1-S15 RV- □ FLC-Q1-S15	CR750- □ VQ1-1-S15	Source type	English (ENG)
RV- □ F-Q1-SH15xx RV- □ FL-Q1-SH15xx	CR750- □ VQ1-1-S15xx		
RV-7FLL-Q1-S15 RV-7FLLM-Q1-S15 RV-7FLLC-Q1-S15	CR750-07VLQ1-1-S15		
RV-20F-Q1-S15 RV-20FM-Q1-S15 RV-20FC-Q1-S15	CR750-20VQ1-1-S15		
RV-20F-Q1-SH15xx	CR750-20VQ1-1-S15xx		

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

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

(2) CR751 controller

Table 1-6 : 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		
RV- □ F-1Q1-SH15xx RV- □ FL-1Q1-SH15xx	CR751- □ VQ1-0-S15xx	Source type	English (ENG)
RV-7FLL-1Q1-S15 RV-7FLLM-1Q1-S15 RV-7FLLC-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.

(3) CR760 controller

Table 1-7 : Combination of the robot arm and the CR760 controller

Robot type Note1)	Controller	External signal logic	Language setting
RV- □ F-Q1-S15	CR760- □ VQ1-1-S15	Source type	English (ENG)
RV- □ FM-Q1-S15			

Note1) The " □ " indicates the load mass."35" for 35kg, "50" for 50kg, "70" for 70kg. (" □ " of the controller type name is "35", "50" or "70".)

1.4 Indirect export

The display in English is available by setting parameter LNG as "ENG."

1.5 Instruction manuals

The instruction manuals supplied in CD-ROM, except for the Safety Manual. This CD-ROM (electronic manual) includes instruction manuals in both Japanese and English versions.

1.6 Contents of the structural equipment

1.6.1 Robot arm

The list of structural equipment is shown in below.

(1) RV-4F/7F/13F series

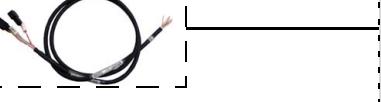
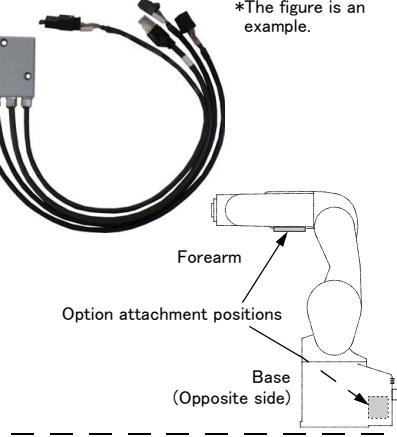
<p>Vertical six-axis multiple-jointed type (RV-4F/4FL/4FJL, RV-7F/7FL)</p>  <p>Either one</p>	<p>Vertical six-axis multiple-jointed type (RV-13F/13FL, RV-7FLL/RV-20F)</p> 	<p>Machine cable</p> <p>Fixed type: RV-4F/7F series 5m RV-13F series 7m</p> <p>For CR750 controller For CR751 controller</p>  <p>Machine cable (Fixed type: 2m)</p> <ul style="list-style-type: none"> For CR750 controller: 1S-02UCBL-01 For CR751 controller: 1F-02UCBL-02 <p>Machine cable extension</p> <ul style="list-style-type: none"> CR750 controller <ul style="list-style-type: none"> Fixed type: 1S-□□□ CBL-01 Flexed type: 1S-□□□ LCBL-01 CR751 controller <ul style="list-style-type: none"> Fixed type: 1F-□□□ UCBL-02 Flexed type: 1F-□□□ LUCBL-02 <p>Note1) □□□ refer the length. Refer to Table 1-8 for details.</p>							
<p>Solenoid valve set (Special hand output cable is attached)</p> <p><Sink type/Source type></p> <ul style="list-style-type: none"> 1 set: 1F-VD01-**/1F-VD01E-** 2 set: 1F-VD02-**/1F-VD02E-** 3 set: 1F-VD03-**/1F-VD03E-** 4 set: 1F-VD04-**/1F-VD04E-** <p><u>1F-VD04-02</u> <u>1F-VD04-03</u></p>  <p>Hand output cable</p> <ul style="list-style-type: none"> 1F-GR35S-02  <p>Hand input cable</p> <ul style="list-style-type: none"> 1F-HC35S-02  <p>Hand curl tube</p> <p>RV-4F/7F series, RV-7FLL</p> <ul style="list-style-type: none"> 1E-ST040*C (1 – 4 set) <p>RV-13F/13FL/20F</p> <ul style="list-style-type: none"> 1N-ST060*C (1 – 4 set) <p>Note) * differs by 1 – 4 set. Refer to Table 1-8 for details.</p>	<p>Pneumatic hand customer-manufactured parts</p>  <p>J1 axis operating range change (Stopper parts)</p> <ul style="list-style-type: none"> RV-4F series: 1F-DH-03 RV-7F series: 1F-DH-04 RV-13F series: 1F-DH-05J1 <p>* Installed by customer.</p> <p>[Caution]</p> <table border="1"> <tr> <td style="width: 10px; height: 10px;"></td> <td>Standard configuration equipment</td> </tr> <tr> <td style="width: 10px; height: 10px;"></td> <td>Special specifications</td> </tr> <tr> <td style="width: 10px; height: 10px;"></td> <td>Option</td> </tr> <tr> <td style="width: 10px; height: 10px;"></td> <td>Prepared by customer</td> </tr> </table>		Standard configuration equipment		Special specifications		Option		Prepared by customer
	Standard configuration equipment								
	Special specifications								
	Option								
	Prepared by customer								

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

(2) RV-35F/50F/70F series

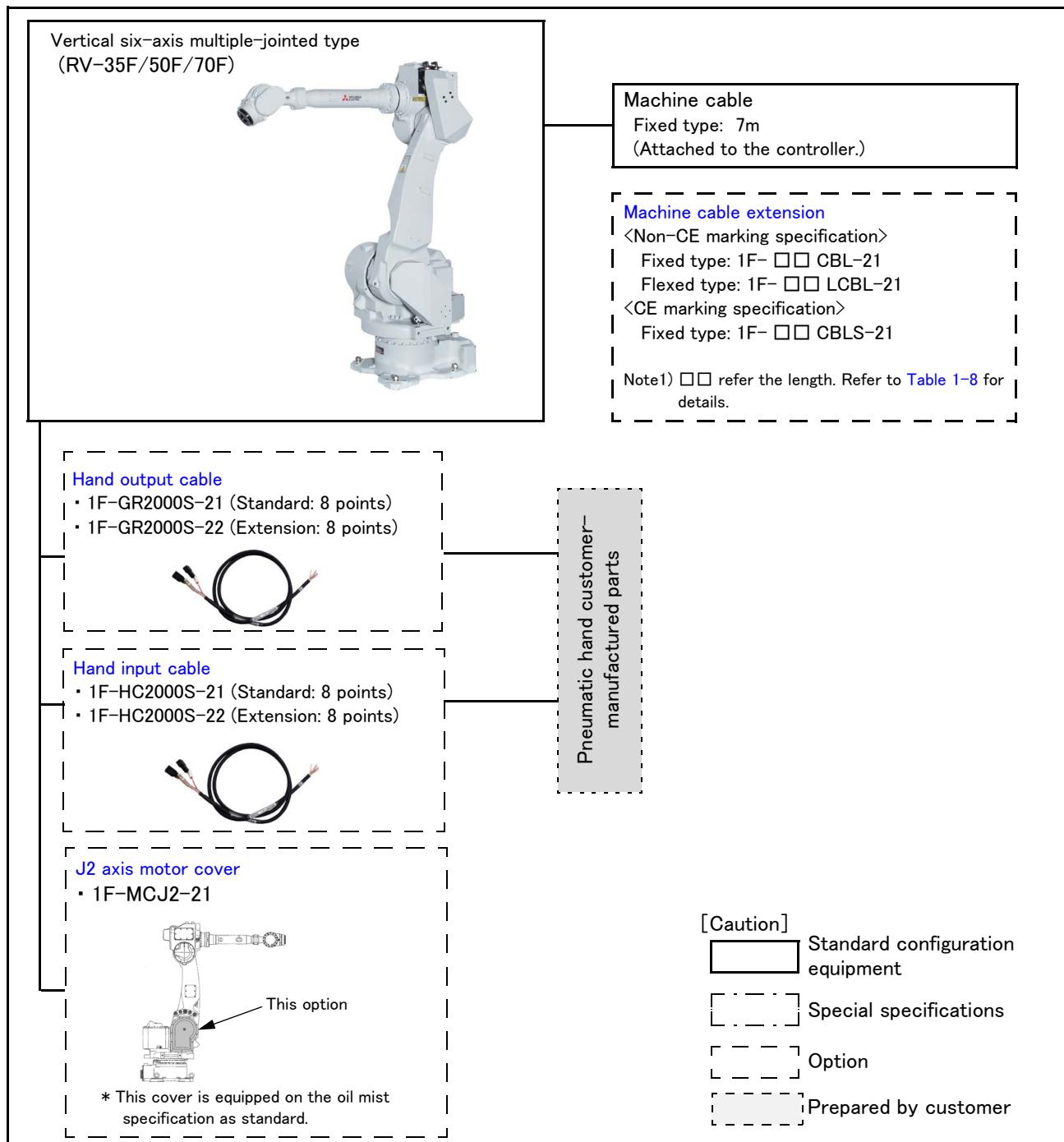


Fig.1-2 : Structural equipment (Robot arm)

1.6.2 Controller

The devices shown below can be installed on the controller.

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

(1) CR750controller

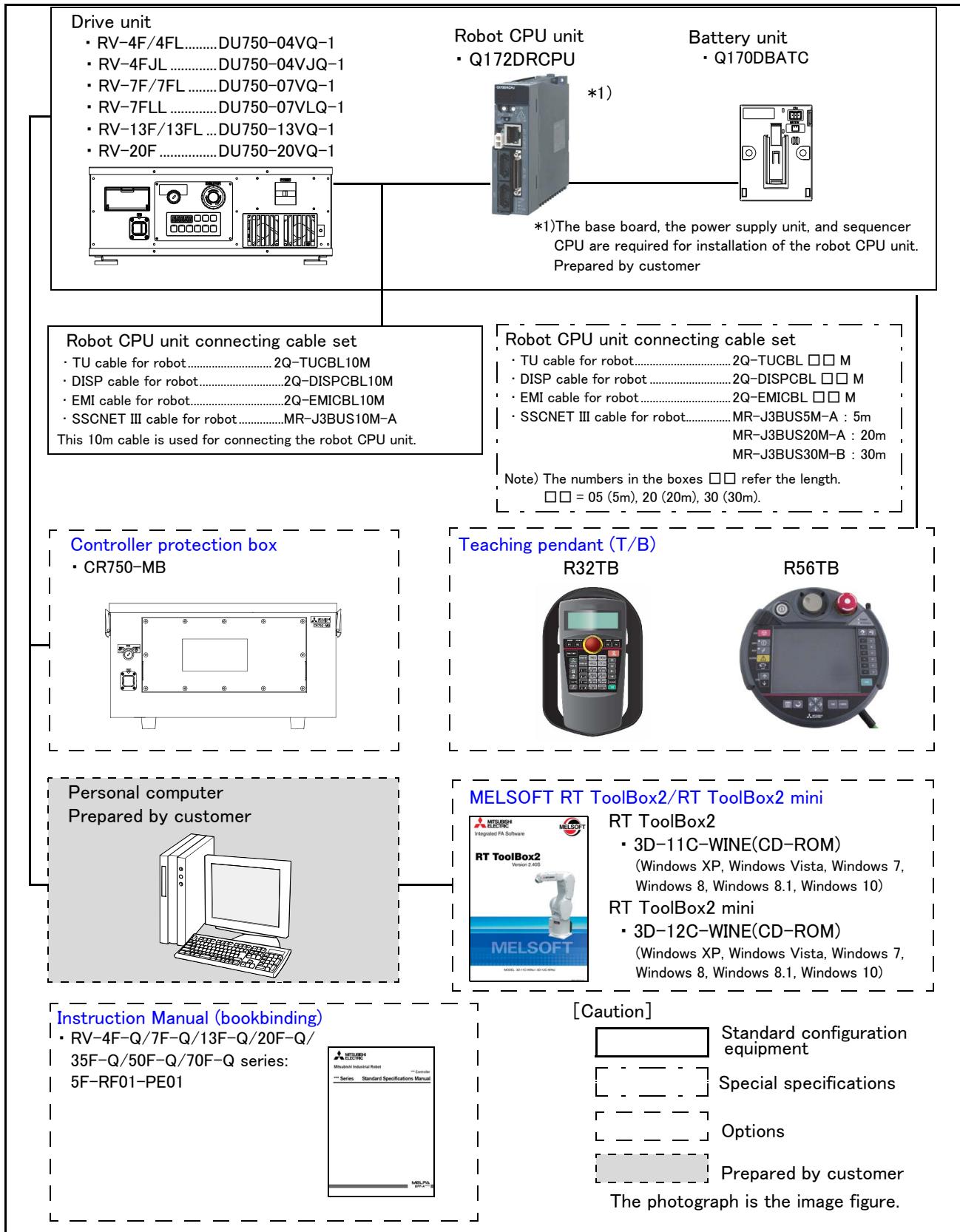


Fig.1-3 : Structural equipment (CR750 controller)

(2) CR751 controller

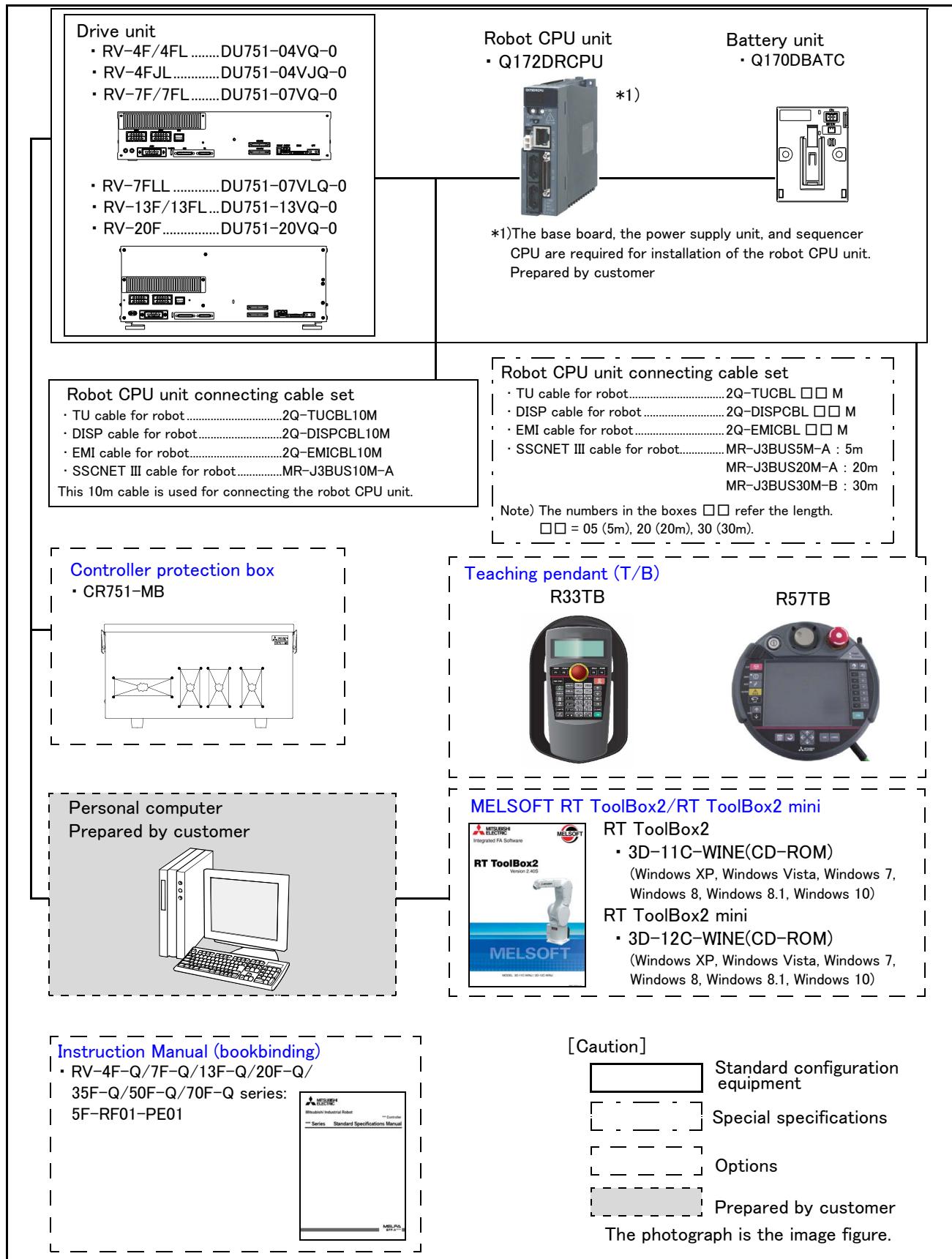


Fig.1-4 : Structural equipment (CR751 controller)

(3) CR760 controller

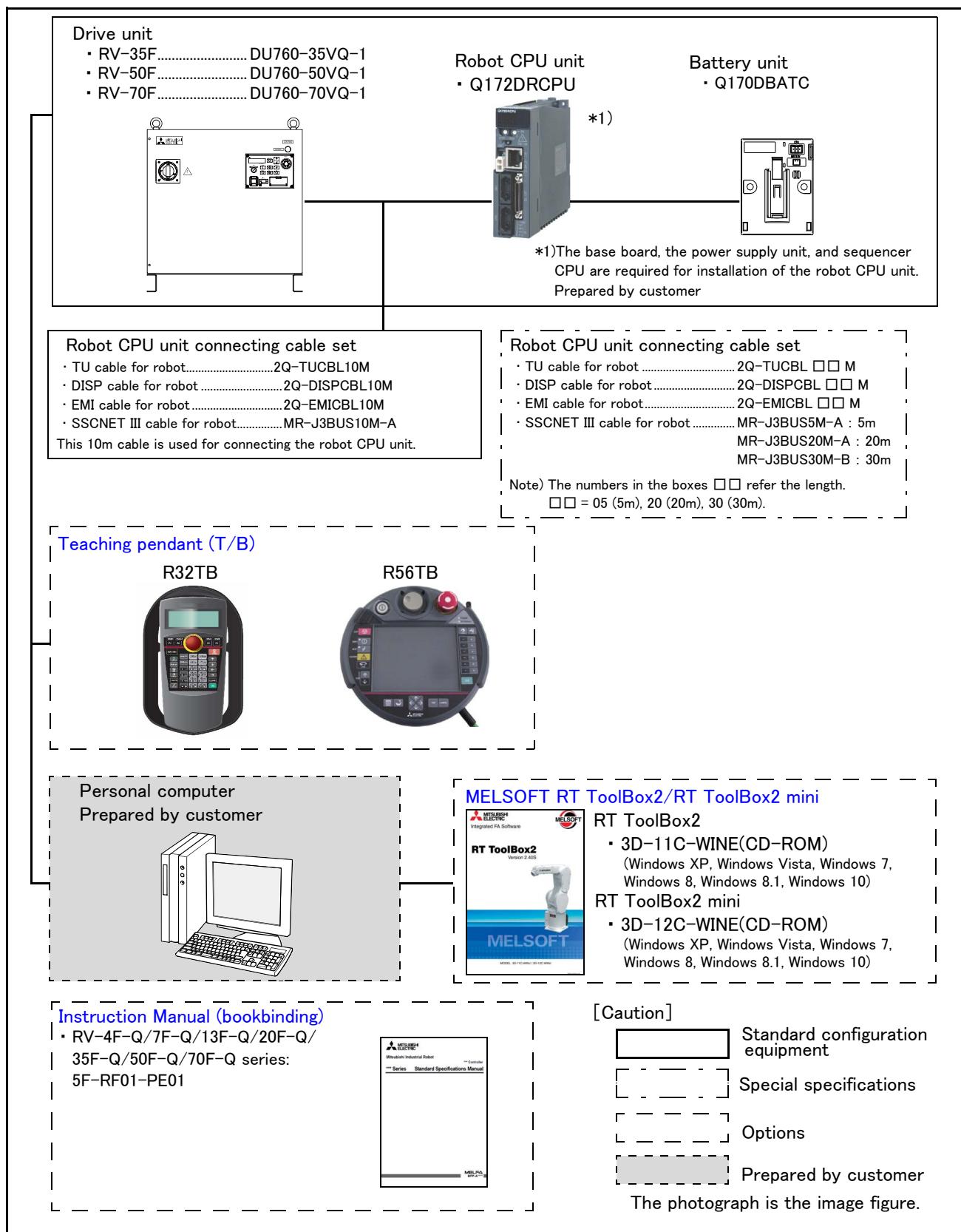


Fig.1-5 : Structural equipment (CR760 controller)

1.7 Contents of the Option equipment and special specification

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

(1) RV-4F/7F/13F series

Table 1-8 : The list of the robot arm option equipment and special specification

Item	Type	Specifications	Classification Note1)		Description
			CR750	CR751	
Internal wiring and piping specification (robot arm)	Special model number -SH01	Functions equipped inside of wrist: Air-hose $\phi 4 \times 4$, Eight hand input signals.	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> In order to confirm a special model number, see at the end of a type name of a robot. Example: RV-4F-Q-SH01 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.
	Special model number -SH02	Functions equipped inside of wrist: Eight hand input signals, connection cable for vision-sensor camera, connection cable for force sensor unit.	<input type="checkbox"/>	<input type="checkbox"/>	
	Special model number -SH03	Functions equipped inside of wrist: Connection cable for vision-sensor camera and force sensor unit.	<input type="checkbox"/>	<input type="checkbox"/>	
	Special model number -SH04	Functions equipped inside of wrist: Air-hose $\phi 4 \times 2$, Eight hand input signals, connection cable for force sensor unit.	<input type="checkbox"/>	<input type="checkbox"/>	
	Special model number -SH05	Functions equipped inside of wrist: Air-hose $\phi 4 \times 2$, Eight hand input signals, connection cable for vision-sensor camera.	<input type="checkbox"/>	<input type="checkbox"/>	
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.	<input type="radio"/>	<input type="radio"/>	<p>This must be installed and setting the parameter by the customer. * Refer to Page 88, "(2) J1 axis operating range change" for details.</p>
	1F-DH-04	Stopper part for RV-7F series: Sets as the + side/- side each by the combination within 35, 77, 99 and 141.	<input type="radio"/>	<input type="radio"/>	
	1F-DH-05J1	Stopper part for RV-13F series: Sets as the + side/- side each by the combination within 30, 73, 103 and 146.	<input type="radio"/>	<input type="radio"/>	
Machine cable (Replaced to shorter cable)	1S-02UCBL-01	For fixing (Set of power and signal)	<input type="radio"/> · <input type="checkbox"/>	-	<p>2m (A 2m cable is supplied instead of the 5m cable that is supplied as standard)</p>
	1F-02UCBL-02	For fixing (Set of power and signal)	-	<input type="radio"/> · <input type="checkbox"/>	
Extended machine cable (extension type)	1S- □□ CBL-01	For fixing (Set of power and signal)	<input type="radio"/>	-	<p>" □□ " in type shows the length of the cables as follows. 05=5m, 10=10m, 15=15m</p>
	1S- □□ LCBL-01	For flexing (Set of power and signal)	<input type="radio"/>	-	
Extended machine cable (direct type)	1F- □□ UCBL-02	For fixing (Set of power and signal)	-	<input type="radio"/>	<p>" □□ " in type shows the length of the cables as follows. 10=10m, 15=15m, 20=20m</p>
	1F- □□ LUCBL-02	For flexing (Set of power and signal)	-	<input type="radio"/>	
Solenoid valve set	1F-VD01-02/VD01E-02	1 set (Sink type)/(Source type)	<input type="radio"/>	<input type="radio"/>	<p>The solenoid-valve set for the hand of the customer setup. Use for RV-4F/7F series and RV-7FLL.</p>
	1F-VD02-02/VD02E-02	2 set (Sink type)/(Source type)	<input type="radio"/>	<input type="radio"/>	
	1F-VD03-02/VD03E-02	3 set (Sink type)/(Source type)	<input type="radio"/>	<input type="radio"/>	
	1F-VD04-02/VD04E-02	4 set (Sink type)/(Source type)	<input type="radio"/>	<input type="radio"/>	
	1F-VD01-03/VD01E-03	1 set (Sink type)/(Source type)	<input type="radio"/>	<input type="radio"/>	<p>The solenoid-valve set for the hand of the customer setup. Use for RV-13F/13FL and RV-20F.</p>
	1F-VD02-03/VD02E-03	2 set (Sink type)/(Source type)	<input type="radio"/>	<input type="radio"/>	
	1F-VD03-03/VD03E-03	3 set (Sink type)/(Source type)	<input type="radio"/>	<input type="radio"/>	
	1F-VD04-03/VD04E-03	4 set (Sink type)/(Source type)	<input type="radio"/>	<input type="radio"/>	
Hand input cable	1F-HC35S-02	Robot side: connector. Hand side: wire.	<input type="radio"/>	<input type="radio"/>	The cable is connected to the sensor by the customer.
Hand output cable	1F-GR35S-02	Robot side: connector. Hand side: wire	<input type="radio"/>	<input type="radio"/>	This cable can be used for the solenoid valve prepared by the customer.

1 General configuration

Item	Type	Specifications	Classification Note1)		Description
			CR750	CR751	
Hand curl tube	1E-ST0402C	For solenoid valve 1set.: $\phi 4 \times 2$	<input type="radio"/>	<input type="radio"/>	Curl type air tube For RV-4F/7F series and RV-7FLL.
	1E-ST0404C	For solenoid valve 2set.: $\phi 4 \times 4$	<input type="radio"/>	<input type="radio"/>	
	1E-ST0406C	For solenoid valve 3set.: $\phi 4 \times 6$	<input type="radio"/>	<input type="radio"/>	
	1E-ST0408C	For solenoid valve 4set.: $\phi 4 \times 8$	<input type="radio"/>	<input type="radio"/>	
	1N-ST0602C	For solenoid valve 1set.: $\phi 6 \times 2$	<input type="radio"/>	<input type="radio"/>	Curl type air tube For RV-13F/13FL and RV-20F.
	1N-ST0604C	For solenoid valve 2set.: $\phi 6 \times 4$	<input type="radio"/>	<input type="radio"/>	
	1N-ST0606C	For solenoid valve 3set.: $\phi 6 \times 6$	<input type="radio"/>	<input type="radio"/>	
Forearm external wiring set	1F-HB01S-01	The following cables can be wired outside: hand input signals, force sensor and vision sensor.	<input type="radio"/>	<input type="radio"/>	Pulls out from forearm lower part.
	1F-HB02S-01	The following cables can be wired outside: force sensor and vision-sensor.	<input type="radio"/>	<input type="radio"/>	
Base external wiring set	1F-HA01S-01	The following cables can be wired outside: force sensor and vision-sensor.	<input type="radio"/>	<input type="radio"/>	Pulls out from base side.
	1F-HA02S-01	The following cables can be wired outside: force sensor and vision-sensor.	<input type="radio"/>	<input type="radio"/>	

Note1) : option, : special specifications.

Table 1-9 : The list of the CR750/CR751 controller option equipment and special specification

Item	Type	Specifications	Classification Note1)		Description
			CR750	CR751	
Simple teaching pendant	R32TB	Cable length 7m	<input type="radio"/>	-	With 3-position enable switch IP65
	R32TB-15	Cable length 15m	<input type="radio"/>	-	
	R33TB	Cable length 7m	-	<input type="radio"/>	
	R33TB-15	Cable length 15m	-	<input type="radio"/>	
Highly efficient teaching pendant	R56TB	Cable length 7m	<input type="radio"/>	-	
	R56TB-15	Cable length 15m	<input type="radio"/>	-	
	R57TB	Cable length 7m	-	<input type="radio"/>	
	R57TB-15	Cable length 15m	-	<input type="radio"/>	
Controller protection box	CR750-MB	IP54	<input type="radio"/>	-	The controller protection box is used to protect the controller from an oil mist or other operating environment.
	CR751-MB		-	<input type="radio"/>	
RT ToolBox2 (Personal computer Support software)	3D-11C-WINE	CD-ROM	<input type="radio"/>	<input type="radio"/>	Windows XP, Windows Vista, Windows 7, Windows 8, Windows 8.1, Windows 10 (With the simulation function)
RT ToolBox2 mini (Personal computer Support software mini)	3D-12C-WINE	CD-ROM	<input type="radio"/>	<input type="radio"/>	Windows XP, Windows Vista, Windows 7, Windows 8, Windows 8.1, Windows 10
Robot CPU unit connection cable set	2Q-RC-CBL <input type="checkbox"/> M	Cable length 05, 20, 30m	<input type="checkbox"/>	<input type="checkbox"/>	This option include TU, DISP, EMI and SSCNET cables.
TU cable for robot	2Q-TUCBL <input type="checkbox"/> M	Cable length 05, 20, 30m	<input type="checkbox"/>	<input type="checkbox"/>	For communication between robot CPU and DU.
DISP cable for robot	2Q-DISPCBL <input type="checkbox"/> M	Cable length 05, 20, 30m	<input type="checkbox"/>	<input type="checkbox"/>	For communication between robot CPU and DU.
EMI cable for robot	2Q-EMICBL <input type="checkbox"/> M	Cable length 05, 20, 30m	<input type="checkbox"/>	<input type="checkbox"/>	For a robot CPU emergency stop input.
SSCNET III cable for robot	MR-J3BUS <input type="checkbox"/> M-A	Cable length 5, 20m	<input type="checkbox"/>	<input type="checkbox"/>	For the servo communication between robot CPU and DU .
	MR-J3BUS30M-B	Cable length 30m	<input type="checkbox"/>	<input type="checkbox"/>	
Instruction Manual	5F-RF01-PE01	RV-4F/7F/13F/20F/35F/50F/70F-Q series	<input type="radio"/>	<input type="radio"/>	

Note1) : option, : special specifications.

(2) RV-35F/50F/70F series

Table 1-10 : The list of the robot arm option equipment and special specification

Item	Type	Specifications	Classification Note1)	Description
Extended machine cable (extension type)	1F-□□ CBL-21	For fixing A set of three cables. (power and signal)	○	" □□ " in type shows the length of the cables as follows. 05=5m, 10=10m, 15=15m
	1F-□□ LCBL-21	For flexing A set of three cables. (power and signal)	○	For non-CE marking specification.
	1F-□□ CBLS-21	For fixing A set of three cables. (power and signal)	○	" □□ " in type shows the length of the cables as follows. 05=5m, 10=10m, 15=15m For CE marking specification.
Hand input cable	1F-HC2000S-21/ 1F-HC2000S-22	Robot side: connector. Hand side: wire. (Standard: 8 points/extension: 8 points)	○	The cable is connected to the sensor by the customer. Attaches the cable clamp (drip proof type)
Hand output cable	1F-GR2000S-21/ 1F-GR2000S-22	Robot side: connector. Hand side: wire (Standard: 8 points/extension: 8 points)	○	This cable can be used for the solenoid valve prepared by the customer.
J2 axis motor cover	1F-MCJ2-21	Oil mist specification	○	This cover protect the J2 axis motor from dust and water. Oil mist specification robot is equipped with the cover as standard.

Note1) ○ : option, □ : special specifications.

Table 1-11 : The list of the CR760 controller option equipment and special specification

Item	Type	Specifications	Classification Note1)	Description
Simple teaching pendant	R32TB	Cable length 7m	○	With 3-position enable switch IP65
	R32TB-15	Cable length 15m	○	
Highly efficient teaching pendant	R56TB	Cable length 7m	○	
	R56TB-15	Cable length 15m	○	
RT ToolBox2 (Personal computer Support software)	3D-11C-WINE	CD-ROM	○	Windows XP, Windows Vista, Windows 7, Windows 8, Windows 8.1, Windows 10 (With the simulation function)
RT ToolBox2 mini (Personal computer Support software mini)	3D-12C-WINE	CD-ROM	○	Windows XP, Windows Vista, Windows 7, Windows 8, Windows 8.1, Windows 10
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-RF01-PE01	RV-4F/7F/13F/20F/35F/50F/ 70F-Q series	○	

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 RV-4F/7F series 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		-					
	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	$\phi 6 \times 2$								
	Secondary piping	$\phi 4 \times 8$								
Supply pressure	MPa	0.54								

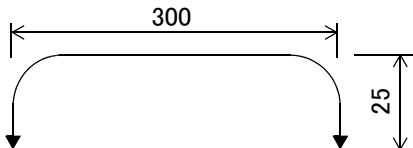
Item	Unit	Specifications
Protection specification ^{Note6)}		Standard specification: IP40 Clean specification: ISO class 3 ^{Note7)} Oil mist specification: IP67 ^{Note8)} Note9)
Painting color		Light gray (Equivalent to Munsell: 0.6B7.6/0.2)

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 26, "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 32, "2.2.6 Protection specifications"](#).

Note7) The details of the clean specifications are described in [Page 33, "2.2.7 Clean specifications"](#).

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

Note9) If you use the controller in oil mist or similar environments, use the controller protection box to protect the controller from the operation environment. A robot equipped with the controller protection box as standard is available.

Table 2-2 : Standard specifications of RV-4F/7F series 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		$-115 \sim 125$	$-110 \sim 130$			
	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	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		720				
Maximum reach radius (P point)	mm	514.5	648.7	713.4	907.7				
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		-				
	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	$\phi 6 \times 2$							
	Secondary piping	$\phi 4 \times 4$: forearm section $\phi 4 \times 4$: 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)							

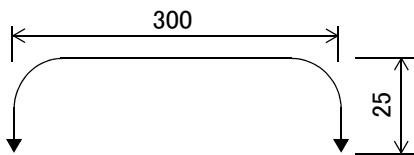
Note1) When used by mounting on the wall, a special specification that limits the operating range of the J1 axis will be used.
Please give an order separately.

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 26, "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 32, "2.2.6 Protection specifications"](#).

(2) RV-13F series

Table 2-3 : Standard specifications of RV-13F series 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		
	Shoulder (J2)		234	164	110		
	Elbow (J3)		312	219	110		
	Wrist twist (J4)		375		124		
	Wrist pitch (J5)		375		125		
	Wrist roll (J6)		720		360		
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 ^{Note3)})	kg	12(13)			15(20)		
Pose repeatability ^{Note4)}	mm	±0.05			±0.06		
Cycle time ^{Note5)}	sec	0.53	0.68	0.70	0.63		
Ambient temperature ^{Note6)}	°C	0 to 40					
Mass	kg	120	130	120	130		
Allowable moment load	Wrist twist (J4)	N · m	19.3		49		
	Wrist pitch (J5)		19.3		49		
	Wrist roll (J6)		11		6.86		
Allowable inertia	Wrist twist (J4)	kg · m ²	0.47		1.4		
	Wrist pitch (J5)		0.47		1.4		
	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.>					
Tool pneumatic pipes	Promary piping	Ø 6 × 2					
	Secondary piping	Ø 6 × 8					
Supply pressure	MPa	0.54					
Protection specification ^{Note7)}		Standard specification: IP40 Clean specification: ISO class 3 ^{Note8)} Oil mist specification: IP67 ^{Note9)} Note10)			IP40		
Painting color		Light gray (Equivalent to Munsell: 0.6B7.6/0.2)					

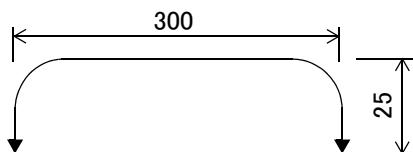
Note1) When used by mounting on the wall, a special specification that limits the operating range of the J1 axis will be used.
Please give an order separately.

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

Note3) The maximum load means the load which can be carried when the posture of the mechanical interface is restricted downward (less than $\pm 10\%$ to a vertical direction).

Note4) The pose repeatability details are given in [Page 26, "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 protection specification details are given in [Page 32, "2.2.6 Protection specifications"](#).

Note8) The details of the clean specifications are described in [Page 33, "2.2.7 Clean specifications"](#).

Note9) The protection performance cannot be ensured with some oil characteristics. Contact the dealer.

Note10) To use a controller in an oil mist environment, use the optional controller protection box and protect the controller from oil mists.

Table 2-4 : Standard specifications of RV-13F series 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		
	Shoulder (J2)		234	164	110		
	Elbow (J3)		312	219	110		
	Wrist twist (J4)		375		124		
	Wrist pitch (J5)		375		125		
	Wrist roll (J6)		720		360		
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 ^{Note4)})	kg	12(13)		15(20)	7(7)		
Pose repeatability ^{Note5)}	mm	± 0.05			± 0.06		
Cycle time ^{Note6)}	sec	0.53	0.68	0.70	0.63		
Ambient temperature ^{Note7)}	°C	0~40					
Mass	kg	120	130	120	130		
Allowable moment load	Wrist twist (J4)	N · m	19.3		49		
	Wrist pitch (J5)		19.3		49		
	Wrist roll (J6)		11		6.86		
Allowable inertia	Wrist twist (J4)	kg · m ²	0.47		1.4		
	Wrist pitch (J5)		0.47		1.4		
	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.>					
Tool pneumatic pipes	Promary piping	$\phi 6 \times 2$					
	Secondary piping	$\phi 4 \times 4$ ^{Note8)}					
Supply pressure	MPa	0.54					
Protection specification ^{Note9)}		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.

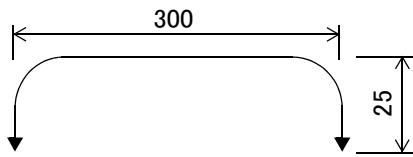
Note2) The operating range of the wrist roll is small compared to the model without internal cables/pipes.

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

Note4) The maximum load means the load which can be carried when the posture of the mechanical interface is restricted downward (less than $\pm 10\%$ to a vertical direction).

Note5) The pose repeatability details are given in [Page 26, "2.2.1 Pose repeatability"](#)

Note6) 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.



Note7) Sets the robot's operating environmental temperature as parameter OLT MX. 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.)

Note8) The internal wiring and piping specification is $\phi 4 \times 4$.

Note9) The protection specification details are given in [Page 32, "2.2.6 Protection specifications"](#).

(3) RV-35F/50F/70F series

Table 2-5 : Standard specifications of RV-35F/50F/70F series robot

Item		Unit	Specifications				
Type			RV-35F	RV-50F	RV-70F		
Environment			Omitted: Standard specification M: Oil mist specification				
Degree of freedom			6				
Installation posture			On floor				
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	4500				
	Shoulder (J2)		4500				
	Elbow (J3)		3000				
	Wrist twist (J4)		1000				
	Wrist pitch (J5)		1000				
	Wrist roll (J6)		750				
Operating range	Waist (J1)	Degree	± 165				
	Shoulder (J2)		-80 to +135				
	Elbow (J3)		-90 to +171				
	Wrist twist (J4)		± 360				
	Wrist pitch (J5)		± 125				
	Wrist roll (J6)		± 450				
Speed of motion	Waist (J1)	Degree/s	185	180	175		
	Shoulder (J2)		180				
	Elbow (J3)		190	180	165		
	Wrist twist (J4)		305	255	235		
	Wrist pitch (J5)		305	255	235		
	Wrist roll (J6)		420	370	350		
Maximum reach radius (P point)	mm		2050				
Maximum resultant velocity ^{Note1)}	mm/sec		13450	13000	11500		
Load Rating	kg		35	50	70		
Pose repeatability ^{Note2)}	mm		± 0.07				
Ambient temperature ^{Note3)}	°C		0 to 40				
Mass	kg		640				
Allowable moment load	Wrist twist (J4)	N · m	160	210	300		
	Wrist pitch (J5)		160	210	300		
	Wrist roll (J6)		90	130	150		
Allowable inertia	Wrist twist (J4)	kg · m ²	16	30			
	Wrist pitch (J5)		16	30			
	Wrist roll (J6)		5	12			
Tool wiring	Hand input/output		Maximum 16 points/16points				
	LAN cable		Equipped (eight cores) <100BASE-TX>				
	Wiring for user		-				
Tool pneumatic pipes	Primary piping		$\phi 10 \times 2$				
	Secondary piping		-				
Supply pressure	MPa		Maximum 0.49				
Protection specification ^{Note4)}	Robot arm		Standard specification: IP54 Oil mist specification: IP67 Note5)				
	Wrist portion		IP67				
Painting color			Light gray (Equivalent to Munsell: 0.6B7.6/0.2)				

Note1) This is the value on the mechanical interface surface when all axes are combined.

Note2) The pose repeatability details are given in [Page 26, "2.2.1 Pose repeatability"](#)

Note3) 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.)

Note4) The protection specification details are given in [Page 32, "2.2.6 Protection specifications"](#).

Note5) The protection performance cannot be ensured with some oil characteristics. Contact the dealer.

Note6) A noise whose noise level exceeds 80 dB (A) may be generated depending on a robot's operating posture or measurement position.

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 2-6 : Value of each counter-force

Item	Unit	Value			
		RV-4F series	RV-7F series	RV-7FLL RV-13F series RV-20F	RV-35F RV-50F RV-70F
Falls moment: M_L	N · m	410	900	2,060	32,900
Torsion moment: M_T	N · m	400	900	2,060	28,300
Horizontal translation force: F_H	N	700	1,000	1,750	16,700
Vertical translation force: F_V	N	1,200	1,700	2,900	23,700

2.2 Definition of specifications

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

2.2.1 Pose repeatability

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

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

[1] Operation pattern factors

- 1) When an operation that approaches from different directions and orientations are included in relation to the teaching position during repeated operations
- 2) When the speed at teaching and the speed at execution are different

[2] Load fluctuation factor

- 1) When work is present/absent in repeated operations

[3] Disturbance factor during operation

- 1) Even if approaching from the same direction and orientation to the teaching position, when the power is turned OFF or a stop operation is performed halfway

[4] Temperature factors

- 1) When the operating environment temperature changes
- 2) When accuracy is required before and after a warm-up operation

[5] Factors due to differences in accuracy definition

- 1) When accuracy is required between a position set by a numeric value in the robot's internal coordinate system and a position within the actual space
- 2) When accuracy is required between a position generated by the pallet function and a position within the actual space

2.2.2 Rated load (mass capacity)

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

- (1) The tooling should have the value less or equal than the smaller of the tolerable inertia and the tolerable moment found in [Page 16, "2.1.1 Basic specifications"](#).
- (2) [Fig. 2-1 to Fig. 2-7](#) 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 16, "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.

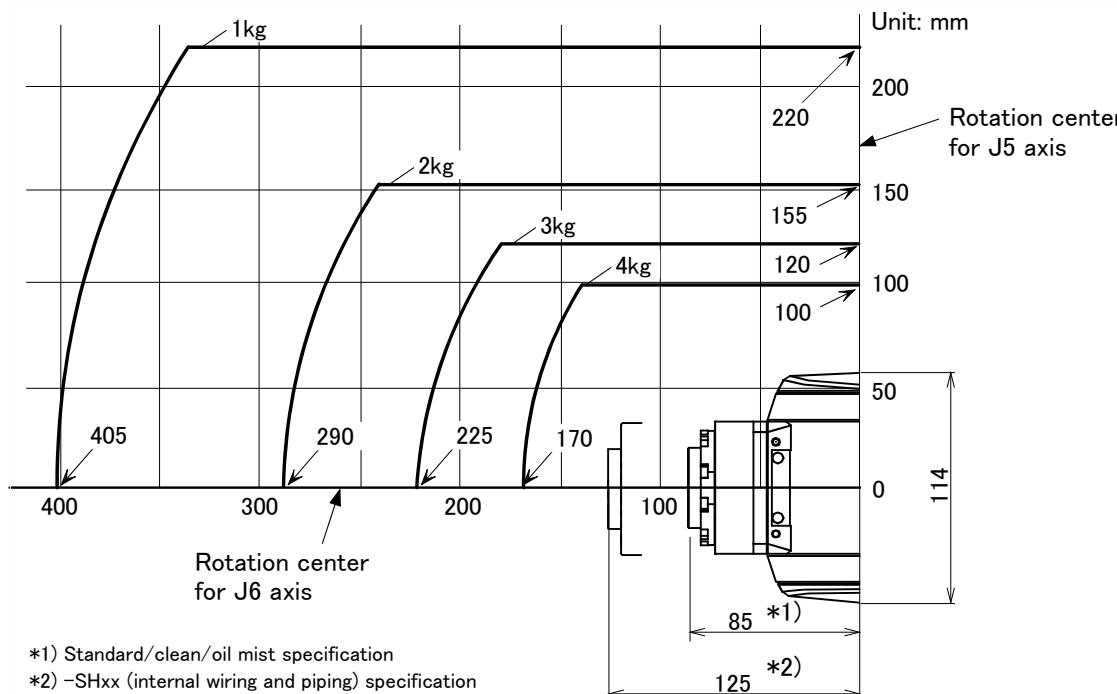


Fig.2-1 : Position of center of gravity for loads (for loads with comparatively small volume): RV-4F/4FL/4FJL

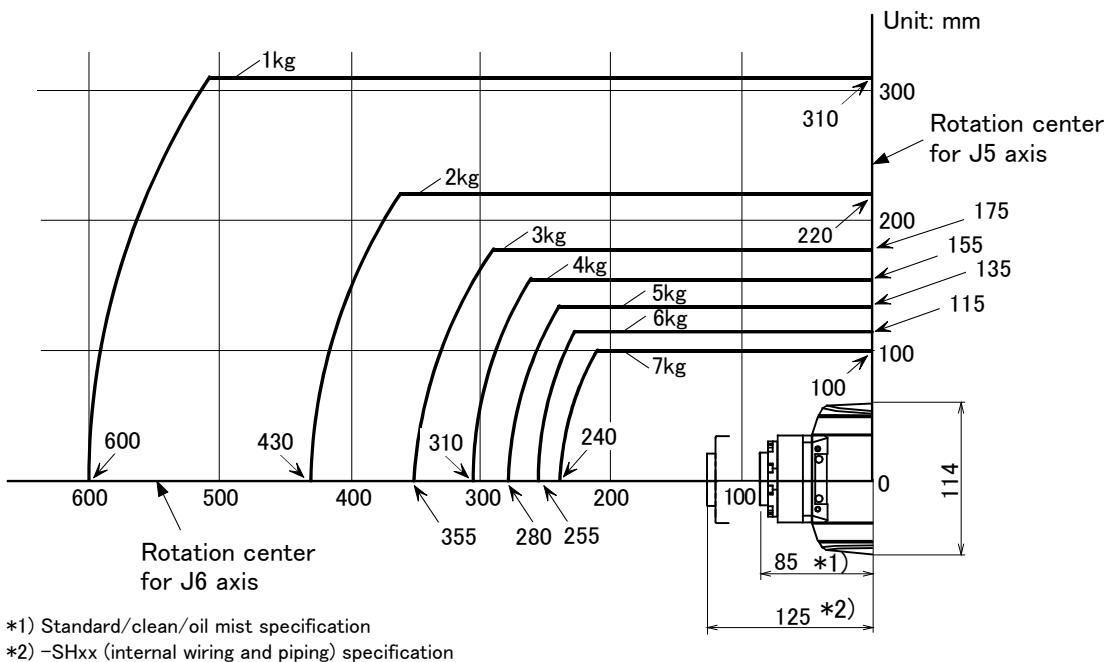


Fig.2-2 : Position of center of gravity for loads (for loads with comparatively small volume): RV-7F/7FL/7FLL

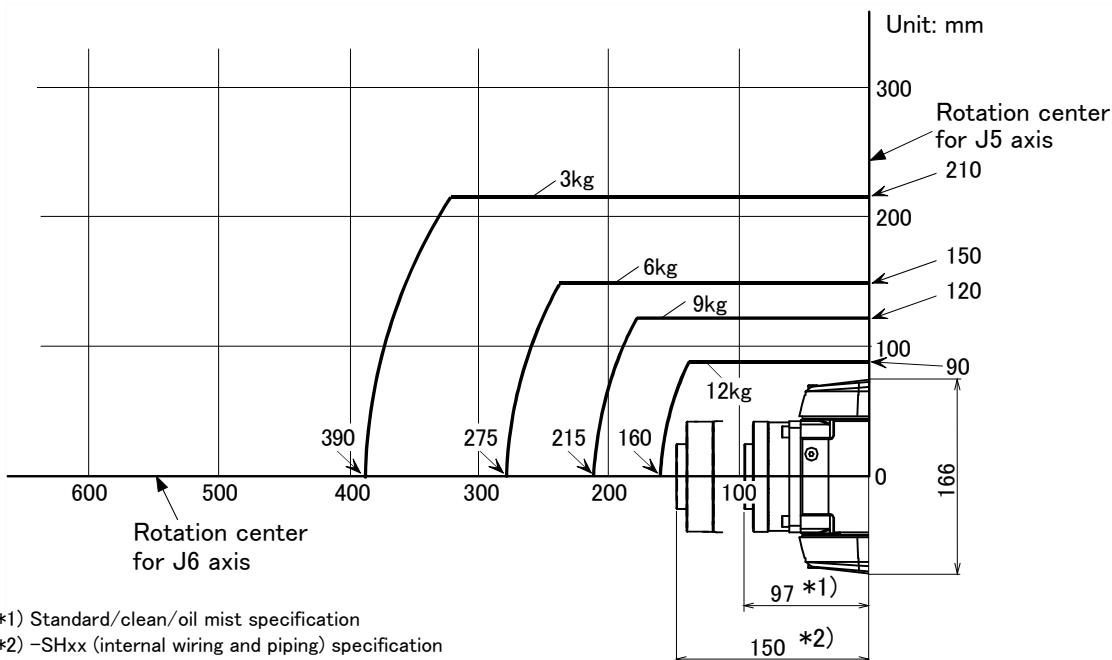


Fig.2-3 : Position of center of gravity for loads (for loads with comparatively small volume): RV-13F/13FL

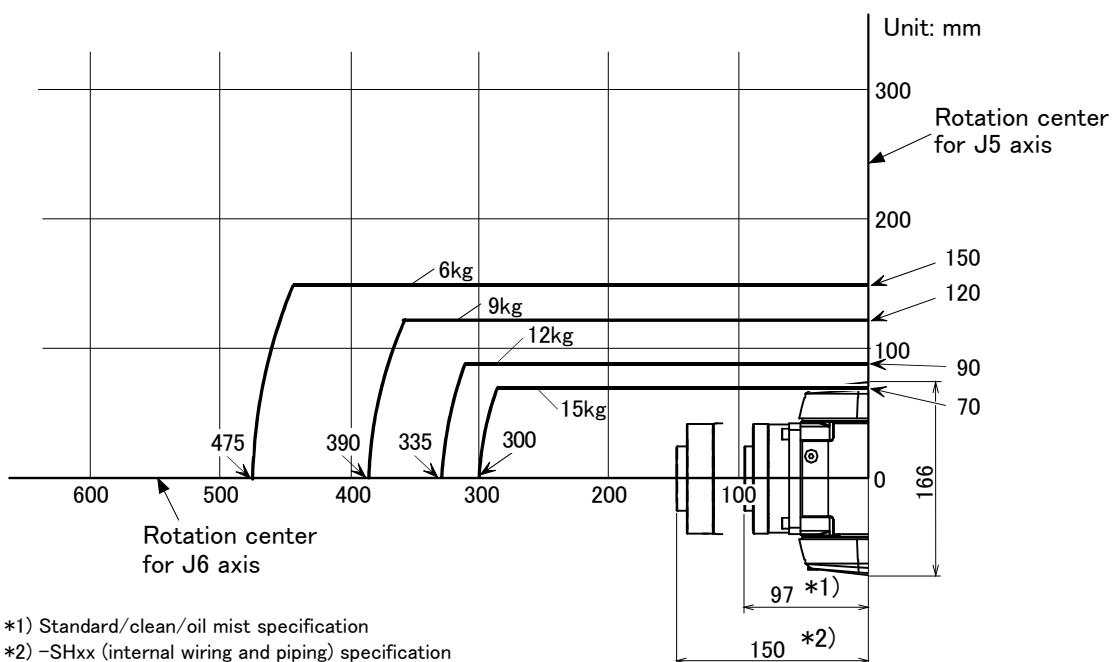


Fig.2-4 : Position of center of gravity for loads (for loads with comparatively small volume): RV-20F

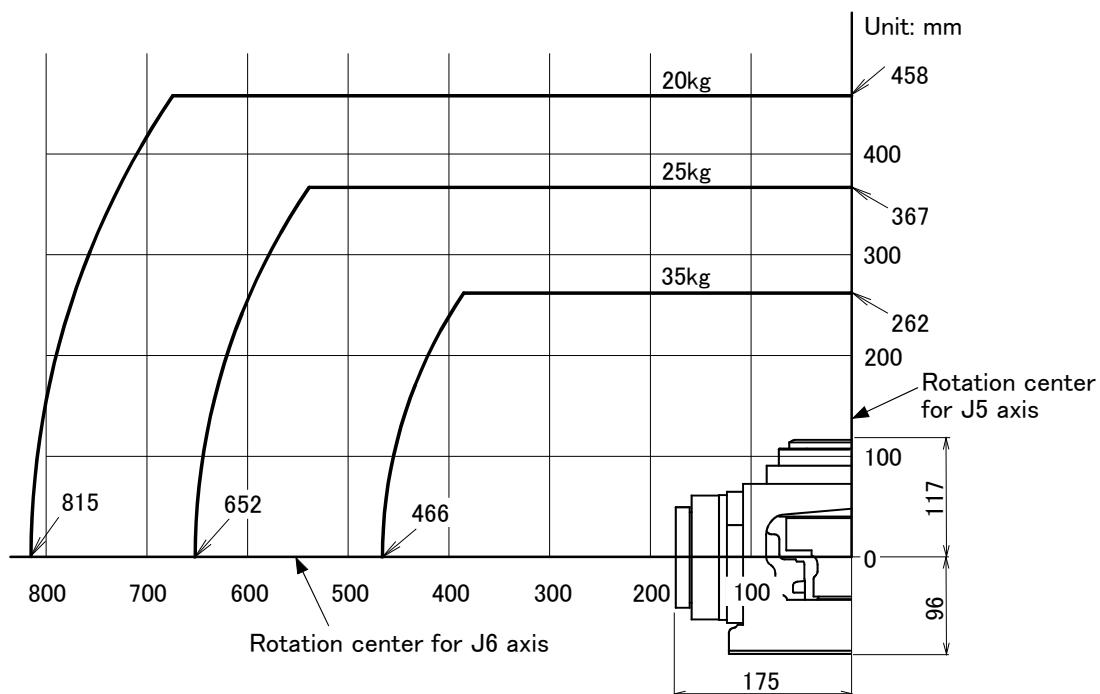


Fig.2-5 : Position of center of gravity for loads (for loads with comparatively small volume): RV-35F

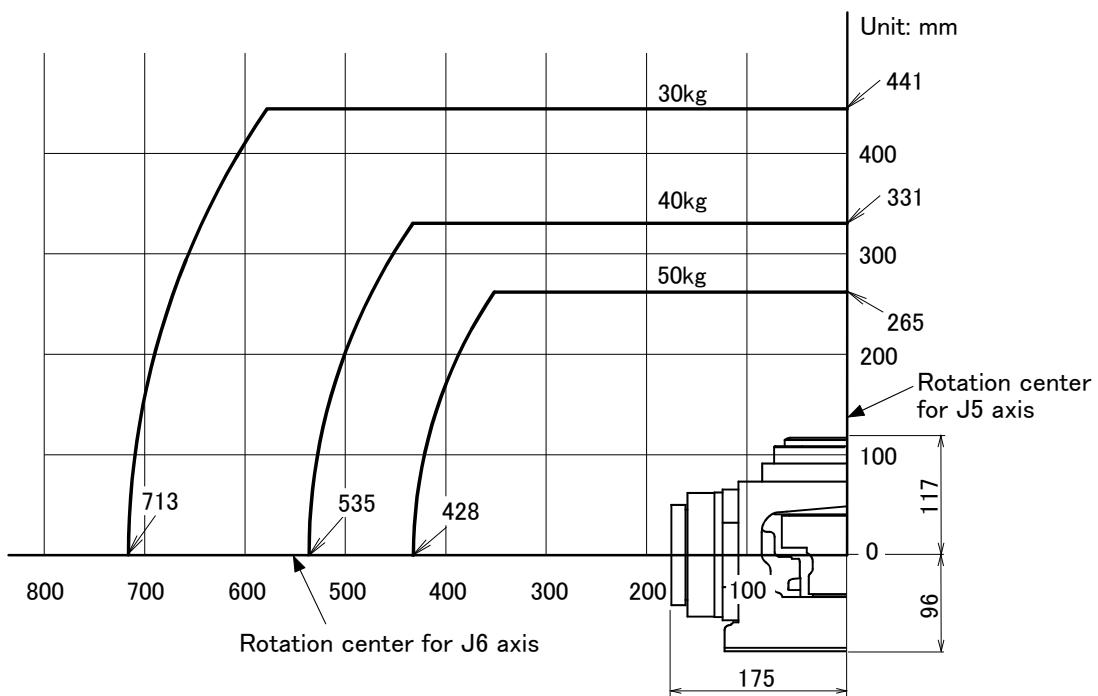


Fig.2-6 : Position of center of gravity for loads (for loads with comparatively small volume): RV-50F

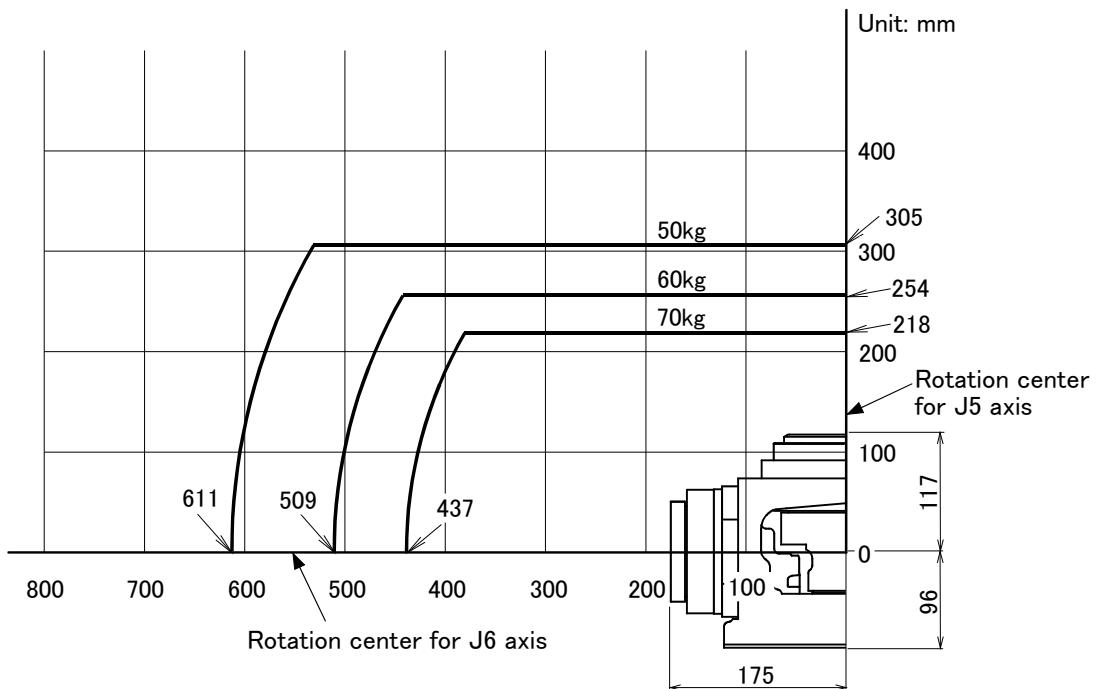


Fig.2-7 : Position of center of gravity for loads (for loads with comparatively small volume): RV-70F

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

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

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

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

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

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

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

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

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

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

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

2.2.5 Collision detection

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

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

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

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

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

Table 2-7 : Factory-shipments condition

	JOG operation	Automatic
RV-4F/7F/13F/50F series	Invalid	Invalid

2.2.6 Protection specifications

(1) Types of protection specifications

The robot arm has protection specifications that comply with the IEC Standards. The protection specifications and applicable fields are shown in [Table 2-8](#).

Table 2-8 : Protection specifications and applicable fields

Type	Protection specifications (IEC Standards value)	Classification	Applicable field	Remarks
RV-4F/4FL/4FJL RV-7F/7FL RV-7FLL RV-13F/13FL RV-20F	IP40	General environment specifications	General assembly Slightly dusty environment	
RV-35F RV-50F RV-70F	IP54	Oil mist specifications	Machine shop with oil mist Dusty work shop	
RV-4FM/4FLM/4FJLM RV-7FM/7FLM RV-7FLLM RV-13FM/13FLM RV-20FM RV-35FM RV-50FM RV-70FM	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.



CAUTION

Use the controller protection box to protect the controller from the environment when the CR750/CR751 controller will be used in the environment such as the oil mist shown in the [Table 2-8](#).

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.

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

【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 IP54

The IEC IP54 standard refers to protection structure designed to prevent any harmful effects by fresh water scattering vertically onto the testing equipment in a radius of 180 degrees from a distance of 300 to 500 mm, with 10 ± 0.5 liters of water every minute, at a water pressure of 80 to 100kPa, covering the entire area of the robot with the exception of the installation section at 1 m² per minute, for a total of 5 minutes or more.

• 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 RV-4F/7F/13F series 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 2-9 : 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 211, "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 2-9](#).

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 2-10 : Clean specifications

Type	Degree of cleanliness	Internal suction	Remarks
RV-4FC/4FLC/4FJLC	ISO class3	Concentrated suction with vacuum generating valve.	
RV-7FC/7FLC			
RV-7FLLC			
RV-13FC/13FLC			
RV-20FC			

■ 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. 2-25](#)) When using the robot, connect this coupling with the vacuum generating valve (Refer to [Table 2-11](#)) 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 2-11 : Specifications of vacuum generation valve (Confirmed in our company)

Type	Maker	Air pressure ^{Note1)}	Quantity
MEDT 14	KOGANEI 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

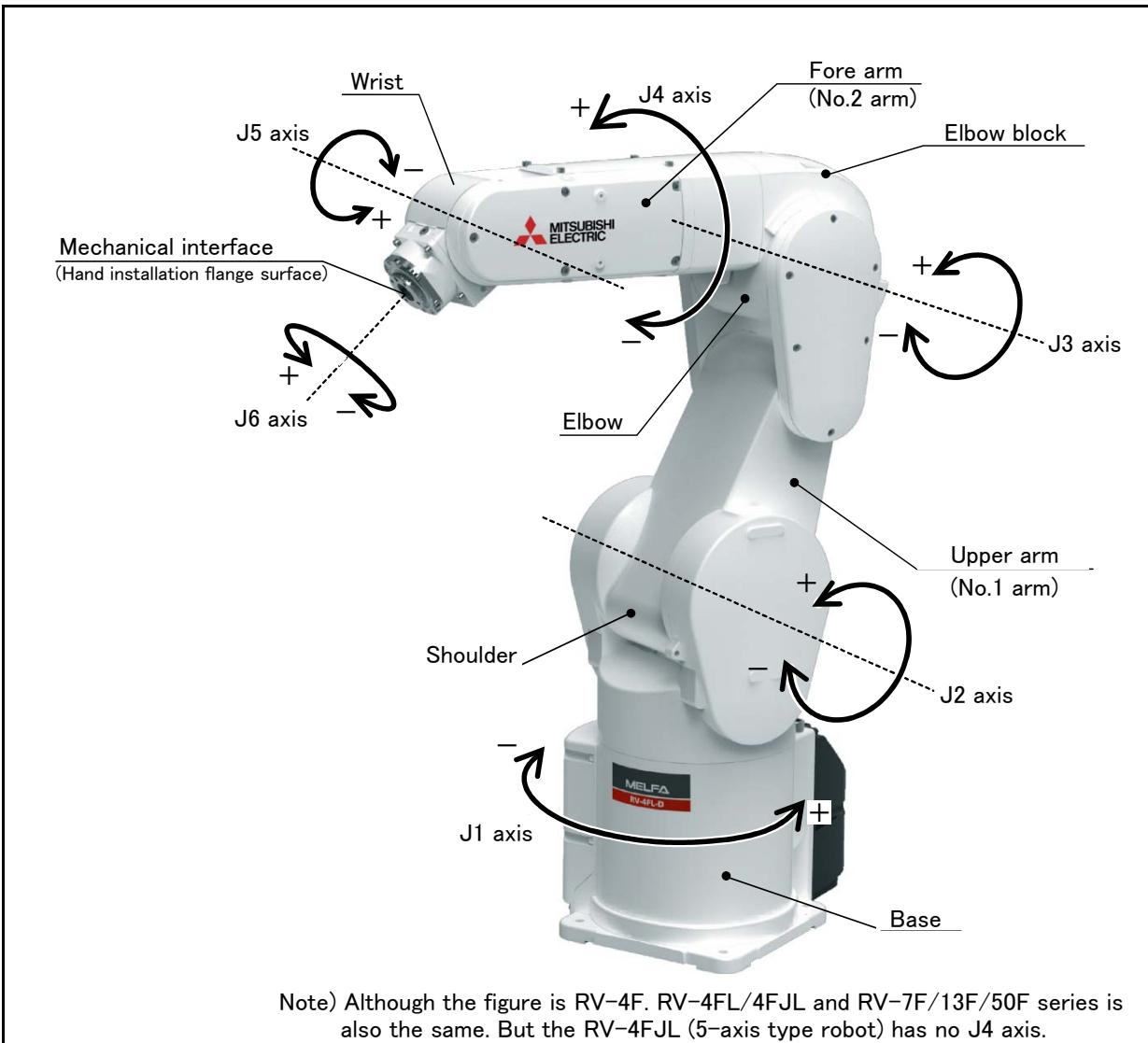


Fig.2-8 : Names of each part of the robot

2.4 Outside dimensions • Operating range diagram

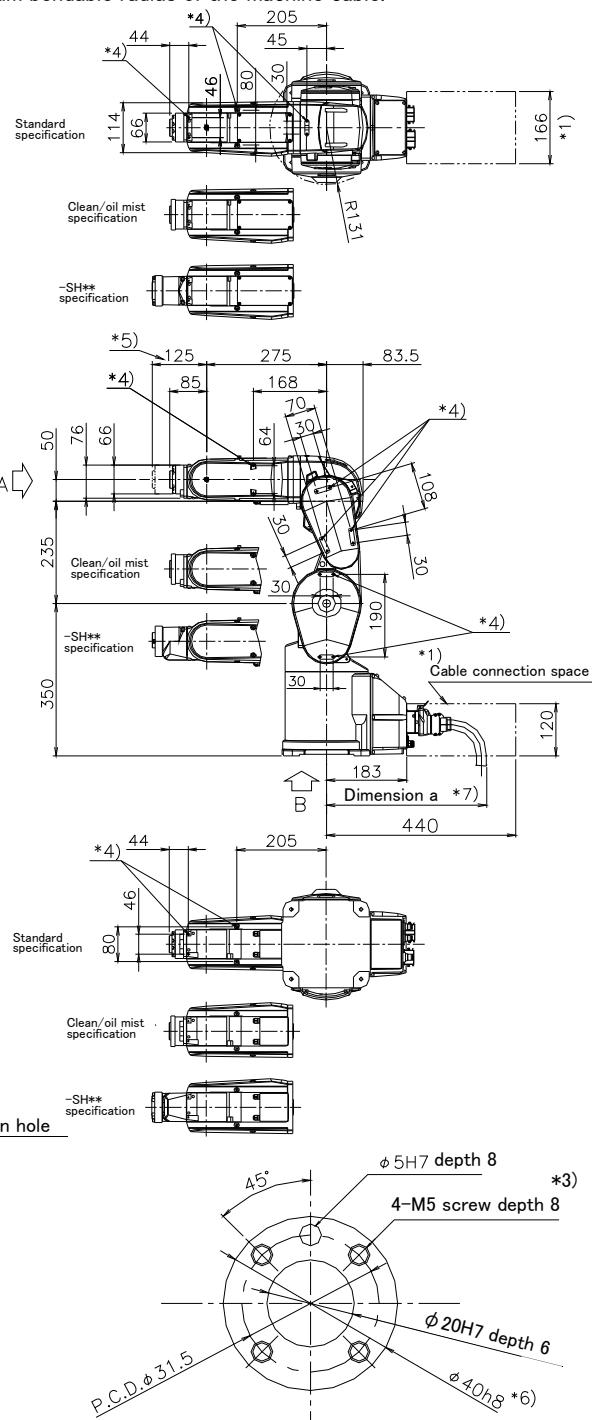
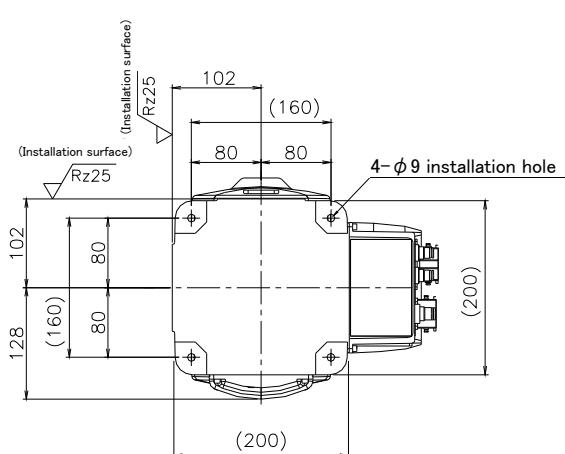
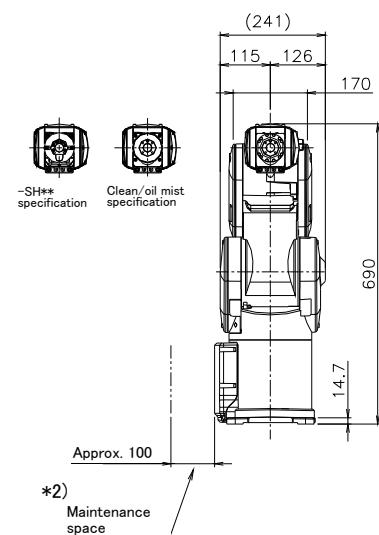
(1) RV-4F

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.
7. *7) The dimension a shows the distance to a minimum bendable radius of the machine cable.

Controller	Dimension a
CR750	Minimum. 366
CR751	Minimum. 300



View B bottom view drawing: Detail of installation dimension

View A: Detail of mechanical interface

Note) The drawing shows an example of the CR750 controller connection robot.

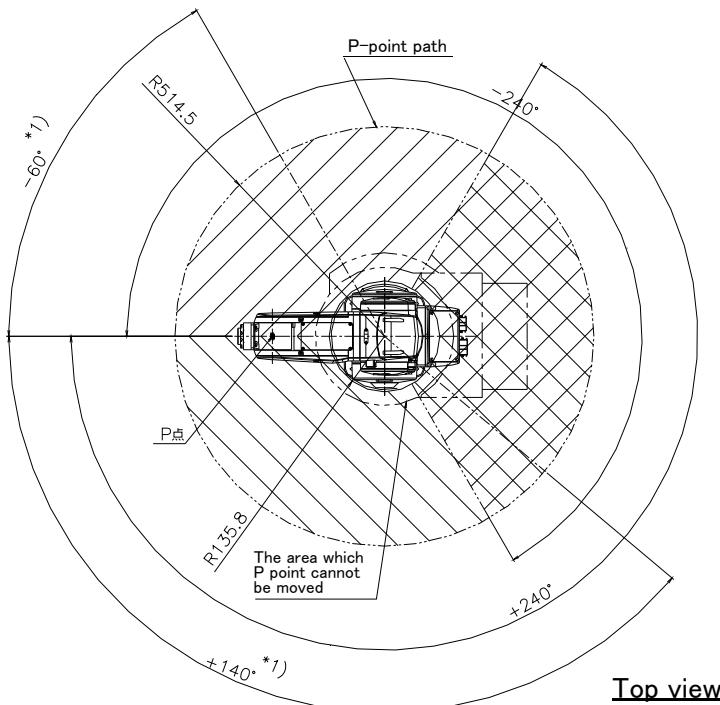
Note) Don't install the robot arm in the position where direct rays or the heat of lighting hits. The skin temperature of the robot arm may rise, and the error may occur.

Fig.2-9 : Outside dimensions: RV-4F

Rev. B

Notes

1. *1) Rear face operation limit: When the J axis angle is $-60^\circ \leq J_1 \leq +140^\circ$, the J2 axis operation is limited to $-113^\circ \leq J_2 \leq +120^\circ$.
2. The following figure shows a robot at the position of: $J_1=0^\circ$, $J_2=0^\circ$, $J_3=90^\circ$, $J_4=0^\circ$, $J_5=0^\circ$, and $J_6=0^\circ$
3. *3) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping, but it can be released by parameter MELTEXS.



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): $\pm 200^\circ$

Top view

*3)

The area which P point cannot be moved

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

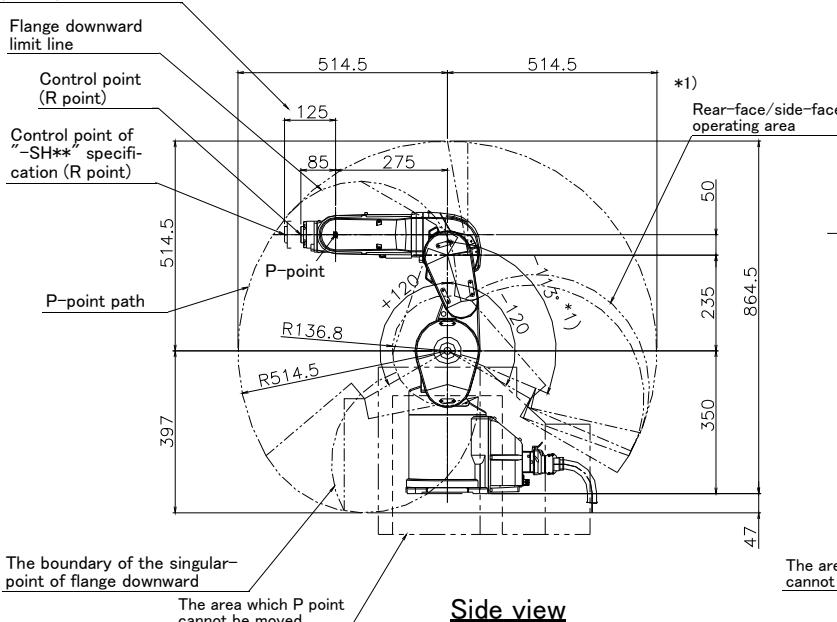
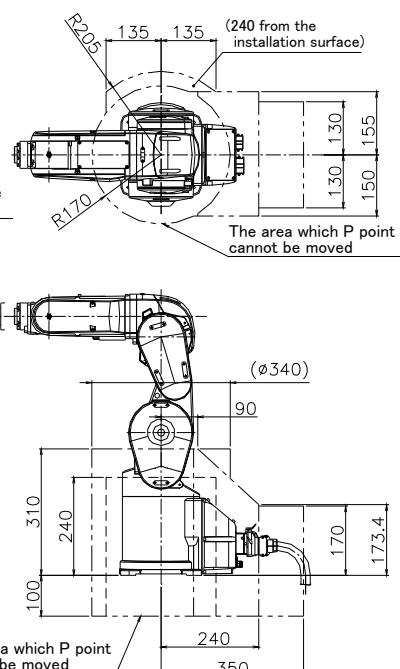
Side view

Fig.2-10 : 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.
7. *7) The dimension a shows the distance to a minimum bendable radius of the machine cable.

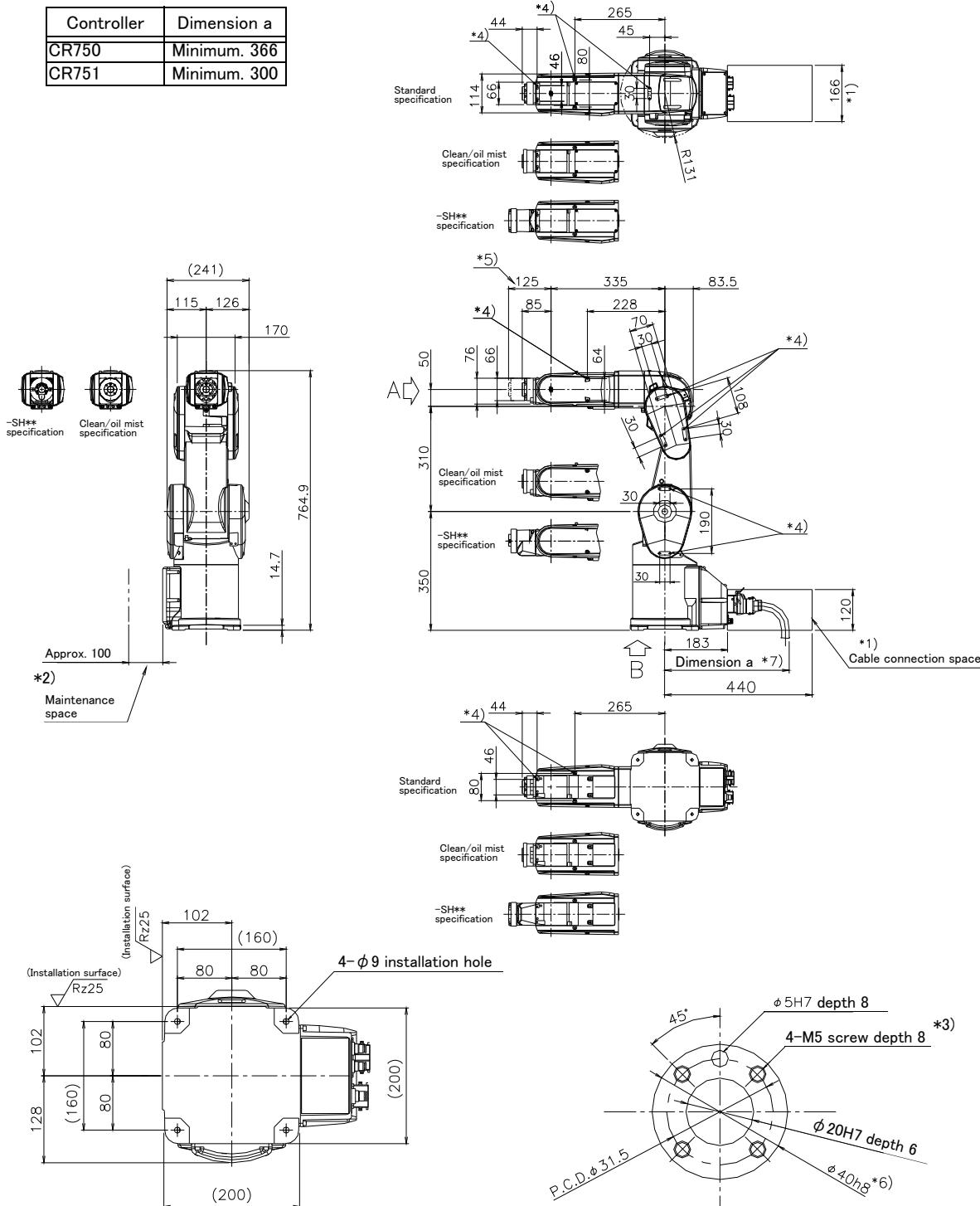
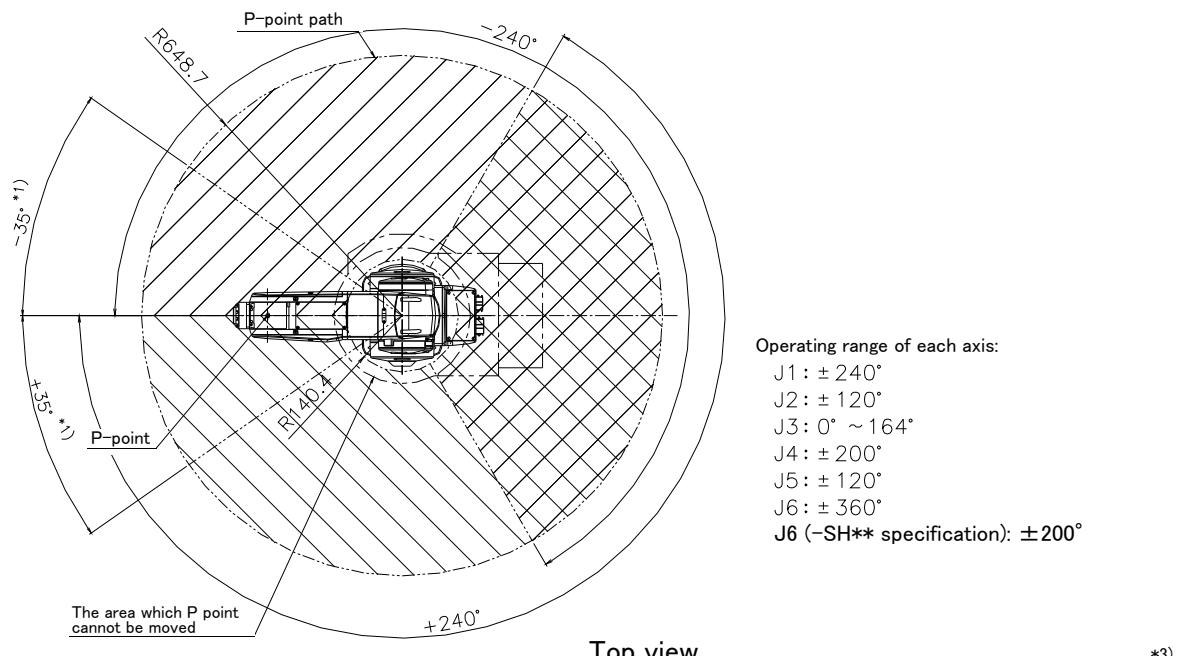


Fig.2-11 : Outside dimensions: RV-4FL/4FJL

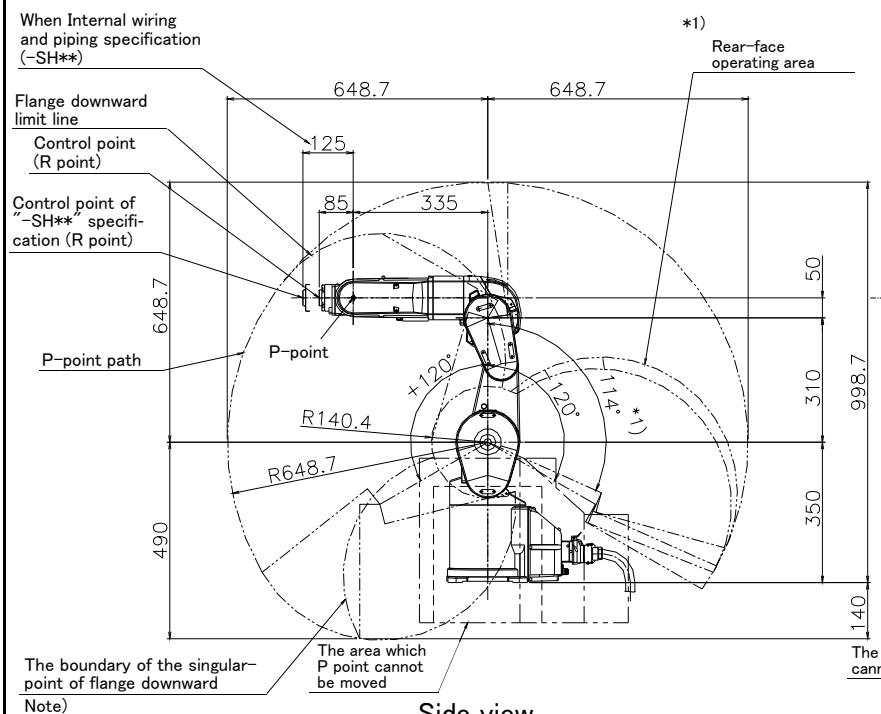
Rev. B

Notes

- 1.*1) Rear face operation limit: When the J axis angle is $-35^\circ \leq J_1 \leq +35^\circ$, the J2 axis operation is limited to $-114^\circ \leq J_2 \leq +120^\circ$.
 2. The following figure shows a robot at the position of:
 $J_1=0^\circ$, $J_2=0^\circ$, $J_3=90^\circ$, $J_4=0^\circ$, $J_5=0^\circ$, and $J_6=0^\circ$
 - 3.*3) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping, but it can be released by parameter MELTEXS.



Top view



Side view

Note) RV-4FJL does not have this.

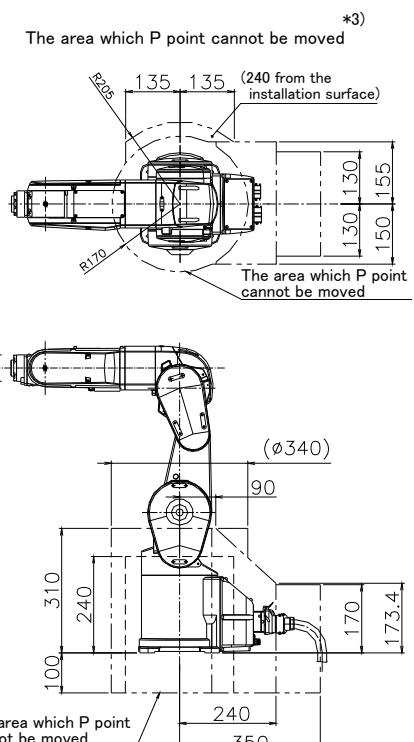


Fig. 2-12 : Operating range diagram: RV-4EII / 4E-II

(3) RV-7F

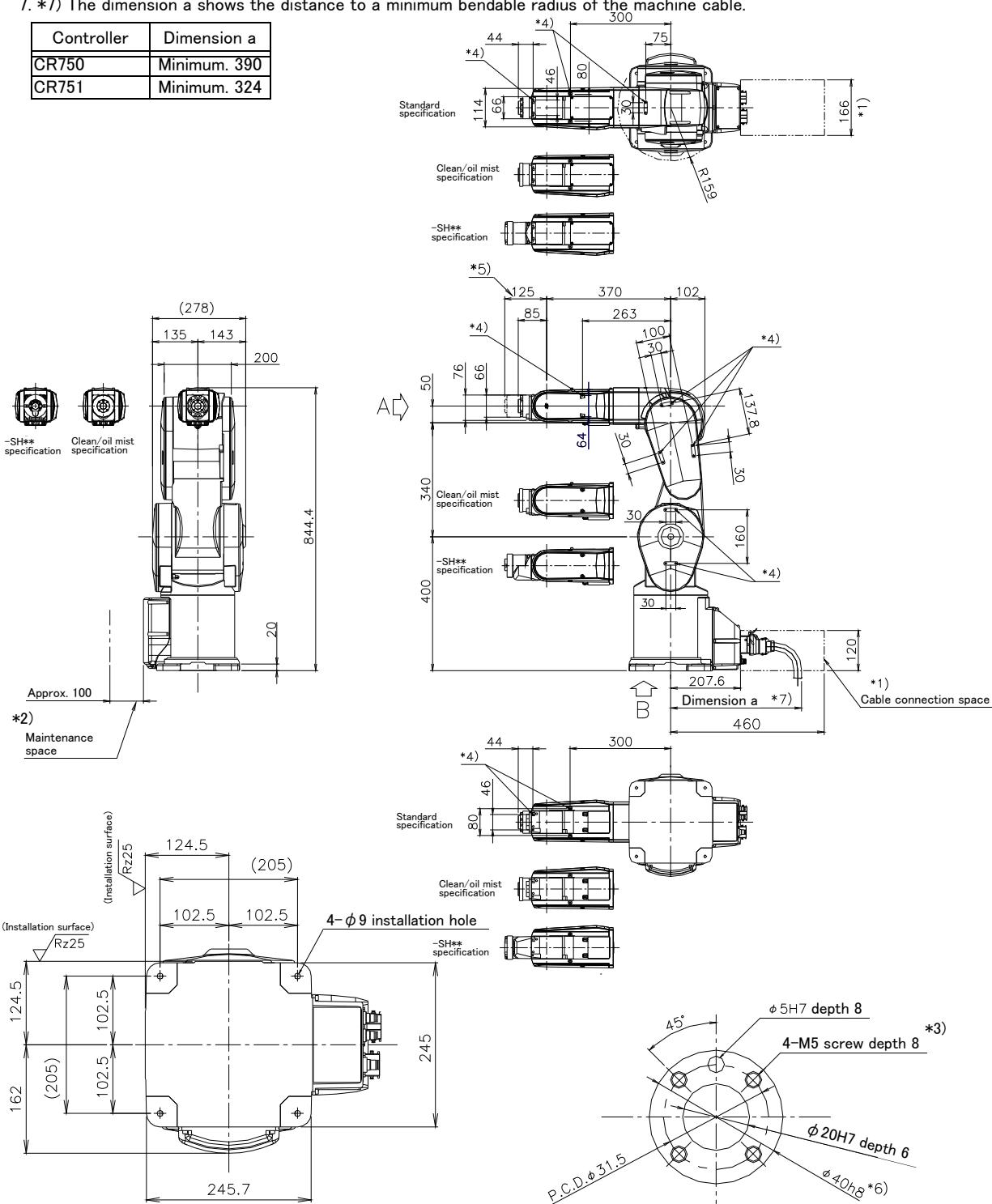
Notes

Rev. C

- Rev. C

 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.
 7. *7) The dimension a shows the distance to a minimum bendable radius of the machine cable.
700

Controller	Dimension a
CR750	Minimum. 390
CR751	Minimum. 324



View B bottom view drawing: Detail of installation dimension

View A: Detail of mechanical interface

Note) The drawing shows an example of the CR750 controller connection robot.

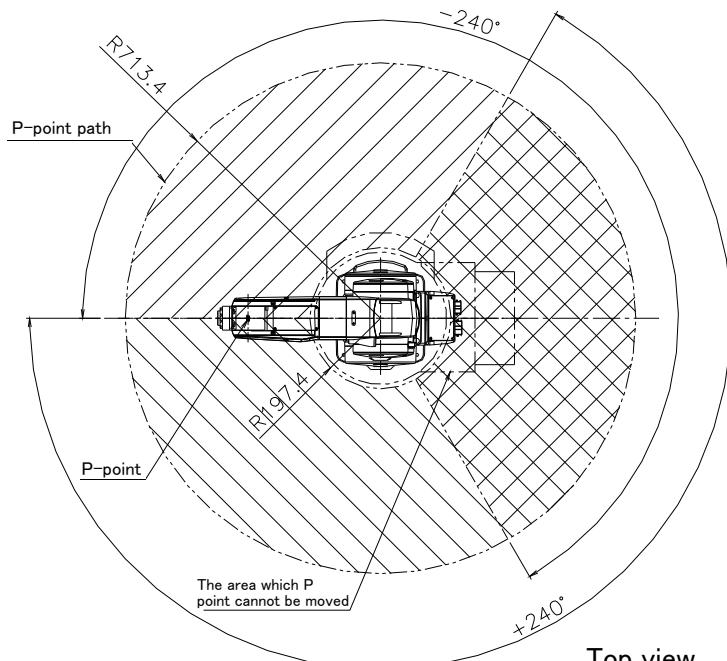
Note) Don't install the robot arm in the position where direct rays or the heat of lighting hits. The skin temperature of the robot arm may rise, and the error may occur.

Fig.2-13 : Outside dimensions: RV-7F

Rev. C

Notes

1. The following figure shows a robot at the position of:
J1=0°, J2=0°, J3=90°, J4=0°, J5=0°, and J6=0°
2. *1) The area which P point cannot be moved: P point cannot move to this area. This limitation is valid at factory shipping, but it can be released by parameter MELTEXS.

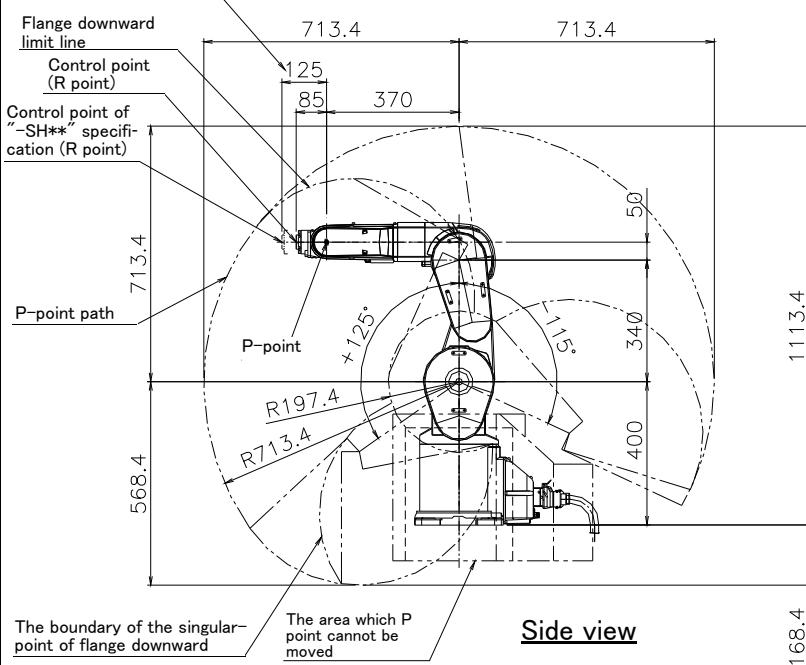
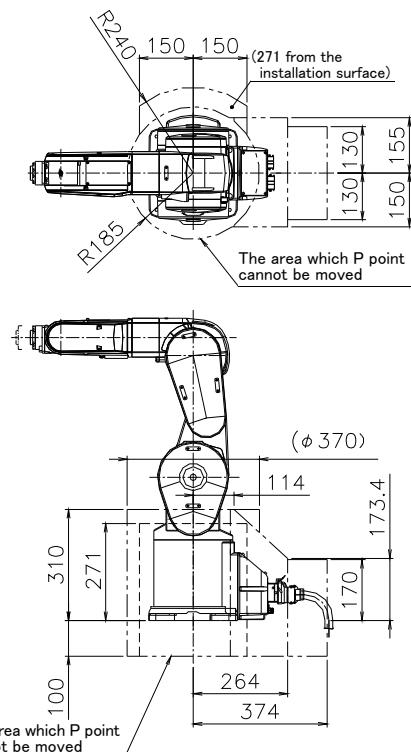
**Operating range of each axis:**

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): $\pm 200^\circ$

Top view

*1)

The area which P point cannot be moved

When Internal wiring
and piping specification
(-SH**)**Side view****Fig.2-14 : Operating range diagram: RV-7F**

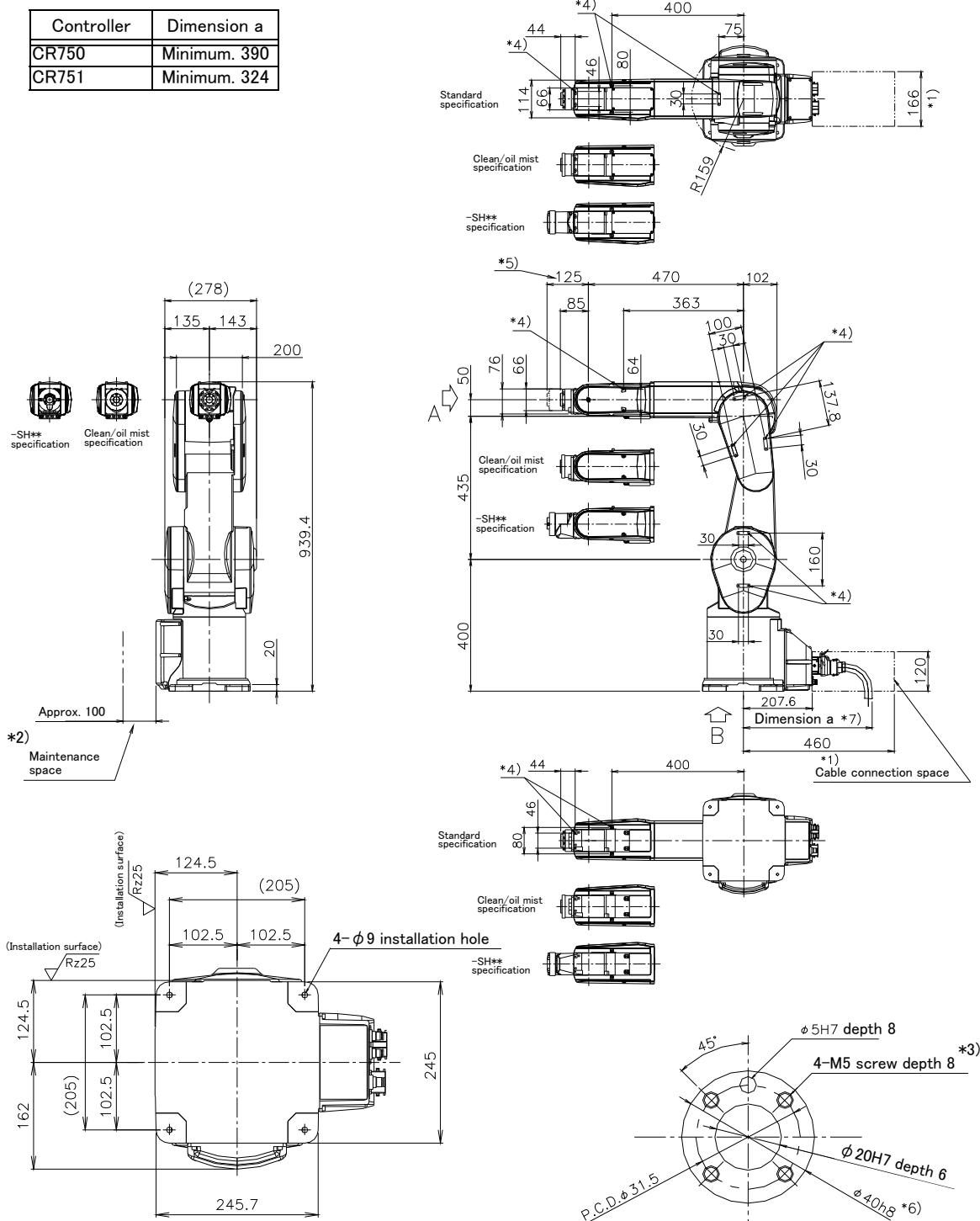
(4) RV-7FL

Notes

Rev. C

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.
7. *7) The dimension a shows the distance to a minimum bendable radius of the machine cable.

Controller	Dimension a
CR750	Minimum. 390
CR751	Minimum. 324



View B bottom view drawing: Detail of installation dimension

View A: Detail of mechanical interface

Note) The drawing shows an example of the CR750 controller connection robot.

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

Fig.2-15 : Outside dimensions: RV-7FL

Notes

Rev. C

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.

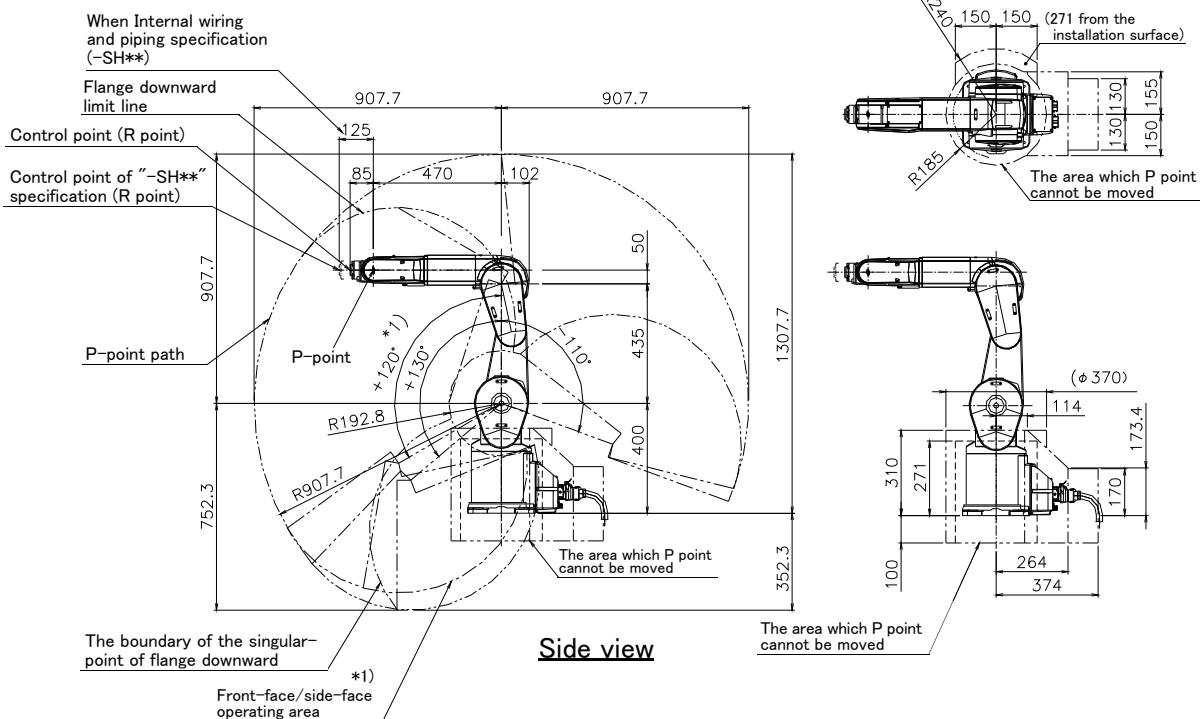
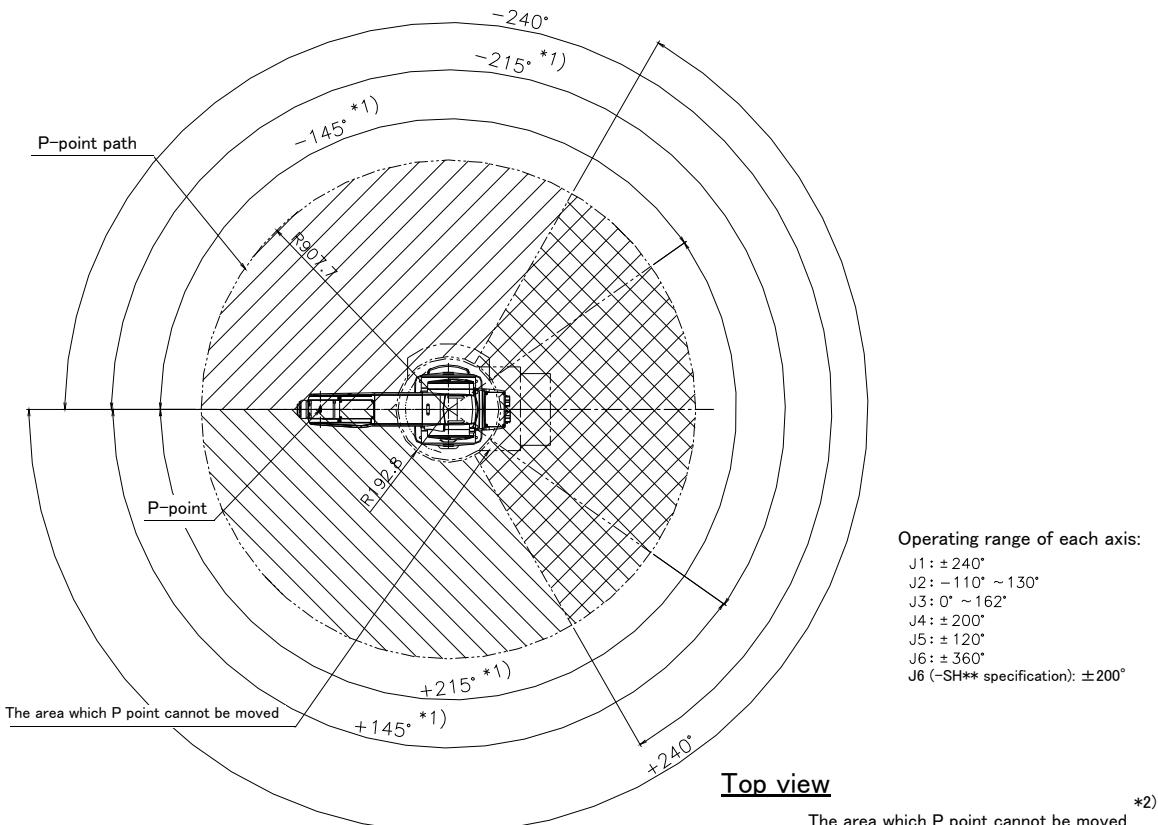


Fig.2-16 : Operating range diagram: RV-7FL

(5) RV-7FLL

Notes

Rev. B

1. *1) Ensure the cable connection space to connect machine cables.
2. *2) The screw should go in to a depth of 7.5mm to 8mm.
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).
5. *5) The depth is 6mm for the normal specification, 3.5mm for the clean/oil mist specification and 6.5mm for -SH** specification.
6. *6) The dimension a shows the distance to a minimum bendable radius of the machine cable.

Controller	Dimension a
CR750	Minimum. 430
CR751	Minimum. 375

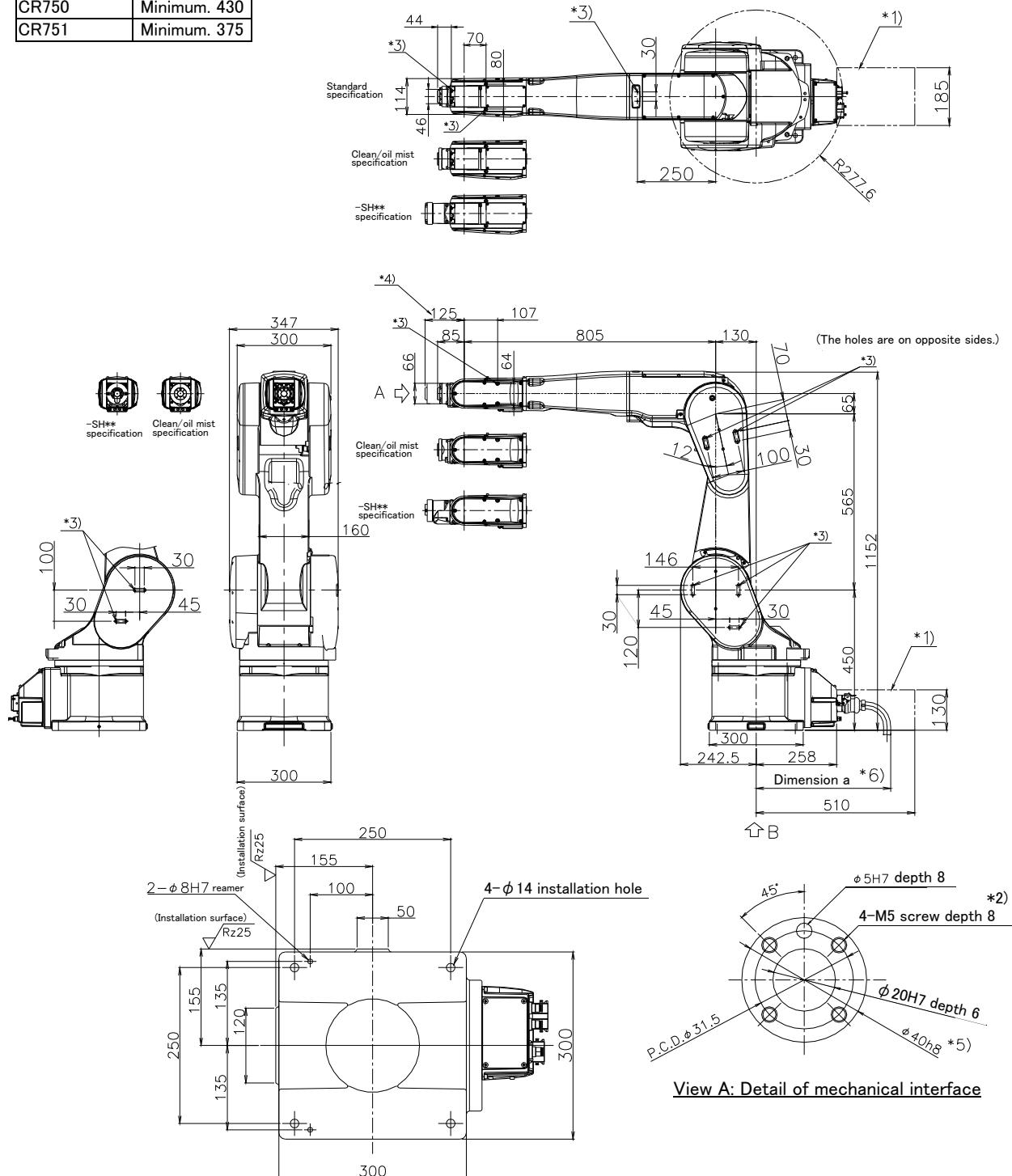
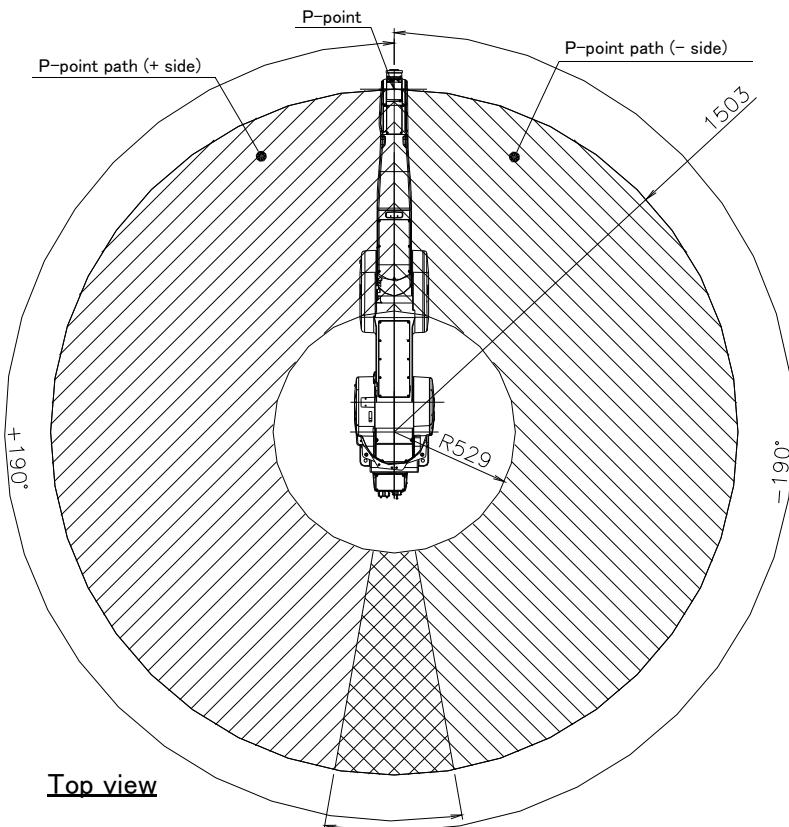


Fig.2-17 : Outside dimensions: RV-7FLL

Notes

Rev. *

1. The side view 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.

**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): $\pm 200^\circ$

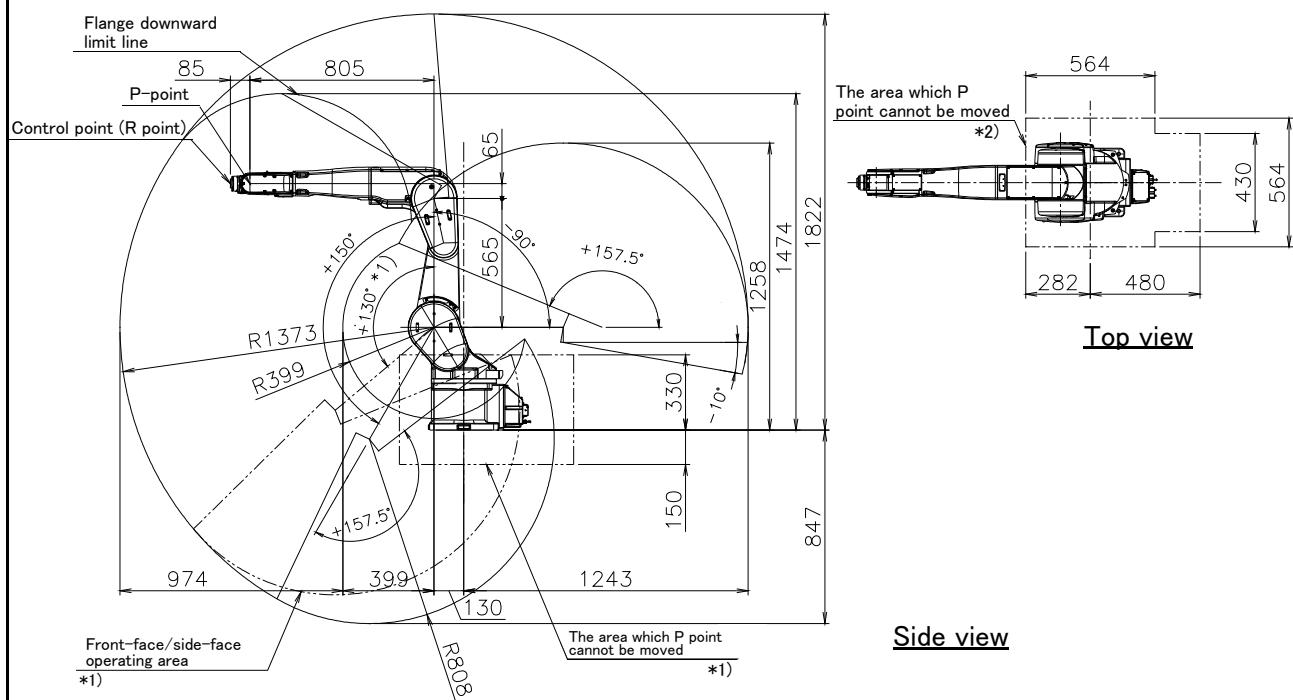


Fig.2-18 : Operating range diagram: RV-7FLL

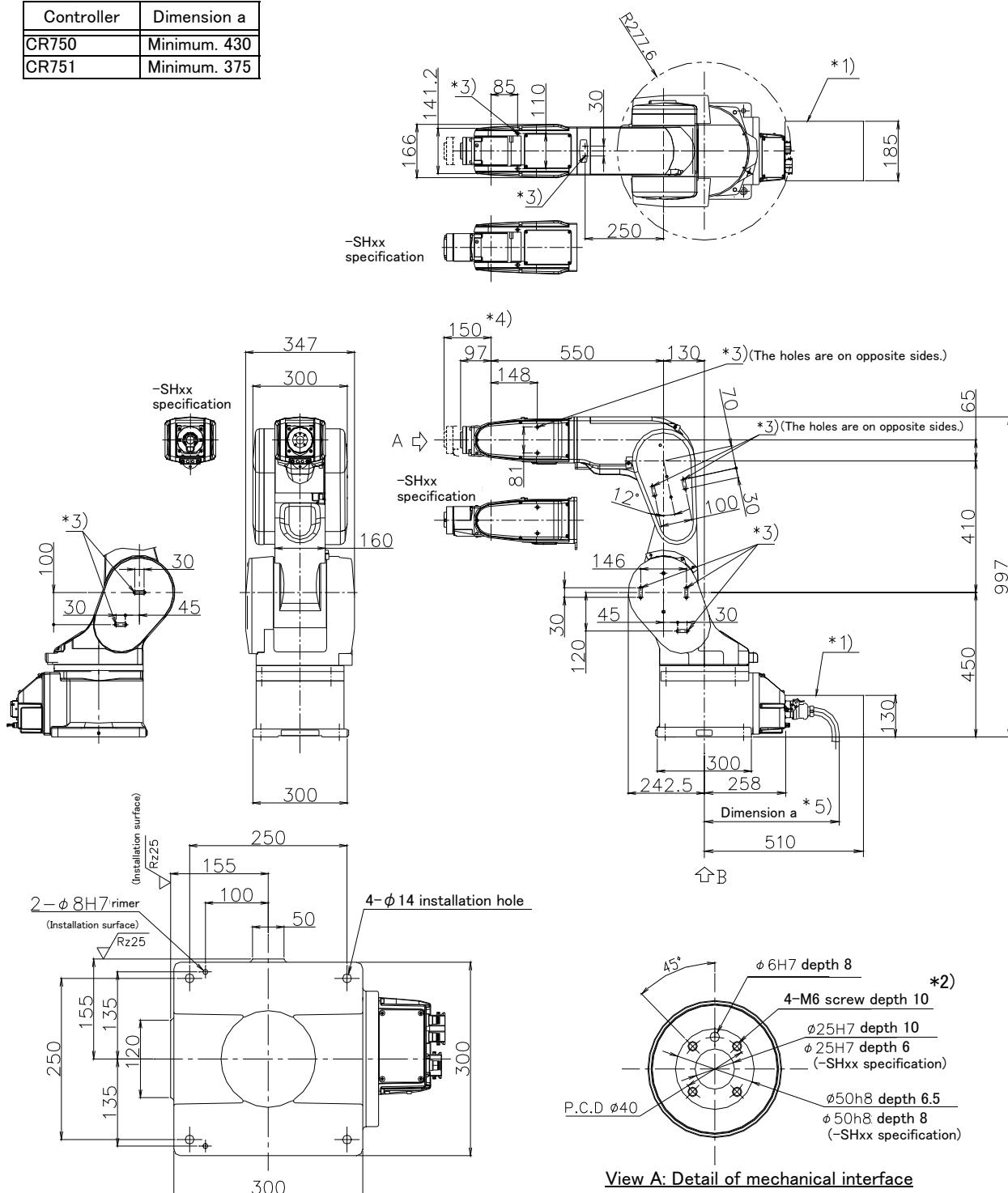
(6) RV-13F/20F

Notes

Rev. B

1. *1) Ensure the cable connection space to connect machine cables.
2. *2) The screw should go in to a depth of 9mm to 10mm.
3. *3) Screw hole (M4 depth 8) for securing the user cables/piping.
4. *4) The size of the internal wiring and piping specification model (-SHxx).
5. *5) The dimension a shows the distance to a minimum bendable radius of the machine cable.

Controller	Dimension a
CR750	Minimum. 430
CR751	Minimum. 375

View B bottom view drawing: Detail of installation dimension

Note) The drawing shows an example of the CR750 controller connection robot.

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

Fig.2-19 : Outside dimensions: RV-13F/20F

Notes

Rev. A

1. The side view figure shows a robot at the position of:
 $J1=0^\circ$, $J2=0^\circ$, $J3=90^\circ$, $J4=0^\circ$, $J5=0^\circ$, and $J6=0^\circ$
 2. *1) Front face operation limit: When the $J1$ axis angle is $+120^\circ \leq J1 \leq -130^\circ$, 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.

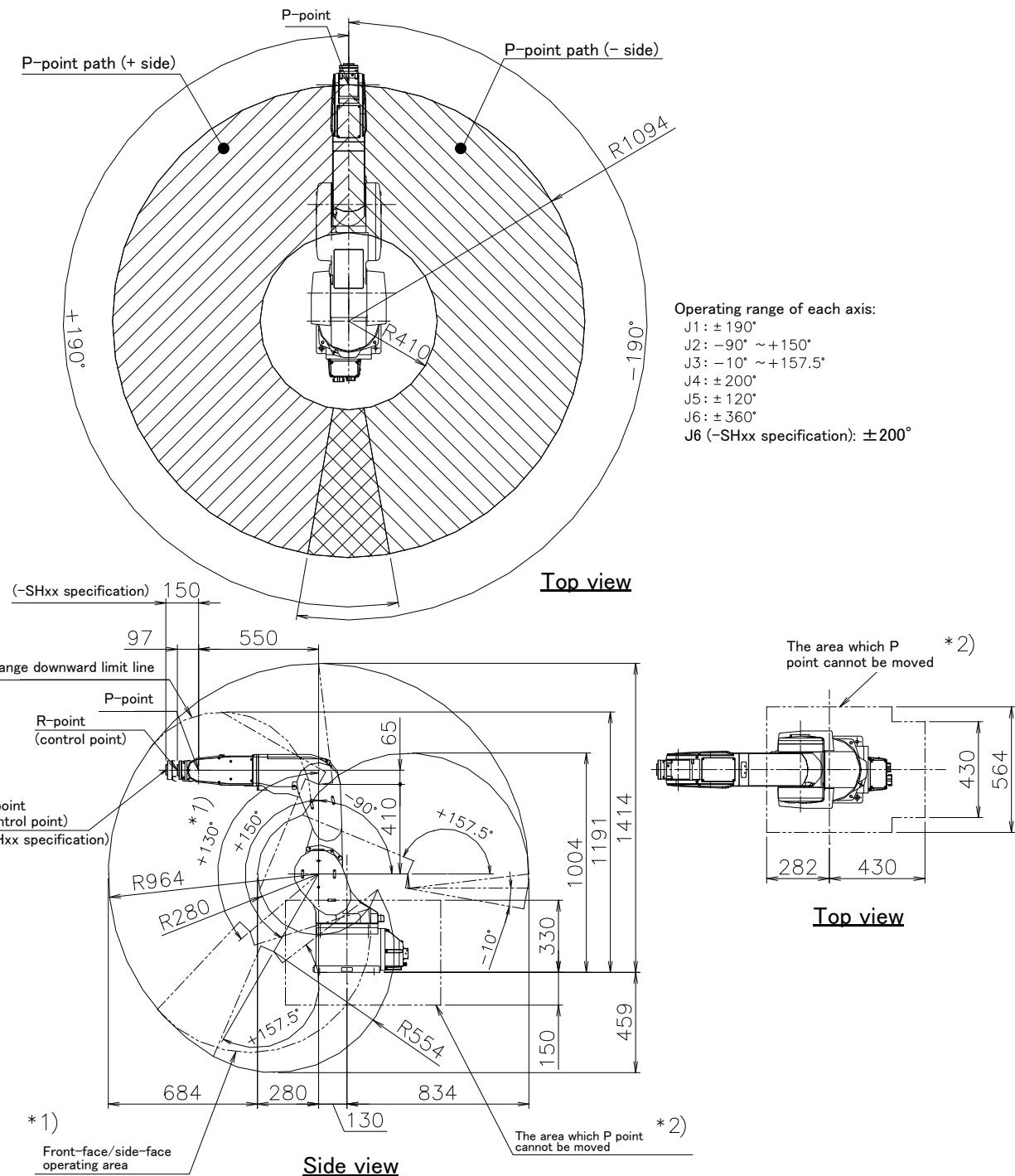


Fig.2-20 : Operating range diagram: RV-13F/20F

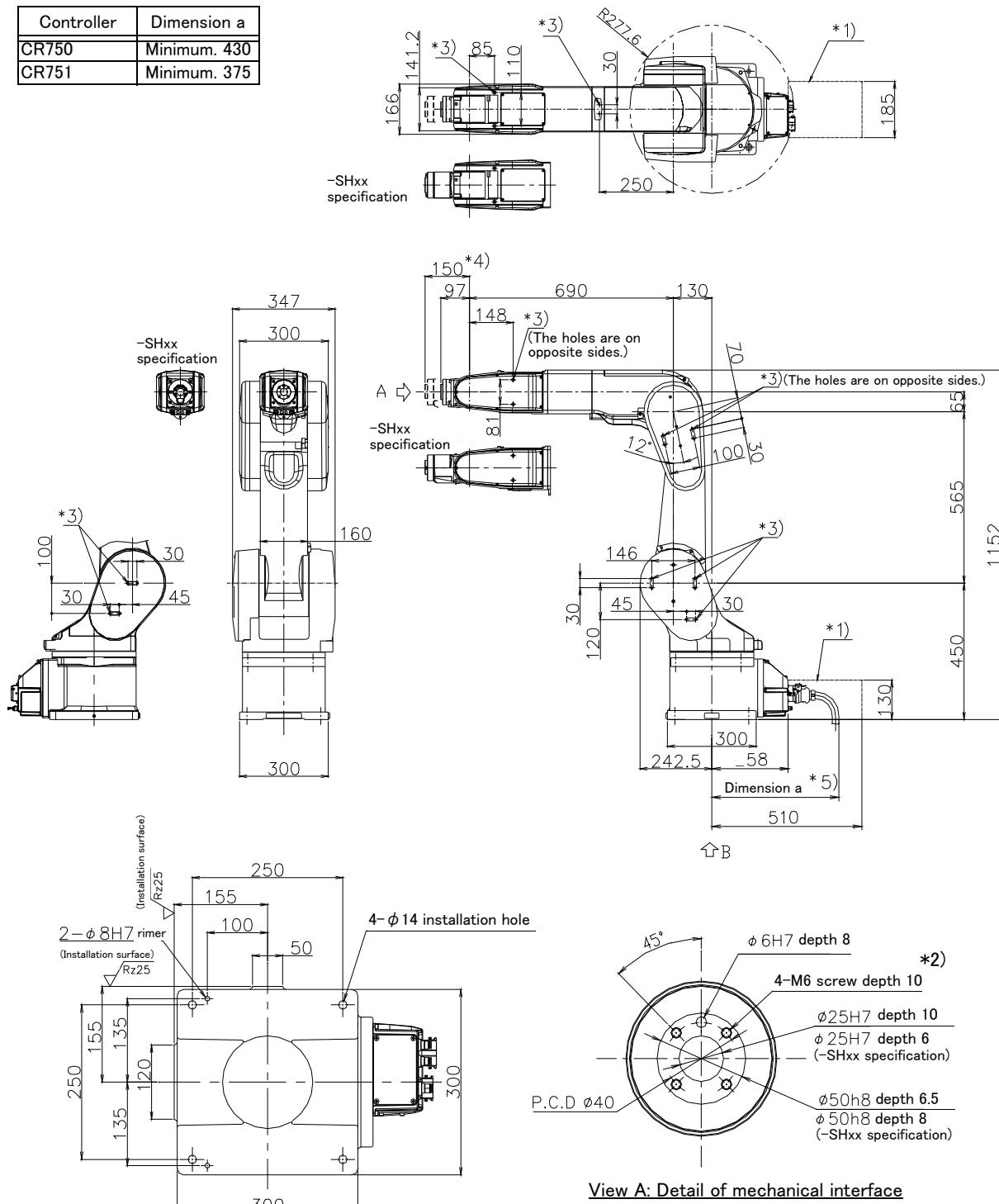
(7) RV-13FL

Notes

Rev. B

1. *1) Ensure the cable connection space to connect machine cables.
2. *2) The screw should go in to a depth of 9mm to 10mm.
3. *3) Screw hole (M4 depth 8) for securing the user cables/piping.
4. *4) The size of the internal wiring and piping specification model (-SHxx).
5. *5) The dimension a shows the distance to a minimum bendable radius of the machine cable.

Controller	Dimension a
CR750	Minimum. 430
CR751	Minimum. 375



View B bottom view drawing: Detail of installation dimension

Note) The drawing shows an example of the CR750 controller connection robot.

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

Fig.2-21 : Outside dimensions: RV-13FL

Notes

Rev. A

1. The side view figure shows a robot at the position of:
 $J_1=0^\circ$, $J_2=0^\circ$, $J_3=90^\circ$, $J_4=0^\circ$, $J_5=0^\circ$, and $J_6=0^\circ$
 2. *1) Front face operation limit: When the J_1 axis angle is $+130^\circ \leq J_1 \leq -140^\circ$, the J_2 axis operation is limited to $-90^\circ \leq J_2 \leq +130^\circ$.
 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.

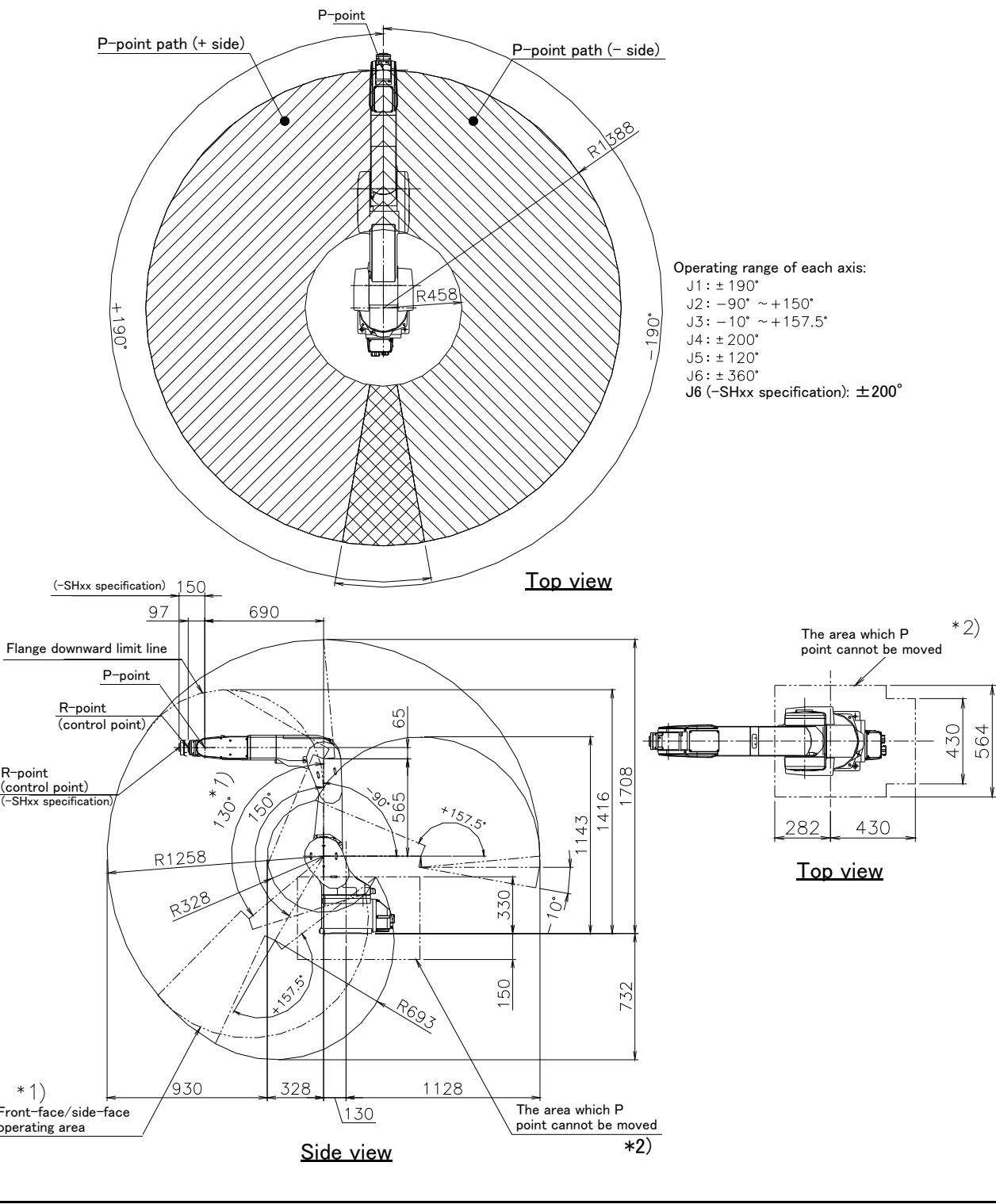


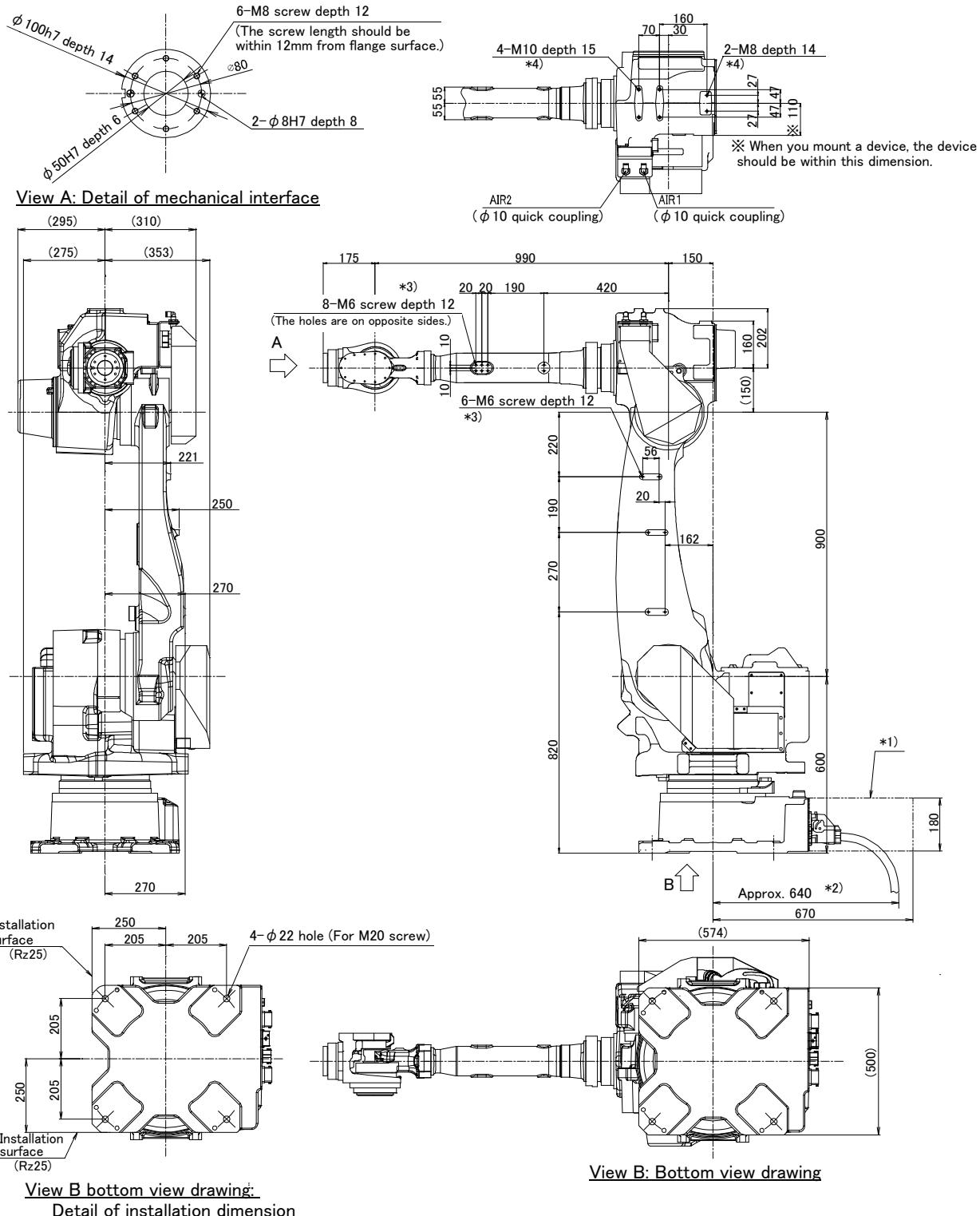
Fig.2-22 : Operating range diagram: RV-13FL

(8) RV-35F/50F/70F series

Notes

Rev. *

1. *1) Ensure the cable connection space to connect machine cables.
2. *2) The dimension a shows the distance to a minimum bendable radius of the machine cable.
3. *3) The screw hole can be used for fixing user cables/pipings.
4. *4) The screw hole can be used for fixing user cables/pipings or user equipment.



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.2-23 : Outside dimensions: RV-35F/50F/70F series

Notes

Rev. A

1. The side view figure shows a robot at the position of:
 $J_1=0^\circ$, $J_2=0^\circ$, $J_3=90^\circ$, $J_4=0^\circ$, $J_5=0^\circ$, and $J_6=0^\circ$
2. Movable area: The robot can be operated in the area where the following conditions are satisfied.
When J_2 axis angle is $11^\circ \leq J_2 < 56^\circ$, the J_3 axis operation is limited to $J_3 \leq [171 - (1/6) \times (J_2 - 8)]^\circ$.
When J_2 axis angle is $J_2 \geq 56^\circ$, P point does not move to the operating range limitation area.
When J_3 axis angle is $J_3 \geq 170.5^\circ$, J_2 axis operation is $J_2 < 11^\circ$.
When J_2 axis angle is $J_2 \geq 130^\circ$, J_1 axis operation is $J_1 \leq 110^\circ$, or J_1 axis angle is $J_1 > 110^\circ$, J_2 axis operation is $J_2 \leq 130^\circ$.
3. *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.

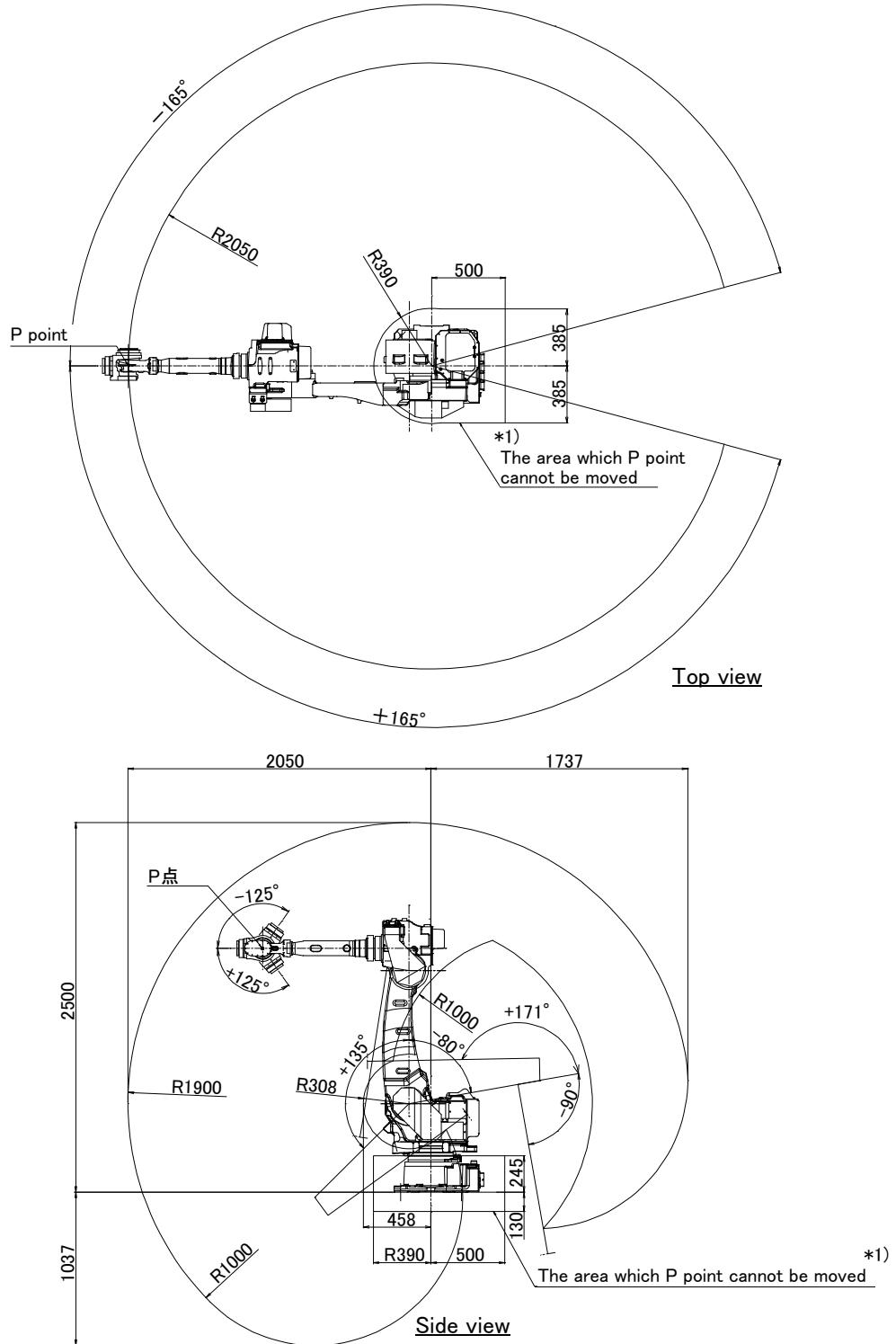
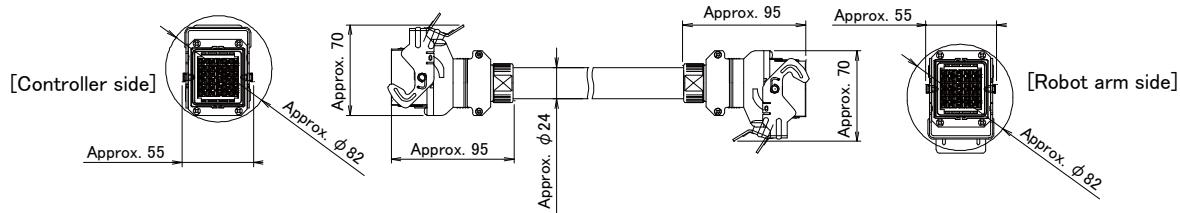


Fig.2-24 : Operating range diagram: RV-35F/50F/70F series

2.4.1 Outside dimensions of machine cables

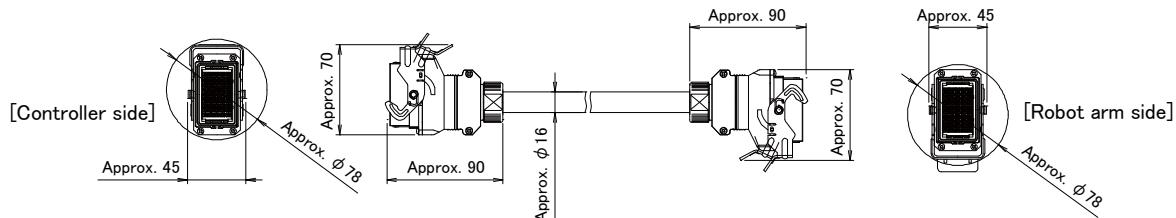
(1) Connection with the CR750 controller

1) Power cable



Note) If using an optional machine cable extension, refer to [Page 82, "\(1\) Machine cable extension"](#) in a diameter of the cable.

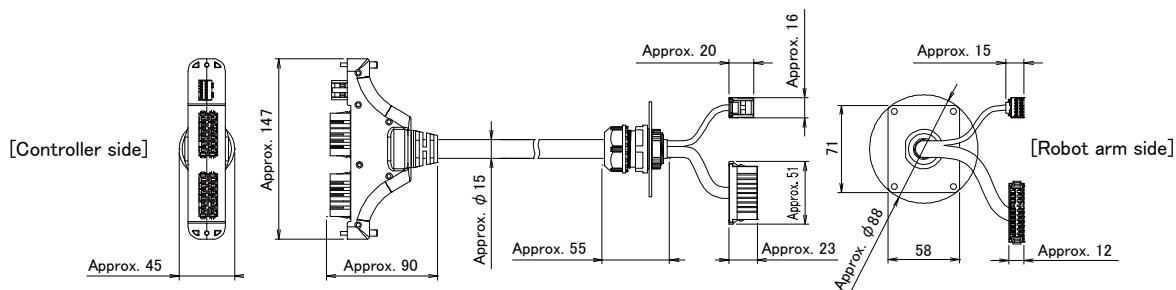
2) Signal cable



Note) If using an optional machine cable extension, refer to [Page 82, "\(1\) Machine cable extension"](#) in a diameter of the cable.

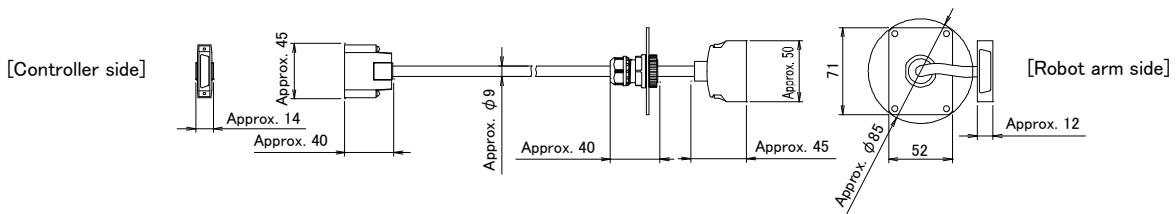
(2) Connection with the CR751 controller

1) Power cable



Note) If using an optional machine cable extension, refer to [Page 82, "\(1\) Machine cable extension"](#) in a diameter of the cable.

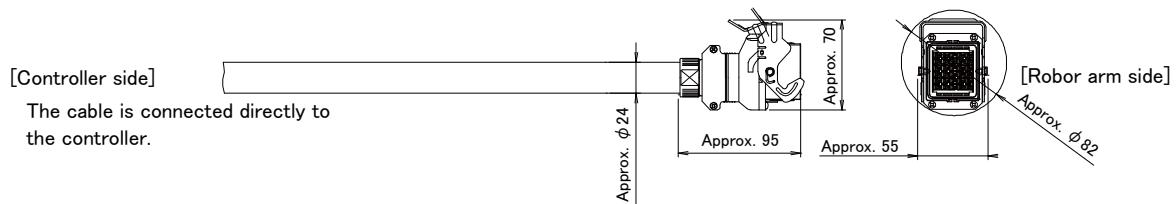
2) Signal cable



Note) If using an optional machine cable extension, refer to [Page 82, "\(1\) Machine cable extension"](#) in a diameter of the cable.

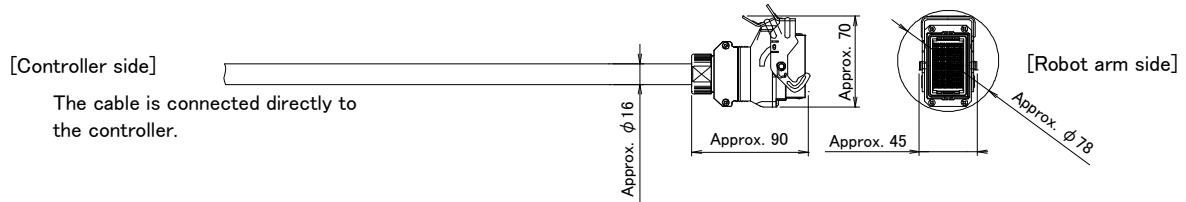
(3) Connection with CR760 controller

1) Power cable (CN1)



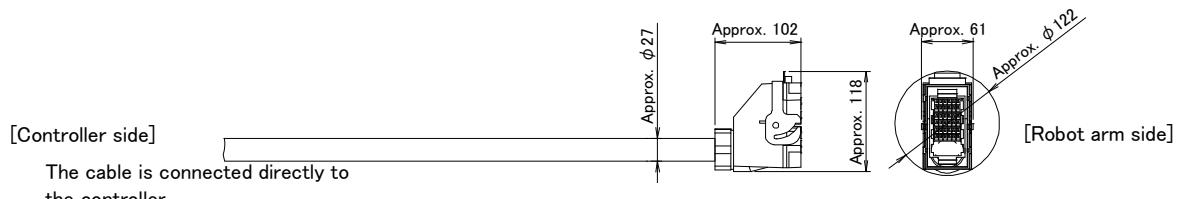
Note) If using an optional machine cable extension, refer to [Page 82, "\(1\) Machine cable extension"](#) in a diameter of the cable.

2) Signal cable (CN2)



Note) If using an optional machine cable extension, refer to [Page 82, "\(1\) Machine cable extension"](#) in a diameter of the cable.

3) Power cable (CN3)



Note) If using an optional machine cable extension, refer to [Page 82, "\(1\) Machine cable extension"](#) in a diameter of the cable.

2.5 Tooling

2.5.1 Wiring and piping for hand

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

- (1) RV-4F/7F/13F series standard specification (with no internal wiring and piping)

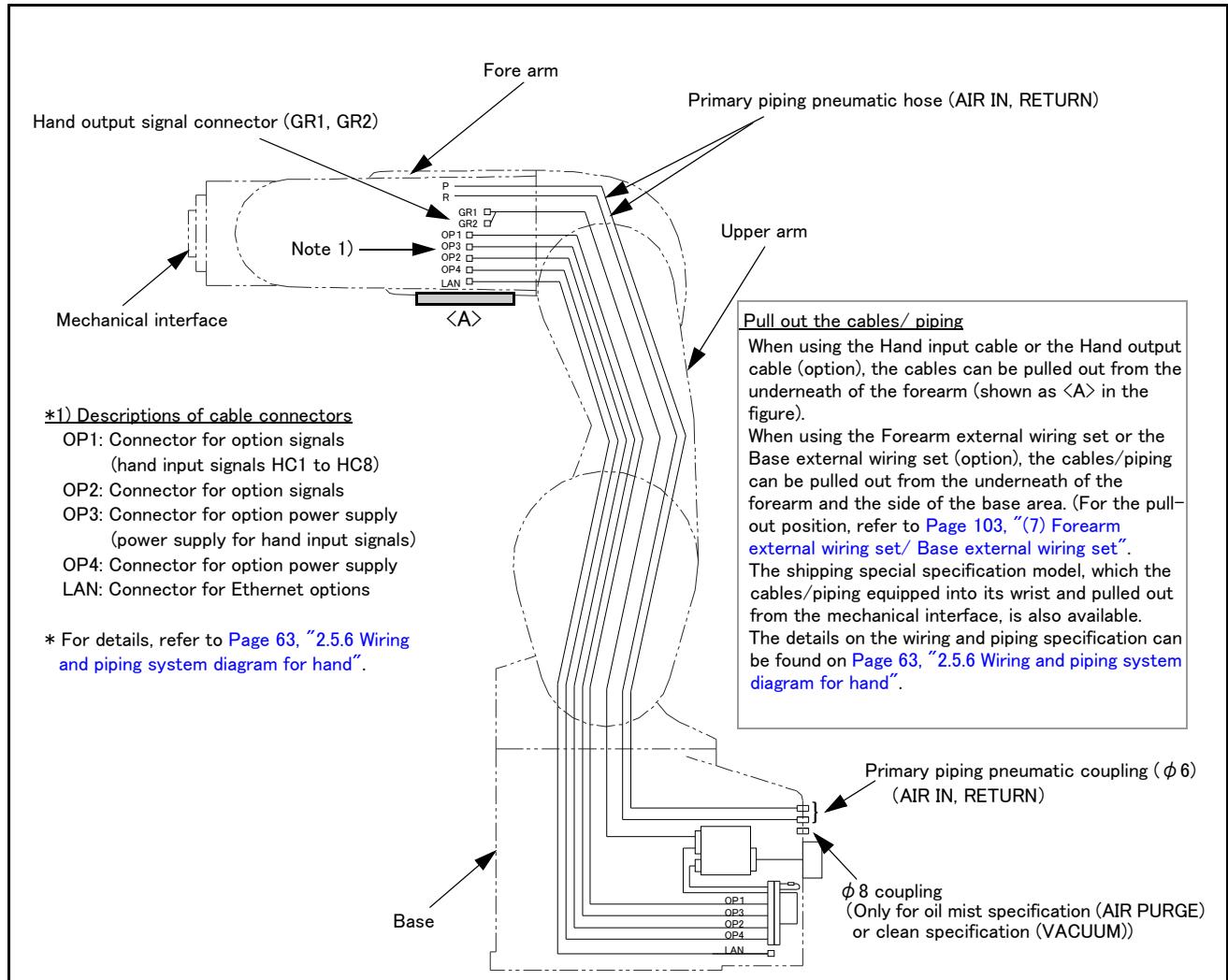
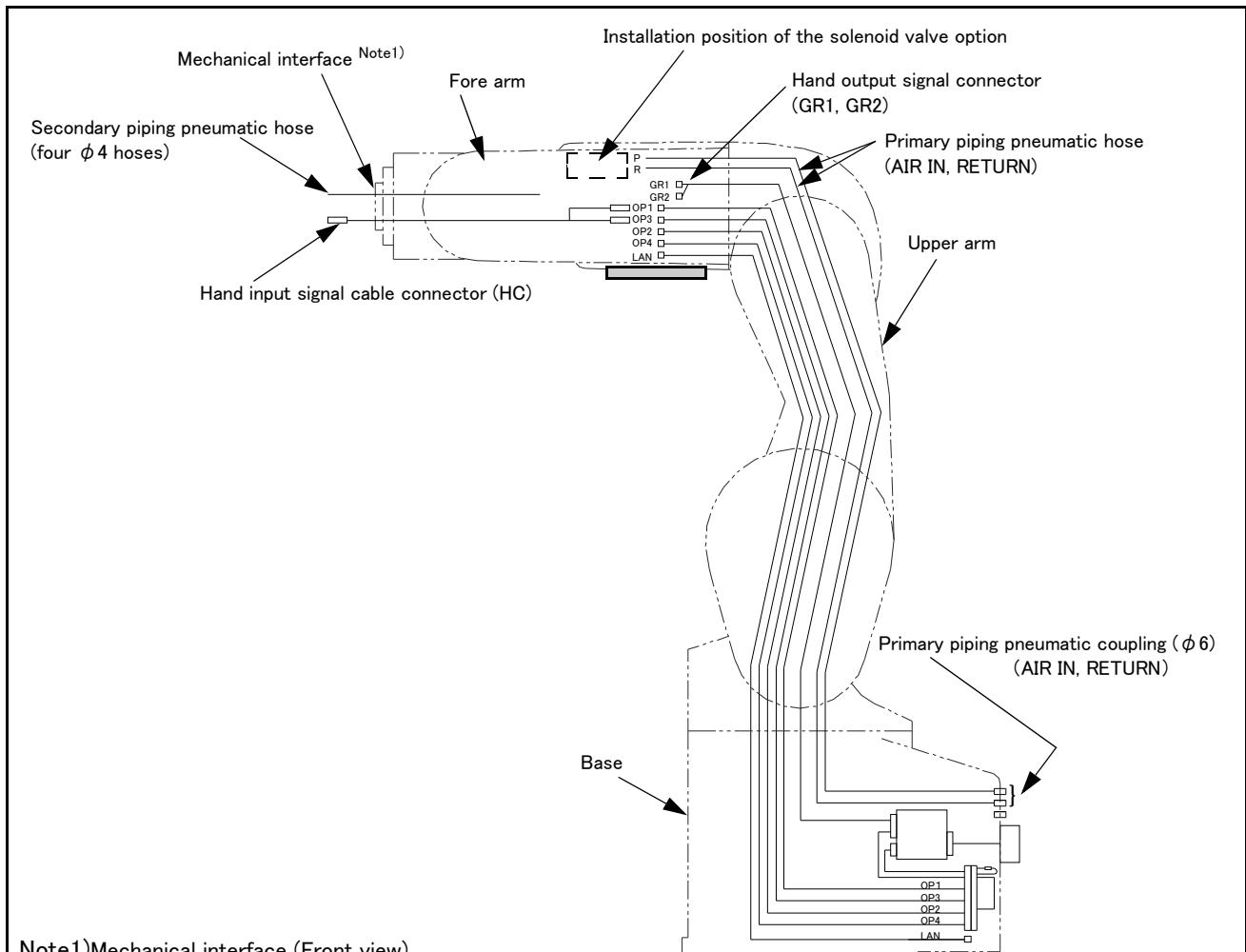
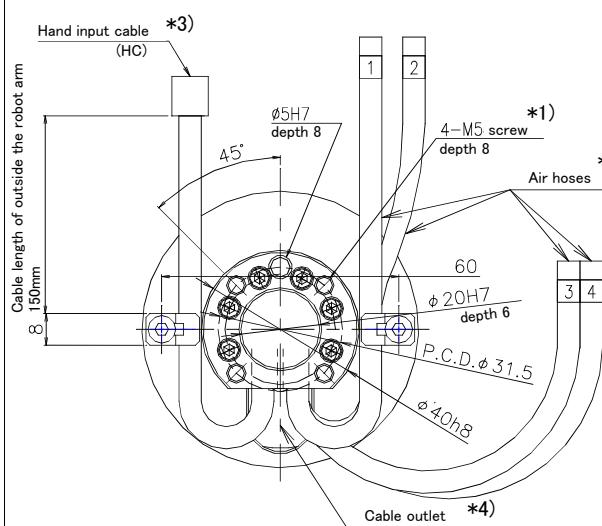


Fig.2-25 : RV-4F/7F/13F series wiring and piping for hand

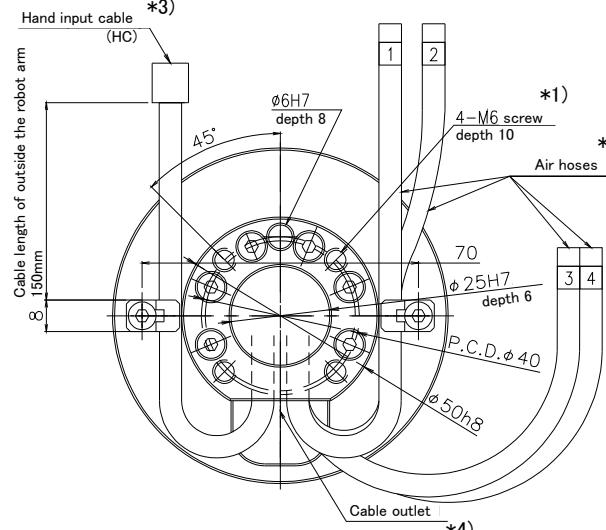
(2) RV-4F/7F/13F series internal wiring and piping specification (SH01)



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



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



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

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

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

*2) Four air tubes have numbered marking tube. Those lengths from the cable outlet are 300 mm.

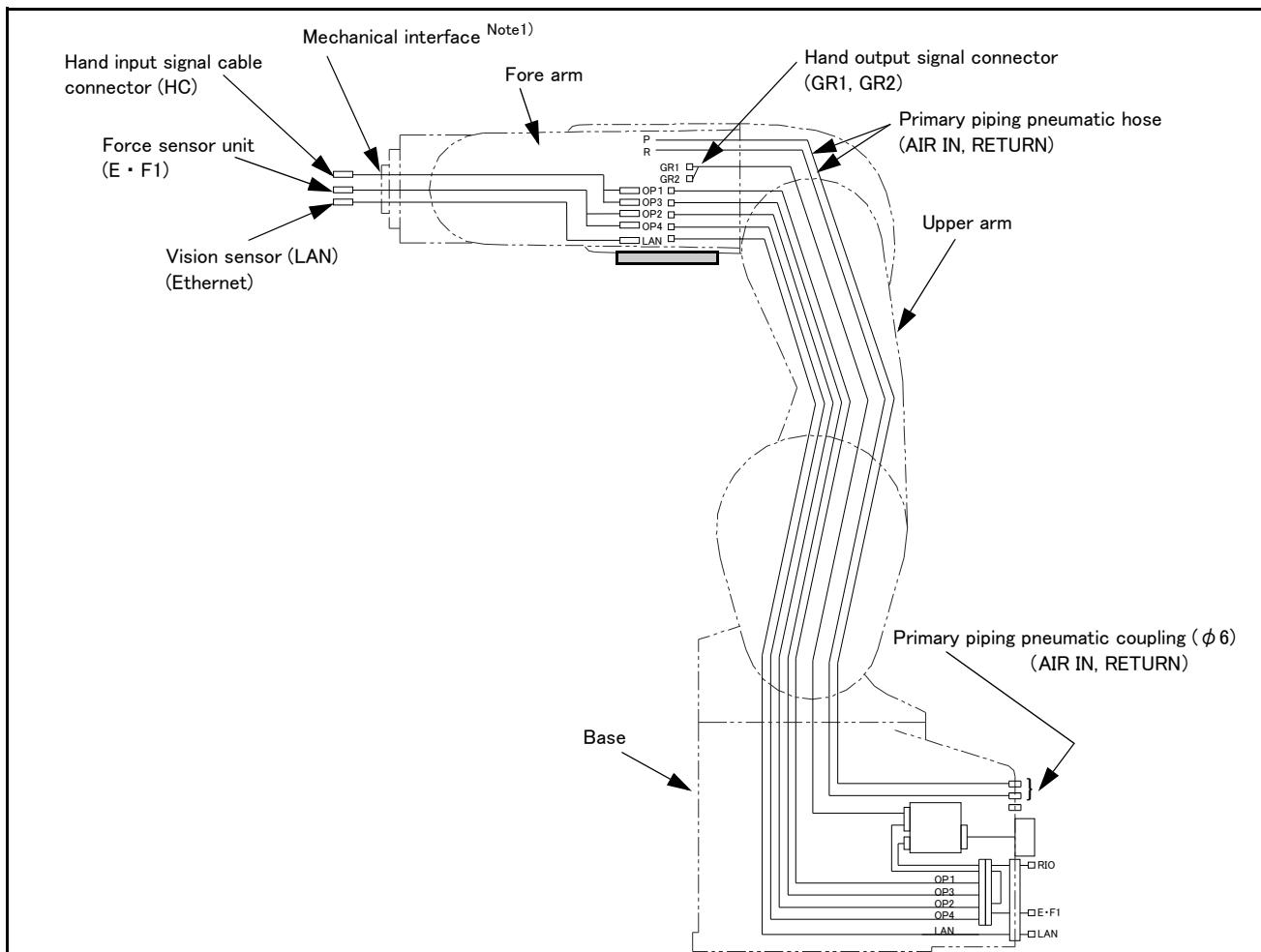
*3) Refer to Fig. 2-33 for pin assignment of the hand input cable (HC).

*4) 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 63, "2.5.6 Wiring and piping system diagram for hand".

Fig.2-26 : RV-4F/7F/13F series wiring and piping for hand (SH01)

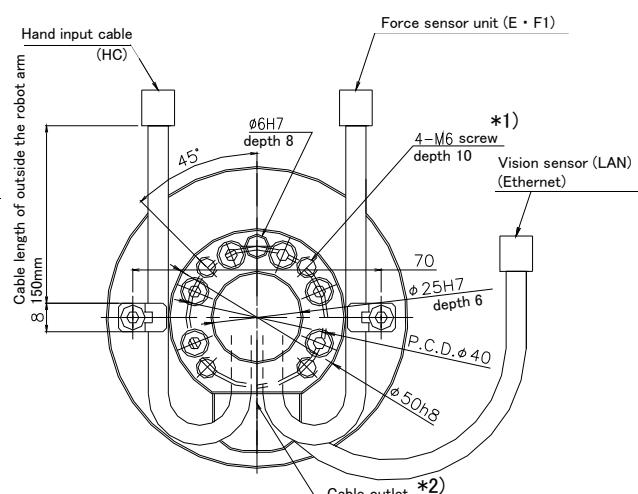
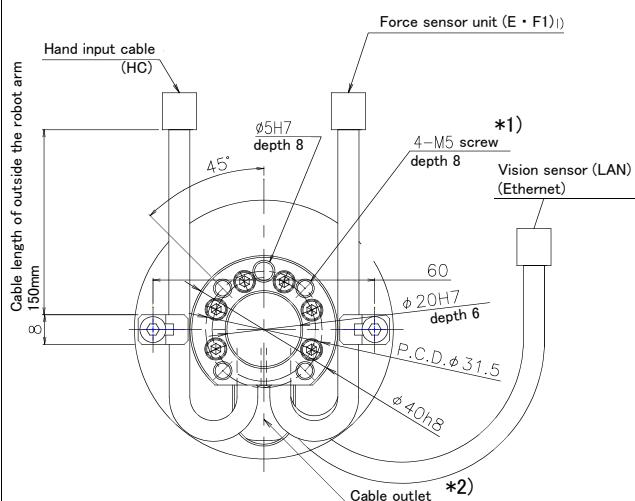
(3) RV-4F/7F/13F series internal wiring and piping specification (SH02)



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

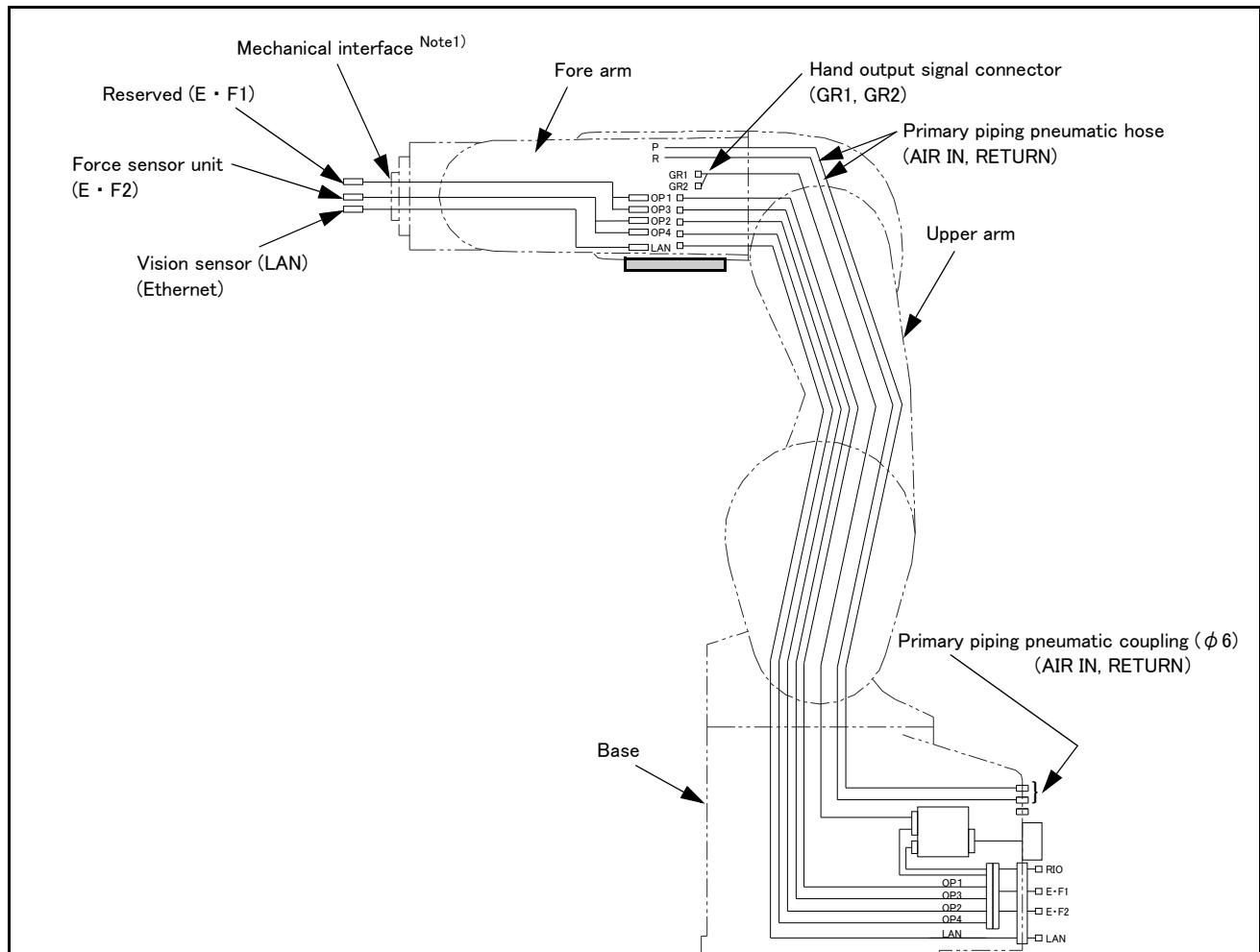
RV-13F/13FL, RV-20F 9mm to 10mm

*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 63, "2.5.6 Wiring and piping system diagram for hand".](#)

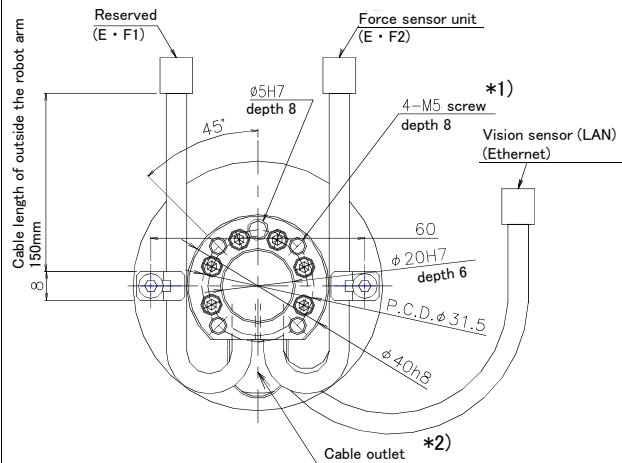
Fig.2-27 : RV-4F/7F/13F series wiring and piping for hand (SH02)

(4) RV-4F/7F/13F series internal wiring and piping specification (SH03)

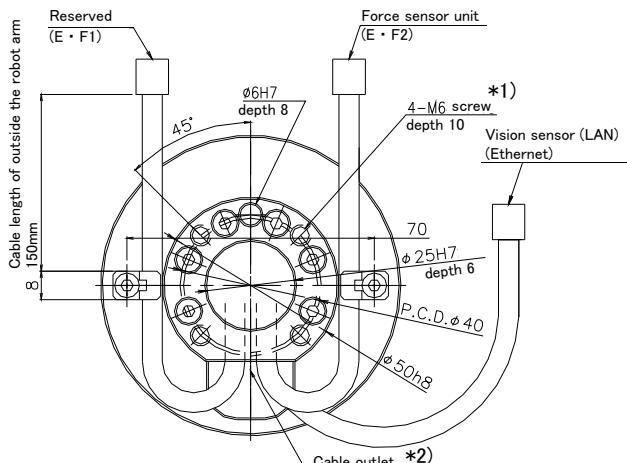


Note1)Mechanical interface (Front view)

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



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



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

The screws should go in to a depth of shown below.
RV-4F/7F series, RV-7FLL 7.5mm to 8mm

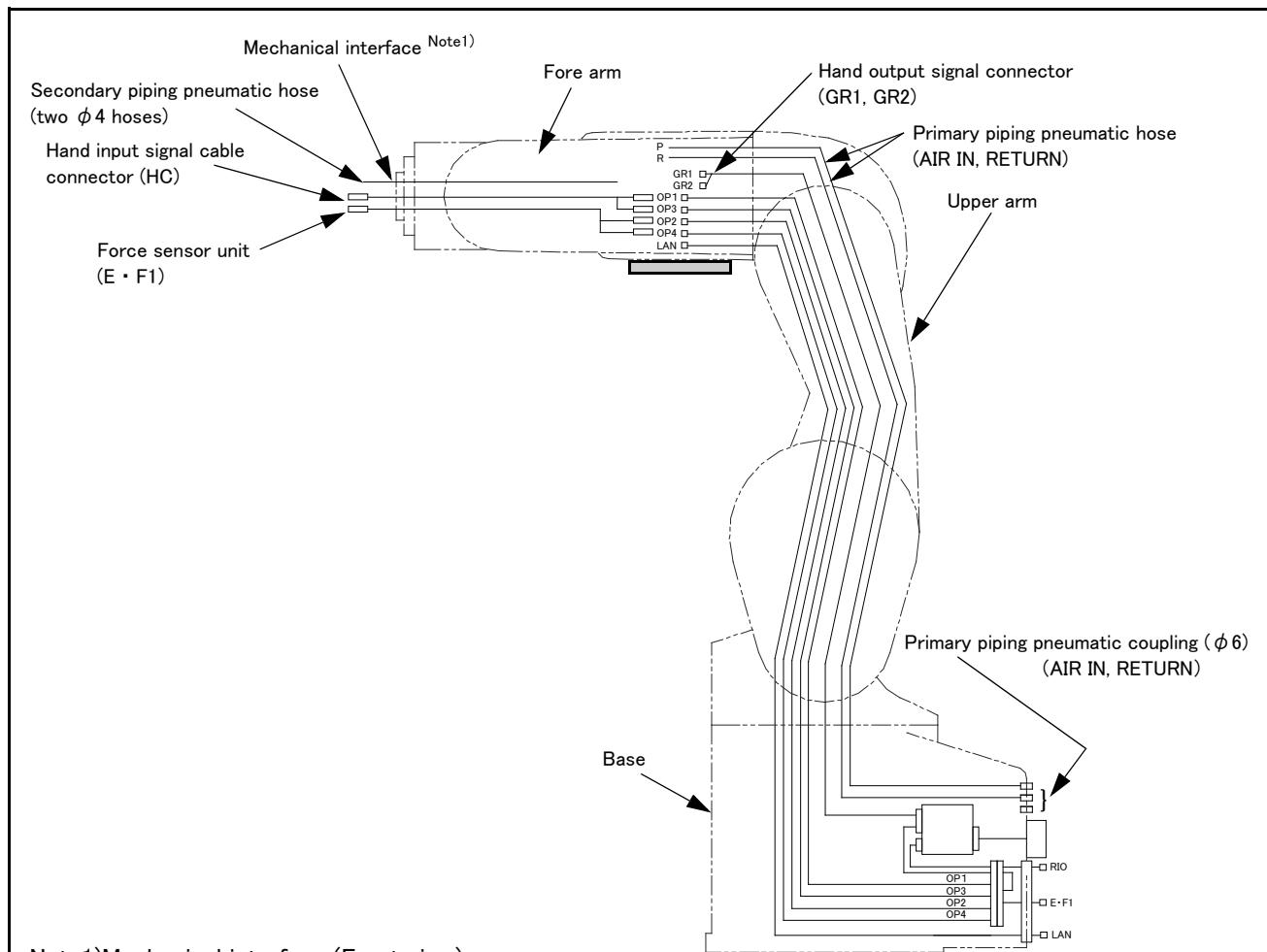
RV-4F/7F Series, RV-7FL 7.0mm to 8mm
RV-13F/13FL, RV-20F 9mm to 10mm

*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 63, "2.5.6 Wiring and piping system diagram for hand".

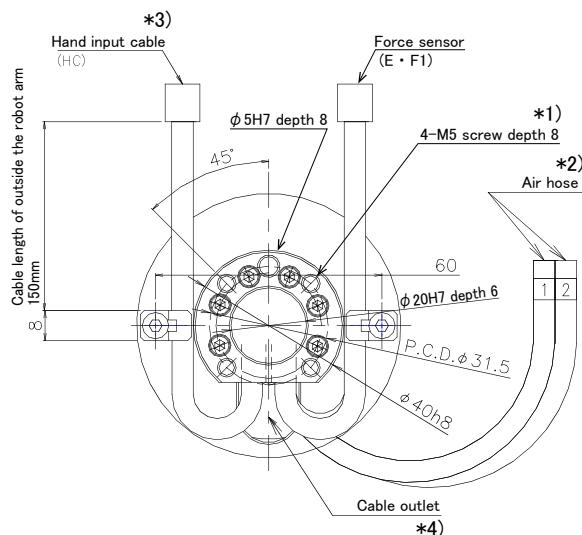
Fig.2-28 : RV-4F/7F/13F series wiring and piping for hand (SH03)

(5) RV-4F/7F/13F series internal wiring and piping specification (SH04)

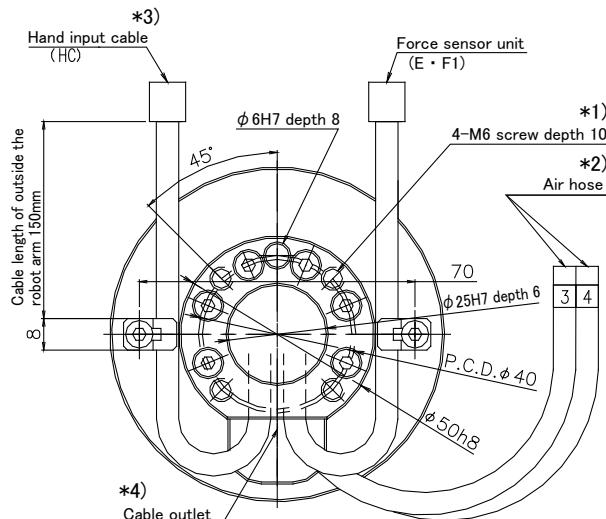


Note1)Mechanical interface (Front view)

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) Two air tubes have numbered marking tube. Those lengths from the cable outlet are 300 mm.

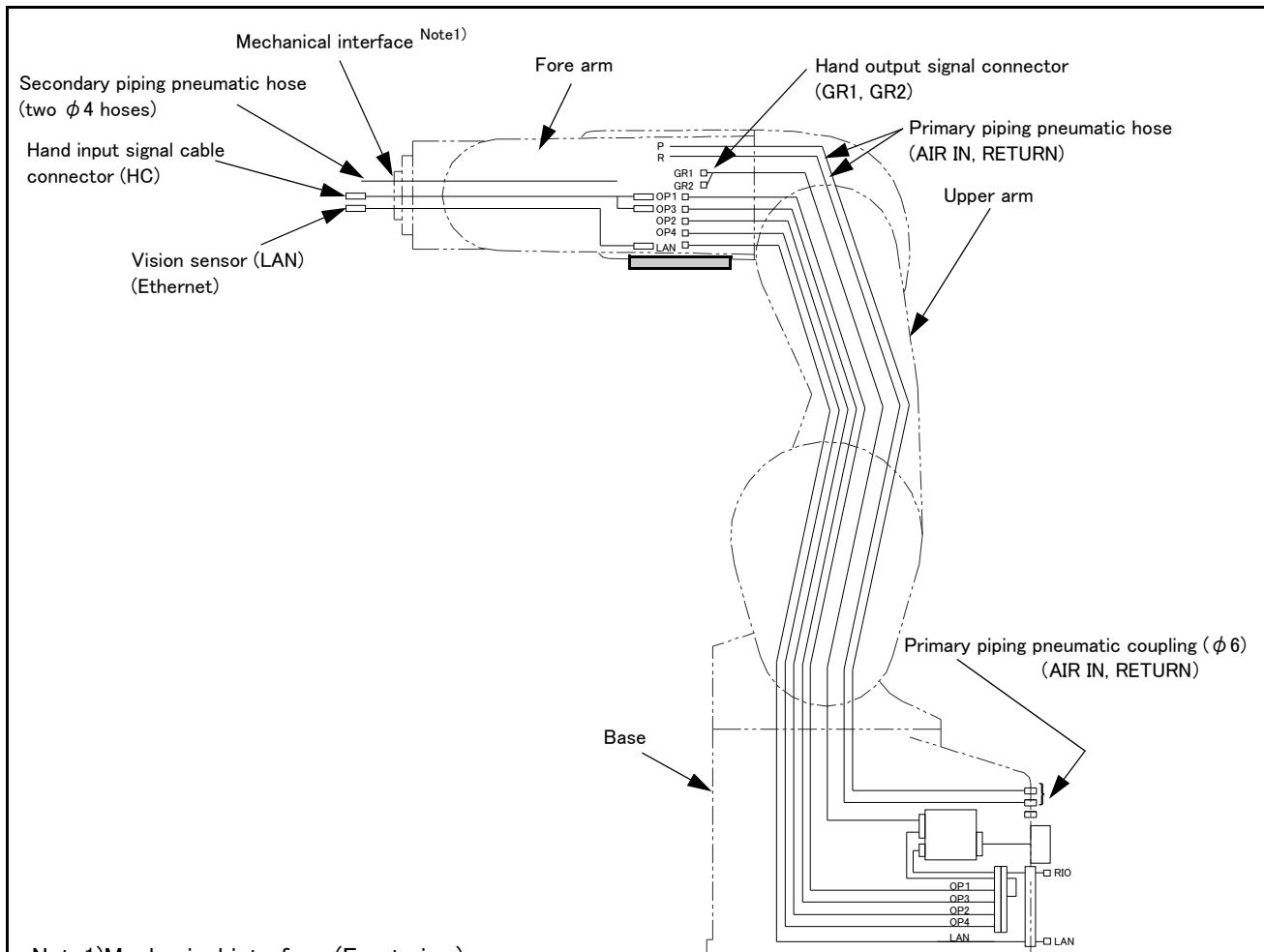
*3) Refer to Fig. 2-36 for pin assignment of the hand input cable (HC).

*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.

* For details, refer to Page 63, "2.5.6 Wiring and piping system diagram for hand".

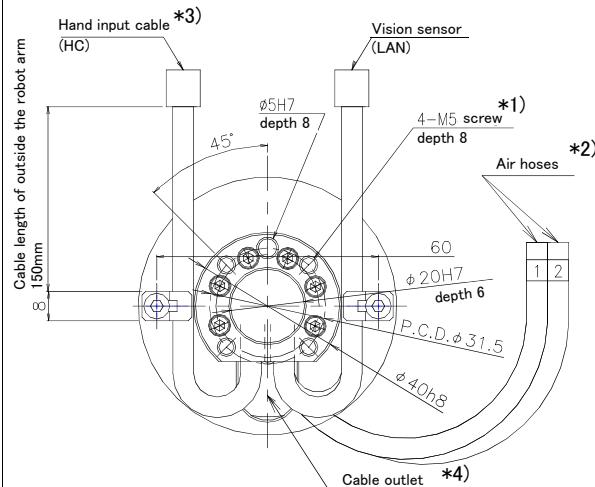
Fig.2-29 : RV-4F/7F/13F series wiring and piping for hand (SH04)

(6) RV-4F/7F/13F series 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

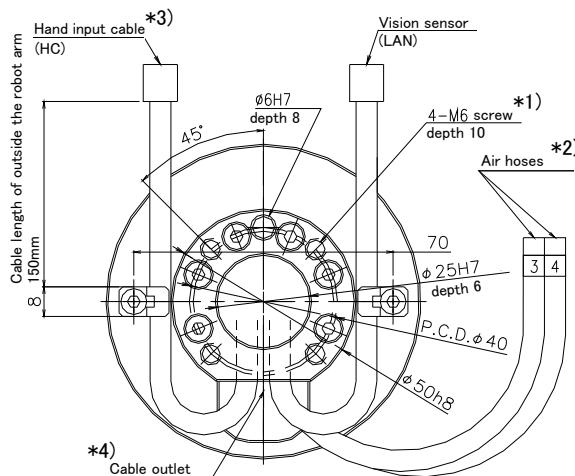
RV-13F/13FL, RV-20F 9mm to 10mm

*2) Two air tubes have numbered marking tube. Those lengths from the cable outlet are 300 mm.

*3) Refer to Fig. 2-37 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 63, "2.5.6 Wiring and piping system diagram for hand".

Fig.2-30 : RV-4F/7F/13F series wiring and piping for hand (SH05)

(7) RV-35F/50F/70F series

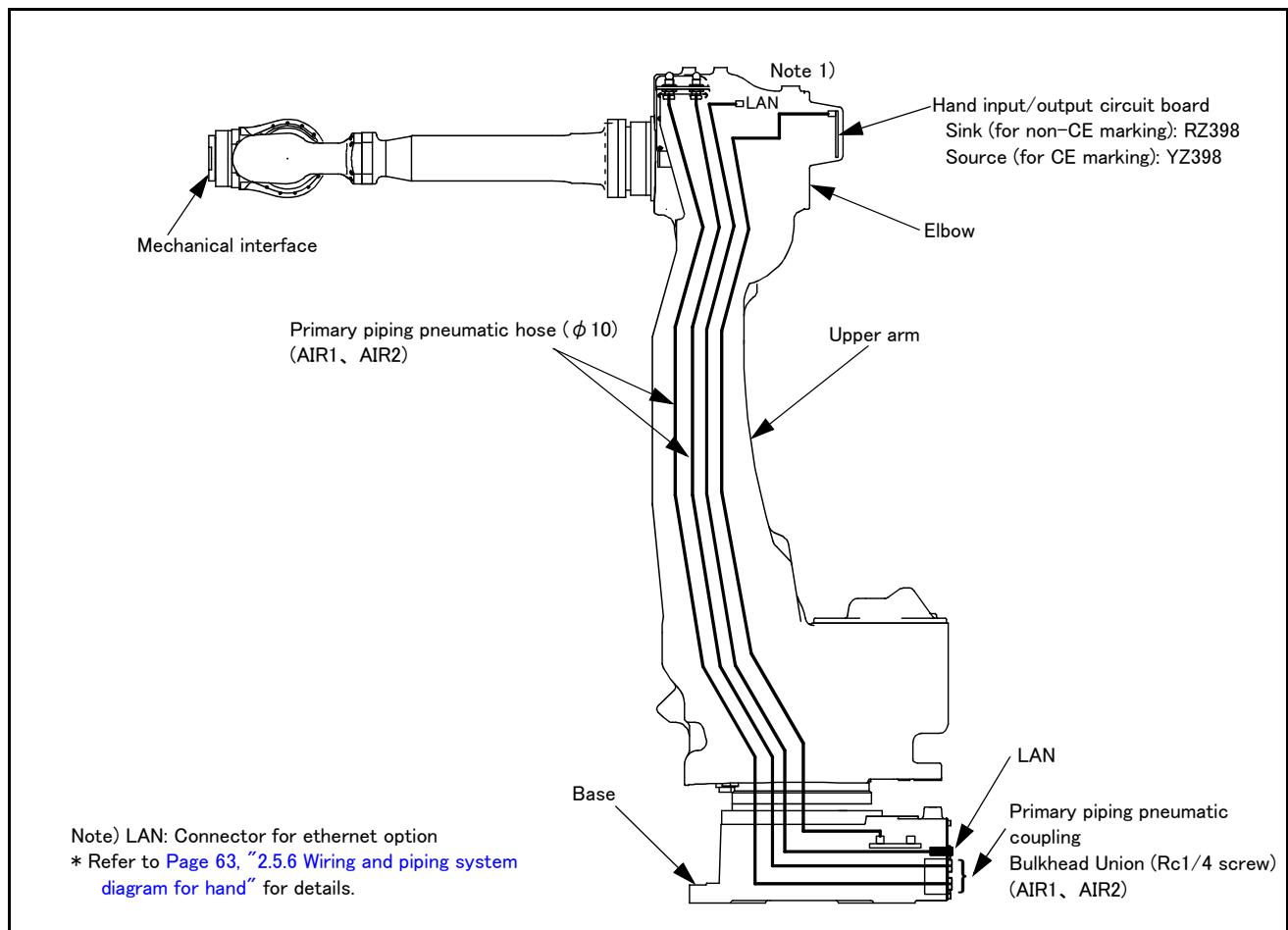


Fig.2-31 : RV-35F/50F/70F series wiring and piping for hand

2.5.2 Internal air piping

(1) RV-4F/7F/13F series

■ Standard type/Oil mist specifications

- 1) The robot has two $\phi 6$ urethane hoses from the pneumatic entrance on the base section to the fore arm. One hose is the primary piping for the pneumatic equipment, and the other pipe is used for air exhaust.
- 2) The optional solenoid is provided with a maximum of eight couplings for the air hose. The diameter of the couplings are shown below.
 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 94, "\(3\) 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 32, "2.2.6 Protection specifications"](#) for the details of dry air.

■ 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 33, "2.2.7 Clean specifications"](#) for details of the vacuum for suction.
- 4) Supply clean air to the vacuum generator.

(2) RV-35F/50F/70F series

■ Standard type/Oil mist specifications

- 1) The robot has two $\phi 10$ urethane hoses from the pneumatic entrance on the base portion to the elbow portion.
- 2) Air inlet on the base portion is bulkhead female union (Rc1/4).

2.5.3 Internal wiring for the hand output cable

(1) RV-4F/7F/13F series

- 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) RV-35F/50F/70F series

- 1) The built-in RZ398 card at the elbow section has connector bridges for hand output. The connector names are Y00 to Y15.
 To extend the wiring to the outside of the arm, user-made cables are required.
 Or the separate cables (optional "hand output cable 1F-GR2000S-21 and 1F-GR2000S-22") are required.

2.5.4 Internal wiring for the hand input cable

(1) RV-4F/7F/13F series

- 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-HC35S-02") is required.

(2) RV-35F/50F/70F series

- 1) The built-in RZ398 card at the elbow section has connector bridges for hand output. The connector names are X00 to X15.
 To extend the wiring to the outside of the arm, user-made cables are required.
 Or the separate cables (optional "hand input cable 1F-HC2000S-21 and 1F-HC2000S-22") are required.

2.5.5 Ethernet cable, option wiring cable

(1) RV-4F/7F/13F series

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 2-12 : 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) RV-35F/50F/70F series

Ethernet cables internally run from the robot's base portion up to the elbow portion.

Table 2-13 : 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) RV-4F/7F/13F series standard specification (with no internal wiring and piping)

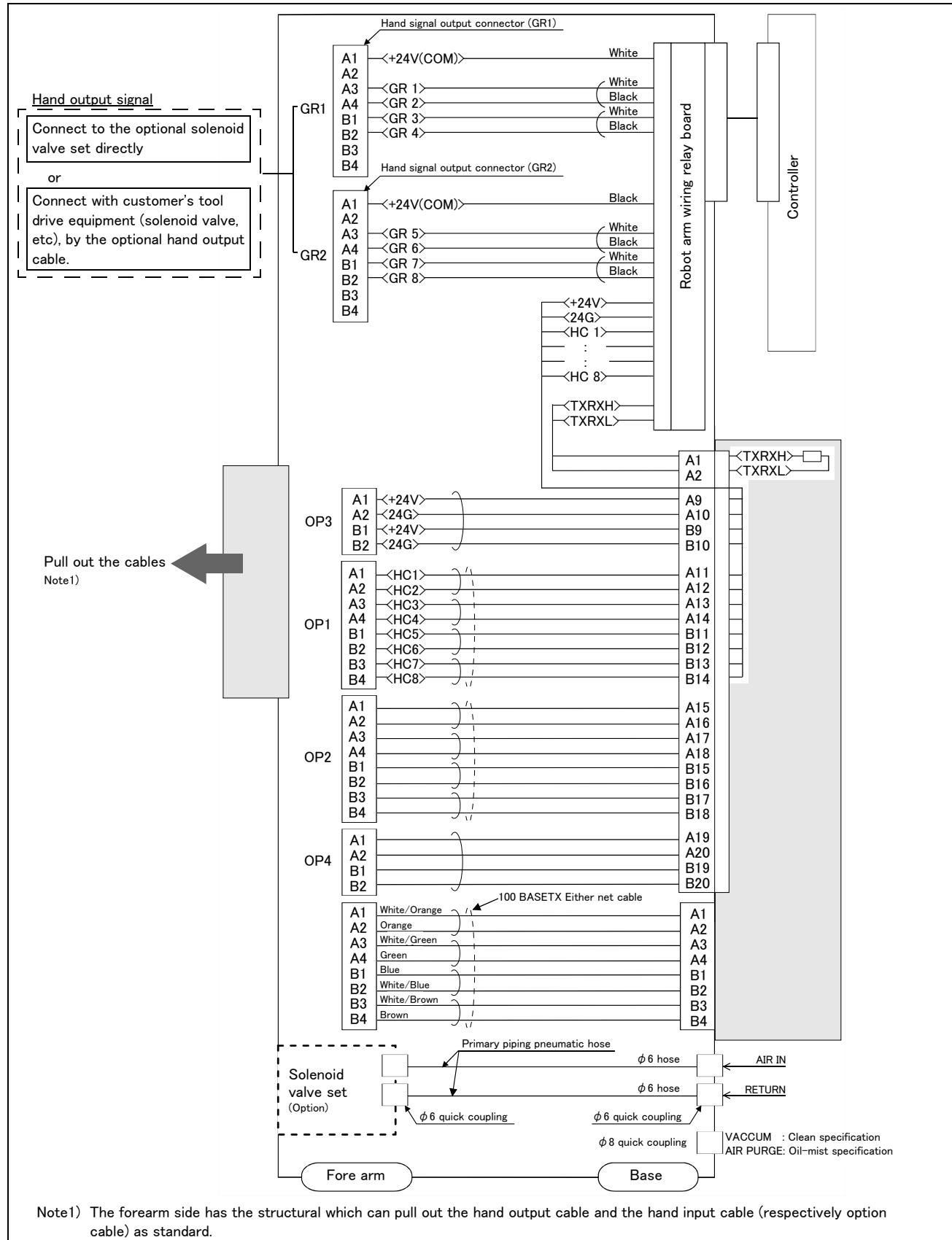


Fig.2-32 : Wiring and piping system diagram for hand and example the solenoid valve installation: RV-4F/7F/13F series standard

(2) RV-4F/7F/13F series internal wiring and piping specification (SH01)

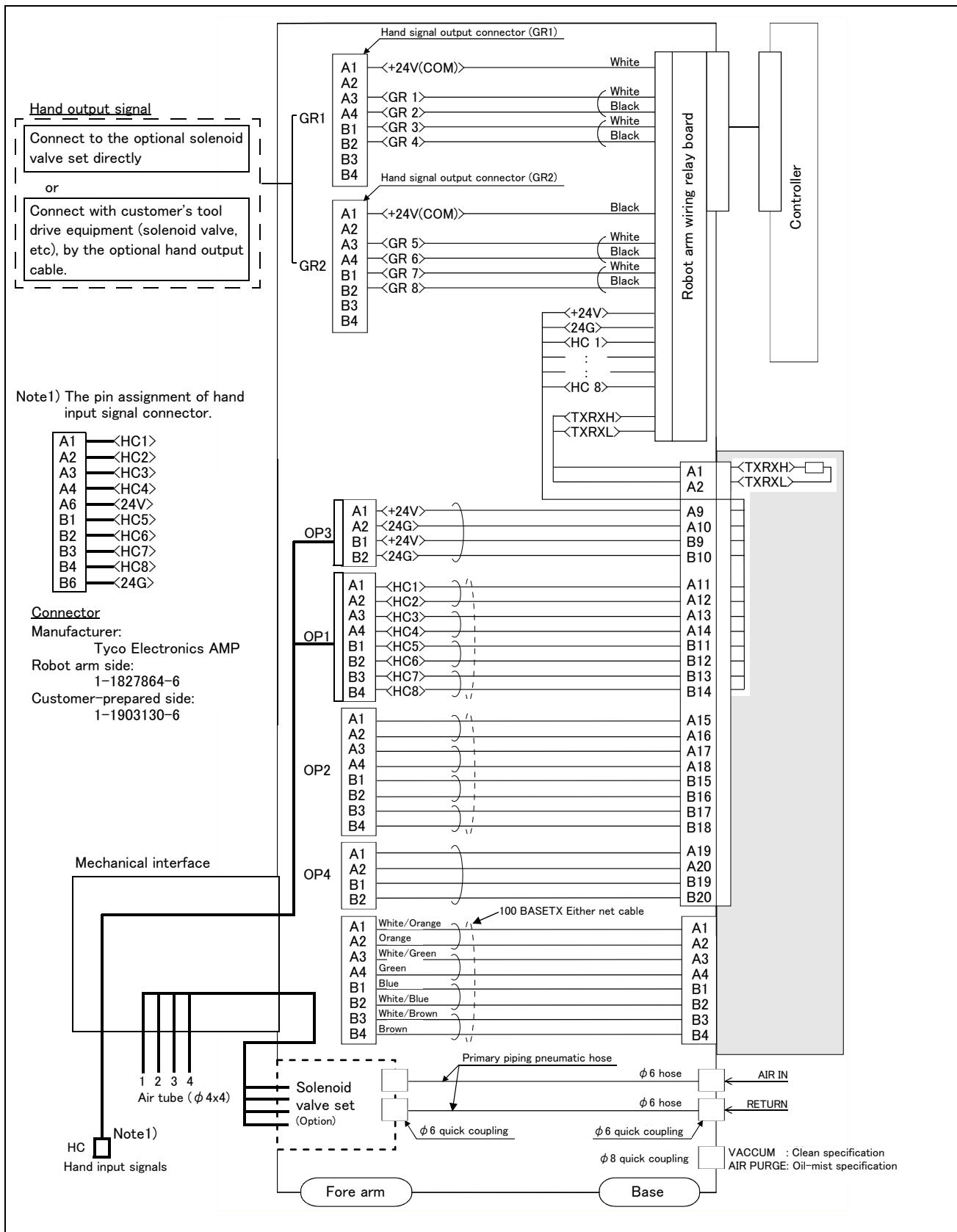


Fig.2-33 : Wiring and piping system diagram for hand and example the solenoid valve installation: RV-4F/7F/13F series SH01

(3) RV-4F/7F/13F series internal wiring and piping specification (SH02)

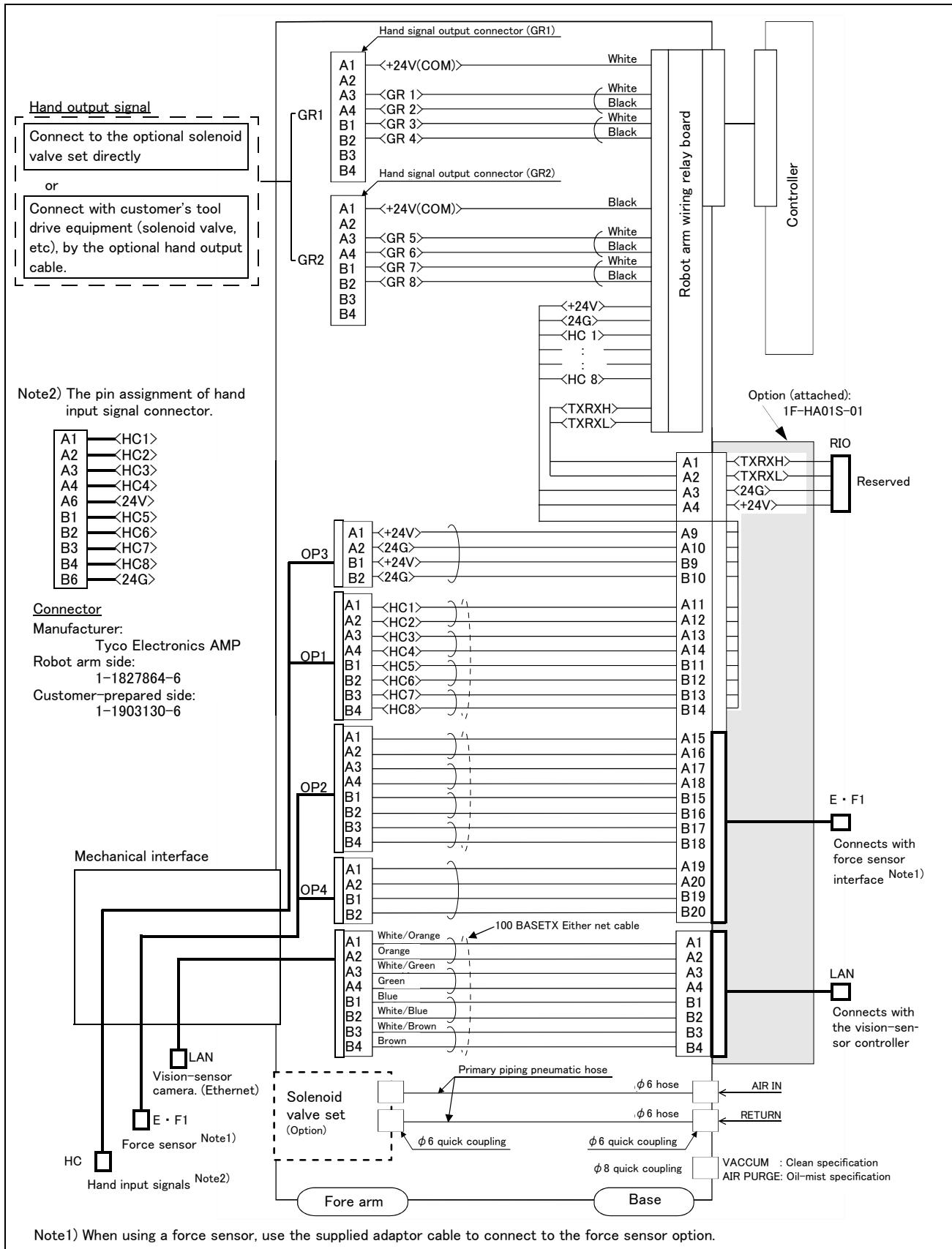


Fig.2-34 : Wiring and piping system diagram for hand and example the solenoid valve installation: RV-4F/7F/13F series SH02

(4) RV-4F/7F/13F series internal wiring and piping specification (SH03)

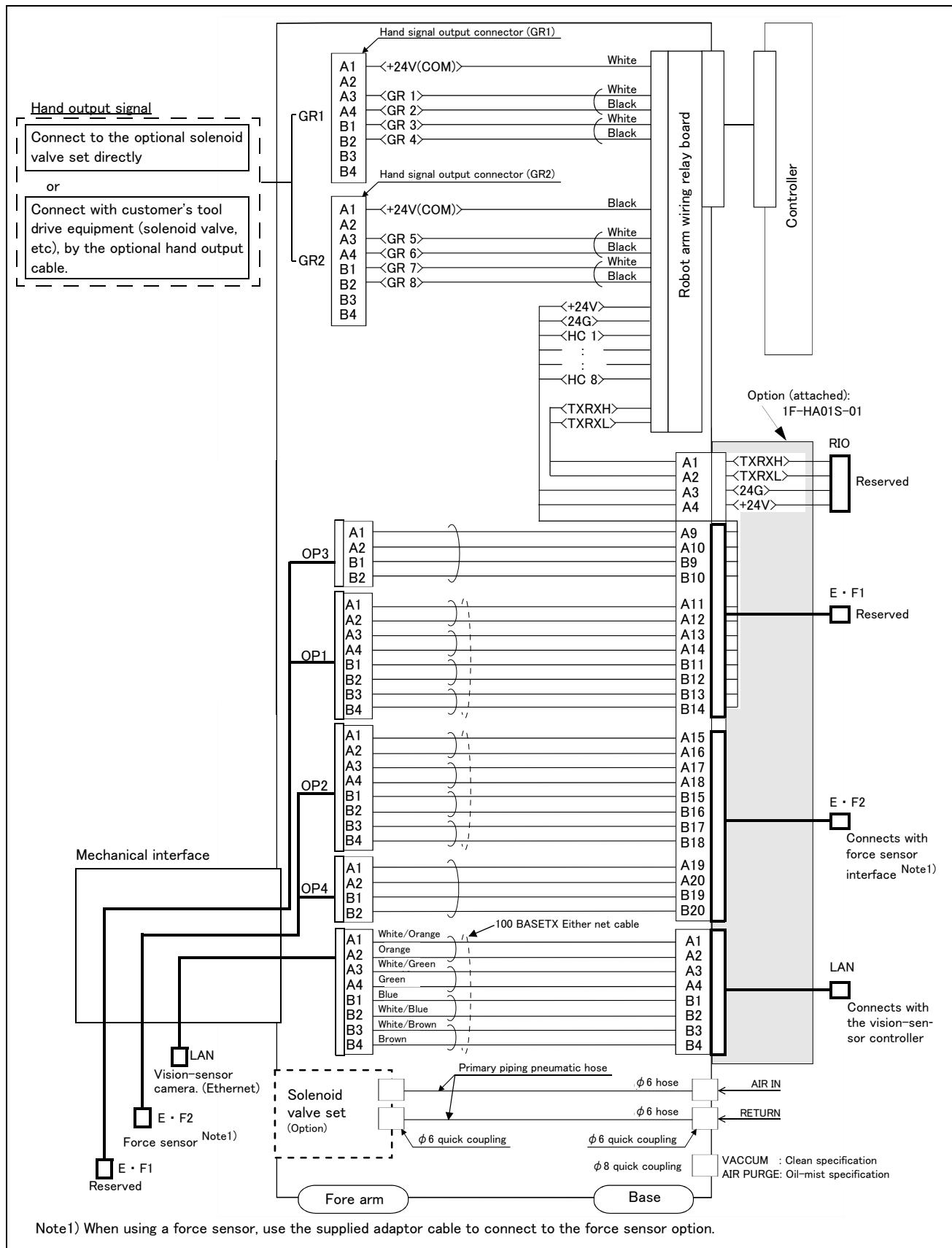


Fig.2-35 : Wiring and piping system diagram for hand and example the solenoid valve installation: RV-4F/7F/13F series SH03

(5) RV-4F/7F/13F series internal wiring and piping specification (SH04)

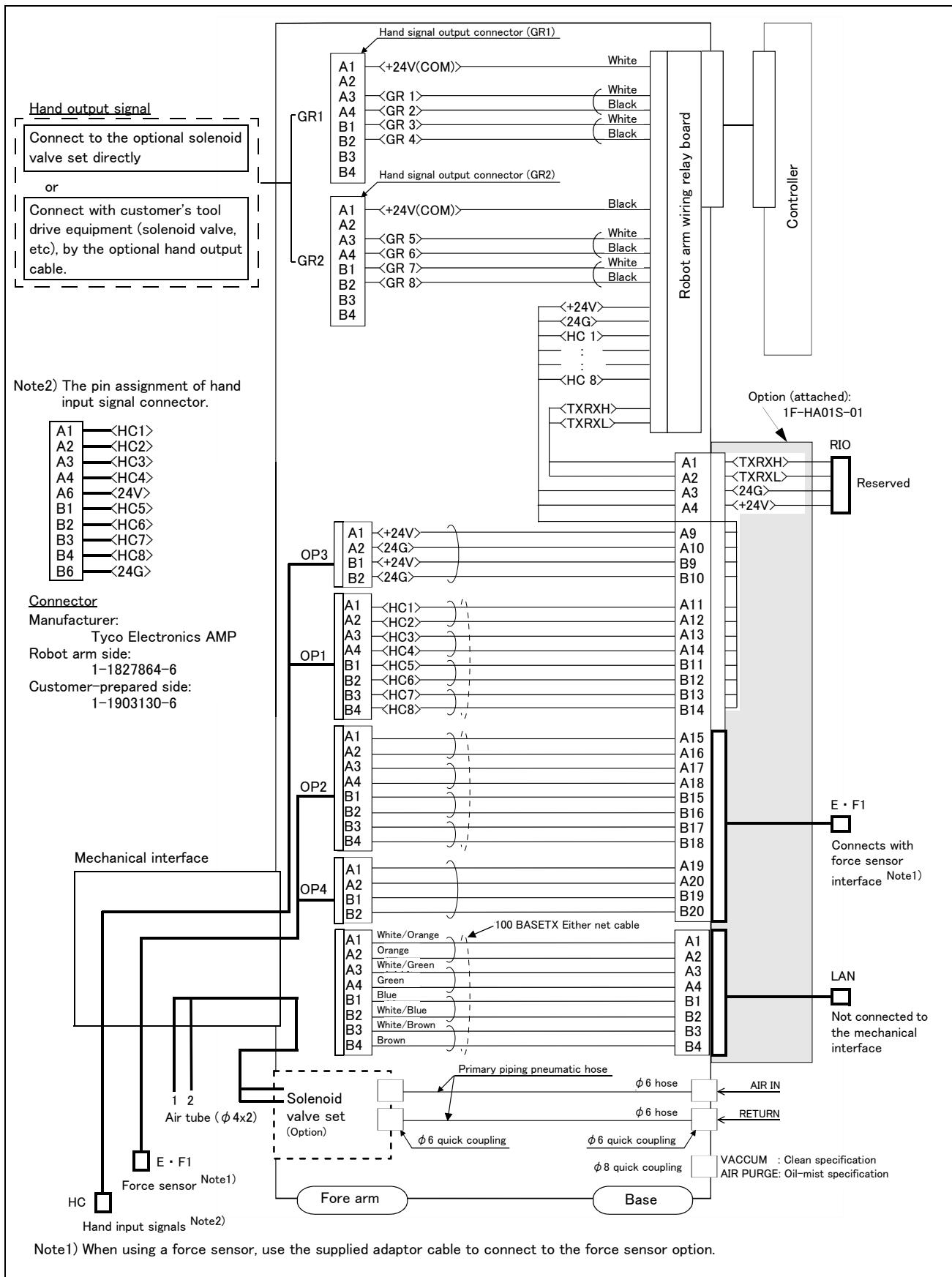


Fig.2-36 : Wiring and piping system diagram for hand and example the solenoid valve installation: RV-4F/7F/13F series SH04

(6) RV-4F/7F/13F series internal wiring and piping specification (SH05)

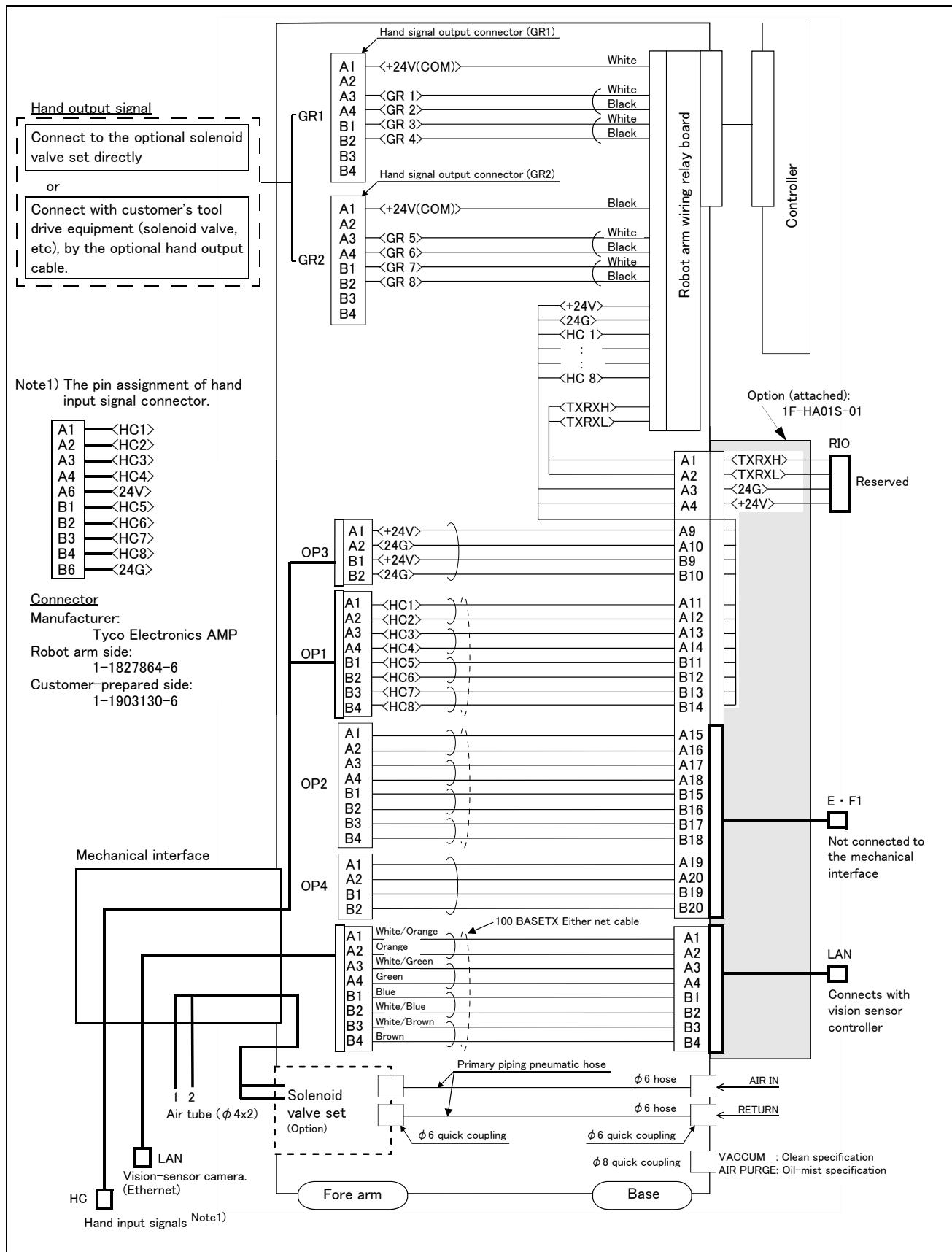


Fig.2-37 : Wiring and piping system diagram for hand and example the solenoid valve installation: RV-4F/7F/13F series SH05

(7) RV-35F/50F/70F series

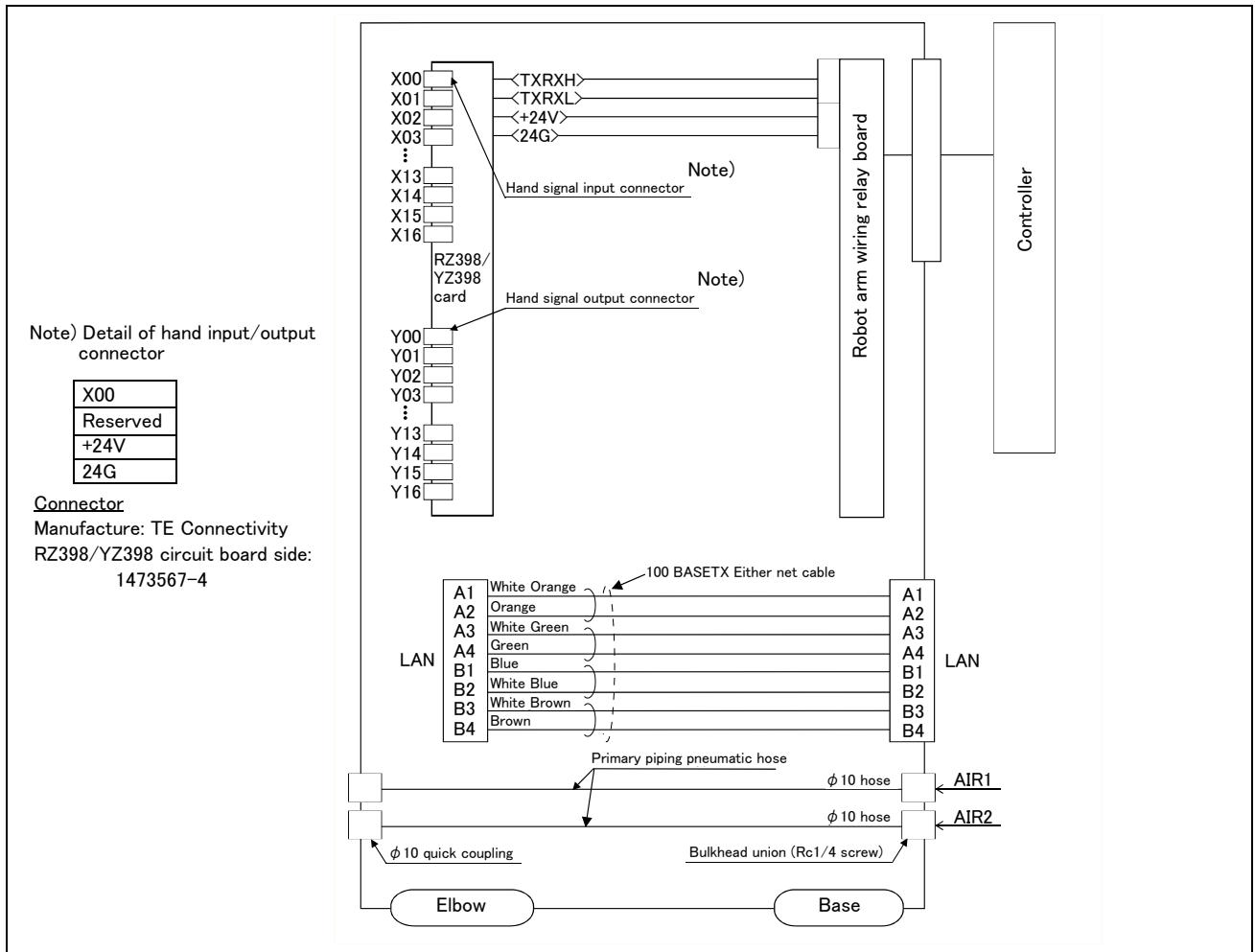


Fig.2-38 :Wiring and piping system diagram for hand and example the solenoid valve installation: RV-35F/50F/70F series

2.5.7 Electrical specifications of hand input/output: For RV-4F/7F/13F series

Table 2-14 : Electrical specifications of input circuit

Item		Specifications	Internal circuit
Type	DC input		<Sink type>
No. of input points	8		+24V +24V 820 3.3K HCn* 24G
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. 3.3k Ω		
Response time	OFF-ON ON-OFF	10ms or less (DC24V) 10ms or less (DC24V)	<Source type> +24V +24V 3.3K HCn* 24G 820

* HCn = HC1 to HC8

Table 2-15 : Electrical specifications of output circuit

Item		Specification	Internal circuit
Type	Transistor output		<Sink type>
No. of output points	8		+24V(COM) (Initial power supply)
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 ON-OFF	2ms or less (hardware response time) 2ms or less (resistance load) (hardware response time)	GRn* Protection of over-current 24G
Protects	Protects the over-current (0.9A)		<Source type> Protection of over-current 24G GRn*

* GRn = GR1 to GR8

2.6 Hand I/O card (RZ398/YZ398 card): For RV-35F/50F/70F series

2.6.1 Specifications

(1) RZ398 card (for non-CE marking specification)

Table 2-16 : Specifications

Item			Specification	Remarks		
Name			Hand I/O card			
Type			RZ398	For non-CE marking specification.		
Sink/source			Sink type			
Number of input points			16 point			
Insulation method			Photo coupler insulation			
Number of output points			16 point			
Insulation method			Photo coupler insulation, transistor output (100mA/point)			
General specification	Ambient temperature	When in use	0 to 55 deg.			
		When stored	-10 to 60 deg.			
	Ambient humidity	When in use	45 to 75% RH	Without dew drops.		
		When stored	20 to 80% RH	Without dew drops.		
	Vibration resistance		4.9m/s ² (0.5G) or less.	When in use		
	Shock resistance		29.4m/s ² (3.0G) or less	When transporting		
	Operating atmosphere		There must not be corrosive gas, dust, and oil mist			
Power supply specification	Power supply voltage		24VDC±5% (Ripple factor should be less than 5% (P-P))			
	Allowable momentary power failure period		16.5ms			
	Current consumption		5W Approx. 40W	When the power is ON When all output points (16 points) are ON		
Maximum heat generation			Approx. 10W	Predicted value		
Mass			0.1kg			

Table 2-17 : Electrical specifications of input circuits

Item		Specification	Internal circuit
Type		DC input	
Number of input points		16	
Insulation method		Photo coupler insulation	
Rated input voltage		DC24V	
Rated input current		Approx. 7mA	
Working voltage range		DC10.2V to DC26.4V (Ripple factor should be less than 5%)	
ON voltage/ON current		DC0.8V or more/2mA or less	
OFF voltage/ OFF current		DC0.4V or more/1mA or less	
Input resistance		Approx. 3.3k Ω	
Response time	OFF-ON	10ms or less(DC24V)	
	ON-OFF	10ms or less(DC24V)	
Common method		8 point 1 common	
External cable connection method		Connector	

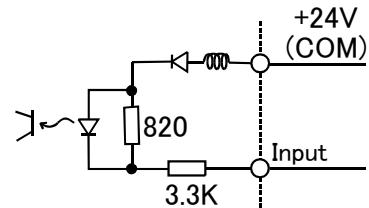
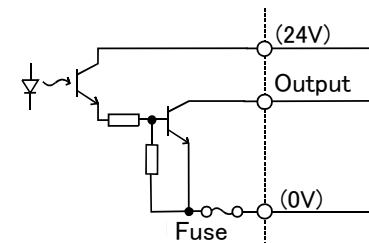
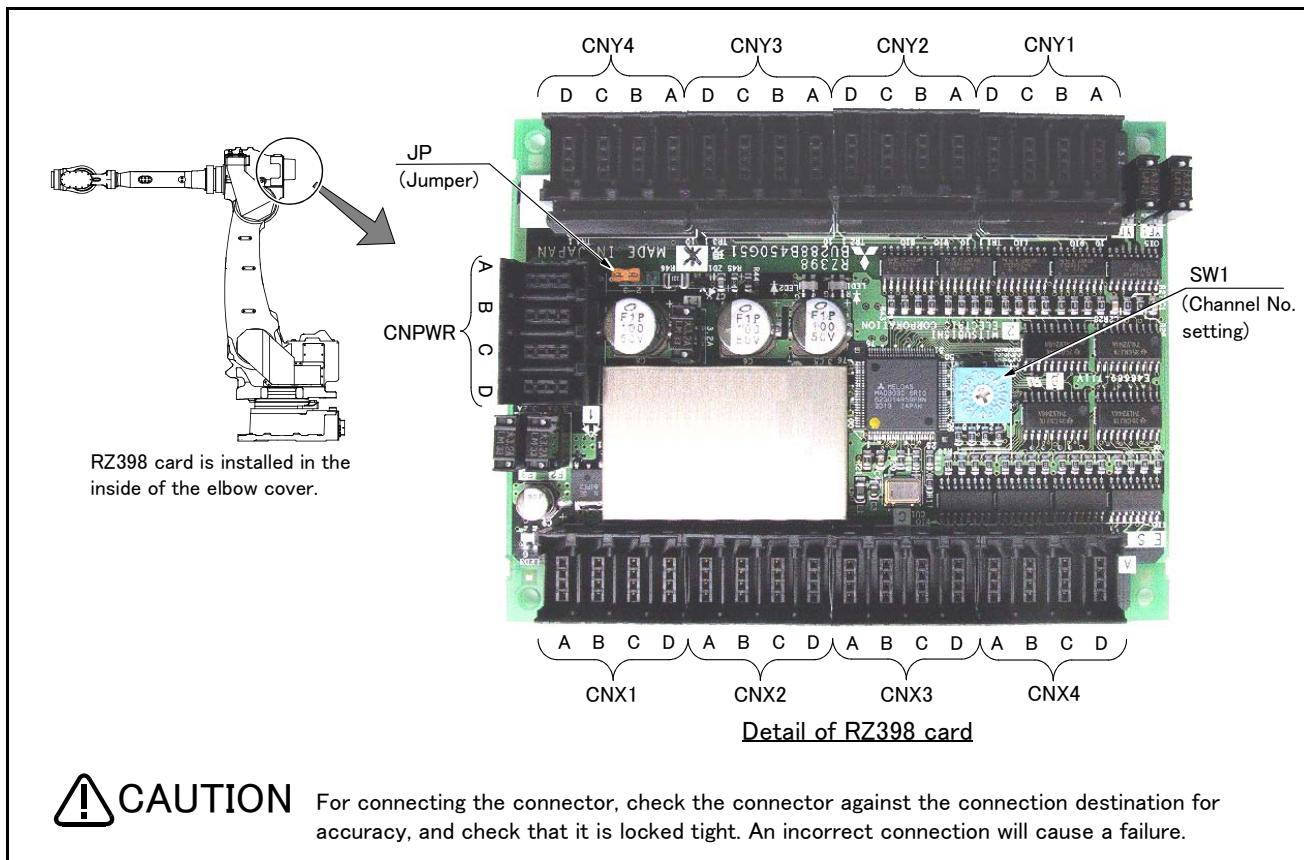


Table 2-18 : Electrical specifications of output circuits

Item		Specification	Internal circuit
Type		Transistor output	
Number of output points		16	
Insulation method		Photo coupler insulation	
Rated load voltage		DC24V	
Rated load voltage range		DC21.6V to DC26.4V	
Max. load current		0.1A/1 point (100%)	
Leakage current at OFF		0.1mA or less	
Max. voltage drop at ON		DC0.9V(TYP.)	
Response time	OFF-ON	2ms or less (hardware response time)	
	ON-OFF	2ms or less (Resistance load)(hardware response time)	
Fuse rating		Fuse rating:Fuse 3.2A (A fuse for 16 points)	
Common method		1 point 1 common (common terminal: 4 points)	
External wire connection method		connector (e-Con)	
External power supply	Voltage	DC24V(DC21.6 to 26.4V)	
	Current	60mA (TYP. 24VDC per common)(base drive current)	





CAUTION For connecting the connector, check the connector against the connection destination for accuracy, and check that it is locked tight. An incorrect connection will cause a failure.

Fig.2-39 : Detail of hand I/O card (RZ398)

(2) YZ398 card (for CE marking specification)

Table 2-19 : Specifications

Item			Specification	Remarks		
Name			Hand I/O card			
Type			YZ398	For CE marking specification.		
Sink/source			Sink/source changeable	Default setting is source.		
Number of input points			16 point			
Insulation method			Photo coupler insulation			
Number of output points			16 point			
Insulation method			Photo coupler insulation, transistor output (100mA/point)			
General specification	Ambient temperature	When in use	0 to 55 deg.			
		When stored	-10 to 60 deg.			
	Ambient humidity	When in use	45 to 75% RH	Without dew drops.		
		When stored	20 to 80% RH	Without dew drops.		
	Vibration resistance		4.9m/s ² (0.5G) or less.	When in use		
	Shock resistance		29.4m/s ² (3.0G) or less	When transporting		
Operating atmosphere			There must not be corrosive gas, dust, and oil mist			
Power supply specification	Power supply voltage		24VDC±5% (Ripple factor should be less than 5% (P-P))			
	Allowable momentary power failure period		16.5ms			
	Current consumption		5W Approx. 40W	When the power is ONWhen all output points (16 points) are ON		
Maximum heat generation			Approx. 10W	Predicted value		
Mass			0.1kg			

Table 2-20 : Electrical specifications of input circuits

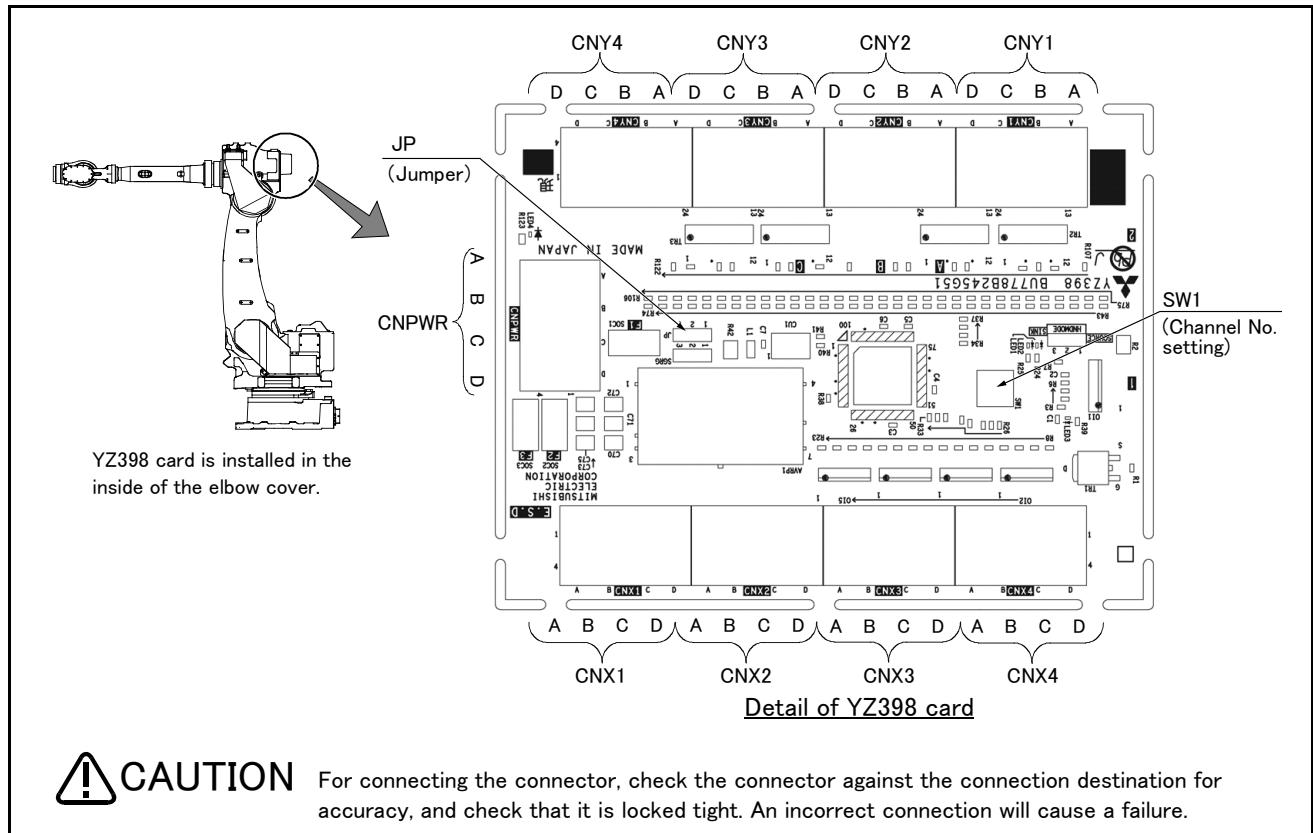
Item		Specification	Internal circuit
Type		DC input	<Sink type>
Number of input points		8	+24V +24V 820 3.3K HCn* 24G Ground
Insulation method		Photo coupler insulation	
Rated input voltage		DC24V	
Rated input current		Approx. 7mA	
Working voltage range		DC10.2V to DC26.4V (ripple rate within 5%)	
ON voltage/ON current		DC8V or more/2mA or more	
OFF voltage/ OFF current		DC4V or less/1mA or less	
Input resistance		Approx. 3.3k Ω	
Response time	OFF-ON	10ms or less (DC24V)	<Source type> +24V +24V 3.3K HCn* 24G Ground
	ON-OFF	10ms or less (DC24V)	

* HCn = HC1 to HC8

Table 2-21 : Electrical specifications of output circuits

Item	Specification		Internal circuit
Type	Transistor output		<Sink type>
Number of output points	8		Fuse 3.2A +24V GRn Protection over current 24G
Insulation method	Photo coupler insulation		
Rated load voltage	DC24V		
Rated load voltage range	DC21.6V to DC26.4V		
Max. load current	0.1A/1 point (100%)		
Leakage current at OFF	0.1mA or less		
Max. voltage drop at ON	DC0.9V(TYP.)		
Response time	OFF-ON	2ms or less (hardware response time)	
	ON-OFF	2ms or less (Resistance load)(hardware response time)	
Protects	Protects the over-current (0.9A)		

* GRn = GR1 to GR8

**CAUTION**

For connecting the connector, check the connector against the connection destination for accuracy, and check that it is locked tight. An incorrect connection will cause a failure.

Fig.2-40 : Detail of hand I/O card (YZ398)

2.6.2 I/O connector for hand

■ Connector pin assignments

CNX1

	A	B	C	D
1	X00	X01	X02	X03
2				
3	+24V	+24V	+24V	+24V
4	24G	24G	24G	24G

CNX2

	A	B	C	D
1	X04	X05	X06	X07
2				
3	+24V	+24V	+24V	+24V
4	24G	24G	24G	24G

CNX3

	A	B	C	D
1	X08	X09	X0A	X0B
2				
3	+24V	+24V	+24V	+24V
4	24G	24G	24G	24G

CNX4

	A	B	C	D
1	X0C	X0D	X0E	X0F
2				
3	+24V	+24V	+24V	+24V
4	24G	24G	24G	24G

CNY1

	A	B	C	D
1	Y00	Y01	Y02	Y03
2				
3	+24V	+24V	+24V	+24V
4	24G	24G	24G	24G

CNY2

	A	B	C	D
1	Y04	Y05	Y06	Y07
2				
3	+24V	+24V	+24V	+24V
4	24G	24G	24G	24G

CNY3

	A	B	C	D
1	Y08	Y09	Y0A	Y0B
2				
3	+24V	+24V	+24V	+24V
4	24G	24G	24G	24G

CNY4

	A	B	C	D
1	Y0C	Y0D	Y0E	Y0F
2				
3	+24V	+24V	+24V	+24V
4	24G	24G	24G	24G

■ Assignment of power supply input and communication lines

1) Power supply communication lines

CNPWR

	A	B	C	D
1	TXRXH 1	TXRXH 2	+24V	+24V
2	TXRXL 1	TXRXL 2	24G	24G
3			+24V	+24V
4	SG	SG	24G	24G

(Columns A and B).....Although the same signals are wired for TXRXH and TXRXL, they are described as separate signals in the pin assignment. The plug with a terminator (330Ω) is installed in column B.

(Column C).....Power supply input of this card (Insert a fuse to supply power to the card.)

(Column D).....Transfers the column A power supplies as they are. (No fuse is supplied.)

2) JPs (jumper pins for setting terminators)

1	REG 1
2	REG 2
3	open

(REG 1).....When a jumper pin is used to short-circuit between 1 and 2, the terminator is effective (embedded 100Ω resistor).

(REG 2).....When a jumper pin is used to short-circuit between 2 and 3, the terminator is disabled (The plug with a terminator installed in column B is effective).

(1) Outline of RZ398/YZ398 card

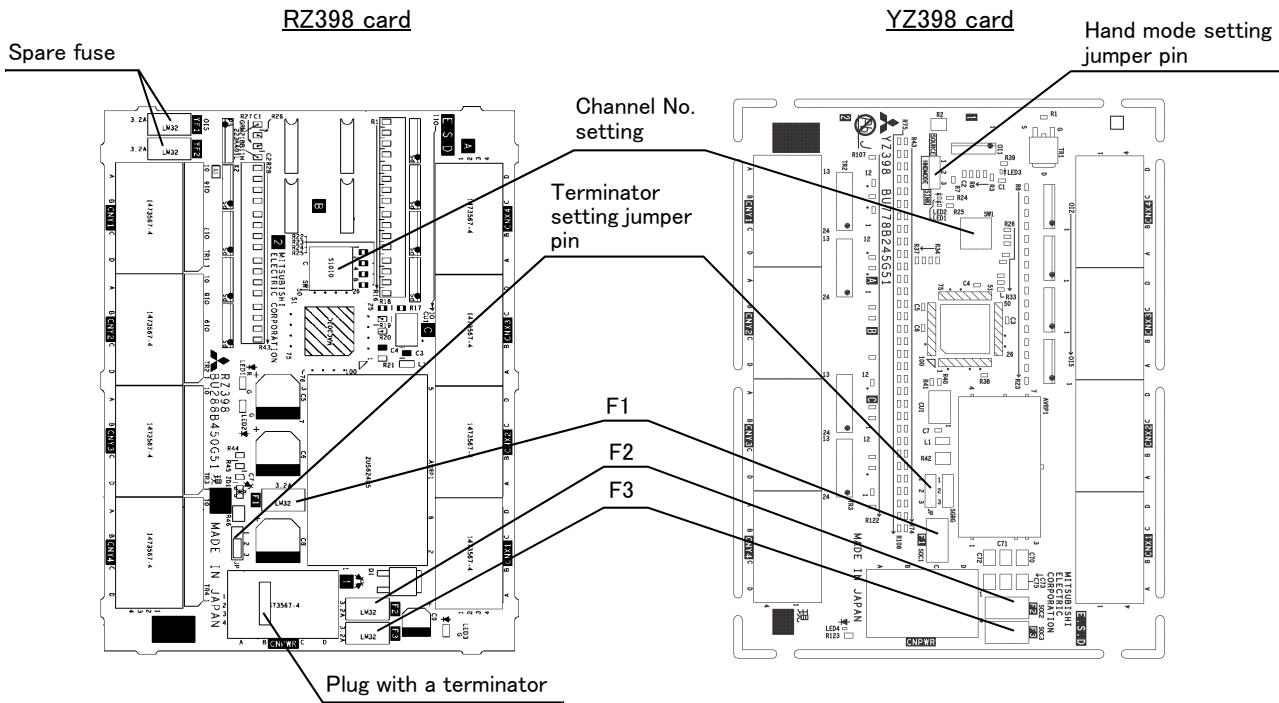


Fig.2-41 : Outline of RZ398/YZ398 card

1) Jumper setting for terminator

Short-circuits between 2 and 3 with jumper pin to disable the terminator. The plug with a terminator installed in column B is effective. (Default setting)

2) Channel No. setting

Channel No. 7 (Default setting)

3) Station number settings and input signal assignments (Channel No. 7)

4) Jumper setting for hand mode (YZ398 card only)

Short-circuits between 1 and 2 with jumper pin: Source type (Default setting)

Short-circuits between 2 and 3 with jumper pin: Sink type

Table 2-22 : Station number settings and input signal assignment (channel No. 7)

Signal name ^{Note1)}	Connector name	X (input)	Signal name ^{Note1)}	Connector name	Y (output)
X00		764	Y00		764
X01	CNX1	765	Y01	CNY1	765
X02		766	Y02		766
X03		767	Y03		767
X04		768	Y04		768
X05	CNX2	769	Y05	CNY2	769
X06		770	Y06		770
X07		771	Y07		771
X08		772	Y08		772
X09	CNX3	773	Y09	CNY3	773
X0A		774	Y0A		774
X0B		775	Y0B		775
X0C		776	Y0C		776
X0D	CNX4	777	Y0D	CNY4	777
X0E		778	Y0E		778
X0F		779	Y0F		779

Note1) The signal names represent the names described in Page 75, "■ Connector pin assignments" on the previous page.

Status	Signal assignment
Input circuit power supply line fuse blown	792
Output circuit power supply line fuse blown	793

Table 2-23 : Fuse list

No.	Capacity	Model	Uses	Remarks
F1	3.2A	LM32	To protect the output circuit power supply line.	16 points in a batch
F2	3.2A	LM32	To protect 24V power supply	
F3	3.2A	LM32	To protect the iutput circuit power supply line.	16 points in a batch

2.6.3 Air supply circuit example for the hand

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

- (1) Make sure that a surge voltage protection circuit such as a diode is connected to the solenoid coil in parallel.
- (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. 2-42 (RV-4F/7F/13F series), Fig. 2-43 (RV-35F/50F/70F series) 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 RV-4F/7F/13F series 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 coupling or the hose surface.

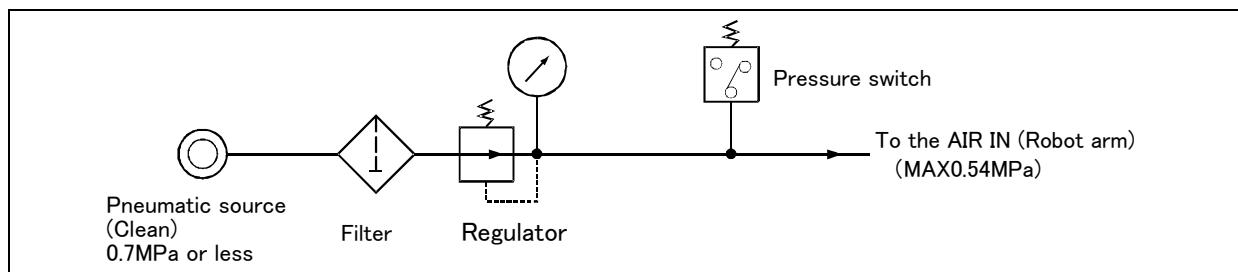


Fig.2-42 : Air supply circuit example for the hand (RV-4F/7F/13F series)

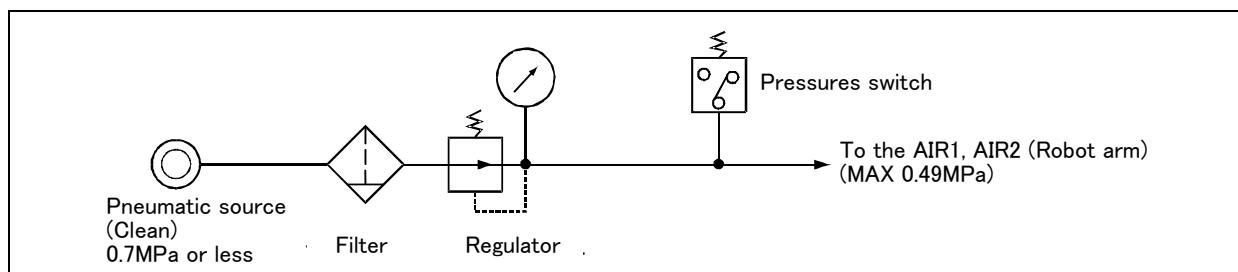


Fig.2-43 : Air supply circuit example for the hand (RV-35F/50F/70F series)

2.6.4 About the Installation of Tooling Wiring and Piping

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

Screw holes are provided on the robot arm for the installation of tooling wiring, piping and metal fixtures. (Refer to the [Page 36, "2.4 Outside dimensions • Operating range diagram"](#).)

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

<Precautions>

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

2.7 Shipping special specifications, options, and maintenance parts

2.7.1 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 typeCR750 drive unit: 1S-02UCBL-01 (2m)
CR751 drive unit: 1F-02UCBL-02 (2m)

■ Outline



<CR751 drive unit>



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 2-24 : Configuration equipment and types

Part name	Type	Qty.	Mass (Kg) Note1)	Remarks Note2)
CR750 drive unit				
Fixed	Set of signal and power cables	1S-02UCBL-01	1 set	3.4
	Motor signal cable		(1 cable)	—
	Motor power cable		(1 cable)	—
RCR751 drive unit				
Fixed	Set of signal and power cables	1F-02UCBL-02	1 set	2.6
	Motor signal cable		(1 cable)	—
	Motor power cable		(1 cable)	—

Note1) Mass indicates one set.

Note2) Standard 5 m (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.

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

(1) Machine cable extension

■ Order type:	● CR750 drive unit.....Fixed type: 1S- □□ CBL-01 Flexed type: 1S- □□ LCBL-01	(extension type) (extension type)
	● CR751 drive unit.....Fixed type: 1F- □□ UCBL-02 Flexed type: 1F- □□ LUCBL-02	(direct type) (direct type)
	● CR760 drive unit.....Fixed type: 1F- □□ CBL-21 Flexed type: 1F- □□ LCBL-21 Fixed type: 1F- □□ CBLS-21	(extension type, for non-CE marking) (extension type, for non-CE marking) (extension type, for CE marking)

Note) □□ refer the length.

■ Outline

<CR750drive unit>



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

A fixed type and flexible type are available.

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

The extended method is discriminated as follows.

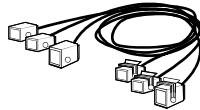
Direct type • Exchanges with the machine cable attached in the standards.

Extension type • Adds to the machine cable attached in the standards.

<CR751drive unit>



<CR760drive unit>



■ Configuration

Table 2-25 : Configuration equipment and types

Part name	Type ^{Note1)}	Qty.		Mass (kg) ^{Note2)}	Remarks
		Fixed	Flexed		
CR750 drive unit					
Fixed	Set of signal and power cables	1S- □□ CBL-01	1 set	-	6.7(5m) 12(10m) 17(15m)
	Motor signal cable		(1 cable)	-	
	Motor power cable		(1 cable)	-	
Flexed	Set of signal and power cables	1S- □□ LCBL-01	-	1 set	7(5m) 13(10m) 17(15m)
	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	-	
CR751 drive unit					
Fixed	Set of signal and power cables	1F- □□ UCBL-02	1 set	-	6.7(10m) 12(15m) 17(20m)
	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)
	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	-	

Part name	Type ^{Note1)}	Qty.		Mass (kg) ^{Note2)}	Remarks			
		Fixed	Flexed					
CR760 drive unit								
Non-CE marking specification								
Fixed	Set of signal and power cables	1F- □□ CBL-21	1 set	-	13.5(5m) 24.5(10m) 34.5(15m)			
	Motor signal cable (CN2)		(1 cable)	-				
	Motor power cable (CN1)		(1 cable)	-				
	Motor power cable (CN3)		(1 cable)	-				
Flexed	Set of signal and power cables	1F- □□ LCBL-21	-	1 set	13.5(5m) 24.5(10m) 34.5(15m)			
	Motor signal cable (CN2)		-	(1 cable)				
	Motor power cable (CN1)		-	(1 cable)				
	Motor power cable (CN3)		-	(1 cable)				
Nylon clamp		NK-14N	-	2 pcs.	-			
Nylon clamp		NK-18N	-	2 pcs.	-			
Nylon clamp		NK-24N	-	2 pcs.	-			
Silicon rubber			-	6 pcs	-			
CE marking specification								
Fixed	Set of signal and power cables	1F- □□ CBLS-21	1 set	-	14.0(5m) 25.4(10m) 35.8(15m)			
	Motor signal cable (CN2)		(1 cable)	-				
	Motor power cable (CN1)		(1 cable)	-				
	Motor power cable (CN3)		(1 cable)	-				

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 2-26](#).

Table 2-26 : Conditions for the flexed type cables

Item		Specifications		
Cable		1S- □□ LCBL-01	1F- □□ LUCBL-02	1F- □□ LCBL-21
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	IP54 (except for the area approximately 500 mm from the end of the connector on the controller side)	IP54
Cable configuration	Motor signal cable	φ 6 x 5, φ 8.5 x 1, and φ 1.7 x 1	φ 6 x 7 and φ 1.7 x 1	CN2: φ 6 x 5, φ 8.5 x 1, and φ 1.7 x 1
	Motor power cable	φ 6.5 x 8 and φ 8.9 x 2	φ 6.5 x 8 and φ 8.9 x 2	CN1: φ 6.5 x 8 and φ 8.9 x 2 CN3: φ 12.6 x 4

[Caution] The guidance of life count may greatly differ according to the usage state items related to [Table 2-26](#) 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 2–27](#). Refer to this table when selecting the cableveyor.

Table 2–27 : Cable configuration (Flexed type)

Item	Motor signal cable			Motor power cable		
CR750 drive unit						
No. of cores	AWG#24 (0.2mm ²)–4P	AWG#24 (0.2mm ²)–7P	AWG#18 (0.75mm ²)	AWG#16 (1.25mm ²)–4C	AWG#18 (0.75mm ²)–4C	
Finish dimensions	Approx. φ 6mm	Approx. φ 8.5mm	Approx. φ 1.7mm	Approx. φ 8.9mm	Approx. φ 6.5mm	
No.of cables used	5 cables	1 cable	1 cable	3 cable	6 cable	
No. in total	7 cables			9 cables		
CR751drive unit						
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	AWG#18 (0.75mm ²)–3C	
Finish dimensions	Approx. φ 6mm	Approx. φ 1.7mm	Approx. φ 8.9mm	Approx. φ 6.5mm	Approx. φ 6.5mm	
No.of cables used	7 cables	1 cable	2 cable	8 cable	8 cable	
No. in total	8 cables			10 cables		
Item	Motor signal cable (CN2)			Motor power cable (CN1)	Motor power cable (CN3)	
CR760drive unit						
No. of cores	AWG #24 (0.2mm ²)–4P	AWG #24 (0.2mm ²)–7P	AWG #18 (0.75mm ²)	AWG #16 (1.25mm ²)–4C	AWG #18 (0.75mm ²)–4C	AWG #15 (2.0mm ²)–8C
Finish dimensions	Approx. φ 6mm	Approx. φ 8.5mm	Approx. φ 1.7mm	Approx. φ 1.7mm	Approx. φ 1.7mm	Approx. φ 31mm
No.of cables used	5 cables	1 cable	1 cable	2 cables	8 cables	4 cables
No. in total	7 cables			10 cables		4 cables

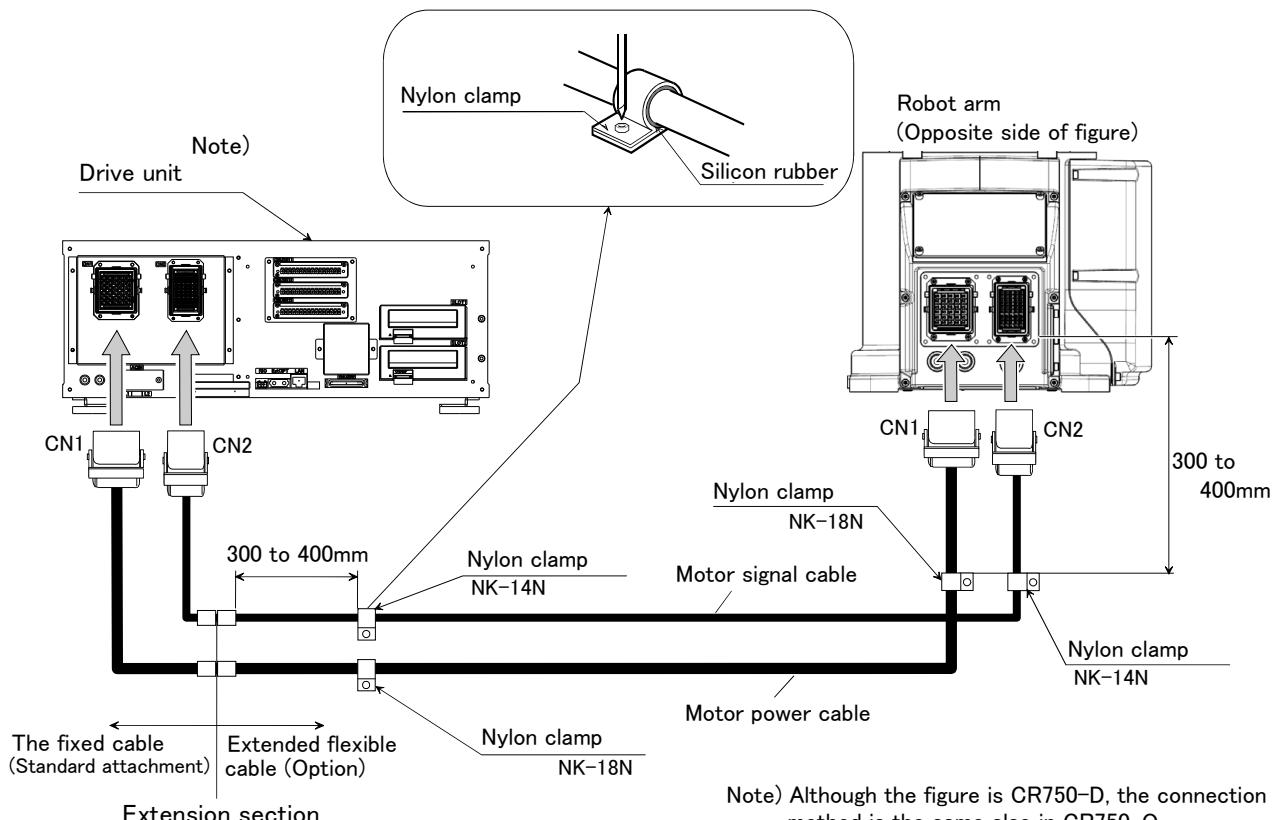
■ Fixing the flexible cable

<CR750 drive unit>

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

The connection method to a robot arm is the same as a standard machine cable. Please refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" and connect.

- (2) Wind the silicon rubber around the cable at a position 300 to 400 mm from the side of robot arm and extension section as shown below, and fix with the nylon clamp to protect the cable from external stress.

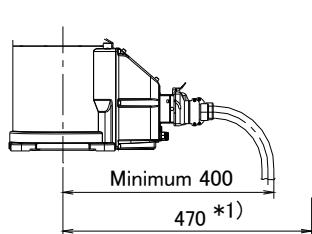


CAUTION

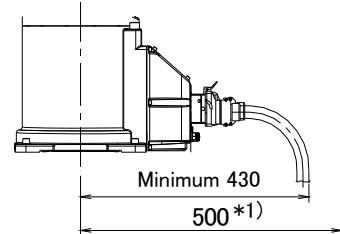
Cover the extension terminal area with the cover etc. so that it may not be easily touched to the latch lever.

The bend size of cables are as follows.

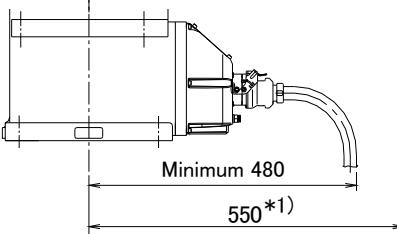
<RV-4F series>



<RV-7F series>



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



*1) The connection space for a machine cable.

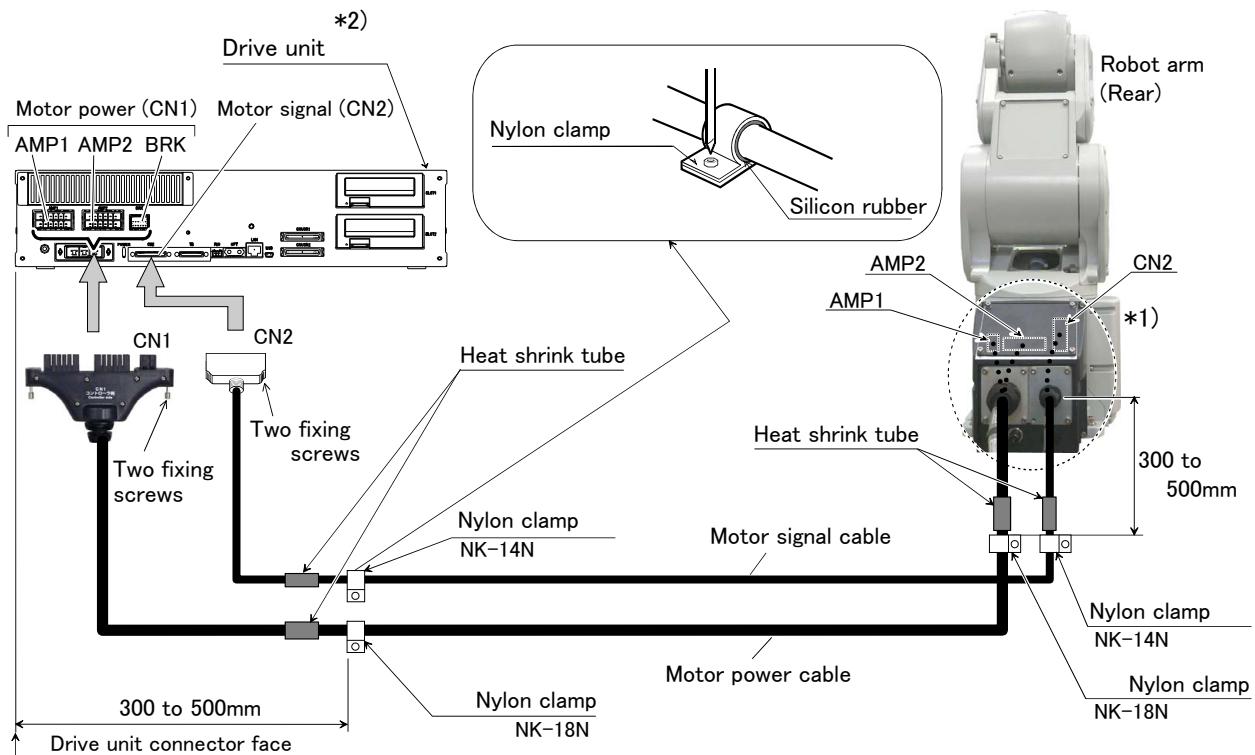
Fig.2-44 : Fixing the flexible cable (CR750 drive unit)

<CR751 drive unit>

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

The connection method to a robot arm is the same as a standard machine cable. Please refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" and connect.

- (2) For protection of wires from external stress, refer to following. Wrap the cable with the supplied silicon rubber and fix the cable with nylon clamps in the area between the heat shrink tubes on the robot and the controller sides (flexible cable area).



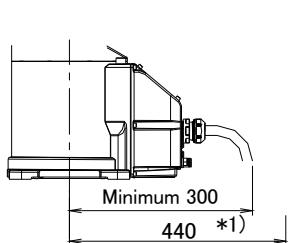
*1) Connect the robot arm side connector to the connector which is inside the CONBOX cover.

*2) The flexible cable area is the area between the heat shrink tubes on the robot and the drive unit sides.

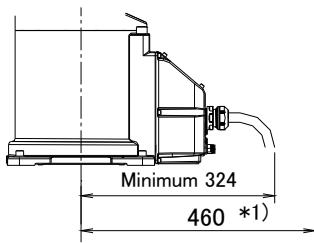
*3) Although the figure is CR750-D, the connection method is the same also in CR750-Q.

The bend size of cables are as follows.

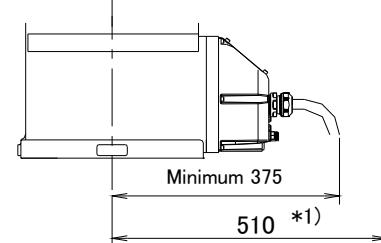
<RV-4F series>



<RV-7F series>



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



*1) The connection space for a machine cable.

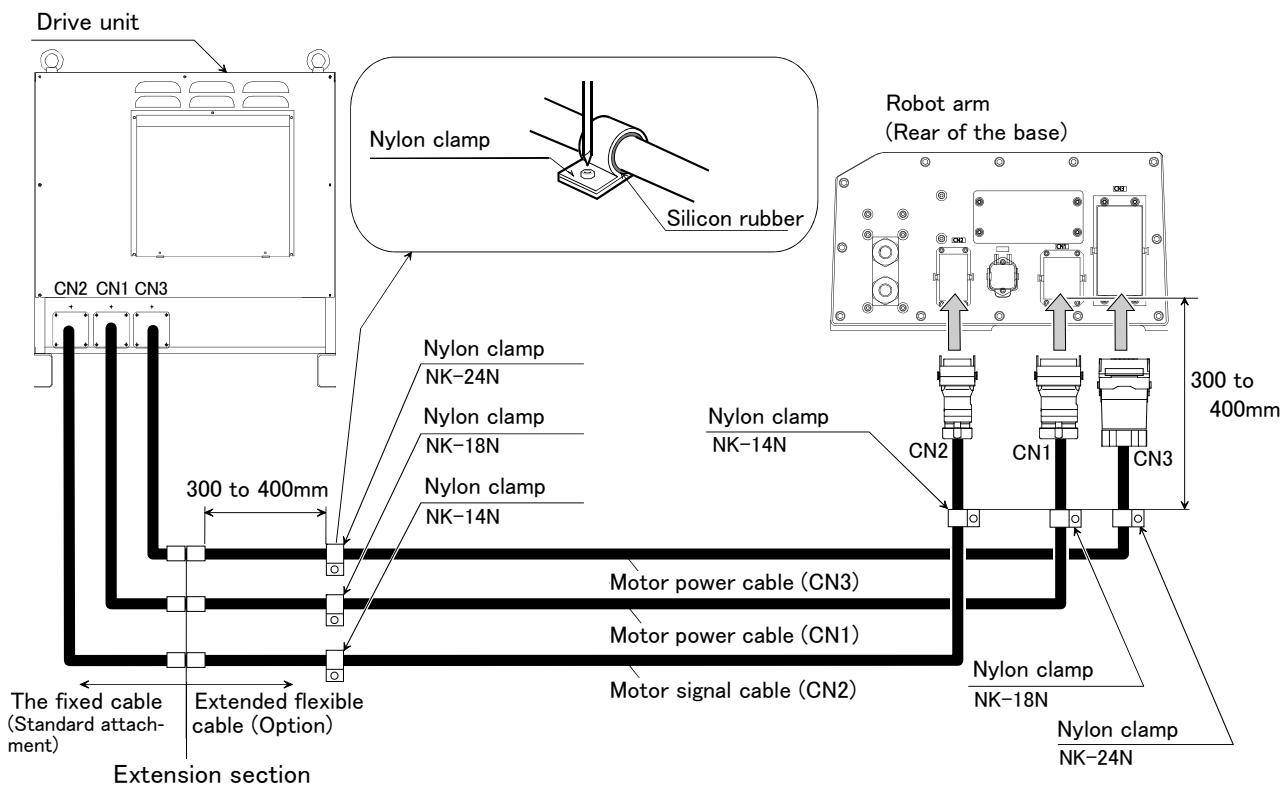
Fig.2-45 : Fixing the flexible cable (CR751 drive unit)

<CR760 drive unit>

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

The connection method to a robot arm is the same as a standard machine cable. Please refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" and connect.

- (2) Wind the silicon rubber around the cable at a position 300 to 400 mm from the side of robot arm and extension section as shown below, and fix with the nylon clamp to protect the cable from external stress.



⚠ CAUTION

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

The bend size of cables are as follows.

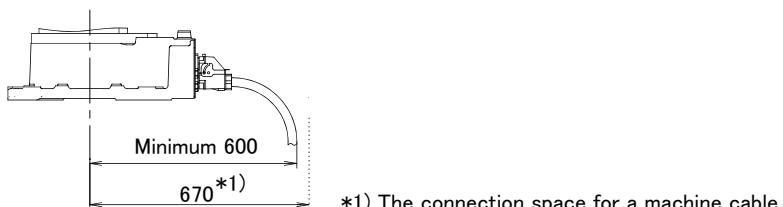


Fig.2-46 : Fixing the flexible cable (CR760 drive unit)

(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 2-28 : 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

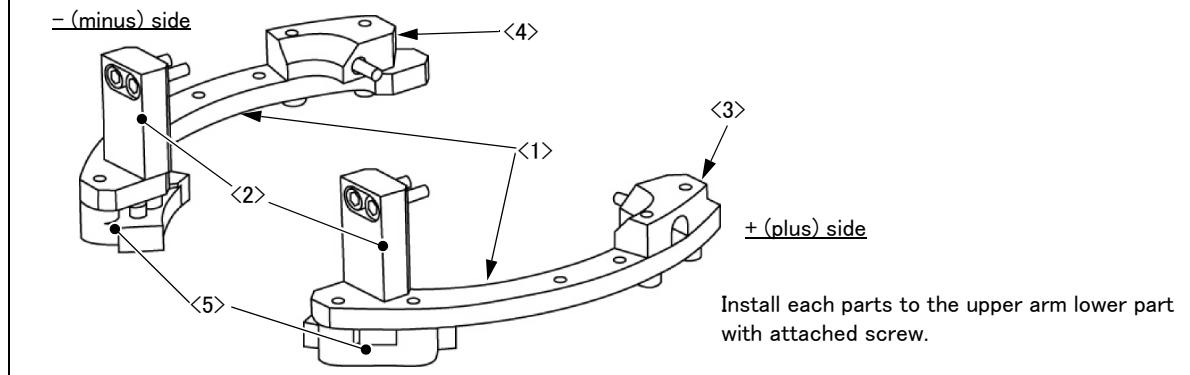


Table 2-29 : Changeable angle (RV-4F series)

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 91 “Fig. 2-47: 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 2-29](#). The changeable angle shown in [Table 2-29](#) 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 2-29](#).
- 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 2-30 : Configuration devices (RV-7F 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 (M12x25)	2		Use for mechanical stopper screw A and B
<7>	Screw (M8x25)	14		For fixing
<8>	Screw (M8x20)	4		For fixing

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

Table 2-31 : 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 91 "Fig. 2-47: 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.

- The changeable angle of RV-7F series is shown in [Table 2-31](#). The changeable angle shown in [Table 2-31](#) 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.
- The changeable angle can be set independently on the + (plus) side/ - (minus) side, within the condition shown in [Table 2-31](#).

- 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)

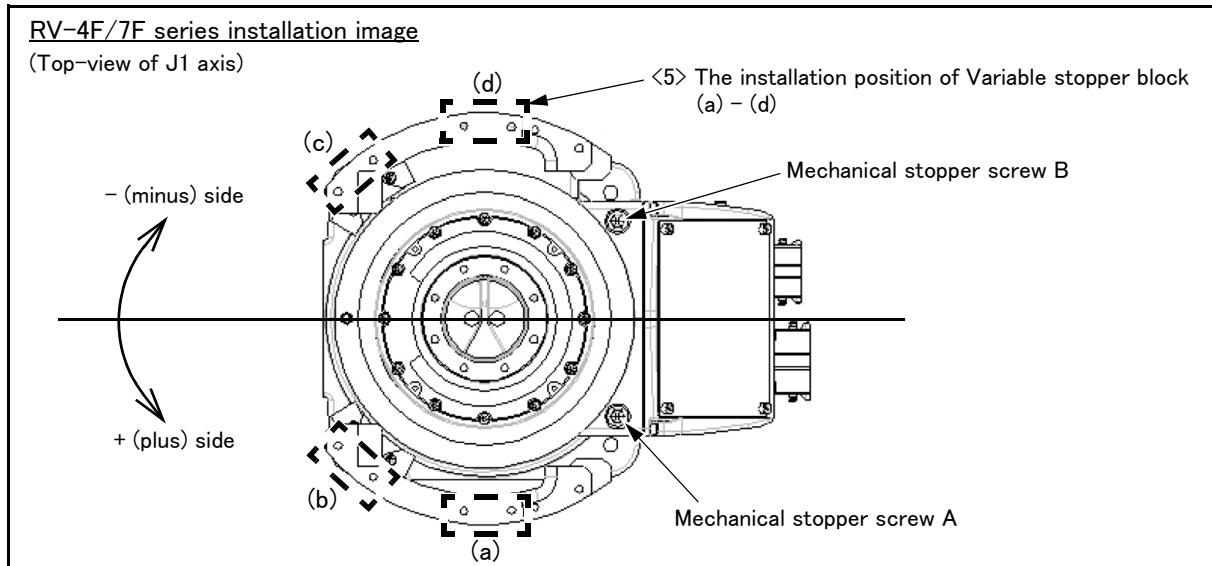


Fig.2-47 : Installation image of J1axis operating range change option (RV-4F/7F series)

[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 2-32 : Configuration devices (RV-13F series)

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

The image shows three 3D technical drawings of mechanical parts. On the left is a long rectangular block labeled <1> Stopper Block J1, featuring two circular holes near one end and two small circular features on the side. In the center is a smaller, L-shaped block labeled <2> Resin Stopper B, which has a central slot and two protrusions. To its right is another similar L-shaped block.

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

Table 2-33 : 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 2-33 is related with the symbol of "Fig. 2-48: Installation image of J1axis operating range change option (RV-13F series)".

- 1) The changeable angle of RV-13F series is shown in Table 2-33. The changeable angle shown in Table 2-33 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 2-33.
- 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.

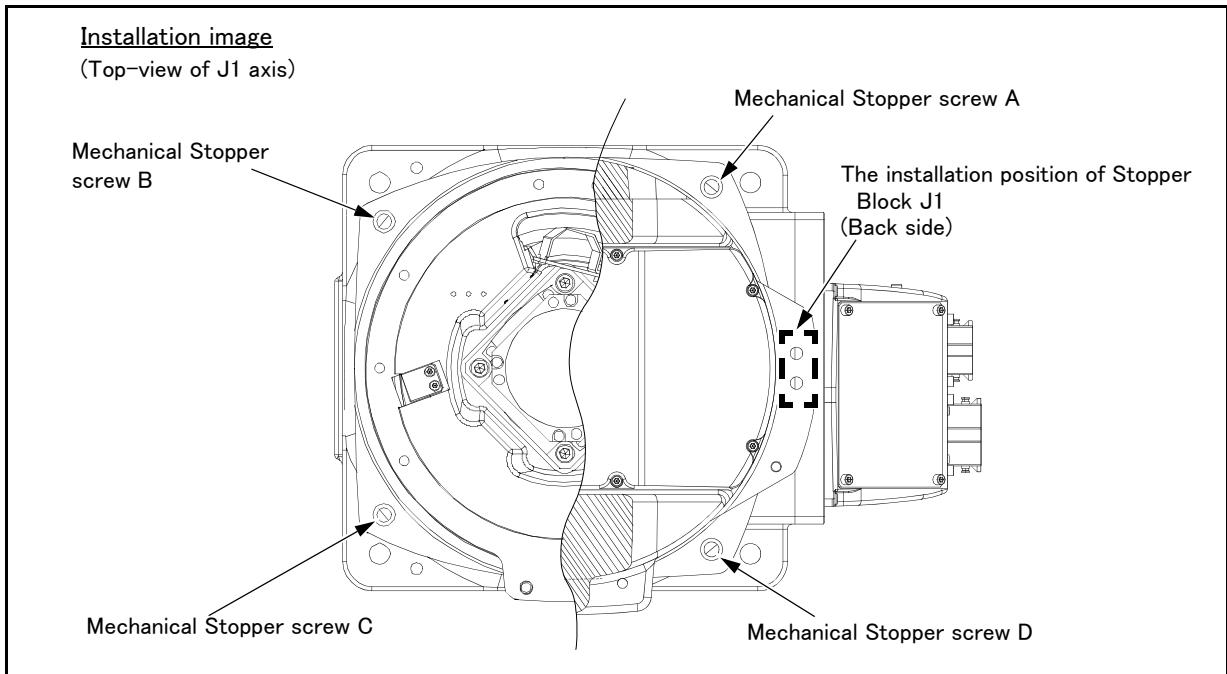


Fig.2-48 : Installation image of J1axis operating range change option (RV-13F series)

[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-7FL “-02”
· RV-13F/13FL and RV-20F “-03”

■ Outline

1F-VD0*-021F-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 electromechanical set onto the robot, it comes equipped with a manifold, couplings, connectors, among other things.

■ Configuration

Table 2-34 : 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 99, "(5) Hand output cable".
Solenoid valve set (2 sets)	1F-VD02-**/ 1F-VD02E-**	—	1 pc.	—	—	0.4	1F-VD0*-01: Sink type 1F-VD0*-E-01: Source type.
Solenoid valve set (3 sets)	1F-VD03-**/ 1F-VD03E-**	—	—	1 pc.	—	0.4	Coupling size of A/B-port (output side of solenoid valve) · 1F-VD0*-02/1F-VD0*-E-02 : Φ4 · 1F-VD0*-03/1F-VD0*-E-03 : Φ6
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 2-35 : Valve specifications

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

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

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

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 2-36 : Solenoid specifications

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

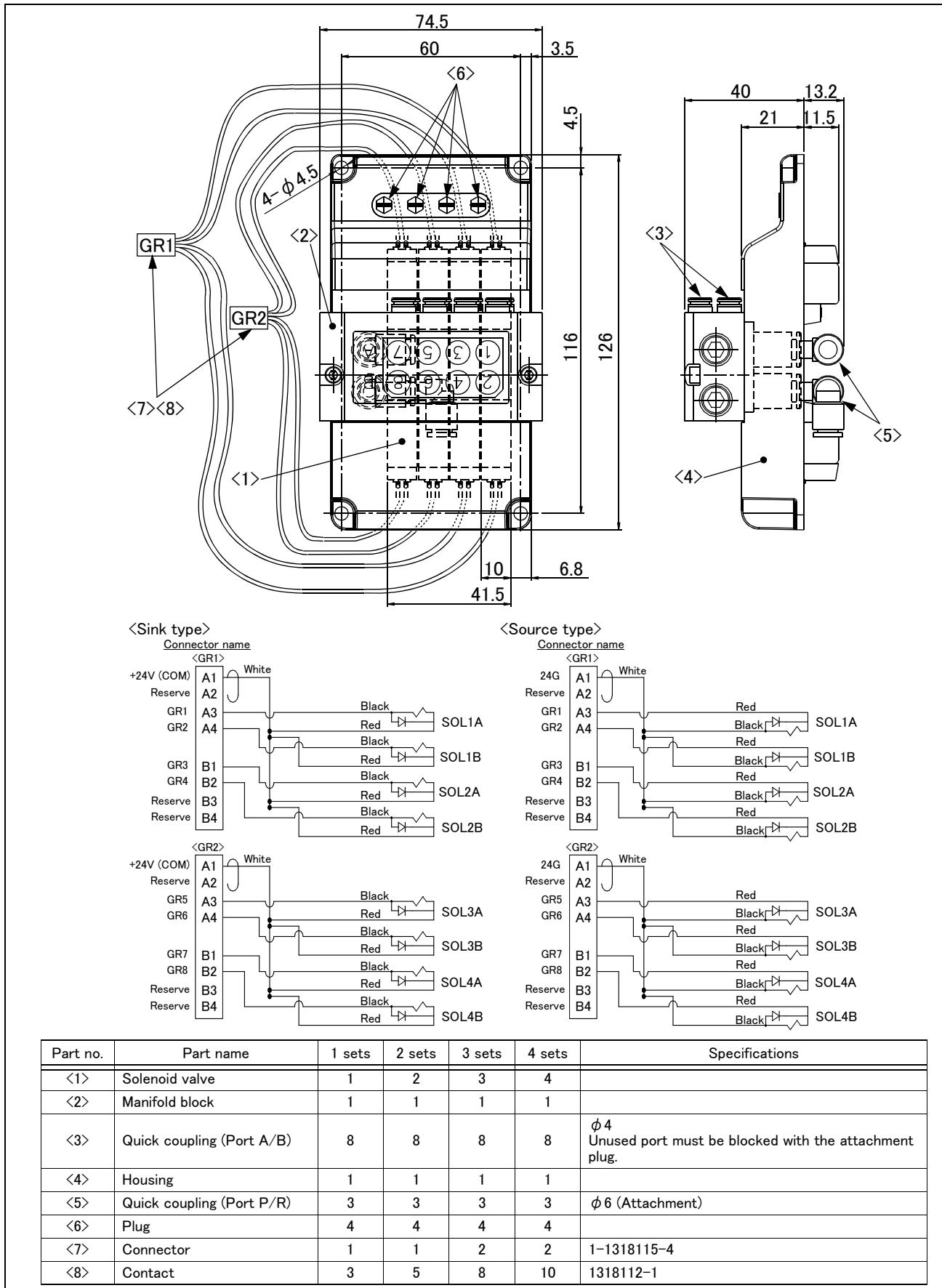


Fig.2-49 : Outline dimensional drawing (1F-VDO*-02/1F-VDO*-E-02)

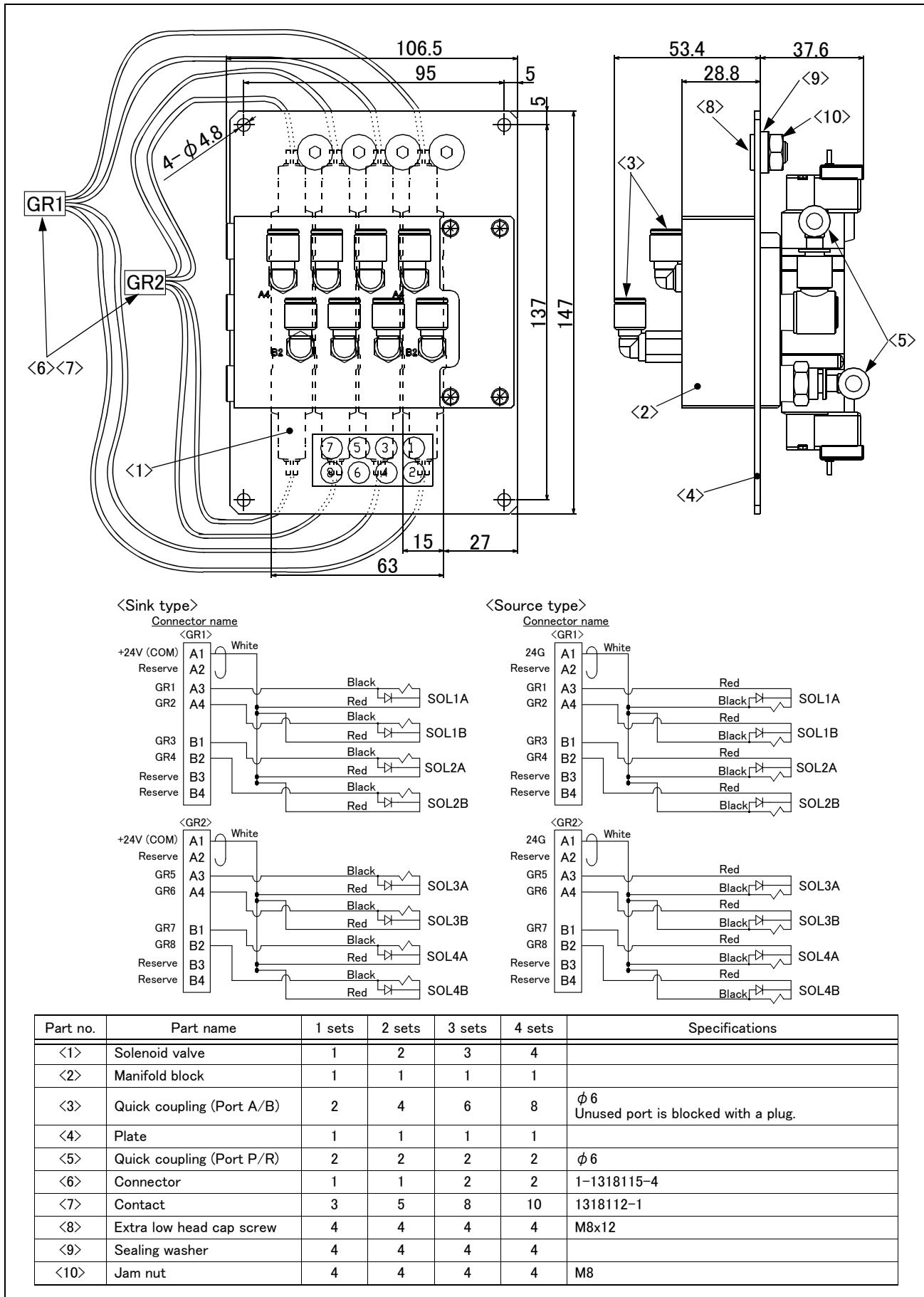


Fig.2-50 : Outline dimensional drawing (1F-VD0*-03/1F-VD0*E-03)

(4) Hand input cable

- Order type: RV-4F/7F/13F series 1F-HC35S-02
RV-35F/50F/70F series 1F-HC2000S-21 (standard: 8 points)
1F-HC2000S-22 (extension: 8 points)

■ 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 2-37 : Configuration equipment

Part name	Type	Qty.	Mass (kg) <small>Note1)</small>	Remarks
RV-4F/7F/13F series				
Hand input cable	1F-HC35S-02	1 cable	0.2	
RV-35F/50F/70F series				
Hand input cable standard: 8 points	1F-HC2000S-21	1 cable	0.3	For HC1 to HC8
Hand input cable extension: 8 points	1F-HC2000S-22	1 cable	0.3	For X08 to X15

Note1) Mass indicates one set.

■ Specifications

Table 2-38 : Specifications

Item	Specifications	Remarks
RV-4F/7F/13F series		
Size x cable core	AWG #24 (0.2mm ²) x 10 cores	One-sided connector, one-sided cable bridging
Total length	1000mm	
RV-35F/50F/70F series		
Size x cable core	AWG #25 (0.16mm ²) x 12 pairs (total 24)	One-sided connector, one-sided cable bridging
Total length	2000mm	

Pin assign of the hand input cable is shown below.

(1) RV-4F/7F/13F series

Table 2-39 : Pin assign of hand input cable

Color	Connector <small>Note1)</small>	Pin number: names	Color	Connector <small>Note1)</small>	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.

(2) RV-35F/50F/70F series

● 1F-HC2000S-21

Table 2-40 : Pin assign of hand input cable

Color ^{Note1)}	Connector	Pin number: names	Color ^{Note1)}	Connector	Pin number: names
[Blue	X00	1: X00	[Yellow	X04	1: X04
White		3: +24V	Brown		3: +24V
[Yellow	X01	4: 24G	[Green	X05	4: 24G
White		1: X01	Brown		1: X05
[Green	X02	3: +24V	[Red	X06	3: +24V
White		4: 24G	Brown		4: 24G
[Red	X03	1: X02	[Purple	X06	1: X06
White		3: +24V	Brown		3: +24V
[Purple	X03	4: 24G	[Blue	X07	4: 24G
White		1: X03	Black		1: X07
[Blue	X03	3: +24V	[Yellow	X07	3: +24V
Brown		4: 24G	Black		4: 24G

Note1) “[“ means twisted pair.

● 1F-HC2000S-22

Table 2-41 : Pin assign of hand input cable

Color ^{Note1)}	Connector	Pin number: names	Color ^{Note1)}	Connector	Pin number: names
[Blue	X08	1: X08	[Yellow	X12	1: X12
White		3: +24V	Brown		3: +24V
[Yellow	X09	4: 24G	[Green	X13	4: 24G
White		1: X09	Brown		1: X13
[Green	X10	3: +24V	[Red	X14	3: +24V
White		4: 24G	Brown		4: 24G
[Red	X10	1: X10	[Purple	X14	1: X14
White		3: +24V	Brown		3: +24V
[Purple	X11	4: 24G	[Blue	X15	4: 24G
White		1: X11	Black		1: X15
[Blue	X11	3: +24V	[Yellow	X15	3: +24V
Brown		4: 24G	Black		4: 24G

Note1) “[“ means twisted pair.

(5) Hand output cable

- Order type: RV-4F/7F/13F series..... 1F-GR35S-02
 RV-35F/50F/70F series 1F-GR2000S-21 (standard: 8 points)
 1F-GR2000S-22 (extension: 8 points)

■ 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 2-42 : Configuration equipment

Part name	Type	Qty.	Mass (kg) Note1)	Remarks
RV-4F/7F/13F series				
Hand output cable	1F-GR35S-02	1 cable	0.2	
RV-35F/50F/70F series				
Hand output cable standard: 8 points	1F-GR2000S-21	1 cable	0.3	For GR1 to GR8
Hand output cable extension: 8 points	1F-GR2000S-22	1 cable	0.3	For X08 to X15

Note1) Mass indicates one set.

■ Specifications

Table 2-43 : Specifications

Item	Specifications		Remarks
RV-4F/7F/13F series			
Size x cable core	AWG #24 (0.2mm ²) x 10 cores		One-sided connector, one-sided cable bridging
Total length	500mm		
RV-35F/50F/70F series			
Size x cable core	AWG #25 (0.16mm ²) x 12 pairs (total 24)		One-sided connector, one-sided cable bridging
Total length	2000mm		

Pin assign of the hand output cable is shown below.

(1) RV-4F/7F/13F series

Table 2-44 : 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.

(2) RV-35F/50F/70F series

● 1F-GR2000S-21

Table 2-45 : Pin assign of hand input cable

Color ^{Note1)}	Connector	Pin number: names	Color ^{Note1)}	Connector	Pin number: names
[Blue	X00	1: X00	[Yellow	X04	1: X04
White		3: +24V	Brown		3: +24V
[Yellow	X01	4: 24G	[Green	X05	4: 24G
White		1: X01	Brown		1: X05
[Green	X02	3: +24V	[Red	X06	3: +24V
White		4: 24G	Brown		4: 24G
[Red	X03	1: X02	[Purple	X06	1: X06
White		3: +24V	Brown		3: +24V
[Purple	X03	4: 24G	[Blue	X07	4: 24G
White		1: X03	Black		1: X07
[Blue	X03	3: +24V	[Yellow	X07	3: +24V
Brown		4: 24G	Black		4: 24G

Note1) “[“ means twisted pair.

● 1F-GR2000S-22

Table 2-46 : Pin assign of hand input cable

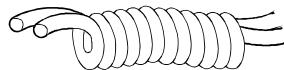
Color ^{Note1)}	Connector	Pin number: names	Color ^{Note1)}	Connector	Pin number: names
[Blue	X08	1: X08	[Yellow	X12	1: X12
White		3: +24V	Brown		3: +24V
[Yellow	X09	4: 24G	[Green	X13	4: 24G
White		1: X09	Brown		1: X13
[Green	X10	3: +24V	[Red	X14	3: +24V
White		4: 24G	Brown		4: 24G
[Red	X10	1: X10	[Purple	X14	1: X14
White		3: +24V	Brown		3: +24V
[Purple	X11	4: 24G	[Blue	X15	4: 24G
White		1: X11	Black		1: X15
[Blue	X11	3: +24V	[Yellow	X15	3: +24V
Brown		4: 24G	Black		4: 24G

Note1) “[“ means twisted pair.

(6) Hand curl tube

- Order type: RV-4F/7F series, RV-7FLL One set: 1E-ST0402C
Two sets: 1E-ST0404C
Three sets: 1E-ST0406C
Four sets: 1E-ST0408C
- RV-13F/13FL/20F One set: 1N-ST0602C
Two sets: 1N-ST0604C
Three sets: 1N-ST0606C
Four sets: 1N-ST0608C

■ Outline



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

■ Configuration

Table 2-47 : Configuration equipment

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

Note1) Mass indicates one set.

■ Specifications

Table 2-48 : Specifications

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

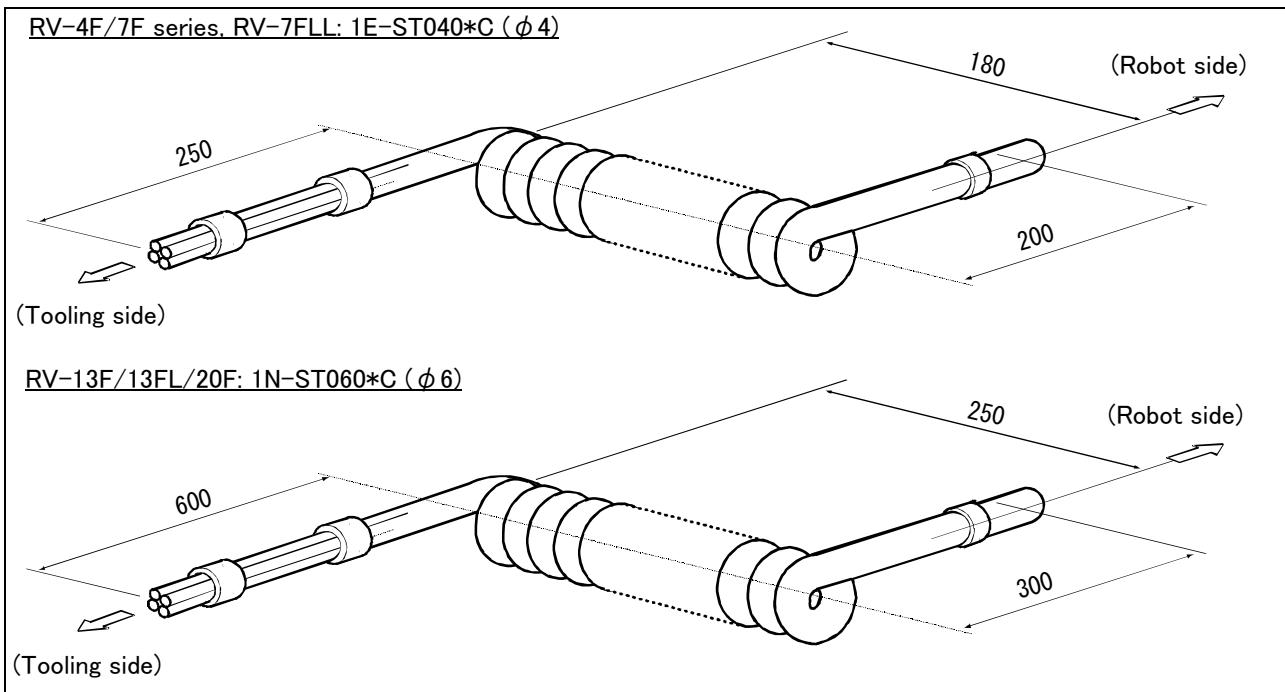


Fig.2-51 : Outline dimensional drawing

[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

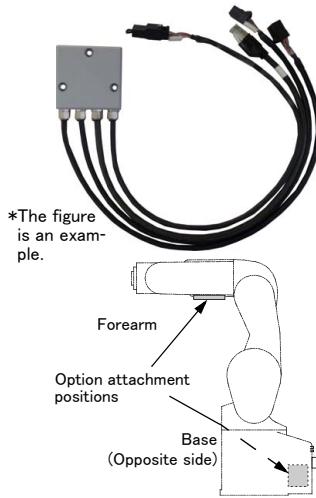
■ Order type

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

2) Communication cable

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

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

■ Configuration

Table 2-49 : 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 2-50](#). Because to pull out the cable of the same purpose also as the forearm side and the base side, you should use the option in pair shown in "the pairing (recommendation)" of the table. And, each wiring system figure is shown after the following page.

Table 2-50 : 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 2-51](#).

Table 2-51 : 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)

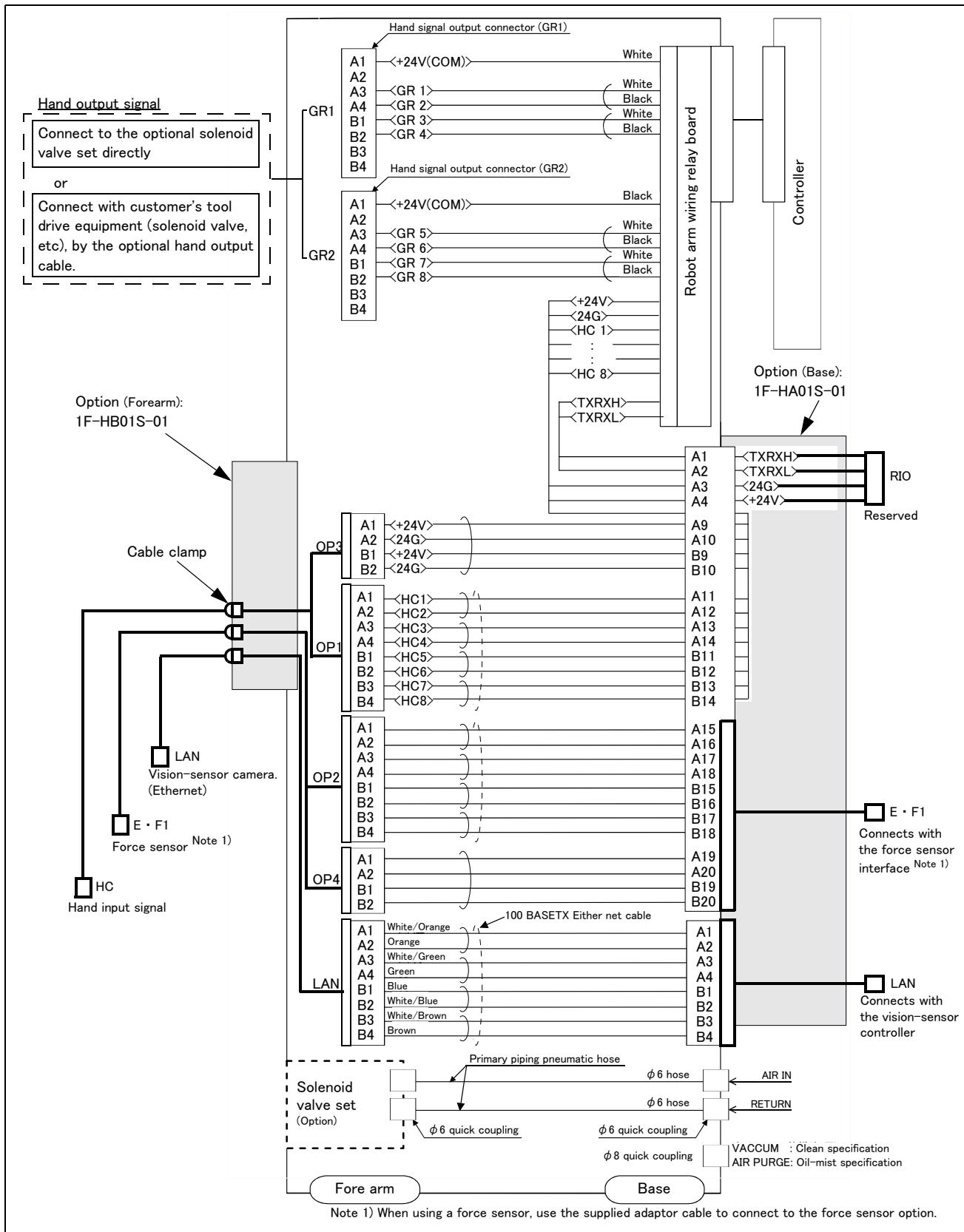


Fig.2-52 : Wiring system diagram (1F-H*01S-01)

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

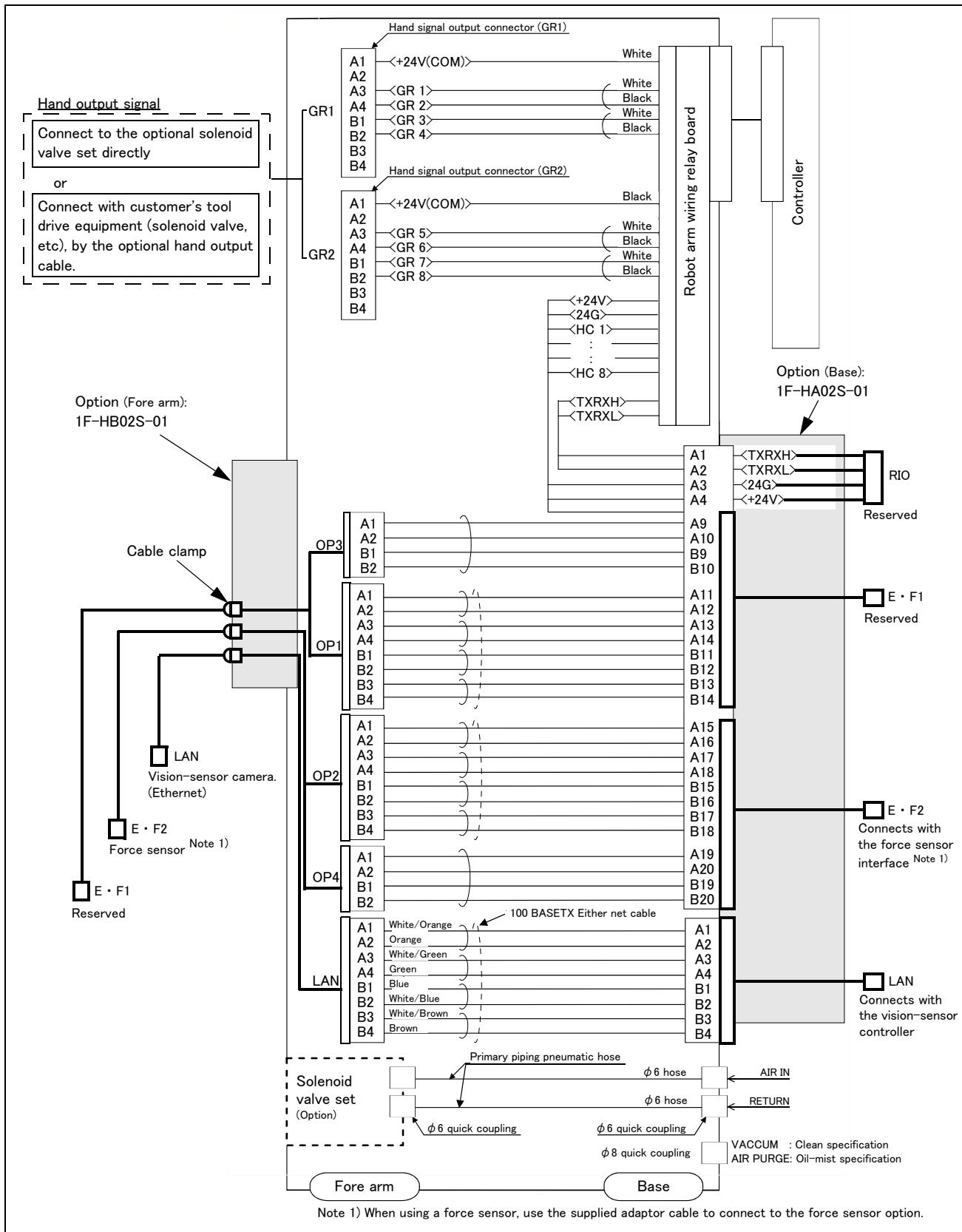
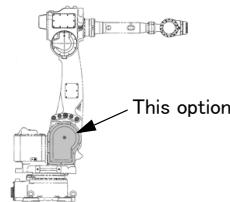


Fig.2-53 : Wiring system diagram (1F-H*02S-01)

(8) J2 axis motor cover

■ Order type: 1F-MCJ2-21

■ Outline

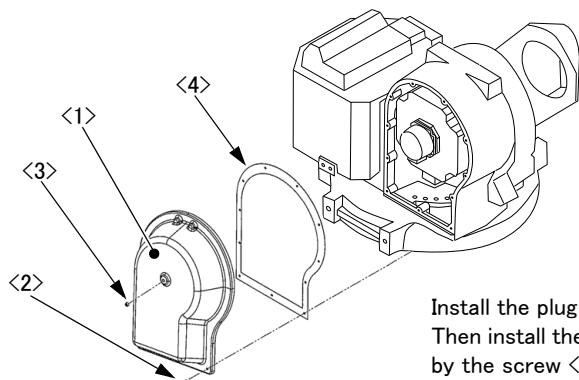


This cover protect the J2 axis motor from dust and water. Oil mist specification robot is equipped with the cover as standard.

■ Configuration

Table 2-52 : Configuration equipment

No.	Part name	Qty.	Mass (kg)	Remarks
<1>	Cover	1	2.0	
<2>	Hexagon socket head cap screw	11		
<3>	Plug with hole	1		
<4>	Packing	1		



Install the plug with hole <3> to the cover <1>. Then install the cover <1> to the J2 motor portion of the robot arm by the screw <2> with the packing <4> in between.

2.9 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. As a rule of thumb, it is recommended that overhaul be carried out before the total amount of servo-on time reaches the specified time (24,000 hours for the robot arm and 36,000 hours for the controller) (See Fig. 2-54.). However, the degree of the equipment's wear and deterioration presumably varies depending on their operating conditions. Especially for operation with high load and frequency, the maintenance cycle may be shorter. For details on the part selection for replacement and the timing of overhaul, contact your dealer.

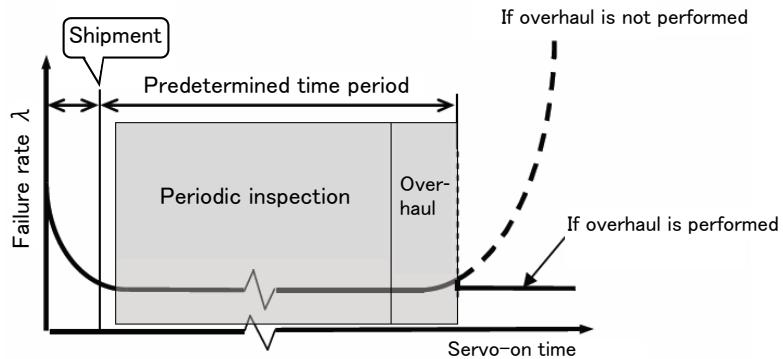


Fig.2-54 : Periodic inspection/overhaul periods

2.10 Maintenance parts

The consumable parts used in the robot arm are shown in [Table 2–53](#). 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 2–53 : 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

3.1.1 Basic specifications

Use the robot CPU unit which consists of CR750-Q/CR751-Q/CR760-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 121 "Fig. 3-6"](#) (Names of each part), [Page 127 "Fig. 3-12"](#) and [Page 128 "Fig. 3-13"](#) (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](#) or [Table 3-2](#), the specification of the drive unit is mainly described.

Table 3-1 : Specifications of controller (CR750-Q/CR751-Q controller)

Item	Unit	Specification		Remarks		
Type		CR750-□ VQ-1 CR751-□ VQ-0 CR750-04VJQ-1 CR751-04VJQ-0 CR750-07VLQ-1 CR751-07VLQ-0		" □ " in type name shows the load (4kg: "04", 7kg: "07", 13kg: "13", 20kg: "20") of robot arm. CR750-04VJQ-1 and CR751-04VJQ-0 controller are for RV-4FJL only. CR750-07VLQ-1 and CR751-07VLQ-0 controller are for RV-7FLL only.		
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 <small>Note1)</small>				
External input and output	Input and output	point	0/0			
	Dedicated input/output		Assign to the multi-CPU shared device.			
	Hand open/close input/output	point	8/8			
	Emergency stop input	point	1			
	Door switch input	point	1			
	Enabling device input	point	1			
	Emergency stop output	point	1			
	Mode output	point	1			
	Robot error output	point	1			
	Addition axis synchronization	point	1			
Interface	Mode changeover switch input	point	1 (CR751 controller only)			
	RS-422	port	1			
	Ethernet	port	1			
Power source	Additional axis interface	Channel	1			
	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			
Power supply frequency		Hz	50/60			

Item	Unit	Specification	Remarks
Outline dimensions Note4)	mm	CR750 controller 430(W) x 425(D) x 174(H)	Excluding protrusions. Refer to the table in "■ Introduction " for details of the robot type.
		CR751 controller RV-4F/7F series: 430(W) x 425(D) x 98(H) RV-13F series: 430(W) x 425(D) x 174(H)	
Mass	kg	CR750 controller: Approx. 18	
		CR751 controller RV-4F/7F series: Approx. 12 RV-13F series: Approx. 15	Refer to the table in "■ Introduction " for details of the robot type.
Construction		Self-contained floor type, Opened type. Installation vertically or horizontally	IP20 Note5)
Operating temperature range	°C	0 to 40	
Ambient humidity	%RH	45 to 85	Without dew drops
Grounding	Ω	100 or less	100Ω or less (class D grounding) Note6)
Paint color		Dark gray	Equivalent to Munsell: 3.5PB3.2/0.8

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

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 122, "3.3.1 Outside dimensions"](#) for details.

Note5) This controller is standard specification. (Refer to [Page 112, "3.1.2 Protection specifications and operating supply"](#).)

Note6) The robot must be grounded by the customer.

Table 3-2 : Specifications of controller (CR760-Q controller)

Item	Unit	Specification	Remarks
Type		CR760-□ VQ-1	“□” in type name shows the load (35kg: “35”, 50kg: “50”, 70kg: “70”) of robot arm.
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
	Dedicated input/output		Assigned with general-purpose input/output The signal number of “STOP” input signals is fixing.
	Hand open/close input/output	point	16/16
	Emergency stop input	point	1
	Door switch input	point	1
	Enabling device input	point	1
	Emergency stop output	point	1
	Mode output	point	1
	Robot error output	point	1
Interface	RS-422	port	1
	Ethernet	port	For teaching pendant: 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	Three phase: AC180 to 253 (non-CE marking) Three phase Y-connection: AC360 to 480 (CE marking)
	Power capacity	kVA	20
	Power supply frequency	Hz	50/60
Outline dimensions Note3)	mm	670(W) x 415(D) x 700(H) (non-CE marking) 700(W) x 535(D) x 1115(H) (CE marking)	Excluding protrusions
Mass	kg	Approx. 95 (non-CE marking) Approx. 296 (CE marking)	
Construction		Self-contained floor type, closed type.	IP54 Note4)
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) Note5)
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) 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.

* 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.

Note3) Refer to Page 122, “3.3.1 Outside dimensions” for details.

Note4) This controller is standard specification. (Refer to Page 112, “3.1.2 Protection specifications and operating supply”.)

Note5) The robot must be grounded by the customer.

Table 3-3 : 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

3.1.2 Protection specifications and operating supply

A protection method complying with the IEC Standard IP20 (Opened type) is adopted for CR750/CR751 controller, and the IEC Standard IP54 (Closed type) is adopted for CR760 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 $3.1 \text{ kg} \pm 10\%$, from going through the opening in the outer sheath of the supplied equipment.

- The IEC IP54

The IEC IP54 standard refers to protection structure designed to prevent any harmful effects by fresh water scattering vertically onto the testing equipment in a radius of 180 degrees from a distance of 300 to 500 mm, with 10 ± 0.5 liters of water every minute, at a water pressure of 80 to 100kPa, covering the entire area of the robot with the exception of the installation section at 1 m^2 per minute, for a total of 5 minutes or more.

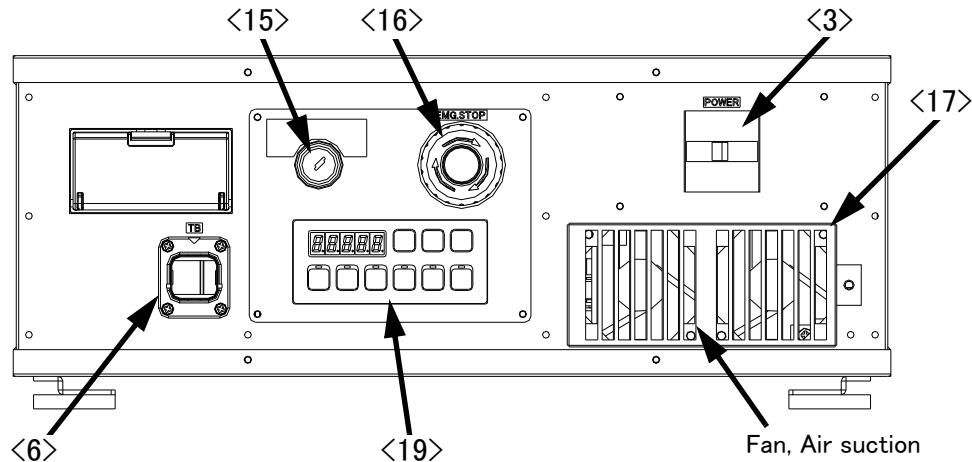
Refer to the section [Page 211, "6.2 Working environment"](#) for details on the working environment.

3.2 Names of each part

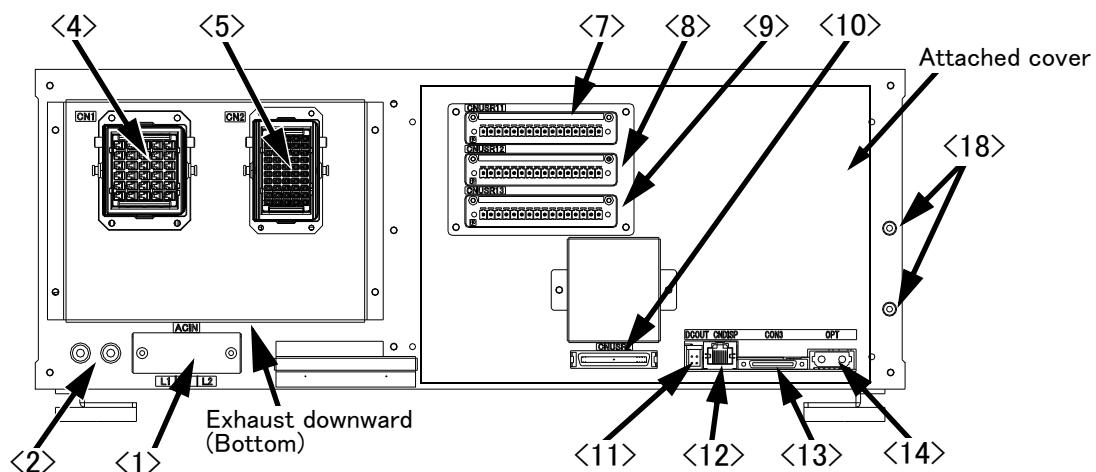
3.2.1 Drive unit

(1) CR750 drive unit

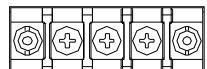
Drive unit (Front side)



Drive unit (Rear side)



<1>: ACIN terminal



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

<19>: The operation panel

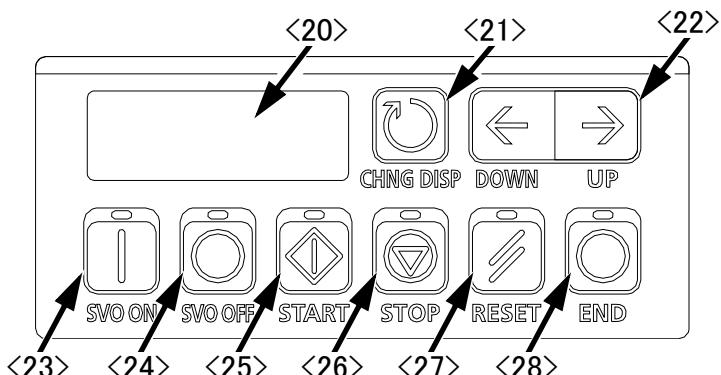
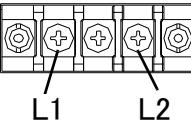
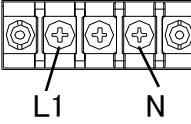
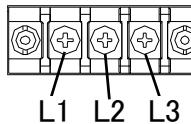


Fig.3-1 : Names of drive unit parts (CR750)

<1> ACIN terminal The terminal box for AC power source (single phase or single phase/three phase, AC200V) input. (Inner side of a cover)
 There are three types of the terminal and the terminal differs depending on the model and specification (CE or non-CE).

Model	Non-CE specification	CE specification
RV-4F/4FL series RV-4FJL series	<p>Type A: For single phase</p>  <p>Connect the primary power supply to L1 and L2 terminal.</p>	<p>Type C: For single phase</p>  <p>Connect the primary power supply to L1 and N terminal.</p>
RV-7F/7FL series RV-7FLL series RV-13F/13FL series RV-20F series	<p>Type B: For single phase/three phase</p>  <p>When using the three phase primary power supply, connect to L1, L2, and L3 terminal. When using the single phase primary power supply, connect to L1 and L3 terminal.</p>	

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

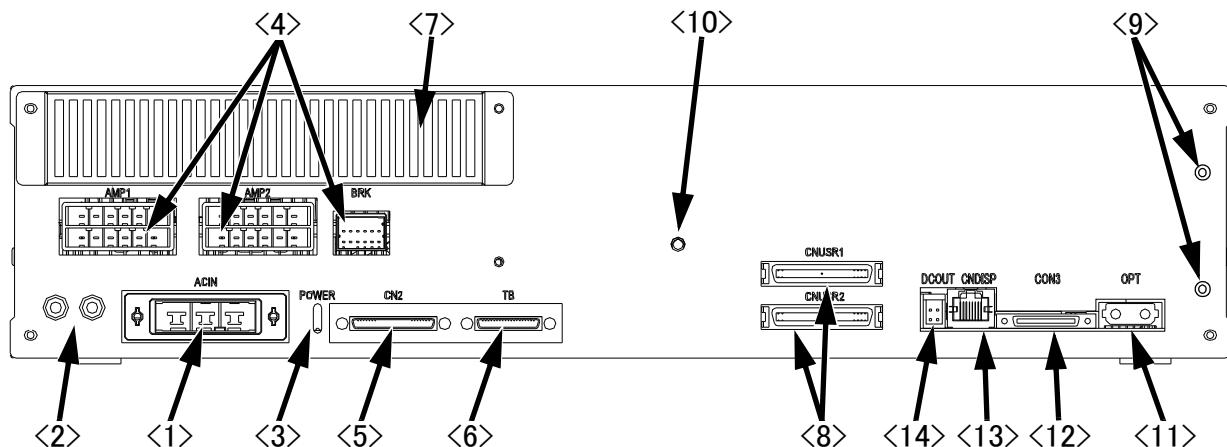
- <2> PE terminal The screw for grounding of the cable. (M4 screw x 2 place)
- <3> Power switch This turns the control power ON/OFF. (With earth leakage breaker function)
- <4> Machine cable connector (motor signal) (CN1)
 Connect with the CN1 connector of the robot arm.
- <5> Machine cable connector (motor power) (CN2)
 Connect with the CN2 connector of the robot arm.
- <6> T/B connection connector (TB) This is a dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.
- <7><8><9><10> CNUSR connector The connector for input/ output connection dedicated for robot. (a plug connector attached)
 <7>: CNUSR11, <8>: CNUSR12, <9>: CNUSR13, <10>: CNUSR2
 Refer to a separate manual "INSTRUCTION MANUAL/Controller setup, basic operation, and maintenance" for the connection method and the further description of pin assign.
 Note) <9>: CNUSR13 connector is not used in this controller.
- <11> DCOUT connector (DCOUT) For emergency stop
- <12> CNDISP connector (CNDISP) For LAN of T/B connection
- <13> CON3 connector (CON3) For RS422 of T/B connection
- <14> OPT connector (OPT) For SSCNETIII connection
- <15> Mode key switch This key switch changes the robot's operation mode.
AUTOMATIC Operations from the controller or external equipment are valid. Operations for which the operation mode must be at the external device or T/B are not possible. (Exclude the start of automatic operation.)
MANUAL When the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device or controller are not possible.
- <16> Emergency stop switch This switch stops the robot in an emergency state. The servo turns OFF.
- <17> Filter cover There is an air filter inside the cover.
- <18> Grounding terminal The grounding terminal for connecting cables of option card. (M3 screw x 2 places)
- <19> Operation panel The operation panel for servo ON/OFF, START/STOP the program etc.
- <20> Display panel (STATUS.NUMBER) The alarm No., program No., override value (%), etc., are displayed.
- <21> CHNGDISP button This button changes the details displayed on the display panel in the order of "Override" → "Line No." → "Program No." → "User information." → "Maker information.."

-
- <22> UP/DOWN button..... This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.
 - <23> SVO.ON button This turns ON the servo power. (The servo turns ON.)
 - <24> SVO.OFF button..... This turns OFF the servo power. (The servo turns OFF.)
 - <25> START button..... This executes the program and operates the robot. The program is run continuously.
 - <26> STOP button This stops the robot immediately. The servo does not turn OFF.
 - <27> RESET button This resets the error. This also resets the program's halted state and resets the program.
 - <28> END button This stops the program being executed at the last line or End statement.

(2) CR751 drive unit

Drive unit (Front side)

Note) The drive unit is an example.



Controller (Rear side)

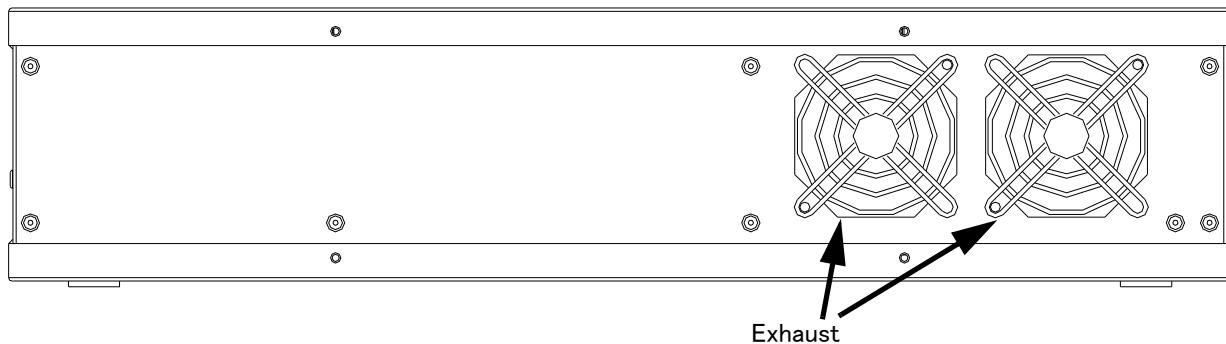


Fig.3-2 : Names of drive unit parts (CR751)

- <1> ACIN terminalThe connector for AC power source (single phase or single phase/three phase, AC200V) input. (a socket housing and a terminal are attached). Refer to a separate manual “INSTRUCTION MANUAL/Controller setup, basic operation, and maintenance” for how to connect a power cable.
- <2> PE terminalThe screw for grounding of the cable. (M4 screw x 2 place)
- <3> POWER lampLamp 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 inside this cover.
- <8>CNUSR connector.....The connector for input/ output connection dedicated for robot. (a plug connector attached)
Refer to a separate manual “INSTRUCTION MANUAL/Controller setup, basic operation, and maintenance” for the connection method and the further description of pin assign.
- <9>Grounding terminalThe 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) CR760 drive unit

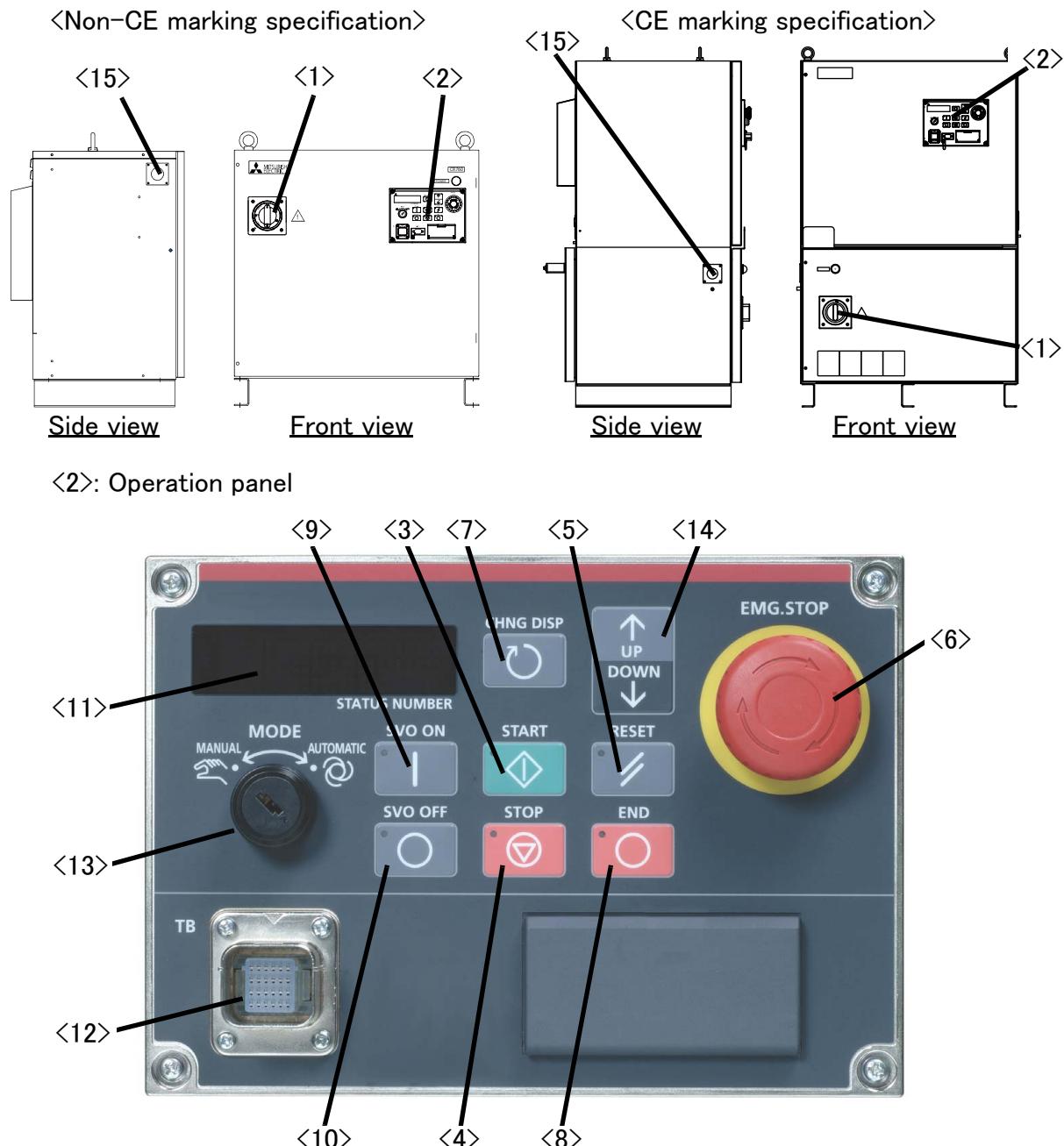


Fig.3-3 : Names of drive unit parts (CR760)

- <1> Power switch.....This turns the control power ON/OFF. (With earth leakage breaker function)
- <2> Operation panel.....The operation panel for servo ON/OFF, START/STOP the program etc.
- <3> START buttonThis executes the program and operates the robot. The program is run continuously.
- <4> STOP button.....This stops the robot immediately. The servo does not turn OFF.
- <5> RESET button.....This resets the error. This also resets the program's halted state and resets the program.
- <6> Emergency stop switchThis switch stops the robot in an emergency state. The servo turns OFF.
- <7> CHNG DISP button.....This button changes the details displayed on the display panel in the order of "Override" → "Line No." → "Program No." → "User information." → "Maker information."
- <8> END buttonThis stops the program being executed at the last line or End statement.

- <9> SVO.ON button.....This turns ON the servo power. (The servo turns ON.)
 <10> SVO.OFF button.....This turns OFF the servo power. (The servo turns OFF.)
 <11> Display panel (STATUS.NUMBER).....The alarm No., program No., override value (%), etc., are displayed.
 <12> T/B connection connector (TB).....This is a dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.
 <13> Mode key switch.....This key switch changes the robot's operation mode.
 AUTOMATICOperations from the controller or external equipment are valid. Operations for which the operation mode must be at the external device or T/B are not possible. (Exclude the start of automatic operation.)
 MANUALWhen the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device or controller are not possible.
 <14> UP/DOWN button.....This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.
 <15> Cable lead-in port.....Draw in the primary power cable.

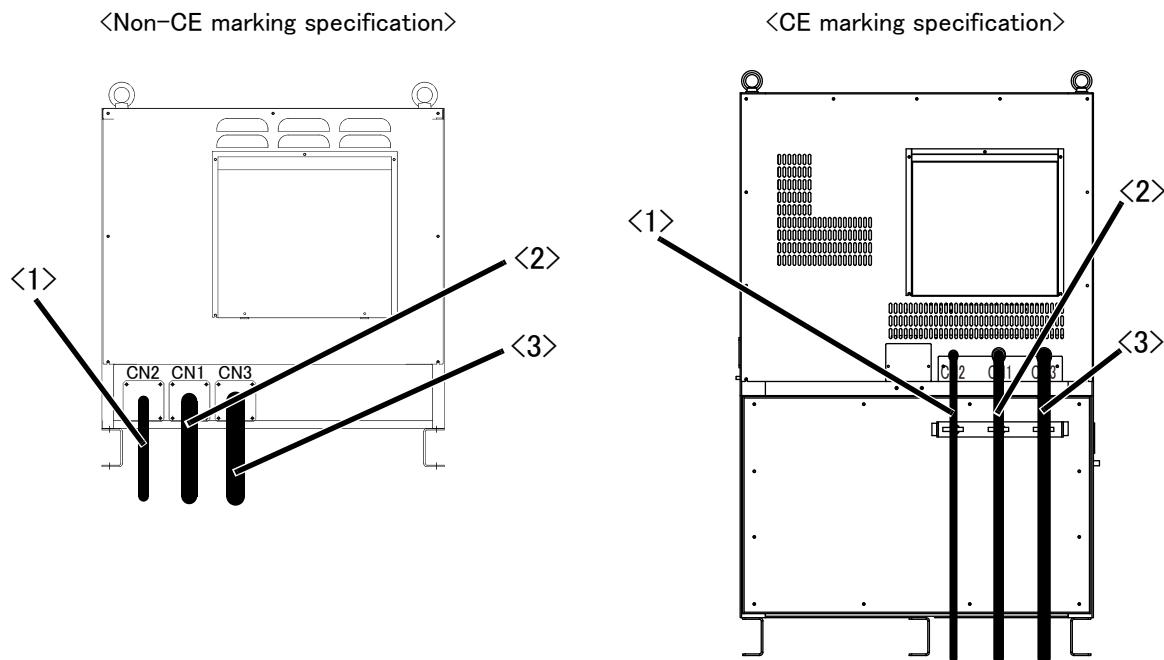


Fig.3-4 : Names of drive unit parts (Rear of CR760)

- <1> Machine cable (For motor signal: CN2).....Connects to the robot arm base. (CN2 connector)
 <2> Machine cable (For motor power: CN1).....Connects to the robot arm base. (CN1 connector)
 <3> Machine cable (For motor power: CN3).....Connects to the robot arm base. (CN3 connector)

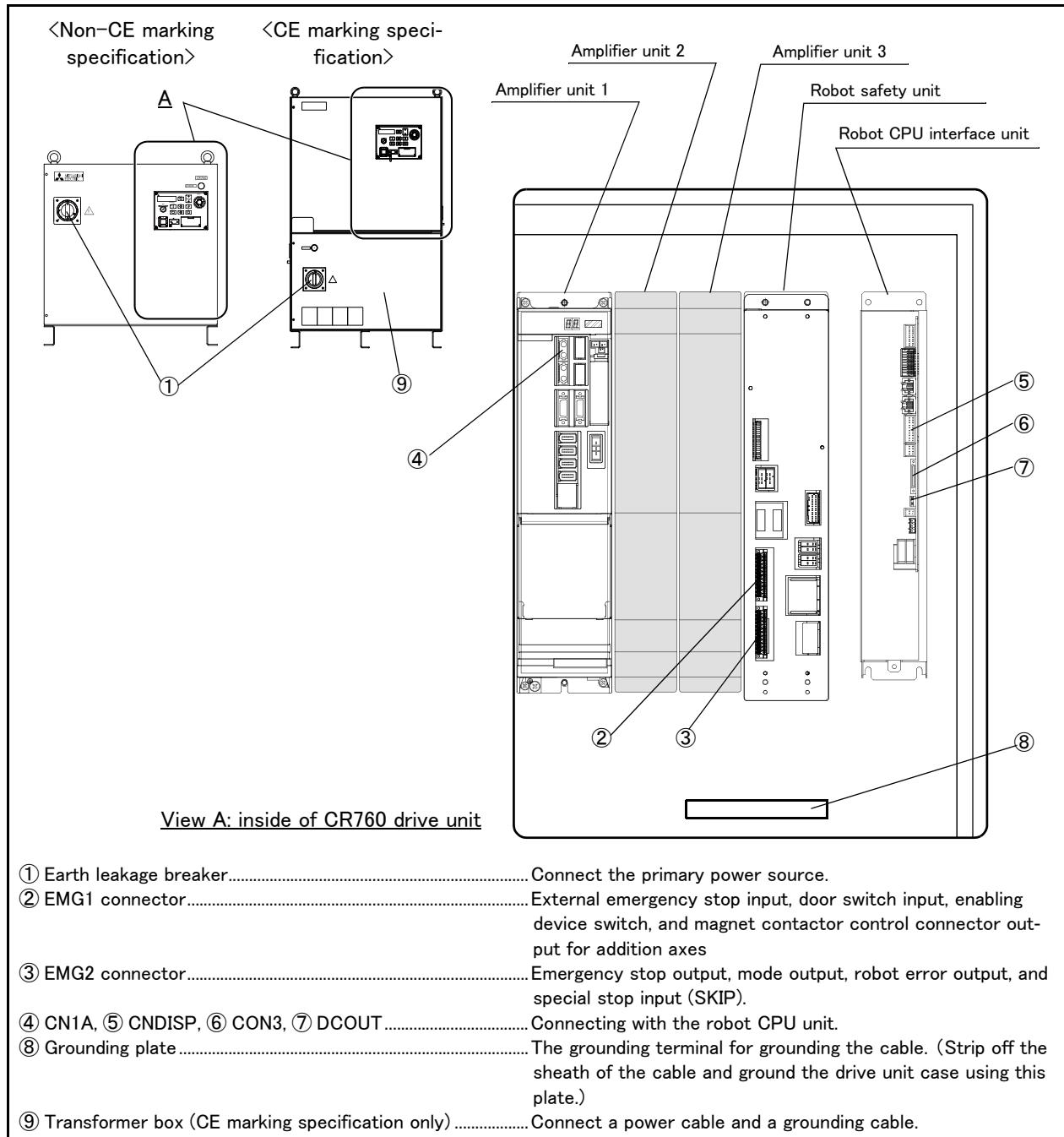


Fig.3-5 : Names of drive unit parts (inside of CR760)

3.2.2 Robot CPU

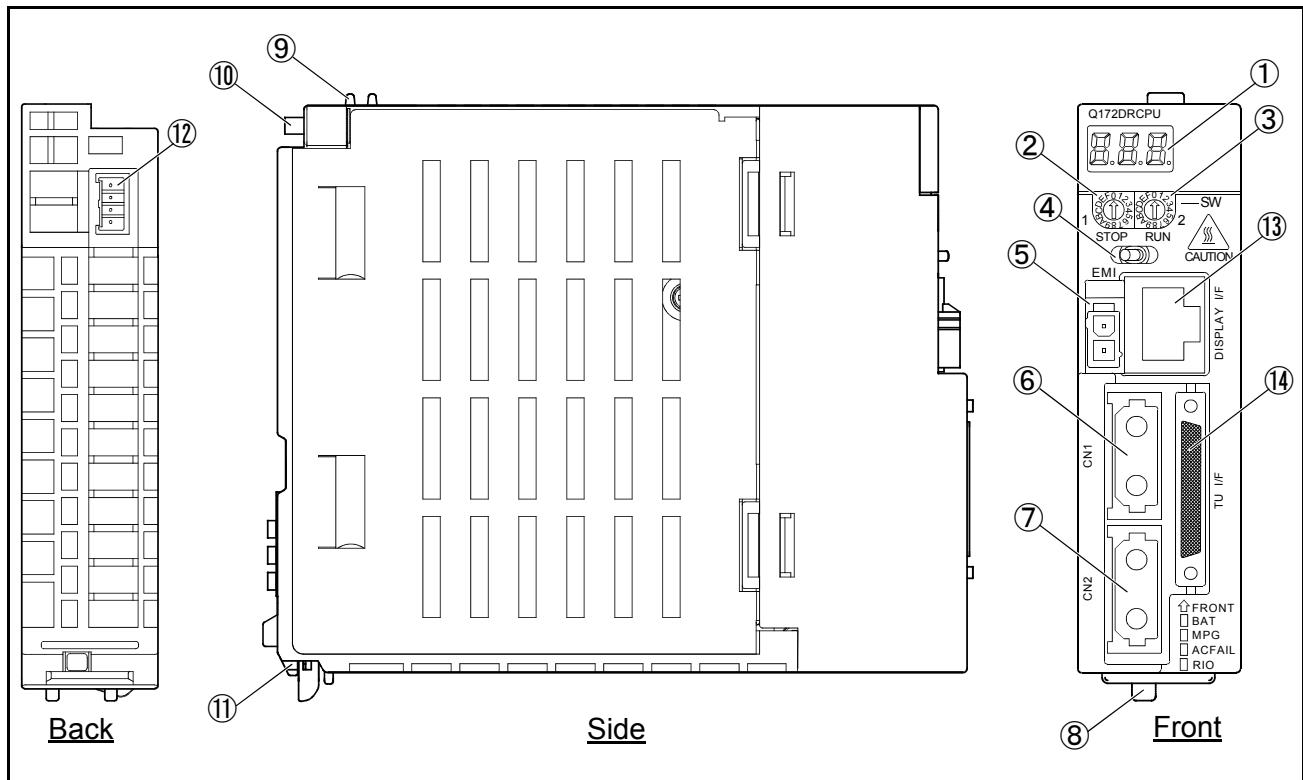


Fig.3-6 : Names of each part of the robot CPU

- 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 fixing The 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.

3.3 Outside dimensions/Installation dimensions

3.3.1 Outside dimensions

(1) CR750 drive unit

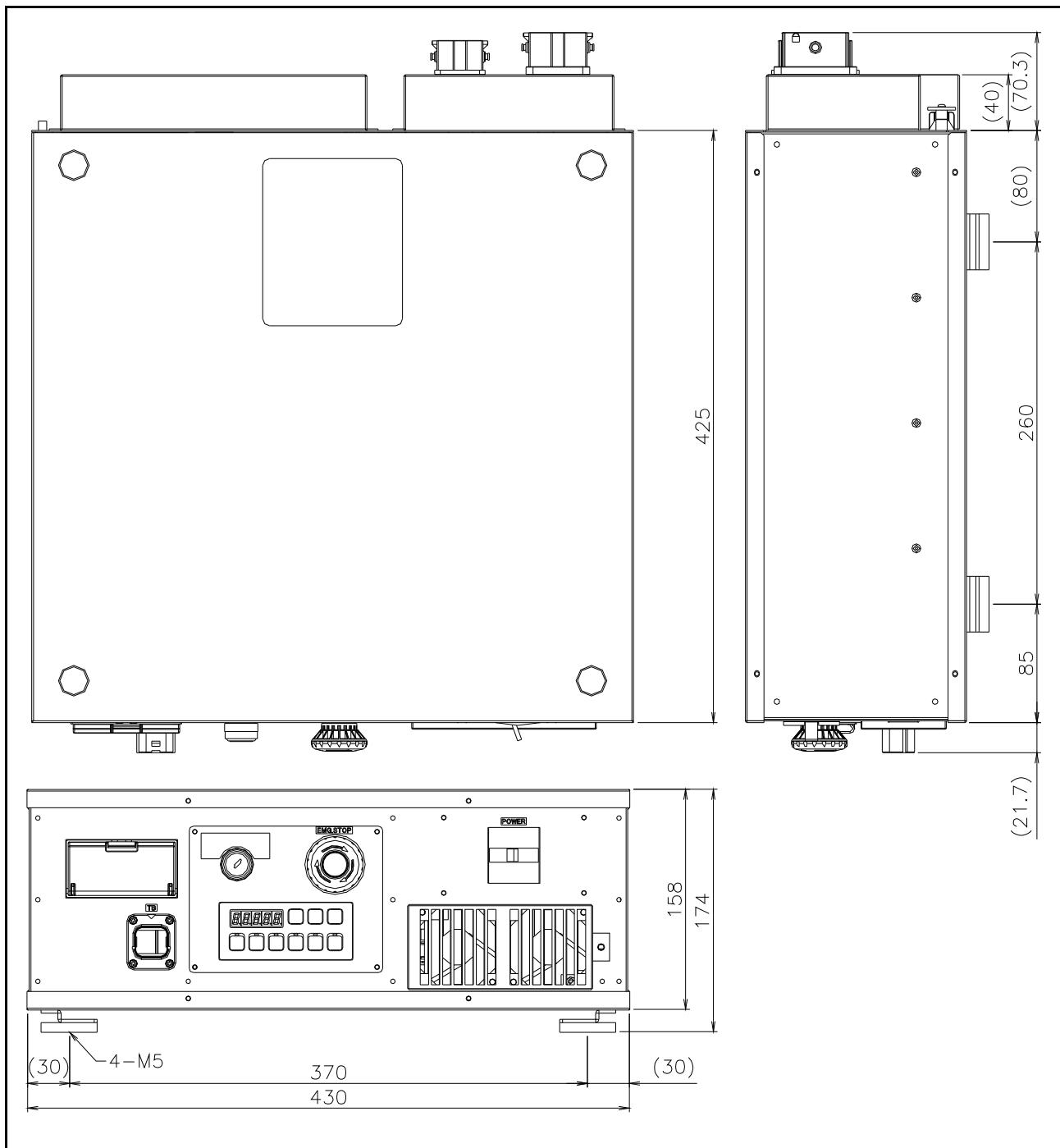


Fig.3-7 : Outside dimensions of drive unit (CR750)

(2) CR751 drive unit

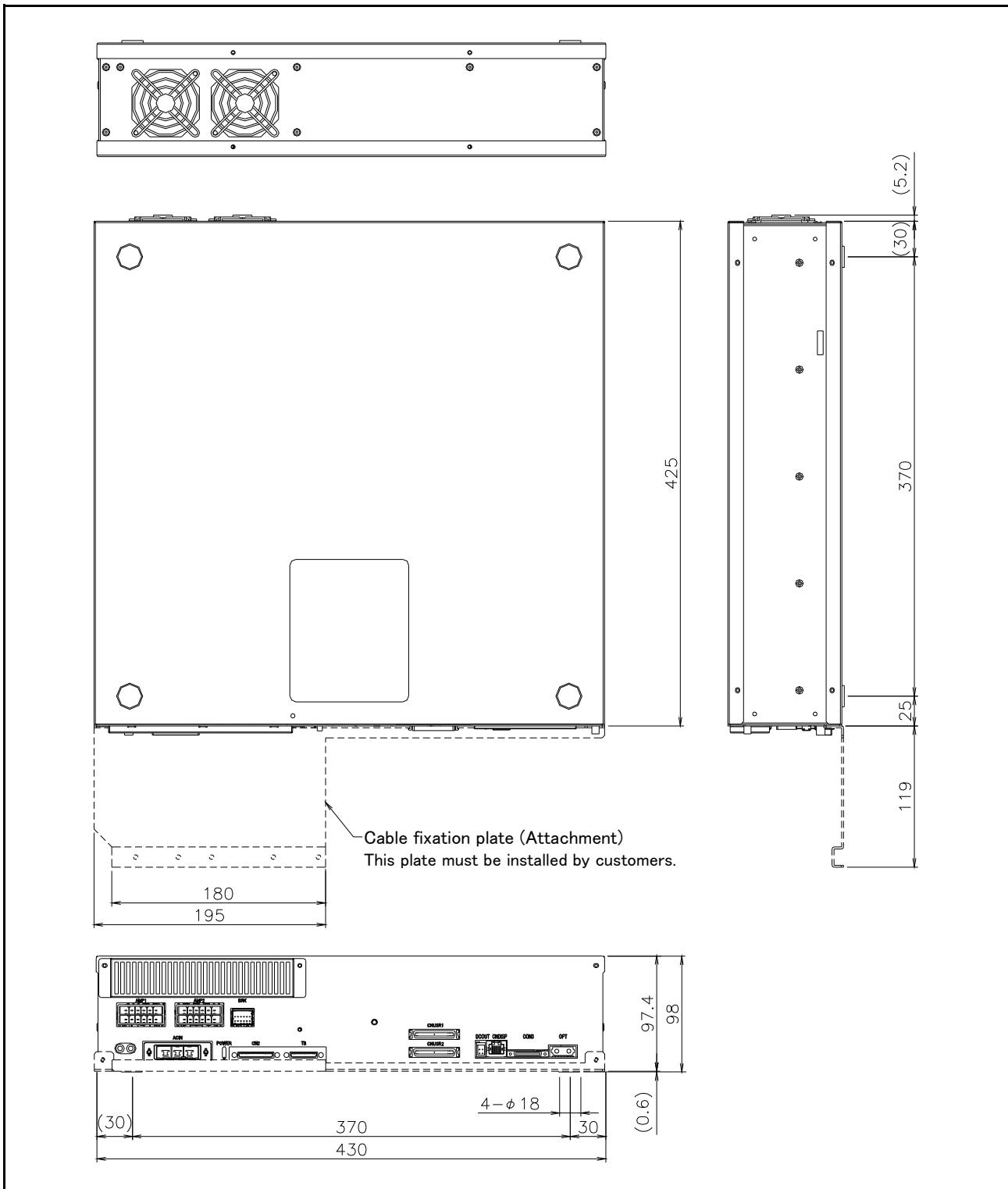


Fig.3-8 : Outside dimensions of drive unit (CR751: RV-4F/7F series)

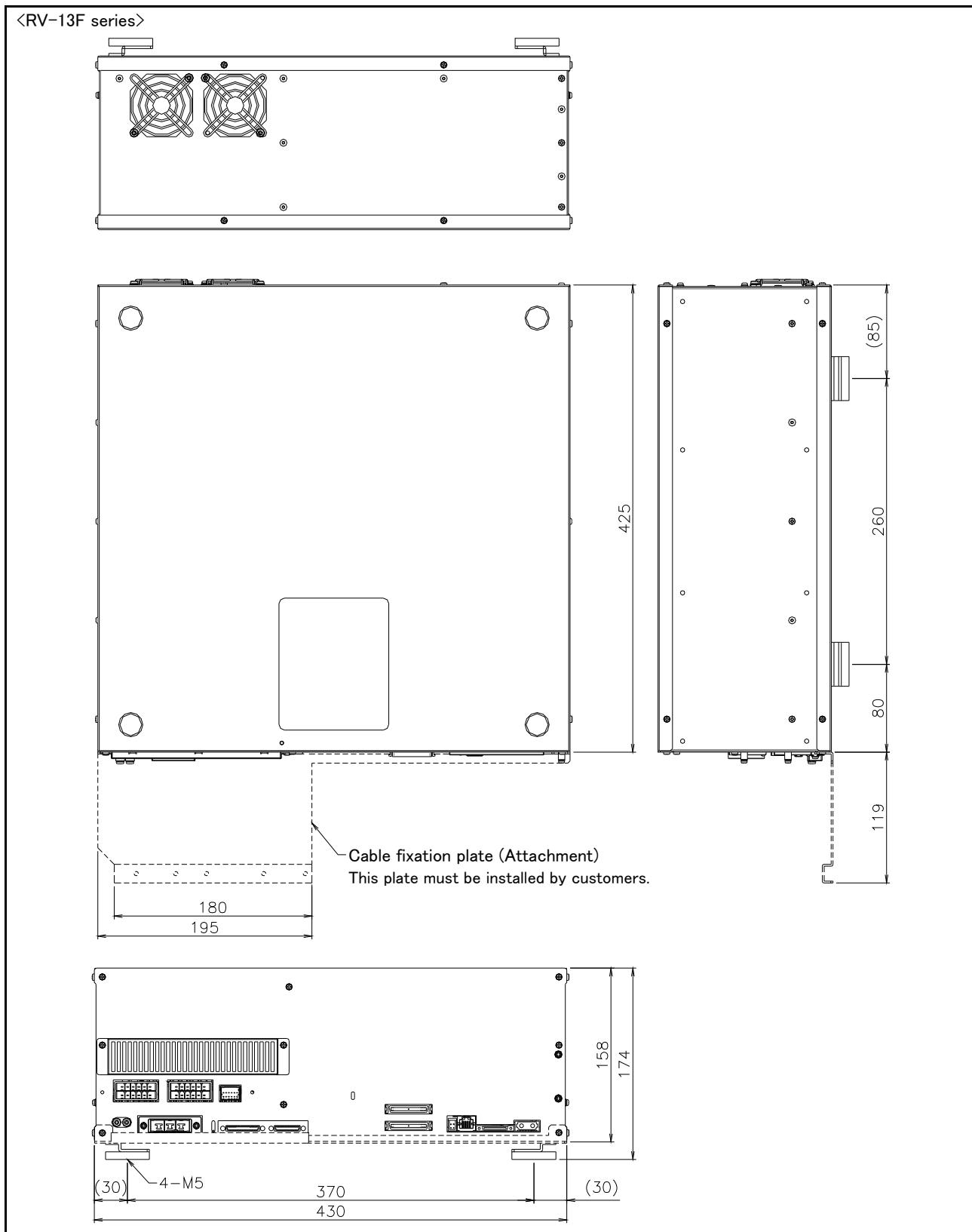


Fig.3-9 : Outside dimensions of drive unit (CR751: RV-13F series)

(3) CR760 drive unit

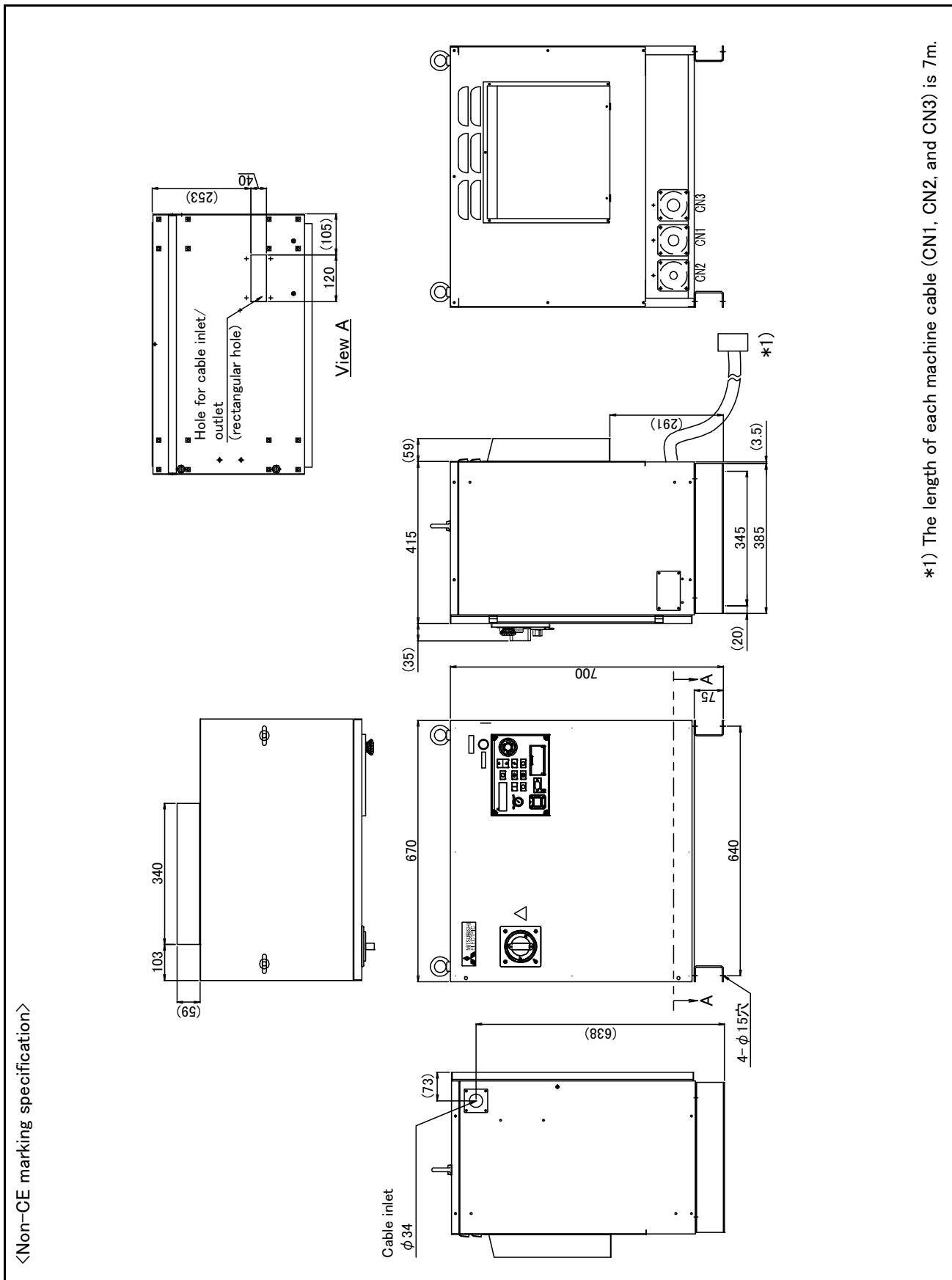


Fig.3-10 : Outside dimensions of drive unit (CR760 non-CE marking)

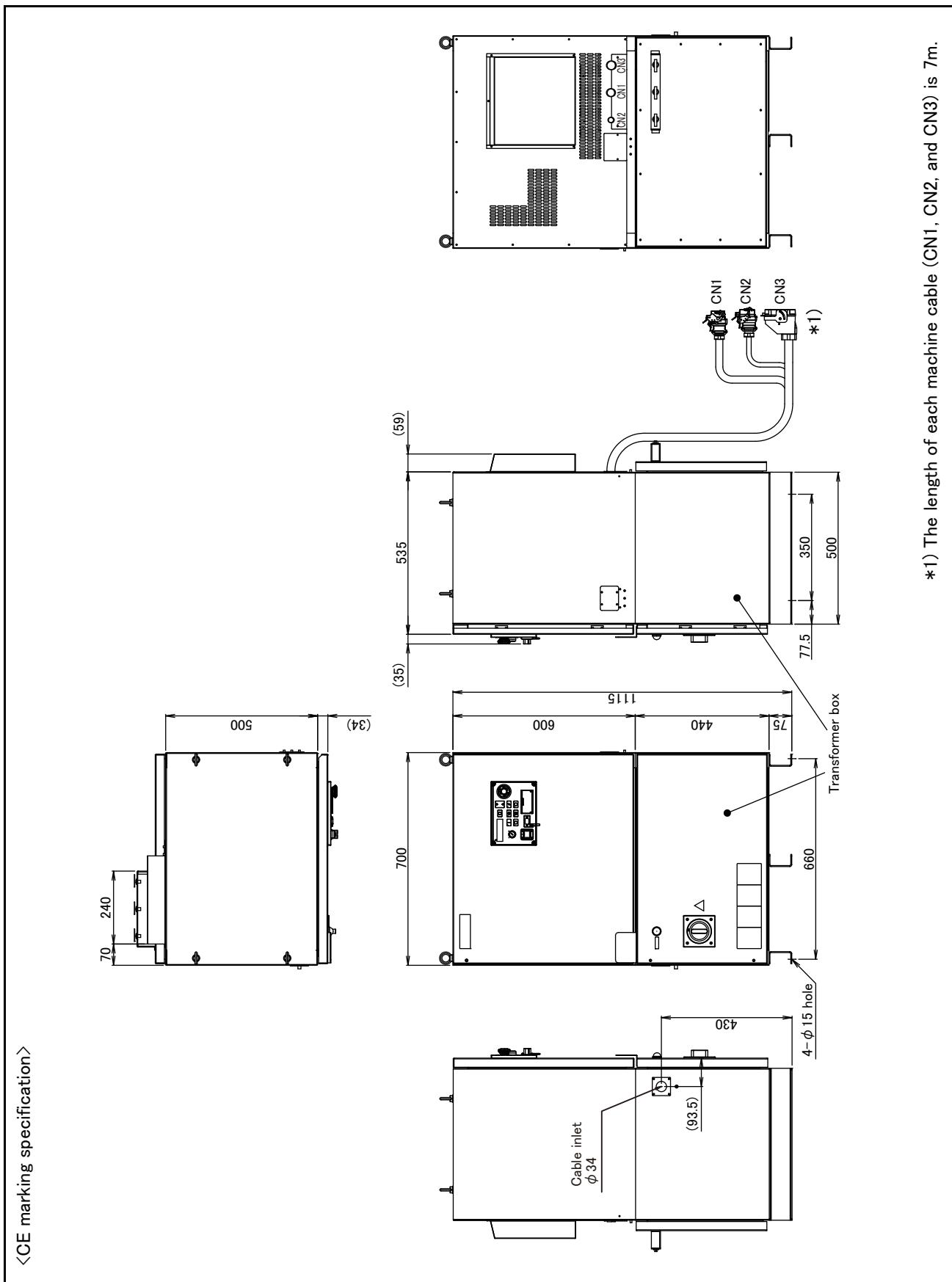


Fig.3-11 : Outside dimensions of drive unit (CR760 CE marking)

(4) Outside dimensions of robot CPU unit

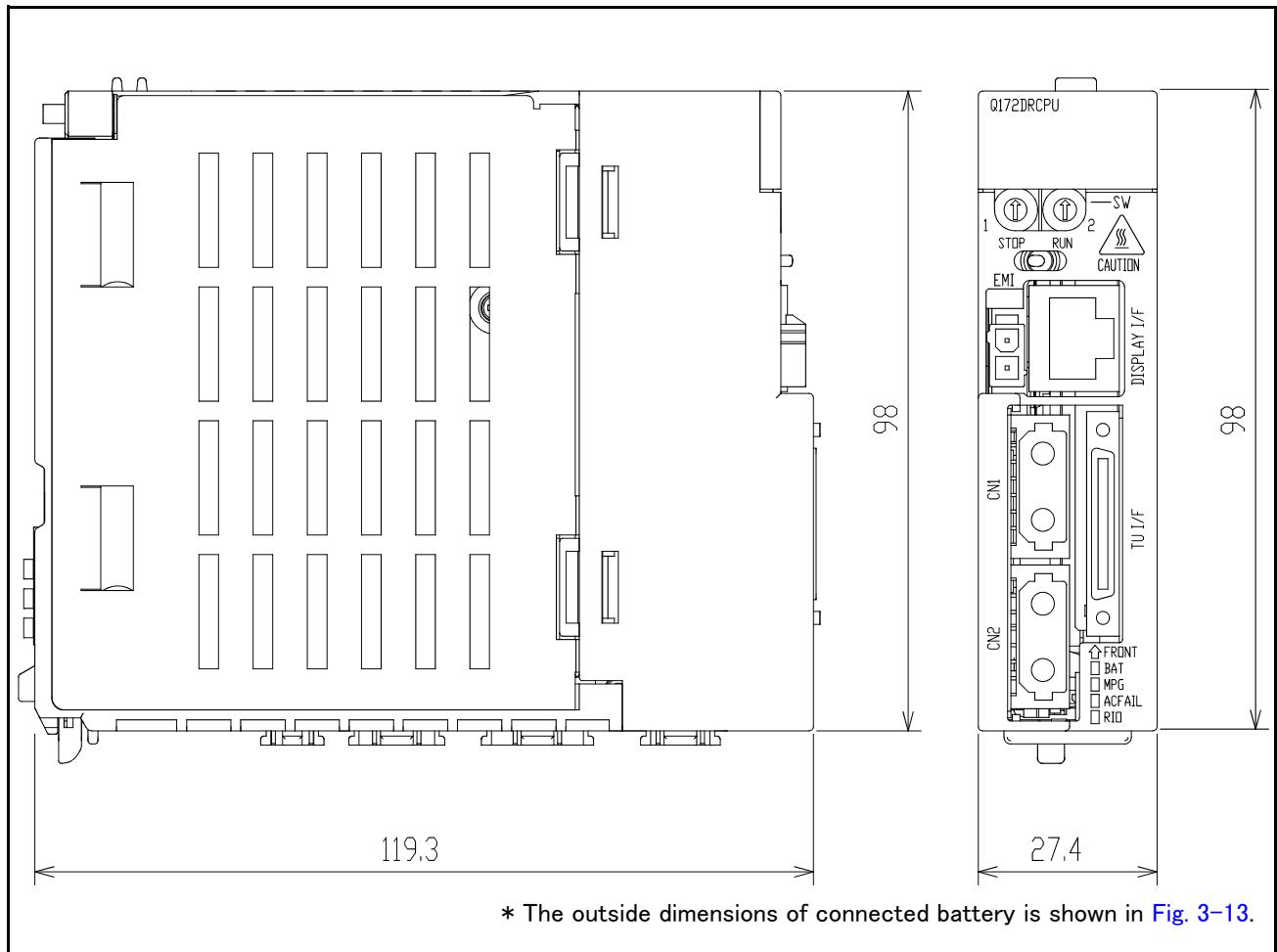


Fig.3-12 : Outside dimensions of robot CPU

(5) Battery unit outside dimension

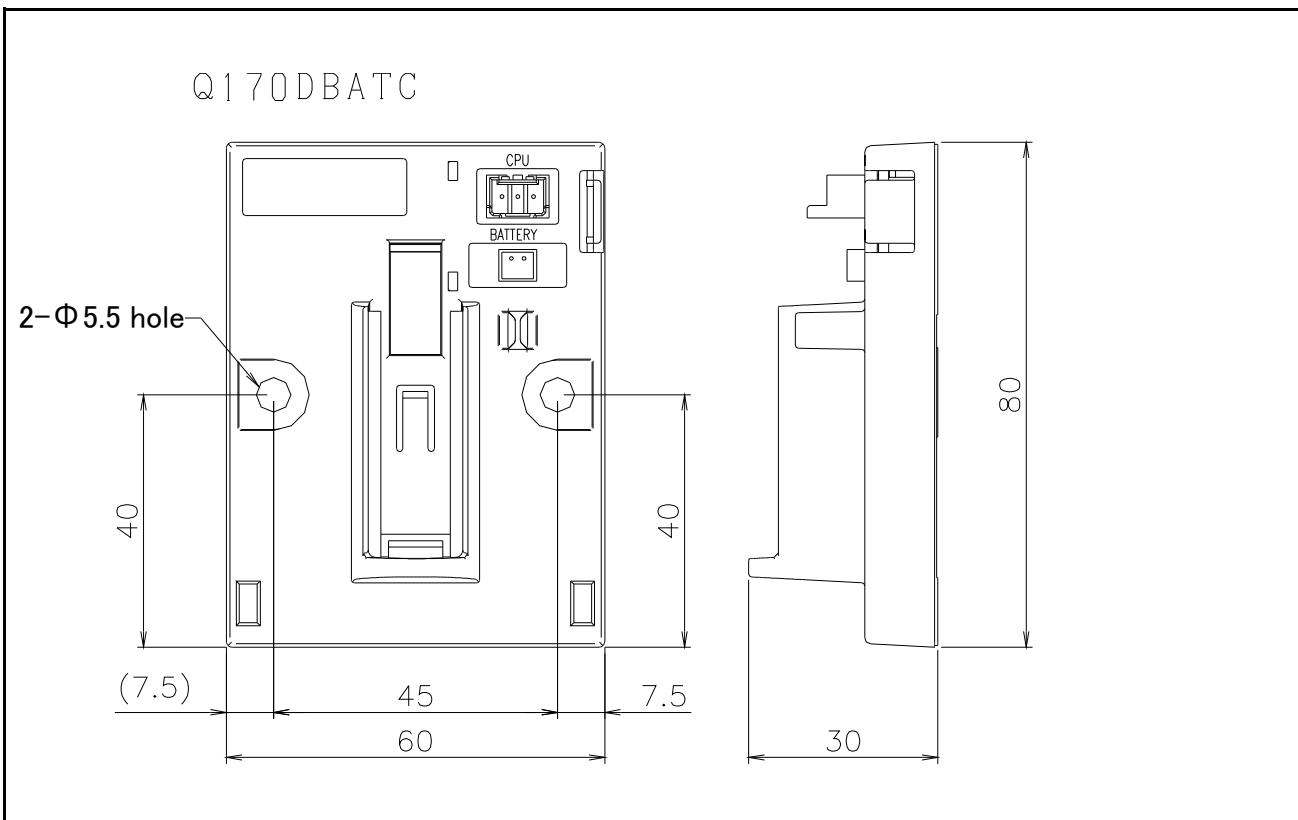
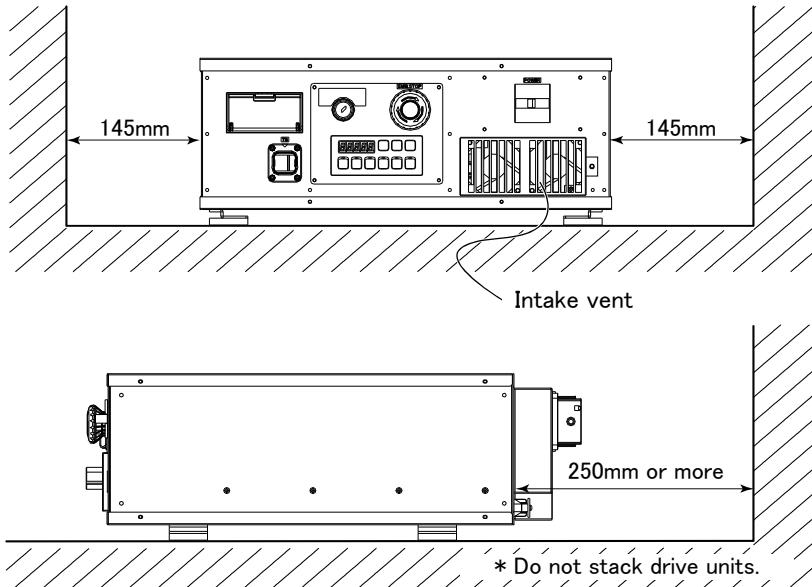


Fig.3-13 : Outside dimensions of battery unit

3.3.2 Installation dimensions

(1) CR750 drive unit

<Placed horizontally>



<Placed vertically>

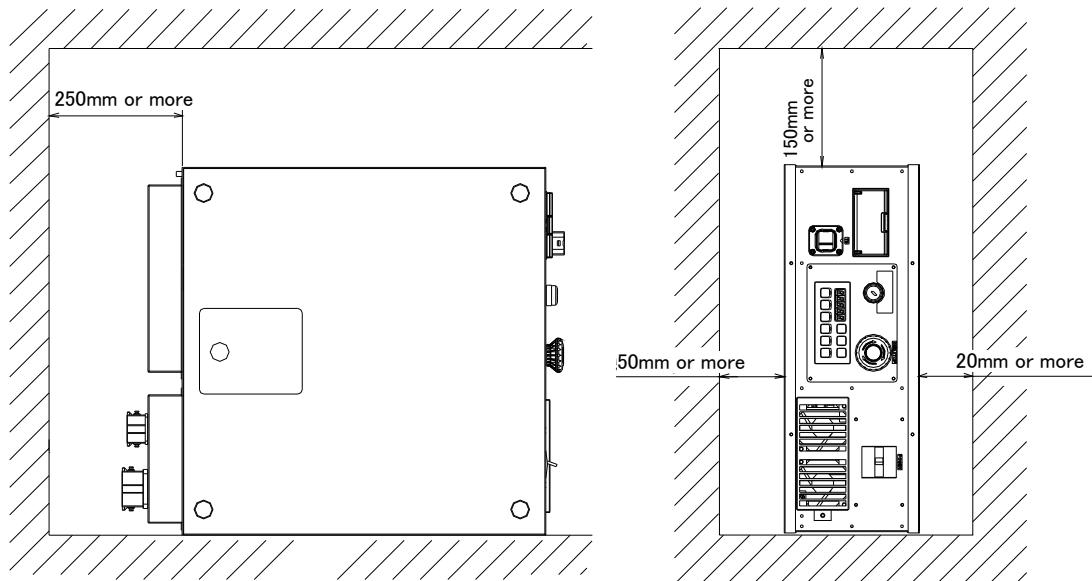


Fig.3-14 : Installation of controller (CR750)

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. 3-15](#). You should install the metal plate for fixation to the drive unit with M4 x 8 or the shorter screw. The screw projection length inside the controller (side board thickness is 1.2 mm) surely makes 6.8 mm or less.

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.

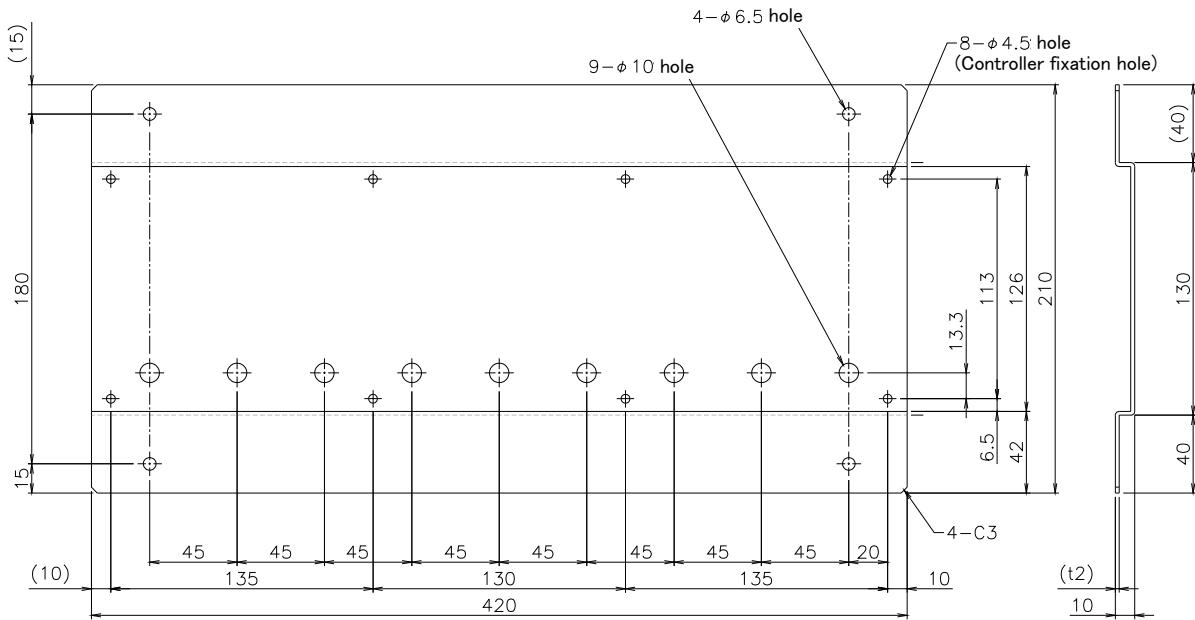
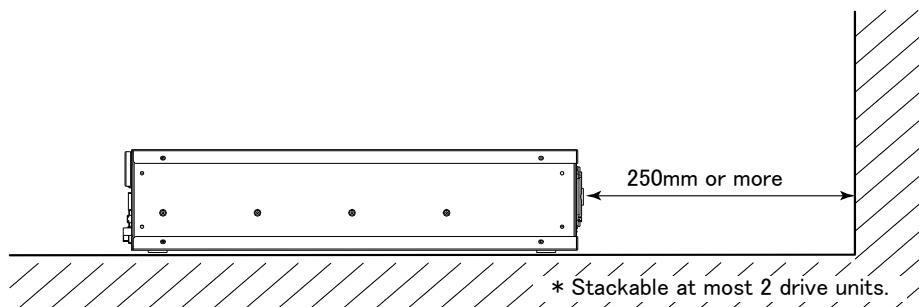
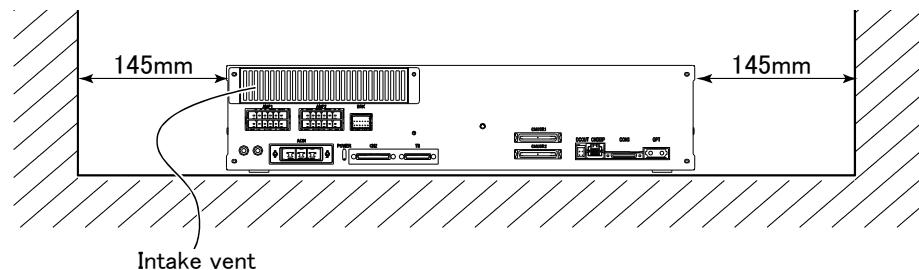


Fig.3-15 : Metal plate for fixation to placing vertically (Reference for CR750)

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

<Placed horizontally>



<Placed vertically>

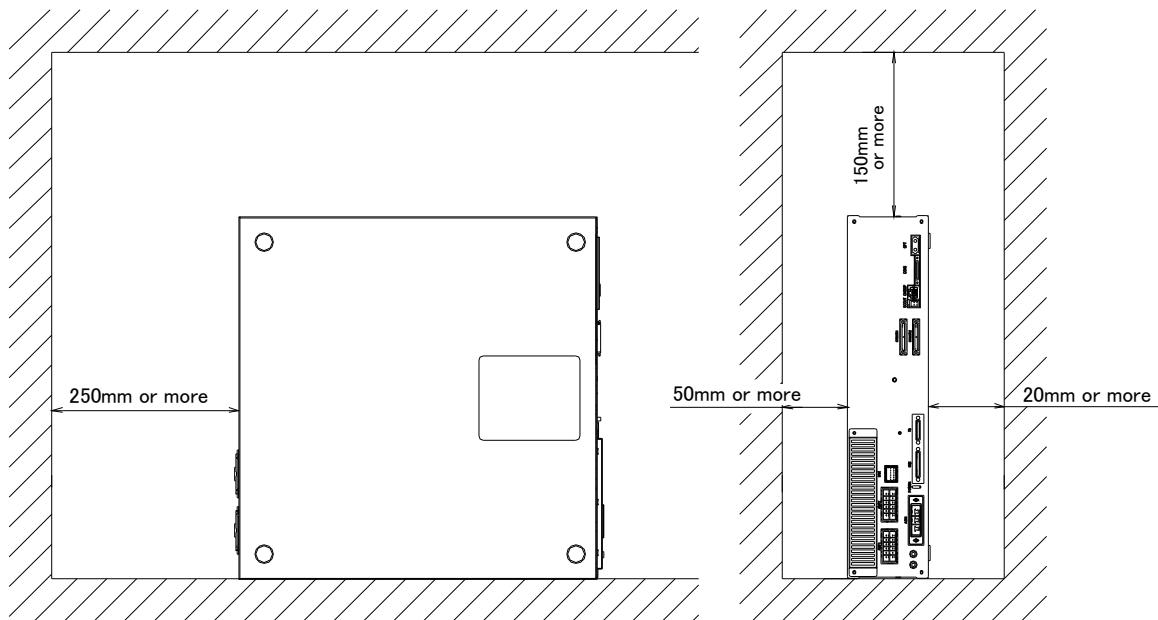


Fig.3-16 : Installation of controller (CR751: RV-4F/7F series)

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. 3-17. 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.

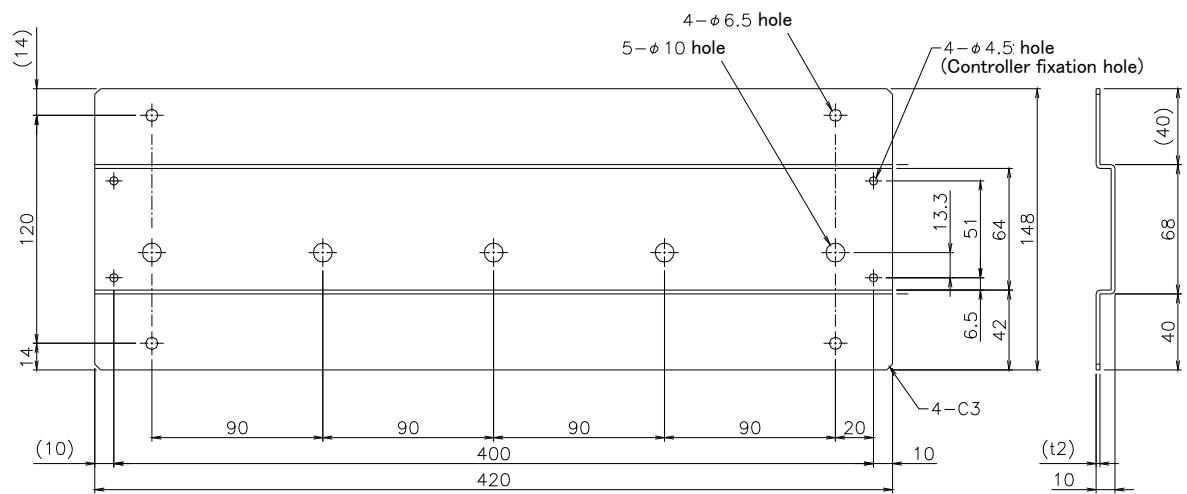
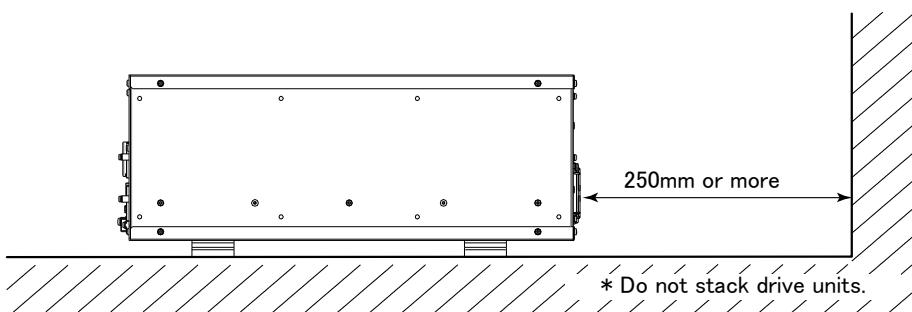
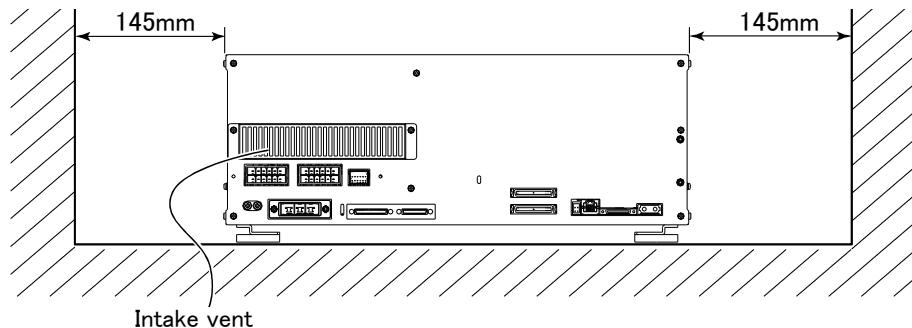


Fig.3-17 : Metal plate for fixation to placing vertically (Reference for CR751: RV-4F/7F series)

(3) CR751 drive unit: RV-13F series

<Placed horizontally>



<Placed vertically>

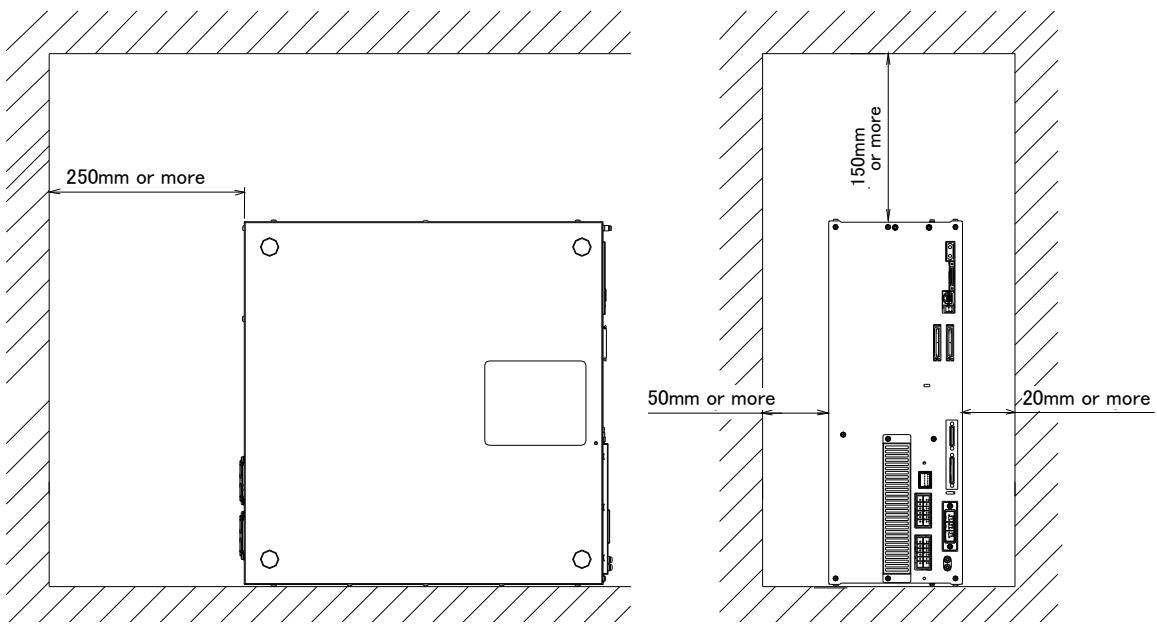


Fig.3-18 : Installation of controller (CR751: RV-13F series)

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. 3-19](#). 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.

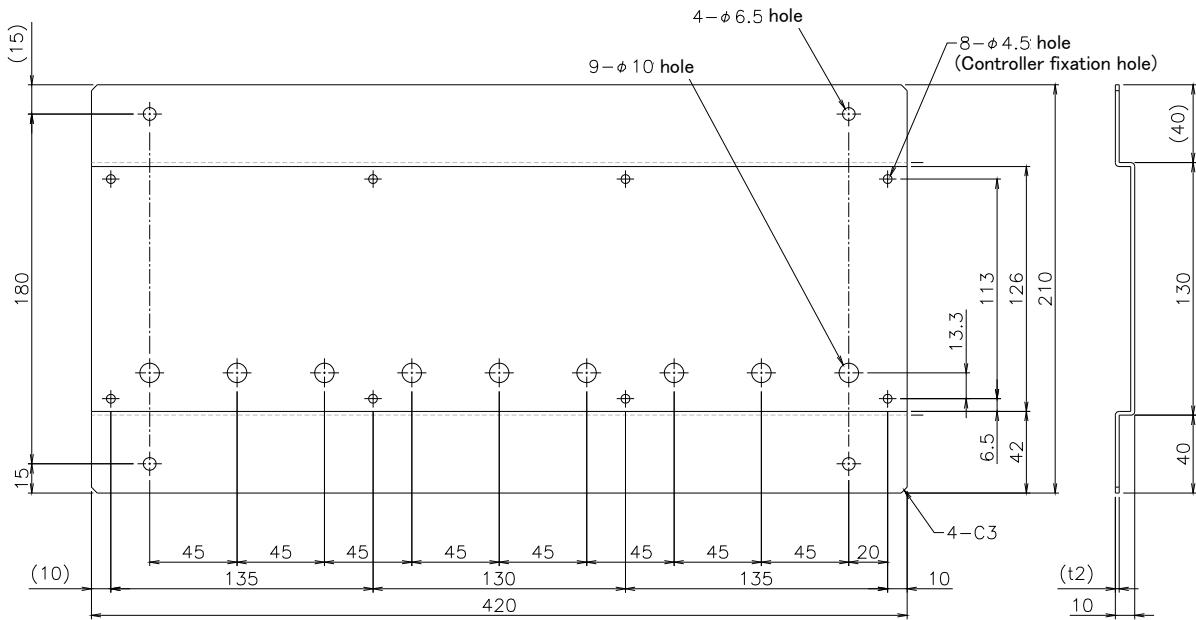
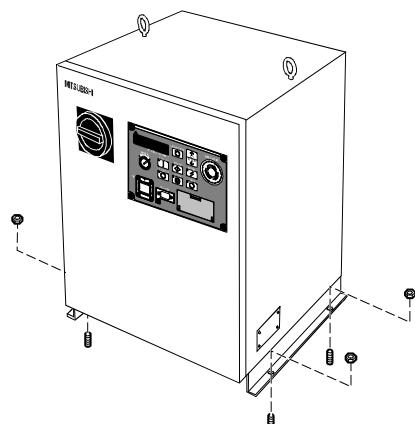


Fig.3-19 : Metal plate for fixation to placing vertically (Reference for CR751: RV-13F series)

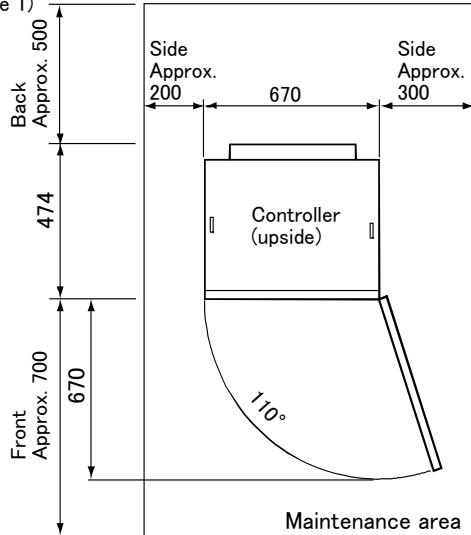
(4) CR760 drive unit

<Non-CE marking specification>



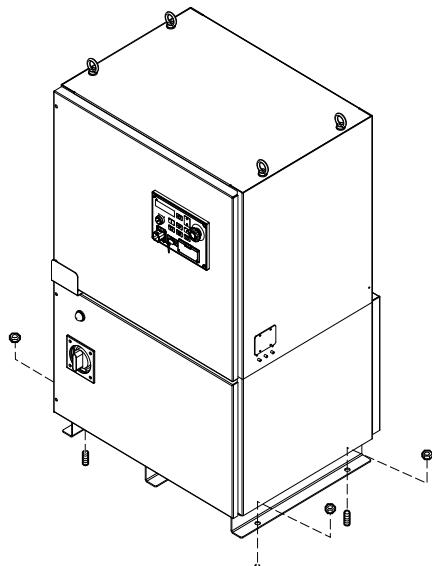
(Anchor bolt installation: 4 places)

Note 1)



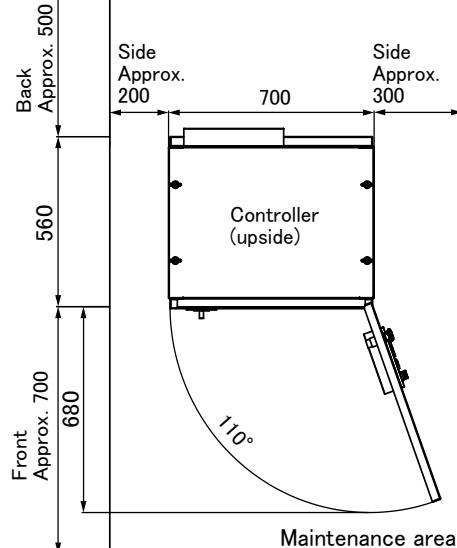
(View from upside)

<CE marking specification>



(Anchor bolt installation: 4 places)

Note 1)



(View from upside)

Note 1) The controller sucks in the outside air and discharges the inside air after cooling. The space required for cooling is 100 mm minimum. Reserve approximately 500 mm of space behind the unit as the maintenance work area.

Fig.3-20 : Installation of controller (CR760)

(5) 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.

<Q172DRCPU>

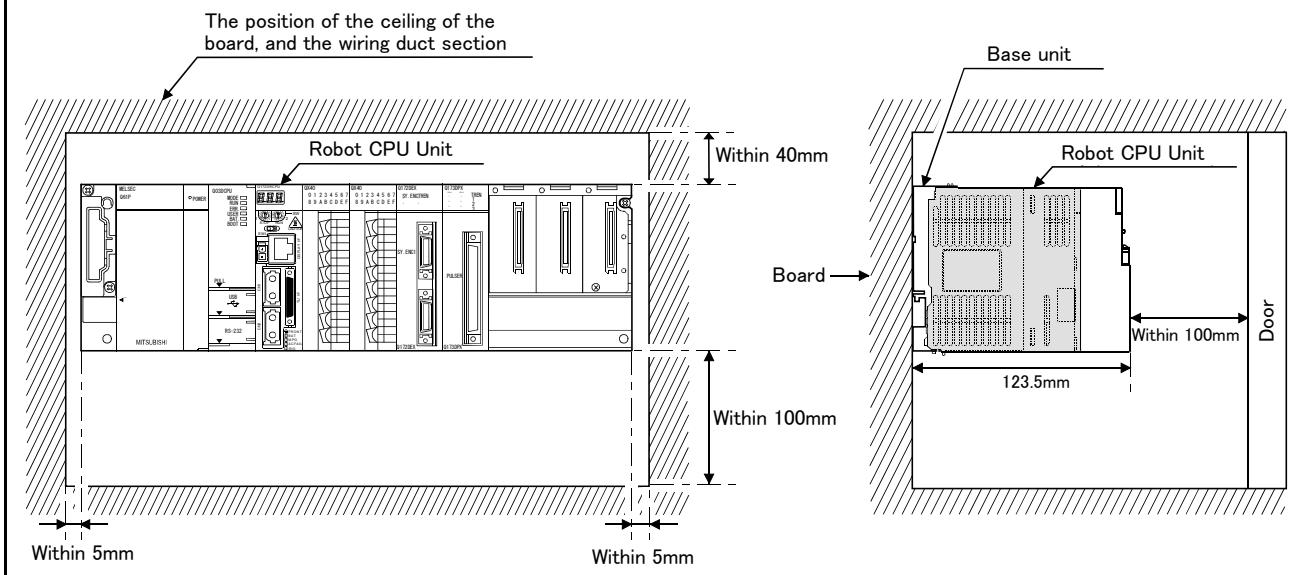


Fig.3-21 : Installation of robot CPU Unit

3.4 External input/output

3.4.1 Types

- (1) Dedicated input/output.....These inputs and outputs carry out the robot remote operation and status display.
- (2) General-purpose input/output.....These are inputs and outputs that the customer can program for peripheral device control.
- (3) Hand input/output.....These are inputs and outputs related to the hand that the customer can program.
- (4)Emergency stop/Door switch input.....The wiring for the safe security of the emergency stop etc. is shown in on [Page 141, "3.6 Emergency stop input and output etc."](#) and on [Page 192, "6.1.7 Examples of safety measures"](#).

<For Reference>

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

3.5 Dedicated input/output

Show the main function of dedicated input/output in the **Table 3-4**. 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 3-4 : Dedicated input/output list

Parameter name	Input			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			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.

3.6 Emergency stop input and output etc.

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

Table 3-5 : 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 151, "3.6.2 Special stop input (SKIP)")
Input	Door switch	Servo-off. Dual line, normal close (Page 153, "3.6.3 Door switch function")
Input	Enabling device	Servo-off. Dual line, normal close (Page 153, "3.6.4 Enabling device function")
Output	Robot error output	Contactor is opening during error occurrence.
Output	Emergency stop output	The point of contact opens under occurrence of emergency stop of external input signal, emergency stop of OP, emergency stop of T/B.
Output	Mode output	MANUAL mode: contactor is opening, AUTOMATIC mode: contactor is closing.
Output	Magnet contactor control connector output for addition axes	When an additional axis is used, the servo ON/OFF status of the additional axis can be synchronized with the robot arm. (Page 162, "3.9 Magnet contactor control connector output (AXMC) for addition axes")

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

[Note] The contact capacity of each input/output terminal is DC24V/10mA – 100mA. Don't connect the equipment except for this range. The use exceeding contact capacity causes failure.

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

Pin number assignment of each terminal and the circuit diagram are shown in [Fig. 3-23 \(CR750\)](#), [Fig. 3-27 \(CR751\)](#), or [Fig. 3-30 \(CR760\)](#).

3.6.1 Connection of the external emergency stop

The external emergency stop input and door switch input and enabling device input are opened at shipment as shown in [Fig. 3-23 \(CR750\)](#), [Fig. 3-27 \(CR751\)](#), or [Fig. 3-30 \(CR760\)](#).

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 192, "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

- CR750 drive unit.....CNUSR11 connector "between 3 and 4" and CNUSR12 Connector "between 3 and 4".
- CR751 drive unit.....CNUSR1 connector "between 2 and 27" and "between 7 and 32".
- CR760 drive unit.....EMG1 connector "between 3 and 15" and "between 4 and 16".

b) Door switch

- CR750 drive unit.....CNUSR11 connector "between 7 and 8" and CNUSR12 connector "between 7 and 8".
- CR751 drive unit.....CNUSR1 connector "between 4 and 29" and "between 9 and 34".
- CR760 drive unit.....EMG1 connector "between 9 and 21" and "between 10 and 22".

c) Enabling device

- CR750 drive unit.....CNUSR11 connector "between 9 and 10" and CNUSR12 connector "between 9 and 10".
- CR751 drive unit.....CNUSR1 connector "between 5 and 30" and "between 10 and 35".
- CR760 drive unit.....EMG1 connector "between 7 and 19" and "between 8 and 20".

[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).

(1) CR750 drive unit

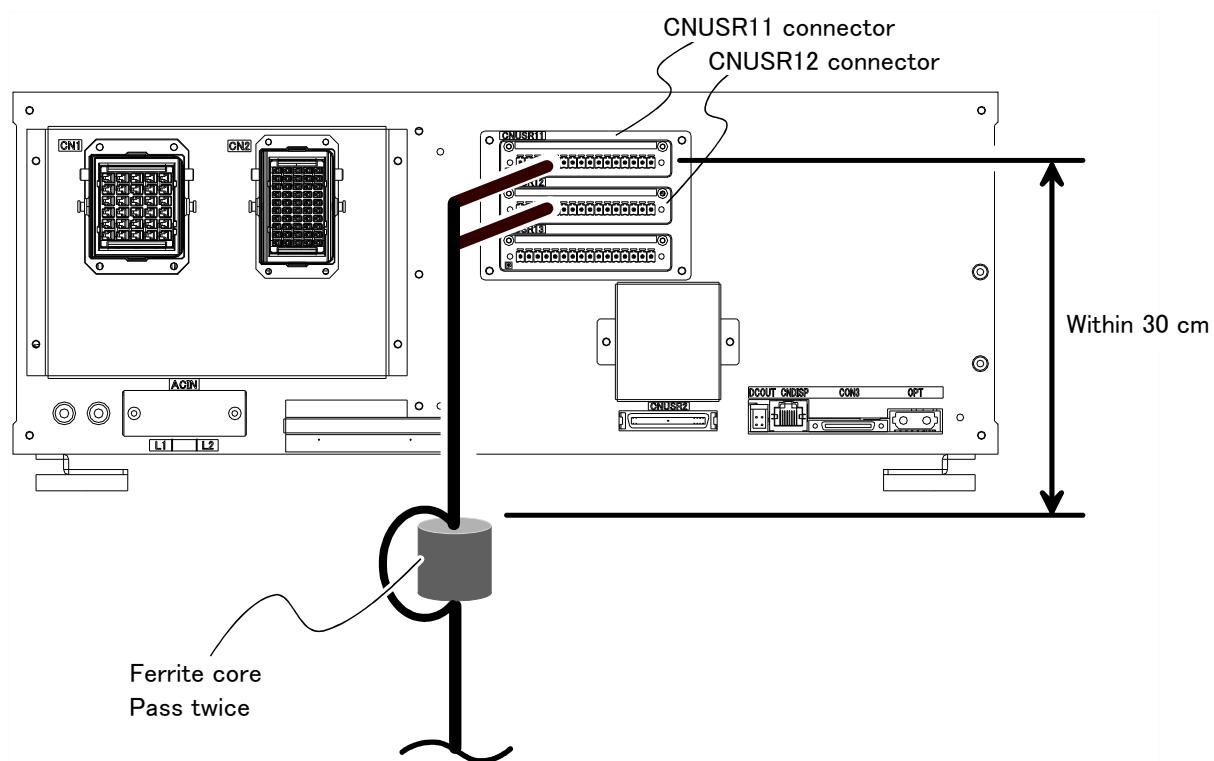


Fig.3-22 : Emergency stop cable connection (CR750)

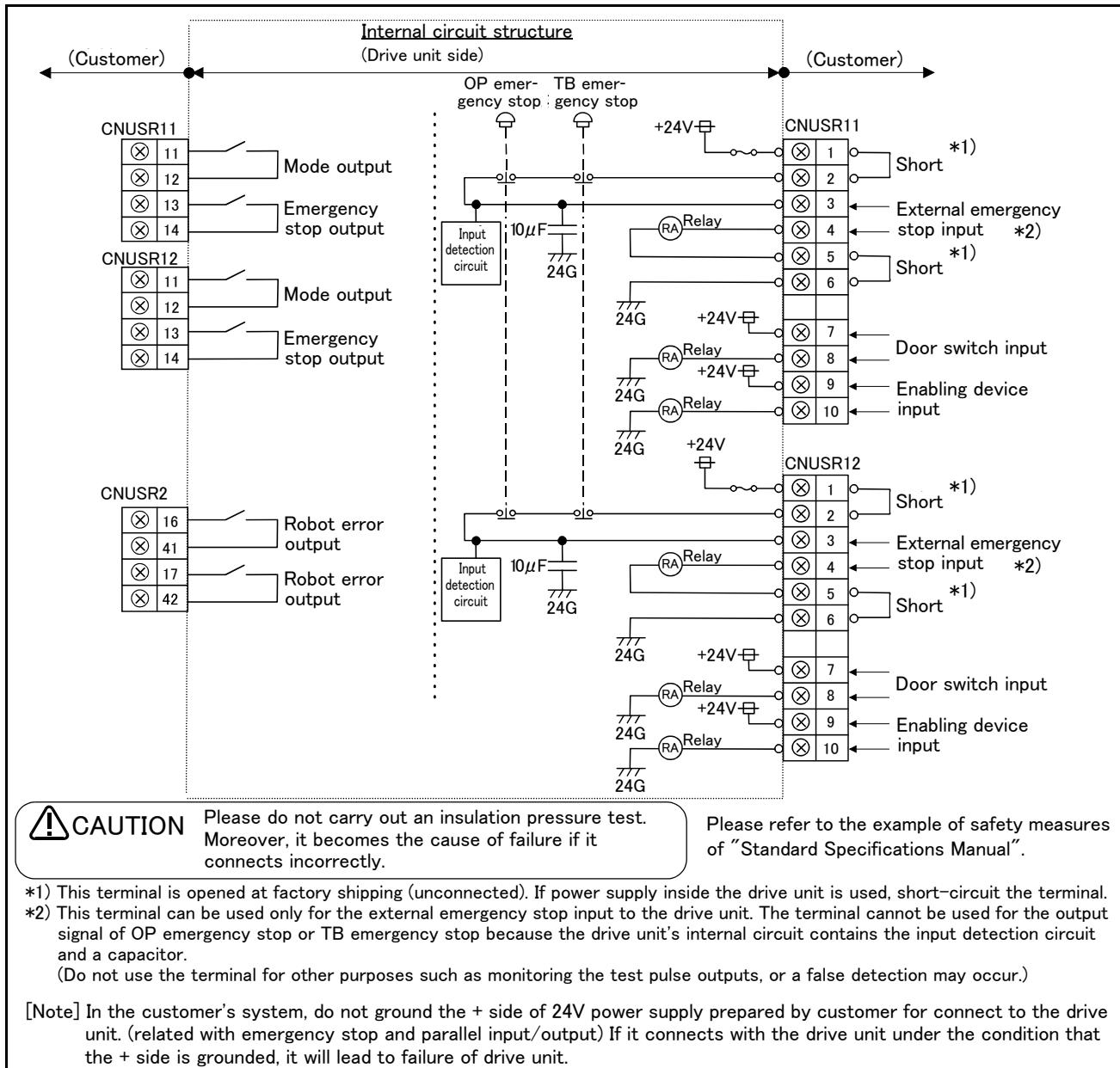


Fig.3-23 : External emergency stop connection (CR750)

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 192, "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.

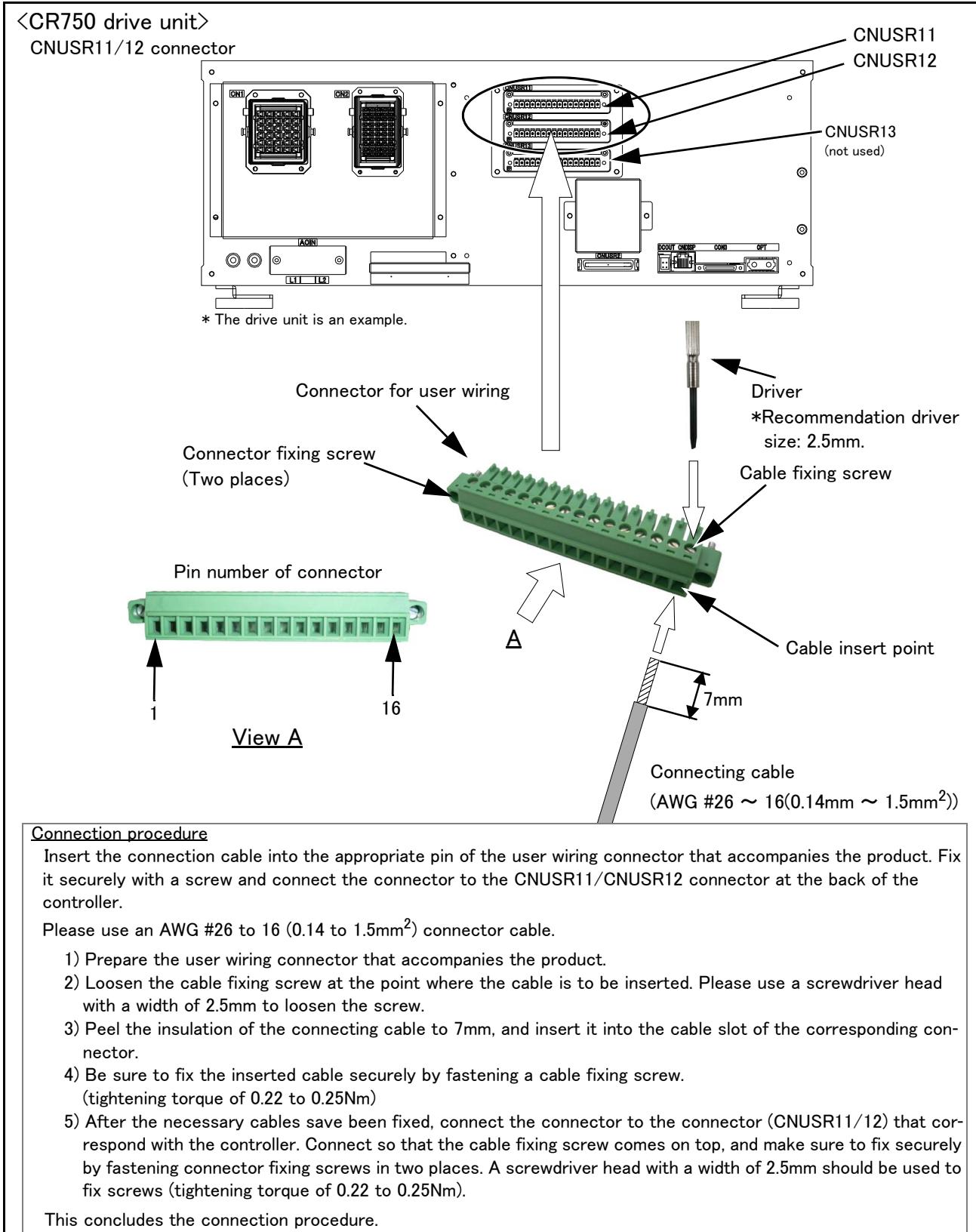


Fig.3-24 : Method of wiring for external emergency stop connection (CR750 (CNUSR11/12))

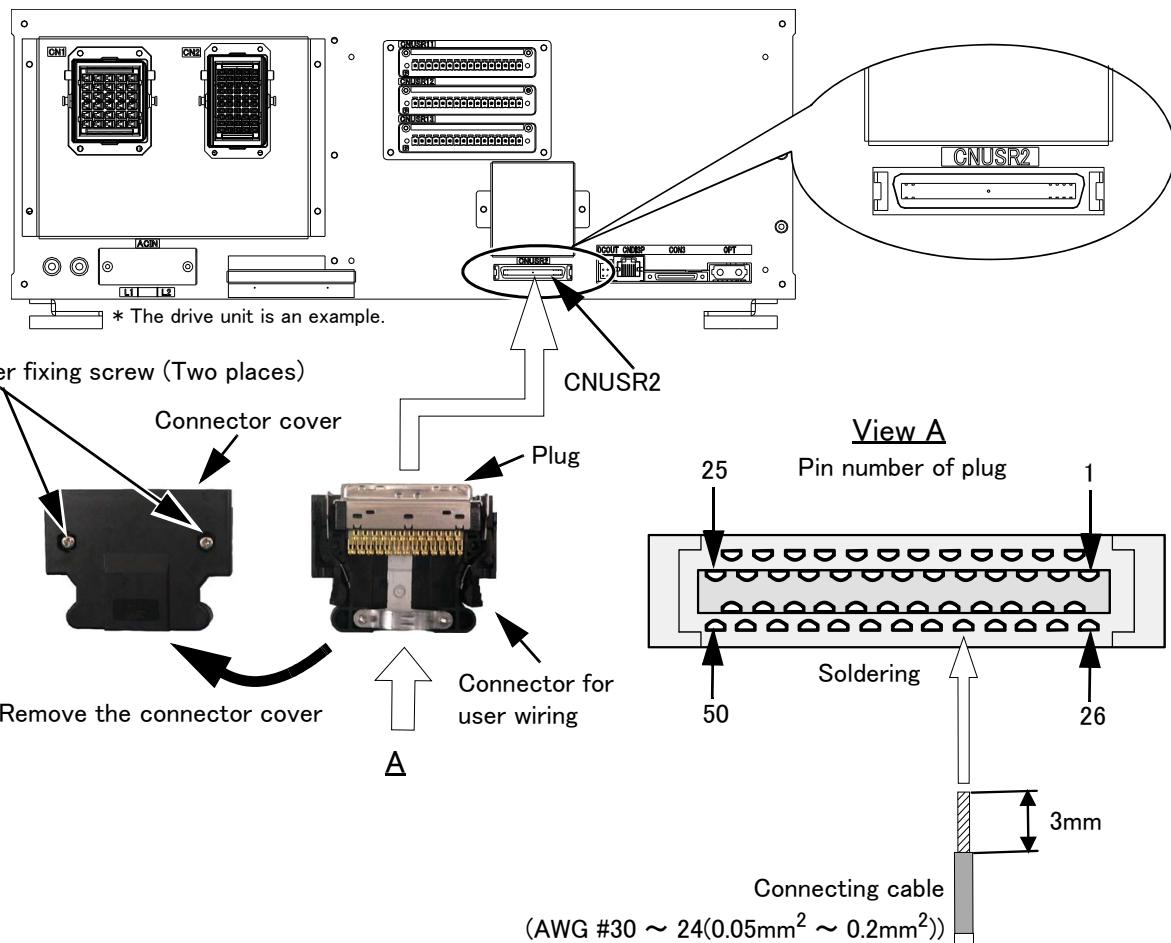


CAUTION

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

<CR750 drive unit>

CNUSR2 connector

**Connection procedure**

Solder the pins of the user wiring connector that accompanies the product, and connect the connector to the CNUSR2 connector at the back of the drive unit. For the connection cables, please use AWG #30 to 24 (0.05 to 0.2mm²).

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

This concludes the connection procedure.

Fig.3-25 : Method of wiring for external emergency stop connection (CR750 (CNUSR2))

**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.

(2) CR751 drive unit

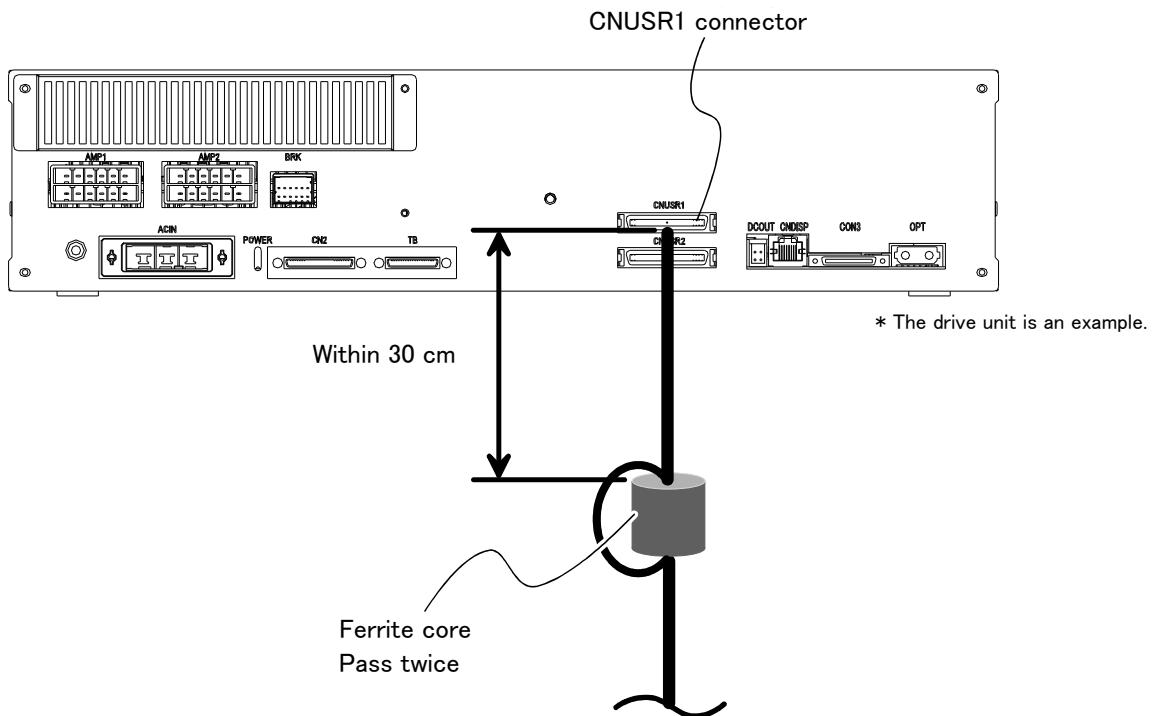


Fig.3-26 : Emergency stop cable connection (CR751)

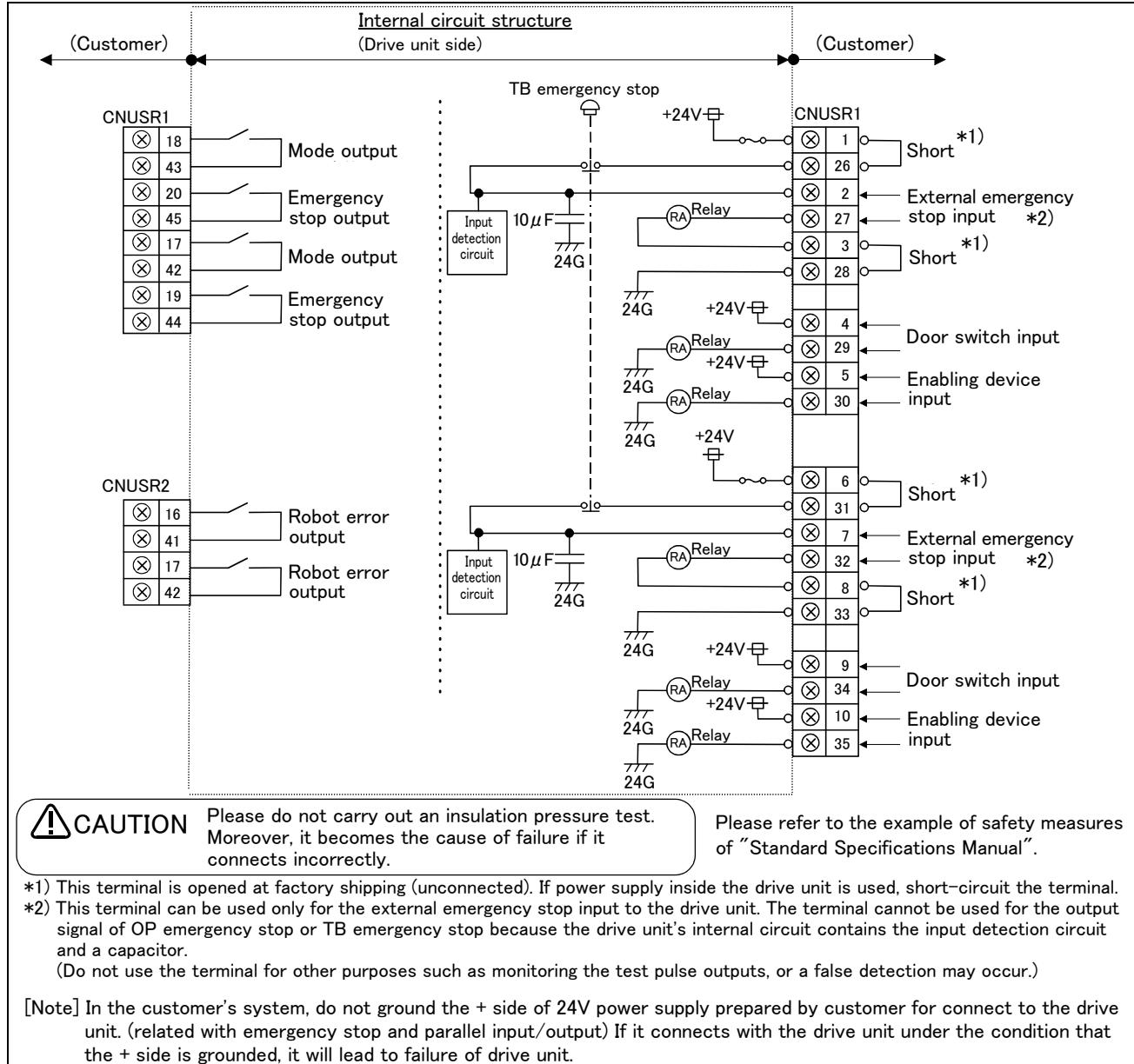


Fig.3-27 : External emergency stop connection (CR751)



! 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 192, "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.

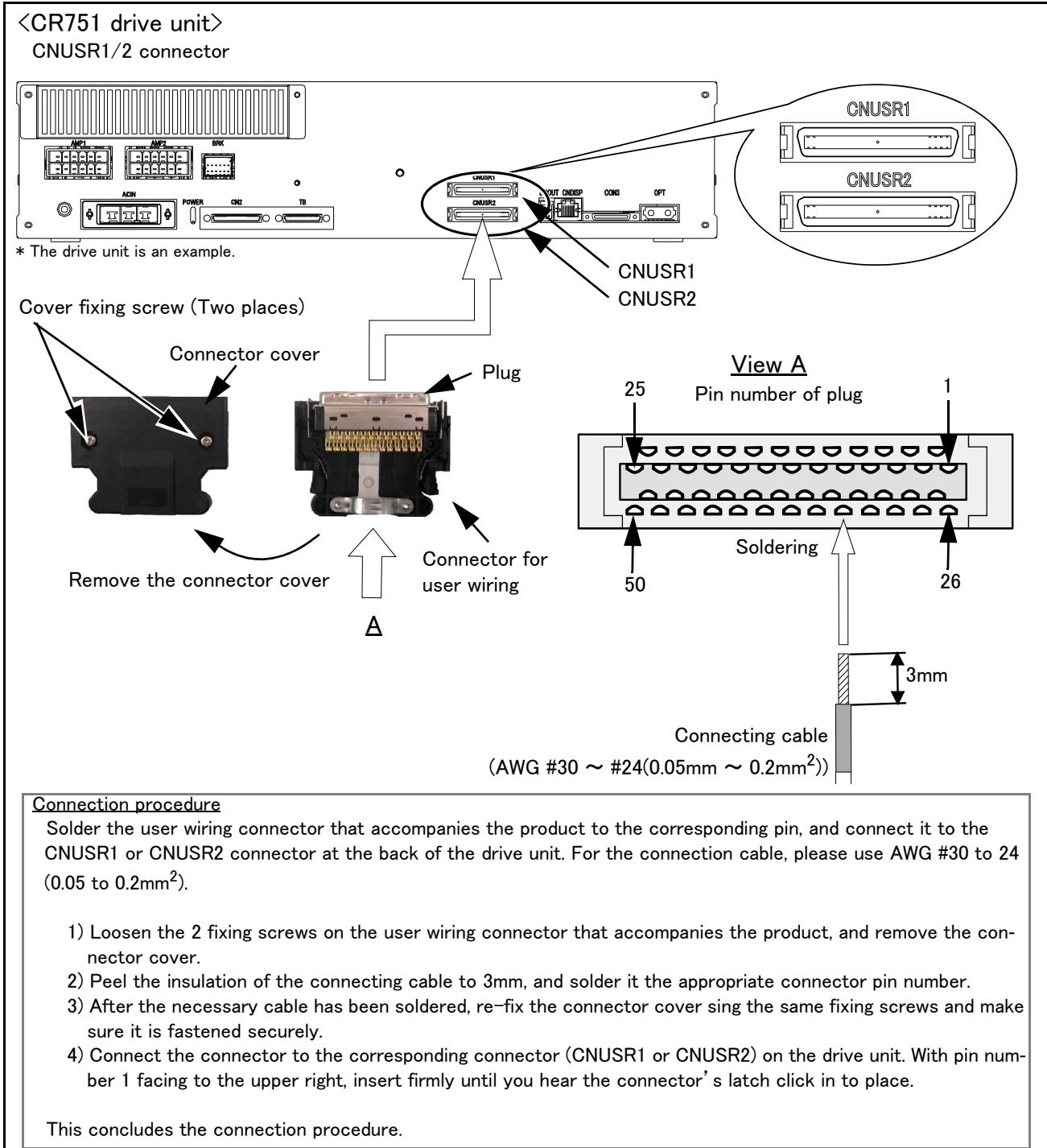


Fig.3-28 : Method of wiring for external emergency stop connection (CR751 (CNUSR1/2))

⚠ 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) CR760 drive unit

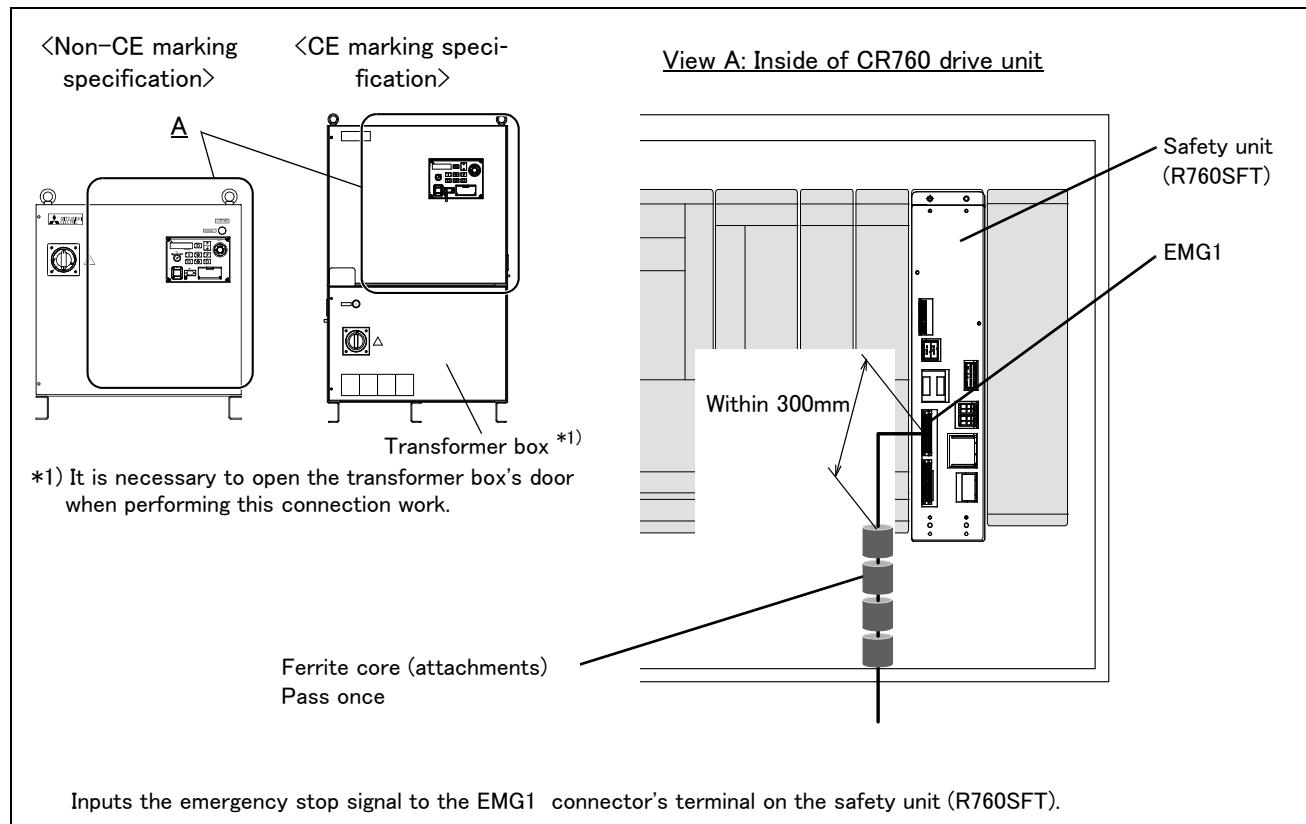


Fig.3-29 : Emergency stop cable connection (CR760)

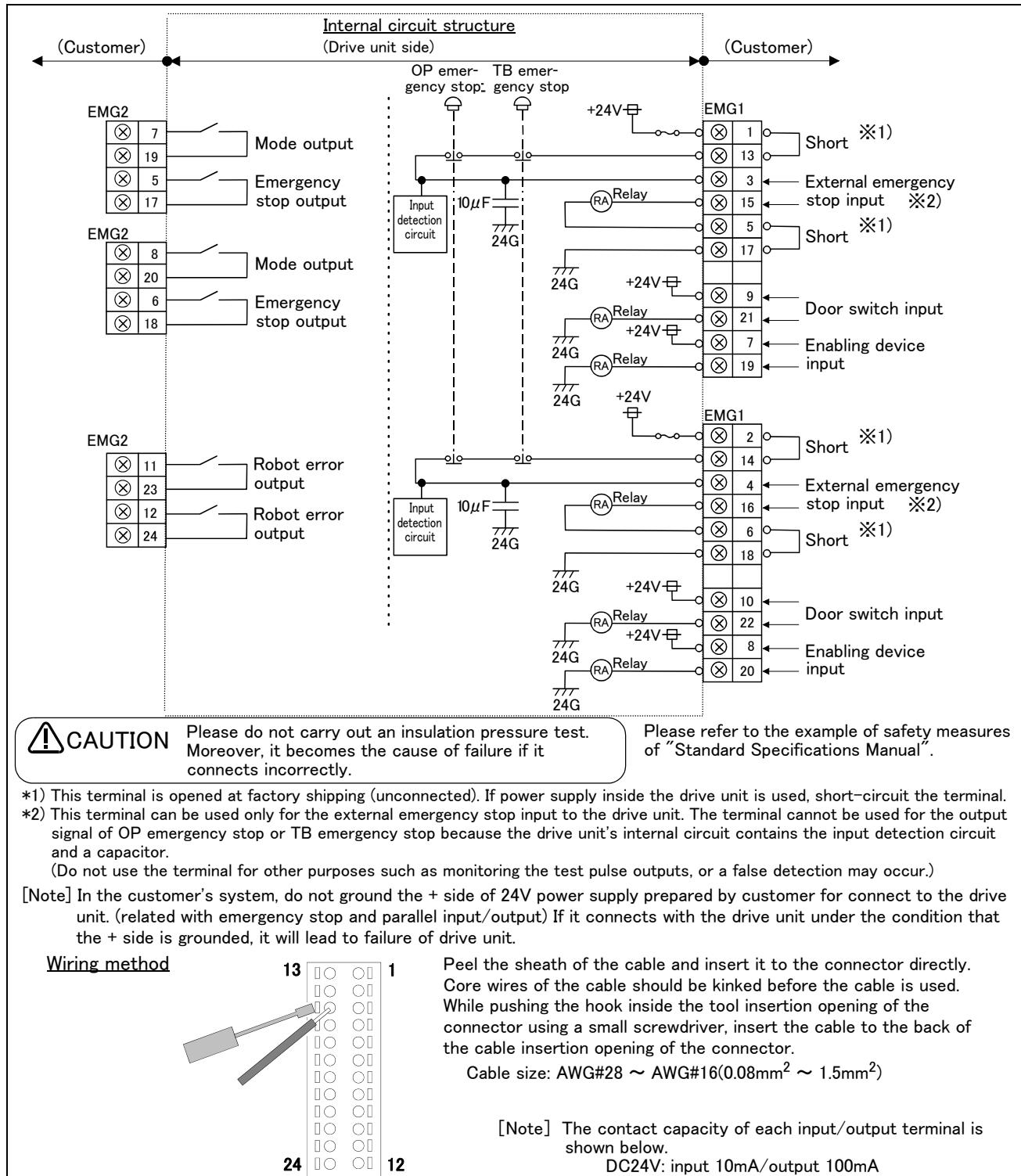


Fig.3-30 : External emergency stop connection (CR760)



Place the emergency stop switch in an easily operable position, and be sure to wire it to the emergency stop correctly by referencing [Page 192, "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.



Be careful of the short circuit at cable connection.

And, do not give plating solder to the electric wire. Loose connection may occur.

3.6.2 Special stop input (SKIP)

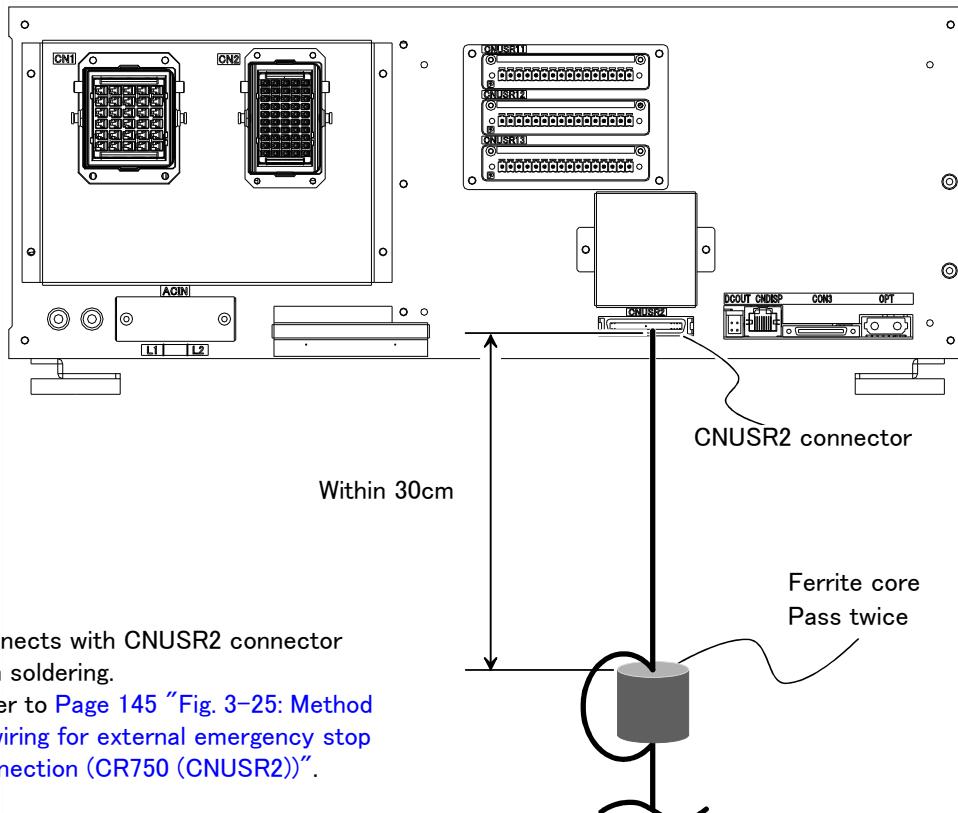
The skip is the input signal to stop the robot. The pin 9, 34 of the CNUSR2 connector shown in Fig. 3-31 (CR750) or Fig. 3-32 (CR751).

In CR760 controller, the pin 1, 13 of the EMG2 connector shown in Fig. 3-33.

Table 3-6 : Special stop input electric specification

Item		Specifications	Internal circuit
Type	DC input	CR750/CR751 controller	
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 kΩ		
Response time	OFF → ON ON → OFF		
Common method	1 point per common	CR760 controller	
External wire connection method	Connector		

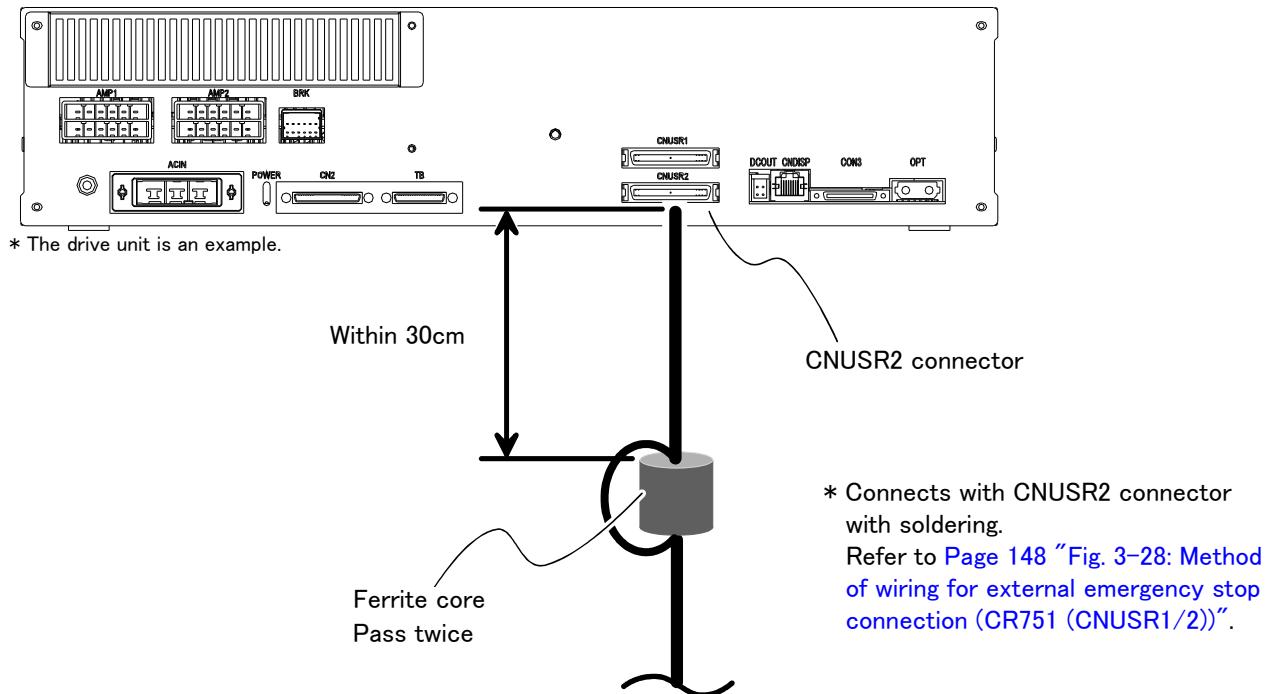
(1) CR750 drive unit



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.3-31 : Connection of the special-stop-input (CR750)

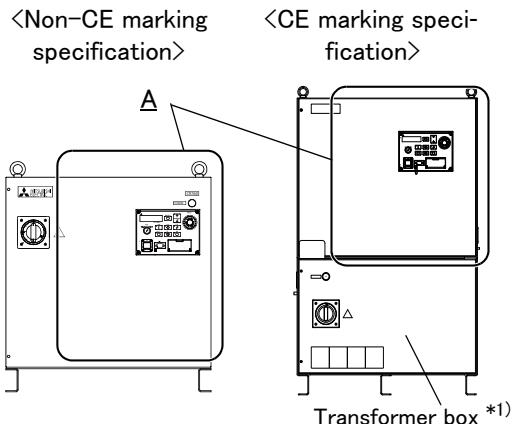
(2) CR751 drive unit



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.3-32 : Connection of the special-stop-input (CR751)

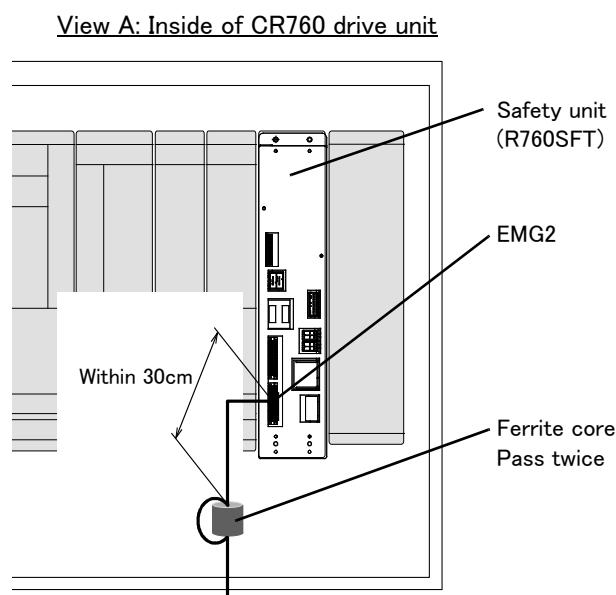
(3) CR760 drive unit



* Connection method is the same as the connection of emergency stop.
Refer to [Page 150 "Fig. 3-30: External emergency stop connection \(CR760\)"](#).

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.3-33 : Connection of the special-stop-input (CR760)



3.6.3 Door switch function

This function retrieves the status of the switch installed on the door of the safety fence, etc., and stops the robot when the door is opened. This differs from an emergency stop in that the servo turns OFF when the door is opened and an error does not occur. Follow the wiring example shown in [Page 143 "Fig. 3-23: External emergency stop connection \(CR750\)"](#), [Page 147 "Fig. 3-27: External emergency stop connection \(CR751\)"](#), or [Page 150 "Fig. 3-30: External emergency stop connection \(CR760\)"](#), and [Page 192, "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 operation When 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.

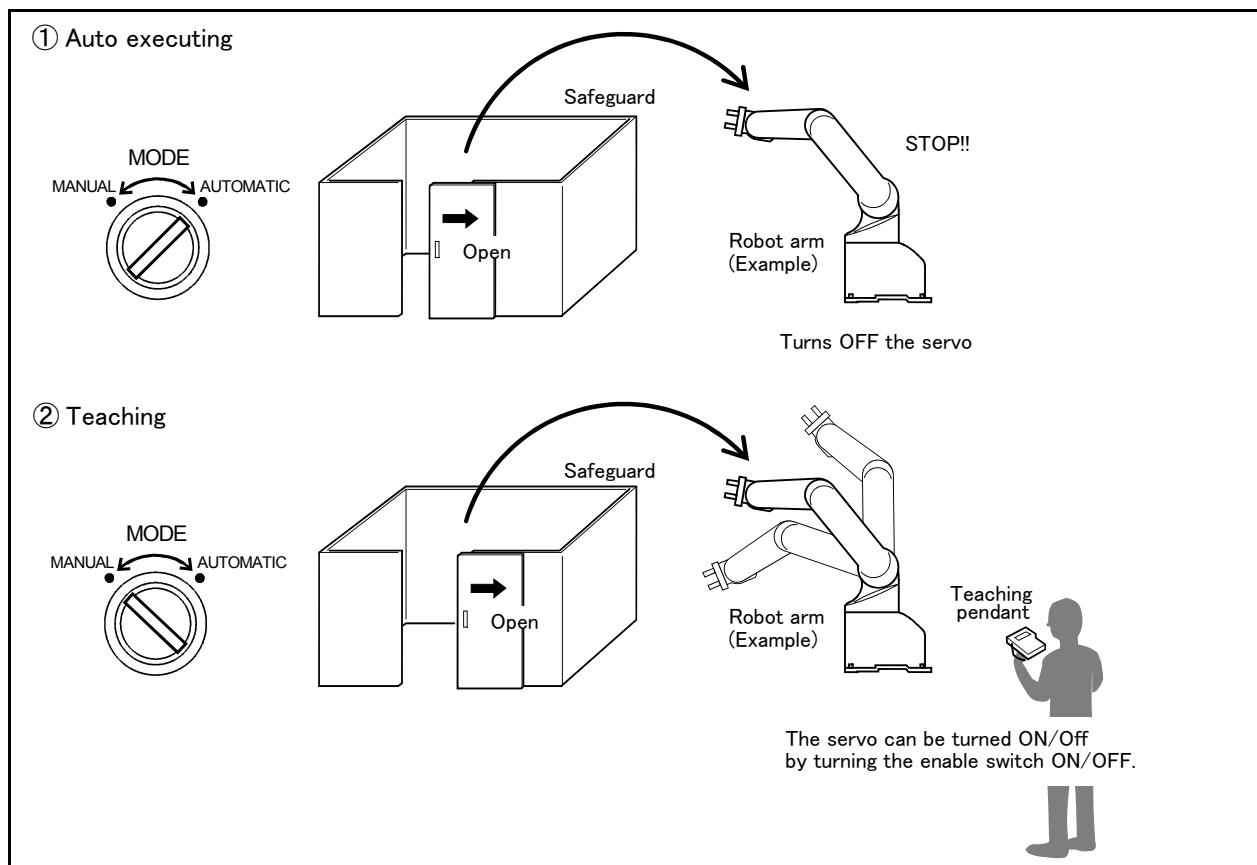


Fig.3-34 : Door switch function

3.6.4 Enabling device function

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

(1) When door is opening

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

(2) When door is closing

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

*1) Recommendation products: HE1G-L20MB (IDEK)

(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 3-7 : Various operations and necessary switch settings

No	Operation	Related switch settings <small>Note1)</small>					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 <small>Note2)</small>	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 <small>Note3)</small>	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 CR750 controller: [Page 113, "3.2 Names of each part"](#)
- Mode of CR751 controller: [Page 155, "3.7 Mode changeover switch input"](#)
- Mode of CR760 controller: [Page 113, "3.2 Names of each part"](#)
- T/B enable/disable: [Page 166, "\(1\) Teaching pendant \(T/B\)"](#)
- T/B enable switch: [Page 166, "\(1\) Teaching pendant \(T/B\)"](#)
- Enabling device input terminal: [Page 192, "6.1.7 Examples of safety measures"](#)
- Door switch input terminal: [Page 192, "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.

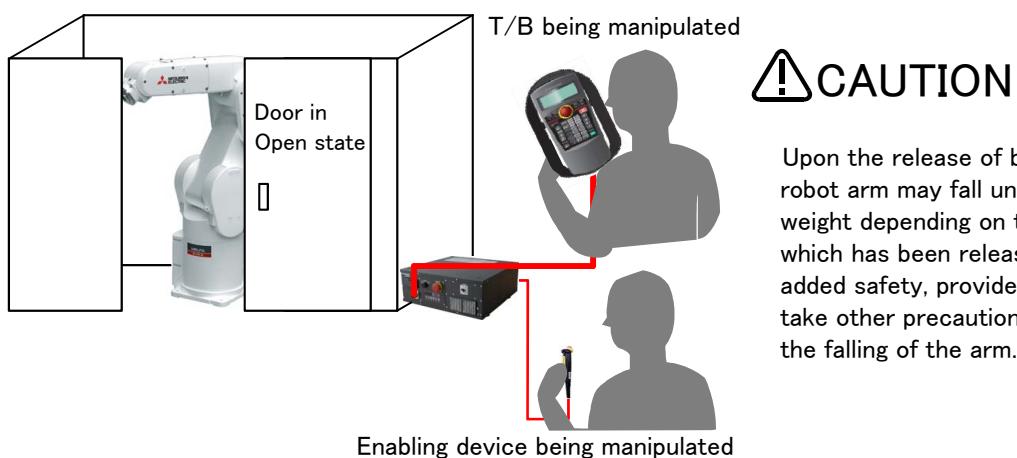


Fig.3-35 : Brake release operation

3.7 Mode changeover switch input

Connect the key switch of customer prepared and change the right of robot's operation by switch operation.

The key switch can be installed in the operation panel of customer preparation.

<Right of operation (mode)>

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.

MANUAL When 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.

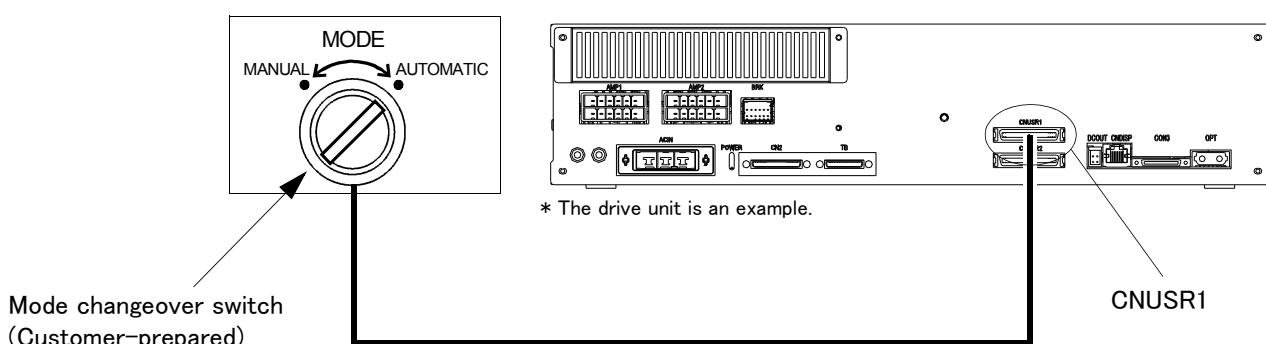


Fig.3-36 : Mode changeover switch image figure (CR751)

(1) Specification of the key switch interface

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

Table 3-8 : 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 49–24 pin and between 50–25 pin.

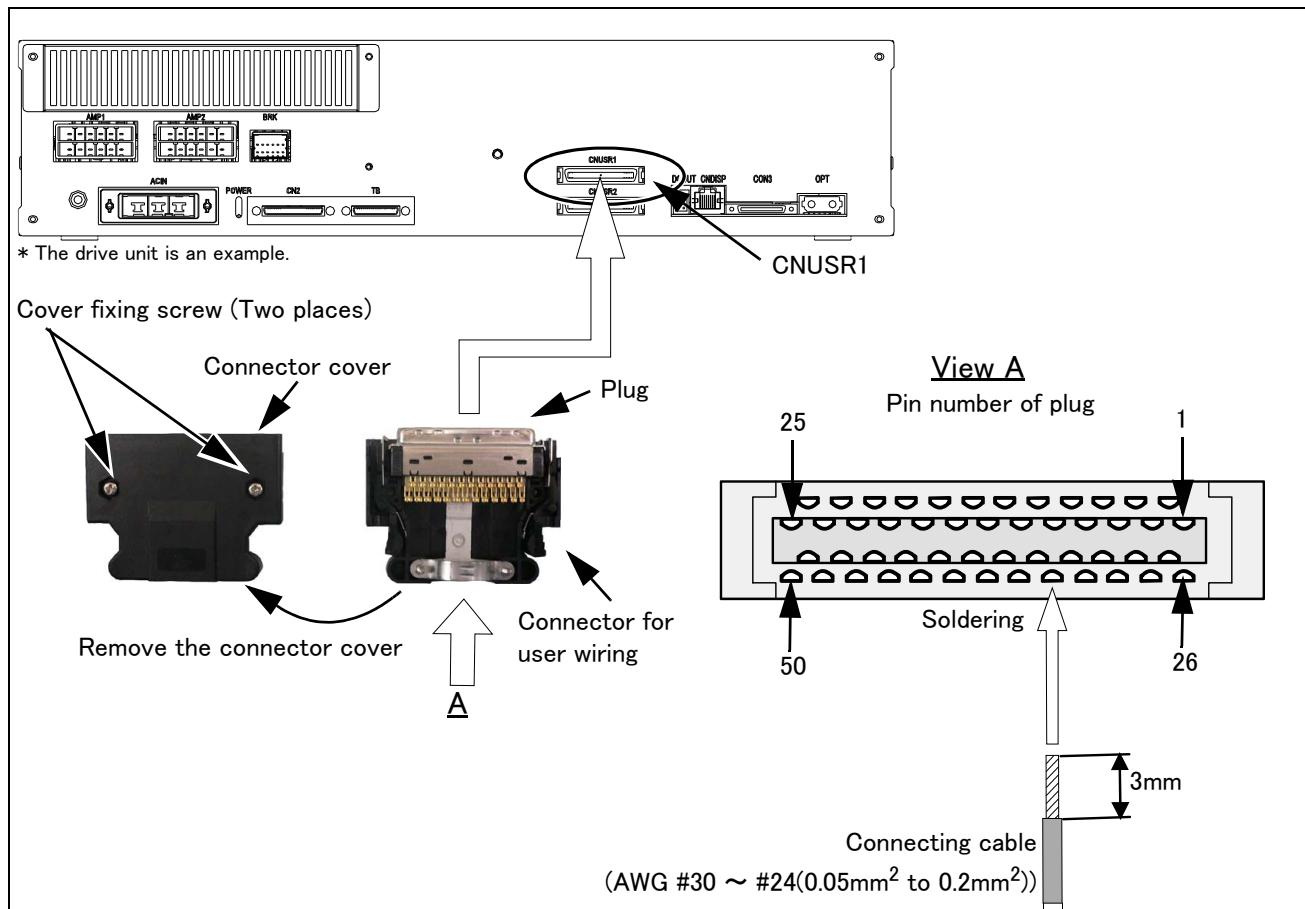
When input states differ between two lines, error H0044 (OP Mode key line is faulty) will occur.

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

Table 3-9 : 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. 2.2kΩ	
Response time (OFF→ON)	Approx. 15ms	Example: The response time the program starts, after pushing the run button.
Common method	1 point per common	
Connection method	Connector	
Conformity electric wire size	AWG#24 to #18	0.2 to 0.75mm ²
Maker/Type	-	Maker: PHOENIX CONTACT/ Type: FKC2.5/4-STF-5.0B

(2) Connection of the mode changeover switch input

Connection procedure

Solder the user wiring connector that accompanies the product to the corresponding pin, and connect it to the CNUSR1 connector at the back of the drive unit. For the connection cable, please use AWG #30 to 24 (0.05 to 0.2mm²).

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

This concludes the connection procedure.

Fig.3-37 : Connection of the mode changeover switch input (CR751)

3.8 Additional Axis Function

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

3.8.1 Wiring of the Additional Axis Interface

Table 3-10 shows the connectors for additional axes inside the drive unit. [Fig. 3-38 \(CR750\)](#), [Fig. 3-39 \(CR751\)](#), and [Fig. 3-39 \(CR760\)](#) shows a connection example (configuration example).

Table 3-10 : 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.

(1) CR750 drive unit

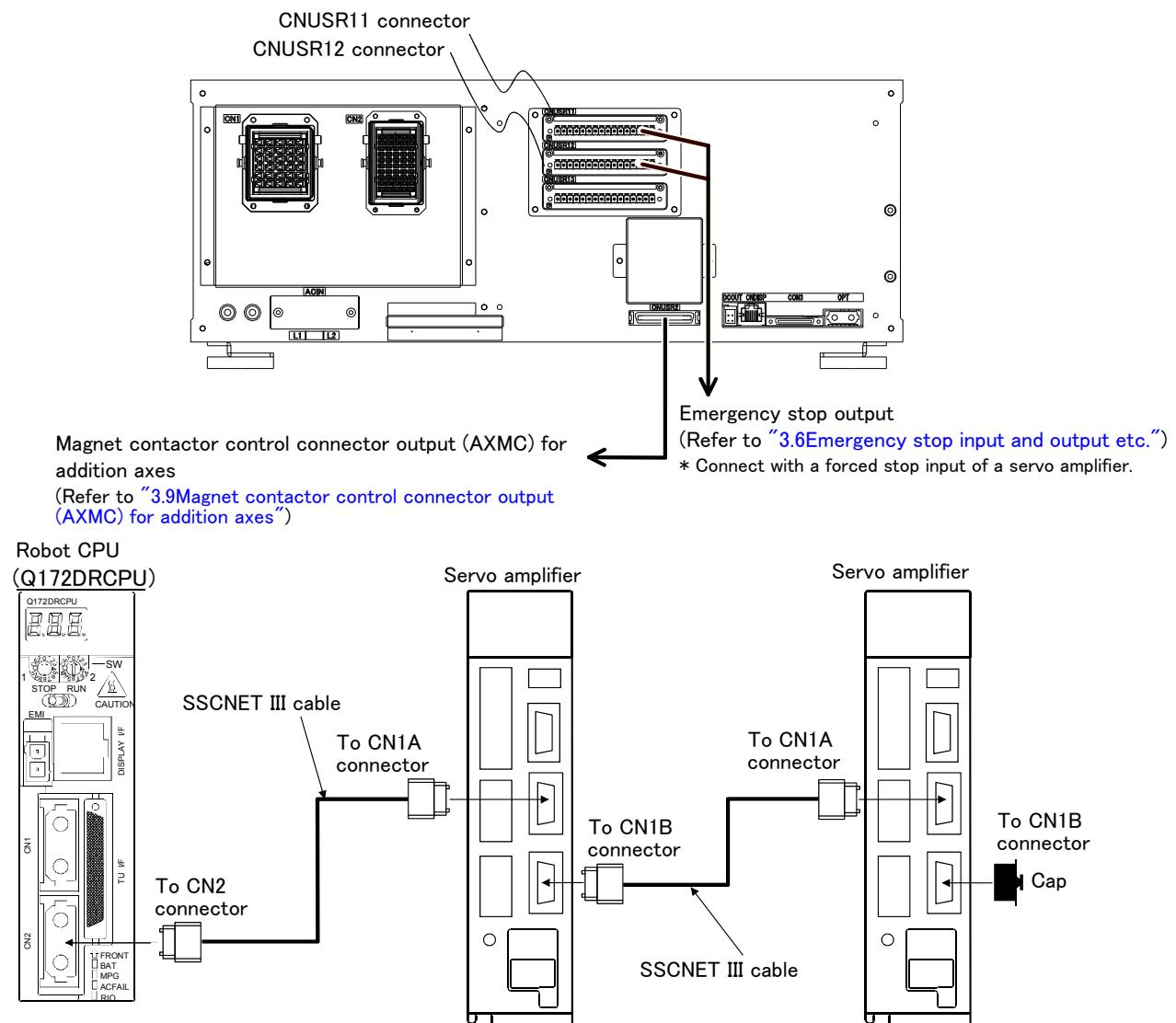


Fig.3-38 : Example of addition axis connection (CR750)

(2) CR751 drive unit

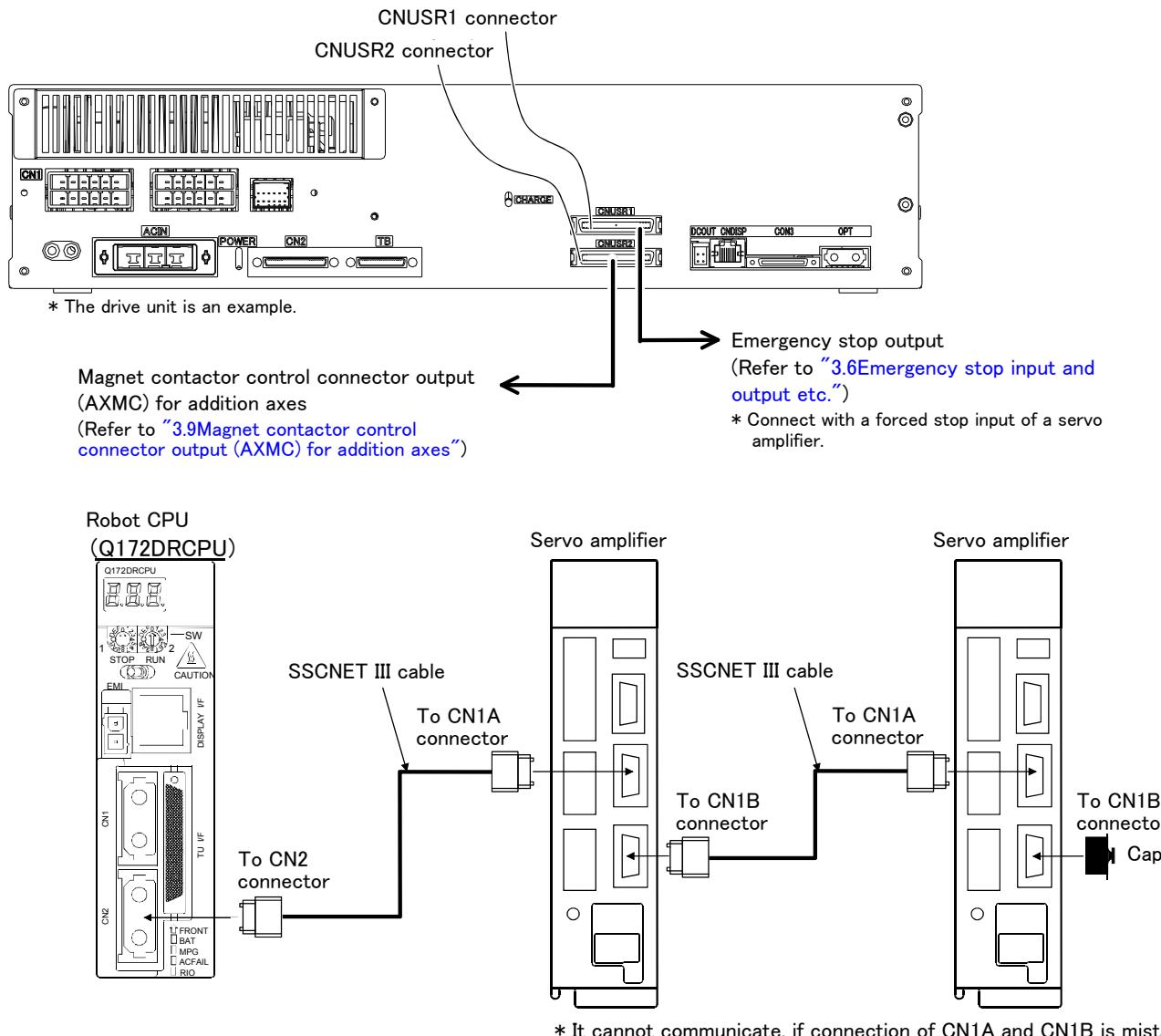
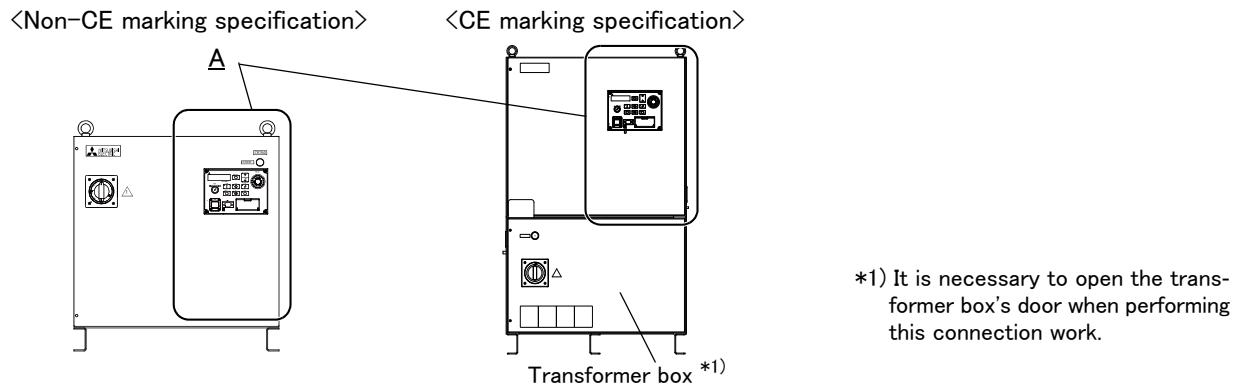
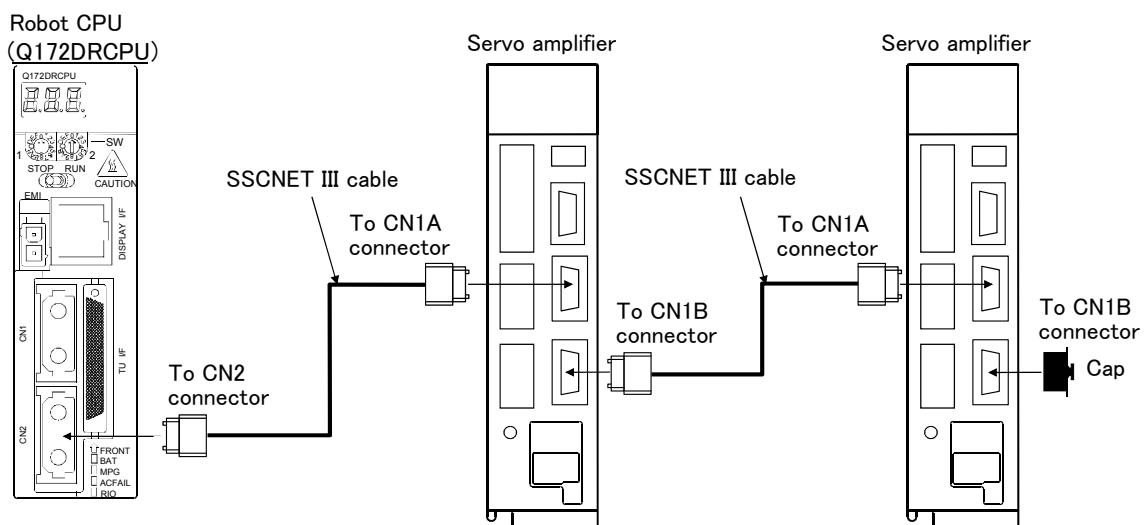
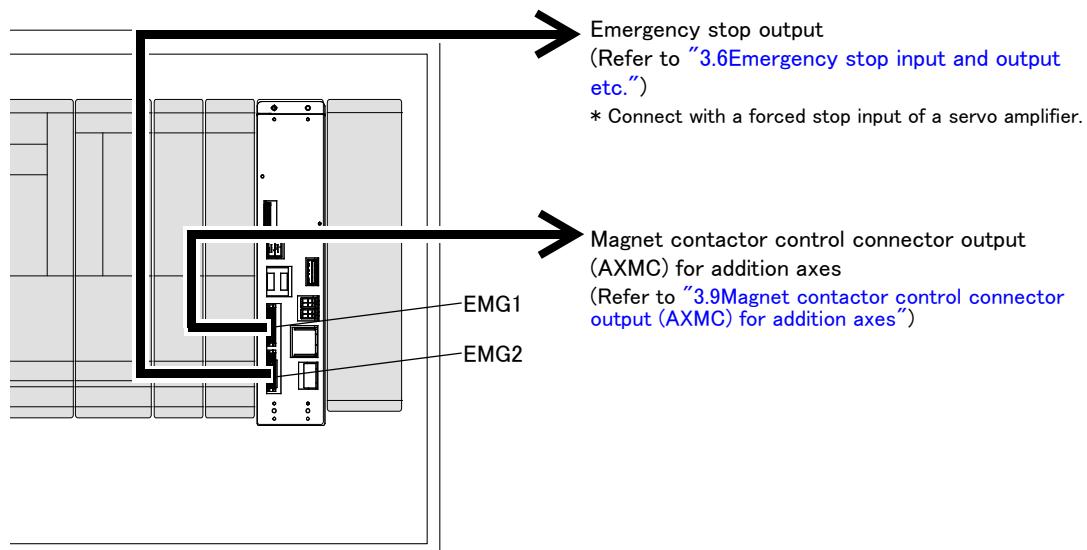


Fig.3-39 : Example of addition axis connection (CR751)

(3) CR760 drive unit

View A: Inside of CR760 drive unit

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

Fig.3-40 : Example of addition axis connection (CR760)

(4) Example of the installation of the noise filter

1) EMC filter (recommended)

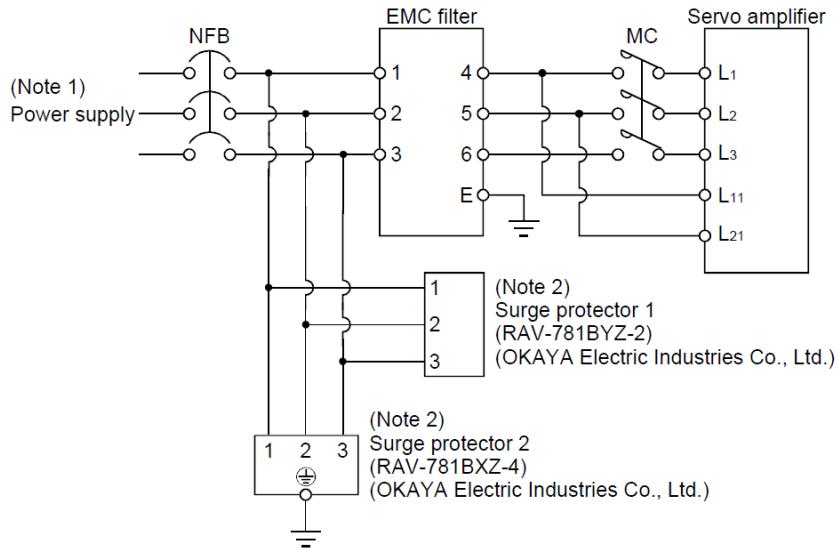
Please install the recommendation filter shown below according to the example of connection.

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		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		
MR-J3-11KB4	TF3030C-TX		7.5(16.54)
MR-J3-15KB4	TF3040C-TX		12.5(27.56)
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.3-41 : 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.

Connection diagram	Outline drawing [Unit: mm]
<p>Use the line noise filters for wires of the main power supply ($L_1 \cdot L_2 \cdot L_3$) and of the motor power supply ($U \cdot V \cdot W$). Pass each of the 3-phase wires through the line noise filter an equal number of times in the same direction. For the main power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the motor power supply, passes must be four times or less. Do not pass the grounding (earth) wire through the filter, or the effect of the filter will drop. Wind the wires by passing through the filter to satisfy the required number of passes as shown in Example 1. If the wires are too thick to wind, use two or more filters to have the required number of passes as shown in Example 2. Place the line noise filters as close to the servo amplifier as possible for their best performance.</p> <p>Example 1</p> <p>(Number of turns: 4)</p> <p>Example 2</p> <p>Two filters are used (Total number of turns: 4)</p>	<p>FR-BSF01 (for wire size 3.5mm^2 (AWG12) or less))</p> <p>Approx.110</p> <p>95±0.5</p> <p>2-φ5</p> <p>Approx.22.5</p> <p>Approx.65</p> <p>φ33</p> <p>4.5</p> <p>Approx.65</p> <p>FR-BLF(for wire size 5.5mm^2 (AWG10) or more))</p> <p>φ7</p> <p>31.5</p> <p>130</p> <p>85</p> <p>7</p> <p>80</p> <p>35</p> <p>2.3</p> <p>160</p> <p>180</p>

Fig.3-42 : Example of noise filter installation

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

When an additional axis is used, the servo ON/OFF status of the additional axis can be synchronized with the servo ON/OFF status of the robot itself by using the output contact (AXMC) provided on the rear or inside of the 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 is shown "[\(1\)Example circuit](#)". An image of how to connect the controller connector are shown "[\(2\)Image of how to connect the controller connector](#)".

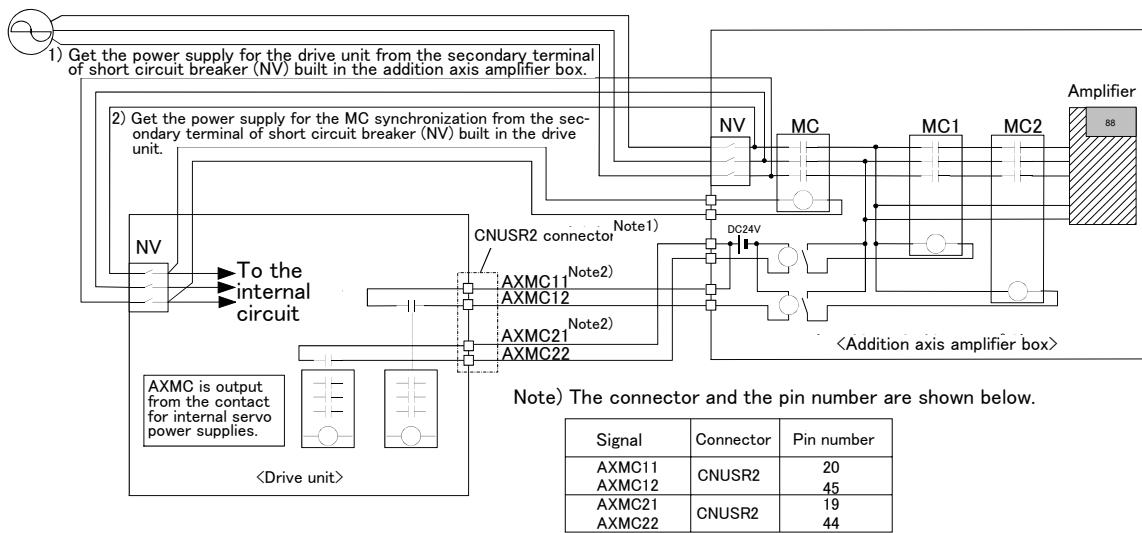
When you are using an additional axis, please perform appropriate circuit connections by referring to these drawings.

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

Note1) If 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.

(1) Example circuit

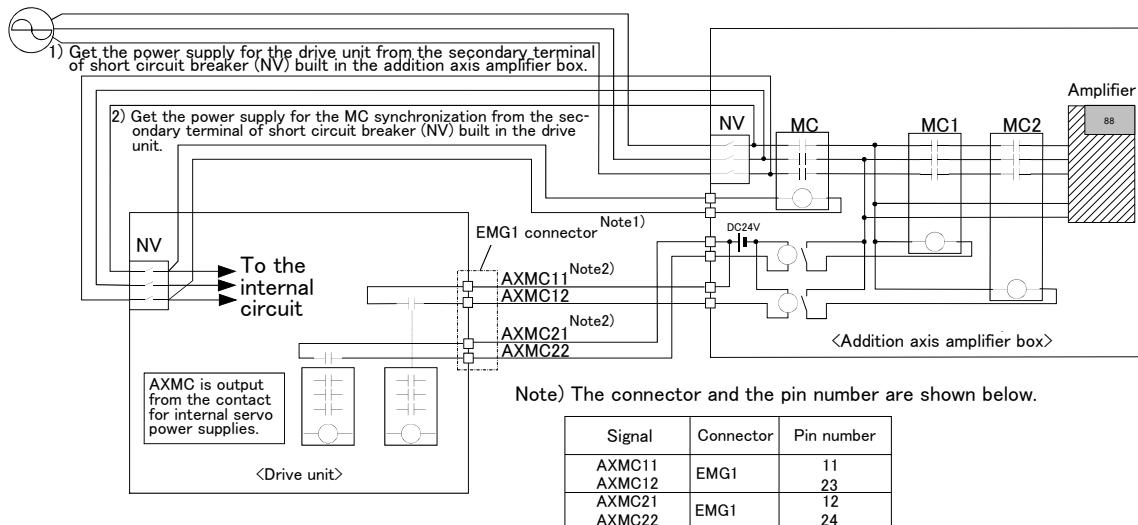
■ CR750/CR751 drive unit



[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.3-43 : Example of circuit for addition axes of Magnet contactor control output (CR750/CR751 drive unit)

■ CR760 drive unit



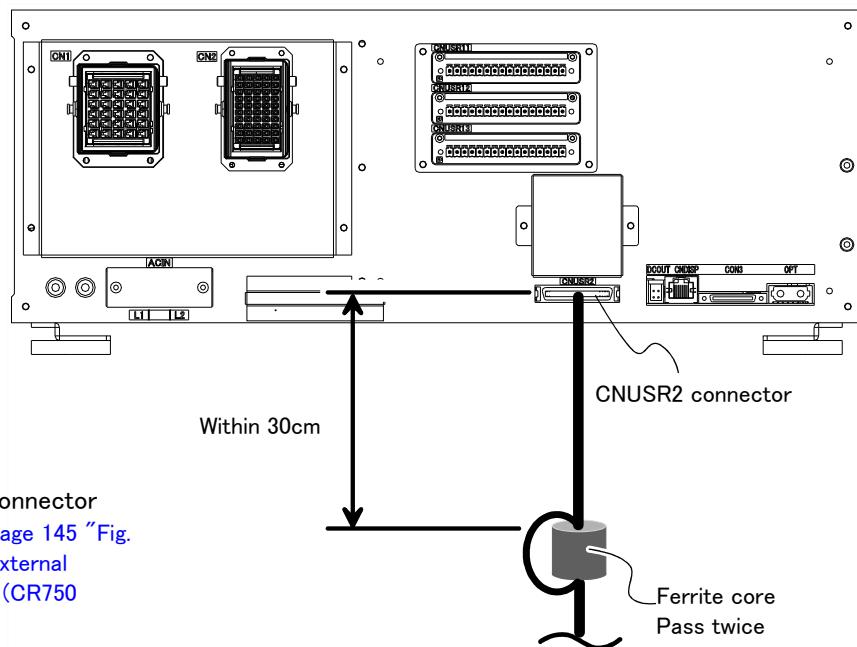
Note2) This output is opened, if the robot turns off the servo by occurrence of alarm etc.
 <Electric specification>
 DC24V/10mA to 100mA

[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.3-44 : Example of circuit for addition axes of Magnet contactor control output (CR760 drive unit)

(2) Image of how to connect the controller connector

■ CR750 drive unit



*Connects with CNUSR2 connector
 with soldering. Refer to Page 145 "Fig.
 3-25: Method of wiring for external
 emergency stop connection (CR750
 (CNUSR2))".

Fig.3-45 : AXMC terminal connector (CR750)

■ CR751 drive unit

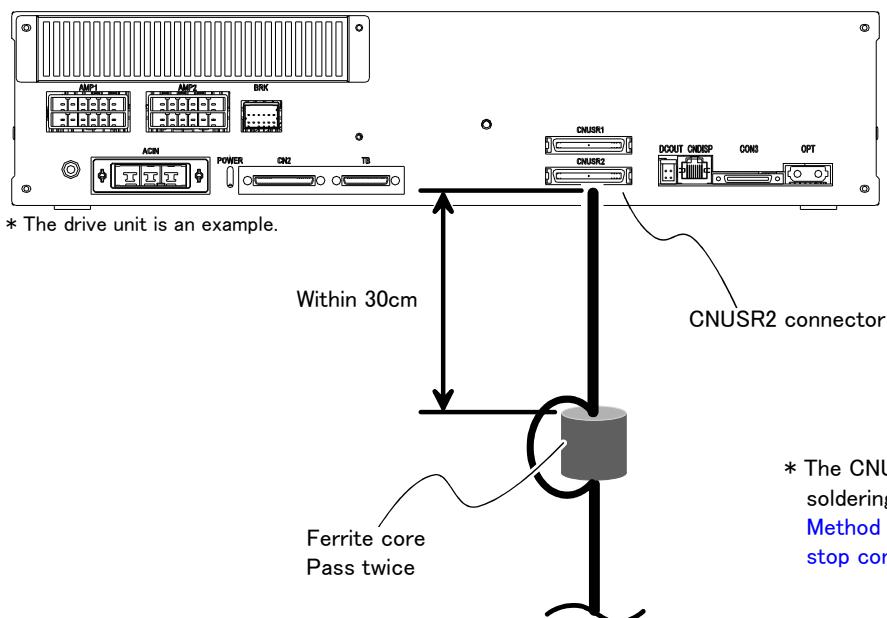
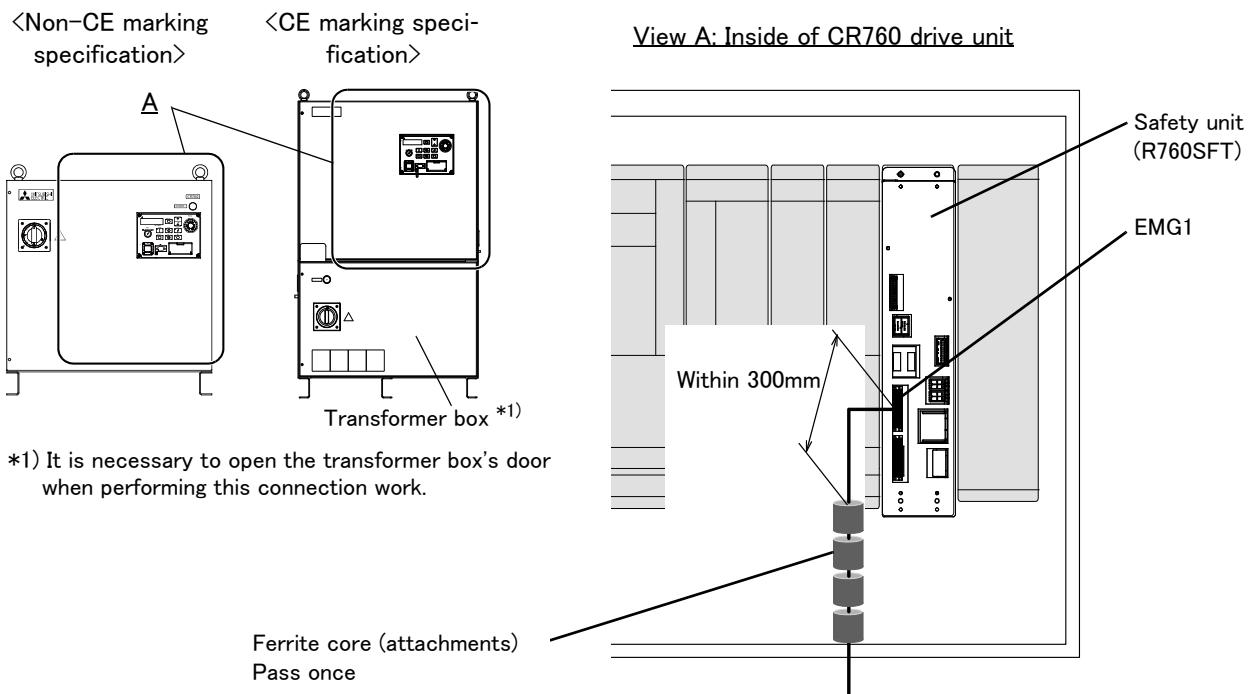


Fig.3-46 : AXMC terminal connector (CR751)

■ CR760 drive unit



* Connection method is the same as the connection of emergency stop.
Refer to [Page 150 "Fig. 3-30: External emergency stop connection \(CR760\)"](#).

Fig.3-47 : AXMC terminal connector (CR760)

3.10 Options

■ What are options?

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

User installation is required for the options.

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

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

(1) Teaching pendant (T/B)

- Order type: CR750/CR760 drive unit..... ● R32TB: Cable length 7m
● R32TB-15: Cable length 15m
- CR751 drive unit ● 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 3-11 : Configuration device

Part name	Type	Qty.	Mass (kg) Note1)	Remarks
CR750/CR760 drive unit				
Teaching pendant	R32TB	Either one pc.	1.7	Cable length is 7m. Hand strap is attached.
	R32TB-15		2.8	Cable length is 15m. Hand strap is attached.
CR751 drive unit				
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 3-12 : 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.

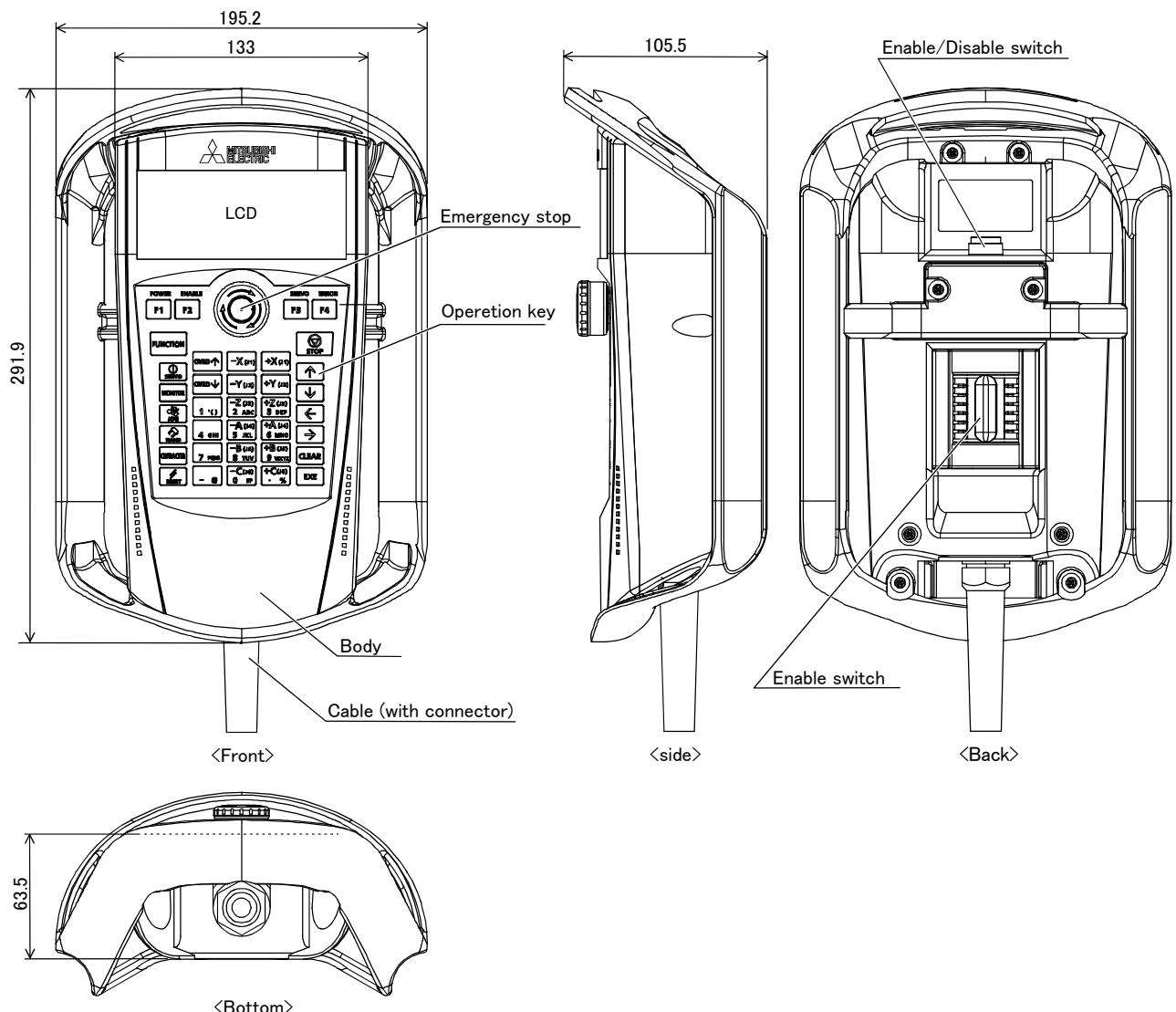


Fig.3-48 : Outside dimensions of teaching pendant

■ Installation method

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

■ Key layout and main functions



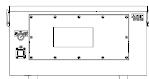
Fig.3-49 : Teaching pendant key layout and main functions

(2) Controller protection box

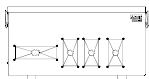
- Order type: CR750 drive unit CR750-MB
CR751 drive unit..... CR751-MB

■ Outline

<CR750-MB>



<CR751-MB>



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

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

■ Configuration

Table 3-13 : Configuration equipment and types

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

Note1) Mass indicates one set.

■ Specifications

Table 3-14 : Specifications

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

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

■ Outside dimension

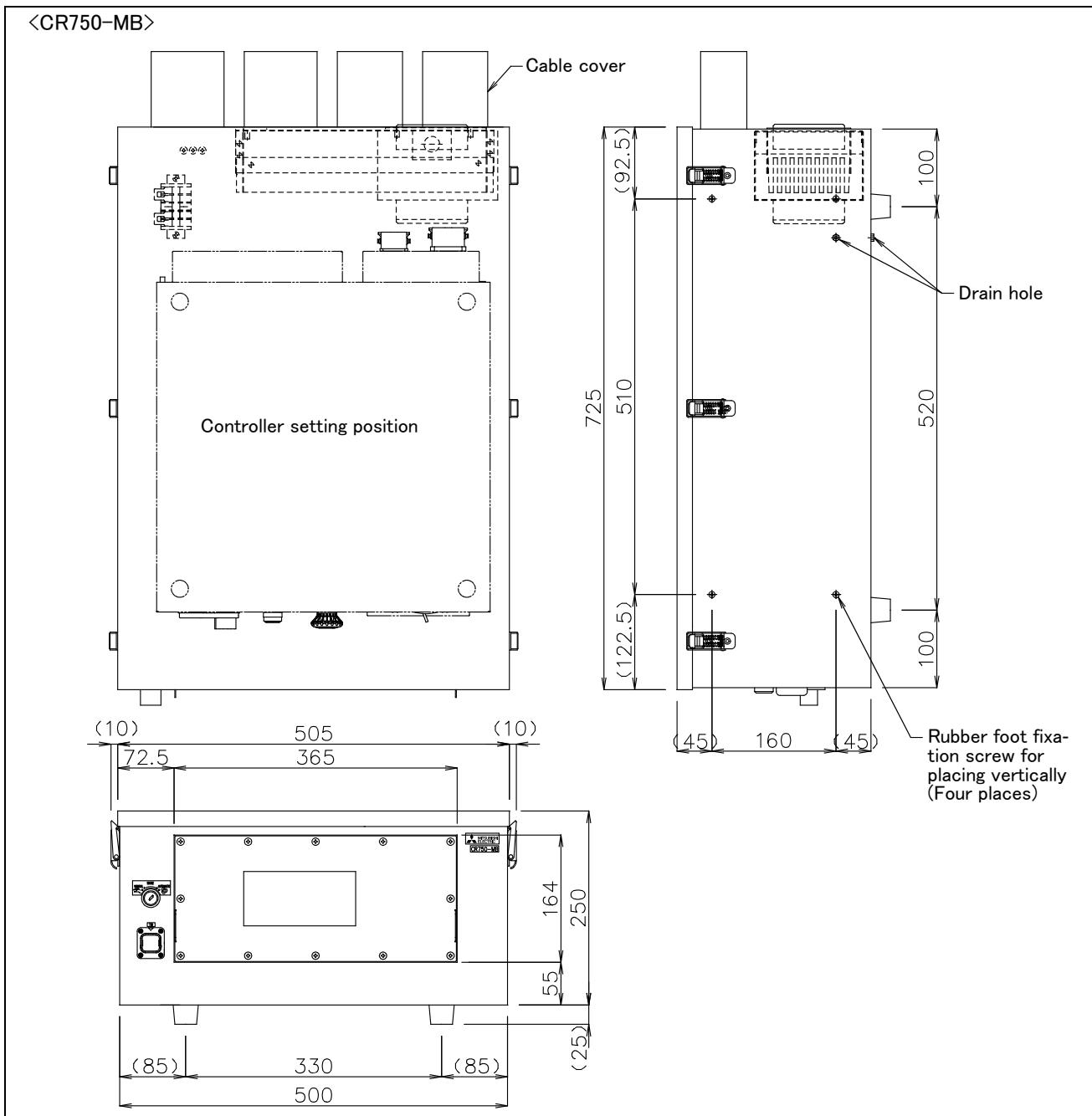


Fig.3-50 : Outside dimension of CR750-MB

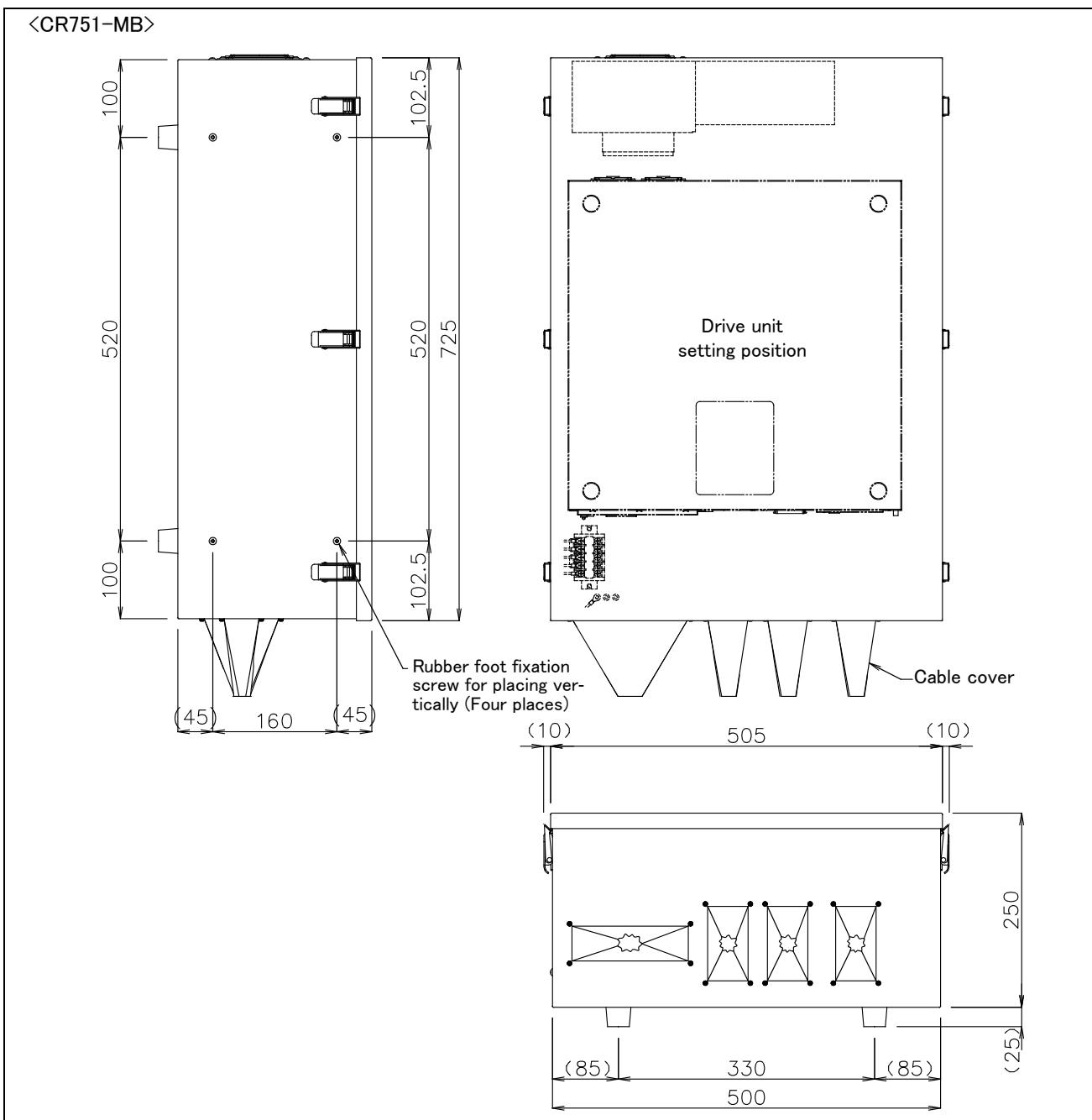


Fig.3-51 : Outside dimension of CR751-MB

■ Names of each part

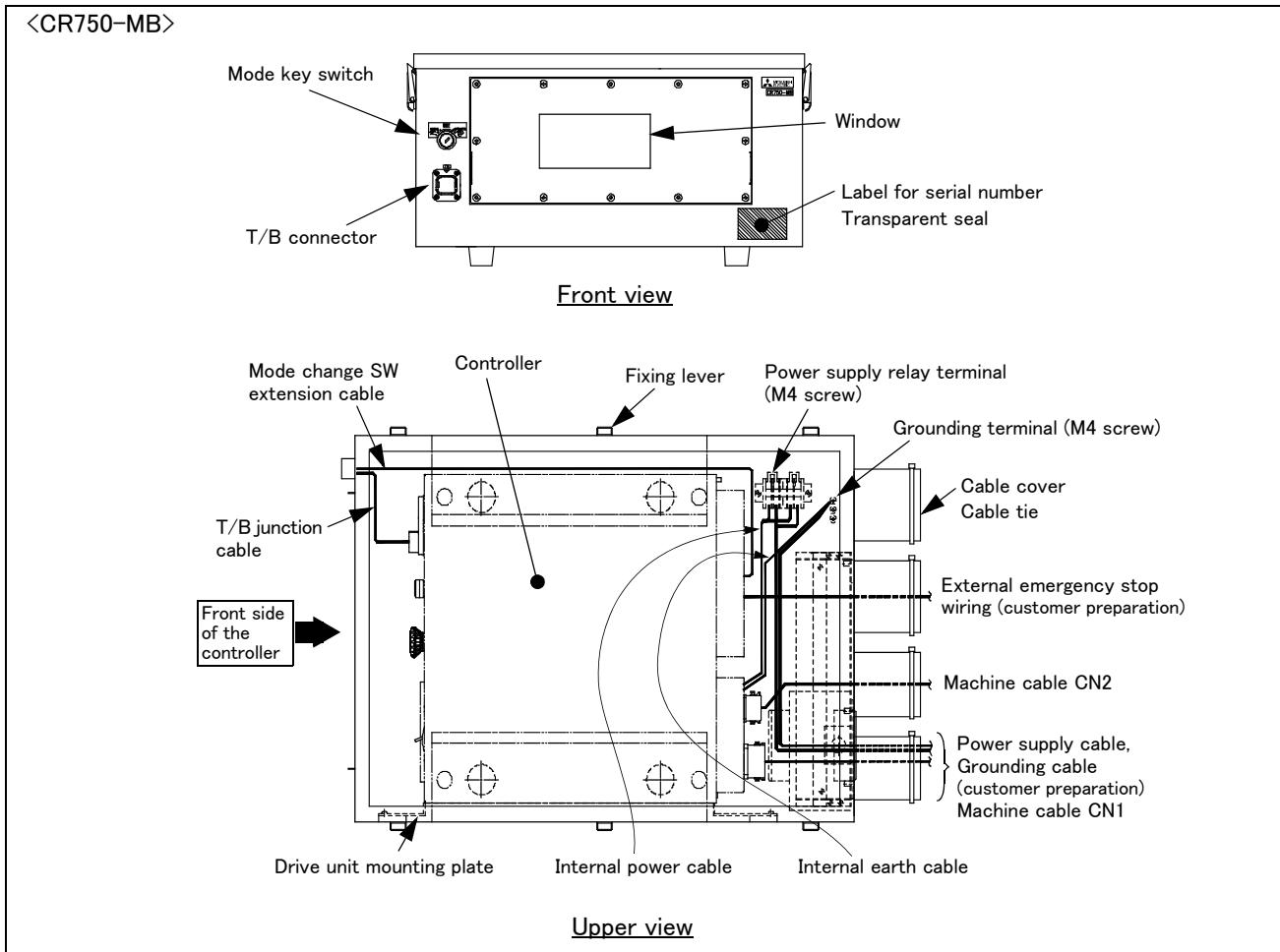


Fig.3-52 : Names of each part (CR750-MB)

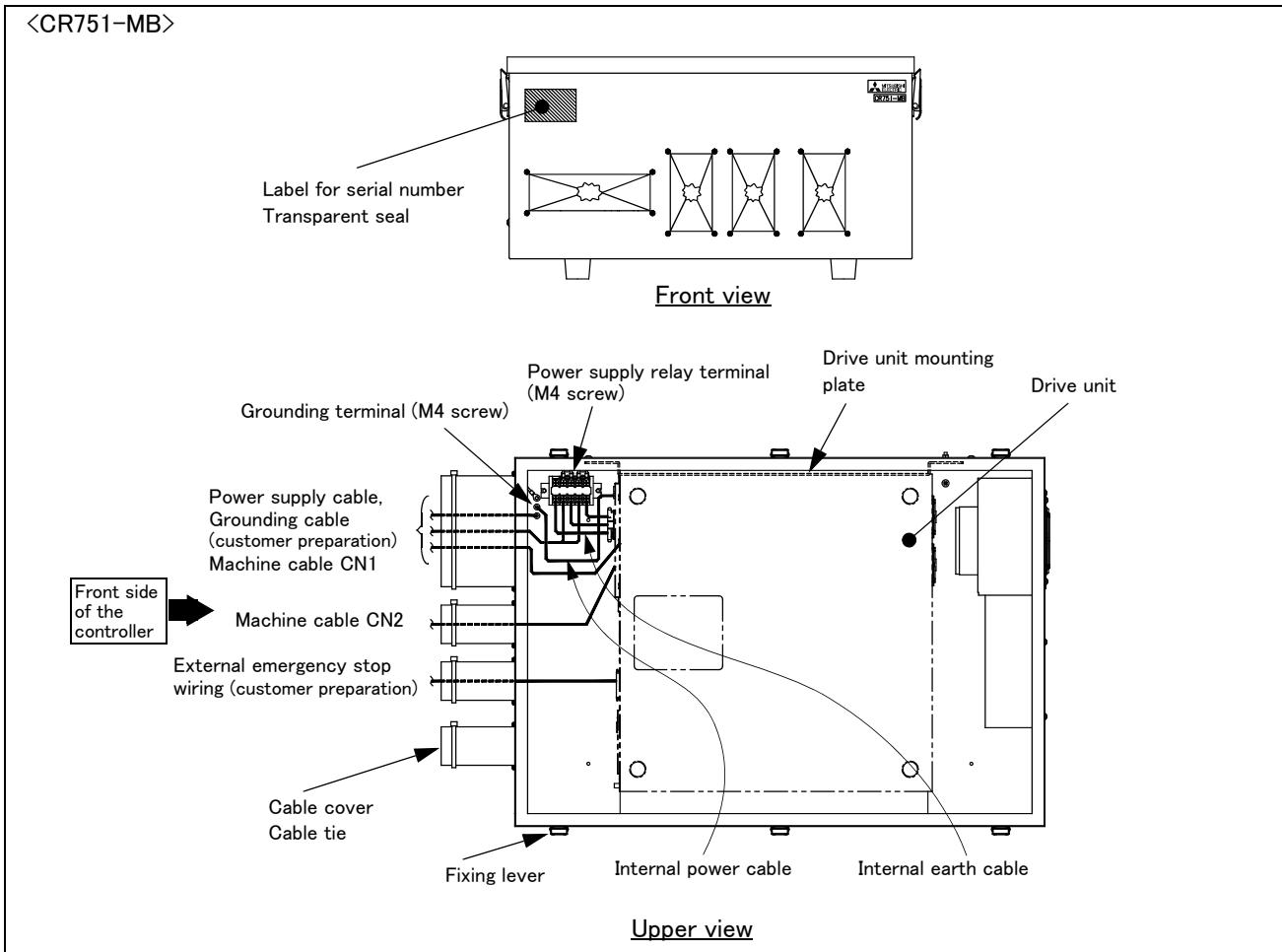
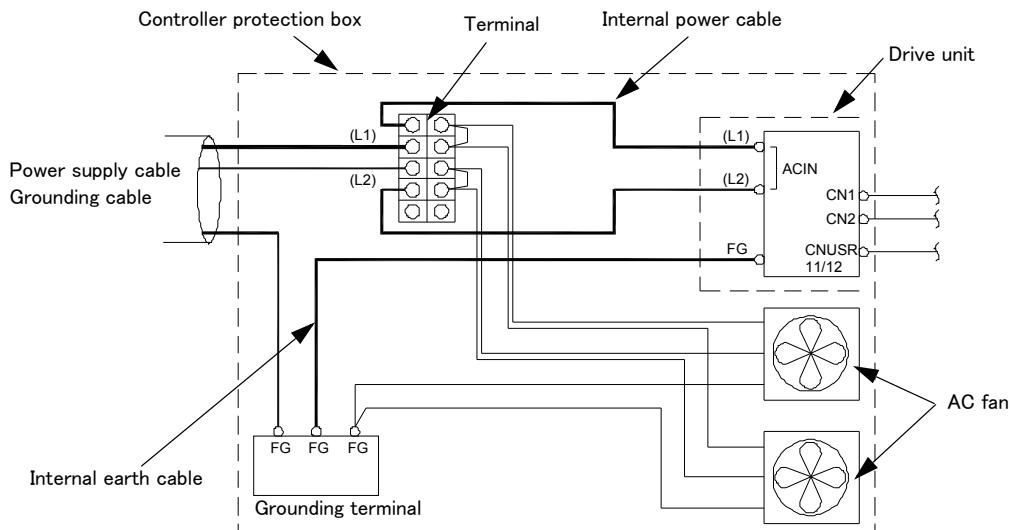


Fig.3-53 : Names of each part (CR751-MB)

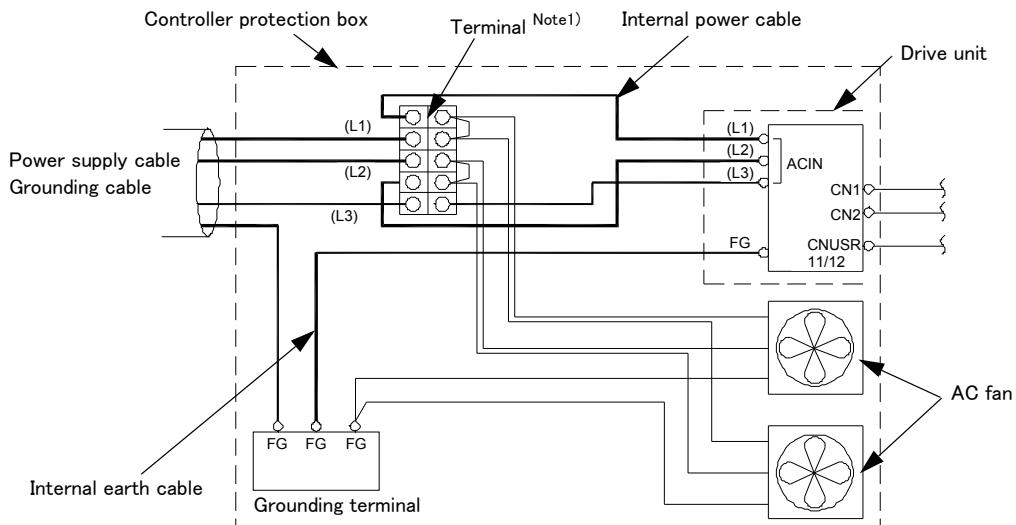
■ Wiring system diagram

<CR750-MB>

Single phase: RV-4F series



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



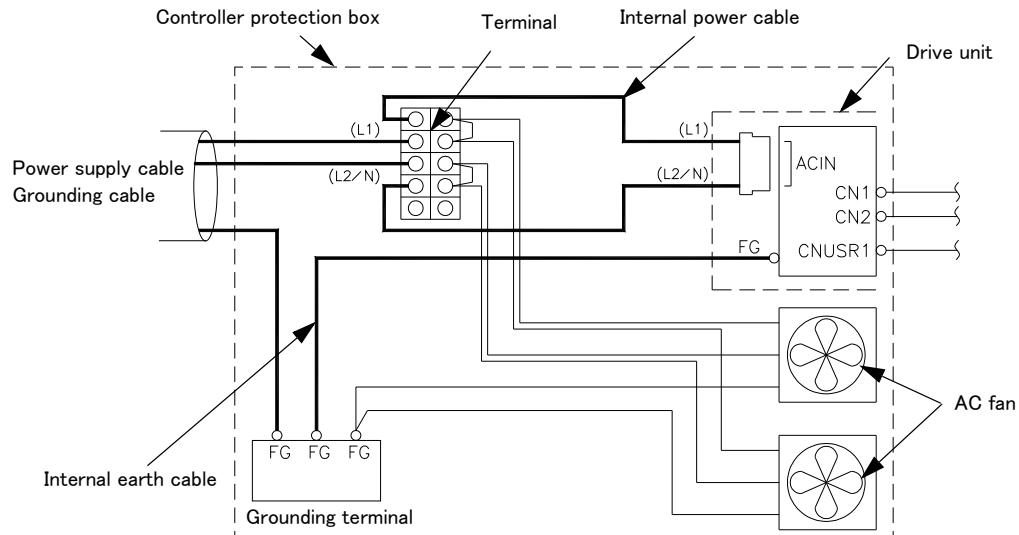
Note1) When using the drive unit for the three phases with the single-phase power supply, connect the primary power supply to L1 and L2 electric terminal of the protection box so that the power supply may be supplied to the heat-exchanger AC fan of the protection box.

Connects with L1 and L3 electric terminal to the ACIN terminal block of the drive unit. Refer to the separate manual "Controller setup, basic operation, and maintenance" for detail of connecting the power cable and the grounding cable.

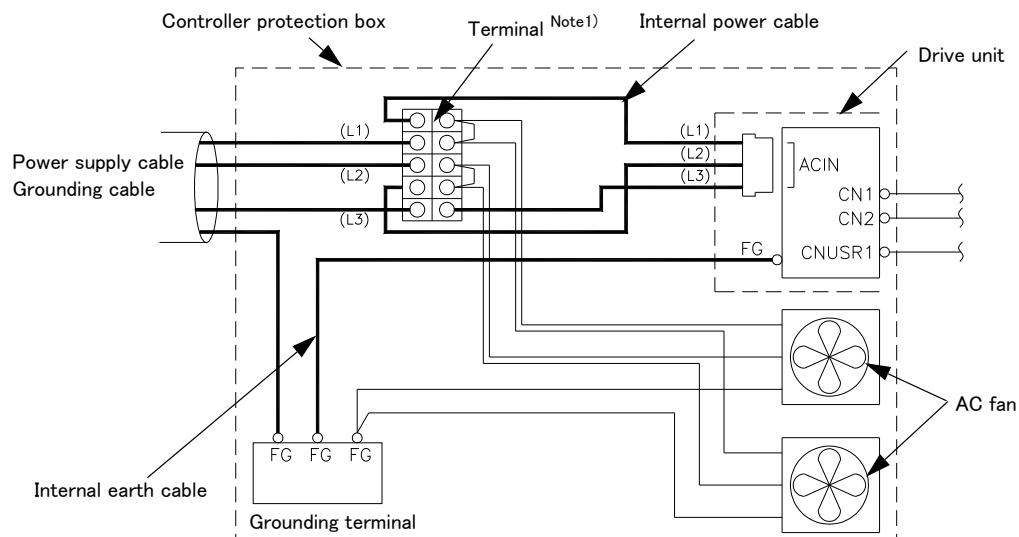
Fig.3-54 : Wiring system diagram (CR750-MB)

<CR751-MB>

Single phase: RV-4F series

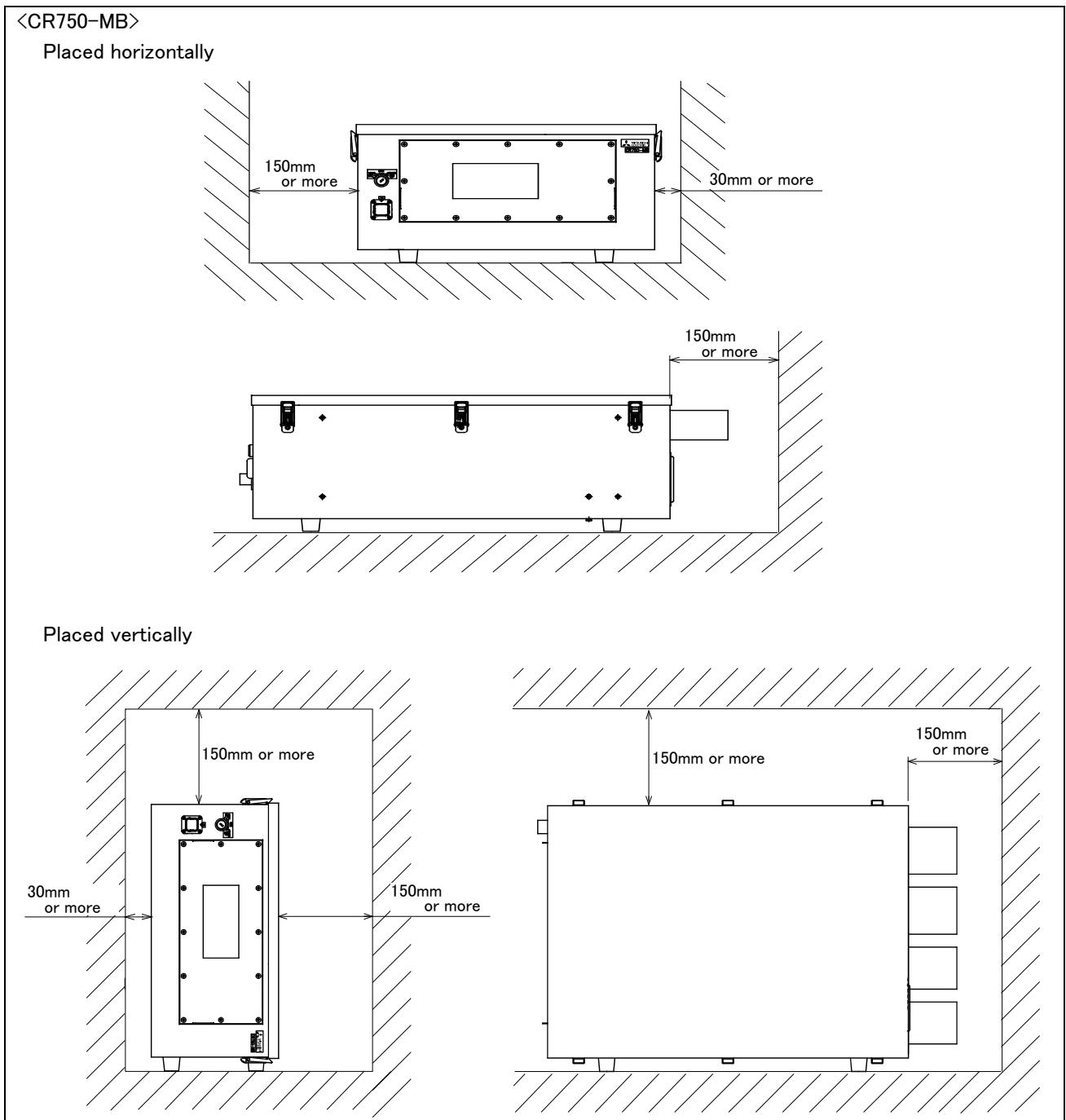


Single phase/Three phase: RV-7F/13F series



Note1) When using the drive unit for the three phases with the single-phase power supply, connect the primary power supply to L1 and L2 electric terminal of the protection box so that the power supply may be supplied to the heat-exchanger AC fan of the protection box.
 Connects with L1 and L3 electric terminal to the ACIN terminal block of the drive unit. Refer to the separate manual "Controller setup, basic operation, and maintenance" for detail of connecting the power cable and the grounding cable.

Fig.3-55 : Wiring system diagram (CR751-MB)

■ Installation dimensions

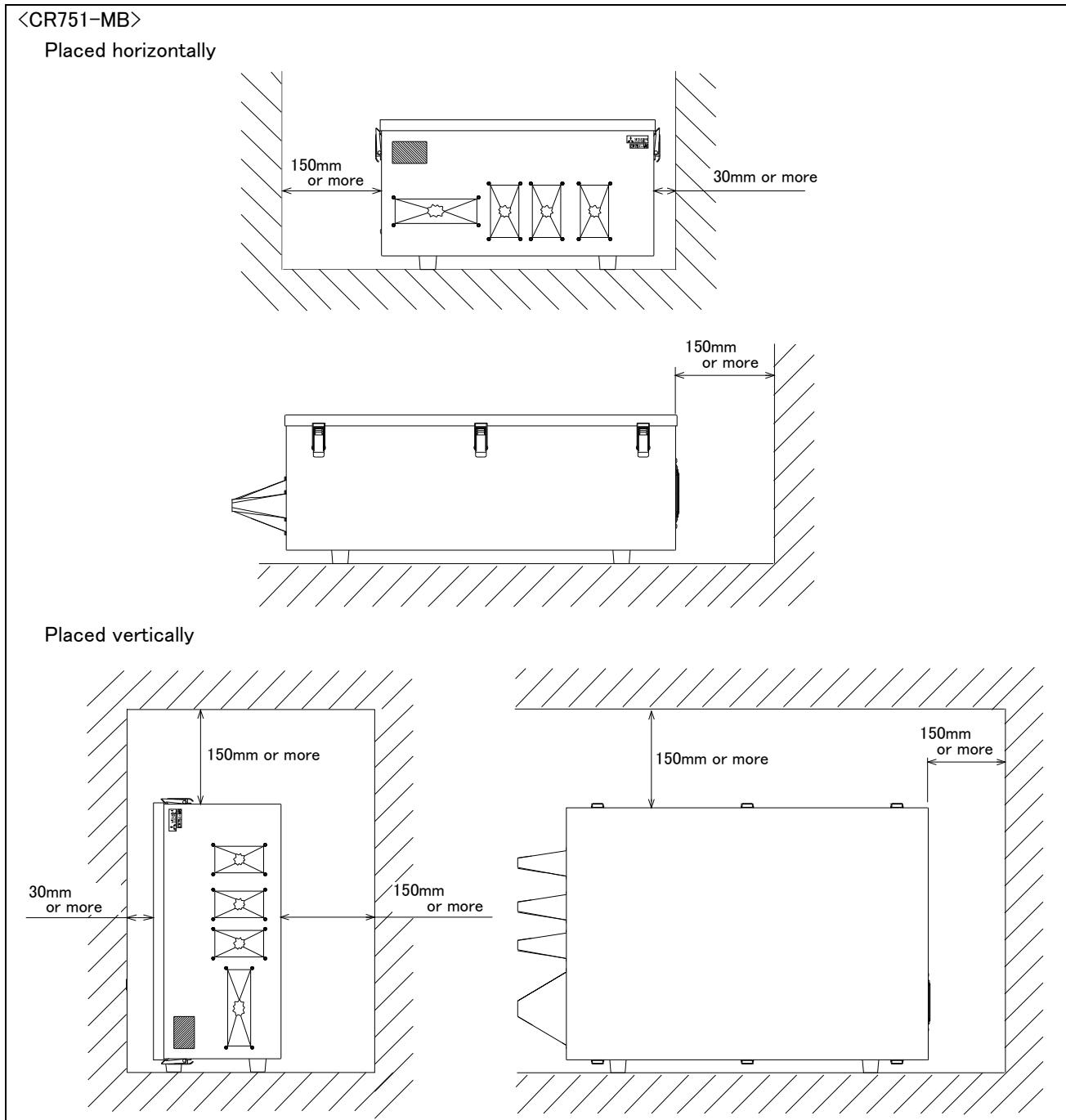


Fig.3-57 : Installation dimensions (CR751-MB)

(3) MELSOFT RT ToolBox2/RT ToolBox2 mini

- Order type :
 - MELSOFT RT ToolBox2
 - *For windows CD-ROM : 3D-11C-WINE
 - MELSOFT RT ToolBox2 mini
 - *For windows CD-ROM : 3D-12C-WINE

■ Outline



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

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

■ Configuration

Table 3-15 : 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 3-16 : Functions

Function		Functional existence ^{Note1)}		Details
Compatible model		○	○	Personal computer running Windows XP, Windows Vista, Windows 7, Windows 8, Windows 8.1, or Windows 10. <small>Note2)</small>
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.

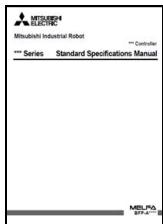
○ : Function provided ×: Function not provided

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

(4) Instruction Manual (bookbinding)

■ Order type: ● 5F-RF01-PE01 RV-4F-Q/7F-Q/13F-Q/20F-Q/35F-Q/50F-Q/70F-Q series

■ Outline



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

■ Configuration

Table 3-17 : Product configuration

Name	Type	Mass (Kg) Note1)	Specifications
Instruction Manual	5F-RF01-PE01	2.6	The instructions manual set of RV-4F-Q series, RV-7F-Q series, RV-13F-Q series, and RV-50F-Q series.
Safety Manual	BFP-A8006	-	Items relating to safety in handling the robot
Standard Specifications	BFP-A8933	-	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.

3.11 Maintenance parts

The consumable parts used in the controller are shown in [Table 3-18](#). 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 3-18 : 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	
2	Filter	CR750 drive unit: BK0FA0773H42 CR751 drive unit: BK0FA0773H41	1	Inside the filter cover	Mitsubishi Electric

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

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
		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 1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0
	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.	XStop 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	SFC1P : SFC8P	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. 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	AREA1CS : AREA32CS	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. 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 turn the buzzer ON or OFF.
Jog setting	JOGJSP	Designate the joint jog and step operation speed. (Set dimension H/L amount, max. override.)
	JOGPSP	Designate the linear jog and step operation speed. (Set dimension H/L amount, max. override.)
Jog speed limit value	JOGSPMX	Limit the operation speed during the teaching mode. Max. 250[mm/s]
Hand type	HANDTYPE	Set the hand type of the single/double solenoid, and the signal No. (Single/double = S/D) Set the signal No. after the hand type. Example) D900
Stop input B contact designation	INB	Change the dedicated input (stop) to either of normal open or normal close.

Parameter		Details
User-designated origin	USERORG	Designate the user-designated origin position.
Program selection memory	SLTON	Select the program selected previously when initializing the slot. The non-selected state will be entered when not set.
Communication setting	CBAU232	Set the baud rate.
	CLEN232	Set the character length.
	CPRTY232	Set the parity.
	CSTOP232	Set the stop bit.
	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	QMLTCPU N	At the multi CPU system, set the number of CPU units with which the standard base unit is equipped.
	QMLTCPU n	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.
	QMLTCPU S	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	MESNGLS W	Designate the valid/invalid of the singular point adjacent alarm. (Invalid/Valid = 0/1) When this parameter is set up "VALID", this warning sound is buzzing even if parameter: BZR (buzzer ON/OFF) is set up "OFF".
Display language.	LNG	Change the language to display on the LCD display of teaching pendant.

5 Instruction Manual

5.1 The details of each instruction manuals

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

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

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

Safety Manual	Explains the common precautions and safety measures to be taken for robot handling, system design and manufacture to ensure safety of the operators involved with the robot.
Standard Specifications	Explains the product's standard specifications, factory-set special specifications, option configuration and maintenance parts, etc. Precautions for safety and technology, when incorporating the robot, are also explained.
Robot Arm Setup & Maintenance	Explains the procedures required to operate the robot arm (unpacking, transportation, installation, confirmation of operation), and the maintenance and inspection procedures.
Controller Setup, Basic Operation and Maintenance	Explains the procedures required to operate the controller (unpacking, transportation, installation, confirmation of operation), basic operation from creating the program to automatic operation, and the maintenance and inspection procedures.
Detailed Explanation of Functions and Operations	Explains details on the functions and operations such as each function and operation, commands used in the program, connection with the external input/output device, and parameters, etc.
Troubleshooting	Explains the causes and remedies to be taken when an error occurs. Explanations are given for each error No.
Additional axis function	Explains the specifications, functions and operations of the additional axis control.
Tracking Function Manual	Explains the control function and specifications of conveyor tracking
Extended Function Instruction Manual	Explains the detailed description of data configuration of shared memory, monitoring, and operating procedures, about the PLC(CR750-Q/CR751-Q controller) and the GOT(CR750-D/CR751-D controller).

6 Safety

6.1 Safety

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

6.1.1 Self-diagnosis stop functions

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

Table 6-1 : Self-diagnosis stop functions

No.	Function		Details	Remarks
1	Overload protection function		Activates when the total servo current time exceeds the specified value.	The drive circuit is shut off. The robot stops, and an alarm displays.
2	Overcurrent diagnosis function		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	Operation panel Note1)	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.

Note1) Only CR750 drive unit has operation panel.

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

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

	Signal	Connection point	Parameter	Functions	Usage method
Input	External emergency stop Note1)	Connector (CR750 drive unit: CNSUSR11/12) (CR751 drive unit: CNSUSR1) (CR760 drive unit: EMG1)	—	This servo power is shut off, and the robot stops immediately.	Externally installed emergency stop switch. Door switch on safety protection fence. Stopping at high-level error occurrence.
	Door switch	(CR751 drive unit: CNSUSR1) (CR760 drive unit: EMG1)	—		The door switch of the safe protection fence
	Enabling device input		—		Enabling device. The safety switch during teaching work
	Stop	Sequencer unit	STOP	The program execution is stopped, and the robot stops. The servo power is not shut off.	The robot is stopped when a peripheral device fault occurs. The servo power is not shut off.
	Servo OFF		SRVOFF	The servo power can be shut off.	The robot is stopped when a peripheral device fault occurs. The servo power is not shut off.
	Automatic operation enable		AUTOENA	Disables automatic operation when inactive.	Door switch on safety protection fence
Output	Emergency stop output	Connector (CR750 drive unit: CNSUSR11/12) (CR751 drive unit: CNSUSR1) (CR760 drive unit: EMG2)	—	Outputs the input signal of external emergency stop or emergency stop switch of T/B turned on.	Display and warn the pilot lamp, the input signal of external emergency stop or the emergency stop switch of T/B turned on.
	In servo ON	Sequencer unit	SRVON	The servo power ON/OFF state is output.	The servo power ON/OFF state is shown and alerted with the display lamps.
	Waiting		STOP	Outputs that the robot is temporarily stopped.	The temporary stop state is shown and alerted with the display lamps.
	In alarm	Connector (CR750/CR751 drive unit: CNUSR2) (CR760 drive unit: EMG1)	ERRRESET —	Outputs when an alarm occurs in the robot.	The alarm state is shown and alerted with the display lamps.

Note1) The external emergency stop input is prepared as a normal close for safety proposes. Thus, if the emergency stop input circuit is opened when the robot is started up, the robot will not operate. Refer to [Page 192, "6.1.7 Examples of safety measures"](#) for details.
And, refer to [Page 154, "\(3\) 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 207, "\(4\) 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.

(1) CR750 drive unit

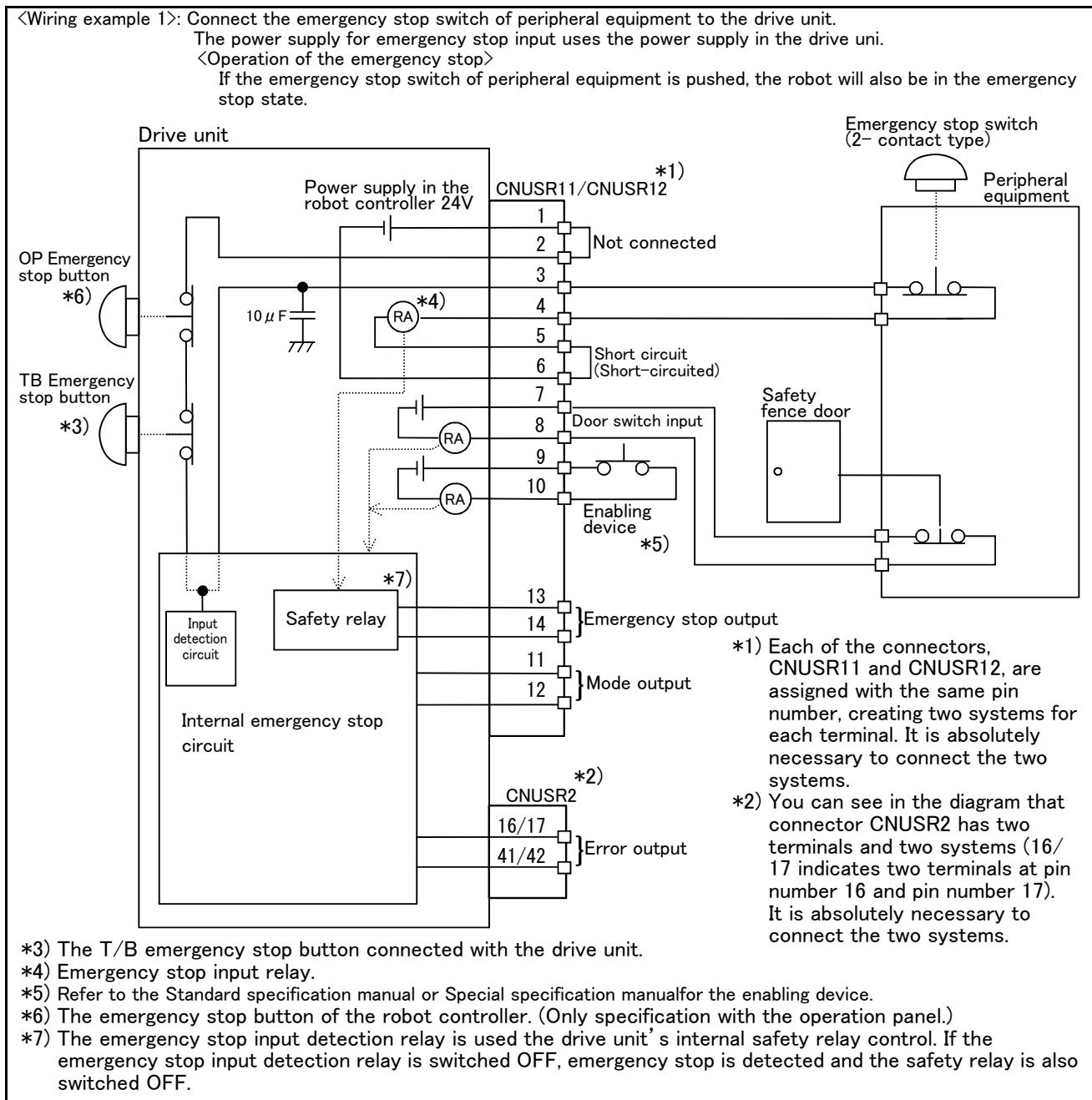


Fig.6-1 : Example of safety measures (CR750 wiring example 1)

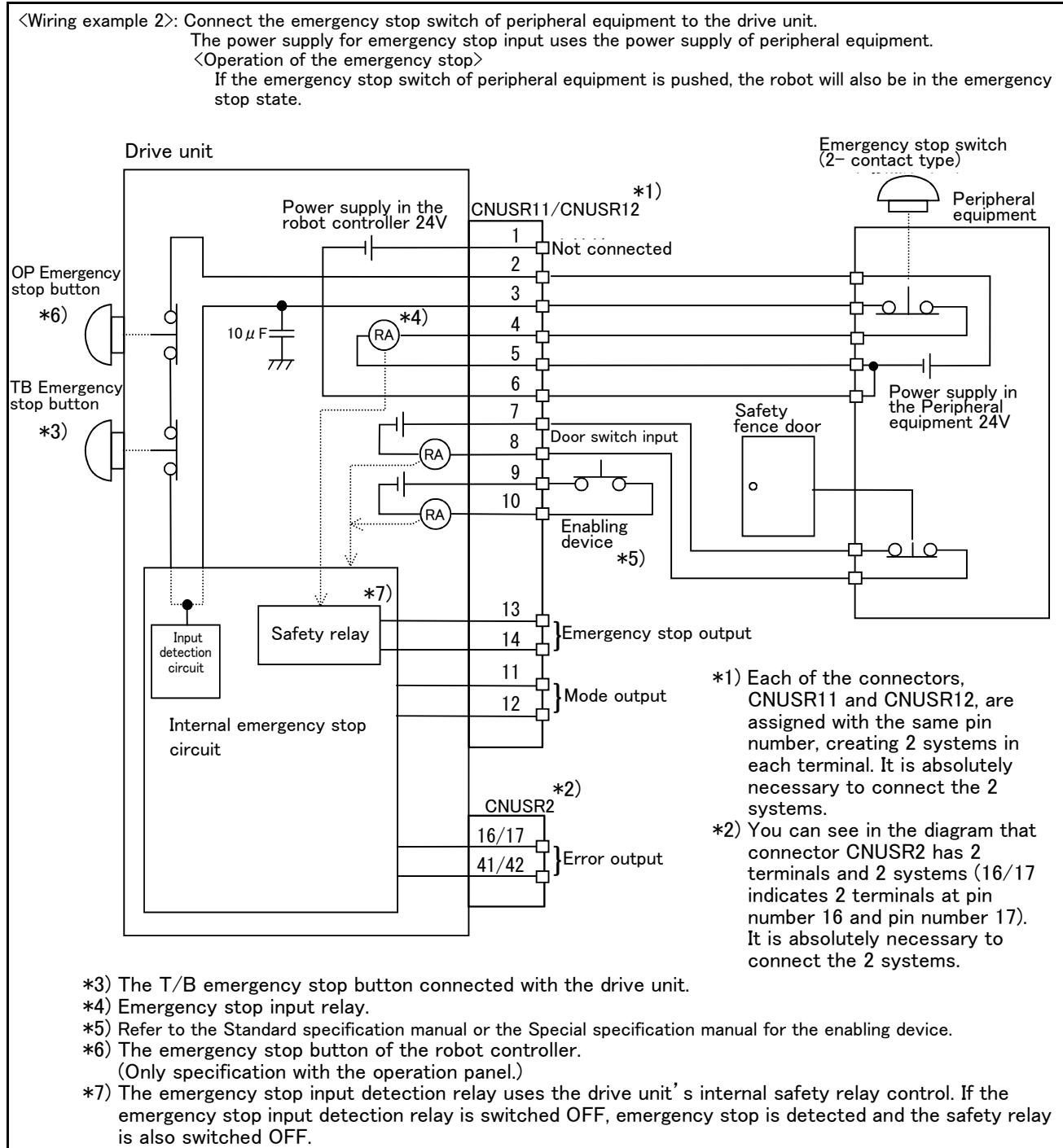
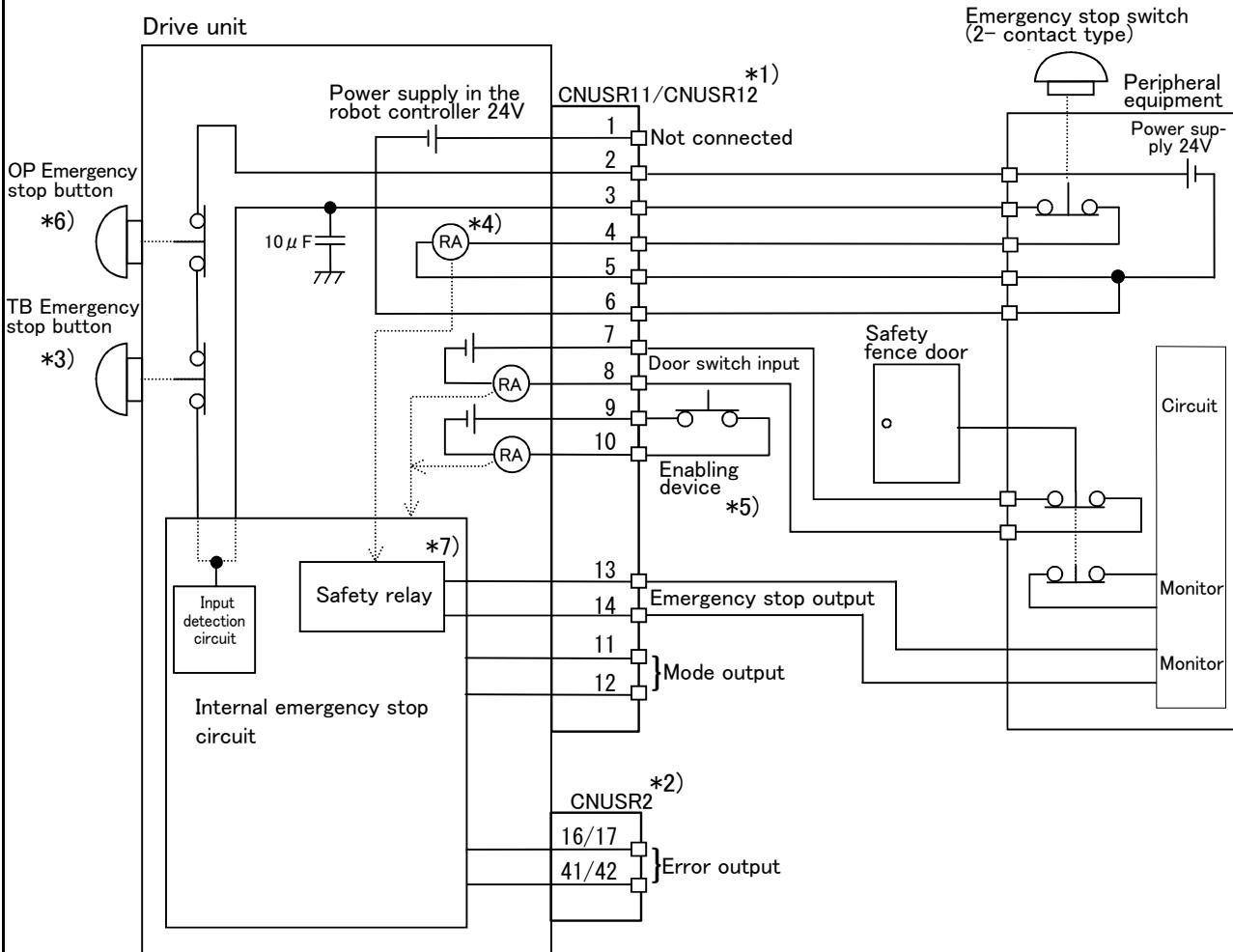


Fig.6-2 : Example of safety measures (CR750 wiring example 2)

<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 of the connectors, CNUSR11 and CNUSR12, are assigned with the same pin number, creating 2 systems in each terminal. It is absolutely necessary to connect the 2 systems.

*2) You can see in the diagram that connector CNUSR2 has 2 terminals and 2 systems (16/17 indicates 2 terminals at pin number 16 and pin number 17). It is absolutely necessary to connect the 2 systems.

*3) The T/B emergency stop button connected with the controller.

*4) Emergency stop input relay.

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

*6) The emergency stop button of the robot controller.

(Only specification with the operation panel.)

*7) 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.

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

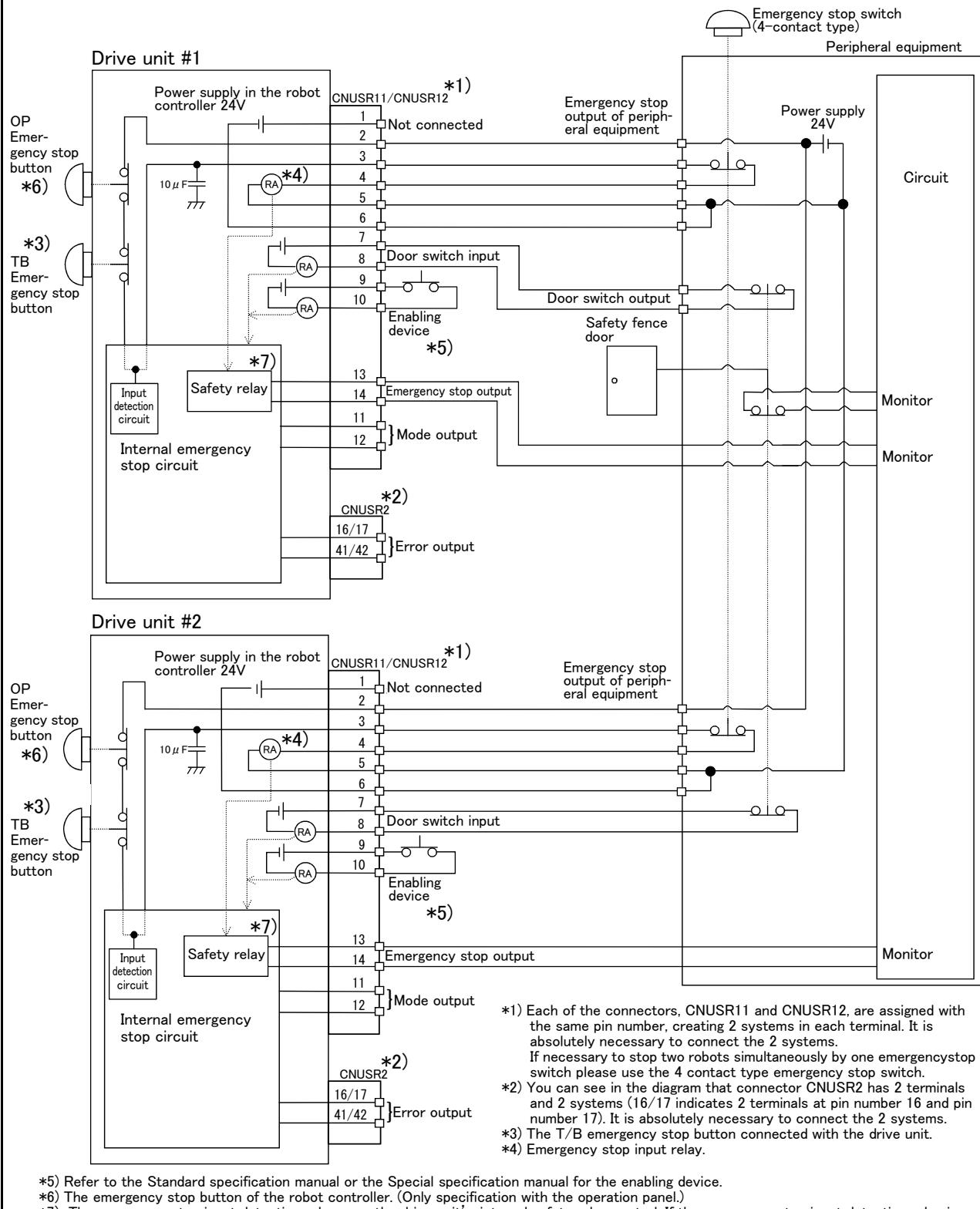
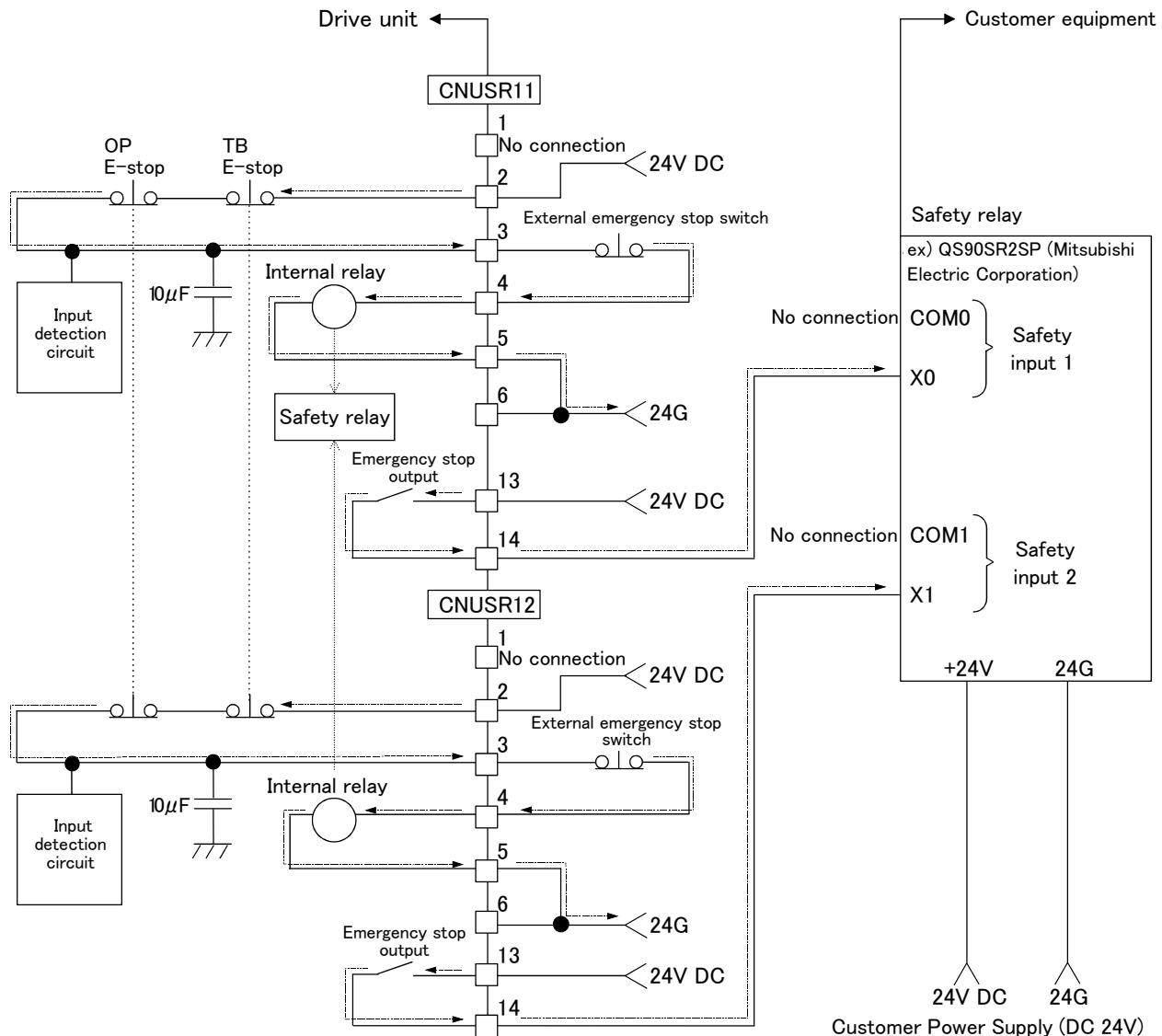


Fig.6-4 : Example of safety measures (CR750 wiring example 4)

<Wiring example 5>: Connect the drive unit to the safety relay
Use the drive unit's emergency stop button command as an input to the 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 terminal 2 of CNUSR11/12, then connect the emergency stop button (or contact points) in the user equipment to across the terminals 3 and 4 of CNUSR11/12, and ultimately connect the negative side (24G).
- 3) When installing a safety relay to use it as an input point of the controller's emergency stop button command, use a safety relay that is activated by an input from one of the two systems (i.e. QS90SR2SP (Manufacture: Mitsubishi Electric Corporation)).
- 4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
- 5) When connecting emergency stop button output to an external safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly, this function will not operate correctly. Please connect the terminal 13 of CNUSR11/12 to 24V.

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

(2) CR751 drive unit

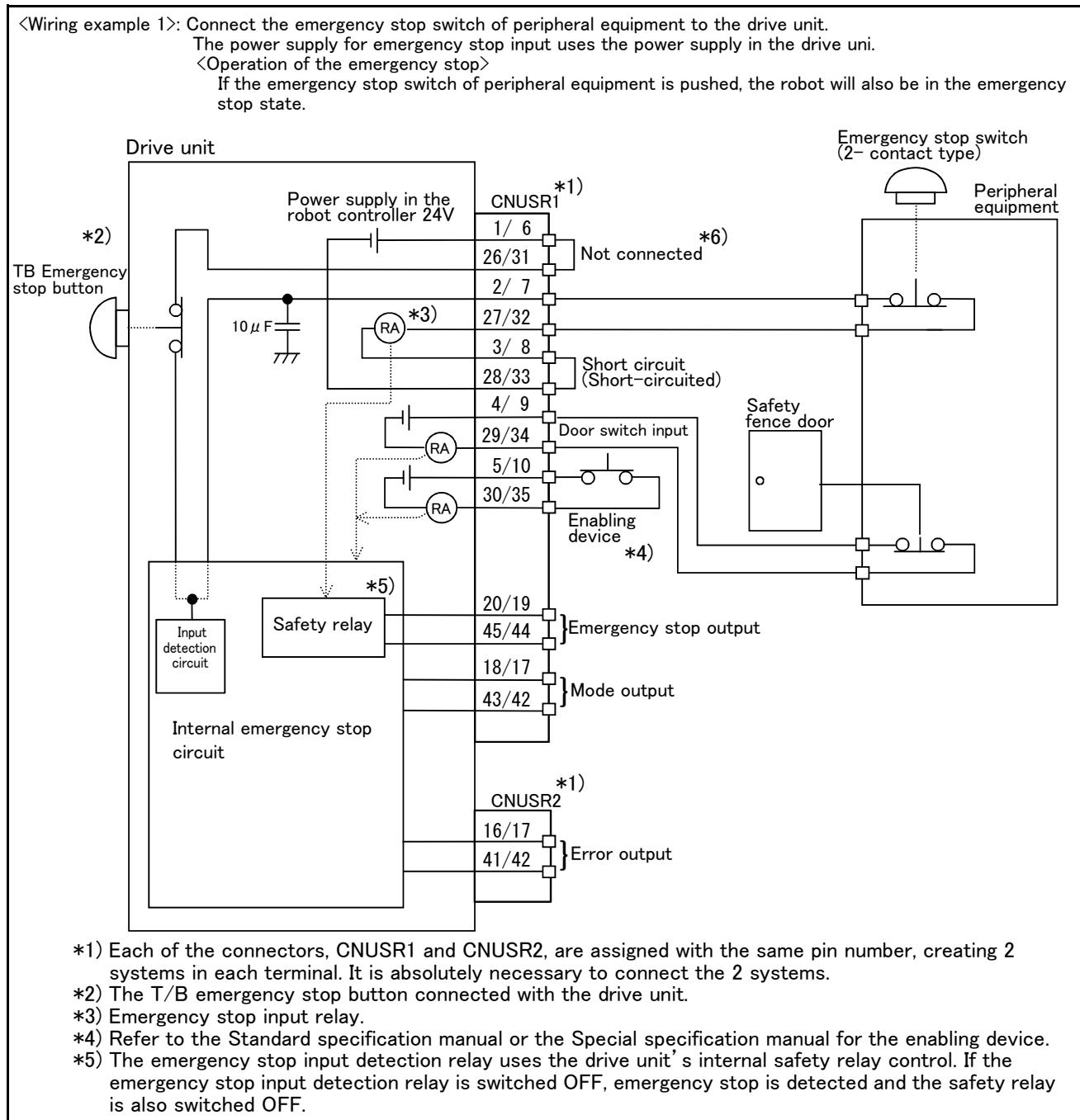
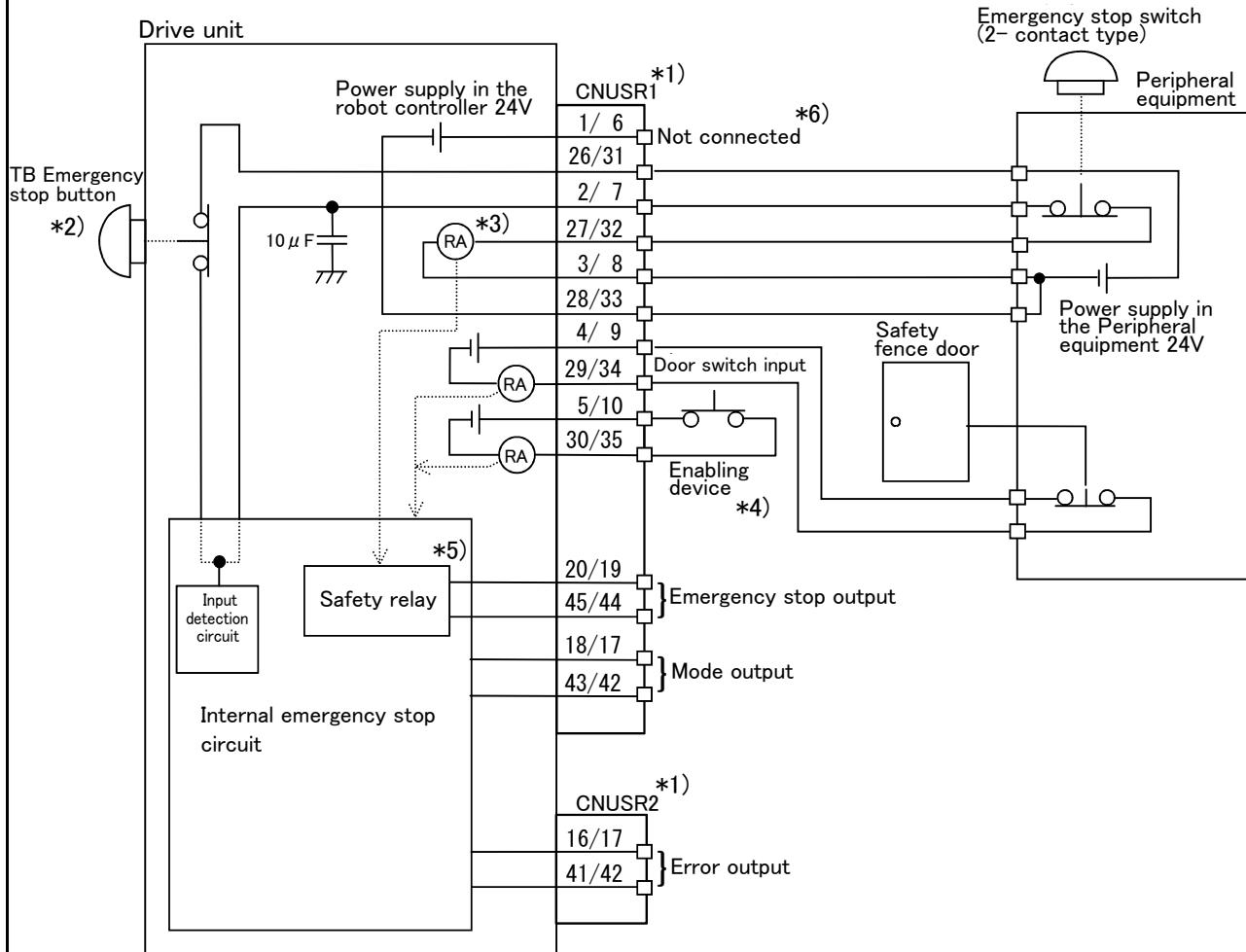


Fig.6-6 : Example of safety measures (CR751 wiring example 1)

<Wiring example 2>: Connect the emergency stop switch of peripheral equipment to the drive unit.
 The power supply for emergency stop input uses the power supply of peripheral equipment.
 <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.



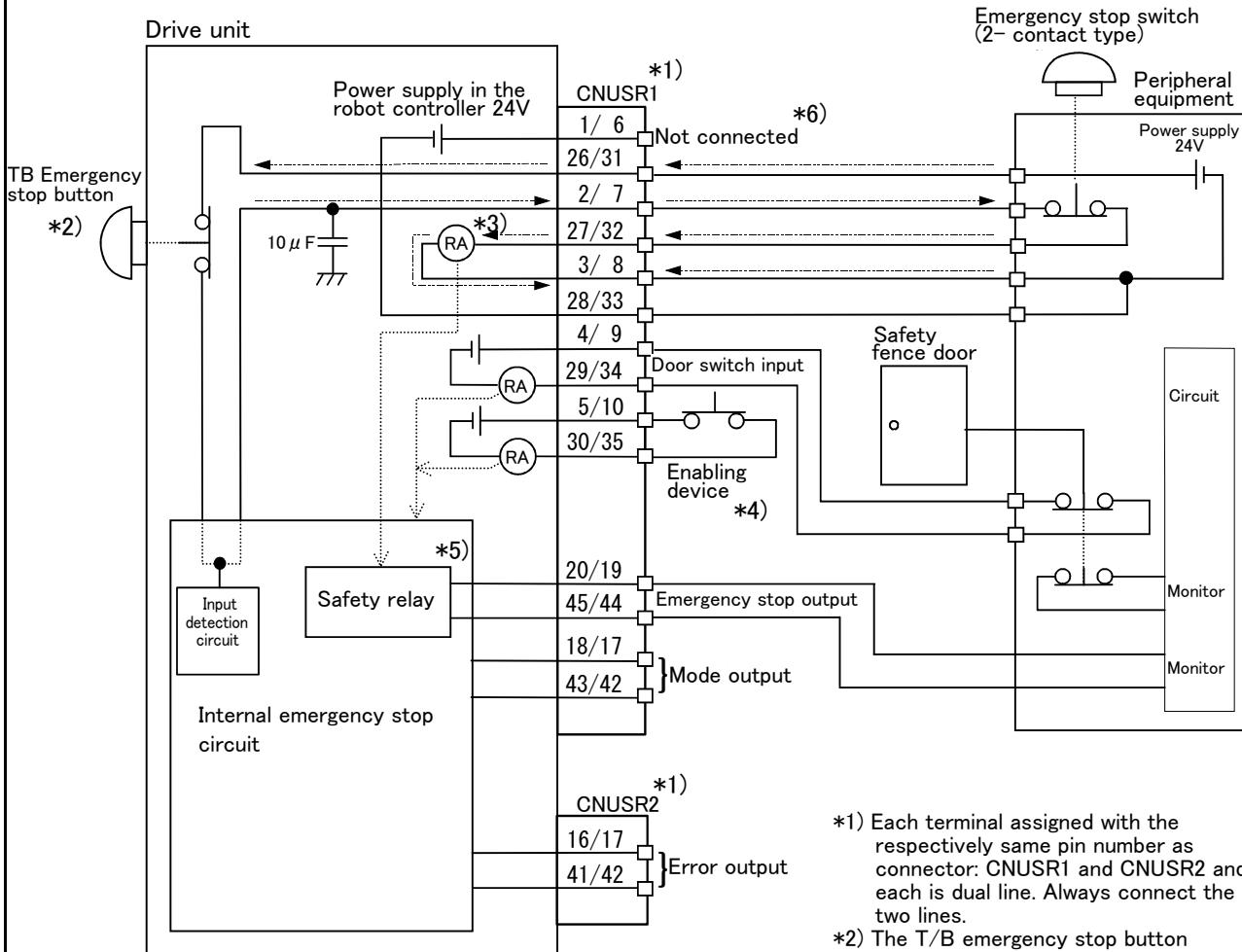
- *1) Each of the connectors, CNUSR1 and CNUSR2, are assigned with the same pin number, creating 2 systems in each terminal. It is absolutely necessary to connect the 2 systems.
- *2) The T/B emergency stop button connected with the drive unit.
- *3) Emergency stop input relay.
- *4) Refer to the Standard specification manual or the Special specification manual for the enabling device.
- *5) The emergency stop input detection relay uses the 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.6-7 : 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 the Standard specification manual or the Special 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.

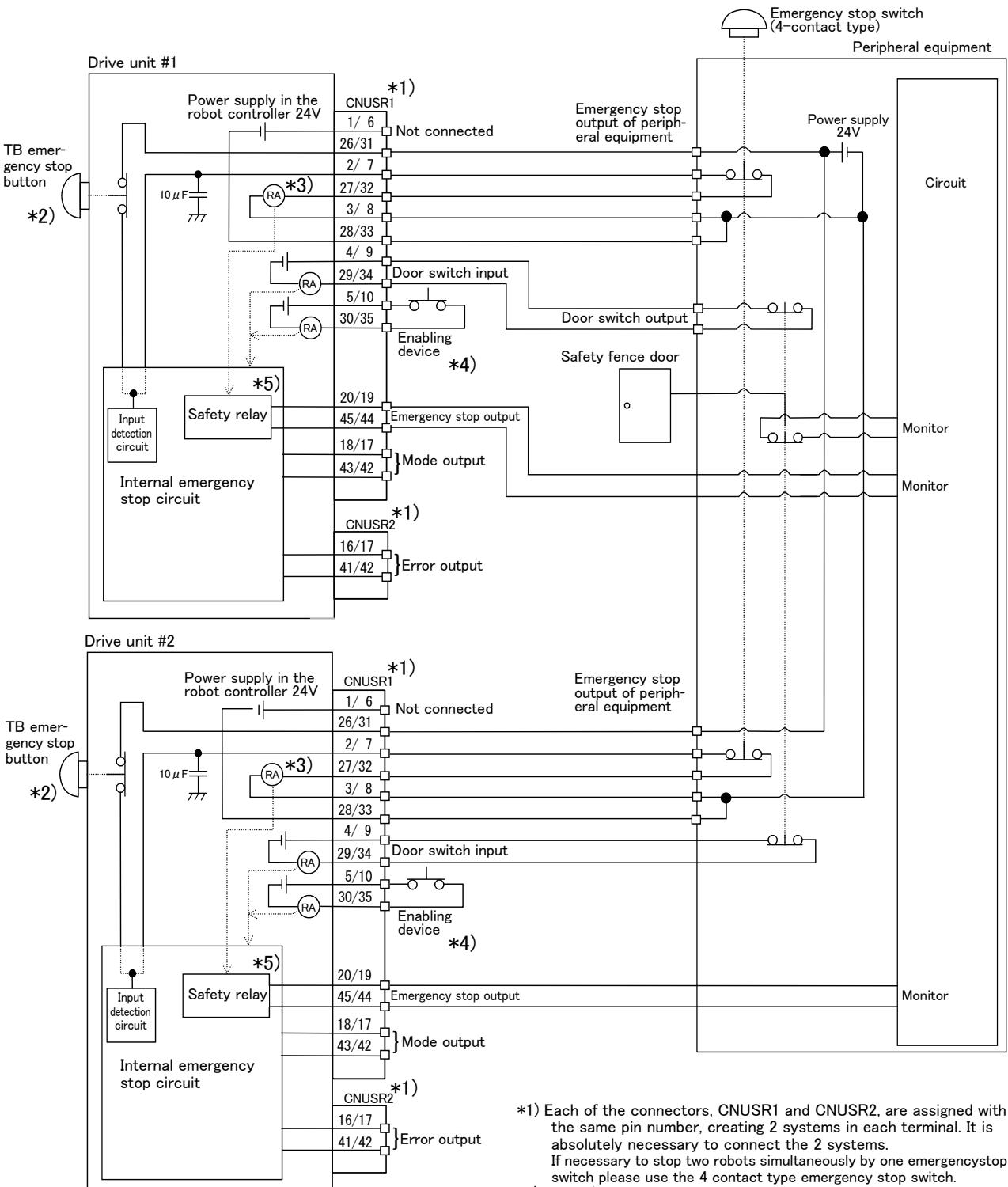
*6) When using emergency stop button output function, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity of the circuit is wrong, the emergency stop button output may not work properly. Please connect the 24V power supply to 26/31 terminals.

Fig.6-8 : 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.



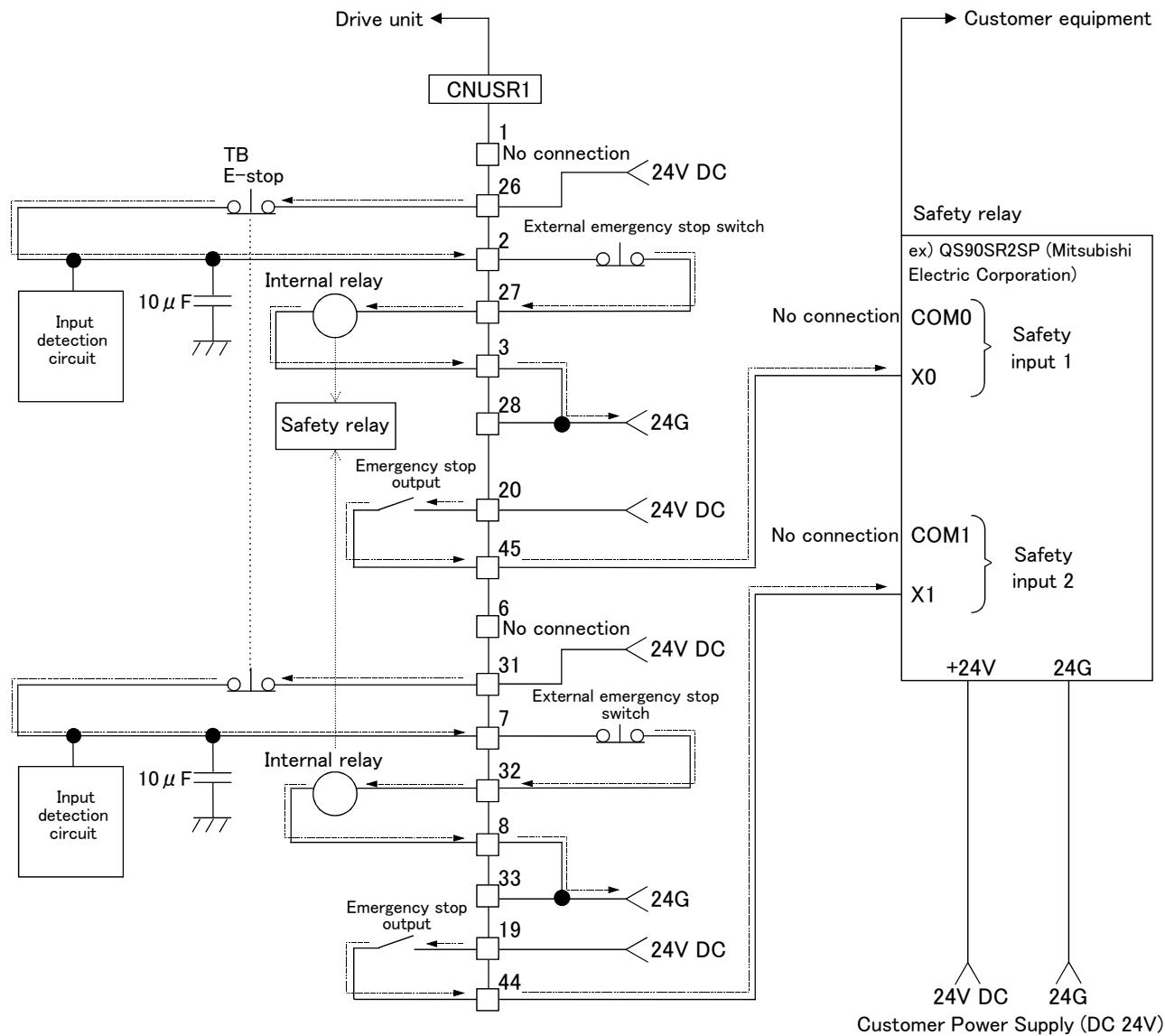
*3) Emergency stop input relay.

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

*5) The emergency stop input detection relay uses the 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.

Fig.6-9 : 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.



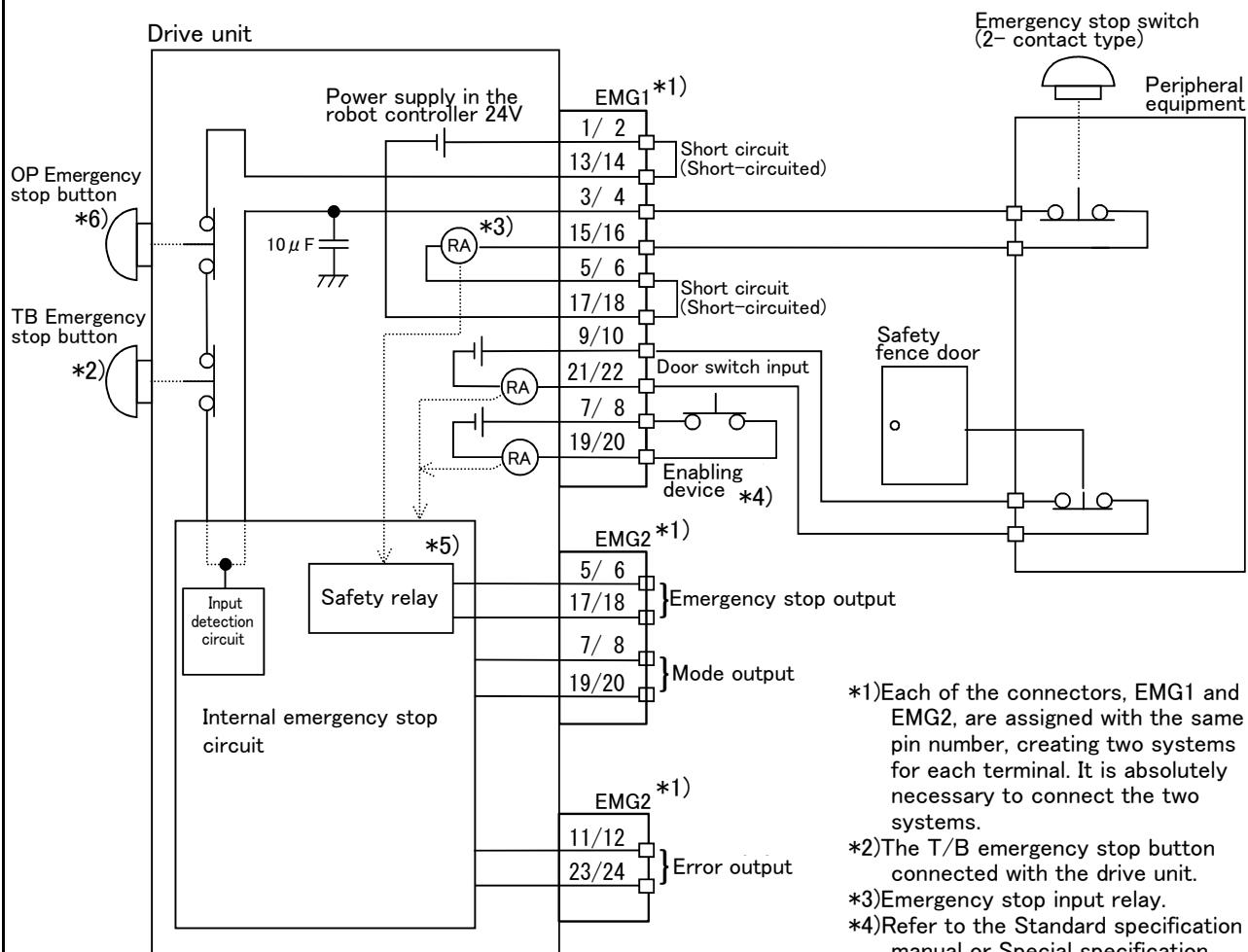
[Caution]

- 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. QS90SR2SP (Manufacture: Mitsubishi Electric Corporation)).
- 4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
- 5) When connecting emergency stop button output to an exterior safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly this function will not operate correctly. Please connect 20/19 terminal to 24V.

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

(3) CR760 drive unit

<Wiring example 1>: Connect the emergency stop switch of peripheral equipment to the drive unit.
 The power supply for emergency stop input uses the power supply in the drive uni.
 <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.



*5)The emergency stop input detection relay is used 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)The emergency stop button of the robot controller. (Only specification with the operation panel.)

Fig.6-11 : Example of safety measures (CR760 wiring example 1)

<Wiring example 2>: Connect the emergency stop switch of peripheral equipment to the drive unit.

The power supply for emergency stop input uses the power supply of peripheral equipment.

<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.

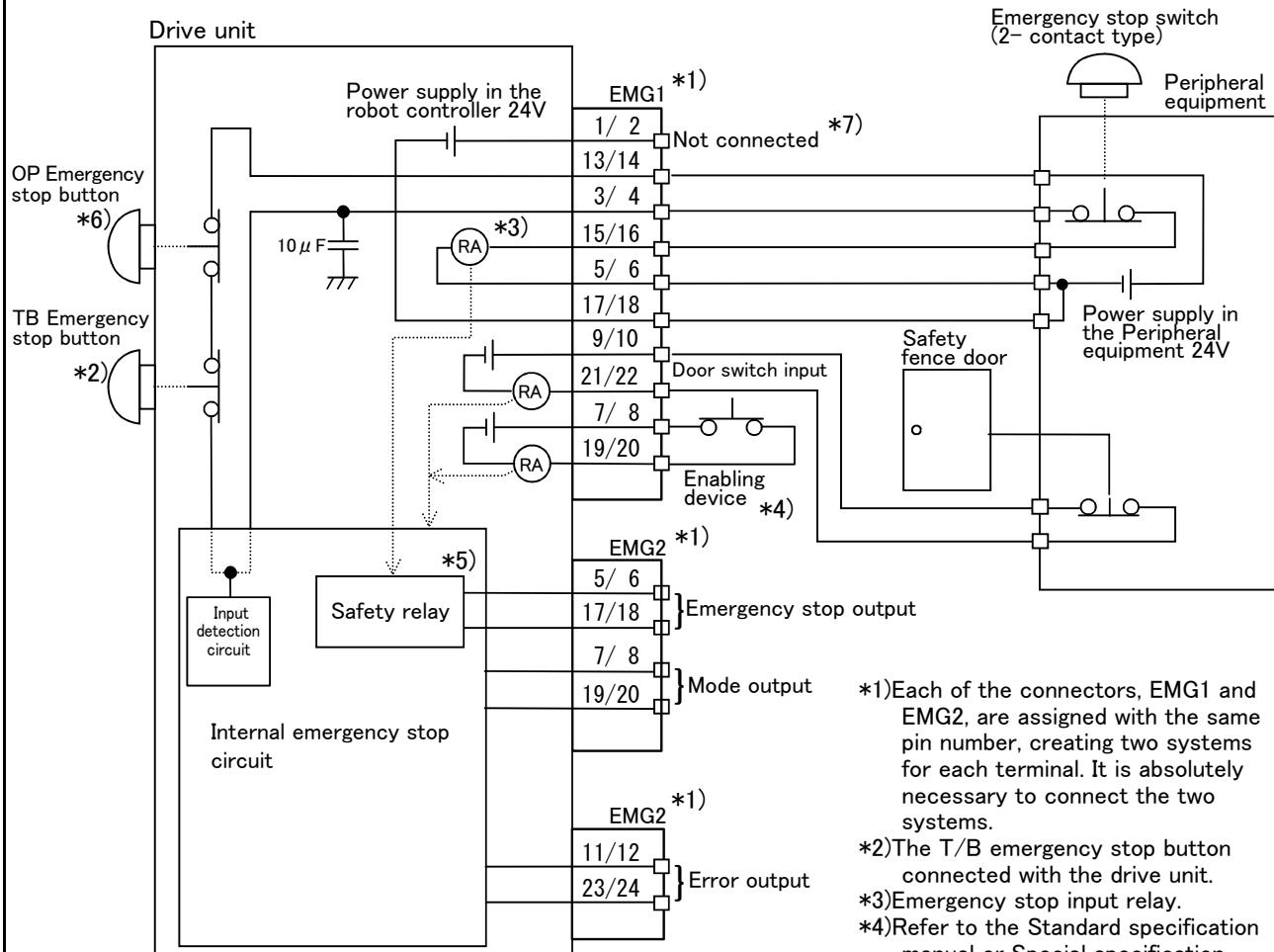


Fig.6-12 : Example of safety measures (CR760 wiring example 2)

<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.

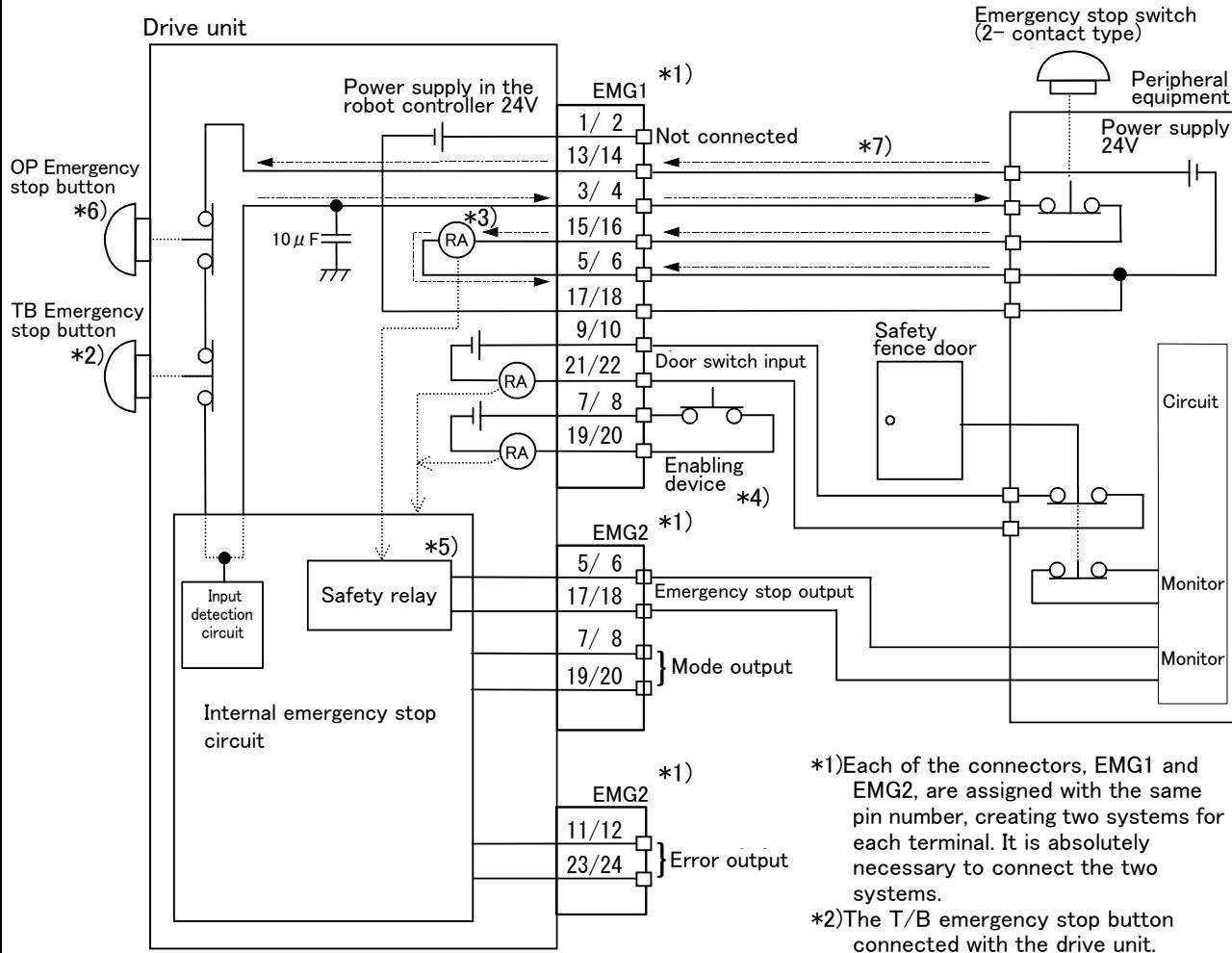


Fig.6-13 : Example of safety measures (CR760 wiring example 3)

<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.

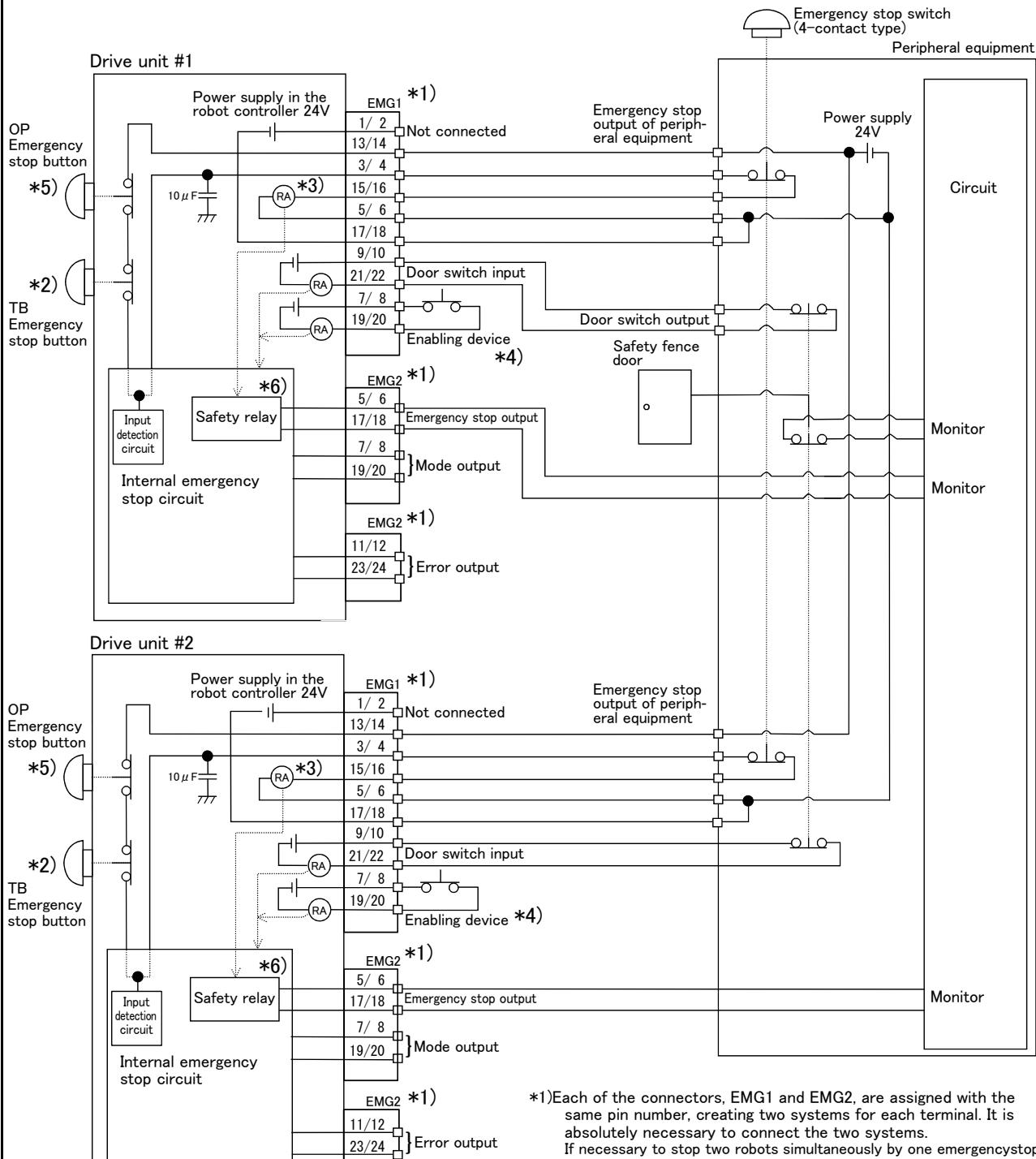
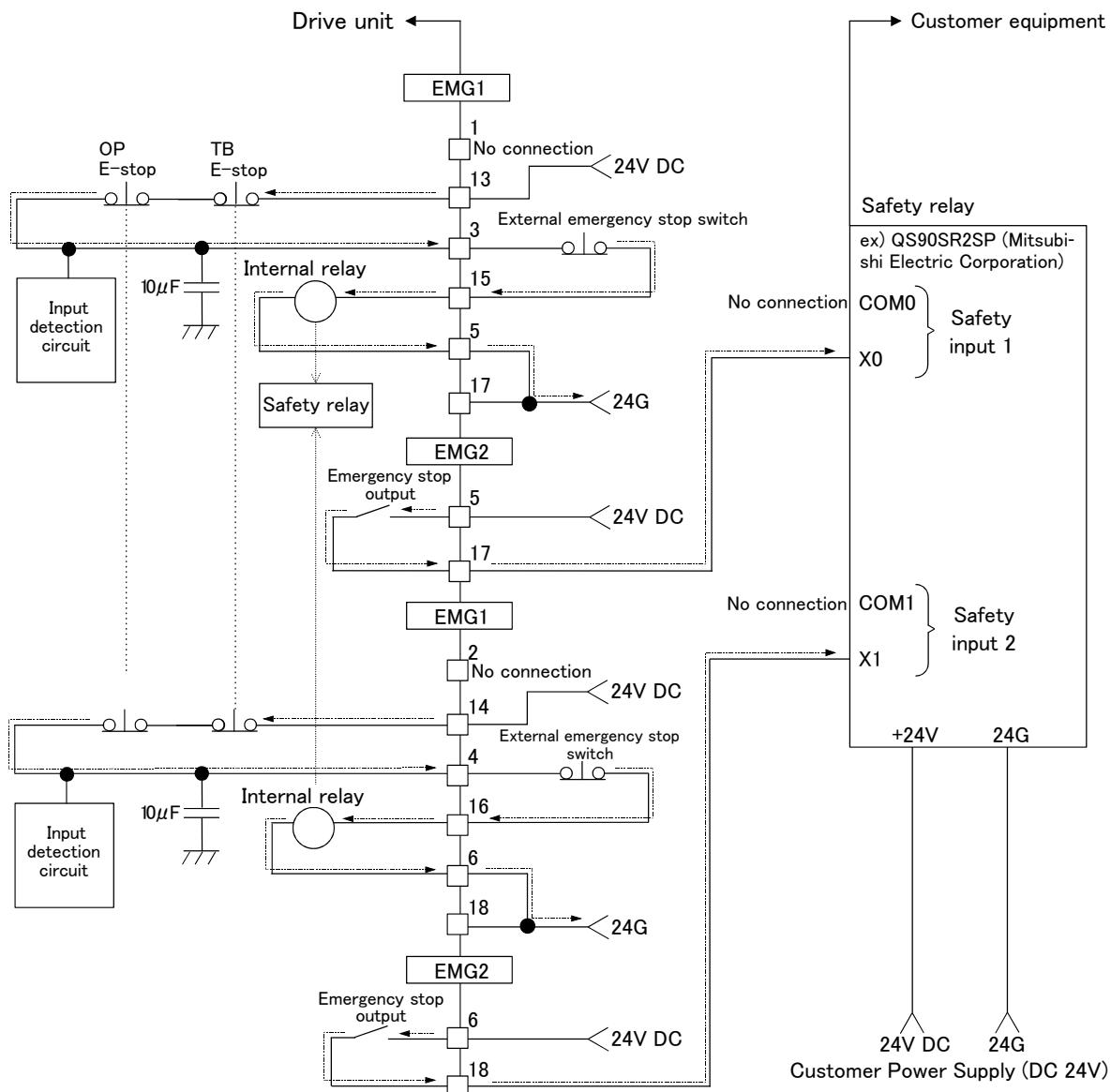


Fig.6-14 : Example of safety measures (CR760 wiring example 4)

<Wiring example 5> Connect the drive unit to the safety relay
Use the drive unit's emergency stop button command as an input to the 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 13/14 of EMG1, then connect the emergency stop button (or contact points) in the user equipment to the 3-15 and 4-16 terminals of EMG1, and ultimately connect the negative side (24G).
- 3) When installing a safety relay to use it as an input point of the controller's emergency stop button command, use a safety relay that is activated by an input from one of the two systems (i.e. QS90SR2SP (Manufacture: Mitsubishi Electric Corporation)).
- 4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
- 5) When connecting emergency stop button output to an external safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly, this function will not operate correctly. Please connect the two terminals 5/6 of EMG2 to 24V.

Fig.6-15 : Example of safety measures (CR760 wiring example 5)

(4) 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. 6-17, Fig. 6-16, Fig. 6-18)
- Cable length..... The length of the wire between the switch and terminal block must be max. 15m or less. Please use the shield line, in case of the cable may receive the noise etc. by other equipment, such as servo amplifier. And, since the ferrite core is attached as noise measures parts, please utilize.
The size of the wire that fits to use is shown below.
 - CR750 drive unit..... CNUSR11/12/13 connector:
AWG #26 to #16 (0.14mm² to 1.5mm²)
 - CR750 drive unit..... CNUSR2 connector:
AWG #30 to #24 (0.05mm² to 0.2mm²)
 - CR751 drive unit..... CNUSR1/2 connector:
AWG #30 to #24 (0.05mm² to 0.2mm²)
 - CR760 drive unit..... EMG1/2 connector:
AWG #28 to #16 (0.08mm² to 1.5mm²)

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

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

The electric-current value limitation when connecting the coils, such as the Relays (CR750 drive unit)

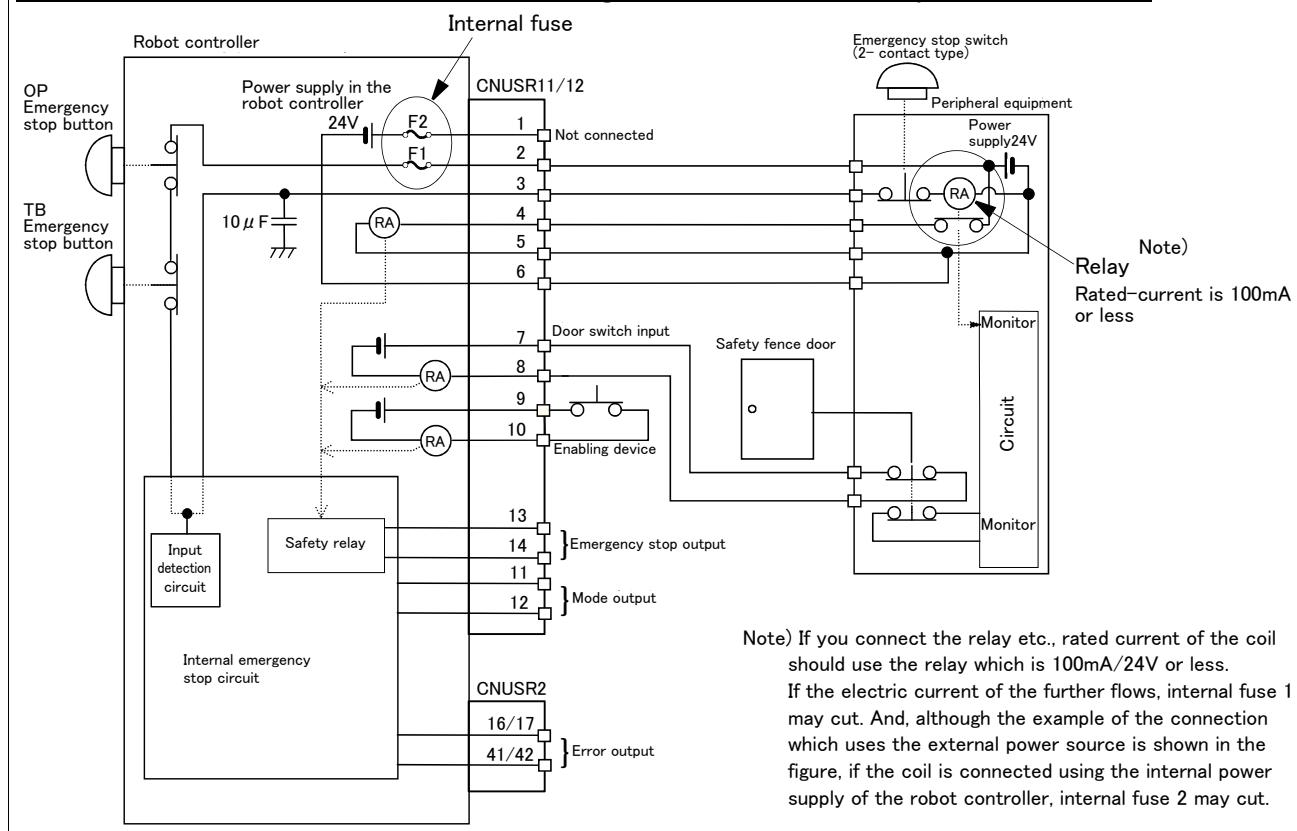


Fig.6-16 : Limitations when connecting the relay etc. (CR750)

The electric-current value limitation when connecting the coils, such as the Relays (CR751 drive unit)

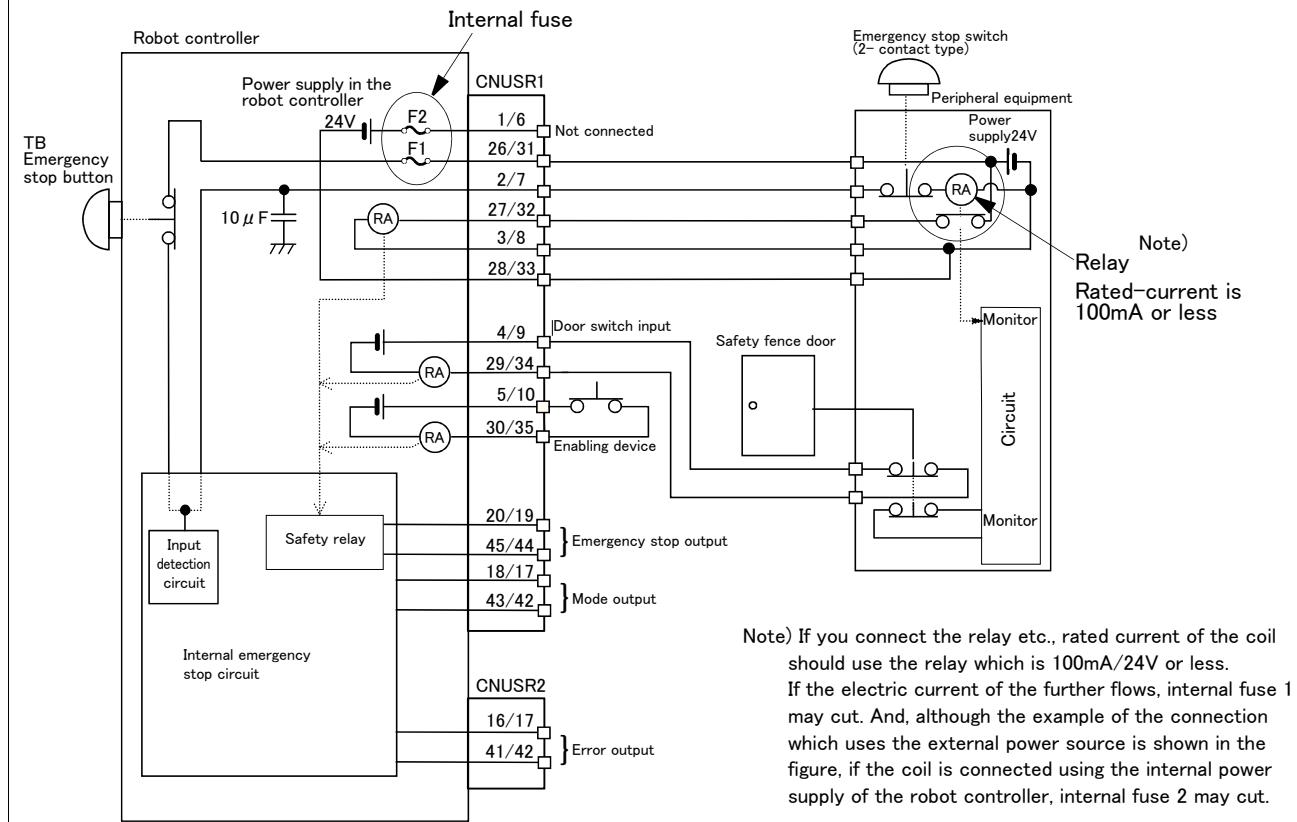


Fig.6-17 : Limitations when connecting the relay etc. (CR751)

The electric-current value limitation when connecting the coils, such as the Relays (CR760 drive unit)

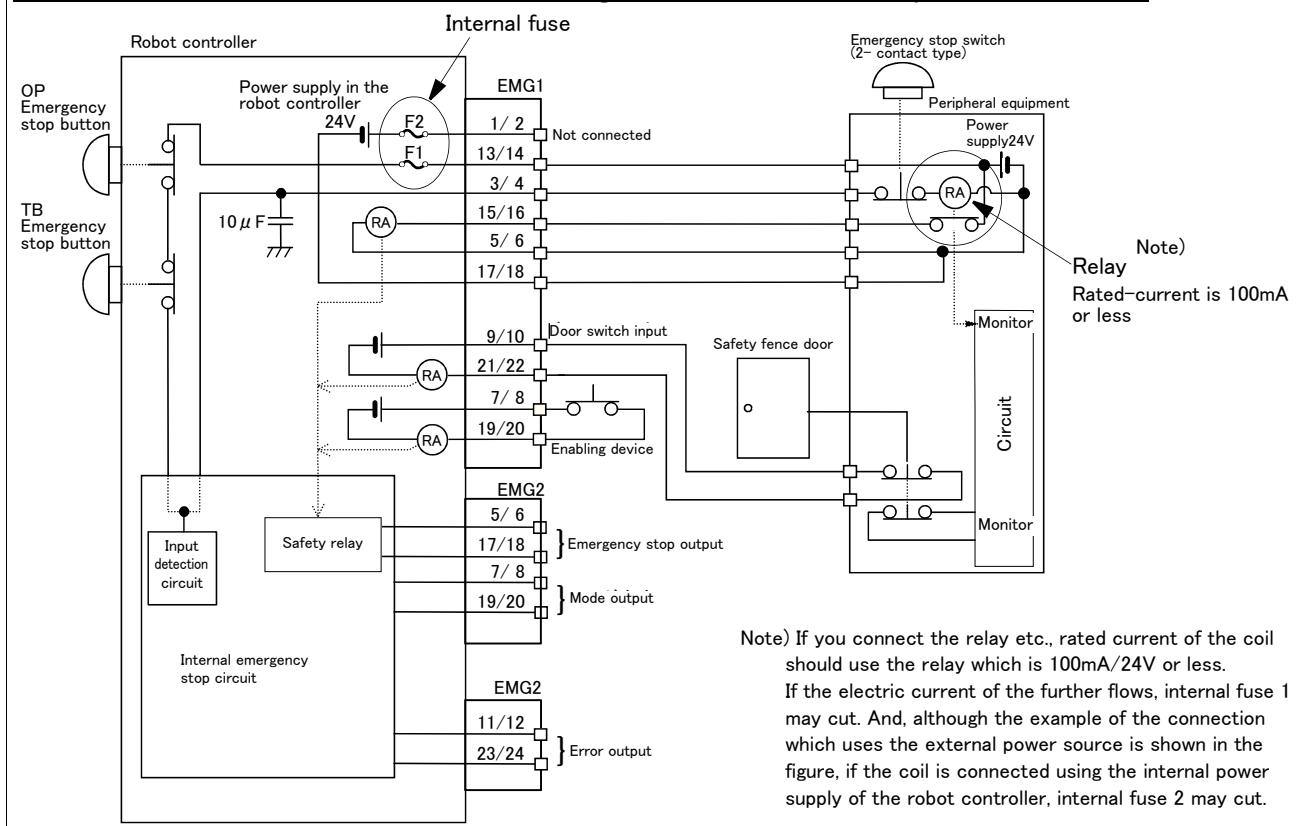


Fig.6-18 : Limitations when connecting the relay etc. (CR760)

[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.

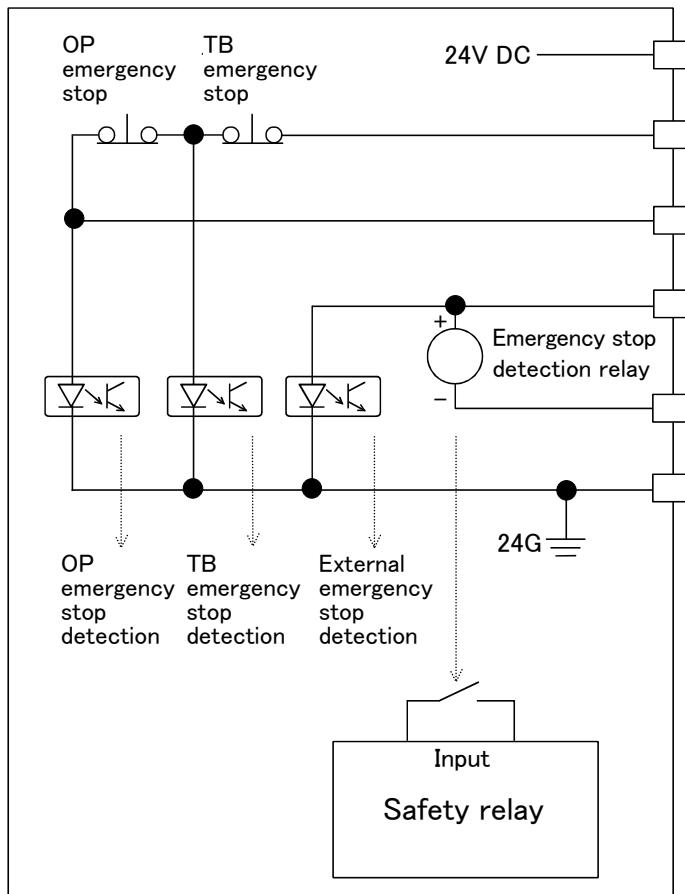


Fig.6-19 : Internal circuit of controller

⚠ CAUTION

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

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

⚠ 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 or overvoltage error may occur.

(2) Noise

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

(3) Temperature and humidity

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

(4) Vibration

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

(5) Installation environment

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

6.3 Precautions for handling

- (1) This robot has brakes on all axes. The precision of the robot may drop, looseness may occur and the reduction gears may be damaged if the robot is moved with force with the brakes applied.
- (2) Avoid moving the robot arm by hand. When unavoidable, gradually move the arm. If moved suddenly, the accuracy may drop due to an excessive backlash, or the backed up data may be destroyed.
- (3) Note that depending on the posture, even when within the movement range, the wrist section could interfere with the base section. Take care to prevent interference during jog. ^{*1)}
- (4) The robot arm consists of precision parts such as bearing. Lubricants such as grease are also applied on the moving parts to keep the mechanical accuracy. In a cold start under low temperature or in the first start after being stored for one month or longer, lubricants may not be spread enough. Such condition may lower the positioning accuracy, cause servo and overload alarms, and early wearing of the moving parts. To avoid such situation, perform warm-up operation of the machine at a low speed (at about 20% of normal operation speed). Move the robot arm from the lower to the upper limit of the movable range with the 30 degree joint angle or more for about 10 minutes. After that, speed up the operation gradually.
Please use the warm-up operation. (About the details of the warm-up operation, refer to "INSTRUCTION MANUAL/Detailed explanations of functions and operations".)
- (5) The robot arm and controller must be grounded with 100Ω 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 lithium and fall under the definition.
When the lithium batteries are shipped for storage, etc., they will be classified as Class 9: Miscellaneous dangerous substances and articles. Please contact your transportation company and must provide appropriate transport safety measures as the customer's consignor.
- (20) If the air supply temperature (primary piping) used for the tool etc. is lower than ambient air temperature, the dew condensation may occur on the coupling or the hose surface.
- (21) When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

6.4 EMC installation guideline

6.4.1 Outlines

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

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

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

6.4.2 EMC directive

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

(1) Emission (EMI : Electromagnetic Interference)The capacity not to generate the disturbance noise

which has a bad influence outside.

(2) Immunity (EMS : Electromagnetic Susceptibility).....The capacity which does not malfunction for the disturbance noise from the outside.

Each contents are shown below.

Item	Name	Contents	Testing technical-standard number
Emission (EMI)	Radiative noise disturbance	The electromagnetic noise etc. which are emitted to environs.	EN61000-6-2 : 2005 EN61000-6-4 : 2007 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

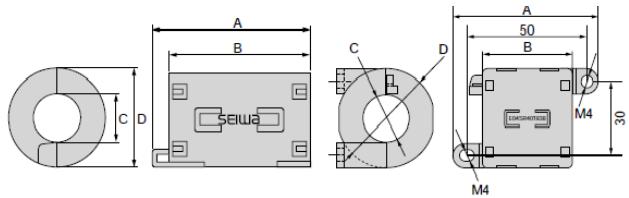
(1) Ferrite core

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.

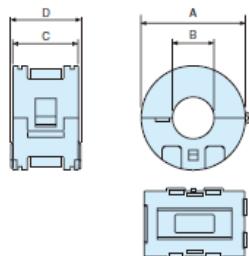
Maker: SEIWA ELECTRIC MFG. Co.,Ltd.

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



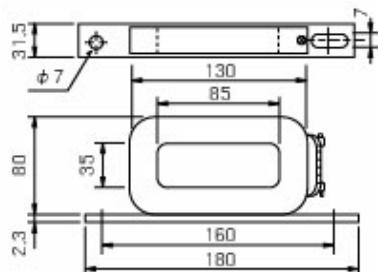
Maker: TAKACHI ELECTRONICS ENCLOSURE CO., LTD.

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 model

Type <small>Note1)</small>					Controller <small>Note2)</small>
<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	CR750-0*VQ-1
<input type="checkbox"/> RV-4F-1Q	<input type="checkbox"/> RV-4FL-1Q	<input type="checkbox"/> RV-4FJL-1Q	<input type="checkbox"/> RV-7F-1Q	<input type="checkbox"/> RV-7FL-1Q	CR751-0*VQ-0

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

Note2) "*" in the controller shows the maximum load of the robot arm. (4kg: "4", 7kg: "7")

■ Shipping special specifications

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 <small>Note1)</small>	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
	CE Marking specification	Not conforming with EMC directive.	<input type="checkbox"/> Not provided	<input type="checkbox"/> -S15
Machine cable		<input type="checkbox"/> 5m fixed type	2m fixed type: <input type="checkbox"/> 1S-02UCBL-01 (For CR750) <input type="checkbox"/> 1F-02UCBL-02 (For CR751)	
Controller	Robot CPU unit connecting cable set <small>Note2)</small>	<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-03 1F-DH-04	For RV-4F series: <input type="checkbox"/> Not provided	<input type="checkbox"/> Provided
	Machine cable extension	1S- <input type="checkbox"/> CBL-01	Fixed type (For CR750 controller): <input type="checkbox"/> Not provide	<input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m
		1S- <input type="checkbox"/> LCB-01	Flexed type (For CR750 controller): <input type="checkbox"/> Not provide	<input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m
		1F- <input type="checkbox"/> UCBL-02	Fixed type (For CR751 controller): <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 ((For CR751 controller): <input type="checkbox"/> Not provide	<input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
	Solenoid valve set	1F-VDO <input type="checkbox"/> -02 1F-VDO <input type="checkbox"/> E-02	<input type="checkbox"/> Not provide 1F-VDO <input type="checkbox"/> -02 (Sink type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set 1F-VDO <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	R32TB- <input type="checkbox"/> R33TB- <input type="checkbox"/>	<input type="checkbox"/> Not provided	R32TB (CR750 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m R33TB (CR751 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Highly efficient teaching pendant	R56TB- <input type="checkbox"/> R57TB- <input type="checkbox"/>	<input type="checkbox"/> Not provided	R56TB (CR750 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m R57TB (CR751 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Controller protection box	CR750-MB CR751-MB	For CR750 drive unit: <input type="checkbox"/> Not provided	<input type="checkbox"/> Provided
	RT ToolBox2	3D-11C-WINE	<input type="checkbox"/> Not provided	<input type="checkbox"/> Windows XP/Vista/7/8.1/10 English CD-ROM
	RT ToolBox2 mini	3D-12C-WINE	<input type="checkbox"/> Not provided	<input type="checkbox"/> Windows XP/Vista/7/8.1/10 English CD-ROM
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 32, "2.2.6 Protection specifications"](#) about oil resistance.

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

■ Customer information

Company name	Name
Address	Telephone

■ Purchased model

Type Note1)	Controller
<input type="checkbox"/> RV-7FLL-Q (General environment specification (IP40))	CR750-07VLQ-1
<input type="checkbox"/> RV-7FLL-1Q (General environment specification (IP40))	CR751-07VLQ-0

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

■ Shipping special specifications

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
	CE Marking specification Not conforming with EMC directive.	<input type="checkbox"/> Not provided <input type="checkbox"/> -S15
Machine cable	<input type="checkbox"/> 5m fixed type	2m fixed type: <input type="checkbox"/> 1S-02UCBL-01 (For CR750) <input type="checkbox"/> 1F-02UCBL-02 (For CR751)
Controller	Robot CPU unit connecting cable set Note2)	<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	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Machine cable extension	1S- <input type="checkbox"/> CBL-01 Fixed type (For CR750 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m
		1S- <input type="checkbox"/> LCB-01 Flexed type (For CR750 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m
		1F- <input type="checkbox"/> UCBL-02 Fixed type (For CR751 controller): <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 ((For CR751 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
Solenoid valve set	1F-VDO <input type="checkbox"/> -02 1F-VDO <input type="checkbox"/> E-02	<input type="checkbox"/> Not provide 1F-VDO <input type="checkbox"/> -02 (Sink type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set 1F-VDO <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
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
Controller	Simple teaching pendant	R32TB- <input type="checkbox"/> R33TB- <input type="checkbox"/> R32TB (CR750 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m R33TB (CR751 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Highly efficient teaching pendant	R56TB- <input type="checkbox"/> R57TB- <input type="checkbox"/> R56TB (CR750 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m R57TB (CR751 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Controller protection box	CR750-MB CR751-MB CR750 drive unit: <input type="checkbox"/> Not provided <input type="checkbox"/> Provided CR751 drive unit: <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	RT ToolBox2	3D-11C-WINE <input type="checkbox"/> Not provided <input type="checkbox"/> Windows XP/Vista/7/8/8.1/10 English CD-ROM
	RT ToolBox2 mini	3D-12C-WINE <input type="checkbox"/> Not provided <input type="checkbox"/> Windows XP/Vista/7/8/8.1/10 English CD-ROM
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
-------------------	--

■ 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 32, "2.2.6 Protection specifications"](#) about oil resistance.

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

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased model

Type	Note1)	Controller
<input type="checkbox"/> RV-13F-Q	<input type="checkbox"/> RV-13FL-Q	CR750-13VQ-1
<input type="checkbox"/> RV-13F-1Q	<input type="checkbox"/> RV-13FL-1Q	CR751-13VQ-0

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

■ Shipping special specifications

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
	CE Marking specification	Not conforming with EMC directive.	<input type="checkbox"/> Not provided	<input type="checkbox"/> -SH03	<input type="checkbox"/> -SH04
Machine cable		<input type="checkbox"/> 7m fixed type	2m fixed type: <input type="checkbox"/> 1S-02UCBL-01 (For CR750) <input type="checkbox"/> 1F-02UCBL-02 (For CR751)		
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 checked="" type="checkbox"/> Provided				
	Machine cable extension	1S- <input type="checkbox"/> <input type="checkbox"/> CBL-01	Fixed type (For CR750 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m					
		1S- <input type="checkbox"/> <input type="checkbox"/> LCBL-01	Flexed type (For CR750 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m					
		1F- <input type="checkbox"/> <input type="checkbox"/> UCBL-02	Fixed type (For CR751 controller): <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 ((For CR751 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m					
	Solenoid valve set	1F-VDO <input type="checkbox"/> -03 1F-VDO <input type="checkbox"/> E-03	<input type="checkbox"/> Not provide 1F-VDO <input type="checkbox"/> -03 (Sink type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set 1F-VDO <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					
	Hand output cable	1F-GR35S-02	<input type="checkbox"/> Not 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					
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	R32TB- <input type="checkbox"/> <input type="checkbox"/> R33TB- <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> Not provided R32TB (CR750 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m R33TB (CR751 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m					
	Highly efficient teaching pendant	R56TB- <input type="checkbox"/> <input type="checkbox"/> R57TB- <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> Not provided R56TB (CR750 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m R57TB (CR751 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m					
	Controller protection box	CR750-MB	CR750 drive unit: <input type="checkbox"/> Not provided <input checked="" type="checkbox"/> Provided					
		CR751-MB	CR751 drive unit: <input type="checkbox"/> Not provided <input checked="" type="checkbox"/> Provided					
	RT ToolBox2	3D-11C-WINE	<input type="checkbox"/> Not provided <input type="checkbox"/> Windows XP/Vista/7/8/8.1/10 English CD-ROM					
	RT ToolBox2 mini	3D-12C-WINE	<input type="checkbox"/> Not provided <input type="checkbox"/> Windows XP/Vista/7/8/8.1/10 English CD-ROM					
	Instructions manual	5F-RF01-PE01	<input type="checkbox"/> Not provided <input checked="" type="checkbox"/> Provided () sets					

Maintenance parts (Consumable parts)

Maintenance parts (Consumable parts) Backup batteries ER6 () pcs. Backup batteries Q6BAT () pcs. Grease () cans

■ 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: <input type="checkbox"/> Confirm oil proof <input type="checkbox"/> request (Oil name:) <input type="checkbox"/> Other ()			
Remarks						

Note1) Refer to Page 32, "2.2.6 Protection specifications" about oil resistance.

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

■ Customer information

Company name	Name
Address	Telephone

■ Purchased model

Type ^{Note1)}	Controller
<input type="checkbox"/> RV-20F-Q	CR750-20VQ-1
<input type="checkbox"/> RV-20F-1Q	CR751-20VQ-0

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

■ Shipping special specifications

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
	CE Marking specification	Not conforming with EMC directive. <input type="checkbox"/> Not provided <input type="checkbox"/> -S15
Machine cable	<input type="checkbox"/> 7m fixed type	2m fixed type: <input type="checkbox"/> 1S-02UCBL-01 (For CR750) <input type="checkbox"/> 1F-02UCBL-02 (For CR751)
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	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	Machine cable extension	1S- <input type="checkbox"/> CBL-01 Fixed type (For CR750 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m
		1S- <input type="checkbox"/> LCB-01 Flexed type (For CR750 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m
		1F- <input type="checkbox"/> UCBL-02 Fixed type (For CR751 controller): <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 ((For CR751 controller): <input type="checkbox"/> Not provide <input type="checkbox"/> 10m <input type="checkbox"/> 15m <input type="checkbox"/> 20m
	Solenoid valve set	1F-VDO <input type="checkbox"/> -03 <input type="checkbox"/> Not provide 1F-VDO <input type="checkbox"/> E-03 1F-VDO <input type="checkbox"/> -03 (Sink type): <input type="checkbox"/> 1set <input type="checkbox"/> 2set <input type="checkbox"/> 3set <input type="checkbox"/> 4set 1F-VDO <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	R32TB- <input type="checkbox"/> R33TB- <input type="checkbox"/> <input type="checkbox"/> Not provided R32TB (CR750 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m R33TB (CR751 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Highly efficient teaching pendant	R56TB- <input type="checkbox"/> R57TB- <input type="checkbox"/> <input type="checkbox"/> Not provided R56TB (CR750 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m R57TB (CR751 drive unit): <input type="checkbox"/> 7m <input type="checkbox"/> 15m
	Controller protection box	CR750-MB CR750 drive unit: <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
		CR751-MB CR751 drive unit: <input type="checkbox"/> Not provided <input type="checkbox"/> Provided
	RT ToolBox2	3D-11C-WINE <input type="checkbox"/> Not provided <input type="checkbox"/> Windows XP/Vista/7/8.1/10 English CD-ROM
	RT ToolBox2 mini	3D-12C-WINE <input type="checkbox"/> Not provided <input type="checkbox"/> Windows XP/Vista/7/8.1/10 English CD-ROM
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)						
Remarks	<input type="checkbox"/> Other ()					

Note1) Refer to [Page 32, "2.2.6 Protection specifications"](#) about oil resistance.

Appendix 5 : Specifications discussion material (RV-35F/50F/70F series)

■ Customer information

Customer information	
Company name	Name
Address	Telephone

■ Purchased model

Type ^{Note1)}	Controller ^{Note2)}
<input type="checkbox"/> RV-35F-Q <input type="checkbox"/> RV-50F-Q <input type="checkbox"/> RV-70F-Q	CR760-*VQ-1

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

Note2) "*" in the controller shows the maximum load of the robot arm (35kg: "35", 50kg: "50", 70kg: "70").

■ Shipping special specifications

Item		Standard specifications	Shipping special specifications	
Robot arm	Oil mist specification (IP67)	General environment specification (IP54) <small>Note1)</small>	<input type="checkbox"/> Not provided	<input type="checkbox"/> Provided
	CE Marking specification	Not conforming with EMC directive.	<input type="checkbox"/> Not provided	<input type="checkbox"/> -S15
Controller	Robot CPU unit connecting cable set <small>Note2)</small>	<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 wrist portion is IP67 rating

Note1) The wrist portion is IP67 rating.
Note2) The four type cables shown in below are contained. (Each cable length is the same.)

the four type cables shown in below are contained. (Each cable length is 1)2Q-TUCBI □□ M 2)2Q-DISPCBI □□ M 3)2Q-EMICBI □□ M

4) MB=J3BUS □□ M=A (5m, 20m) or MB=J3BUS □□ M=B (30m)

■ Options (Installable after shipment)

Item		Type	Provision, and specifications when provided.			
Robot arm	Machine cable extension (For non-CE marking)	1F- □□ CBL-21 1F- □□ LCBL-21	Fixed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m Flexed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m			
	Machine cable extension (For CE marking)	1F- □□ CBLS-21	Fixed type: <input type="checkbox"/> Not provide <input type="checkbox"/> 5m <input type="checkbox"/> 10m <input type="checkbox"/> 15m			
	Hand input cable	1F-HC2000S-21 1F-HC2000S-22	<input type="checkbox"/> Not provided <input type="checkbox"/> 1F-HC2000S-21 (standard: 8 points) <input type="checkbox"/> 1F-HC2000S-22 (extension: 8 points)			
	Hand output cable	1F-GR2000S-21 1F-GR2000S-22	<input type="checkbox"/> Not provided <input type="checkbox"/> 1F-GR2000S-21 (standard: 8 points) <input type="checkbox"/> 1F-GR2000S-22 (extension: 8 points)			
	J2 axis motor cover	1F-MCJ2-21	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided			
	Simple teaching pendant	R32TB- □□	<input type="checkbox"/> Not provided <input type="checkbox"/> 7m <input type="checkbox"/> 15m			
Controller	Highly efficient teaching pendant	R56TB- □□	<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"/> Windows XP/Vista/7/8/8.1/10 English CD-ROM			
	RT ToolBox2 mini	3D-12C-WINE	<input type="checkbox"/> Not provided <input type="checkbox"/> Windows XP/Vista/7/8/8.1/10 English CD-ROM			
	Instructions manual	5F-RF01-PE01	<input type="checkbox"/> Not provided <input type="checkbox"/> Provided () sets			

Maintenance parts (Consumable parts)

Maintenance parts (consumable parts) Backup batteries ER6 () pcs. Backup batteries Q6BAT () pcs. Grease () cans

■ 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"/> Oil mist: <input type="checkbox"/> Confirm oil proof <input type="checkbox"/> request (Oil name:) <input type="checkbox"/> Other ()			
Remarks						

Note1) Refer to Page 32, "2.2.6 Protection specifications" about oil resistance.



Product Service

EC-Statement of Compliance

No. E6 15 02 25554 053

Holder of Certificate: Mitsubishi Electric Corporation

Tokyo BILD., 2-7-3 Marunouchi,
Chiyoda-ku
Tokyo
100-8310 JAPAN

Name of Object: Industrial, Scientific and Medical equipment
Industrial Robot**Model(s):** F series
(See Attachment for Nomenclature)**Description of Object:** Rated Voltage: 230 VAC
Rated Power: 1.7 kW
Protection Class: 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.: 73552066

Date, 2015-02-10

(Johann Roidt)



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

Page 1 of 8



Product Service

Attachment

Statement No.

E6 15 02 25554 053A: 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 15 02 25554 053

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



Product Service

Attachment

Statement No.

E6 15 02 25554 053

A3:RV-2Fseries 1.7kW

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

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

(1)**RV**: Vertical Robot

(2) Maximum Payload specification:

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

(4)Robot Joint type

B :All axes have brake units.

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

(5)Robot Arm length

L : Long Arm model

[none] : normal model

(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**Sxx** :Mechanical option



Product Service

Attachment

Statement No.

E6 15 02 25554 053

A4:RV-4F,7Fseries 1.7kW

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

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

(1)**RV**: Vertical Robot

(2) Maximum Payload specification:

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

(4) Robot axes:

J : 5 axes model

[none]: normal model

(5) Robot arm length:

L : Long arm model

[none]: normal model

(6) Dimension and Ambient specification:

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

[none] : Basic model(IP40)

(7) Type of Robot controller cabinet

[none] :CR750 controller

1 :CR751 controller

(8) Robot controller type:

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

(9) Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(10) 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



Product Service

Attachment

Statement No.

E6 15 02 25554 053

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 only RV-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



Product Service

Attachment

Statement No.

E6 15 02 25554 053

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

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

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

(1)**RH**: Horizontal Robot

(2) Maximum Payload specification:

1 : 1kg**3** : 3kg(3) **F** : F series robot(4)**HR** :4 joints ,reverse mount model

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

35 : 350 mm arm **75** : 750 mm arm**55** : 550 mm arm

(6) Z stroke length specification:

12 : 120 mm arm**15** : 150 mm arm

(7) Dimension and Ambient specification:

W : Water proof model**M** : Oil mist model**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



Product Service

Attachment

Statement No.

E6 15 02 25554 053B: 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:

01 : 1kg**03** : 3kg**06** : 6kg**12** : 12kg**20** : 20kg**02** : 2kg**04** : 4kg**07** : 7kg**13** : 13kg

(3) Robot type

H : Horizontal robot**HR** : Horizontal robot(reverse mount)**V** : Vertical robot**VJ** : 5 axes 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

사용자안내문

User's Guide

기종별 Type of Equipment	사용자안내문 User's Guide
A 급 기기 (업무용 방송통신기자재)	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)	이 기기는 가정용(B 급) 전자파적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다.
Class B Equipment (For Home Use Broadcasting & Communication Equipment)	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.

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