MITSUBISHI

Mitsubishi Industrial Robot

RV-2F-D Series

Standard Specifications Manual
(CR750-D/CR751-D Controller)

MELFA

BFP-A8900-G

⚠ Safety Precautions

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

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

⚠ CAUTION	Use the robot within the environment given in the specifications. Failure to do so could lead to a drop or reliability or faults. (Temperature, humidity, atmosphere, noise environment, etc.)
⚠ CAUTION	Transport the robot with the designated transportation posture. Transporting the robot in a non-designated posture could lead to personal injuries or faults from dropping.
⚠ CAUTION	Always use the robot installed on a secure table. Use in an instable posture could lead to positional deviation and vibration.
⚠ CAUTION	Wire the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.
⚠ CAUTION	Do not apply excessive force on the connector or excessively bend the cable. Failure to observe this could lead to contact defects or wire breakage.
⚠ CAUTION	Make sure that the workpiece weight, including the hand, does not exceed the rated load or tolerable torque. Exceeding these values could lead to alarms or faults.
⚠ WARNING	Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.
⚠ WARNING	Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.
⚠ CAUTION	Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.
⚠ WARNING	When carrying out teaching work in the robot's movement range, always secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.
⚠ CAUTION	Keep the jog speed as low as possible, and always watch the robot. Failure to do so could lead to interference with the workpiece or peripheral devices.
⚠ CAUTION	After editing the program, always confirm the operation with step operation before starting automatic operation. Failure to do so could lead to interference with peripheral devices because of programming mistakes, etc.
⚠ CAUTION	Make sure that if the safety fence entrance door is opened during automatic operation, the door is locked or that the robot will automatically stop. Failure to do so could lead to personal injuries.
⚠ CAUTION	Never carry out modifications based on personal judgments, or use non-designated maintenance parts. Failure to observe this could lead to faults or failures.
⚠ WARNING	When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers catching depending on the posture.

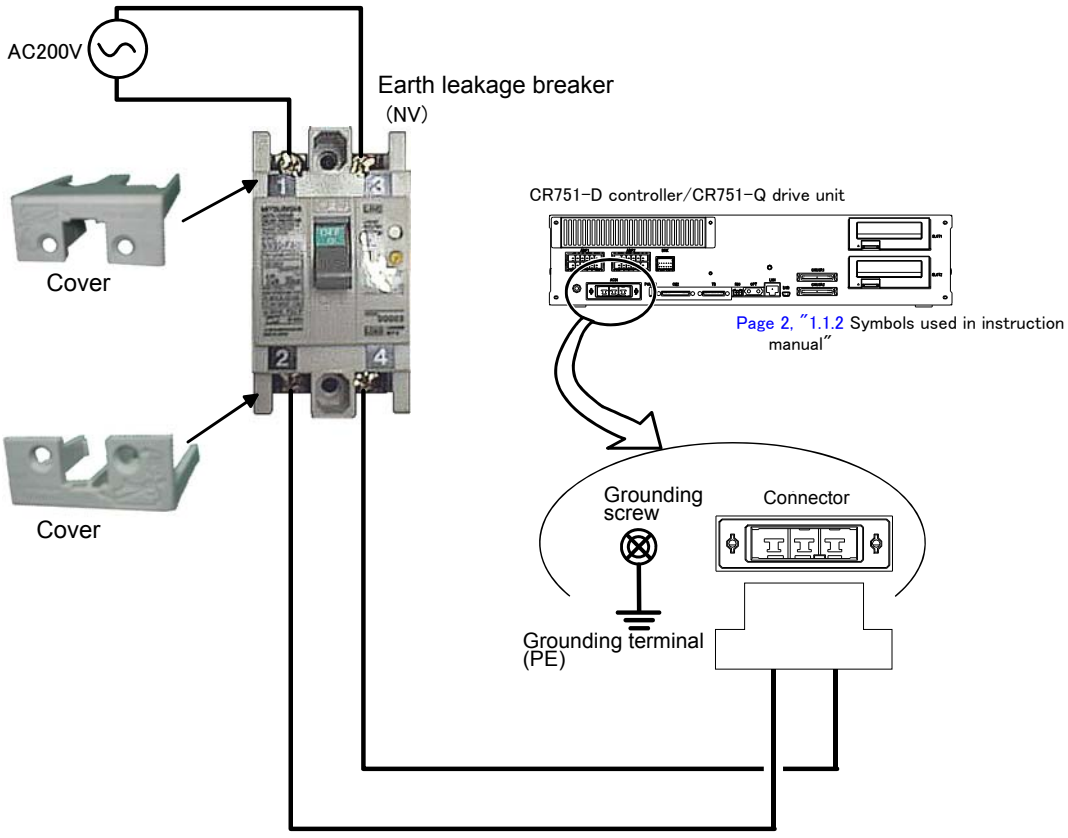
⚠ CAUTION Do not stop the robot or apply emergency stop by turning the robot controller's main power OFF. If the robot controller main power is turned OFF during automatic operation, the robot accuracy could be adversely affected. Moreover, it may interfere with the peripheral device by drop or move by inertia of the arm.

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

⚠ 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.



■Revision history

Date of print	Specifications No.	Details of revisions
2012-06-14	BFP-A8900	・First print.
2012-10-04	BFP-A8900-A	・The power supply capacity was corrected. ・The notes were added to "Fig 3-24: Example of EMC noise filter installation". ・The lithium battery (ER6) was added to The United Nations' Recommendations on the Transport of Dangerous Goods. ・The notes about installation of the controller and the robot arm were added. (neither direct rays nor the heat of lighting)
2012-10-11	BFP-A8900-B	・"Fig.2-5 : Wiring and piping for hand" was corrected.
2012-10-18	BFP-A8900-C	・"1.3 CE marking specifications" was added. ・"Declaration of Incorporation" was added. ・The user's guide of KC mark was added.
2012-11-26	BFP-A8900-D	・The statement about trademark registration was added. ・The machine-cable extension option was corrected to the replacement type. ・The machine-cable extension option of CE specification was added. ・The RIO cable was added to Wiring and piping system diagram for hand. ・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 updated. ・The robot type of KC mark was added. ・"Fig.2-13: Outside dimensions (CE marking/KC mark specification)" was added.
2012-12-21	BFP-A8900-E	・EC-Statement of Compliance was updated. ・Note of the external emergency stop were added (opens the connector terminal at factory shipping). ・The terminator was added to the connector of the hand input cable. ・The connection place of machine cable connector CN2 of the CR751 controller was corrected. (Error in writing)
2013-02-15	BFP-A8900-F	・The operation panel of CR751 controller was deleted. ・1.2.1 How to identify the robot model was corrected.
2013-03-19	BFP-A8900-G	・The metal plate which fixes CR750 controller vertically was changed. (upward compatibility)

■ Introduction

This series provides compact vertical multi-joint robots for use in machine processes and assemblies. This series is especially designed to answer the needs of users who want to create compact and highly flexible production facilities to cope with shortened product life cycles as well as the diffusion of small and high density product groups in recent years, such as personal computer related devices, information terminal devices and small car-mounted electronic devices.
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 8, "2 Robot arm", the specifications related to the controllerPage 38, "3 Controller", and software functions and a command list Page 107, "4 Software" separately.

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

*RV-2F-D (CR750-D controller) series
*RV-2F-D (CR751-D controller) series

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1 General configuration

1.1 Structural equipment

Structural equipment consists of the following types.

1.1.1 Standard structural equipment

The following items are enclosed as a standard.

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

1.1.2 Special specifications

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

1.1.3 Options

User can install options after their delivery.

1.1.4 Maintenance parts

Materials and parts for the maintenance use.

1.2 Model type name of robot

1.2.1 How to identify the robot model

RV - 2F ▲ - ● D ◆ -Sxx
(a) (b) (c) (d) (e) (f)

(a). RV-2F..... Indicates the RV-2F series

(b). ▲ ..... Indicates the existence of the brake.
Ex)
Omitted: J2, J3, J5 axis has brake.
B: All axes have the brake.

(c). ● ..... Indicates the controller type.
Ex.)
Omitted: CR750 controller
1: CR751 controller

(d). D ..... Indicates the controller type.
D: Stand alone type

(e). ◆ ..... Technical standard of Conformity.
Ex.)
Omitted: No conformity of technical standard.
1: Conforms to the CE Marking specification.

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

1.2.2 Combination of the robot arm and the controller

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

Protection specification	Robot arm	Axial constitution	Controller
Standard specification	RV-2F-D/RV-2FB-D	6-axis type	CR750-02VD-1
	RV-2F-1D/RV-2FB-1D		CR751-02VD

1.3 CE marking/KC mark specifications

The robot shown in the Table 1-2 is the CE Marking/KC mark specification.

Table 1-2 : Robot models with CE marking/KC mark specifications

Specification	Robot type	Controller	External signal logic	Language setting
CE marking	RV-2FB-D1-S15	CR750-02VD1-1-S15	Source type	English (ENG)
KC mark	RV-2FB-1D1-S19	CR751-02VD1-S19		

1.4 Contents of the structural equipment

1.4.1 Robot arm

The list of structural equipment is shown in below.

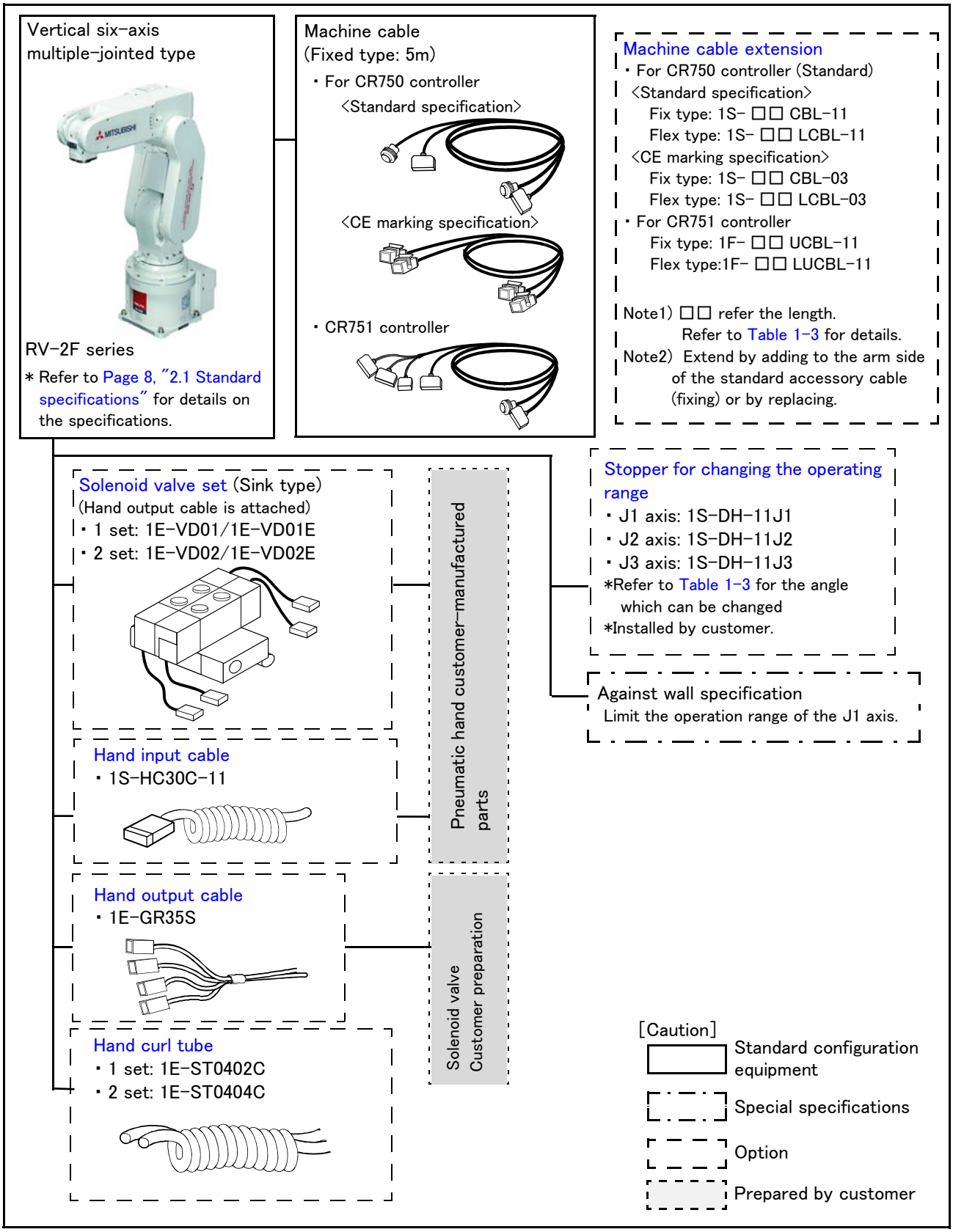


Fig.1-1 : Structural equipment (Robot arm)

1.4.2 Controller

The devices shown below can be installed on the controller.

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

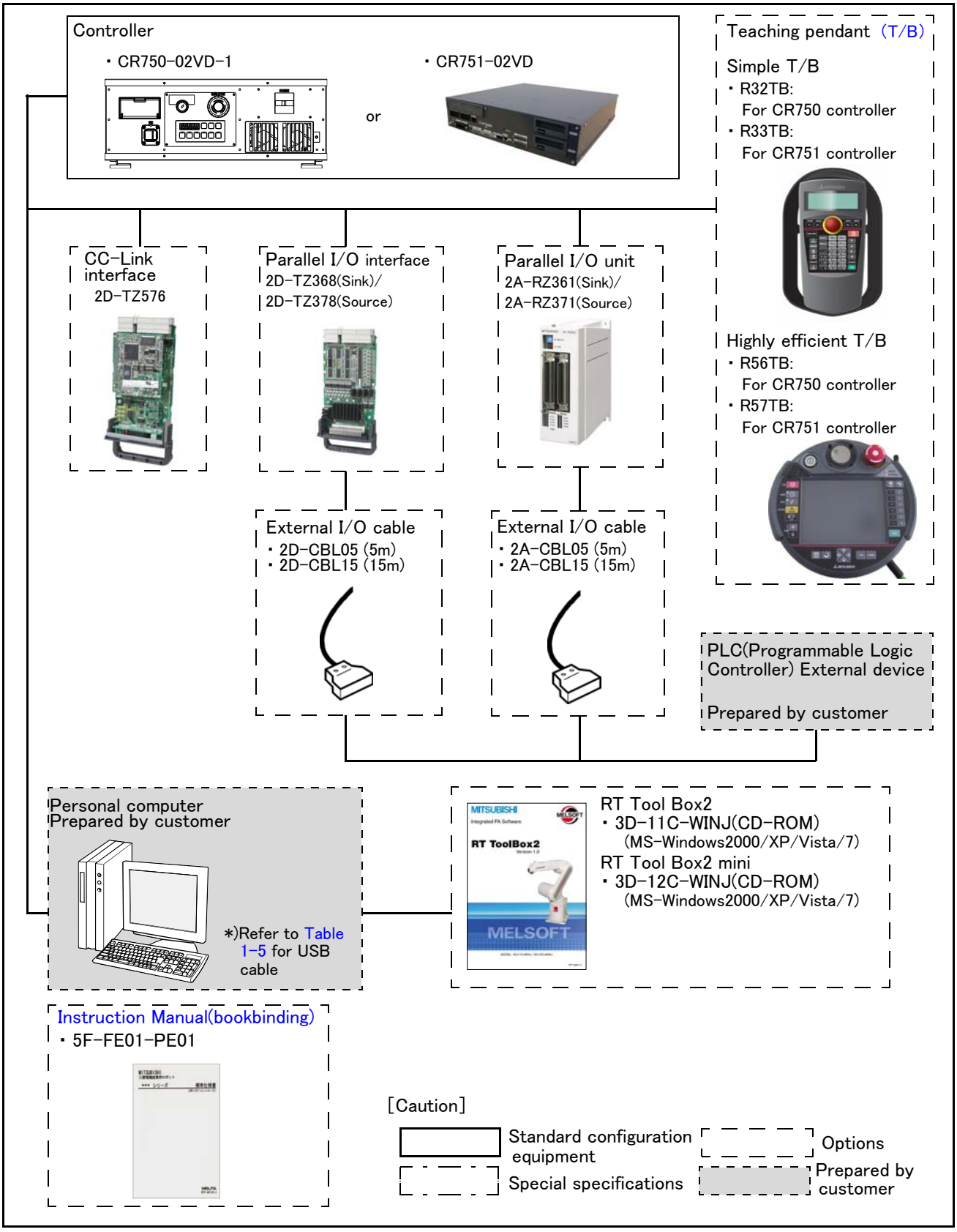


Fig.1-2 : Structural equipment

1.5 Contents of the Option equipment and special specification

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

Table 1-3 : The list of robot option equipment and special

Item	Type	Specifications	Classification Note1)		Description
			CR750	CR751	
Stopper for changing the operating range	1S-DH-11J1	J1 axis + side: +210、+150、+90 deg. − side: −210、−150、−90 deg. One place selection is possible each for + side / − side. Standard specification is +/−240 deg.	○	○	This must be installed by the customer.
	1S-DH-11J2	J2 axis + side: +30 deg. − side: −30 deg. One place selection is possible each for + side / − side. Standard specification is +/−120 deg	○	○	
	1S-DH-11J3	J3 axis + side: +70 deg. − side: Nothing Standard specification is 0 to +160 deg	○	○	
Extended machine cable	1S- □□ CBL-11	For fixing (Set of power and signal)	○	−	10, 15 For standard specification
	1S- □□ LCBL-11	For flexing (Set of power and signal)	○	−	5, 10, 15m For standard specification
	1S- □□ CBL-03	For fixing (Set of power and signal)	○	−	10, 15m For CE marking specification
	1S- □□ LCBL-03	For flexing (Set of power and signal)	○	−	5, 10, 15m For CE marking specification
	1F- □□ UCBL-11	For fixing (Set of power and signal)	−	○	10, 15m
	1F- □□ LUCBL-11	For flexing (Set of power and signal)	−	○	5, 10, 15m
Solenoid valve set	1E-VD01/1E-VD01E	1 set (Sink type)/(Source type)	○	○	A solenoid valve set for the pneumatic hand
	1E-VD02/1E-VD01E	2 set (Sink type)/(Source type)	○	○	
Hand input cable	1S-HC30C-11	Robot side: connector. Hand side: wire.	○	○	The cable is connected to the sensor by the customer.
Hand output cable	1E-GR35S	Robot side: connector Hand side: wire	○	○	The cable is connected to the hand output connector by the customer. Attaches the cable clamp (drip proof type) Straight cable 600mm (total length)
Hand curl tube	1E-ST0402C	For solenoid valve 1set: φ4x2	○	○	Curl type air tube
	1E-ST0404C	For solenoid valve 2set: φ4x4	○	○	

Note1) Distinction of ○ (is option) and □ (is special specification at shipping) is shown for each pair with the controller.

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

Item	Type	Specifications	Classification Note1)		Description
			CR750	CR751	
Simple teaching pendant	R32TB	Cable length 7m	○	-	With 3-position enable switch IP65
	R32TB-15	Cable length 15m	○	-	
	R33TB	Cable length 7m	-	○	
	R33TB-15	Cable length 15m	-	○	
Highly efficient teaching pendant	R56TB	Cable length 7m	○	-	
	R56TB-15	Cable length 15m	○	-	
	R57TB	Cable length 7m	-	○	
	R57TB-15	Cable length 15m	-	○	
Parallel I/O Interface	2D-TZ368 (Sink type)	DO: 32 point DI: 32 point Insulated type output signal (0.1A/24V /point)	○	○	The card type external input-and-output. Interface. Install to the slot of controller.
	2D-TZ378 (Source type)	DO: 32 point/ DI: 32 point Insulated type output signal (9mA/ 24V /point)			
External I/O cable (For Parallel I/O Interface)	2D-CBL05	5m	○	○	Use to connect the external peripheral device to the parallel input/output interface.
	2D-CBL15	15m	○	○	
Parallel I/O Unit	2A-RZ361 (Sink type)	DO: 32 point/ DI: 32 point Insulated type output signal (0.1A/24V /point)	○	○	The unit for expansion the external input/output. Electrical isolated Type (100mA/Point)
	2A-RZ371 (Source type)	DO: 32 point/ DI: 32 point Insulated type output signal (7mA/ 24V /point)			
External I/O cable (For Parallel I/O Unit)	2A-CBL05	5m	○	○	Use to connect the external peripheral device to the parallel input/output unit
	2A-CBL15	15m	○	○	
CC-Link interface	2D-TZ576	Only Intelligent device station, Local station	○	○	For MELSEC PLC with CC-Link connection.
RT ToolBox2 (Personal computer Support software)	3D-11C-WINE	CD-ROM	○	○	MS-Windows2000/XP/Vista/7 (With the simulation function)
RT ToolBox2 mini (Personal computer Support software mini)	3D-12C-WINE	CD-ROM	○	○	MS-Windows2000/XP/Vista/7
Instruction Manual	5F-FE01-PE01	RV-2F-D series	○	○	

Note1) Distinction of ○ (is option) and □ (is special specification at shipping) is shown for each pair with the controller.

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

Table 1-5 : Recommendation article of the USB cable

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

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

⚠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.

2 Robot arm

2.1 Standard specifications

2.1.1 Basic specifications

Table 2-1 : Standard specifications of robot

Item		Unit	Specifications
Type			RV-2F/2FB Note1)
Degree of freedom			6
Installation posture			On floor, hanging (against wall Note2))
Structure			Vertical, multiple-joint type
Drive system			AC servo motor (RV-2F: J2, J3, J5 axes have the brake) (RV-2FB: All axes have the brake)
Position detection method			Absolute encoder
Arm length	Upper arm	mm	230
	Fore arm		270
Operating range	Waist (J1)	Degree	480 (-240 to +240)
	Shoulder (J2)		240 (-120 to +120)
	Elbow (J3)		160 (0 to +160)
	Wrist twist (J4)		400 (-200 to +200)
	Wrist pitch (J5)		240 (-120 to +120)
	Wrist roll (J6)		720 (-360 to +360)
Speed of motion	Waist (J1)	Degree/s	300
	Shoulder (J2)		150
	Elbow (J3)		300
	Wrist twist (J4)		450
	Wrist pitch (J5)		450
	Wrist roll (J6)		720
Maximum resultant velocity Note3)		mm/sec	4,950
Load	Maximum Note4)	kg	3.0
	Rating		2.0
Pose repeatability Note5)		mm	±0.02
Ambient temperature		℃	0 to 40
Mass		kg	19
Allowable moment load	Wrist twist (J4)	N・m	4.17
	Wrist pitch (J5)		4.17
	Wrist roll (J6)		2.45
Allowable inertia	Wrist twist (J4)	$kg \cdot m^2$	0.18 (0.27)
	Wrist pitch (J5)		0.18 (0.27)
	Wrist roll (J6)		0.04 (0.1)
Arm reachable radius front p-axis center point		mm	504
Tool wiring			Hand input 4 point / hand output 4 point
Tool pneumatic pipes			Primary side: φ4 x 4 (Base to fore arm section)
Supply pressure		MPa	0.5±10%
Protection specification Note6)			IP30 (All axis)
Degree of cleanliness			—
Painting color			Light gray (Equivalent to Munsell: 0.08GY7.64/0.81)

Note1) RV-2FB is with the brake to all the axes.
Note2) When used by mounting on the wall, a special specification that limits the operating range of the J1 axis will be used. Please give an order separately.
Note3) This is the value on the mechanical interface surface when all axes are combined.
Note4) The maximum load capacity is the mass with the mechanical interface posture facing down word at the ±10° limit.
Note5) The pose repeatability details are given in Page 9, "2.2.1 Pose repeatability"
Note6) The protection specification details are given in Page 11, "2.2.5 Protection specifications".

2.2 Definition of specifications

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

2.2.1 Pose repeatability

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

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

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

[2] Load fluctuation factor
1) When work is present/absent in repeated operations

[3] Disturbance factor during operation
1) Even if approaching from the same direction and orientation to the teaching position, when the power is turned OFF or a stop operation is performed halfway

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

[5] Factors due to differences in accuracy definition
1) When accuracy is required between a position set by a numeric value in the robot's internal coordinate system and a position within the actual space
2) When accuracy is required between a position generated by the pallet function and a position within the actual space

2.2.2 Rated load (mass capacity)

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

(1) The tooling should have the value less or equal than the smaller of the tolerable inertia and the tolerable moment found in Page 8, "2.1.1 Basic specifications".

(2) Fig. 2-1 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 8, "2.1 Standard specifications" for details of allowable moment value.

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

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

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

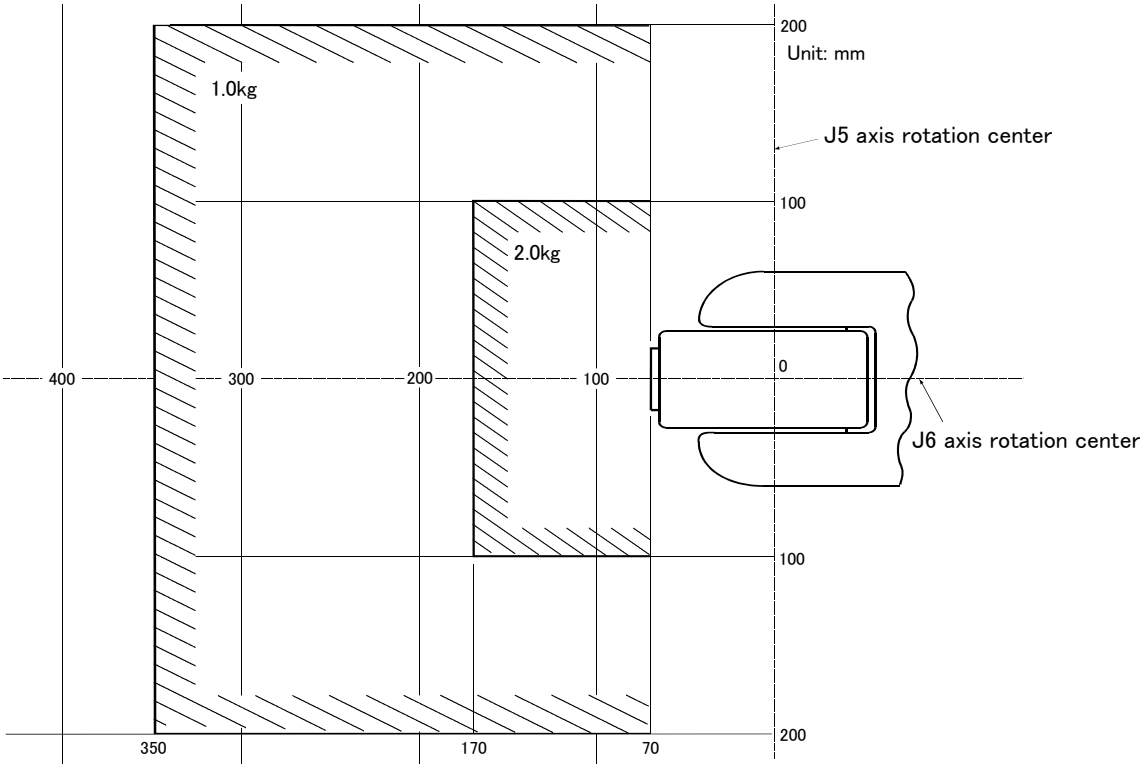


Fig.2-1 : Position of center of gravity for loads (for loads with comparatively small volume)

2.2.3 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.

2.2.4 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 2-2 : Factory-shipments condition

	JOG operation	Automatic
RH-2F series	Invalid	Invalid

2.2.5 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 2-3.
Even oil mist environment can be used in addition to the general environment.

Table 2-3 : Protection specifications and applicable fields

Type	Protection specifications (IEC Standards value)	Classification	Applicable field	Remarks
RV-2F series	Robot arm: IP30 (all axes)	General environment specifications	General assembly Slightly dusty environment	

The IEC IP symbols define the degree of protection against solids and fluids, and do not indicate a protective structure against the entry of oil or water.
The IEC standard is described by the following "Information" And, the corrosion of the rust etc. may occur to the robot with the liquids, such as the water and the oil.

【Information】

・The IEC IP30

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.

2.3 Names of each part of the robot

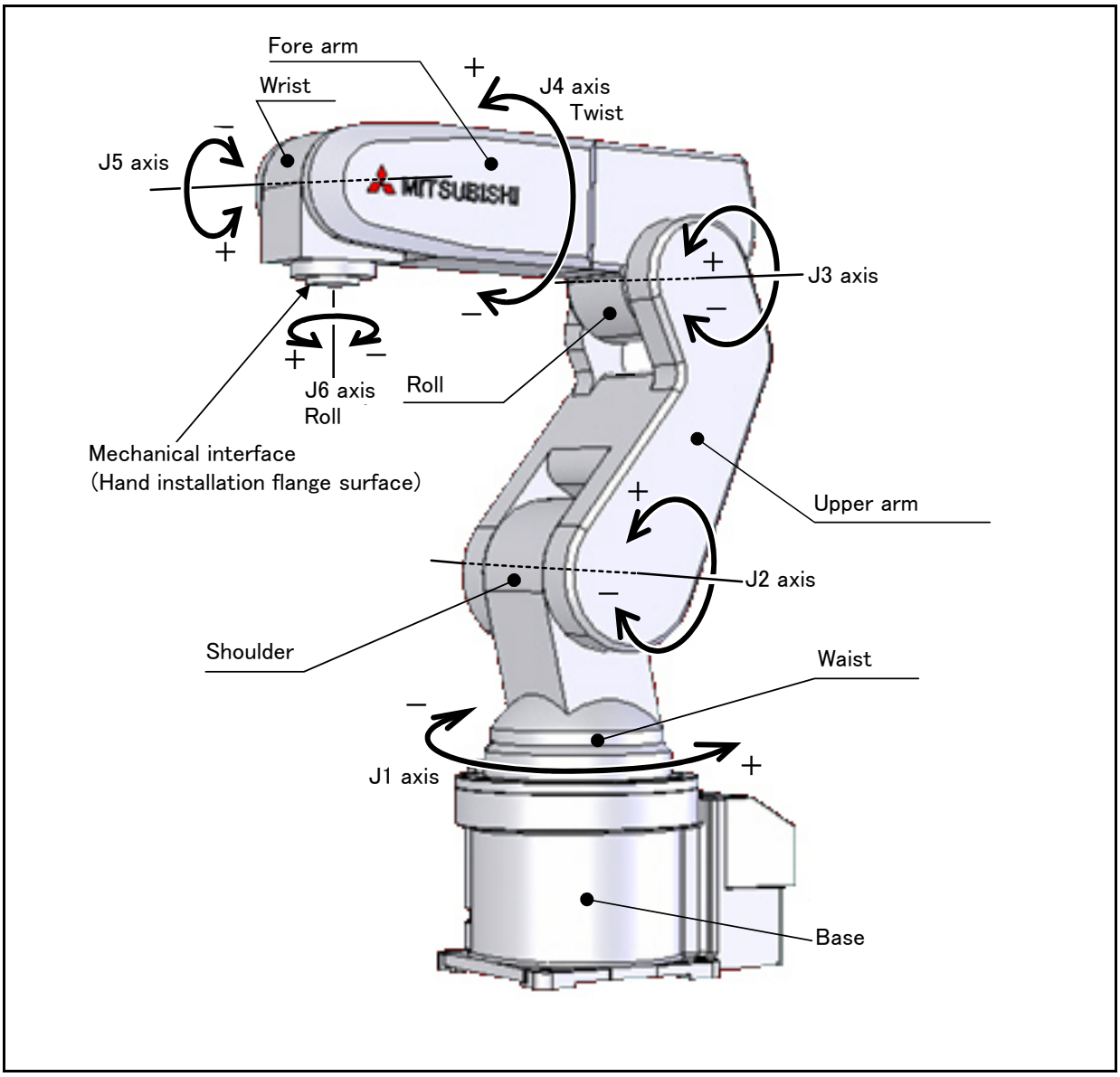
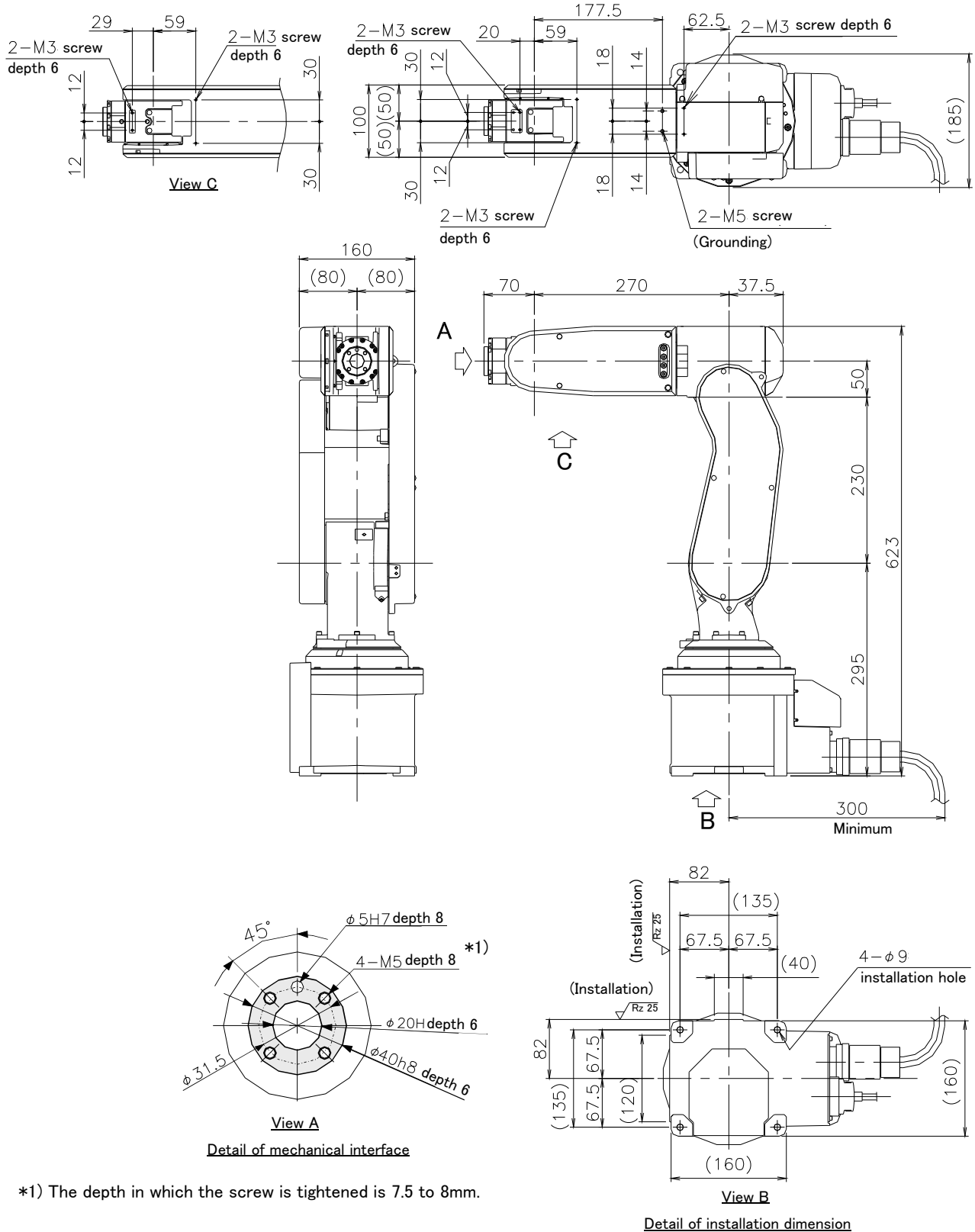


Fig.2-2 : Names of each part of the robot

2.4 Outside dimensions・Operating range diagram

(1) RV-2F (standard specification)

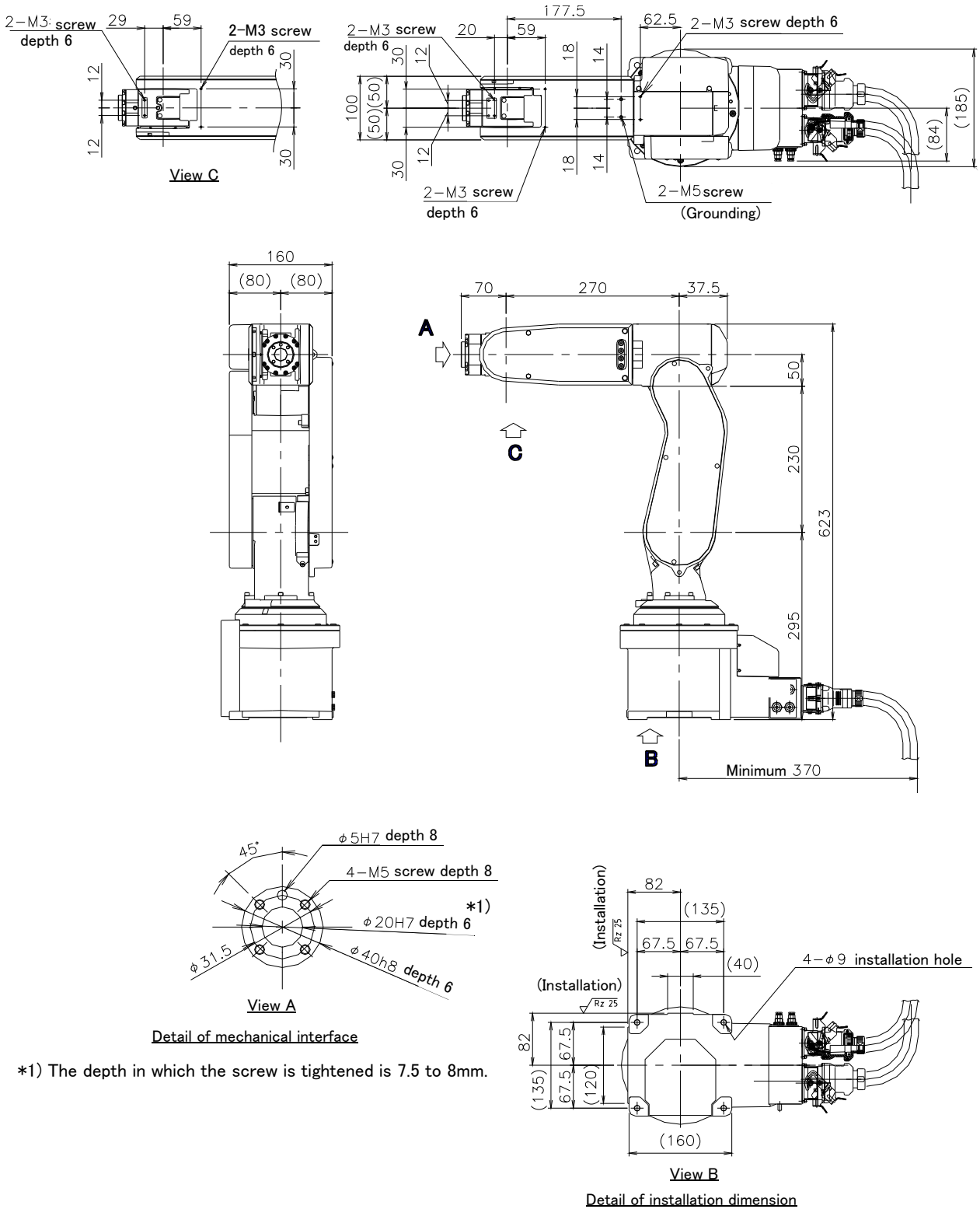


*1) The depth in which the screw is tightened is 7.5 to 8mm.

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.2-3 : Outside dimensions (standard specification)

(2) RV-2F (CE marking/KC mark specification)



*1) The depth in which the screw is tightened is 7.5 to 8mm.

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.2-4 : Outside dimensions (CE marking/KC mark specification)

(3) Operating range (Common to the standard/ CE Marking/ KC mark)

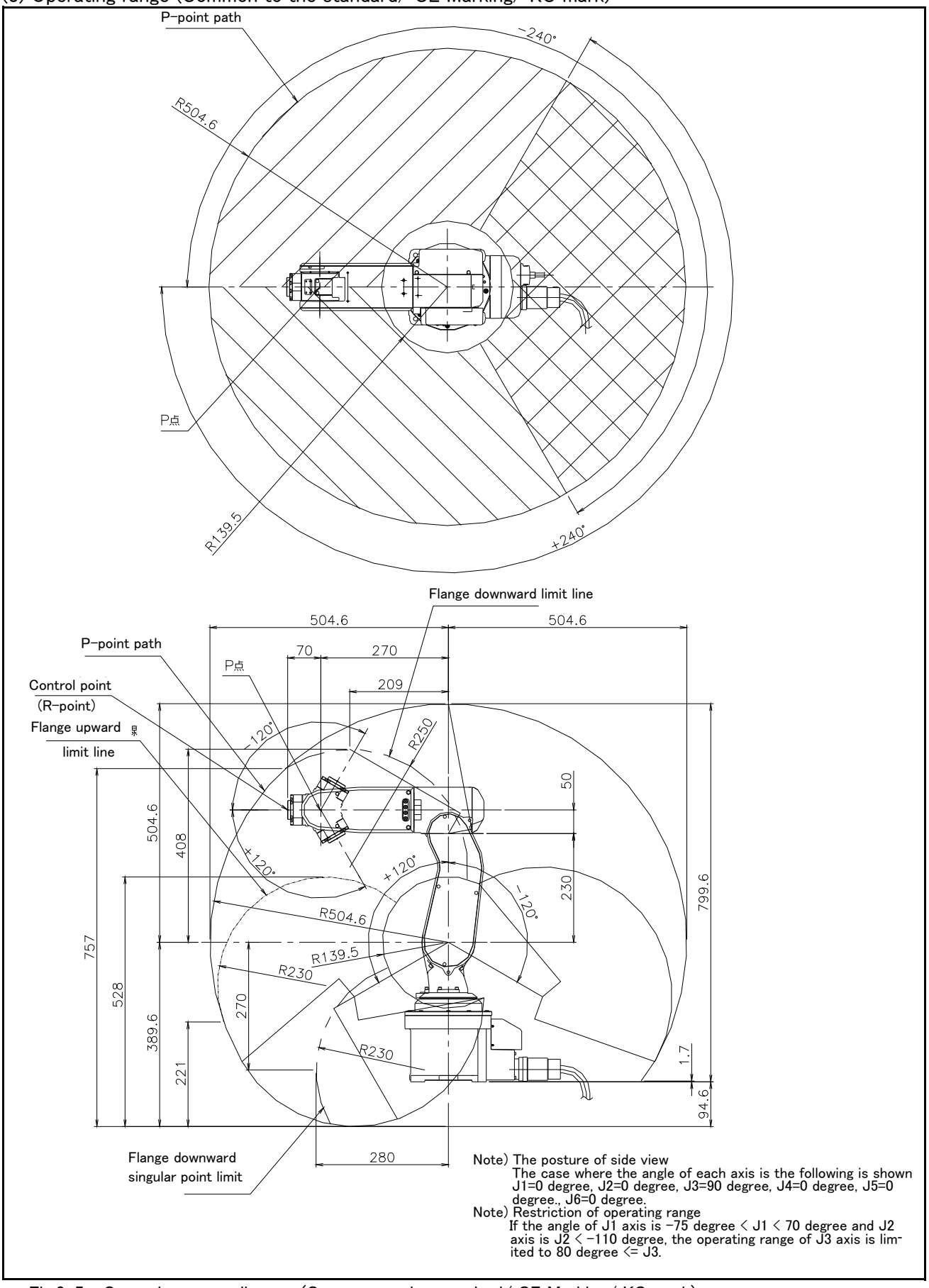


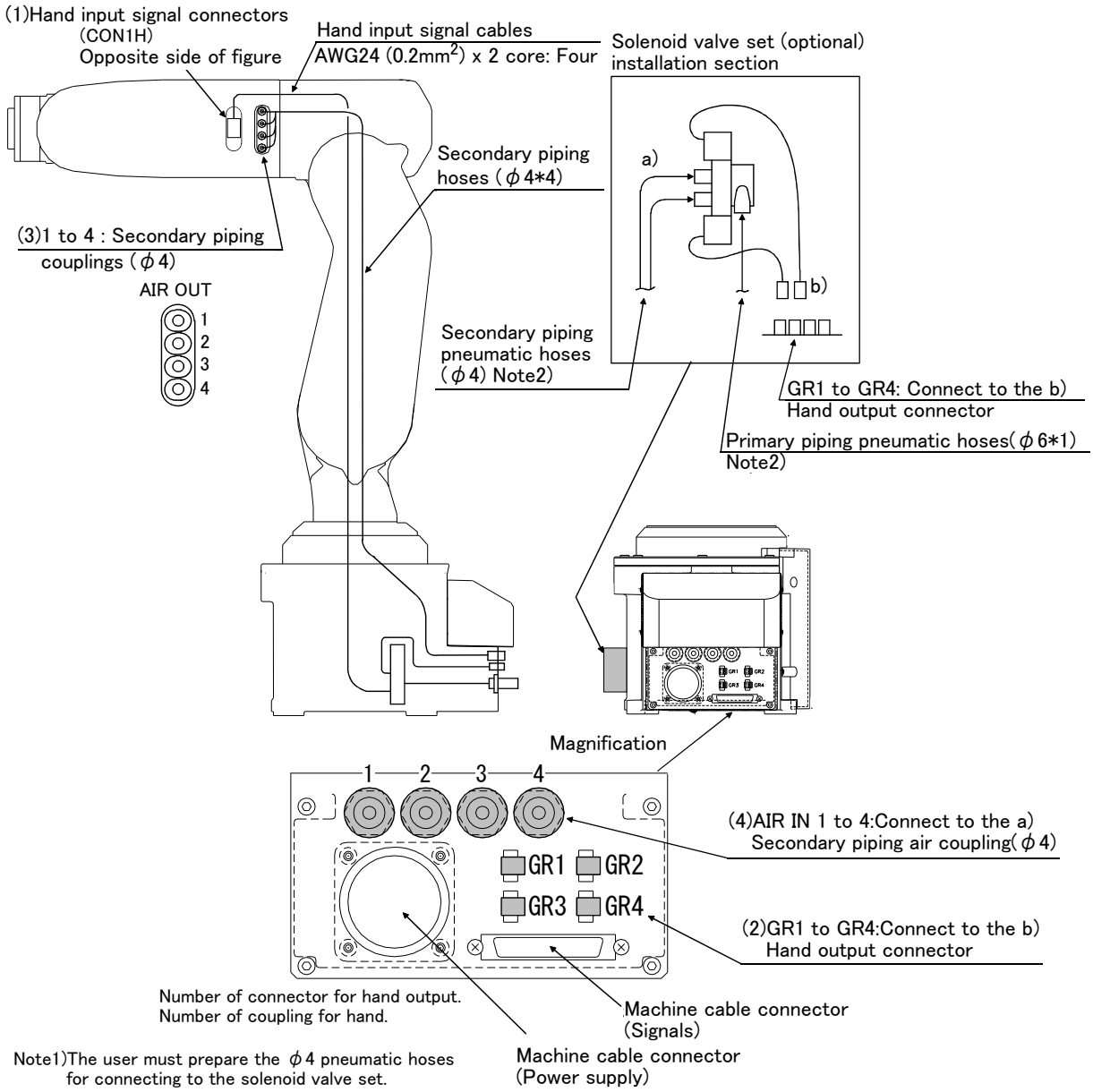
Fig.2-5 : Operating range diagram (Common to the standard/ CE Marking/ KC mark)

2.5 Tooling

2.5.1 Wiring and piping for hand

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

(1) RV-2F (standard specification)



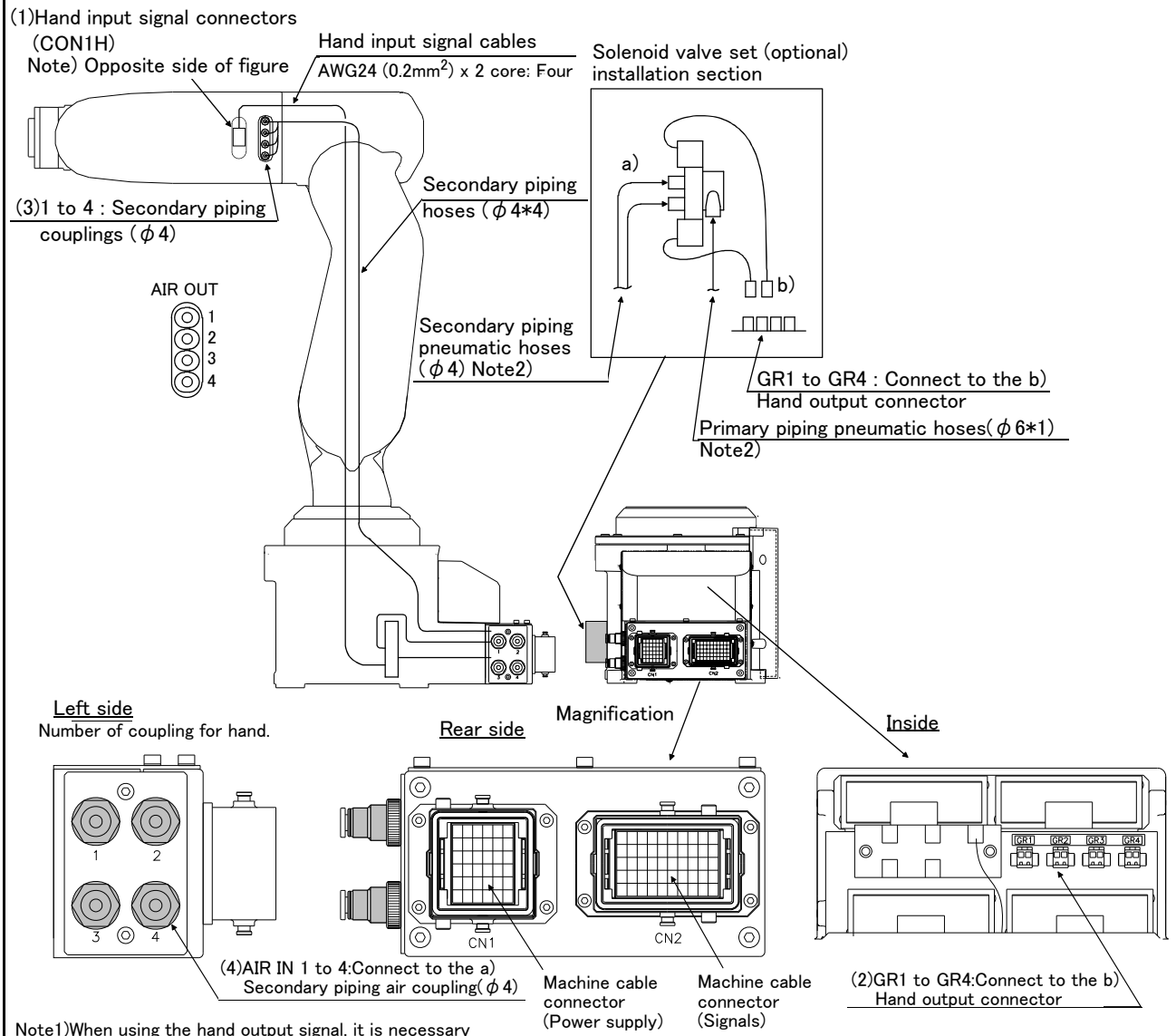
Connector and pneumatic coupling

No	Name	Qty.	Robot side(Robot arm side)		Counter side (customer-prepared) Note1)		Manufacturer
			Connectors, couplings	Connector pins	Connector	Connector pins	
(1)	Connector	1	1-1903131-6	1903112-2	1-1827864-6	1827587-2	AMP
(2)	Connector	4	SMP-02V-BC	BHF-001GI-0.8BS	SMR-02V-B	BYM-001T-0.6	Japan solderless terminal MFG. Co.,LTD
(3)	Coupling	4	KJS04-M3	—	—	—	SMC. Co.,LTD
(4)	Coupling	4	UKB4	—	—	—	Koganei

Note1) The resistance (100-ohm, 1/4W) is installed to B1 and B2 terminal at factory shipping. When hand input signal line is wired by the customer, please install the resistance.

Fig.2-6 : Wiring and piping for hand (standard specification)

(2) RV-2F (CE marking/KC mark specification)



Note1)When using the hand output signal, it is necessary to use the optional pneumatic hand interface (2A-RZ365/2A-RZ375)

Note2)The user must prepare the φ4 pneumatic hoses for connecting to the solenoid valve set.

Connector and pneumatic coupling

No	Name	Qty.	Robot side(Robot arm side)		Counter side (customer-prepared) Note1)		Manufacturer
			Connectors, couplings	Connector pins	Connector	Connector pins	
(1)	Connector	1	1-1903131-6	1903112-2	1-1827864-6	1827587-2	AMP
(2)	Connector	4	SMP-02V-BC	BHF-001GI-0.8BS	SMR-02V-B	BYM-001T-0.6	Japan solderless terminal MFG. Co.,LTD
(3)	Coupling	4	KJS04-M3	—	—	—	SMC. Co.,LTD
(4)	Coupling	4	UKB4	—	—	—	Koganei

Note1) The resistance (100-ohm, 1/4W) is installed to B1 and B2 terminal at factory shipping. When hand input signal line is wired by the customer, please install the resistance.

Fig.2-7 : Wiring and piping for hand (CE marking/KC mark specification)

2.5.2 Internal air piping

1) The robot has four ϕ4 x 2.5 urethane hoses from the pneumatic entrance on the base section to the forearm side. The hose end section has four coupling bridges for a ϕ4 hose on both the base and forearm side
2) The robot can have up to two pneumatic valve sets on the side of base (optional). (Refer to Page 31, "(3) Solenoid valve set")

2.5.3 Internal wiring for the hand output cable

1) The hand output cable extends from the connector of the base section to the back side of the base section. (AWG#24(0.2mm^2) x 2: 8 cables) The cable terminals have connector bridges for four hand outputs. The connector names are GR1 to GR4.

2.5.4 Internal wiring for the hand input cable

The hand check input cable is wired to four points on the forearm side from the base. To extend the wiring to the outside of the arm, a separate cable (optional "hand input cable "1S-HC30C-11" is recommended) is required.

Note) Refer to Page 33, "(4) Hand input cable" for wiring diagram, and always should connect the 100-ohm resistance to B1 and B2 terminals .

2.5.5 Wiring and piping system diagram for hand

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

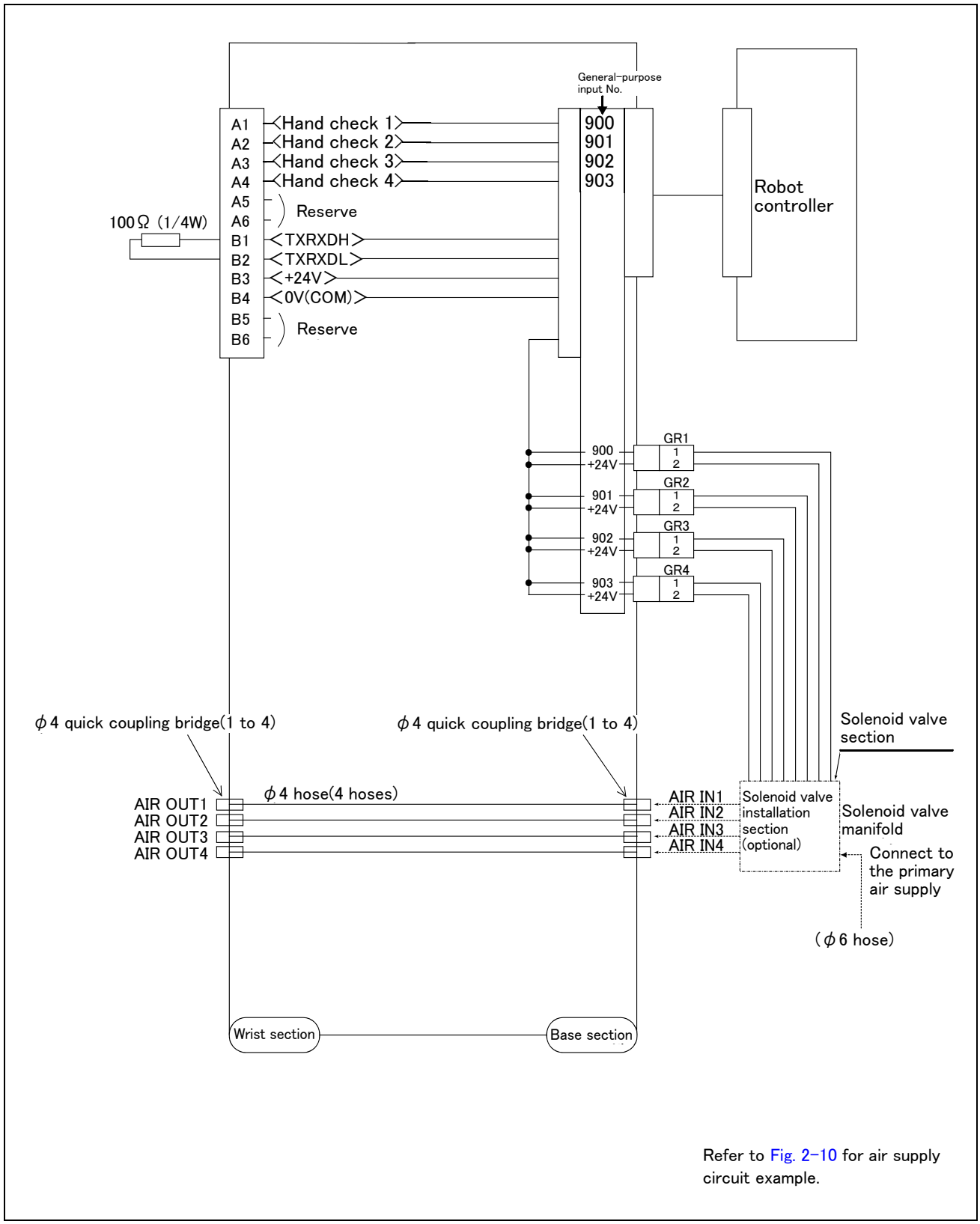


Fig.2-8 : Wiring and piping system diagram for hand and example the solenoid valve installation (Sink type)

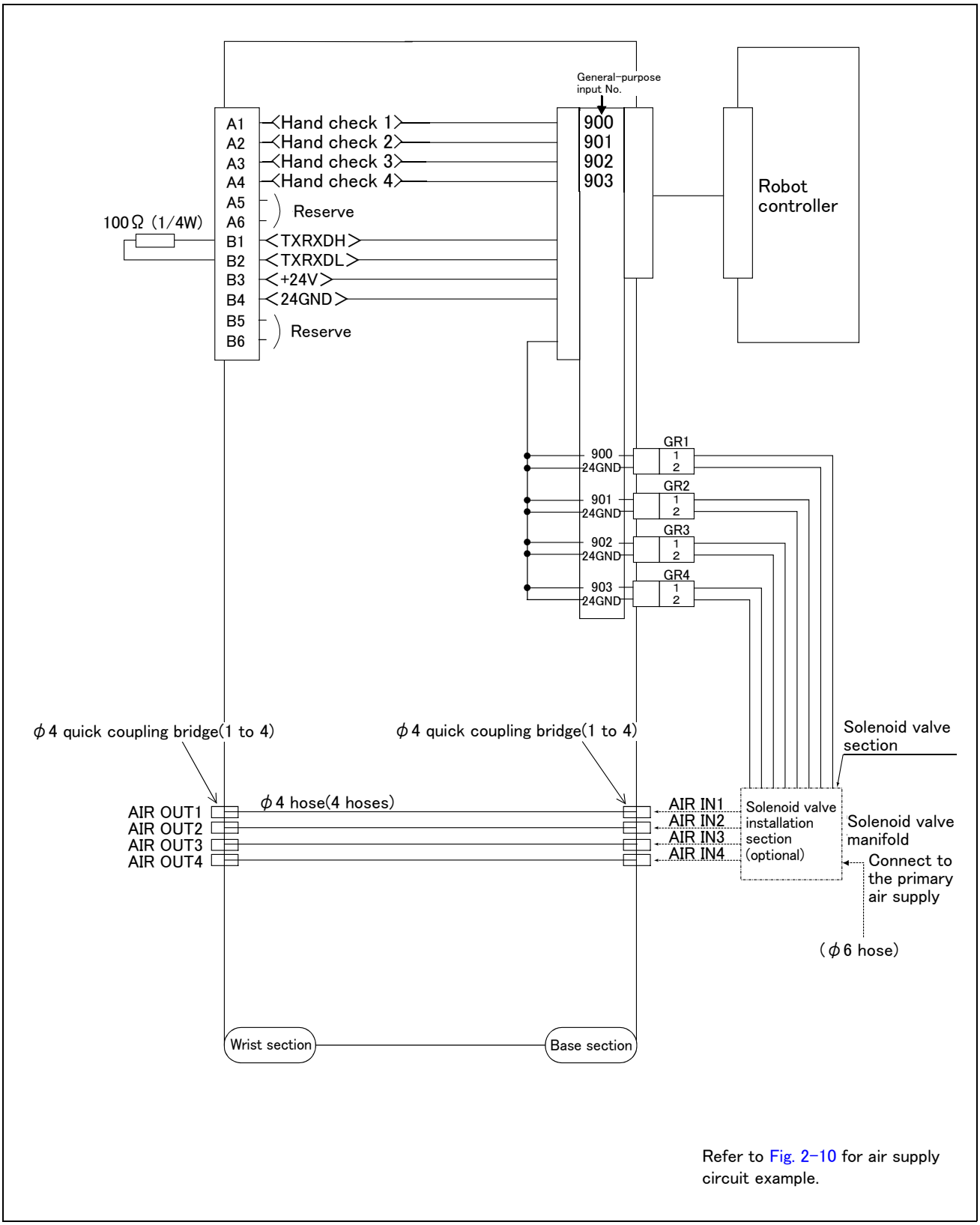


Fig.2-9 : Wiring and piping system diagram for hand and example the solenoid valve installation (Source type)

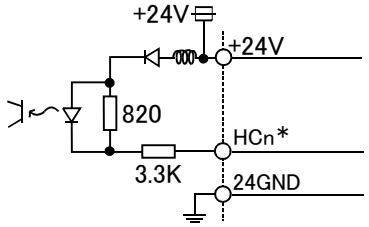
2.5.6 Electrical specifications of hand input/output

Table 2-4 : Electrical specifications of input circuit

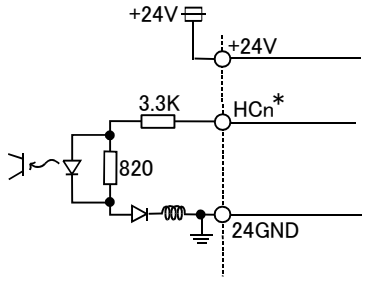
Item		Specifications
Type		DC input
No. of input points		8
Insulation method		Photo-coupler insulation
Rated input voltage		24VDC
Rated input current		approx. 7mA
Working voltage range		DC10.2 to 26.4V (ripple rate within 5%)
ON voltage/ON current		8VDC or more/2mA or more
OFF voltage/OFF current		4VDC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

Internal circuit

<Sink type>



<Source type>



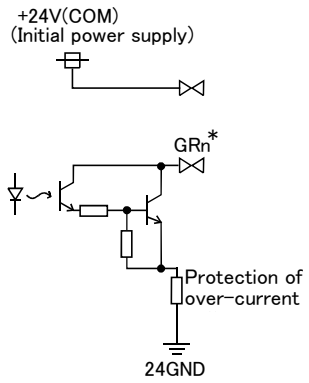
* HCn = HC1 to HC4

Table 2-5 : Electrical specifications of output circuit

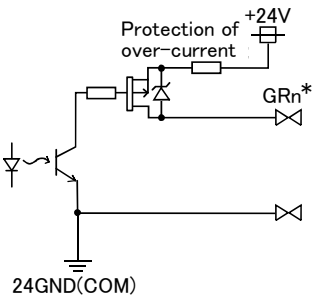
Item		Specification
Type		Transistor output
No. of output points		8
Insulation method		Photo coupler insulation
Rated load voltage		DC24V
Rated load voltage range		DC21.6 to 26.4VDC
Max. current load		0.1A/ 1 point (100%)
Current leak with power OFF		0.1mA or less
Maximum voltage drop with power ON	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

Internal circuit

<Sink type>



<Source type>



* GRn = GR1 to GR4

2.5.7 Air supply circuit example for the hand

Fig. 2-10 shows an example of pneumatic supply circuitry for the hand.

(1) Place diodes parallel to the solenoid coil.

(2) When the factory pneumatic pressure drops, as a result of the hand clamp strength weakening, there can be damage to the work. To prevent it, install a pressure switch to the source of the air as shown in Fig. 2-10 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) 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.

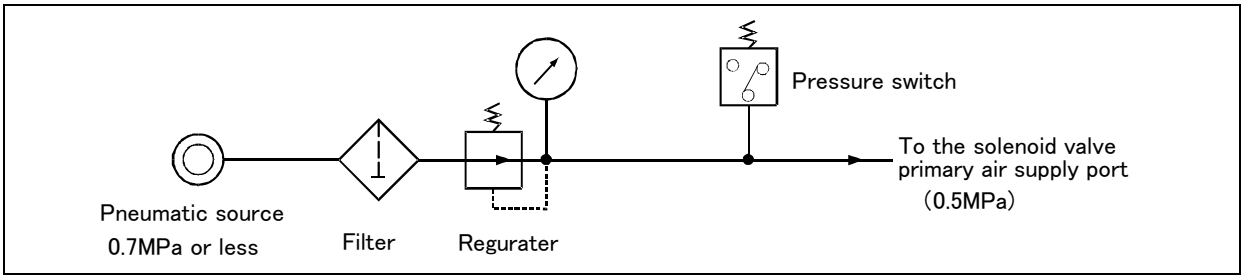


Fig.2-10 : Air supply circuit example for the hand

2.6 Shipping special specifications, options, and maintenance parts

2.6.1 Shipping special specifications

■ What are sipping special specifications?

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

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

■ How to order

(1) Confirm beforehand when the factory special specifications can be shipped, because they may not be immediately available.

(2) Specify, before shipping from our company.

(3) Specified method …… Specify the part name, model, and robot model type.

2.7 Options

■ What are options?

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

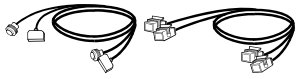
1. Set options .....A combination of single options and parts that together, from a set for serving some purpose.
2. Single options .....That are configured from the fewest number of required units of a part. Please choose customer's purpose additionally.

(1) Machine cable extension

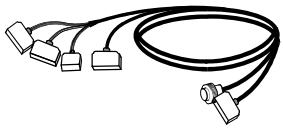
■ Order type: For CR750 controller.....● Fixed 1S- □□ CBL-11 (Standard specification)
● Flexed 1S- □□ LCBL-11 (Standard specification)
● Fixed 1S- □□ CBL-03 (CE marking specification)
● Flexed 1S- □□ LCBL-03 (CE marking specification)
For CR751 controller.....● Fixed 1F- □□ UCBL-11
● Flexed 1S- □□ LUCBL-11
Note) The numbers in the boxes □□ refer the length.

■ Outline

CR750 controller
(Standard) (For CE)



CR751 controller



The distance between the robot controller and the robot arm is extensible by this option.
A fixed type and flexible type are available.
The fix and flexible types are both configured of the motor signal cable and motor power cable.

■ Configuration

Table 2-6 : Configuration equipment and types

Part name			Type Note1)	Qty. Fixed	Qty. Flexed	Mass (kg) Note2)	Remarks
CR750 controller							
Standard specification							
	Fixed	Set of signal and power cables	1S- □□ CBL-11	1 set	–	7.6(10m) 10.9(15m)	10m, or 15m each
		Motor signal cable	1S- □□ CBL(S)-11	(1 cable)	–		
		Motor power cable	1S- □□ CBL(P)-11	(1 cable)	–		
	Flexed	Set of signal and power cables	1S- □□ LCBL-11	–	1 set	6.2.(5m) 11.0(10m) 15.4(15m)	5m, 10m, or 15m each
		Motor signal cable	1S- □□ LCBL(S)-11	–	(1 cable)		
		Motor power cable	1S- □□ LCBL(P)-11	–	(1 cable)		
CE marking specification							
	Fixed	Set of signal and power cables	1S- □□ CBL-03	1 set	–	7.6(10m) 10.9(15m)	10m, or 15m each
		Motor signal cable	1S- □□ CBL(S)-01	(1 cable)	–		
		Motor power cable	1S- □□ CBL(P)-02	(1 cable)	–		
	Flexed	Set of signal and power cables	1S- □□ LCBL-03	–	1 set	6.2.(5m) 11.0(10m) 15.4(15m)	5m, 10m, or 15m each
		Motor signal cable	1S- □□ LCBL(S)-01	–	(1 cable)		
		Motor power cable	1S- □□ LCBL(P)-02	–	(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 controller							
	Fixed	Set of signal and power cables	1F- □□ UCBL-11	1 set	–	7.6(10m) 10.9(15m)	10m, or 15m each
		Motor signal cable	1F- □□ UCBL(S)-11	(1 cable)	–		
		Motor power cable	1F- □□ UCBL(P)-11	(1 cable)	–		
	Flexed	Set of signal and power cables	1F- □□ LUCBL-11	–	1 set	6.2.(5m) 11.0(10m) 15.4(15m)	5m, 10m, or 15m each
		Motor signal cable	1F- □□ LUCBL(S)-11	–	(1 cable)		
		Motor power cable	1F- □□ LUCBL(P)-11	–	(1 cable)		
	Nylon clamp		NK-14N	–	2 pcs.	–	for motor signal cable
	Nylon clamp		NK-18N	–	2 pcs.	–	for motor power cable
	Silicon rubber			–	4 pcs.	–	

Note1) The numbers in the boxes □□ refer the length.
Note2) Mass indicates one set.

■ Specifications

The specifications for the fixed type cables are the same as those for standard cables.
Shows usage conditions for flexed type cables in Table 2-7.

Table 2-7 : Conditions for the flexed type cables

Item		Specifications
Minimum flexed radius		100R 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
Environmental proof		Oil-proof specification sheath (for silicon grease, cable sliding lubricant type) IP54
Cable configuration	Motor signal cable	φ6 x 5, φ8.5 x 1 and φ1.7 x 1
	Motor power cable	φ6.5 x 10

[Caution] The guidance of life count may greatly differ according to the usage state (items related to Table 2-7 and to the amount of silicon grease applied in the cableveyor.

■ Cable configuration

The configuration of the flexible cable is shown in Table 2-8. Refer to this table when selecting the cableveyor.

Table 2-8 : Cable configuration (CR750/CR751 common)

Item	Motor signal cable			Motor power cable
Type	1S- □□ LCBL(S)-11/1S- □□ LCBL(S)-01 /1F- □□ LUCBL(S)-11			1S- □□ LCBL(P)-11/1S- □□ LCBL(P)-02 /1F- □□ LUCBL(P)-11
No. of cores	AWG#24(0.2mm^2)-4P	AWG#24(0.2mm^2)-7P	AWG#18(0.75mm^2)	AWG #18 (0.75mm2)-3C
Finish dimensions	Approx. φ6mm	Approx. φ8.5mm	Approx. φ1.7mm	Approx. φ6.5mm
No.of cables used	5 cables	1 cable	1 cable	10 cables
No. in total	7 cables			10 cables

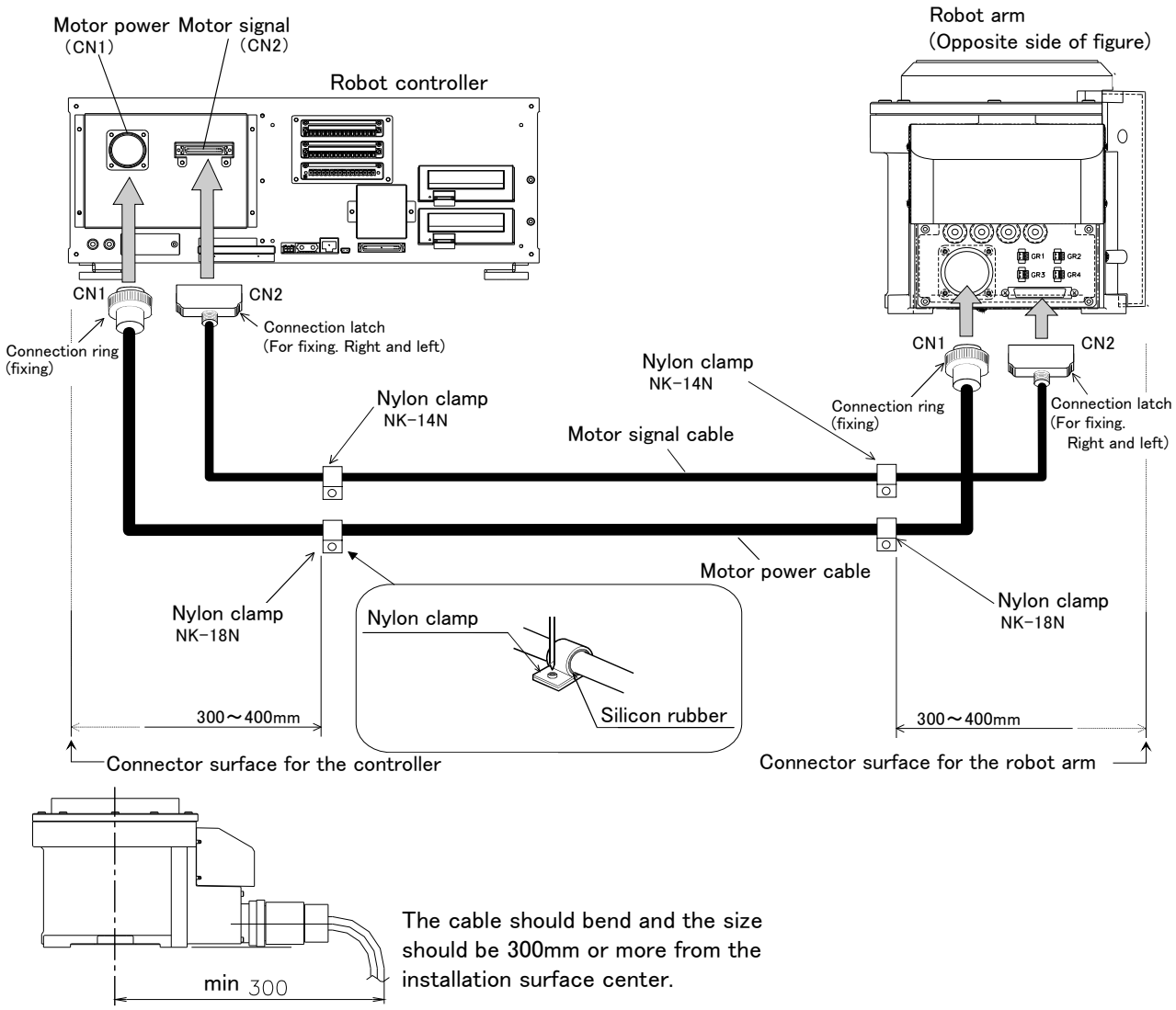
Note) The square in the cable name indicates the cable length.

■ Fixing the flexible cable

(1) Connect the connector to the robot arm.

(2) Wind the silicon rubber around the cable at a position 300 to 400 mm from the side of robot arm and controller as shown in Fig. 2-11 (CR750), Fig. 2-12 (CR750 CE marking specification) or Fig. 2-13 (CR751), and fix with the nylon clamp to protect the cable from external stress.

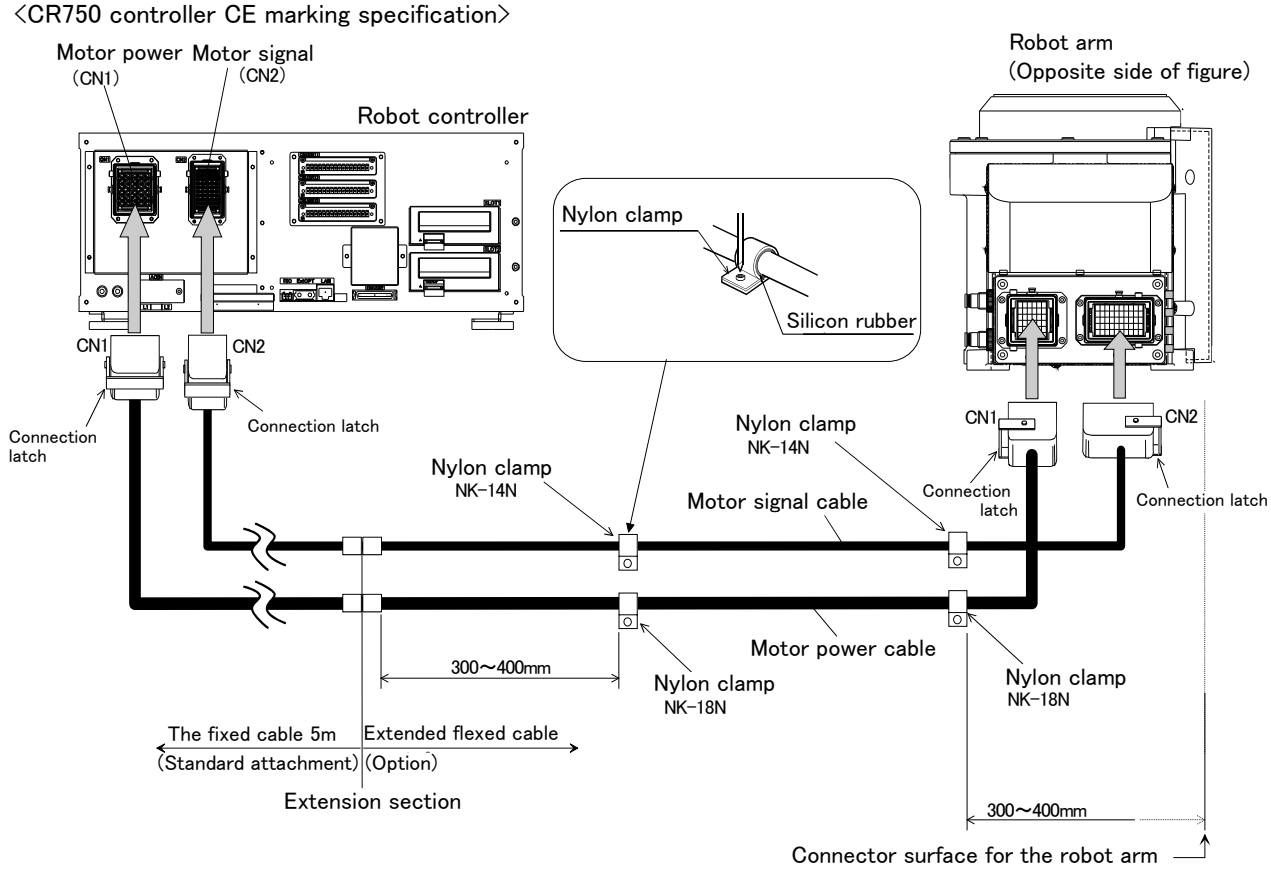
<CR750 controller>

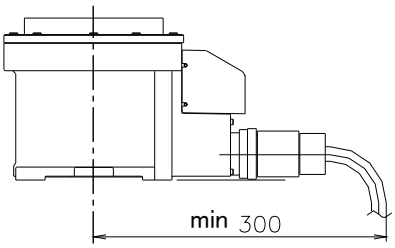


The cable should bend and the size should be 300mm or more from the installation surface center.

Fig.2-11 : Fixing the flexible cable (CR750)

<CR750 controller CE marking specification>





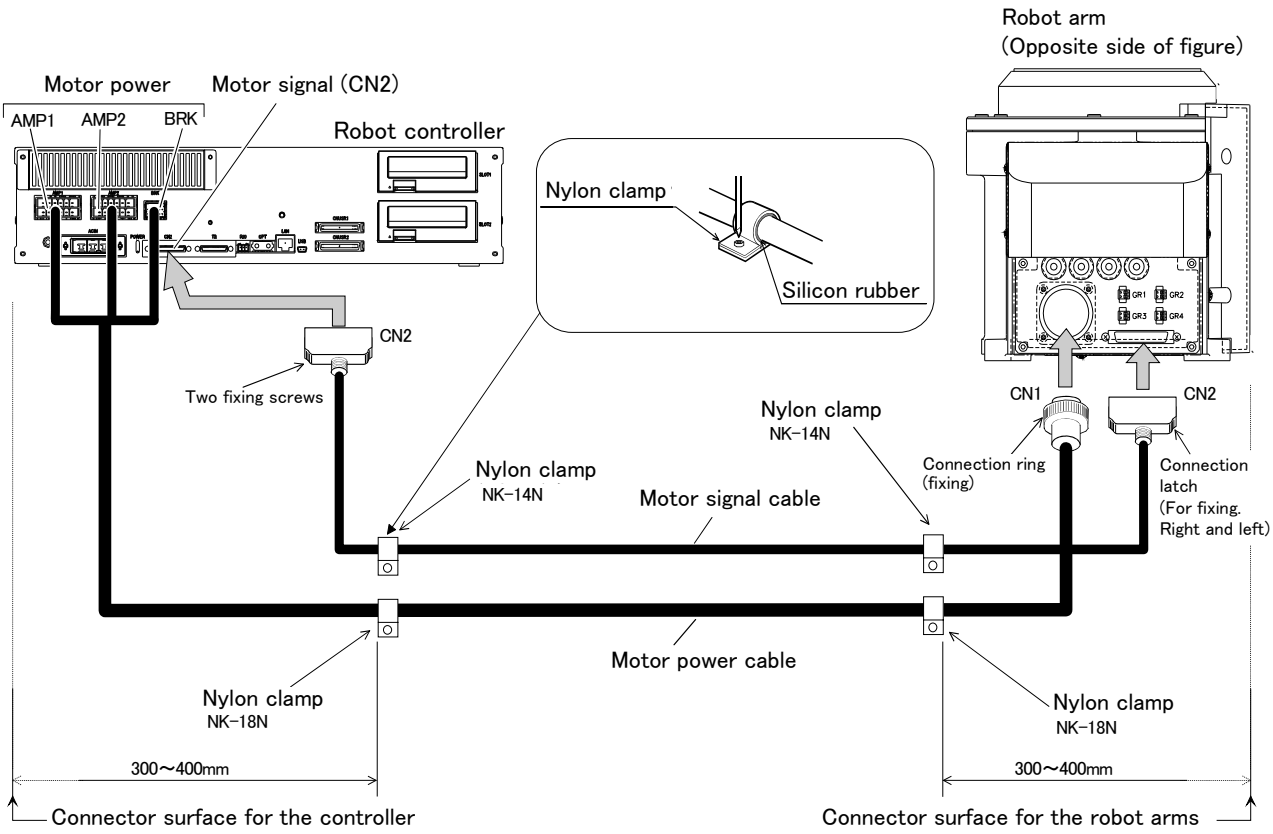
The cable should bend and the size should be 300mm or more from the installation surface center.

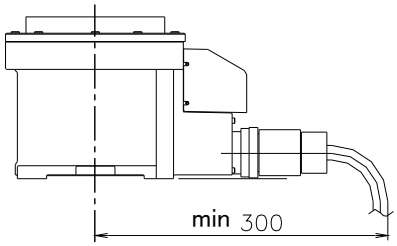
⚠ CAUTION

Cover the extension connection section with the cover etc. so that the connector latch part may not touch easily.

Fig.2-12 : Fixing the flexible cable (CR750 CE marking specification)

<CR751controller>





The cable should bend and the size should be 300mm or more from the installation surface center.

Fig.2-13 : Fixing the flexible cable (CR751)

(2) Stopper for changing the operating range

■ Order type J1 axis: 1S-DH-11J1
J2 axis: 1S-DH-11J2
J3 axis: 1S-DH-11J3

■ Outline

The operating range of J1, J2 or J3 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

Table 2-9 : Configuration devices

Part name	Type	Qty.	Mass(kg)	Remarks
Stopper for changing the operating range	1S-DH-11J1	2 pcs.	0.1	Stopper block Moving side : One Set Fixing side : Two blocks Installation bolt (M5 x 20) : Six bolts
	1S-DH-11J2	2 pcs.	0.1	Stopper block Plus side : One block Minus side : One block Installation bolt (M4 x 10) : Four bolts
	1S-DH-11J3	2 pcs.	0.1	Stopper block: One set Installation bolt (M4 x 8) : One bolt (M4 x 22) : One bolt

■ Specifications

Table 2-10 : Specifications

Axis		Standard	Changeable angle Note1)
J1	+ side	+240 degree	Change to +210(+217), +150(+155) or +90 (+93) degree are possible.
	- side	-240 degree	Change to -210(-217), -150(-155) or -90 (-93) degree are possible.
J2	+ side	+120 degree	Change to +30(+33) degree is possible.
	- side	-120 degree	Change to -30(-33) degree is possible.
J3	+ side	+160 degree	Change to +70(+69) degree is possible.
	- side	0 degree	Nothing

Note 1) The number in bracket ( ) shows the mechanical stopper's installation position.
Note 2) Change of the operating range has limitation of combination. Change the operating range to +/-150, +/-90, +210 to -90, +90 to -210, +150 to -90 or +90 to -150 degree are possible.

Table 2-11 : Operating range change combination of the J1 axis.

	+210	+150	+90
-210	×	×	○
-150	×	○	○
-90	○	○	○

O: Possible. X: Impossible.

The operating range change stopper installs in the position (near 0 degree) that the J1 axis has turned to the front.

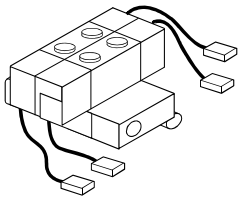
Note 3) Change the operating range to +70 to +160 degree is possible.

(1) The changeable angle shown in Table 2-10 indicates the operation range by the software. The changeable angle can be set independently on the + side and - side.
(2) 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) Solenoid valve set

■ Order type : One set : 1E-VD01(Sink type)/1E-VD01E(Source type)
Two sets : 1E-VD02(Sink type)1E-VD02E(Source type)

■ Outline



The solenoid valve set is an option that is used for controlling toolings when various toolings, such as the hand, are installed at the end of the arm.
Also, for easy installation of this electromagnetic set onto the robot, it comes equipped with a manifold, couplings, silencers, among other things.

■ Configuration

Table 2-12 : Configuration equipment

Part name	Type	Q'ty		Remark
		One set	Two sets	
Solenoid valve set (1 set)	1E-VD01/1E-VD01E	1 pc.	—	M3 x 25 two screws (installation screws).
Solenoid valve set (2 sets)	1E-VD02/1E-VD02E	—	1 pc.	

■ Specifications

Table 2-13 : Valve specifications

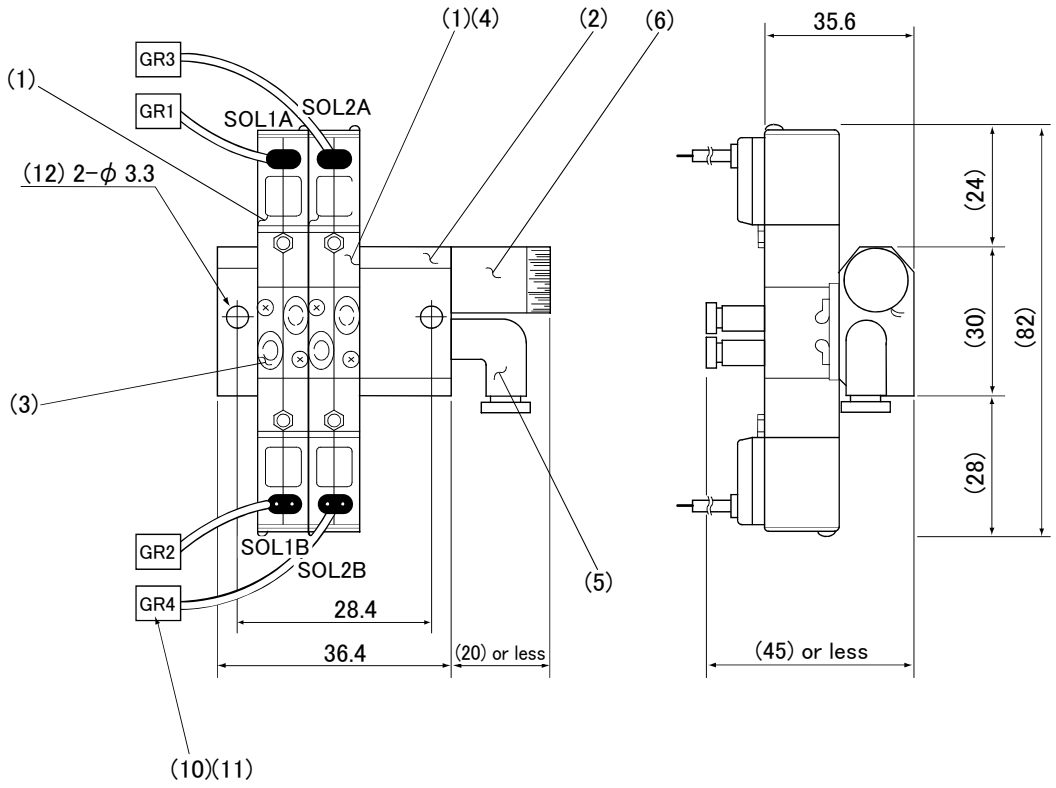
Item	Specifications
Number of positions	2
Port	5 Note1)
Valve function	Double solenoid
Operating fluid	Clean air Note2)
Operating method	Internal pilot method
Effective sectional area (CV value)	1.5mm(0.008)
Oiling	Unnecessary
Operating pressure range	0.2 to 0.7MPa
Response time	12msec or less
Max. operating frequency	5Hz
Ambient temperature	5 to 50 ℃

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 plugs made by SMC).

Note2) ⚠CAUTION The air to be provided must be clean, i.e., filtered with a mist separator or air filter. Failing to do so may lead to malfunctions.

Table 2-14 : Solenoid specifications

Item	Specifications
Method	Built-in fly-wheel diodes with surge protection
Operation voltage	DC24V ±10%
Current value	40mA
Insulation	B type
Insulation resistance	100MΩ or more
Surge protection	Fly-wheel diode



Part no.	Part name	1 sets	2 sets	Specifications
(1)	Solenoid valve	1	2	
(2)	Manifold block	1	1	
(3)	Quick coupling	2	4	φ4
(4)	Block plate	1	0	
(5)	Quick coupling	1	1	φ6
(6)	Silencer	1	1	
(10)	Connector	2	4	SMR-02V-B
(11)	Contact	4	8	SYM-001T-0.6
(12)	Installation screw	2	2	M3 × 25

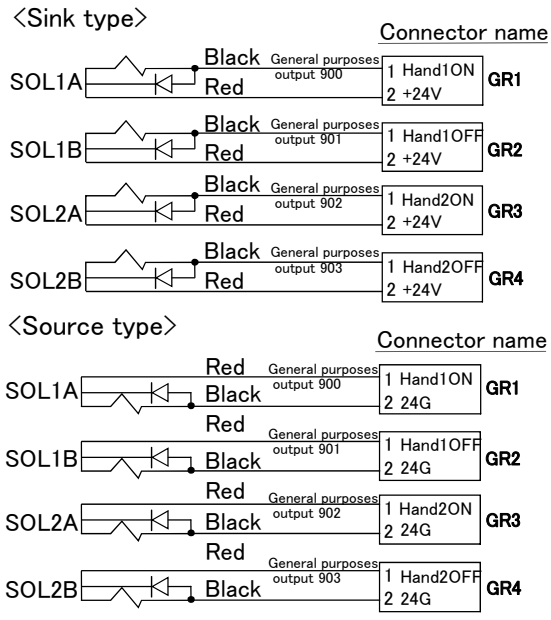


Fig.2-14 : Outline dimensional drawing

(4) Hand input cable

■ Order type: 1S-HC30C-11

■ 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 2-15 : Configuration equipment

Part name	Type	Qty.	Mass (kg) Note1)	Remarks
Hand input cable	1S-HC30C-11	1 cable	0.2	

Note1) Mass indicates one set.

■ Specifications

Table 2-16 : Specifications

Item	Specifications	Remarks
Size x cable core	AWG#24 (0.2 mm^2) × 12 cores	One-sided connector, one-sided cable bridging
Total length	700mm (Including the curl section, which is 300mm long)	

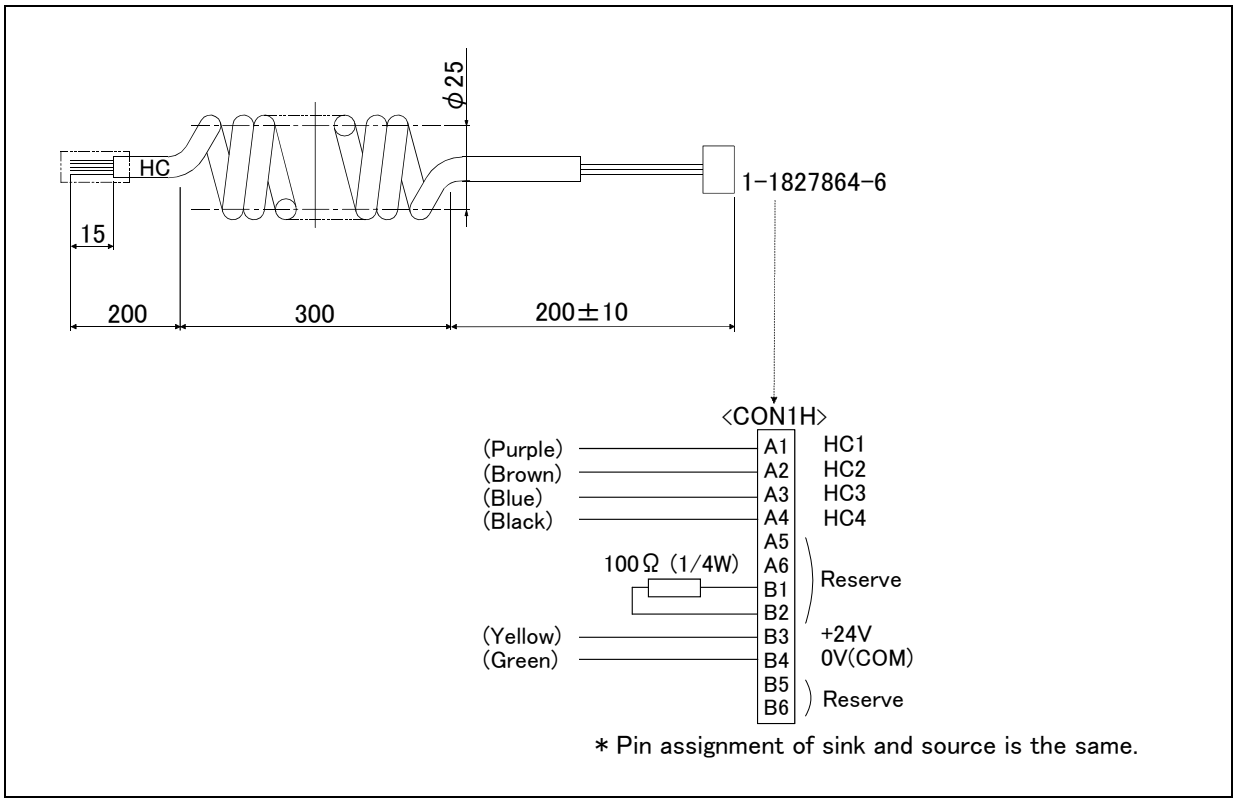
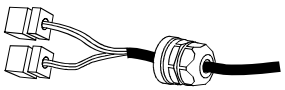


Fig.2-15 : Outside dimensional drawing and pin assignment

(5) Hand output cable

■ Order type: 1E-GR35S

■ 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 2-17 : Configuration equipment

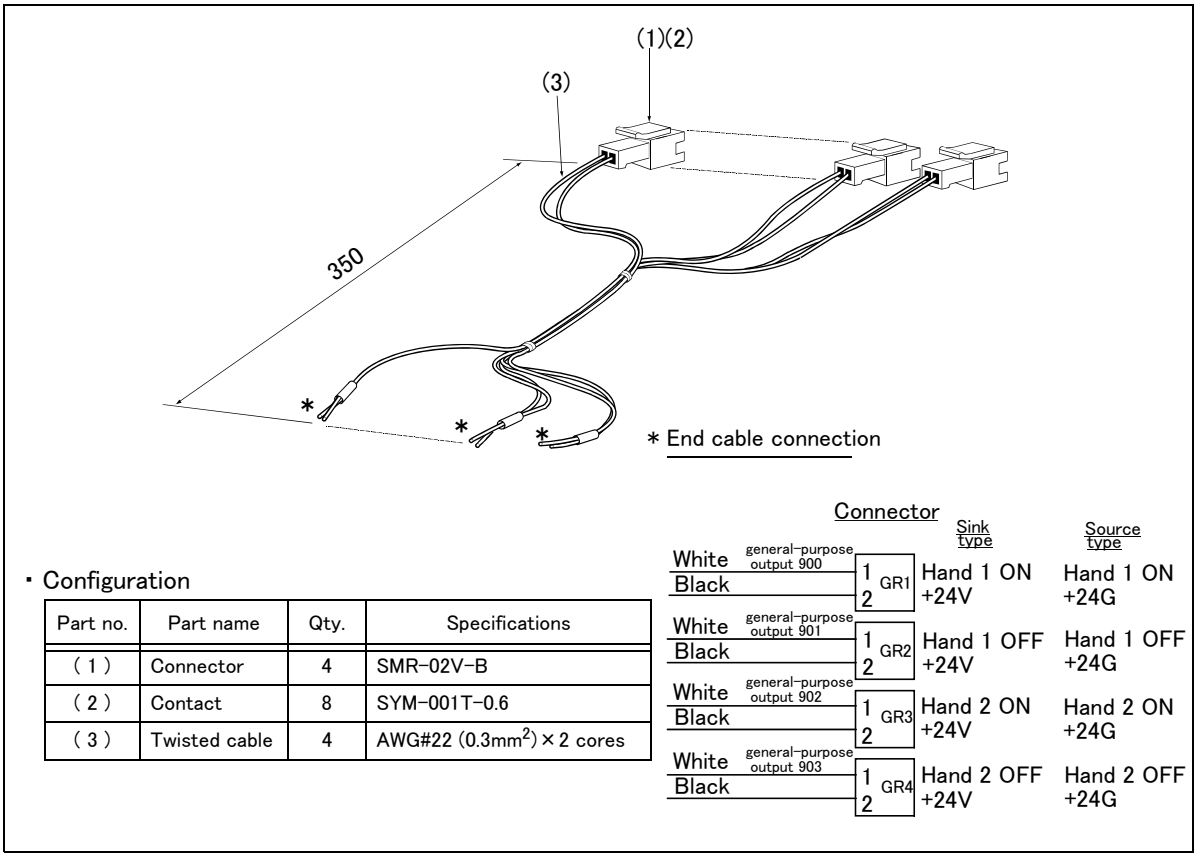
Part name	Type	Qty.	Mass (kg) Note1)	Remarks
Hand output cable	1E-GR35S	1 cable	0.1	

Note1) Mass indicates one set.

■ Specifications

Table 2-18 : Specifications

Item	Specifications	Remarks
Size x Cable core	AWG#22(0.3mm^2) × 8 cores	One side connector and one side cable connection
Total length	350mm	



・ Configuration

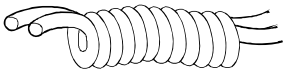
Part no.	Part name	Qty.	Specifications
(1)	Connector	4	SMR-02V-B
(2)	Contact	8	SYM-001T-0.6
(3)	Twisted cable	4	AWG#22 (0.3mm^2) × 2 cores

Fig.2-16 : Outline dimensional drawing and pin assignment

(6) Hand curl tube

■ Order type: One set :1E-ST0402C
Two sets :1E-ST0404C

■ Outline



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

■ Configuration

Table 2-19 : Configuration equipment

Part name	Type	Qty.	Mass(kg)Note1)	Remarks
Hans curl tube (One set: 2 pcs.)	1E-ST0402C	1 pc.	0.1	ϕ4 tube, 2pcs.
Hans curl tube (Two set: 4 pcs.)	1E-ST0404C	1 pc.	0.1	ϕ4 tube, 4pcs.

Note1) Mass indicates one set.

■ Specifications

Table 2-20 : Specifications

Item	Specifications
Material	Urethane
Size	Outside diameter: ϕ4 x Inside diameter: ϕ2.5

Specifications

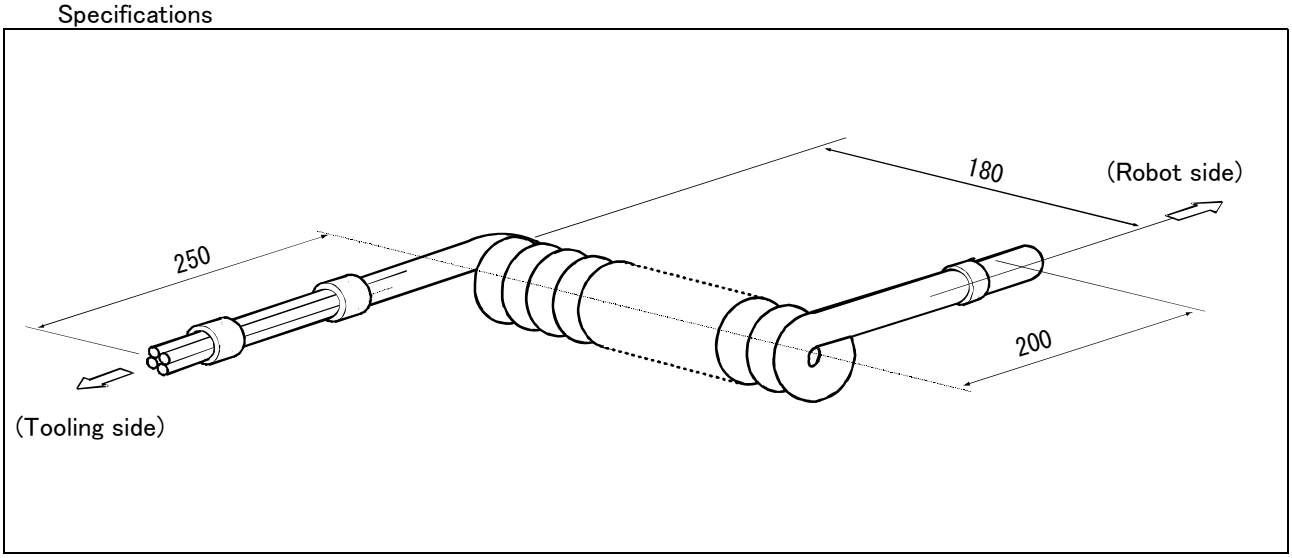


Fig.2-17 : Outline dimensional drawing

2.8 About Overhaul

Robots which have been in operation for an extended period of time can suffer from wear and other forms of deterioration. In regard to such robots, we define overhaul as an operation to replace parts running out of specified service life or other parts which have been damaged, so that the robots may be put back in shape for continued use. Overhaul interval for robots presumably varies with their operating conditions and thus with the degree of the equipment's wear and loss of performance. As a rule of thumb, however, it is recommended that overhaul be carried out before the total amount of servo-on time reaches the predetermined levels (24,000 hours for the robot body and 36,000 hours for the controller). (See Fig. 2-18.) For specific information about parts to be replaced and timing of overhaul, contact your local service representative.

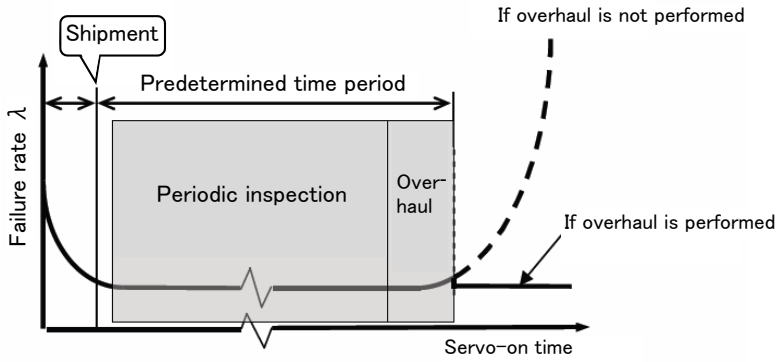


Fig.2-18 : Periodic inspection/overhaul periods

2.9 Maintenance parts

The consumable parts used in the robot arm are shown in Table 2-21. 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 2-21 : 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	In the battery cover	4 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

Table 3-1 : Specifications of controller

Item			Unit	Specification	Remarks
Type				CR750-02VD-1 CR751-02VD	
Number of control axis				Simultaneously 6	
Memory capacity	Programmed positions		point	39,000	
	No. of steps		step	78,000	
	Number of program			512	
Robot language				MELFA-BASIC V	
Teaching method				Pose teaching method, MDI method Note1)	
External input and output	Input and output		point	0/0	Max. 256/256 by option
		Dedicated input/output		Assigned with general-purpose input/output	The signal number of "STOP" input signals is fixing.
	Hand open/close input/output		point	8/8	Built-in
	Emergency stop input		point	1	Dual line
	Door switch input		point	1	Dual line
	Enabling device input		point	1	Dual line
	Emergency stop output		point	1	Dual line
	Mode output		point	1	Dual line
	Robot error output		point	1	Dual line
	Addition axis synchronization		point	1	Dual line
	Mode changeover switch input		point	1	Dual line
Interface	RS-422		port	1	Only for T/B
	Ethernet		port	1	10BASE-T/100BASE-Tx
	USB		port	1	Ver.2.0 FullSpeed Only device function
	Additional axis interface		Channel	1	SSCNET III (Connects with MR-J3-BS, MR-J4-B series)
	Tracking interface		Channel	2	
	Option slot		slot	2	For option interface
Power source	Input voltage range		V	Single phase, AC180 to 253	
	Power capacity		kVA	0.5	Does not include rush current Note2)
	Power supply frequency		Hz	50/60	
Outline dimensions Note3)			mm	CR750: 430(W) x 425(D) x 174(H)	Excluding protrusions
				CR751: 430(W) x 425(D) x 98(H)	
Mass			kg	CR750: Approx. 16	
				CR751: Approx. 12	
Construction				Self-contained floor type, Opened type. Installation vertically or horizontally	IP20 Note4)
Operating temperature range			℃	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	

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. The power consumption in the specific operation pattern with the RV-2F is approx. 0.33kW. 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.

Note3) Refer to Page 44, "3.4 Outside dimensions/Installation dimensions" for details.

Note4) This controller is standard specification. (Refer to Page 39, "3.2 Protection specifications and operating supply".)

Note5) The robot must be grounded by the customer.

3.2 Protection specifications and operating supply

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

【Information】
・The IEC IP20
It indicates the protective structure that prevents an iron ball 12 $^{+0.05}_{0}$mm diameter, which is being pressed with the power of 3.1 kg±10%, from going through the opening in the outer sheath of the supplied equipment.

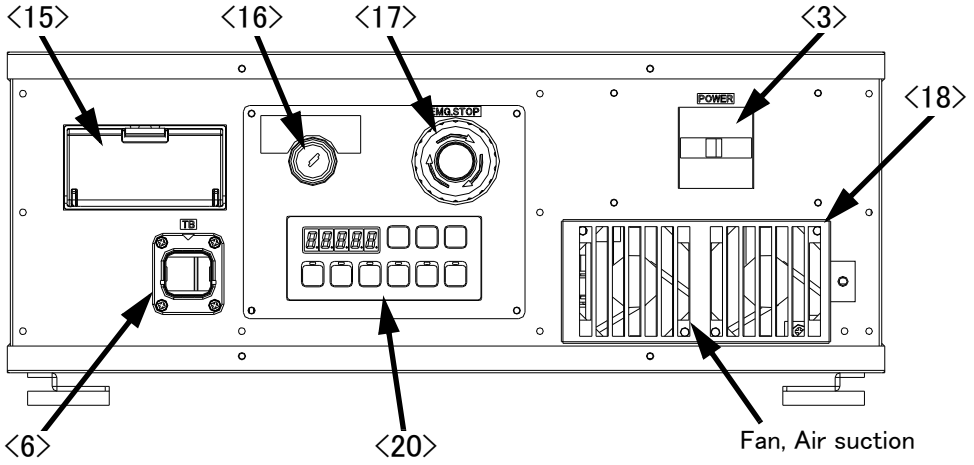
Refer to the section Page 129, "6.2 Working environment" for details on the working environment.

3.3 Names of each part

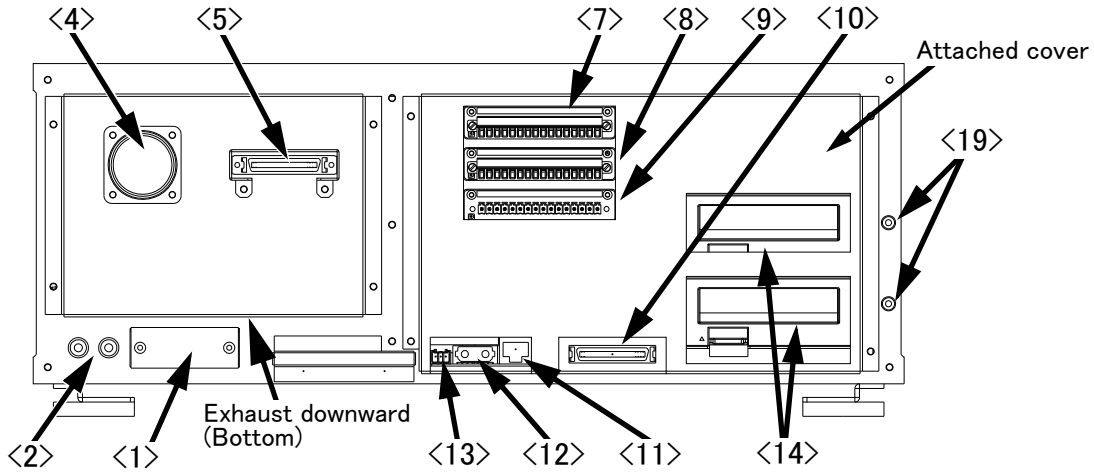
3.3.1 Controller

(1) CR750 controller

Controller (Front side)

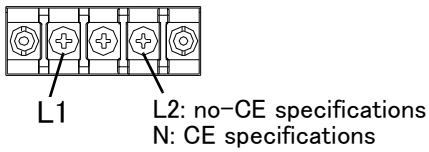


Controller (Rear side)



<1>: ACIN terminal

Single phase



<20>: The operation panel

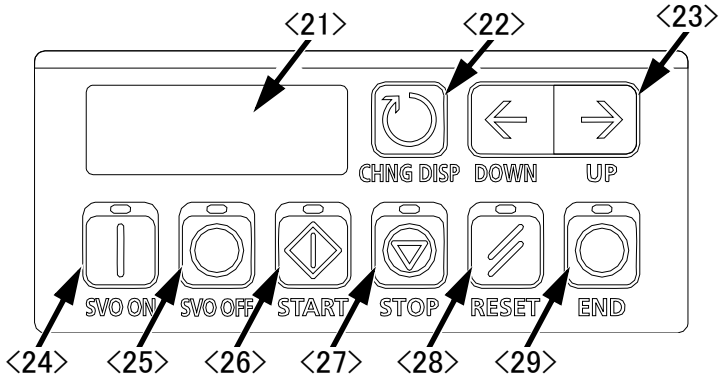
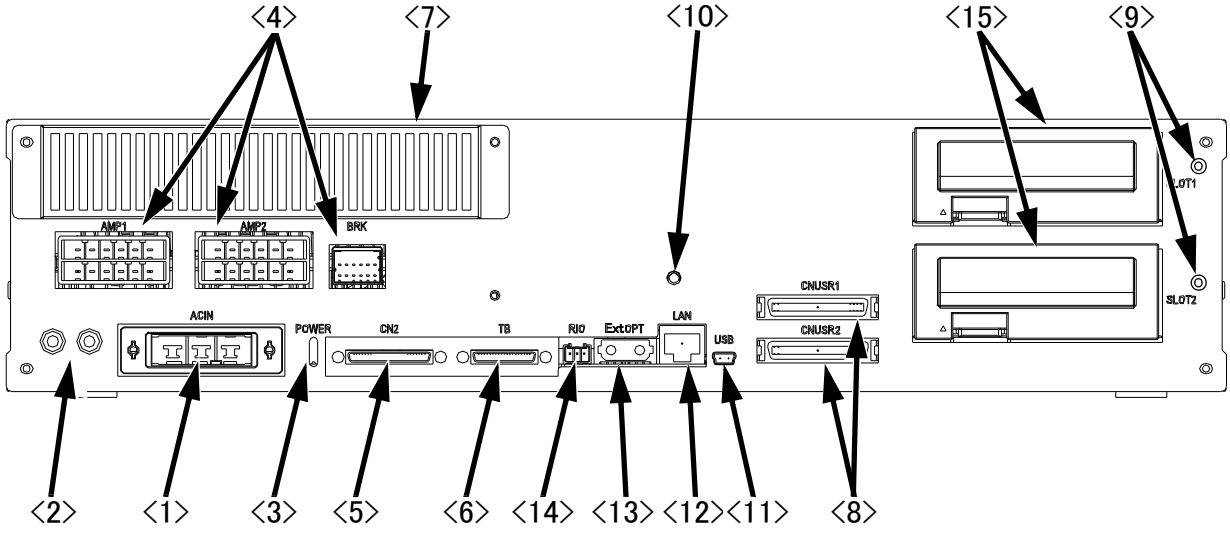


Fig.3-1 : Names of controller parts (CR750)

<1> ACIN terminal ..... The terminal box for AC power source (single phase, AC200V) input. (Inner side of a cover)
<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
<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
<11> LAN connector (LAN) ..... For LAN connection
<12> ExtOPT connector (ExtOPT) ..... Connect the cable for addition axis control.
<13> RIO connector (RIO) ..... Connect the extension parallel input/output unit.
<14> Option slot (SLOT1, SLOT2) ..... Install the interface optional. (Install the cover, when not using.)
<15> Interface cover ..... USB interface and battery are mounted.
<16> 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.
<17> Emergency stop switch ..... This switch stops the robot in an emergency state. The servo turns OFF.
<18> Filter cover ..... There is an air filter inside the cover.
<19> Grounding terminal ..... The grounding terminal for connecting cables of option card. (M3 screw x 2 places)
<20> Operation panel ..... The operation panel for servo ON/OFF, START/STOP the program etc.
<21> Display panel (STATUS.NUMBER) ..... The alarm No., program No., override value (%), etc., are displayed.
<22> CHNGDISP button ..... This button changes the details displayed on the display panel in the order of "Override" → "Program No." → "Line No.".
<23> UP/DOWN button ..... This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.
<24> SVO.ON button ..... This turns ON the servo power. (The servo turns ON.)
<25> SVO.OFF button ..... This turns OFF the servo power. (The servo turns OFF.)
<26> START button ..... This executes the program and operates the robot. The program is run continuously.
<27> STOP button ..... This stops the robot immediately. The servo does not turn OFF.
<28> RESET button ..... This resets the error. This also resets the program's halted state and resets the program.
<29> END button ..... This stops the program being executed at the last line or END statement.

(2) CR751 controller

Controller (Front side)



Controller (Rear side)

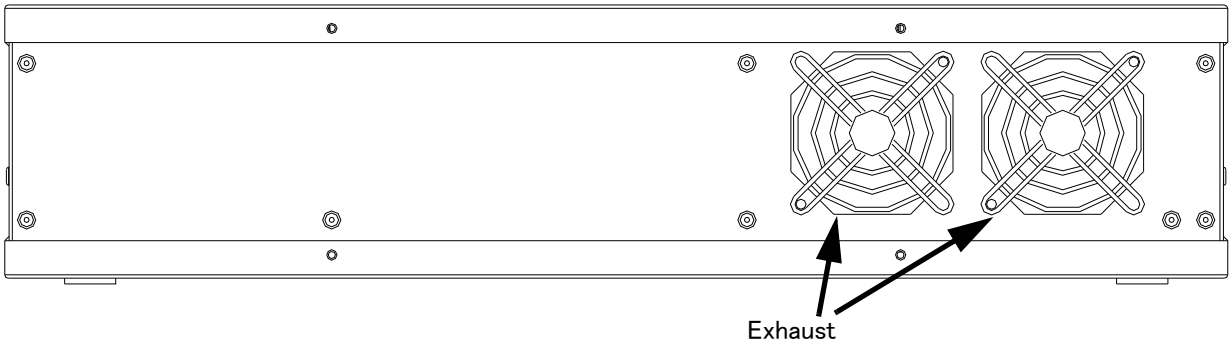


Fig.3-2 : Names of controller parts (CR751)

<1> ACIN connector.....The connector for AC power source (single phase, AC200V) input (a socket housing and a terminal are attached)
<2> PE terminal.....The screw for grounding of the cable. (M4 screw x 2 place)
<3> POWER lamp.....Lamp of control power source
<4> Machine cable connector (motor power)
AMP1, AMP2: Motor power, BRK: Motor brake
<5> Machine cable connector (motor signal)
CN2: Motor signal
<6>T/B connection connector (TB).....This is a dedicated connector for connecting the R33TB. When not using T/B, connect the attached dummy plug.
<7>Filter cover.....There is an air filter and buttery inside this cover.
<8>CNUSR connector.....The connector for input/ output connection dedicated for robot. (CNUSR1、CNUSR2) (a plug connector attached)
<9>Grounding terminal.....The grounding terminal for connecting cables of option card. (M3 screw x 2 places)
<10>Power supply charge lamp (CRARGE)
The lamp is to ensure safe timing (prevent electric shocks) when removing the cover (users are not normally required to remove the cover).
This lamp is illuminated (red) when electrical energy accumulates on the controller's power supply circuit board due to the robot's servo being ON. After turning the control power OFF and allowing a few minutes to pass, the lamp will go out.

<11>USB connecting connector (USB)..For USB connection
<12>LAN connector (LAN).....For LAN connection
<13>ExtOPT connector (ExtOPT).....Connect the cable for addition axis control.
<14>RIO connector (RIO).....Connect the extension parallel input/output unit.
<15>Option slot .....Install the interface optional. (Install the cover, when not using.)
(SLOT1、SLOT2)

⚠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.

3.4 Outside dimensions/Installation dimensions

3.4.1 Outside dimensions

(1) CR750 controller

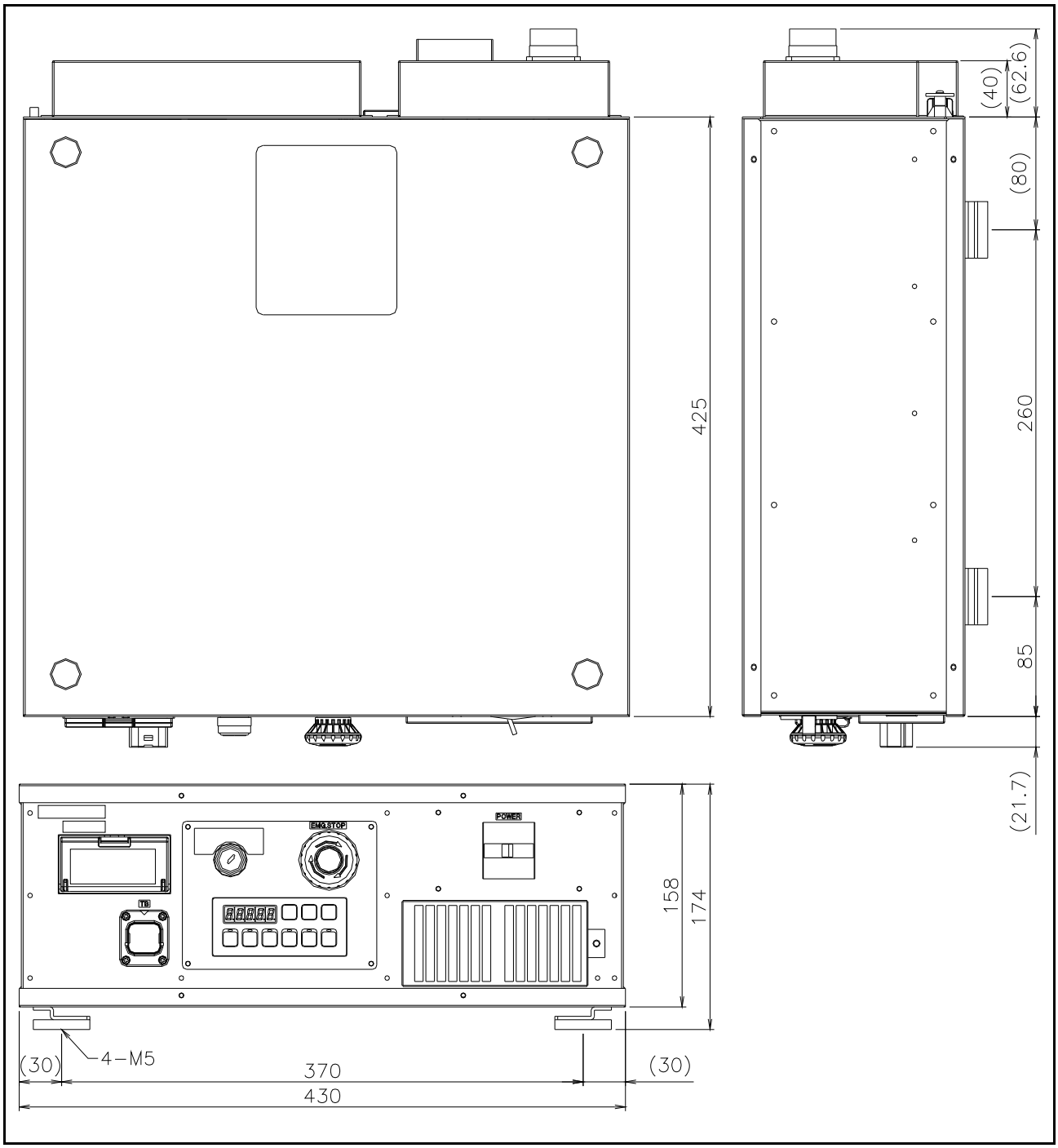


Fig.3-3 : Outside dimensions of controller (CR750)

(2) CR751 controller

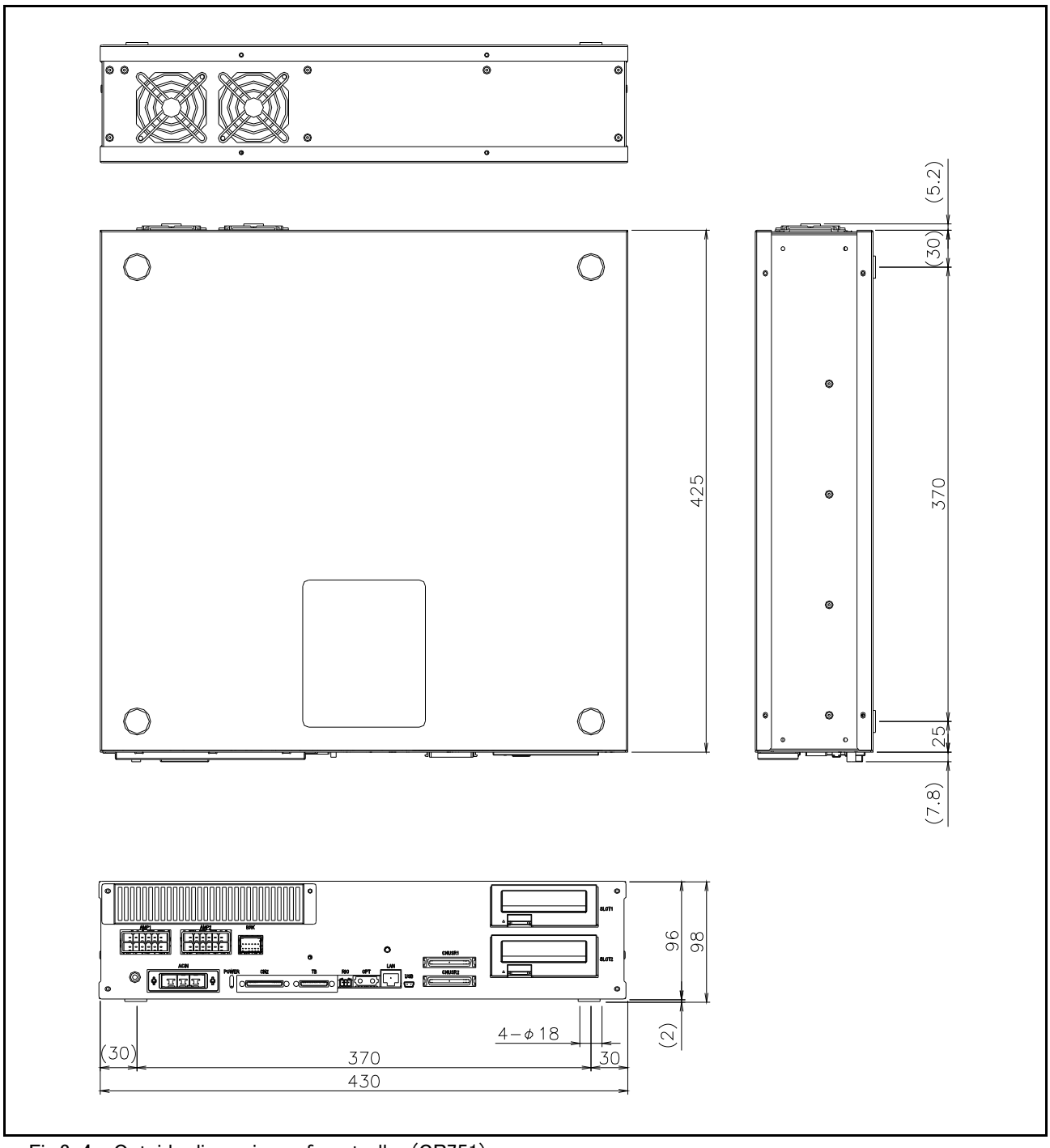


Fig.3-4 : Outside dimensions of controller (CR751)

3.4.2 Installation dimensions

(1) CR750 controller

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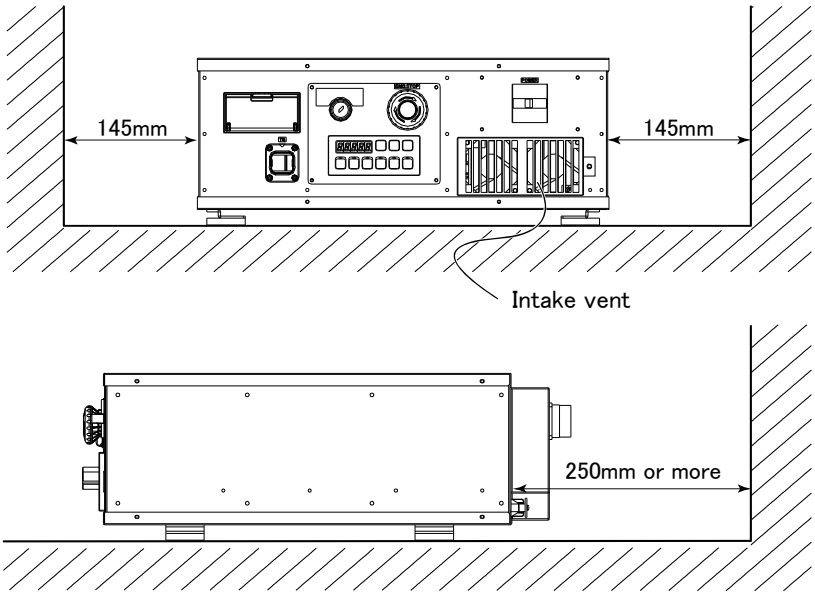

<Placed vertically>

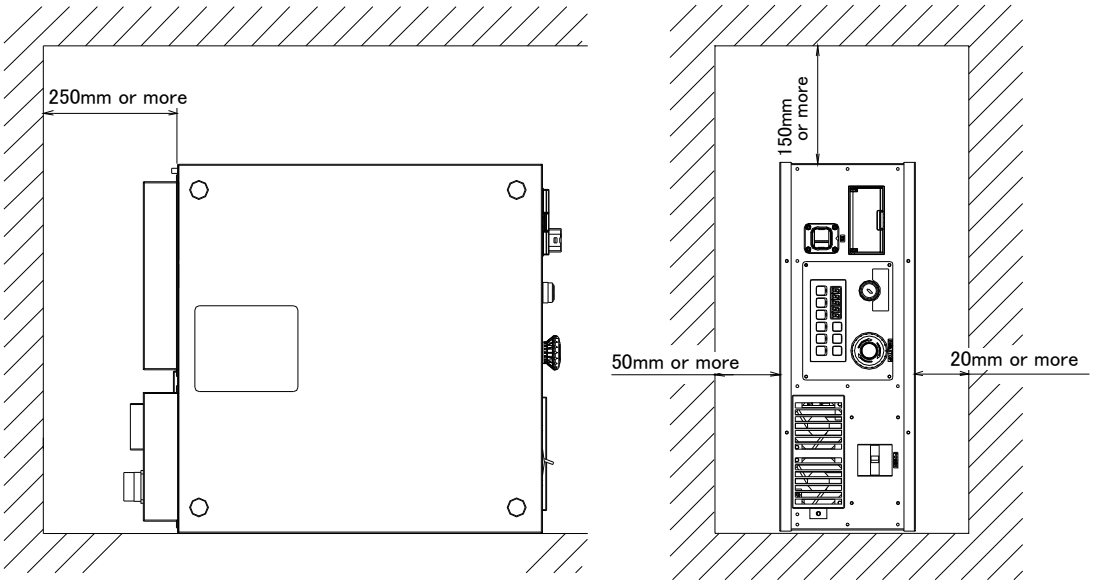

Fig.3-5 : Installation of controller (CR750)

⚠CAUTION Fixing installation section sure for prevention from the fall, when using the controller placing vertically. The reference figure of the metal plate for fixing is shown in Fig. 3-6. You should install the metal plate for fixation to the controller with M4 x 8 or the shorter screw. The screw projection length inside the controller (side board thickness is 1.2 mm) surely makes 6.8 mm or less.

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

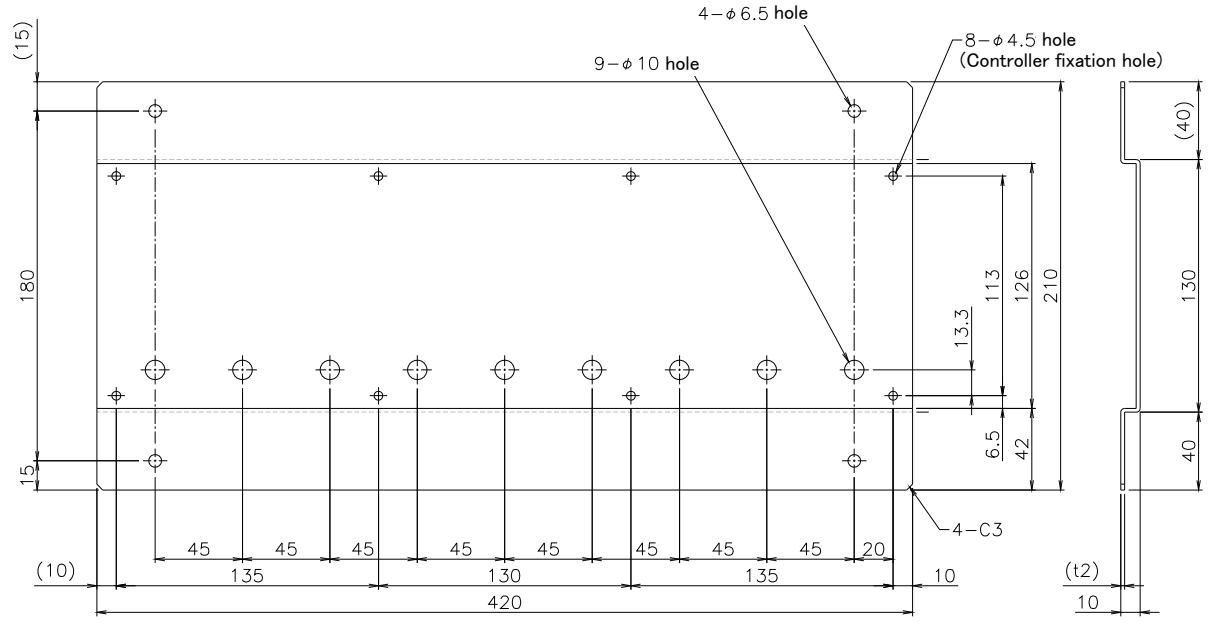

Fig.3-6 : Metal plate for fixation to placing vertically (Reference for CR750)

(2) CR751 controller

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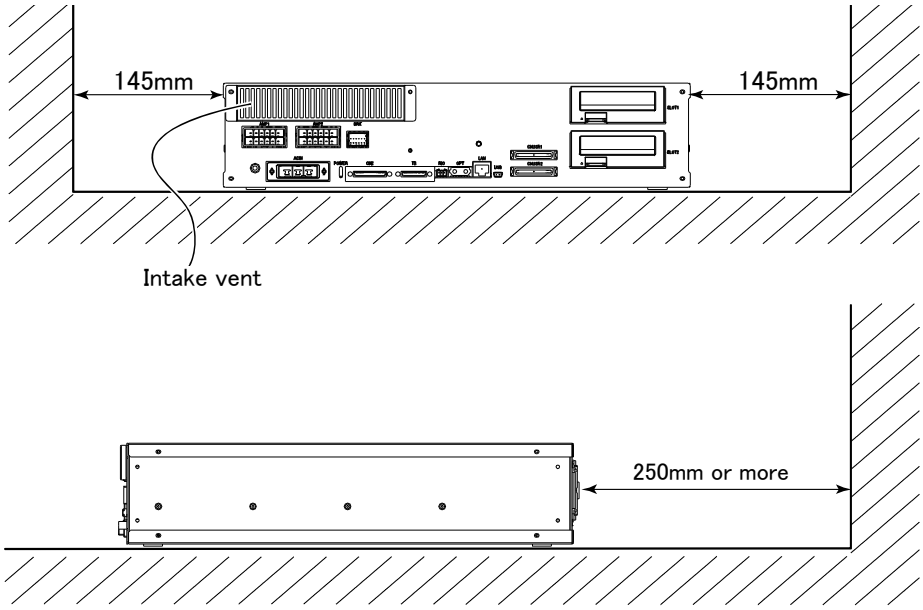


<Placed vertically>

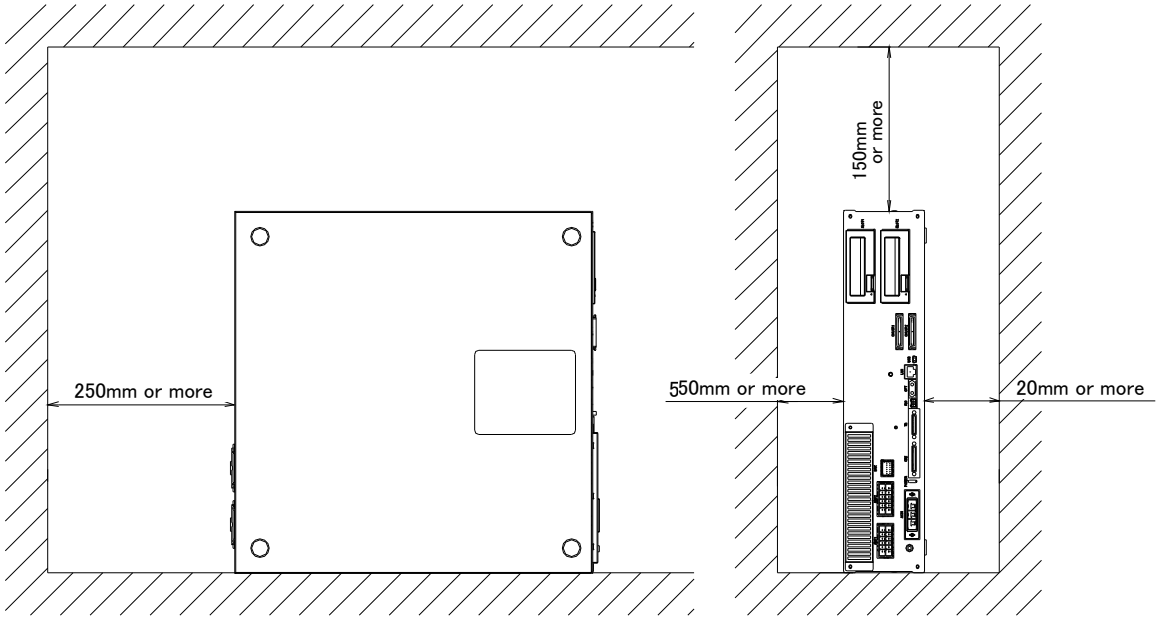


Fig.3-7 : Installation of controller (CR751)

CAUTION

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

CAUTION

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

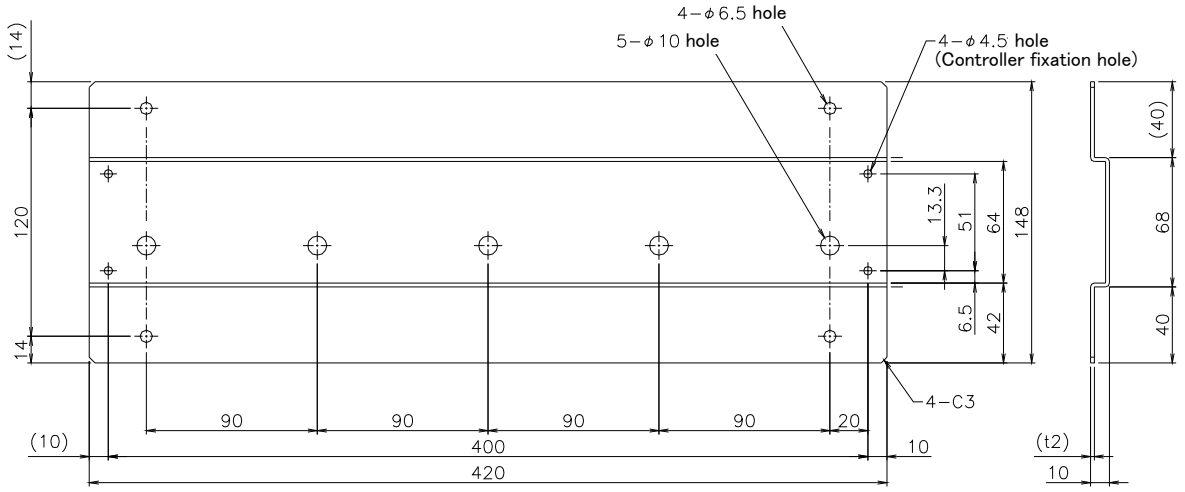


Fig.3-8 : Metal plate for fixation to placing vertically (Reference for CR751)

3.5 External input/output

3.5.1 Types

(1) Dedicated input/output ..... These inputs and outputs carry out the robot remote operation and status display.

(2) General-purpose input/output ..... These are inputs and outputs that the customer can program for peripheral device control.

(3) Hand input/output ..... These are inputs and outputs related to the hand that the customer can program.

(4)Emergency stop/Door switch input..... The wiring for the safe security of the emergency stop etc. is shown in on Page 54, "3.7 Emergency stop input and output etc." and on Page 116, "6.1.7 Examples of safety measures".

<For Reference>

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

3.6 Dedicated input/output

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

Table 3-2 : Dedicated input/output list

Parameter name	Input		Note1)	Output	
	Name	Function	Level	Name	Function
TEACHMD	None			Teaching mode output signal	Outputs that the teaching mode is entered.
ATTOPMD	None			Automatic mode output signal	Outputs that the automatic mode is entered.
ATEXTMD	None			Remote mode output signal	Outputs that the remote mode is entered.
RCREADY	None			Controller power ON complete signal	Outputs that external input signals can be received.
AUTOENA	Automatic operation enabled input signal	Allows automatic operation.	L	Automatic operation enabled output signal	Outputs the automatic operation enabled state.
START	Start input signal	Starts all slots.	E	Operating output signal	Outputs that the slot is operating.
STOP	Stop input signal	Stops all slots. The input signal No. is fixed to 0. Note) Use the emergency stop input for stop inputs related to safety.	L	Wait output signal	Outputs that the slot is temporarily stopped.
STOP2	Stop input signal	The program during operation is stopped. Unlike the STOP parameter, change of the signal number is possible. Notes) Specification is the same as the STOP parameter.	L	Wait output signal	Outputs that the slot is temporarily stopped. Notes) Specification is the same as the STOP parameter.
SLOTINIT	Program reset input signal	Resets the wait state.	E	Program selection enabled output signal	Outputs that the slot is in the program selection enabled state.
ERRRESET	Error reset input signal	Resets the error state.	E	Error occurring output signal	Outputs that an error has occurred.
CYCLE	Cycle stop input signal	Carries out cycle stop.	E	In cycle stop operation output signal	Outputs that the cycle stop is operating.
SRVOFF	Servo ON enabled input signal	Turns the servo OFF for all mechanisms.	L	Servo ON enabled output signal	Outputs servo-on disable status. (Echo back)
SRVON	Servo ON input signal	Turns the servo ON for all mechanisms.	E	In servo ON output signal	Outputs the servo ON state.
IOENA	Operation rights input signal	Requests the operation rights for the external signal control.	L	Operation rights output signal	Outputs the operation rights valid state for the external signal control.
MELOCK	Machine lock input signal	Sets/resets the machine lock state for all mechanisms.	E	In machine lock output signal	Outputs the machine lock state.
SAFEPOS	Evasion point return input signal	Requests the evasion point return operation.	E	In evasion point return output signal	Outputs that the evasion point return is taking place.
OUTRESET	General-purpose output signal reset	Resets the general-purpose output signal.	E	None	
EMGERR	None			Emergency stop output signal	Outputs that an emergency stop has occurred.
S1START : S32START	Start input	Starts each slot.	E	In operation output	Outputs the operating state for each slot.

Parameter name	Input Note1)			Output	
	Name	Function	Level	Name	Function
S1STOP : S32STOP	Stop input	Stops each slot.	L	In wait output	Outputs that each slot is temporarily stopped.
PRGSEL	Program selection input signal	Designates the setting value for the program No. with numeric value input signals.	E	None	
OVRDSEL	Override selection input signal	Designates the setting value for the override with the numeric value input signals.	E	None	
IODATA Note2)	Numeric value input (start No., end No.)	Used to designate the program name, override value., mechanism value.	L	Numeric value output (start No., end No.)	Used to output the program name, override value., mechanism No.
PRGOUT	Program No. output request	Requests output of the program name.	E	Program No. output signal	Outputs that the program name is being output to the numeric value output signal.
LINEOUT	Line No. output request	Requests output of the line No.	E	Line No. output signal	Outputs that the line No. is being output to the numeric value output signal.
OVRDOUT	Override value output request	Requests the override output.	E	Override value output signal	Outputs that the override value is being output to the numeric value output signal.
ERROUT	Error No. output request	Requests the error No. output.	E	Error No. output signal	Outputs that the error No. is being output to the numeric value output signal.
JOGENA	Jog valid input signal	Validates jog operation with the external signals	E	Jog valid output signal	Outputs that the jog operation with external signals is valid.
JOGM	Jog mode input 2-bit	Designates the jog mode.	L	Jog mode output 2-bit	Outputs the current jog mode.
JOG+	Jog feed + side for 8-axes	Requests the + side jog operation.	L	None	
JOG-	Jog feed - side for 8-axes	Requests the - side jog operation.	L	None	
HNDCNTL1 : HNDCNTL3	None			Mechanism 1 hand output signal status : Mechanism 3 hand output signal status	Mechanism 1: Outputs the status of general-purpose outputs 900 to 907. Mechanism 2: Outputs the status of general-purpose outputs 910 to 917. Mechanism 3: Outputs the status of general-purpose outputs 920 to 927.
HNDSTS1 : HNDSTS3	None			Mechanism 1 hand input signal status : Mechanism 3 hand input signal status	Mechanism 1: Outputs the status of hand inputs 900 to 907. Mechanism 2: Outputs the status of hand inputs 910 to 917. Mechanism 3: Outputs the status of hand inputs 920 to 927.
HNDERR1 : HNDERR3	Mechanism 1 hand error input signal : Mechanism 3 hand error input signal	Requests the hand error occurrence.	L	Mechanism 1 hand error output signal : Mechanism 3 hand error output signal	Outputs that a hand error is occurring.

Parameter name	Input		Note1)	Output	
	Name	Function	Level	Name	Function
AIRERR1 : AIRERR3	Pneumatic pressure error 1 input signal : Pneumatic pressure error 3 input signal	Request the pneumatic pressure error occurrence.	L	Pneumatic pressure error 1 output signal. : Pneumatic pressure error 3 output signal.	Outputs that a pneumatic pressure error is occurring.
M1PTEXC : M3PTEXC	None		L	Maintenance parts replacement time warning signal	Outputs that the maintenance parts have reached the replacement time.
USERAREA Note3)	None			User-designated area 8-points	Outputs that the robot is in the user-designated area.

Note1) The level indicates the signal level.
L: Level signal → The designated function is validated when the signal is ON, and is invalidated when the signal is OFF.
E: Edge signal → The designated function is validated when the signal changes from the OFF to ON state, and the function maintains the original state even when the signal then turns OFF.
Note2) Four elements are set in the order of input signal start No., end No., output signal start No. and end No.
Note3) Up to eight points can be set successively in order of start output signal No. and end output signal No.

3.7 Emergency stop input and output etc.

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

Table 3-3 : Special input/output terminal

Item	Name	Function
Input	Emergency stop	Applies the emergency stop. Dual emergency line
Input	Special stop input	Applies the stop. (Refer to Page 63, "3.7.2 Special stop input (SKIP)")
Input	Door switch	Servo-off. Dual line, normal close (Page 65, "3.7.3 Door switch function")
Input	Enabling device	Servo-off. Dual line, normal close (Page 65, "3.7.4 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 73, "3.10 Magnet contactor control connector output (AXMC) for addition axes")

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

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

Pin number assignment of each terminal and the circuit diagram are shown in Fig. 3-14 (CR750) or Fig. 3-13 (CR751).

3.7.1 Connection of the external emergency stop

The external emergency stop input and door switch input and enabling device input are opened at shipment as shown in Fig. 3-14 (CR750) or Fig. 3-13 (CR751).
Connect the external emergency stop switch and door switch with the following procedure.
And, the example of the connection and notes of the emergency stop are described in Page 116, "6.1.7 Examples of safety measures" Refer to it together

[Caution] The emergency stop circuit is duplicated inside the controller. The emergency stop switch uses a double contact-type switch, so please be sure to fix both of the contacts to the connector pins as shown below in order to ensure the wiring is duplicated. An error will continue to occur in the event that only one of the pins is connected.

1) Please prepare the emergency stop switch, door switch and enabling device.
   a) External emergency switch
      - CR750 controller.....CNUSR11 connector "between 3 and 4" and CNUSR12 Connector "between 3 and 4".
      - CR751 controller.....CNUSR1 connector "between 2 and 27" and "between 7 and 32".
   b) Door switch
      - CR750 controller.....CNUSR11 connector "between 7 and 8" and CNUSR12 connector "between 7 and 8".
      - CR751 controller.....CNUSR1 connector "between 4 and 29" and "between 9 and 34".
   c) Enabling device
      - CR750 controller.....CNUSR11 connector "between 9 and 10" and CNUSR12 connector "between 9 and 10".
      - CR751 controller.....CNUSR1 connector "between 5 and 30" and "between 10 and 35".

[Caution] Be sure to use a shield cable for the emergency stop wiring cable. And when operating in an environment that is easily affected by noise, be sure to fix the attached ferrite core (model number: E04SR301334, manufacturer: Seiwa Electric Mfg. Co., Ltd.). Be sure to place the ferrite core more than 30 cm from the connecting terminal section.

⚠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 controller

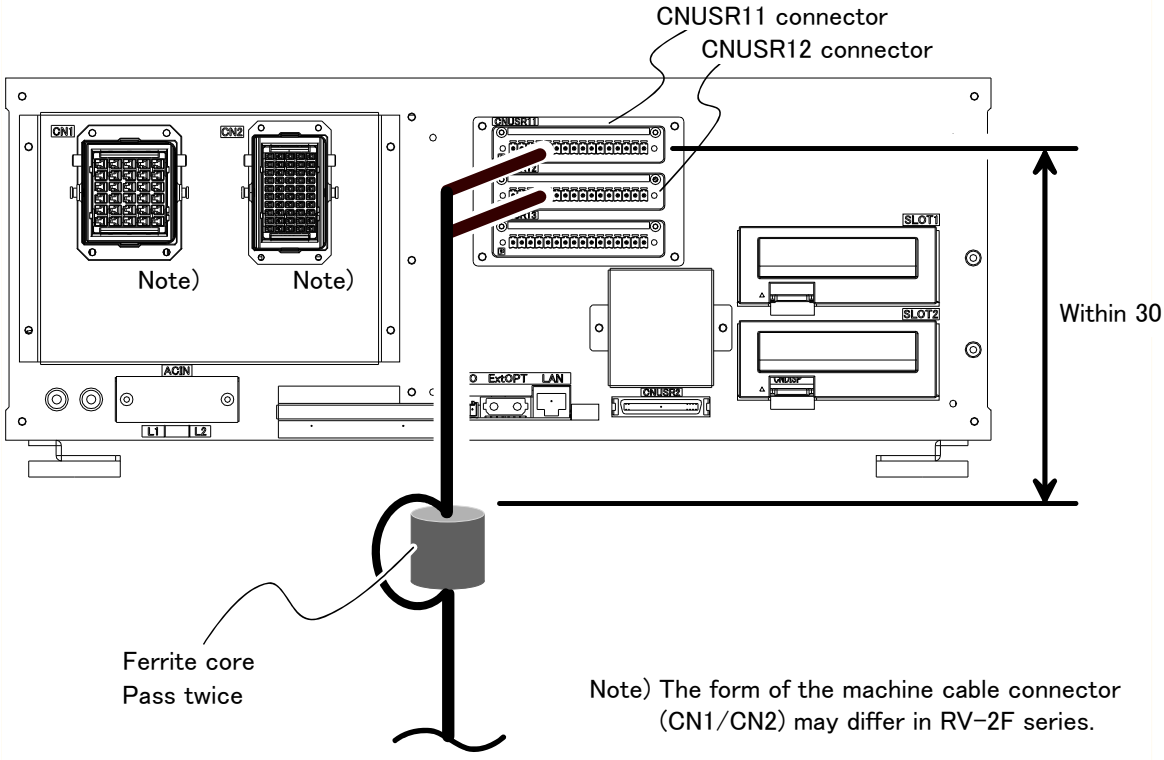
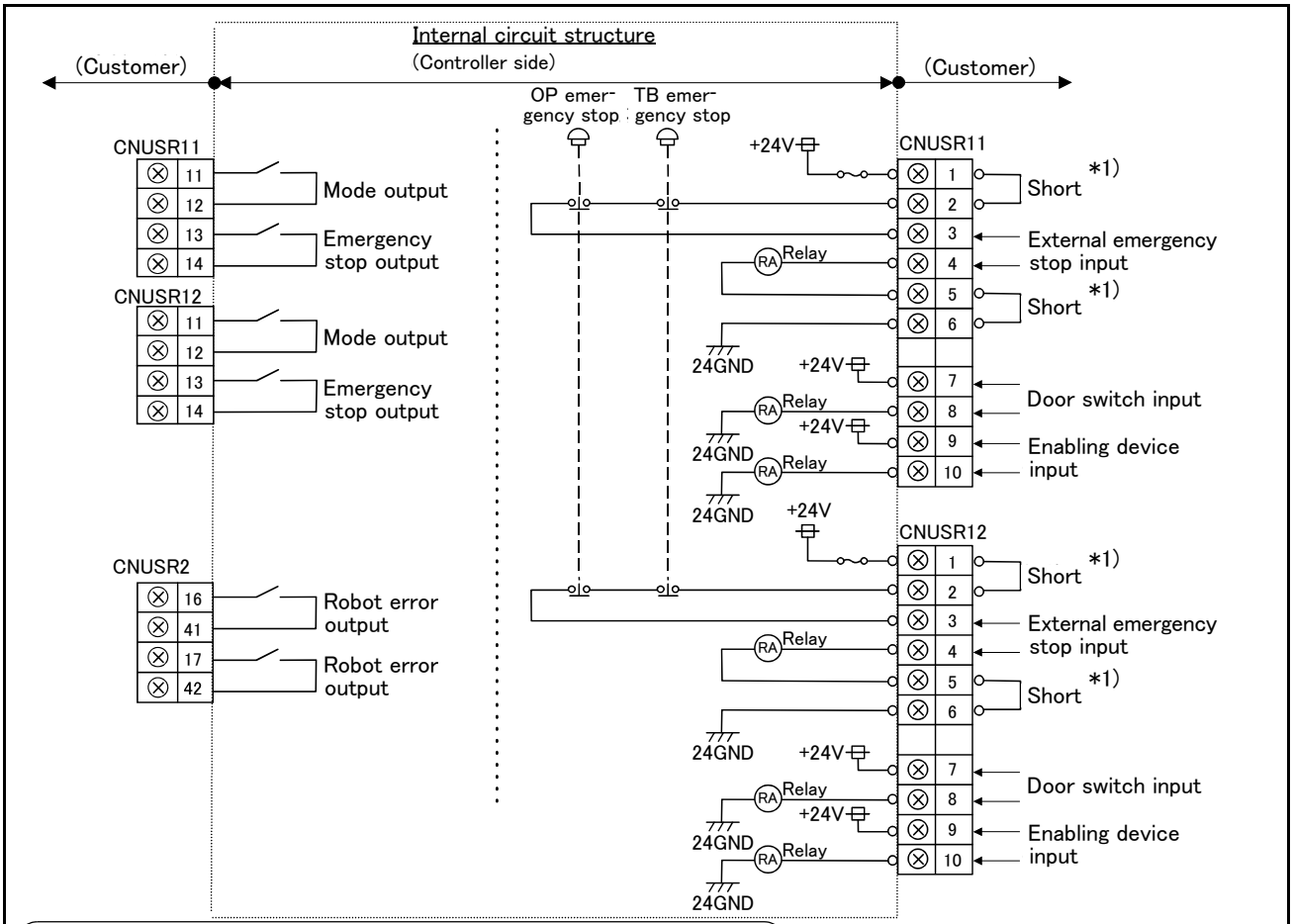


Fig.3-9 : Emergency stop cable connection (CR750)



CAUTION Please do not carry out an insulation pressure test. Moreover, it becomes the cause of failure if it connects incorrectly.

Please refer to the example of safety measures of "Standard Specifications Manual".

*1) This terminal is opened at factory shipping (unconnected). If power supply inside the controller is used, short-circuit the terminal.

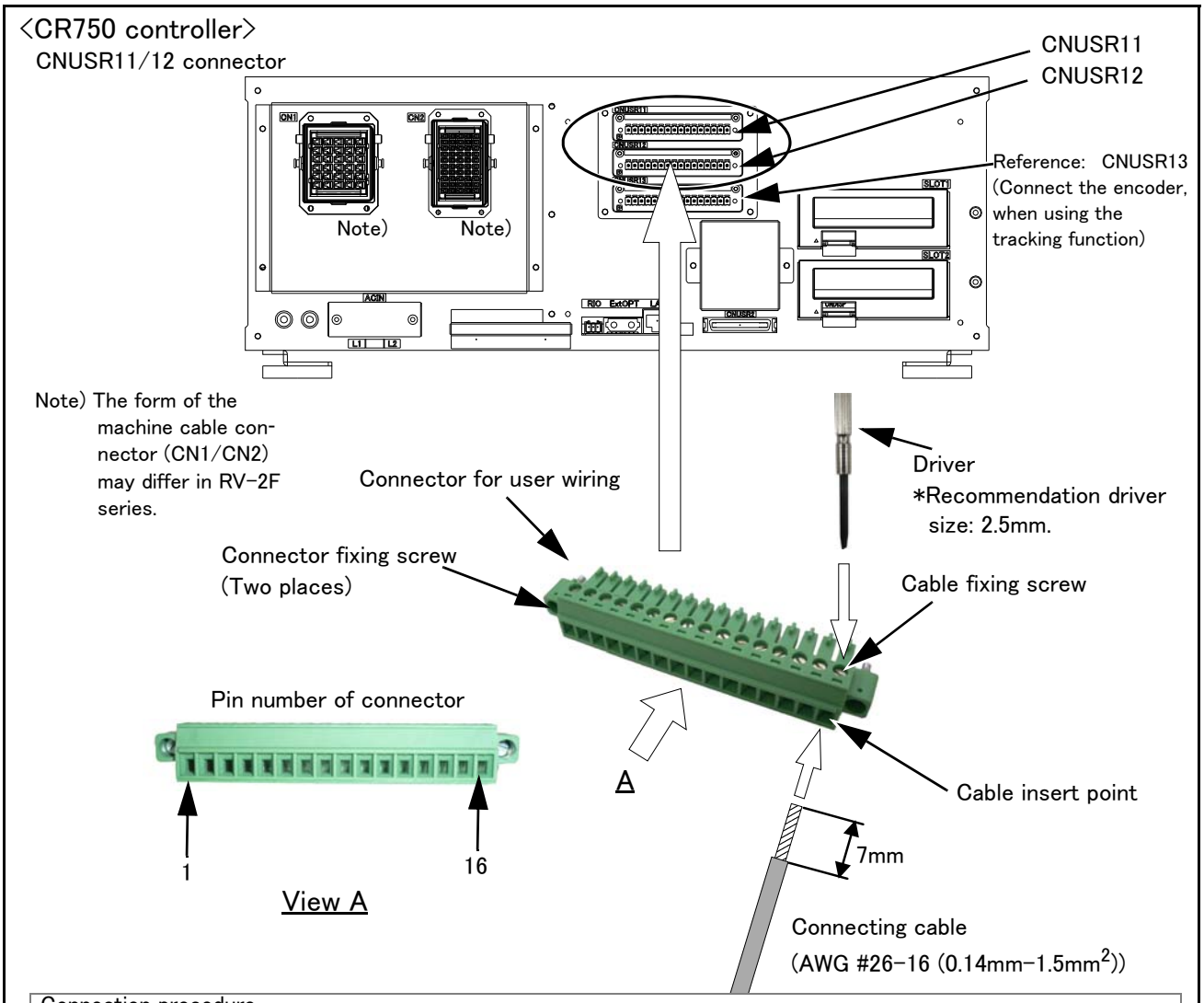
[Note] In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

Fig.3-10 : 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 116, "6.1.7 Examples of safety measures".

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



Connection procedure

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

Please use an AWG #26 to 16 (0.14 to 1.5mm^2) connector cable.

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

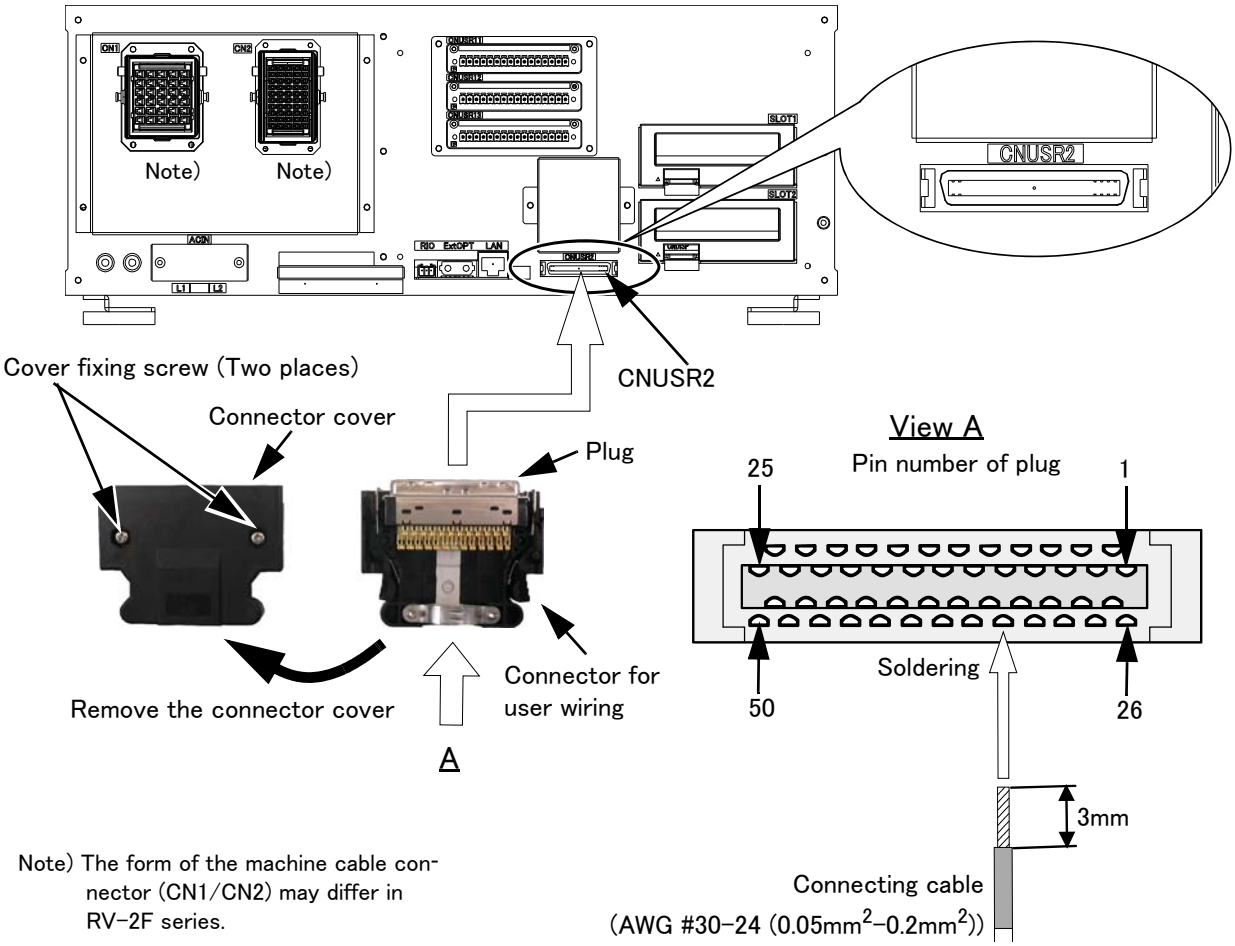
This concludes the connection procedure.

Fig.3-11 : Method of wiring for external emergency stop connection (CR750 (CNUSR11/12))

⚠CAUTION 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 controller>

CNUSR2 connector



Note) The form of the machine cable connector (CN1/CN2) may differ in RV-2F series.

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 controller. For the connection cables, please use AWG #30 to 24 (0.05 to 0.2mm^2).

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

This concludes the connection procedure.

Fig.3-12 : 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 controller

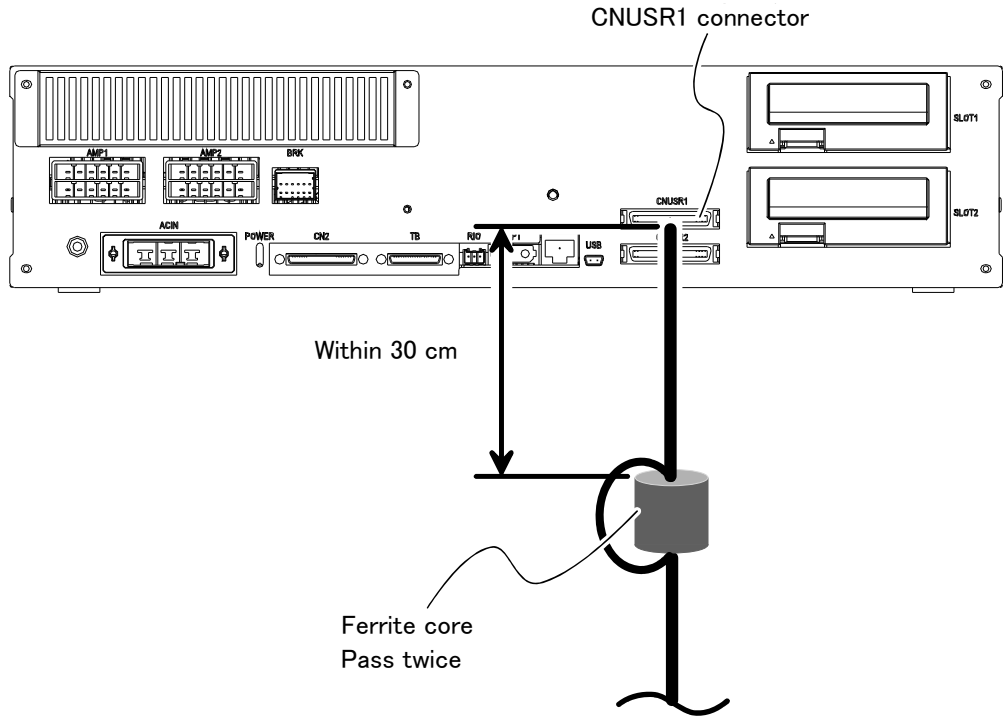


Fig.3-13 : Emergency stop cable connection (CR751)

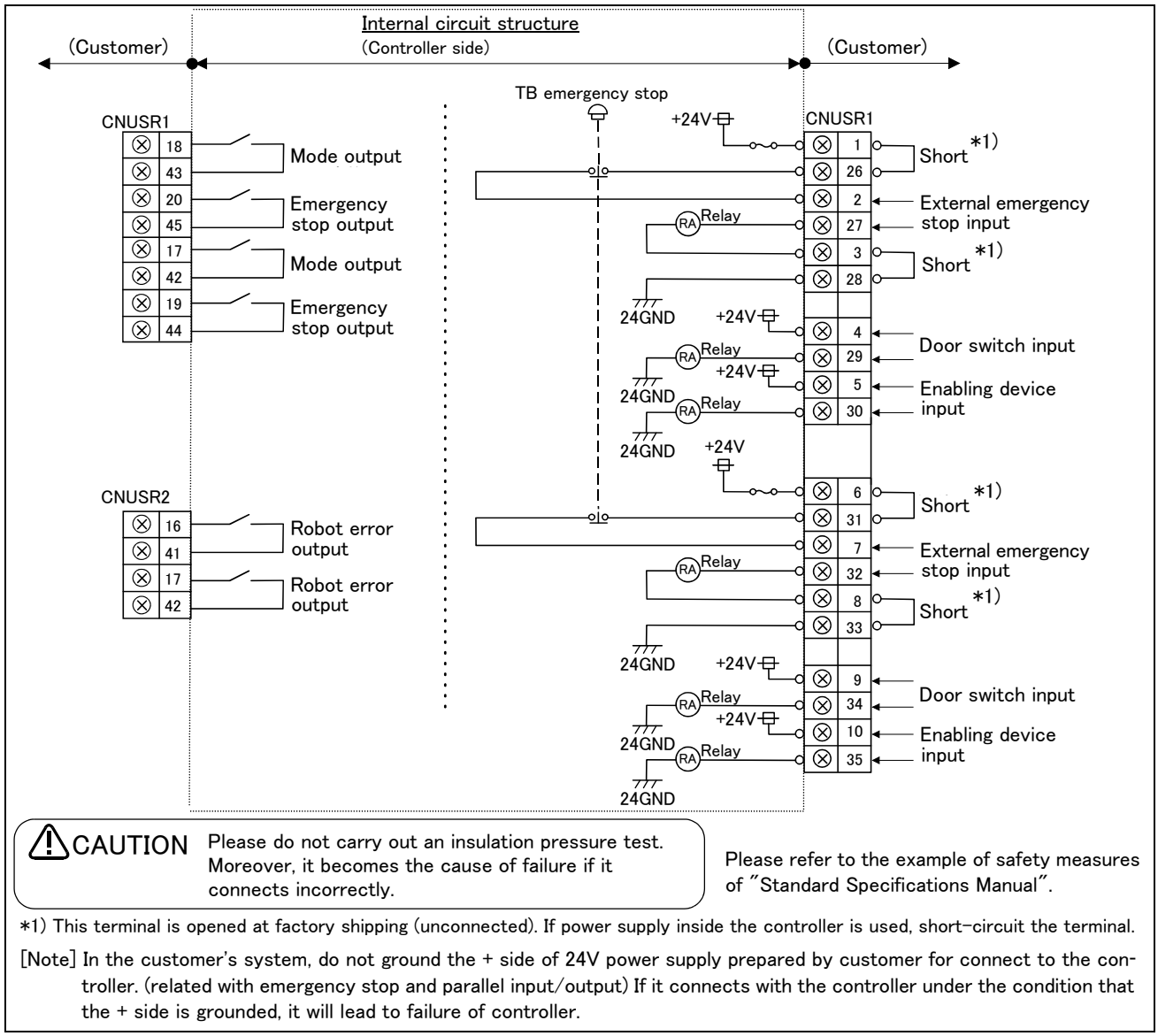
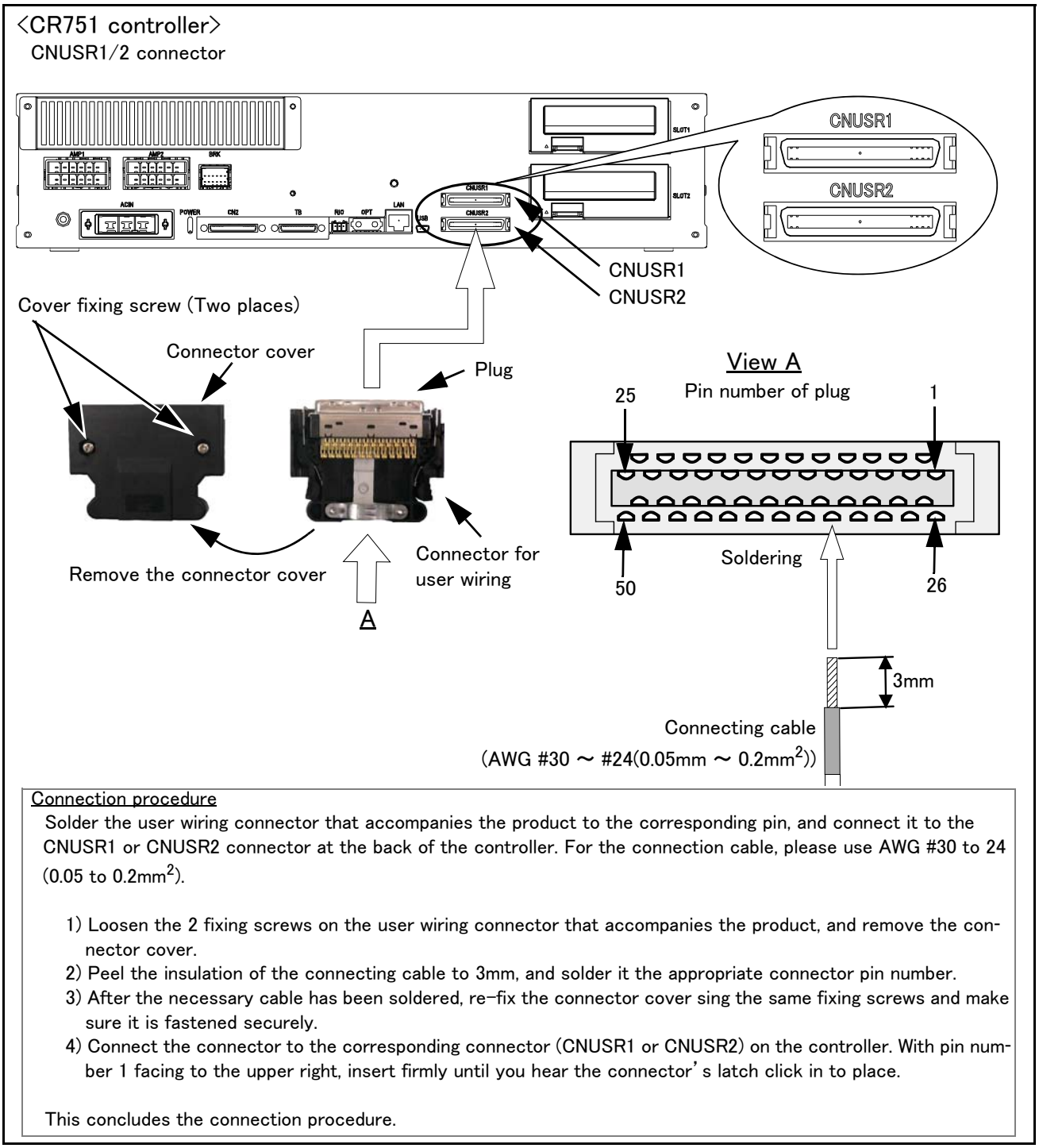


Fig.3-14 : External emergency stop connection (CR751)

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 116, "6.1.7 Examples of safety measures".
This is a necessary measure in order to ensure safe operation so that the robot can be stopped immediately by pressing the emergency stop switch in the event that the robot malfunctions.



Connection procedure

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

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

This concludes the connection procedure.

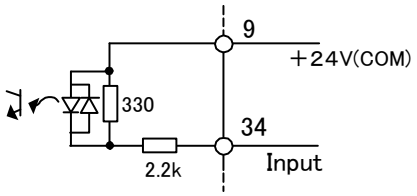
Fig.3-15 : Method of wiring for external emergency stop connection (CR751 (CNUSR1/2))

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

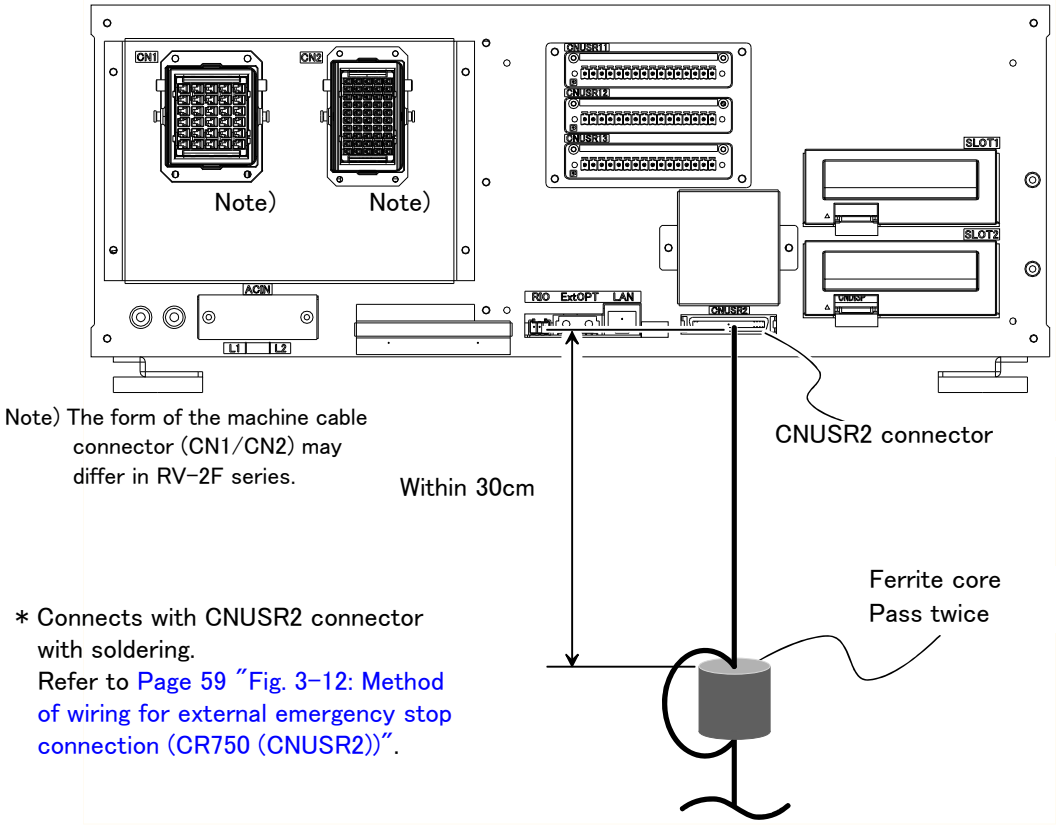
3.7.2 Special stop input (SKIP)

The skip is the input signal to stop the robot. The pin 9, 34 of the CNUSR2 connector shown in Fig. 3-16 (CR750) or Fig. 3-17 (CR751).

Table 3-4 : Special stop input electric specification

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

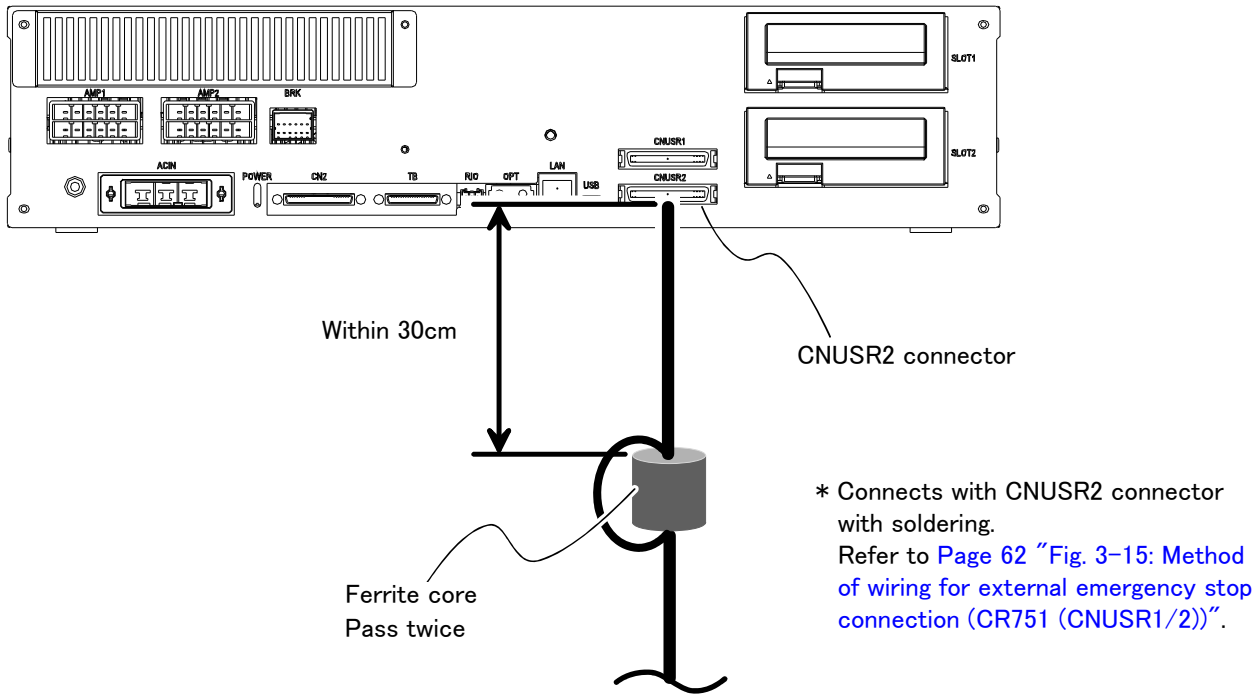
(1) CR750 controller



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

Fig.3-16 : Connection of the special-stop-input (CR750)

(2) CR751 controller



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

Fig.3-17 : Connection of the special-stop-input (CR751)

3.7.3 Door switch function

This function retrieves the status of the switch installed on the door of the safety fence, etc., and stops the robot when the door is opened. This differs from an emergency stop in that the servo turns OFF when the door is opened and an error does not occur. Follow the wiring example shown in Page 61 "Fig. 3-14: External emergency stop connection (CR751)" or Page 60 "Fig. 3-13: Emergency stop cable connection (CR751)", and Page 116, "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.

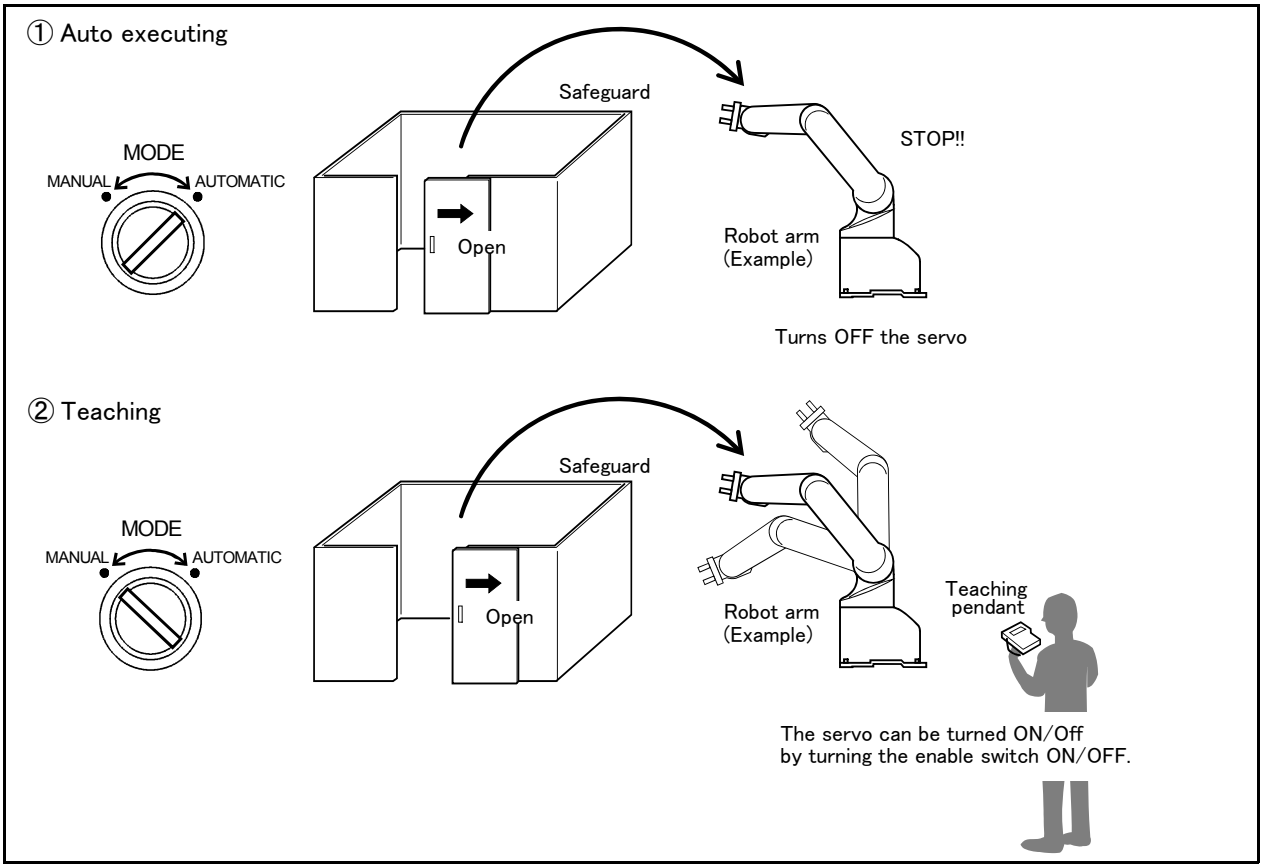


Fig.3-18 : Door switch function

3.7.4 Enabling device function

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

(1) When door is opening

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

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

(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.

(3) Automatic Operation/Jog Operation/Brake Release and Necessary Switch Settings

The following is a description of various operations performed on the robot and switch settings that are required.

Table 3-5 : Various operations and necessary switch settings

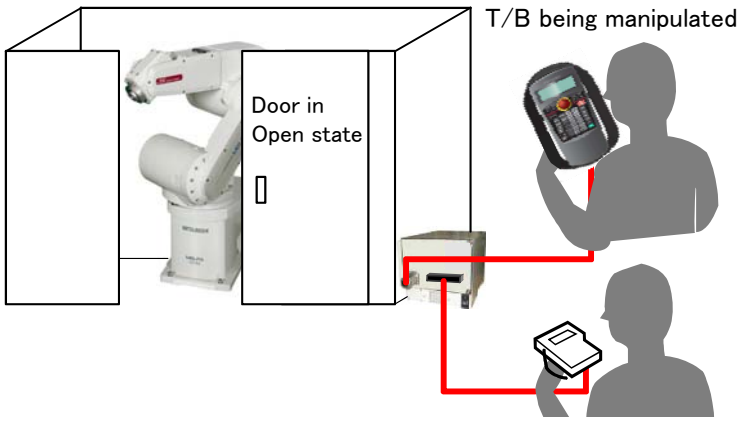
No	Operation	Related switch settings Note1)					Description
		Mode of controller	T/B enable/ disable	T/B enable switch	Enabling device input terminal	Door switch input terminal	
1	Jog operation	Manual	Enable	ON	Close(ON)	—	If the enabling device input is set to Close (On), the state of door switch input does not matter.
2	Jog operation Note2)	Manual	Enable	ON	Open(OFF)	Close (Door Close)	If the enabling device input is set to Open (Off), door switch input must be in a state of Close
3	Brake release Note3)	Manual	Enable	ON	Close(ON)	—	Irrespective of the state of door switch input, enabling device input must be in a state of Close (On).
4	Automatic operation	Automatic	Disable	—	—	Close (Door Close)	Door switch input must always be in a state of Close (Door Close).

Note1) "–" in the table indicates that the state of switch concerned does not matter.
Refer to the following for operation of each switch.

- Mode of controller: ..... Page 67, "3.8 Mode changeover switch input"
- T/B enable/disable: ..... Page 77, "(1) Teaching pendant (T/B)"
- T/B enable switch: ..... Page 77, "(1) Teaching pendant (T/B)"
- Enabling device input terminal: ..... Page 116, "6.1.7 Examples of safety measures"
- Door switch input terminal: ..... Page 116, "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.



⚠CAUTION

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

Fig.3-19 : Brake release operation

3.8 Mode changeover switch input

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

<Right of operation (mode)>

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

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.

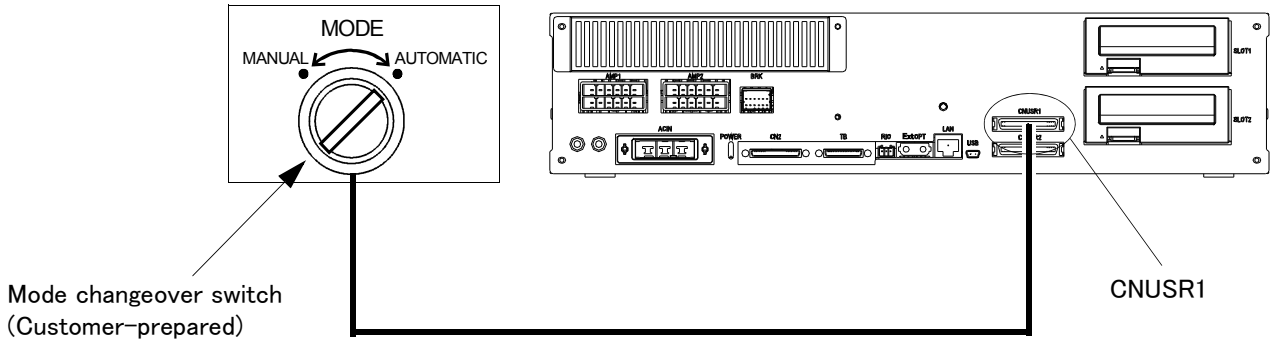


Fig.3-20 : Mode changeover switch image figure (CR751)

(1) Specification of the key switch interface

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

Table 3-6 : Function of the key switch interface

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

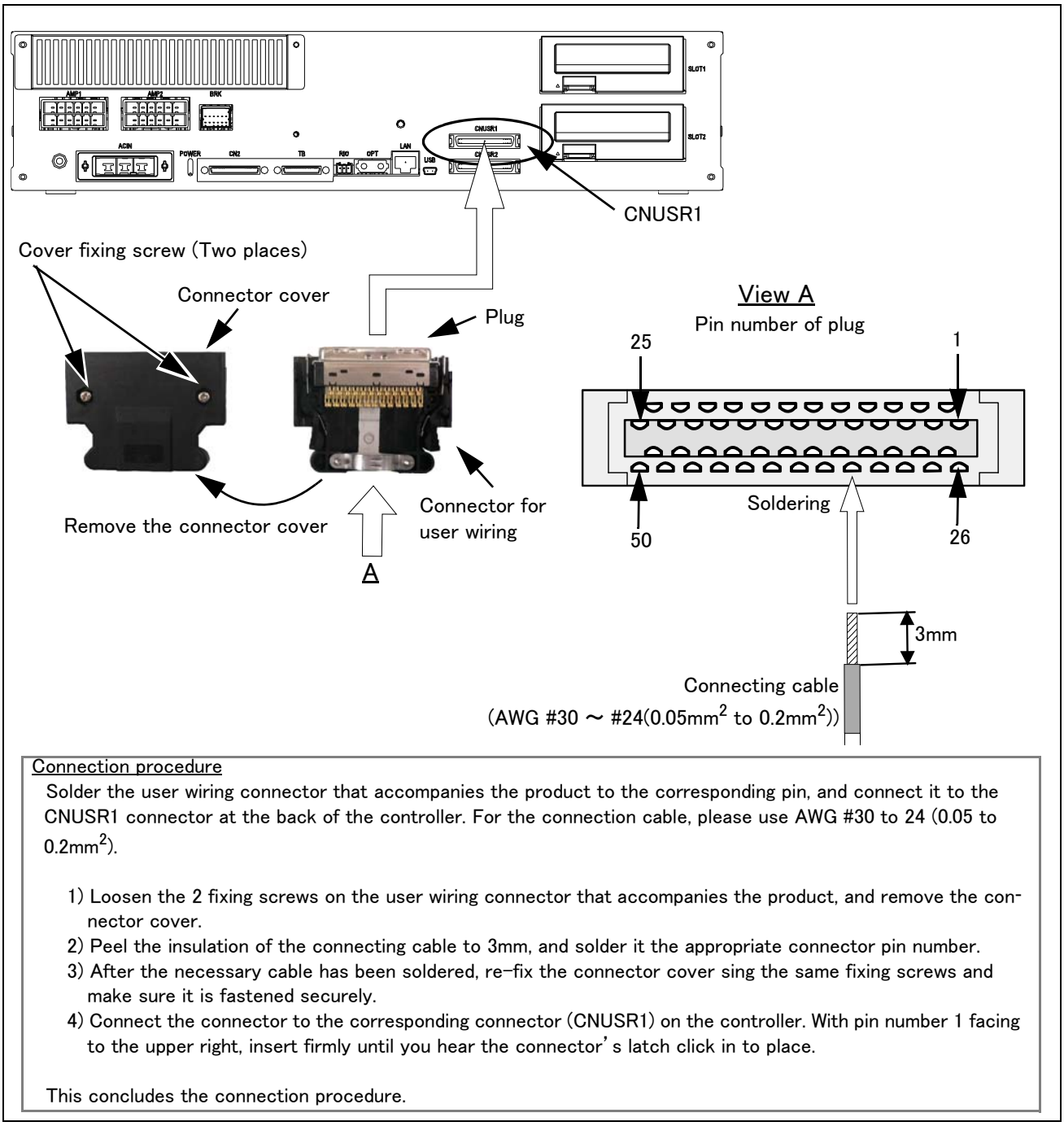
Note1) The mode changes by both opening or both closing between 30-5 pin and between 35-10 pin. Maintain the current mode except it.

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

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

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

(2) Connection of the mode changeover switch input



Connection procedure

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

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

This concludes the connection procedure.

Fig.3-21 : Connection of the mode changeover switch input (CR751)

3.9 Additional Axis Function

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

3.9.1 Wiring of the Additional Axis Interface

Table 3-8 shows the connectors for additional axes inside the controller. Fig. 3-22 (CR750) and Fig. 3-23 (CR751) shows a connection example (configuration example).

Table 3-8 : Dedicated connectors inside the controller

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

(1) CR750 controller

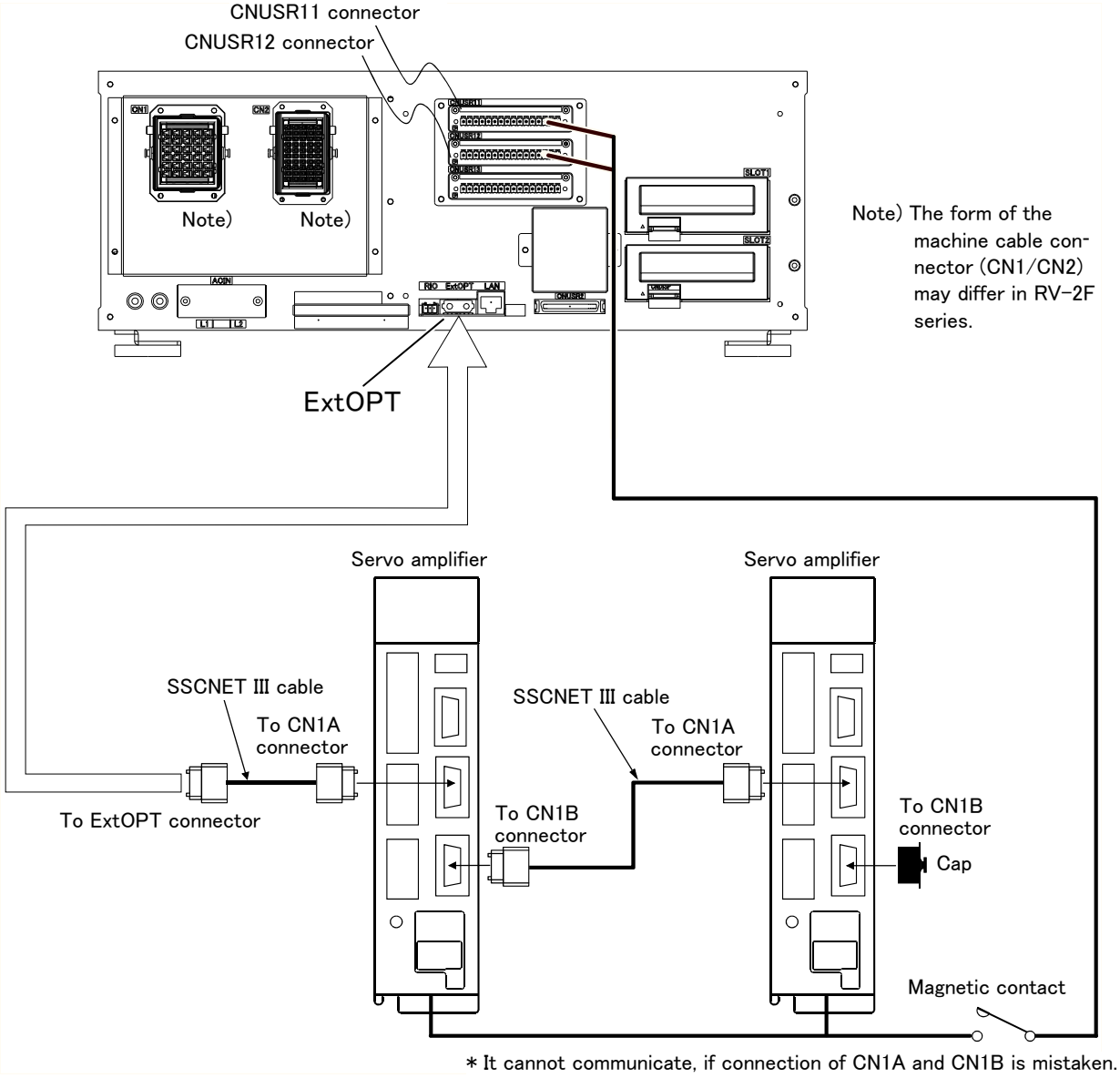


Fig.3-22 : Example of addition axis connection (CR750)

(2) CR751 controller

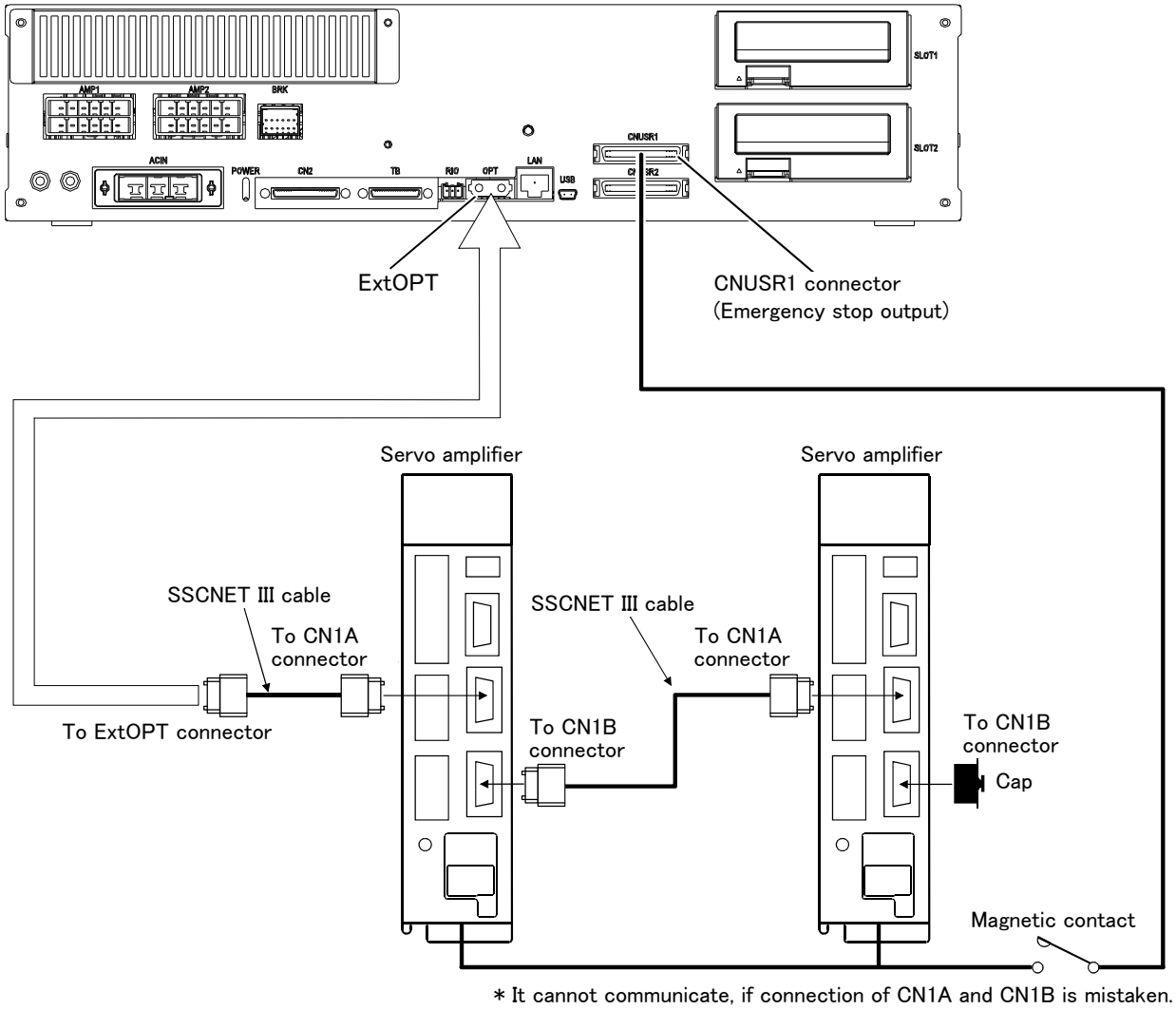


Fig.3-23 : Example of addition axis connection (CR751)

(3) Example of the installation of the noise filter

1) EMC filter (recommended)

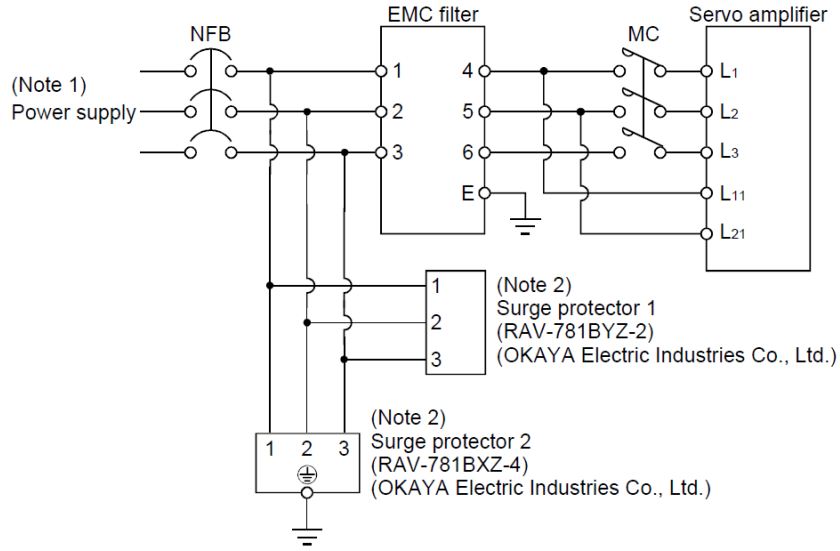
Please install the recommendation filter shown below according to the example of connection.

1) Combination with the servo amplifier

Servo amplifier	Recommended filter (Soshin Electric)		Mass [kg]([lb])
	Model	Leakage current [mA]	
MR-J3-10B to MR-J3-100B MR-J3-10B1 to MR-J3-40B1	(Note) HF3010A-UN	5	3 (6.61)
MR-J3-250B ▪ MR-J3-350B	(Note) HF3030A-UN		5.5 (12.13)
MR-J3-500B ▪ MR-J3-700B	(Note) HF3040A-UN	1.5	6.0 (13.23)
MR-J3-11KB to MR-J3-22KB	(Note) HF3100A-UN	6.5	15 (33.07)
MR-J3-60B4 ▪ MR-J3-100B4	TF3005C-TX	5.5	6(13.23)
MR-J3-200B4 to MR-J3-700B4	TF3020C-TX		
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.3-24 : 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.

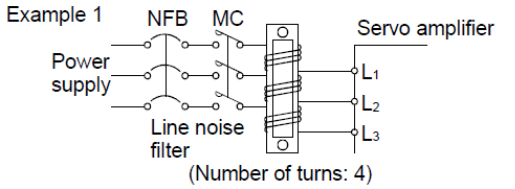
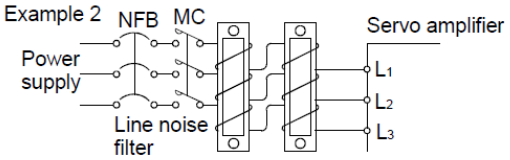
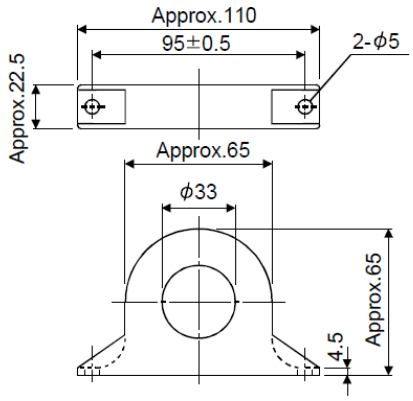
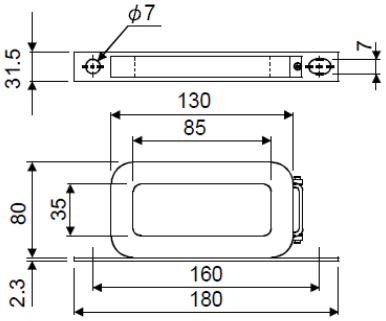
Connection diagram	Outline drawing [Unit: mm]
Use the line noise filters for wires of the main power supply (L_1 • L_2 • L_3) and of the motor power supply (U • V • W). Pass each of the 3-phase wires through the line noise filter an equal number of times in the same direction. For the main power supply, 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.  (Number of turns: 4)  Two filters are used (Total number of turns: 4)	FR-BSF01 (for wire size 3.5mm^2 (AWG12) or less))  FR-BLF(for wire size 5.5mm^2 (AWG10) or more)) 

Fig.3-25 : Example of noise filter installation

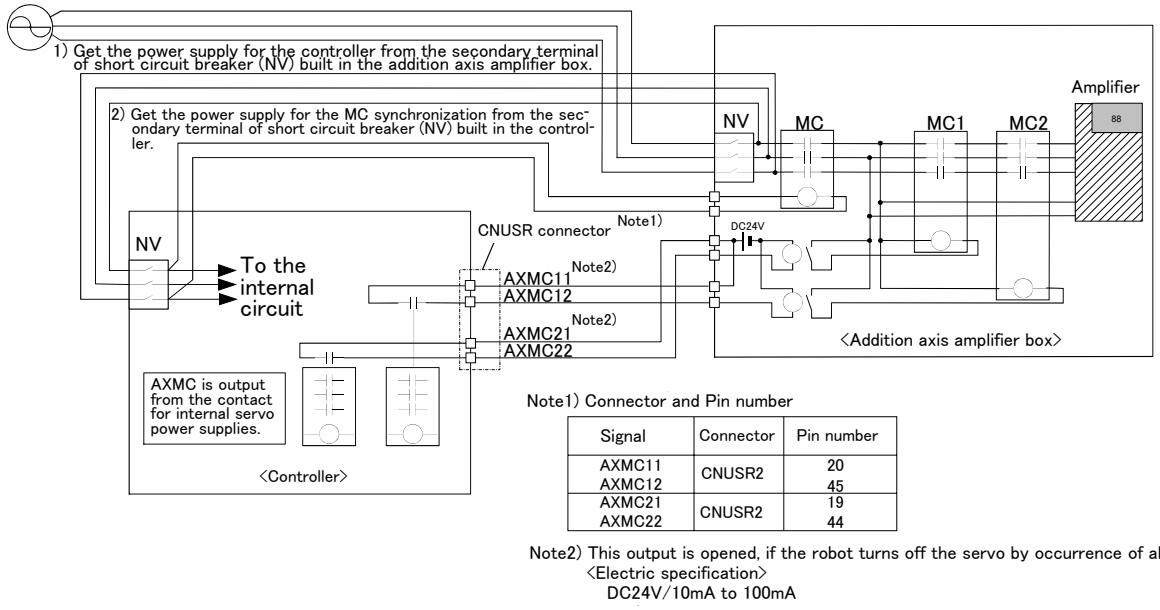
3.10 Magnet contactor control connector output (AXMC) for addition axes

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

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

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

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



Note1) Connector and Pin number

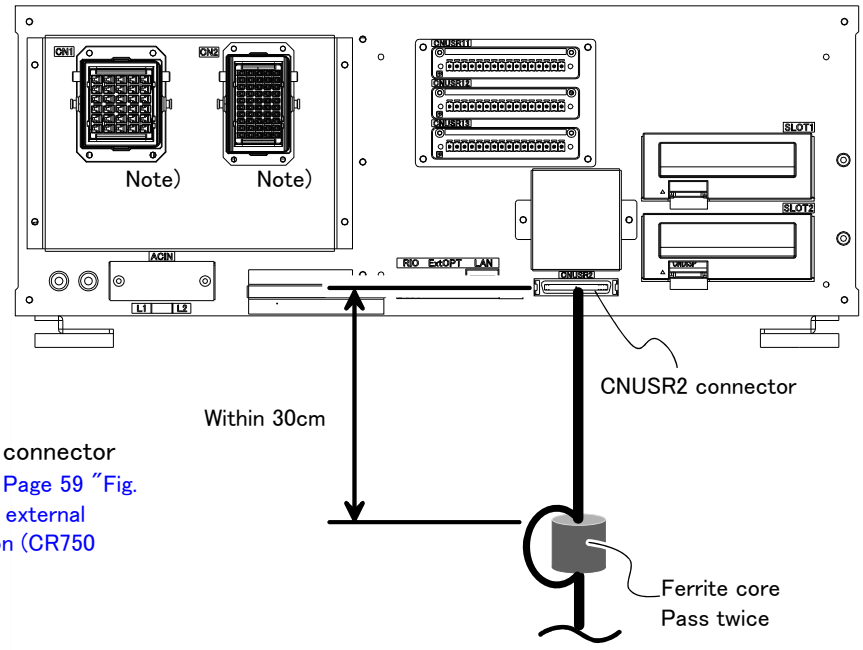
Signal	Connector	Pin number
AXMC11	CNUSR2	20
AXMC12		45
AXMC21	CNUSR2	19
AXMC22		44

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.3-26 : Example of circuit for addition axes of Magnet contactor control output

(1) CR750 controller

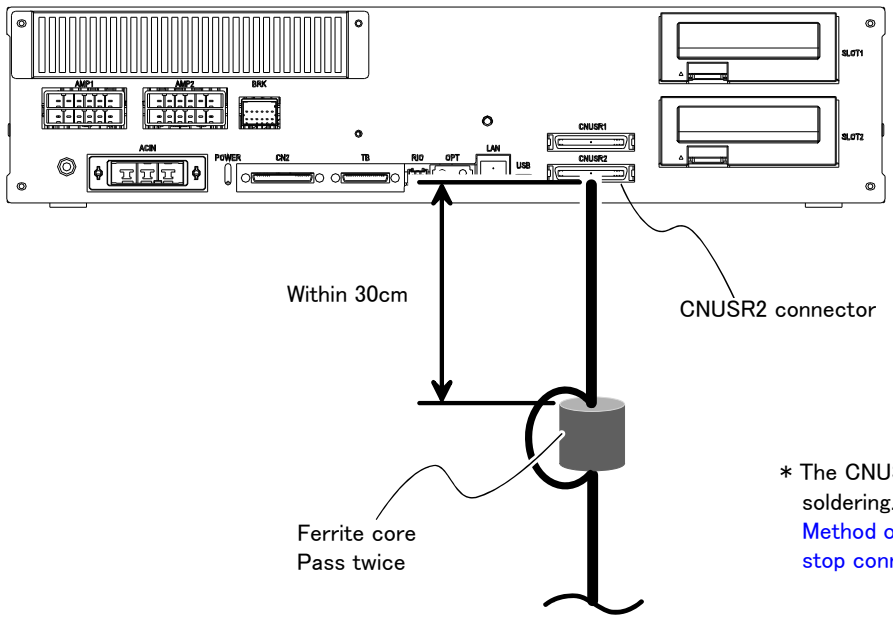


Note) The form of the machine cable connector (CN1/ CN2) may differ in RV-2F series.

*Connects with CNUSR2 connector with soldering. Refer to Page 59 "Fig. 3-12: Method of wiring for external emergency stop connection (CR750 (CNUSR2))".

Fig.3-27 : AXMC terminal connector (CR750)

(2) CR751 controller



* The CNUSR2 connector is connected by soldering. Refer to Page 62 "Fig. 3-15: Method of wiring for external emergency stop connection (CR751 (CNUSR1/2))".

Fig.3-28 : AXMC terminal connector (CR751)

3.11 Options

■ What are options?

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

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

(1) Teaching pendant (T/B)

■ Order type: CR750 controller.....R32TB: Cable length 7m
R32TB-15: Cable length 15m
CR751 controller.....R33TB: Cable length 7m
R33TB-15: Cable length 15m

■ Outline

This is used to create, edit and control the program, teach the operation position and for jog feed, etc.
For safety proposes, a 3-position enable switch is mounted.*1)

■ Configuration

Table 3-9 : Configuration device

Part name		Type	Qty.	Mass (kg) Note1)	Remarks
CR750 controller					
	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 controller					
	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 3-10 : Specifications

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

*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.

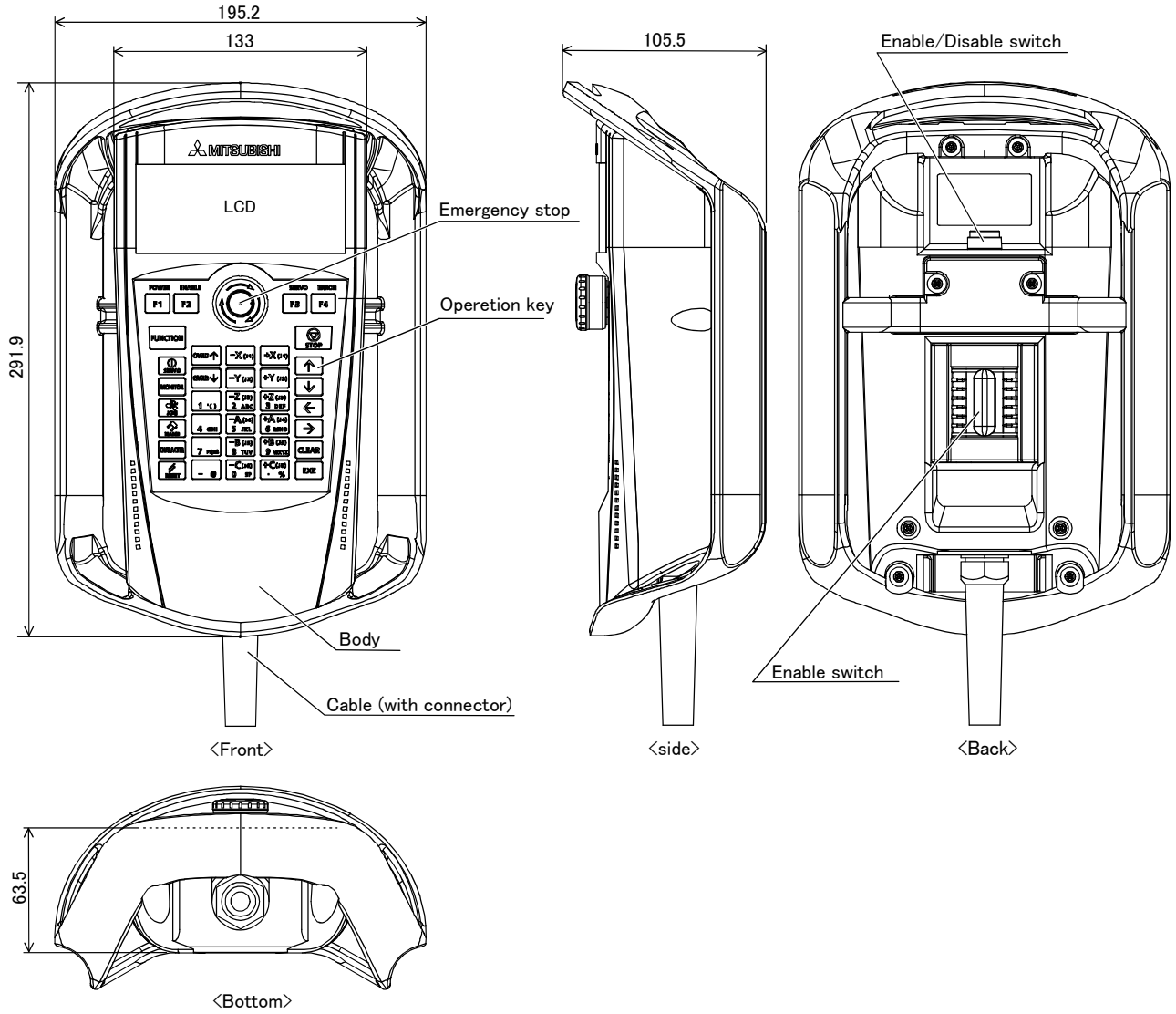
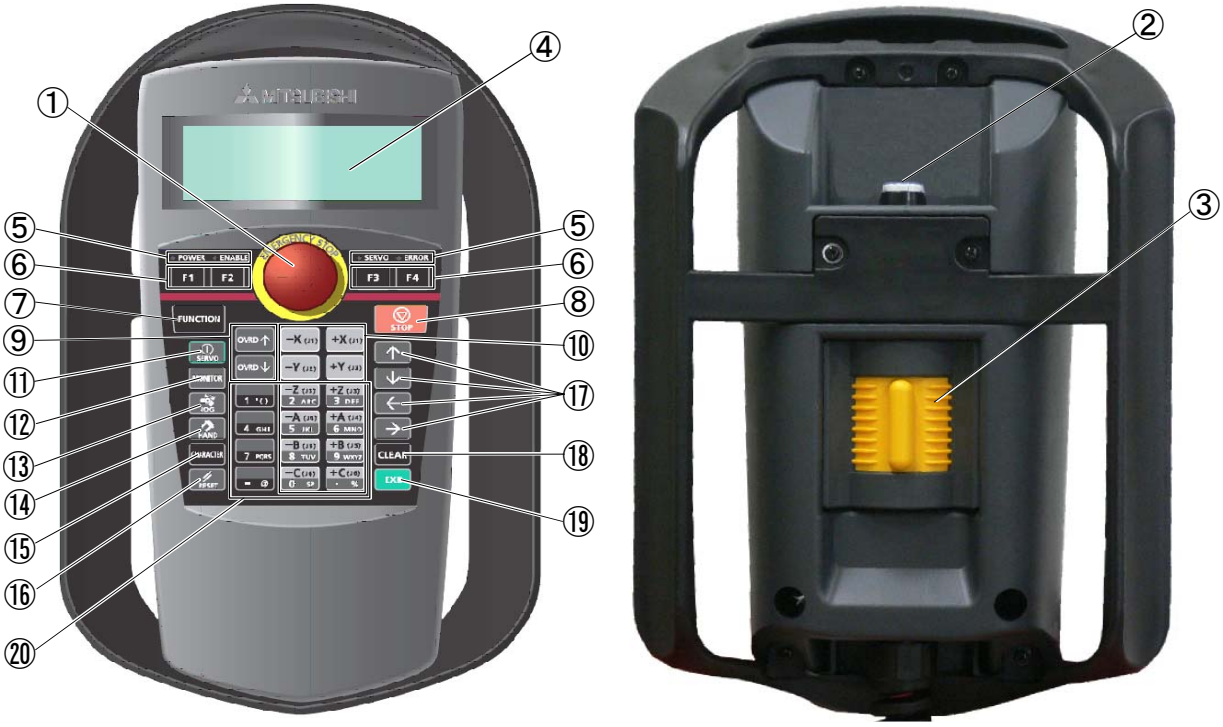


Fig.3-29 : Outside dimensions of teaching pendant

■ Installation method

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

■ Key layout and main functions



① [Emergency stop] switch ..... The robot servo turns OFF and the operation stops immediately.
② [Enable/Disable] switch ..... This switch changes the T/B key operation between enable and disable.
③ [Enable] switch..... When the [Enable/Disable] switch " ② " is enabled, and this key is released or pressed with force, the servo will turn OFF, and the operating robot will stop immediately.
④ LCD display panel ..... The robot status and various menus are displayed.
⑤ Status display lamp ..... Display the state of the robot or T/B.
⑥ [F1], [F2], [F3], [F4]..... Execute the function corresponding to each function currently displayed on LCD.
⑦ [FUNCTION] key ..... Change the function display of LCD.
⑧ [STOP] key..... This stops the program and decelerates the robot to a stop.
⑨ [OVRD ↑][OVRD ↓] key ..... Change moving speed. Speed goes up by [OVRD ↑] key. Speed goes down by [OVRD ↓] key
⑩ [JOG] operation key..... Move the robot according to jog mode. And, input the numerical value.
⑪ [SERVO] key..... Press this key with holding AA key lightly, then servo power will turn on.
⑫ [MONITOR] key ..... It becomes monitor mode and display the monitor menu.
⑬ [JOG] key..... It becomes jog mode and display the jog operation.
⑭ [HAND] key..... It becomes hand mode and display the hand operation.
⑮ [CHARCTER] key..... This changes the edit screen, and changes between numbers and alphabetic characters.
⑯ [RESET] key..... This resets the error. The program reset will execute, if this key and the EXE key are pressed.
⑰ [↑][↓][←][→] key..... Moves the cursor each direction .
⑱ [CLEAR] key ..... Erase the one character on the cursor position.
⑲ [EXE] key..... Input operation is fixed. And, while pressing this key, the robot moves when direct mode.
⑳ Number/Character key..... Erase the one character on the cursor position . And, inputs the number or character

Fig.3-30 : Teaching pendant key layout and main functions

(2) Parallel I/O interface

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

■ Outline

This is used to expand the external inputs and outputs

・The connecting cable with external equipment is not attached. Since we are preparing the external input-and-output cable (2D-CBL05 or 2D-CBL15) as the option, please use.

Notes)Although the combined use with the parallel input-and-output unit (2A-RZ361/2A-RZ371) of another option is also possible, please use the setup of the station number by the different number separately. The station number is automatically determined by the position of the option slot which installed this interface. (station number 0 to 2)

■ Configuration

Table 3-11 : Configuration device

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

Note1) Mass indicates one set.

■ Specifications

Table 3-12 : Electrical specifications of input circuits

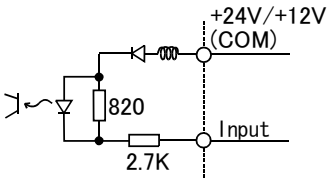
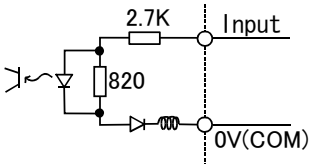
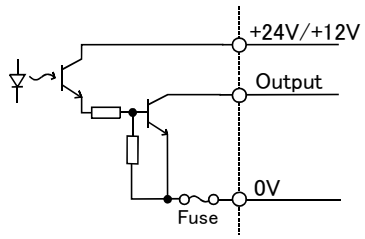
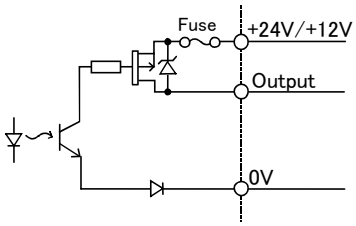
Item		Specification		Internal circuit
Type		DC input		<Sink type>  <Source type> 
Number of input points		32		
Insulation method		Photo coupler insulation		
Rated input voltage		DC12V	DC24V	
Rated input current		Approx. 3mA	Approx.9mA	
Working voltage range		DC10.2 ～ 26.4V (Ripple factor should be less than 5%)		
ON voltage/ON current		DC8V or more/2mA or more		
OFF voltage/ OFF current		DC4V or less/1mA or less		
Input resistance		Approx. 2.7kΩ		
Response time	OFF-ON	10ms or less(DC24V)		
	ON-OFF	10ms or less(DC24V)		
Common method		32 points per common		
External cable connection method		Connector		

Table 3-13 : Electrical specifications for the output circuits

Item		Specification	Internal circuit
Type		Transistor output	<Sink type>  <Source type> 
No. of output points		32	
Insulation method		Photo-coupler insulation	
Rated load voltage		DC12V/DC24V	
Rated load voltage range		DC10.2 ～ 30V (peak voltage DC30V)	
Max. load current		0.1A/point (100%)	
Leakage current at OFF		Within 0.1mA	
Max. voltage drop at ON		DC0.9V(TYP.) Note1)	
Respons e time	OFF-ON	10ms or less(Resistance load) (hardware response time)	
	ON-OFF	10ms or less(Resistance load) (hardware response time)	
Fuse rating		Fuse 1.6A(one per common) Replacement possible (max. 3)	
Common method		16 points per common (common terminal: 2points)	
External wire connection method		Connector	
External power supply	Voltage	DC12/24V(DC10.2 ～ 30V)	
	Current	60mA(TYP.DC24V per common)(base drive current)	

Note1) The maximum voltage drop value at signal ON.
Refer to it for the equipment connected to the output circuit.

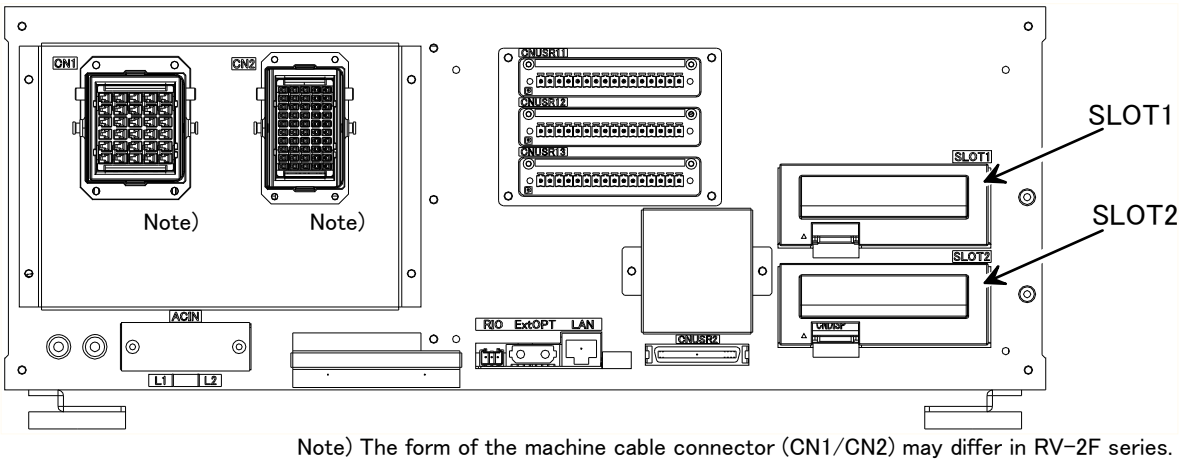
⚠ Caution The protection fuse of the output circuit prevents the failure at the time of the load short circuit and incorrect connection. The load connected of the customer should be careful not to exceed maximum rating current. The internal transistor may be damaged if maximum rating current is exceeded.

■ Installation method

The expansion parallel input/output interface is installed in the controller. Refer to separate "Instruction Manual/ Controller setup, basic operation, and maintenance" for details on the installing method.
If it installs in the option SLOT of the controller, the station number will be assigned automatically.
SLOT1: station number 0(0 to 31)
SLOT2: station number 1(32 to 63)

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

<CR750 controller>



Note) The form of the machine cable connector (CN1/CN2) may differ in RV-2F series.

Fig.3-31 : Parallel I/O interface installation position (CR750)

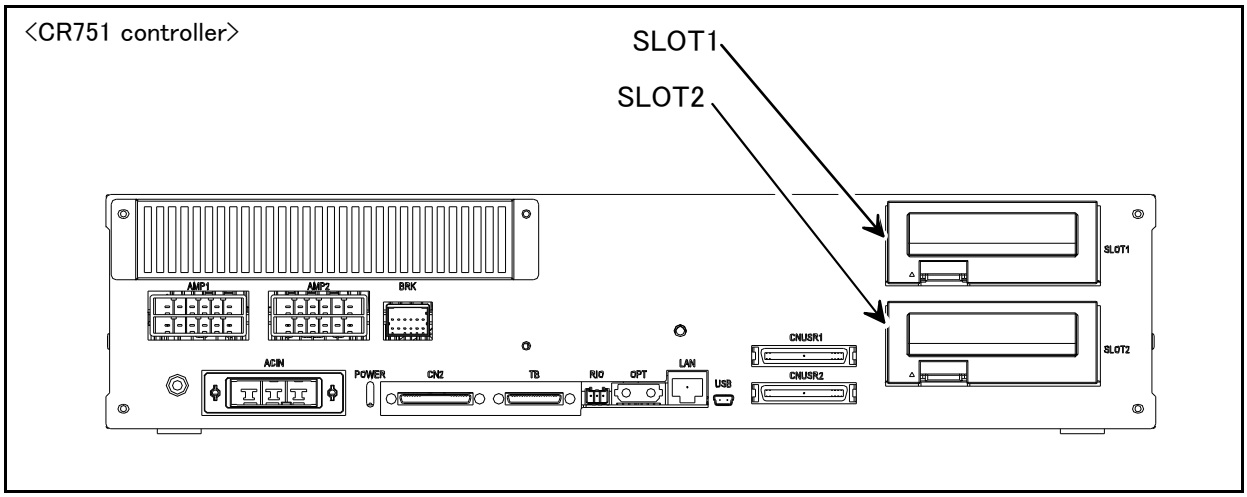


Fig.3-32 : Parallel I/O interface installation position (CR751)

■ Pin layout of connector

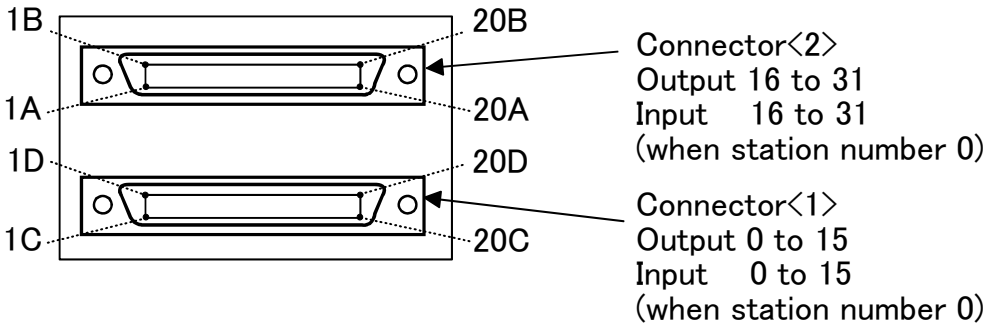


Fig.3-33 : Pin layout of connector

■ Connector pin No. and signal assignment

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

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

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

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

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

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

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

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

Pin No.	Line color	Function name		Pin No.	Line color	Function name	
		General-purpose	Dedicated/power supply, common			General-purpose	Dedicated/power supply, common
1A	Orange/Red a		0V : For pins 5B-20B	1B	Orange/Black a		12V/24V : For pins 5B-20B
2A	Gray/Red a		COM : For pins 5A-20A Note1)	2B	Gray/Black a		Reserved
3A	White/Red a		Reserved	3B	White/Black a		Reserved
4A	Yellow/Red a		Reserved	4B	Yellow/Black a		Reserved
5A	Pink/Red a	General-purpose input 31		5B	Pink/Black a	General-purpose output 31	
6A	Orange/Red b	General-purpose input 30		6B	Orange/Black b	General-purpose output 30	
7A	Gray/Red b	General-purpose input 29		7B	Gray/Black b	General-purpose output 29	
8A	White/Red b	General-purpose input 28		8B	White/Black b	General-purpose output 28	
9A	Yellow/Red b	General-purpose input 27		9B	Yellow/Black b	General-purpose output 27	
10A	Pink/Red b	General-purpose input 26		10B	Pink/Black b	General-purpose output 26	
11A	Orange/Red c	General-purpose input 25		11B	Orange/Black c	General-purpose output 25	
12A	Gray/Red c	General-purpose input 24		12B	Gray/Black c	General-purpose output 24	
13A	White/Red c	General-purpose input 23		13B	White/Black c	General-purpose output 23	
14A	Yellow/Red c	General-purpose input 22		14B	Yellow/Black c	General-purpose output 22	
15A	Pink/Red c	General-purpose input 21		15B	Pink/Black c	General-purpose output 21	
16A	Orange/Red d	General-purpose input 20		16B	Orange/Black d	General-purpose output 20	
17A	Gray/Red d	General-purpose input 29		17B	Gray/Black d	General-purpose output 19	
18A	White/Red d	General-purpose input 18		18B	White/Black d	General-purpose output 18	
19A	Yellow/Red d	General-purpose input 17		19B	Yellow/Blackc d	General-purpose output 17	
20A	Pink/Red d	General-purpose input 16		20B	Pink/Black d	General-purpose output 16	

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

<Reference> The example of connection with our PLC

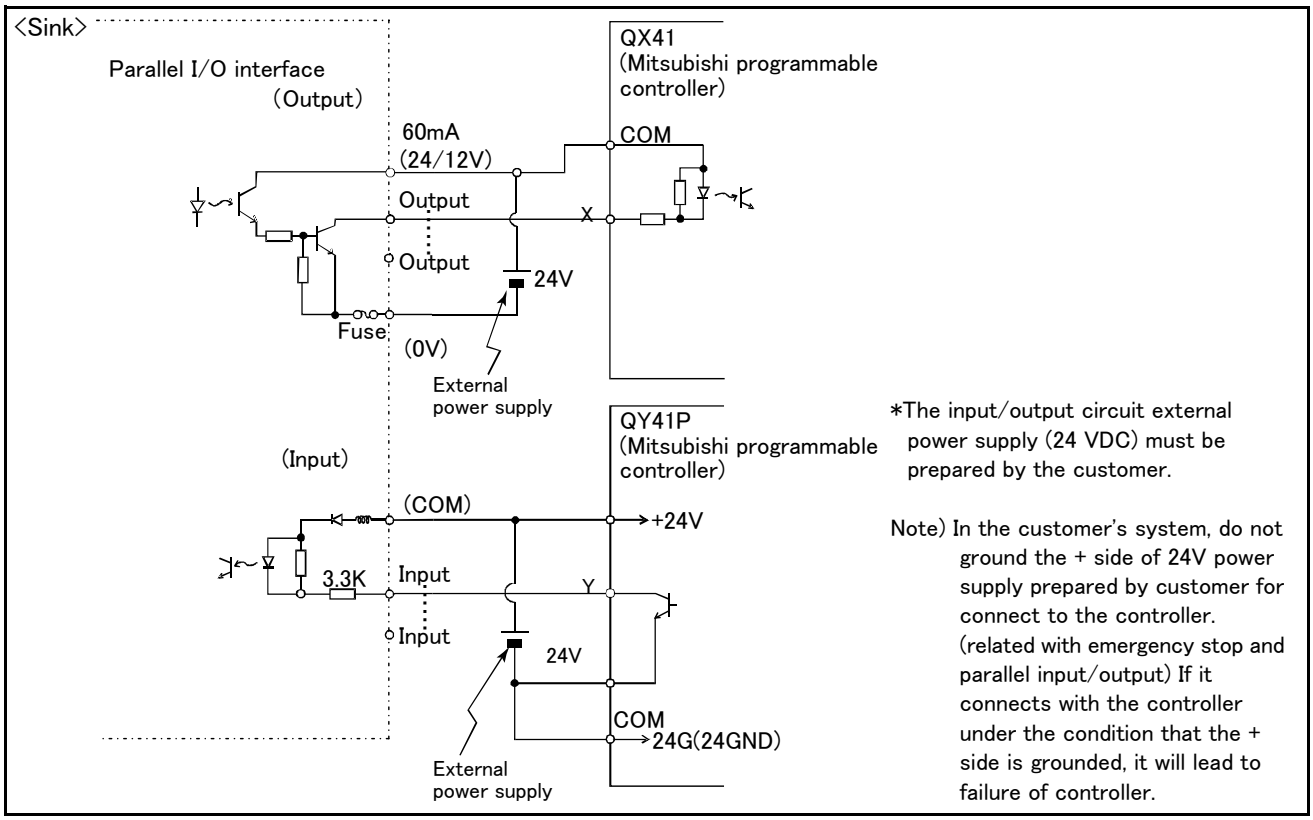


Table 3-17 : Connection with a Mitsubishi PLC (Example of sink type)

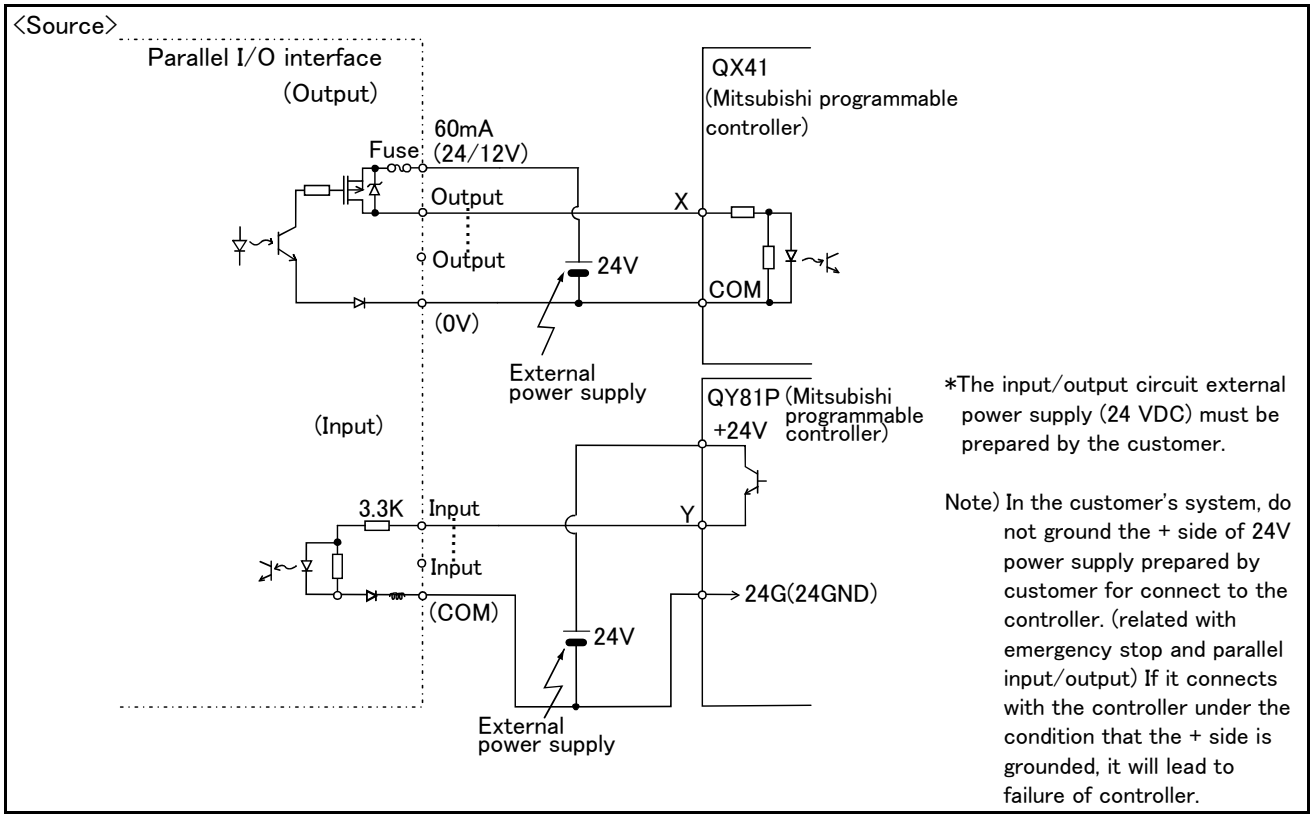


Table 3-18 : Connection with a Mitsubishi PLC (Example of source type)

(3) External I/O cable

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

■ Outline

This is the dedicated cable used to connect an external peripheral device to the connector on the parallel I/O interface. For parallel I/O unit is another option 2A-CBL.**.
One end matches the connector on the parallel input/output unit, and the other end is free. Connect the peripheral device's input/output signal using the free end.
One cable correspond to the input 16 points and output 16 points.
Two cables are needed to connection of (input 32 points and output 32 points) with built-in standard.

■ Configuration

Table 3-19 : Configuration device

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

Note1) Mass indicates one set.

■ Specifications

Table 3-20 : Specifications

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

■ Connector pin numbers and cable colors

Table 3-21 : Connector pin numbers and cable colors

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

Notes) Pin number of connector<1> are 1C, 2C, ...20C, 1D, 2D, ...20D, connector<2> are 1A, 2A, ...20A, 1B, 2B, ...20B.

■ Connections and outside dimensions

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

(Eg.) Pin number: color indication

1 : Orange ／ Red ／ A

- Type of dot mark (see figure below)
- Color of dot mark
- Color of sheath

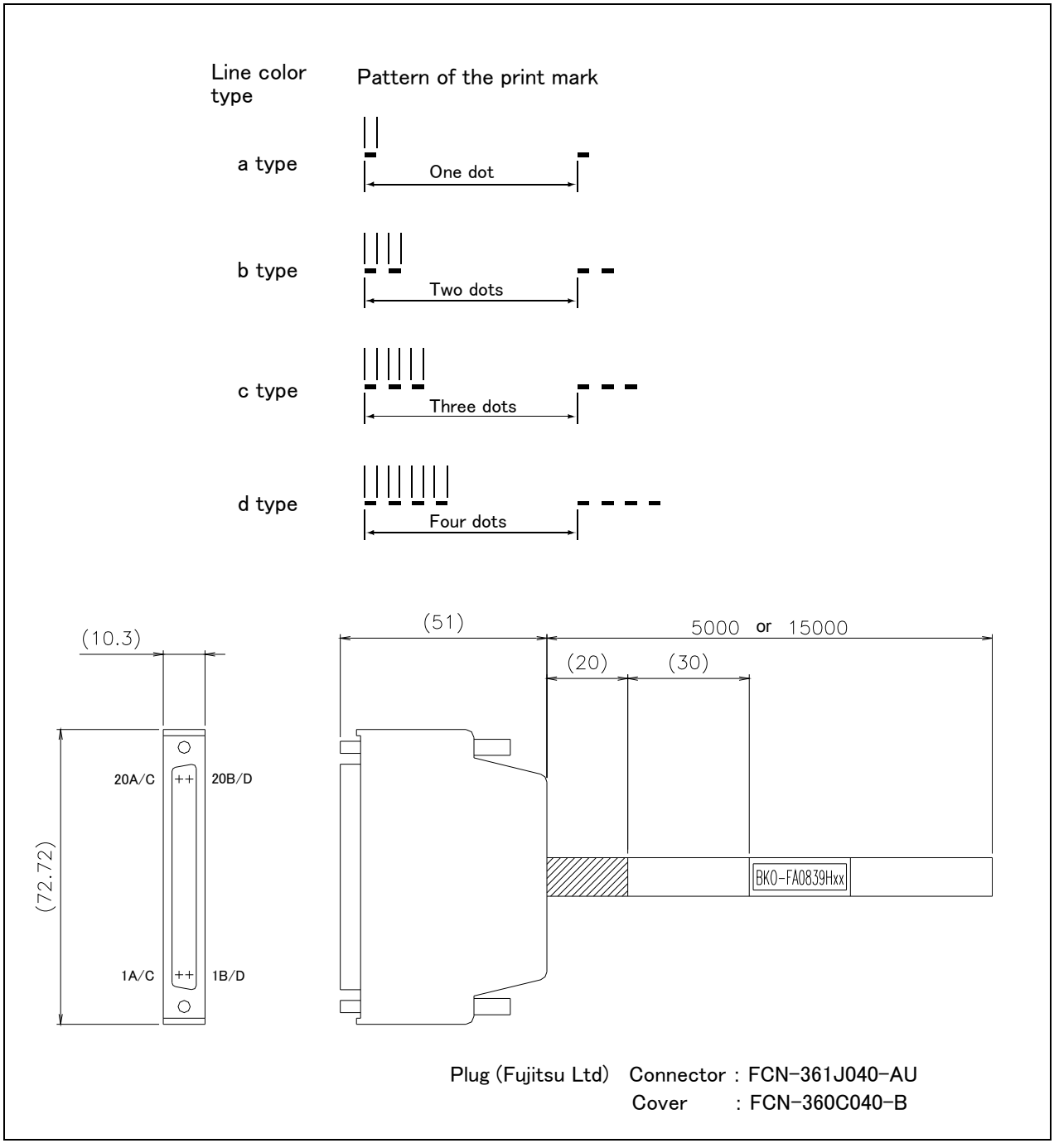


Fig.3-34 : Connections and outside dimensions

(4) Parallel I/O unit

■ Order type: 2A-RZ361(Sink type)
2A-RZ371(Source type)

■ Outline

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

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

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

■ Configuration

Table 3-22 : Configuration device

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

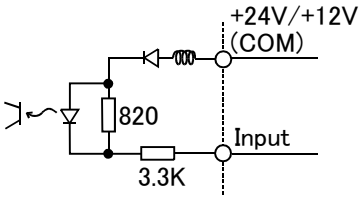
Note1) Mass indicates one set.

■ Specifications

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

Table 3-23 : Electrical specifications of input circuits

Item		Specification		Internal circuit
Type		DC input		<Sink type>
Number of input points		32		
Insulation method		Photo coupler insulation		
Rated input voltage		24VDC	24VDC	
Rated input current		Approx 3mA	Approx 7mA	
Working voltage range		10.2 to 26.4VDC(Ripple factor should be less than 5%.)		
ON voltage/ON current		8VDC or more/ 2mA or more		
OFF voltage/ OFF current		4VDC or less/ 1mA or less		
Input resistance		Approx. 3.3kΩ		<Source type>
Response time	OFF-ON	10ms or less (24VDC)		
	ON-OFF	10ms or less (24VDC)		
Common method		8 points per common		
External cable connection method		Connector		



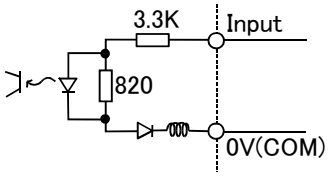
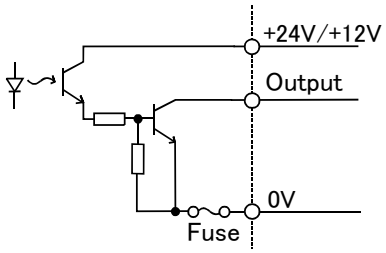
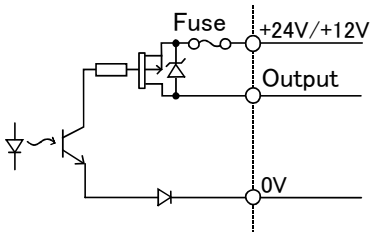


Table 3-24 : Electrical specifications for the output circuits

Item		Specification	Internal circuit
Type		Transistor output	<Sink type> 
No. of output points		32	
Insulation method		Photo-coupler insulation	
Rated load voltage		12VDC/24VDC	
Rated load voltage range		10.2 to 30VDC(peak voltage 30VDC)	
Max. load current		0.1A/point (100%)	
Leakage current at OFF		0.1mA or less	
Max. voltage drop at ON		0.9VDC(TYP.) Note1)	
Response time	OFF-ON	2ms or less (hardware response time)	
	ON-OFF	2ms or less (Resistance load) (hardware response time)	<Source type> 
Fuse rating		Fuse 3.2A (one per common) Replacement not possible	
Common method		8 points per common (common terminal: 4 points)	
External wire connection method		Connector	
External power supply	Voltage	12VDC/24VDC(10.2 to 30VDC)	
	Current	60mA (TYP. 24VDC per common) (base drive current)	

Note1) The maximum voltage drop value at signal ON.
Refer to it for the equipment connected to the output circuit.

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

NETcable-1 (Network cable)

Pin No.	RIO1/2
1	TXRXH
2	TXRXL
3	SG(GND)

Note 2)

RIO1/2	Pin No.
TXRXH	1
TXRXL	2
SG(GND)	3

FG

DCcable-2 (Power cable)

Pin No.	DCIN
1	24V
2	24G(RG)
3	FG(PE)

+ Note 1)
24V Power
−

Connected the frame ground or protect ground

R-TM (Terminator)

Pin No.	RIO1/2
1	TXRXH
2	TXRXL
3	SG(GND)

100Ω

List of parts and manufacturer

Type	Connector type	Contact type	Resistant	Manufacturer
NETcable-1	51103-0300 (1)	50351-8100 (3)	—	MOLEX (White connector)
DCcable-2	2-178288-3 (1)	175218-3 (3)	—	Tyco Electronics (Black connector)
R-TM	1-178288-3 (1)	175218-3 (2)	100Ω(1/4W) (1)	Equivalent to KOA.

Note 1) The 24V power supply is prepared by customer (The power consumption is approx. 0.3A.)
In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

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

Fig.3-35 : Spacifications for the connection cable

■ Installation method

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

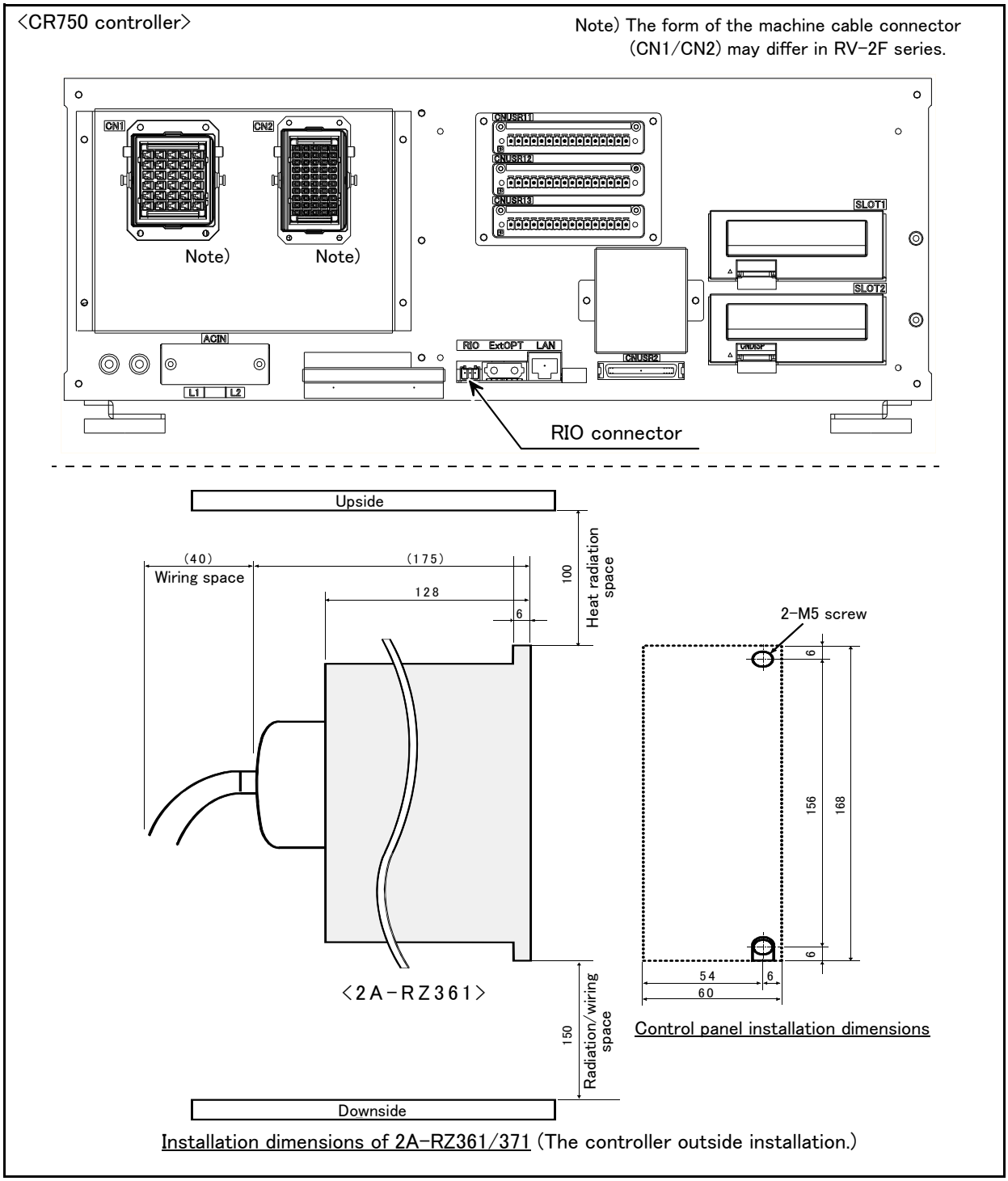
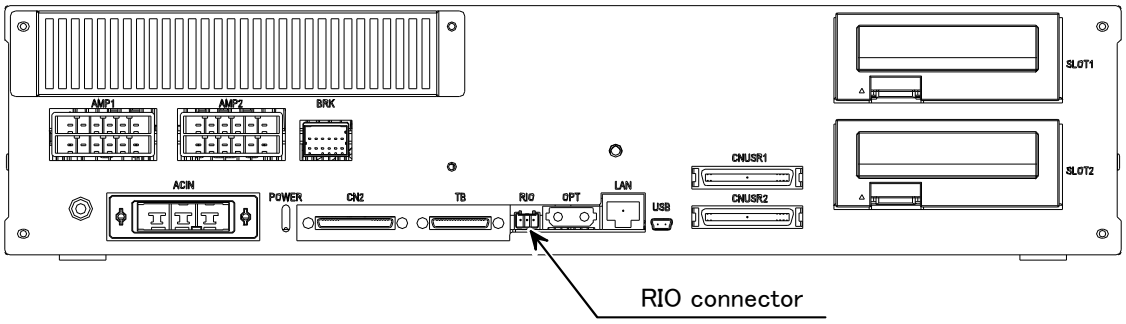
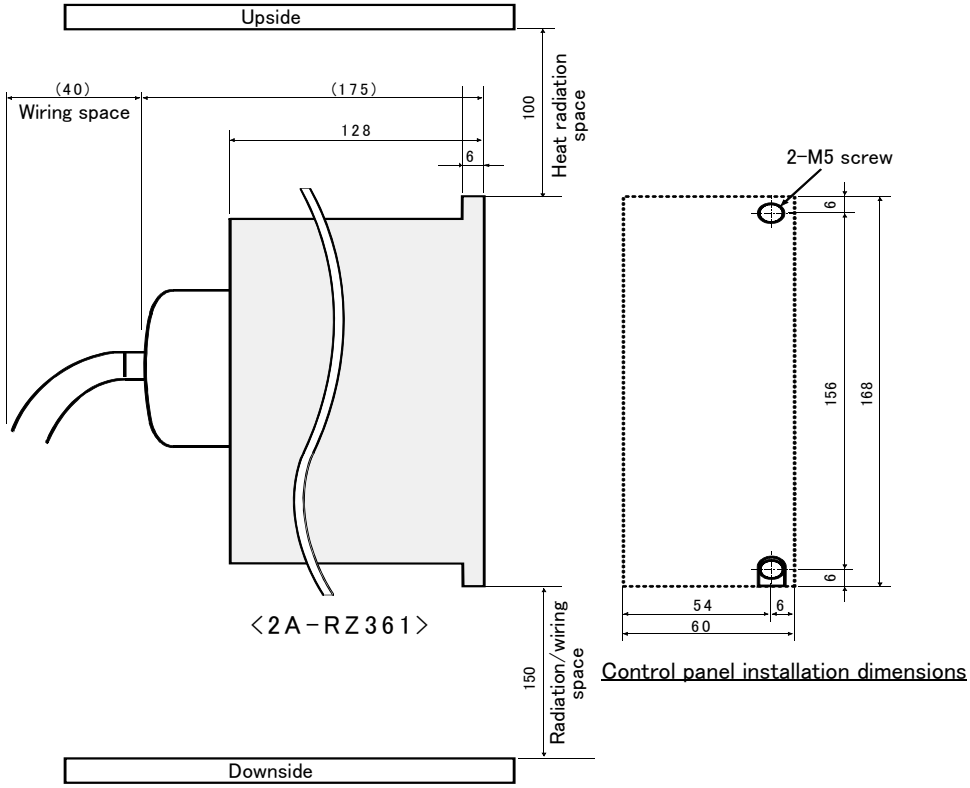


Fig.3-36 : Installing the parallel I/O unit (CR750)

<CR751 controller>

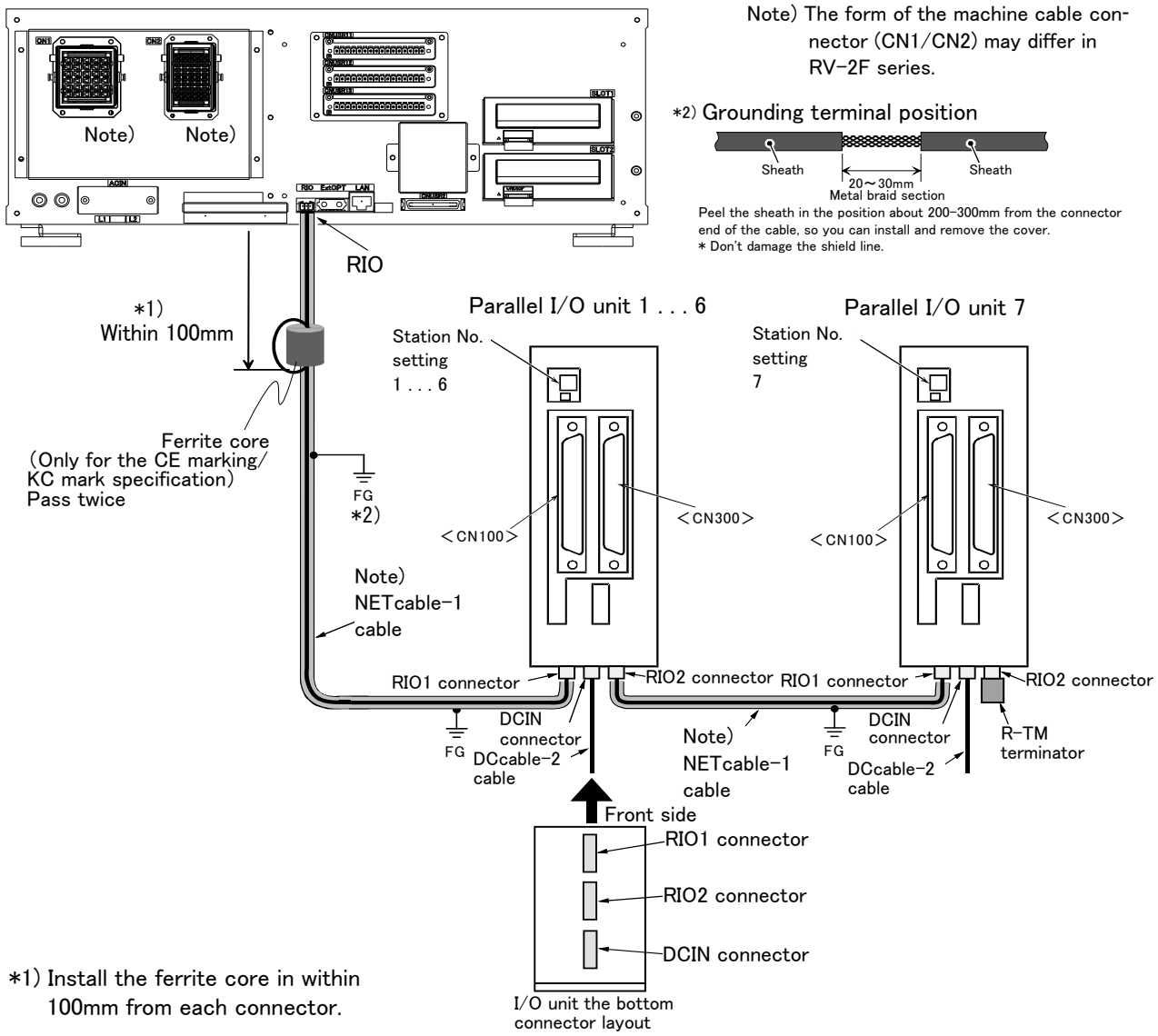




Installation dimensions of 2A-RZ361/371 (The controller outside installation.)

Fig.3-37 : Installing the parallel I/O unit (CR751)

<CR750 controller>



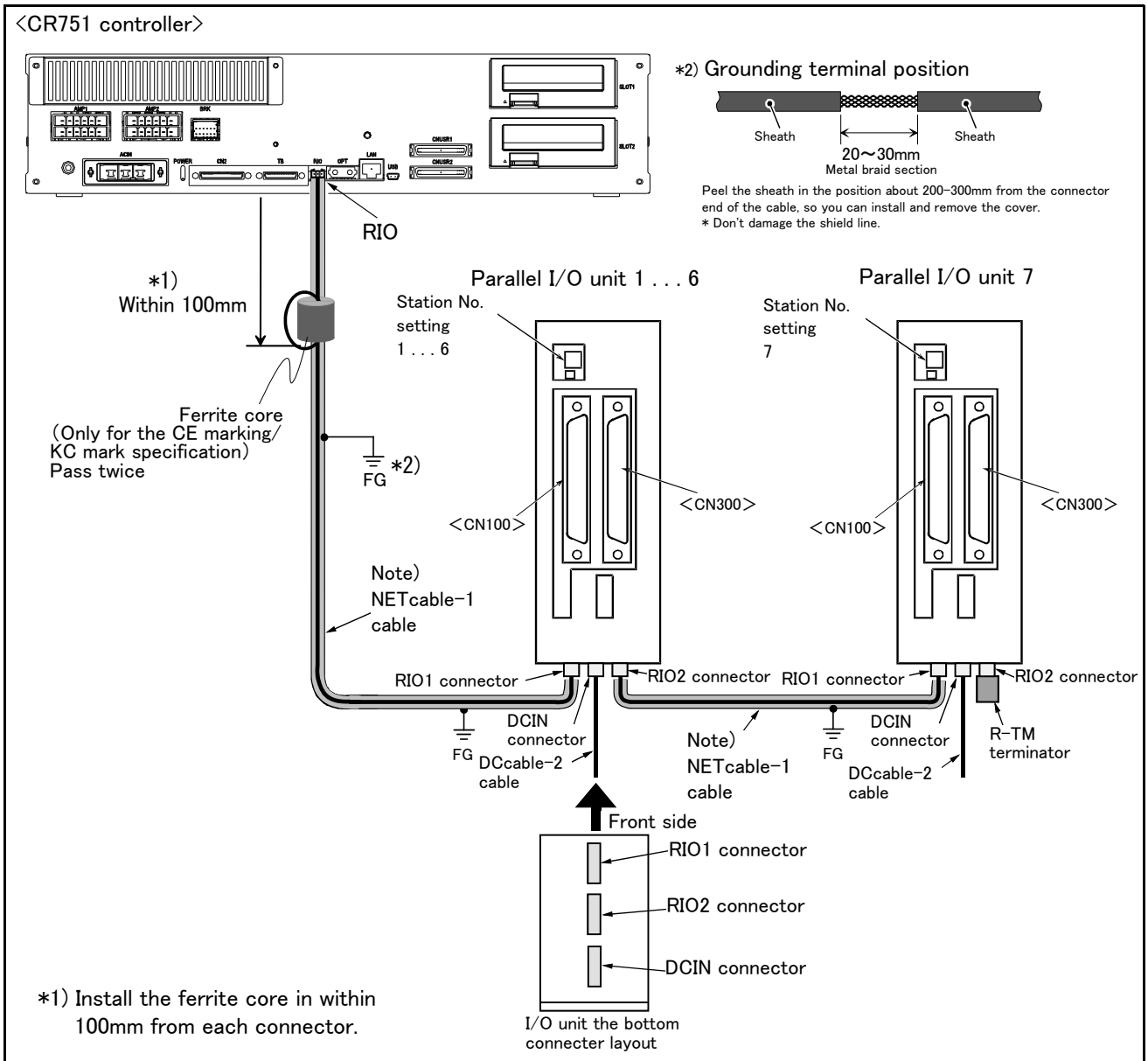
Note) The form of the machine cable connector (CN1/CN2) may differ in RV-2F series.

*2) Grounding terminal position

Peel the sheath in the position about 200-300mm from the connector end of the cable, so you can install and remove the cover.
* Don't damage the shield line.

*1) Install the ferrite core in within 100mm from each connector.

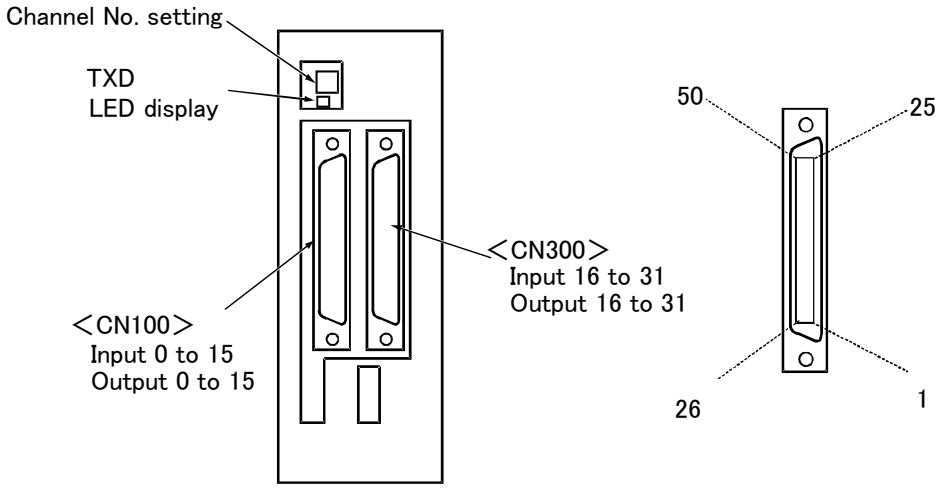
Connect the NET cable-1 to the RIO connector on the back of the controller. Each unit is connected to from a daisy chain.
Always install a terminator (R-TM) to the last unit.
Note) Use a shield cable for NET cable-1 as a measure against noise.
Always connect the shield to FG. Install the attached ferrite core in both ends.
The unit could malfunction because of noise if the shield cable is not used.



Connect the NET cable-1 to the RIO connector on the back of the controller. Each unit is connected to from a daisy chain.
Always install a terminator (R-TM) to the last unit.
Note) Use a shield cable for NET cable-1 as a measure against noise.
Always connect the shield to FG. Install the attached ferrite core in both ends.
The unit could malfunction because of noise if the shield cable is not used.

Fig.3-38 : Connection method of expansion parallel I/O unit (CR751)

■ Pin arrangement of the connector



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

Fig.3-39 : Pin arrangement of the parallel I/O unit

■ Assignment of pin number and signal

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

Table 3-25 : Assignment of pin number and signal

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

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

■ Parallel I/O interface (First expansion unit)

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

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

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

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

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

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

<Reference> The example of connection with our PLC

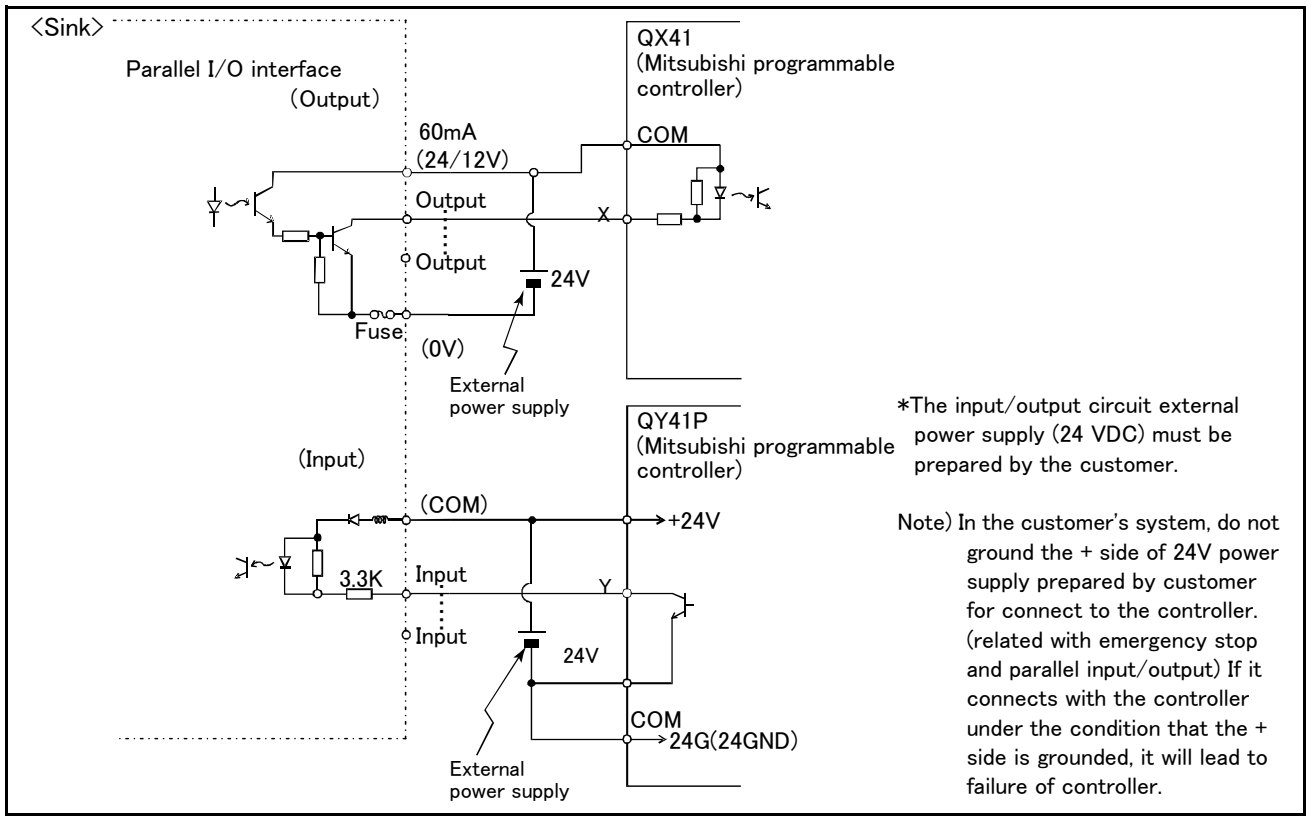


Table 3-28 : Connection with a Mitsubishi PLC (Example of sink type)

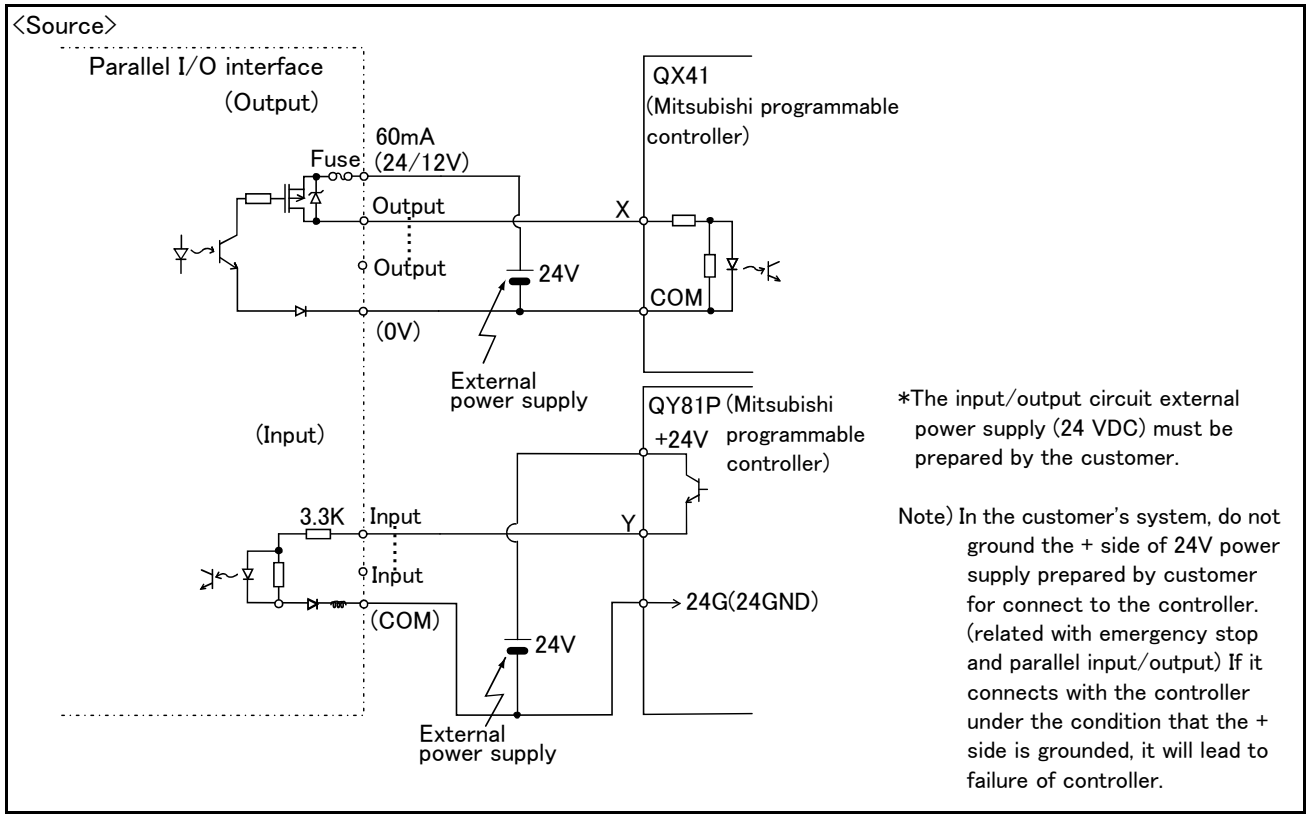


Table 3-29 : Connection with a Mitsubishi PLC (Example of source type)

(5) External I/O cable

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

■ Outline

This is the dedicated cable used to connect an external peripheral device to the connector on the parallel input/output unit.
One end matches the connector on the parallel input/output unit, and the other end is free. Connect the peripheral device's input/output signal using the free end.
One cable correspond to the input 16 points and output 16 points.
Two cables are needed to connection of (input 32 points and output 32 points) with built-in standard.

■ Configuration

Table 3-30 : Configuration device

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

Note1) Mass indicates one set.

■ Specifications

Table 3-31 : Specifications

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

■ Connector pin numbers and cable colors

Table 3-32 : Connector pin numbers and cable colors

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

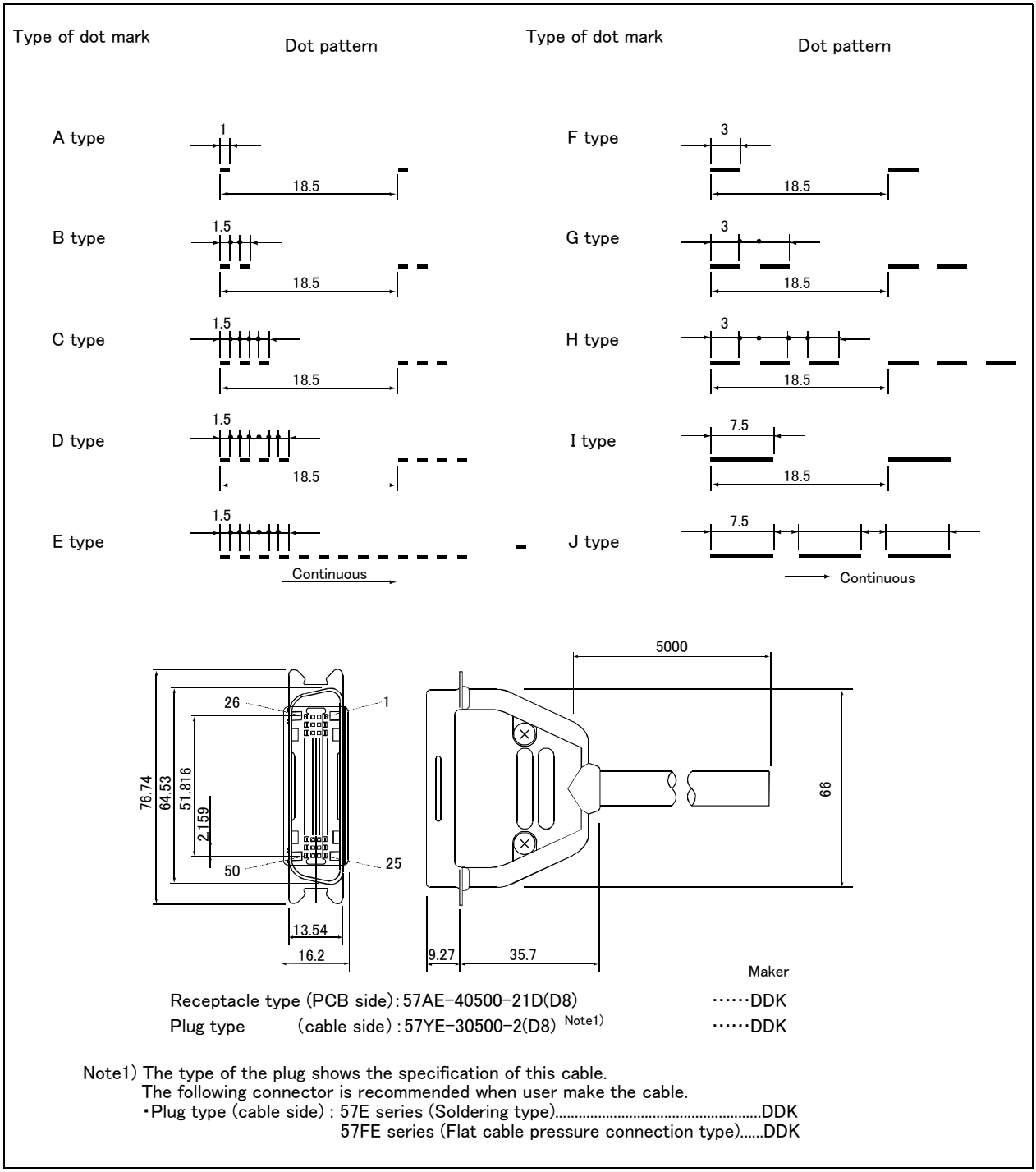
■ Connections and outside dimensions

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

(Eg.) Pin number: color indication

1 : Orange ／ Red ／ A

- A: Type of dot mark (see figure below)
- Red: Color of dot mark
- Orange: Color of sheath



Note1) The type of the plug shows the specification of this cable.
The following connector is recommended when user make the cable.
・Plug type (cable side) : 57E series (Soldering type).....DDK
57FE series (Flat cable pressure connection type).....DDK

Fig.3-40 : Connections and outside dimensions

(6) CC-Link interface

■ Order type: ● 2D-TZ576

■ Outline

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

■ Configuration

Table 3-33 : Configuration device

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

Note1) Mass indicates one set.

Table 3-34 : Procured by the customer

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

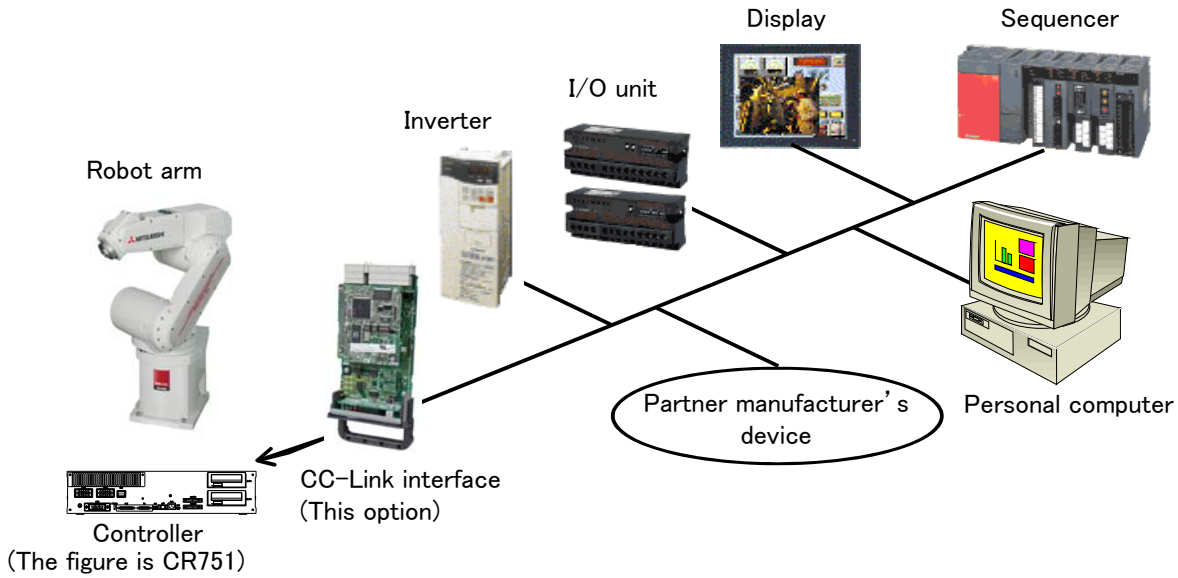


Fig.3-41 : Example of CC-Link Product Configuration

■ Specifications

Table 3-35 : Specifications

Item			Specifications				Remarks
Communication function			Bit data and word data can be transmitted.				Word data are used by the registers.
Station type			Intelligent device station Note1)				
Support station			Local station				No master station function
The version corresponding to CC-Link			Ver.2				The extended cyclic setup is possible.
Mountable option slot			Slot 1, 2				
Number of mountable CC-Link interface cards			1				Multiple CC-Link interface cards cannot be inserted.
Number of stations			1 to 64 stations				When four stations are occupied, continuous station numbers are used. The station numbers are set by a DIP switch.
Transmission speed			10M/5M/2.5M/625K/156K bps				This is set by the rotary SW.
Station number			1 to 64				When two or more stations are occupied, continuous station numbers are used.
Number of occupied stations			1/2/3/4				
Extended cyclic setup			1/2/4/8				
Maximum link point		Remote I/O (RX, RY).	Each 896 points				The two last cannot be used.
		Remote register (RWr, RWw)	Each 128 register				16 bits/register
Extended cyclic setup		–	1 fold setup	2 fold setup	3 fold setup	4 fold setup	
Link point per set	When one station is occupied	Remote I/O (RX, RY).	32 point	32 point	64 point	128 point	
		Remote register (RWw)	4 word	8 word	16 word	32 word	
		Remote register (RWr)	4 word	8 word	16 word	32 word	
	When two stations is occupied	Remote I/O (RX, RY).	64 point	96 point	192 point	384 point	
		Remote register (RWw)	8 word	16 word	32 word	64 word	
		Remote register (RWr)	8 word	16 word	32 word	64 word	
	When three stations is occupied	Remote I/O (RX, RY).	96 point	160 point	320 point	640 point	
		Remote register (RWw)	12 word	24 word	48 word	96 word	
		Remote register (RWr)	12 word	24 word	48 word	96 word	
	When four stations is occupied	Remote I/O (RX, RY).	128 point	224 point	448 point	896 point	
		Remote register (RWw)	16 word	32 word	64 word	128 word	
		Remote register (RWr)	16 word	32 word	64 word	128 word	
Number of the maximum occupancy station			4 stations				
The I/O first number of the robot controller.			No. 6000 –. The number corresponding to the station number by the setup of the parameter "CCFIX."				

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

■ Functions

(1) Communication function

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

(2) Easy setup

・ The CC-Link interface card can be set by a rotary switch or DIP switch.

・No separate space is required to mount the CC-Link interface card as it is embedded in the robot controller (can only be mounted into slot 2).

・ Easy wiring since only four terminals need to be connected.

・ Dedicated commands have been added to MELFA-BASIC V (robot programming language); thus, no complex interface programming is required.

(3) High-speed response

・The link scan time when connecting 64 stations is approximately 7.2 ms, achieving superior high-speed response performance.

・ A transmission speed can be selected from 10M, 5M, 2.5M, 625K and 156K bps according to the transmission distance.

(7) RT ToolBox2/RT ToolBox2 mini

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

■ Outline

This is handy software that fully uses the personal computer functions. It can be used in various stages from the robot specifications study (tact study, etc.) to the design support (creation and editing of programs), start up support (execution, control and debugging of program), and maintenance.
The "personal computer support software" which supports these function fully, and the "personal computer support software mini" which does not have the simulation function are available.

■ Configuration

Table 3-36 : 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 3-37 : Functions

Function		Functional existence[Note1)]		Details
Compatible model		○	○	Personal computer running Microsoft Windows2000/XP/Vista/7. [Note2)]
Program editing functions	Editing functions	○	○	・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	○	○	・Program file control (list, copy, movement, delete, content comparison, name change, protect)
	Debugging functions	○	○	・Direct editing of program in controller ・Confirmation of robot program operation (step execution, direct execution)
Simulation function		○	×	・Off-line simulation of robot program operation using CG (computer graphics) ・Tact time calculation
Monitor functions		○	○	・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		○	○	・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.

(8) Instruction Manual(bookbinding)

■ Order type: ● 5F-FE01-PE01 .....RV-2F-D series

■ Outline

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

■ Configuration

Table 3-38 : Product configuration

Name	Type	Mass (Kg) Note1)	Specifications
Instruction Manual	5F-FE01-PE01	2.6	The instructions manual set of "RV-2F-D series".
Safety Manual	BFP-A8006	-	Items relating to safety in handling the robot
Standard Specifications	BFP-A8900	-	Specification of the robot arm and controller
Robot Arm Setup & Maintenance	BFP-A8904	-	Installation method of the robot arm, jog operation, and maintenance and inspection procedures
Controller Setup, Basic Operation and Maintenance	BFP-A8867	-	Installation method of the controller, basic operation, and maintenance and inspection procedures
Detailed Explanation of Functions and Operations	BFP-A8869	-	Functions of the controller and T/B, operation method, and explanation of MELFA-BASIC V
Troubleshooting	BFP-A8871	-	Causes of errors occurred and their countermeasures
Additional axis function	BFP-A8863	-	Function of the additional axis, operation method.
Tracking Function Manual	BFP-A8664	-	Function of the Tracking, operation method.
GOT Direct Connection Extended Function	BFP-A8849	-	Explains of data configuration of shared memory, monitoring, and operating procedures, between the GOT and controller.

Note1) Mass indicates one set.

3.12 Maintenance parts

The consumable parts used in the controller are shown in Table 3-39. 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 3-39 : Controller consumable parts list

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

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

4 Software

4.1 List of commands

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

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

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

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

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

4.2 List of parameters

Show the main parameter in the Table 4-2.

Table 4-2 : List of parameters

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

Parameter		Details
Hand type	HANDTYPE	Set the hand type of the single/double solenoid, and the signal No. (Single/double = S/D) Set the signal No. after the hand type. Example) D900
Stop input B contact designation	INB	Change the dedicated input (stop) to either of normal open or normal close.
User-designated origin	USERORG	Designate the user-designated origin position.
Program selection memory	SLOTON	Select the program selected previously when initializing the slot. The non-selected state will be entered when not set.
Communication setting	CBAU232	Set the baud rate.
	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)
Select the function of singular point adjacent alarm	MESNGLSW	Designate the valid/invalid of the singular point adjacent alarm. (Invalid/Valid = 0/1) When this parameter is set up "VALID", this warning sound is buzzing even if parameter: BZR (buzzer ON/OFF) is set up "OFF".
Display language.	LNG	Change the language to display on the LCD display of teaching pendant.

5 Instruction Manual

5.1 The details of each instruction manuals

The contents and purposes of the documents enclosed with this product are shown below. Use these documents according to the application.
Instruction manuals enclosed in dashed lines in the list below are for optional products.
For special specifications, a separate instruction manual describing the special section may be enclosed.

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

6 Safety

6.1 Safety

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

6.1.1 Self-diagnosis stop functions

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

Table 6-1 : Self-diagnosis stop functions

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

Table 6-2 : List of stop functions

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

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

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

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

Note1) The external emergency stop input is prepared as a normal close for safety proposes. Thus, if the emergency stop input circuit is opened when the robot is started up, the robot will not operate. Refer to Page 116, "6.1.7 Examples of safety measures"for details.
And, refer to Page 66, "(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
・lways 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 controller. Create a circuit as shown below for safety measures. In addition, the figure shows the normal state which is not in the emergency stop state.

[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 126, "(3) External emergency stop connection [supplementary explanation]".

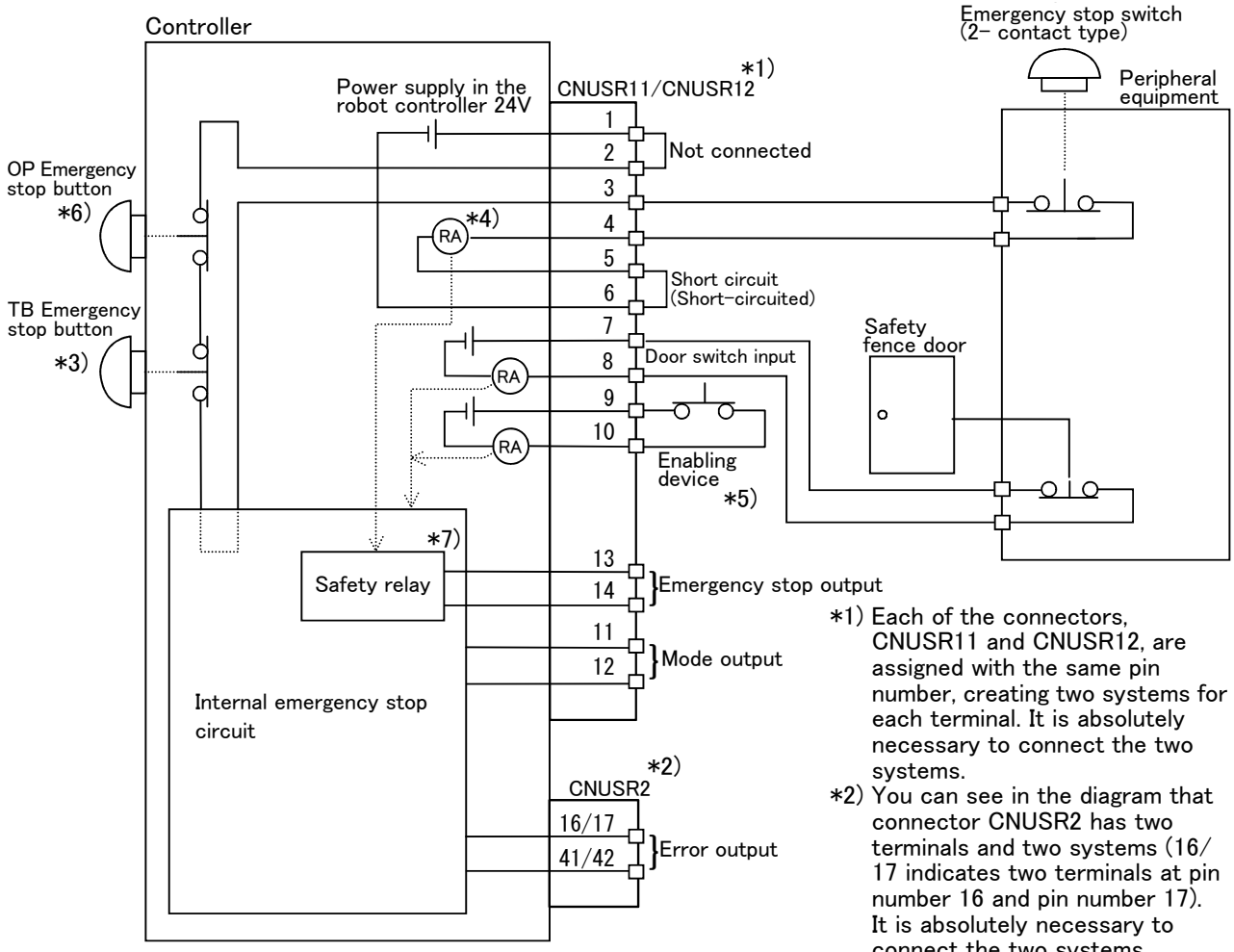
[Note] ・In the emergency-stop related wiring by the customer, if the coil (is not the contact points) of the relay prepared by the customer is connected to the controller, please be sure to implement the measure against the noise by the customer in the coil section. And, please also take the lifetime of noise suppression parts into consideration.

・Electric specification of the emergency-stop-related output terminal: 100mA/24V or less

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

(1) CR750 controller

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



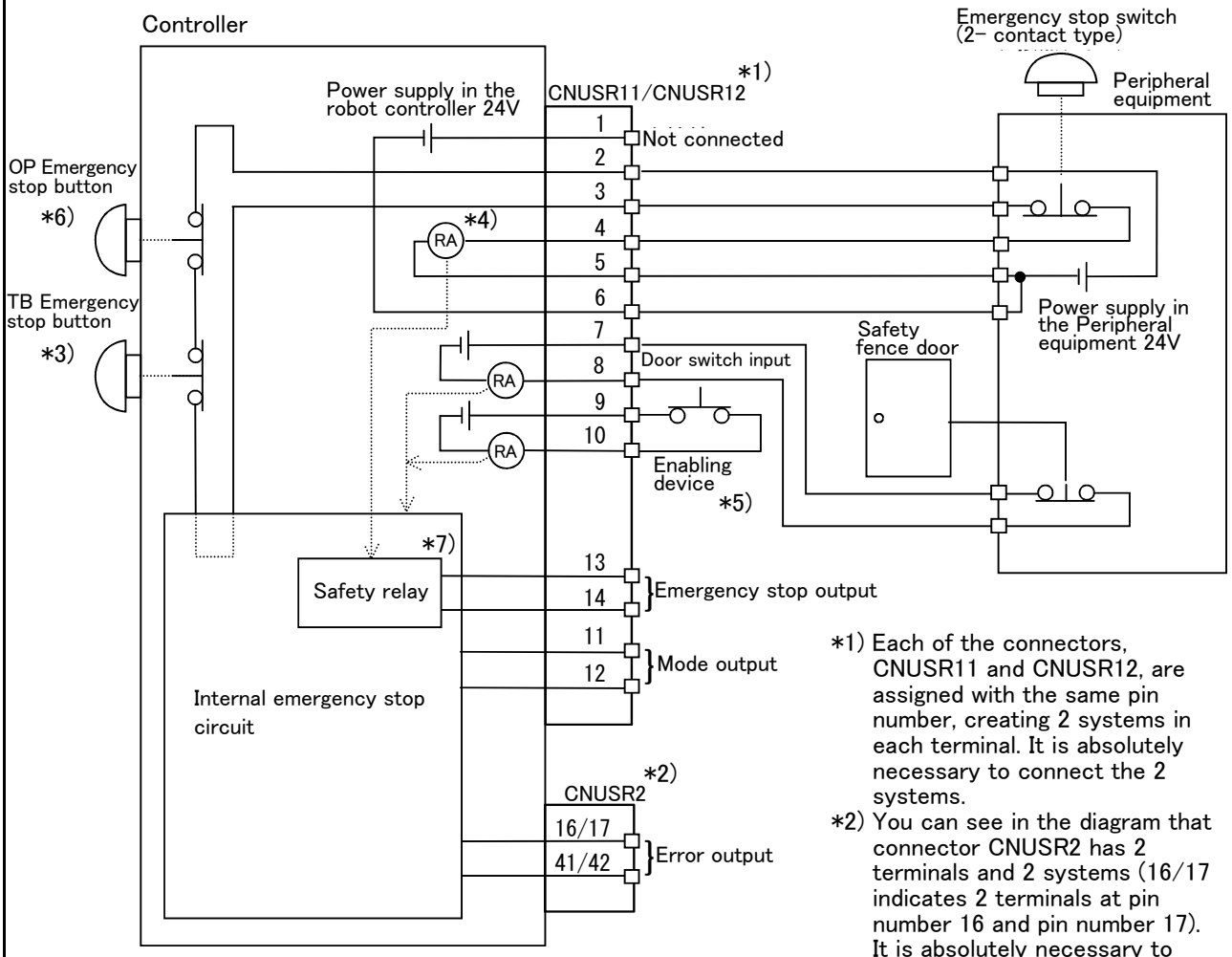
*1) Each of the connectors, CNUSR11 and CNUSR12, are assigned with the same pin number, creating two systems for each terminal. It is absolutely necessary to connect the two systems.

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

*3) The T/B emergency stop button connected with the controller.
*4) Emergency stop input relay.
*5) Refer to Standard 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 is used 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.

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

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

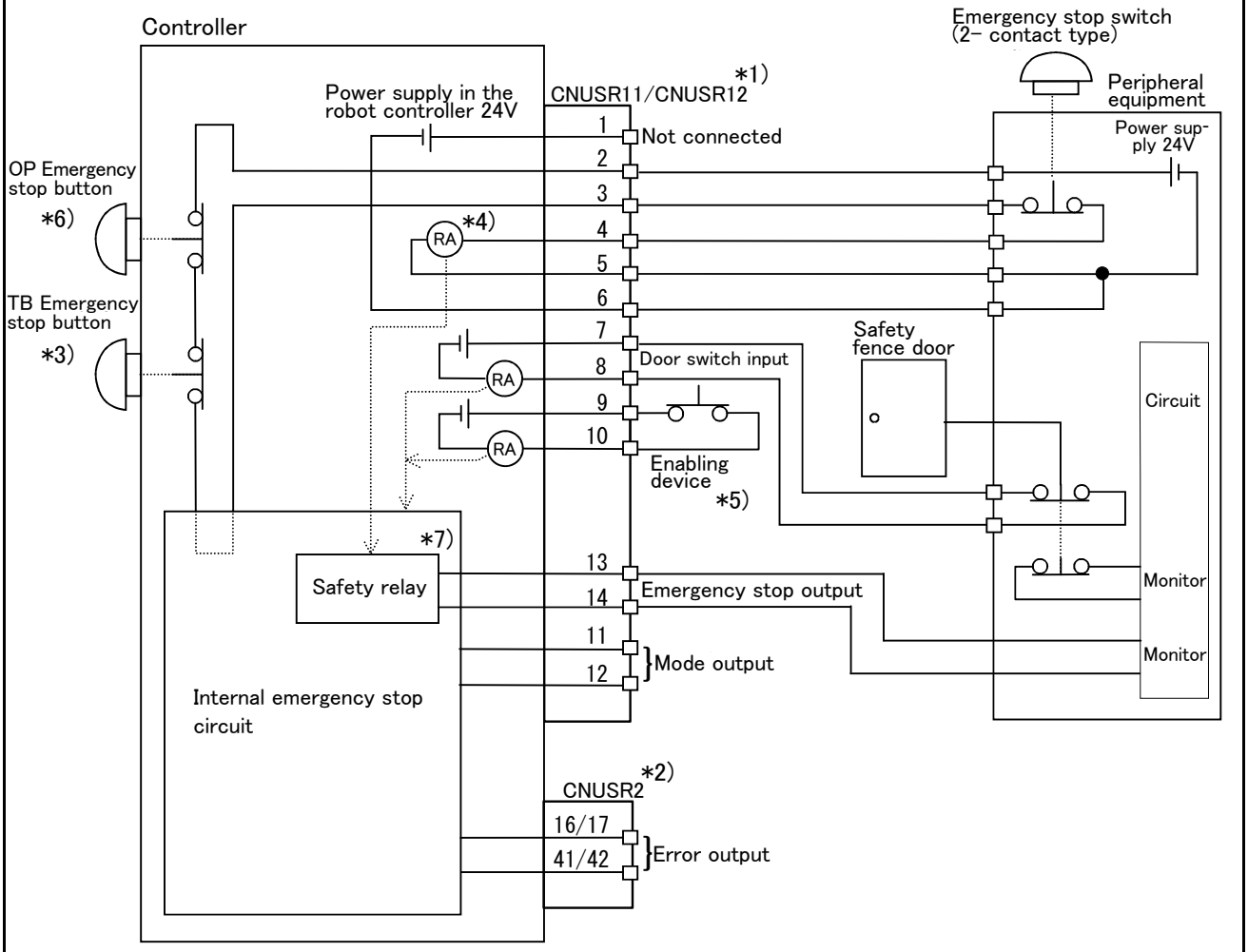
*3) The T/B emergency stop button connected with the controller.
*4) Emergency stop input relay.
*5) Refer to Standard specification manual for the enabling device.
*6) The emergency stop button of the robot controller.
(Only specification with the operation panel.)
*7) The emergency stop input detection relay uses the 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.

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 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 controller 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.

*4) Emergency stop input relay.

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

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

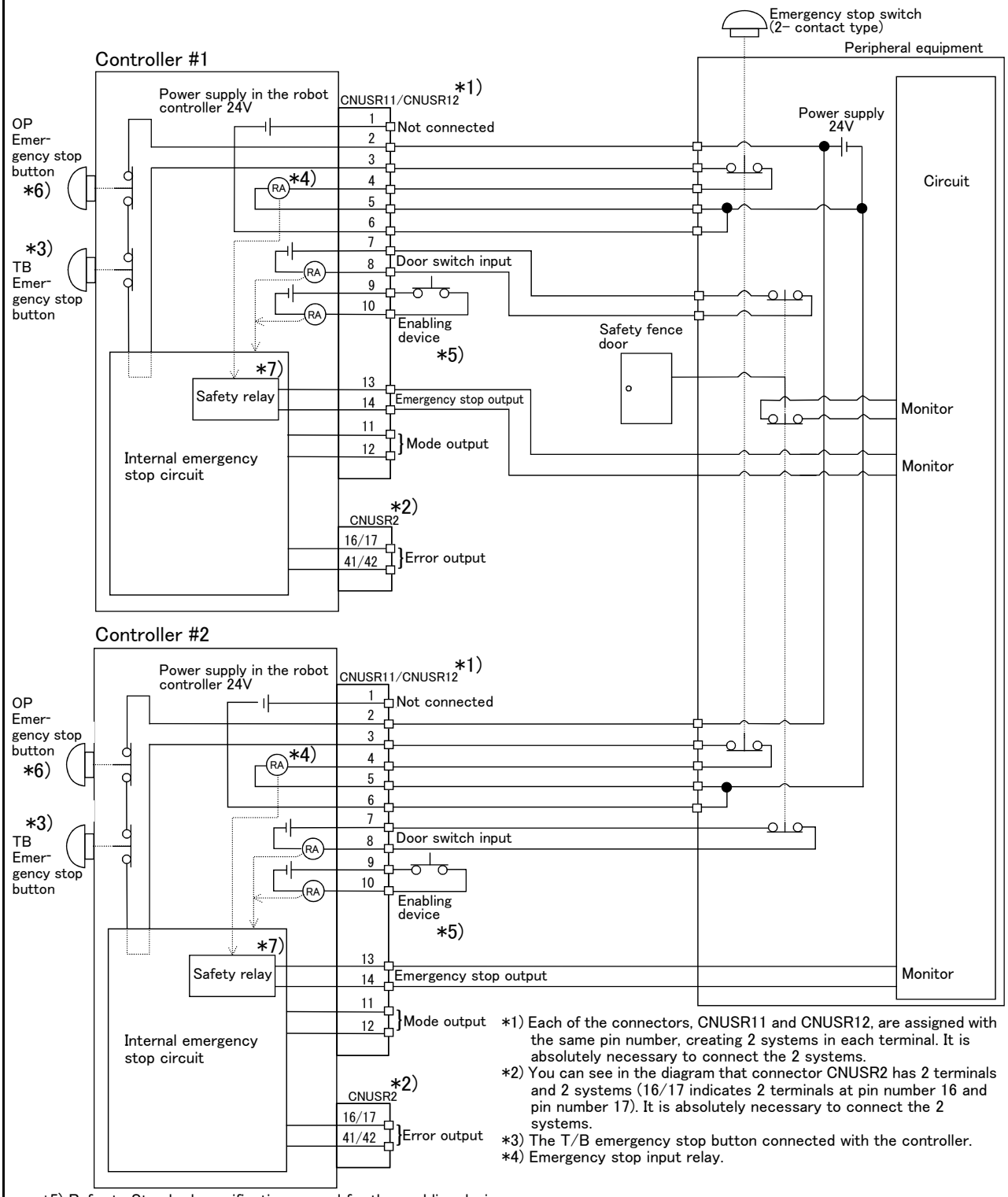
*7) The emergency stop input detection relay uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.

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 controllers, 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 controller 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.

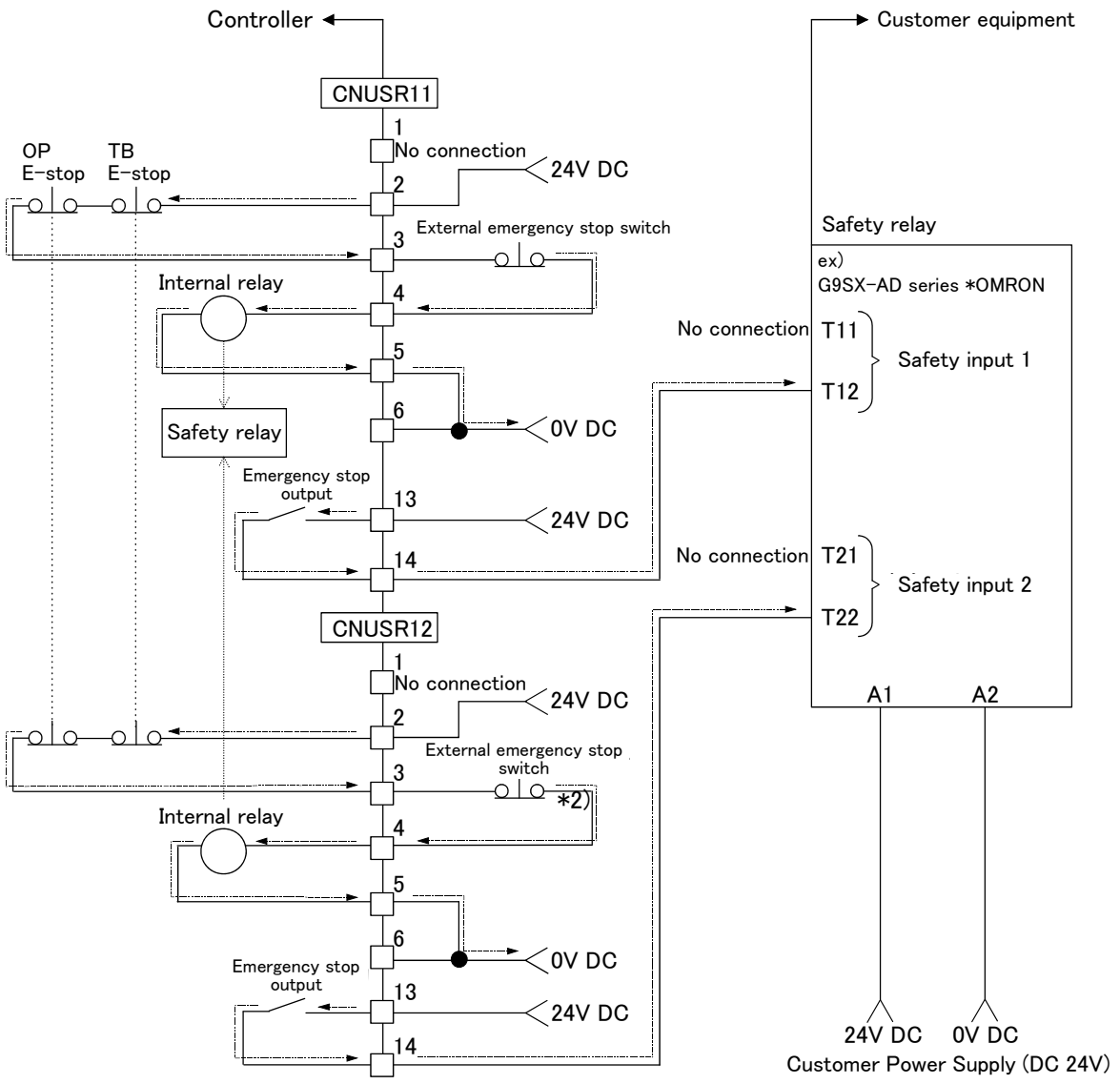
*5) Refer to Standard specification manual for the enabling device.

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

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

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

<Wiring example 5>: Connect the controller to the safety relay
Use the controller's emergency stop button command as an input to the safety relay.



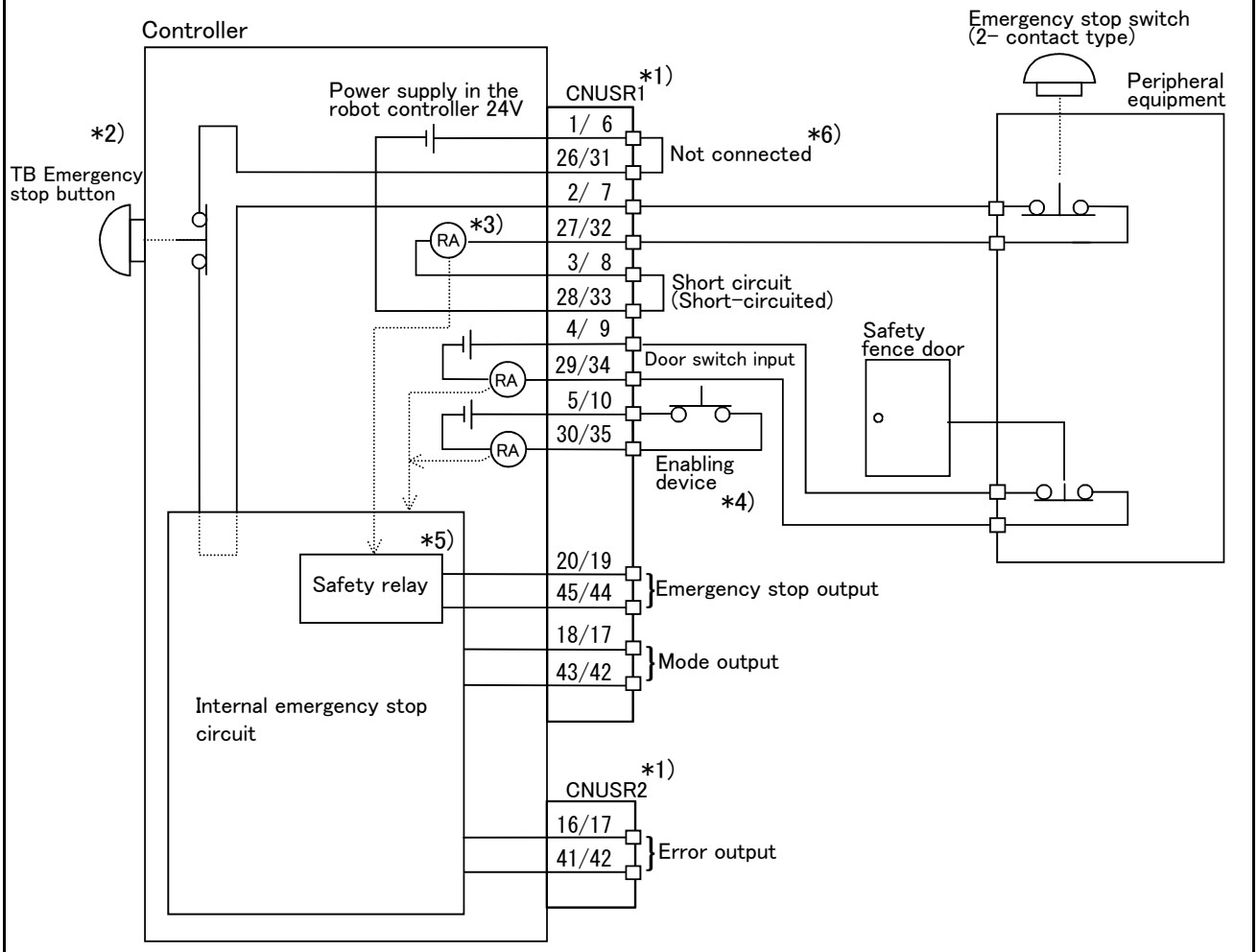
[Caution]

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 (0V DC).
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. Omron's G9S Series).
4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
5) When connecting emergency stop button output to an external safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly, this function will not operate correctly. Please connect the terminal 13 of CNUSR11/12 to 24V.

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

(2) CR751 controller

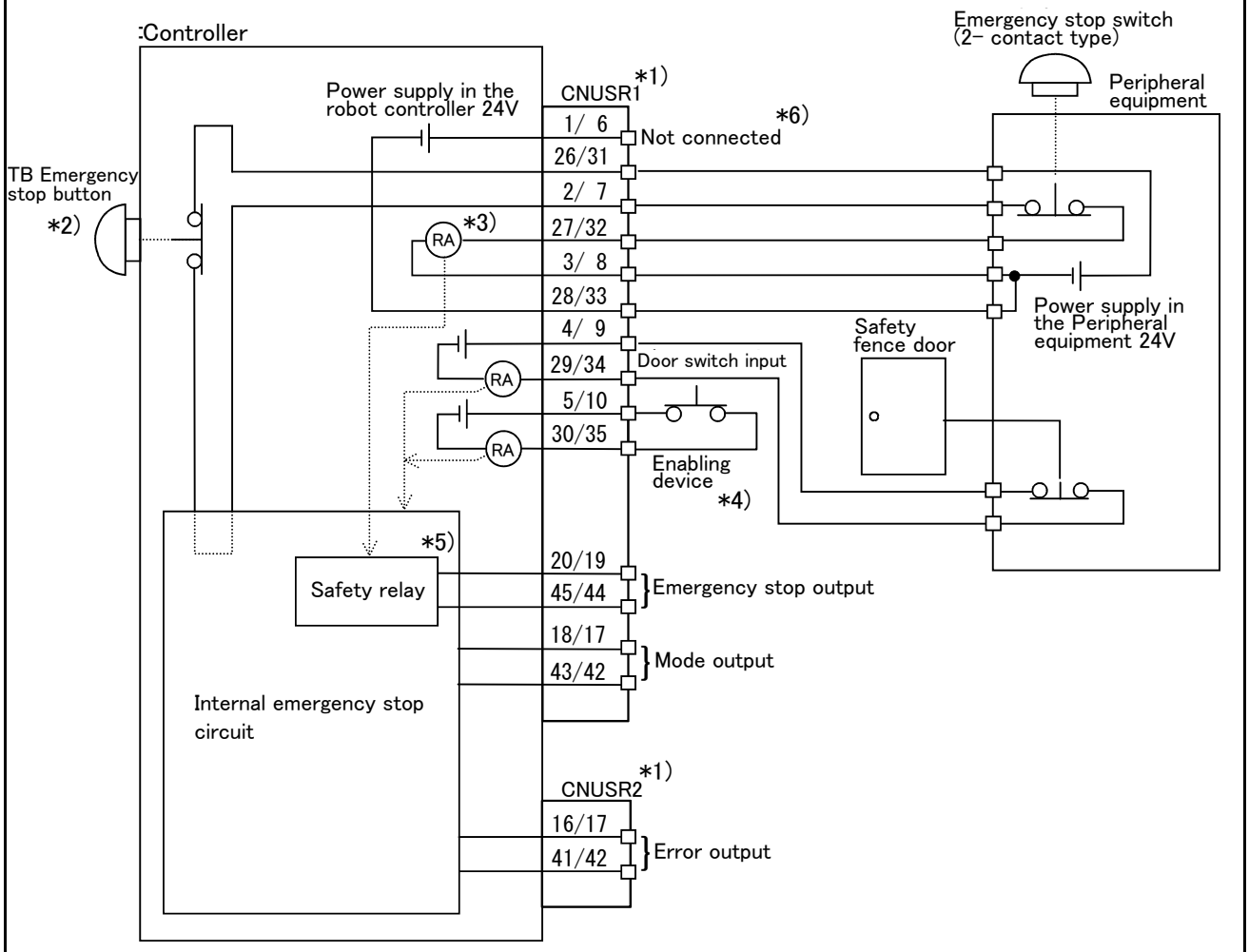
<Wiring example 1>: Connect the emergency stop switch of peripheral equipment to the controller.
The power supply for emergency stop input uses the power supply in the controller.
<Operation of the emergency stop>
If the emergency stop switch of peripheral equipment is pushed, the robot will also be 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 controller.
*3) Emergency stop input relay.
*4) Refer to Standard specification manual for the enabling device.
*5) The emergency stop input detection relay uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.

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

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



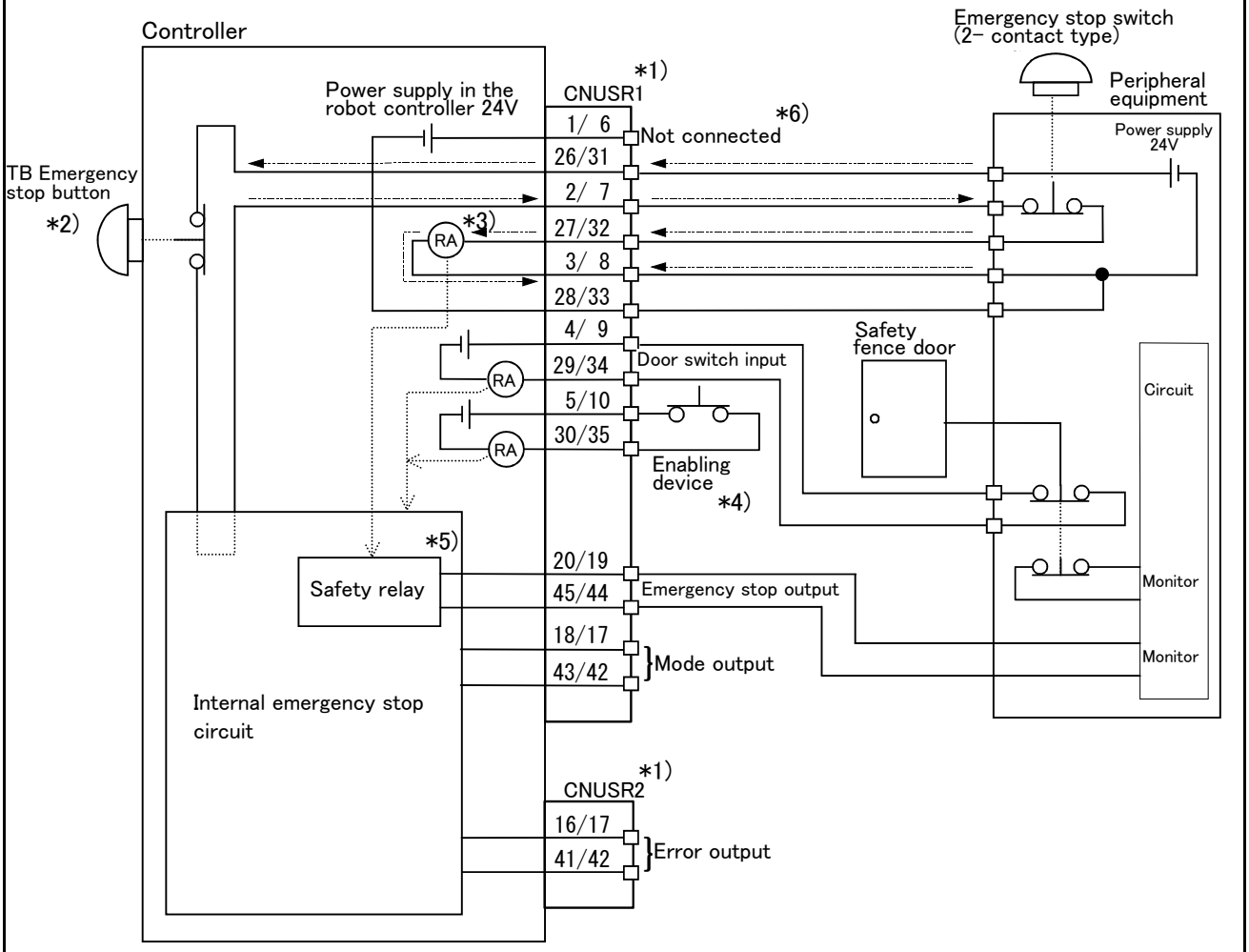
*1) Each of the connectors, CNUSR1 and CNUSR2, are assigned with the same pin number, creating 2 systems in each terminal. It is absolutely necessary to connect the 2 systems.
*2) The T/B emergency stop button connected with the controller.
*3) Emergency stop input relay.
*4) Refer to Standard specification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

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

<Wiring example 3>: Connect the emergency stop switch, door switch, and enabling device of peripheral equipment to the 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 controller OFF, peripheral equipment state can be the emergency stop also.



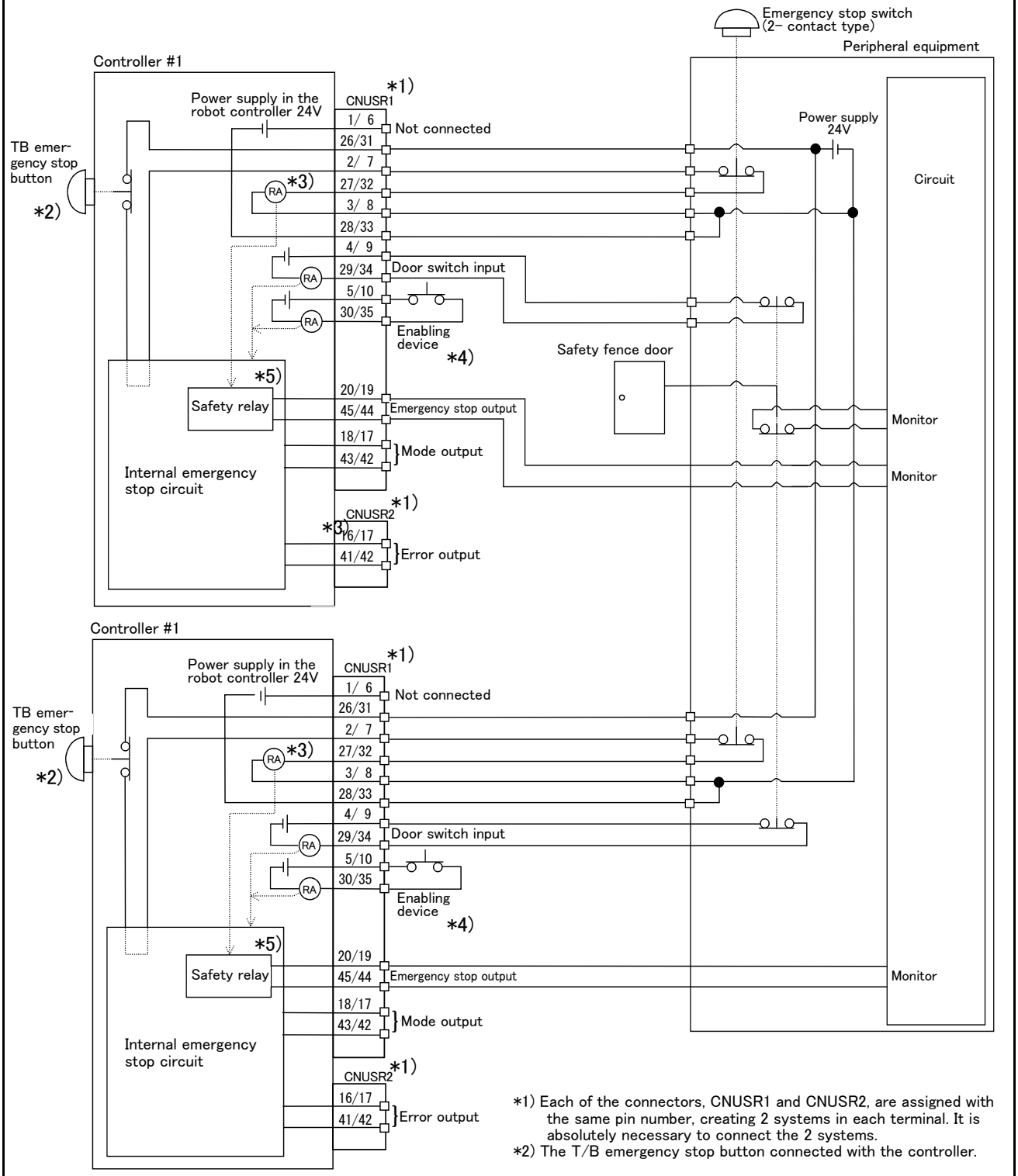
*1) Each terminal assigned with the respectively same pin number as connector: CNUSR1 and CNUSR2 and each is dual line. Always connect the two lines.
*2) The T/B emergency stop button connected with the controller.
*3) Emergency stop input relay.
*4) Refer to Standard specification manual for the enabling device.
*5) The emergency stop input detection relay uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
*6) Connect the 24V power supply to 26/31 terminals.

Fig.6-8 : 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 controllers, 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 controller OFF, peripheral equipment state can be the emergency stop also.



*1) Each of the connectors, CNUSR1 and CNUSR2, are assigned with the same pin number, creating 2 systems in each terminal. It is absolutely necessary to connect the 2 systems.

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

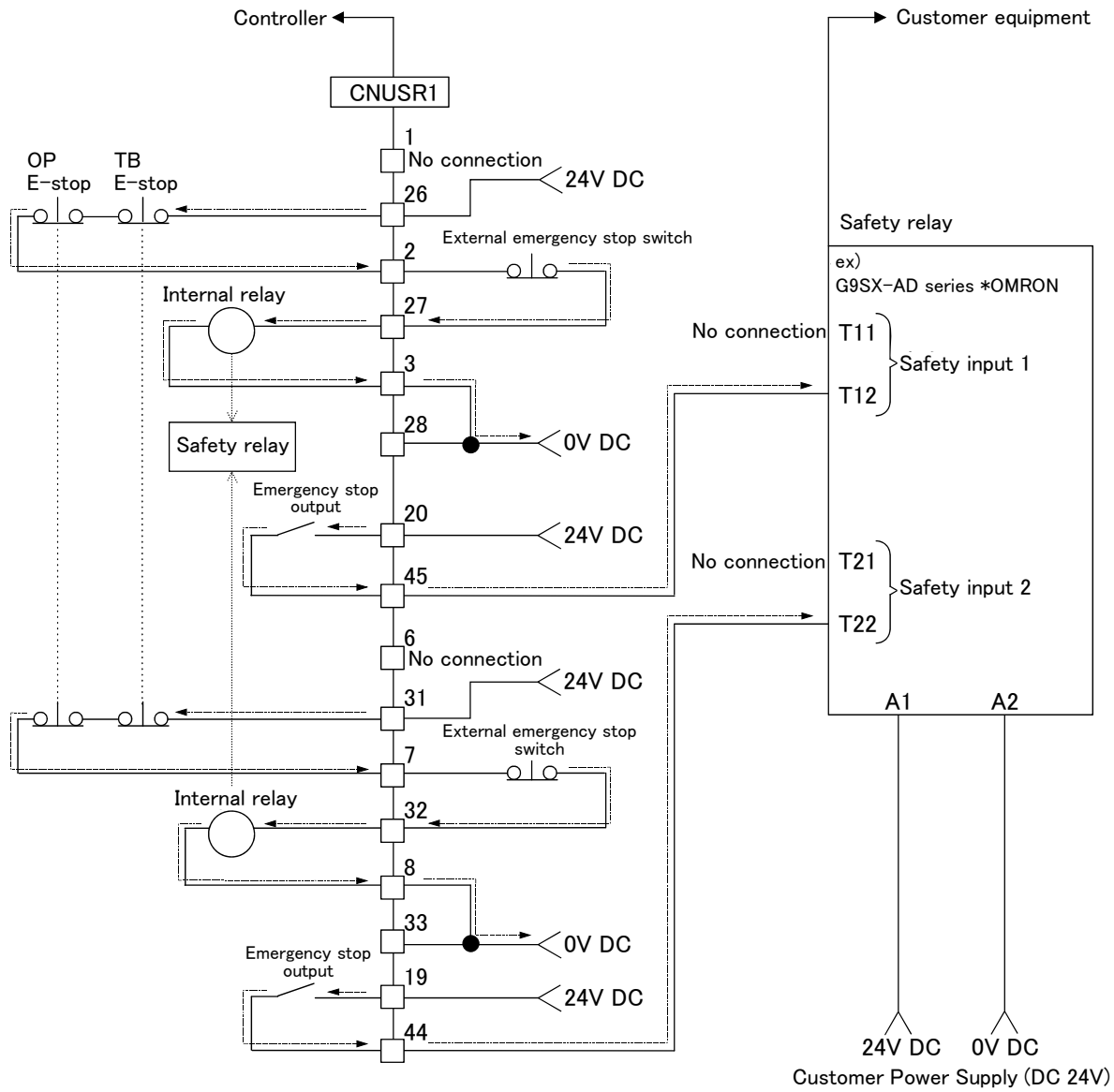
*3) Emergency stop input relay.

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

*5) The emergency stop input detection relay uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.

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

<Wiring example 5>: Connect the controller to the safety relay
Use the controller'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 (0V DC).
3) Setup a safety relay on the user equipment, and when using to input the emergency stop button on the controller, please only use a safety relay that functions when connecting the input to the one end of the 2 systems (i.e. Omron's G9S Series).
4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
5) When connecting emergency stop button output to an exterior safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly this function will not operate correctly. Please connect 20/19 terminal to 24V.

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

(3) External emergency stop connection [supplementary explanation]

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

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

- Switch 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. 6-11 and Fig. 6-12)
- Cable length..... The length of the wire between the switch and terminal block must be max. 15m or less. Please use the shield line, in case of the cable may receive the noise etc. by other equipment, such as servo amplifier. And, since the ferrite core is attached as noise measures parts, please utilize.
  The size of the wire that fits to use is shown below.
  - CR750 controller..... CNUSR11/12/13 connector: AWG #26 to #16 (0.14mm^2 to 1.5mm^2)
  - CR750 controller..... CNUSR2 connector: AWG #30 to #24 (0.05mm^2 to 0.2mm^2)
  - CR751 controller..... CNUSR1/2 connector: AWG #30 to #24 (0.05mm^2 to 0.2mm^2)

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

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

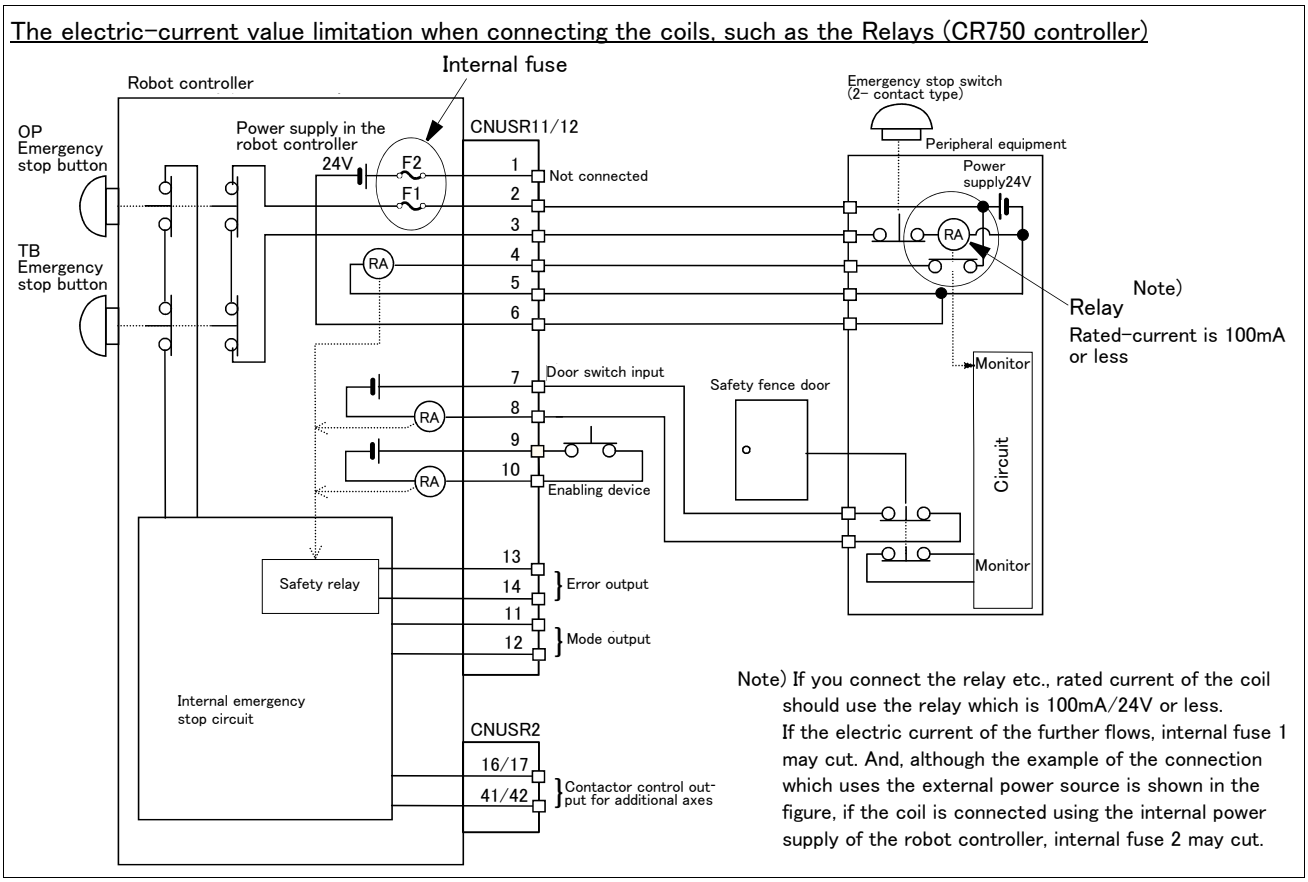


Fig.6-11 : Limitations when connecting the relay etc. (CR750)

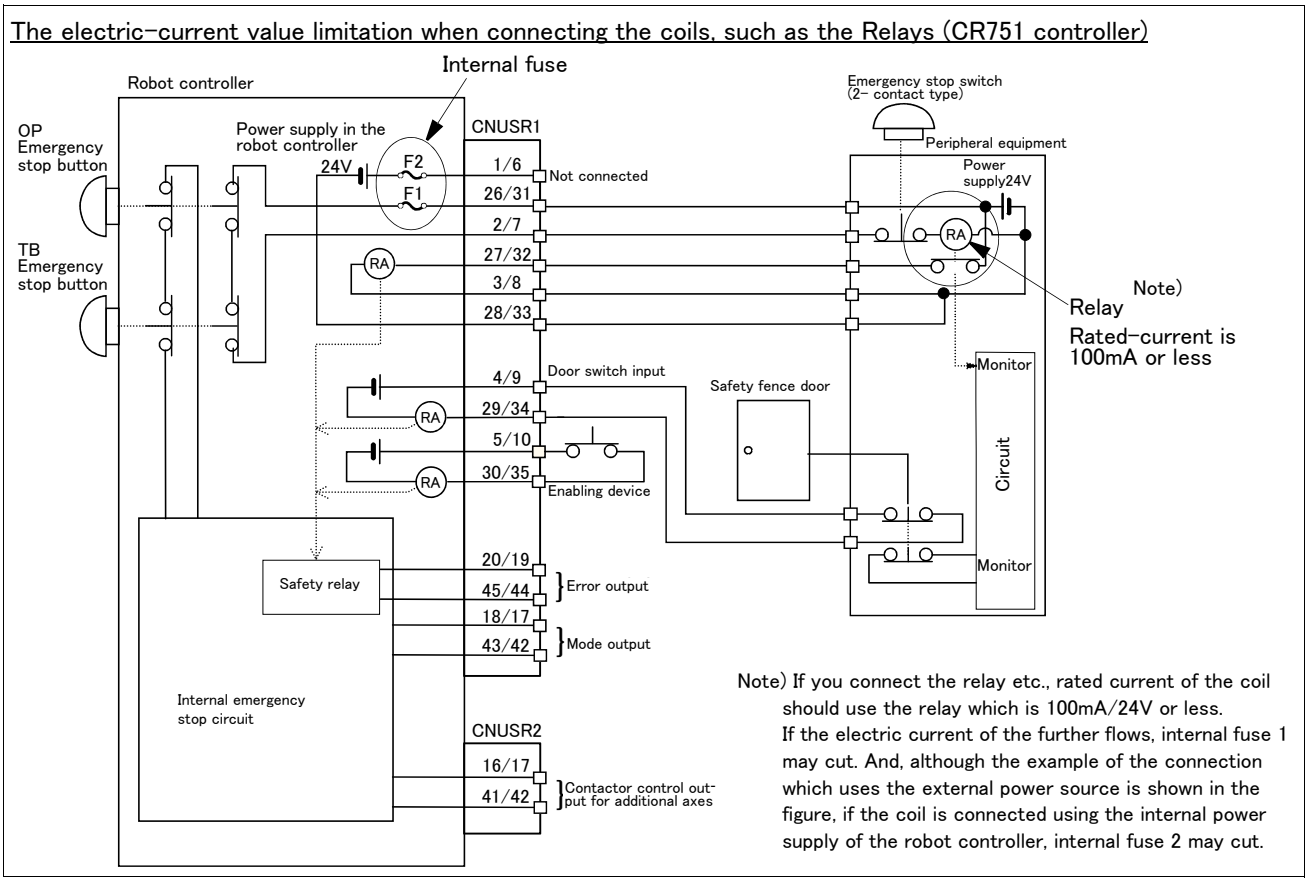
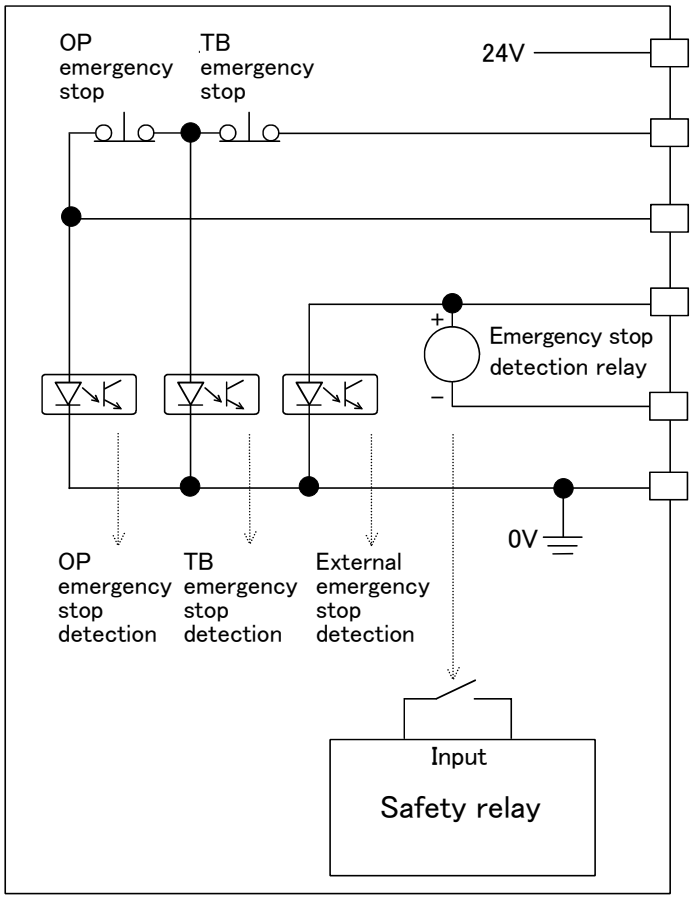


Fig.6-12 : Limitations when connecting the relay etc. (CR751)

[Supplementary explanation regarding emergency stop circuit]

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



⚠CAUTION Be sure to perform wiring correctly. If there are mistakes in the wiring, the robot may not stop when the emergency stop button is pressed and there will be a risk of damage or personal injury occurring.
After wiring, be sure to press each of the installed emergency stop switches and check whether the emergency stop circuit works properly.

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

6.2 Working environment

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

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

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

(2) Noise
- Where a surge voltage exceeding 1000V, 1 μs 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) RV-2F series robot has brakes on J2, J3 and J5 axes. And RV-2FB series 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. Moreover, when the axis without the brake is servo-off, take care to falling by the self-weight.

(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 is configured of precision parts such as bearings. Grease is used for lubricating these parts. When cold starting at low temperatures or starting operation after long-term stoppage, the position accuracy may drop or servo alarms may occur. If these problems occur, perform a 5 to 10 minute running-in operation at a low speed (about a half of normal operating speed).

(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.

(6) The items described in these specifications are conditions for carrying out the periodic maintenance and inspections described in the instruction manual.

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

(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) 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.
(10) 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.
(11) 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.
(12) 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.
(13) Do not conduct an insulated voltage test. If conducted by mistake, it may result in a breakdown.
(14) 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.
(15) The United Nations' Recommendations on the Transport of Dangerous Goods must be observed for trans-border transportation of lithium batteries by air, sea, and land. The lithium batteries (ER6, Q6BAT) used in Mitsubishi industrial robots contain less than 1 g of lithium and are not classified as dangerous goods. However, if the quantity of lithium batteries exceeds 24 batteries for storage, etc., they will be classified as Class 9: Miscellaneous dangerous substances and articles. Shipping less than 24 batteries is recommended to avoid having to carry out transport safety measures as the customer's consignor. Note that some transportation companies may request an indication that the batteries are not dangerous goods be included on the invoice. For shipping requirement details, please contact your transportation company.
(16) 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.

7 Appendix

Appendix 1 : Specifications discussion material

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased mode

Specification	Type Note1)			
Standard specification	☐ RV-2F-D	☐ RV-2FB-D	☐ RV-2F-1D	☐ RV-2FB-1D

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

■ Options (Installable after shipment)

Item		Type	Provision, and specifications when provided.
Robot arm	Stopper for changing the operating range	1S-DH-11J1	☐ Not provided ☐ Provided
		1S-DH-11J2	☐ Not provided ☐ Provided
		1S-DH-11J3	☐ Not provided ☐ Provided
	Machine cable extension (For CR750, standard specification)	1S- ☐☐ CBL-11	Fixed type: ☐ Not provide ☐ 10m ☐ 15m
		1S- ☐☐ LCBL-11	Flexed type: ☐ Not provide ☐ 5m ☐ 10m ☐ 15m
	Machine cable extension (For CR750, CE marking specification)	1S- ☐☐ CBL-03	Fixed type: ☐ Not provide ☐ 10m ☐ 15m
		1S- ☐☐ LCBL-03	Flexed type: ☐ Not provide ☐ 5m ☐ 10m ☐ 15m
	Machine cable extension (For CR751)	1F- ☐☐ UCBL-11	Fixed type: ☐ Not provide ☐ 10m ☐ 15m
		1F- ☐☐ LUCBL-11	Flexed type: ☐ Not provide ☐ 5m ☐ 10m ☐ 15m
	Solenoid valve set	1E-VD0 ☐ 1E-VD0 ☐ E	☐ Not provide 1E-VD0 ☐ (Sink type): ☐ 1set ☐ 2set ☐ 3set ☐ 4set 1E-VD0 ☐ E (Source type): ☐ 1set ☐ 2set ☐ 3set ☐ 4set
	Hand input cable	1S-HC30C-11	☐ Not provided ☐ Provided
	Hand output cable	1E-GR35S	☐ Not provided ☐ Provided
	Hand curl tube	1E-ST040 ☐ C	☐ Not provided ☐ 1set ☐ 2set
Controller	Simple teaching pendant	R32TB- ☐☐ (For CR750 controller R33TB- ☐☐ (For CR751 controller	☐ Not provided R32TB: ☐ 7m ☐ 15m R33TB: ☐ 7m ☐ 15m
	Highly efficient teaching pendant	R56TB- ☐☐ (For CR750 controller R57TB- ☐☐ (For CR751 controller	☐ Not provided R56TB: ☐ 7m ☐ 15m R57TB: ☐ 7m ☐ 15m
	Parallel I/O interface	2D-TZ368/ 2D-TZ378	☐ Not provided 2D-TZ368(Sink type)/ ☐ -1pc. ☐ -2pc. 2D-TZ378(Source type)/ ☐ -1pc. ☐ -2pc.
	External I/O cable (For parallel I/O interface)	2D-CBL ☐☐ (2D-TZ368/TZ378)	☐ Not provided ☐ 5m-( )pc. ☐ 15m-( )pc.
	Parallel I/O unit	2A-RZ361/ 2A-RZ371	☐ Not provided ☐ 2A-RZ361(Sink type)/( ) unit ☐ 2A-RZ371(Source type)/( ) unit
	External I/O cable (For Parallel I/O unit)	2A-CBL ☐☐ (2A-RZ361/RZ371)	☐ Not provided ☐ 5m-( )pc. ☐ 15m-( )pc.
	CC-Link interface	2D-TZ576	☐ Not provided ☐ Provided
	RT ToolBox2	3D-11C-WINJ	☐ Not provided ☐ Windows2000/XP/Vista/7 English CD-ROM
	RT ToolBox2 mini	3D-12C-WINJ	☐ Not provided ☐ Windows2000/XP/Vista/7 English CD-ROM
	Network vision sensor	4D-2CG5***-PKG	☐ Not provided ☐ Provided
	Instructions manual	5F-FE01-PE01	☐ Not provided ☐ Provided ( ) sets

■ Maintenance parts (Consumable parts)

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

■ Robot selection check list

Work description	☐ Material handling ☐ Assembly ☐ Machining L/UL ☐ Sealing ☐ Testing and inspection ☐ Other ( )	
Workpiece mass ( ) g	Hand mass ( ) g	Atmosphere ☐ General environment ☐ Other ( )
Remarks		

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Product Service

EC-Statement of Compliance

No. E6 12 11 25554 047

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.: 73539409

Date, 2012-11-26 (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.

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany

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Attachment

Statement No.

E6 12 11 25554 047

Product Service

Nomenclature

A: Model name of **F** series Robot description is shown as follows.
A1:RH-3FH,RH6FHseries 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
6 : 6kg
(3) **F** : **F** series robot
(4)**H** :4 joints
(5) Robot Arm length(No1 and No2 arm) specification:
35 : 350 mm arm
45 : 450 mm arm
55 : 550 mm arm
(6) Z stroke length specification:
12 : 120 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

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A1 / 04.11

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

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Attachment

Statement No.

E6 12 11 25554 047

Product Service

A3:RV-2Fseries 1.7kW

RV-x F x – x x x–Sxx
(1) (2) (3) (4) (5) (6) (7) (8)

(1)**RV**: Vertical Robot
(2) Maximum Payload specification:
2 : 2kg
(3) **F** : **F** series robot
(4)Robot Joint type
B :All axes have brake units.
[none] :J4 axis doesn't have brake unit.
(5) Type of Robot controller cabinet
[none] :CR750 controller
1 :CR751 controller
(6)Robot controller type:
D :Stand alone type
Q :iQ platform type
(7)Standard:
0: normal type
1:CE marking model
2:CE marking and UL model

(8)Optional Specification:
1 :normal type
SM :added cabinet box over Robot controller for oil mist resist
Sxx :Mechanical option

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A1 / 04.11

Attachment

Statement No.

E6 12 11 25554 047

Product Service

A4:RV-4F,7Fseries 1.7kW

RV-x F x x – x x x–Sxx

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

(1)**RV**: Vertical Robot

(2) Maximum Payload specification:

4 : 4kg

7 : 7kg

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

(4) Robot arm length:

L : Long arm model

[none] : normal model

(5) Dimension and Ambient specification:

M : Oil mist model(IP67)

C : Clean room model(ISO3)

[none] : Basic model(IP40)

(6) Type of Robot controller cabinet

[none] :CR750 controller

1 :CR751 controller

(7)Robot controller type:

D :Stand alone type

Q :iQ platform type

(8)Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(9)Optional Specification:

1 :normal type

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

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

Sxx :Mechanical option

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

CR750- **xx** **x** **x** **x** — **x**— **x**—**Sxx**
(1) (2) (3) (4) (5) (6) (7) (8)

(1)**CR750**: CR750 controller
(2) Maximum Payload specification:
03 : 3kg
06 : 6kg
12 : 12kg
20 : 20kg
02 : 2kg
04 : 4kg
07 : 7kg
(3) Robot type
H : Horizontal robot
V : Vertical robot
(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

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MITSUBISHI ELECTRIC
Changes for the Better

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

We,

Manufacturer: MITSUBISHI ELECTRIC Corporation Nagoya Works

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

(Place of Declare):

Declare under our sole responsibility that the Product

Description: Industrial Robot

Type of Model: F series

Notice: Details of Serial No. are as per attached sheet(P7).

Restrictive use: For industrial environment only

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

EU Harmonized Standards		Non-harmonized Standard
EMC(2004/108/EC)	EN61000-6-4:2007 EN61000-6-2:2005	N/A
Machinery(2006/42/EC)	Type A:Fundamental safety standards EN ISO12100-1:2003 EN ISO12100-2:2003 EN 1050:1997 Type B:Group safety standards B1:Safety aspects EN60204-1:2006, EN294:1992, EN349:1993 ISO13849-1:2006 (Category 3 and Performance level "d") Type C:Machine Safety standard ISO10218-1:2011	N/A

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

< Partly completed Machinery>

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

Issue Date (Date of Declaration): November 5,2012

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

Tomoyuki Kobayashi
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■ Declaration Type of models

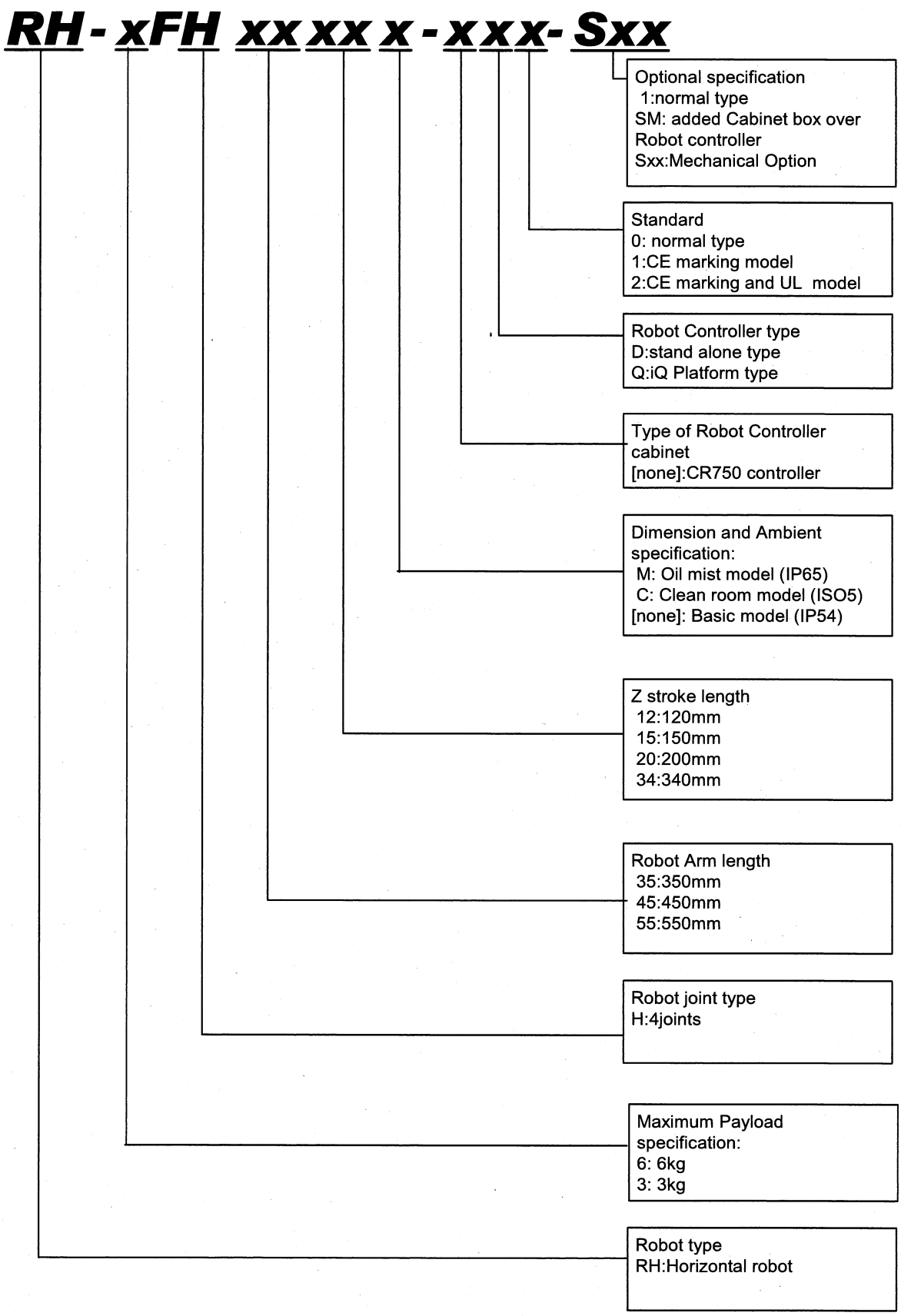

Fig.1-1 Nomenclature of F series robot (RH type Robot)

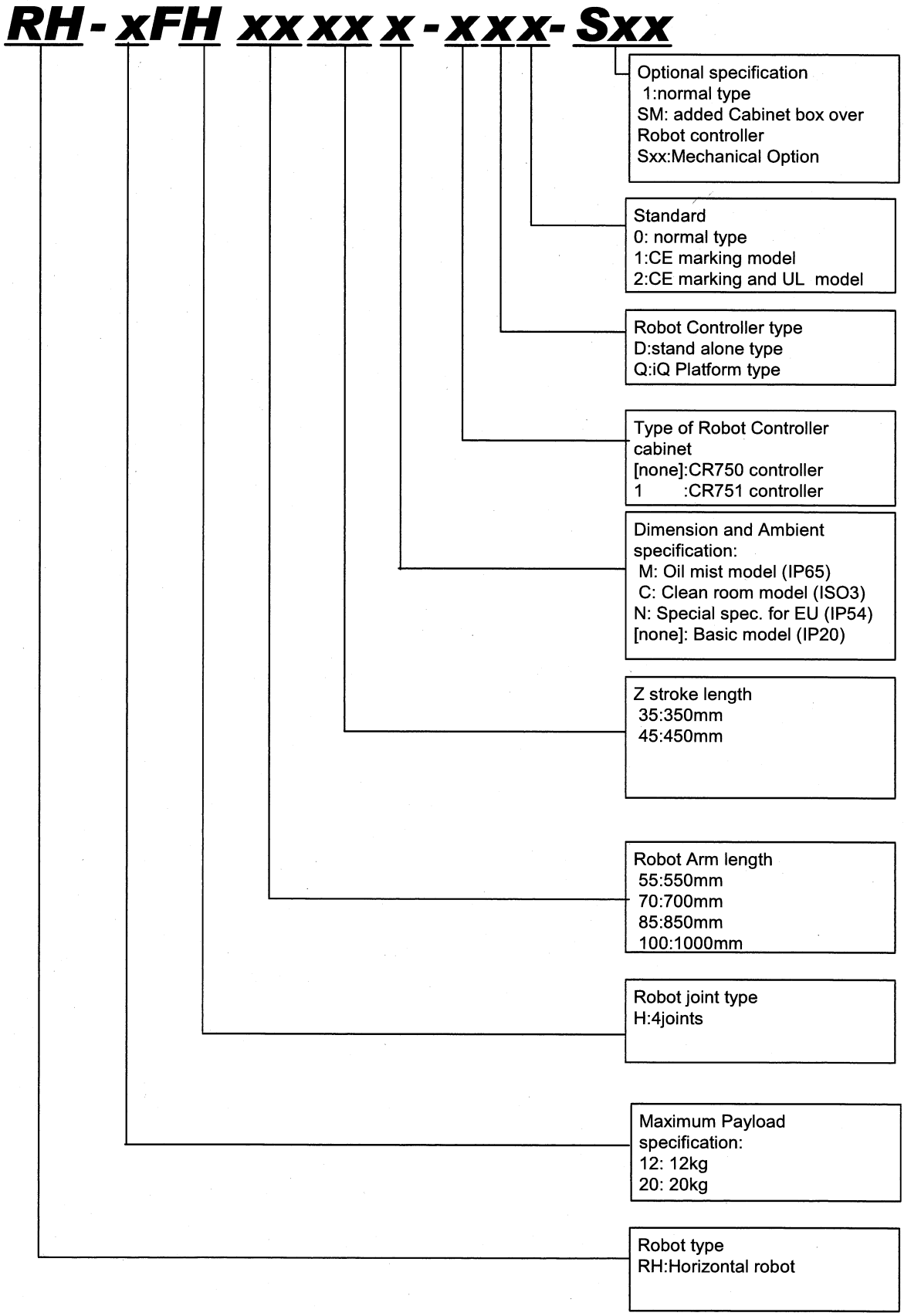

Fig.1-2 Nomenclature of F series robot of RH-12FH,20FH

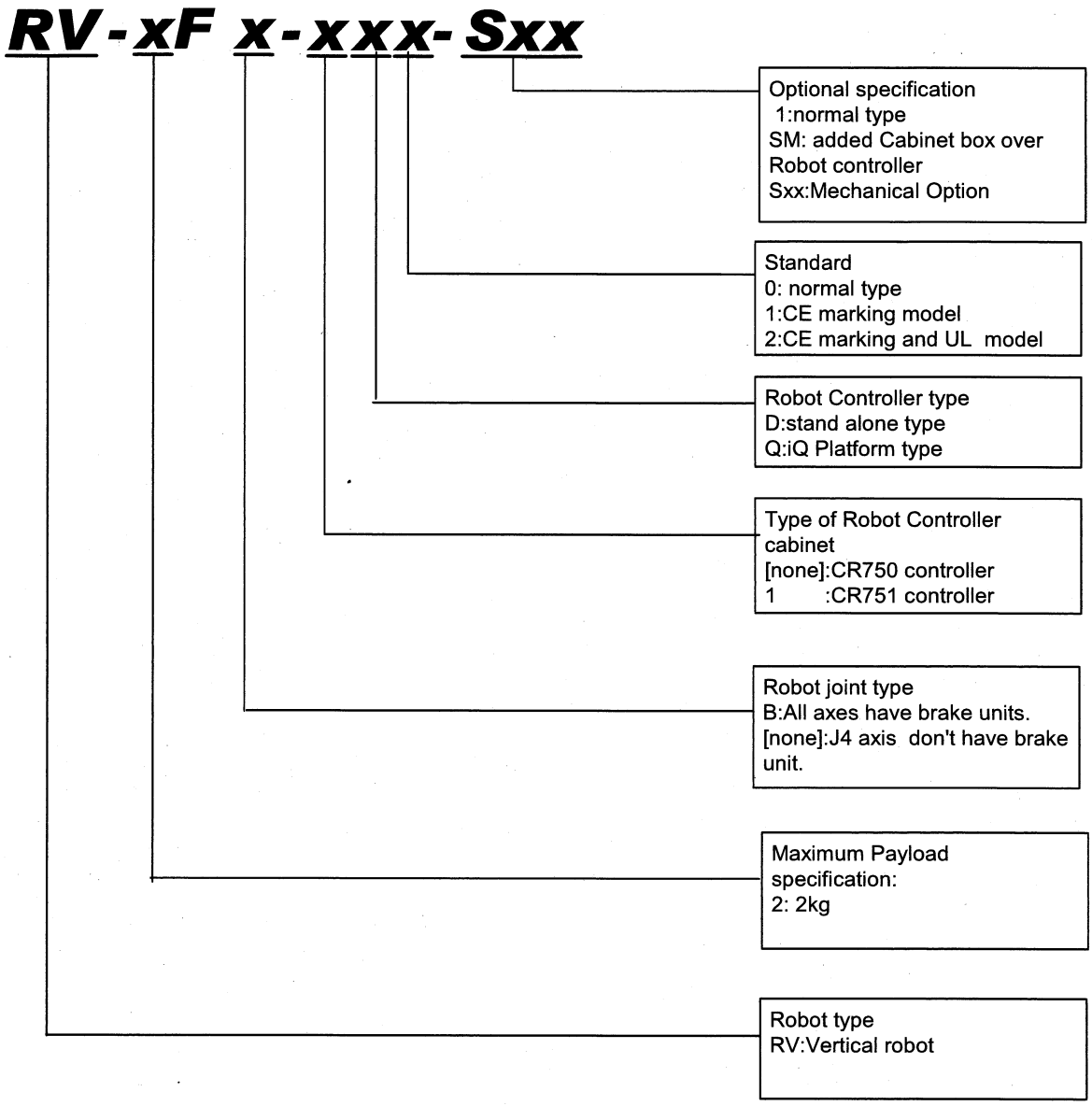

Fig.1-3 Nomenclature of F series robot of RV-2F

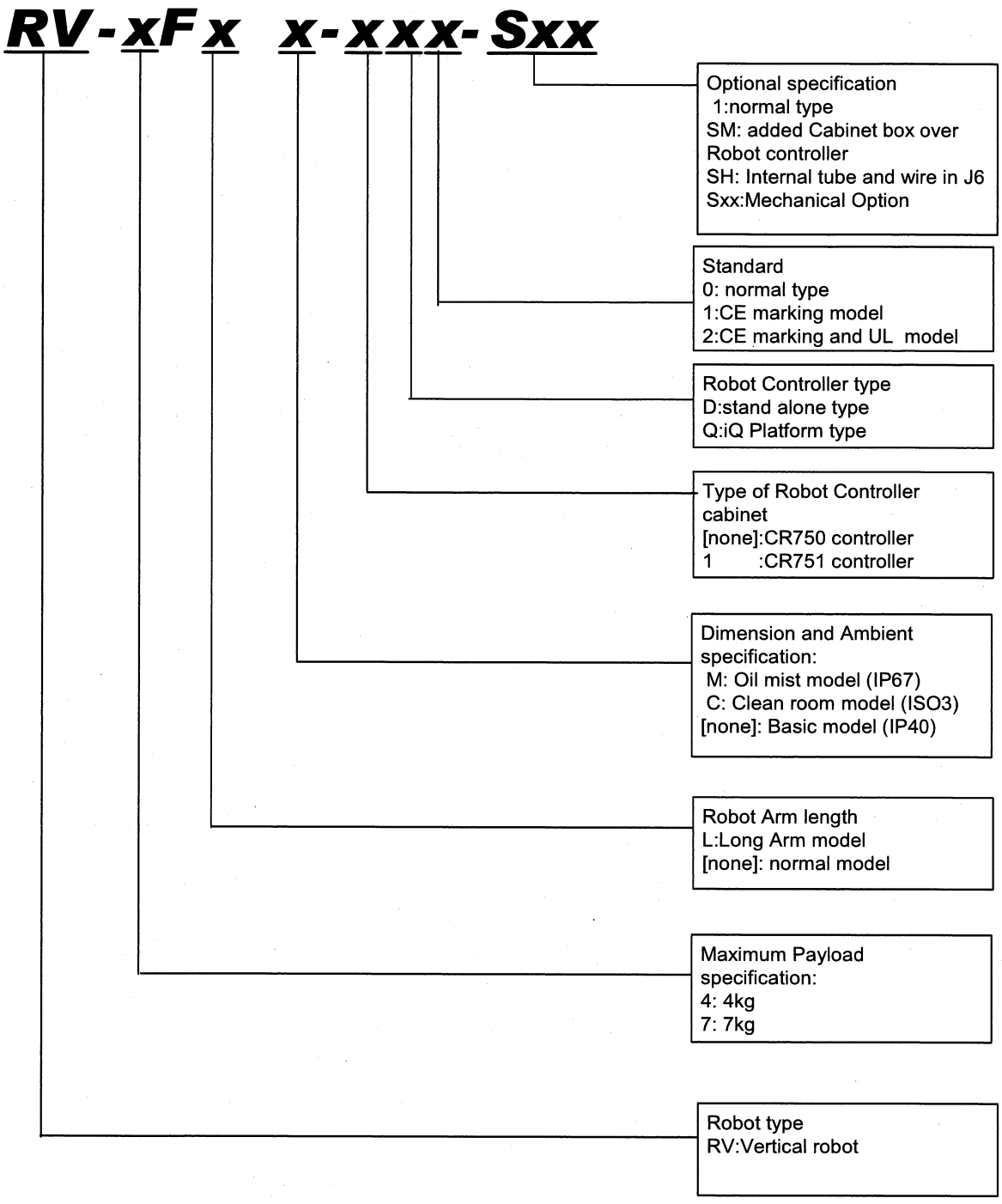

Fig.1-4 Nomenclature of F series robot of RV-4F,7F

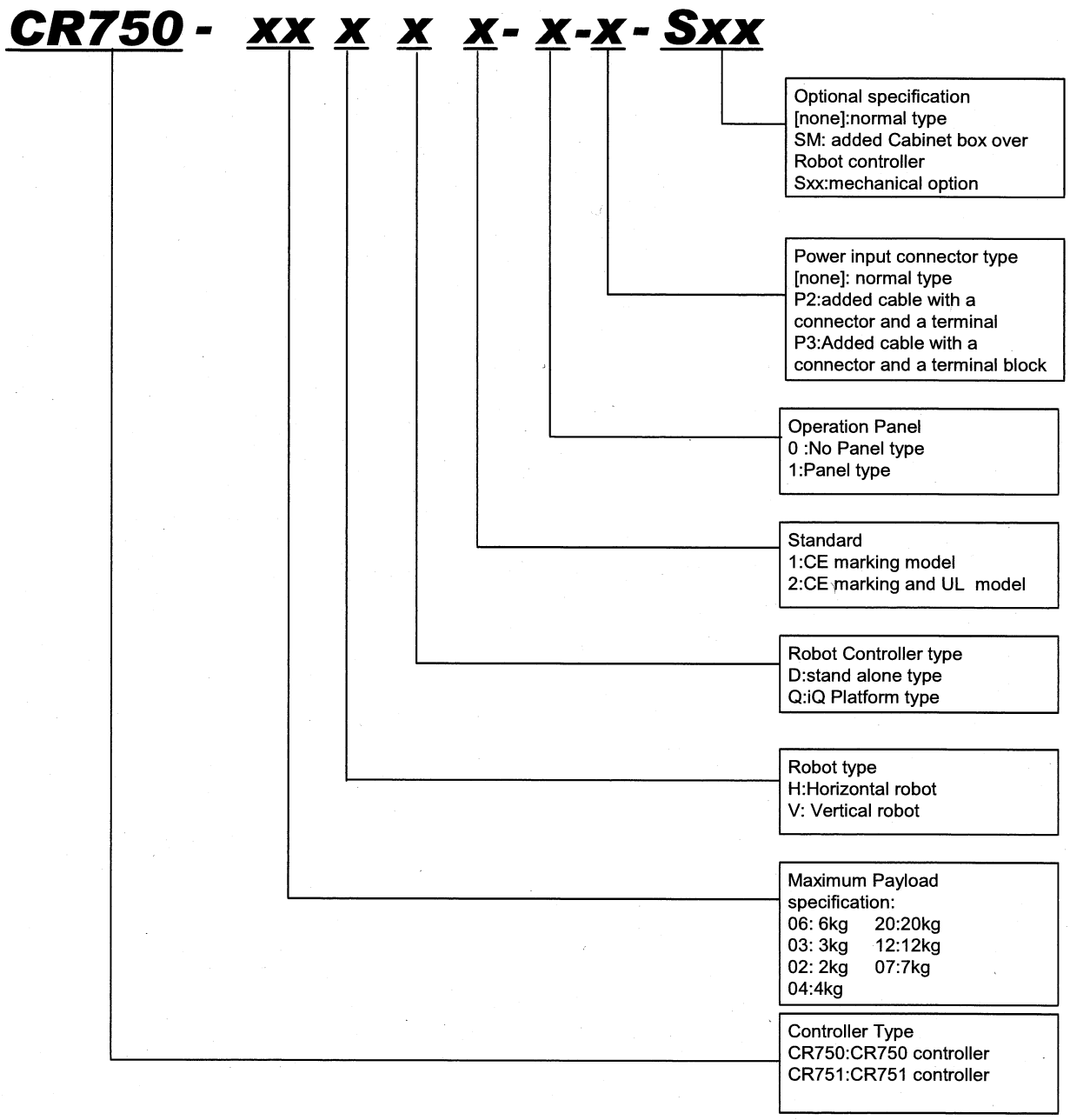

Fig.2-1 Nomenclature of F series robot controller

■ Details of serial number

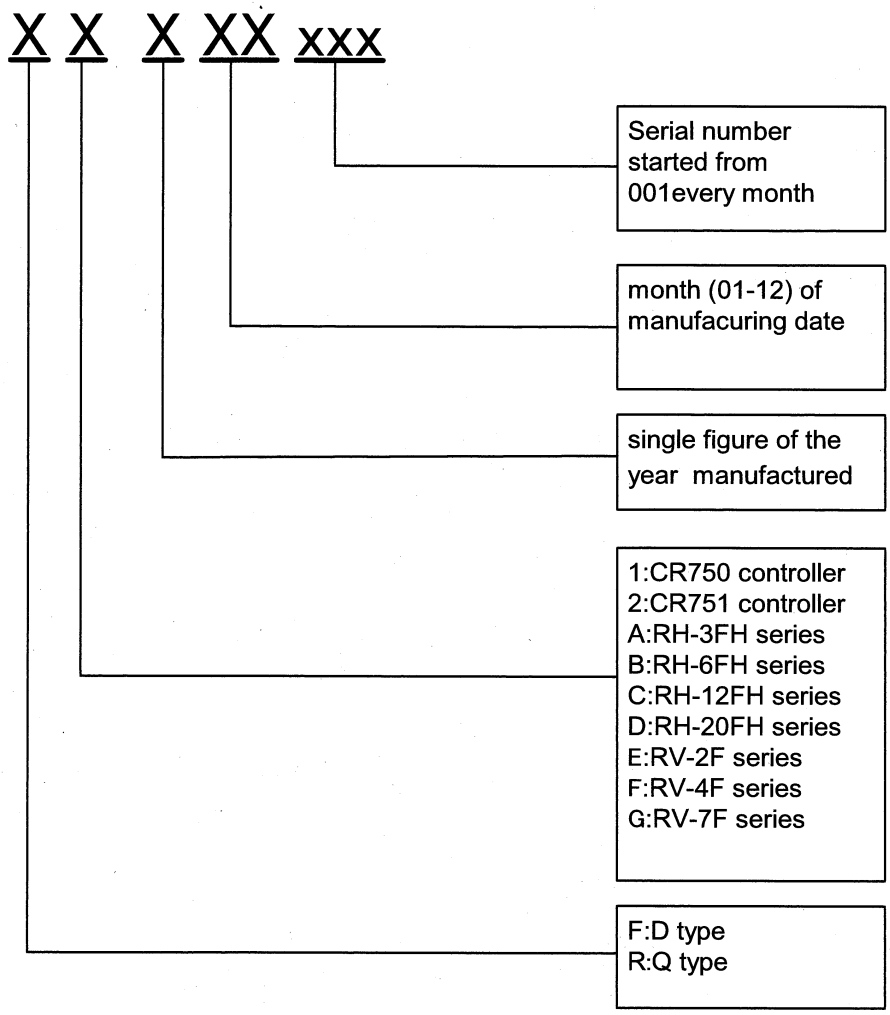

Fig.3.1 Nomenclature of serial number about F series Robot and robot controller

Revision history

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

사용자안내문
User's Guide

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

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