MITSUBISHI

Mitsubishi Industrial Robot

RH-6SH/12SH/18SH Series

Standard Specifications Manual

(CR1B-571/CR2B-574/CR3- 535M Controller)

MELFA

BFP-A8416-E

Precautions for Using the FINE Instruction

Thank you for your purchasing of our Mitsubishi Electric industrial robots.
This document describes additional precautions relating to the specification in the RH-6SH/12SH/18SH Series Standard Specification manual (BFP-A8416).
Please be sure to read this document before using the robot for thorough understanding of the contents.

1. Overview

The RH-6SH/12SH/18SH series robots (below as "RH-SH") has improved the resolution of the encoder that is attached to the motor, compared to the conventional RH-5AH/10AH/15AH series robots (below as "RH-A").
Therefore, if the RH-A's robot programs you are currently using are applied to the RH-SH series without any modification, the positioning time may prolong.

- If the FINE instruction is used in RH-A's robot program, and FINE setting values are used in RH-SH's program *without any modification.*
  * Since the setting values of the FINE instruction varies depending on the application and robot program you are using, *please adjust them according to the actual machine in use*.

2. Description

(1) Improvement of Encoder's Resolution

To achieve higher accuracy and higher response control, the encoder resolution of the RH-SH series has been changed from 8,192 pulses to 131,072 pulses, compared with the RH-A robots.

(2) Characteristics of the FINE Instruction

The FINE instruction specifies the completion of the positioning of an operation instruction by the number of the feedback pulses. Therefore, if the pulse specification value of the FINE instruction is reduced, positioning accuracy will improve but, on the contrary, there is a tendency that the time it takes for positioning will prolong. (See **Figure 1.**)

(3) Will Using RH-A's Programs in RH-SH Without Any Modification Delay the Processing Speed?

If the robot programs used in the RH-A robots (especially ones that use the FINE instruction) are applied to the RH-SH robots without any modification, there is a case where the time it takes to complete positioning prolong excessively.
This delay is caused by the improvement of the encoder resolution and the characteristics of the FINE instruction described above.
For example, assuming that if the FINE is used with setting value **1** in the RH-A robot, its physical angle have a difference of **16 times**, compared to the RH-SH robots. (*1)
(*1): The RH-A's accuracy is 16 times rougher.
Suppose if the response performance is the same, RH-SH robots will take longer until the completion of positioning. However, because RH-SH robots have improved tracking characteristic, **it does not always mean delay.**
It is necessary to make adjustments based on the FINE setting value (required positioning accuracy) and positioning time (required tact) you are using.

Therefore, to utilize any robot program used in the RH-A series, adjust the FINE setting value by checking the positioning accuracy and positioning time.

(4) Guideline for FINE Conversion (Reference)

It will be equal with RH-A and RH-SH, in FINE setting conversion equation 1.

B = (1 + A) x 16 – 1 . . . (Equation 1)

A = "FINE setting value of RH-A series"

B = "FINE setting value of RH-SH series"

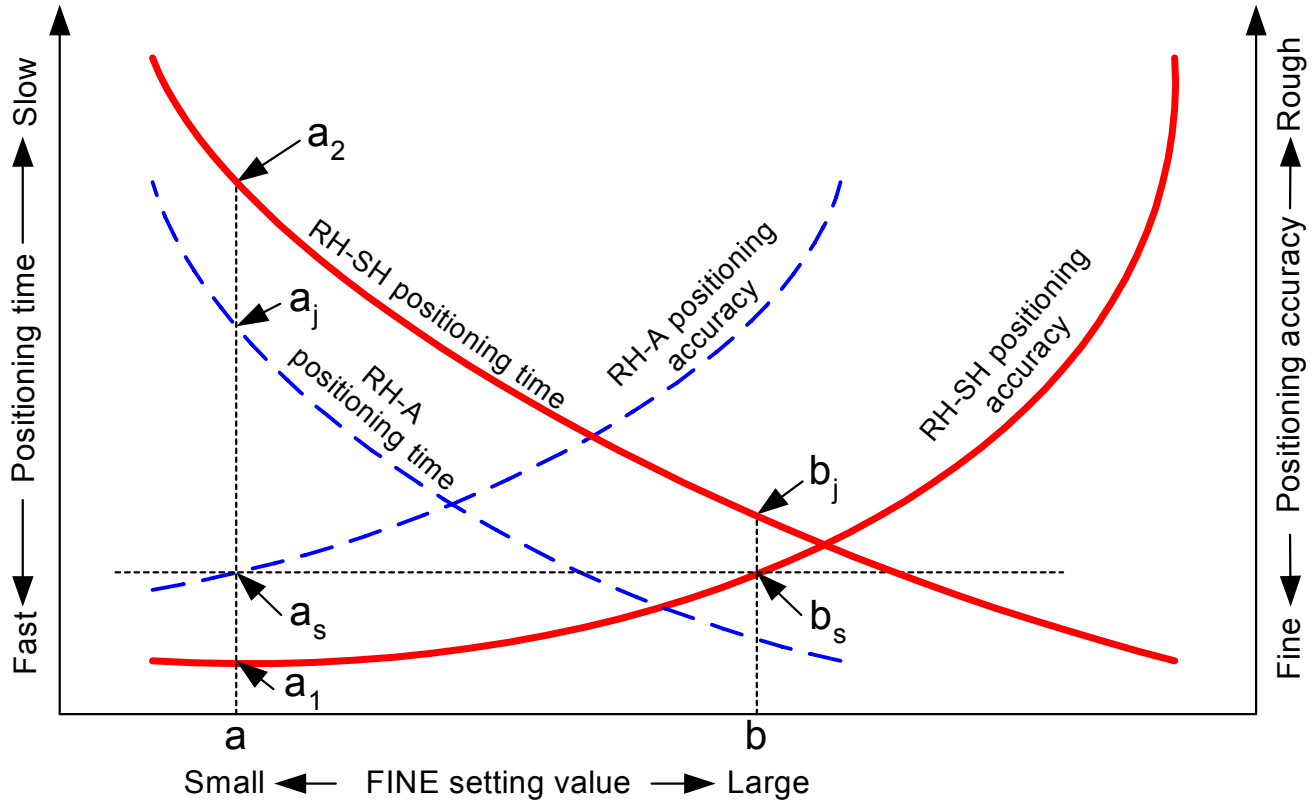


Figure 1: Outline of Relationships Among the FINE Setting Value, Positioning Time and Positioning Accuracy

[Example of Comparison Between the RH-A Series and the RH-SH Series]

- If FINE setting value a, the RH-SH series has higher positioning accuracy ($a_1 < a_s$). The RH-A series has superior positioning time ($a_j < a_2$).
- Regarding the FINE setting value that provides the same positioning accuracy, mutual accuracy of $a_s = b_s$ can be established if the RH-A series uses value a, and the RH-SH series uses value b. The positioning time in this condition is $b_j < a_j$, thus the RH-SH series tends to have faster positioning time.

In this way, by adjusting the FINE setting value according to the target application, the positioning accuracy and speed (time) can be controlled. As these values vary according to the application and robot program you are using, please check them on the actual machine in use.

⚠ 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.

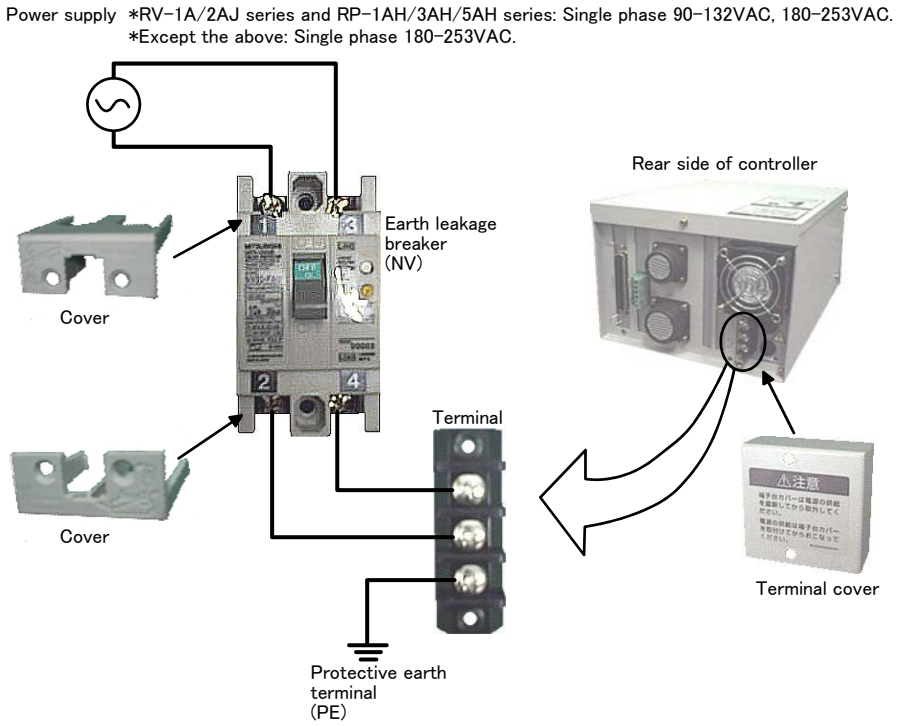
⚠WARNING When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers catching depending on the posture.

⚠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.

Precautions for the basic configuration are shown below.(When CR1-571/CR1B-571 is used for the controller.)

⚠CAUTION Provide an earth leakage breaker that packed together on the primary power supply of the controller as protection against electric leakage. Confirm the setting connector of the input power supply voltage of the controller, if the type which more than one power supply voltage can be used. Then connect the power supply.
Failure to do so could lead to electric shock accidents.



⚠WARNING For using RH-5AH/10AH/15AH series or RH-6SH/12SH/18SH series.
While pressing the brake releasing switch on the robot arm, beware of the arm which may drop with its own weight.
Dropping of the hand could lead to a collision with the peripheral equipment or catch the hands or fingers.

■ Revision history

Date of print	Specifications No.	Details of revisions
2004-07-07	BFP-A8416	First print.
2006-07-12	BFP-A8416-A	Error in writing correction.
2007-07-10	BFP-A8416-B	Error in writing correction.
2009-06-23	BFP-A8416-C	The EC Declaration of Conformity was changed. (Correspond to the EMC directive; 2004/108/EC)
2009-07-29	BFP-A8416-D	The EC-Statement of Compliance was added.
2009-09-29	BFP-A8416-E	The EC Declaration of Conformity was changed. (Correspond to the EMC directive; 2006/42/EC) The tracking function was added.

■ Introduction

The RH-6SH/12SH/18SH series offers small-size industrial robots developed using Mitsubishi's latest technology. They are especially designed to handle and assemble mechanical parts. They are Mitsubishi's answer to the customer's need to achieve a compact manufacturing facility capable of highly flexible production, as necessitated by the diffusion of high-density product groups and the shorter product life cycles that have become commonplace in recent years.

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 "2 Robot arm" on page 13 , the specifications related to the controller "3 Controller" on page 81 , and software functions and a command list "4 Software" on page 158 separately.

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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) Earth leakage breaker (CR1B-571 only)
(6) Safety manual, CD-ROM (Instruction manual)
(7) Guarantee card

1.1.2 Shipping special specifications

Part of the standard structural equipment is changed at the time of factory shipment. Consequently, kindly confirm the delivery date.

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.

1.1.3 Options

Installation is possible after shipment. Customer needs to perform the installation work.

1.1.4 Maintenance parts

Consumable parts and spare parts for maintenance use.

For items not listed, contact the dealer where you made your purchase.

1.2 Model type combination of robot

The model names of the RH-SH series are determined according to the load capacity, arm length, up/down stroke length and environment specification. The details are shown below; please select a robot that suits your intended purposes.

1.2.1 How to identify the robot model

RH - ◇◇ **SH** □□ △△ ○ **-S300**
(a) (b) (c) (d) (e) (f) (g)

(a). RH.....Indicates the horizontal multi-joint type.
Examples)
RV: Vertical multi-joint type
RC: Cylindrical coordinate type
RS: XYZ coordinate type, etc.

(b). ◇◇ .....Indicates the maximum load capacity.
Examples)
6: 6kg
12: 12kg
18: 18kg

(c). SH.....Indicates the SH series.

(d). □□ .....Indicates the arm length.
Examples)
35: 350mm
45: 450mm
55: 550mm
70: 700mm
85: 850mm

(e). △△ .....Indicates the up/dpwn stroke length.
Examples)
17: 170mm stroke
20: 200mm stroke
30: 300mm stroke
35: 350mm stroke

(f). ○ .....Indicates environment specification.
Examples)
Blank: Standard specifications
C: Clean specifications
M: Oilmist specifications

(g). -S3 00 ..... [1] Indicates a special model number.
(A) (B)

(A). -S3: Indicates that the special model number is between 300 and 599. Note that numbers in the three hundred-range indicate combinations of the RH-6SH series and the CR2B-574 controller.

(B). 00: The least significant two digits of the special model number indicate a combination number of the external signal logic setting and the language setting at shipment. The combinations of the least significant two digits are shown below.

Table 1-1 : Reserved special numbers

External signal logic	Language setting (parameter: LNG) Note1)	
	Japanese (JPN)	English (ENG)
Sink type	00	11
Source type	– Note2)	12

Note1) Robots are shipped with the language displayed on T/B set by the language setting parameter (LNG). (Settings can be changed by the customer.)
JPN: Japanese display
ENG: English display

Note2) There is no source type setting for the Japanese display.

[2] -SM** ..... Indicates a specification with controller protection box (RH-6SH series) or a controller specification with countermeasure against oil mist (RH-12SH/18SH series).

1.2.2 Combinations of robot arms and controllers

Table 1-2 : List of combinations of robot arms and controllers

Environment specifications	Robot arm	Arm length (mm)	Up/dpwn stroke length (mm)	Controller
RH-6SH seires				
Standard specification	RH-6SH3520	350	200	CR1B-571
	RH-6SH4520	450		
	RH-6SH5520	550		
Clean specification	RH-6SH3517C	350	170	
	RH-6SH4517C	450		
	RH-6SH5517C	550		
Oilmist specifications	RH-6SH3517M	350		
	RH-6SH4517M	450		
	RH-6SH5517M	550		
RH-12SH seires				
Standard specification	RH-12SH5535	550	350	CR2B-574
	RH-12SH7035	700		
	RH-12SH8535	850		
Clean specification	RH-12SH5530C	550	300	
	RH-12SH7030C	700		
	RH-12SH8530C	850		
Oilmist specifications	RH-12SH5530M	550		
	RH-12SH7030M	700		
	RH-12SH8530M	850		
RH-18SH seires				
Standard specification	RH-18SH8535	850	350	CR2B-574
Clean specification	RH-18SH8530C		300	
Oilmist specifications	RH-18SH8530M			

1.3 CE marking specifications

The RH-6SH/12SH/18SH series provides models with CE marking specifications as well,

Table 1-3 : Robot models with CE marking specifications

Robot type		Controller	External signal logic	Language setting (parameter: LNG)
RH-6SH series Note1)	RH-6SH3520-S312	CR2B-574	Source type	English (ENG)
	RH-6SH4520-S312			
	RH-6SH5520-S312			
RH-12SH series	RH-12SH5535-S12			
	RH-12SH7035-S12			
	RH-12SH8535-S12			
RH-18SH series	RH-18SH8535-S12			

Note1) The CE marking specification of the RH-6SH series is changed to CR2B-574 controller connection. Please be aware that there are no robots with CE marking specifications that can be connected to the CR1B-571 controller.

1.4 Indirect export

If you intend to export robots bought from us, be sure to choose robots whose language setting parameter (LNG) is set to English (ENG).

1.5 Instruction manuals

The instruction manuals supplied with the shipment are provided in electronic form in a CD-ROM, except for the Safety Manual. This CD-ROM (electronic manual) includes instruction manuals in both Japanese and English versions. Please note that the instruction manuals are the same for both language settings (parameter LNG).

1.6 Contents of the structural equipment

1.6.1 Robot arm

The devices shown below can be installed on the robot arm.

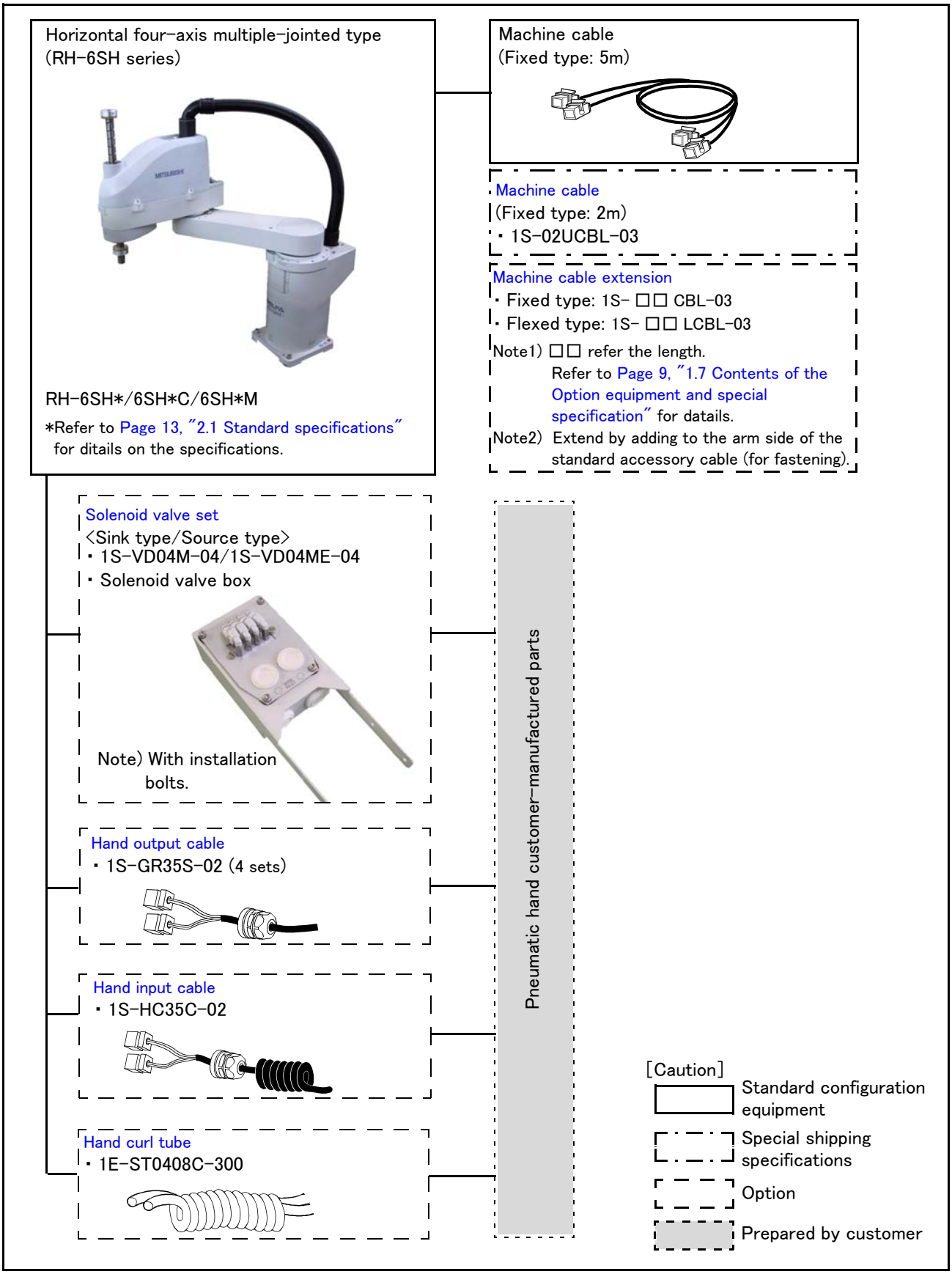


Fig.1-1 : Structural equipment (Robot arm: RH-6SH series)

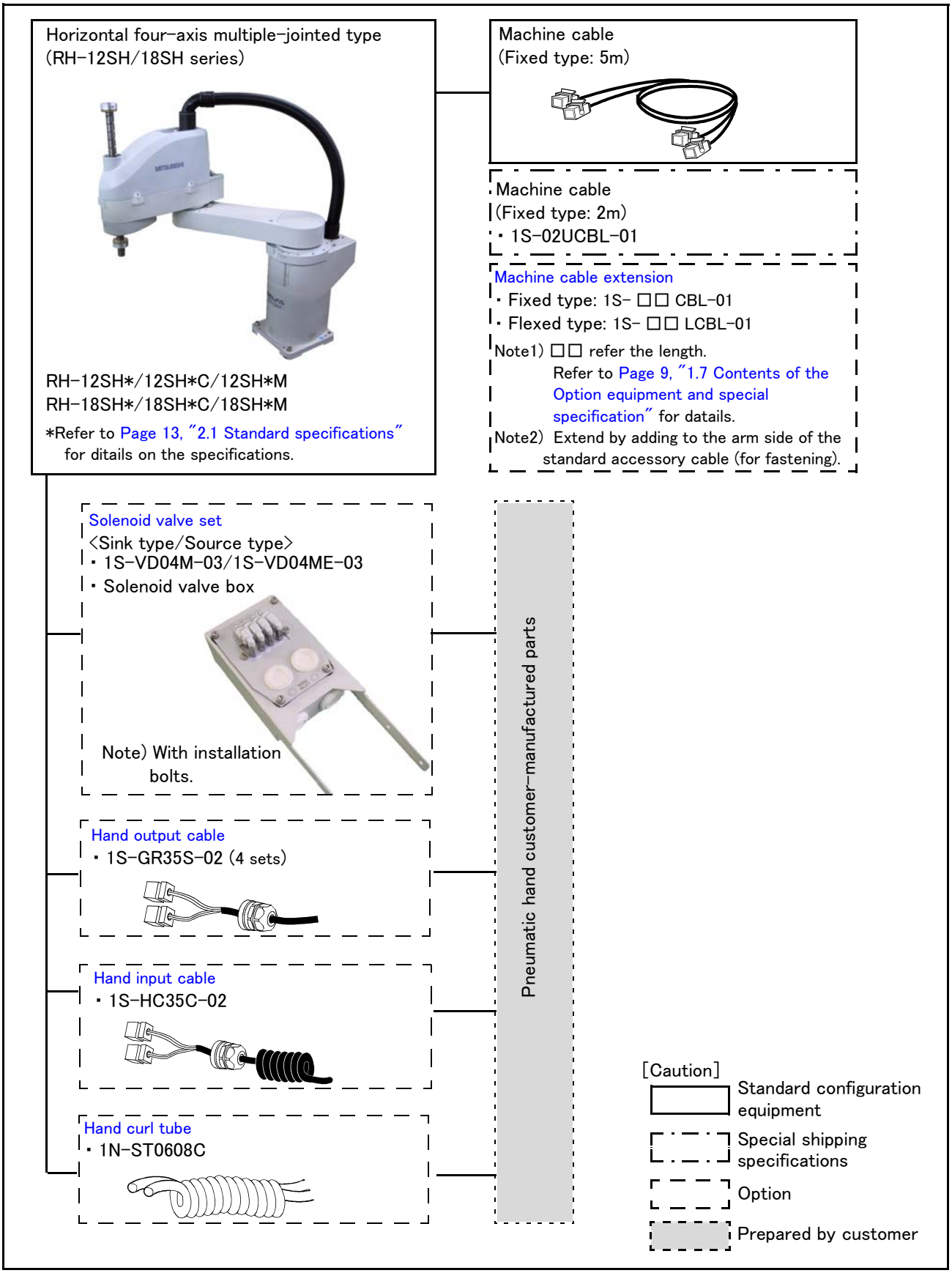
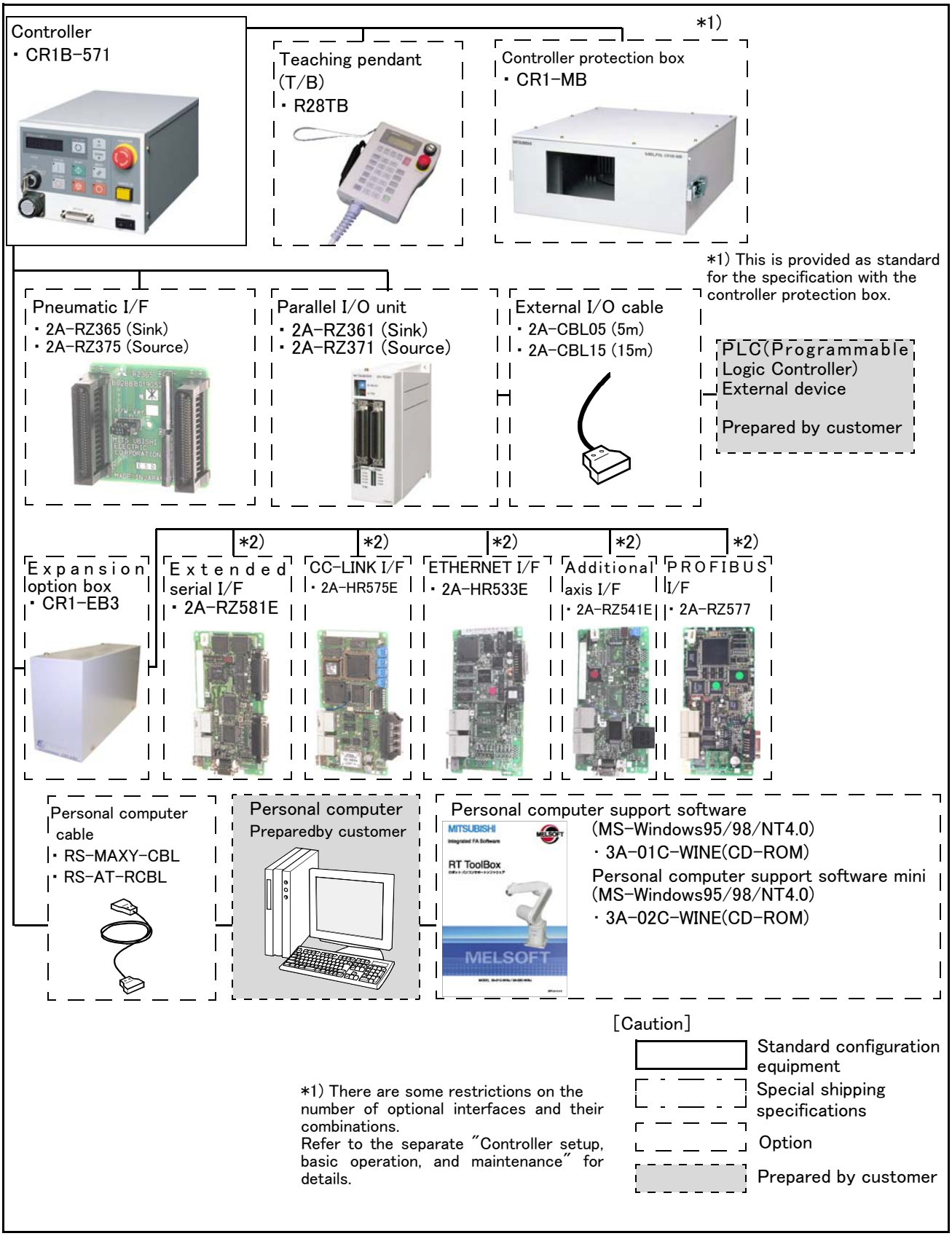


Fig.1-2 : Structural equipment (Robot arm: RH-12SH/18SH series)

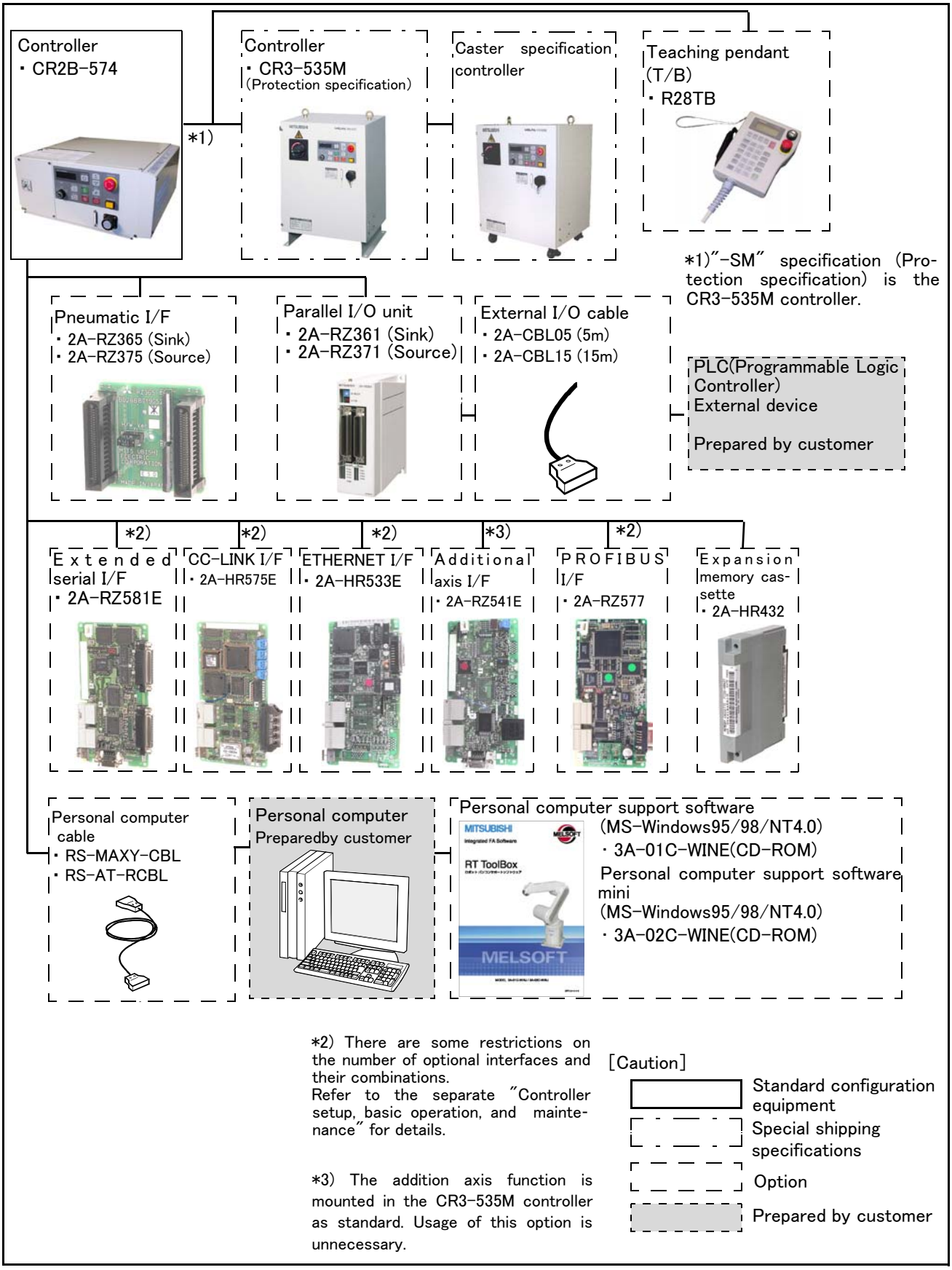
1.6.2 Controller

The devices shown below can be installed on the controller.

1.6.3 CR1B-500 series controller



1.6.4 CR2B-500/CR3-500 series controller



(CR2B-574/CR3-535M controller)

1.6.5

1.7 Contents of the Option equipment and special specification

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

Table 1-4 : RH-6SH Series: List of Optional Devices and Special Specifications for the CR1B-571 Controller

Item	Type	Specifications	Classification Note1)	Descripsion
Machine cable(Replaced with shorter cable)	1S-02UCBL-03	For fixing (Two sets for power and signal)	○・□	2m(A 2 m cable is supplied instead of the 5 m cable that is supplied as standard)
Extended machine cable (Extension type)	1S- □□ CBL-03	For fixing (Two sets for power and signal)	○	5, 10, 15m
	1S- □□ LCBL-03	For flexing (Two sets for power and signal)	○	5, 10, 15m
Solenoid valve set Note2)	1S-VD04M-04	4 set (Sink type)	○	A solenoid valve set for the pneumatic hand
	1S-VD04ME-04	4 set (Source type)		
Hand output cable Note3)	1S-GR35S-02	One terminal is not treated.	○	The cable is connected to the hand output connector by the customer.
Hand input cable	1S-HC35C-02	One terminal is not treated.	○	The cable is connected to the sensor by the customer.
Hand curl tube	1E-ST0408C-300	For solenoid valve 4set.:Φ4x8	○	Curl type air tube
Teaching pendant	R28TB	Cable length 7m	○	With 3-position deadman switch/ IP 65
	R28TB-15	Cable length 15m (special specification)	○	
Pneumatic hand interface	2A-RZ365	DO: 8 point (Sink type)	○	It is necessary when the hand output signal of the robot arm is used. (Integrated in the controller.)
	2A-RZ375	DO: 8 point (Source type)	○	
Parallel I/O Unit	2A-RZ361	DO: 32 point (Sink type)/ DI : 32 point (Sink type)	○	The unit for expansion the external input/output. Electrical isolated Type (100mA/Point)
	2A-RZ371	DO: 32 point (Source type)/ DI : 32 point (Source type)	○	
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	○	
Personal computer cable	RS-MAXY-CBL	RS-232C cable 3m for PC-AT compatible model	○	Use RS-AT-RCBL for the connection from the expansion option box.
	RS-AT-RCBL		○	
Personal computer Support software	3A-01C-WINE	CD-ROM	○	MS-Windows98/2000/NT4.0/Me/XP (With the simulation function)
Personal computer Support software mini	3A-02C-WINE	CD-ROM	○	MS-Windows98/2000/NT4.0/Me/XP
RT ToolBox2 (Personal computer Support software)	3D-11C-WINE	CD-ROM	○	MS-Windows2000/XP/Vista (With the simulation function)
RT ToolBox2 mini (Personal computer Support software mini)	3D-12C-WINE	CD-ROM	○	MS-Windows2000/XP/Vista
Expansion option box	CR1-EB3	Up to three option cards can be mounted	○	Install on the side of the controller
Extended serial interface	2A-RZ581-E	RS-232C x 1 RS-232C or RS-422 x 1	○	CR-EB3 is need.
CC-Link interface	2A-HR575-E	Local station (The local station alone is supported.)	○	for MELSEC PLC with CC-Link connection. CR-EB3 is need.
Ethernet interface	2A-HR533-E	ETHERNET x 1	○	CR-EB3 is need.
Additional axis interface	2A-RZ541-E	SSC x 1 Up to 8 axises can be added	○	MR-J2 servoAmplifer Unit connection. CR-EB3 is need.
PROFIBUS interface	2A-RZ577-E	PROFIBUS-DP slave	○	GSD file (FD) attached. CR-EB3 is need.
Controller protection box Note4)	CR1B-MB	IP54	○・□	The controller protection box is used to protect the controller from an oil mist or other operating environment.

Note1) In the classification column, ○ refers to an option,and □ to a Shipping special specifications.

Note2) The solenoid valve box which protects the solenoid valve is attached to this option.

Note3) It is necessary to take measures to prevent oil mist and secure that the environment is sufficiently clean if this option is used in an environment where oil mist, etc. is present or in a clean environment. For more details, refer to the Page 66, "2.6 Shipping special specifications, options, and maintenance parts".

Note4) This is provided as standard for the specification with the controller protection box. Use the controller protection box to protect the controller from the oil mist when the controller will be installed in the environment such as the oil mist.

Table 1-4 : RH-6SH Series: List of Optional Devices and Special Specifications for the CR1B-571 Controller(Continued)

Item	Type	Specification	Classification Note1)	Descripsion
Instruction Manual	4S-MAP-107Note2)	A set of the instructions manual bookbinding editions.	○	For the CR1B-571 controller

Note1)In the classification column, ○ refers to an option,and □ to a Shipping special specifications.
Note2)The CE marking specification is set the "4S-MAP-108". Refer to Page 12, "Table 1-5" for details.

Table 1-5 : RH-12/18SH Series: List of Optional Devices and Special Specifications for the CR2B-574/CR3-535M Controller

Item	Type	Specifications	Classification Note1)	Descripsion
Machine cable(Replaced with shorter cable)	1S-02UCBL-01	For fixing (Two sets for power and signal)	○・□	2m(A 2 m cable is supplied instead of the 5 m cable that is supplied as standard)
Extended machine cable (Extension type)	1S- □□ CBL-01	For fixing (Two sets for power and signal)	○	5, 10, 15m
	1S- □□ LCBL-01	For flexing (Two sets for power and signal)	○	5, 10, 15m
Solenoid valve set Note2)	1S-VD04M-03	4 set (Sink type)	○	A solenoid valve set for the pneumatic hand
	1S-VD04ME-03	4 set (Source type)		
Hand output cable Note3)	1S-GR35S-02	One terminal is not treated.	○	The cable is connected to the hand output connector by the customer.
Hand input cable	1S-HC35C-02	One terminal is not treated.	○	The cable is connected to the sensor by the customer.
Hand curl tube	1N-ST0608C	For solenoid valve 4set.:Φ6x8	○	Curl type air tube
Teaching pendant	R28TB	Cable length 7m	○	With 3-position deadman switch/ IP 65
	R28TB-15	Cable length 15m (special specification)	○	
Pneumatic hand interface	2A-RZ365	DO: 8 point (Sink type)	○	It is necessary when the hand output signal of the robot arm is used. (Integrated in the controller.)
	2A-RZ375	DO: 8 point (Source type)	○	
Parallel I/O interface	2A-RZ361	DO: 32 point (Sink type)/ DI : 32 point (Sink type)	○	The unit for expansion the external input/output. Electrical isolated Type (100mA/Point)
	2A-RZ371	DO: 32 point (Source type)/ DI : 32 point (Source type)	○	
External I/O cable	2A-CBL05	5m	○	Use to connect the external peripheral device to the parallel input/output unit
	2A-CBL15	15m	○	
Personal computer cable	RS-MAXY-CBL	RS-232C cable 3m for PC-AT compatible model	○	
Personal computer Support software	3A-01C-WINE	CD-ROM	○	MS-Windows98/2000/NT4.0/Me/XP (With the simulation function)
Personal computer Support software mini	3A-02C-WINE	CD-ROM	○	MS-Windows98/2000/NT4.0/Me/XP
Extended serial interface	2A-RZ581-E	RS-232C x 1 RS-232C or RS-422 x 1	○	
CC-Link interface	2A-HR575-E	Local station (The local station alone is supported.)	○	for MELSEC PLC with CC-Link connection.
Ethernet interface	2A-HR533-E	ETHERNET x 1	○	
Additional axis interface Note4)	2A-RZ541-E	SSC x 1 Up to 8 axises can be added	○	MR-J2 servoAmplifer Unit connection.
PROFIBUS interface	2A-RZ577-E	PROFIBUS-DP slave	○	GSD file (FD) attached.
Extended memory cassette	2A-HR432	Teaching point number: 25,400 Steps number: 50,800 Program number: 100	○	The battery backup function is provided. Together with 2,500 points of standard teaching positions, the total number of teaching positions is 27,900 points.
Controller specification with countermeasure against oil mist Note5)	CR3-535M	Self-contained floor type, Closed type (IP54)	□	

Note1) In the classification column, ○ refers to an option,and □ to a Shipping special specifications.

Note2) The solenoid valve box which protects the solenoid valve is attached to this option.

Note3) A procedure for securing protection and cleanliness is required for customers. For more details, refer to the Page 66, "2.6 Shipping special specifications, options, and maintenance parts".

Note4) The CR3-535M controller is installed with the additional axis function as standard. This optional function is applicable to the CR2B-574 controller only.

Note5) Be sure to select the controller specification with countermeasure against oil mist (-SM specification) if you intend to use the controller in environments where oil mist is present.

Table 1-5 : RH-12/18SH Series: List of Optional Devices and Special Specifications for the CR2B-574/CR3-535M Controller (Continued)

Item	Type	Specification	Classification Note1)	Descripsion
Instruction Manual	4S-MAP-108	A set of the instructions manual bookbinding editions.	○	For the CR2B-574 controller
	4S-MAP-109		○	For the CR3-535M controller

Note1)In the classification column, ○ refers to an option,and □ to a Shipping special specifications.

2 Robot arm

2.1 Standard specifications

2.1.1 RH-6SH series

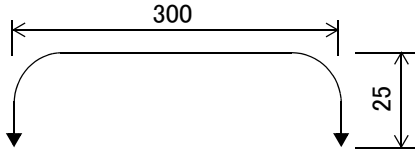
Table 2-1 : Tab Standard specifications of robot (Standard Specification)

Item		Unit	Specifications		
Type			RH-6SH3520	RH-6SH4520	RH-6SH5520
Environment			Standard specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	400		
	J2	W	100		
	J3 (Z)	W	100		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	125	225	325
	No. 2 arm	mm	225		
Max.reach radius(No. 1+ No. 2)		mm	350	450	550
Operating range	J1	deg	254(± 127)		
	J2	deg	274(± 137)	290(± 145)	
	J3 (Z)	mm	200(97 to 297)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	375		
	J2	deg/s	612		
	J3 (Z)	mm/s	1,177		
	J4 (θ axis)	deg/s	2,411		
Maximum horizontal composite speed Note1)		mm/s	6,473(4,694)	7,128(5,349)	7,782(6,003)
Cycle time Note2)		sec	0.45	0.46	0.47
Load (Including hand)	Rating	kg	2		
	Maximum	kg	6		
Allowable moment load	Rating	kg・m^2	0.01		
	Maximum	kg・m^2	0.04		
Pose repeatability Note3)	X-Y direction	mm	± 0.02		
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.02		
Ambient temperature		℃	0 to 40		
Mass		kg	20	21	
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5)			IP20		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in parentheses is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 20, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

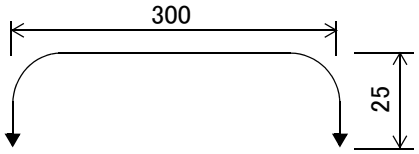
Table 2-2 : Tab Standard specifications of robot (Clean Specification)

Item		Unit	Specifications		
Type			RH-6SH3517C	RH-6SH4517C	RH-6SH5517C
Environment			Clean specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	400		
	J2	W	100		
	J3 (Z)	W	100		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	125	225	325
	No. 2 arm	mm	225		
Max.reach radius(No. 1+ No. 2)		mm	350	450	550
Operating range	J1	deg	254(± 127)		
	J2	deg	274(± 137)	290(± 145)	
	J3 (Z)	mm	170(97 to 267)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	375		
	J2	deg/s	612		
	J3 (Z)	mm/s	1,177		
	J4 (θ axis)	deg/s	2,411		
Maximum horizontal composite speed Note1)		mm/s	6,473(4,694)	7,128(5,349)	7,782(6,003)
Cycle time Note2)		sec	0.45	0.46	0.47
Load (Including hand)	Rating	kg	2		
	Maximum	kg	6		
Allowable moment load	Rating	kg・m^2	0.01		
	Maximum	kg・m^2	0.04		
Pose repeatability Note3)	X-Y direction	mm	± 0.02		
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.02		
Ambient temperature		℃	0 to 40		
Mass		kg	20	21	
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Degree of cleanliness Note5)			10(0.3 μ m)		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in parentheses is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 20, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The details of the clean specifications are described in Page 28, "2.2.5 Clean specifications". Protection of the cleanness of the robot is required if the down flow in a clean room is 0.3 m/s or more and robot internal suction is 60 NL/min. A ϕ8 joint is prepared at the base rear part for suction.

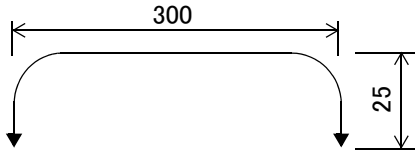
Table 2-3 : Tab Standard specifications of robot (Oil mist Specification)

Item		Unit	Specifications		
Type			RH-6SH3517M	RH-6SH4517M	RH-6SH5517M
Environment			Oil mist specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	400		
	J2	W	100		
	J3 (Z)	W	100		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	125	225	325
	No. 2 arm	mm	225		
Max.reach radius(No. 1+ No. 2)		mm	350	450	550
Operating range	J1	deg	254(± 137)		
	J2	deg	274(± 137)	290(± 145)	
	J3 (Z)	mm	170(97 to 267)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	375		
	J2	deg/s	612		
	J3 (Z)	mm/s	1,177		
	J4 (θ axis)	deg/s	2,411		
Maximum horizontal composite speed Note1)		mm/s	6,473(4,694)	7,128(5,349)	7,782(6,003)
Cycle time Note2)		sec	0.45	0.46	0.47
Load (Including hand)	Rating	kg	2		
	Maximum	kg	6		
Allowable moment load	Rating	kg・m^2	0.01		
	Maximum	kg・m^2	0.04		
Pose repeatability Note3)	X-Y direction	mm	± 0.02		
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.02		
Ambient temperature		℃	0 to 40		
Mass		kg	20	21	
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5) Note6)			IP54		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in parentheses is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 20, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

Note6) If you intend to use the controller in oil mist or similar environments, use the controller protection box (CR1B-MB) to protect the controller from the operation environment. A robot equipped with the controller protection box as standard is available(indicated with "-SM" on type).

2.1.2 RH-12SH sereis

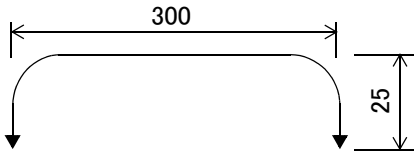
Table 2-4 : Tab Standard specifications of robot (Standard Specification)

Item		Unit	Specifications		
Type			RH-12SH5535	RH-12SH7035	RH-12SH8535
Environment			Standard specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	400		
	J3 (Z)	W	200		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	225	375	525
	No. 2 arm	mm	325		
Max.reach radius(No. 1+ No. 2)		mm	550	700	850
Operating range	J1	deg	280(± 140)		
	J2	deg	290(± 145)		306(± 153)
	J3 (Z)	mm	350(-10 to 340)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	360		288
	J2	deg/s	412.5		
	J3 (Z)	mm/s	1,300		
	J4 (θ axis)	deg/s	1,500		
Maximum horizontal composite speed Note1)		mm/s	10,555(5,796)	11,498(6,738)	11,221(6,612)
Cycle time Note2)		sec	0.43	0.44	0.46
Load (Including hand)	Rating	kg	2		
	Maximum	kg	12		
Allowable moment load	Rating	kg・m^2	0.02		
	Maximum	kg・m^2	0.1		
Pose repeatability Note3)	X-Y direction	mm	± 0.02	± 0.025	
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	41	43	45
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5)			IP20		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in parentheses is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 20, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

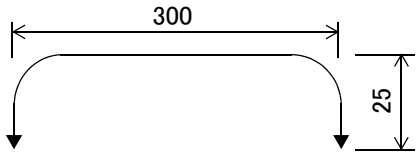
Table 2-5 : Tab Standard specifications of robot (Clean Specification)

Item		Unit	Specifications		
Type			RH-12SH5530C	RH-12SH7030C	RH-12SH8530C
Environment			Clean specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	400		
	J3 (Z)	W	200		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	225	375	525
	No. 2 arm	mm	325		
Max.reach radius(No. 1+ No. 2)		mm	550	700	850
Operating range	J1	deg	280(± 140)		
	J2	deg	290(± 145)		306(± 153)
	J3 (Z)	mm	300(-10 to 290)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	360		288
	J2	deg/s	412.5		
	J3 (Z)	mm/s	1,300		
	J4 (θ axis)	deg/s	1,500		
Maximum horizontal composite speed Note1)		mm/s	10,555(5,796)	11,498(6,738)	11,221(6,612)
Cycle time Note2)		sec	0.43	0.44	0.46
Load (Including hand)	Rating	kg	2		
	Maximum	kg	12		
Allowable moment load	Rating	kg・m^2	0.02		
	Maximum	kg・m^2	0.1		
Pose repeatability Note3)	X-Y direction	mm	± 0.02	± 0.025	
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	41	43	45
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Degree of cleanliness Note5)			10(0.3 μ m)		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in parentheses is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 20, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The details of the clean specifications are described in Page 28, "2.2.5 Clean specifications" To secure cleanliness, a clean room down flow of 0.3 m/s or more and an internal robot suction of 60 NL/min are required. A coupling of ϕ8 is provided in the rear of the base for suction.

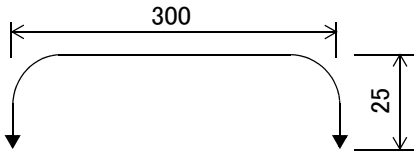
Table 2-6 : Tab Standard specifications of robot (Oil mist Specification)

Item		Unit	Specifications		
Type			RH-12SH5530M	RH-12SH7030M	RH-12SH8530M
Environment			Oil mist specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	400		
	J3 (Z)	W	200		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4 : no brake J3 : with brake		
Arm length	No. 1 arm	mm	225	375	525
	No. 2 arm	mm	325		
Max.reach radius(No. 1+ No. 2)		mm	550	700	850
Operating range	J1	deg	280(± 140)		
	J2	deg	290(± 145)		306(± 153)
	J3 (Z)	mm	300(-10 to 290)		
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	360		288
	J2	deg/s	412.5		
	J3 (Z)	mm/s	1,300		
	J4 (θ axis)	deg/s	1,500		
Maximum horizontal composite speed Note1)		mm/s	10,555(5,796)	11,498(6,738)	11,221(6,612)
Cycle time Note2)		sec	0.43	0.44	0.46
Load (Including hand)	Rating	kg	2		
	Maximum	kg	12		
Allowable moment load	Rating	kg・m^2	0.02		
	Maximum	kg・m^2	0.1		
Pose repeatability Note3)	X-Y direction	mm	± 0.02	± 0.025	
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	41	43	45
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5) Note6)			IP54		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in parentheses is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 20, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

Note6) When using the controller in an oil mist environment, etc., select the oil mist compatible controller specifications (indicated with "-SM" on type). The CR3-535M controller, compatible with an oil mist environment, is available as factory-shipped special specifications.

2.1.3 RH-18SH series

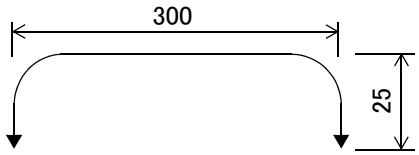
Table 2-7 : Tab Standard specifications of robot

Item		Unit	Specifications		
Type			RH-18SH8535	RH-18SH8530C	RH-18SH8530M
Environment			Standard specification	Clean specification	Oil mist specification
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	400		
	J3 (Z)	W	400		
	J4 (θ axis)	W	100		
Brake			J1, J2 : no brake J3, J4 : with brake		
Arm length	No. 1 arm	mm	525		
	No. 2 arm	mm	325		
Max.reach radius(No. 1+ No. 2)		mm	850		
Operating range	J1	deg	280(± 140)		
	J2	deg	306(± 153)		
	J3 (Z)	mm	350(-10 to 340)	300(-10 to 290)	
	J4 (θ axis)	deg	720(± 360)		
Speed of motion	J1	deg/s	288		
	J2	deg/s	412.5		
	J3 (Z)	mm/s	1,200		
	J4 (θ axis)	deg/s	1,500		
Maximum horizontal composite speed Note1)		mm/s	11,221		
Cycle time Note2)		sec	0.53		
Load (Including hand)	Rating	kg	5		
	Maximum	kg	18		
Allowable moment load	Rating	kg・m^2	0.02		
	Maximum	kg・m^2	0.2		
Pose repeatability Note3)	X-Y direction	mm	± 0.025		
	J3 (Z)	mm	± 0.01		
	J4 (θ axis)	deg	± 0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	47		
Tool wiring Note4)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6 × 2		
Supply pressure		MPa	0.5 ± 10%		
Protection specification Note5) Note6)			IP20	—	IP54
Degree of cleanliness Note7)			—	10(0.3 μ m)	—
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1)The value when J1, J2 and J4 are composed. The value in parentheses is the value when J1 and J2 are composed.

Note2)Values of the operation below at rated load capacity.

・The cycle time may increase when the positioning accuracy or other criterion of a work is required, or depending on the position of operation.



Note3)The pose repeatability details are given in Page 20, "2.2.1 Pose repeatability".

Note4)The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note5)The protection specification details are given in Page 26, "2.2.4 Protection specifications and working environment".

Note6) When using the controller in an oil mist environment, etc., select the oil mist compatible controller specifications (indicated with "-SM" on type). The CR3-535M controller, compatible with an oil mist environment, is available as factory-shipped special specifications.

Note7)The details of the clean specifications are described in Page 28, "2.2.5 Clean specifications" To secure cleanliness, a clean room down flow of 0.3 m/s or more and an internal robot suction of 60 NL/min are required. A coupling of ϕ8 is provided in the rear of the base for suction.

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 Note1) and a position within the actual space

Note1)
The pallet function is a function that teaches only the position of the work used as reference (3 to 4 points) and obtains the remaining positions by calculations, for an operation that arranges works orderly or for an operation that unloads orderly arranged works. By using this function, for example, in the case of an operation that arranges works on grid points of 100 x 100, by teaching only three points of four corners, the remaining grid points are automatically generated; thus, it is not necessary to teach all 10,000 points. For more information about the pallet function, refer to the separate volume, "Instruction Manual/Detailed Explanation of Functions and Operations."

2.2.2 Mass capacity and the allowable moment

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 13, "2.1 Standard specifications".

(2) Fig. 2-1, Fig. 2-2 and Fig. 2-3 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.

[CAUTION]The mass capacity and the allowable moment of inertia are significantly affected by the operating speed and operating posture of the robot. Even when these values are within the allowable range described above, an overload or overcurrent alarm may occur. In such cases, the acceleration/deceleration time settings, operating speed and/or operating posture must be adjusted.

[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 flange surface by long and low-rigid tooling, the positioning accuracy may deteriorate or may cause vibration.
Note that the allowable offset value (Z direction) from the lower edge of the shaft to the position of center of gravity is 100 mm.

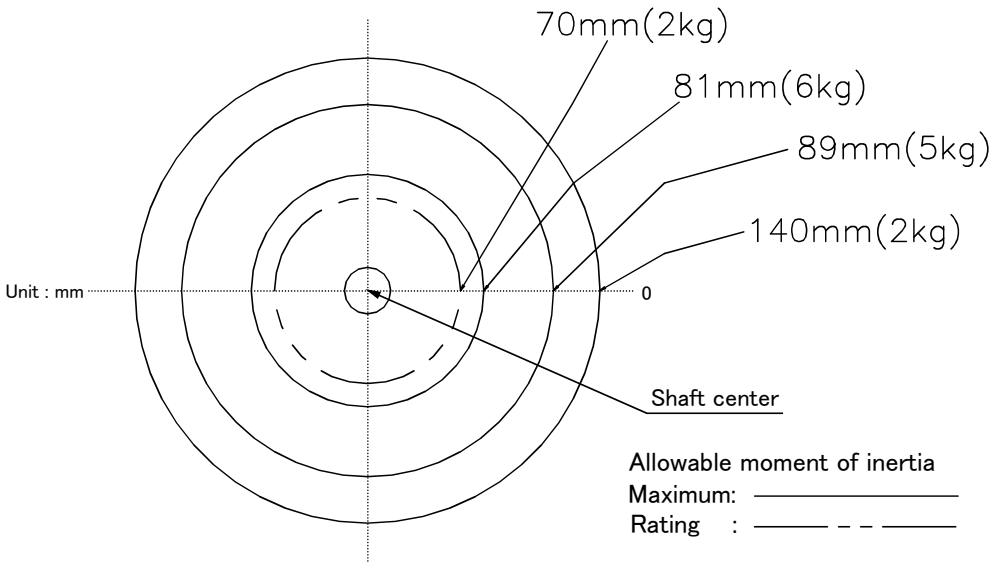


Fig.2-1 : Position of center of gravity for loads (for loads with comparatively small volume): RH-6SH series

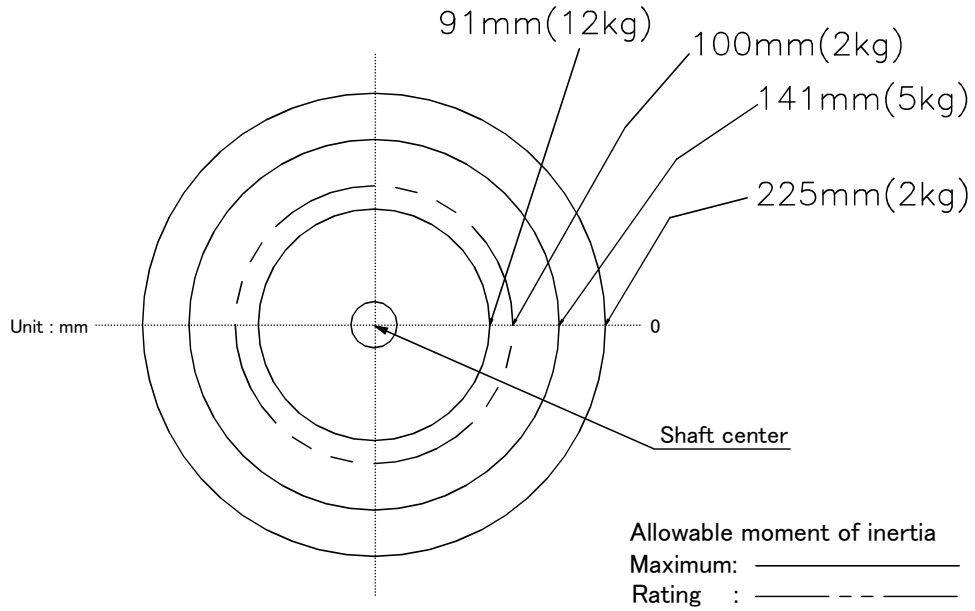


Fig.2-2 : Position of center of gravity for loads (for loads with comparatively small volume): RH-12SH series

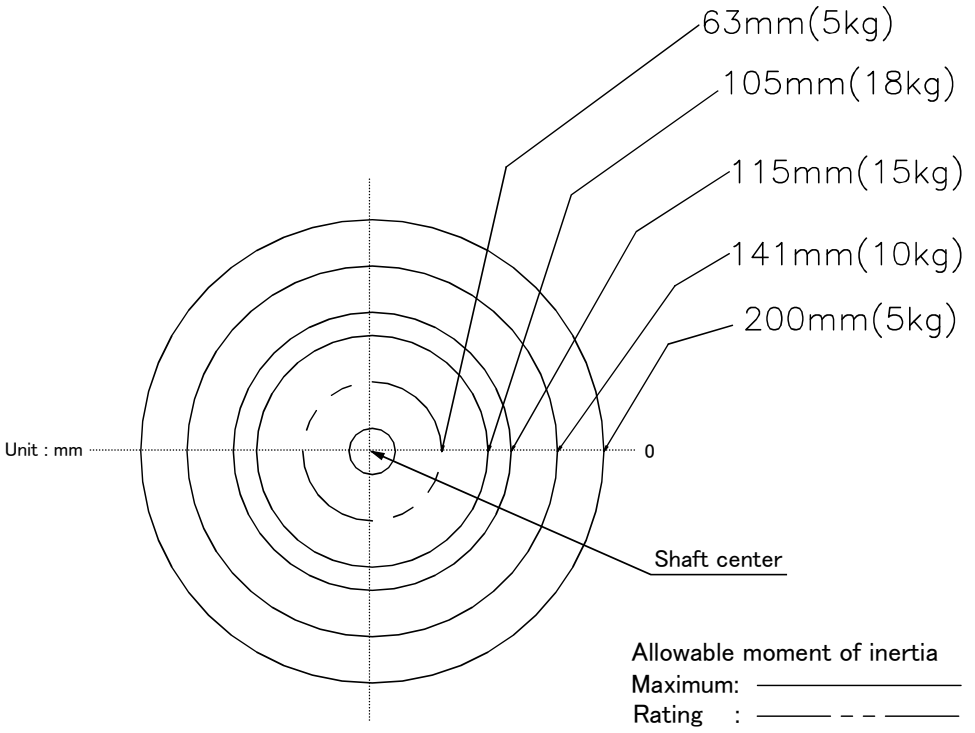


Fig.2-3 : Position of center of gravity for loads (for loads with comparatively small volume): RH-18SH series

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

This robot automatically sets the optimum acceleration and deceleration speeds and maximum speed, according to the load capacity and size that have been set, and operates using these automatically set speeds.
In order to achieve this, it is necessary to set the actual load used. Since the setting value may vary up to ± 20 % from the applied load, there is a possibility that vibration, excessive error, excessive load and other error may occur depending on the operation pattern and ambient temperature. In such cases, specify speed (OVRD 1 to 9) and acceleration/deceleration (ACCEL 1 to 99, 1 to 99) settings for each operation in the robot program. If a value smaller than the applied load is specified, the lifetime of the mechanical parts used on the robot may be shortened. If you perform tasks requiring high precision, please be sure to set the load correctly and lower the acceleration/deceleration rate during usage.

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

Set up the capacity and size of the hand with the "HNDDAT*" parameter (optimum acceleration/deceleration setting parameter), and set up the capacity and size of the work with the "WRKDAT*" parameter. Numbers 1 to 8 can be used for the asterisk (*) part. Designate the "HNDDAT*" and "WRKDAT*" parameters to be used using the "LOADSET" command in a program.
For more details, refer to the INSTRUCTION MANUAL entitled "Detailed explanations of functions and operations."

<Factor default settings>

	Hand mass (kg)	size X (mm)	size Y (mm)	size Z (mm)	center-of-gravity position X (mm)	center-of-gravity position Y (mm)	center-of-gravity position Z (mm)
RH-6SH series							
HNDDAT*	6.0	99.0	99.0	76.0	0.0	0.0	38.0
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RH-12SH series							
HNDDAT*	12.0	225.0	225.0	30.0	0.0	0.0	15.0
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RH-18SH series							
HNDDAT*	18.0	258.0	258.0	34.0	0.0	0.0	17.0
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note 1)The center-of-gravity position is located at the center of the lower edge surface of the shaft. X, Y and Z set the center-of-gravity position in the tool's coordinate direction.
(For the center-of-gravity position Z, the downward direction is the minus direction.)

(2) Relationship Between Mass Capacity and Speed

A function to optimize the maximum speed of each axis according to the setting value of the load capacity will be activated (Refer to Fig. 2-4). However, this function does not work with the setting of 2kg (5kg in the case of RH-18SH85 sereis) or lighter load mass. When the setting of the load mass is changed to 2kg (5kg in the case of RH-18SH85 sereis) or heavier, the maximum speed is compensated according to the load mass.

[CAUTION] Depending on the operation pattern, the speed and/or acceleration/deceleration at the front edge may not be parallel with the speed and the rate of change of acceleration/deceleration specified in a program.

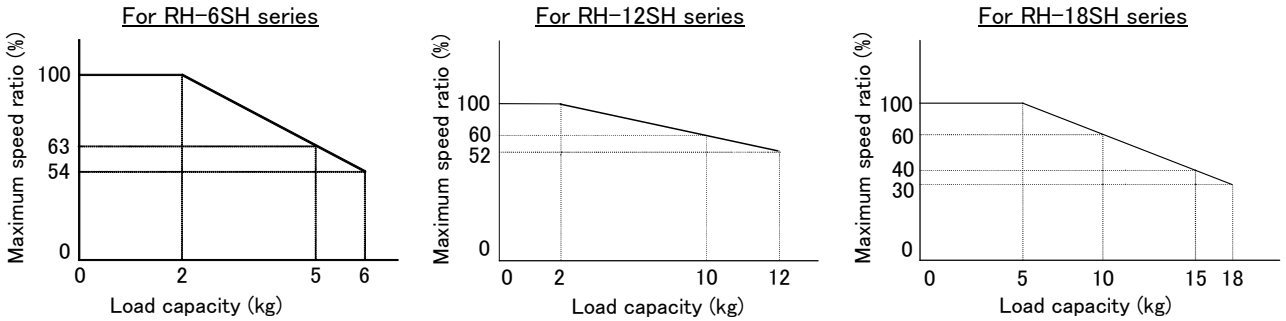
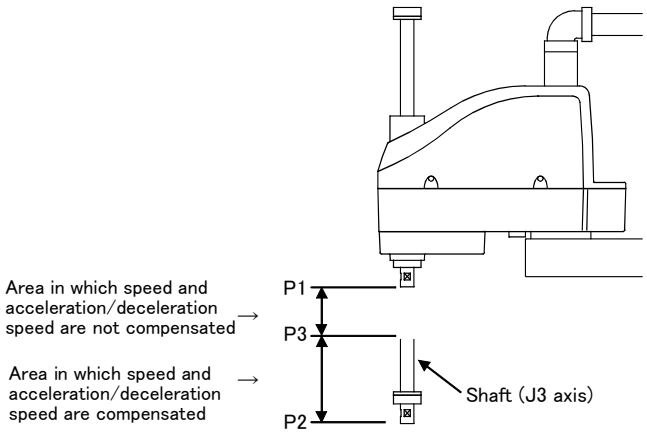


Fig.2-4 : Automatic compensation of speed

(3) Relationship Between Height of Shaft (J3 Axis) and Acceleration/Deceleration Speed

A function to optimize the acceleration/deceleration speed according to the height of the shaft (Refer to Fig. 2-6) will be activated. This function is invalid if the shaft (axis J3) operates at a position above P3 in Fig. 2-5. Acceleration/deceleration is compensated for at a position below P3 in Fig. 2-5 if the position of the center of gravity of the load is located at the front edge of the shaft.



	Upper stroke edge P1(mm)	Lower stroke edge P2(mm)	Position P3(mm)
RH-6SH series	297	-23	247 (Position 50 mm below the upper stroke edge.)
RH-12SH series	340	-10	248 (Position 92 mm below the upper stroke edge.)
RH-18SH series	340	-10	320 (Position 20 mm below the upper stroke edge.)

Fig.2-5 : Area in which acceleration/deceleration speed is compensated

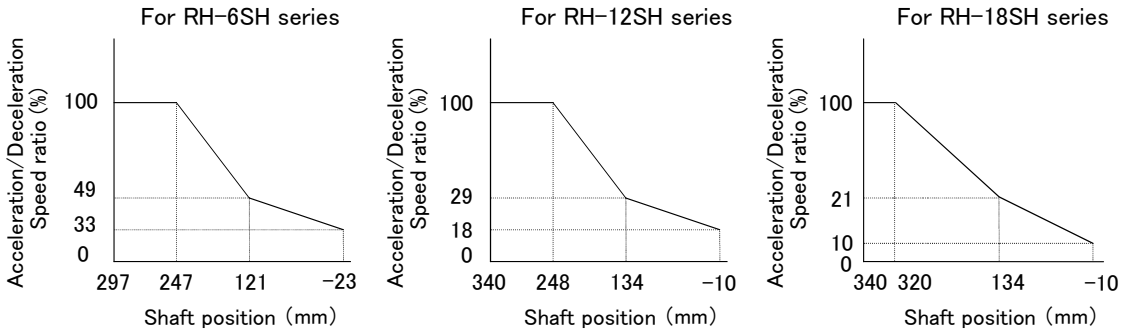


Fig.2-6 : Automatic compensation of acceleration/deceleration speed

(4) Time to reach the position repeatability (only for RH-12SH/18SH series)

When using this robot, the time to reach the position repeatability may be prolonged due to the effect of residual vibration at the time of stopping. If this happens, take the following measures:

1) Change the operation position of the Z axis to the location near the top as much as possible.
2) Increase the operation speed prior to stopping.
3) When positioning the work near the bottom edge of the Z axis, if no effectiveness is achieved in step <2> above, perform operation <1> (robot path: O -> A -> C). In the case of operation 2 (robot path: O -> B -> C), residual vibration may occur. (Refer to Fig. 2-7.)

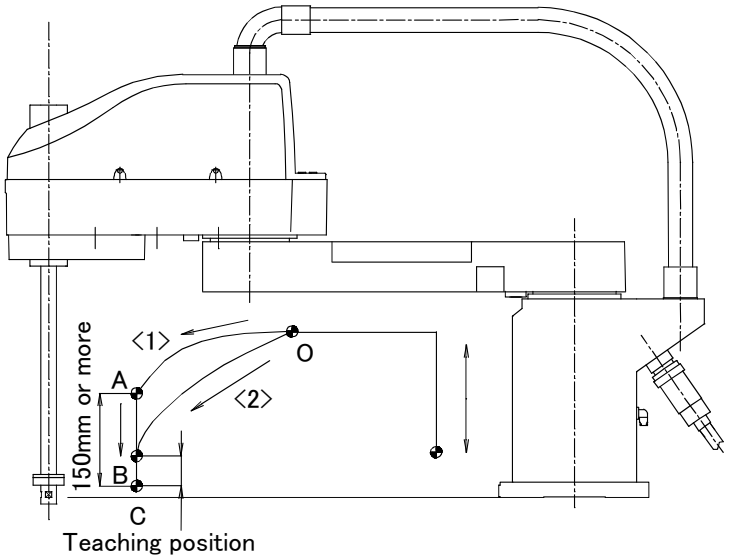


Fig.2-7 : Recommended path when positioning at the bottom edge of the Z axis

2.2.4 Protection specifications and working environment

(1) Types of protection specifications

The robot arm has protection specifications that comply with the IEC Standards. The protection specifications and applicable fields are shown in Table 2-8. Because the products with the oilmist specifications are produced upon receiving an order, please check the delivery schedule.

Table 2-8 : Protection specifications and applicable fields

Type	Protection specifications (IEC Standards value)	Classification	Applicable field	Remarks
RH-6SH series				
RH-6SH 3520 RH-6SH 4520 RH-6SH 5520	Robot arm : IP20 Controller : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-6SH 3517M RH-6SH 4517M RH-6SH 5517M	Robot arm : IP54 Controller : IP20	Oil mist specifications	Machine tool (cutting) Machine shop with heavy oil mist Dusty work shop	Note that if the cutting machine contains abrasive materials, the machine line will be shortened.
RH-6SH 3517M-SM Note1) RH-6SH 4517M-SM RH-6SH 5517M-SM	Robot arm : IP54 Controller : IP54			
RH-12SH series				
RH-12SH 5535 RH-12SH 7035 RH-12SH 8535	Robot arm : IP20 Controller : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-12SH 5530M RH-12SH 7030M RH-12SH 8530M	Robot arm : IP54 Controller : IP20	Oil mist specifications	Machine tool (cutting) Machine shop with heavy oil mist Dusty work shop	Note that if the cutting machine contains abrasive materials, the machine line will be shortened.
RH-12SH 5530M-SM Note2) RH-12SH 7030M-SM RH-12SH 8530M-SM	Robot arm : IP54 Controller : IP54			
RH-18SH series				
RH-18SH 8535	Robot arm : IP20 Controller : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-18SH 8530M	Robot arm : IP54 Controller : IP20	Oil mist specifications	Machine tool (cutting) Machine shop with heavy oil mist Dusty work shop	Note that if the cutting machine contains abrasive materials, the machine line will be shortened.
RH-18SH 8530M-SM Note2)	Robot arm : IP54 Controller : IP54			

Note1) The "-SM" specification (specification with the controller protection box) comes with the controller protection box (CR1B-MB) as standard.

Note2) Replaced with the CR3-535M controller in the case of the "-SM" specification (controller specification with countermeasure against oil mist).

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 evaluation regarding oil mist specifications has been confirmed with Mitsubishi's standard testing methods using the cutting oils shown in Table 2-9.

Table 2-9 : Tested cutting oil for oil mist specifications

Name	Maker	Relevant JIS	Main characteristics	Application
Emulcut FA-800	Kyodo Yushi Co., Ltd	Class A 1 No. 2	Water soluble cutting oil ・Base oil ..... 50-60 % ・Surfactant and rust inhibitor ..... 30-40 % ・Additives ..... 5 %or less ・Water ..... The rest	Water soluble cutting oil Emulcut

【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.

・The IEC IP54

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

(2) About the use with the bad environment

This robot has protection methods that conform to IEC's IP54 standards (splashproof type). It has protection structure designed to prevent harmful effects caused by splashing water coming from various directions, as the robot is operating. Recommended usage conditions.

1) The robot is designed for use in combination with machining device.
2) Please examine cutting oil referring to Table 2-9 used by a standard examination of our company.
3) Take measures so that water, oil, and chips do not directly fall on the robot.

The warranty is invalid for any faults that occur when the robot is used under the following conditions.
Also, if the cover and/or other parts are damaged by interferences caused by the peripheral devices and the robot, the protection specification (seal performance, etc.) may be degraded. Therefore, please pay extra attention when handling the robot.
Refer to Page 170, "6.2 Working environment".

1) In surroundings that generate inflammable gases or corrosive gasses.
2) Robot is used for cutting.
3) Atmosphere used excluding cutting oil shown in Table 2-9.
4) Environment where the robot is exposed to water, oil and/or chips for a long period of time.
5) In surroundings where chips fall directly on the robot.In surroundings where the minimum diameter of chips is less than 0.5mm.
6) Mist atmosphere exceeding the specification.

2.2.5 Clean specifications

(1) Types of clean specifications

Because the products with the clean specifications are produced upon receiving an order, please check the delivery schedule.

Table 2-10 : Clean specifications

Type	Degree of cleanliness	Internal suction	Remarks
RH-6SH 3517C RH-6SH 4517C RH-6SH 5517C	10(0.3 μ m)	Internal suction	Internal suction: 60 NL/min *Prepare the above suction by customer.
RH-12SH 5530C RH-12SH 7030C RH-12SH 8530C			
RH-18SH8530C			

Table 2-11 : Specifications of vacuum generation valve

Type	Qty.	Maker	Air pressure
MEDT 14 Note1)	2 pcs.	Koganei	0.2 to 0.6 MPa

Note1) Internal suction: Two MEDT14 vacuum generation valves are required in order to secure a flow rate of 60 NL/min or higher.

■ Precautions for use

1) When using a device that moves or rotates the robot arm, the down flow may not be secured because of the air flow. In this case, the degree of cleanliness cannot be ensured.
2) For suction inside the robot arm, couplings of ϕ8 are provided in the base section of the robot arm. Connect these couplings with your vacuum generating valve(2 pcs.) or vacuum pump.
   * Install the vacuum generating valve downstream of the downflow or install a filter in the exhaust air section so that the exhaust air from the vacuum generating valve does not affect cleanness.
   Recommended filter: Exhaust filter EF300-02, Koganei Corporation
   * If any vacuum pump is prepared by the customer, assure on the vacuum side flow rate 60 liters/min.(ANR) or more .
3) When using the Mitsubishi standard option solenoid valve set, use the spare piping (ϕ6 pneumatic hose) of the primary piping to exhaust the air.
   Be aware that exhausting near the solenoid valve set installation area may give adverse effects on cleanliness.

⚠ CAUTION Controllers with the clean specifications are of the general environment specifications. When installing these controllers, be sure to install them at locations where cleanliness is not affected.

2.3 Names of each part of the robot

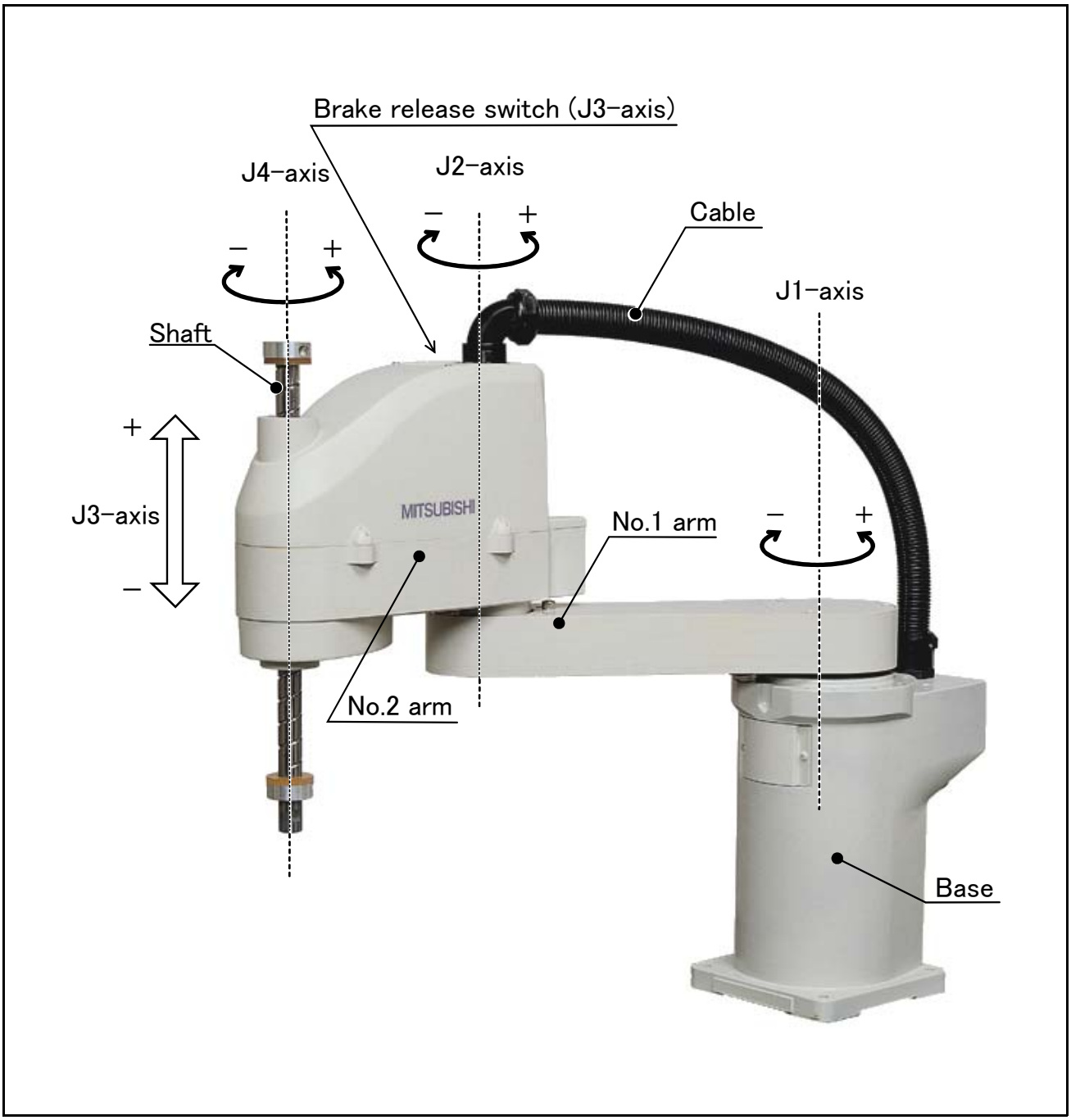
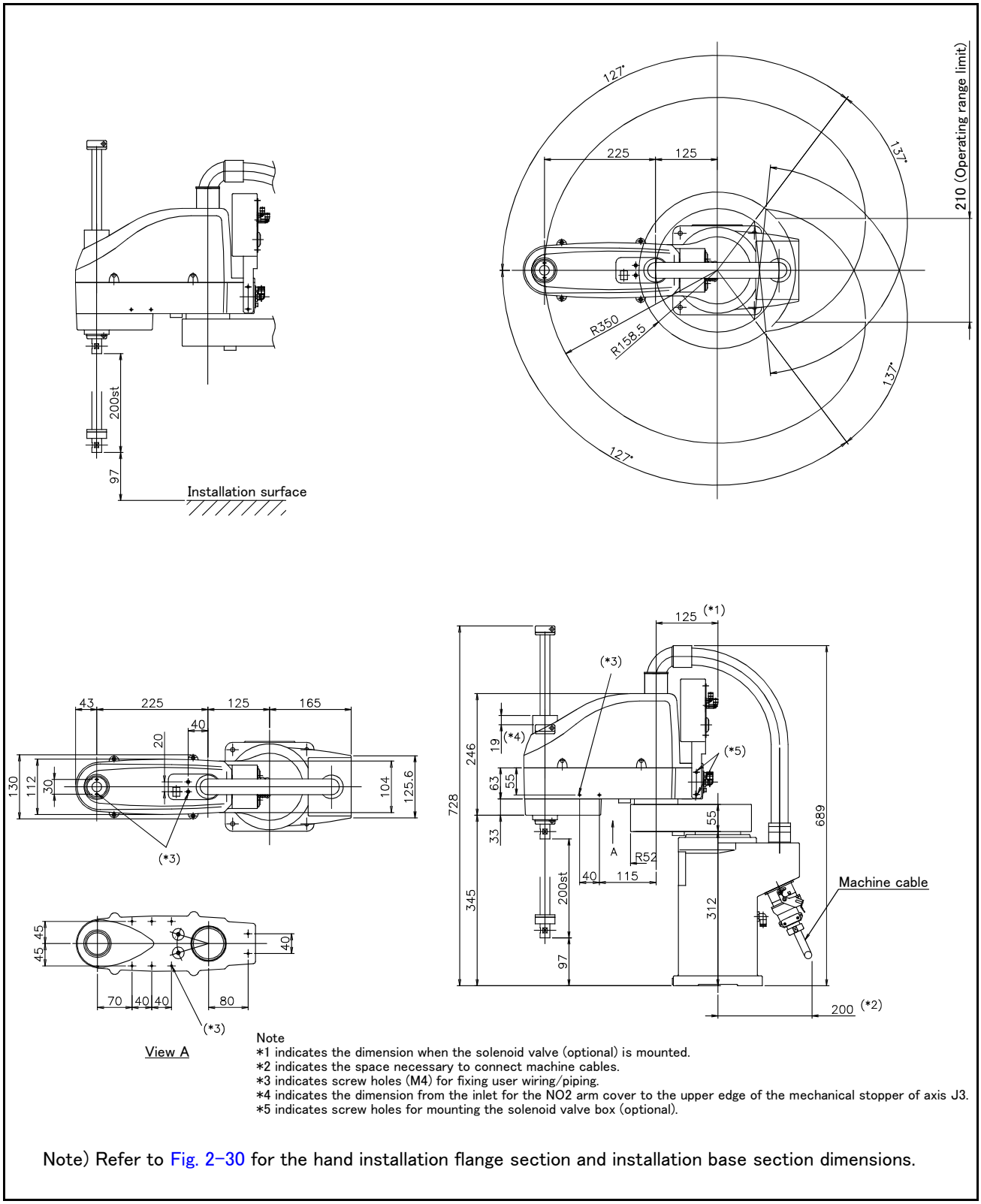


Fig.2-8 : Names of each part of the robot

2.4 Outside dimensions・Operating range diagram

2.4.1 Outside dimensions・Operating range diagram (RH-6SH series)

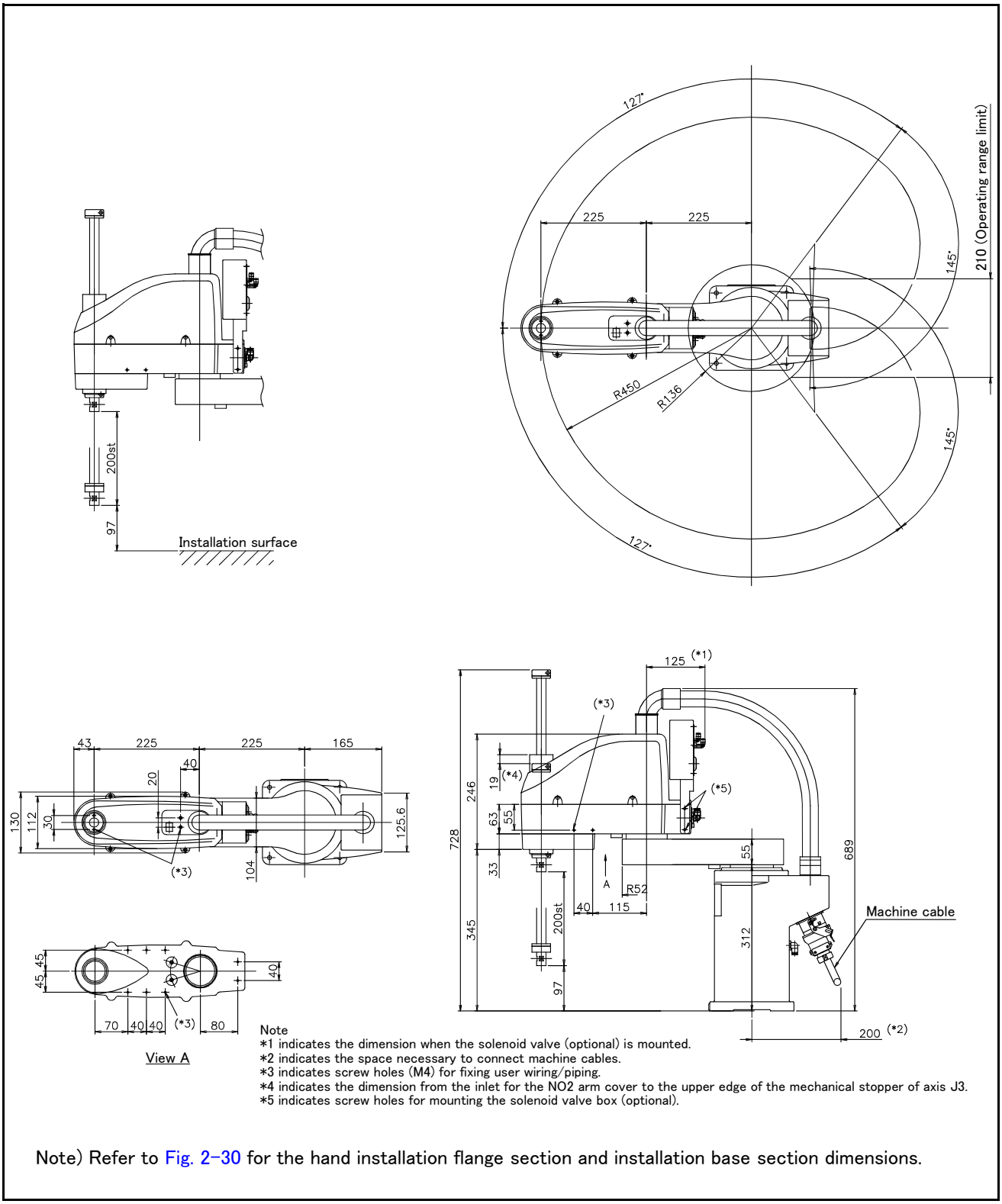
(1) Srandard Specification



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

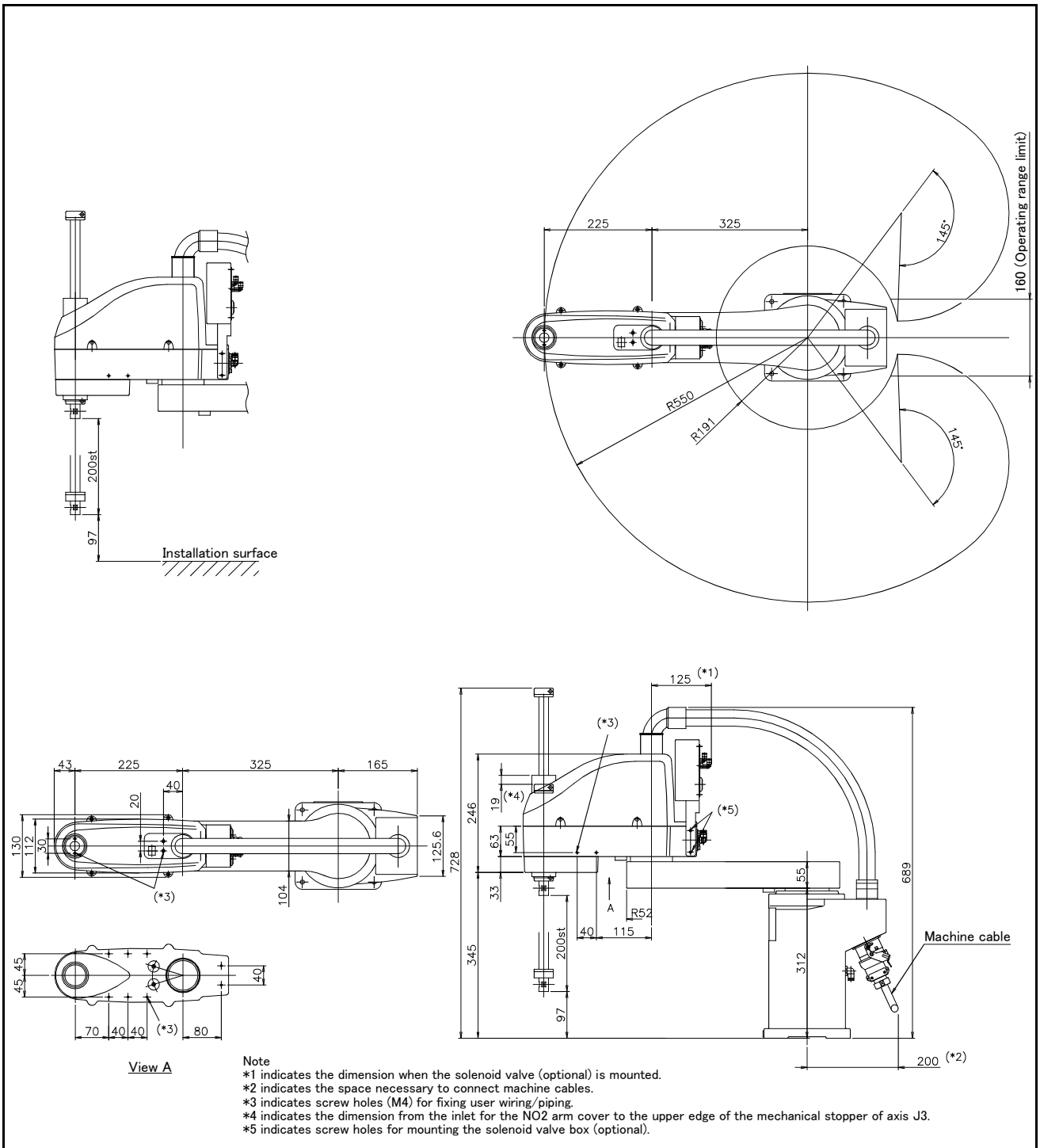
Fig.2-9 : Outside dimensions, Operating range diagram of RH-6SH3520



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-10 : Outside dimensions, Operating range diagram of RH-6SH4520

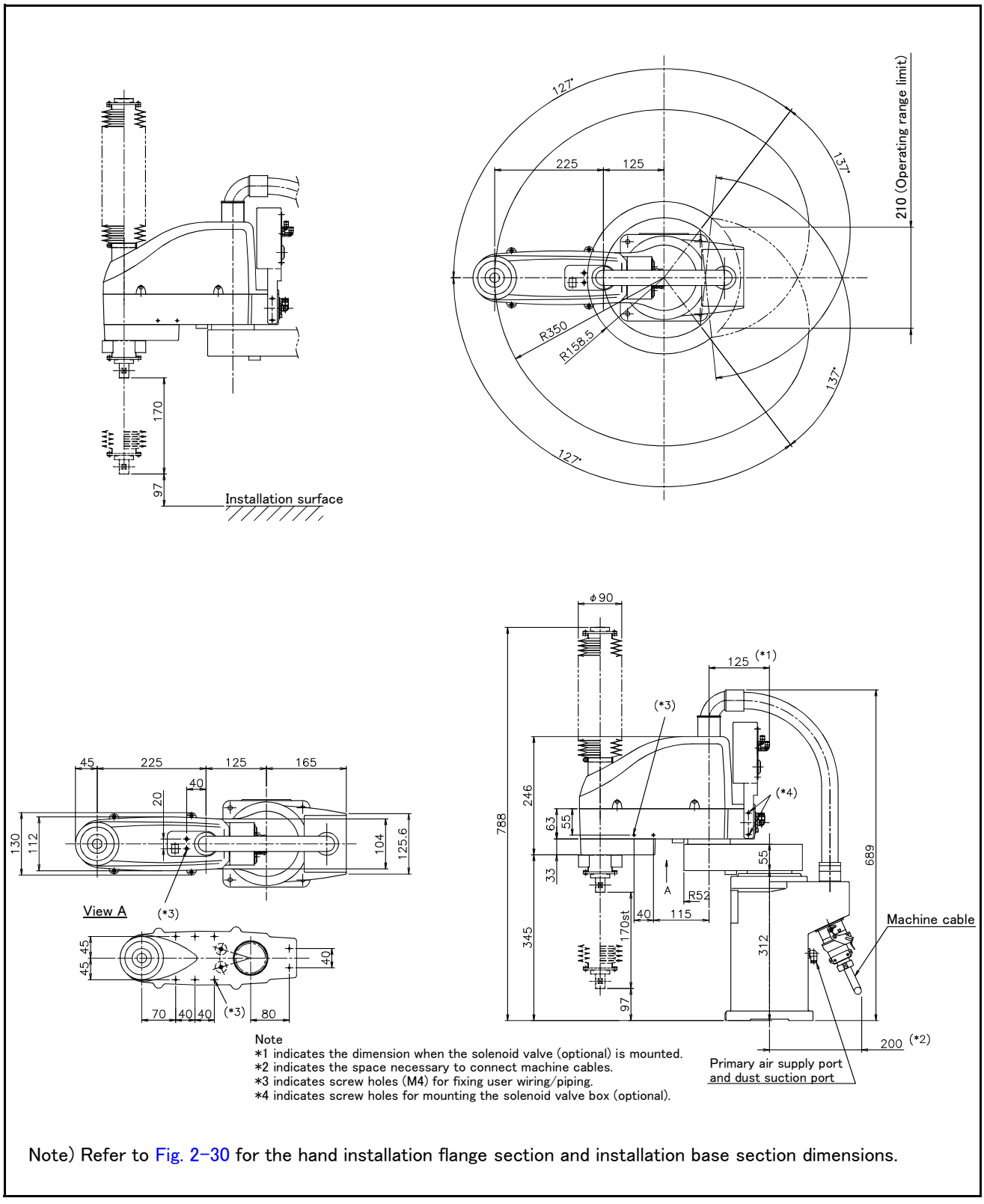


Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-11 : Outside dimensions, Operating range diagram of RH-6SH5520

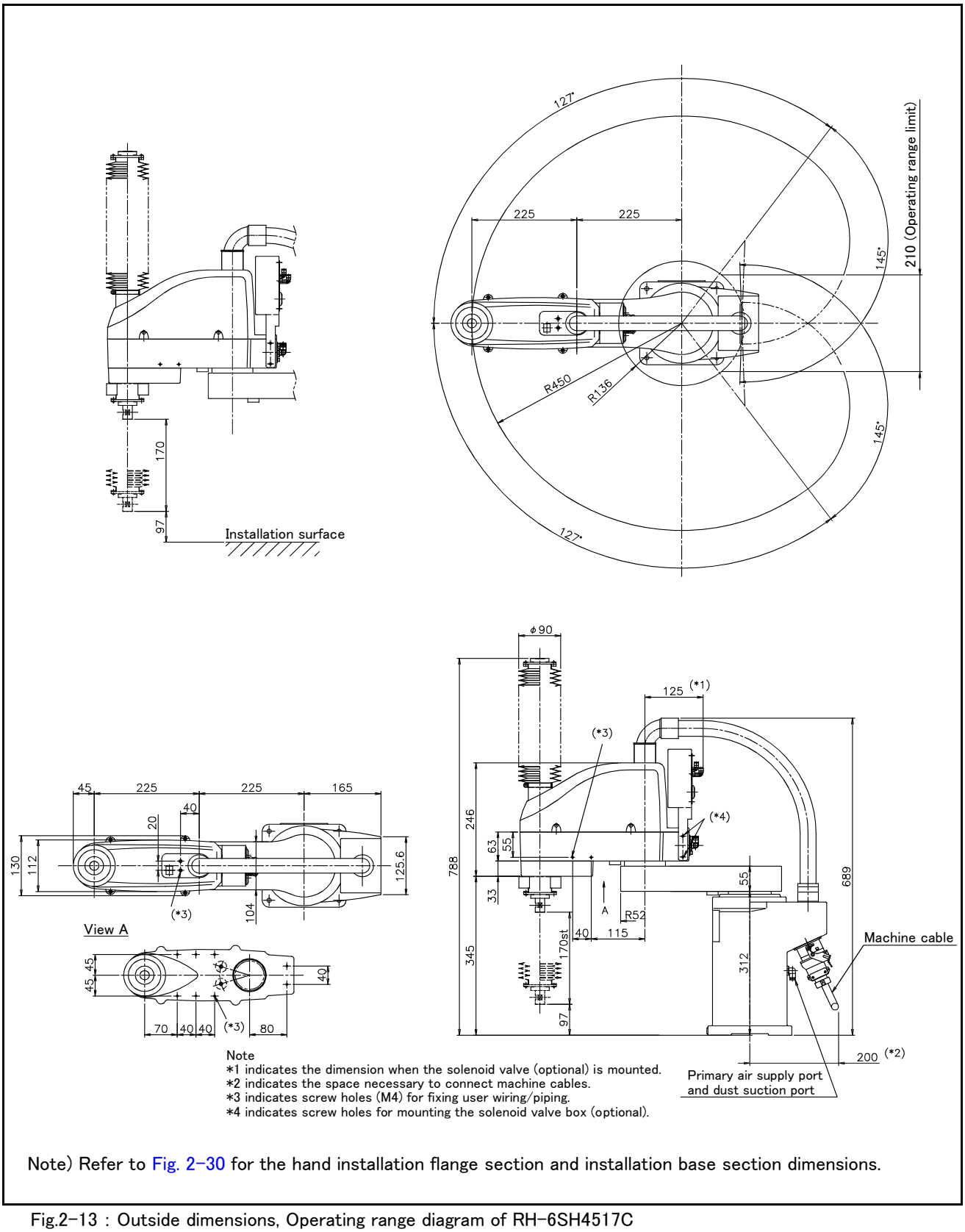
(2) Clean Specification



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

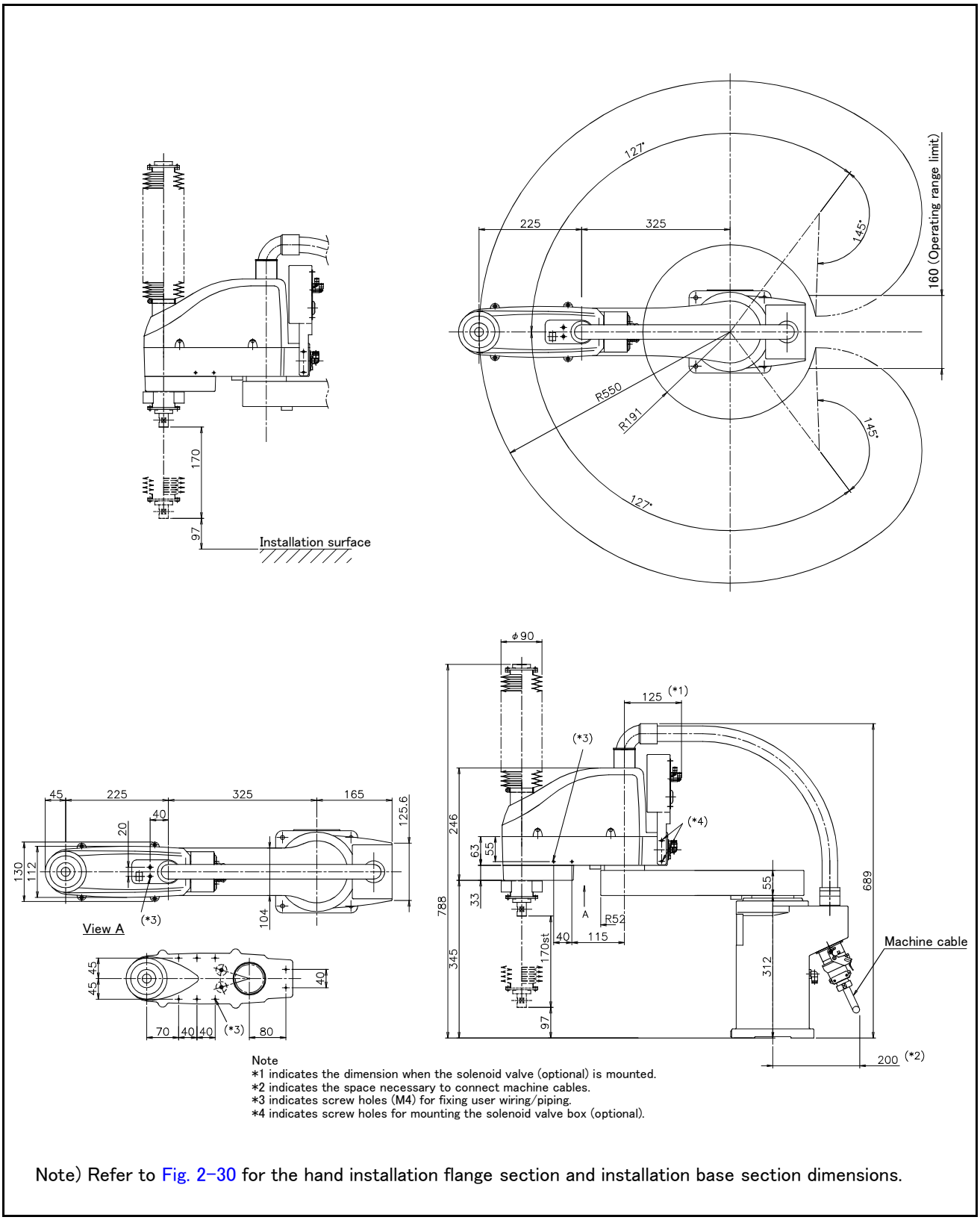
Fig.2-12 : Outside dimensions, Operating range diagram of RH-6SH3517C



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-13 : Outside dimensions, Operating range diagram of RH-6SH4517C

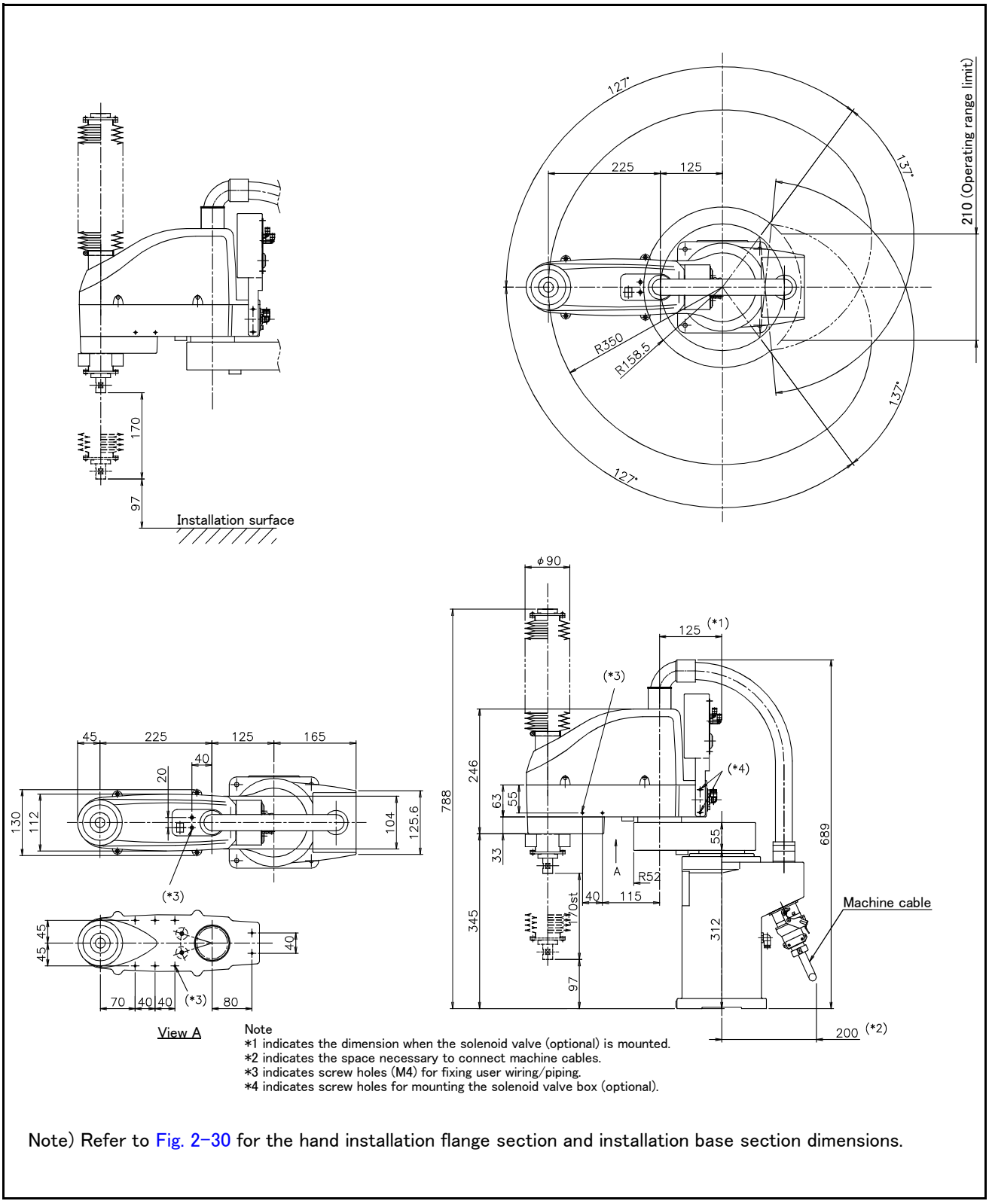


Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

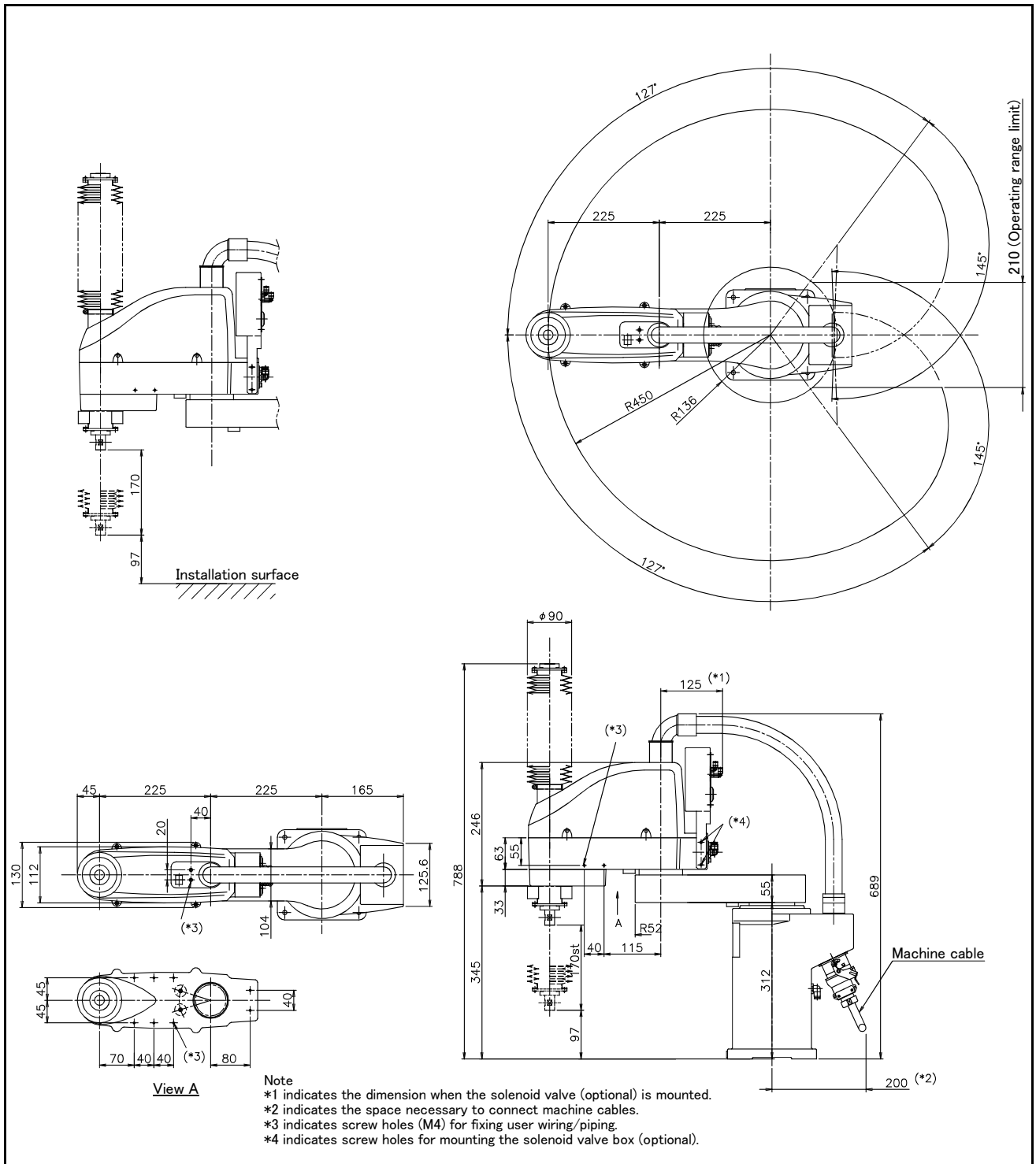
Fig.2-14 : Outside dimensions, Operating range diagram of RH-6SH5517C

(3) Oil mist Specification



Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

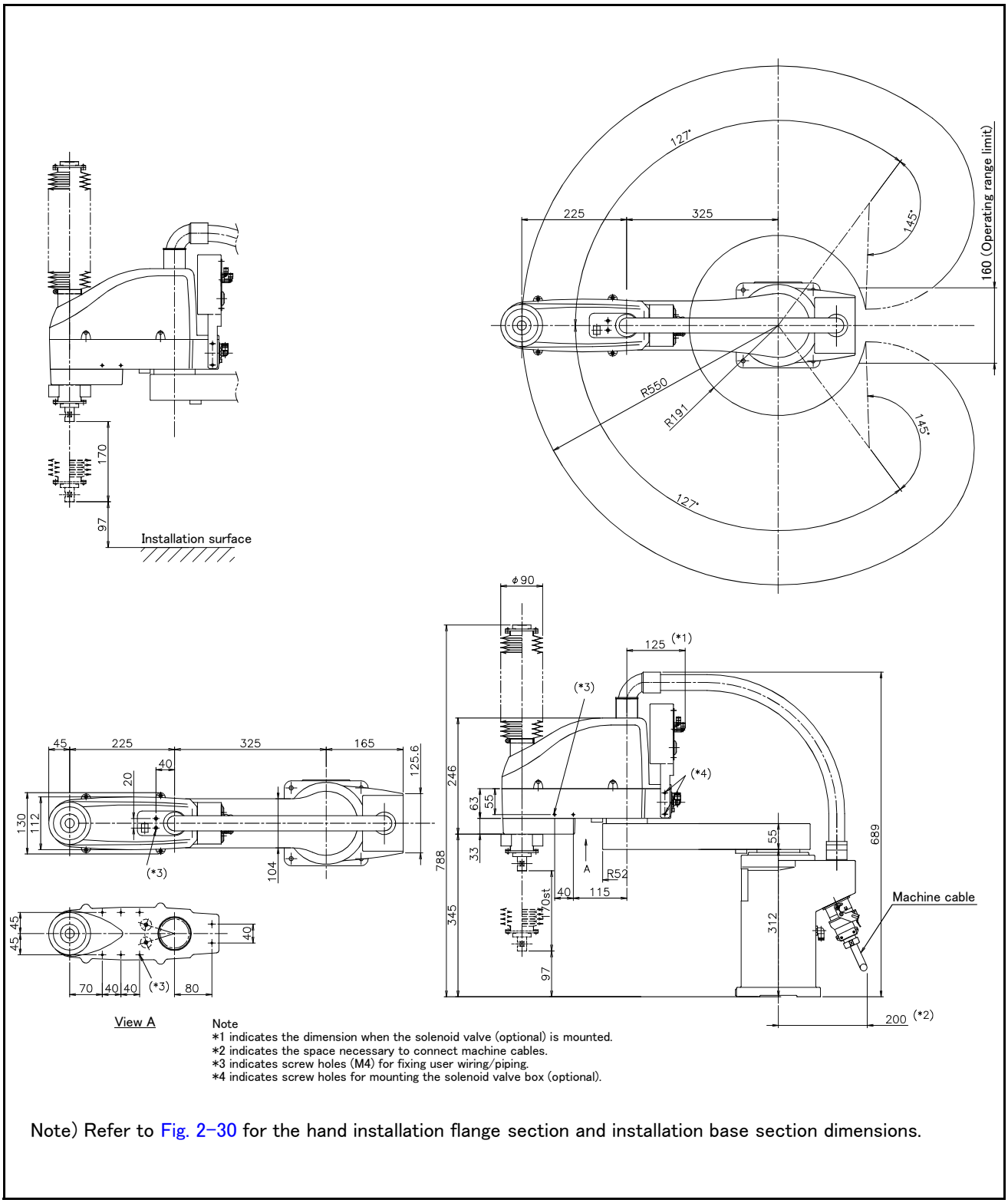
Fig.2-15 : Outside dimensions, Operating range diagram of RH-6SH3517M



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-16 : Outside dimensions, Operating range diagram of RH-6SH4517M



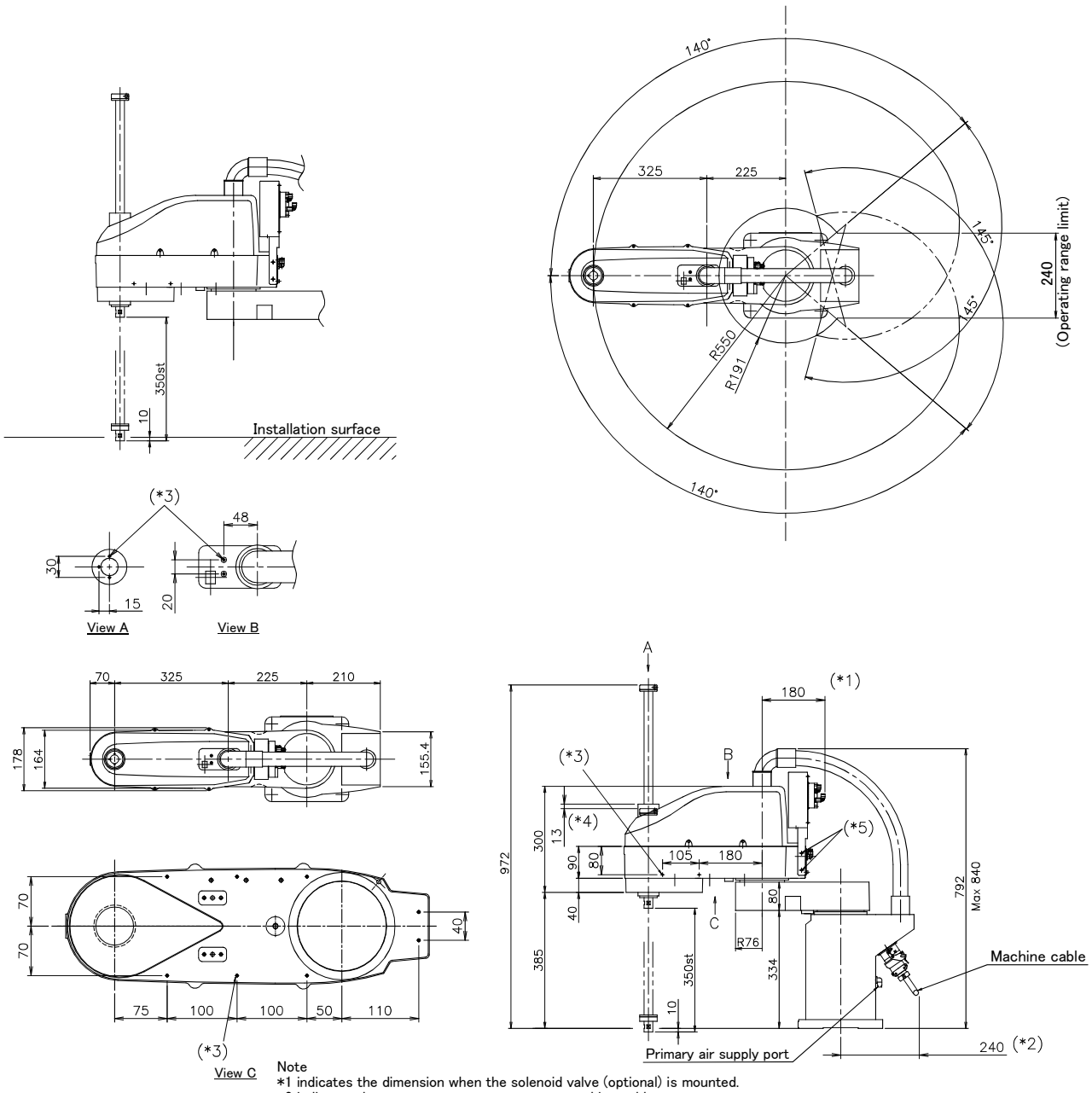
Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-30 for the hand installation flange section and installation base section dimensions.

Fig.2-17 : Outside dimensions, Operating range diagram of RH-6SH5517M

2.4.2 Outside dimensions・Operating range diagram of RH-12SH series

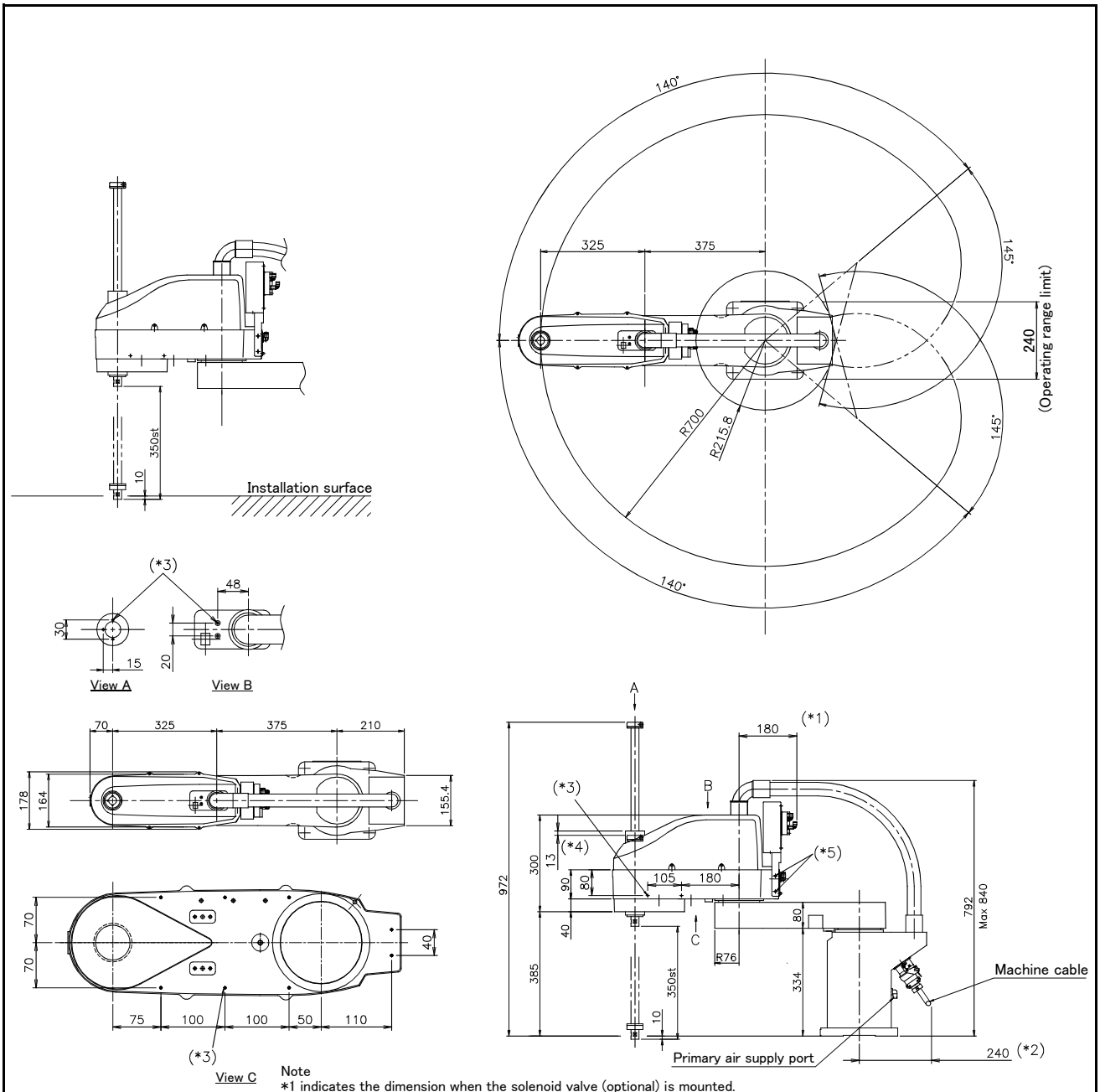
(1) Srandard Specification



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

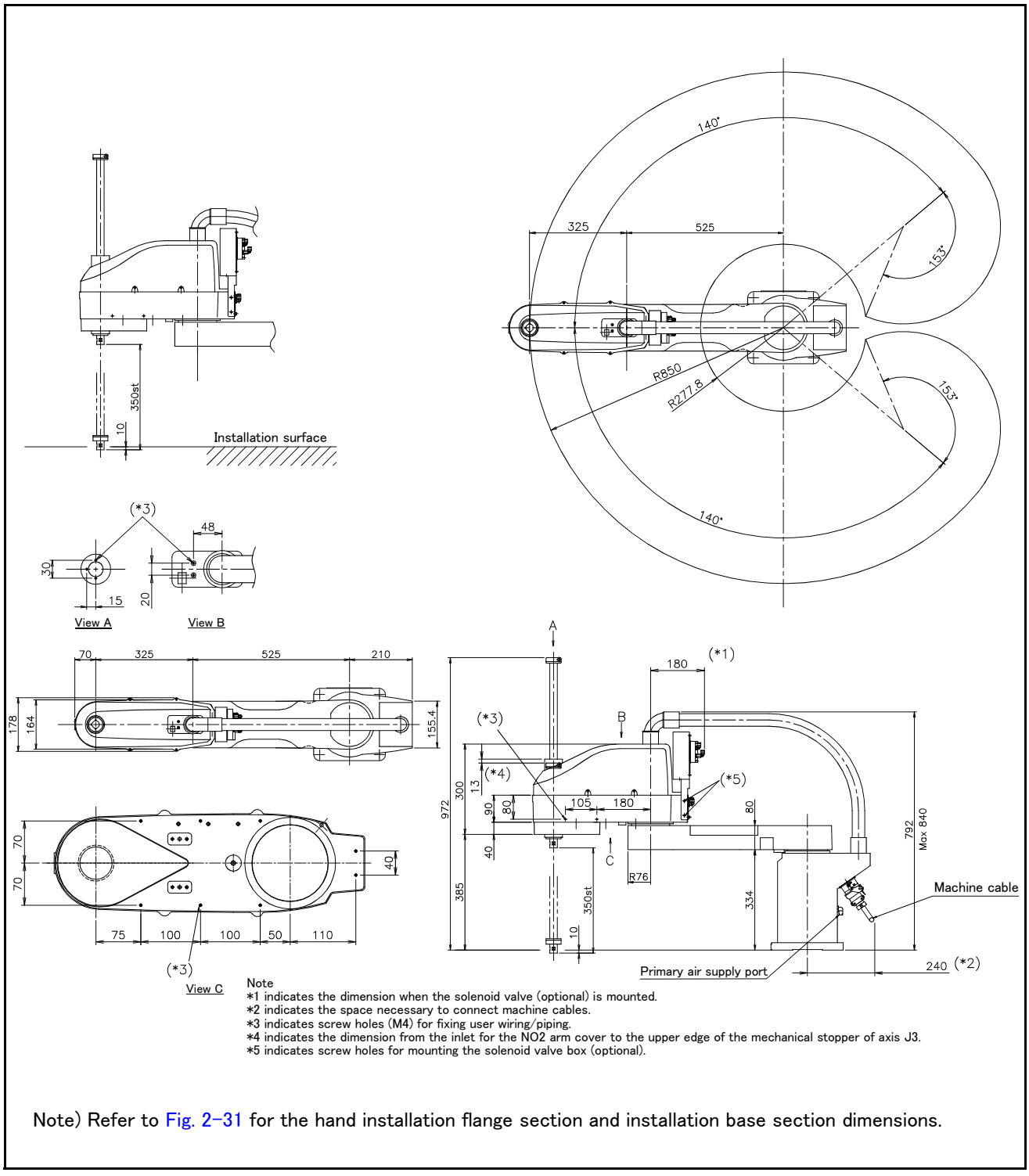
Fig.2-18 : Outside dimensions, Operating range diagram of RH-12SH5535



Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

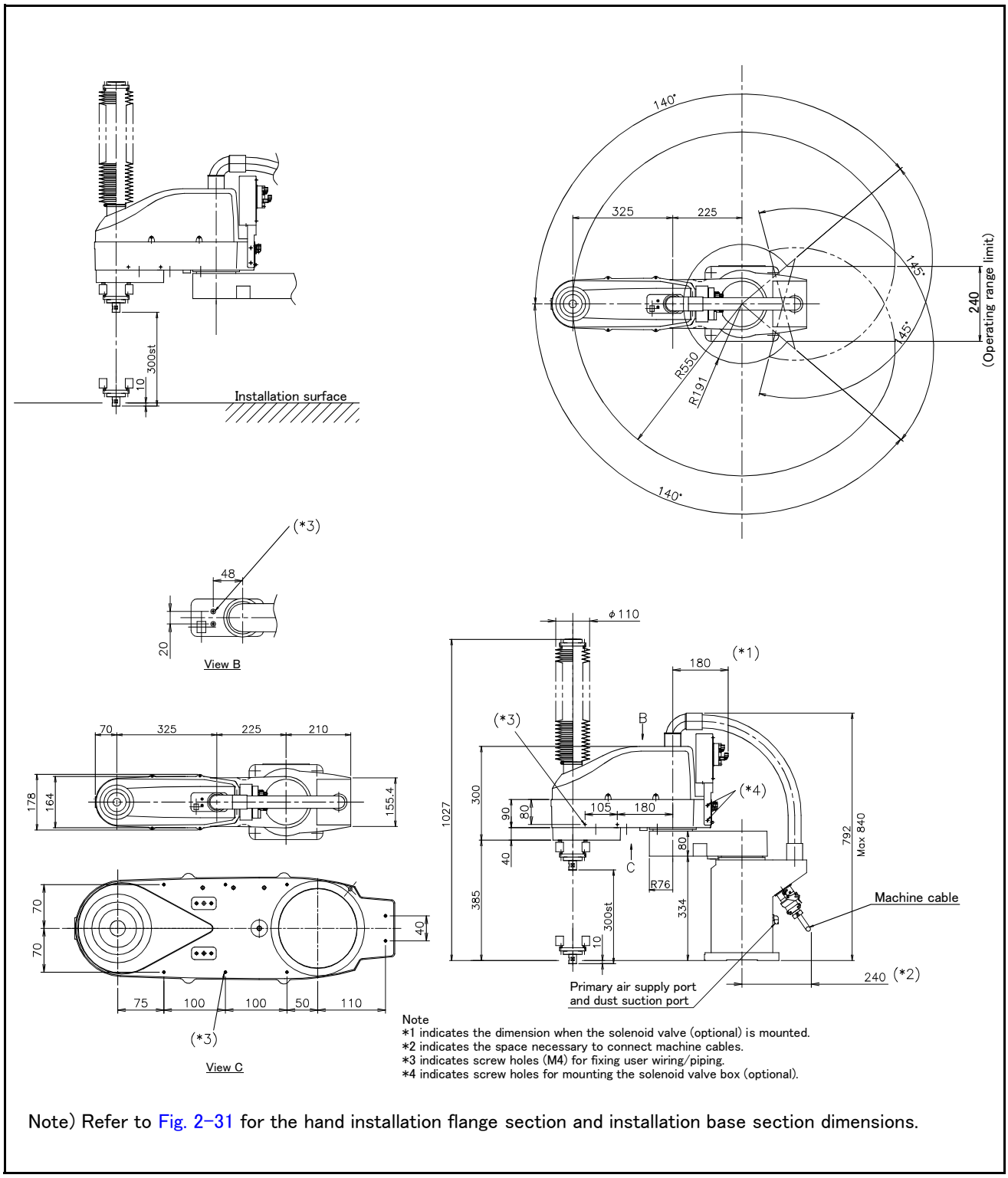
Fig.2-19 : Outside dimensions, Operating range diagram of RH-12SH7035



Note) Refer to Fig. 2–31 for the hand installation flange section and installation base section dimensions.

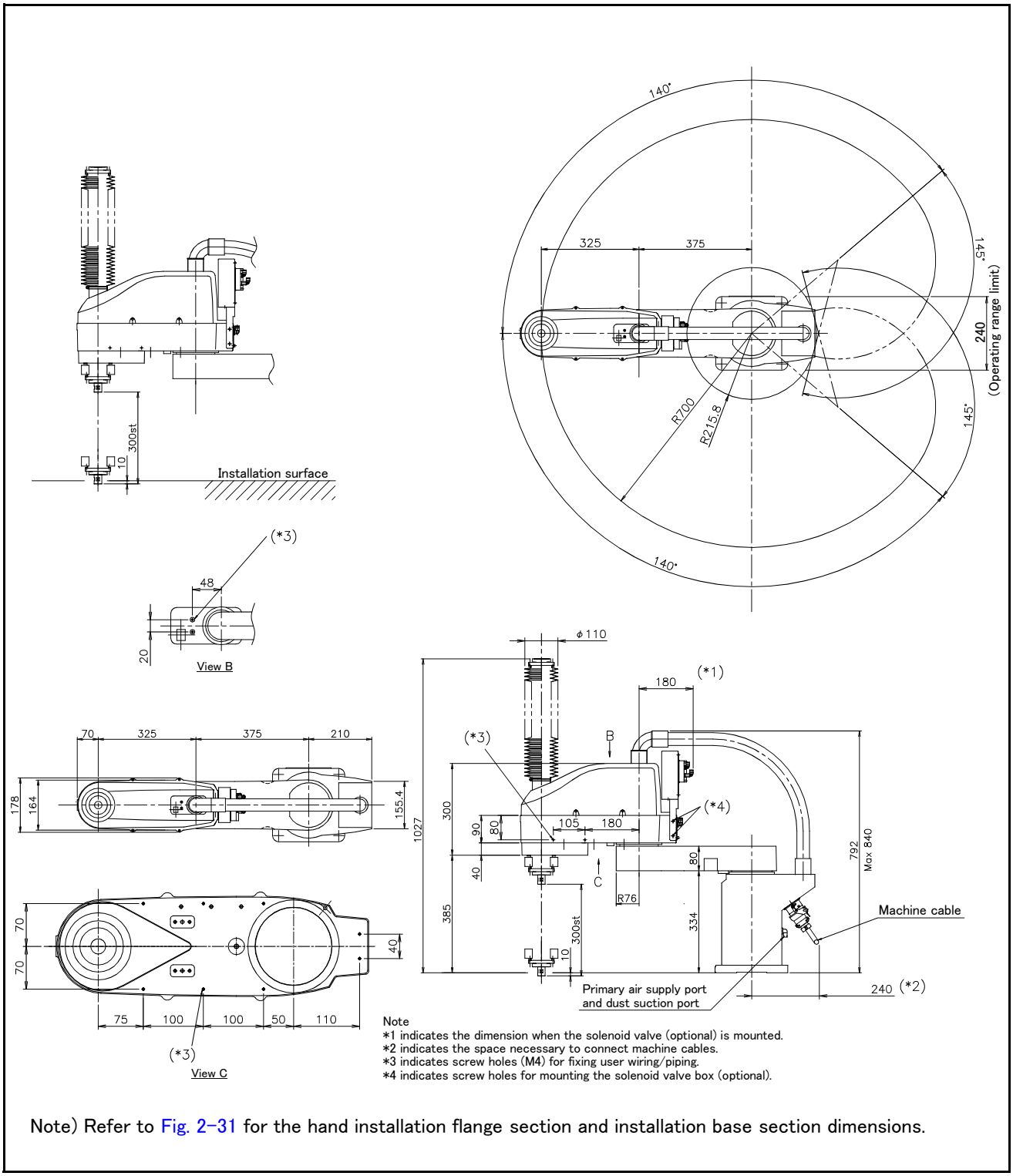
Fig.2–20 : Outside dimensions, Operating range diagram of RH–12SH8535

(2) Clean Specification



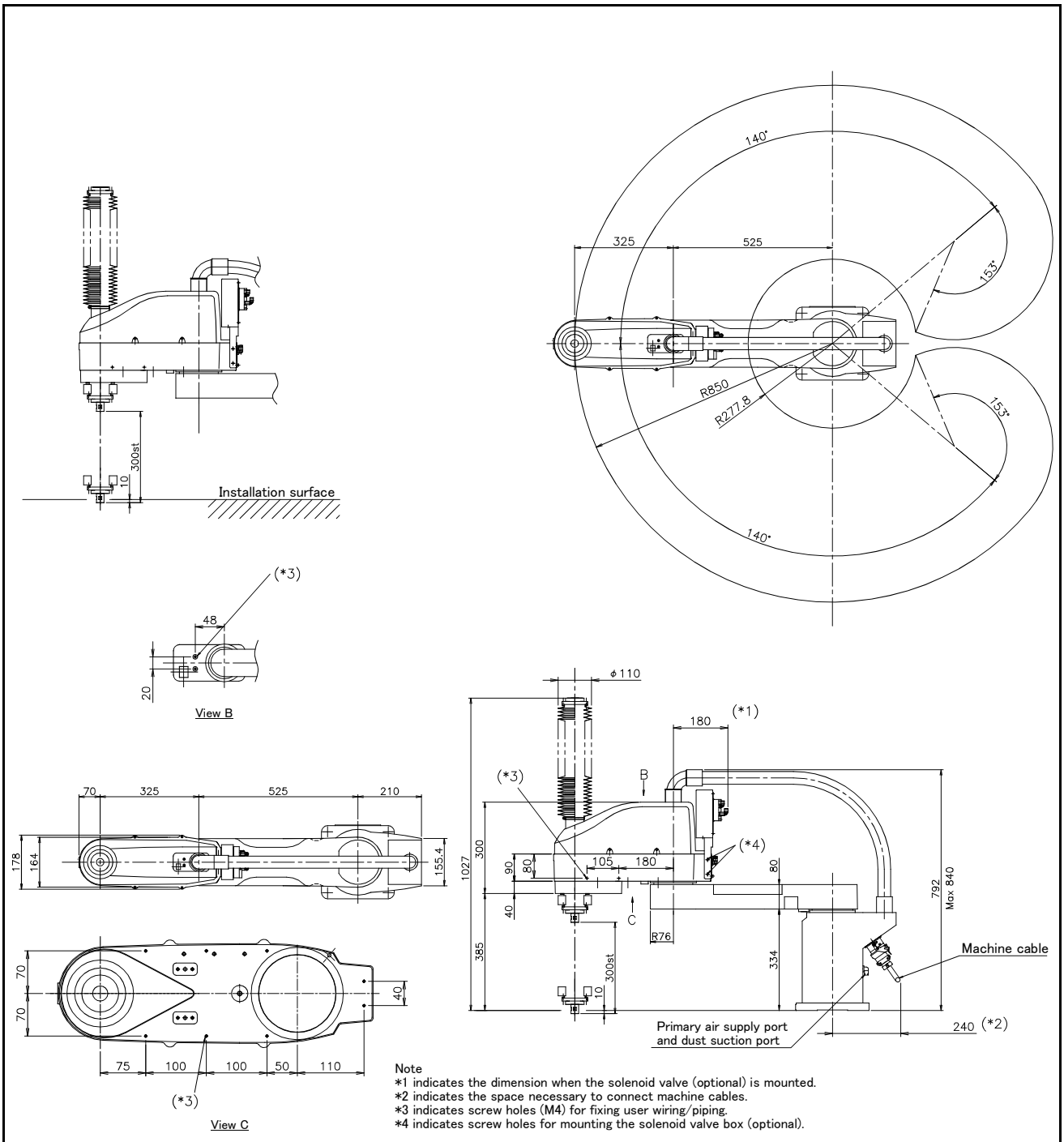
Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-21 : Outside dimensions, Operating range diagram of RH-12SH5530C



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

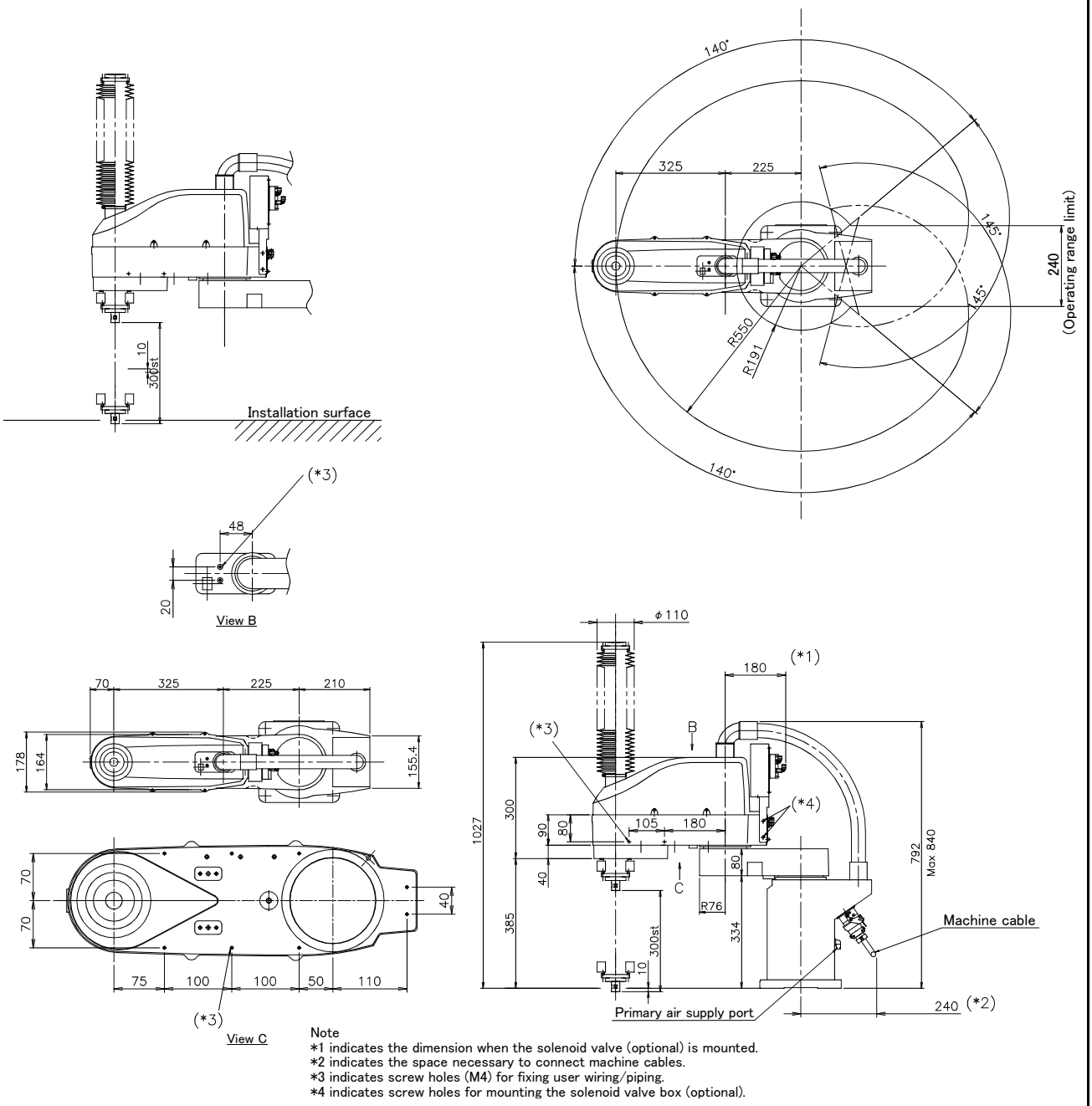
Fig.2-22 : Outside dimensions, Operating range diagram of RH-12SH7030C



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

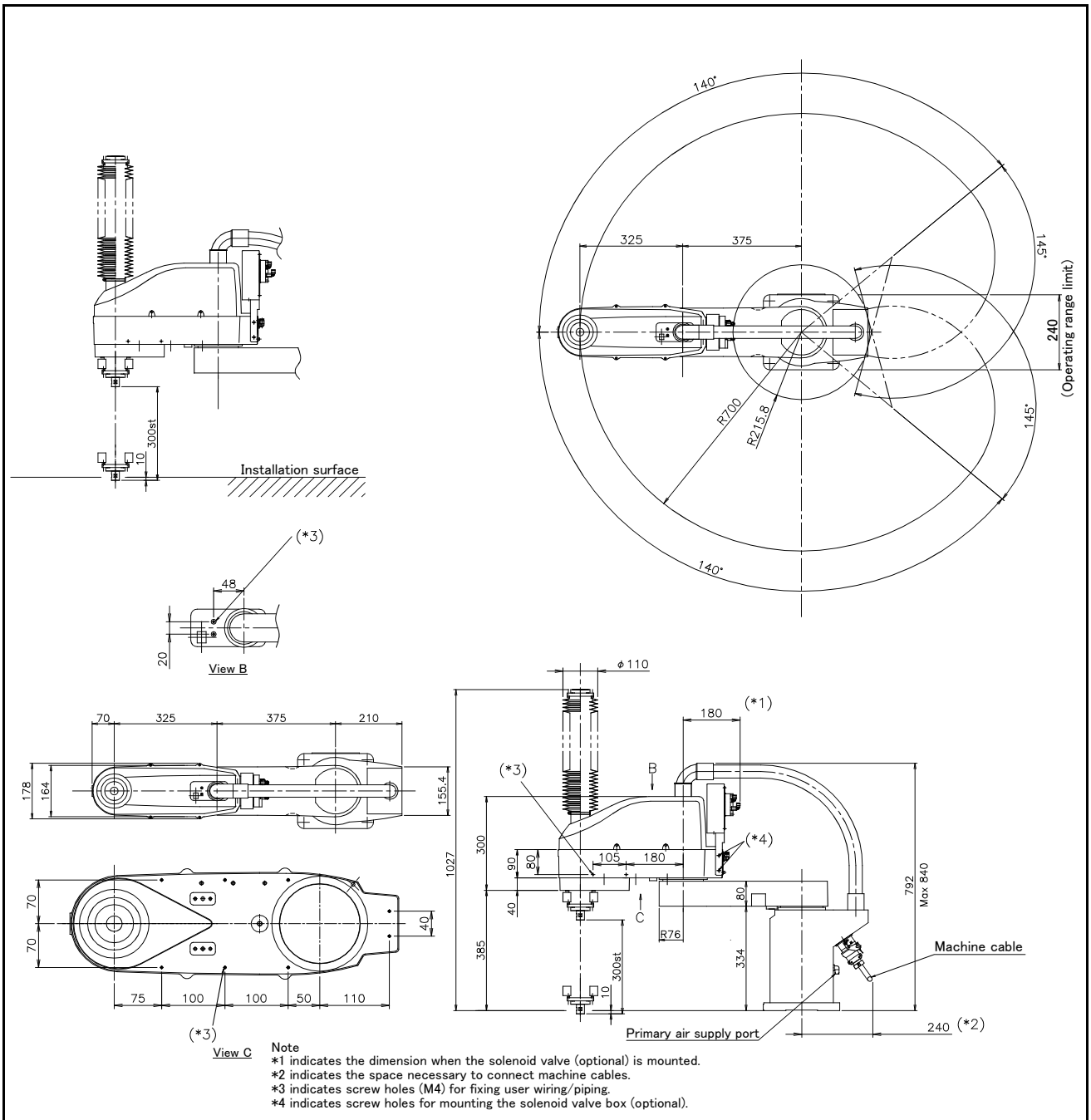
Fig.2-23 : Outside dimensions, Operating range diagram of RH-12SH8530C

(3) Oil mist Specification



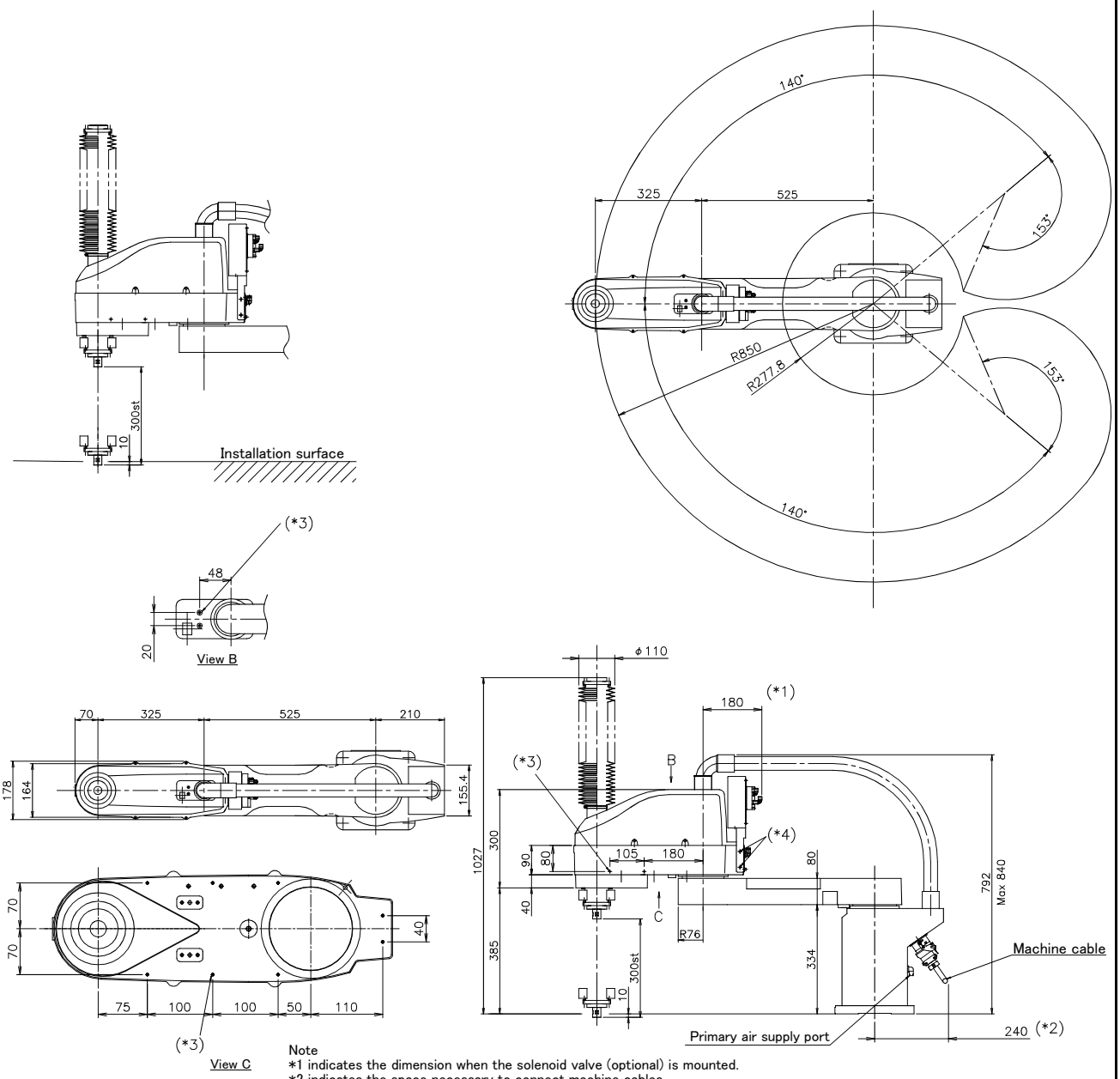
Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-24 : Outside dimensions, Operating range diagram of RH-12SH5530M



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-25 : Outside dimensions, Operating range diagram of RH-12SH7030M



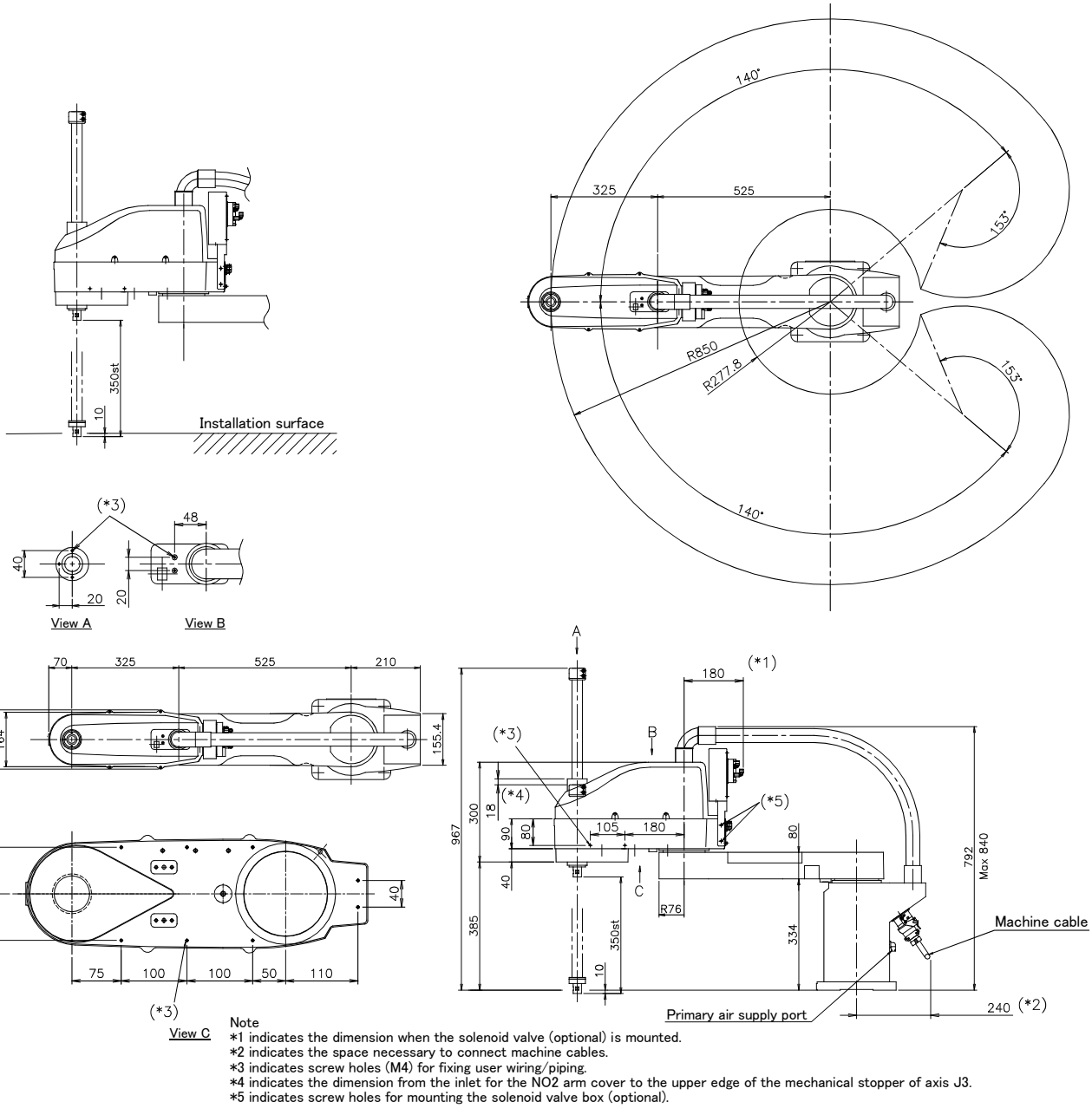
Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-26 : Outside dimensions, Operating range diagram of RH-12SH8530M

2.4.3 Outside dimensions・Operating range diagram of RH-18SH series

(1) Srandard Specification

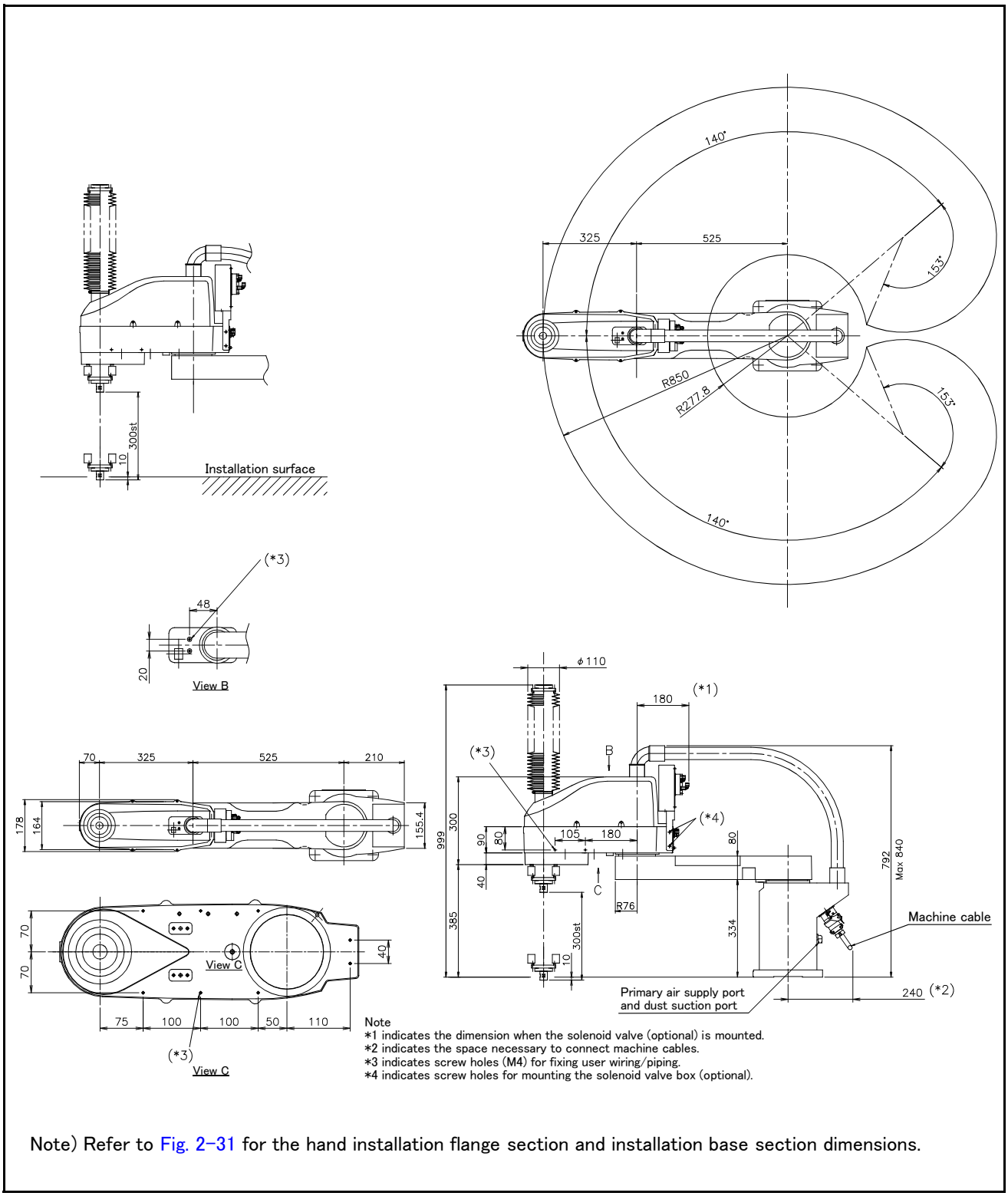


Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper of axis J3.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-27 : Outside dimensions, Operating range diagram of RH-18SH8535

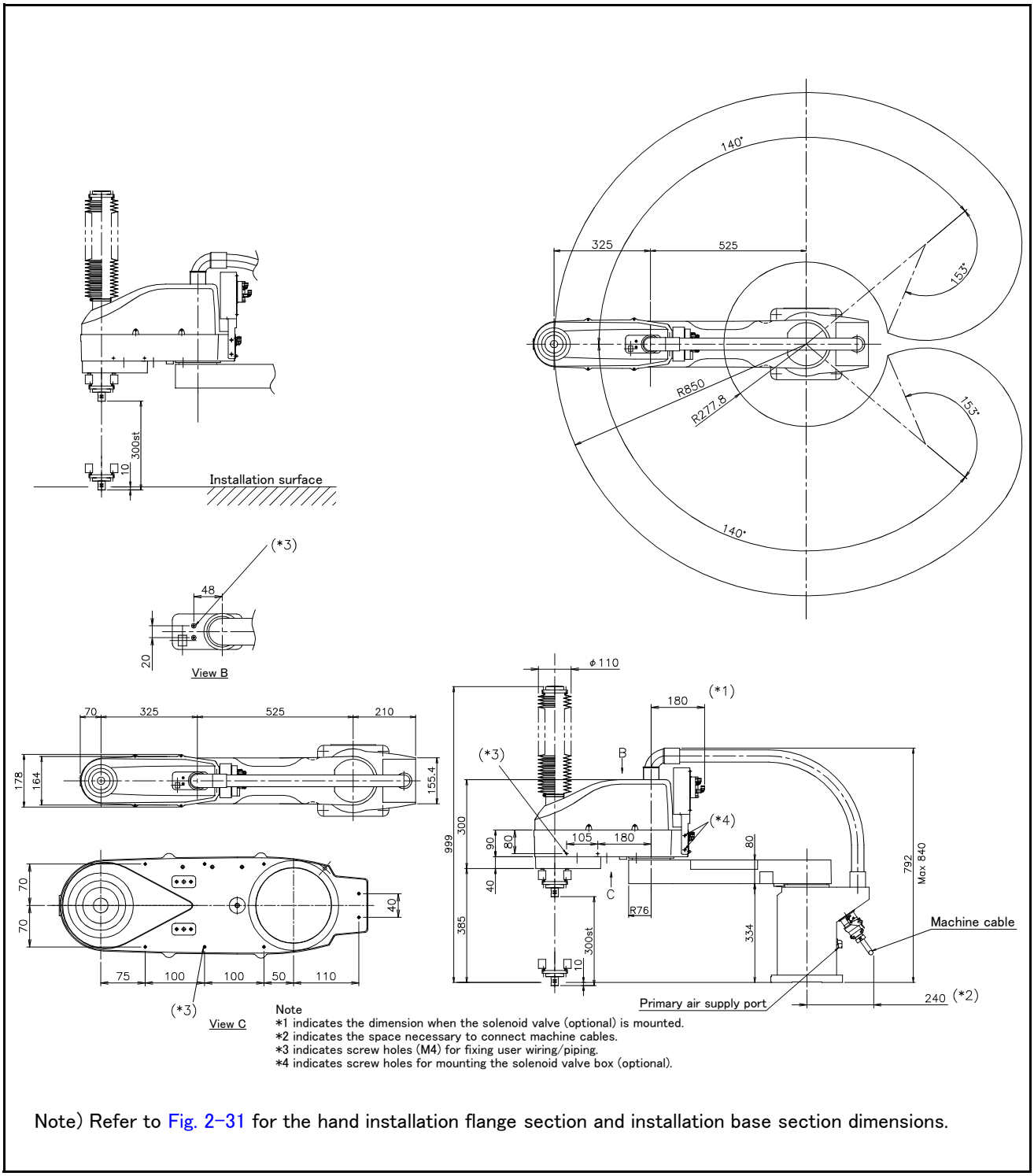
(2) Clean Specification



Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-28 : Outside dimensions, Operating range diagram of RH-18SH8530C

(3) Oil mist Specification

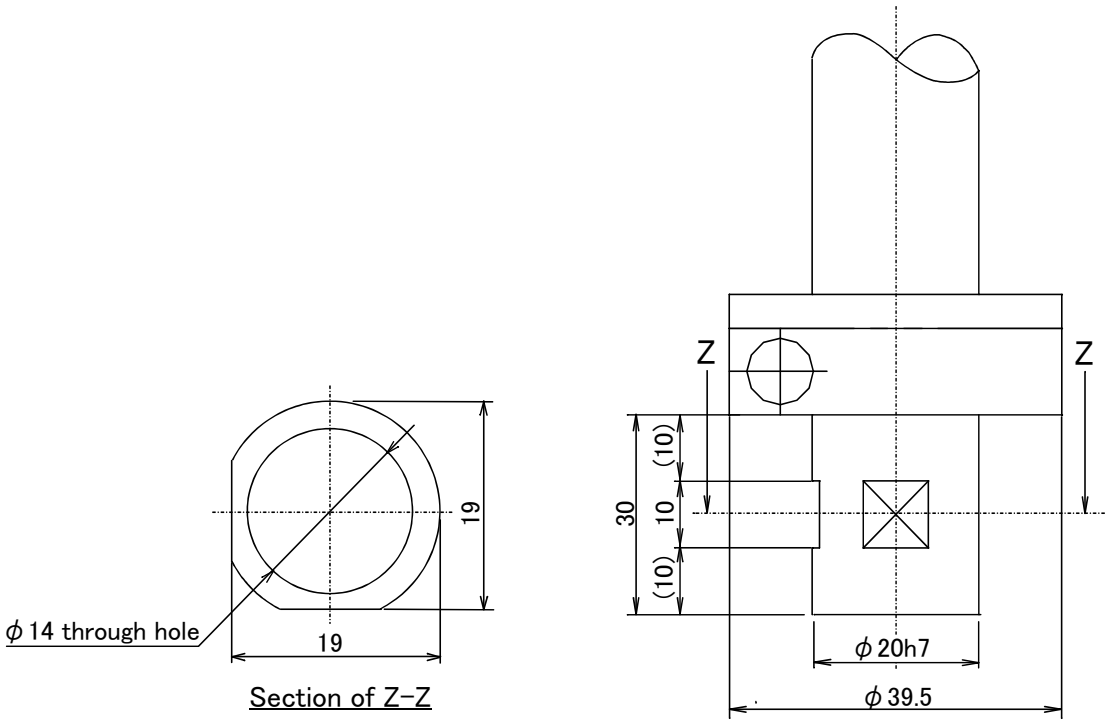


Note) Refer to Fig. 2-31 for the hand installation flange section and installation base section dimensions.

Fig.2-29 : Outside dimensions, Operating range diagram of RH-18SH8530M

2.4.4 Mechanical interface and Installation surface

(1) Mechanical interface and Installation surface of RH-6SH sereis



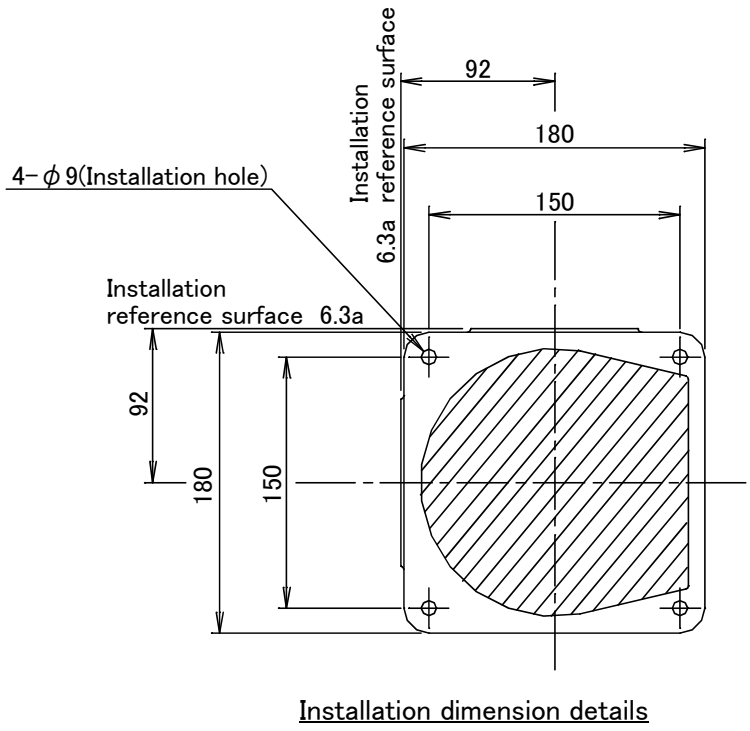
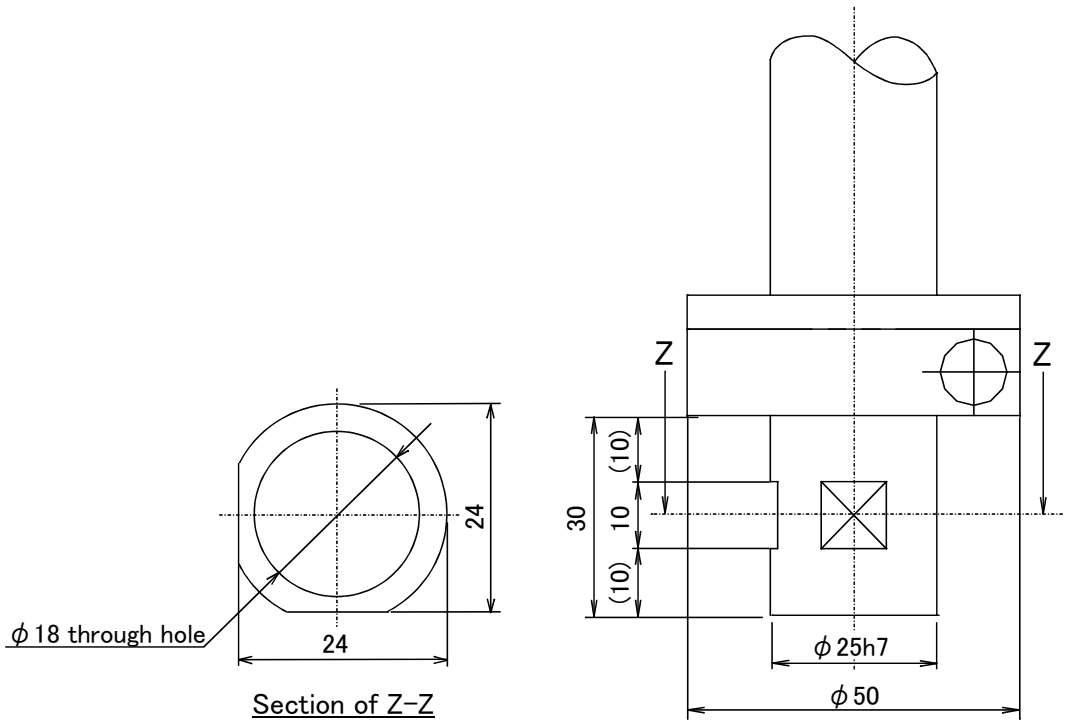


Fig.2-30 : Mechanical interface and Installation surface of RH-6SH series

(2) Mechanical interface and Installation surface of RH-12SH/18SH series



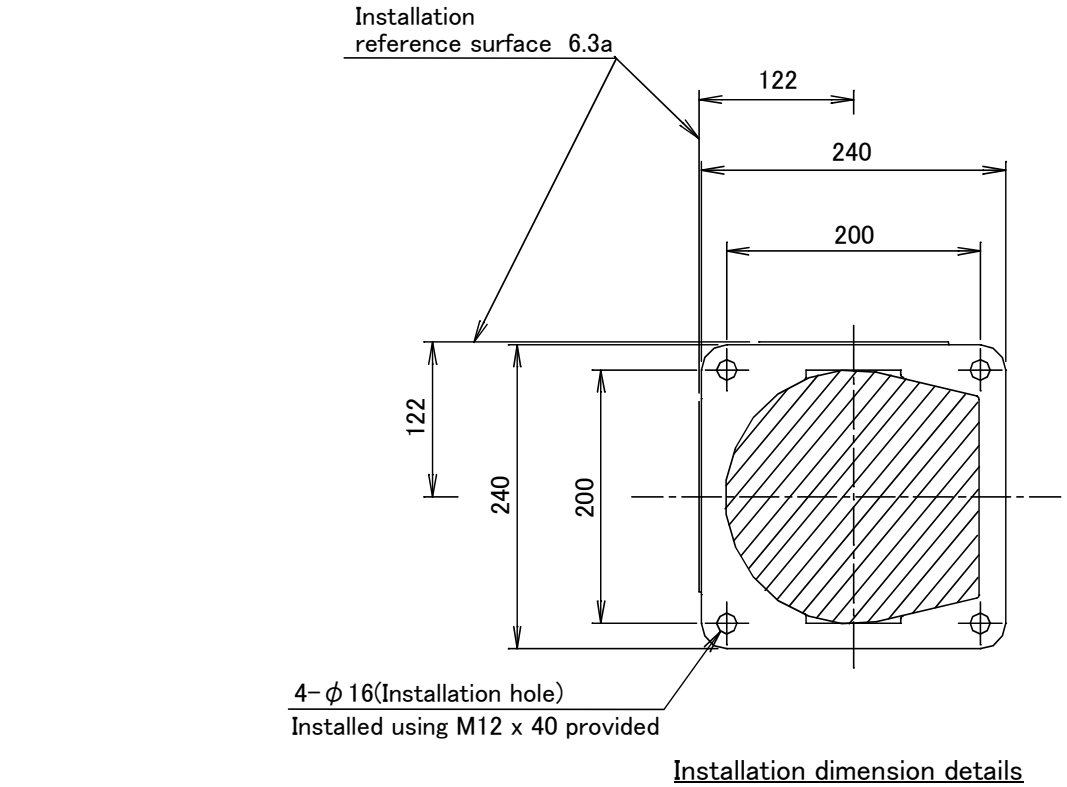


Fig.2-31 : Mechanical interface and Installation surface of RH-12SH/18SH series

2.4.5 Change the operating range

The operating ranges of both the J1 and J2 axes can be limited. Change the mechanical stopper and the operating range to be set inside of that area.
If the operating range must be limited for example, to avoid interference with peripheral devices or to ensure safety--set up the operating range as shown below.

(1) Operating range changeable angle

The operating range must be set up at angels indicated by Table 2-12.

Table 2-12 : Operating range changeable angle

Axis	Type	Direction	Standard	Changeable angle				
RH-6SH series								
J1	RH-6SH35*/45*/55*	+ side	+127 deg.	+90 deg.	+60 deg.	+30 deg.	0 deg.	Any one point shown at the left
		Mechanical stopper angle	+130 deg.	+95 deg.	+65 deg.	+35 deg.	+5 deg.	
		Mechanical stopper position	P11	P12	P13	P14	P15	
		- side	-127 deg.	-90 deg.	-60 deg.	-30 deg.	0 deg.	Any one point shown at the left
		Mechanical stopper angle	-130 deg.	-95 deg.	-65 deg.	-35 deg.	-5 deg.	
		Mechanical stopper position	N11	N12	N13	N14	N15	
J2	RH-6SH35*	+ side	+137 deg.	+117 deg.	+97 deg.	—	—	Any one point shown at the left
		Mechanical stopper angle	+139 deg.	+119 deg.	+99 deg.			
		Mechanical stopper position	P21	P22	P23			
		- side	-137 deg.	-117 deg.	-97 deg.	—	—	Any one point shown at the left
		Mechanical stopper angle	-139 deg.	-119 deg.	-99 deg.			
		Mechanical stopper position	N21	N22	N23			
	RH-6SH45*/55*	+ side	+145 deg.	+125 deg.	+105 deg.	—	—	Any one point shown at the left
		Mechanical stopper angle	+147 deg.	+127 deg.	+107 deg.			
		Mechanical stopper position	P21	P22	P23			
		- side	-145 deg.	-125 deg.	-105 deg.	—	—	Any one point shown at the left
		Mechanical stopper angle	-147 deg.	-127 deg.	-107 deg.			
		Mechanical stopper position	N21	N22	N23			
RH-12SH/18SH series								
J1	RH-12SH55*/70*/85* RH-18SH85*	+ side	+140 deg.	+105 deg.	+75 deg.	+45 deg.	+15 deg.	Any one point shown at the left
		Mechanical stopper angle	+143 deg.	+110 deg.	+80 deg.	+50 deg.	+20 deg.	
		Mechanical stopper position	P11	P12	P13	P14	P15	
		- side	-140 deg.	-105 deg.	-75 deg.	-45 deg.	-15 deg.	Any one point shown at the left
		Mechanical stopper angle	-143 deg.	-110 deg.	-80 deg.	-50 deg.	-20 deg.	
		Mechanical stopper position	N11	N12	N13	N14	N15	
J2	RH-12SH55*/70*	+ side	+145 deg.	+125 deg.	—	—	—	Any one point shown at the left
		Mechanical stopper angle	+150 deg.	+130 deg.				
		Mechanical stopper position	P21	P22				
		- side	-145 deg.	-125 deg.	—	—	—	Any one point shown at the left
		Mechanical stopper angle	-150 deg.	-130 deg.				
		Mechanical stopper position	N21	N22				
	RH-12SH85* RH-18SH85*	+ side	+153 deg.	+125 deg.	—	—	—	Any one point shown at the left
		Mechanical stopper angle	+155 deg.	+130 deg.				
		Mechanical stopper position	P21	P22				
		- side	-153 deg.	-125 deg.	—	—	—	Any one point shown at the left
		Mechanical stopper angle	-155 deg.	-130 deg.				
		Mechanical stopper position	N21	N22				

Note1) The * symbols next to the robot types indicate the up/down stroke length, environment specification, specification with controller protection box (RH-6SH series) or controller specification with countermeasure against oil mist (RH-12SH/18SH series). In this case, it is possible to change the movement ranges shown in Table 2-12 for any model.

Note2) The changeable angle shown in Table 2-12 indicates the operation range by the software.
The mechanical stopper angle in the table shows the limit angle by the mechanical stopper. Use caution when laying out the robot during the designing stage.

Note3) The changeable angle can be set independently on the + side and - side.

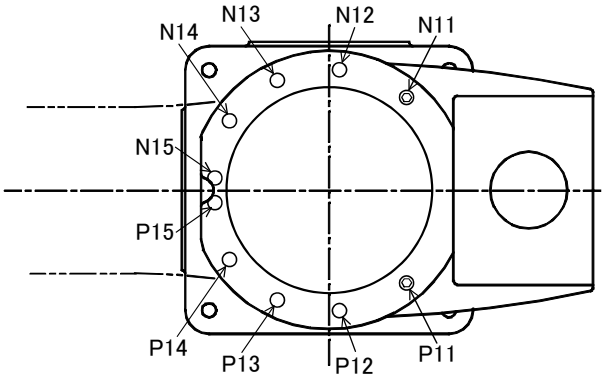
Note4) Refer to Fig. 2-32 and Fig. 2-33 for mechanical stopper position.

(2) Changing the operating range

■ Installing the mechanical stopper

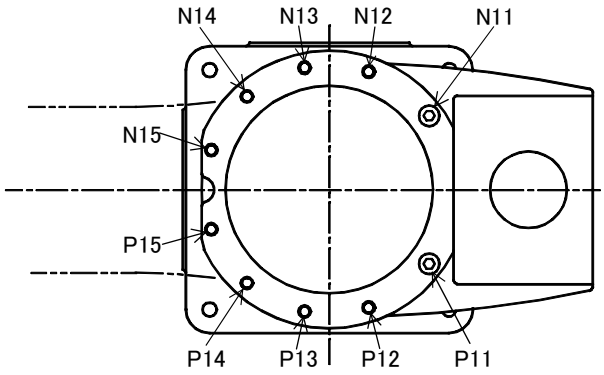
1) Turn the controller power OFF.

2) Refer to Table 2-12 and Fig. 2-32 and Fig. 2-33, install the hexagonal socket head bolts in the screw holes corresponding to the angles to be set. Fig. 2-32 shows the mechanical stopper position and bolt size of the J1 axis, and Fig. 2-33 shows those of the J2 axis. If the screw holes are hidden behind the arms, slowly move the No. 1 and No. 2 arms.



*Hexagon socket bolt = M8 x 16

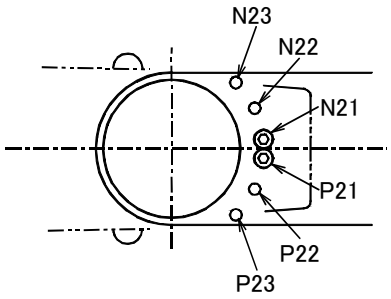
For RH-6SH series



*Hexagon socket bolt = M12 x 25

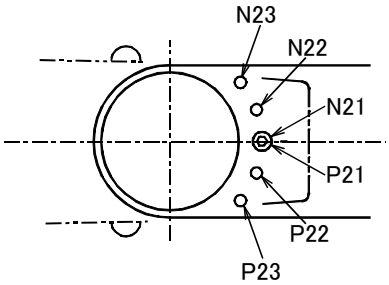
For RH-12SH/18SH series

Fig.2-32 : Mechanical stopper position (J1 axis)



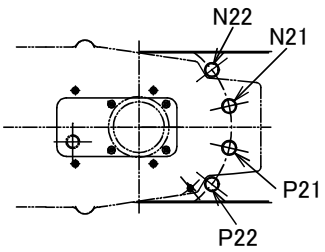
*Hexagon socket bolt = M8 x 16

For RH-6SH35* series



*Hexagon socket bolt = M8 x 16

For RH-6SH45*/55* series



*Hexagon socket bolt = M8 x 16

For RH-12SH/18SH series

Fig.2-33 : Mechanical stopper position (J2 axis)

■ Setting the operation range parameter

Set up the operation range (Changeable angle in Table 2-12) to the Joint movement range parameter MEJAR.

1) Turn the controller power ON.

2) Set up the changed operation range to the Joint movement range parameter.

MEJAR: (J1 minus side movement range, J1 plus side movement range, J2 minus side movement range, J2 plus side movement range, ...)

■ Setting the mechanical stopper origin parameter

If the movement range of either the minus (-) side of the J1 axis or the plus (+) side of the J2 axis has been changed, change the mechanical stopper origin parameter MORG.

1) Change the parameter MORG to the angle of the mechanical stopper position that has been set.

MORG: (J1 side mechanical stopper position, J2 side mechanical stopper position, ...)

■ Confirming the operation range

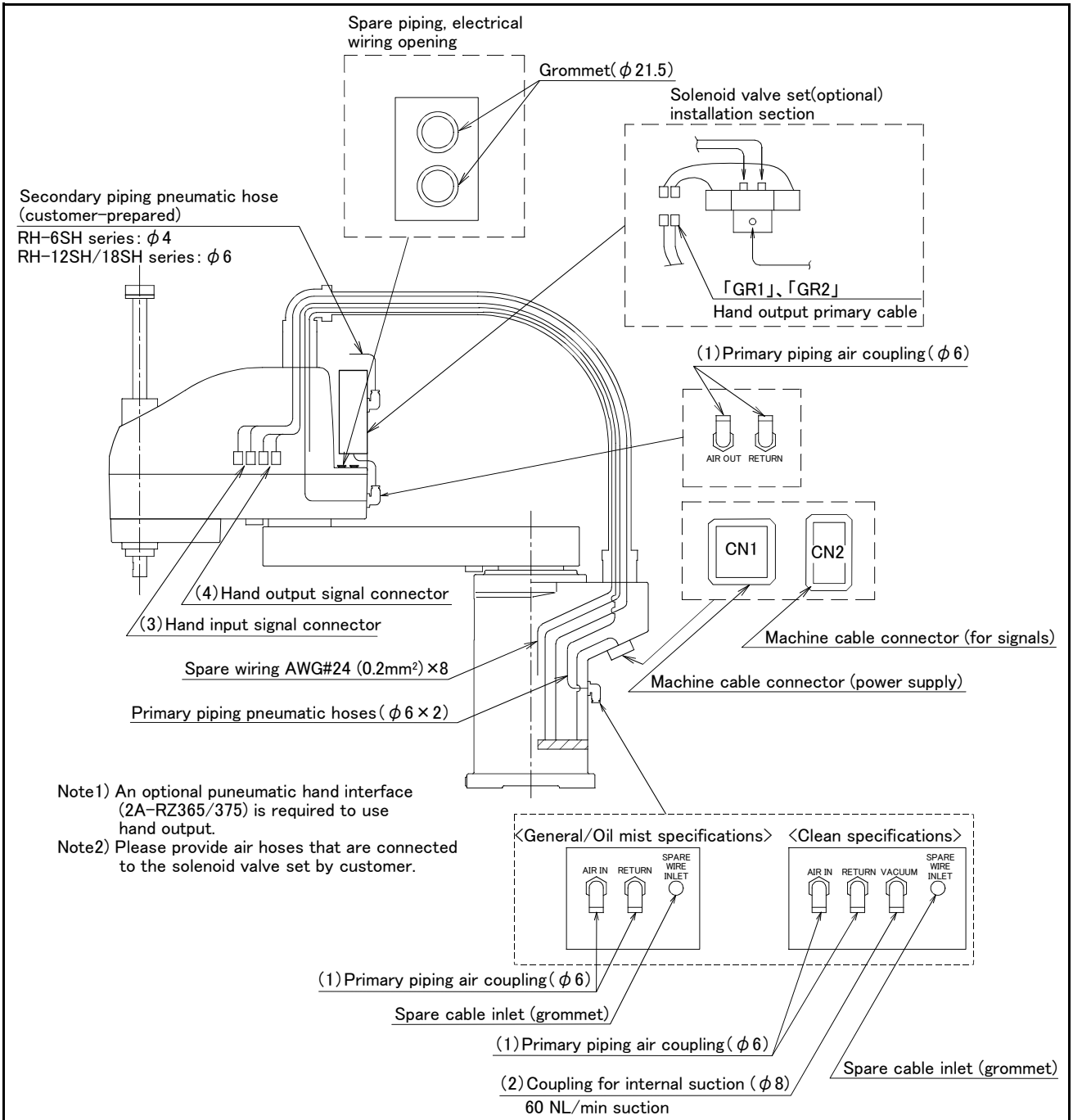
When completed changing the parameters, turn the controller power OFF and ON. Move the changed axis to the operation range limit with joint jog operation, and confirm that the limit over occurs and the robot stops at the angle changed for both the +/- side.

This completes the changing the operating range.

2.5 Tooling

2.5.1 Wiring and piping for hand

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



Connector and pneumatic coupling

No	Name	Qty.	Robot side (Robot arm side)		Counter side (customer-prepared)		Manufacturer
			Connectors, couplings	Connector pins	Connector	Connector pins	
(1)	Coupling	4	UKBL6	—	—	—	Koganei Corporation
(2)	Cou pling Note1)	1	UKBL8	—	—	—	Koganei Corporation
(3)	Connector	2	1-1717834-3	1318108-1	1-1318115-3	1318112-1	Tyco Electronics AMP
(4)	Connector	2	1-1717834-4	1318108-1	1-1318115-4	1318112-1	Tyco Electronics AMP

Note1) For dust suction in the clean specification.

Fig.2-34 : Wiring and piping for hand

2.5.2 Internal air piping

(1) Two φ6 x 4 urethane hoses are piped internally from the air intake opening at the base part to the rear part of the No. 2 arm.
(2) Two air joints for φ6 hoses are attached at the hose edge area on both the base side and No. 2 arm side.
(3) One φ8 hose joint (VACUUM) is dedicated to centralized suction in the case of the clean specification only.
(4) The solenoid valve set (optional) can be mounted at the No. 2 arm area.
(5) Refer to Page 72, "Solenoid valve set" for details on the electronic valve set (optional).

2.5.3 Internal wiring for the pneumatic hand output cable

(1) When the controller uses the optional pneumatic hand interface (2A-RZ365/RZ375), the hand output signal works as the pneumatic hand cable.
(2) The hand output primary cable extends from the connector PCB of the base section to the end of the No. 2 arm. (AWG#24(0.2mm^2)) The cable terminals have connector bridges. The connector names are GR1 and GR2. To extend the wiring to the outside of the arm, a separate cable (optional "hand output cable 1S-GR35S-02" IP65 is recommended) is required.
The hand output cable is located outside at the time of shipping. If this cable is not used, place the connectors for GR1 and GR2 inside, and install the attached grommet. For the oil mist specifications, fill the fringe of the grommet with silicon rubber.

2.5.4 Internal wiring for the hand check input cable

(1) The hand input primary cable extends from the connector PCB of the base section to the end of the No. 2 arm. (AWG#24(0.2mm^2)) The cable terminals have connector bridges. The connector names are HC1 and HC2.
(2) The hand check signal of the pneumatic hand is input by connecting this connector. To extend the wiring to the outside of the arm, a separate cable (optional "hand input cable 1S-HC35C-02" IP65 is recommended) is required.

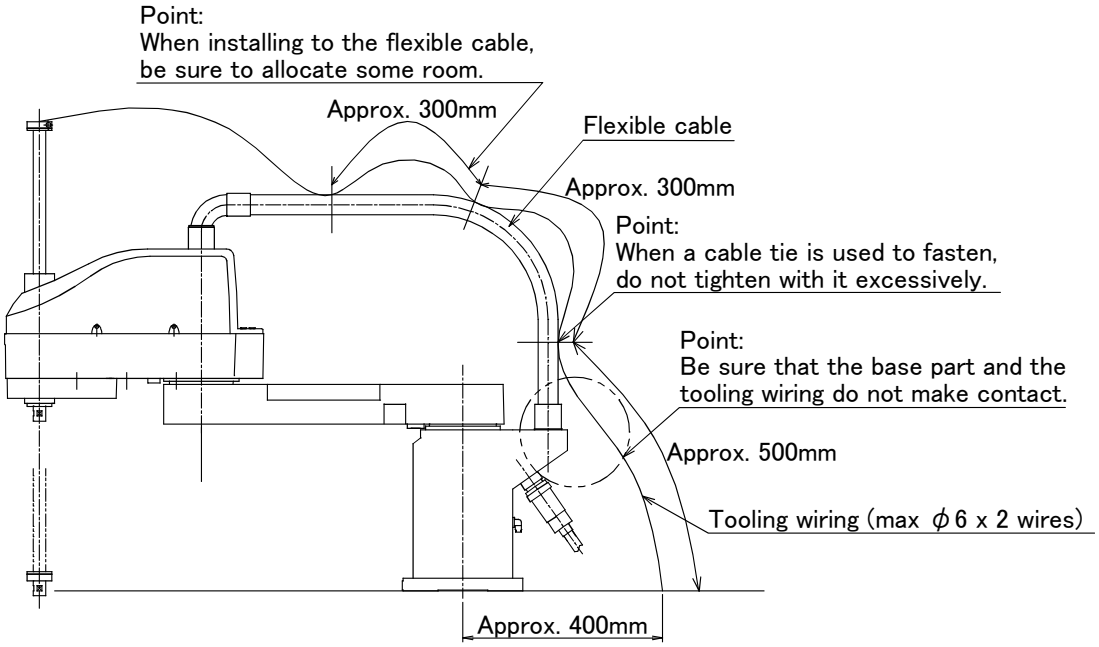
2.5.5 Spare wiring

As spare wiring, four pairs of AWG#24(0.2mm^2) cab tire cables (total of eight cores) are preinstalled between the base section and the No. 2 arm end section. Refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" for details.
Both ends of the wire terminals are unprocessed. Use them under the following circumstances:

- For folding as the hand output cable when installing the solenoid valve in outside the robot.
- For when installing six or more hand I/O points for the sensor in the hand section
  (Connects to the parallel I/O general purpose input.)

2.5.6 Precautions for piping to the flexible cable

If the piping of the hand is performed to the flexible cable of this robot, be sure to perform wiring and piping by following the precautions listed below so that they will not interfere with the functionality of the flexible cable.



If many hand cables are installed to the flexible cable and depending on the manner of installation, excessive force may be applied to the flexible cable and the life span of the flexible cable may be shortened and also the mounting nuts of the flexible cable may come loose.

2.5.7 About the Installation of Tooling Wiring and Piping (Examples of Wiring and Piping)

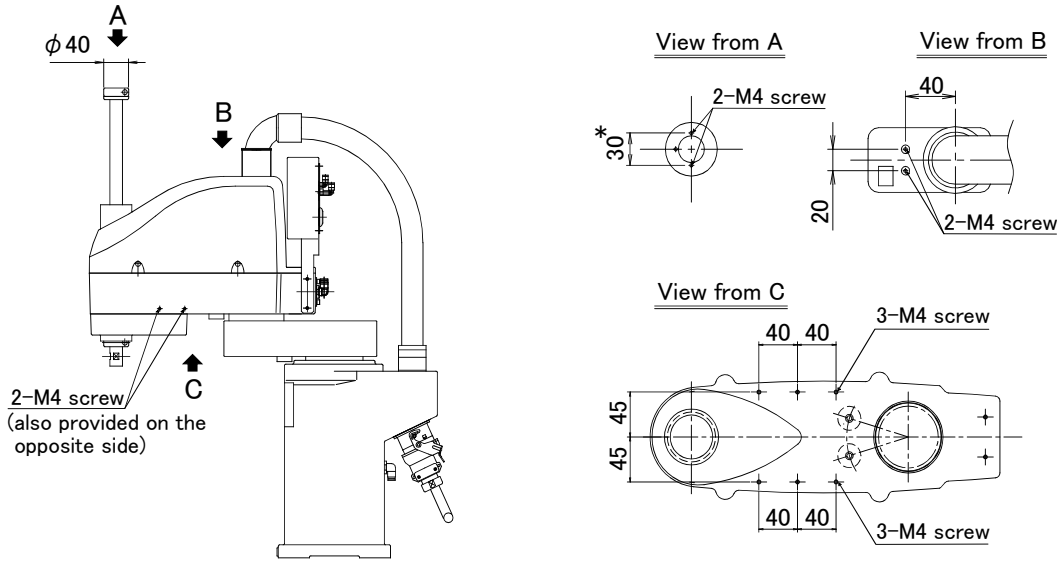
The customer is required to provide tooling wiring, piping and metal fixtures.

Screw holes are provided on the robot arm for the installation of tooling wiring, piping and metal fixtures. (Refer to the Table 2-35, Table 2-36 and Table 2-37.)

The length of wiring and piping and the installation position on the robot must be adjusted according to the work to be done by the robot. Please use the following example as reference. Pay extra attention to the precautions and interfering points described in the example during the adjustment.

- A hand input cable and a hand curl cable are available as optional accessories for your convenience.
- After performing wiring and piping to the robot, operate the robot at low speed to make sure that each part does not interfere with the robot arm and the peripheral devices. (Interfering points and precautions are indicated in the example.)
- Please be aware that dust may be generated from friction if wires and pipes come into contact with the robot arm when using it according to the clean specifications.

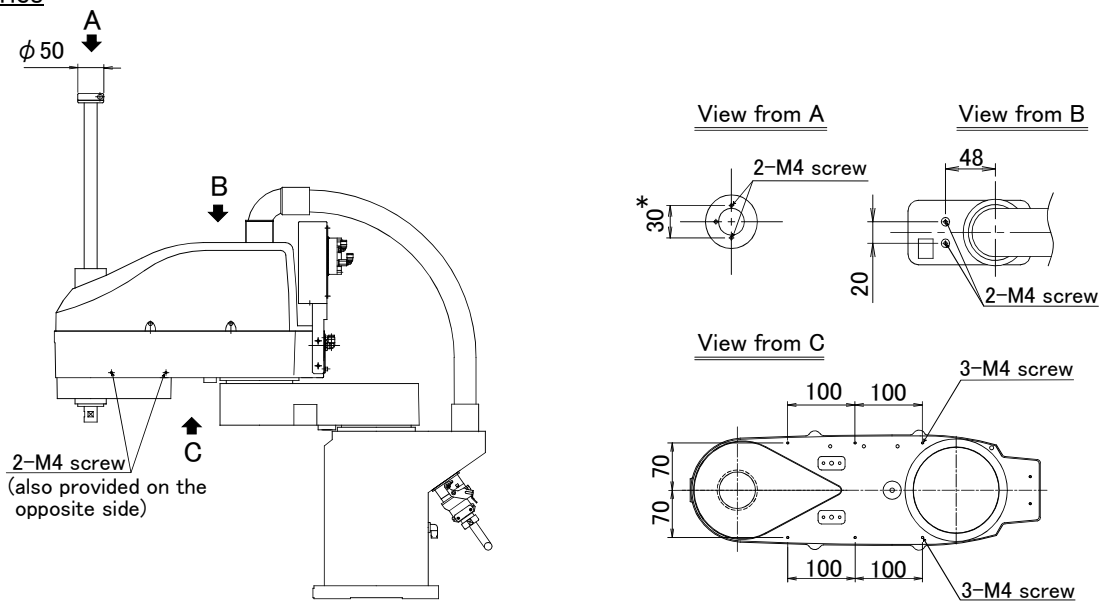
RH-6SH series



* The dimension is 33 mm for the clean/oil mist specifications.

Fig.2-35 : Location of screw holes for fixing wiring/piping(RH-6SH series)

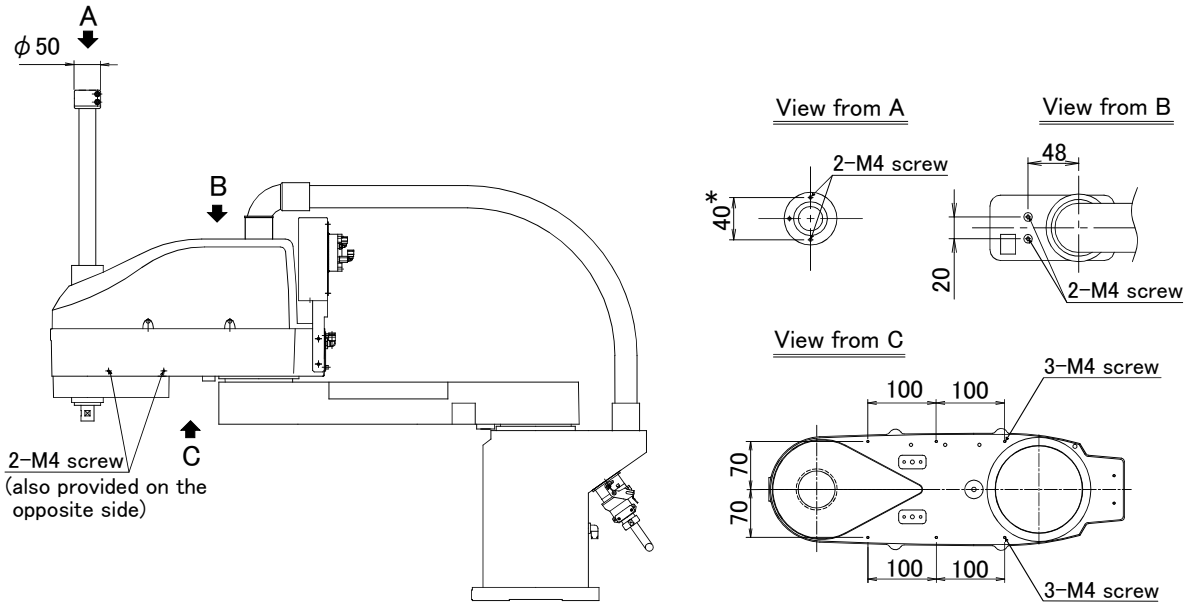
RH-12SH series



* The dimension is 33 mm for the clean/oil mist specifications.

Fig.2-36 : Location of screw holes for fixing wiring/piping(RH-12SH series)

RH-18SH series



* The dimension is 33 mm for the clean/oil mist specifications.

Fig.2-37 : Location of screw holes for fixing wiring/piping(RH-18SH series)

(1) Example of wiring and piping <1>

This method is effective when the rotation of the hand is small (within ± 90 deg.) and provides easy maintenance of the robot arm as well as during the replacement of wiring and piping.

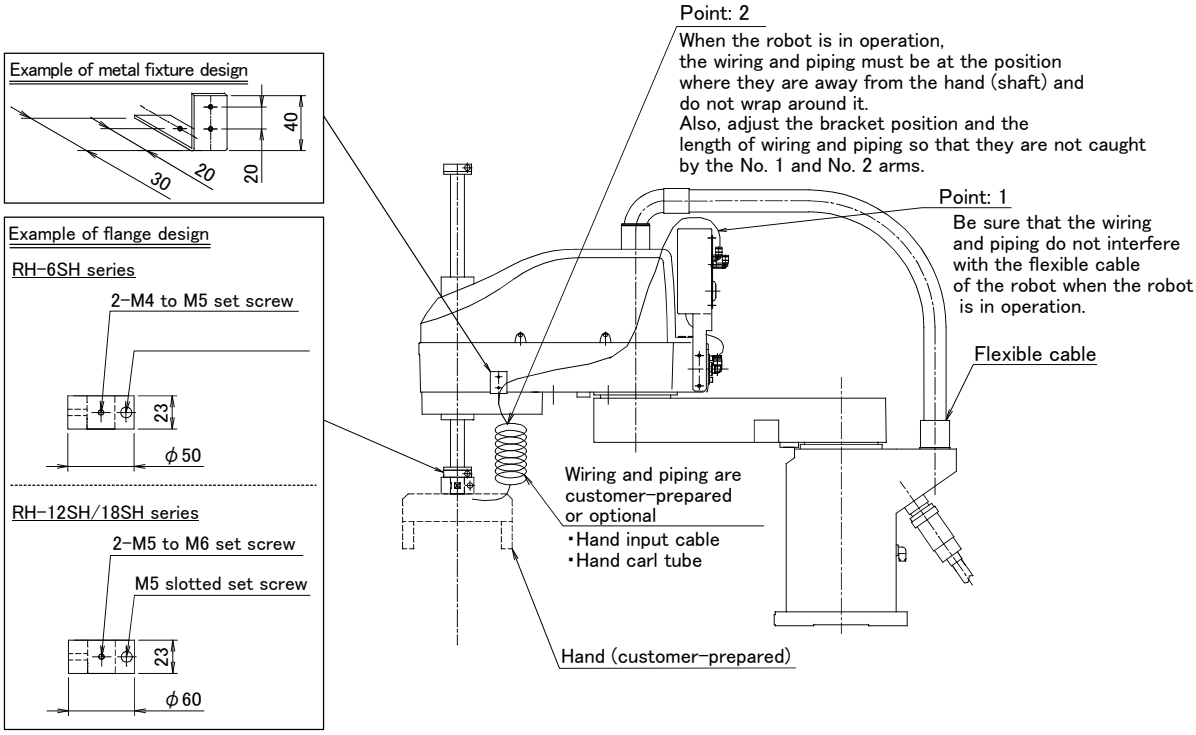


Fig.2-38 : Example of wiring and piping <1>

(2) Wiring and piping example <2>

If wiring and piping are fed through the hollow section of the shaft, the wiring and piping to the hand can be streamlined.

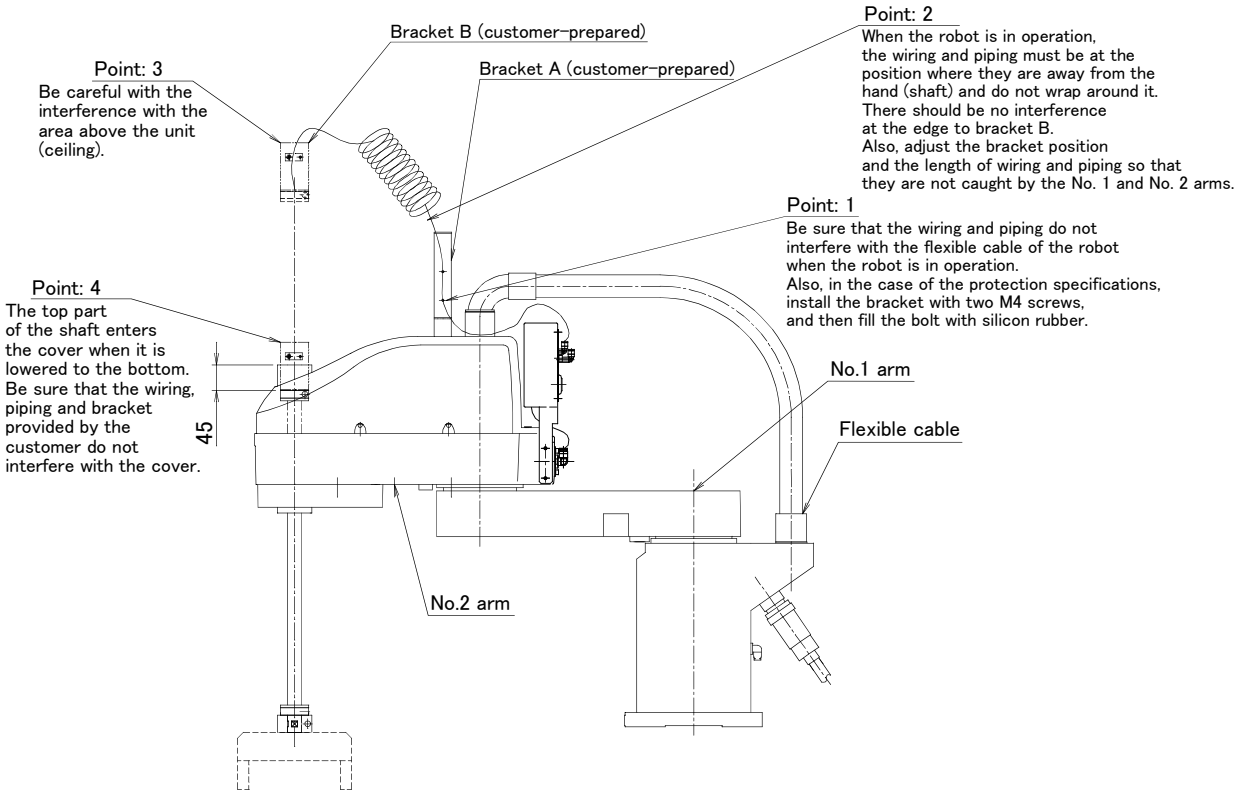
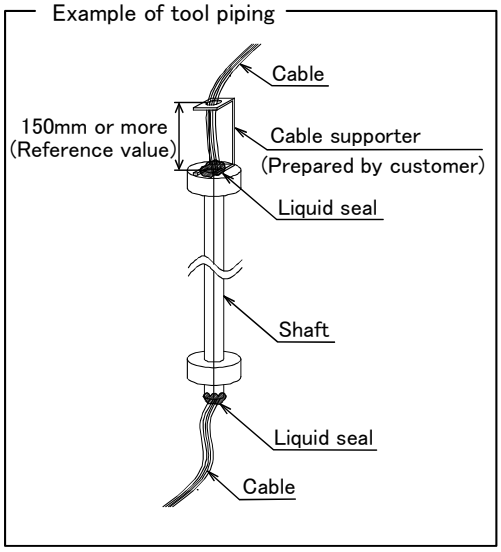
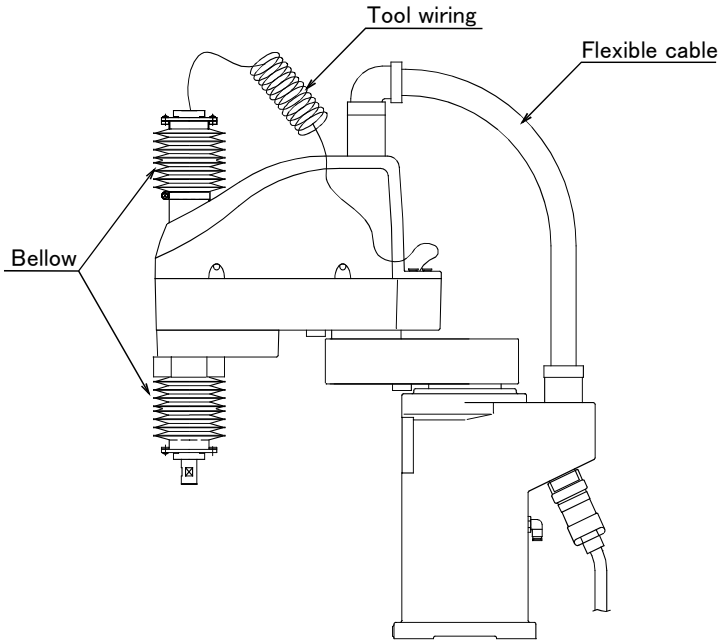


Fig.2-39 : Example of wiring and piping <2>

(3) Precautions for the oil mist specification and clean specification

- Bellows are attached to the tips so confirm not interfering in the tooling wiring, piping, and the flexible tube.
- Please use wiring materials that are sufficiently flexible. Furthermore, please perform the wiring in such a way that the bending radii of the selection tube and wires will not become less than the minimum values allowed while the robot is operating.





(4) Precautions for the clean specification

The top and bottom parts of the through hole of the tip shaft are taped at shipment.
Perform the following actions as necessary in order to ensure that the robot is sufficiently clean during the operation:

1) When the through hole of the shaft is not used
   - Keep the tip shaft taped while the robot is in use.

2) When the through hole of the shaft is used for wiring.
   - Peel the tape of the tip shaft off and perform the necessary wiring. Once the wiring is completed, seal the tip shaft using liquid seal in order to avoid accumulation of dust.
   - Perform the wiring in such a way that the wires around the area below the tip shaft will not get into contact with other parts while the robot is operating.

2.5.8 Wiring and piping system diagram for hand

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

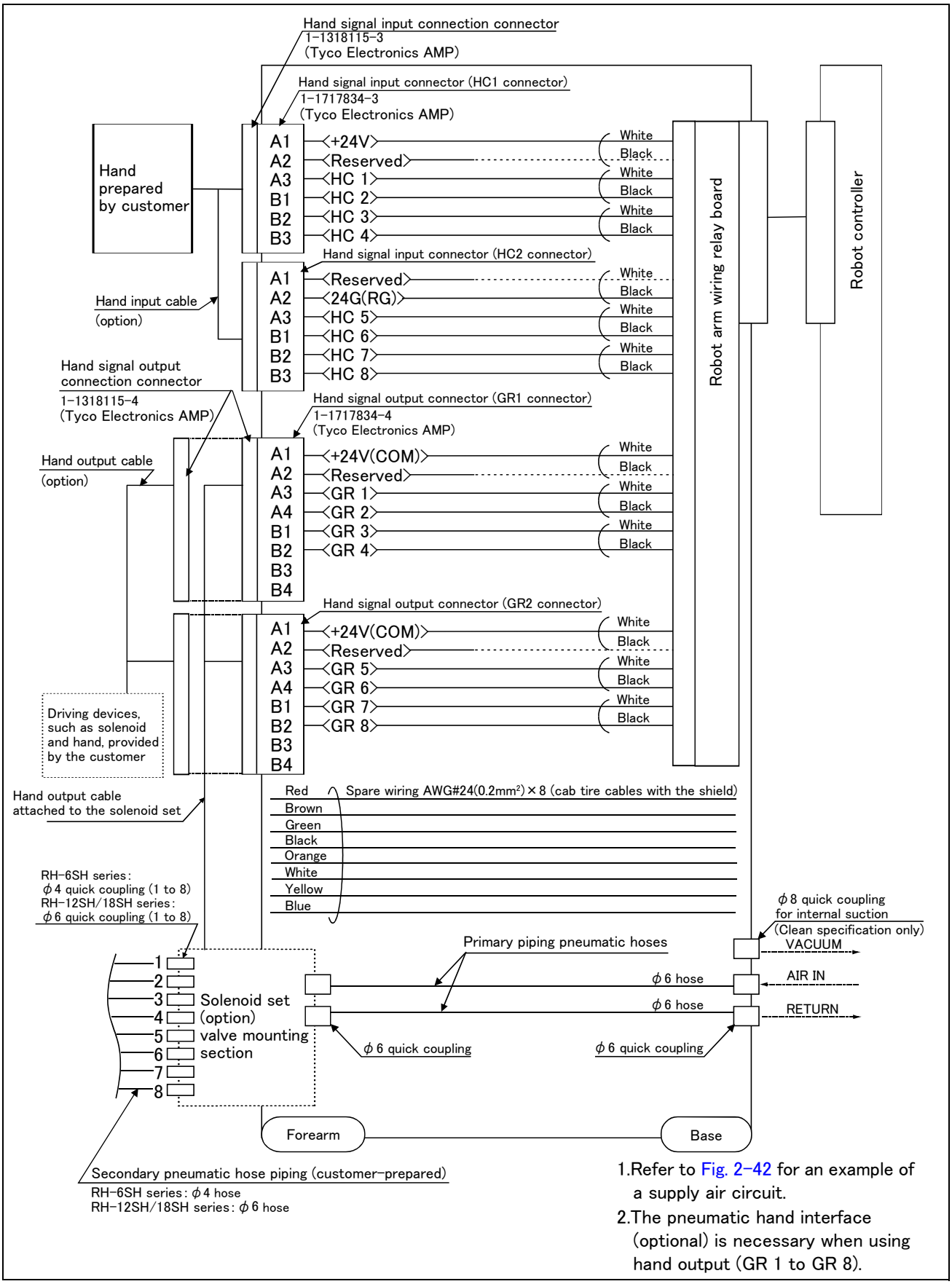


Fig.2-40 : Wiring and piping system diagram for hand and example the solenoid valve installation(Sink type)

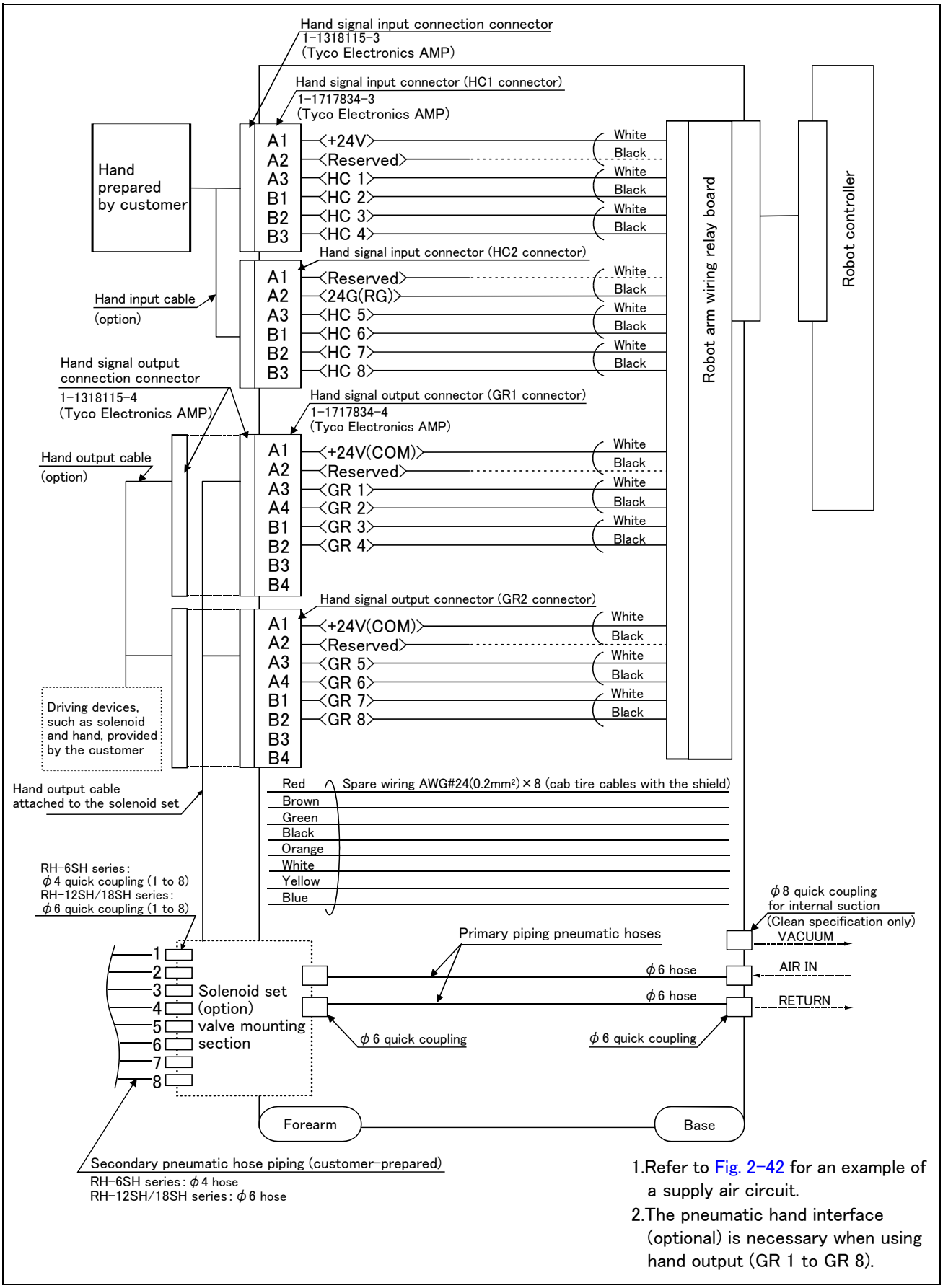


Fig.2-41 : Wiring and piping system diagram for hand and example the solenoid valve installation(Source type)

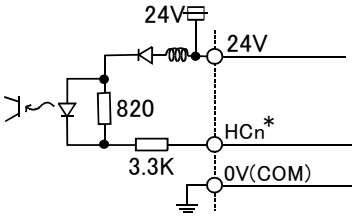
2.5.9 Electrical specifications of hand input/output

Table 2-13 : Electrical specifications of input circuit

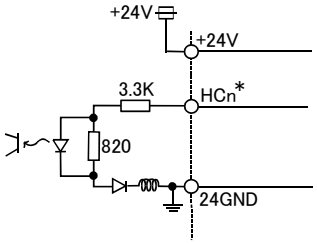
Item		Specifications
Type		DC input
No. of input points		8
Insulation method		Photo-coupler insulation
Rated input voltage		12VDC/24VDC
Rated input current		Approx. 3mA/approx. 7mA
Working voltage range		DC10.2 to 26.4V(ripple rate within 5)
ON voltage/ON current		8VDC or more/2mA or more
OFF voltage/OFF current		4VDC or more/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>



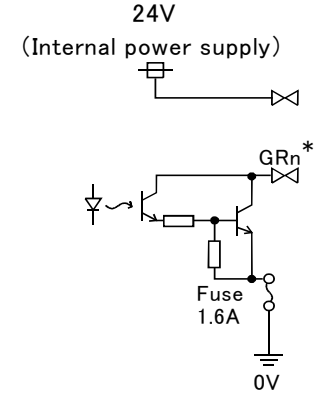
* HCn = HC1 ~ 8

Table 2-14 : 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)
Fuse rating		Fuses 1.6A (each one common) Cannot be exchanged

Internal circuit

<Sink type>



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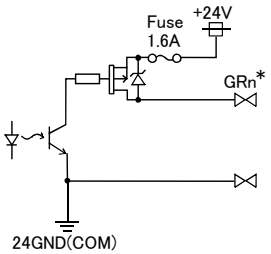


* GRn = GR1 ~ GR8

Note) The pneumatic hand interface (2A-RZ365/RZ375) is necessary when using hand output.

2.5.10 Air supply circuit example for the hand

Fig. 2-42 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. 2-42 and use the circuit described so that the robot stops when pressure drops. Use a hand with a spring-pressure clamp, or a mechanical lock-type hand, that can be used in cases where the pressure switch becomes damaged.

(3) The optional hand and solenoid valve are of an oilless type. If they are used, don't use any lubricator.

(4) Supply clean air to the vacuum generation valve when you use clean type robot.

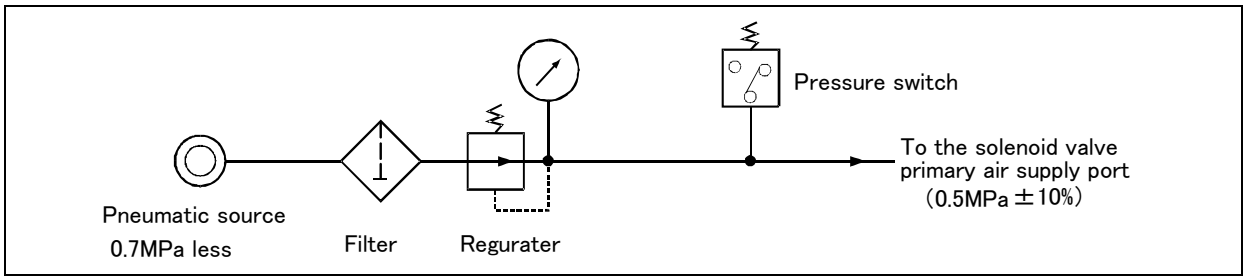


Fig.2-42 : Air supply circuit example for the hand

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 at the time of shipment from the factory. Consequently, customer need to confirm the delivery date.

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.

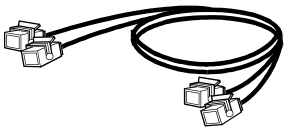
■ How to order

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

(1) Machine cable

■ Order type: RH-6SH series.....● Fixed type(2m) 1S-02UCBL-03
RH-12SH/18SH series.....● Fixed type(2m) 1S-02UCBL-01

■ Outline



This cable is exchanged for the machine cable (5 m for fixed type) that was supplied as standard to shorten the distance between the controller and the robot arm.

■ Configuration

Table 2-15 : Configuration equipments and types

Part name			Type	Qty.	Mass(kg) Note1)	Remarks
RH-6SH series						
	Fixed	Set of signal and power cables	1S-02UCBL-03	1 set	2.6	2m
		Motor signal cable	BKO-FA0741H02	(1 cable)		
		Motor power cable	BKO-FA0768H02	(1 cable)		
RH-12SH/18SH series						
	Fixed	Set of signal and power cables	1S-02UCBL-01	1 set	3.4	2m
		Motor signal cable	BKO-FA0741H02	(1 cable)		
		Motor power cable	BKO-FA0739H02	(1 cable)		

Note1)Mass indicates one set.

Note) Standard 5 m (for fixed type) is not attached.

[Caution] Orders made after purchasing a robot are treated as purchases of optional equipment. In this case, the machine cable (5 m for fixed type) that was supplied as standard is not reclaimed.
Please keep it in storage.

2.7 Options

■ What are options?

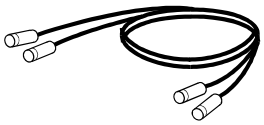
There are a variety of options for the robot designed to make the setting up process easier for customer needs. customer installation is required for the options. Options come in two types: ″set options″ and ″single options″.

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 : RH-6SH series..... ● Fixed type 1S- □□ CBL-03
● Flexed type 1S- □□ LCBL-03
RH-12SH/18SH series..... ● Fixed type 1S- □□ CBL-01
● Flexed type 1S- □□ LCBL-01
Note) The numbers in the boxes □□ refer the length.

■ Outline



This cable is exchanged with the standard machine cable (5m) accessory to extend the distance between the controller and the robot arm.
A fixed type and flexible type are available.
Exchanges after shipment will be charged (for packaging, shipping costs).
The fixing and flexible types are both configured of the motor signal cable and motor power cable.

■ Configuration

Table 2-16 : Configuration equipments and types

Part name		Type	Qty. Fixed	Qty. Flexed	Mass(kg) Note1)	Remarks
RH-6SH series						
Fixed	Set of signal and power cables	1S- □□ CBL-03	1 set	–	4.3(5m)	5m, 10m, or 15m each
	Motor signal cable	1S- □□ CBL(S)-01	(1 cable)	–	7.6(10m)	
	Motor power cable	1S- □□ CBL(P)-02	(1 cable)	–	11.0(15m)	
Flexed	Set of signal and power cables	1S- □□ LCBL-03	–	1 set	6.2(5m)	5m, 10m, or 15m each
	Motor signal cable	1S- □□ LCBL(S)-01	–	(1 cable)	11.0(10m)	
	Motor power cable	1S- □□ LCBL(P)-02	–	(1 cable)	15.4(15m)	
Nylon clamp		NK-14N	–	2 pcs.	–	for motor signal cable
Nylon clamp		NK-18N	–	2 pcs.	–	for motor power cable
Silicon rubber			–	4 pcs.	–	
RH-12SH/18SH series						
Fixed	Set of signal and power cables	1S- □□ CBL-01	1 set	–	6.7(5m)	5m, 10m, or 15m each
	Motor signal cable	1S- □□ CBL(S)-01	(1 cable)	–	12.0(10m)	
	Motor power cable	1S- □□ CBL(P)-01	(1 cable)	–	17.3(15m)	
Flexed	Set of signal and power cables	1S- □□ LCBL-01	–	1 set	6.7(5m)	5m, 10m, or 15m each
	Motor signal cable	1S- □□ LCBL(S)-01	–	(1 cable)	12.2(10m)	
	Motor power cable	1S- □□ LCBL(P)-01	–	(1 cable)	18.0(15m)	
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)Mass indicates one set.

Note) The numbers in the boxes □□ refer the length.

■ 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 2-17.

Table 2-17 : Conditions for the flexed type cables

Item		Specifications
Minimum flexed radius		100R or more
Cable bare, etc., occupation rate		50% or less
Maximum movement speed		2000mm/s or less
Guidance of life count		7.5 million times
Environmental proof		Oil-proof specification sheath (for silicon grease, cable sliding lubricant type)
Cable configuration	Motor signal cable	φ6 × 5, φ8.5 × 1, φ1.7 × 1 本
	Motor power cable	φ6.5 x 10 (RH-6SH series)/ φ8.9 x 3 and φ6.5 x 6 (RH-12SH series)

[Caution] The warranty life may greatly differ according to the usage state (items related to Table 2-17 and to the amount of silicon grease applied in the cable conduit.

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

■ Cable configuration

Table 2-18 shows the configuration of bending type cables of the RH-6SH series and Table 2-19 shows that of the RH-12SH/18SH series. Please use these as reference when selecting cable bearers.

Table 2-18 : Cable configuration(RH-6SH series)

Item	Motor signal cable 1S- □□ LCBL(S)-01			Motor power cable 1S- □□ LCBL(P)-02
No. of cores	AWG#24 (0.2mm^2)-4P	AWG#24 (0.2mm^2)-7P	AWG#18 (0.75mm^2)	AWG#18 (0.75mm^2)-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.

Table 2-19 : Cable configuration(RH-12SH/18SH series)

Item	Motor signal cable 1S- □□ LCBL(S)-01			Motor power cable 1S- □□ LCBL(P)-01	
No. of cores	AWG#24 (0.2mm^2)-4P	AWG#24 (0.2mm^2)-7P	AWG#18 (0.75mm^2)	AWG#16 (1.25mm^2)-4C	AWG#18 (0.75mm^2)-4C
Finish dimensions	Approx. ϕ6mm	Approx. ϕ8.5mm	Approx. ϕ1.7mm	Approx. ϕ8.9mm	Approx. ϕ6.5mm
No.of cables used	5 cables	1 cable	1 cable	3 cables	6 cables
No. in total	7 cables			9 cables	

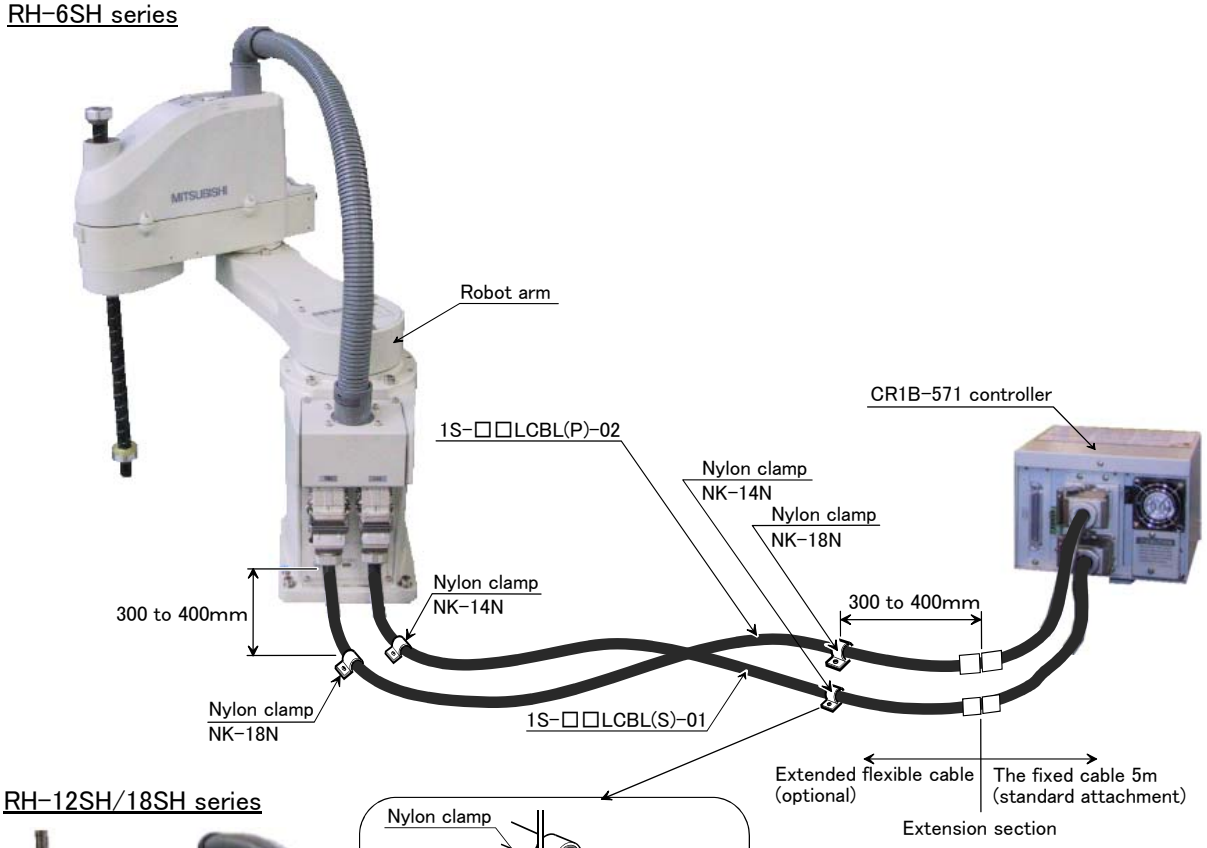
Note) The square in the cable name indicates the cable length.

■ 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 extension section as shown in Fig. 2-43, and fix with the nylon clamp to protect the cable from external stress.

RH-6SH series



RH-12SH/18SH series

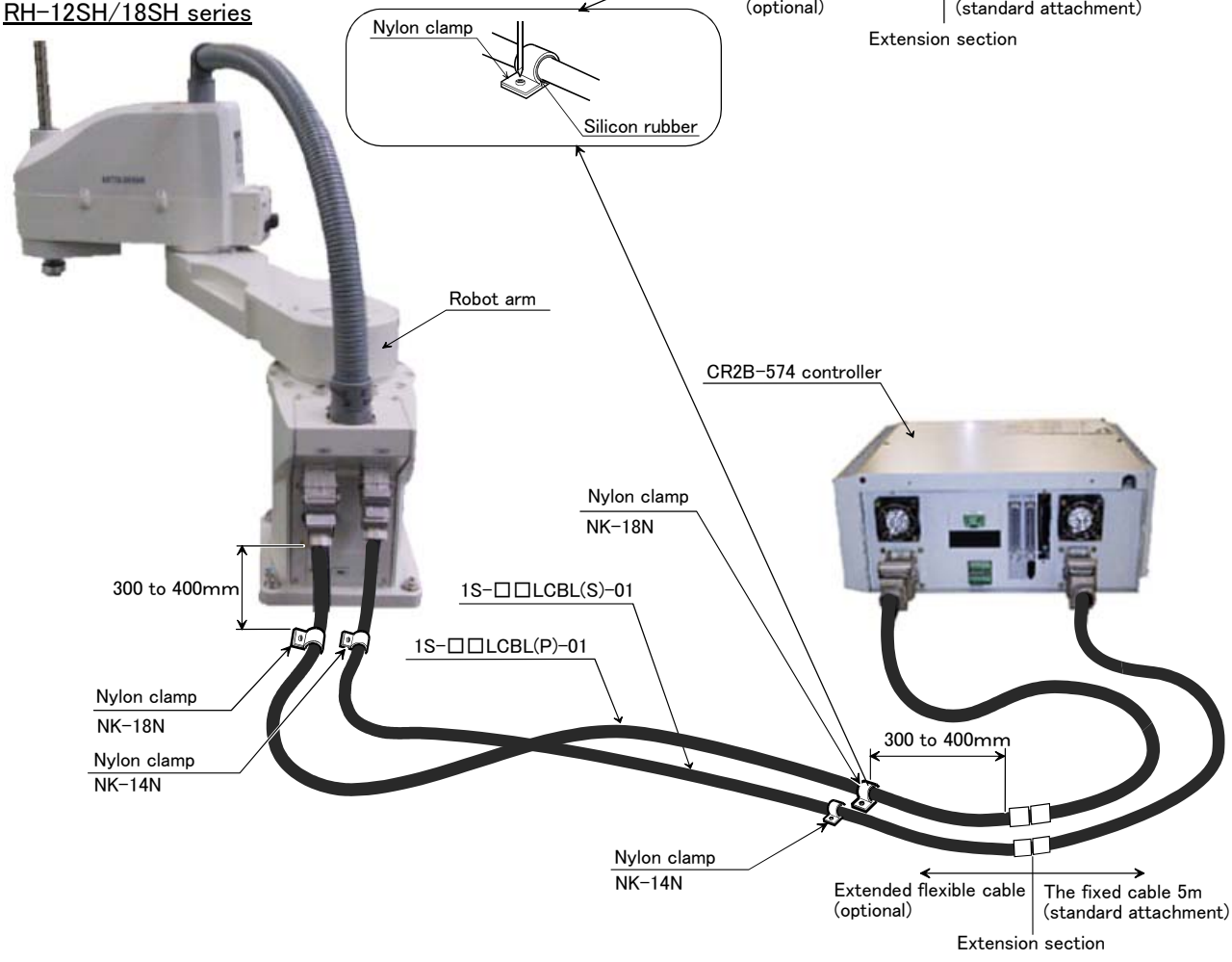


Fig.2-43 : Fixing the flexible cable

(2) Solenoid valve set

■ Order type: RH-6SH series ..... ● Four sets:1S-VD04M-04(Sink type)/1S-VD04ME-04(Source type)
RH-12SH/18SH series ● Four sets:1S-VD04M-03(Sink type)/1S-VD04ME-03(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. All have double solenoid specification, and either one or two or three sets can be selected. This solenoid valve set has a hand output cable attached to the solenoid valve. Also, for easy installation of this electromaagnetic set onto the robot, it comes equipped with a manifold, couplings, silencers, among other things.
When using the robot arm's hand output signal, the pneumatic hand interface option[Note1)] must be installed on the separate controller.

■ Configuration

Table 2-20 : Configuration equipment

Part name	Type	Q'ty	Mass(kg) Note1)	Remark
RH-6SH series				
Solenoid valve set (4 sets)	1S-VD04M-04/ 1S-VD04ME-04	1 pc.	1.0	M4x8 four screws (installation screws). 1S-VD04M-04 is the sink type. 1S-VD04ME-04 is the source type.
RH-12SH/18SH series				
Solenoid valve set (4 sets)	1S-VD04M-03/ 1S-VD04ME-03	1 pc.	1.8	M4x8 four screws (installation screws). 1S-VD04M-03 is the sink type. 1S-VD04ME-03 is the source type.

Note1)Mass indicates one set.

■ Specifications

Table 2-21 : Valve specifications

Item	Specifications
Number of positions	2
Port	5[Note2)]
Valve function	Double solenoid
Operating fluid	Clean air [Note3)]
Operating method	Internal pilot method
Effective sectional area (CV value)	0.64mm
Oiling	Unnecessary
Operating pressure range	0.1 to 0.7MPa
Guaranteed proof of pressure	1.0MPa or more
Response time	22msec or less (at 0.5 MPa)
Max. operating frequency	5c/s
Ambient temperature	-5 to 50 ℃ (However, there must be no condensation.)

Note2) 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).

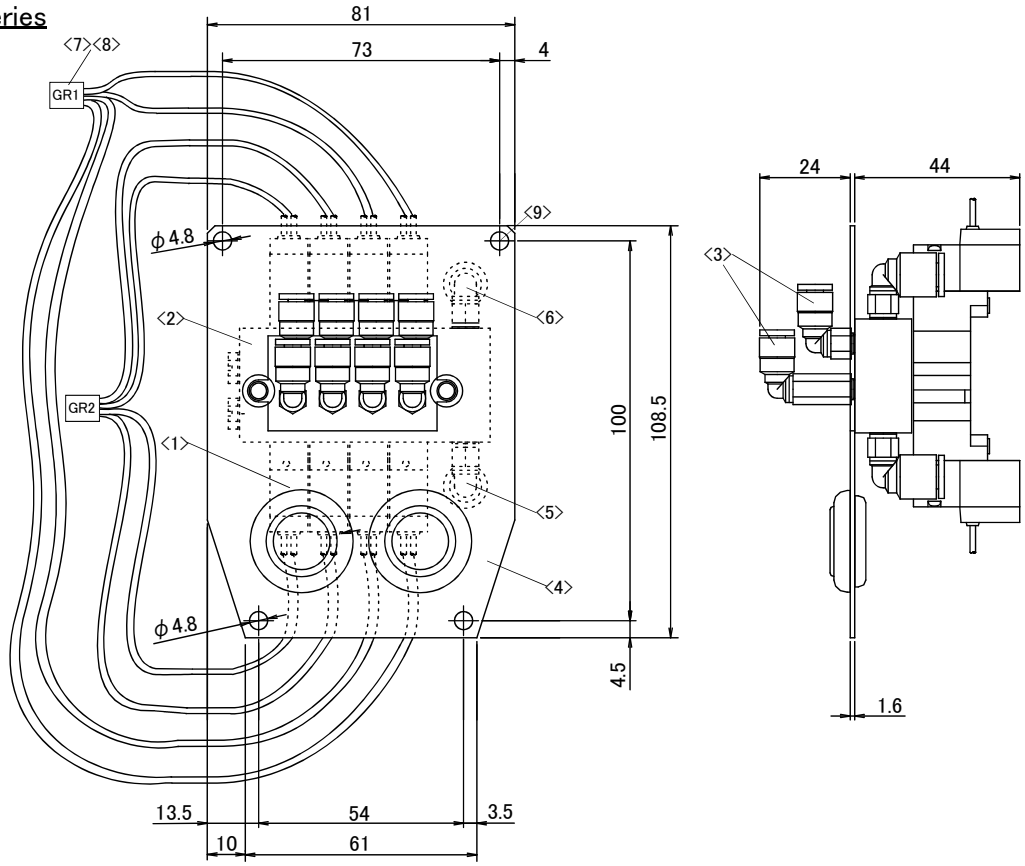
⚠ CAUTION Note3) The air to be provided must be clean, i.e., filtered with a mist separator or air filter. Failing to do so may lead to malfunctions.

Table 2-22 : Solenoid specifications

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

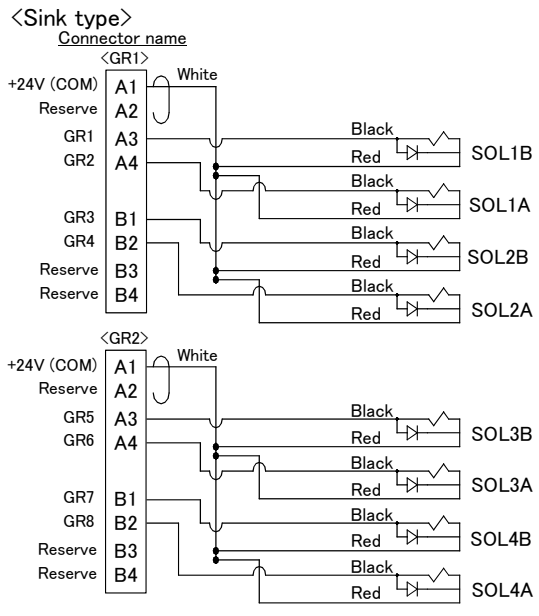
Note1) 1S-VD04M-04/1S-VD04M-03 (sink type) corresponds to 2A-RZ365 and 1S-VD04ME-04/1S-VD04ME-03 (source type) corresponds to 2A-RZ375.

RH-6SH series



Part no.	Part name	Qty.	Specifications
<1>	Solenoid valve	4	
<2>	Manifold block	1	
<3>	Quick coupling	8	φ4
<4>	Block plate	1	
<5>	Quick coupling	1	φ6
<6>	Quick coupling	1	φ6
<7>	Connector	2	1-1318115-4
<8>	Contact	12	1318112-1
<9>	Installation screw	4	M4 × 8

<Sink type>



<Source type>

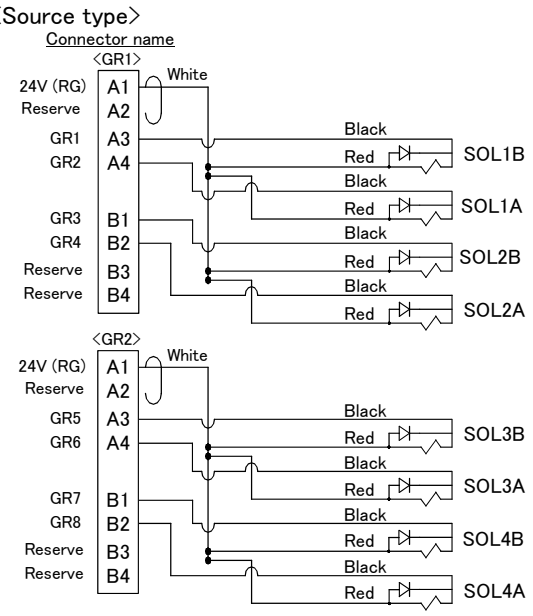


Fig.2-44 : Outside dimensional drawing(RH-6SH series)

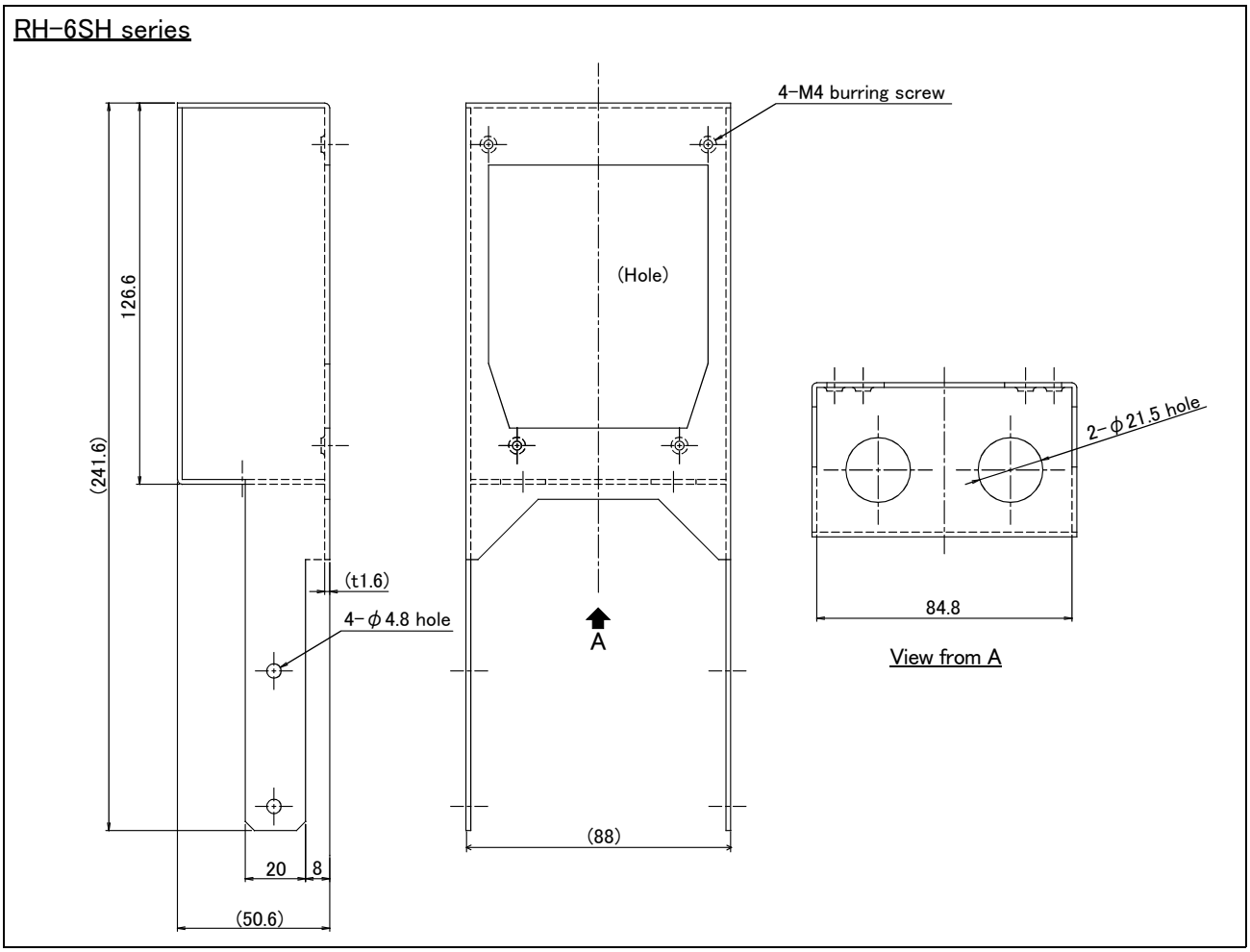
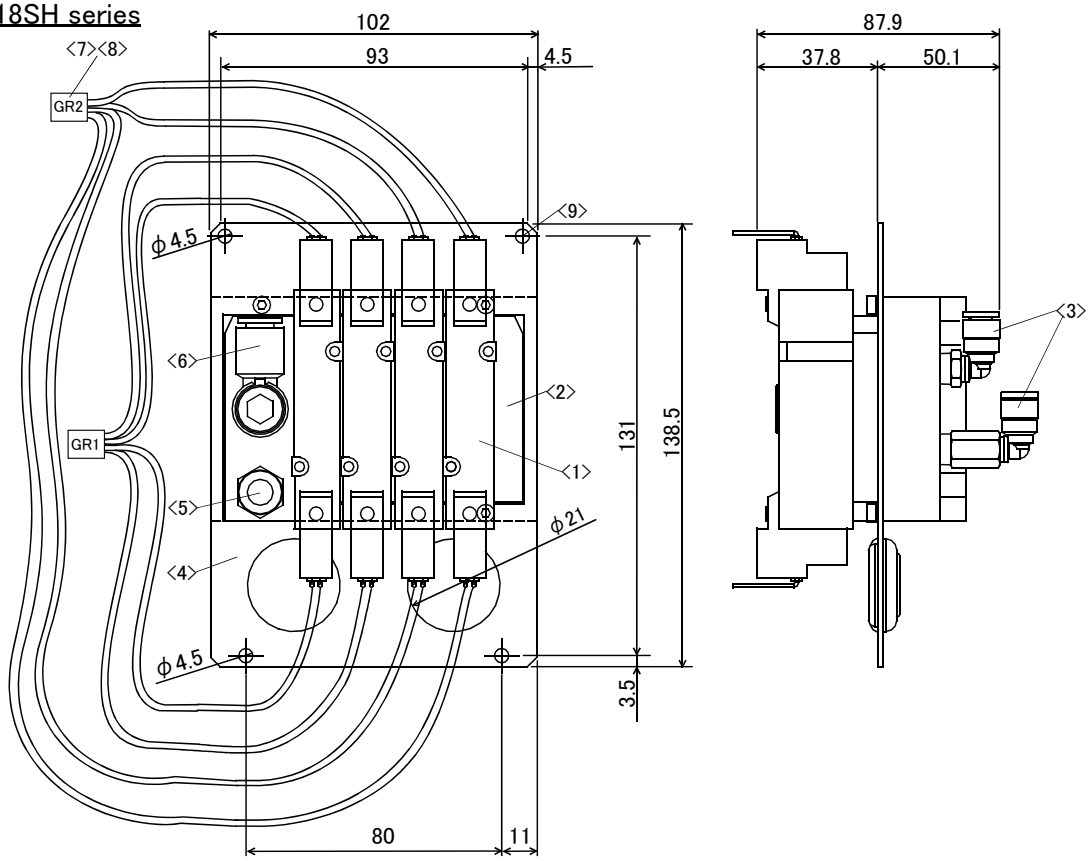


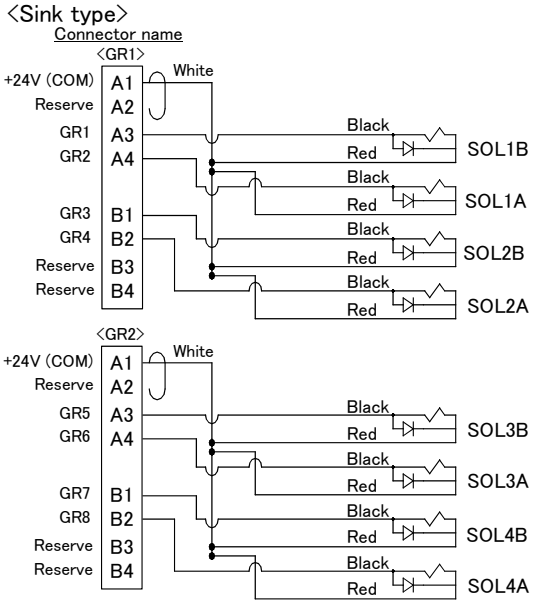
Fig.2-45 : Outside dimensions of solenoid valve box (RH-6SH series)

RH-12SH/18SH series



Part no.	Part name	Qty.	Specifications
<1>	Solenoid valve	4	
<2>	Manifold block	1	
<3>	Quick coupling	8	φ4
<4>	Block plate	1	
<5>	Quick coupling	1	φ6
<6>	Quick coupling	1	φ6
<7>	Connector	2	1-1318115-4
<8>	Contact	12	1318112-1
<9>	Installation screw	4	M4 × 8

<Sink type>



<Source type>

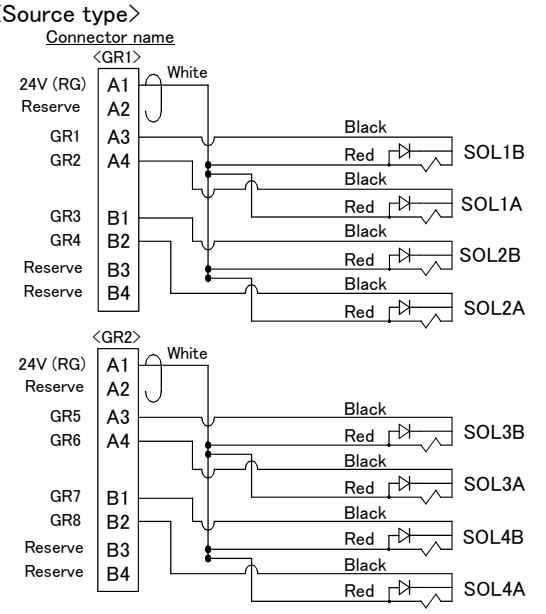


Fig.2-46 : Outside dimensional drawing(RH-12SH/18SH series)

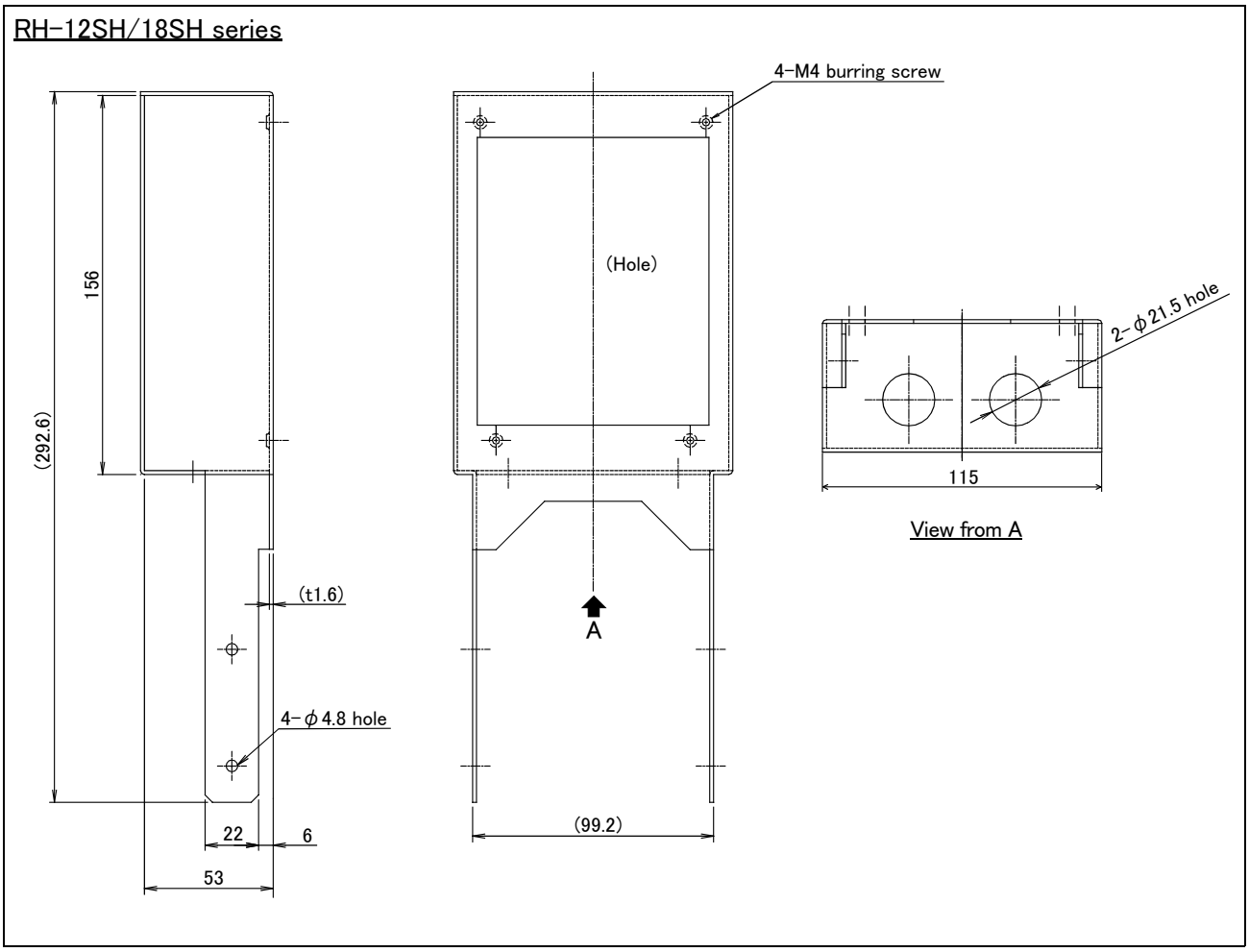
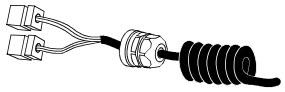


Fig.2-47 : Outside dimensions of solenoid valve box (RH-12SH/18SH series)

(3) Hand input cable

■ Order type:1S-HC35C-02

■ Outline



The hand input cable is used for customer-designed pneumatic hands.
It is necessary to use this to receive the hand's open/close confirmation signals and grasping confirmation signals, at the controller.
One end of the cable connects to the connector for hand input signals, which is in the No.2 arm back side. The other end of the cable connects to the sensor inside the hand customer designed.

■ Configuration

Table 2-23 : Configuration equipment

Part name	Type	Qty.	Mass(kg)	Remarks
Hand input cable	1S-HC35C-02	1 cable	0.1	

■ Specifications

Table 2-24 : Specifications

Item	Specifications	Remarks
Size x cable core	AWG#24(0.2mm^2) x 12 cores	One-sided connector, one-sided cable bridging
Total length	1,200mm (Including the curl section, which is 350mmlong)	

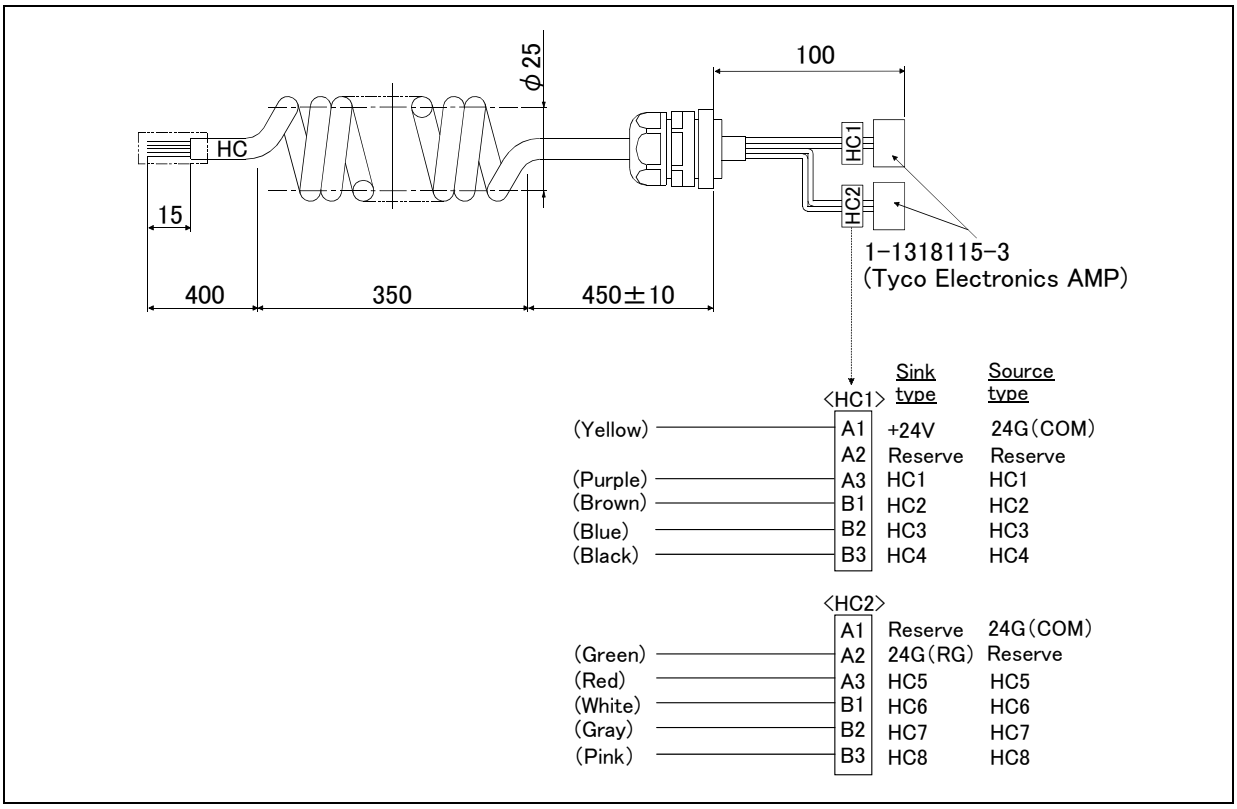


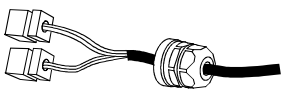
Fig.2-48 : Outside dimensional drawing and pin assignment

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

(4) Hand output cable

■ Order type: 1S-GR35S-02

■ Outline



The hand output cable (solenoid valve connection cable) is an option that is used when an 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 2-25 : Configuration equipment

Part name	Type	Qty.	Mass(kg)	Remarks
Hand output cable	1S-GR35S-02	1 cable	0.2	

■ Specifications

Table 2-26 : Specifications

Item	Specifications	Remarks
Size x Cable core	AWG#24(0.2mm^2) x 12 cores	One side connector and one side cable connection
Total length	350mm	

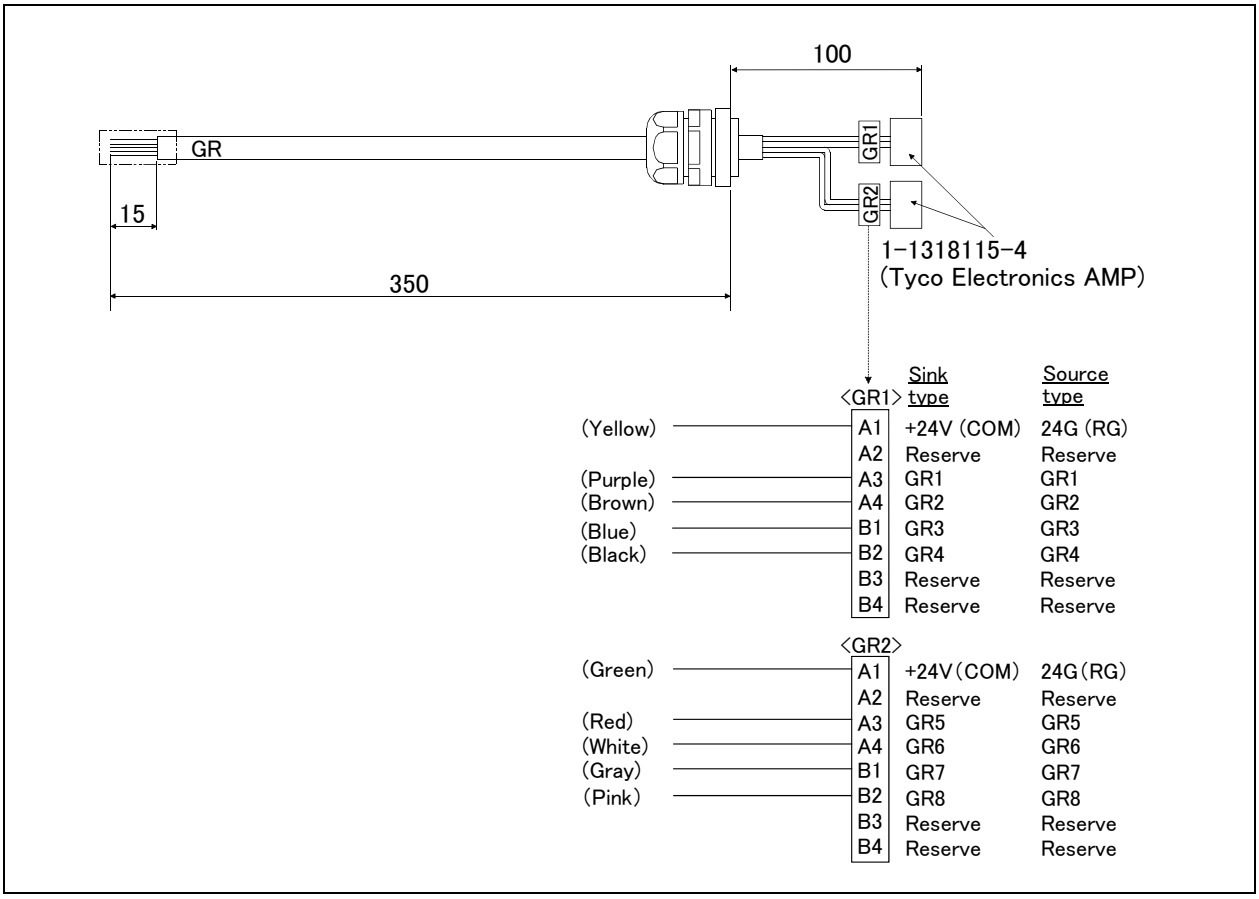


Fig.2-49 : Outline dimensional drawing and pin assignment

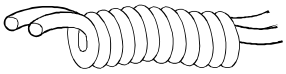
[Caution] This option can be installed on clean-type, but its cleanliness is not under warranty.

(5) Hand curl tube

■ Order type: RH-6SH series..... 1E-ST0408C-300
RH-12SH/18SH series..... 1N-ST0608C

■ Outline

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



■ Configuration

Part name	Type	Qty.	Mass(kg)	Remarks
RH-6SH series				
Hand curl tube (Four set: 8 pcs.)	1E-ST0408C-300	1 pc.	0.1	Φ4 tube, 8pcs
RH-12SH/18SH series				
Hand curl tube (Four set: 8 pcs.)	1N-ST0608C	1 pc.	0.4	Φ6 tube, 8pcs

■ Specifications

Table 2-27 : Specifications

Item	Specifications	
	RH-6SH series	RH-12SH/18SH series
Material	Urethane	Urethane
Size	Outside diameter: Φ4 x Inside diameterΦ2.5	Outside diameter: Φ6 x Inside diameterΦ4

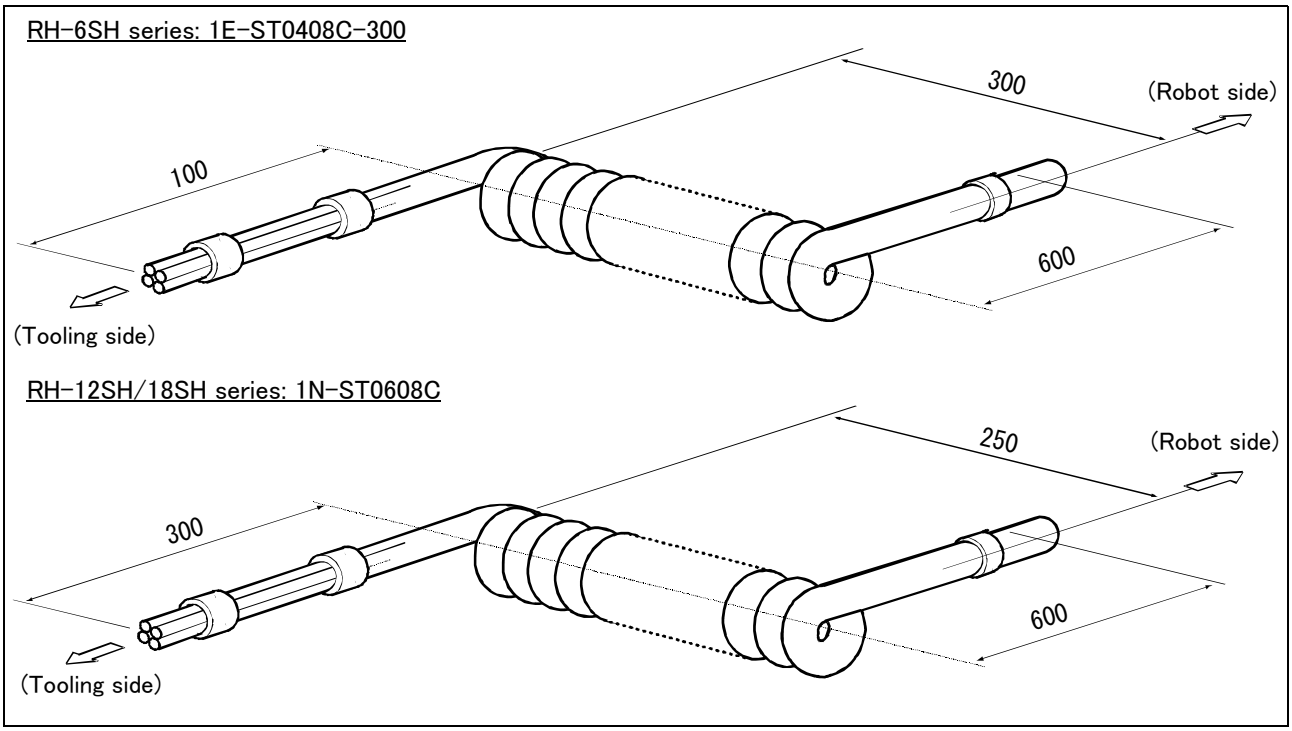


Fig.2-50 : Outline dimensional drawing

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

2.8 Maintenance parts

The consumable parts used in the robot arm are shown in Table 2-28. 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 2-28 : Consumable part list

No.	Part name	Type Note1)	Usage place	Qty.	Supplier
1	Grease	SK-1A	Reduction gears of each axis	As needed	Mitsubishi Electric System & Service;Co.,Ltd.
2		Marutenpu PS No.2	Shaft	As needed	
3	Lithium battery	A6BAT	Rear section of the base	4	
RH-6SH series					
4	Timing belt		J3 axis	1	Mitsubishi Electric System & Service;Co.,Ltd.
5			J4 axis motor side	1	
6			J4 axis shaft side	1	
RH-12SH/18SH series					
7	Timing belt		J3 axis	1	Mitsubishi Electric System & Service;Co.,Ltd.
8			J4 axis motor side	1	
9			J4 axis shaft side	1	

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

3 Controller

3.1 Standard specifications

3.1.1 Standard specifications

Table 3-1 : Standard specifications of controller (CR1B-571)

Item		Unit	Specification	Remarks
Type			CR1B-571	
Number of control axis			Simultaneously 4(Maximum)	
CPU			64 bit RISC, and DSP	
Memory capacity	Programmed positions and No. of steps	point step	2,500 5,000	
	Number of programs		88	
Robot language			MELFA-BASIC Ⅳ	
Teaching method			Pose teaching method ,MDI method	
External input and output	Input and output	point		Max. 240/240 Note1)
	Dedicated input/output	point	Assigned with general-purpose input/output	"STOP" 1 point is fixed
	Hand open/close input/output	point	Input 8 point/Output 0 point	Up to 8 output points can be added as an option Note2)
	Emergency stop input	point	1	Single emergency line
	Door switch input	point	1	Single door switch line
	Emergency stop output	point	1	Single emergency line
Interface	RS-232C	port	1	For expansion such as the personal cpmputer, Vision sensor
	RS-422	port	1	Dedicated for T/B
	Hand dedicated slot	slot	1	Dedicated for pneumatic hand interface
	Expansion slot	slot	0	Can be expanded to up to 3 slots by mounting the expansion option box.
	Robot input/output link	channel	1	Used for general-purpose input/output (Max. 240/240)
Power source	Input voltage range	V	1-phase, AC180 to 253	Note3)
	Power capacity	KVA	1.0	Does not include rush current Note4)
Outline dimensions		mm	212(W)x290(D)x165(H)	The height includes the length of the foot.
Mass		kg	Approx. 8	
Construction			Self-contained floor type , Opened type	IP20 Note5)
Operating temperature range		deg.	0 to 40	
Ambient humidity		%RH	45 to 85	Without dew drops
Grounding		Ω	100 or less	D class grounding earth Note6)
Paint color			Light gray	Munsell 0.08GY7.64/0.81

Note1) It is the value when seven maximums expand (224/224) the Parallel I/O unit. (2A-RZ361 or 2A-RZ371:Input 32 points / Output 32 points.)

Note2)It is when an pneumatic hand interface (2A-RZ365 or 2A-RZ375) is installed.

Note3) Please use the controller with an input power supply voltage fluctuation rate of 10% or less.

Note4) The power capacity (1.0kVA) 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. he power consumption in the specific operation pattern with the RH-6SHseries is approx. 0.3kw

Note5)The controller (CR1B-571) of this robot is a general environment specification. (Refer to Page 84, "3.1.2 Protection specifications and operating supply") If the robot is used in an oil mist environment, use the optional controller protection box (CR1B-MB) to protect the controller from the oil mist environment. Install to the place not to influence the cleanliness when using in the clean environment. (Refer to Page 10, "2.2.6 Clean specifications")

Note6) The robot must be grounded by the customer.

Table 3-2 : Standard specifications of controller (CR2B-574)

Item		Unit	Specification	Remarks
Type			CR2B-574	
Number of control axis			Simultaneously 4(Maximum)	
CPU			64 bit RISC, and DSP	
Memory capacity	Programmed positions and No. of steps	point step	2,500 5,000	When the expansion memory cassette is installed
	Number of programs		88	When the expansion memory cassette is installed
Robot language			MELFA-BASIC Ⅳ	
Teaching method			Pose teaching method ,MDI method	
External input and output	input and output	point	32/32	Max. 256/256 Note1)
	Dedicated input/output	point	Assigned with general-purpose input/output	"STOP" 1 point is fixed
	Hand open/close input/output	point	Input 8 point/Output 0 point	Up to 8 output points can be added as an option Note2)
	Emergency stop input	point	1	Dual emergency line
	Door switch input	point	1	Dual door switch line
	Emergency stop output	point	1	Dual emergency line
Interface	RS-232C	port	1	For expansion such as the personal cpmputer, Vision sensor
	RS-422	port	1	Dedicated for T/B
	Hand dedicated slot	slot	1	Dedicated for pneumatic hand interface
	Expansion slot	slot	3	Extended option
	Memory expand slot	slot	1	Memory option
	Robot input/output link	channel	1	Used for general-purpose input/ output (Max. 256/256)
Power source	Input voltage range	V	1-phase, AC180 to 253	Note3)
	Power capacity	KVA	2.0	Does not include rush current Note4)
Outline dimensions		mm	460(W)x400(D)x200(H)	The height includes the length of the foot
Mass		kg	Approx. 20	
Construction			Self-contained floor type, Opened type (IP20) Note5)	
Operating temperature range		deg.	0 to 40	
Ambient humidity		%RH	45 to 85	Without dew drops
Grounding		Ω	100 or less	D class grounding earth Note6)
Paint color			Light gray	Munsell 0.08GY7.64/0.81

Note1) It is the value when seven maximums expand (224/224) the Parallel I/O unit.
(2A-RZ361 or 2A-RZ371:Input 32 points / Output 32 points.)

Note2) It is when an pneumatic hand interface (2A-RZ365 or 2A-RZ375) is installed.

Note3) Please use the controller with an input power supply voltage fluctuation rate of 10% or less.

Note4) The power capacity (2.0kVA) 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 RH-12SH/18SH series is approx. 0.6kW.

Note5) The controller (CR2B-574) of this robot is a general environment specification (Refer to Page 84, "3.1.2 Protection specifications and operating supply"). If you intend to use the controller in oil mist or dusty environments, please contact your nearest Mitsubishi branch or dealer. Install to the place not to influence the cleanliness when using in the clean environment (Refer to Page 10, "2.2.6 Clean specifications"). The customer must take appropriate measures required for the clean room specification.

Note6) The robot must be grounded by the customer.

Table 3-3 : Standard specifications of controller (CR3-535M)

Item		Unit	Specification	Remarks
Type			CR3-535M Note1)	
Number of control axis			Simultaneously 4(Maximum)	
CPU			64 bit RISC, and DSP	
Memory capacity	Programmed positions and No. of steps	point step	2,500 5,000	
	Number of programs		88	
Robot language			MELFA-BASIC Ⅳ	
Teaching method			Pose teaching method ,MDI method	
External input and output	Input and output	point	32/32	Max. 256/256 Note2)
	Dedicated input/output	point	Assigned with general-purpose input/output	"STOP" 1 point is fixed
	Hand open/close input/output	point	Input 8 point/ Output 0 point	Up to 8 output points can be added as an option Note3)
	Emergency stop input	point	1	Dual emergency line
	Door switch input	point	1	Dual door switch line
	Emergency stop output	point	1	Dual emergency line
Interface	RS-232C	port	1	For expansion such as the personal cpmputer, Vision sensor
	RS-422	port	1	Dedicated for T/B
	Hand dedicated slot	slot	1	Dedicated for pneumatic hand interface
	Expansion slot	slot	2	Extended option
	Memory expand slot	slot	1	Memory option
	Robot input/output link	channel	1	Used for general-purpose input/output (Max. 256/256)
	Additional axis interface	channel	1	SSC-NET
Power source	Input voltage range	V	3-phase, AC180 to 253	Note4)
	Power capacity	KVA	2.0	Does not include rush current Note5) Note6)
Outline dimensions		mm	450(W)x380(D)x625(H)	Excluding protrusions Note7)
Mass		kg	Approx. 60	
Construction			Self-contained floor type, Closed type (IP54)	Note8)
Operating temperature range		deg.	0 to 40	
Ambient humidity		%RH	45 to 85	Without dew drops
Grounding		Ω	100 or less	D class grounding earth Note9)
Paint color			Light gray	Munsell 0.08GY7.64/0.81

Note1) This controller is provided with special factory shipment specifications in the case of the controller specification with countermeasure against oil mist (RH-12SH/18SH series)

Note2) It is the value when seven maximums expand (224/224) the Parallel I/O unit.
(2A-RZ361 or 2A-RZ371:Input 32 points / Output 32 points.)

Note3) It is when an pneumatic hand interface (2A-RZ365 or 2A-RZ375) is installed.

Note4) Please use the controller with an input power supply voltage fluctuation rate of 10% or less.

Note5) The power capacity (2.0kVA) 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 RH-12SH/18SH series is approx. 0.6kW.

Note6) Approximately 7.5 mA of leakage current flows. If a no-fuse circuit breaker is installed on the primary side of the robot, select one with at least 20A and set the leakage current to at least 10 mA.

Note7)Becomes 615(H) at the caster specification.

Note8) This controller exchanges heat using the internal air circulation self-cooling method. Furthermore, the rear side sucks in the outside air and the top and bottom sections of the rear side discharges the inside air. This controller can also be used in the oil-mist environment.

Note9) The robot must be grounded by the customer.

3.1.2 Protection specifications and operating supply

A protection method complying with the IEC Standard CR1B-571/CR2B-574: IP20(Opened type), CR3-535M: IP54(Closed 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】
<CR1B-571/CR2B-574 controller>
・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.

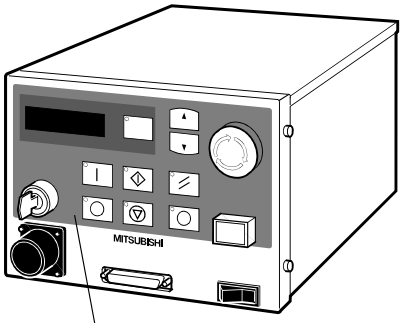
<CR3-535M controller>
・The IEC IP54
The IEC IP54 standard refers to protection structure designed to prevent any harmful effects by fresh water scattering vertically onto the testing equipment in a radius of 180 degrees from a distance of 300 to 500 mm, with 10 ± 0.5 liters of water every minute, at a water pressure of 80 to 100kPa , covering the entire area of the robot with the exception of the installation section at 1 ㎡ per minute, for a total of 5 minutes or more.

Refer to the section Page 170, "6.2 Working environment" for details on the working environment.

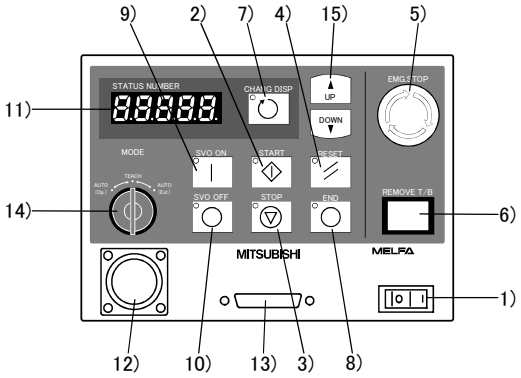
3.2 Names of each part

CR1B-571controller

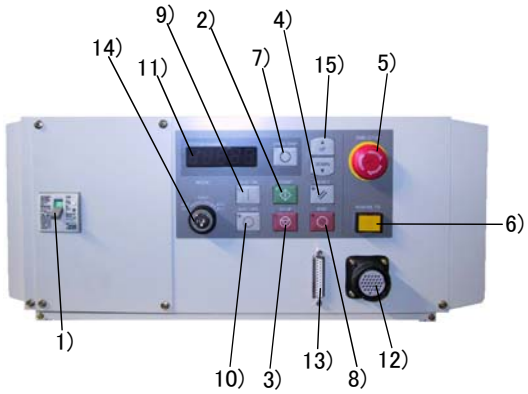
<Front>



<Front side of operation panel>



CR2B-574 controller



CR3-535M controller

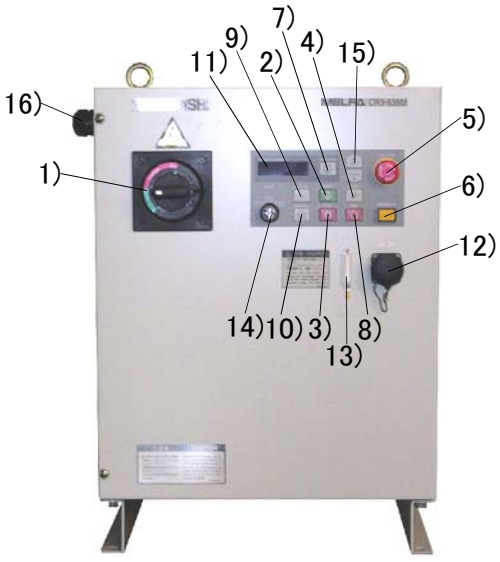


Fig.3-1 : Names of controller parts

1) POWER switch.....This turns the control power ON/OFF.
2) START button.....This executes the program and operates the robot. The program is run continuously.
3) STOP button.....This stops the robot immediately. The servo does not turn OFF.
4) RESET button.....This resets the error. This also resets the program's halted state and resets the program.
5) Emergency stop switch.....This stops the robot in an emergency state. The servo turns OFF.
6) T/B remove switch.....This is used to connect/disconnect the T/B without turning OFF the controller's control power.
7) CHNGDISP button.....This changes the details displayed on the display panel in the order of "Override" → "Program No." → "Line No.".
8) END button.....This stops the program being executed at the last line or END statement.
9) SVO.ON button.....This turns ON the servo power. (The servo turns ON.)
10) SVO.OFF button..... This turns OFF the servo power. (The servo turns OFF.)
11) STATUS NUMBER (display panel).....The alarm No., program No., override value (%), etc., are displayed.
12) T/B connection connector .....This is a dedicated connector for connecting the T/B.
13) Personal computer connection connector.....This is an RS-232C specification connector for connecting the personal computer.
14) MODE key switch.....This changes the robot's operation mode. Note)
AUTO (Op.).....Only operations from the controller are valid. Operations for which the operation mode must be at the external device or T/B are not possible.
TEACH.....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.
AUTO (Ext.).....Only operations from the external device are valid. Operations for which the operation mode must be at the T/B or controller are not possible.
15) UP/DOWN button.....This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.
16) Power cable clamp .....Fix the primary power cable.

⚠ CAUTION Note) The servo will turn OFF when the controller's [MODE] switch is changed. Note that axes not provided with brakes could drop with their own weight.

Carry out the following operations to prevent the servo from turning OFF whenthe [MODE] switch is changed.

The servo on status can be maintained by changing the mode with keeping pressing lightly the deadman switch of T/B. The operating method is shown below.

■ When the mode is changed from TEACH to AUTO.
1) While holding down the deadman switch on the T/B, set the [ENABLE/DISABLE] switch to "DISABLE".
2) While holding down the deadman switch on the T/B, set the controller [MODE] switch to "AUTO".
3) Release the T/B deadman switch.

■ When the mode is changed from AUTO to TEACH.
1) While the [ENABLE/DISABLE] switch on the T/B is "DISABLE", hold down the deadman switch.
2) While holding down the deadman switch on the T/B, set the controller [MODE] switch to "TEACH".
3) While holding down the deadman switch on the T/B, set the [ENABLE/DISABLE] switch to "ENABLE", then do the operation of T/B that you wish.

CR1B-571 controller

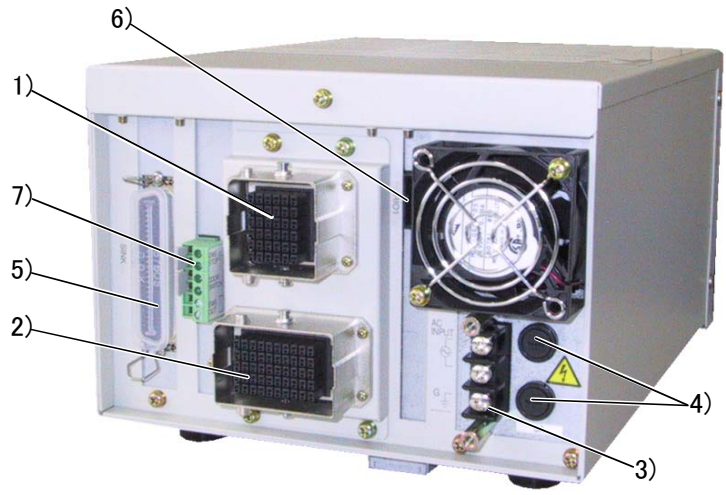


Fig.3-2 : Names of each CR1B-571 controller part (Rear side)

1) Machine cable connector (for motor power) ..... Connects to the robot arm base. (CN1 connector)
2) Machine cable connector (for motor signal) ..... Connects to the robot arm base. (CN2 connector)
3)Power supply terminals.
4)Fuse box.
5)External input/output signal connector.
6)Network cable connector for parallel I/O unit expansion.
7)Emergency stop switch and door switch terminals connector.

CR2B-574 controller

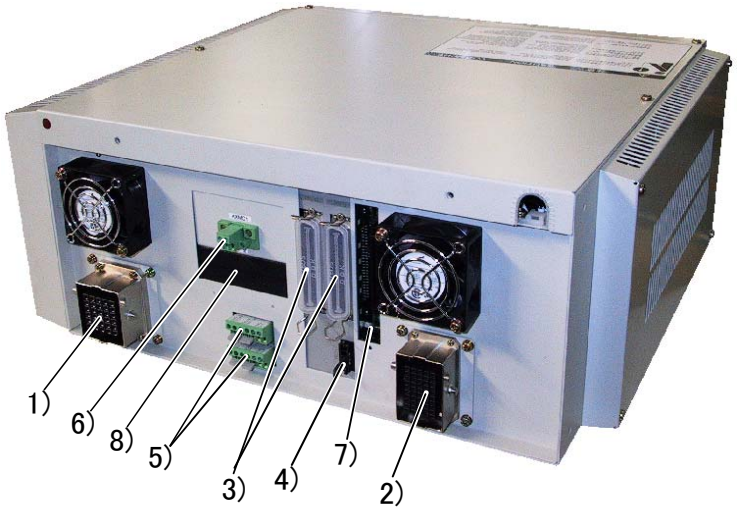


Fig.3-3 : Names of each CR2B-574 controller part (Rear side)

1) Machine cable connector (for motor power) ..... Connects to the robot arm base. (CN1 connector)
2) Machine cable connector (for motor signal) ..... Connects to the robot arm base. (CN2 connector)
3) External input/output signal connector.
4) Network cable connector for parallel I/O unit expansion.
5) Emergency stop switch and door switch terminals.
6) Magnet contactor control connector for additional axis (AXMC1)
7) Memory cassette entry
8) Optional cable inlet

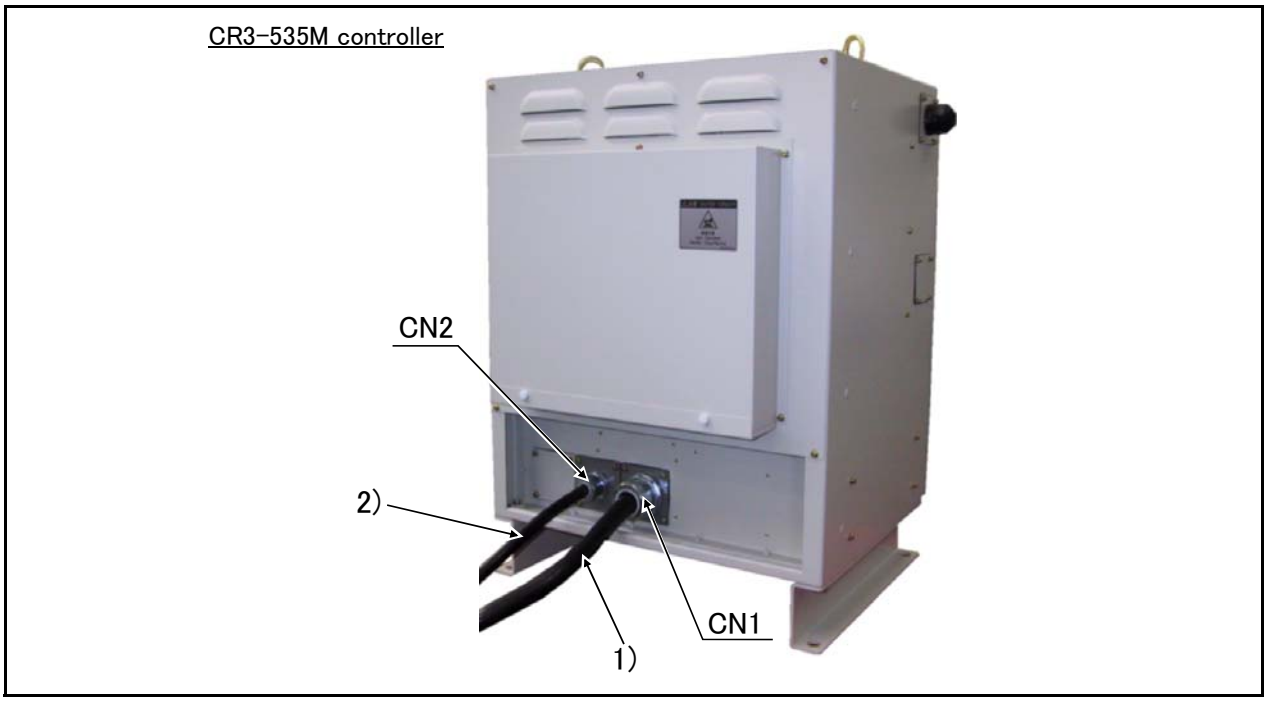


Fig.3-4 : Names of each CR3-353M controller part (Rear side)

1) Machine cable (for motor power)..... Connects to the robot arm base. (CN1 connector)
2) Machine cable (for motor signal)..... Connects to the robot arm base. (CN2 connector)

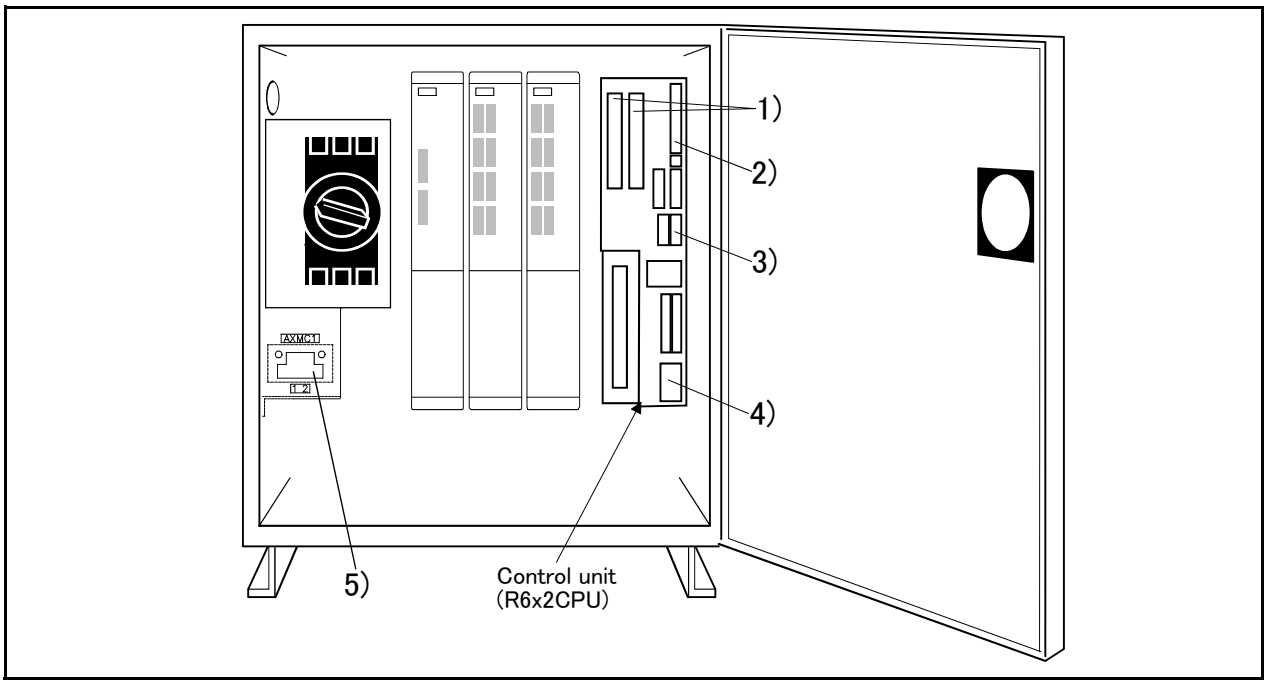


Fig.3-5 : Names of each CR3-353M controller part (interior)

1) External input/output signal connector.
2) Memory cassette entry
3) Network cable connector for parallel I/O unit expansion.
4) Emergency stop switch and door switch terminals.
5) Magnet contactor control connector for additional axis (AXMC1)

3.3 Outside dimensions/Installation dimensions

3.3.1 Outside dimensions

<CR1B-571>

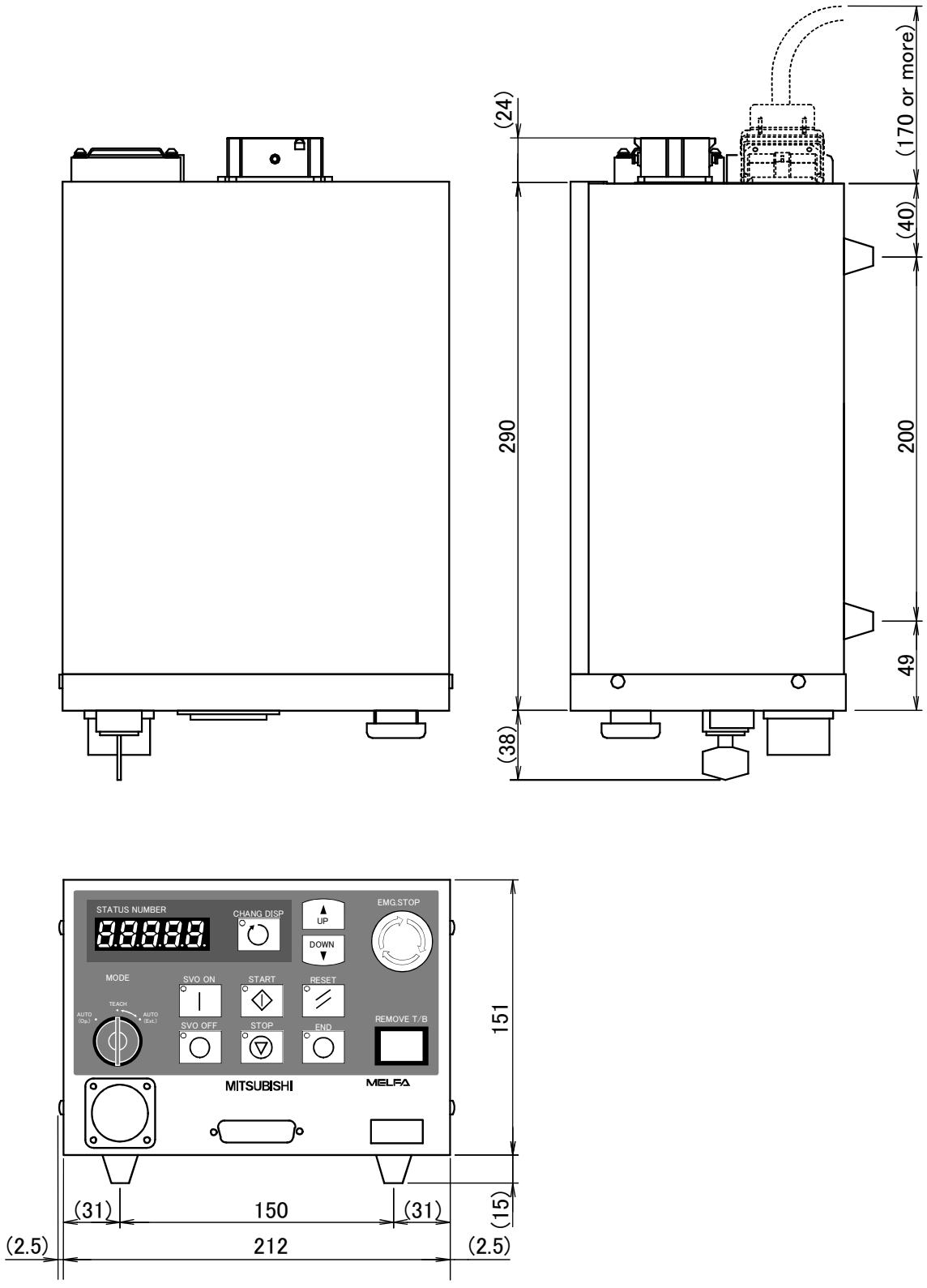


Fig.3-6 : Outside dimensions of controller (CR1B-571 controller)

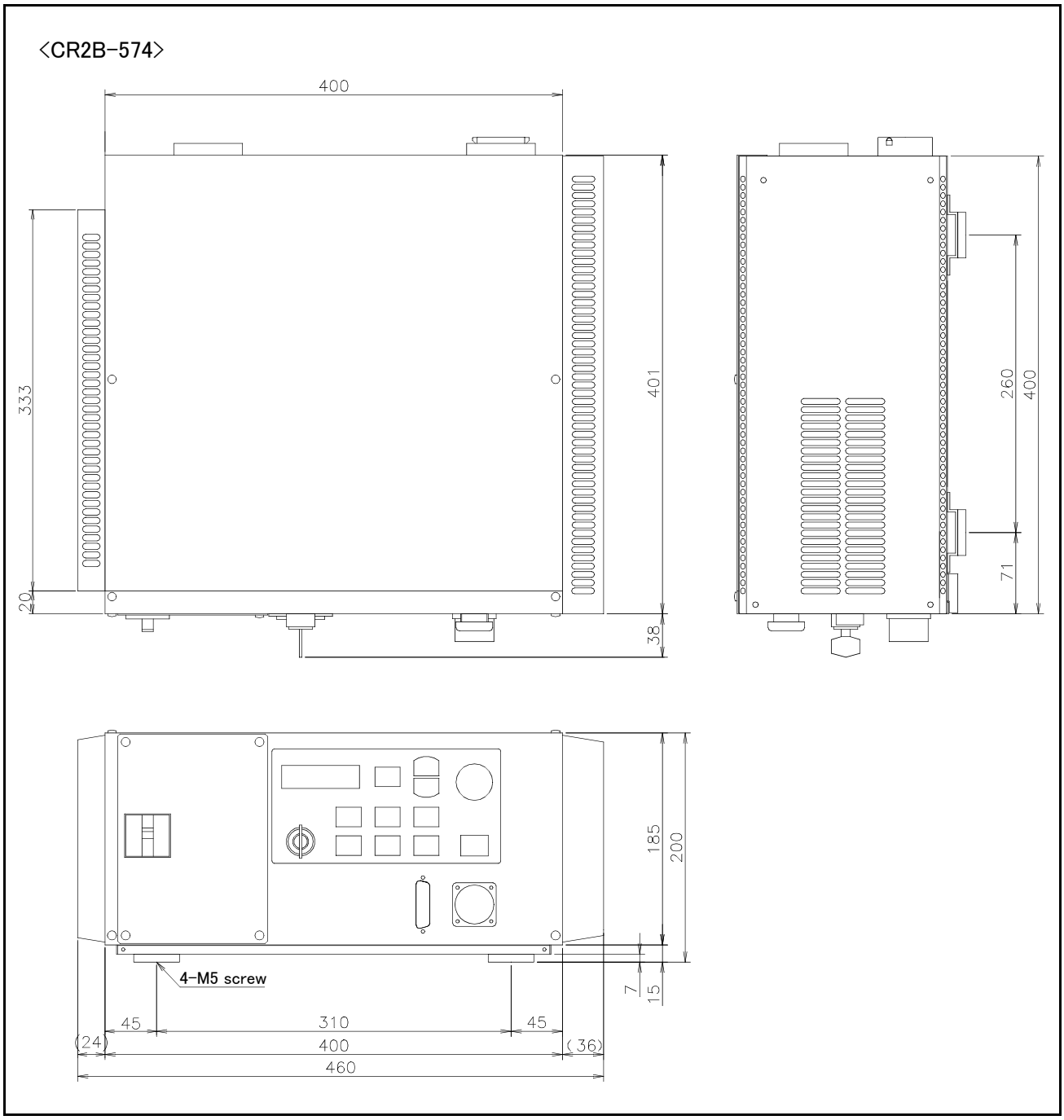


Fig.3-7 : Outside dimensions of controller (CR2B-574 controller)

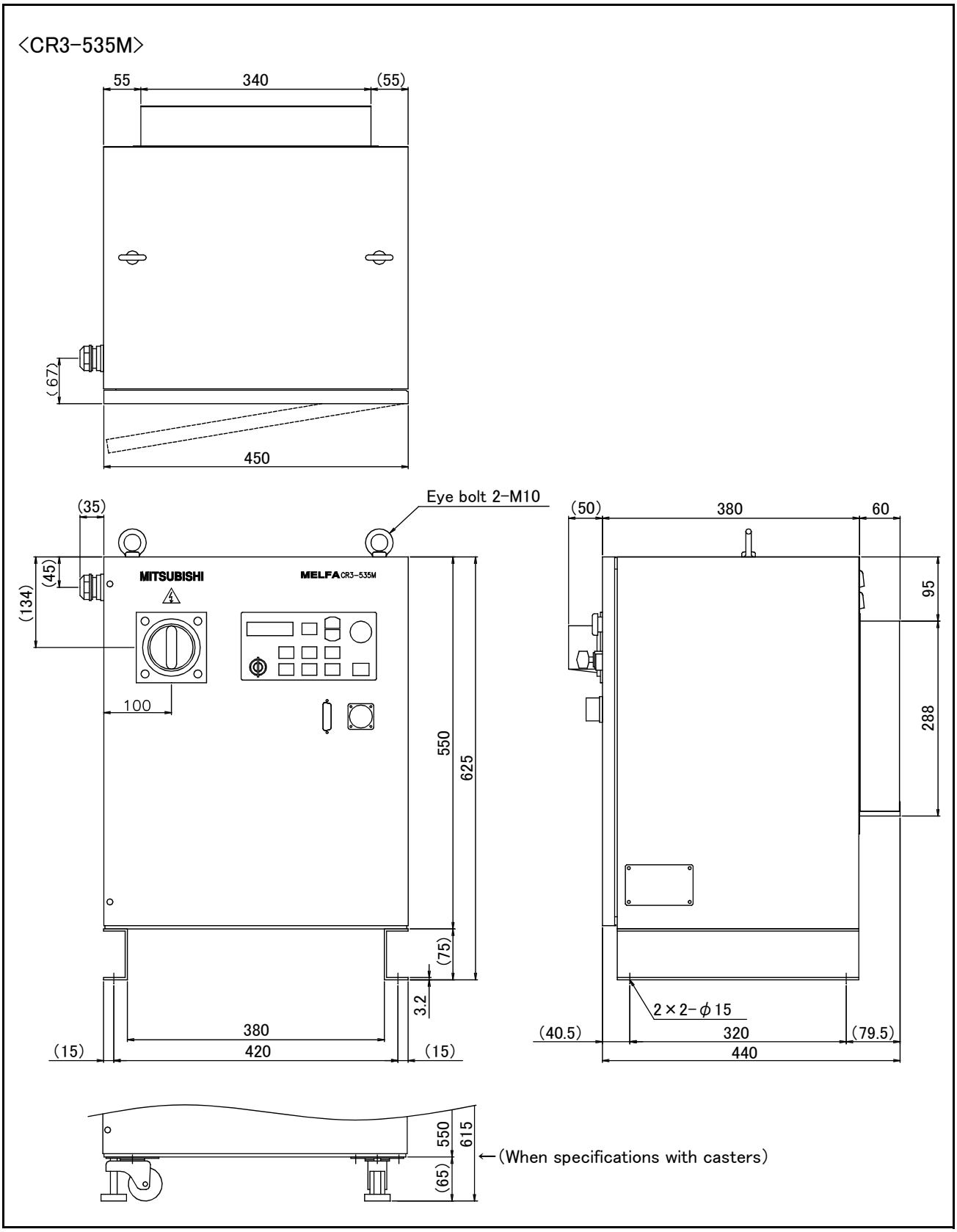


Fig.3-8 : Outside dimensions of controller (CR3-353M controller)

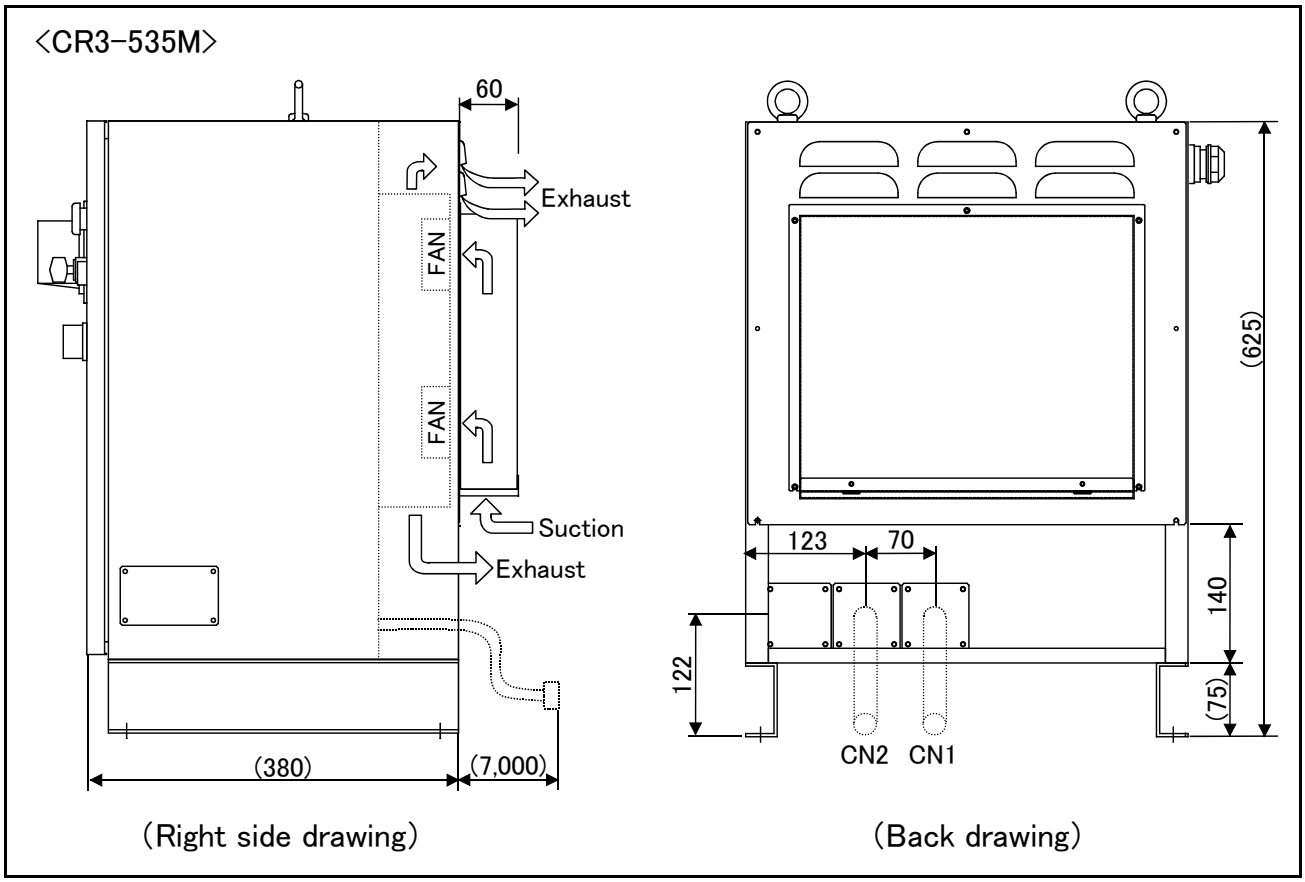


Fig.3-9 : Outside dimensions of controller (CR3-353M controller)(Supplement)

3.3.2 Installation dimensions

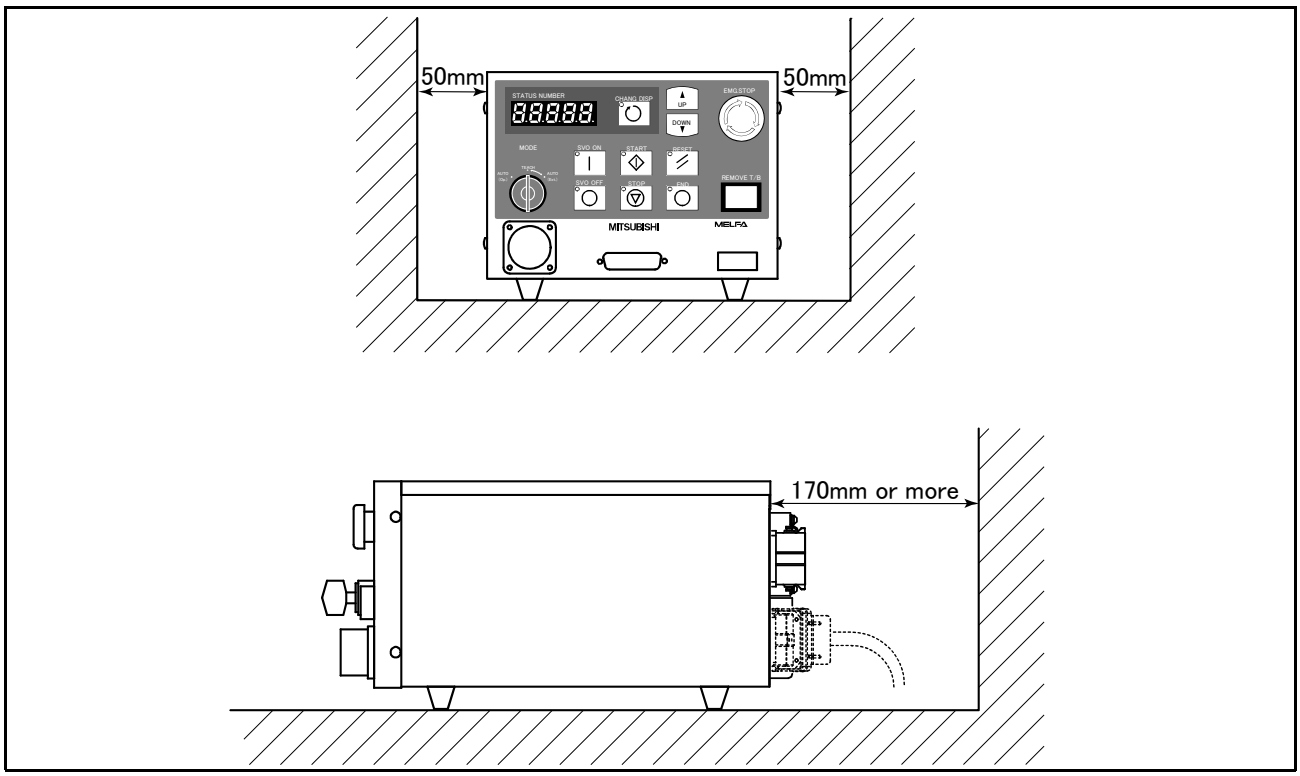
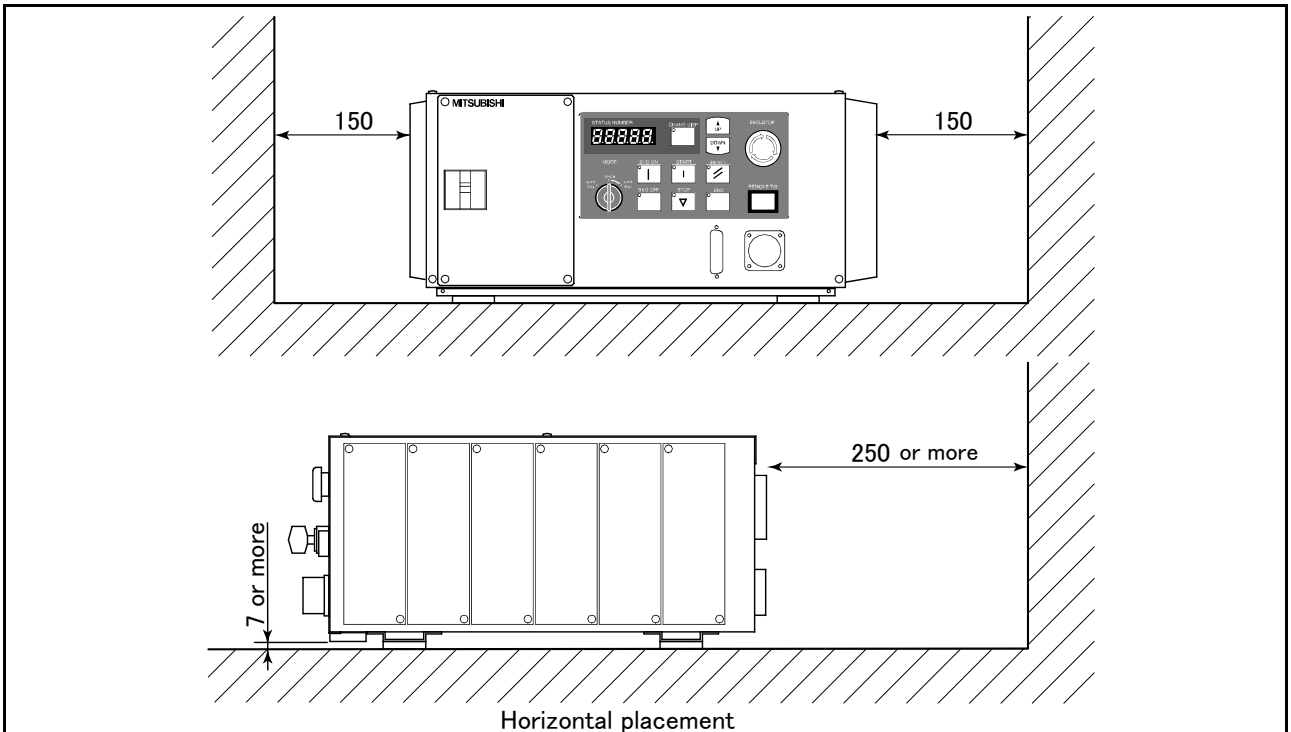


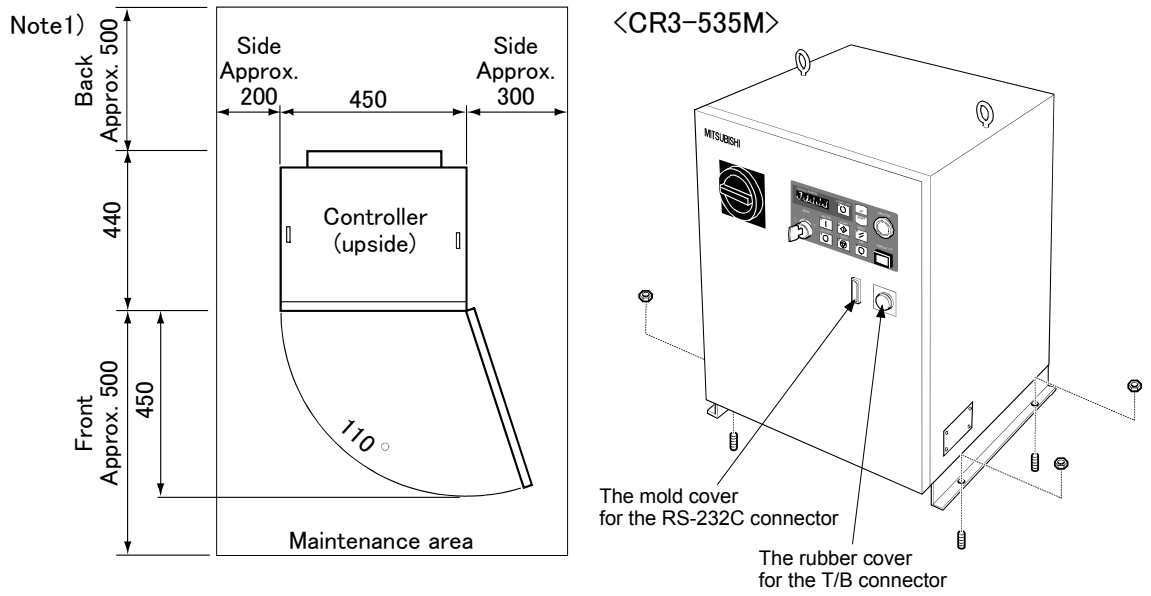
Fig.3-10 : Installation of controller (CR1B-571 controller)



Horizontal placement

⚠CAUTION Use the rubber foot (4 positions) at the bottom of the controller as it is, or put the spacer, and leave the space between the installation side and the controller installation side more than 7mm when you fix the controller with the installation screw.In the other case, the air intake hole at the bottom of the controller is occupied, and temperature rises in the board, and causes the trouble.

Fig.3-11 : Installation of controller (CR2B-574 controller)



Note1) The controller sucks in the outside air and discharges the inside air after cooling (Fig. 3-7). The space required for cooling is 100 mm minimum. Reserve approximately 500 mm of space behind the unit as the maintenance work area.

Fig.3-12 : Installation of controller(CR3-535M controller)

The controller has the openings (1) to (4) as shown in Fig. 3-13.

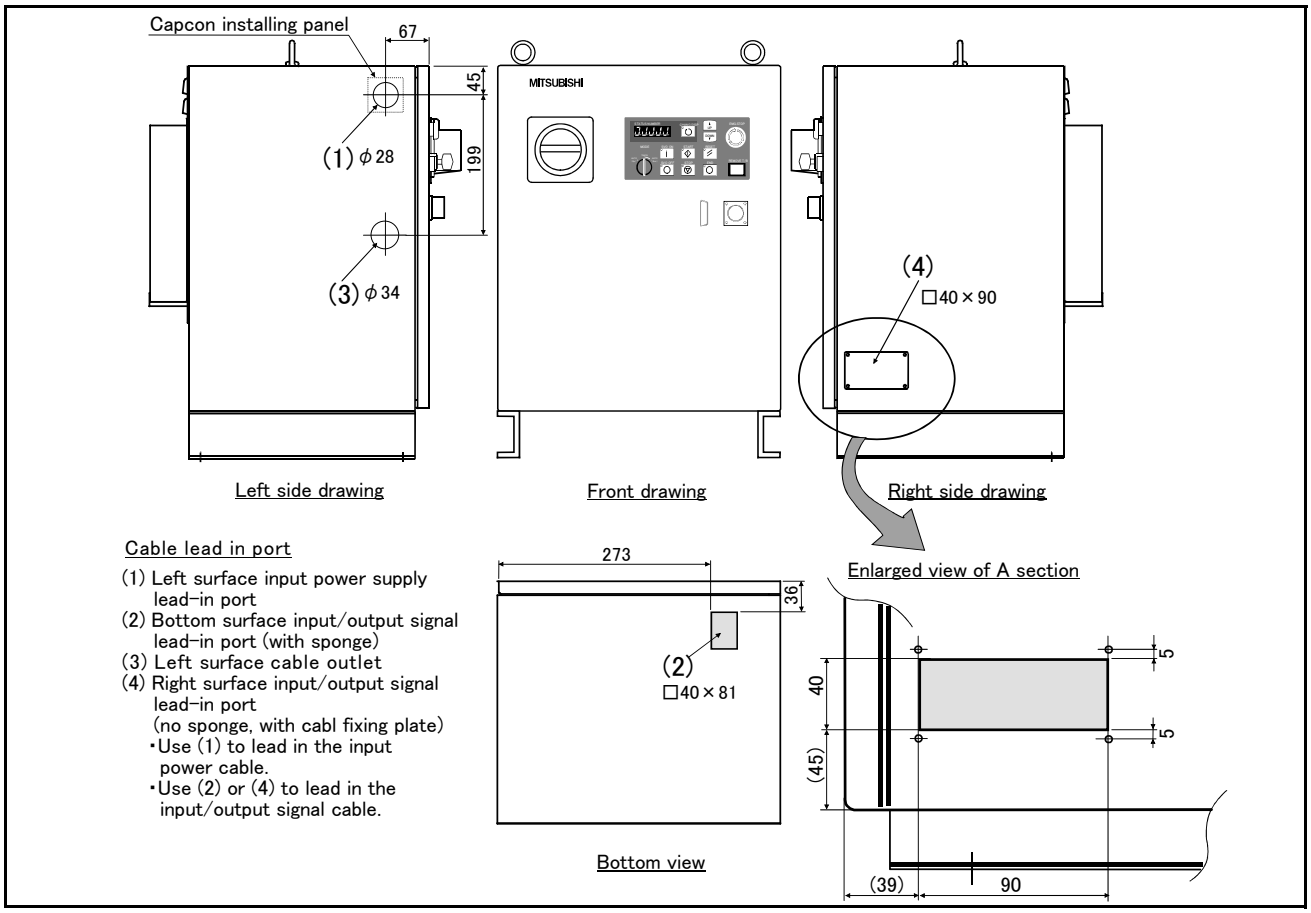


Fig.3-13 : Cable lead-in ports and dimensions (CR3-535M controller)

3.4 External input/output

3.4.1 Types

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

(2) General-purpose input/output.....These are inputs and outputs that the customer can program for peripheral device control. Moreover, it is possible to use parallel input/output units and input/output signals via CC-Link.

(3) Hand input/output.....These are inputs and outputs related to the hand that the customer can program. (The hand output is an option. The Page 115, "(2) Pneumatic hand interface" is required.)

Class	Name		No. of input/output points		Connection format
			Input	Output	
Standard	Emergency stop		1	1	Connector
Standard	Door switch		1	–	
Standard	Parallel input/output	CR1B-571 controller	Occupies 16 general-purpose points/(6) dedicated points in general-purpose	Occupies 16 general-purpose points/(4) dedicated points in general-purpose	
		CR2B-574/ CR3-353M controller	Occupies 32 general-purpose points/(6) dedicated points in general-purpose	Occupies 32 general-purpose points/(4) dedicated points in general-purpose	

3.4.2 Explanation

The parallel input/output unit uses connector bridging. Purchase the "External I/O cable" for connection with external devices.

The hand output is an option. Refer to Page 115, "(2) Pneumatic hand interface" for details

The parallel input/output unit can be expanded outside of the controller.
The expansion parallel input/output unit is connected with the control unit in the controller using a robot I/O link cable. Parallel input and output units can be expand as an option to seven maximums. Adding parallel input/output units in this way allows using up to 240 input points and 240 output points, including the 16 input and 16 output general-purpose points in the case of CR1B-571 controller, and up to 256 input points and 256 output points, including the 32 input and 32 output general-purpose points in the case of the CR2B-574/CR3-535M controller.

Refer to Page 124, "(5) Parallel I/O unit" for details on the parallel input/output unit.

3.5 Dedicated input/output

Show the main function of dedicated input/output in the Table 3-4. Refer to attached instruction manual "Detailed explanations of functions and operations" in the product for the other functions. Each parameter indicated with the parameter name is used by designated the signal No., assigned in the order of input signal No. and output signal No. If the number of dedicated inputs and general-purpose input points used exceeds the standard No. of input/output points, install the parallel input /output unit (1st to 7th station: option).

Table 3-4 : 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.
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.
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	

Parameter name	Input		Note1)	Output	
	Name	Function	Level	Name	Function
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.
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.
USER-AREA Note3)	None			User-designated area 8-points	Outputs that the robot is in the user-designated area.

Note1) The level indicates the signal level.

L: Level signal → The designated function is validated when the signal is ON, and is invalidated when the signal is OFF.

E: Edge signal → The designated function is validated when the signal changes from the OFF to ON state, and the function maintains the original state even when the signal then turns OFF.

Note2) Four elements are set in the order of input signal start No., end No., output signal start No. and end No.

Note3) Up to eight points can be set successively in order of start output signal No. and end output signal No.

3.6 Emergency stop input/output

This signal is input from the "emergency stop input" terminal in the controller.

Table 3-5 : Dedicated input terminals in controller

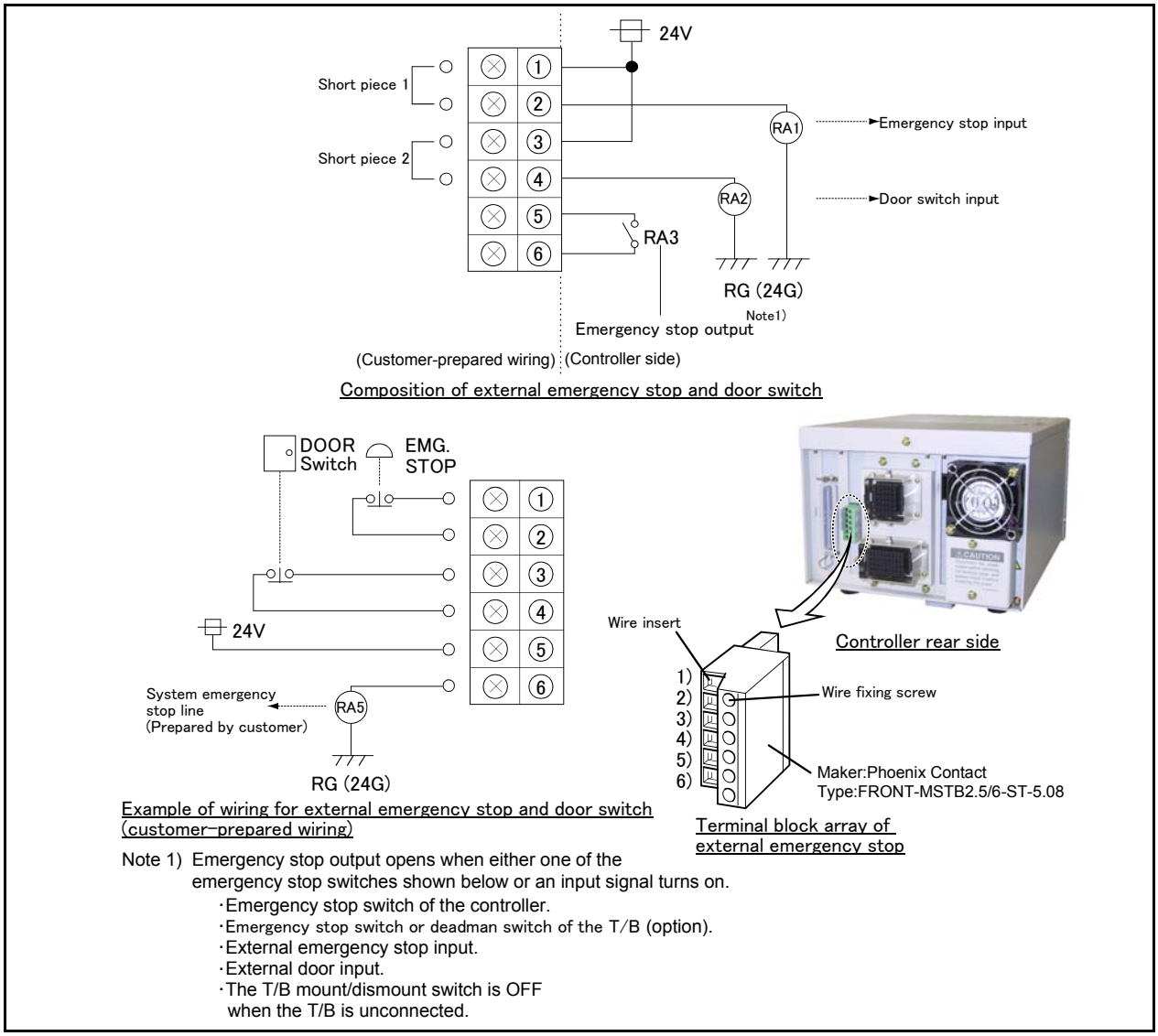
Class	Name	Details
Input	Emergency stop	Applies the emergency stop (CR1B-571:Single emergency line, CR2B-574/CR3-535M: Dual emergency line.)
Input	Door switch	The servo turns OFF.
Output	Emergency stop	CR1B-571:This output indicates that the emergency stop input or the door switch input is turned on. CR2B-574/CR3-535M:This output indicates that the emergency stop is being input.

3.6.1 Connection of the external emergency stop

The external emergency stop input and door switch input are short-circuited with a short cable at shipment as shown in Fig. 3-14.

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

1) Prepare the "emergency stop switch" and "door switch".
2) Remove the short pieces 1 and 2.
3) Securely connect the external emergency stop's contacts across "1)-2), and the door switch's contacts across 3)-4)" on the terminal block.



Note 1) Emergency stop output opens when either one of the emergency stop switches shown below or an input signal turns on.
- ・Emergency stop switch of the controller.
- ・Emergency stop switch or deadman switch of the T/B (option).
- ・External emergency stop input.
- ・External door input.
- ・The T/B mount/dismount switch is OFF when the T/B is unconnected.

Fig.3-14 : Connection of the external emergency stop (CR1B-571 controller)

[Caution] When wiring the emergency stop switch (duble emergency line type), wire both contacts to the two terminal blocks on the controller. If both contacts are wired to only one of the terminal blocks, errors cannot be cancelled using the door switch.

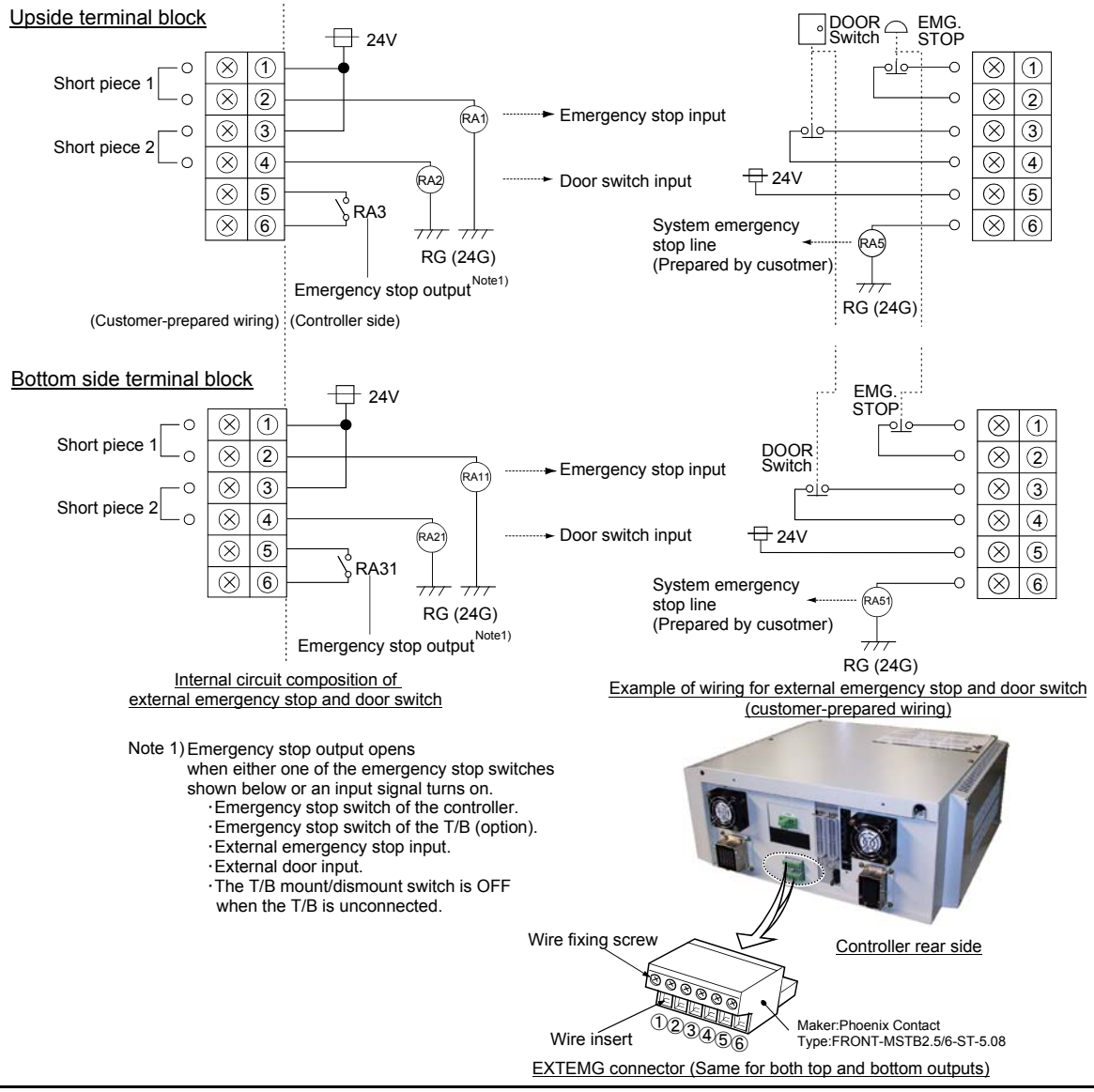
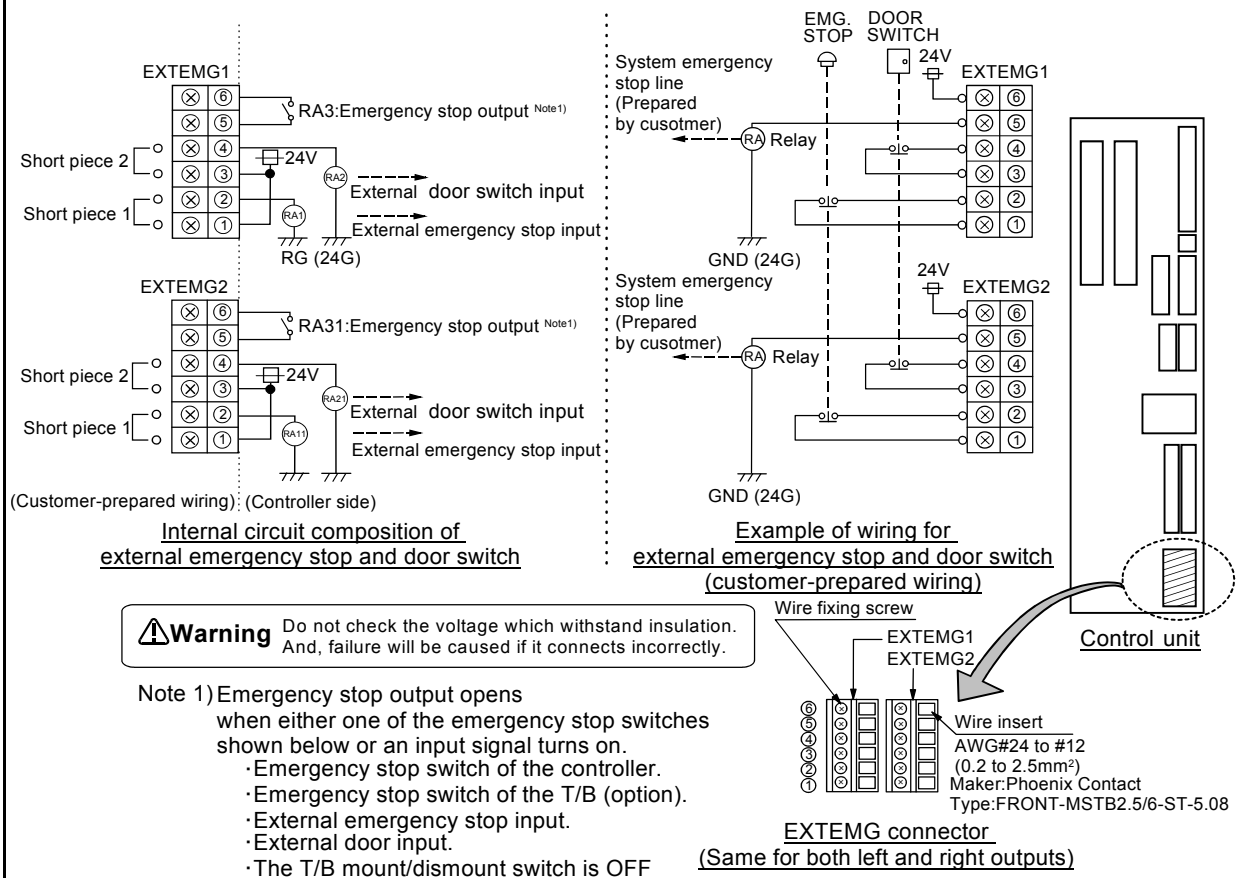


Fig.3-15 : Connection of the external emergency stop (CR2B-574 controller)

[Caution] When wiring the emergency stop switch (duble emergency line type), wire both contacts to the two terminal blocks on the controller. If both contacts are wired to only one of the terminal blocks, errors cannot be cancelled using the door switch.



⚠Warning Do not check the voltage which withstand insulation. And, failure will be caused if it connects incorrectly.

Note 1) Emergency stop output opens when either one of the emergency stop switches shown below or an input signal turns on.
- ·Emergency stop switch of the controller.
- ·Emergency stop switch of the T/B (option).
- ·External emergency stop input.
- ·External door input.
- ·The T/B mount/dismount switch is OFF when the T/B is unconnected.

Fig.3-16 : Connection of the external emergency stop (CR3-535M controller)

[Note] Refer to Page 168, "6.1.7 Examples of safety measures" together, and carry out wiring to the emergency stop.

3.6.2 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 Fig. 3-14, and wire so that the 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.

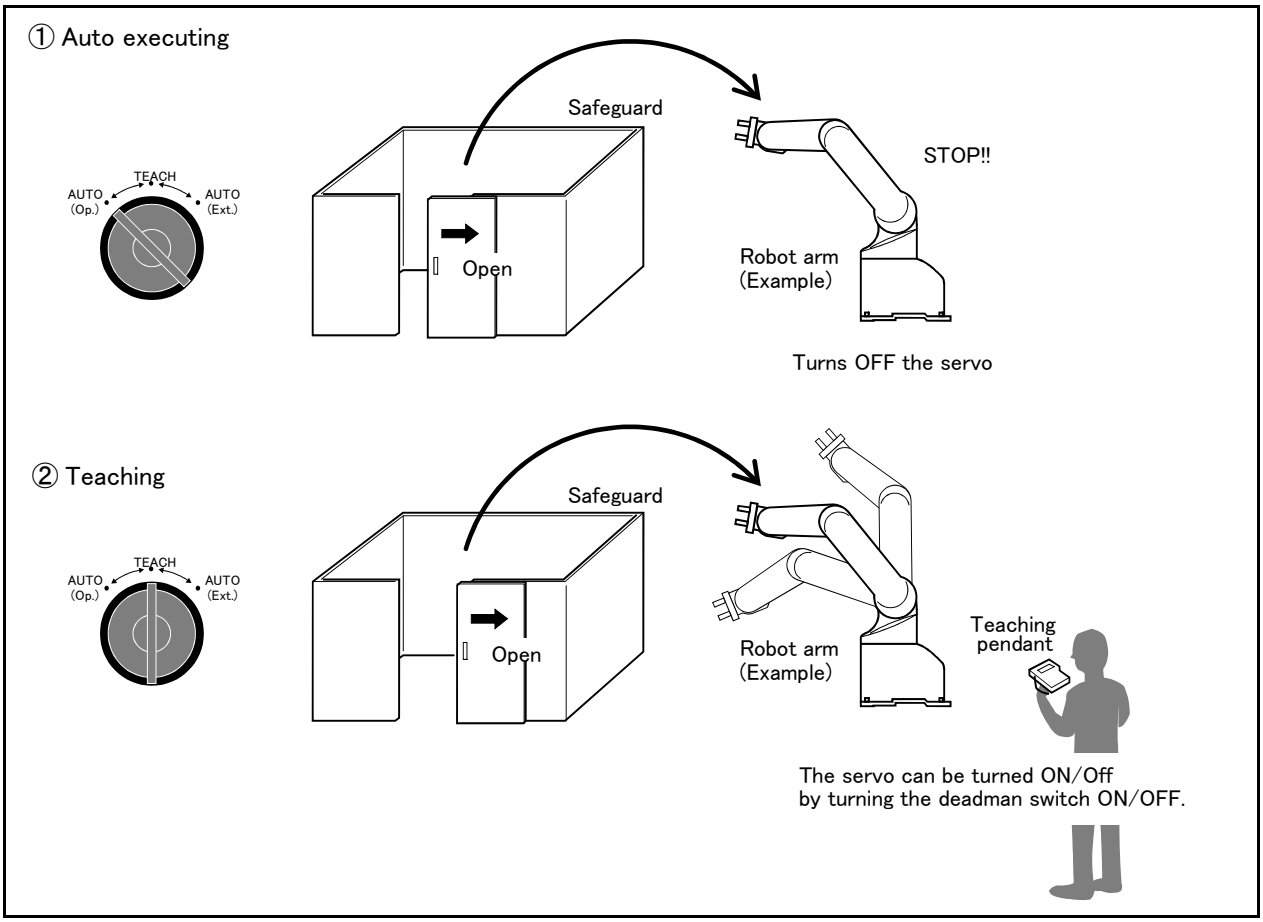


Fig.3-17 : Door switch function

3.7 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-J2S-B, MR-J2M series) that supports Mitsubishi's SSC Net. Refer to the separate "Additional axis interface Instruction Manual" for details on the additional axis function.

3.7.1 Wiring of the Additional Axis Interface

Table 3-6 shows the connectors for additional axes inside the controller and Fig. 3-7 shows a connection example (configuration example). The magnet contactor control connector for additional axes, AXMC1, is designed to accommodate circuit connection with improved safety in Mitsubishi's industrial robot systems connecting additional axes. Please implement the appropriate circuit connection by refere to Page 103, "3.8 Magnet contactor control connector output (AXMC) for addition axes".

Table 3-6 : Dedicated Connectors inside the Controller

Name	Connector name	Details
Connector for additional axes	CN1B Note1)	This connector is used to connect between general-purpose servo amplifiers and the controller.
Magnet contactor control connector for additional axes	AXMC1	This contact output is used to turn ON/OFF the motor power by connecting to general-purpose servo amplifiers.

Note1) The CN1A connector has already been in use.

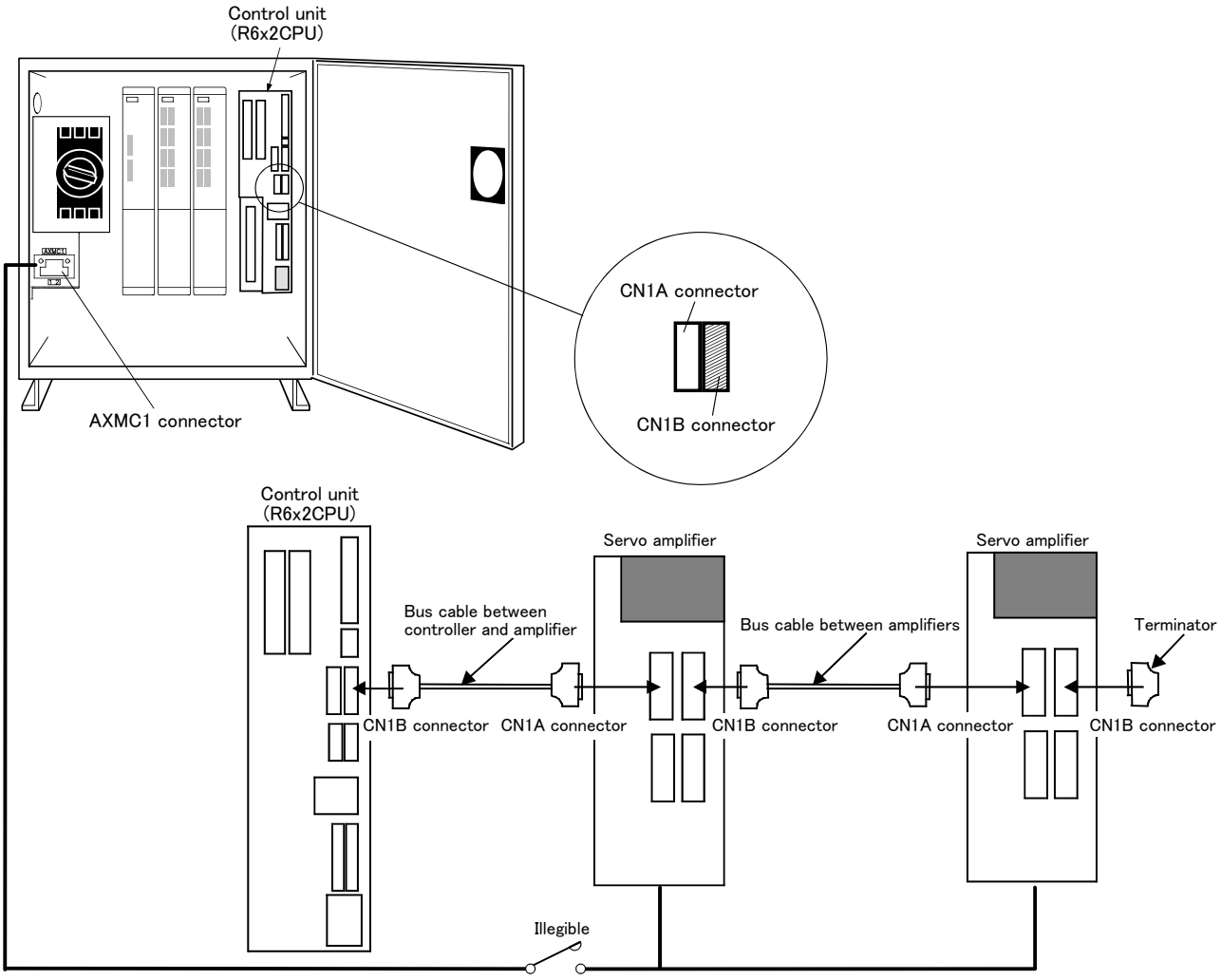


Table 3-7 : Connection Example of Additional Axis Interface Connection (Configuration Example)

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

When an additional axis Note1) 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 (AXMC1) 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.
Note that if you are using the CR1B-571 controller, it is not possible to synchronize with a servo sequence of the robot controller; the user should use the external input/output function attached to the controller and create a specific sequence for this purpose.
Fig. 3-19 and Fig. 3-18 shows an example of its circuit, and Fig. 3-21 and Fig. 3-21 show the layout drawings of the output contact (AXMC1). 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)The additional axis interface (optional) is required for the CR1B-571/CR2B-574 controller.

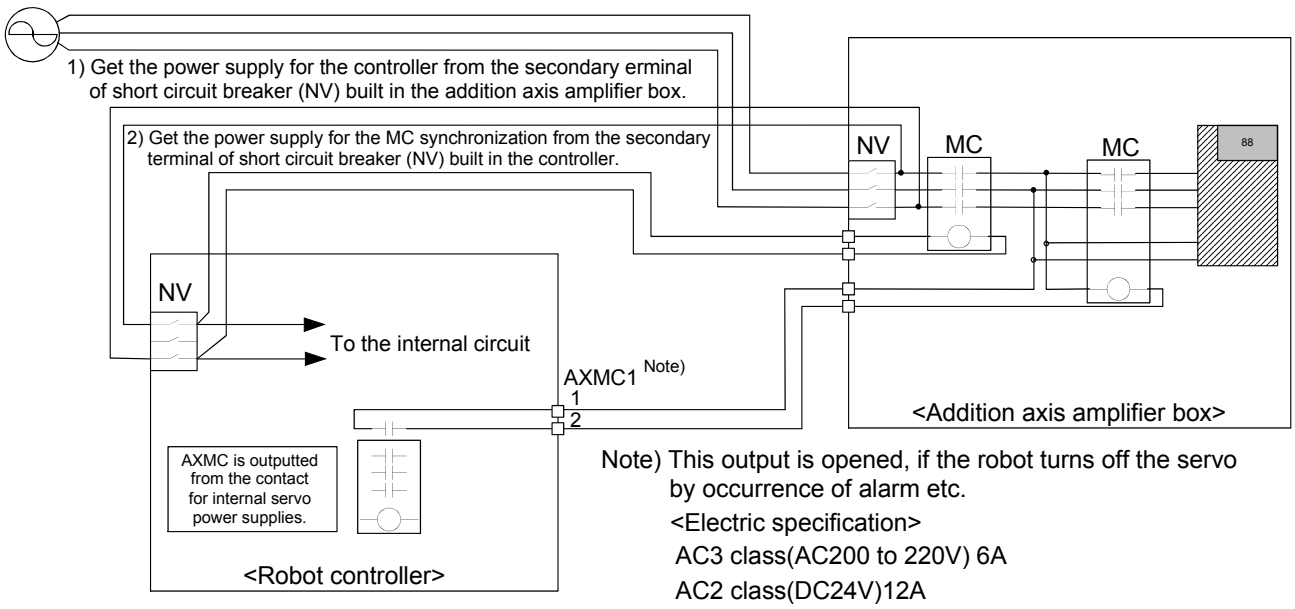


Fig.3-18 : Example of circuit for addition axes of Magnet contactor control output (CR2B-574 controller)

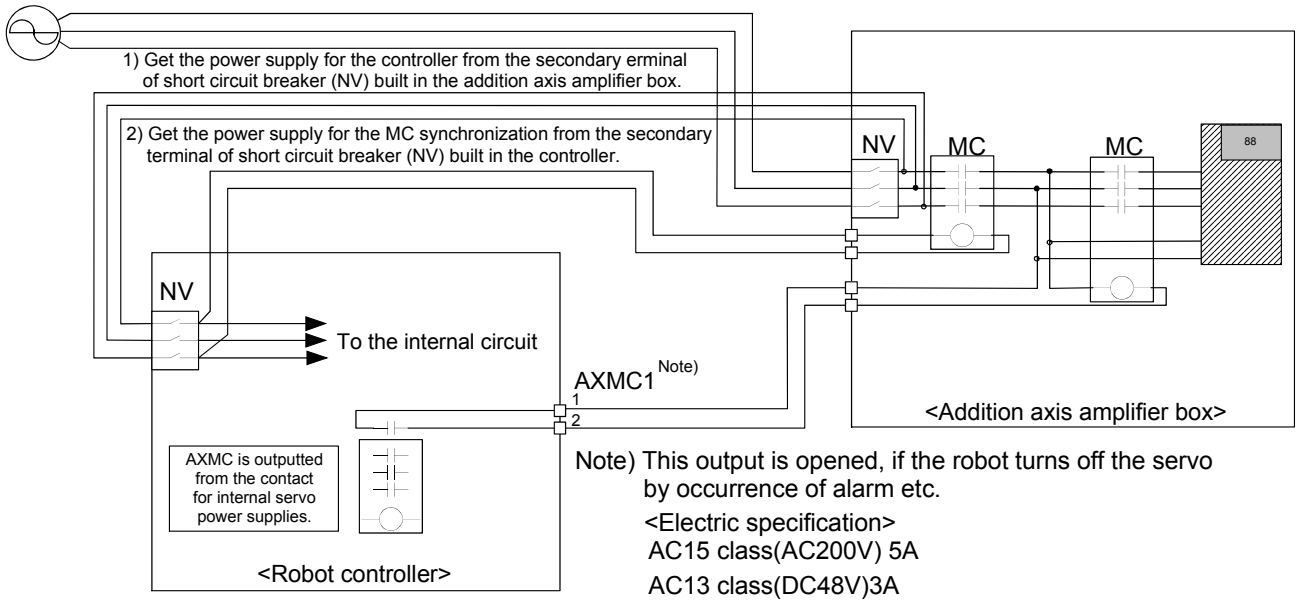


Fig.3-19 : Example of circuit for addition axes of Magnet contactor control output (CR3-535M controller)

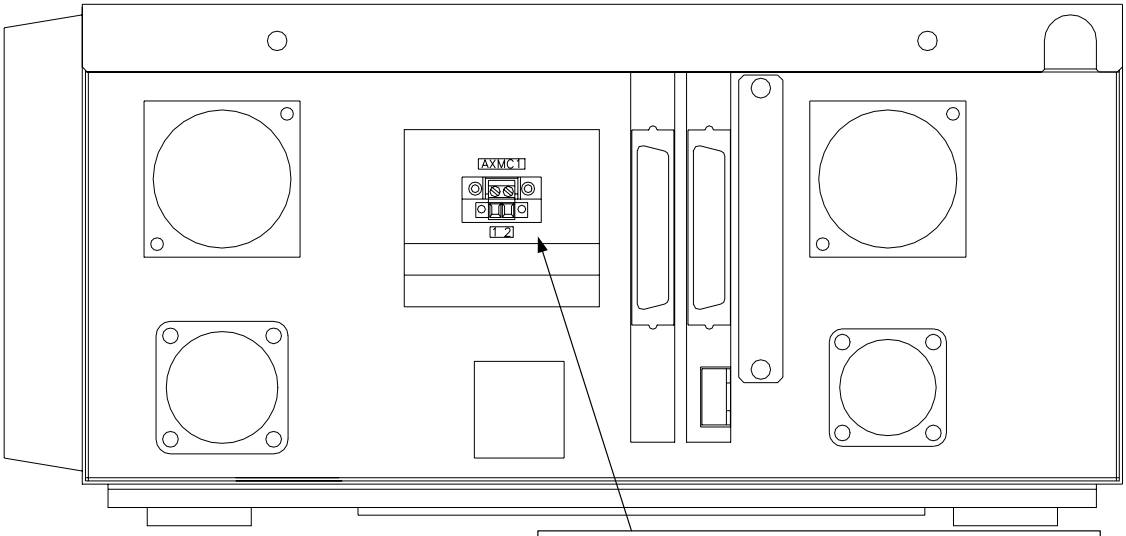


Fig.3-20 : Arrangement figure of the AXMC1 connector (CR2B-574 controller)

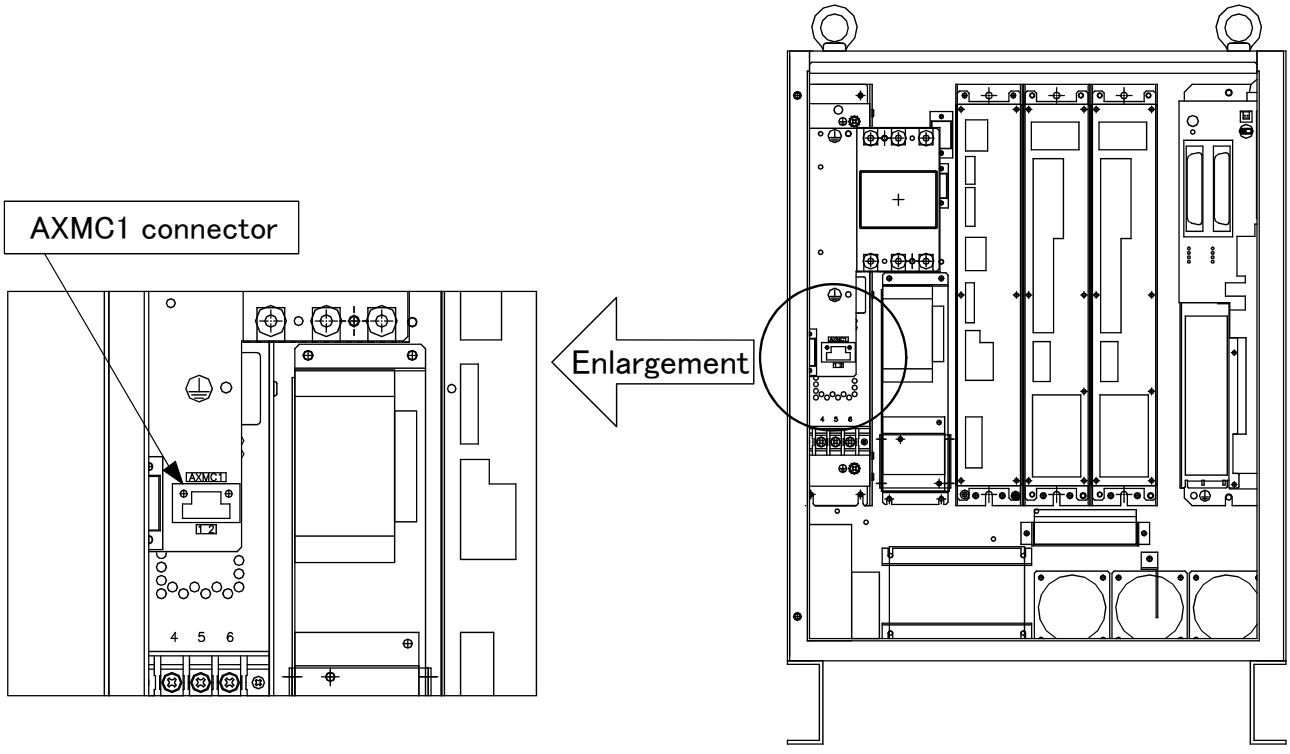


Fig.3-21 : Arrangement figure of the AXMC1 connector (CR3-535M controller)

3.9 Parallel input/output unit

- A parallel input/output card is mounted as a standard in the controller's control unit.
- The external input/output circuit specifications are shown in Table 3-8 and Table 3-9.
- The pin numbers of external input/output connectors and the corresponding line colors of the connected optional "external I/O cables" are explained in "(1)Pin numbers of standard parallel input/output cards and signal assignment(CR1B-571)" and "(2)Pin numbers of standard parallel input/output cards and signal assignment(CR2B-574)". Refer to Page 137, "(6) External I/O cable" for details of external I/O cable.
- Pin Nos. described as both general-purpose signal and dedicated signal can be shared.
- The other dedicated input/output signals that are not assigned can be assigned to required general-purpose input/output pins when creating the program.
- If the standard inputs and outputs are insufficient, install the parallel input/output unit connection option outside the controller.

Table 3-8 : Electrical specifications of input circuit

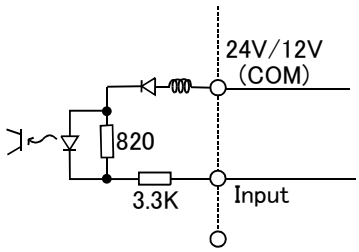
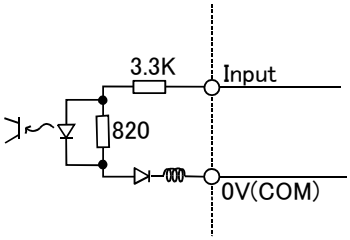
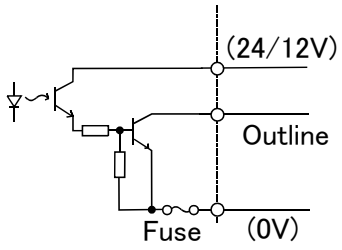
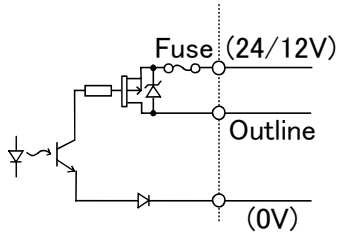
Item		Specifications	Internal circuit
Type		DC input	<Sink type>  <Source type> 
No. of input points		CR1B-571: 16, CR2B-574/CR3-535M: 32	
Insulation method		Photo-coupler insulation	
Rated input voltage		12VDC/24VDC	
Rated input current		Approx. 3mA/approx. 7mA	
Working voltage range		10.2VDC to 26.4VDC(ripple 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)	
Common method		8 points per common	
External wire connection method		Connector	

Table 3-9 : Electrical specifications of output circuit

Item		Specifications	Internal circuit
Type		Transistor output	<Sink type>  <Source type> 
No. of output points		CR1B-571: 16, CR2B-574/CR3-535M: 32	
Insulation method		Photo-coupler insulation	
Rated load voltage		DC12V/DC24V	
Rated load voltage range		DC10.2 ～ 30V(peak voltage 30VDC)	
Max. load current		0.1A/point (100%)	
Leakage current at OFF		0.1mA or less	
Max. voltage drop at ON		DC0.9V(TYP.)	
Response time	OFF-ON	2ms or less (hardware response time)	
	ON-OFF	2ms or less (Resistance load) (hardware response time)	
Fuse rating		Fuse 3.2A (one per common) Replacement not possible	
Common method		8 points per common (common terminal: 8 points)	
External wire connection method		Connector	
External power supply	Voltage	DC12/24V(DC10.2 ～ 30V)	
	Current	60mA (TYP. 24VDC per common) (base drive current)	

[Caution] When connecting the phototransistor output to the input circuit, be sure to allocate an input current of approximately 7 mA at 24 VDC. Especially when using a photo diode and a phototransistor (sensor) away from each other, it is recommended to verify the current that can be carried in the design stage.

⚠ 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.

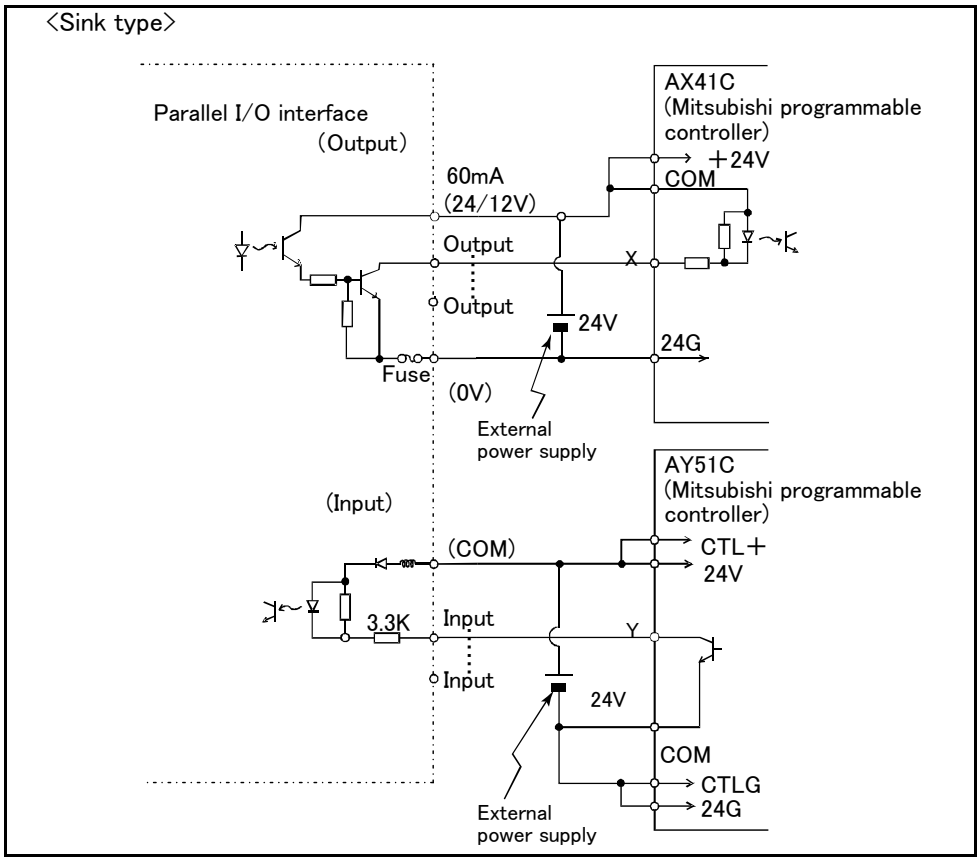


Fig.3-22 : Connection with a Mitsubishi PLC (Example of sink type)

*The input/output circuit external power supply (24 VDC) must be prepared by the customer.

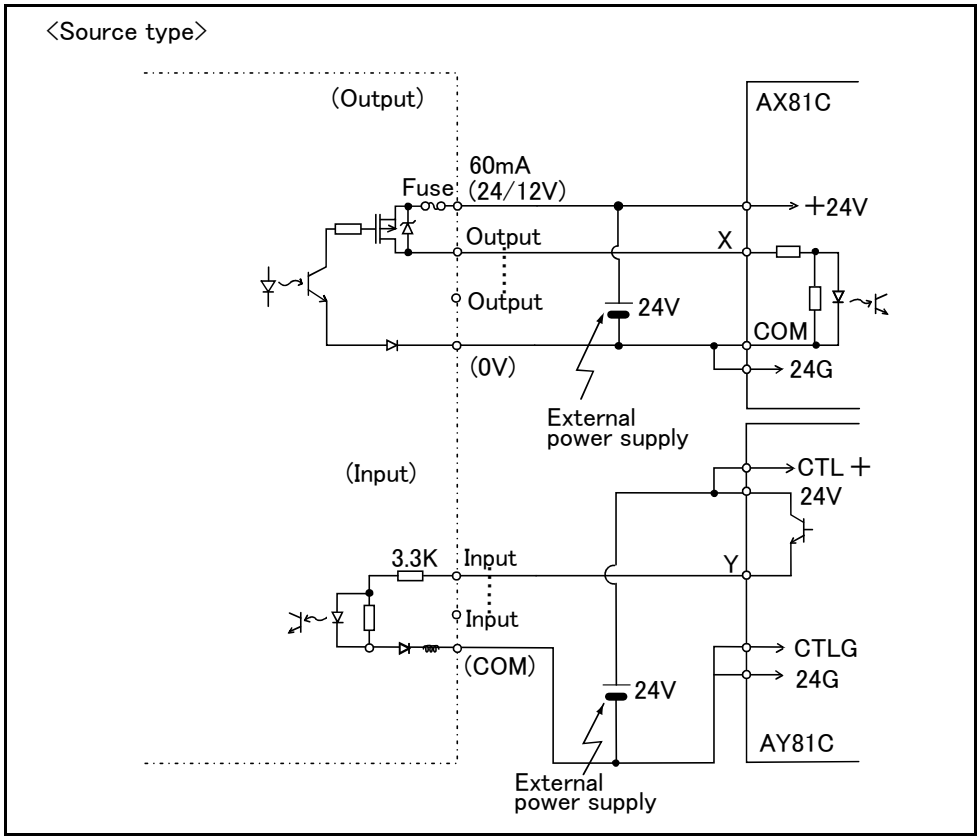


Fig.3-23 : Connection with a Mitsubishi PLC (Example of source type)

*The input/output circuit external power supply (24 VDC) must be prepared by the customer.

(1) Pin numbers of standard parallel input/output cards and signal assignment(CR1B-571)

Table 3-10 : Standard parallel I/O interface CN100pin No. and signal assignment list <Sink type> (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	Running	29	Yellow/Blue A	General-purpose output 4	
5	Pink/Red A	General-purpose output 1	Servo on	30	Pink/Blue A	General-purpose output 5	
6	Orange/Red B	General-purpose output 2	Error	31	Orange/Blue B	General-purpose output 6	
7	Gray/Red B	General-purpose output 3	Operation rights	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 Note1)	39	Yellow/Blue C		COM1:For pins 40-47 Note1)
15	Pink/Red C	General-purpose input 0	Stop(All slot) Note2)	40	Pink/Blue C	General-purpose input 8	
16	Orange/Red D	General-purpose input 1	Servo off	41	Orange/Blue D	General-purpose input 9	
17	Gray/Red D	General-purpose input 2	Error reset	42	Gray/Blue D	General-purpose input 10	
18	White/Red D	General-purpose input 3	Start	43	White/Blue D	General-purpose input 11	
19	Yellow/Red D	General-purpose input 4	Servo on	44	Yellow/Blue D	General-purpose input 12	
20	Pink/Red D	General-purpose input 5	Operation rights	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)Sink type:24V/12V(COM), Source type:0V(COM)
Note2)The assignment of the dedicated input signal "STOP" is fixed.

Table 3-11 : Standard parallel I/O interface CN100pin No. and signal assignment list <Source type> (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	Running	29	Yellow/Blue A	General-purpose output 4	
5	Pink/Red A	General-purpose output 1	Servo on	30	Pink/Blue A	General-purpose output 5	
6	Orange/Red B	General-purpose output 2	Error	31	Orange/Blue B	General-purpose output 6	
7	Gray/Red B	General-purpose output 3	Operation rights	32	Gray/Blue B	General-purpose output 7	
8	White/Red B		Reserved	33	White/Blue B		Reserved
9	Yellow/Red B		Reserved	34	Yellow/Blue B		Reserved
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 Note1)	39	Yellow/Blue C		COM1:For pins 40-47 Note1)
15	Pink/Red C	General-purpose input 0	Stop(All slot) Note2)	40	Pink/Blue C	General-purpose input 8	
16	Orange/Red D	General-purpose input 1	Servo off	41	Orange/Blue D	General-purpose input 9	
17	Gray/Red D	General-purpose input 2	Error reset	42	Gray/Blue D	General-purpose input 10	
18	White/Red D	General-purpose input 3	Start	43	White/Blue D	General-purpose input 11	
19	Yellow/Red D	General-purpose input 4	Servo on	44	Yellow/Blue D	General-purpose input 12	
20	Pink/Red D	General-purpose input 5	Operation rights	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)Sink type:24V/12V(COM), Source type:0V(COM)
Note2)The assignment of the dedicated input signal "STOP" is fixed.

(2) Pin numbers of standard parallel input/output cards and signal assignment(CR2B-574)

Table 3-12 : Standard parallel I/O interface 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	Running	29	Yellow/Blue A	General-purpose output 4	
5	Pink/Red A	General-purpose output 1	Servo on	30	Pink/Blue A	General-purpose output 5	
6	Orange/Red B	General-purpose output 2	Error	31	Orange/Blue B	General-purpose output 6	
7	Gray/Red B	General-purpose output 3	Operation rights	32	Gray/Blue B	General-purpose output 7	
8	White/Red B		0V:For pins 10-13	33	White/Blue B		0V:For pins 29-32, 35-38
9	Yellow/Red B		12V/24V:For pins 4-7, 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 Note1)	39	Yellow/Blue C		COM1:For pins 40-47 Note1)
15	Pink/Red C	General-purpose input 0	Stop(All slot) Note2)	40	Pink/Blue C	General-purpose input 8	
16	Orange/Red D	General-purpose input 1	Servo off	41	Orange/Blue D	General-purpose input 9	
17	Gray/Red D	General-purpose input 2	Error reset	42	Gray/Blue D	General-purpose input 10	
18	White/Red D	General-purpose input 3	Start	43	White/Blue D	General-purpose input 11	
19	Yellow/Red D	General-purpose input 4	Servo on	44	Yellow/Blue D	General-purpose input 12	
20	Pink/Red D	General-purpose input 5	Operation rights	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)Sink type:24V/12V(COM), Source type:0V(COM)
Note2)The assignment of the dedicated input signal "STOP" is fixed.

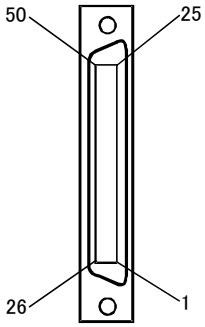
Table 3-13 : Standard parallel I/O interface CN300pin No. and signal assignment list (2A-CBL □□)

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

・The signals assigned as dedicated inputs can be used as general-purpose inputs during program execution. Note that for safety proposes, these should not be shared with the general-purpose inputs other than for numeric value inputs. The signals assigned as dedicated outputs cannot be used in the program. An alarm will occur during operation if used.

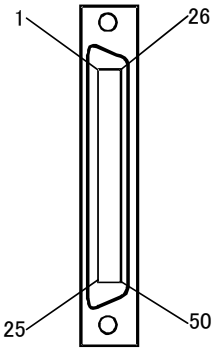
CR1B-571controller



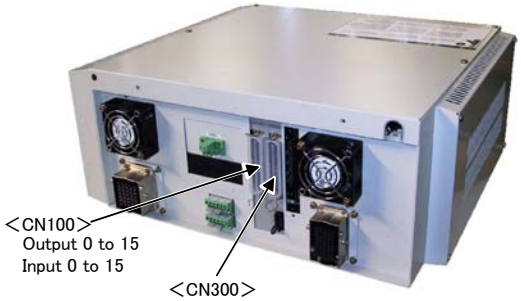
Connector pin layout

Controller back side

CR2B-574 controller

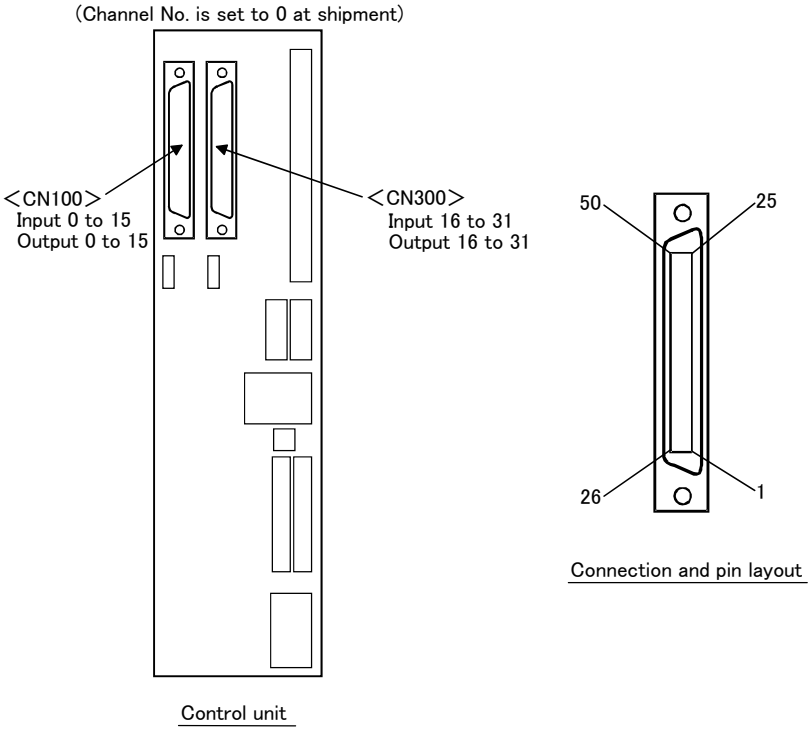


Connector pin layout



Controller back side

CR3-535M controller



Control unit

Connection and pin layout

*The I/O card in the control unit is equal to the PIO unit of the option. (Input 32/Output 32 points)

Fig.3-24 : Parallel input/output unit (in the control unit) connection and pin layout

3.10 Options

■ What are options?

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

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

(1) Teaching pendant (T/B)

■ Order type: R28TB :Cable length 7m
R28TB-15 :Cable length 15m
Note) There is a cable length 15m as special spcification. Confirm the delivery date.

■ 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 deadman switch is mounted.Note1)

If there are several robots, one teaching pendant can be used by connecting it to the respective robot.

■ Configuration

Table 3-14 : Configuration device

Part name	Type	Qty.	Mass(kg)	Remarks
Teaching pendant	R28TB	Either one pc.	2.0	Cable length is 7m. Hand strap is attached.
	R28TB-15		2.3	Cable length is 15m. Hand strap is attached.

■ Specifications

Table 3-15 : Specifications

Items	Specifications	Remarks
Outline dimensions	153(W) x 203(H) x 70(D) (refer to outline drawing)	
Body color	Light gray (reference Munsell color: 0.08GY7.64/0.81)	
Mass	Approx. 0.8kg (only arm, excluding cable)	
Connection method	Connection with controller and round connector (30-pin)	
Interface	RS-422	
Display method	LCD method: 16 characters x 4 lines, LCD illumination: with backlight	
Operation section	28 keys	
Protection specifications	IP65	Note2)

Note2) The manual operation section of the teaching pendant has a protection method that complies with the IEC Standards IP65 (protection type).
[Reference] IProtection against water infiltration as specified in IP65 indicates a protective structure that is not harmfully affected when 12.5 ± 5% liters of water is supplied from a test device at a position approx. 3m away in various directions and a water pressure of 30kPa at the nozzle section. The water is filled one minute per $1m^2$ of test device surface area for a total of three minutes.
.

Note1) <3-position deadman 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 "Deadman switch".
The 3-position deadman switch has three statuses. The following modes are entered according to the switch state.
"Not pressed".....The robot does not operate. *)
"Pressed lightly".....The robot can be operated and teaching is possible.
"Pressed with force".....The robot does not operate. *)
*) Operations, such as program editing and status display, other than robot operation are possible.
Safety is secured as the servo power is turned OFF simultaneously with the input of the emergency stop.

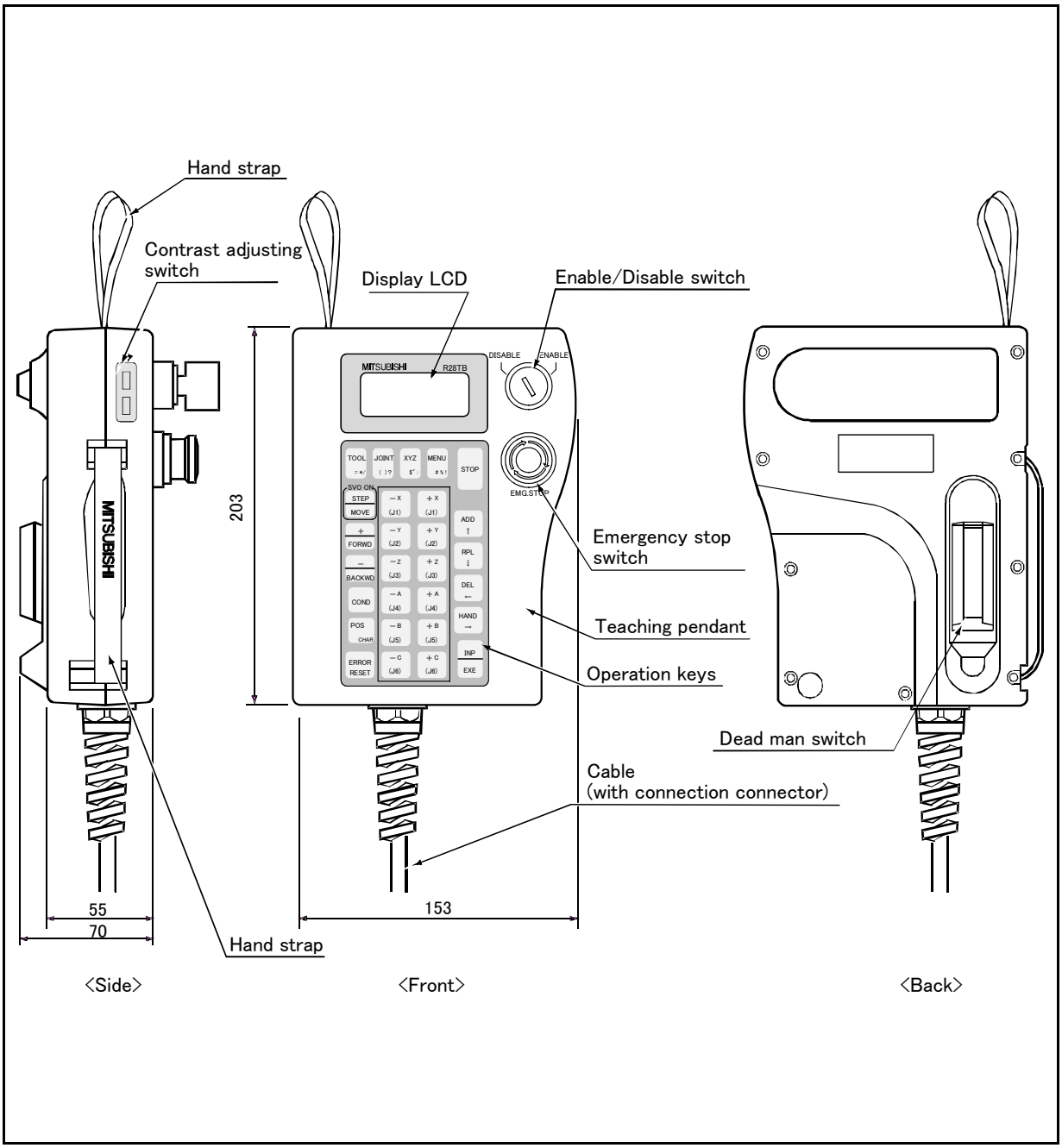
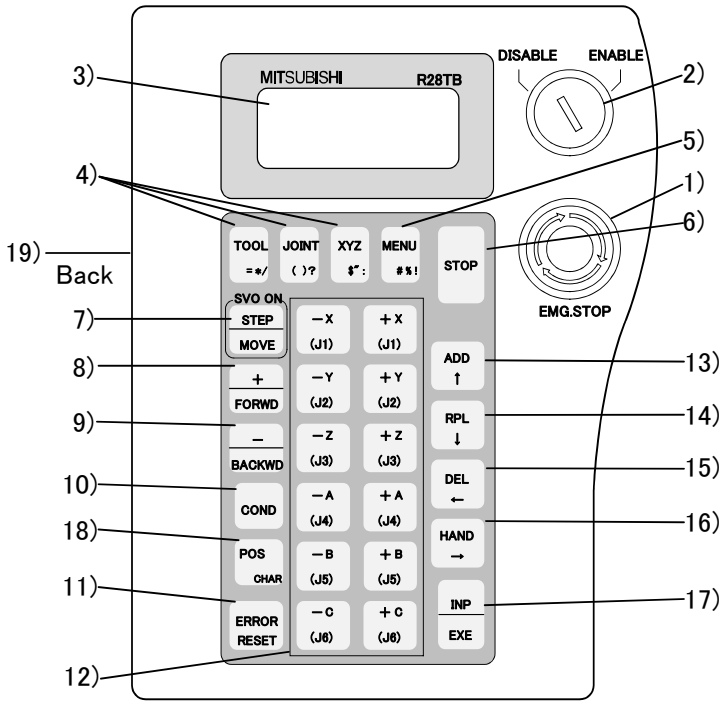


Fig.3-25 : Outside dimensions of teaching pendant

■ Installation method

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

■ Key layout and main functions



1) : Emergency stop switch.....The robot servo turns OFF and the operation stops immediately.
2) : T/B enable/disable changeover switch.....This switch changes the T/B key operation between enable and disable.
3) : LCD display panel.....The robot status and various menus are displayed.
4) : <TOOL, JOINT, XYZ> key.....This selects the jog mode (JOINT, XYZ, 3-AXIS XYZ, CYLINDER, TOOL).
5) : <MENU> key.....This returns the display screen to the menu screen.
6) : <STOP> key.....This stops the program and decelerates the robot to a stop.
7) : <STEP/MOVE> key.....Jog operation is carried out when this key is pressed simultaneously with the jog operation key. This also turns the Servo ON and carries out step jump.
8) : <(＋ FORWD> key.....This carries out step feed and increases the override.
9) : <(－ BACKWD> key.....This carries out step return (return along operation path) and decreases the override.
10) : <COND> key.....This sets the program.
11) : <ERROR RESET> key.....This resets the error, and releases the software limit.
12) : Jog operation key.....This operates the robot according to the jog mode. When inputting numeric values, this inputs each numeric value.
13) : <ADD/ ↑ > key.....This additionally registers the position data. It also moves the cursor upward.
14) : <RPL/ ↓ > key.....It also moves the cursor downward.
15) : <DEL/ ← > key.....This deletes the position data. It also moves the cursor to the left.
16) : <HAND/ → > key.....This opens and closes the hand. It also moves the cursor to the right.
17) : <INP/EXE> key.....This inputs the program, and carries out step feed/return.
18) : <POS CHAR> key.....This changes the edit screen, and changes between numbers and alphabetic characters.
19) : Deadman 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.

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

(2) Pneumatic hand interface

■ Order type: 2A-RZ365(Sink type)
2A-RZ375(Source type)

■ Outline

This interface is required to use the robot arm's hand output signals. This interface is pre-installed on the controller.

- Up to eight hand output points can be used with this interface.
- The eight hand input points can be used without this interface.
- When using more than eight hand input/output points, install the "Parallel I/O unit". Refer to Page 124, "Parallel I/O unit" for detail.
- Use 2A-RZ365 if the external input/output signal logic is of the sink type and 2A-RZ375 for source type signal logic.

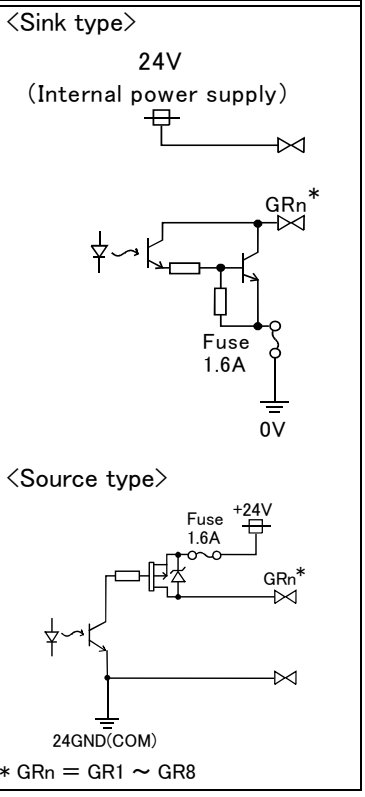
■ Configuration

Table 3-16 : Configuration device

Part name	Type	Qty.	Mass(kg)	Remarks
Pneumatic hand interface	2A-RZ365/ 2A-RZ375	1pc.	0.1	Output 8 points expansion. 2A-RZ365 is the sink type. 2A-RZ375 is the source type.

■ Specifications

Table 3-17 : Specifications

Item		Specification	Internal circuit
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)	
Fuse rating		Fuses 1.6A (each one common)	
Common method		8 points, 1 common	

* GRn = GR1 ~ GR8

■ Installation method

This is mounted on the control unit in the controller.

Securely insert the pneumatic hand interface (2A-RZ365/375) into the CNHNDOUT/CNHND connector on the control unit. Refer to separate "Instruction Manual/ Controller setup, basic operation, and maintenance" for details on the installing method.

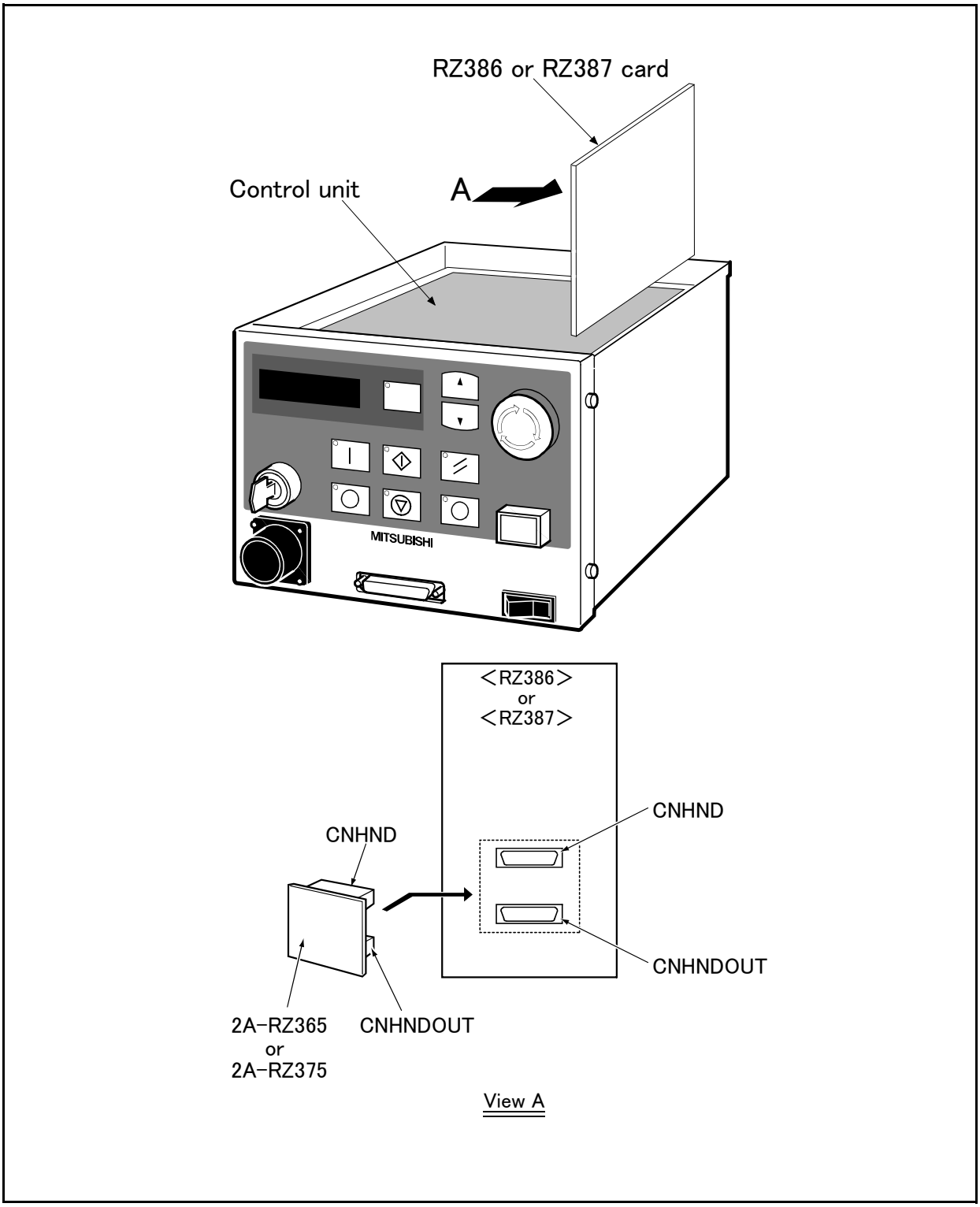


Fig.3-27 : Installation of pneumatic hand interface (CR1B-571 controller)

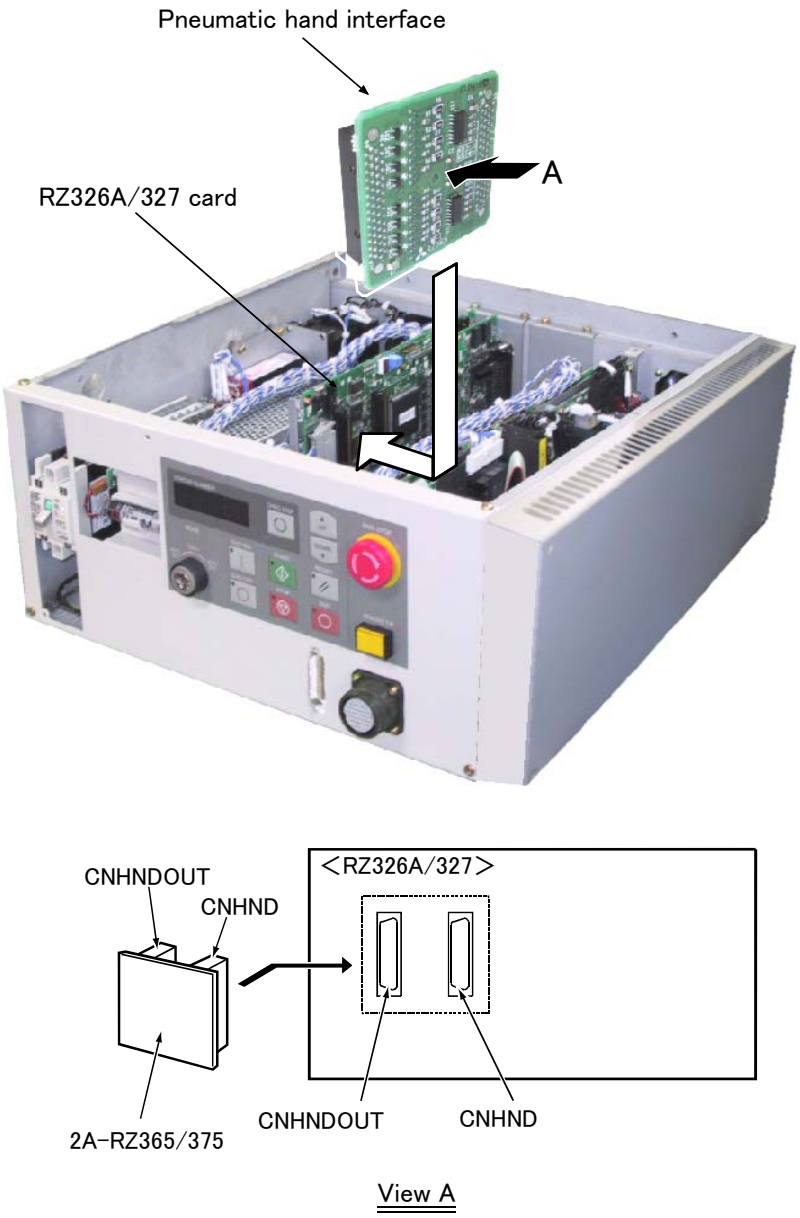
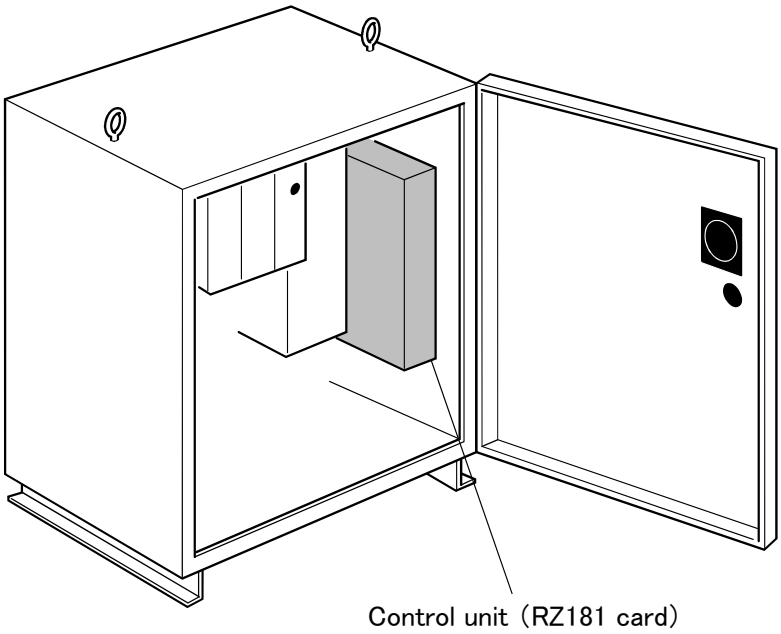


Fig.3-28 : Installation of pneumatic hand interface (CR2B-574 controller)



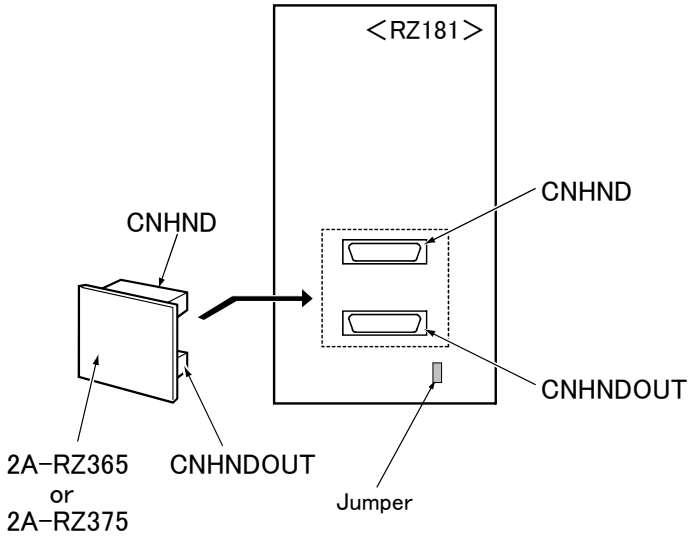


Fig.3-29 : Installation of pneumatic hand interface (CR3-535M controller)

(3) Controller protection box
(CR1B-571 controller only)

■ Order type : ● CR1B-MB

■ Outline

The controller protection box is used to protect the controller from an oil mist or other operating environment. Put the controller and the earth leakage breaker, etc. in controller protection box, and use it. Since the front cover of the controller protection box can be removed, it is possible to operate the controller's front panel and to install and remove the T/B.

■ Configuration

Table 3-18 : Configuration device

Part name	Type	Qty.	Remarks
Controller protection box	CR1B-MB	1 unit	
Serial number posting label		1	
Protection seal transparent		1	Protection for the serial number posting label.
Cable tie		2	
Power supply wiring cable		1	For connecting the power relay terminal and the controller inside the box.
Grounding cable		1	For connecting the FG terminal and the controller inside the box.
External emergency stop box (Controll box)	HW1X-BV401R	1 unit	Single emergency line. Install at a location outside the controller protection box where operation can be performed easily. The outside dimensions is shown in Fig. 3-32.

■ Specifications

Table 3-19 : Specifications

Item	Unit	Specifications	Remarks
Outside dimensions	mm	414(W) × 492(D) × 202(H)	Excluding protrusions
Mass	Kg	10	
Structure		Self-contained floor type	IP54
Grounding		D class grounding earth	
Coating color		Light gray	Munsell 0.08GY7.64/0.81

(1) The installation of the controller, earth leakage breaker and wiring are constructed by customer.
(2) Prepare the 2 power cable and 1 grounding cable (both AWG#14(2mm^2) or more).
(3) The emergency stop box does not come with a cable clamp (wiring connector). The cable clamp must be provided by the customer according to the size of the cable.
The following table shows recommended cable clamps for your reference.

Table 3-20 : Cable clamp for external emergency stop box (recommendation)

Type	JIS wiring tube	Adaptation cable outside diameter	Manufacturer
OA-W1606	G1/2	φ4 ～ 6	OHM electric Corp
OA-W1608		φ6 ～ 8	
OA-W1609		φ7 ～ 9	
OA-W1611		φ9 ～ 11	
OA-W1613		φ11 ～ 13	

■ Names of each part

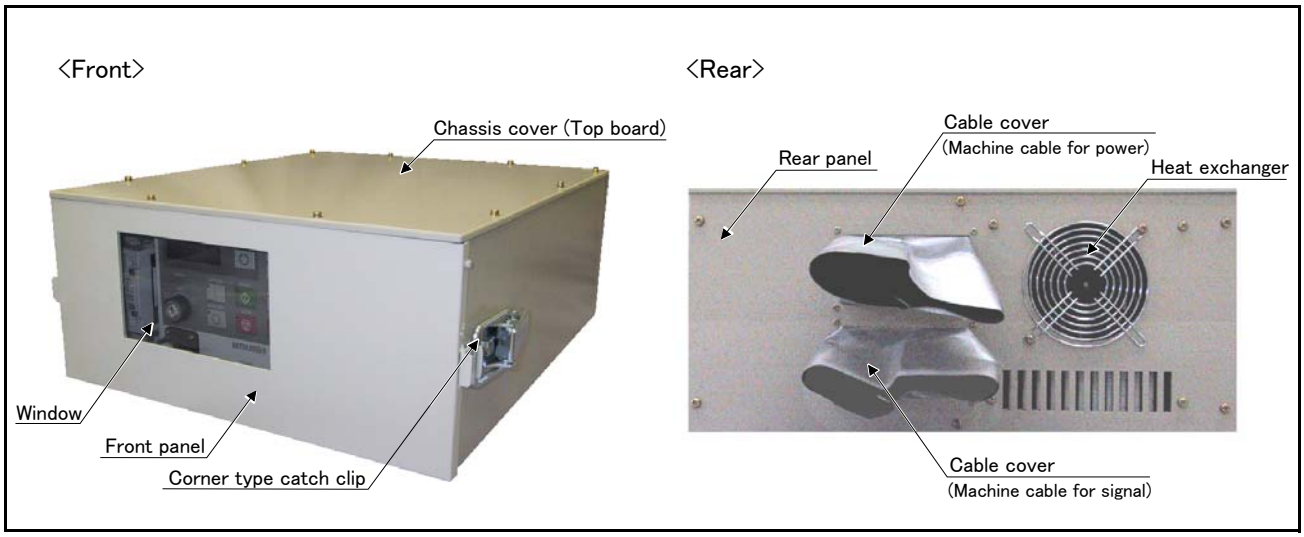


Fig.3-30 : Names of controller parts

■ The outside dimension and controller layout

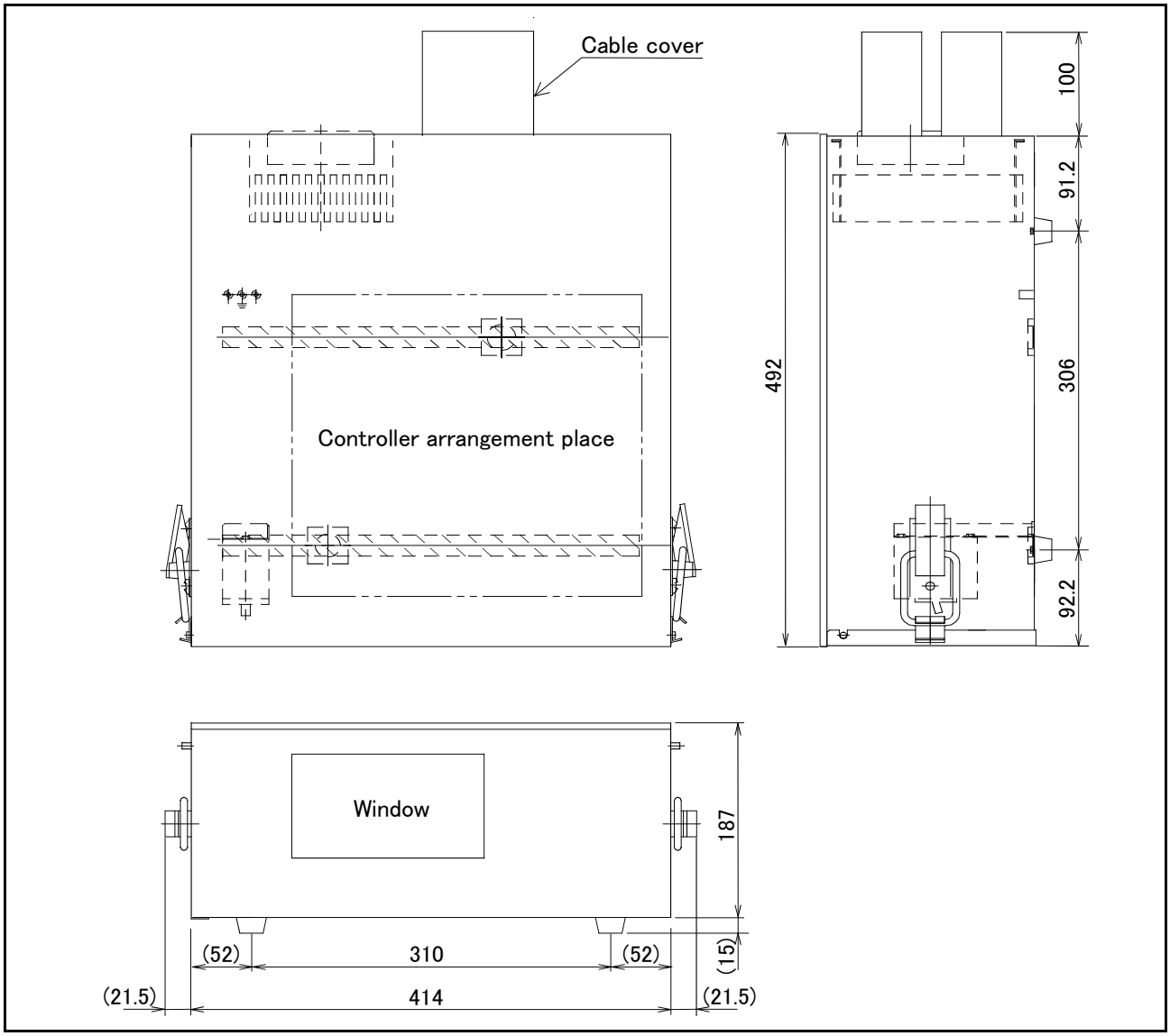


Fig.3-31 : The outside dimension and controller layout

■ The outside dimensions and installation dimensions of emergency stop box

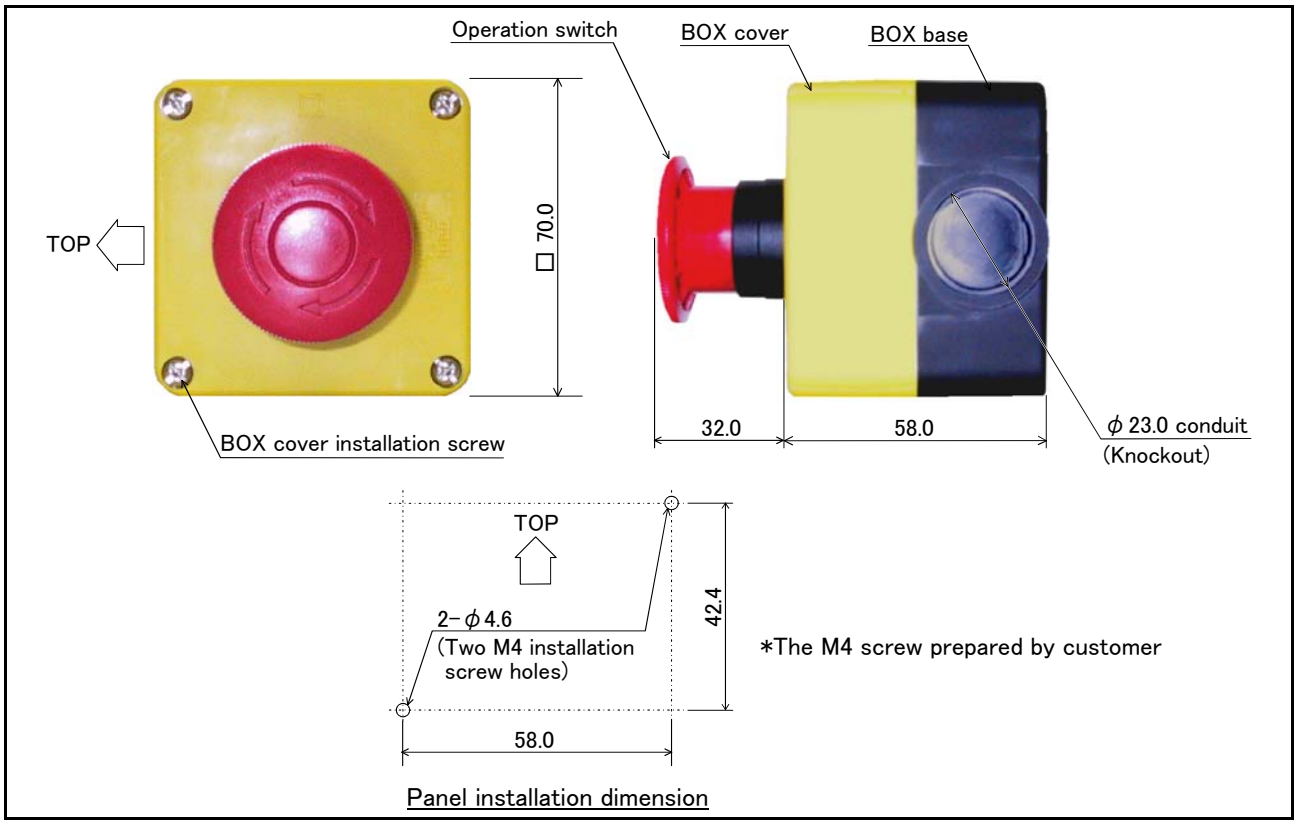


Fig.3-32 : The outside dimensions and installation dimensions of emergency stop box

■ Installation dimensions

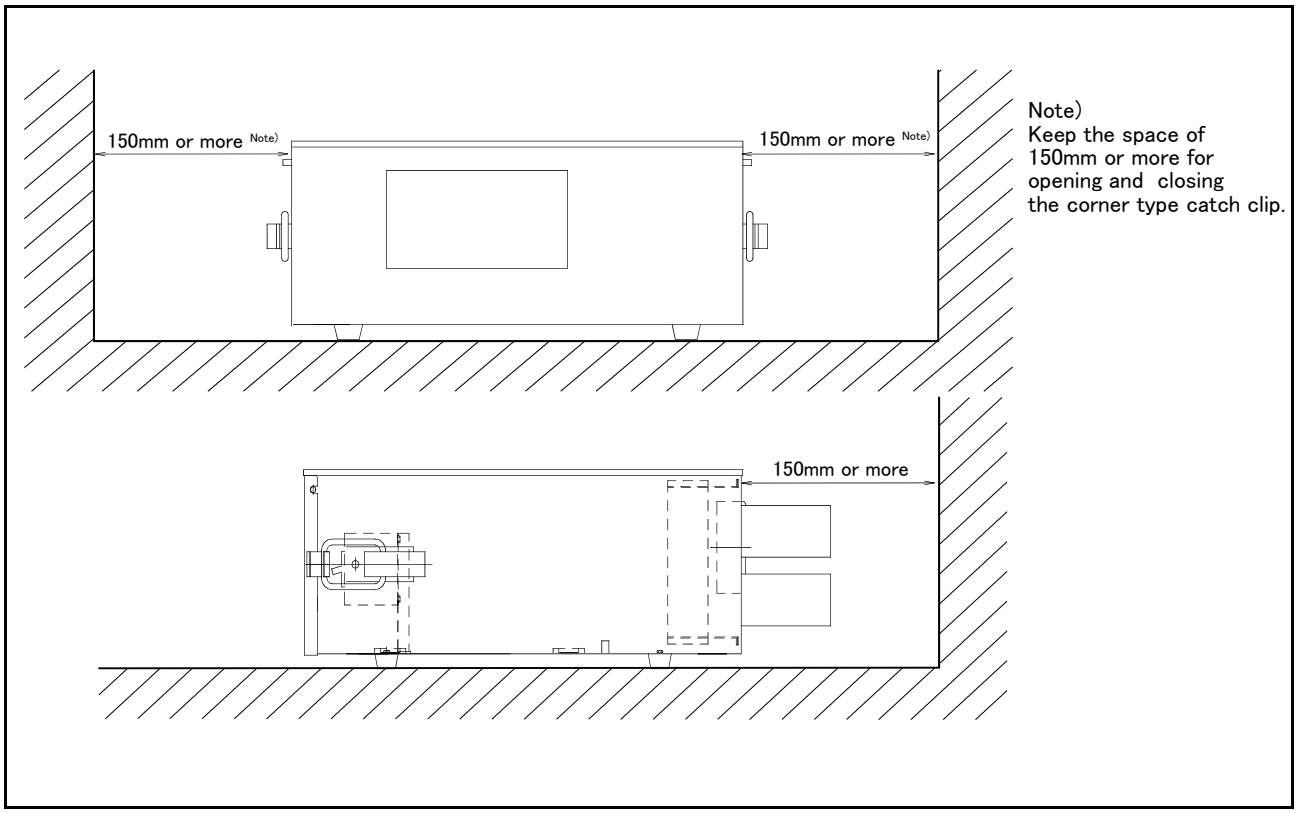


Fig.3-33 : Installation of controller

(4) Expansion option box
(CR1B-571 controller only)

■ Order type : ● CR1-EB3

■ Outline

By installing this expansion option box to the side of the controller, the expansion serial interface, CC-Link interface, Ethernet interface, Addtional interface and PROFIBUS interface can be used.
Up to three option cards can be mounted.

■ Configuration

Table 3-21 : Configuration device

Part name	Type	Qty.	Mass(kg) Note1)	Remarks
Expansion option box	CR1-EB3	1	1.7	With rubber foot
Installation screw		4	-	

Note1)Mass indicates one set.

■ Specifications

Table 3-22 : Specifications

Item	Unit	Specifications	Remarks
Number of slot	slot	3	RT-Bus 1, 2, 3
Power supply method		Power supply is supplied from controller by the RT-Bus coupling(+5V/SG)	
Current value	A	Max. 3	Max. 1A/slot
Ambient temperature	deg.	0 to 40	
Ambient humidity	%RH	45 to 85	Without dew drops
Grounding		D class grounding earth	Grounding from external terminal
Structure		Self-contained floor type opened structure	Note1)
Outside dimensions	mm	85(W) x 290(D) x 165(H)	
Mass	kg	Approx. 3	

Note1) Self-contained floor type, under the condition combined with the body.

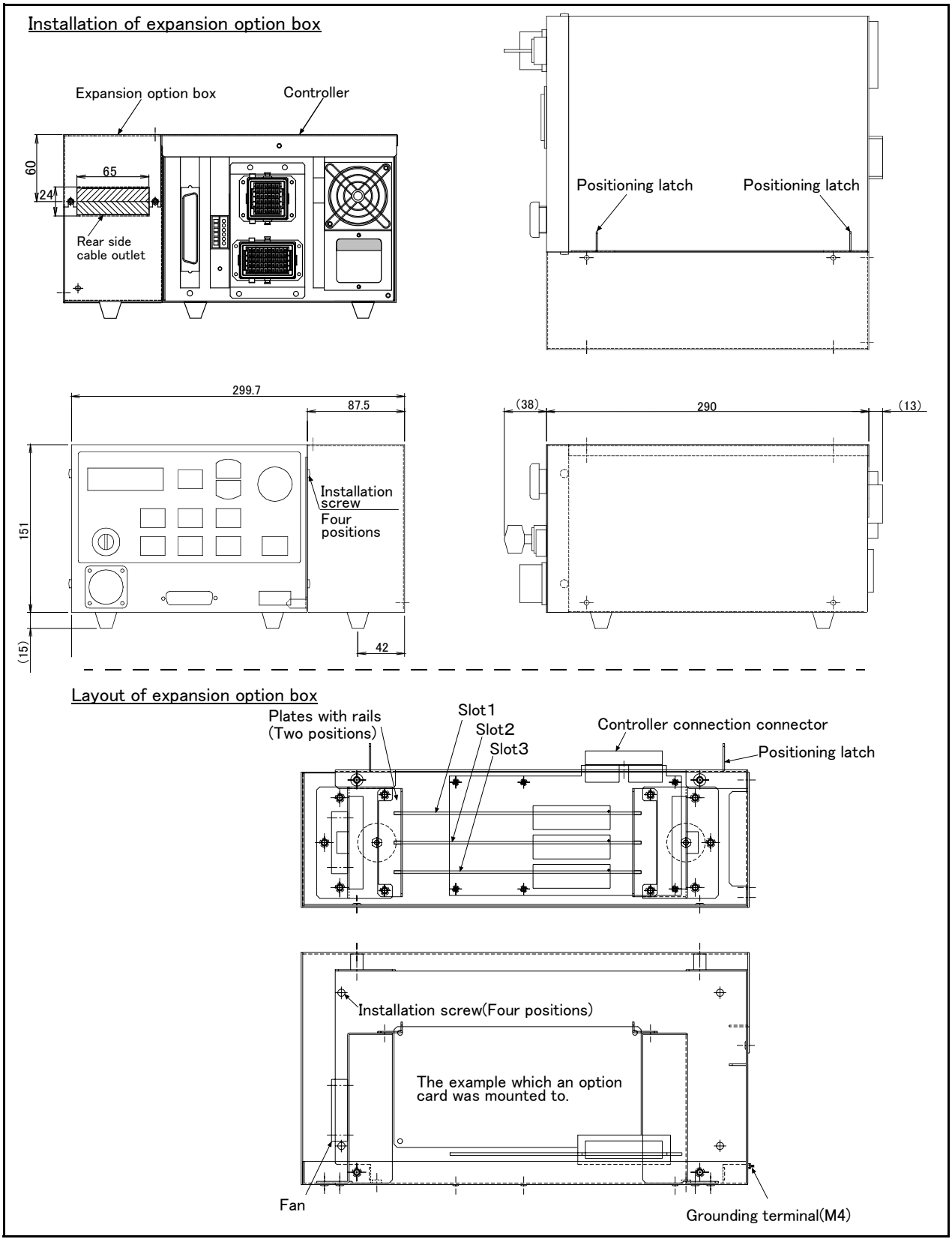


Fig.3-34 : Outside dimensions and layout

■ Installation method

Remove the side plate of the controller, connect the connectors, and fix to the controller with the four fixing screws in the expansion option box.

The option cards mounted in the slot are fixed with the plates with rails.

The cables required for the option card are lead out from the cable outlet on the rear side.

(5) 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.
- 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.

■ Configuration

Table 3-23 : Configuration device

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

■ Specifications

1) Up to eight stations can be connected to this unit. (One station occupies one unit.)
One unit is built into the controller as a standard, so up to seven units can be installed as expansions.
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.

The detailed specifications of the input/output circuit are the same as the parallel input/output unit mounted as a standard. Refer to Page 105, "3.9 Parallel input/output unit" for details.

Table 3-24 : Electrical specifications of input circuits

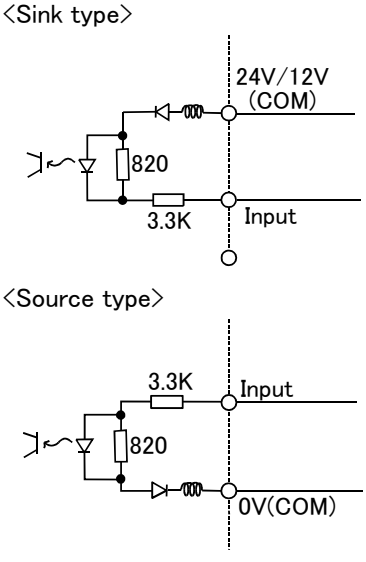
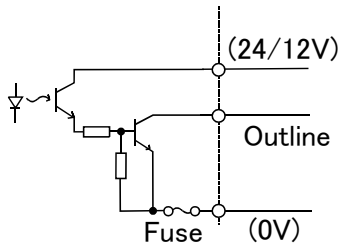
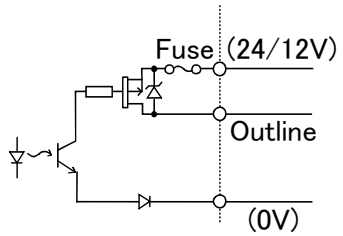
Item		Specification	Internal circuit
Type		DC input	
Number of input points		32	
Insulation method		Photo coupler insulation	
Rated input voltage		12VDC/24VDC	
Rated input current		Approx 3mA/7mA	
Working voltage range		10.2 to 26.4VDC(Ripple factor should be less than 5%.)	
ON voltage/ON current		8VDC or more/ 2mA or more	
OFF voltage/ OFF current		4VDC or less/ 1mA or less	
Input resistance		Approx. 3.3kΩ	
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 3-25 : 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		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.)	
Response time	OFF-ON	2ms or less (hardware response time)	
	ON-OFF	2ms or less (Resistance load) (hardware response time)	
Fuse rating		Fuse 3.2A (one per common) Replacement not possible	
Common method		8 points per common (common terminal: 8 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)	

⚠ 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

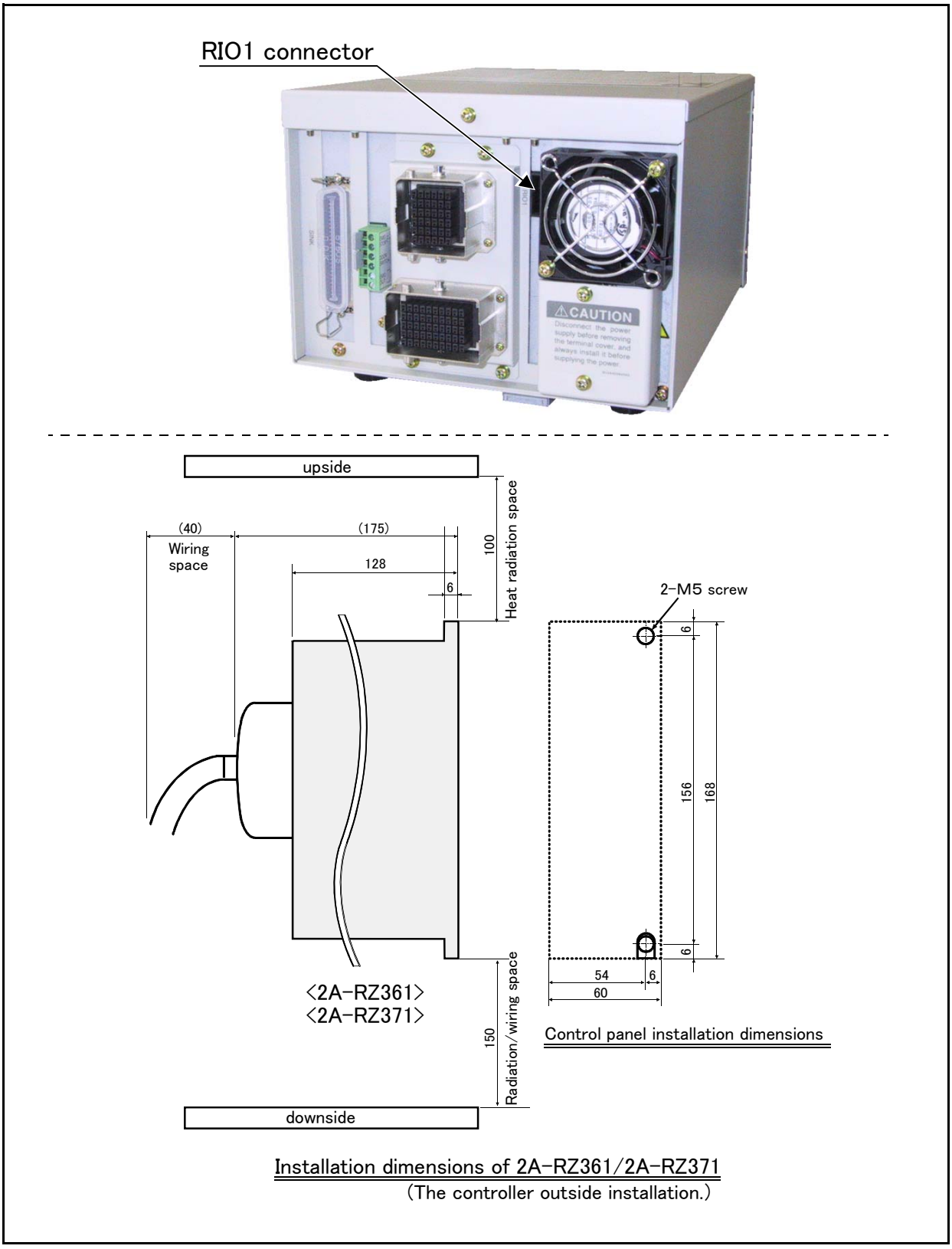
Type	Connector type	Contact type	Resistant	Manufacturer
NETcable-1	1-178288-3 (2)	175218-3 (6)	—	AMP
DCcable-2	2-178288-3 (1)	175218-3 (3)	—	AMP
R-TM	1-178288-3 (1)	175218-3 (2)	100Ω(1/4W) (1)	Equivalent to KOA.

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

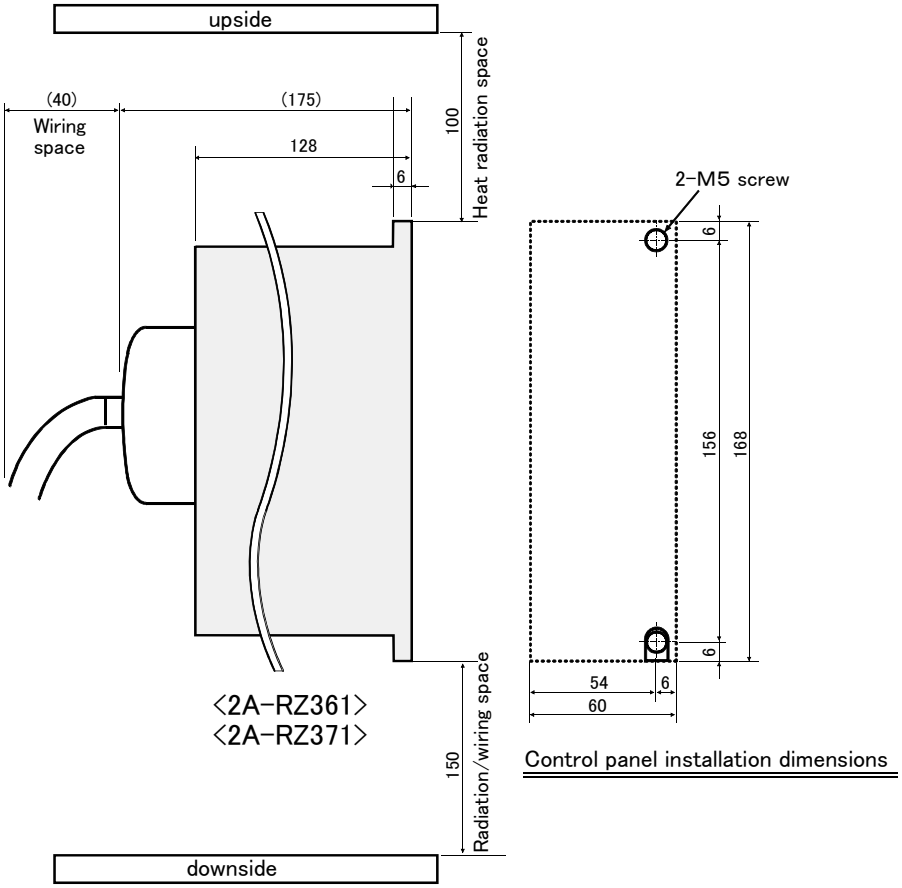
■ Installation method

The expansion parallel input/output unit is installed outside of the controller. Connect with the network connection cable (NETcable-1) from the RIO1 connector in the rear of the controller.



Installation dimensions of 2A-RZ361/2A-RZ371
(The controller outside installation.)

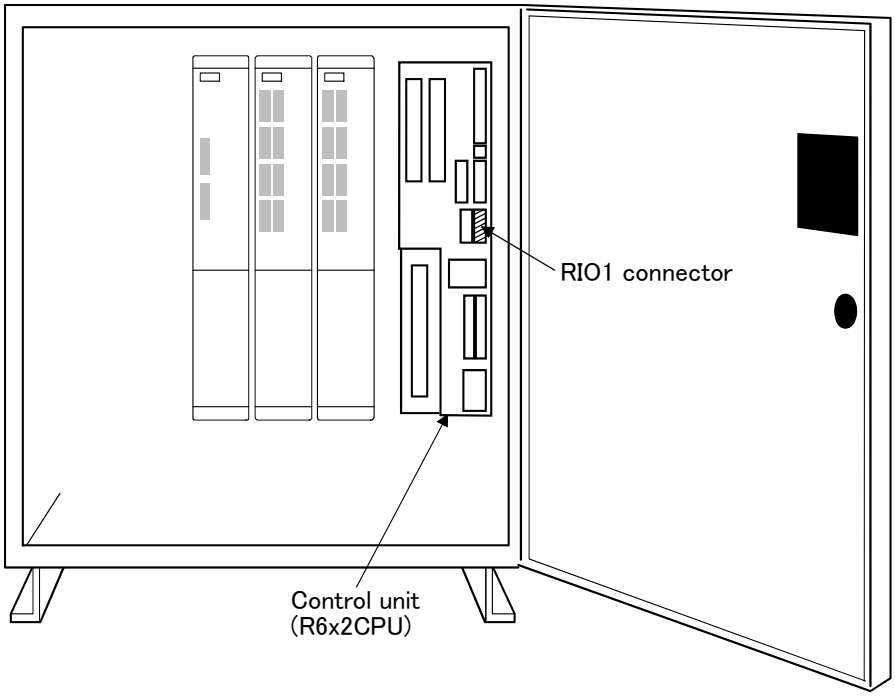
Fig.3-36 : Installing the parallel input/output unit (CR1B-571 controller)

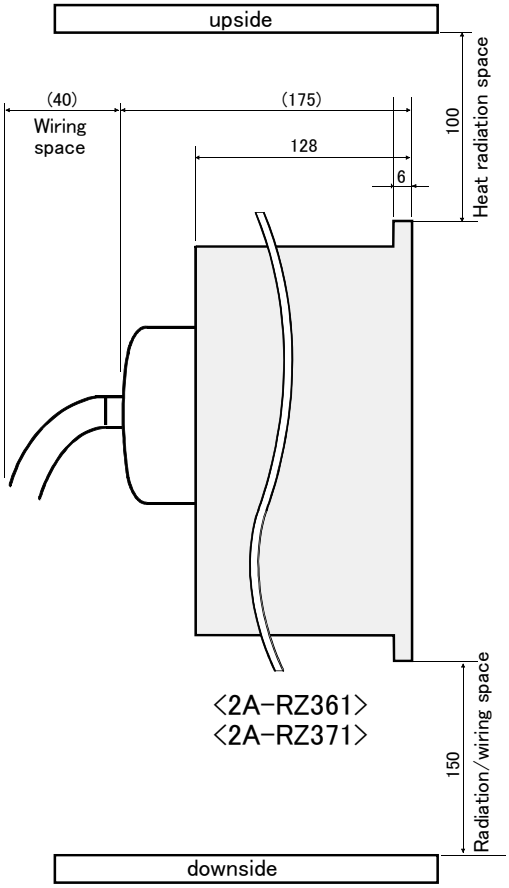


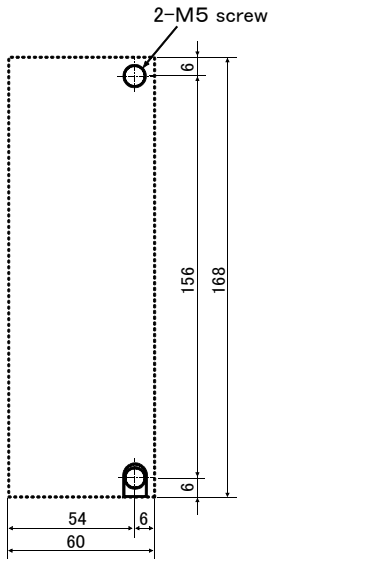
Control panel installation dimensions

Installation dimensions of 2A-RZ361/2A-RZ371
(The controller outside installation.)

Fig.3-37 : Installing the parallel input/output unit (CR2B-574 controller)



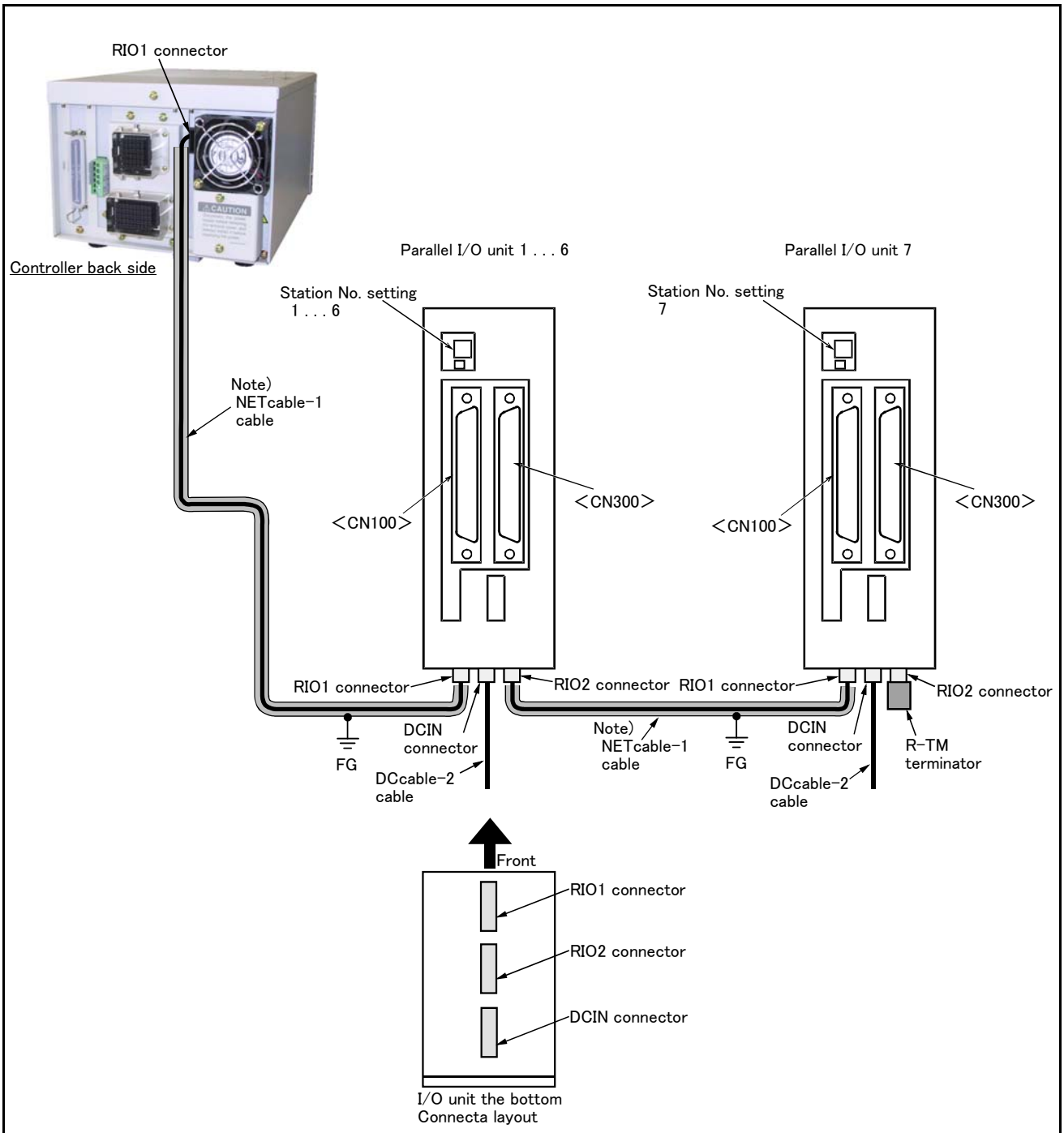




Control panel installation dimensions

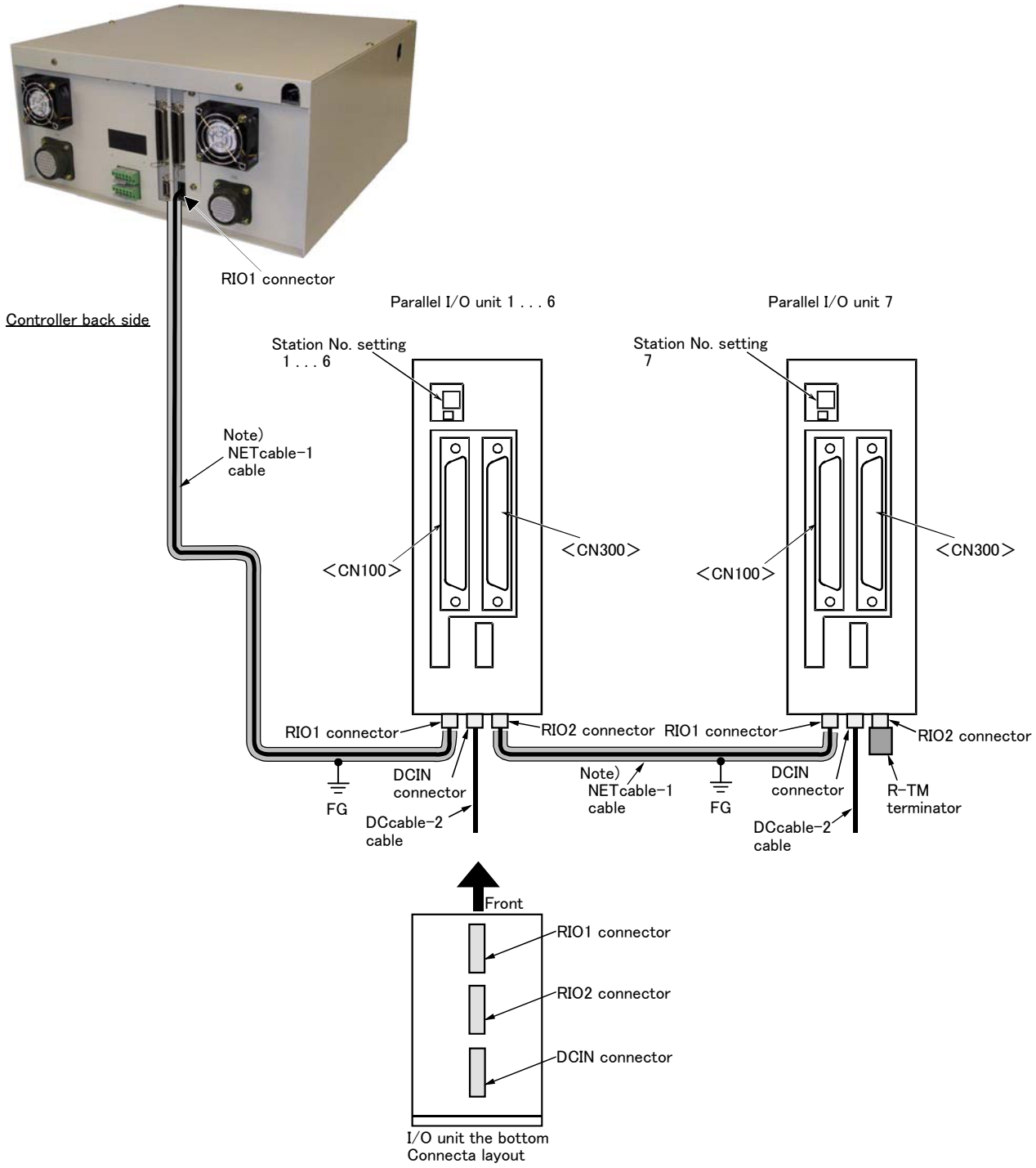
Installation dimensions of 2A-RZ361/2A-RZ371 The controller outside installation.

Fig.3-38 : Installing the parallel input/output unit (CR3-535M controller)



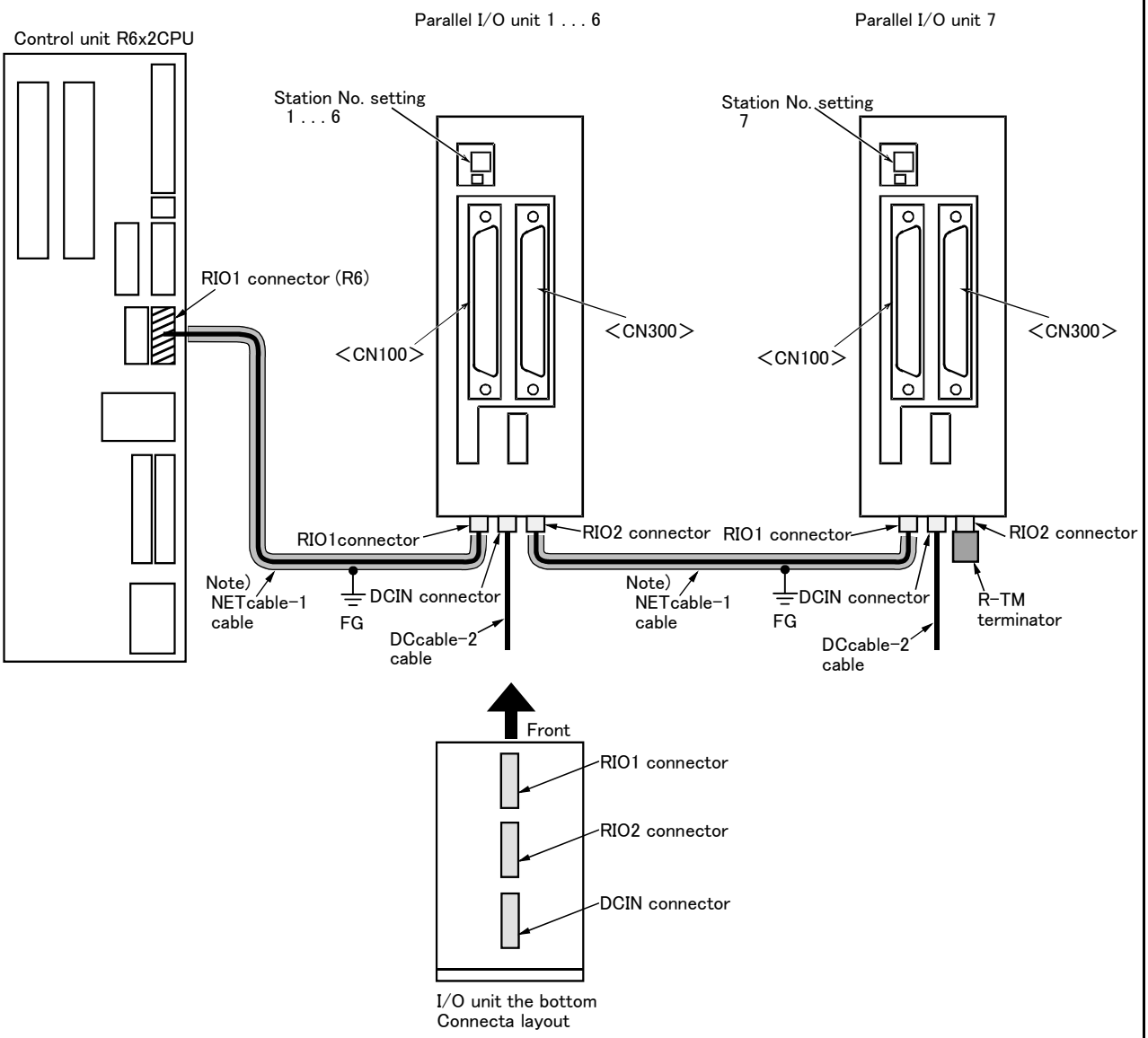
Connect the NET cable-1 to the RIO1 connector on the back of the controller. Each unit is connected to from a daisy chain.
Always install a terminator (R-TM) to the last unit.
Note) Use a shield cable for NET cable-1 as a measure against noise.
Always connect the shield to FG.
The unit could malfunction because of noise if the shield cable is not used.

Fig.3-39 : Connection method of expansion parallel input/output unit (CR1B-571 controller)



Connect the NET cable-1 to the RIO1 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.
The unit could malfunction because of noise if the shield cable is not used.

Fig.3-40 : Connection method of expansion parallel input/output unit (CR2B-574 controller)



Connect the NET cable-1 to the RIO1 connector (R6) on the front of the control unit (R6x2CPU) in 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.
The unit could malfunction because of noise if the shield cable is not used.

Fig.3-41 : Connection method of expansion parallel input/output unit (CR3-535M controller)

■ 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 32		29	Yellow/Blue A	General-purpose output 36	
5	Pink/Red A	General-purpose output 33		30	Pink/Blue A	General-purpose output 37	
6	Orange/Red B	General-purpose output 34		31	Orange/Blue B	General-purpose output 38	
7	Gray/Red B	General-purpose output 35		32	Gray/Blue B	General-purpose output 39	
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 40		35	Pink/Blue B	General-purpose output 44	
11	Orange/Red C	General-purpose output 41		36	Orange/Blue C	General-purpose output 45	
12	Gray/Red C	General-purpose output 42		37	Gray/Blue C	General-purpose output 46	
13	White/Red C	General-purpose output 43		38	White/Blue C	General-purpose output 47	
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 32		40	Pink/Blue C	General-purpose input 40	
16	Orange/Red D	General-purpose input 33		41	Orange/Blue D	General-purpose input 41	
17	Gray/Red D	General-purpose input 34		42	Gray/Blue D	General-purpose input 42	
18	White/Red D	General-purpose input 35		43	White/Blue D	General-purpose input 43	
19	Yellow/Red D	General-purpose input 36		44	Yellow/Blue D	General-purpose input 44	
20	Pink/Red D	General-purpose input 37		45	Pink/Blue D	General-purpose input 45	
21	Orange/Red E	General-purpose input 38		46	Orange/Blue E	General-purpose input 46	
22	Gray/Red E	General-purpose input 39		47	Gray/Blue E	General-purpose input 47	
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:24V/12V(COM), Source type:0V(COM)

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 48		29	Yellow/Blue A	General-purpose output 52	
5	Pink/Red A	General-purpose output 49		30	Pink/Blue A	General-purpose output 53	
6	Orange/Red B	General-purpose output 50		31	Orange/Blue B	General-purpose output 54	
7	Gray/Red B	General-purpose output 51		32	Gray/Blue B	General-purpose output 55	
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 56		35	Pink/Blue B	General-purpose output 60	
11	Orange/Red C	General-purpose output 57		36	Orange/Blue C	General-purpose output 61	
12	Gray/Red C	General-purpose output 58		37	Gray/Blue C	General-purpose output 62	
13	White/Red C	General-purpose output 59		38	White/Blue C	General-purpose output 63	
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 48		40	Pink/Blue C	General-purpose input 56	
16	Orange/Red D	General-purpose input 49		41	Orange/Blue D	General-purpose input 57	
17	Gray/Red D	General-purpose input 50		42	Gray/Blue D	General-purpose input 58	
18	White/Red D	General-purpose input 51		43	White/Blue D	General-purpose input 59	
19	Yellow/Red D	General-purpose input 52		44	Yellow/Blue D	General-purpose input 60	
20	Pink/Red D	General-purpose input 53		45	Pink/Blue D	General-purpose input 61	
21	Orange/Red E	General-purpose input 54		46	Orange/Blue E	General-purpose input 62	
22	Gray/Red E	General-purpose input 55		47	Gray/Blue E	General-purpose input 63	
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:24V/12V(COM), Source type:0V(COM)

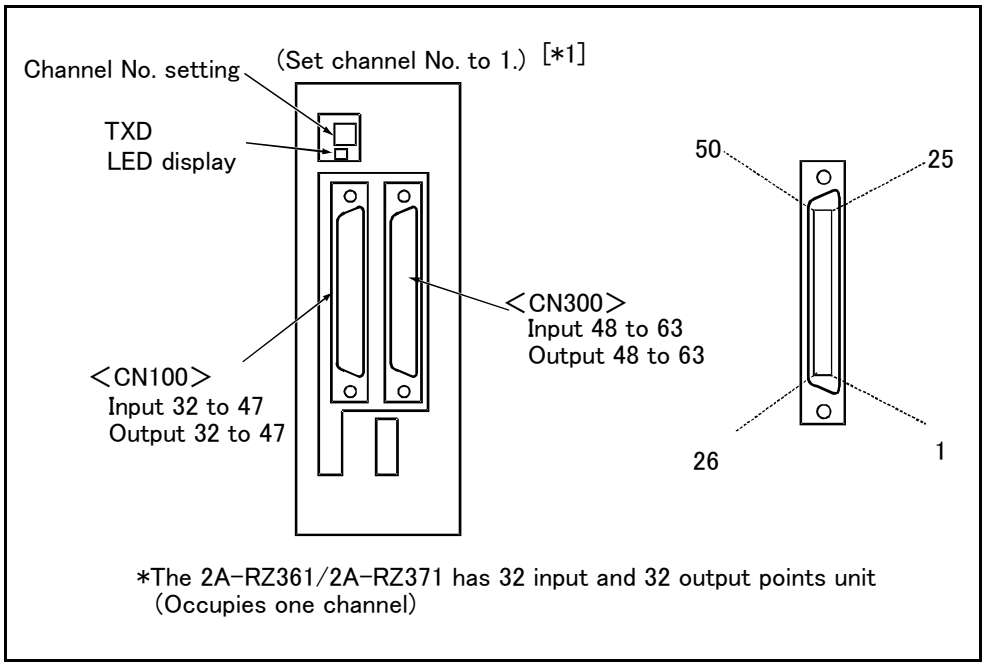


Fig.3-42 : Parallel input/output unit <2A-RZ361/2A-RZ371:First expansion> connection and pin layout

⚠ CAUTION [*1] For the 1st expansion unit, set the channel No. to "1".
The channel No. of 8 to F is used for the maker test. If any value of 8 to F is set, it may be dangerous since the robot unexpectedly moves. Don't set any value of 8 to F.

■ Parallel I/O interface (Second expansion unit)

Table 3-28 : 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 64		29	Yellow/Blue A	General-purpose output 68	
5	Pink/Red A	General-purpose output 65		30	Pink/Blue A	General-purpose output 69	
6	Orange/Red B	General-purpose output 66		31	Orange/Blue B	General-purpose output 70	
7	Gray/Red B	General-purpose output 67		32	Gray/Blue B	General-purpose output 71	
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 72		35	Pink/Blue B	General-purpose output 76	
11	Orange/Red C	General-purpose output 73		36	Orange/Blue C	General-purpose output 77	
12	Gray/Red C	General-purpose output 74		37	Gray/Blue C	General-purpose output 78	
13	White/Red C	General-purpose output 75		38	White/Blue C	General-purpose output 79	
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 64		40	Pink/Blue C	General-purpose input 72	
16	Orange/Red D	General-purpose input 65		41	Orange/Blue D	General-purpose input 73	
17	Gray/Red D	General-purpose input 66		42	Gray/Blue D	General-purpose input 74	
18	White/Red D	General-purpose input 67		43	White/Blue D	General-purpose input 75	
19	Yellow/Red D	General-purpose input 68		44	Yellow/Blue D	General-purpose input 76	
20	Pink/Red D	General-purpose input 69		45	Pink/Blue D	General-purpose input 77	
21	Orange/Red E	General-purpose input 70		46	Orange/Blue E	General-purpose input 78	
22	Gray/Red E	General-purpose input 71		47	Gray/Blue E	General-purpose input 79	
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:24V/12V(COM), Source type:0V(COM)

Table 3-29 : 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 80		29	Yellow/Blue A	General-purpose output 84	
5	Pink/Red A	General-purpose output 81		30	Pink/Blue A	General-purpose output 85	
6	Orange/Red B	General-purpose output 82		31	Orange/Blue B	General-purpose output 86	
7	Gray/Red B	General-purpose output 83		32	Gray/Blue B	General-purpose output 87	
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 88		35	Pink/Blue B	General-purpose output 92	
11	Orange/Red C	General-purpose output 89		36	Orange/Blue C	General-purpose output 93	
12	Gray/Red C	General-purpose output 90		37	Gray/Blue C	General-purpose output 94	
13	White/Red C	General-purpose output 91		38	White/Blue C	General-purpose output 95	
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 80		40	Pink/Blue C	General-purpose input 88	
16	Orange/Red D	General-purpose input 81		41	Orange/Blue D	General-purpose input 89	
17	Gray/Red D	General-purpose input 82		42	Gray/Blue D	General-purpose input 90	
18	White/Red D	General-purpose input 83		43	White/Blue D	General-purpose input 91	
19	Yellow/Red D	General-purpose input 84		44	Yellow/Blue D	General-purpose input 92	
20	Pink/Red D	General-purpose input 85		45	Pink/Blue D	General-purpose input 93	
21	Orange/Red E	General-purpose input 86		46	Orange/Blue E	General-purpose input 94	
22	Gray/Red E	General-purpose input 87		47	Gray/Blue E	General-purpose input 95	
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:24V/12V(COM), Source type:0V(COM)

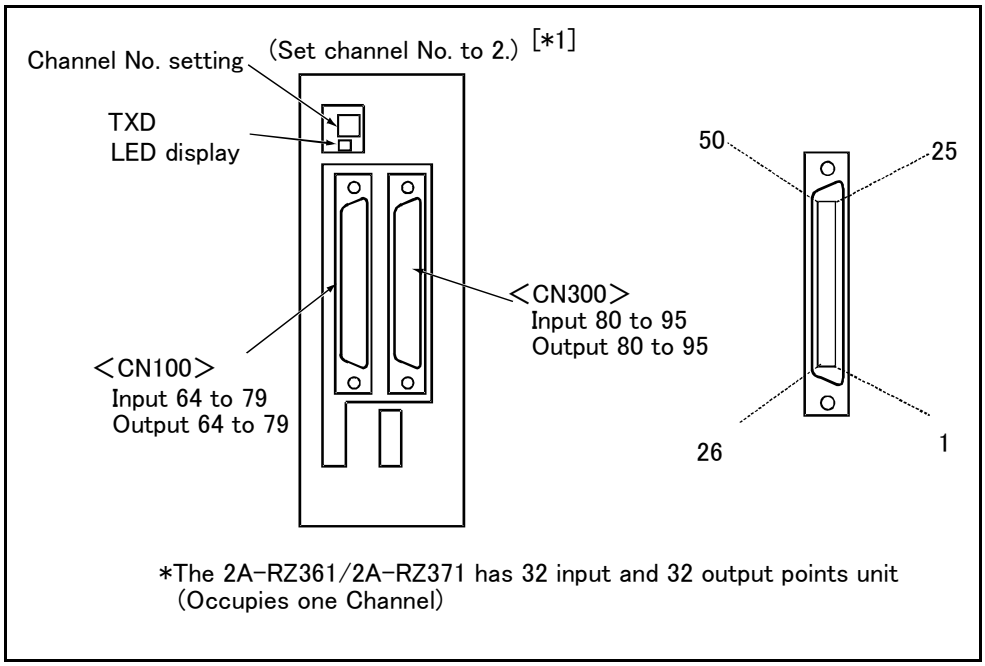


Fig.3-43 : Parallel input/output unit <2A-RZ361/2A-RZ371:Second expansion unit> connection and pin layout

⚠ CAUTION [*1] For the 2nd expansion unit, set the channel No. to "2".
The channel No. of 8 to F is used for the maker test. If any value of 8 to F is set, it may be dangerous since the robot unexpectedly moves. Don't set any value of 8 to F.

Table 3-30 lists the correspondence between the station numbers to be set and the I/O signal assignment. Refer to this table when the third and subsequent units are used.

Table 3-30 : Station Number Settings and I/O Signal Assignment

Unit No.	Station number setting	CN100	CN300
1st unit	1	Input: 32 ～ 47 Output: 32 ～ 47	Input: 48 ～ 63 Output: 48 ～ 63
2nd unit	2	Input: 64 ～ 79 Output: 64 ～ 79	Input: 80 ～ 95 Output: 80 ～ 95
3rd unit	3	Input: 96 ～ 111 Output: 96 ～ 111	Input: 112 ～ 127 Output: 112 ～ 127
4th unit	4	Input: 128 ～ 143 Output: 128 ～ 143	Input: 144 ～ 159 Output: 144 ～ 159
5th unit	5	Input: 160 ～ 175 Output: 160 ～ 175	Input: 176 ～ 191 Output: 176 ～ 191
6th unit	6	Input: 192 ～ 207 Output: 192 ～ 207	Input: 208 ～ 223 Output: 208 ～ 223
7th unit	7	Input: 224 ～ 239 Output: 224 ～ 239	Input: 240 ～ 255 Output: 240 ～ 255

(6) 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.
This cable can also be used to connect the parallel input/output connector that is supplied as standard equipment with the controller.

■ Configuration

Table 3-31 : 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 3-32 : 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 3-33 : 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

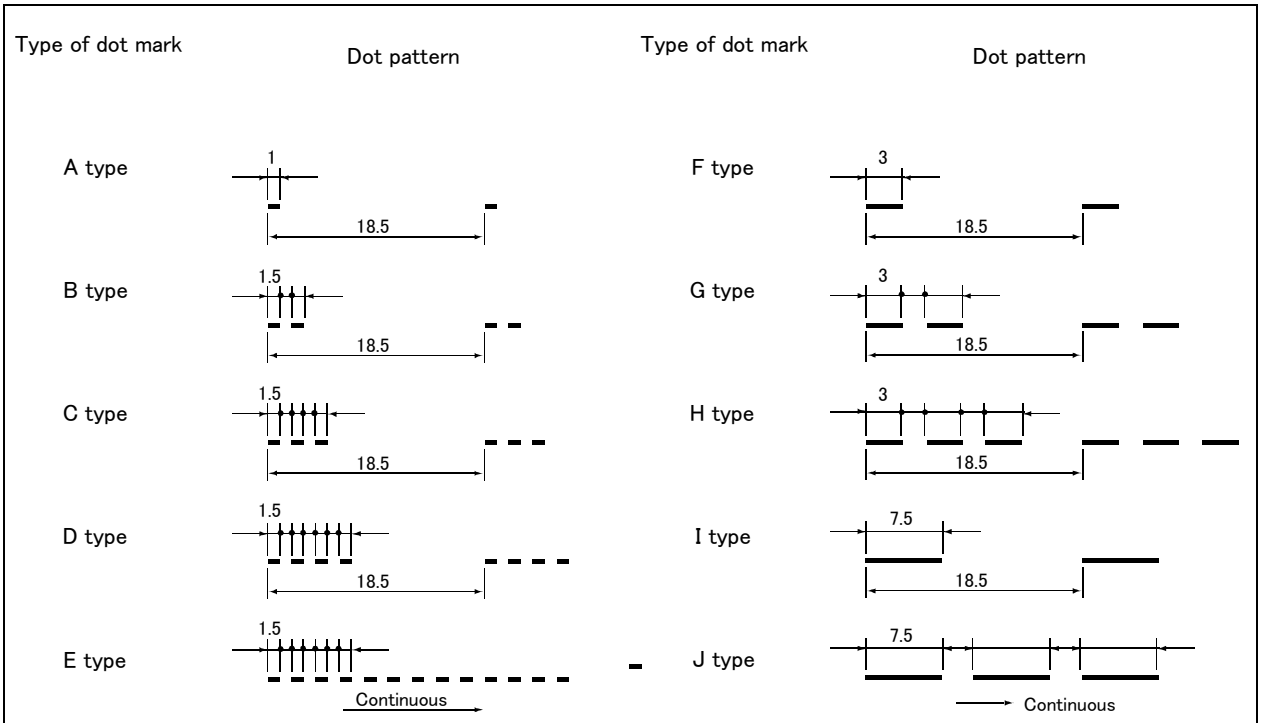
■ Connections and outside dimensions

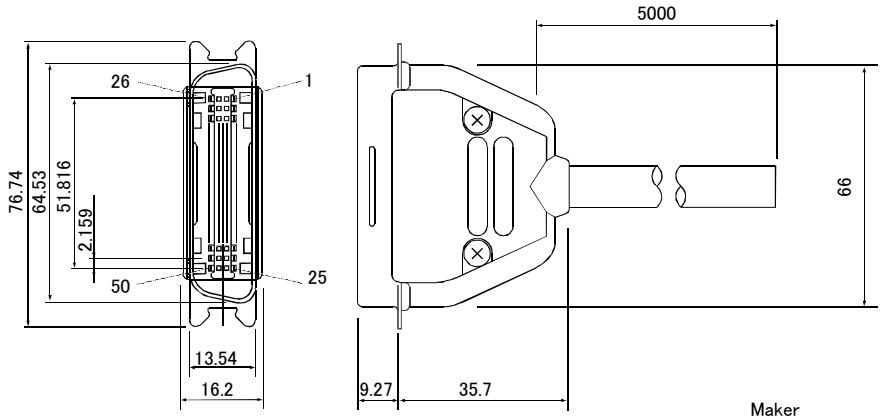
The sheath of each signal cable (50 lines) is color indicated and marked with dots. Refer to the cable color specifications in "Table 3-33: Connector pin numbers and cable colors" when making the connections.

(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





		Maker
Receptacle type (PCB side)	57AE-40500-21D(D8)	……DDK
Plug type (cable side)	57YE-30500-2(D8) Note1)	……DDK

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.3-44 : Connections and outside dimensions

(7) Personal computer cable

■ Order type: ● For PC/AT : RS-MAXY-CBL
RS-AT-RCBL (For expansion option box(CR1-EB3).)

■ Outline

This is the RS-232C interface cable used for connecting the controller with a personal computer. The personal computer on hand may be usable with the above interface cable. Confirm the connection specifications when placing an order.
Personal computer cables for the PC/AT compatible model is available.
The cable for the NEC PC9821 (half-pitch 14-pin) must be manufactured by the customer.
Use "RS-AT-RCBL" when you use expansion serial I/F with the expansion option box.

■ Configuration

Table 3-34 : Configuration device

Part name	Type	Qty.	Mass(kg) Note1)	Remarks
Personal computer cable (for PC/AT)	RS-MAXY-CBL	1pc.	4	3m, D-SUB 9 pin Note2)
	RS-AT-RCBL	1pc.	4	3m, D-SUB 9 pin For expansion serial I/F at expansion option box(CR1-EB3).

Note1)Mass indicates one set.
Note2)The personal computer cable is the same as that for use with "Movemaster M1/M2/E/EN series".

■ Specifications

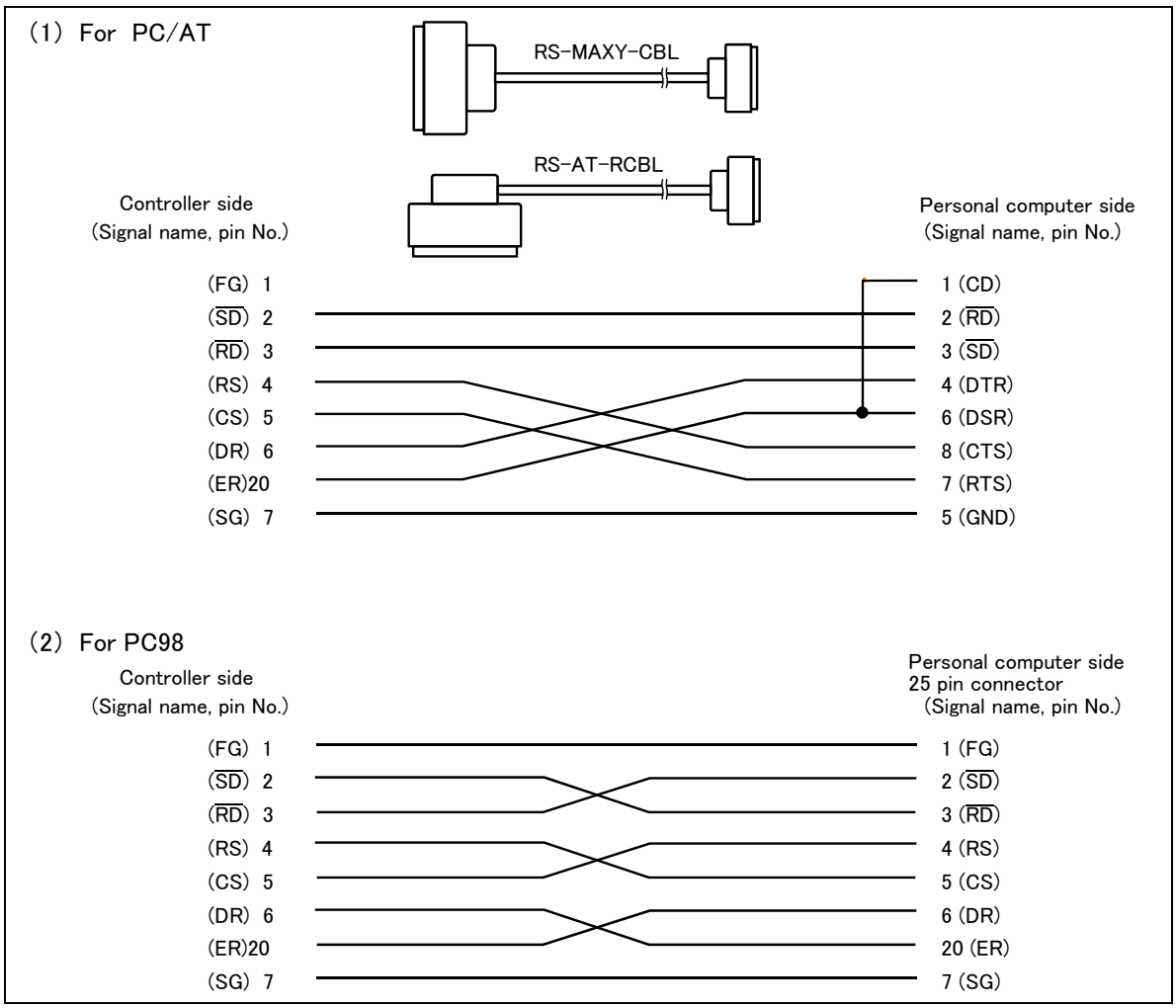


Fig.3-45 : Personal computer cabe connection

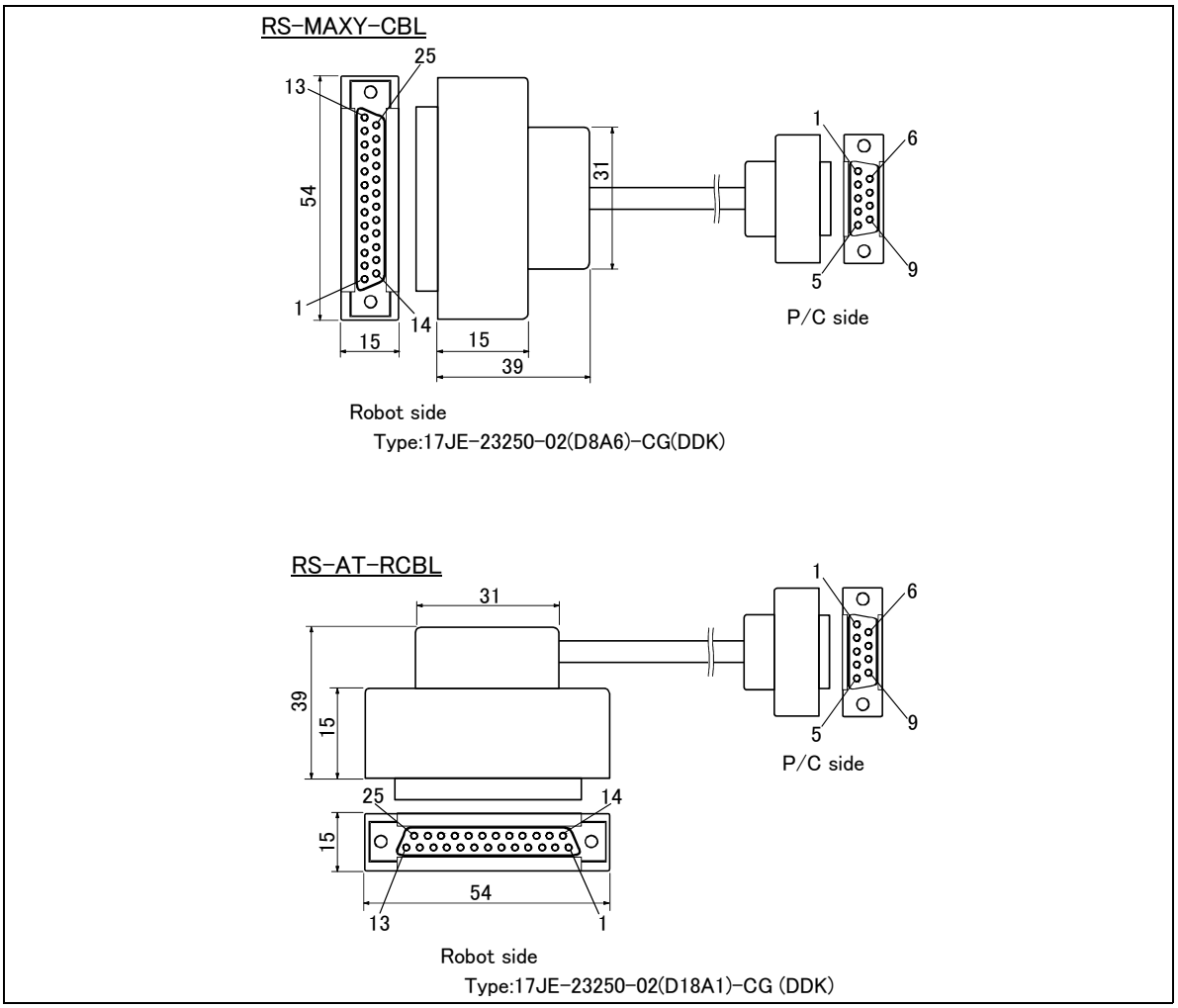


Fig.3-46 : Personal computer cabe connector

(8) Extended serial interface

■ Order type: ● 2A-RZ581-E

■ Outline

The extension serial interface is the option to add a serial communication function to the robot controller. One channel of RS-232C interface is provided in the front of the controller. By using the extension serial interface, more channels can be added in order to allow the use of a personal computer, vision sensor and PLC at the same time. Also, in addition to RS-232C communication, RS-422 communication, which is superior in noise resistance, is also supported.

The extended option box (CR1-EB3) is required separately(CR1-571 controller only).
Refer to Page 122, "(4) Expansion option box" for ditails.

Caution) 1)This option can only be used with the robot controller's main unit software version E1 or later.

2)It is now possible to install up to three expansion serial interface cards per controller from version B. In addition, the software version of the controller is K8 edition or later, the tracking function has been added

■ Configuration

Table 3-35 : Configuration device

Part name	Type	Qty.	Mass(kg)	Remarks
Extended serial interface	2A-RZ581?	1	0.6	The "?" show the version of card.
Instruction Manual	BFP-A8106	1	-	
Tracking Function Manual	BFP-A8524	1	-	Refer to this manual, if the tracking function is used.
Ferrite core	E04SR301334	4	-	Be sure to install this for noise countermeasure.

Table 3-36 : Procured by the customer

Part name	Type	Qty.	Remarks
Personal computer, vision sensor, etc.		From 1 unit.	Two channel per one board.
Communication cable (used when the length of the standard RS-232C cable is too short, or when RS-422 communication is implemented)	RS-232C or RS-422	From 1 cable.	

■ Specifications

Table 3-37 : Specifications

Item	Specifications	Remarks
Mountable optional slots	Slot 1 or 2	
Number of mountable interface cards	Maximum 2	
Number of channels	2	Channel 1: Dedicated to RS-232C Channel 2: Either RS-232C or RS-422
Communication data	ASCII data Note1)	
Communication baud rate	2400 / 4800 / 9600 / 19200	This has been set to "9600" at shipment.
Parity	Notiong / Odd/ Even	This has been set to "even" at shipment.
Stop bit	1 / 2	This has been set to "2" at shipment.
End code	CR code/ CR code + LF code	This has been set to "CR code" at shipment.
Protocol	Nonprocedural / Procedural / Data link Note2)	This has been set to "nonprocedural" at shipment.
Remarks	Capable of offering the same functions as provided by the standard RS-232C interface in the front of the controller	

Note1)Binary data communication is not supported.

Note2)Nonprocedural: Nonprocedural protocol with the personal computer support software

Procedural: Procedural protocol with the personal computer support software

Data link: Nonprocedural (ASCII data) protocol for data link between robot programs and a personalcomputer/PLC/vision sensor, etc.

Three cards can be installed on one controller.
(The communication line of maximum 6 channels cable connected.)

Table 3-38 : Difference by the card version

Type	Supporting software version		Rmarks
	From the E1 to K6	K7 or later	
RZ581A or earlier	△	△	Unrelated to the software version, up to two boards can be used. (Slot 1(OPY1)/ 2(OPT2))
RZ581B or later	△ (*1)	○	Up to three boards can be used, by using with version K7 or later. (Slot 1(OPY1)/ 2(OPT2)/ 3(OPT3))

△ : The option slot 1(OPT1) or 2(OPT2) is available. (Up to two boards can be used.)
○ : Every option slot is available. (Up to three boards can be used.)
(*1) Operation is compatible with RZ581A.

■ Functions

(1) Controller communication function

・This function allows to update and download programs as well as to monitor various statuses.

・The personal computer support software (sold separately) is available as a robot controller programming support tool. Refer to (9), Page 154, "(13) Personal computer support software/Personal computer support software mini" of details.

(2) Data link function

・The data link function allows to link numerical values and position data between robot programs and a personal computer using the MELFA-BASIC IV language (OPEN/PRINT/INPUT instruction).

・Data can be exchanged one to one by specifying the COM number at the communication open destination.

■ Pin assignment

(1) RS-232C pin assignment

Refer to Page 139, "(7) Personal computer cable".

(2) RS-422 pin assignment

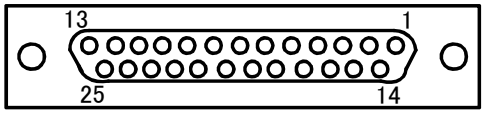


Fig.3-47 : D-SUB25 Pin Female Connector (RZ581 Board Side)

Pin no.	Abbreviated signal name	Signal name	Signal direction 2A-RZ581 ⇔ Device on other end
1	FG	Frame ground	———
7, 9	SG	Signal ground	———
13	TXD+(SDA)	Transmission data (+)	——→
25	TXD-(SDB)	Transmission data (-)	——→
11	DTR+(RSA)	Terminal ready (+)	——→
23	DTR-(RSB)	Terminal ready (-)	——→
12	RXD+(RDA)	Reception data (+)	←——
24	RXD-(RDB)	Reception data (-)	←——
10	DSR+(CSA)	Data set ready (+)	←——
22	DSR-(CSB)	Data set ready (-)	←——

(9) CC-Link interface

■ Order type: ● 2A-HR575-E

■ Outline

The CC-Link interface is the option 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.

The extended option box (CR1-EB3) is required separately(CR1-571 controller only). Refer to Page 122, "(4) Expansion option box" for ditails.

Caution) This option can only be used with the robot controller's main unit software version E1 or later.

■ Configuration

Table 3-39 : Configuration deviceon

Part name	Type	Qty.	Mass(kg) Note1)	Remarks
CC-Link interface	2A-HR575-E	1	0.32	
Instruction Manual	BFP-A8105	1	-	
Ferrite core	E04SR301334	2	-	Be sure to install this for noise countermeasure.

Note1)Mass indicates one set.

Table 3-40 : Procured by the customer

Part name	Type	Qty.	Remarks
Master station	QJ61BT11(Q series)	1	FX series products are not supported.
	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.

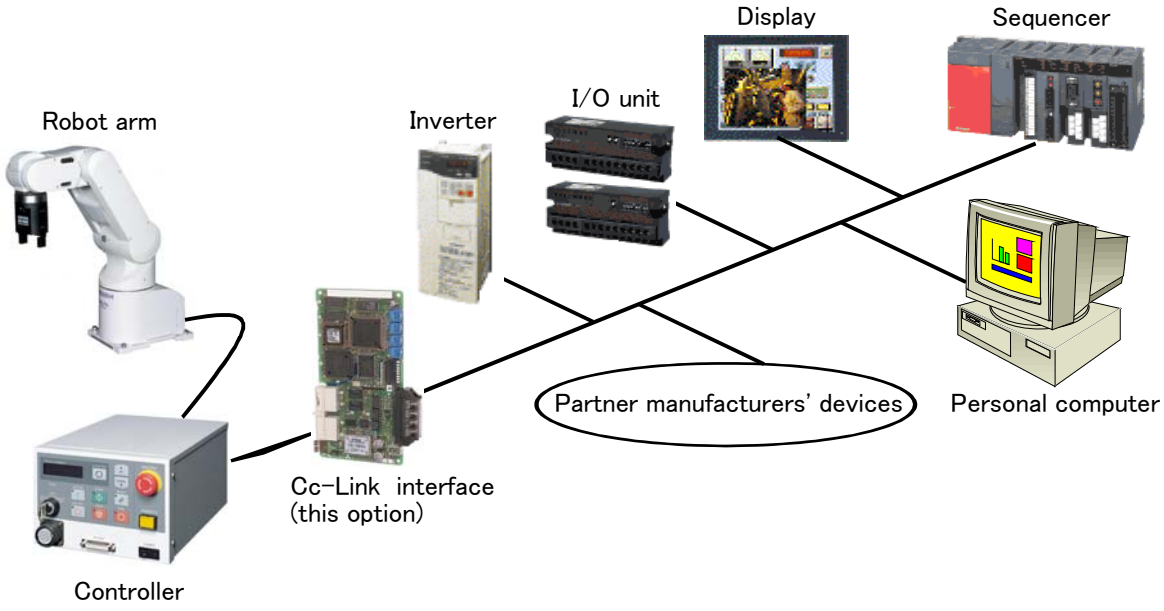


Fig.3-48 : Example of CC-Link Product Configuration

■ Specifications

Table 3-41 : 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
Mountable option slot			Slot 2 only		
Number of mountable CC-Link interface cards			1		Multiple CC-Link interface cards cannot be inserted. Note2)
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.
Number of occupied stations			One or four occupied stations can be set.		When four stations are occupied, continuous station numbers are used. The station numbers are set by a DIP switch.
Number of I/O points	Remote I/O	When one station is occupied	Input: 30 points	Output: 30 points	The last two points of 32 points cannot be used.
		When four stations are occupied	Input: 126 points	Output: 126 points	The last two points of 128 points cannot be used.
	Remote registers	When one station is occupied	Input: 4 registers	Output: 4 registers	One register consists of 16 bits.
		When four stations are occupied	Input: 16 registers	Output: 16 registers	

Note1)The CC-Link interface supports neither the transient transmission function nor the FX series.
Note2)This product cannot be used together with a PROFIBUS interface card.

■ Functions

(1) Communication function

- The number of usable points is 126 points maximum for bit control and 16 points maximum for word control.
- Up to 2,048 points of input bit data can be monitored by a unit being connected. (Input only, output is disabled.)
- Up to 256 points of input word data can be monitored by a unit being connected. (Input only, output is disabled.)

(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 IV (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.

(10) Ethernet interface

■ Order type: ● 2A-HR533-E

■ Outline

The Ethernet interface is the option to add an Ethernet communication function to the robot controller.

The extended option box (CR1-EB3) is required separately(CR1-571 controller only). Refer to Page 122, "(4) Expansion option box" for ditails.

Caution) This option can only be used with the robot controller's main unit software version E2 or later.
Also, compatible version differs for each function(CR1-571 controller only). Refer to "Table 3-46: Software Versions and Functions of the Controller" for details.

■ Configuration

Table 3-42 : Configuration deviceon

Part name	Type	Qty.	Mass(kg) Note1)	Remarks
Ethernet interface	2A-HR533-E	1	0.29	
Instruction Manual	BFP-A8108	1	-	
Ferrite core	E04SR301334	1	-	Be sure to install this for noise countermeasure.

Note1)Mass indicates one set.

Table 3-43 : Procured by the customer

Part name	Type	Qty.	Remarks
Personal computer (A network interface is required.)	Windows 95/98/Me/NT 4.0/2000/XP compatible. Installed with TCP/IP network functions, including Linux OS (However, operation has not be verified.)	From 1 unit.	
Ethernet cable (Select either straight cable or cross cable depending on the connection mode.)	10BASE-T or 10BASE-5	From 1 cable.	

Table 3-44 : Items required as needed

Part name	Type	Qty.	Remarks
Hub (Required for use in LAN environment)	(Commercially sold)	1	
Windows compatible robot controller programming support tool for Mitsubishi CRn-500 series controllers	(Separately sold) Personal computer support software	1	
Windows compatible development tool	(Commercially sold) Microsoft Visual C++, Visual Basic, etc.	1	

■ Specifications

Table 3-45 : Specifications

Item	Specifications	Remarks
Mountable optional slots	Slot 1 only	
Number of mountable interface cards	1	
LAN interface	10BASE-T or 10BASE-5(changeover type)	
Transmission speed	10Mbps	
Connector specification	RJ-45	

A personal computer and the robot controller that communicates with that personal computer must be located on the same network. They cannot communication with each other crossing a firewall (from the Internet) or gateway (from another adjacent network, etc,). If such form of communication must be implemented, consider communicating via a server connected to the same network as that of the robot controller. Be cautious about safety and response performance in this case.

■ Functions

(1) Controller communication function

・This function allows communication with the robot controller via Ethernet.
(Program upload/download, status monitoring, etc.)
The personal computer support software (sold separately) is available as a robot controller programming support tool.

・This function allows communication with a maximum of 16 clients on other end.

(2) Data link function

・The data link function allows to link numerical values and position data between robot programs and a personal computer using the MELFA-BASIC IV language (OPEN/PRINT/INPUT instruction).

・Data can be exchanged one to one by specifying the COM number at the communication open destination.

・This function allows to communicate with up to eight applications of clients on other end by changing COM numbers.

・Either server mode or client mode can be selected as the TCP/IP function.

・The customer needs to write application programs on the personal computer side.

(3) Real-time external control function

・The real-time external control function loads the position command data and performs operation in control cycle units of the robot. The joint, orthogonality and motor pulse can be specified as the position data. Also, this function monitors I/O signals and outputs signals at the same time.

・The data that can be monitored include the encoder feedback values, current command, and current feedback of the position data type mentioned above.

・This function is valid only for the following models:

RP-1AH/3AH/5AH series
RV-1A series
RV-2A/3AJ series
RV-4A/5AJ/3AL/4AJL series
RH-5AH/10AH/15AH series
RV-6S/6SL/12S/12SL series
RV-6SD/6SDL/12SD/12SDL series
RV-3S/3SJ/3SB/3SJB series

・In order to control the robot, an application program on the personal computer side must be created by the customer. It must communicate one to one.

Table 3-46 : Software Versions and Functions of the Controller

Software version of the robot controller	Controller communication function	Data link function (server)	Data link function (server/client)	Real-time external control function
Versions A*, B*, C*, D* and E1	The Ethernet option is disabled.			
Versions E2 to E4	○	○	×	×
Versions F*, G* and H1 to H6	○	○	×	○
Versions H7 and later	○	○	○	○

○ ..... Can be used.
× ..... Cannot be used.

(11) Additional axis interface

■ Order type: ● 2A-RZ541-E

■ Outline

The additional axis interface is an interface, which uses the general-purpose servo amplifier of Mitsubishi and the corresponding servomotors in order to allow the plural above servomotors to be controlled from the robot controller.
The extended option box (CR1-EB3) is required separately(CR1-571 controller only).
Refer to Page 122, "(4) Expansion option box" for ditails.

Caution) Additional axis interface can be used with a robot controller software version of G9 or later.

Servo systems that can be used with the additional axis interface are shown in Table 3-47.

Table 3-47 : Applicable servo systems

Servo amplifier name	Type	Maker name
MELSERVO-J2-Super series Note1)	MR-J2S- □ B (ABS must be designated.)	Mitsubishi Electric

Note1) The J2-Super Series servo amplifiers, use the servo amplifiers with software version of B0 or later.

■ Configuration

Table 3-48 : Configuration deviceon

Part name	Type	Qty.	Mass(kg) Note1)	Remarks
Additional interface	2A-RZ541-E	1	0.29	
Instruction Manual	BFP-A8107	1	-	
Ferrite core	E04SR301334	2	-	Be sure to install this for noise countermeasure.

Note1)Mass indicates one set.

The products necessary in addition to the additional axis interface are listed in Table 3-49.
For these main products, refer to "Instruction Manual for Servo Amplifier and Servomotor".

Table 3-49 : Procured by the customer

Part name	Type	Qty.	Remarks
Servo amplifier, servomotor, option, peripheral device	Refer to "Instruction Manual for Servo Amplifier and Servomotor".	-	
Battery (for absolute position detection system)	MR-BAT or A6BAT	Amplifier quantity	
Setup software (For setup the parameter of servo amplifier and the graph indication, etc.)	MRZJW3-SETUP131 if the MELSERVO-J2-Super is used. MRZJW3-SETUP41 or later if the MELSERVO-J2-B is used.	1	
Communication cable (Communication cable between personal computer and servo amplifier for setup software)	MR-CPCATCBL3M	1	
Bus cable between controller and amplifier (Exclusive cable for communication between controller and servo amplifier)	MR-J2HBUS □ M (Cable length in : 0.5, 1 and 5 [m]) Note) The MR-J2HBUS □ M-A can't be used, caution.	1	
Terminator	MR-A-TM	1	
Bus cable between amplifier and amplifier (Exclusive cable for communication between servo amplifier and servo amplifier)	MR-J2HBUS □ M (Cable length in : 0.5, 1 and 5 [m])	Amplifier quantity-1	

■ Specifications

Table 3-50 : Specifications

Item	Specifications	Specification of user mechanism
Number of controllable robots (mechanisms)	3	
Number of control axes (total)	8 axes	
Number of control axes (for each mechanism)	2 axes	3 axes
Applicable amplifier	MELSERVO-J2-Super series	
Applicable encoder	ABS method only (absolute value encoder)	
Communication method	SSCNET (differential communication) of Mitsubishi	
Mountable optional slots	Slot 1 or 3	
Number of mountable interface cards	1	
Control function	Synchronous interpolation control	
Path control method	CP control/PTP control	PTP control
Acceleration/deceleration	The trapezoidal method/acceleration/deceleration time pattern can be set.	
Position control	Distance control/angle control can be selected. Actual value control with pitch/deceleration ratio setting	
Minimum command value	0.01mm or 0.001mm (can be changed by a parameter)	
Maximum motion range	Max. .80000.00(0) deg. to +80000.00 (0) deg.	

■ Functions

(1) Additional robot axis function

- The robot controller can control a maximum of 2 axes such the travel axis, etc., as the 7th and 8th axes of the robot arm.
- Additional axes are controlled in such a way that they start moving and stop simultaneously with the standard robot axes.

(2) Multi-mechanism function

- The robot controller can control user-created mechanisms, such as a rotation axis and a linear driving axis, for up to 2 units as multi-mechanisms.
- The robot controller controls multi-mechanisms independent of the standard robot axes (asynchronous control). It can control up to 3 axes of user-created mechanisms per unit.

(3) Programming language

- The additional axes can be programmed with MELFA-BASICIV language method and MOVEMASTER command method.
- User-created mechanisms can only be controlled using the MELFA-BASIC IV language.

(12) Extension memory cassette
(CR2B-574/CR3-535M controller only)

■ Order type: ● 2A-HR432

■ Outline

Used to increase the total number of teaching points in the robot program.

■ Configuration

Table 3-51 : Configuration device

Part name	Type	Qty.	Mass(kg)	Remarks
Extension memory cassette	2A-HR432	1	0.08	27,900 total teaching points With a battery backup feature

■ Specifications

Table 3-52 : Specifications

Items	Specifications	Remarks
External dimensions	Approx. 95(W)X65(D)X15(H) mm	Excluding the connection connector
Mass	Approx. 0.2 kg	
Connection method	Connection using a special connector	
Memory size Note1)	Teaching point number: 25,400 Steps number: 50,800 Program number: 100	The battery backup function is provided. Together with 2,500 points of standard teaching positions, the total number of teaching positions is 27,900 points.
Backup	Backup using the controller's internal battery	

Note1) As for the standard 2,500 points, after adding an expansion memory cassette, the information in all backup memory areas in the controller is copied into the expansion memory cassette. Therefore, please note that if the expansion memory cassette is removed after it has been added, there will be no program left in the controller.

[CAUTION]

・Inserting and removing the memory cassette

A memory cassette cannot be inserted or removed while the control power is on. Please turn off the control power before handling the memory cassette to avoid destroying the memory information in the cassette.

・Memory backup

Retaining the contents of memory in a memory cassette is not covered by the warrantee when the memory cassette is removed from the control unit. Nonetheless, memory is retained under the following conditions.

(Conditions) If the power has been on for at least a half-hour before the power is turned off and the cassette is removed, the contents of memory can be retained for approximately one hour. (Not covered by the warrantee.)

■ Installation

<When using the CR2B-574 controller>

The installation method to the CR2B-574 controller is shown below.

1) Completely back up the memory information in the robot controller using the personal computer support software. (This must be performed as a preventive measure in case the contents of the internal memory are destroyed while inserting a memory cassette.)
2) Turn off the controller power.
3) Remove the dust-proof cover installed in the rear of the controller.
4) Install the attached fixing plate of memory cassette with the screw which fixed the dust-proof cover.
5) Attach a memory cassette to the controller.
   - As shown in Fig. 3-49, insert the memory cassette all the way to the back with the " ▲L " facing up.
   - Securely tighten the fixing screws.

   Note) Be careful not to over-tighten the screws, as it may deform the memory cassette.
6) Turn on the controller power.
   Error C.0023 will occur when using the software version J1 edition.
   Press the reset button to clear the error.

   At this point, a new file system has been created in the memory cassette.

[CAUTION]

The programs that are stored in the control unit will be copied into the memory cassette; they will be deleted from the memory in the control unit. Please be careful not to remove the memory cassette, since if you remove it, there will be no program information residing in the controller (the information is in the memory cassette). Although the program information (****.MB4) is copied into the memory cassette, the parameter information (****.PRM) is still stored in the control unit.

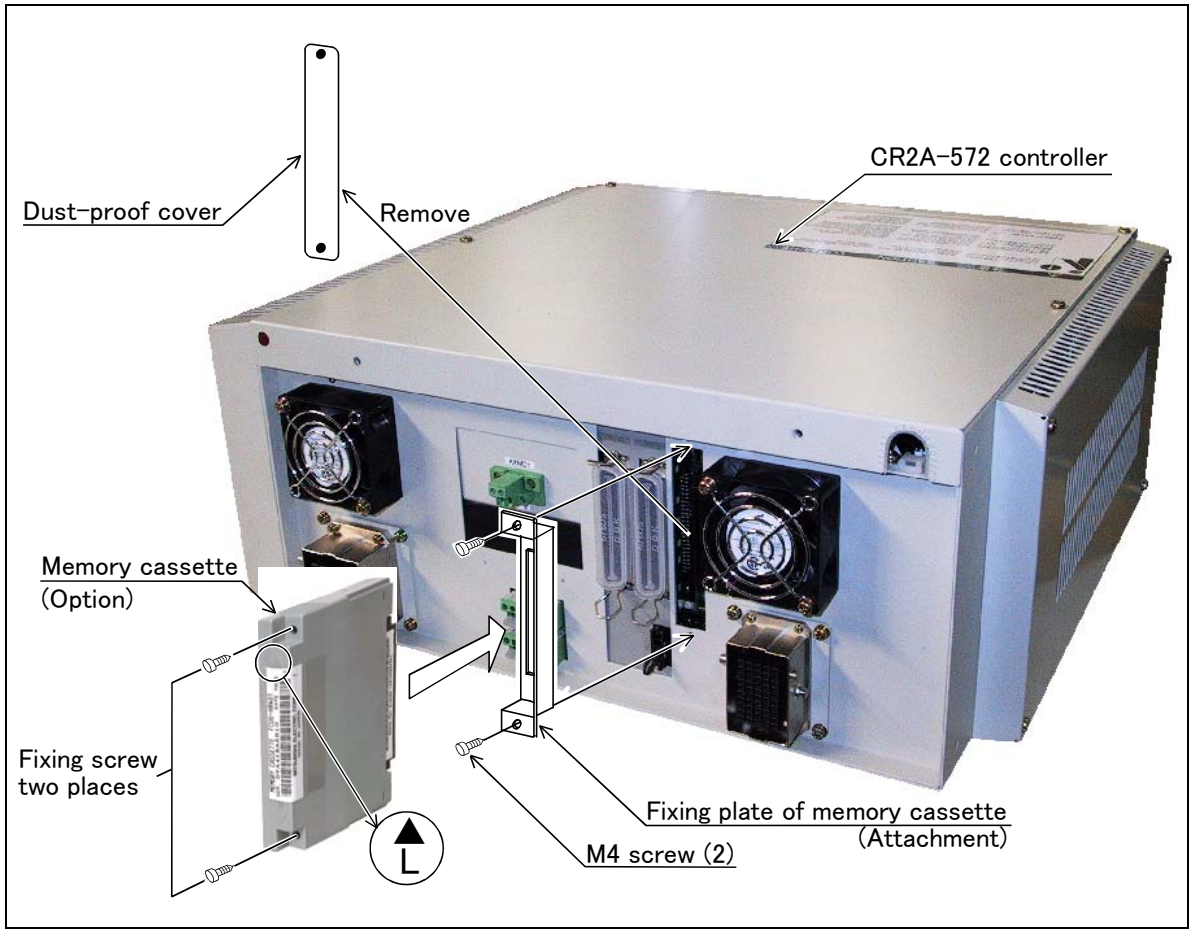


Fig.3-49 : Installation method of extension memory cassette

<When using the CR3-535M controller>

The following describes a sample installation to the R6x2CPU.

7) Completely back up the memory information in the robot controller using the personal computer support software. (This must be performed as a preventive measure in case the contents of the internal memory are destroyed while inserting a memory cassette.)

8) Turn off the control power.

⚠ CAUTION Turn off the primary power.
Failure to observe this could lead to electric shock accidents.

9) Open the controller front door.

10) Attach a memory cassette to the control unit.

- As shown in Fig. 3-50, insert the memory cassette all the way to the back with the " ▲R " facing up.
- Securely tighten the fixing screws.

Note) Be careful not to over-tighten the screws, as it may deform the memory cassette.

11) Turn on the control power.

Error C.0023 will occur when using the software version J1 edition.
Press the reset button to clear the error.

At this point, a new file system has been created in the memory cassette.

[CAUTION]

The programs that are stored in the control unit will be copied into the memory cassette; they will be deleted from the memory in the control unit. Please be careful not to remove the memory cassette, since if you remove it, there will be no program information residing in the controller (the information is in the memory cassette). Although the program information (****.MB4) is copied into the memory cassette, the parameter information (****.PRM) is still stored in the control unit.

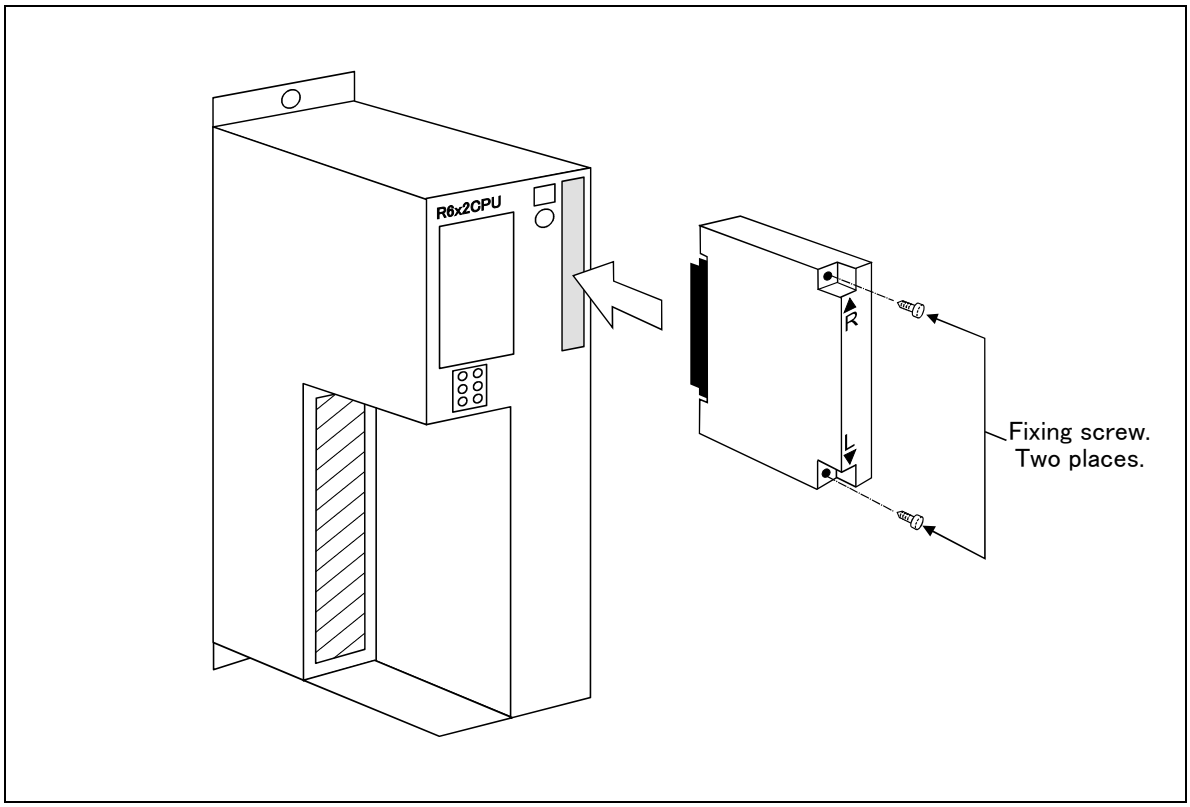


Fig.3-50 : Installation of extension memory cassette

(13) Personal computer support software/Personal computer support software mini (MELSOFT RT ToolBox)

■ Order type : ● Personal computer support software
*For windows CD-ROM : 3A-01C-WINE
● Personal computer support software mini
*For windows CD-ROM : 3A-02C-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 (remote 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. Select according to the required application.

■ Configuration

Table 3-53 : Product configuration

Part name	Type	Medium	Mass(kg) Note1)	Remarks
Personal computer support software	3A-01C-WINE	CD-ROM	0.12	One operation manual included
Personal computer support software mini	3A-02C-WINE	CD-ROM	0.12	One operation manual included

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) Increased maintenance efficiency with remote maintenance function
With remote operations over a telephone line, the robot's operation status can be monitored without going to the site. Losses incurred while moving to the site can be reduced, and the time required to investigate the trouble and determine measures to be taken can be shortened.

(4) 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.
Note) The maintenance forecast function is supported by Personal Computer Support Software Version E1 or later.

(5) 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.
Note) The position recovery support function is supported by Personal Computer Support Software Version F1 or later.

■ Functions

Table 3-54 : Functions

Function		Functional existence[Note1)]		Details
Compatible model		○	○	Personal computer running Microsoft Windows98/2000/NT 4.0/Me/XP.
Program editing functions	Editing functions	○	○	・MELFA BASIC IV 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) ・Tact time measurement[Note2)]
Simulation function[Note3)]		○	×	・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 (position, speed, current, load, power)
Maintenance function		○	○	・Parameter setting ・Batch, divided backup
Remote maintenance function		○	○	・Monitoring and maintenance of robot state at remote site using telephone line. (A separate modem is required for this function.)

Personal computer support software mini (3A-02C-WINE)

Personal computer support software (3A-01C-WINE)

Note1)The functions included with the personal computer support software and the personal computer support software mini are shown below. ○ : Function provided × : Function not provided

Note2)When using the "personal computer support software mini", connect with the controller and measure.

Note3)A simulation function is available only with "MELFA-BASIC Ⅳ".

(14) Instruction Manual(bound edition)

■ Order type : ● 4S-MAP-107 : In the case of CR1B-571 controller
● 4S-MAP-108 : In the case of CR2B-574 controller
● 4S-MAP-109 : In the case of CR3-535M controller

■ Outline

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

■ Configuration

Table 3-55 : Product configuration

Part name	Type	Mass(kg)	Specifications
RH-6SH series			
Instruction Manual(CR1B-571 controller version)	4A-MAP-107	2.2	Instruction manual set for the CR1B-571 controller
Safety Manual	BFP-A8006		Items relating to safety in handling the robot
Standard Specifications	BFP-A8416		Specification of the robot arm and controller
Robot Arm Setup & Maintenance	BFP-A8417		Installation method of the robot arm, jog operation, and maintenance and inspection procedures
Controller Setup, Basic Operation and Maintenance	BFP-A8054		Installation method of the controller, basic operation, and maintenance and inspection procedures
Detailed Explanation of Functions and Operations	BFP-A5992		Functions of the controller and T/B, operation method, and explanation of MELFA-BASIC Ⅳ
Troubleshooting	BFP-A5993		Causes of errors occurred and their countermeasures
RH-6SH/12SH/18SH series			
Instruction Manual(CR2B-574 controller version)	4A-MAP-108	2.2	Instruction manual set for the CR2B-574 controller
Safety Manual	BFP-A8006		Items relating to safety in handling the robot
Standard Specifications	BFP-A8416		Specification of the robot arm and controller
Robot Arm Setup & Maintenance	BFP-A8417		Installation method of the robot arm, jog operation, and maintenance and inspection procedures
Controller Setup, Basic Operation and Maintenance	BFP-A5991		Installation method of the controller, basic operation, and maintenance and inspection procedures
Detailed Explanation of Functions and Operations	BFP-A5992		Functions of the controller and T/B, operation method, and explanation of MELFA-BASIC Ⅳ
Troubleshooting	BFP-A5993		Causes of errors occurred and their countermeasures
RH-12SH/18SH series			
Instruction Manual(CR3-535M controller version)	4A-MAP-109	2.4	Instruction manual set for the CR3-535M controller
Safety Manual	BFP-A8006		Items relating to safety in handling the robot
Standard Specifications	BFP-A8416		Specification of the robot arm and controller
Robot Arm Setup & Maintenance	BFP-A8417		Installation method of the robot arm, jog operation, and maintenance and inspection procedures
Controller Setup, Basic Operation and Maintenance	BFP-A8324		Installation method of the controller, basic operation, and maintenance and inspection procedures
Detailed Explanation of Functions and Operations	BFP-A5992		Functions of the controller and T/B, operation method, and explanation of MELFA-BASIC Ⅳ
Troubleshooting	BFP-A5993		Causes of errors occurred and their countermeasures
Additional axis interface	BFP-A8107		Functions and operation method of the additional axis interface

3.11 Maintenance parts

The consumable parts used in the controller are shown in Table 3-56. 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 3-56 : Contloller consumable parts list

No.	Part name	Type Note1)	Qty.	Usage place	Manufacturer
CR1B-571 controller					
1	Lithium battery	ER6	1	RZ182 card	Mitsubishi Electric System & Service;Co.,Ltd
2	Filter		1	Bottom of the controller	
CR2B-574 controller					
3	Lithium battery	ER6	1	Control unit	Mitsubishi Electric System & Service;Co.,Ltd
4	Filter		1	Bottom of the controller	
CR3-535M controller					
5	Lithium battery	ER6	1	Control unit	Mitsubishi Electric System & Service;Co.,Ltd
6	Fan (40 square)		5	Amplifier unit Converter unit	
7	Fan (90 square)		1	Inside of the controller	
8	Filter		1	Rear of the controller	

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 IV are given in Table 4-1.

Table 4-1 : The available new functions in MELFA-BASIC IV

Class	Command example	Function
Robot Status Variable	P_TOOL	keep current tool length
	M_SPD	keep current speed (linear/circular interpolation)
Built-in functions	ABS	Produces the absolute value
	VAL	Converts a character string into a numeric value
	ATN	Calculates the arc tangent
	STR$	Converts the numeric expression value into a decimal character string
	ZONE	Check current position area
Operation function	P1=P1*P2	Relative calculation of position data
	M1=M1*M2	Multiplication of numerical variable
	P1.X=10	Operation of the position element data
Conditional branching	SELECT CASE	More than one condition branch
	ON GOSUB	Condition branch by the value
	WHILE WEND	Repeat with condition
Optimum acceleration/ deceleration control	LOADSET	Load condition setting
	OADL	valid/invalid setting for the optimum acceleration/deceleration
Float control (compliance in the XYZ coordinate system)	CMP POS	Compliance control
	CMPG	Force control
Parallel execution (Multitask)	XRUN, XSTP, XRST, XLOAD, XCLR	Parallel executions of another task, the stops, the resets the clear, and, the loads
Conveyor trucking [Special specification]	TRKON, TRKOFF	Valid/invalid of the trucking
	TRBASE	Setting the base coordinate for the trucking
Impact detection Note1)	COLCHK	Set to enable/disable the impact detection.
	COLLVL	Set the detection level of the impact detection.
Singular point passage	MVS P1 TYPE 0,2	Pass a singular point using linear interpolation.

Note1) The impact detection function at jog operation of this robot is enabled at shipment. This function can be enabled at automatic operation as well by setting the parameters appropriately.

(1) MELFA-BASIC Ⅳ commands

Table 4-2 : List of MELFA-BASIC IV 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
		ets 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
		Designates the positioning completion conditions with a No. of pulses.	FINE 200
		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
Program control	Branching	Branches unconditionally to the designated place.	GOTO 120
		Branches according to the designated conditions.	IF M1=1 THEN GOTO 100 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 100,200,300
		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

Type	Class	Function	Input format (example)
Program control	Impact detection	Set to enable/disable the impact detection.	COLCHK ON/OFF
		Set the detection level of the impact detection.	COLLVL 100,80,,,,,,
	Subroutine	Executes the designated subroutine. (Within program)	GOSUB 200
		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 100,200,300
	Interrupt	Defines the interrupt conditions and process.	DEF ACT 1, M1=1 GOTO 100
		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 100
		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
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 FNTASU(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

(1) List of parameters

show the main parameter in the Table 4-3.

Table 4-3 : 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 8.
	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 eight types of area can be designated.
	AREA1P1 : AREA8P1	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 : AREA8P2	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 : AREA8ME	Designate which mechanism to use the eight types of set area. The mechanism No. to use is set with 1 to 8
	AREA1AT : AREA8AT	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 desig-nation	INB	Change the dedicated input (stop) between the A contact and B contact.
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.Note1) 表示言語 Note1)	LNG	Change the language to display on the LCD display of teaching pendant. ティーチングボックスの表示 LCD などに表示する言語を切り替えます。

Note1)The procedure of Language as shown in "(2) Change the display language / 表示言語の切り替え".
注 1) 表示言語切り替え方法の詳細を "(2) Change the display language / 表示言語の切り替え" に示します。

(2) Change the display language / 表示言語の切り替え

The language to display on the LCD display of teaching pendant can be changed by "the display language parameter". (Japanese or English)

Show the details of the parameter in the Table 4-3. Refer to the separate "Instruction Manual/Detailed Explanation of Functions and Operations" for details on changing the parameter.

The parameter is set up based on the order specifications before shipment. Order to dealer when the instruction manual of the other language is necessity.

More, the caution seals that stuck on the robot arm and the controller are made based on the language of the order specification. Use it carefully when selecting the other language.

表示言語設定パラメータによって、ティーチングボックスの表示 LCD などに表示する言語を切り替えることができます。(日本語、または英語) Table 4-3 にそのパラメータの詳細を示します。パラメータの変更方法は、別冊の「取扱説明書／機能と操作の詳細解説」を参照願います。

なお、出荷時はご注文仕様に基づき弊社で設定いたします。別の言語の取扱説明書をご希望の場合はご用命願います。

また、ロボット本体とコントローラに貼り付けてある注意シールは、ご注文仕様に基づいた言語で製作いたします。本パラメータを変更して言語を切り替えてご使用の場合はご注意願います。

Table 4-4 : Display language parameter / 表示言語設定パラメータ

Parameter パラメータ	Parameter name パラメータ名	No. of arrays No. of characters 配列数 文字数	Details explanation 内容説明	Default setting 出荷時設定
Display language 表示言語設定	LNG	Character string 1 文字列 1	Set up the display language. "JPN" : Japanese "ENG" : English The following language is changed. (1)The display LCD of teaching pendant. (2) Personal computer support software. *alarm message of the robot. *Parameter explanation list. (3)Alarm message that read from the robot with external communication. (Standard RS232C, Extended serial I/F, Ethernet I/F) 表示言語を設定します。 "JPN" : 日本語表示 "ENG" : 英語表示 以下に示す表示言語が変更されます。 (1) ティーチングボックスの表示 LCD (2) パソコンサポートソフトウェア ・ロボットのアラームメッセージ ・パラメータ説明リスト (3) 外部通信でロボットから読み出したアラームメッセージ (標準 RS232C、増設シリアルインタフェース、イーサネットインタフェース)	1

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.
Extended serial interface	Explains the specifications, functions and operations of the expansion serial interface optional.

CC-Link interface	Explains the specifications, functions and operations of the CC-Link interface optional.
ETHERNET interface	Explains the specifications, functions and operations of the ETHERNET interface optional.
Additional axis interface	Explains the specifications, functions and operations of the additional axis interface optional.
PROFIBUS interface	Explains the specifications, functions and operations of the PROFIBUS interface optional.
Personal computer Support software	Explains the specifications, functions and operations of the Personal computer Support software optional.

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		Command	Functions	Usage method
Input	External emergency stop	(Input signal)	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.
	Stop	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	In servo ON	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	ERRRESET	Outputs when an alarm occurs in the robot.	The alarm state is shown and alerted with the display lamps.

[Caution] The external emergency stop input is prepared as a b contact 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 "Fig. 6-1 Example of safety measures" for details.

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.

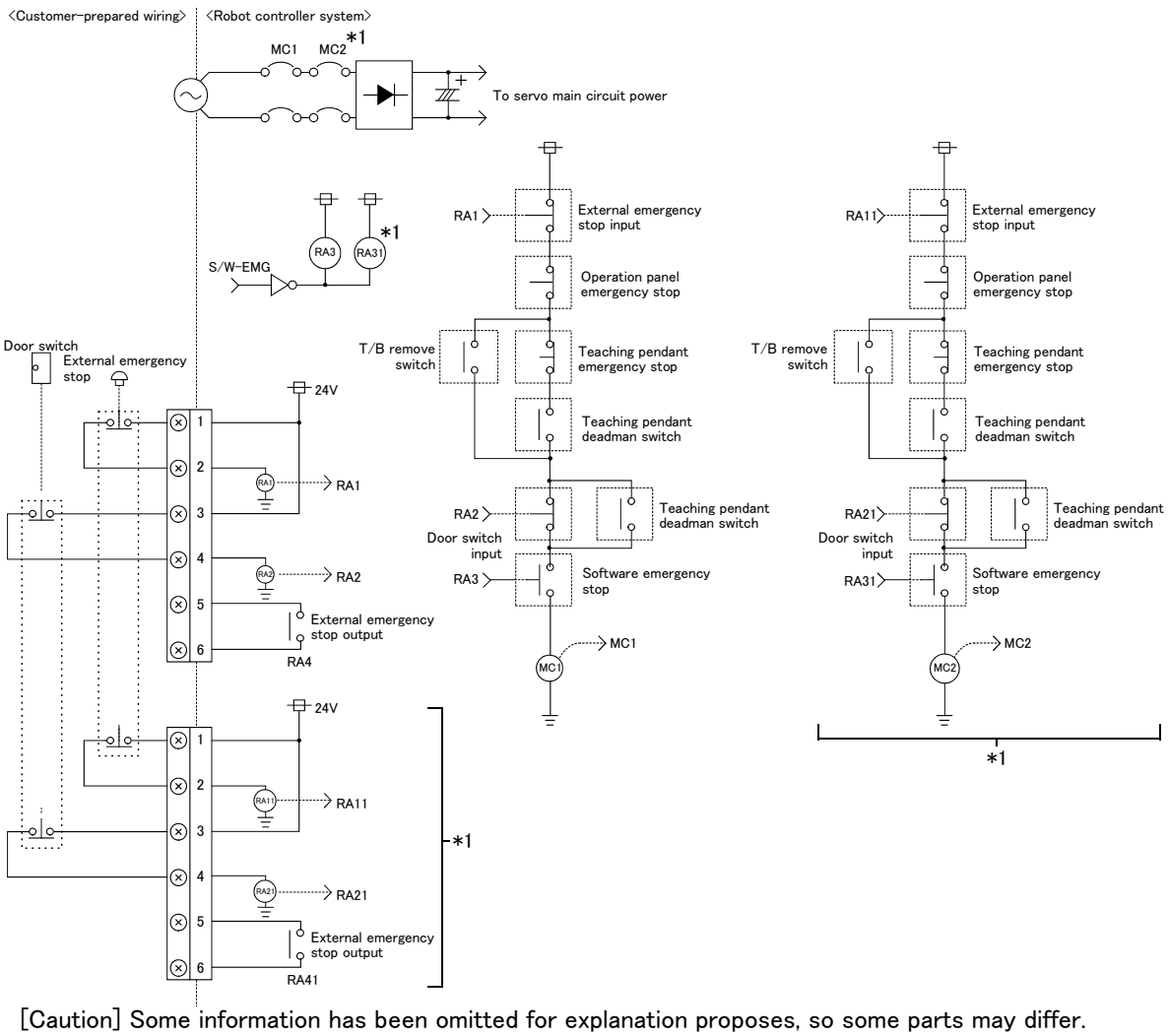
If operation is required, take measures to prevent hazards caused by unintentional or mistaken operations.

(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

Emergency stop input circuits are prepared on the user wiring terminal block of the controller. Create a circuit as shown below for safety measures

.



[Caution] Some information has been omitted for explanation proposes, so some parts may differ.
The area indicated with *1 is a circuit added in the case of CR2B-574 controller.

Fig.6-1 : Example of safety measures

(1) In the case of CR2B-574/CR2-535M controller, use the 2-contact type for all the switches.
(2) Install a limit switch on the safety fence's door. With a constantly open contact (a contact), 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 b-contact (a 2b-contact in the case of CR2B-574/CR3-535M controller) 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 Fig. 6-1. Note that there are limits to the No. of switch contacts, capacity and cable length, so refer to the following and install.

- Switch contact ..... In the case of CR2B-574/CR3-535M controller, prepare a 2-contact type.
- Switch contact capacity..... Use a contact that operates with a switch contact capacity of approx. 1mA to 100mA/24V.
- Cable length..... The length of the wire between the switch and terminal block must be max. 15m or less.
- Emergency stop output capacity..... Set it within 300 mA/24 VDC.
  Connecting an external device outside of the above range will cause a controller failure.

[Reference] The specifications of the RA1 and RA2 coil shown in Fig. 6-1 are as follow.

- Rated voltage ..... DC24V ± 10%
- Rated excitation current ..... 12.5mA ± 10% (at25 deg.)

* Note that these specifications are subject to change without prior notice for modification purposes.

The emergency stop circuit in the robot is a duplex type to ensure safety(CR2B-574 controller only).
Thus, if a 1b contact type is used, faults such as fusing in the emergency stop circuit will not be detected, and could lead to fires.
If a 1b contact type is used and the emergency stop is input with only one side (across No. 1-2 or No. 5-6), the contact fusing alarm will occur, and resetting of the alarm will not be possible.

6.2 Working environment

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

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

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

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

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

(4) Vibration
- Where excessive vibration or impact may be applied. (Use in an environment of 34m/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.)

6.3 Precautions for handling

(1) This robot has brakes on J3 axis. The RH-18SH series has brakes on J3 and J4 axes. The precision of the robot may drop, looseness may occur and the reduction gears may be damaged if the robot is moved with force with the brakes applied.
(2) Avoid moving the robot arm by hand. When unavoidable, gradually move the arm. If moved suddenly, the accuracy may drop due to an excessive backlash, or the backed up data may be destroyed.
(3) Note that depending on the posture, even when within the movement range, the shaftsection could interfere with the base section. Take care to prevent interference during jog. Note1)
(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 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.
(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 withstand voltage tests. If conducted, they may cause failures.
(14) The fretting may occur on the axis which moving angle is the 30 degree or less, or moving distance is the 30mm or less, or not moves. The 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 prevent the fretting, recommends to move these axes about once every day the 30 degree or more, or the 30mm or more.

⚠CAUTION To the users of the RH-A series
The coordinate system of axis J3 of the RH-S series has been changed from the conventional RH-A series.Note2) For this reason, axis J3 may move to a wrong position if a conventional program is executed when an RH-A series robot is replaced by an RH-S series robot. Please be sure to check the robot operation position via step operation and teach the robot again if the position is wrong.

Note1) Jog operation refers to operating the robot manually using the teaching pendant.
Note2) In the conventional RH-A series, there was a gap between the XYZ coordinate value and JOINT coordinate value of axis J3, which is eliminated in the RH-S series.
RH-5AH series.....When the XYZ coordinate value is 0mm, the JOINT coordinate value is 97mm
RH-10AH/15AH series....When the XYZ coordinate value is 0mm, the JOINT coordinate value is -10mm
RH-S series.....JOINT coordinate value = XYZ coordinate value

7 Appendix

Appendix 1 : Specifications discussion material

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased mode

Load	☐ 6kg				☐ 12kg				☐ 18kg			
Environment specifications[Note1)]	☐ Standard	☐ C	☐ M	☐ SM	☐ Standard	☐ C	☐ M	☐ SM	☐ Standard	☐ C	☐ M	☐ SM
Arm rength	☐ 350mm	☐ 450mm	☐ 550mm		☐ 550mm	☐ 700mm	☐ 850mm		☐ 850mm			
Up/douwn stroke	■ 200mm	■ 170mm			■ 350mm	■ 300mm			■ 350mm	■ 300mm		

Note1) C indicates Clean, M indicates oil Mist and SM indicates a controller with the controller protection box/with countermeasure against oil mist. Refer to Page 2, "1.2 Model type combination of robot" for the details of the robot arm model names.

■ Shipping special specifications (Settings can be made only at time of shipment)

Item		Standard specifications	Special shipping specifications
Robot arm	Machine cable	☐ 5m fixed type	☐ 2m fixed type: 1S-02UCBL-03(for RH-6SH series) 1S-02UCBL-01(for RH-12SH/18SH series)
Controller	Controller structure	☐ Floor type	☐ Specification with the controller protection box ☐ Controller specification with countermeasure against oil mist

■ Options (Installable after shipment)

Item		Type	Provision, and specifications when provided.
Robot arm	Machine cable extention	1S- ☐☐ CBL-03	RH-6SH series: fixed type ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
		1S- ☐☐ CBL-01	RH-12SH/18SH series: fixed type ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
		1S- ☐☐ LCBL-03	RH-6SH series: flexed type ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
		1S- ☐☐ LCBL-01	RH-12SH/18SH series: flexed type ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
	Solenoid valve set	1S-VD04M-04/ 1S-VD04ME-04	RH-6SH series: ☐ Not provided ☐ Provided
		1S-VD04M-03/ 1S-VD04ME-03	RH-12SH/18SH series: ☐ Not provided ☐ Provided
	Hand input cable	1S-HC35C-02	☐ Not provided ☐ Provided
	Hand output cable	1S-GR35S-02	☐ Not provided ☐ Provided
	Hand curl tube	1E-ST0408C-300	RH-6SH series: ☐ Not provided ☐ Provided
		1N-ST0608C	RH-12SH/18SH series: ☐ Not provided ☐ Provided
Controller	Teaching pendant	R28TB- ☐☐	☐ Not provided ☐ 7m ☐ 15m
	Pneumatic hand interface	2A-RZ365/2A-RZ375	☐ Not provided ☐ Provided
	Parallel I/O interface[Note1)]	2A-RZ361/2A-RZ371	☐ Not provided ☐ 1pc. ☐ 2pcs. ☐ 3pcs. ☐ 4pcs. ☐ 5pcs. ☐ 6pcs. ☐ 7pcs.
	External I/O cable	2A-CBL ☐☐	☐ Not provided ☐ 5m-1pc. ☐ 5m-2pcs. ☐ 5m-3pcs. ☐ 15m-1pcs. ☐ 15m-2pcs. ☐ 15m-3pcs.
	CC-Link interface	2A-HR575-E	☐ Not provided ☐ Provided
	Ethernet interface	2A-HR533-E	☐ Not provided ☐ Provided
	Extended serial interface	2A-RZ581-E	☐ Not provided ☐ Provided
	Additional axis interface	2A-RZ541-E	☐ Not provided ☐ Provided
	PROFIBUS interface	2A-RZ577-E	☐ Not provided ☐ Provided
	Extended memory cassette[Note2)]	2A-HR432	☐ Not provided ☐ Provided
	Personal computer cable	RS-MAXY-CBL/ RS-AT-RCBL	☐ Not provided ☐ RS-MAXY-CBL ☐ RS-AT-RCBL
	Personal computer support software	3A-01C-WINE	☐ Not provided ☐ Windows98/2000/NT4.0/Me/XP CD-ROM
	Personal computer support software mini	3A-02C-WINE	☐ Not provided ☐ Windows98/2000/NT4.0/Me/XP CD-ROM
	Expansion option box[Note3)]	CR1-EB3	☐ Not provided ☐ Provided
	Controller protection box[Note3)]	CR1B-MB	☐ Not provided ☐ Provided

Note1) Up to eight units, including the one unit mounted as a standard.
Note2)This option only applies to the CR2B-574 controller.
Note3)This option only applies to the CR1B-571 controller.

Maintenance parts (Consumable parts)

Maintenance parts	☐ Backup batteries A6BAT ( ) pcs. ☐ Backup batteries ER6 ( ) pcs. ☐ Grease SK-1 ( ) cans. ☐ Grease Marutenpu PS2 ( ) cans.

■ Robot selection check list

Work description	☐ Material handring ☐ Assembly ☐ Machining L/UL ☐ Sealing ☐ Testing and inspection ☐ Other ( )	
Workpiece mass ( ) g	Hand mass ( ) g	Atmosphere ☐ General enveronment ☐ Clean ☐ Dust provided ☐ Other( )
Remarks		

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ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

EC-Statement of Compliance

No. E6 09 07 25554 018

Holder of Certificate: **Mitsubishi Electric Corporation**
Tokyo BILD., 2-7-3 Marunouchi,
Chiyoda-ku
Tokyo
100-8310 JAPAN

Name of Object: **Industrial Robot**

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.: TYOEMC23260A

222168

Date, 2009-07-14

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

TÜV®

A1 / 03.08

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

EC-Statement of Compliance
No. E6 09 07 25554 018

Model(s):

RV-3S series, RH-xSH series
a) 6-axis Robot Arm:
RV-3S, RV-3SC,
RV-3SB, RV-3SBC,
RV-3S-S3xx, RV-3SC-S3xx,
RV-3SB-S3xx, RV-3SBC-S3xx,
b) 5-axis Robot Arm:
RV-3SJ, RV-3SJC,
RV-3SJB, RV-3SJBC,
RV-3SJ-S3xx, RV-3SJC-S3xx,
RV-3SJB-S3xx, RV-3SJBC-S3xx,
RH-xSH series
c) 4-axis Robot arm, RH-6SHseries:
RH-6SH3520, RH-6SH4520,
RH-6SH5520, RH-6SH3517M,
RH-6SH4517M, RH-6SH5517M,
RH-6SH3517C, RH-6SH4517C,
RH-6SH5517C,
d) 4-axis Robot arm, RH-6SH-S3xxseries:
RH-6SH3520-S3xx, RH-6SH4520-S3xx,
RH-6SH5520-S3xx, RH-6SH3517M-S3xx,
RH-6SH4517M-S3xx, RH-6SH5517M-S3xx,
RH-6SH3517C-S3xx, RH-6SH4517C-S3xx,
RH-6SH5517C-S3xx,
e) 4-axis Robot arm, RH-12SH/18SH series:
RH-12SH5535, RH-12SH7035,
RH-12SH8535, RH-18SH8535,
RH-12SH5530M, RH-12SH7030M,
RH-12SH8530M, RH-18SH8530M,
RH-12SH5530C, RH-12SH7030C,
RH-12SH8530C, RH-18SH8530C
(See Attachment for Nomenclature)

Description of Object:

Rated Voltage:	230 VAC, 1 Phase
Rated Power:	0.9 kW/1.7 kW
Protection Class:	I

Tested according to:

EN 61000-6-4:2007; EN 61000-6-2:2005

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TÜV®

Attachment
Statement No.

Product Service

E6 09 07 25554 018

Group a, b Model name description is shown as follows.

RV-3 S J B x - x
(1)(2)(3) (4) (5) (6) (7)

(1) V: Vertical Robot
(2) Rated Payload specification:
3 : 3kg
(3) S : S series robot
(4) J : 5 axes exist
[none]: 6 axes exist
(5) B : All axes are equipped with brake
[none]: Basic model
J4 axis and J6 axis are not equipped with brake.
(6) C : Clean room model
[none]: Basic model
(7) Special specification number
Pilot number and specification as follows
S3xx: driven by R/C CR2B-574
[none] means S00 : driven by R/C CR1B-571

Number xx of "S3xx" is specified in the table below.

Input/Output type	sink		source	
Language	Japanese	English	Japanese	English
Japanese Domestic	00			
Shipping		11		12

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Attachment
Statement No.

Product Service

E6 09 07 25554 018

Group c,d,e Model name description is shown as follows.

RH-x SH xx xx x – xx
(1)(2)(3) (4) (5)(6) (7)

(1)H: Horizontal Robot
(2) Maximum Payload specification:
6 : 6kg
12 : 12kg
18 : 18kg
(3) S : S series robot
(4) Arm length(No1 and No2 arm) specification:
35 : 350 mm arm
45 : 450 mm arm
55 : 550 mm arm
70 : 700 mm arm
85 : 850 mm arm
(5) Z axis working area specification:
17 : 170 mm arm
20 : 200 mm arm
30 : 300 mm arm
35 : 350 mm arm
(6) Dimension and Ambient specification:
M : Oil mist model
C : Clean room model
[none] : Basic model
(7) Optional specification:
S3xx : driven by R/C CR2B-574
(only RH-6SHseris)
[none] : RH-6SHseries : driven by R/C CR1B-571
RH-12SH、RH18SHseries : driven by R/C CR2B-574
Number xx of "S3xx" is specified in the table below.

Input/Output type	sink		source	
Language	Japanese	English	Japanese	English
Japanese Domestic	00			
Shipping		11		12

MITSUBISHI ELECTRIC
Changes for the Better

EC Declaration of Conformity

We, the undersigned,

Manufacturer	MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS
Address, City	1-14,Yada-minami 5-chome, Higashi-ku, Nagoya 461-8670
Country	Japan
Phone number	+81 52 712 2354
Fax number/e-mail	+81 52 722 0384
Authorized representative in Europe	MITSUBISHI Electric Europe B.V
Address, City	40880 Ratingen
Country	Germany

Certify and declare under our sole responsibility that the following apparatus:

Type Name	Industrial Robot
Manufacturer	MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS
Brand	MELFA
Model No.	RH-xSH series
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	CISPR 11:2003+A2:2006
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 Type C:Machine Safety standard ISO10218-1:2006	N/A

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

MITSUBISHI ELECTRIC
Changes for the Better

The Technical documentation is kept at the following address:

Company	MITSUBISHI Electric Europe B.V
Address, City	Gothaer St. 8 40880 Ratingen
Country	Germany
Phone number	+49 2102 486 0
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Date	September 4, 2009
Name and position of person binding the manufacturer	Takaaki Nishimura Takaaki Nishimura Manager Robot Manufacturing Department MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS

a.4-axis Robot Arm (RH-6SHseries)

Model Name	Robot Arm	Controller	Software Version
RH-6SH3520	BU160C946G51	TU117C171G01	K or Later
	BU160C946G71	TU117C171G01	
RH-6SH4520	BU160C946G52	TU117C171G01	K or Later
	BU160C946G72	TU117C171G01	
RH-6SH5520	BU160C946G53	TU117C171G01	K or Later
	BU160C946G73	TU117C171G01	
RH-6SH3517M	BU160C946G54	TU117C171G01	K or Later
	BU160C946G74	TU117C171G01	
RH-6SH4517M	BU160C946G55	TU117C171G01	K or Later
	BU160C946G75	TU117C171G01	
RH-6SH5517M	BU160C946G56	TU117C171G01	K or Later
	BU160C946G76	TU117C171G01	
RH-6SH3520C	BU160C946G60	TU117C171G01	K or Later
	BU160C946G80	TU117C171G01	
RH-6SH4520C	BU160C946G61	TU117C171G01	K or Later
	BU160C946G81	TU117C171G01	
RH-6SH5520C	BU160C946G62	TU117C171G01	K or Later
	BU160C946G82	TU117C171G01	

b.4-axis Robot Arm (RH-6SH-S300series)

Model Name	Robot Arm	Controller	Software Version
RH-6SH3520-S3xx	BU160C946G51	TU117C238G01	K or Later
	BU160C946G71	TU117C238G01	
RH-6SH4520--S3xx	BU160C946G52	TU117C238G01	K or Later
	BU160C946G72	TU117C238G01	
RH-6SH5520-S3xx	BU160C946G53	TU117C238G01	K or Later
	BU160C946G73	TU117C238G01	
RH-6SH3517M-S3xx	BU160C946G54	TU117C238G01	K or Later
	BU160C946G74	TU117C238G01	
RH-6SH4517M-S3xx	BU160C946G55	TU117C238G01	K or Later
	BU160C946G75	TU117C238G01	
RH-6SH5517M-S3xx	BU160C946G56	TU117C238G01	K or Later
	BU160C946G76	TU117C238G01	
RH-6SH3520C-S3xx	BU160C946G60	TU117C238G01	K or Later
	BU160C946G80	TU117C238G01	
RH-6SH4520C-S3xx	BU160C946G61	TU117C238G01	K or Later
	BU160C946G81	TU117C238G01	
RH-6SH5520C-S3xx	BU160C946G62	TU117C238G01	K or Later
	BU160C946G82	TU117C238G01	

c.4-axis Robot Arm (RH-12/18SH)

Model Name	Robot Arm	Controller	Software Version
RH-12SH5535	BU160C982G51	TU117C228G02	K or Later
	BU160C982G71	TU117C228G02	
RH-12SH7035	BU160C982G52	TU117C228G02	K or Later
	BU160C982G72	TU117C228G02	
RH-12SH8535	BU160C982G53	TU117C228G02	K or Later
	BU160C982G73	TU117C228G02	
RH-18SH8535	BU160C982G54	TU117C228G01	K or Later
	BU160C982G74	TU117C228G01	
RH-12SH5530M	BU160C982G55	TU117C228G02	K or Later
	BU160C982G75	TU117C228G02	
RH-12SH7030M	BU160C982G56	TU117C228G02	K or Later
	BU160C982G76	TU117C228G02	
RH-12SH8530M	BU160C982G57	TU117C228G02	K or Later
	BU160C982G77	TU117C228G02	
RH-18SH8530M	BU160C982G58	TU117C228G01	K or Later
	BU160C982G78	TU117C228G01	
RH-12SH5530C	BU160C982G59	TU117C228G02	K or Later
	BU160C982G79	TU117C228G02	
RH-12SH7030C	BU160C982G60	TU117C228G02	K or Later
	BU160C982G80	TU117C228G02	
RH-12SH8530C	BU160C982G61	TU117C228G02	K or Later
	BU160C982G81	TU117C228G02	
RH-18SH8530C	BU160C982G62	TU117C228G01	K or Later
	BU160C982G82	TU117C228G01	

■ Revision history

Date	Specifications No.	Details of revisions	Rev.
June 23, 2005		First print	*
April 6, 2006	P1	Standards update.	A
June 25 , 2009	P1	Standards update(2004/108/EC)	B
September 4, 2009	P1	Standards update(2006/42/EC)	C

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