MITSUBISHI

Mitsubishi Industrial Robot

SQ Series

RH-6SQH/12SQH/18SQH/20SQH Series
RH-3SQHR series

Special Specifications Manual
(CR1QA/CR2QA/CR3Q-700 Controller)

MELFA

BFP-A8694-W

⚠ Safety Precautions

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

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

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

⚠ CAUTION

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

⚠ CAUTION

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

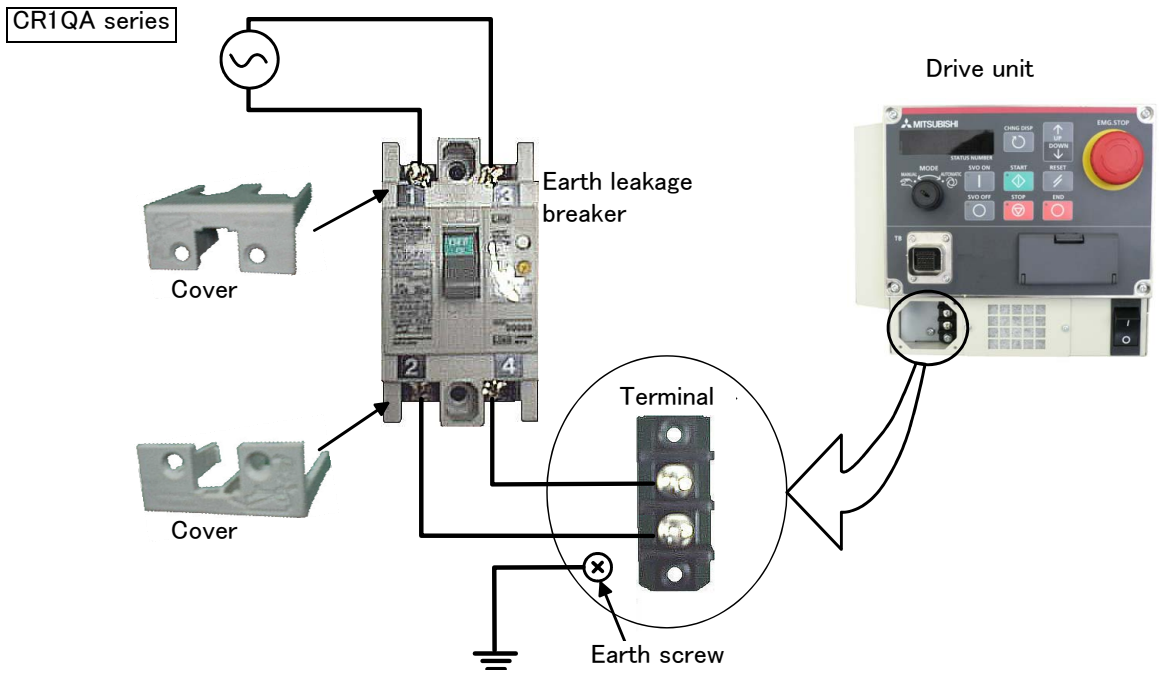
⚠ CAUTION

Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB, RS-232 or LAN. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

C.Notes of the basic component are shown.
*SQ series: CR1QA-700 series

⚠ CAUTION

Please install the earth leakage breaker in the primary side supply power supply of the controller because of leakage protection.



*SQ series: RH-6SQH/12SQH/18SQH/20SQH series/RH-3SQHR series

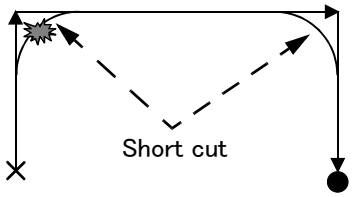
⚠CAUTION Be careful of interference with peripheral equipment.
Especially don't give a shock to the ball screw shaft (J3 axis). The ball screw shaft may be damaged.

Collision detection function is valid condition for both of automatic and jog operation at shipping in RH-3SQHR series. However, damage to the ball screw shaft cannot be prevented completely.

Refer to the separate instruction manual "Detailed explanations of functions and operations" for collision detection function.

Take care also of the following items.

(1)The robot's locus of movement may change with specified speed.
Especially as for the corner section, short cut distance may change. Therefore, when beginning automatic operation, moves at low speed at first, and you should gather speed slowly with being careful of interference with peripheral equipment.



Arch movement (example)

(2)It can be confirmed whether the specified position exist in the defined area by using the instruction command "ZONE". It can utilize as one of the methods for collision evasion. Refer to the "detailed description of the instructions manual/function, and operation" of the separate volume for the details of the instruction command.

⚠CAUTION Don't give a shock to the ball screw shaft at the time of hand installation.
Especially don't strike the shaft end by hammer etc. The ball screw shaft may be damaged.

■ Revision history

Date of print	Specifications No.	Details of revisions
2008-10-30	BFP-A8694	First print.
2009-6-23	BFP-A8694	The English expression was corrected. Safety Precautions , 1.1.2 Special specifications , Table 1.3: The list of Option equipment and special specification , Caution of USB devices , 2.6.1 Shipping special specifications , 6.1.7 Examples of safety measures Error in writing was corrected.
2009-07-17	BFP-A8694-A	Parameter AREA*CS was added. TU cable, DISP cable, EMI cable and SSCNET Ⅲ cable were added.
2009-08-04	BFP-A8694-B	CE Marking specification was added.
2009-09-12	BFP-A8694-C	The examples of safety measures (Wiring example 3 ～ 5) were corrected.
2009-10-26	BFP-A8694-D	・The figure of key switch in "3.6.3 Door switch function " was corrected. (Error in writing) ・The figure of example of safety measures in "6.1.7 Examples of safety measures " was corrected. (connects the enabling switch) ・The EC Declaration of Conformity was changed. (Correspond to the EMC directive; 2006/42/EC)
2009-12-04	BFP-A8694-E	・Fuse rating of pneumatic hand interface (RZ365/375) was corrected. ・The text of "This interface is pre-installed on the controller" in pneumatic hand interface was deleted . ・Extended Function Instruction Manual was added.
2010-03-01	BFP-A8694-F	・Pressure of the dry air for pressurization was corrected.
2010-05-31	BFP-A8694-G	・CE specification of the CR1QA controller was added. ・Error in writing was corrected ・Z stroke extension type was added.
2010-06-17	BFP-A8694-H	・Explanation of the new RH-20SQH series was added. ・The type name of robot controller was changed with specification change.(CR1Q to CR1QA, CR2Q to CR2QA)
2010-07-27	BFP-A8694-J	・Cover packing was added to the consumable part. ・The description of protection specification was changed. (The cutting oil which examined was updated, and replacement of the cover packing was added) ・EC Declaration of Conformity were added.
2010-08-25	BFP-A8694-K	・The input voltage range of the DU2A drive unit was corrected. ("3-phase, AC180 to 253" was the previous.)
2010-10-13	BFP-A8694-L	・The RH-3SQHR3515 was added. ・The dimensions of the hole which draws the power cable were added. (DU2A drive unit) ・The type name optional of hand input cable and hand curl tube for RH-20SQH100** series was changed. ・The EC Declaration of Conformity were added.
2010-11-30	BFP-A8694-M	・The EC Declaration of Conformity were added.
2010-12-02	BFP-A8694-N	・The coupling for air purge in figure of "Wiring and piping for hand (RH-3SQHR)" was deleted. (error in writing). ・The type name of optional hand input cable for RH-3SQHR was changed.
2010-12-21	BFP-A8694-P	・The sink / source expression of pin assignment of hand input cable was corrected. (Sink / Source are common) ・The type name of optional hand curl tube for RH-20SQH100** series was changed. ・The hand curl tube outline drawing was corrected. (Error in writing)
2011-02-02	BFP-A8694-Q	・Ball screw protective measures were added. ・The outside dimension of DU1A drive unit (CE marking specification) was changed. ・The rear cover of the DU1A drive unit was made unnecessary. ・The note about temperature of the air to supply for hand was added. ・Part code was added to the consumable part.
2011-05-09	BFP-A8694-R	・Hand output junction cable was added to the solenoid valve set optional. (RH-6SQH/12SQH/18SQH/20SQH series) ・Table 1-5: Recommendation article of the USB cable was corrected.

Date of print	Specifications No.	Details of revisions
2011-06-01	BFP-A8694-S	・The user's guide was added based on South Korean Radio Law. ・Fuse rating of pneumatic hand interface (RZ365/375) was corrected. (error in writing). ・The setting value range of parameter SFC*ME and AREA*ME were corrected. (error in writing).
2011-07-01	BFP-A8694-T	・The note about the connection of the emergency stop was added. ・The automatic compensation graph of the RH-6SQH's Z-stroke-200mm in "Automatic compensation of acceleration/deceleration speed" was corrected. (Clarified. With no change in acceleration/deceleration speed rate)
2012-01-26	BFP-A8694-U	・The EC Declaration of Conformity were changed.
2012-05-22	BFP-A8694-V	・The target axis and interval of intermittent brake release were added. ・The "Emergency stop output" in the controller standard specification table was deleted. (Overlapped with "Robot error output".) ・The "Table 3-3 : Emergency stop/Door switch input" in "3.4 External input/output" was deleted. (Overlapped with "Table 3-5 : Special input/output terminal".) ・Error in writing in table of Standard specifications of robot was corrected. (allowable moment load -> allowable inertia) ・Hand output junction cable was added to the solenoid valve set optional. (RH-6SQH/12SQH/18SQH/20SQH series) ・Clean specification and waterproof (IP65) specification were added for RH-3SQHR series. ・The EC Declaration of Conformity were changed. ・RH-20SDH100* was added to "2.4.7 Changing the operating range" ・Correction of an error in "2.5.7 About the Installation of Tooling Wiring and Piping". (formerly: Floor installation type)
2012-07-11	BFP-A8694-W	・The notes about frequent installation and removal of TB and the dummy connector were added. ・The note about the connection of the emergency stop was added. ・The explanation about the controller of KC mark specification was added to " ■ Introduction".

■ Introduction

The RH-6SQH/12SQH/18SQH/20SQH series, RH-3SQHR series offers small-size industrial robots developed using Mitsubishi's latest technology. They are especially designed to handle and assemble mechanical parts. They are Mitsubishi's answer to the customer's need to achieve a compact manufacturing facility capable of highly flexible production, as necessitated by the diffusion of high-density product groups and the shorter product life cycles that have become common-place in recent years.
About RH-3SQHR series, because the installation surface does not give limitation to the operating range, it can work to the layout in the customer flexibly.

However, to comply with the target application, a work system having a well-balanced robot arm, peripheral devices or robot and hand section must be structured.
When creating these standard specifications, we have edited them so that the Mitsubishi robot's characteristics and specifications can be easily understood by users considering the implementation of robots.
However, if there are any unclear points, please contact your nearest Mitsubishi branch or dealer.
Mitsubishi hopes that you will consider these standard specifications and use our robots.

Note that in this specification document the specifications related to the robot arm is described Page 10, "2 Robot arm", the specifications related to the controller Page 119, "3 Controller", and software functions and a command list Page 178, "4 Software" separately.

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

On floor type..... *RH-6SQH series
*RH-12SQH series
*RH-18SQH series
*RH-20SQH series
Hanging type ..... RH-3SQHR series

About KC mark specifications

This robot acquires certification of KC mark by the special specification (S19).
Although about DU1A drive unit the two kinds of drive units (standard specification / CE Marking specification) are described in this book and you can choose either one, The external form of drive unit which have KC mark specification is same as the drive unit which described as "CE Marking specification".
Refer to the place described as "CE Marking specification" about the external form of KC mark specification's drive unit.
Especially the places with no distinction are common specifications.
And, it is the same as that of the CE Marking specification in the same manner about DU2A and DU3 drive unit.

- No part of this manual may be reproduced by any means or in any form, without prior consent from Mitsubishi.
- The contents of this manual are subject to change without notice.
- The specifications values are based on Mitsubishi standard testing methods.
- The information contained in this document has been written to be accurate as much as possible. Please interpret that items not described in this document "cannot be performed." or "alarm may occur".
  Please contact your nearest dealer if you find any doubtful, wrong or skipped point.
- This specifications is original.

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1 General configuration

1.1 Structural equipment

Structural equipment consists of the following types.

1.1.1 Standard structural equipment

The following items are enclosed as a standard.

(1) Robot arm
(2) Controller(CPU unit + Drive unit)
(3) The connecting cable for the CPU unit and the drive unit
(4) Machine cable
(5) Robot arm installation bolts
(6) Earth leakage breaker (CR1QA-700 series only)
(7) Safety manual, Instruction manual, CD-ROM (Instruction manual)
(8) Guarantee card

1.1.2 Special specifications

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

1.1.3 Options

User can install options after their delivery.

1.1.4 Maintenance parts

Materials and parts for the maintenance use.

1.2 Model type name of robot

1.2.1 How to identify the robot model

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

(1) Floor installation type

RH-◇◇SQH□□ △△ ○ -SMxx

(a) (b) (c) (d) (e)

(a). RH- ◇◇ SQH.....Indicates the RH-6SQH/12SQH/18SQH/20SQH series
◇◇ : Indicates the maximum load capacity.

(b). □□ .....Indicates the arm length.
Ex.)
55: 550mm, 70: 700mm, 85: 850mm

(c). △△ .....Indicates the vertical stroke length.
Ex.)
30: 300mm stroke, 35: 350mm stroke

(d). ○ .....Indicates environment specification.
Ex.)
Blank: Standard specifications
C: Clean specifications
M: Oilmist specifications

(e). -S M xx.....Indicates a special model. In order, limit special specification.
[1] [2] [3]

[1] -S	Indicates a special model.
[2] M	Indicates a specification with protection specification controller. (The controller protection box is attached in RH-6SQH series.)
M6	Indicates a specification with protection specification controller. (The controller is CR3Q in RH-12SQH / 18SQH/20SQH series..)
[3] xx	Indicates a special model number.

(2) Hanging installation type

RH-3SQHR35 △△ ○ -Sxx

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

(a). RH.....Indicates the horizontal multi joint type robot.

(b). 3.....Indicates the maximum load.
Ex.)
3: 3kg

(c). SQH.....Indicates the SQH series.

(d). R.....Indicates the installation posture is hung.

(e). 35 .....Indicates the arm length.
Ex.)
35: 350mm

(f). △△ .....Indicates vertical stroke length.
Ex.)
12: 120mm stroke 15: 150mm stroke

(g). ○.....Indicates environment specification.
Ex.)
Blank: Standard specifications
C: Clean specifications
W: Waterproof specifications

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

1.2.2 Combination of the robot arm and the controller

Table 1-1 : Combination of the robot arm (floor installation type) and the controller

Protection specification	Robot arm	Arm length (mm)	J3-axis stroke (mm)	Controller[Note1)]
RH-6SQH series				
General-purpose environment	RH-6SQH3520	350	200	CR1QA-761
	RH-6SQH4520	450		
	RH-6SQH5520	550		
	RH-6SQH3532	350	320	
	RH-6SQH4532	450		
	RH-6SQH5532	550		
Clean specifications	RH-6SQH3517C	350	170	
	RH-6SQH4517C	450		
	RH-6SQH5517C	550		
	RH-6SQH3527C	350	270	
	RH-6SQH4527C	450		
	RH-6SQH5527C	550		
Oil mist specifications	RH-6SQH3517M	350	170	
	RH-6SQH4517M	450		
	RH-6SQH5517M	550		
	RH-6SQH3527M	350	270	
	RH-6SQH4527M	450		
	RH-6SQH5527M	550		
RH-12SQH series				
General-purpose environment	RH-12SQH5535	550	350	CR2QA-741
	RH-12SQH7035	700		
	RH-12SQH8535	850		
	RH-12SQH5545	550	450	
	RH-12SQH7045	700		
	RH-12SQH8545	850		
Clean specifications	RH-12SQH5530C	550	300	
	RH-12SQH7030C	700		
	RH-12SQH8530C	850		
	RH-12SQH5538C	550	380	
	RH-12SQH7038C	700		
	RH-12SQH8538C	850		
Oil mist specifications	RH-12SQH5530M	550	300	
	RH-12SQH7030M	700		
	RH-12SQH8530M	850		
	RH-12SQH5538M	550	380	
	RH-12SQH7038M	700		
	RH-12SQH8538M	850		
RH-18SQH series				
General-purpose environment	RH-18SQH8535	850	350	CR2QA-751
Clean specifications	RH-18SQH8530C		300	
Oil mist specifications	RH-18SQH8530M			
RH-20SQH series				
General-purpose environment	RH-20SQH8535	850	350	CR2QA-751
	RH-20SQH10035	1000		
	RH-20SQH8545	850	450	
	RH-20SQH10045	1000		
Clean specifications	RH-20SQH8530C	850	300	
	RH-20SQH10030C	1000		
	RH-20SQH8538C	850	380	
	RH-20SQH10038C	1000		
Oil mist specifications	RH-20SQH8530M	850	300	
	RH-20SQH10030M	1000		
	RH-20SQH8538M	850	380	
	RH-20SQH10038M	1000		

Note1) When you use by adverse environment, please use the protection specification controller.
RH-6SQH series .....: The controller protection box is attached. (IP54)
(Ex. : RH-6SQH3520-SM)
RH-12SQH/18SQH/20SQH series.....: Protection specification controller : CR3Q-700M(IP54)
(Ex. : RH-12SQH5535-SM6)

Table 1-2 : Combination of the robot arm (hanging installation type) and the controller

Protection specification	Robot arm	Arm length (mm)	J3-axis stroke (mm)	Controller
RH-3SQHR series				
General-purpose environment	RH-3SQHR3515	350	150	CR2QA-781
Clean environment	RH-3SQHR3512C	350	120	
Waterproof (IP65) specification	RH-3SQHR3512W	350	120	

1.3 CE marking specifications

The RH-6SQH-S12/RH-6SQH-S312/RH-12SQH-S12/RH-18SQH-S12 series provides models with CE marking specifications as well.

The controller are each CR1QA-761/CR2QA-761/CR2QA-741/CR2QA-751.

Table 1-3 : Robot models with CE marking specifications

Robot type	Controller	External signal logic	Language setting
RH-6SQH*-S12	CR1QA-761-S12	Source type	English (ENG)
RH-6SQH*-S312	CR2QA-761-S312		
RH-12SQH*-S12	CR2QA-741-S12		
RH-12SQH*-SM612	CR3Q-741-SM612		
RH-18SQH*-S12	CR2QA-751-S12		
RH-18SQH*-SM612	CR3Q-751-SM612		

1.4 Indirect export

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

1.5 Instruction manuals

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

1.6 Contents of the structural equipment

1.6.1 Robot arm

The list of structural equipment is shown in Fig. 1-1, Fig. 1-2.

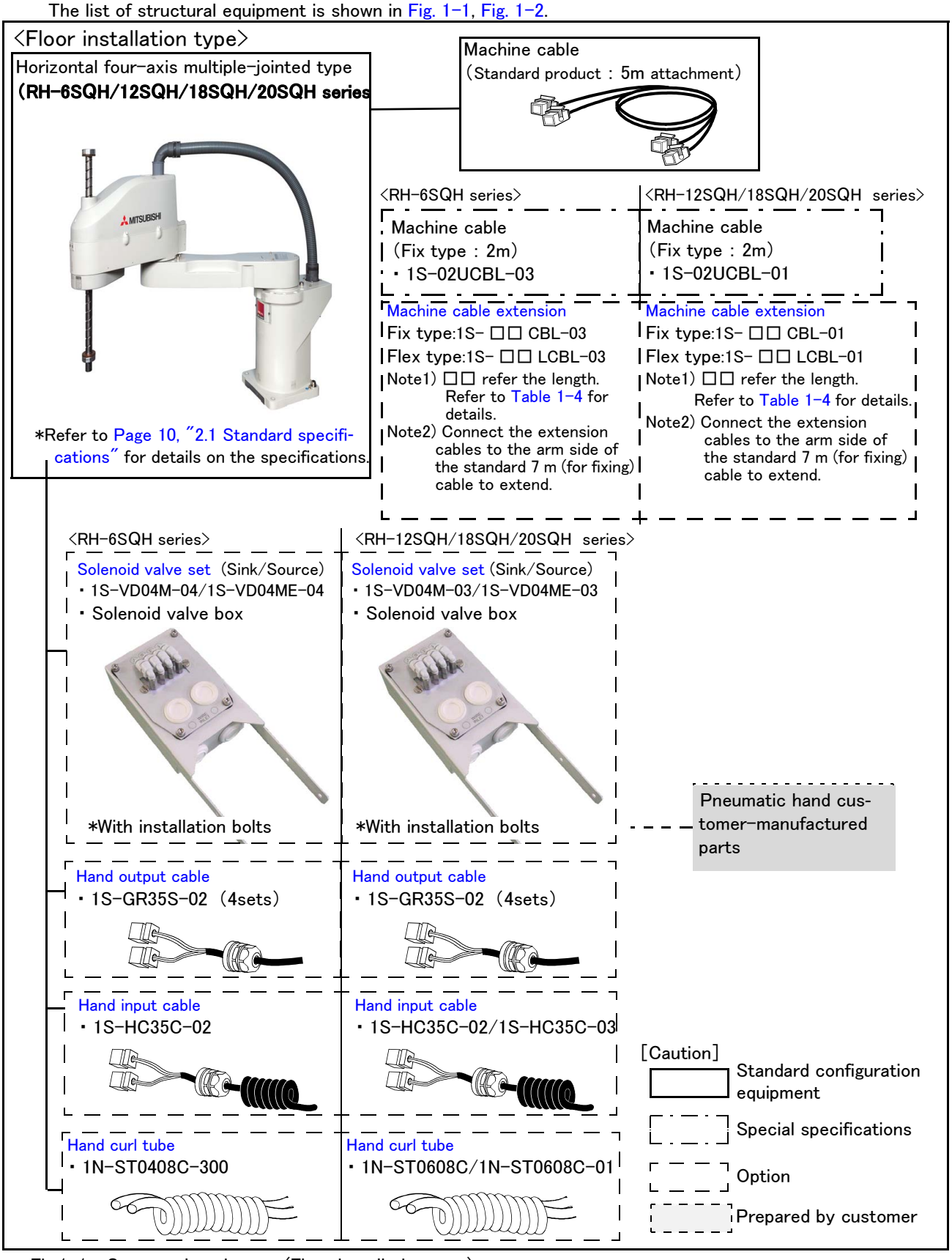


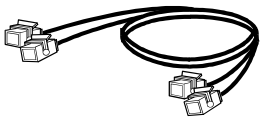
Fig.1-1 : Structural equipment (Floor installation type)

<Hanging installation type>

Horizontal four-axis multiple-jointed type
(RH-3SQHR series)

*Refer to Page 10, "2.1 Standard specifications" for details on the specifications.

Machine cable
(Standard product:
5m attachment)



<RH-3SQHR series>

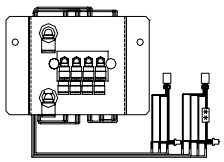
Machine cable
(Fix type : 2m)
・1S-02UCBL-01

Machine cable extension
Fix type:1S- □□ CBL-01
Flex type:1S- □□ LCBL-01
Note1) □□ refer the length.
Refer to Table 1-4 for details.
Note2) Connect the extension cables to the arm side of the standard 7 m (for fixing) cable to extend.

<RH-3SQHR series>

Solenoid valve set (Sink/Source)

[General-purpose environment /Clean specification]
・1S-VD04-05: Sink type
・1S-VD04E-05: Source type



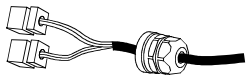
[Waterproof (IP65) specification]
・1S-VD04W-05(Sink type)
・1S-VD04WE-05(Source type)

* With installation bolts

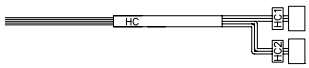
Changing the operating range
・For J1 axis: 1S-DH-05J1
・For J1 axis: 1S-DH-05J2
*Refer to Page 8, "Table 1-4" for the angle which can be changed.
*Installed by customer.

Pneumatic hand customer-manufactured parts

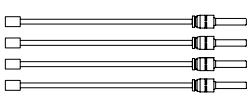
Hand output cable
・1S-GR35S-02 (4sets)



Hand input cable
・1S-HC00S-01



Hand tube
・1S-ST0304S



[Caution]
Standard configuration equipment
Special specifications
Option
Prepared by customer

Fig.1-2 : Structural equipment (Hanging installation type)

1.6.2 Controller

The devices shown below can be installed on the controller.
The controllers that can be connected differ depending on the specification of the robot.

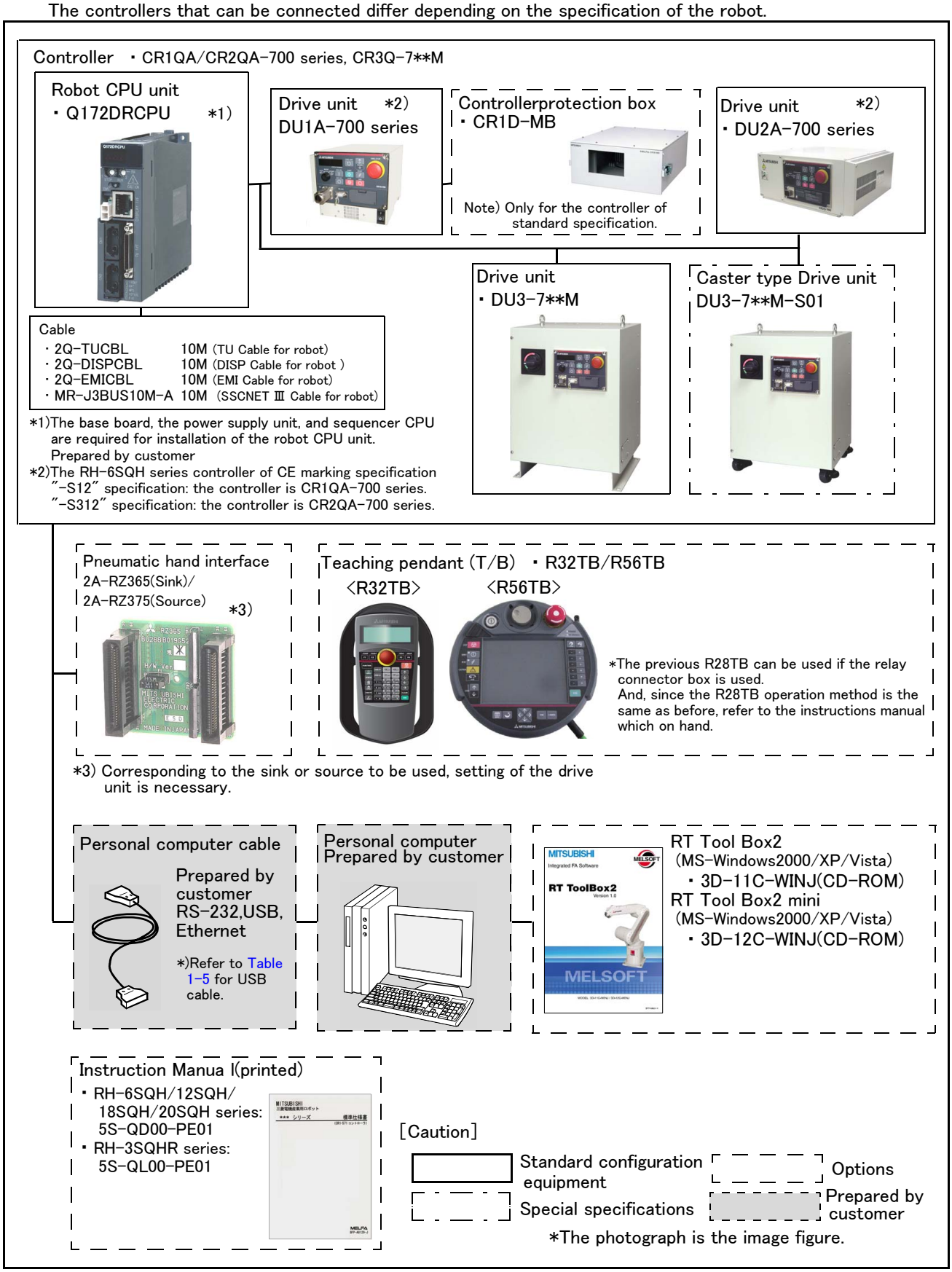


Fig.1-3 : Structural equipment

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 : The list of Option equipment and special specification

Item	Type	Specifications	Classification Note1)	Description
Stopper for changing the operating range	1S-DH-05J1	RH-3SQHR series The stopper parts for J1 axis Plus side / Minus side both are 90 degree. * Change both simultaneously Standard specification is +/- 225 degree.	○	This must be installed by the customer.
	1S-DH-05J2	RH-3SQHR series The stopper parts for J2 axis Plus side / Minus side both are 60 degree. * Change both simultaneously Standard specification is +/- 225 degree.	○	
Machine cable (Replaced with shorter cable)	1S-02UCBL-03	RH-6SQH for fixing (Set of power and signal)	○・□	2m(A 2 m cable is supplied instead of the 5 m cable that is supplied as standard)
	1S-02UCBL-01	RH-12SQH/18SQH/20SQH series, RH-3SQHR series for fixing (Set of power and signal)	○・□	
Extended machine cable	1S- □□ CBL-03	RH-6SQH for fixing (Set of power and signal)	○	5、10、15m
	1D- □□ LCBL-03	RH-6SQH for bending (Set of power and signal)	○	
	1S- □□ CBL-01	RH-12SQH/18SQH/20SQH series, RH-3SQHR series for fixing (Set of power and signal)	○	
	1D- □□ LCBL-01	RH-12SQH/18SQH/20SQH series, RH-3SQHR series for bending (Set of power and signal)	○	
Solenoid valve set	1S-VD04M-04/ 1S-VD04ME-04	RH-6SQH series 4 set (Sink type)/(Source type)	○	1S-VD04M-04: Sink type 1S-VD04ME-04: Source type
	1S-VD04M-03/ 1S-VD04ME-03	RH-12SQ/18QH/20QH series 4 set (Sink type)/(Source type)	○	1S-VD04M-03: Sink type 1S-VD04ME-03: Source type
	1S-VD04-05/ 1S-VD04E-05	RH-3SQHR series 4 set (Sink type)/(Source type)	○	Standard specification and clean specification 1S-VD04-05: Sink type 1S-VD04E-05: Source type
	1S-VD04W-05/ 1S-VD04WE-05	RH-3SQHR series 4 set (Sink type)/(Source type)	○	Waterproof (IP65) specification 1S-VD04W-05: Sink type 1S-VD04WE-05: Source type
Hand output cable	1S-GR35S-02	Robot side: connector. Hand side: wire.	○	The cable is connected to the hand output connector by the customer.
Hand input cable	1S-HC35C-02	Robot side: connector. Hand side: wire.	○	The cable is connected to the sensor by the customer. RH-6SQH/12SQH/18SQH/20SQH85** series.
	1S-HC35C-03	Robot side: connector. Hand side: wire.	○	The cable is connected to the sensor by the customer. RH-20SQH100** series.
	1S-HC00S-01	For four points	○	The cable is connected to the sensor through the ball screw shaft by the customer. RH-3SQHR series
Hand curl tube	1E-ST0408C-300	For solenoid valve 4set.:Φ4x8	○	Curl type air tube 1E-ST0408C-300: RH-6SQH series 1N-ST0608C: RH-12SQH/18SQH/20SQH85** series 1N-ST0608C-01: RH-20SQH100** series
	1N-ST0608C	For solenoid valve 4set.:Φ6x8	○	
	1N-ST0608C-01	For solenoid valve 4set.:Φ6x8	○	
Hand tube	1S-ST0304S	Φ3x4	○	The tube for piping the hand through the ball screw shaft by the customer. RH-3SQHR series
Simple teaching pendant	R32TB	Cable length 7m	○	With 3-position deadman switch IP65
	R32TB-15	Cable length 15m	○	
Highly efficient teaching pendant	R56TB	Cable length 7m	○	
	R56TB-15	Cable length 15m	○	
Pneumatic hand interface	2A-RZ365	DO: 8 point(Sink type)	○	It is necessary when the hand output signal of the robot arm is used.
	2A-RZ375	DO: 8 point(Source type)	○	
Controller protection box Note2)	CR1D-MB	IP54	□	The controller protection box is used to protect the controller from an oil mist or other operating environment
Caster specifications controller	CR3Q-700M	Specifications with casters	□	The controller height will be h =615

Item	Type	Specifications	Classification Note1)	Description
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
TU cable for robot	2Q-TUCBL □ M	Cable length 05、10、20、30m	○	For communication between robot CPU and DU.
DISP cable for robot	2Q-DISPCBL □ M	Cable length 05、10、20、30m	○	For communication between robot CPU and DU.
EMI cable for robot	2Q-EMICBL □ M	Cable length 05、10、20、30m	○	For a robot CPU emergency stop input.
SSCNET Ⅲ cable for robot	MR-J3BUS □ M-A	Cable length 05、10、20m	○	For the servo communication between robot CPU and DU .
	MR-J3BUS30M-B	Cable length 30m	○	
Instruction Manual	5S-QD00-PE01	RH-6SQH/12SQH/18SQH/20SQH series	○	A set of the instructions manual bookbinding editions
	5S-QL00-PE01	RH-3SQHR series	○	

Note1) ○ : option, □ : special specifications.
Note2) This is provided as standard for the specification with the controller protection box. Use this option to protect the controller from the oil mist when the controller will be installed in the environment such as the oil mist.
Only for the CR1QA-700 series controller of standard specification.

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

Table 1-5 : Recommendation article of the USB cable

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

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

⚠Caution Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB, RS-232 or LAN. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

2 Robot arm

2.1 Standard specifications

(1) RH-6SQH series

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

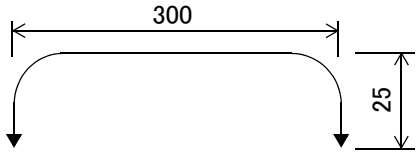
Item		Unit	Specifications		
Type[Note1]			RH-6SQH3520/3532	RH-6SQH4520/4532	RH-6SQH5520/5532
Environment			Standard specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute 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	RH-6SQH3520/H4520/H5520 : 200 (+97 to 297) RH-6SQH3532/H4532/H5532 : 320 (-23 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 [Note2]		mm/s	6,473<4,694>	7,128<5,349>	7,782(6,003)
Cycle time[Note3]		sec	0.42	0.42	0.43
Load	Rating	kg (N)	2 (19.6)		
	Maximum		6 (58.8)		
Allowable inertia	Rating	kg・m^2	0.01		
	Maximum		0.04		
Pose repeatability [Note4]	X-Y direction	mm	±0.02		
	J3 (Z)	mm	±0.01		
	J4 (θ axis)	deg	±0.02		
Ambient temperature		℃	0 to 40		
Mass		k	20	21	
Tool wiring [Note5]			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6×2		
Supply pressure		MPa	0.5±10% (		
Protection specification[Note6]			IP20		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1) The type in which operating range of J3 axis (Z) is 200mm and 320mm is shown together.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The protection specification details are given in Page 35, "2.2.8 Protection specifications".When using the robot in the oil mist environment etc., please choose oil mist specification (Table 2-3).

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

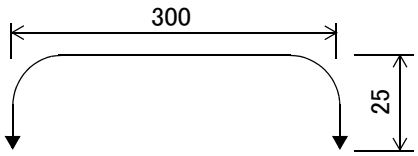
Item		Unit	Specifications		
Type[Note1]			RH-6SQH3517C/3527C	RH-6SQH4517C/4527C	RH-6SQH5517C/5527C
Environment			Clean specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute 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	RH-6SQH3517C/4517C/5517C : 170 (+97 to 267) RH-6SQH3527C/4527C/5527C : 270 (-23 to 247)		
	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 Note2)		mm/s	6,473<4,694>	7,128<5,349>	7,782<6,003>
Cycle time[Note3]		sec	0.45	0.46	0.47
Load	Rating	kg (N)	2 (19.6)		
	Maximum		6 (58.8)		
Allowable inertia	Rating	kg・m^2	0.01		
	Maximum		0.04		
Pose repeatability [Note4]	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 [Note5]			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6×2		
Supply pressure		MPa	0.5±10%		
Degree of cleanliness[Note6]			10(0.3 μ m)		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1) The type in which operating range of J3 axis (Z) is 170mm and 270mm is shown together.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The details of the clean specifications are described in Page 38, "2.2.9 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)

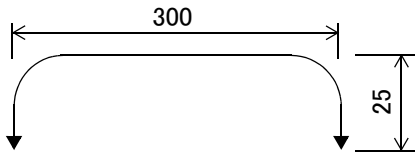
Item		Unit	Specifications		
Type[Note1]			RH-6SQH3517M/3527M	RH-6SQH4517M/4527M	RH-6SQH5517M/5527M
Environment			Oil mist specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			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(±127)		
	J2	deg	274(±137)	290(±145)	
	J3 (Z)	mm	RH-6SQH3517M/4517M/5517M : 170 (+97 to 267) RH-6SQH3527M/4527M/5527M : 270 (-23 to 247)		
	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 Note2)		mm/s	6,473<4,694>	7,128<5,349>	7,782<6,003>
Cycle time[Note3]		sec	0.45	0.46	0.47
Load	Rating	kg (N)	2 (19.6)		
	Maximum		6 (58.8)		
Allowable inertia	Rating	kg・m^2	0.01		
	Maximum		0.04		
Pose repeatability [Note4]	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 [Note5]			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6×2		
Supply pressure		MPa	0.5±10%		
Protection specification[Note6] [Note7]			IP54		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1) The type in which operating range of J3 axis (Z) is 170mm and 270mm is shown together.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The protection specification details are given in Page 35, "2.2.8 Protection specifications".

Note7) 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) RH-12SQH series

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

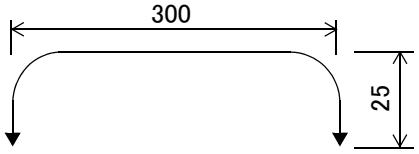
Item		Unit	Specifications		
Type[Note1]			RH-12SQH5535/5545	RH-12SQH7035/7045	RH-12SQH8535/8545
Environment			Standard specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute 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	RH-12SQH5535/7035/8535 : 350 (-10 to 340) RH-12SQH5545/7045/8545 : 450 (-110 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 [Note2]		mm/s	10,555<5,796>	11,498<6,738>	11,221<6,612>
Cycle time[Note3]		sec	0.43	0.44	0.46
Load	Rating	kg (N)	2 (19.6)		
	Maximum		12 (117.6)		
Allowable inertia	Rating	kg・m^2	0.02		
	Maximum		0.1		
Pose repeatability [Note4]	X-Y direction	mm	±0.02	±0.025	
	J3 (Z)	mm	±0.01(±3^{-5})		
	J4 (θ axis)	deg	±0.03		
Ambient temperature		℃	0 to 40		
Mass		kg	41	43	45
Tool wiring [Note5]			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6×2		
Supply pressure		MPa	0.5±10%		
Protection specification[Note6]			IP20		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1) The type in which operating range of J3 axis (Z) is 350mm and 450mm is shown together.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The protection specification details are given in Page 35, "2.2.8 Protection specifications".When using the robot in the oil mist environment etc., please choose oil mist specification (Table 2-6).

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

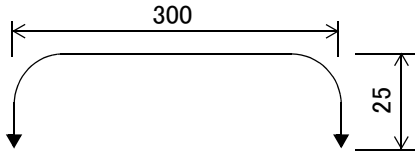
Item		Unit	Specifications		
Type[Note1]			RH-12SQH5530C/5538C	RH-12SQH7030C/7038C	RH-12SQH8530C/8538C
Environment			Clean specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			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	RH-12SQH5530C/7030C/8530C : 300 (-10 to 290) RH-12SQH5538C/7038C/8538C : 380 (-110 to 270)		
	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 [Note2]		mm/s	10,555<5,796>	11,498<6,738>	11,221<6,612>
Cycle time[Note3]		sec	0.43	0.44	0.46
Load	Rating	kg (N)	2 (19.6)		
	Maximum		12 (117.6)		
Allowable inertia	Rating	kg・m^2	0.02		
	Maximum		0.1		
Pose repeatability [Note4]	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 [Note5]			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6×2		
Supply pressure		MPa	0.5±10%		
Degree of cleanliness[Note6]			10(0.3 μ m)		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1) The type in which operating range of J3 axis (Z) is 300mm and 380mm is shown together.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The details of the clean specifications are described in Page 38, "2.2.9 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)

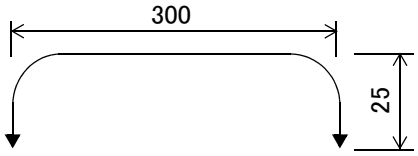
Item		Unit	Specifications		
Type[Note1]			RH-12SQH5530M/5538M	RH-12SQH7030M/7038M	RH-12SQH8530M/8538M
Environment			Oil mist specification		
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			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	RH-12SQH5530M/7030M/8530M : 300 (-10 to 290) RH-12SQH5538M/7038M/8538M : 380 (-110 to 270)		
	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 [Note2]		mm/s	10,555<5,796>	11,498<6,738>	11,221<6,612>
Cycle time[Note3]		sec	0.43	0.44	0.46
Load	Rating	kg (N)	2 (19.6)		
	Maximum		12 (117.6)		
Allowable inertia	Rating	kg・m^2	0.02		
	Maximum		0.1		
Pose repeatability [Note4]	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 [Note5]			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6×2		
Supply pressure		MPa	0.5±10%		
Protection specification[Note6] [Note7]			IP54		
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1) The type in which operating range of J3 axis (Z) is 300mm and 380mm is shown together.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The protection specification details are given in Page 35, "2.2.8 Protection specifications".

Note7) 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.

(3) RH-18SQH series

Table 2-7 : Tab Standard specifications of robot

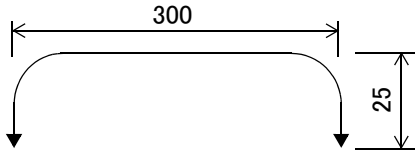
Item		Unit	Specifications Note1)		
Type			RH-18SQH8535	RH-18SQH8530C	RH-18SQH8530M
Environment			Standard specification	Clean specification	Oil mist specification
Installation posture			On floor		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position 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 Note2)		mm/s	11,221 <6,612>		
Cycle time Note3)		sec	0.53		
Load	Rating	kg (N)	5 (49.0)		
	Maximum		18 (176.5)		
Allowable inertia	Rating	kg・m^2	0.02		
	Maximum		0.2		
Pose repeatability Note4)	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 Note5)			Input 8 points/Output 8 points, eight spare wires		
Tool pneumatic pipes			Φ6×2		
Supply pressure		MPa	0.5±10%		
Protection specification Note6) Note7)			IP20	—	IP54
Degree of cleanliness Note8)			—	10(0.3 μm)	—
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)		

Note1) The table is joint writing on the General environment and clean and oil mist specification.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The protection specification details are given in Page 35, "2.2.8 Protection specifications".

Note7) 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.

Note8) The details of the clean specifications are described in Page 38, "2.2.9 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.

(4) RH-20SQH series

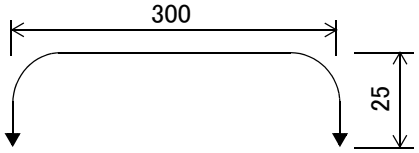
Table 2-8 : Tab Standard specifications of robot (Standard Specification)

Item		Unit	Specifications			
Type			RH-20SQH8535	RH-20SQH8545	RH-20SQH10035	RH-20SQH10045
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	400			
	J4 (θ axis)	W	100			
Brake			J1, J2 : no brake J3, J4 : with brake			
Arm length	No. 1 arm	mm	525		525	
	No. 2 arm	mm	325		475	
Max.reach radius(No. 1+ No. 2)		mm	850		1000	
Operating range	J1	deg	280 (± 140)			
	J2	deg	306 (± 153)			
	J3 (Z)	mm	350(-10 ～ 340)	450(-110 ～ 340)	350(-10 ～ 340)	450(-110 ～ 340)
	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(6,612)		13,055(8,446)	
Cycle time Note2)		sec	0.53		0.69	
Load	Rating	kg (N)	5			
	Maximum		20			
Allowable inertia	Rating	kg・m^2	0.02			
	Maximum		0.2			
Pose repeatability Note3)	X-Y direction	mm	± 0.025		± 0.030	
	J3 (Z)	mm	± 0.01			
	J4 (θ axis)	deg	± 0.03			
Ambient temperature		℃	0～40			
Mass		kg	47	48	50	51
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)			IP30			
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 "< >" 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 24, "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 35, "2.2.8 Protection specifications".When using the robot in the oil mist environment etc., please choose oil mist specification (Table 2-10).

Table 2-9 : Tab Standard specifications of robot (Clean Specification)

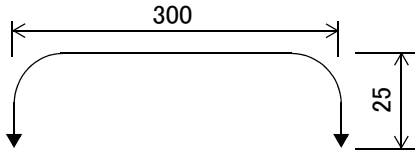
Item		Unit	Specifications			
Type[Note1]			RH-20SQH8530C	RH-20SQH8538C	RH-20SQH10030C	RH-20SQH10038C
Environment			Clean specification			
Installation posture			On floor			
Degree of freedom			4			
Structure			Horizontal, multiple-joint type			
Drive system			AC servo motor			
Position detection method			Absolute encoder			
Motor capacity	J1	W	750			
	J2	W	400			
	J3 (Z)	W	400			
	J4 (θ axis)	W	100			
Brake			J1, J2 : no brake J3, J4 : with brake			
Arm length	No. 1 arm	mm	525		525	
	No. 2 arm	mm	325		475	
Max.reach radius(No. 1+ No. 2)		mm	850		1000	
Operating range	J1	deg	280 (±140)			
	J2	deg	306 (±153)			
	J3 (Z)	mm	300(-10 ~ 290)	380(-110 ~ 270)	300(-10 ~ 290)	380(-110 ~ 270)
	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 [Note2]		mm/s	11,221(6,612)		13,055(8,446)	
Cycle time[Note3]		sec	0.53		0.69	
Load	Rating	kg (N)	5			
	Maximum		20			
Allowable inertia	Rating	kg・m^2	0.02			
	Maximum		0.2			
Pose repeatability [Note4]	X-Y direction	mm	±0.025		±0.030	
	J3 (Z)	mm	±0.01			
	J4 (θ axis)	deg	±0.03			
Ambient temperature		℃	0~40			
Mass		kg	47	48	50	51
Tool wiring [Note5]			Input 8 points/Output 8 points, eight spare wires			
Tool pneumatic pipes			Φ6 × 2			
Supply pressure		MPa	0.5 ± 10%			
Degree of cleanliness[Note6]			10 (0.3μm)			
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)			

Note1) The type in which operating range of J3 axis (Z) is 300mm and 380mm is shown together.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The details of the clean specifications are described in Page 38, "2.2.9 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 2-10 : Tab Standard specifications of robot (Oil mist Specification)

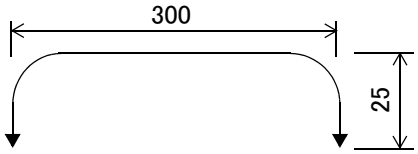
Item		Unit	Specifications			
Type[Note1]			RH-20SQH8530M	RH-20SQH8538M	RH-20SQH10030M	RH-20SQH10038M
Environment			Oil mist specification			
Installation posture			On floor			
Degree of freedom			4			
Structure			Horizontal, multiple-joint type			
Drive system			AC servo motor			
Position detection method			Absolute encoder			
Motor capacity	J1	W	750			
	J2	W	400			
	J3 (Z)	W	400			
	J4 (θ axis)	W	100			
Brake			J1, J2 : no brake J3, J4 : with brake			
Arm length	No. 1 arm	mm	525		525	
	No. 2 arm	mm	325		475	
Max.reach radius(No. 1+ No. 2)		mm	850		1000	
Operating range	J1	deg	280 (±140)			
	J2	deg	306 (±153)			
	J3 (Z)	mm	300(-10 ～ 290)	380(-110 ～ 270)	300(-10 ～ 290)	380(-110 ～ 270)
	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 [Note2]		mm/s	11,221(6,612)		13,055(8,446)	
Cycle time[Note3]		sec	0.53		0.69	
Load	Rating	kg (N)	5			
	Maximum		20			
Allowable inertia	Rating	kg・m^2	0.02			
	Maximum		0.2			
Pose repeatability [Note4]	X-Y direction	mm	±0.025		±0.030	
	J3 (Z)	mm	±0.01			
	J4 (θ axis)	deg	±0.03			
Ambient temperature		℃	0～40			
Mass		kg	47	48	50	51
Tool wiring [Note5]			Input 8 points/Output 8 points, eight spare wires			
Tool pneumatic pipes			Φ6 × 2			
Supply pressure		MPa	0.5 ± 10%			
Protection specification[Note6] [Note7]			IP54			
Painting color			Light gray (Equivalent to Munsell : 0.08GY7.46/0.81)			

Note1) The type in which operating range of J3 axis (Z) is 300mm and 380mm is shown together.

Note2) The value when J1, J2 and J4 are composed. The value in "< >" is the value when J1 and J2 are composed.

Note3) 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.



Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

Note6) The protection specification details are given in Page 35, "2.2.8 Protection specifications".

Note7) 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.

(5) RH-3SQHR series

Table 2-11 : Tab Standard specifications of robot

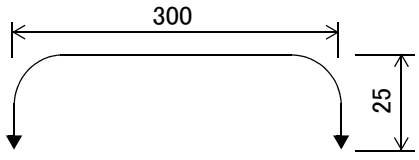
Item		Unit	Specifications Note1)		
Type			RH-3SQHR3515	RH-3SQHR3512C	RH-3SQHR3512W
Environment			Standard specification	Clean specification	Waterproof specification
Installation posture			Hanging		
Degree of freedom			4		
Structure			Horizontal, multiple-joint type		
Drive system			AC servo motor		
Position detection method			Absolute encoder		
Motor capacity	J1	W	750		
	J2	W	200		
	J3 (Z)	W	200		
	J4 (θ axis)	W	100		
Brake			J1, J2, J4: no brake J3: with brake		
Arm length	No. 1 arm	mm	175		
	No. 2 arm	mm	175		
Max.reach radius(No. 1+ No. 2)		mm	350		
Operating range	J1	deg	±225		
	J2	deg	±225		
	J3 (Z)	mm	150	120	
	J4 (θ axis)	deg	±720		
Speed of motion	J1	deg/s	672		
	J2	deg/s	708		
	J3 (Z)	mm/s	1,500		
	J4 (θ axis)	deg/s	3,146		
Maximum horizontal composite speed Note2)		mm/s	6,267		
Cycle time Note3)		sec	0.32		
Load	Rating	kg (N)	1		
	Maximum		3		
Allowable inertia	Rating	kg・m^2	0.005		
	Maximum		0.05		
Pose repeatability Note4)	X-Y direction	mm	±0.01		
	J3 (Z)	mm	±0.01		
	J4 (θ axis)	deg	±0.01		
Ambient temperature		℃	0～40		
Mass		kg	24	28	
Tool wiring Note5)			Input 8 points/Output 8 points (Option: Output 8 points), eight spare wires		
Tool pneumatic pipes			Primary: φ6 x 2 (secondary : φ4 x 8 by option)		
Supply pressure		MPa	0.5 ± 10%		
Protection specification			General-purpose environment: IP20	Clean: ISO class 5	Waterproof: IP65
Painting color			Not painting. Plating (silver)		

Note1) The table is joint writing on the General environment and clean and waterproof (IP65) specification.

Note2) The speed regulation function will operate at moving near the singular point by linear interpolation. Although based on specified speed, speed drops generally. Refer to Page 33, "2.2.6 About moving speed at singular point and near singular point. (RH-3SQHR series)" for details.

Note3) 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.



・The robot's moving time is influenced by the posture etc. As reference, the reduction method of cycle time is shown in Page 31, " [Supplementary explanation 2]: The setting which shortens execution time".

Note4) The pose repeatability details are given in Page 24, "2.2.1 Pose repeatability".

Note5) The pneumatic hand interface (option) is required when the tool (hand) output is used.

2.1.1 The counter-force applied to the installation surface

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

Table 2-12 : Value of each counter-force

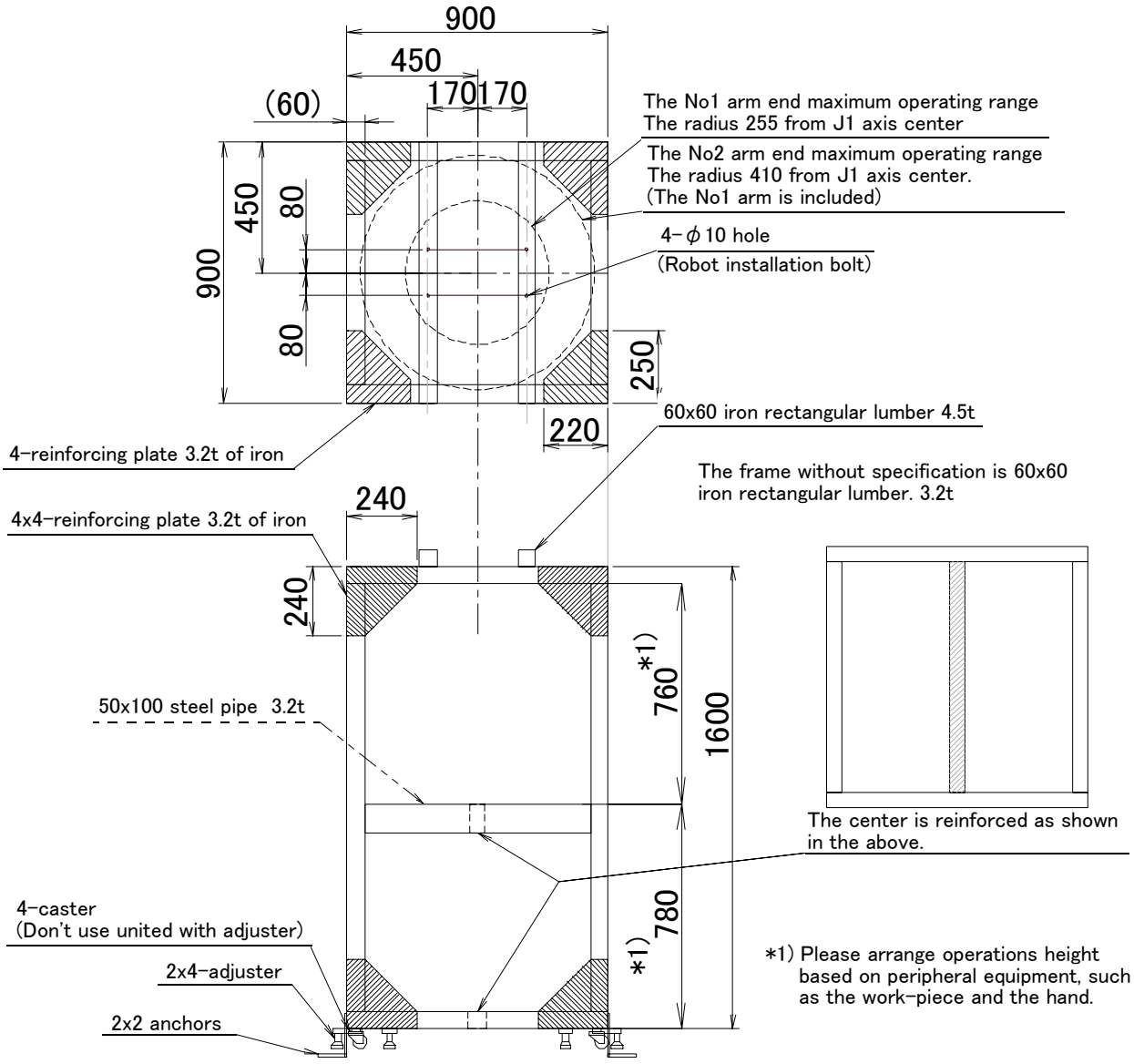
Item	Unit	Value
RH-6SQH series		
Falls moment: M_L	N•m	３８０
Torsion moment: M_T	N•m	４１０
Horizontal translation force: F_H	N	９２０
Vertical translation force: F_V	N	５７０
RH-12SQH/18SQH/20SQH series		
Falls moment: M_L	N•m	１，３１０
Torsion moment: M_T	N•m	１，４４０
Horizontal translation force: F_H	N	１，９００
Vertical translation force: F_V	N	１，２８０
RH-3SQHR series		
Falls moment: M_L	N•m	３，８０
Torsion moment: M_T	N•m	４１０
Horizontal translation force: F_H	N	９２０
Vertical translation force: F_V	N	５７０

2.1.2 RH-3SQHR series installation stage

RH-3SQHR series is the robot which hangs. Please manufacture the stage by the customer as shown below, and install the robot.

As an example of the installation stage, the stage using the iron (cheap) and the stage using the aluminum (easy to process) are shown. Since the product made from the aluminum has strengthened reinforcement, both have the almost same weight.

(1) Example which uses the iron material



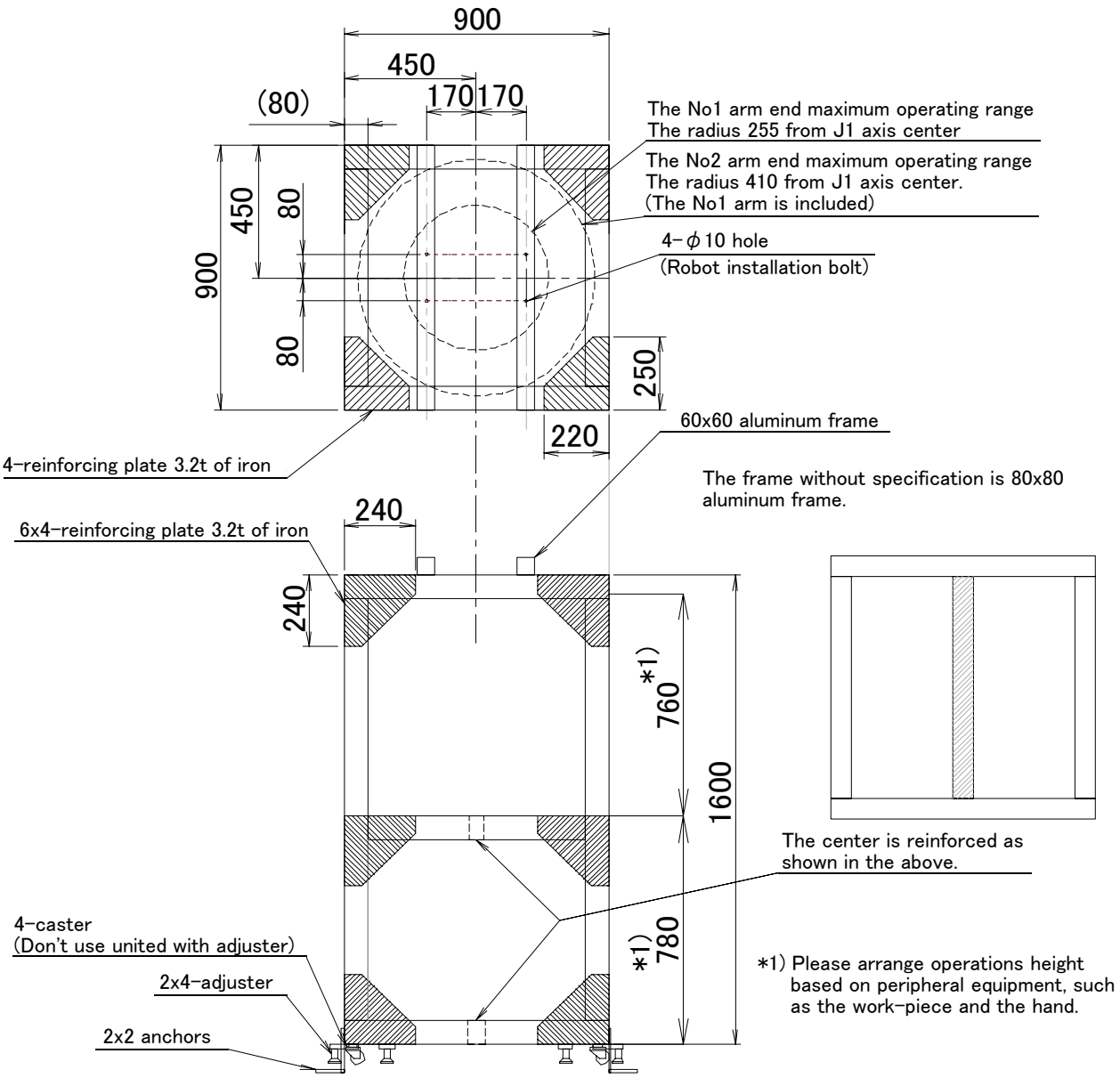
Note1) The gross weight of this stage is about 200kg.

Note2) This stage is an example. Please design based on the conditions of the system.

Note3) Fixing the stage to the floor by anchor etc. If the center of gravity of the stage is in the high position, the stage may fall by movement of the robot.

Fig.2-1 : Installation stage (Example of iron-material use)

(2) Example which uses the aluminum



Note1) The gross weight of this stage is about 200kg.
Note2) This stage is an example. Please design based on the conditions of the system.
Note3) Fixing the stage to the floor by anchor etc. If the center of gravity of the stage is in the high position, the stage may fall by movement of the robot.

Fig.2-2 : Installation stage (Example of aluminum frame use)

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 *1) and a position within the actual space

[6] Positioning movement near the singular point (RH-3SQHR series)

*1)
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 Rated load (mass capacity)

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

(1) The tooling should have the value less or equal than the smaller of the tolerable inertia and the tolerable moment found in Page 10, "2.1 Standard specifications".

(2) Fig. 2-3, Fig. 2-4, Fig. 2-5, Fig. 2-6 and Fig. 2-7 shows the distribution dimensions for the center of gravity in the case where the volume of the load is relatively small. Use this figure as a reference when designing the tooling.

[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 mechanical interface 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.

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

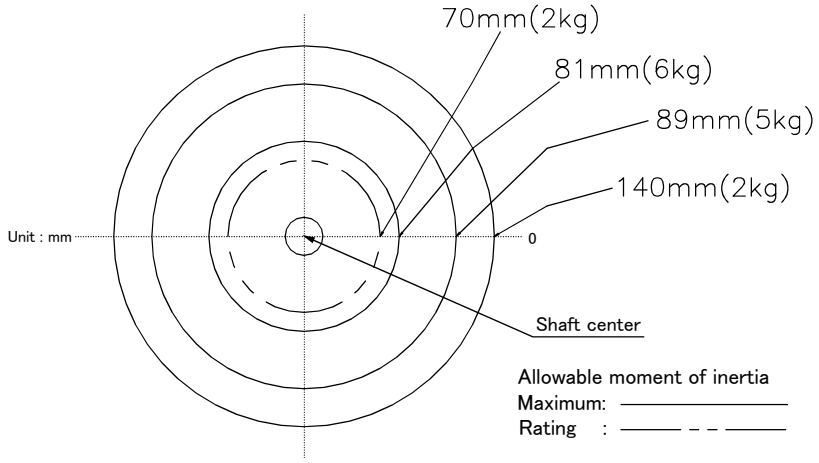


Fig.2-3 : Position of center of gravity for loads (for loads with comparatively small volume): RH-6SQH series

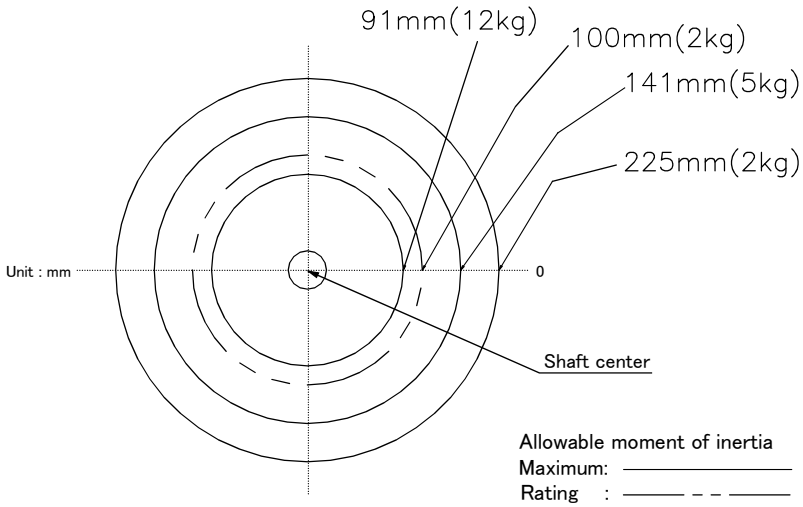


Fig.2-4 : Position of center of gravity for loads (for loads with comparatively small volume): RH-12SQH series

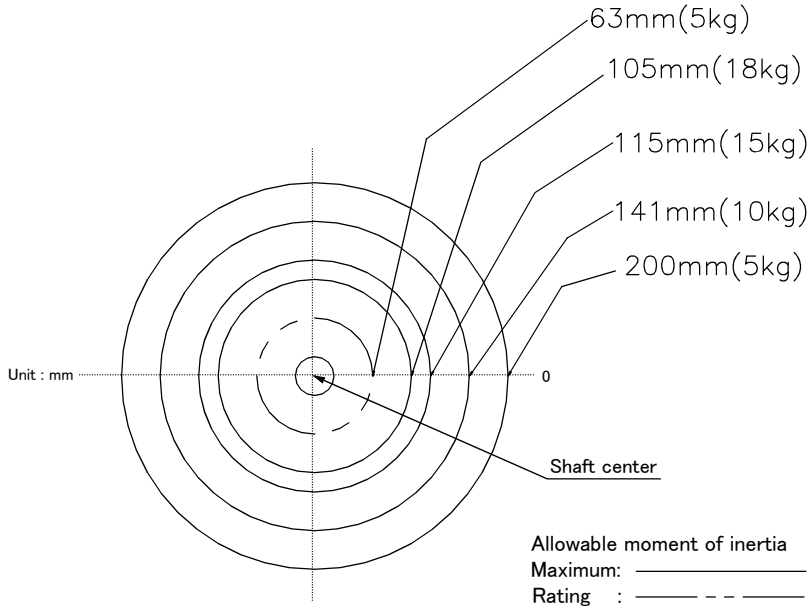


Fig.2-5 : Position of center of gravity for loads (for loads with comparatively small volume): RH-18SQH series

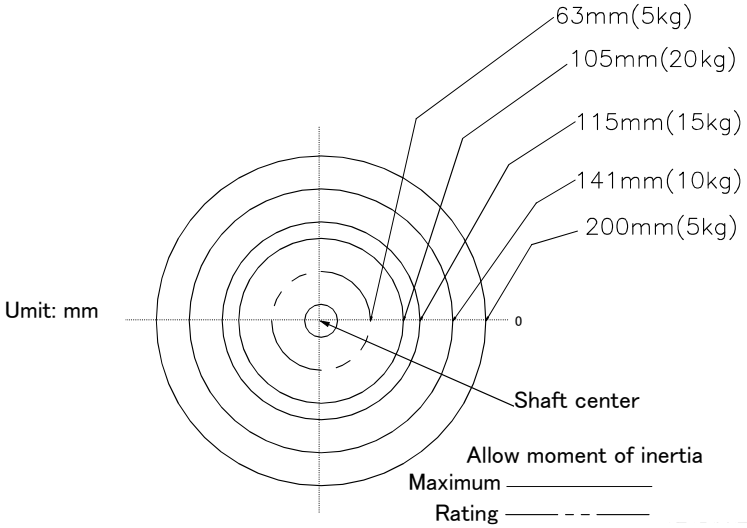
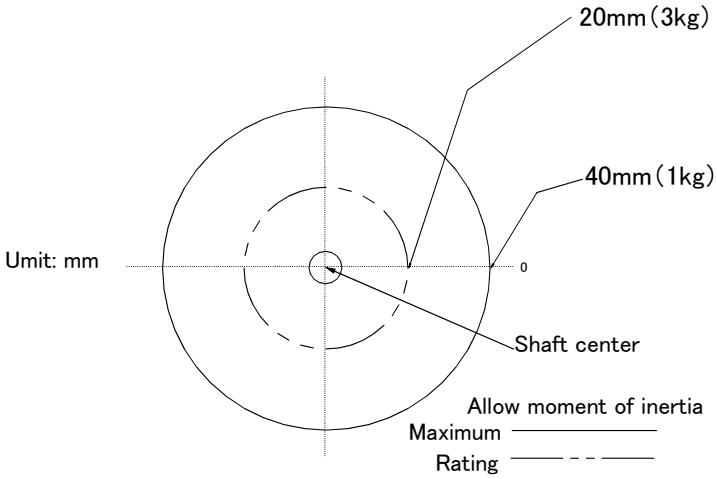


Fig.2-6 : Position of center of gravity for loads (for loads with comparatively small volume): RH-20SQH series



Note) If the center-of-gravity position is away, the arm may shake by rotation of the J4 axis. In this case, please use robot at a low speed.

Fig.2-7 : Position of center of gravity for loads (for loads with comparatively small volume): RH-3SQHR 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.
To achieve that, it is necessary to correctly set the actual load data (mass and size of hand and work) to be used. However, vibration, overheating and errors such as excessive margin of error and overload may occur,depending on the robot operation pattern or ambient temperature. In such a case, change the setting value to the +20% range. If a setting is performed in such a way that it falls below the mounted load, the life span of the mechanism elements used in the robot may be shortened. In the case of a work requiring a high degree of accuracy, set up the load correctly and use the robot by lowering the ratios of the acceleration and deceleration speeds.

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

Set up the capacity and size of the hand with the "HNDDAT*" parameter (optimum acceleration/deceleration setting parameter), and set up the capacity and size of the work with the "WRKDAT*" parameter. Numbers 0 to 8 can be used for the asterisk (*) part. Designate the "HNDDAT*" and "WRKDAT*" parameters to be used using the "LOADSET" command in a program.
For more details, refer to the separate "Instruction Manual/Detailed Explanation of Functions and Operations."
It is the same meaning as "LOADSET 0.0" if not using the "LOADSET".

<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-6SQH 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-12SQH 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-18SQH 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
RH-20SQH series							
HNDDAT*	20.0	258.0	258.0	38.0	0.0	0.0	19.0
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RH-3SQHR series							
HNDDAT*	3.0	76.0	76.0	58.0	0.0	0.0	24.0
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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

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

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

2.2.5 Vibration of shaft (J3 axis) position and arm end

Vibrations at the tip of the arm may increase substantially during operation under the shaft position near the low end or the high end of the robot, depending on the combination of hand mass and hand inertia. This problem occurs according to that inertia, because the distance from the shaft support section to the shaft end becomes long. When this vibration affects the robot's operations, please change operating speed etc. like the above "2.2.4 Vibrations at the Tip of the Arm during Low-Speed Operation of the Robot."

(1) 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. 2-8). However, this function does not work with the setting of 2kg (5kg in the case of RH-18SQH/RH-20SQH sereis) or lighter load mass. When the setting of the load mass is changed to 2kg (5kg in the case of RH-18SQH/RH-20SQH 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.

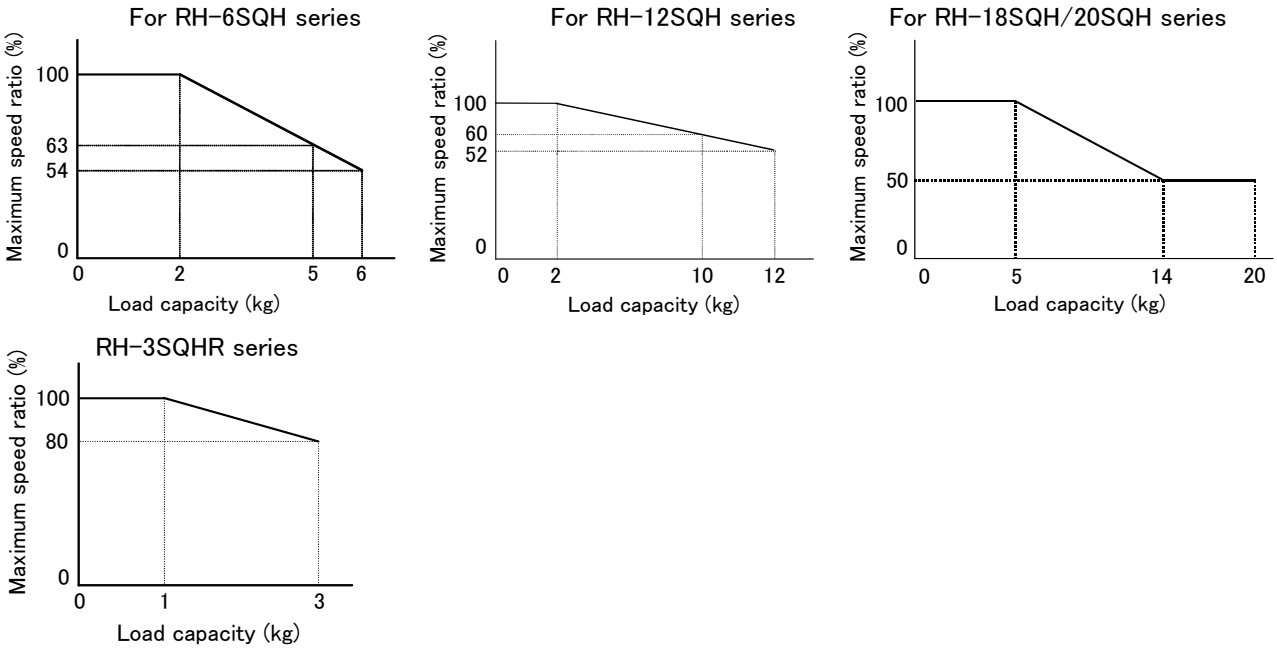


Fig.2-8 : Automatic compensation of speed

(2) 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. 2-9) will be activated. This function is invalid if the shaft (axis J3) operates at a position above P3 in Fig. 2-9. Acceleration/deceleration is compensated for at a position below P3 in Fig. 2-9 if the position of the center of gravity of the load is located at the front edge of the shaft.

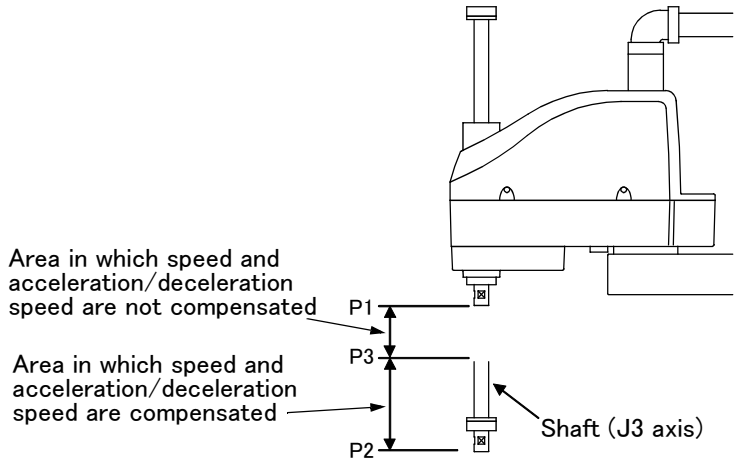


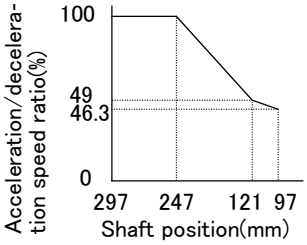
Fig.2-9 : Area in which acceleration/deceleration speed is compensated

Table 2-13 : Area in which acceleration/deceleration speed is compensated

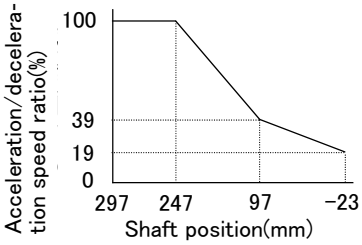
Type	J3 axis stroke(mm)			Compensation area (P2 to P3)
	Stroke length	P1(Upper end)	P2(Lower end)	
RH-6SQH series	200	297	97	97 ～ 247
	320	297	-23	-23 ～ 247
RH-12SQH series	350	340	-10	-10 ～ 248
	450	340	-110	-110 ～ 248
RH-18SQH series	350	340	-10	-10 ～ 320
RH-20SQH series	450	340	-110	-110 ～ 320
RH-3SQHR series	150	-583	-733	-733 ～ -643

<RH-6SQH series>

J3 axis (Z) stroke 200mm
(Standard Acceleration/deceleration speed)

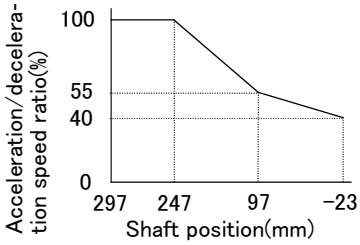


J3 axis(Z) stroke 320mm
(Standard Acceleration/deceleration speed)



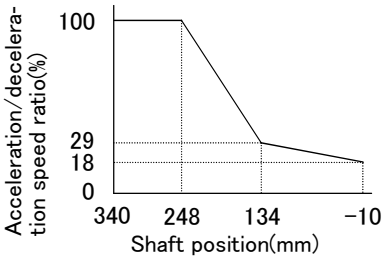
Note 1

J3 axis(Z) stroke 320mm
(High acceleration and deceleration rate)

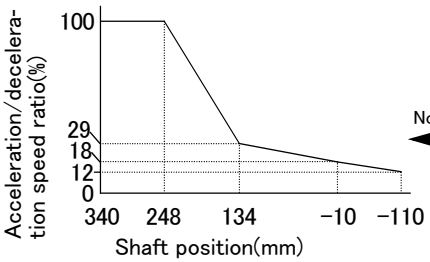


<RH-12SQH series>

J3 axis (Z) stroke 350mm
(Standard Acceleration/deceleration speed)

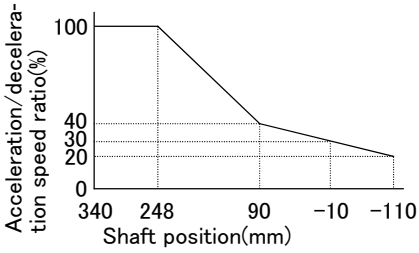


J3 axis (Z) stroke 450mm
(Standard Acceleration/deceleration speed)

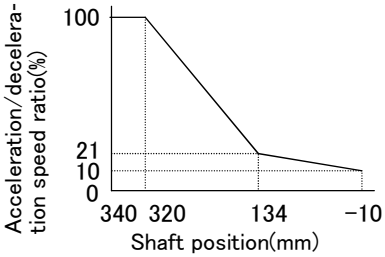


Note 1

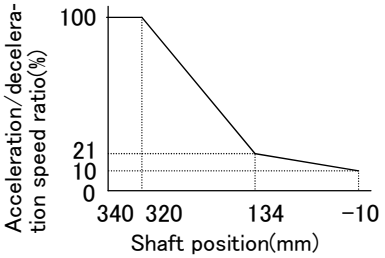
RH-12SQH series common
(High acceleration and deceleration rate)



<RH-18SQH series>
(Standard Acceleration/deceleration speed)

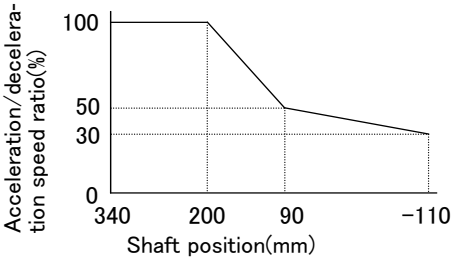


<RH-20SQH series>
(Standard Acceleration/deceleration speed)

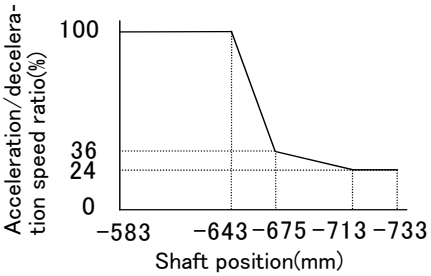


Note 1

<RH-20SQH series common
(High acceleration and deceleration rate)



<RH-3SQHR series>
J3 axis (Z) stroke: 150mm
(Standard Acceleration/deceleration speed)



Note) The high acceleration-and-deceleration pattern of the type without illustration of the high acceleration-and-deceleration pattern is the same as the standard acceleration-and-deceleration pattern.

Fig.2-10 : Automatic compensation of acceleration/deceleration speed

[Supplementary explanation 1]: Acceleration-and-deceleration pattern selection

*To the customer who uses RH-6SQH/12SQH/20SQH series (Note 1 of Fig. 2-10)

In RH-6SQH/12SQH / 20SQH series, the standard acceleration-and-deceleration rate and the high acceleration-and-deceleration rate are prepared for the acceleration-and-deceleration optimization function corresponding to the height of the shaft (J3 axis), and it can be chosen by the parameter. Initial setting is the standard acceleration-and-deceleration rate, and vibration (remains vibration to include) is suppressed to the minimum. When this vibration does not affect the robot's operations, the high acceleration-and-deceleration rate can be chosen, and the robot can be operated at high speed. Please change the parameter if needed and utilize the robot.
The target parameter name and the setting value are shown below. Refer to "separate instructions manual/Detailed explanations of functions and operations" for the details of the parameter and change method .

Parameter name: MAPMODE

The setting value and the function.....0: Standard acceleration-and-deceleration rate (initial value),
1 : High acceleration-and-deceleration rate

*To the customer who uses RH-18SQH85xx series

When work mass including the hand is used in RH-20SQH85xx series on the conditions of 18kg or less as usual, cycle time may differ from the conventional. In this case, the robot can be operated in cycle time almost equivalent to the conventional RH-18SQH85xx series by changing the value of parameter: LOADMODE into "1". Please change the parameter if needed and utilize the robot.
The target parameter name and the setting value are shown below. Refer to "separate instructions manual/Detailed explanations of functions and operations" for the details of the parameter and change method .

Parameter name: LOADMODE

Setting value and function.....0: 20kg mode (initial value), 1: 18kg mode

*To the customer who uses RH-3SQHR series

The RH-3SQHR series have standard acceleration-and-deceleration mode only.

[Supplementary explanation 2]: The setting which shortens execution time

The execution time can be improved by using the following methods.

1) Perform continuous path operation using the Cnt instruction.
2) Control the optimum acceleration/deceleration using the Oadl instruction.
3) Control the optimum speed using the Spd instruction.
4) Setting a larger value in the optimum acceleration/deceleration adjustment rate parameter (JADL). (RH-3SQHR series)

The moving time can be shortened by setting a larger value in the optimum acceleration/deceleration adjustment rate parameter (JADL). In the RH-3SQHR series, the acceleration/deceleration speed is initialized to allow continuous moving with a short wait time (setting of B in the figure).
This setting is suited for continuous operations that have a short tact time, such as palletizing work.
Conversely, if quick moves (short moving time) are required, such as L/UL work on machined parts, the acceleration/deceleration speed can be increased by initial setting (setting of A in the Fig. 2-11).
However, depending on the set values of acceleration/deceleration speed, it becomes easy to cause an overload error and an overheat error. Moreover, excessive error may occur depending on an installation environment.
In such a case, extend the wait time, reduce the acceleration/deceleration speed, or decrease the moving speed.

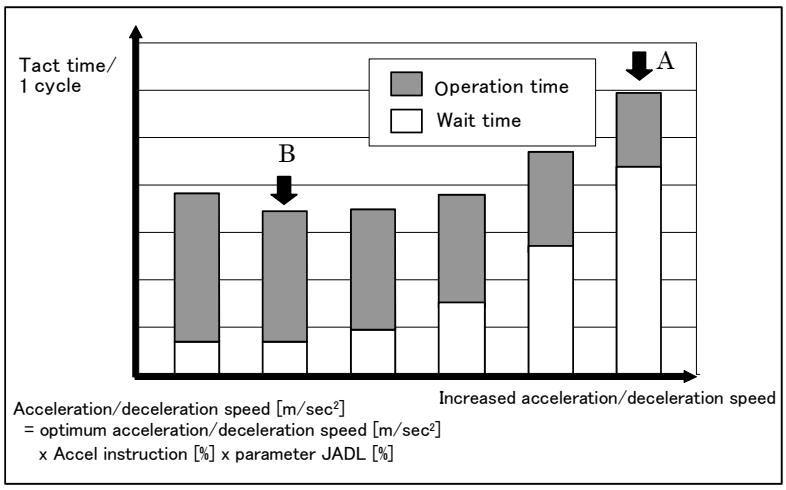


Fig.2-11 : Relationship between Acceleration/deceleration Speed and Tact Time (Conceptual Drawing)

5) Move without changing the posture. (RH-3SQHR series)
The robot's moving time is influenced not only by the size of moving distance but by posture change.
The example is shown in Fig. 2-12. When moving changing the posture (left side of the figure), the movement distance is shorter, but moving time may become long conversely. Conversely, When moving without changing the posture, moving time may become shorter (right side of the figure).

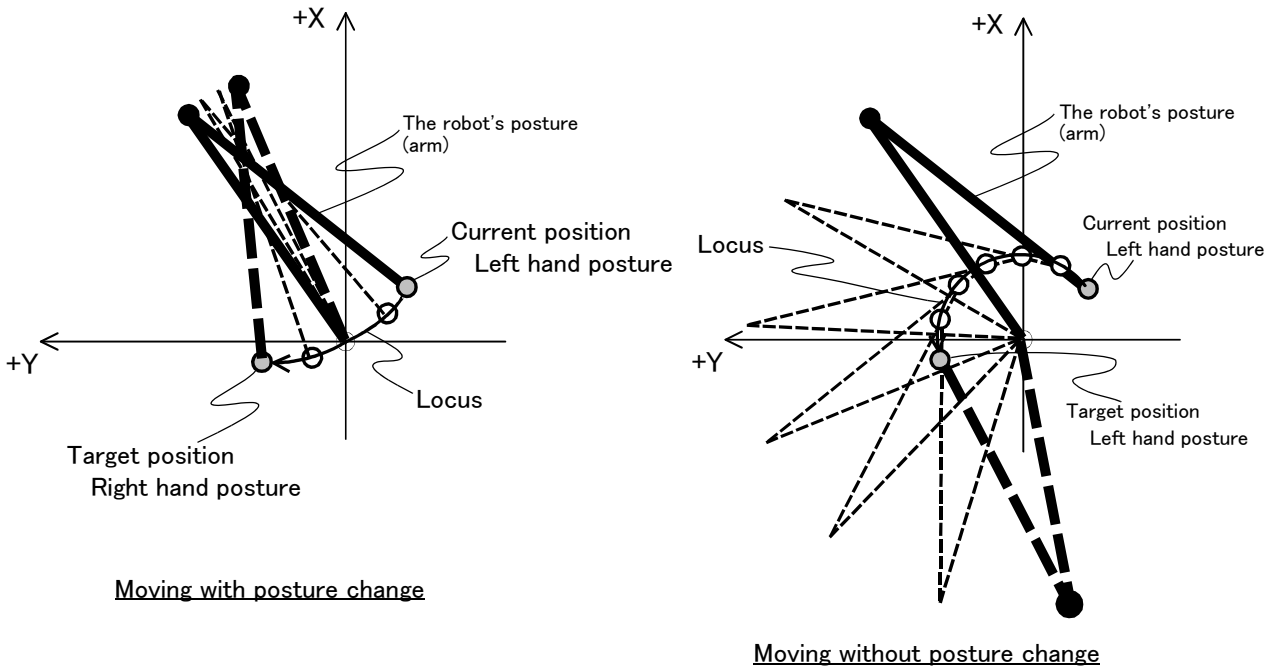


Fig.2-12 : Moving time by posture change (Conceptual Drawing)

(3) Time to reach the position repeatability (only for RH-12SQH/18SQH/20SQH 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. 2-13.)

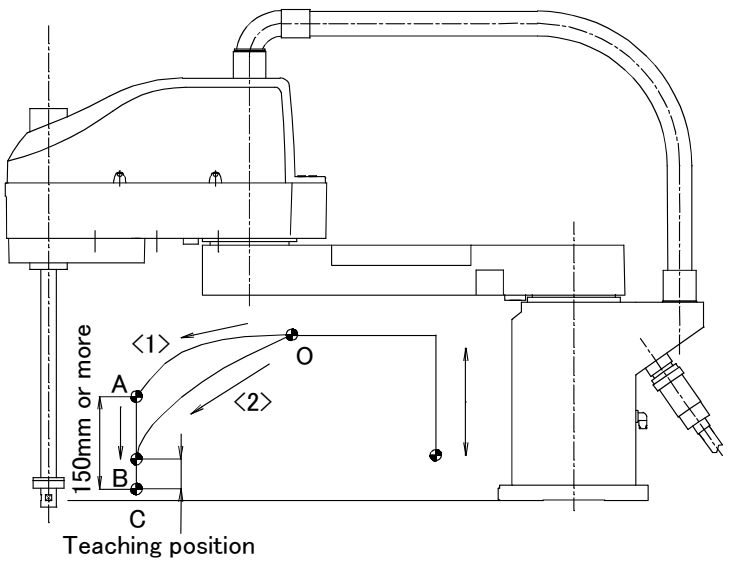


Fig.2-13 : Recommended path when positioning at the bottom edge of the Z axis

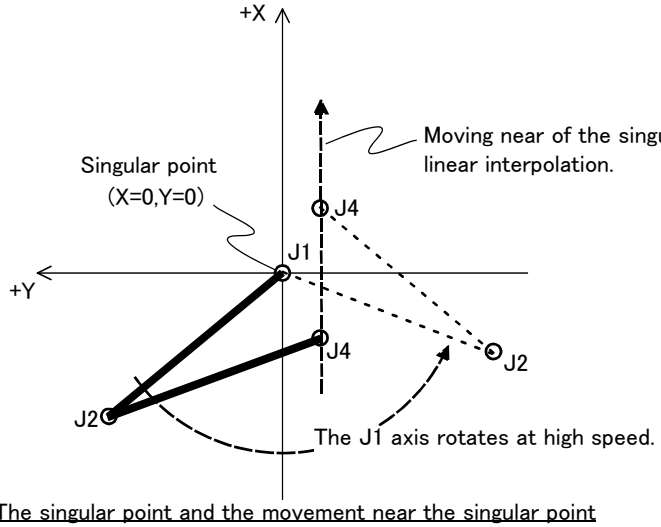
2.2.6 About moving speed at singular point and near singular point. (RH-3SQHR series)

The robot of our company has memorized the teaching position and calculates of linear interpolation movement using the position data in the XYZ coordinate system. Even if it is the same position data, the robot can take two or more postures.

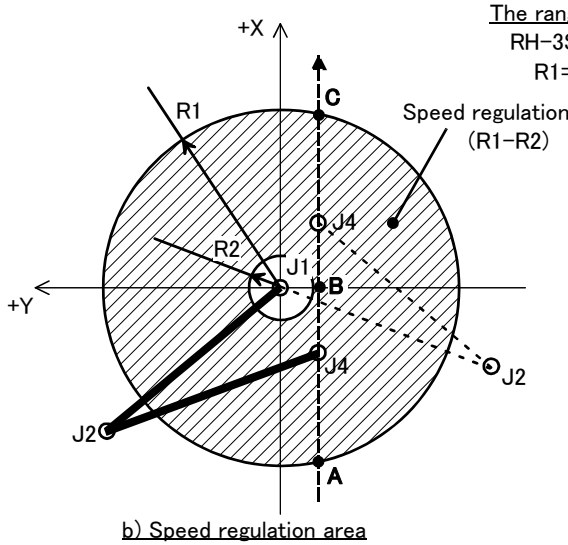
For example, if X coordinate value is "0" and Y coordinate value is also "0", the rotation angle of J1 axis is not decided uniquely. This position is called singular point, and positioning or passing with XYZ JOG and linear interpolation will not be performed. And, even though based on the specified speed, when moving near singular point with linear interpolation , the error occurs , because the J1 axis must rotate at the big speed. ("a)" of Fig. 2-14) However, in RH-3SQHR series, speed was lowered automatically and it has the function which can be passed without the error.

In addition, this function can be changed valid/invalid by setting of parameter:SPDOPT, and SpdOpt command. Refer to the separate manual "Detailed explanations of functions and operations" for details.

And, the area in R2 shown in "b)" of Fig. 2-14 is the singular point, and positioning and passage with linear interpolation movement cannot be performed. In joint interpolation movement, positioning and passage are possible. It is in valid condition at shipping.



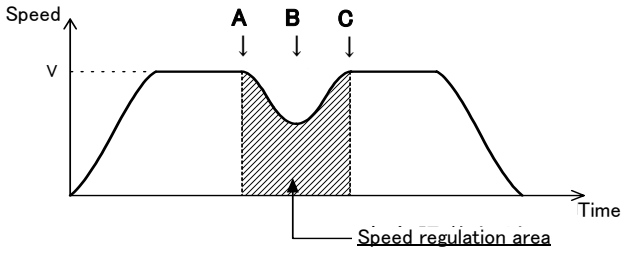
a) The singular point and the movement near the singular point



b) Speed regulation area

The range of the speed regulation area
RH-3SQHR series
R1=240.0mm, R2=1.0mm

A: Starts the slowdown if robot goes into the speed regulation area.
B: Accelerates slowly towards going out.
C: If robot goes out completely from speed regulation area, it returns to specification speed.



c) Speed change in the speed regulation area

Fig.2-14 : The singular point and the speed regulation near the singular point

2.2.7 Collision detection

Collision detection function is valid condition for both of automatic and jog operation at shipping in RH-3SQHR series. (Parameter: COL=1, 1, 1)
So, the robot stops immediately if the robot's tool or arm interferes with a peripheral device, minimizing damage. Therefore, please use in the valid condition.
The abnormalities are detected by the robot's kinetics model, presuming torque necessary for movement at any time. Therefore, the setting parameter (HNDDAT*, WRKDAT*) of the hand and the work piece conditions should be right. And, it may be detected as the collision in movement as speed and motor torque are changed rapidly. (for example, the movement near the place of the origin by linear interpolation, the reversal movement, the cold condition, the operation after long term stoppage)
In such a case, by adjusting the value of the setting parameter (COLLVL, COLLVLJG) of the collision detection level according to actual use environment, the sensitivity of collision detection can be optimized and the damage risk can be reduced further.
And, in the operation after the low temperature or long term stoppage, please operate by accustoming at low speed (warm-up), or use the warm-up operation mode.
Refer to the separate instruction manual "Detailed explanations of functions and operations" for details of related parameter.

Table 2-14 : Factory-shipments condition

	JOG operation	Automatic
RH- □ SQH series	Valid	Invalid
RH-3SQHR series	Valid	Valid

2.2.8 Protection specifications

(1) Types of protection specifications

The robot arm has protection specifications that comply with the IEC Standards. The protection specifications and applicable fields are shown in Table 2-15.
Even oil mist environment can be used in addition to the general environment.

Table 2-15 : Protection specifications and applicable fields

Type	Protection specifications (IEC Standards value)	Classification	Applicable field	Remarks
RH-6SQH series				
RH-6SQH xx20/xx32	Robot arm : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-6SQHxx17M/xx27M	Robot arm : IP54	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 robot machine line will be shortened.
RH-6SQHxx17M-SM/xx27M-SM[Note1)]	Robot arm : IP54			
RH-12SQH series				
RH-12SQHxx35/xx45	Robot arm : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-12SQHxx30M/xx38M	Robot arm : IP54	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 robot machine line will be shortened.
RH-12SQHxx30M-SM/xx38M-SM[Note2)]	Robot arm : IP54			
RH-18SQH series				
RH-18SQH 8535[Note3)]	Robot arm : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-18SQH 8530M	Robot arm : IP54	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 robot machine line will be shortened.
RH-18SQH 8530M-SM [Note2)]	Robot arm : IP54			
RH-20SQH series				
RH-20SQHxx35/xx45	Robot arm : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-20SQHxx30M/xx38M	Robot arm : IP54	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 robot machine line will be shortened.
RH-20SQHxx30M-SM/xx38M-SM[Note4)]	Robot arm : IP54			
RH-3SQHR series				
RH-3SQHR3515	Robot arm : IP20	General environment specifications	General assembly Slightly dusty environment	
RH-3SQHR3512W	Robot arm : IP65	Waterproof specification	Food processing (handling) The field which requires the washing of the robot arm.	

Note1) The "-SM" specification (specification with the controller protection box) comes with the controller protection box (CR1D-MB) as standard.
Note2) Replaced with the CR3D-741M controller in the case of the "-SM" specification (controller specification with countermeasure against oil mist)
Note3) Replaced with the CR3D-751M controller in the case of the "-SM" specification (controller specification with countermeasure against oil mist)
Note4) Replaced with the CR3D-751M controller in the case of the "-SM" specification (controller specification with countermeasure against oil mist)

⚠ CAUTION Use the controller protection box (CR1D-MB) to protect the controller from the environment when the CR1QA-700 series controller will be used in the environment such as the oil mist shown in the Table 2-15. A robot equipped with the controller protection box as standard is available. (Only for the controller of standard specification)

We are confirming examining with the cutting oil shown in Table 2-16, and satisfying protection specification. Our warranty does not cover damages or failure resulting from the robot being operated in any environment where other cutting oils than those listed in the table are used (except cutting oils with respect to which the robot's compatibility with the protection specification is verified through our operability evaluation) or where the robot body may be directly splashed with water, oil or dust in quantities greater than stated in the protection specification.

Table 2-16 : Cutting oil which examined as oil mist environment

No.	Name	Maker	Property	Operating condition
1	CastrolHysol X	Castrol Co., Ltd	Water-soluble	Diluted by a factor of 20
2	CastrolSyntilo9954	Castrol Co., Ltd	Water-soluble	Diluted by a factor of 20
3	Yushiron Oil	YUSHIRO CHEMICAL INDUSTRY CO., LTD	Water-insoluble	-
4	YushirokenE10	YUSHIRO CHEMICAL INDUSTRY CO., LTD	Water-soluble	Diluted by a factor of 20
5	Yushiroken synthetic 770TG	YUSHIRO CHEMICAL INDUSTRY CO., LTD	Water-soluble	Diluted by a factor of 20
6	YushirokenFX90	YUSHIRO CHEMICAL INDUSTRY CO., LTD	Water-soluble	Diluted by a factor of 20
7	SUNCUT ES-50N	NIPPON GREASE CO., LTD	Water-insoluble	-
8	Searching cut SG555	KYOUWA OIL LUBRICANTS CO., LTD,	Water-insoluble	-
9	EMULCUT FA-800	KYODO YUSHI CO., LTD	Water-soluble	-

【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 ㎡ per minute, for a total of 5 minutes or more.

・The IEC IP65

Protection 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.

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.

(2) About the use with the bad environment

The protection specifications 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) We are confirming examining with the cutting oil shown in Table 2-16, and satisfying protection specification. Our warranty does not cover damages or failure resulting from the robot being operated in any environment where other cutting oils than those listed in the table are used (except cutting oils with respect to which the robot's compatibility with the protection specification is verified through our operability evaluation) or where the robot body may be directly splashed with water, oil or dust in quantities larger than stated in the protection specification.
3) Take measures so that the robot will not be exposed to water, oil and/or chips for a long period of time.
4) Robot's protection performance can be improved by pressurizing its interior. If you use a robot in an environment where oil mist is present, it is recommended that the interior of the robot be pressurized to ensure its reliability over a long period of time. Please supply the dry air for pressurization from the phi-8 joint (AIR PURGE) of the robot-arm base rear.

Table 2-17 : Specification of the dry air for pressurization

Item	Dew point	Pressure
Specification	The atmospheric pressure dew point is -20 degree or less.	0 to 0.3kPa

The packing gets deteriorated with the passage of time and must be replaced as required. Table 2-18 provides guidelines for replacing the packing.

Table 2-18 : Packing replacement guideline

Environment	Whether or not robot is pressurized	When packing must be replaced
General environment	Not pressurized Note1)	When signs of cracking or peeling are noted in the packing.
Clean room	Not pressurized Note1)	
Oil mist	Pressurized	
	Not pressurized	When removing and installing the cover.

Note1) The pressurization inside the robot arm is unnecessary in general environment and clean room environment.

Failure to replace deteriorated packing permits water or oil to enter the interior of the robot, possibly causing it to become inoperable.
Table 2-43 lists packings requiring replacement and corresponding robot covers. Packing required and liquid gasket used therewith are available from dealer.

Also, entrained water droplets lead to the formation of rust on the robot, but would not usually affect the robot's ability to operate normally.
The warranty is invalid for any faults that occur when the robot is used under the following conditions.
Also, if the cover and/or other parts are damaged by interferences caused by the peripheral devices and the robot, the protection specification (seal performance, etc.) may be degraded. Therefore, please pay extra attention when handling the robot.
Refer to Page 193, "6.2 Working environment".

1) In surroundings that generate inflammable gases or corrosive gasses.
2) Atmosphere used excluding cutting oil shown in Table 2-16.
3) Environment where the robot is exposed to water, oil and/or chips for a long period of time.
4) In surroundings where chips fall directly on the robot.In surroundings where the minimum diameter of chips is less than 0.5mm.
5) Mist atmosphere exceeding the specification.
6) Pressurization by the dry air exceeding the specification of Table 2-17

2.2.9 Clean specifications

(1) Types of clean specifications

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

Table 2-19 : Clean specifications

Type	Degree of cleanliness	Internal suction	Remarks
RH-6SQHxx17C/xx27C RH-12SQHxx30C/xx38C RH-18SQH8530C RH-20SQHxx30C/xx38C	10(0.3 μm)	Concentrated suction with vacuum generating valve. Use it in the clean room with the down flow (flow velocity 0.3 m/s above).	The use of a vacuum generating valve is recommended.
RH-3SQHR3512C	ISO class 5		

■ 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) A φ 8 coupling is provided in the base section of the robot arm for suction inside the robot arm. When using the robot, connect this coupling with the vacuum generating valve and vacuum pump (furnished by the customer).

[1]When the inside of the robot arm is sucked using the vacuum generator.

Table 2-20 : Specifications of vacuum generation valve （Confirmed in our company）

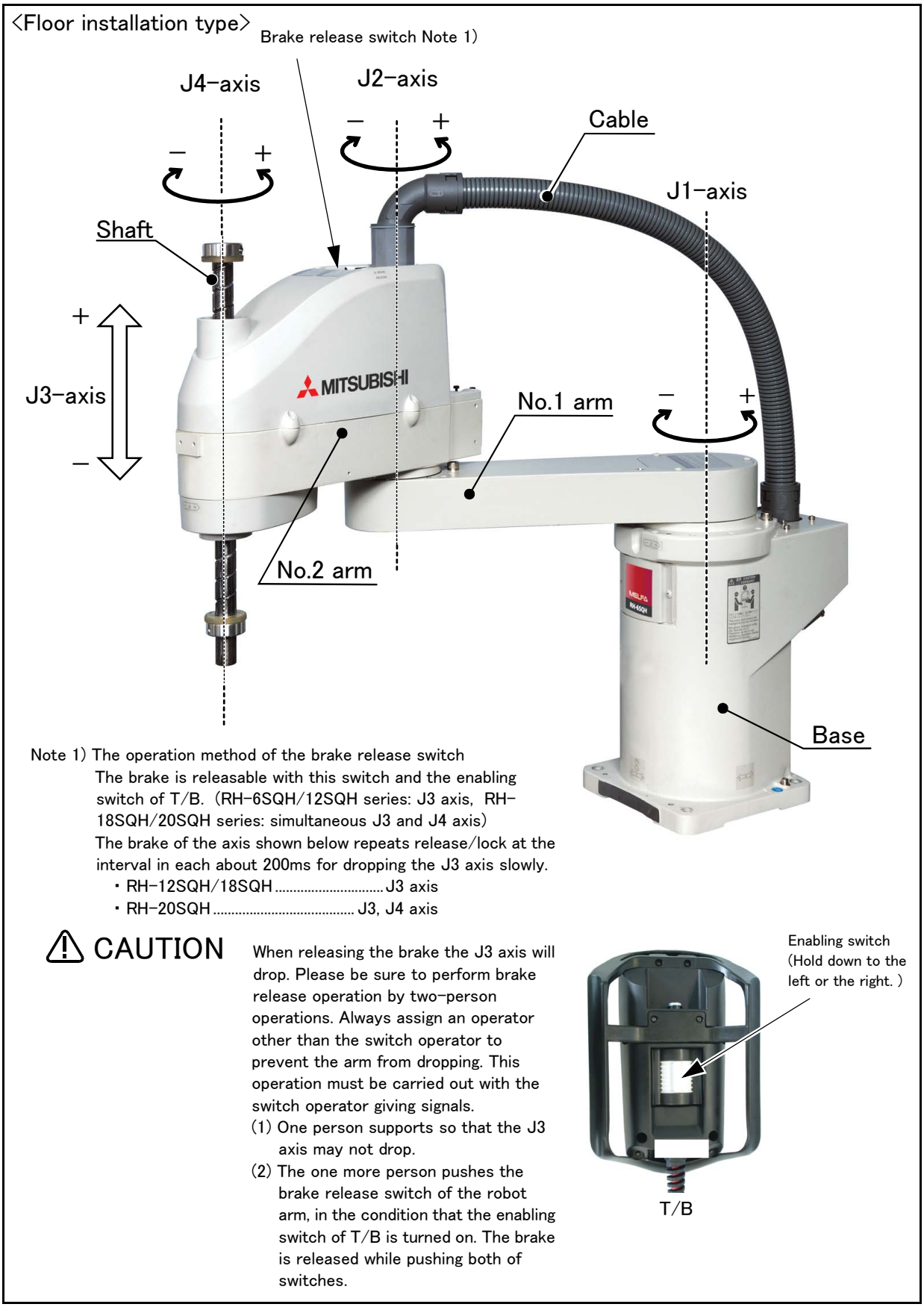
Type	Maker	Air pressure[Note1)]
MEDT 14	KONEGAI CORPORATION	・Vacuum rate (supply pressure is 0.5MPa): 96l. / min ・Ultimate vacuum (supply pressure is 0.5MPa): -84KPa

Note1) 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

[2]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.
If the exhaust leaks into the robot arm, the degree of cleanliness could be affected.

2.3 Names of each part of the robot



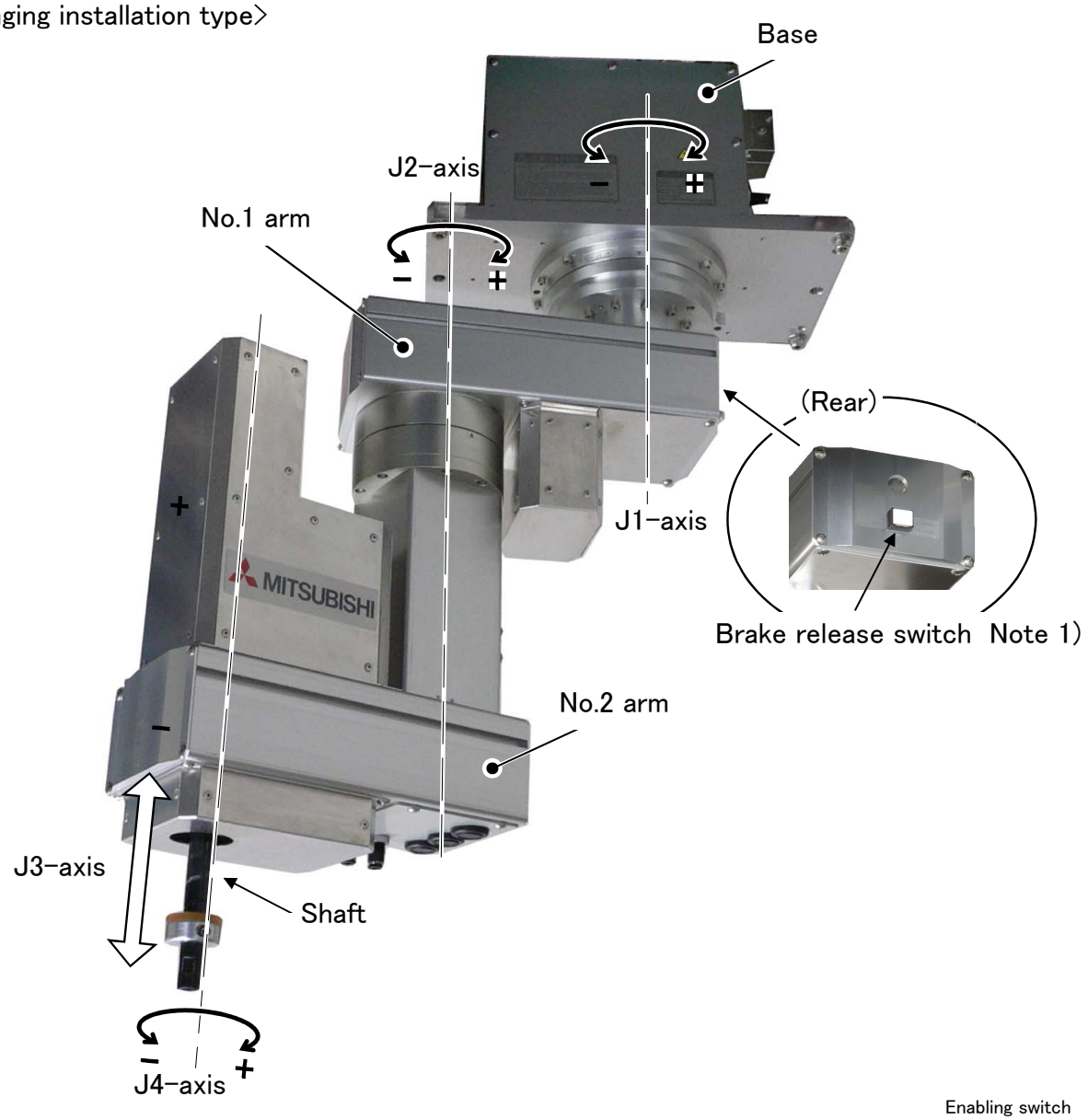
Note 1) The operation method of the brake release switch
The brake is releasable with this switch and the enabling switch of T/B. (RH-6SQH/12SQH series: J3 axis, RH-18SQH/20SQH series: simultaneous J3 and J4 axis)
The brake of the axis shown below repeats release/lock at the interval in each about 200ms for dropping the J3 axis slowly.
- RH-12SQH/18SQH ..... J3 axis
- RH-20SQH ..... J3, J4 axis

⚠ CAUTION

When releasing the brake the J3 axis will drop. Please be sure to perform brake release operation by two-person operations. Always assign an operator other than the switch operator to prevent the arm from dropping. This operation must be carried out with the switch operator giving signals.
(1) One person supports so that the J3 axis may not drop.
(2) The one more person pushes the brake release switch of the robot arm, in the condition that the enabling switch of T/B is turned on. The brake is released while pushing both of switches.

Fig.2-15 : Names of each part of the robot (Floor installation type)

<Hanging installation type>



Note 1) The operation method of the brake release switch
The brake is releasable with this switch and the enabling switch of T/B. (RH-3SQHR series: J3 axis

⚠ CAUTION

When releasing the brake the J3 axis will drop. Please be sure to perform brake release operation by two-person operations. Always assign an operator other than the switch operator to prevent the arm from dropping. This operation must be carried out with the switch operator giving signals.

(1) One person supports so that the J3 axis may not drop.

(2) The one more person pushes the brake release switch of the robot arm, in the condition that the enabling switch of T/B is turned on. The brake is released while pushing both of switches.

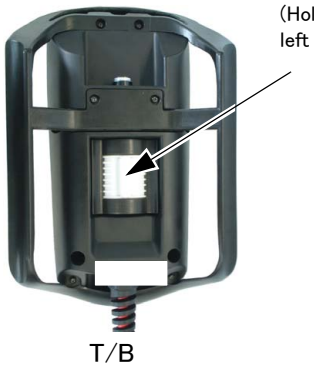
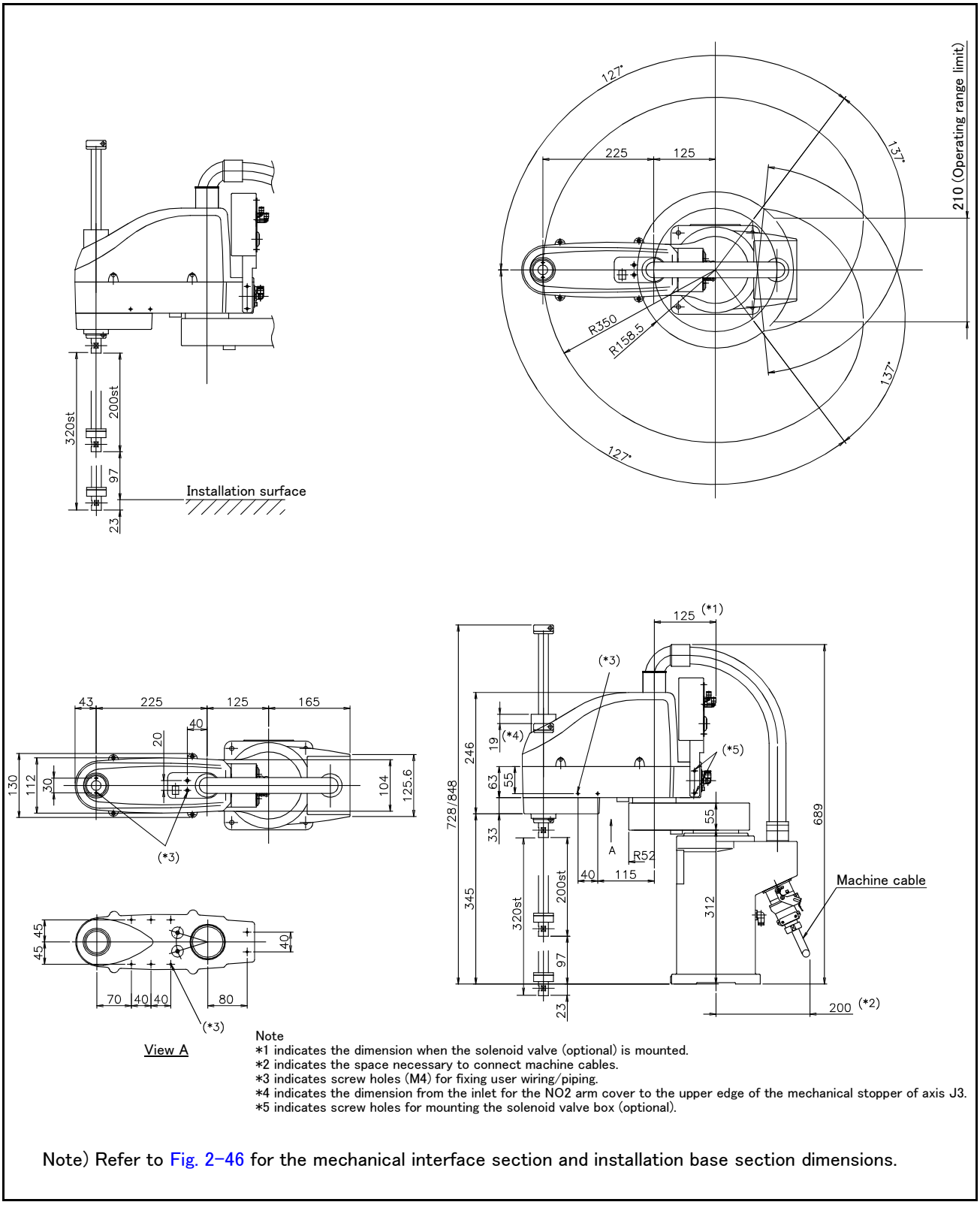


Fig.2-16 : Names of each part of the robot (Hanging installation type)

2.4 Outside dimensions・Operating range diagram

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

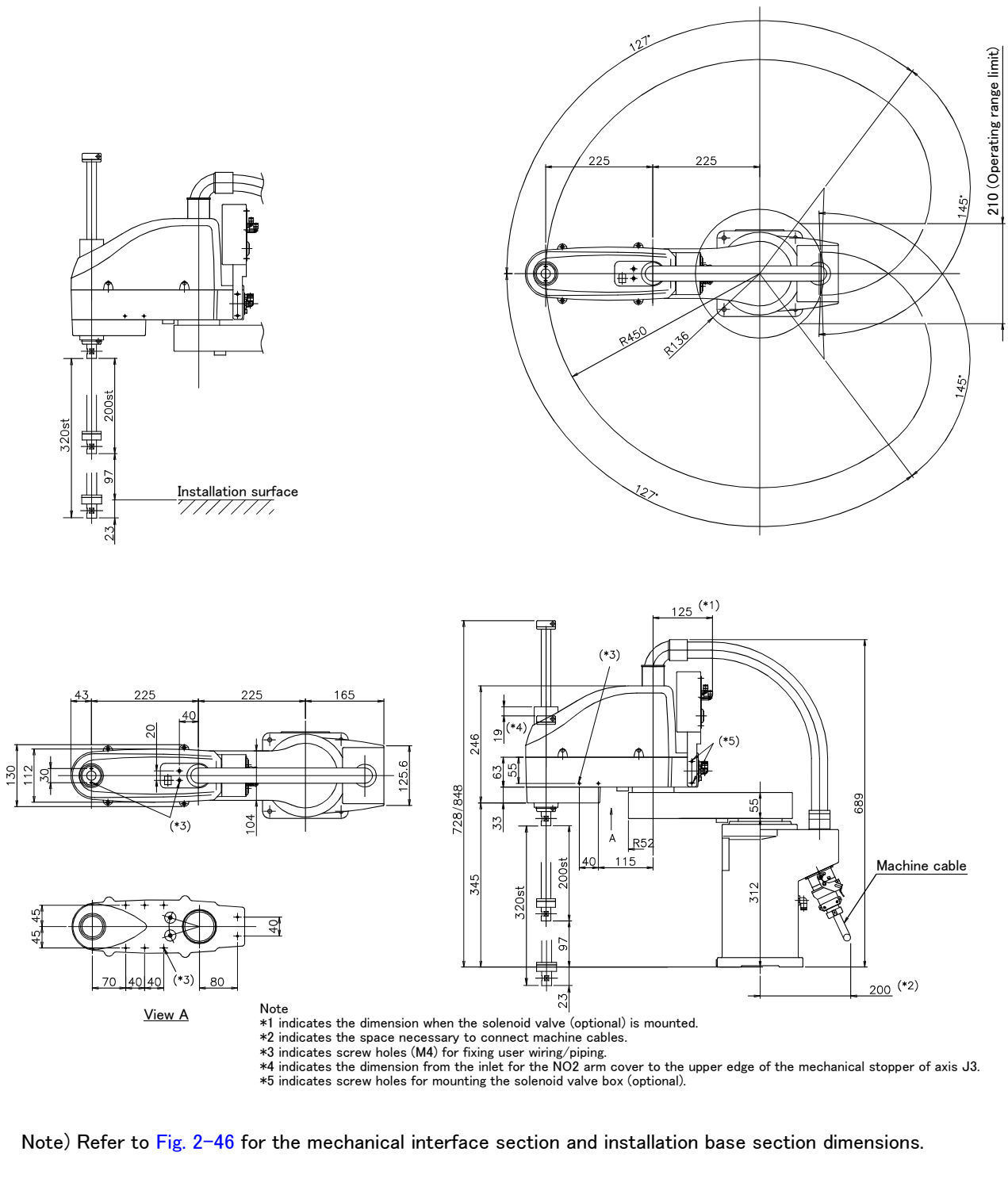
(1) Standard Specification



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. 2-46 for the mechanical interface section and installation base section dimensions.

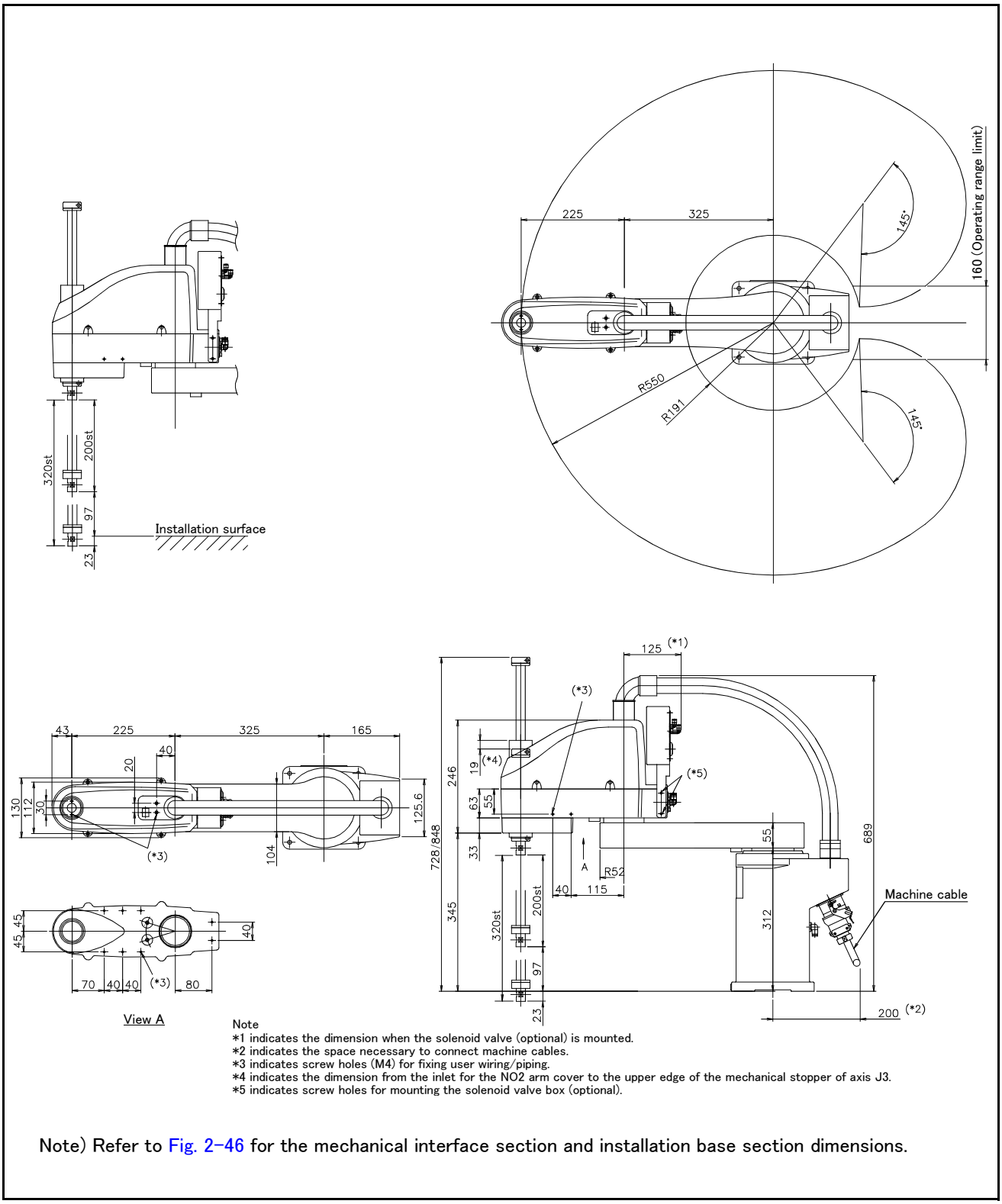
Fig.2-17 : Outside dimensions, Operating range diagram of RH-6SQH35xx



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. 2-46 for the mechanical interface section and installation base section dimensions.

Fig.2-18 : Outside dimensions, Operating range diagram of RH-6SQH45xx

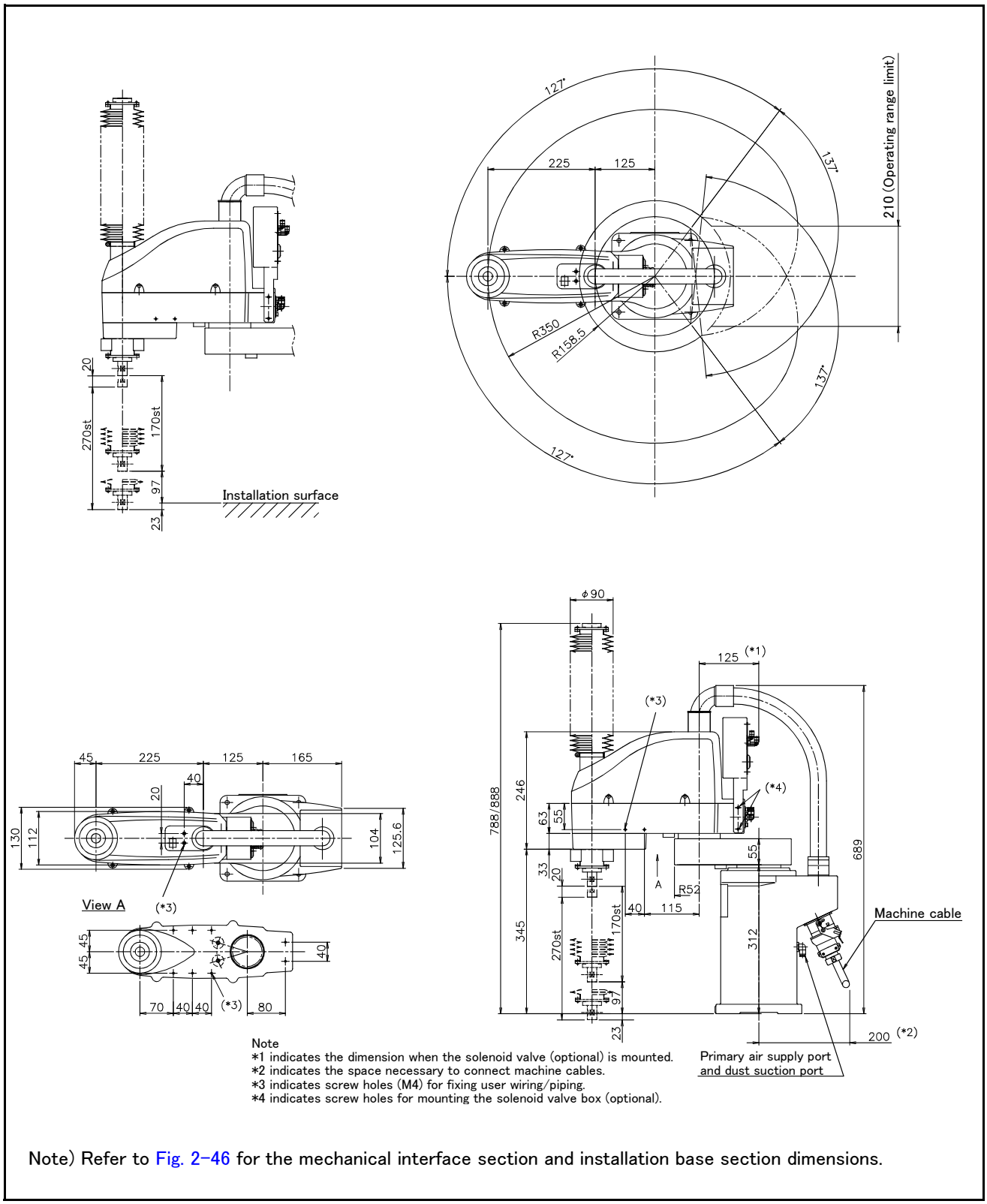


Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates the dimension from the inlet for the NO2 arm cover to the upper edge of the mechanical stopper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

Note) Refer to Fig. 2-46 for the mechanical interface section and installation base section dimensions.

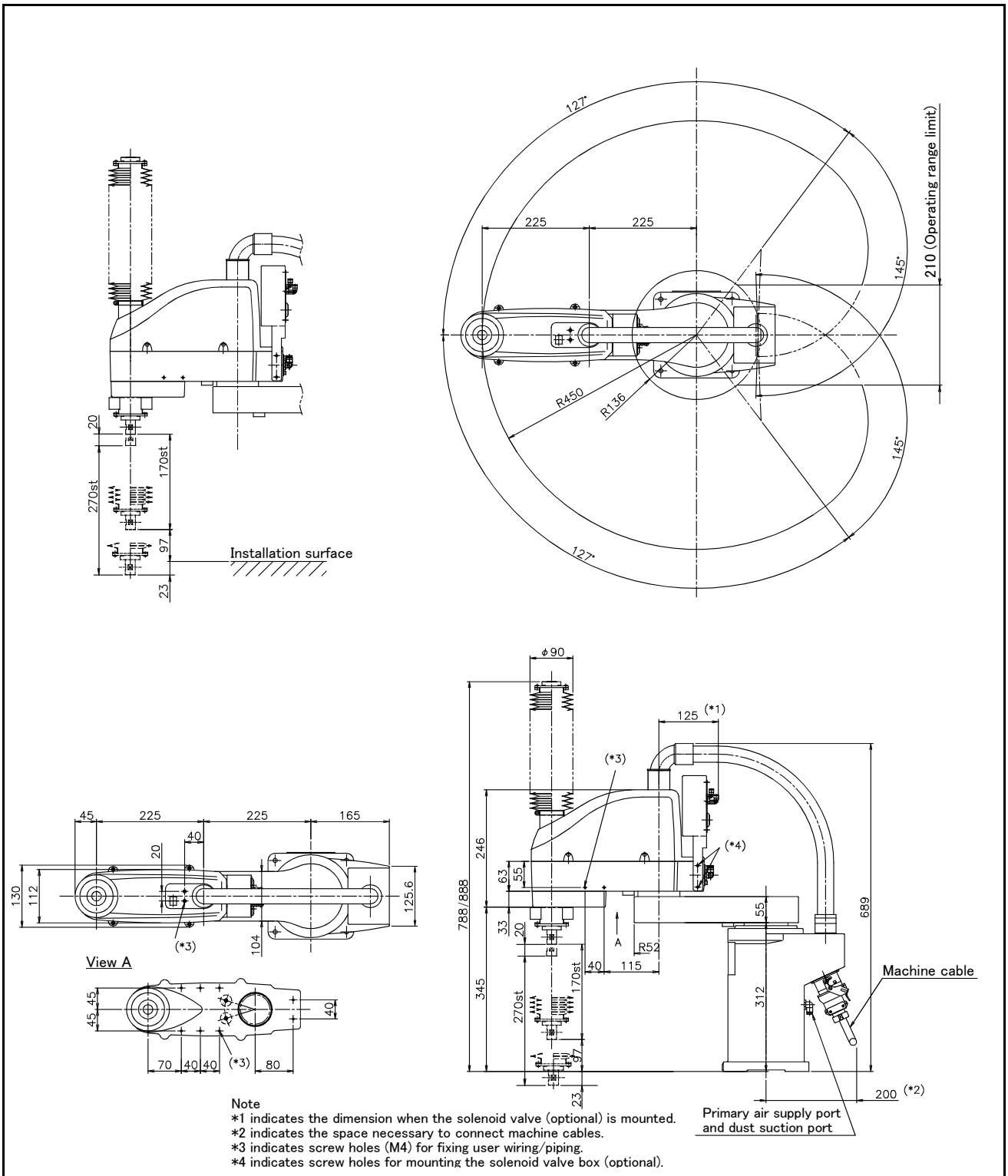
Fig.2-19 : Outside dimensions, Operating range diagram of RH-6SQH55xx

(2) Clean Specification



Note) Refer to Fig. 2-46 for the mechanical interface section and installation base section dimensions.

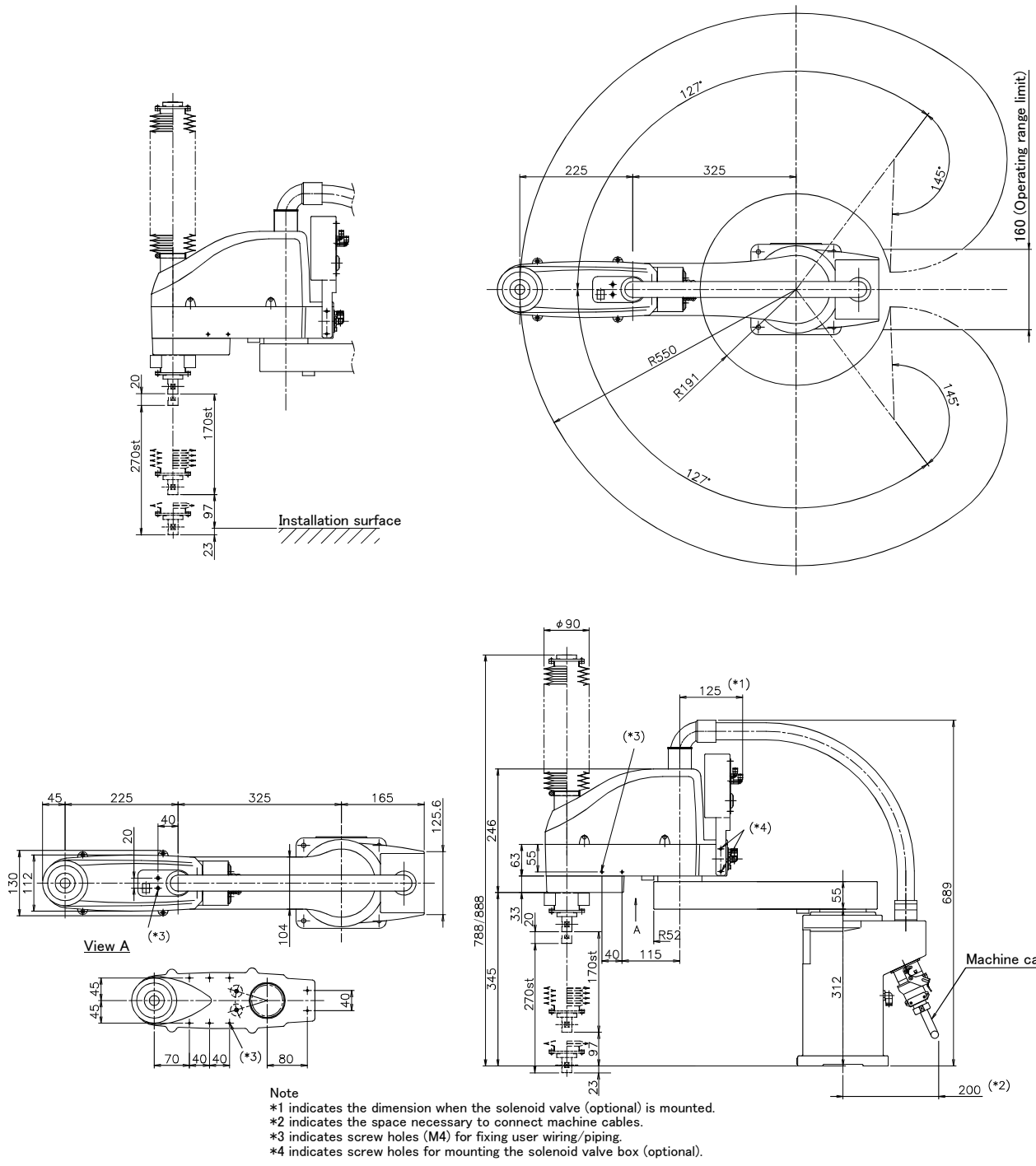
Fig.2-20 : Outside dimensions, Operating range diagram of RH-6SQH35xxC



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. 2-46 for the mechanical interface section and installation base section dimensions.

Fig.2-21 : Outside dimensions, Operating range diagram of RH-6SQH45xxC

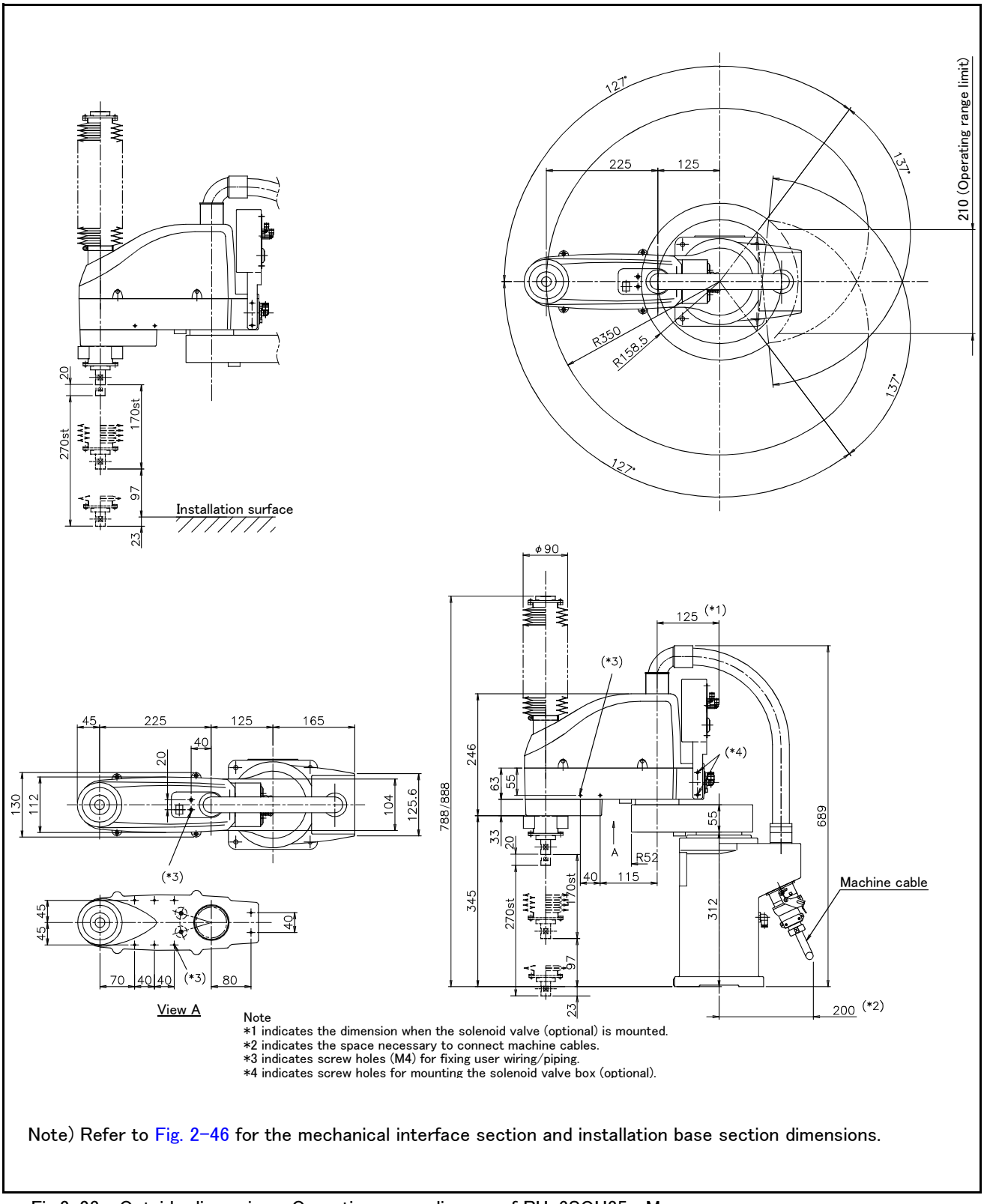


Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-46 for the mechanical interface section and installation base section dimensions.

Fig.2-22 : Outside dimensions, Operating range diagram of RH-6SQH55xxC

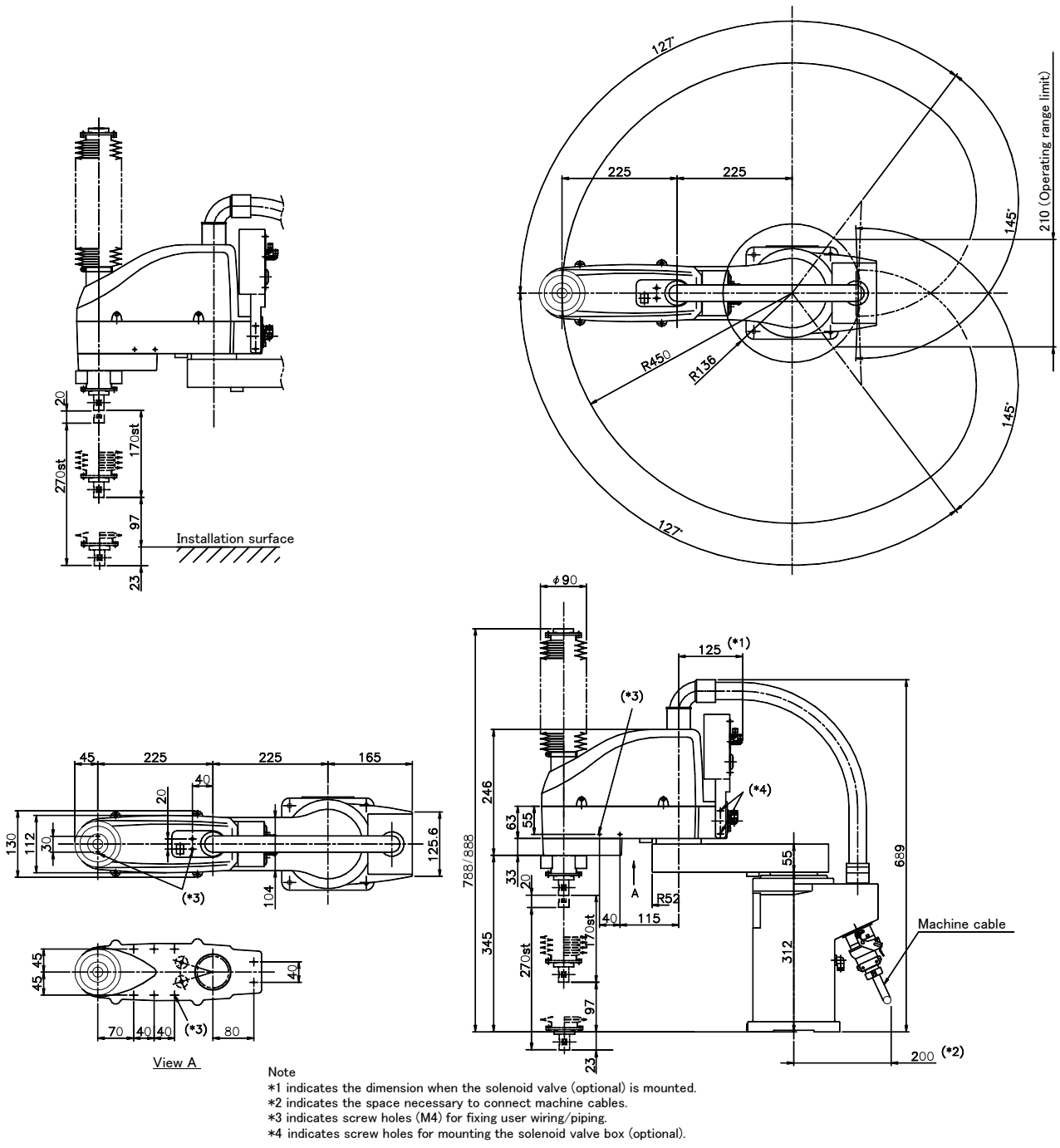
(3) Oil mist Specification



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. 2-46 for the mechanical interface section and installation base section dimensions.

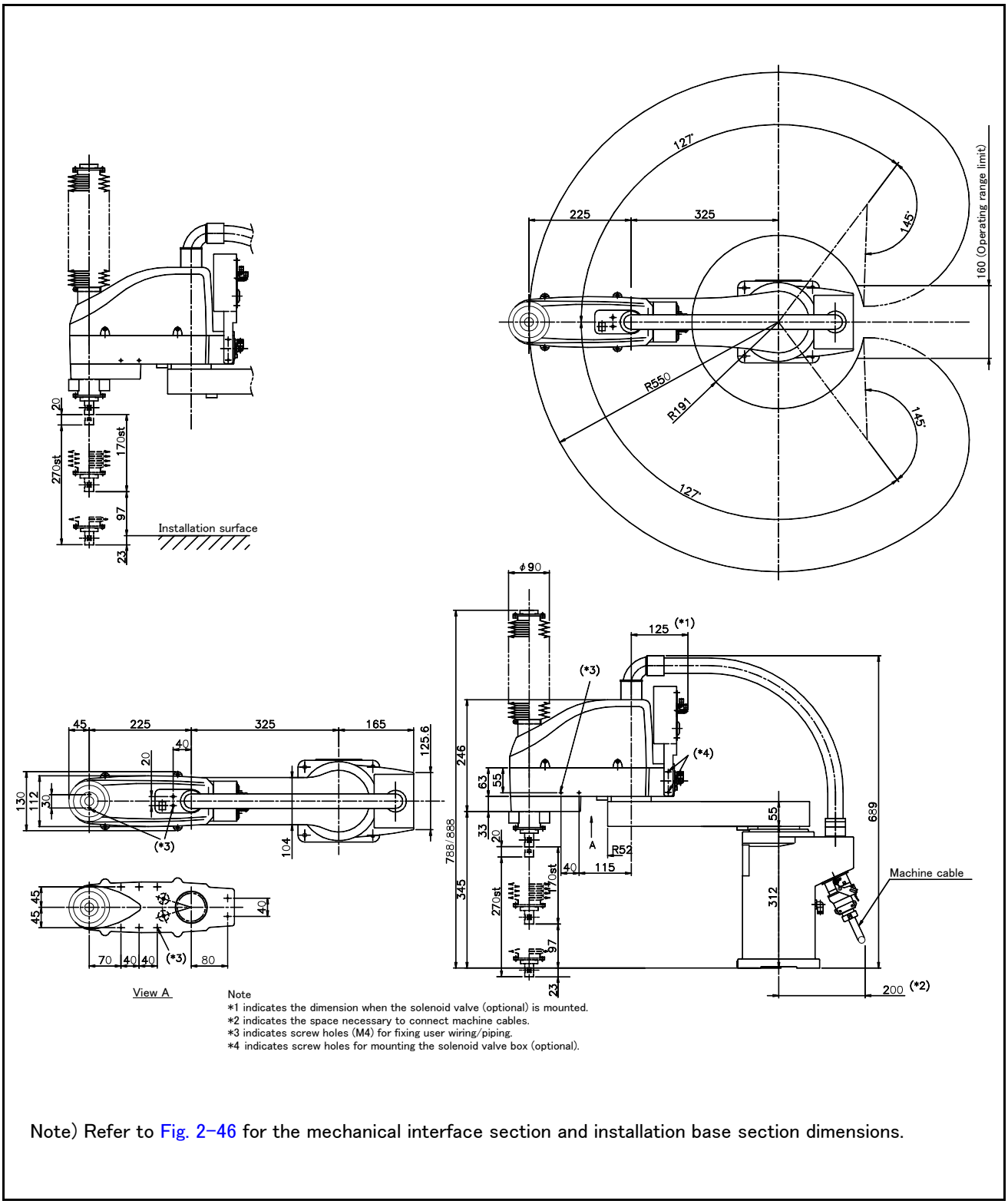
Fig.2-23 : Outside dimensions, Operating range diagram of RH-6SQH35xxM



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. 2-46 for the mechanical interface section and installation base section dimensions.

Fig.2-24 : Outside dimensions, Operating range diagram of RH-6SQH45xxM



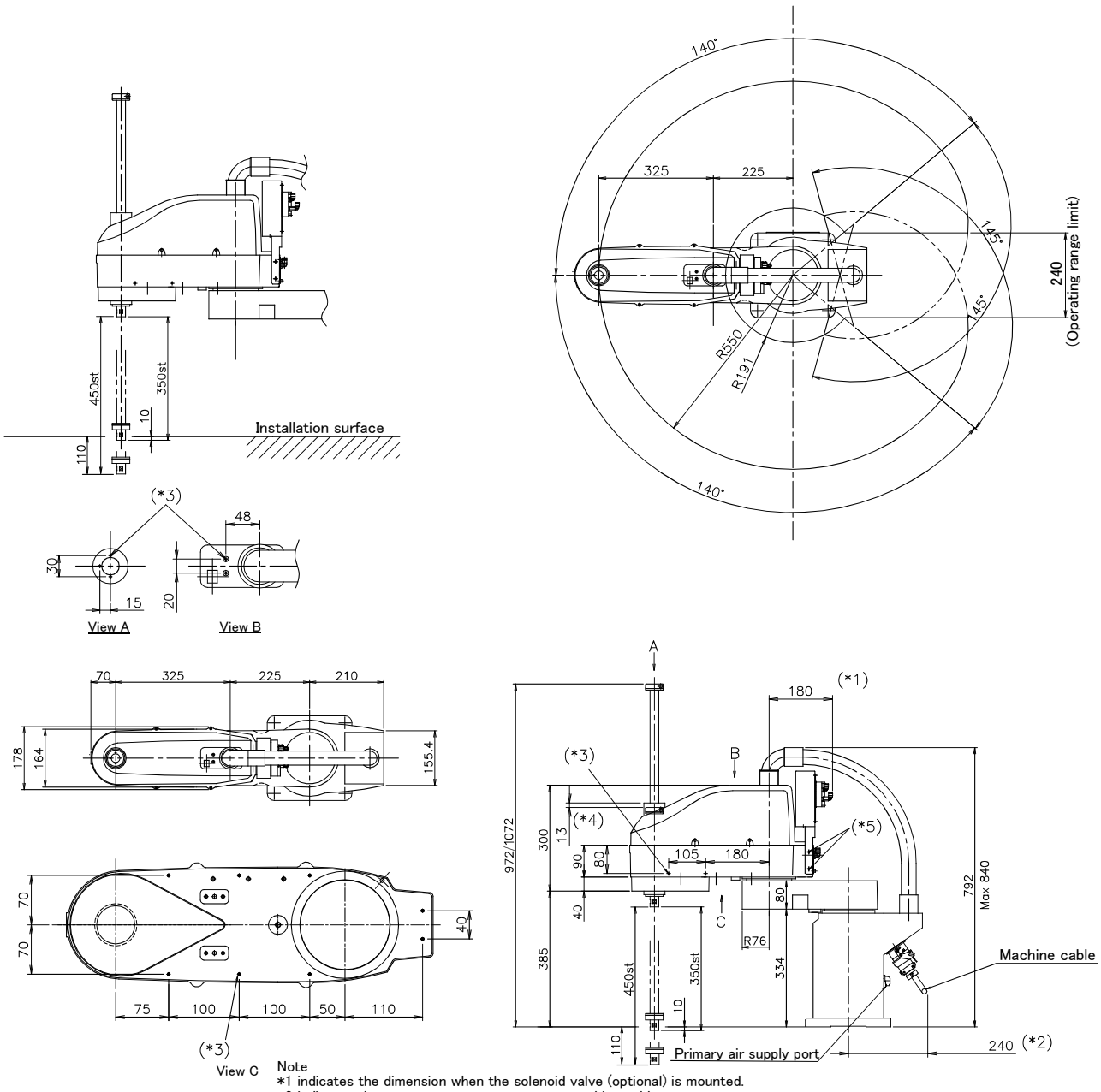
Note
*1 indicates the dimension when the solenoid valve (optional) is mounted.
*2 indicates the space necessary to connect machine cables.
*3 indicates screw holes (M4) for fixing user wiring/piping.
*4 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-46 for the mechanical interface section and installation base section dimensions.

Fig.2-25 : Outside dimensions, Operating range diagram of RH-6SQH55xxM

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

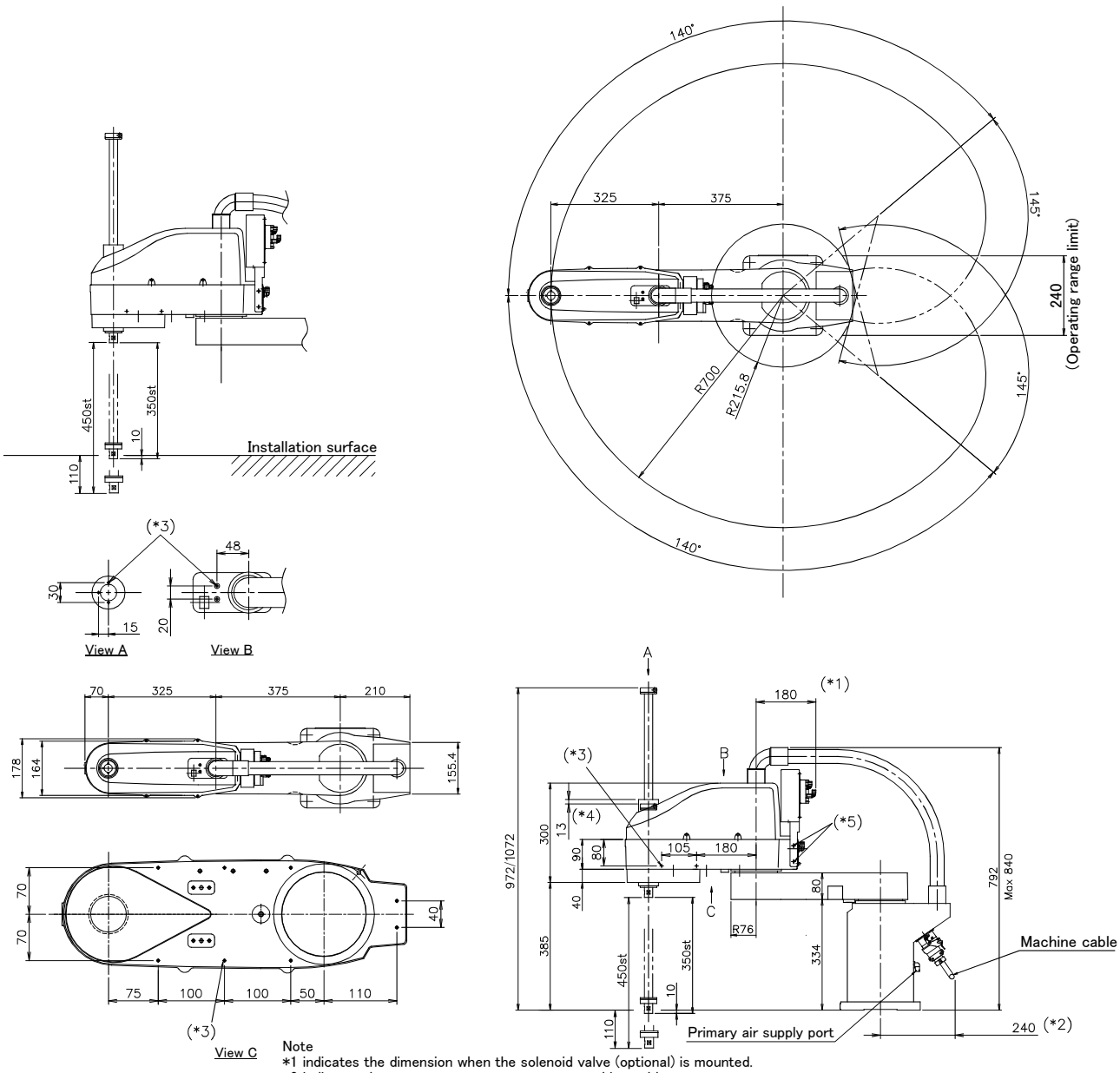
(1) Standard Specification



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. 2-47 for the mechanical interface section and installation base section dimensions.

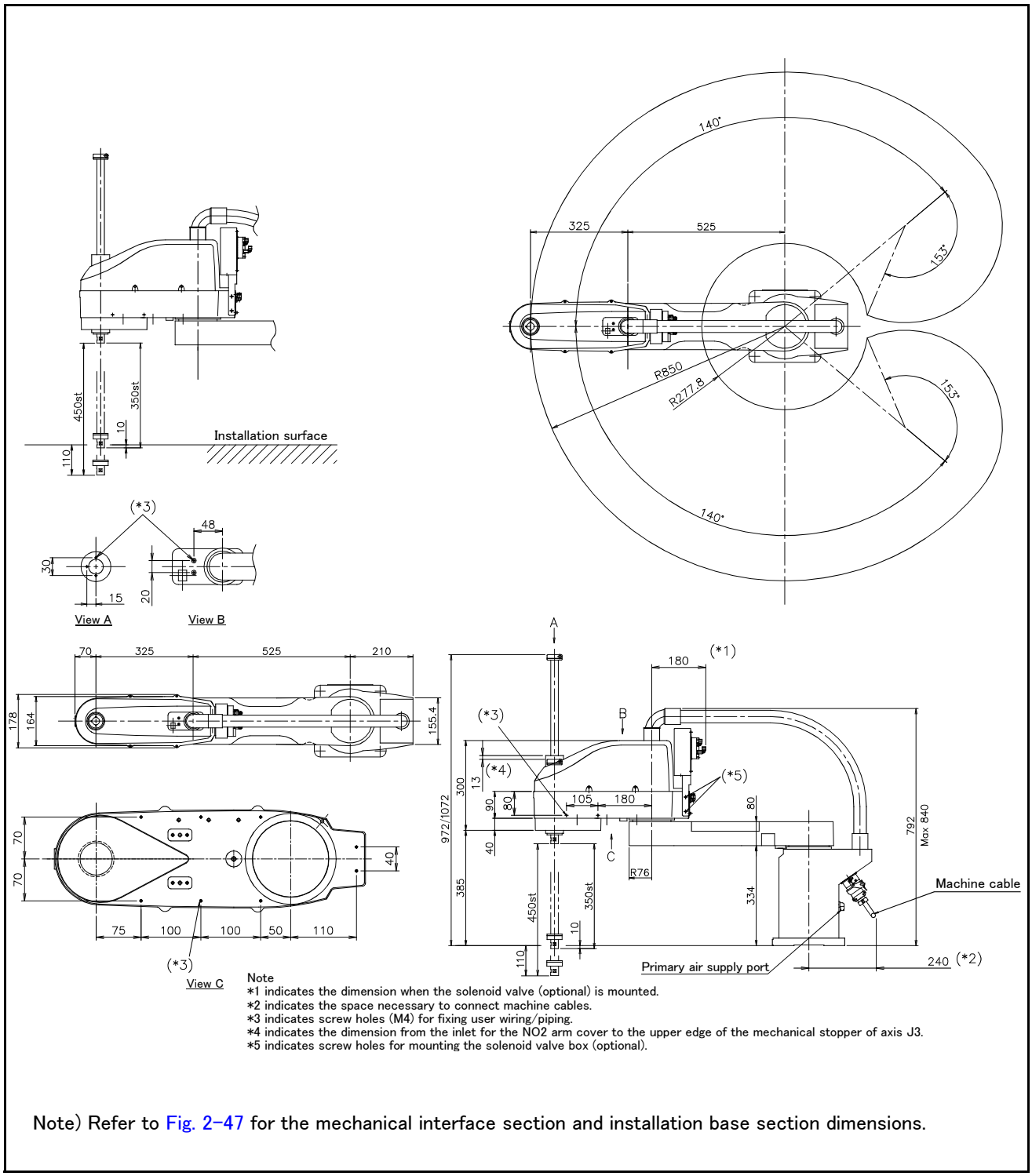
Fig.2-26 : Outside dimensions, Operating range diagram of RH-12SQH55xx



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. 2-47 for the mechanical interface section and installation base section dimensions.

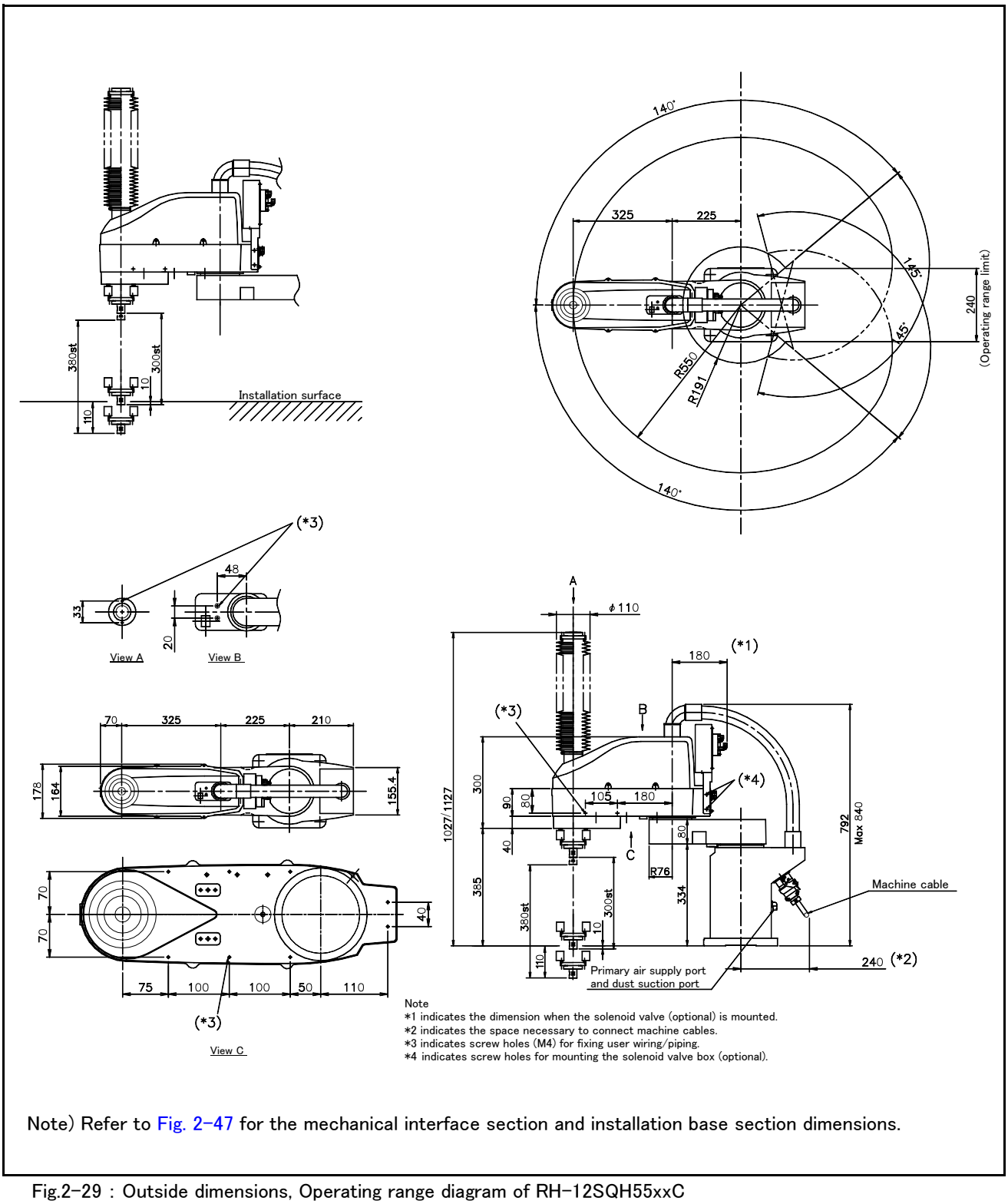
Fig.2-27 : Outside dimensions, Operating range diagram of RH-12SQH70xx



Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

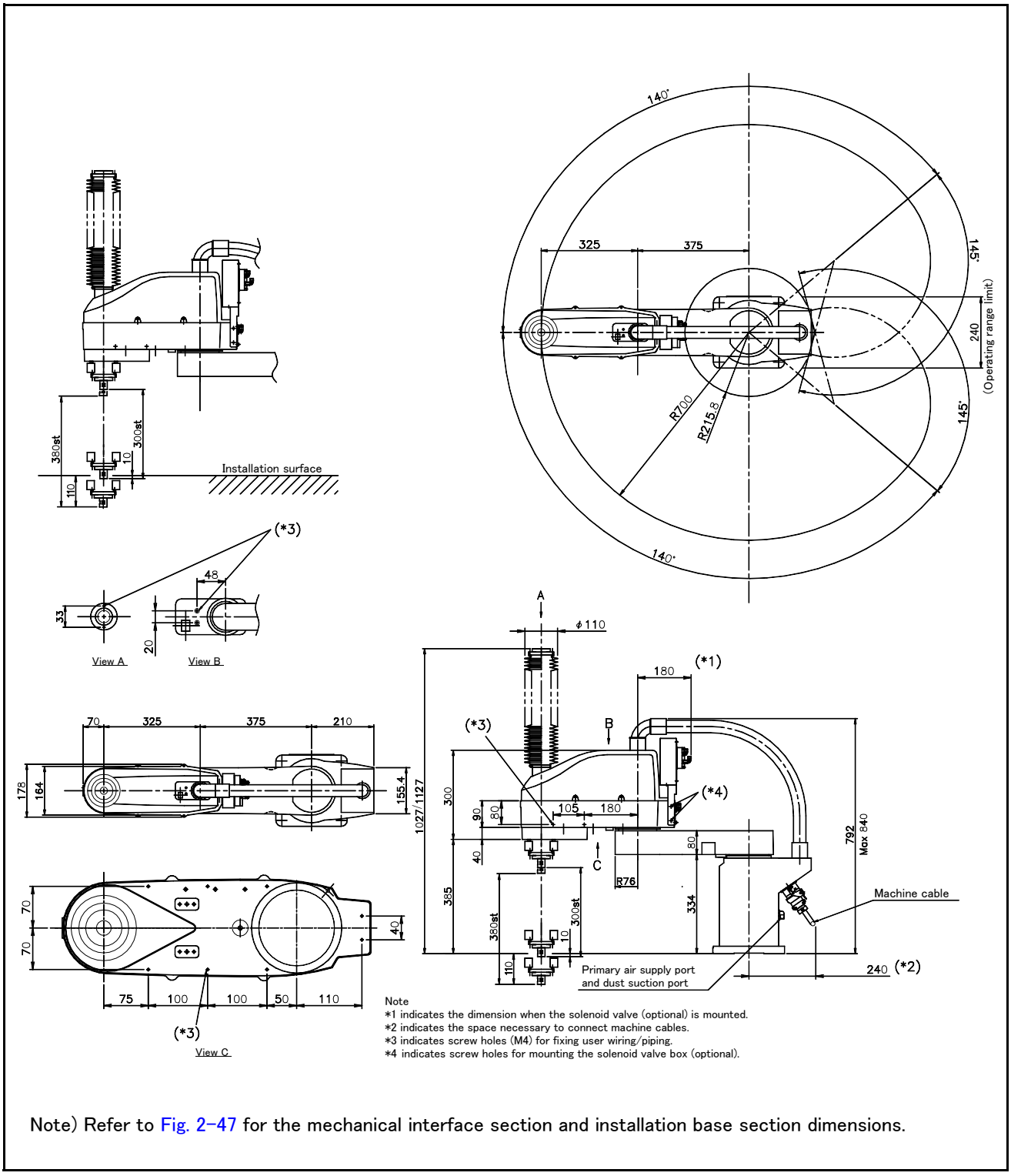
Fig.2-28 : Outside dimensions, Operating range diagram of RH-12SQH85xx

(2) Clean Specification



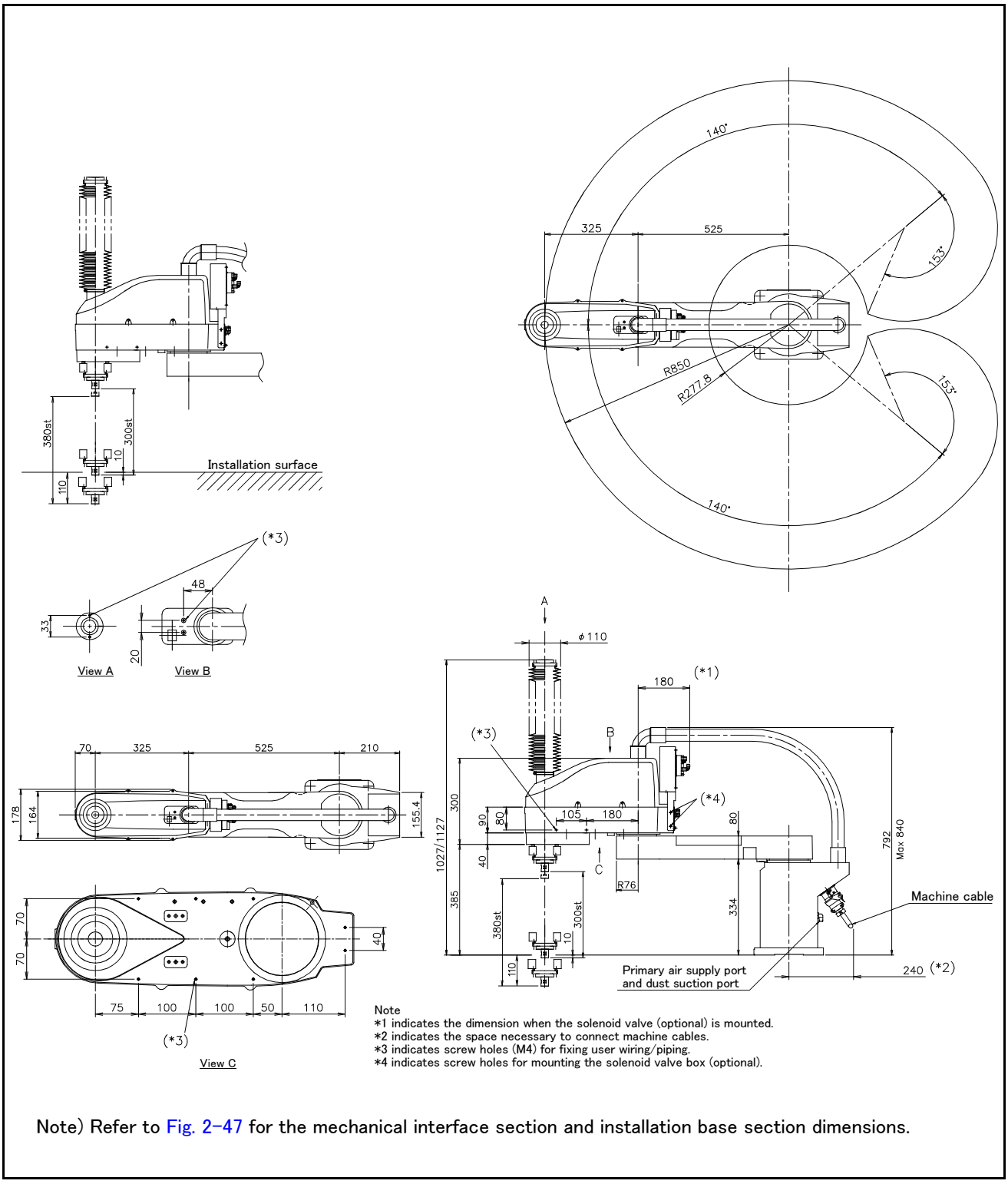
Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-29 : Outside dimensions, Operating range diagram of RH-12SQH55xxC



Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

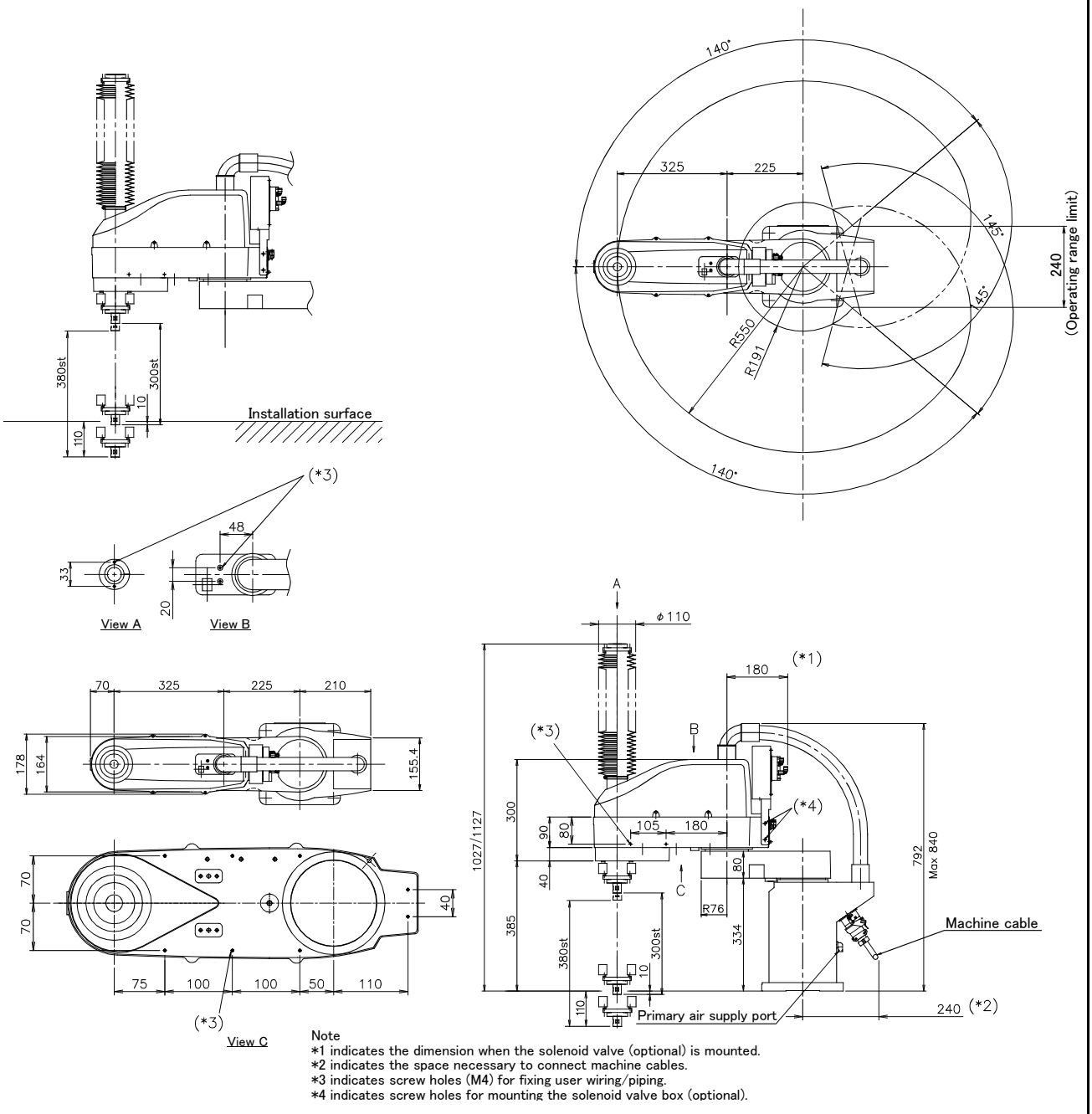
Fig.2-30 : Outside dimensions, Operating range diagram of RH-12SQH70xxC



Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-31 : Outside dimensions, Operating range diagram of RH-12SQH85xxC

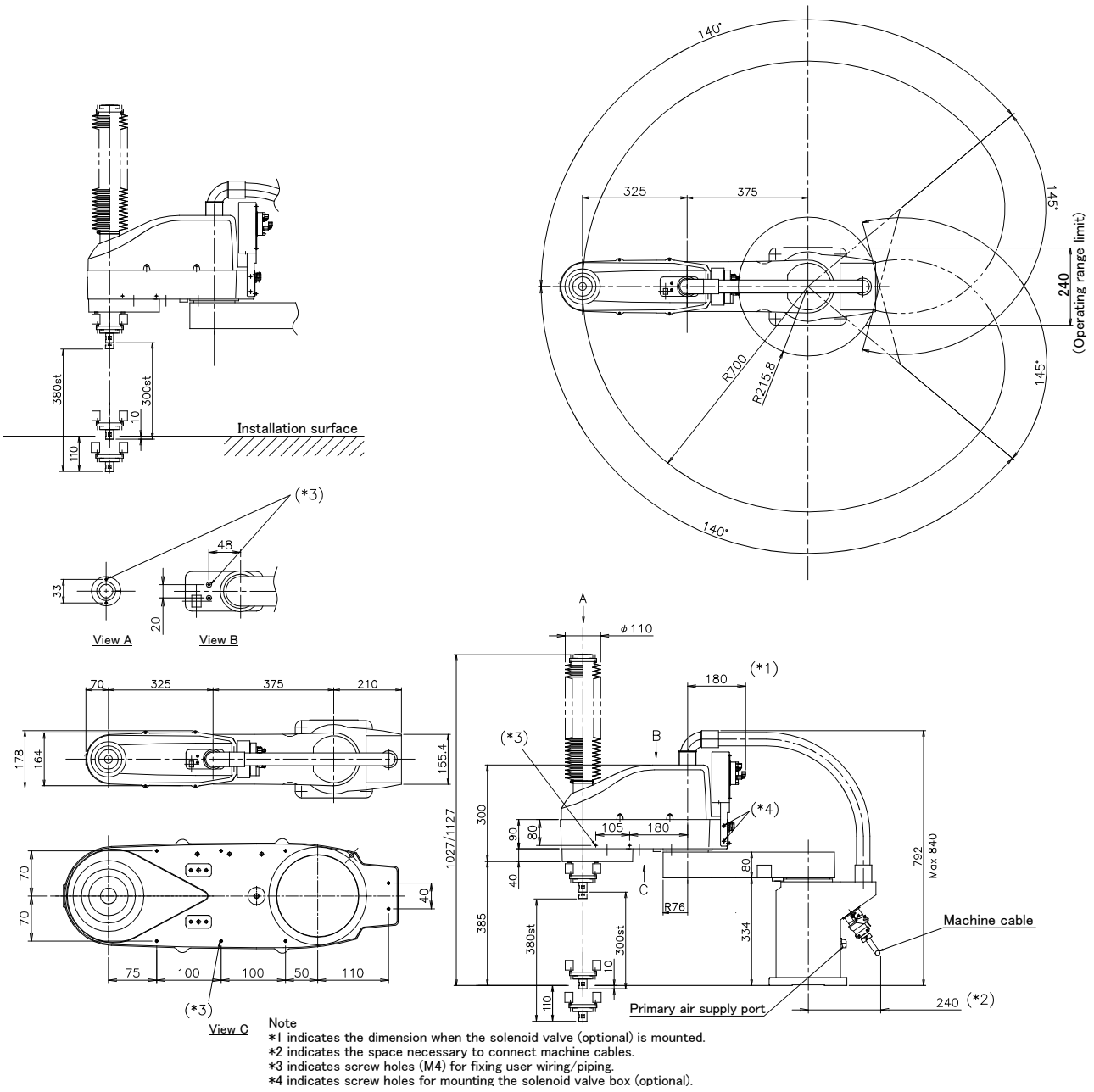
(3) Oil mist Specification



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. 2-47 for the mechanical interface section and installation base section dimensions.

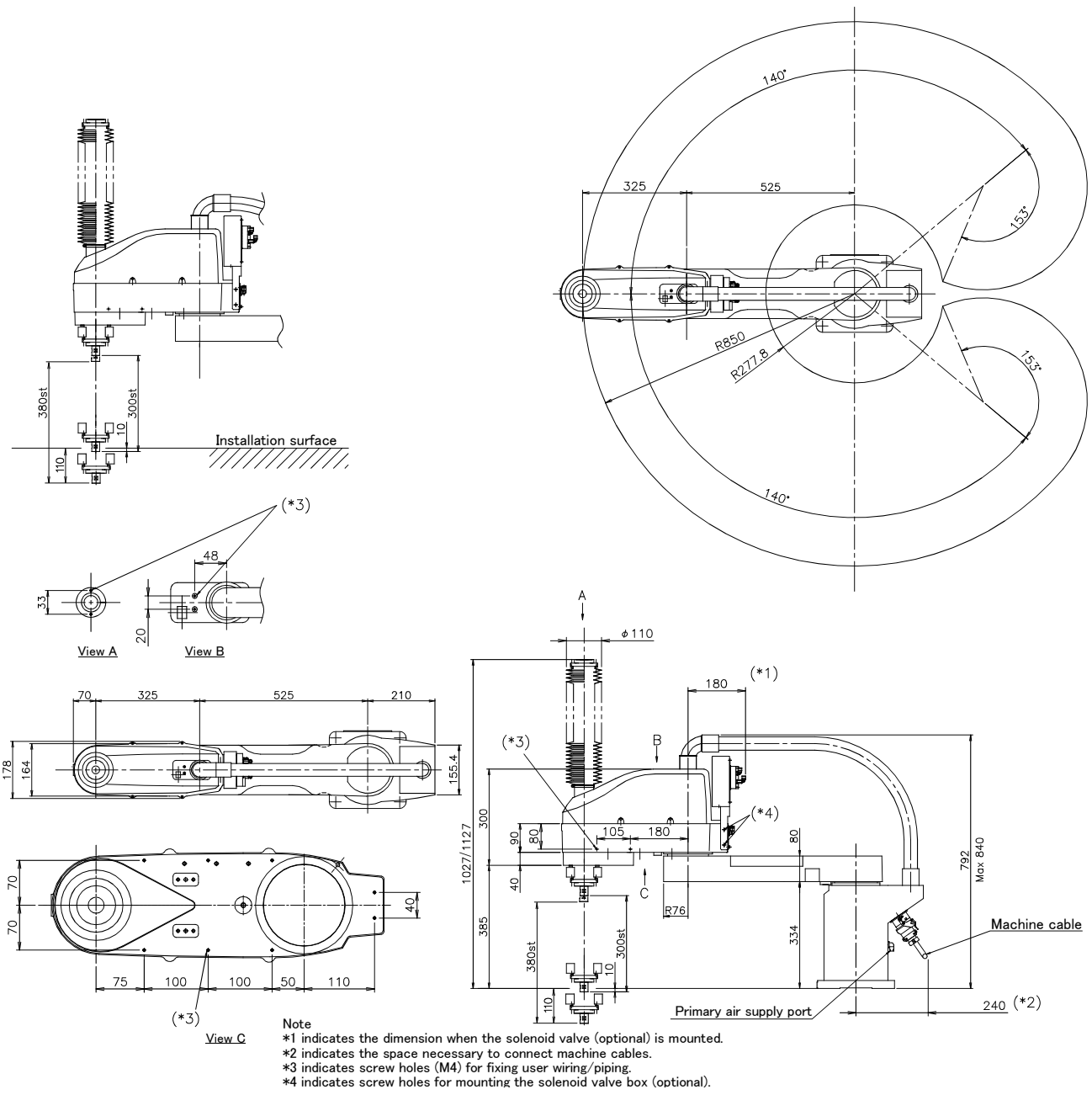
Fig.2-32 : Outside dimensions, Operating range diagram of RH-12SQH55xxM



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. 2-47 for the mechanical interface section and installation base section dimensions.

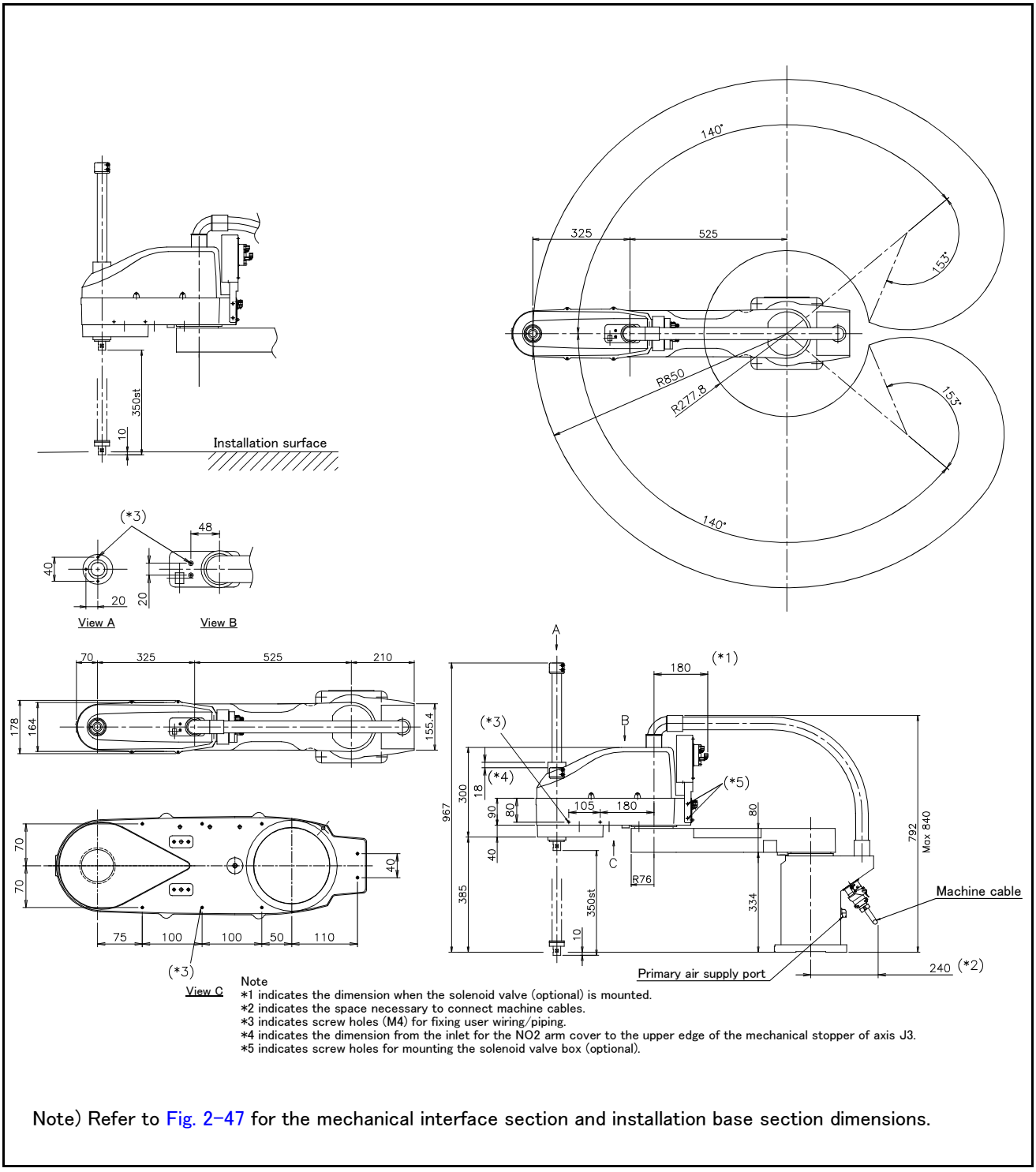
Fig.2-33 : Outside dimensions, Operating range diagram of RH-12SQH70xxM



Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-34 : Outside dimensions, Operating range diagram of RH-12SQH85xxM

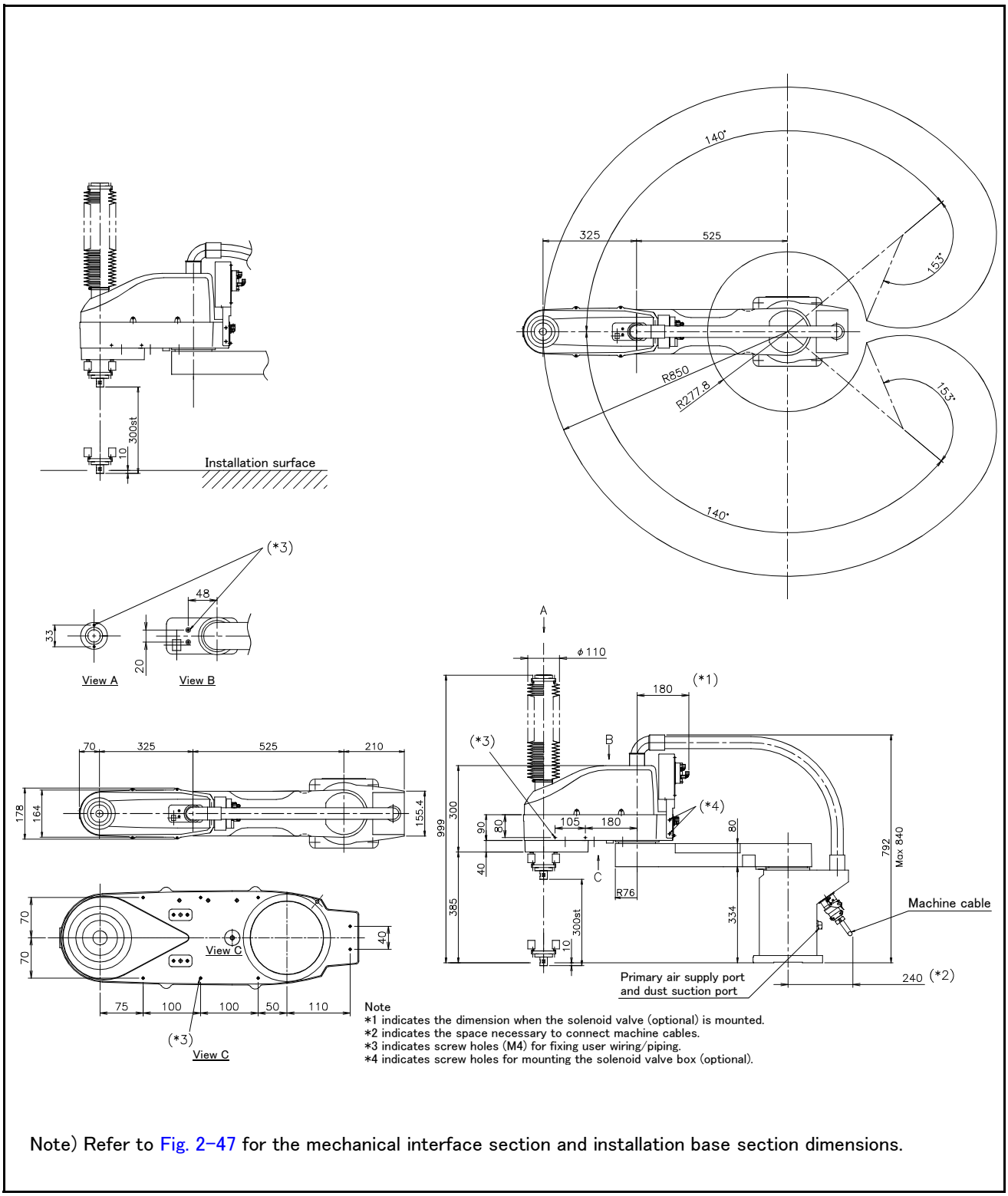
2.4.3 Outside dimensions・Operating range diagram of RH-18SQH series
(1) Srandard Specification



Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-35 : Outside dimensions, Operating range diagram of RH-18SQH8535

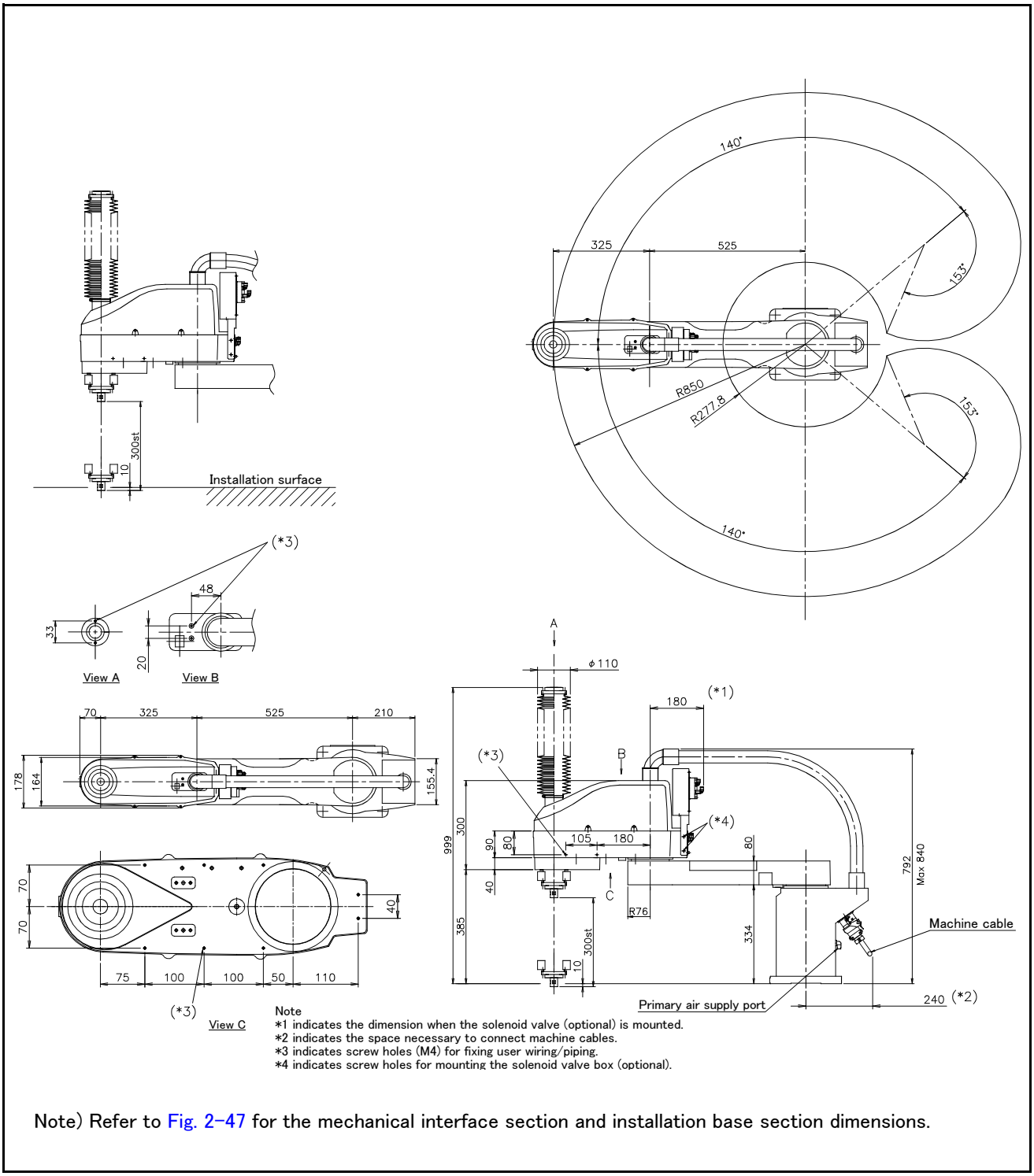
(2) Clean Specification



Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-36 : Outside dimensions, Operating range diagram of RH-18SQH8530C

(3) Oil mist Specification

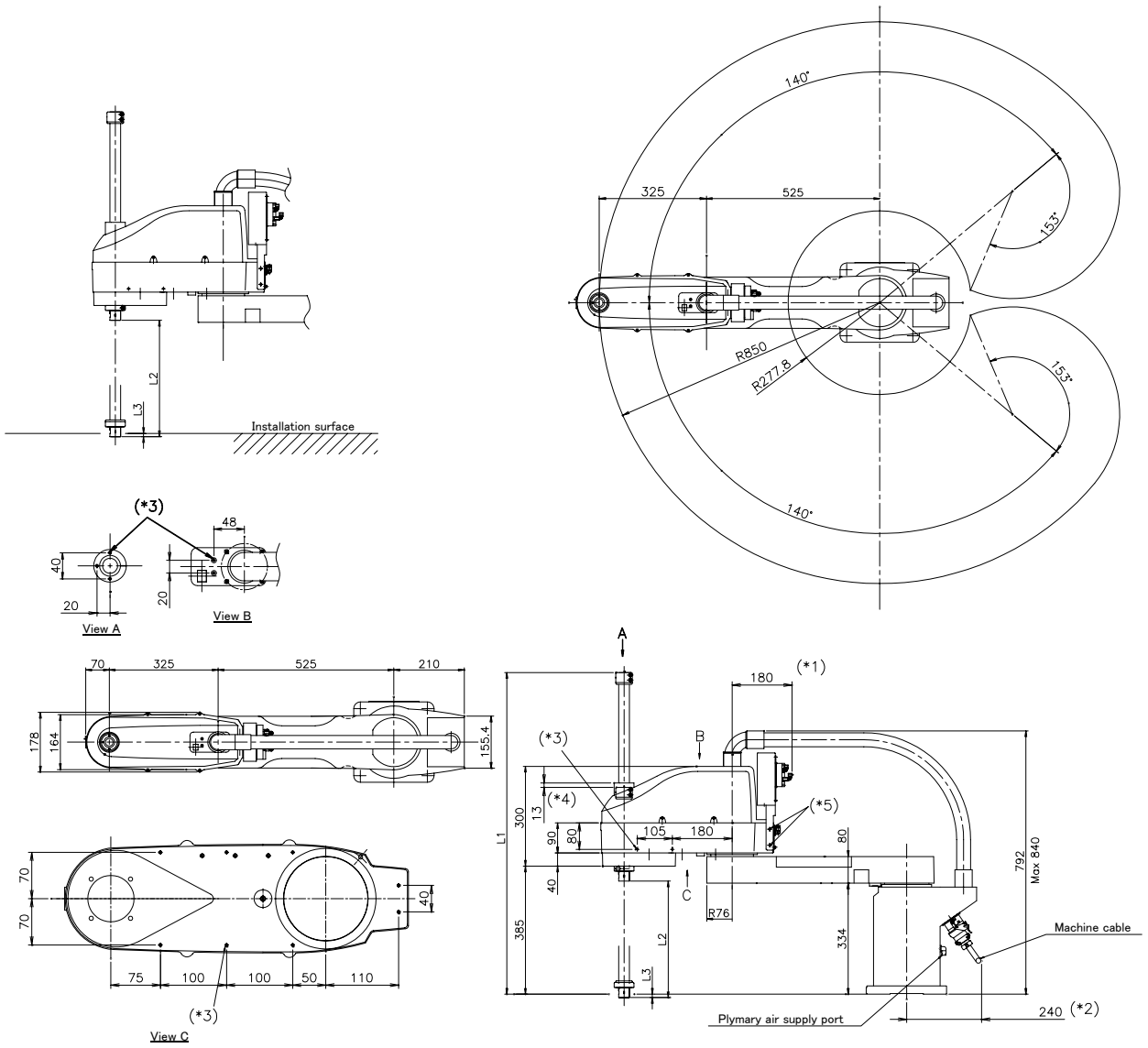


Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-37 : Outside dimensions, Operating range diagram of RH-18SQH8530M

2.4.4 Outside dimensions・Operating range diagram of RH-20SQH series

(1) Standard Specification

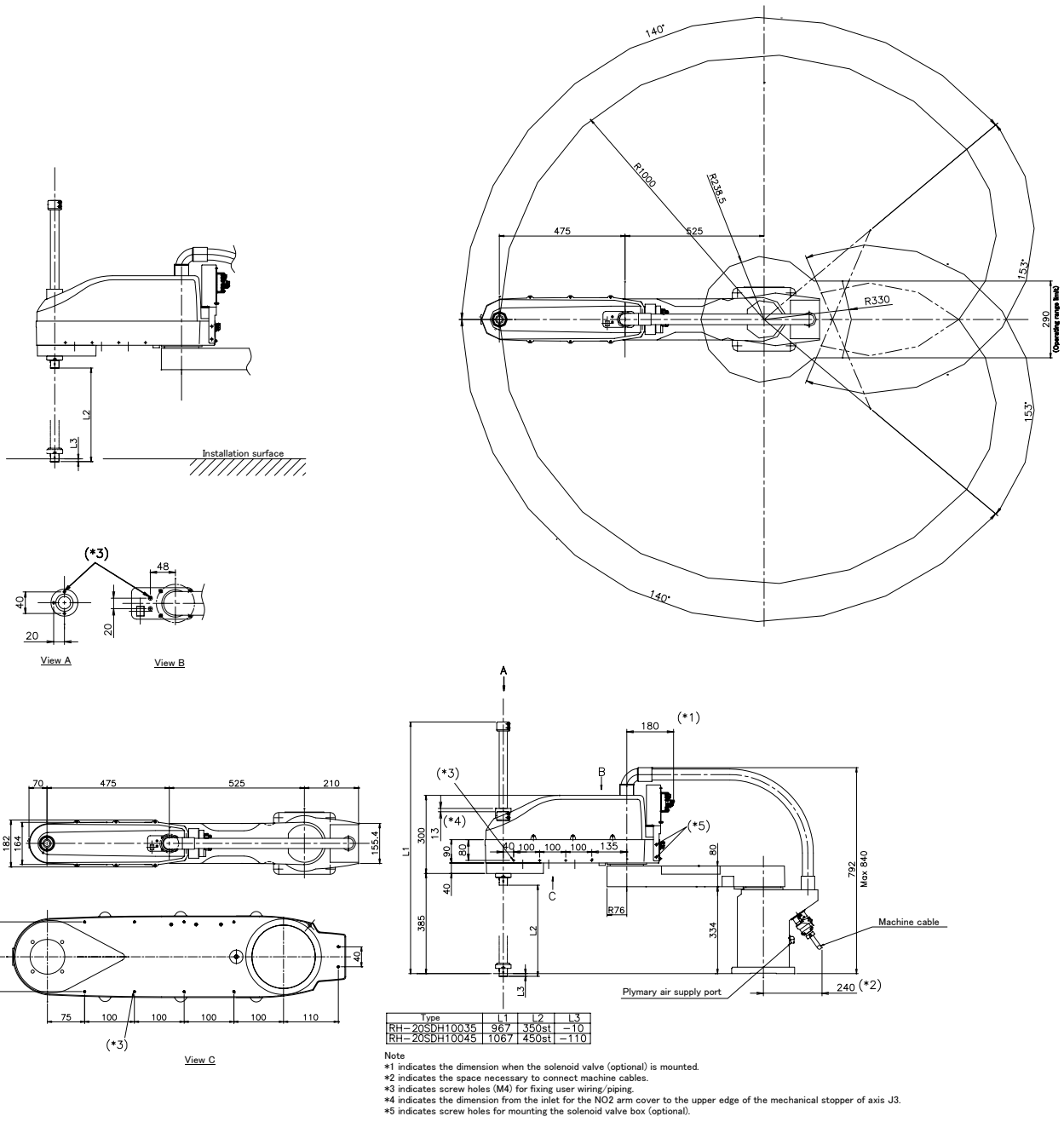


Type	L1	L2	L3
RH-20SDH8535	967	350st	-10
RH-20SDH8545	1067	450st	-110

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. 2-47 for the mechanical interface section and installation base section dimensions.

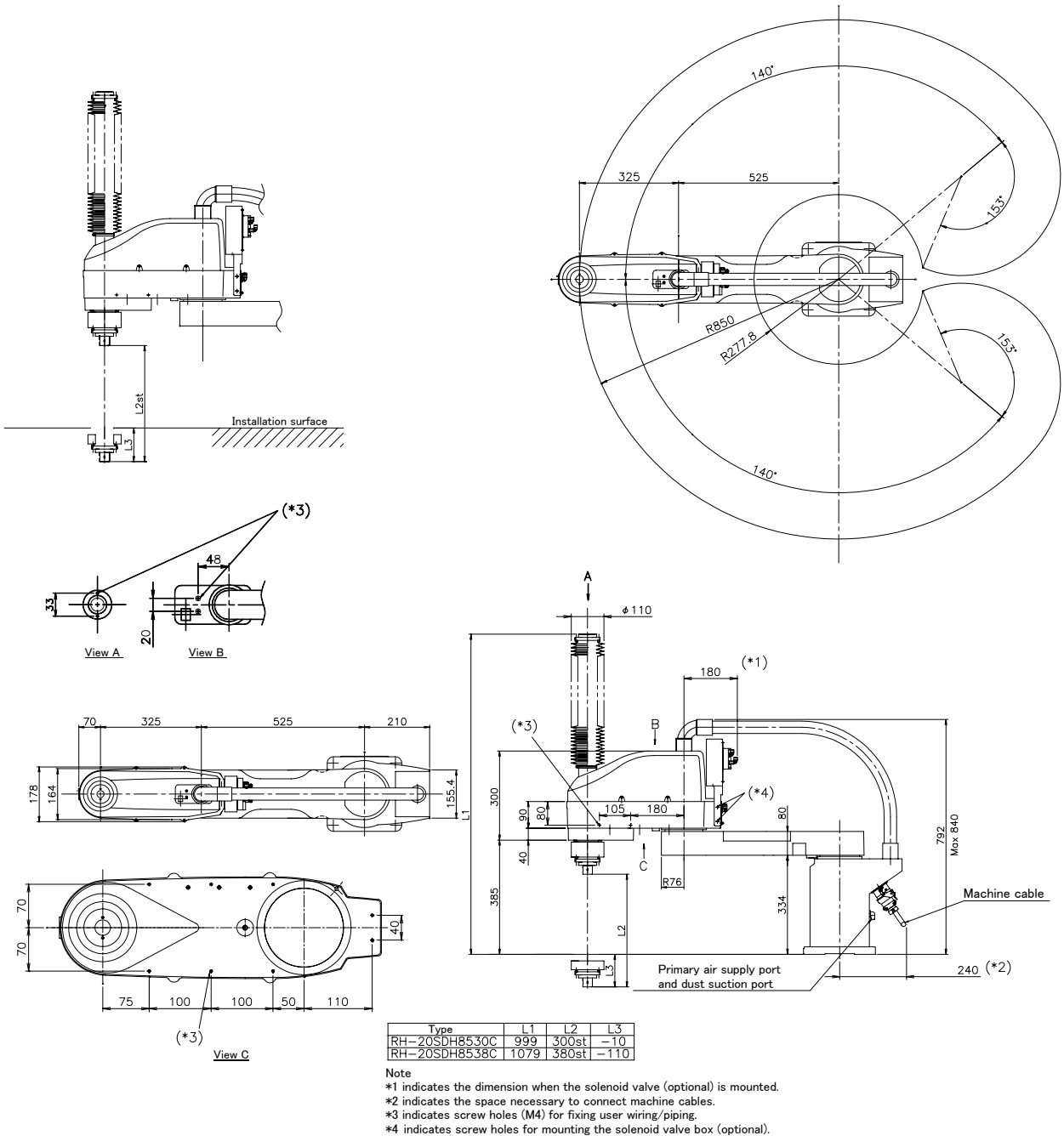
Fig.2-38 : Outside dimensions, Operating range diagram of RH-20SQH85xx



Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-39 : Outside dimensions, Operating range diagram of RH-20SQH100xx

(2) Clean Specification

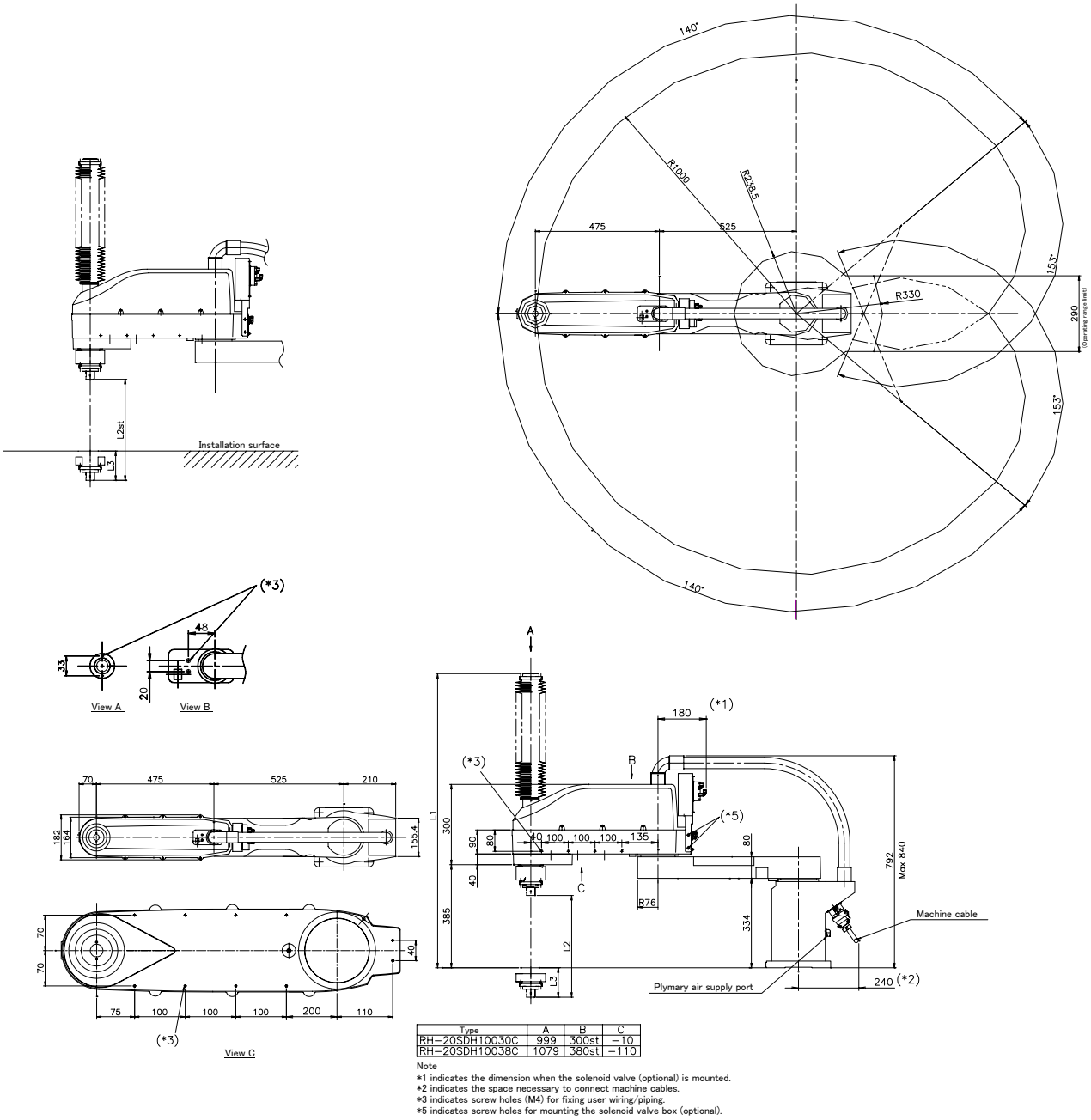


Type	L1	L2	L3
RH-20SDH8530C	999	300st	−10
RH-20SDH8538C	1079	380st	−110

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. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-40 : Outside dimensions, Operating range diagram of RH-20SQH85xxC



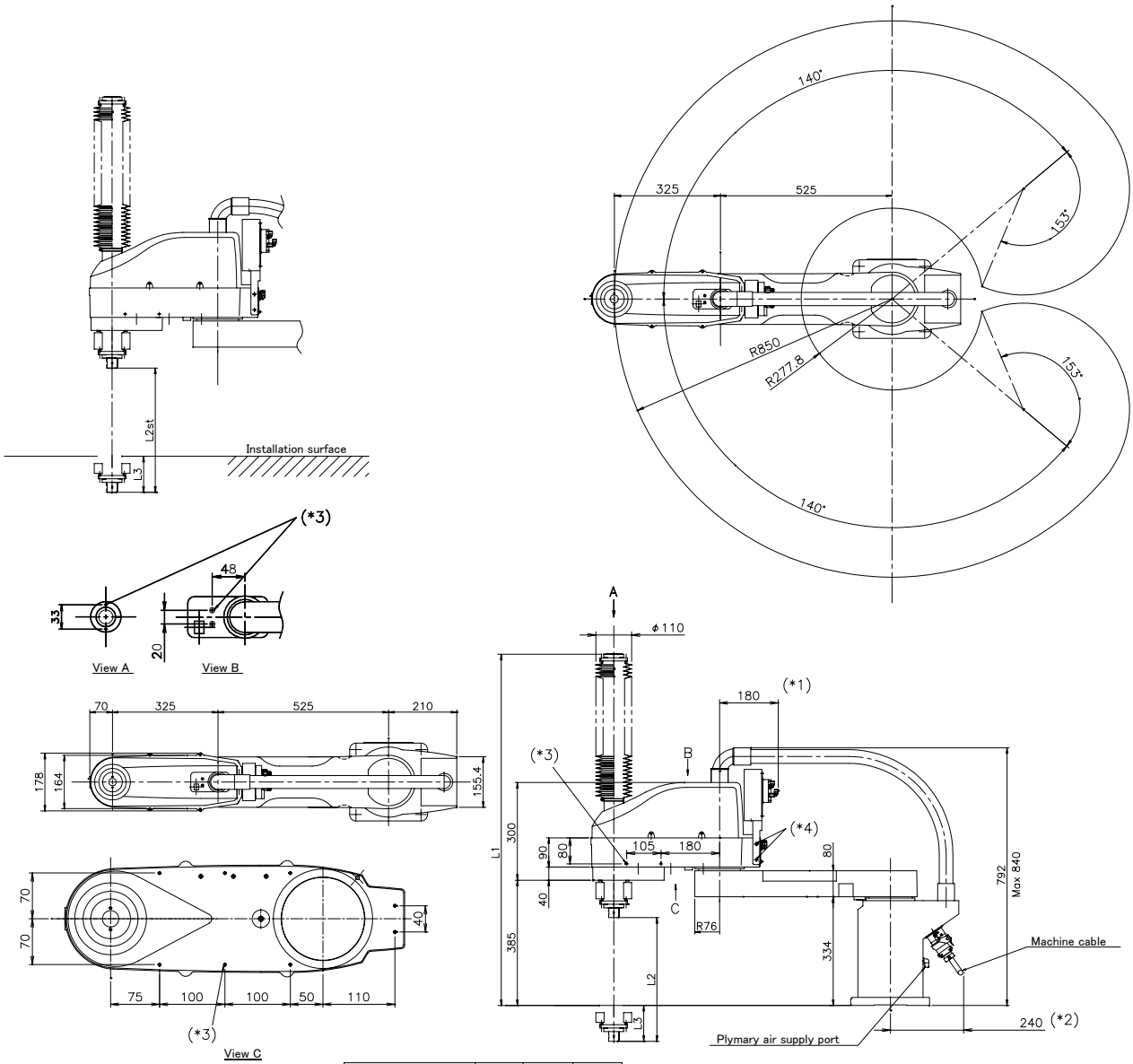
Type	A	B	C
RH-20SDH10030C	999	300st	−10
RH-20SDH10038C	1079	380st	−110

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.
*5 indicates screw holes for mounting the solenoid valve box (optional).

Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-41 : Outside dimensions, Operating range diagram of RH-20SQ100xxC

(3) Oil mist Specification

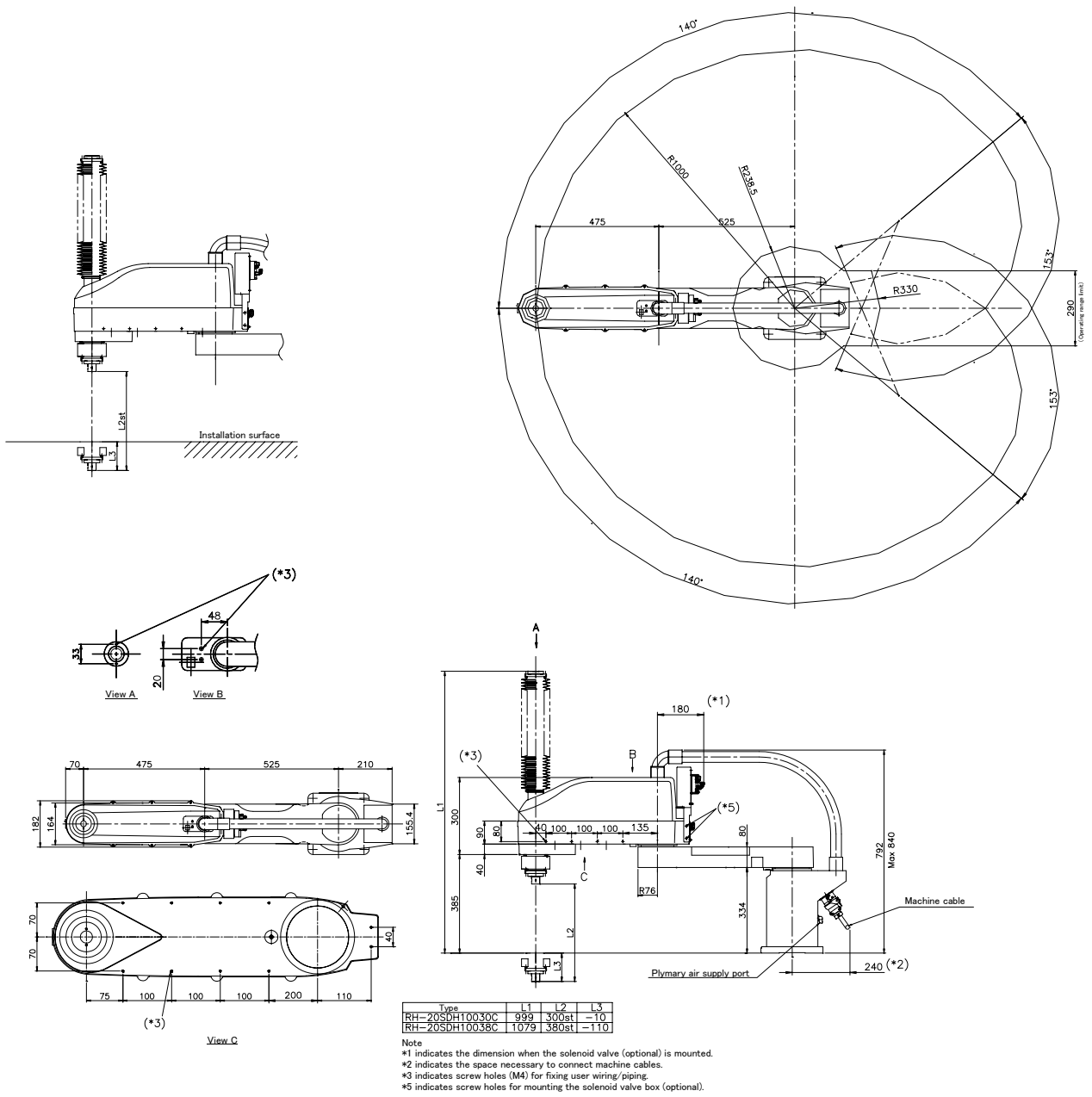


Type	L1	L2	L3
RH-20SDH8530C	999	300st	-10
RH-20SDH8538C	1079	380st	-110

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. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-42 : Outside dimensions, Operating range diagram of RH-20SQH85xxM



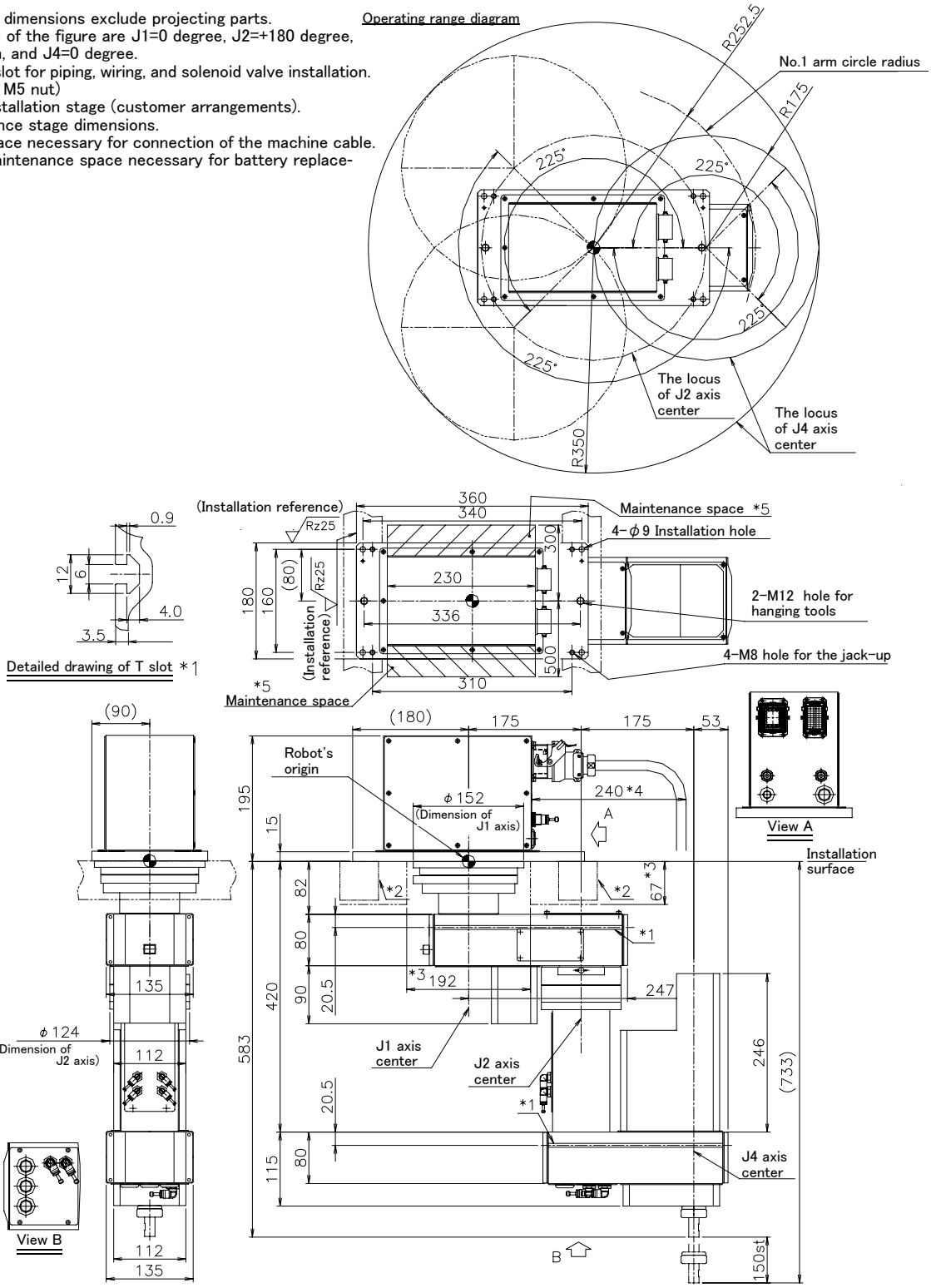
Note) Refer to Fig. 2-47 for the mechanical interface section and installation base section dimensions.

Fig.2-43 : Outside dimensions, Operating range diagram of RH-20SQH100xxM

2.4.5 Outside dimensions・Operating range diagram of RH-3SQHR series

(1) Standard Specification

Notice
1. The outside dimensions exclude projecting parts.
2. The posture of the figure are J1=0 degree, J2=+180 degree, J3=−583mm, and J4=0 degree.
3. *1 is the T slot for piping, wiring, and solenoid valve installation. (Attach the M5 nut)
4. *2 is the installation stage (customer arrangements).
5. *3 is allowance stage dimensions.
6. *4 is the space necessary for connection of the machine cable.
7. *5 is the maintenance space necessary for battery replacement etc



Note1) Refer to Fig. 2-49 for the mechanical interface section and installation base section dimensions.

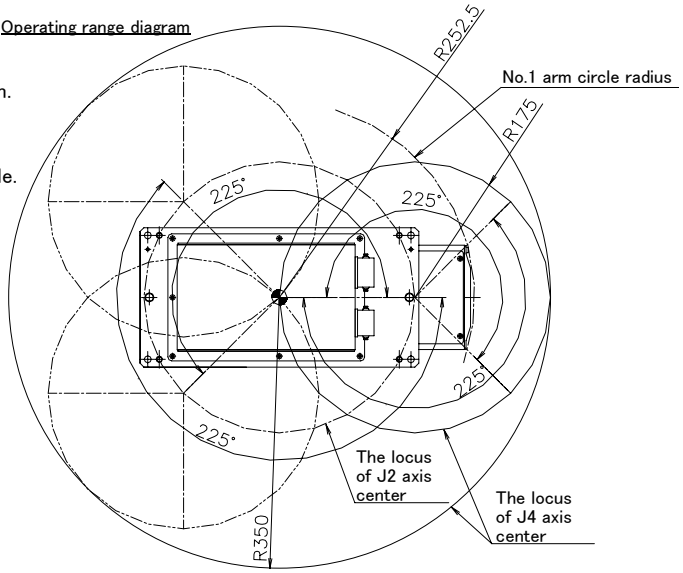
Note2) Use of the optional solenoid valve set. The solenoid valve set installed at the side on the No.2 arm. (*1 mark) Take care at layout design.

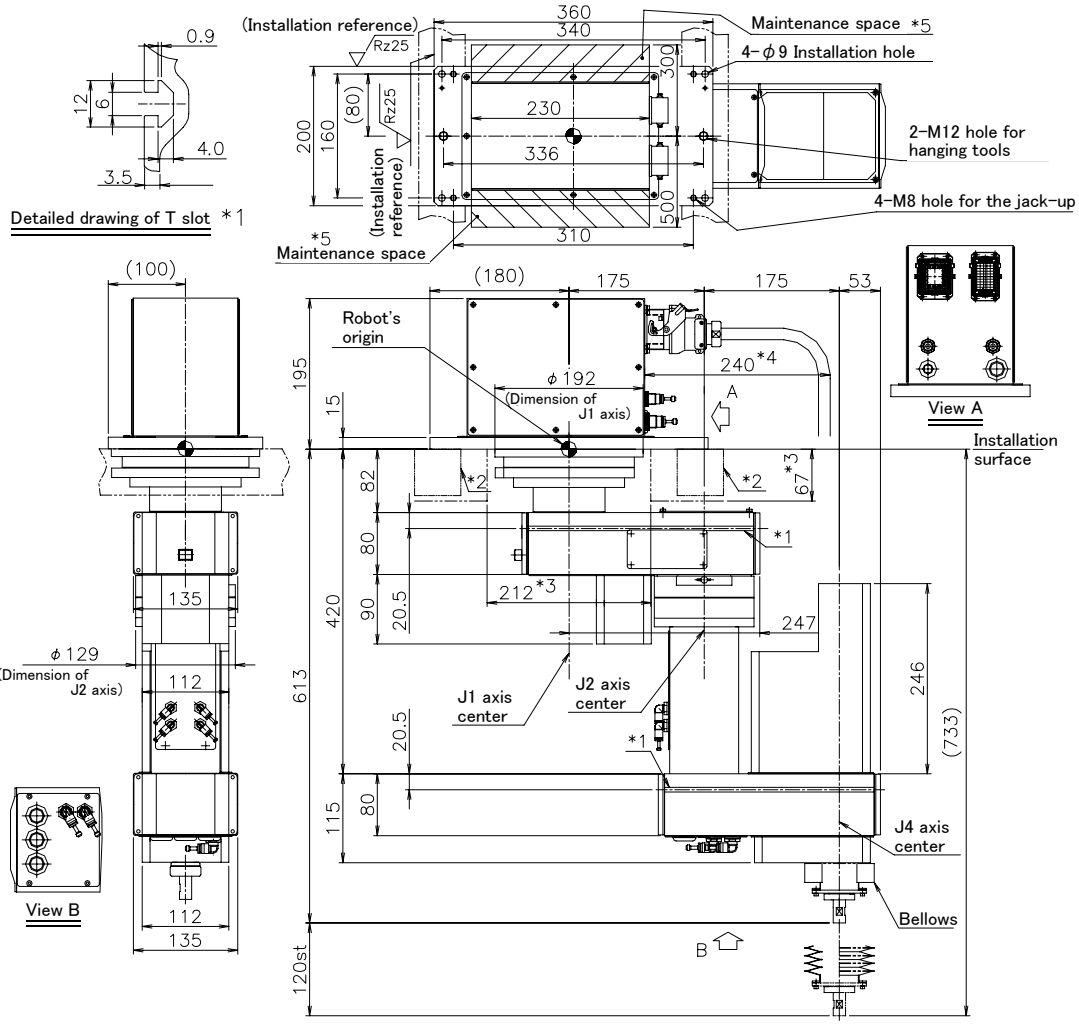
Note3) The position on the vertical extension of the "robot origin" becomes the singular point. Positioning and passage to this position with linear interpolation movement cannot be performed. Take care at layout design.

Fig.2-44 : Outside dimensions, Operating range diagram of RH-3SQHR series

(2) Clean/Waterproof Specification

Notice
1. The outside dimensions exclude projecting parts.
2. The posture of the figure are J1=0 degree, J2=+180 degree, J3=−583mm, and J4=0 degree.
3. *1 is the T slot for piping, wiring, and solenoid valve installation. (Attach the M5 nut)
4. *2 is the installation stage (customer arrangements).
5. *3 is allowance stage dimensions.
6. *4 is the space necessary for connection of the machine cable.
7. *5 is the maintenance space necessary for battery replacement etc





Note1) Refer to Fig. 2-49 for the mechanical interface section and installation base section dimensions.

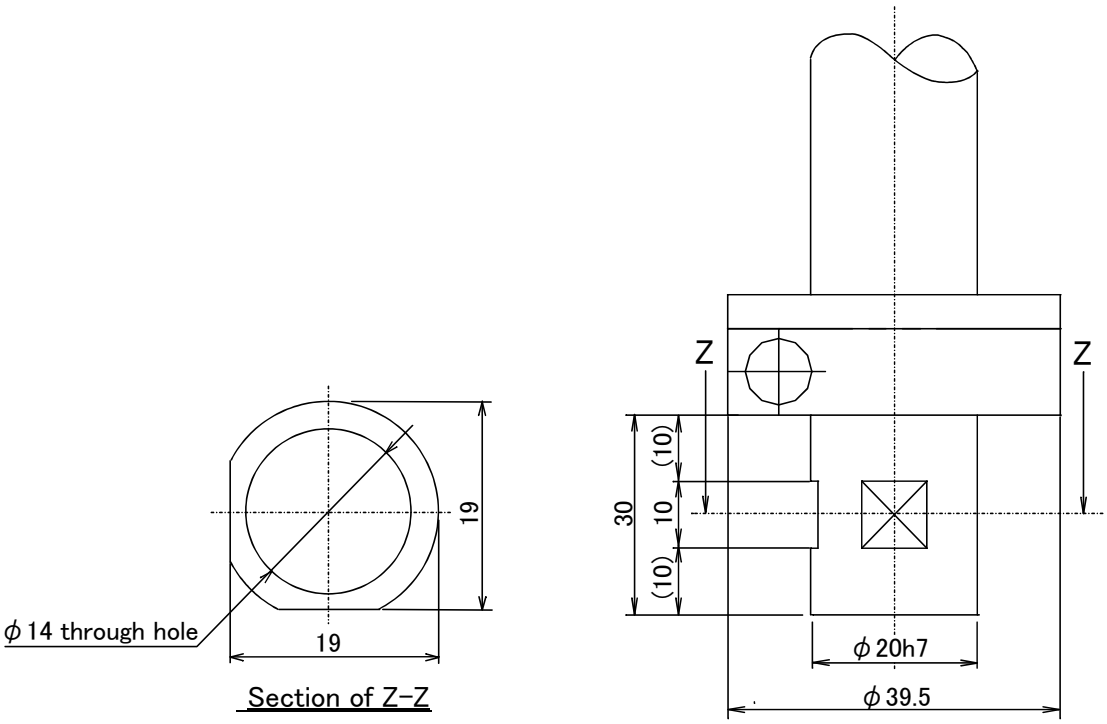
Note2) Use of the optional solenoid valve set. The solenoid valve set installed at the side on the No.2 arm. (*1 mark) Take care at layout design.

Note3) The position on the vertical extension of the "robot origin" becomes the singular point. Positioning and passage to this position with linear interpolation movement cannot be performed. Take care at layout design.

Fig.2-45 : Outside dimensions, Operating range diagram of RH-3SQHR series (Clean/Waterproof specification)

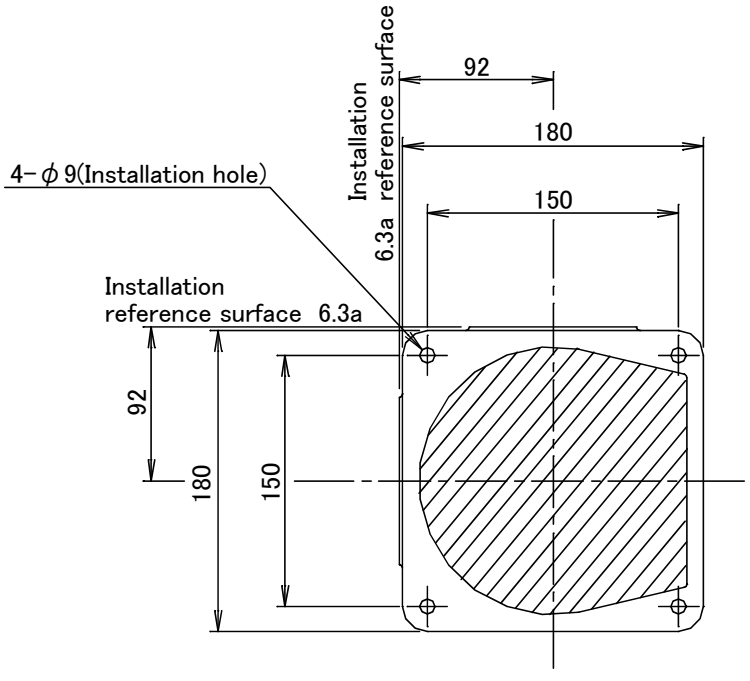
2.4.6 Mechanical interface and Installation surface

(1) Mechanical interface and Installation surface of RH-6SQH series



Section of Z-Z

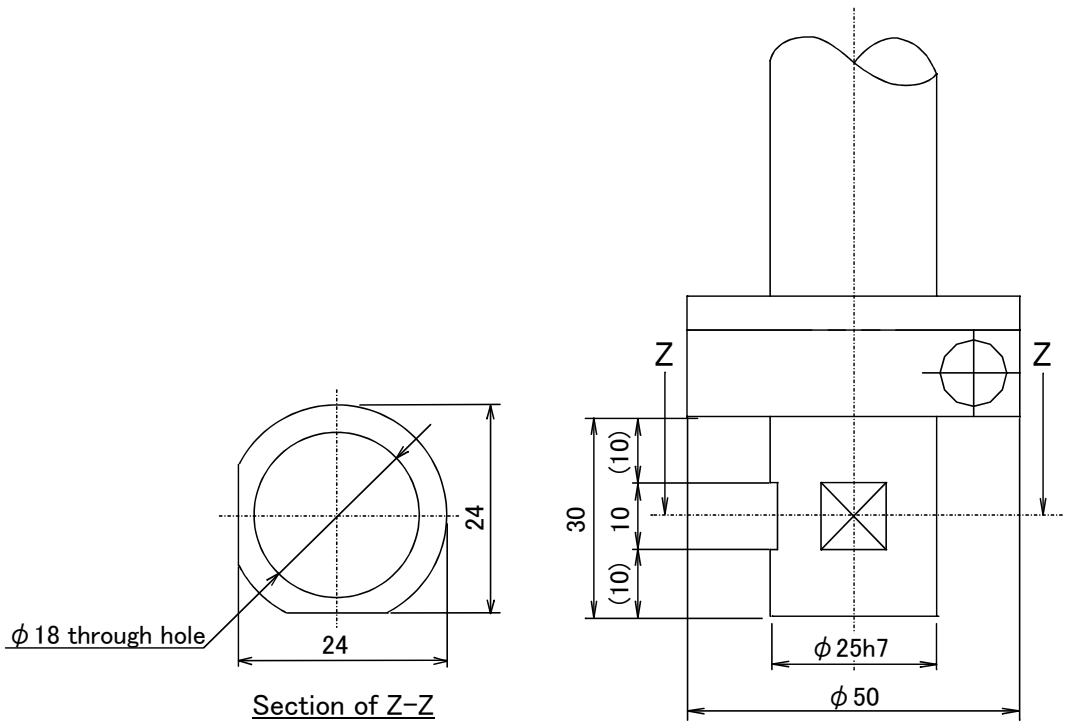
Detail of Mechanical interface



Installation dimension details

Fig.2-46 : Mechanical interface and Installation surface of RH-6SQH series

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



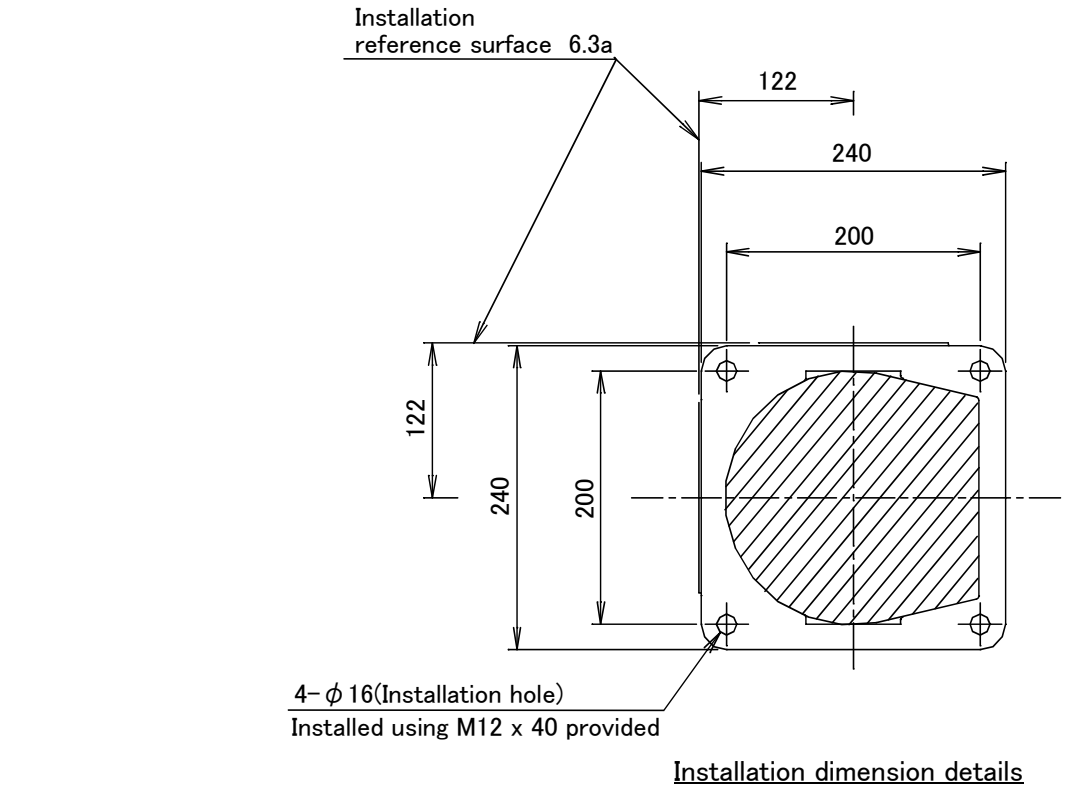


Fig.2-47 : Mechanical interface and Installation surface of RH-12SQH/18SQH series

(3) Mechanical interface and Installation surface of RH-20SQH series

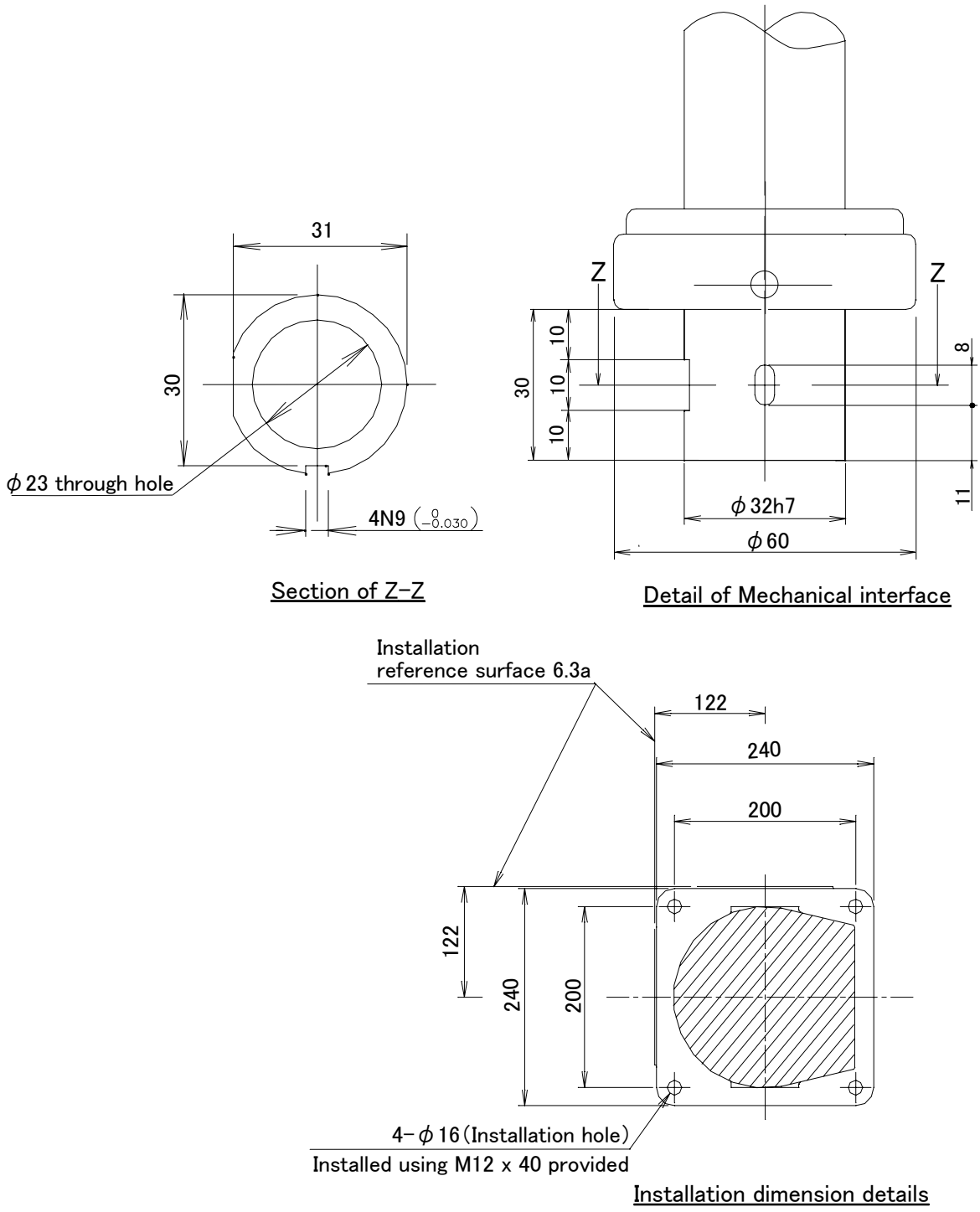


Fig.2-48 : Mechanical interface and Installation surface of RH-20SQH series

(4) Mechanical interface and Installation surface of RH-3SQHR series (Standard specification)

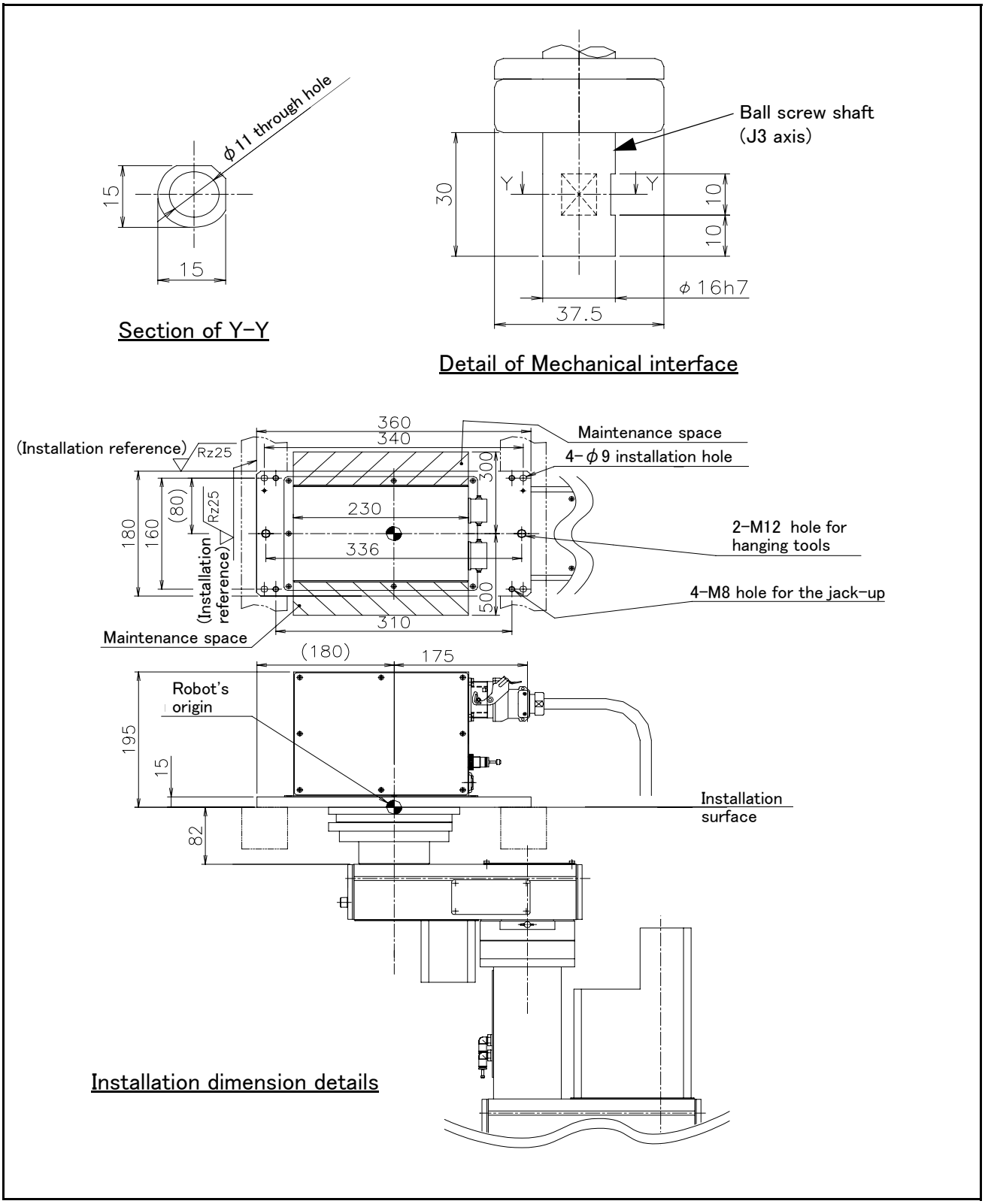


Fig.2-49 : Mechanical interface and Installation surface of RH-3SQHR series (Standard specification)

⚠CAUTION Don't give a shock to the ball screw shaft at the time of hand installation. Especially don't strike the shaft end by hammer etc. The ball screw shaft may be damaged.

(5) Mechanical interface and Installation surface of RH-3SQHR series (Clean/Waterproof specification)

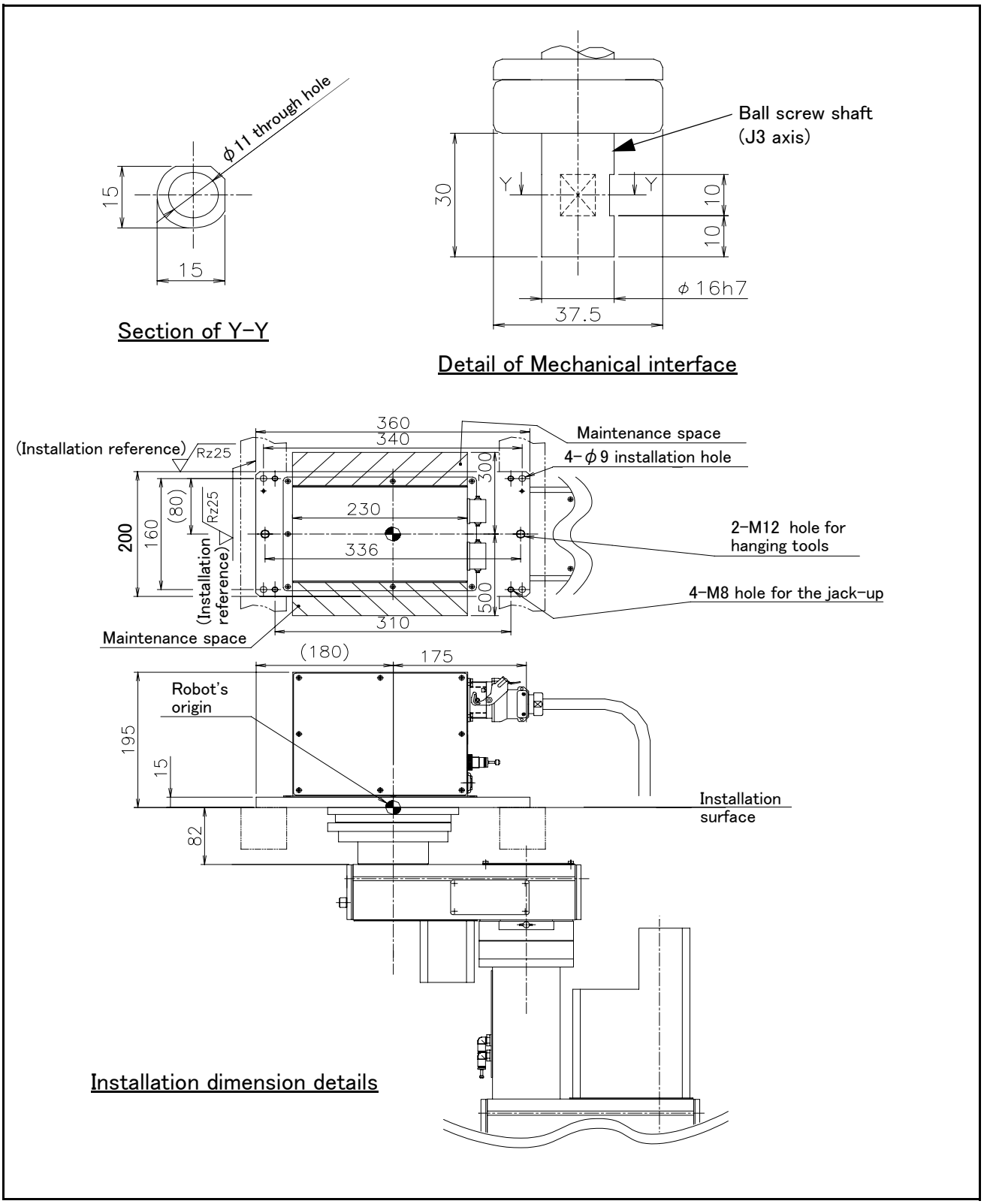


Fig.2-50 : Mechanical interface and Installation surface of RH-3SQHR series (Clean/Waterproof specification)

⚠CAUTION Don't give a shock to the ball screw shaft at the time of hand installation. Especially don't strike the shaft end by hammer etc. The ball screw shaft may be damaged.

2.4.7 Change the operating range

The operating ranges of both the J1, J2 and J3 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.
In addition, change of the operating range in RH-3SQHR series is optional. Refer to Page 101, "(2) Changing the operating range".

(1) Operating range changeable angle

The operating range must be set up at angels indicated by Table 2-21.

Table 2-21 : Operating range changeable angle

Axis	Type	Direction	Standard	Changeable angle				
RH-6SQH series								
J1	RH-6SQH35*/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-6SQH35*	+ 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-6SQH45*/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			
J3	Standard specifications	+ side	+297	Change is impossible.				
		- side	+97	+115 to+ 257mm				
	Clean, oil-mist specifications	+ side	+267	Change is impossible.				
		- side	+97	+115 to+ 227mm				
RH-12SQH/18SQH/20SQH series								
J1	RH-12SQH55*/70*/85* RH-18SQH85* RH-20SQH85* RH-20SQH100*	+ 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-12SQH55*/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-12SQH85* RH-18SQH85* RH-20SQH85* RH-20SQH100*	+ 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				

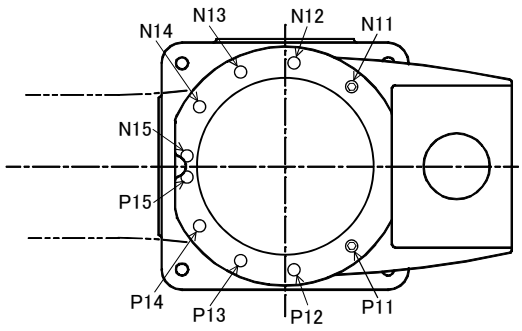
Note1) The * symbols next to the robot types indicate the up/down stroke length, environment specification, specification with controller protection box (RH-6SQH series) or controller specification with countermeasure against oil mist (RH-12SQH/18SQH/20SQH series). In this case, it is possible to change the movement ranges shown in Table 2-21 for any model.

Note2) The changeable angle shown in Table 2-21 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. 2-51 and Fig. 2-52 for mechanical stopper position. The J3 axis makes the mechanical stopper slide.

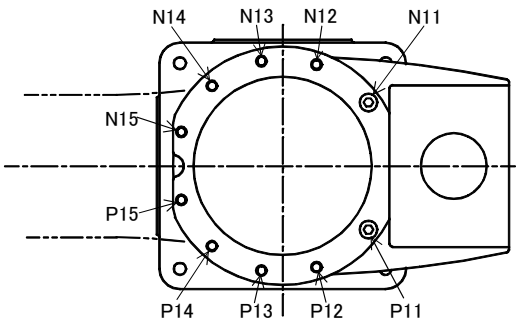
(2) The change method of the operating range

■ Installation of the mechanical stopper

1) Turn off power to the controller.
2) Install the hexagon socket bolt in the screw hole to the angle to set up referring to Table 2-21 and Fig. 2-51, and Fig. 2-52. About the mechanical stopper position and the relation of bolt size, the J1 axis is shown in Fig. 2-51, and the J2 axis is shown in Fig. 2-52. When the screw hole is covered by the arm, move the No.1 arm or the No.2 arm slowly by hand.

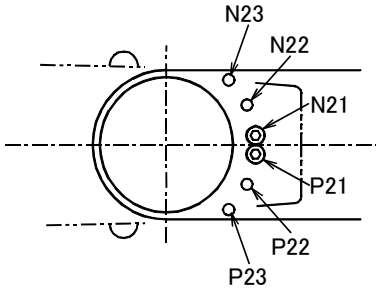


*Hexagon socket bolt = M8 x 16
For RH-6SQH series

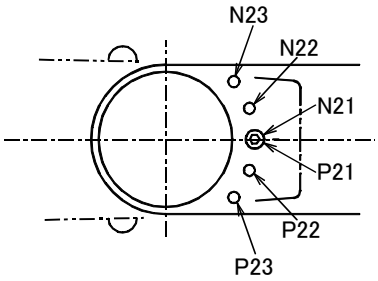


*Hexagon socket bolt = M12 x 25
For RH-12SQH/18SQH/20SQH series

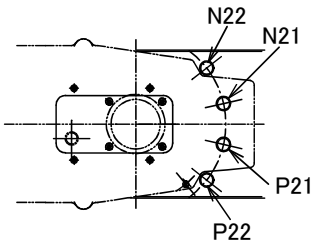
Fig.2-51 : Mechanical stopper position (J1 axis)



*Hexagon socket bolt = M8 x 16
For RH-6SQH35* series



*Hexagon socket bolt = M8 x 16
For RH-6SQH45*/55* series



*Hexagon socket bolt = M8 x 16
For RH-12SQH/18SQH/
20SQH series

Fig.2-52 : Mechanical stopper position (J2 axis)

■ Change the operating range parameters

Specify the operating range to parameters MEJAR with appropriate values (variable angles given in Table 2-21) by the following steps:

1) Turn on power to the controller.
2) Set up the operating range changed into Parameter MEJAR
MEJAR: (J1 minus(−) side, J1 plus(+) side, J2 minus(−) side, J2 plus(+) side, ☐ , ☐ , ...).

■ Change the mechanical stopper origin position parameters

If you have changed operating range on the J1 minus(−) side or J2 plus(+) side, change mechanical stopper origin position parameters by the following step:

1) Set MORG parameter to the angle which set mechanical stopper position.
MORG: (J1 mechanical stopper position, J2 mechanical stopper position, ☐ , ☐ , ...).

■ Check the operating range

After changing the parameter, turn off the controller power and turn on again. Then, move the axis changed by joint jog operation to the limit of the operating range.

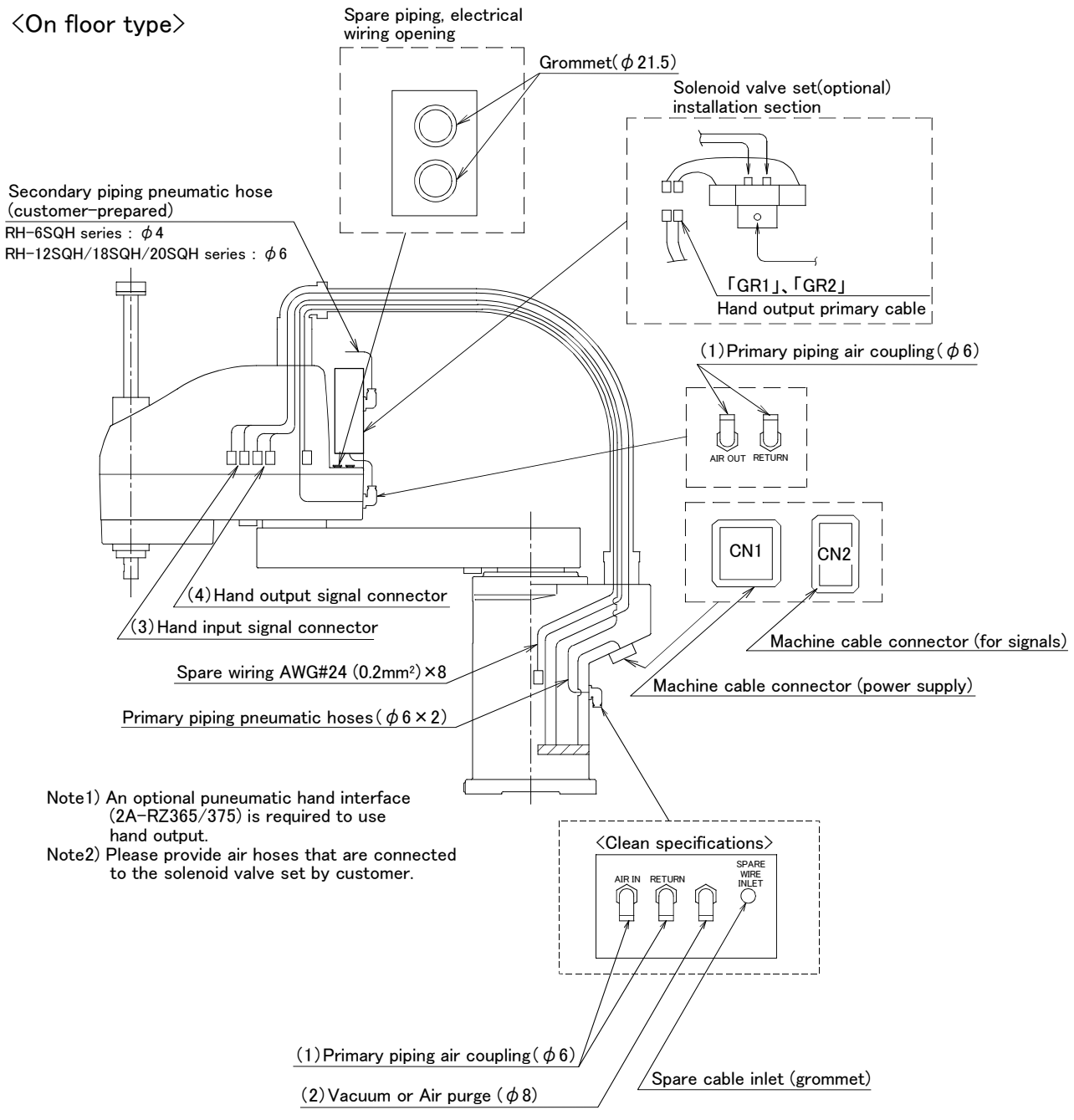
Confirm that the robot stops by limit over at the changed angle.

This completes the procedure to change 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.



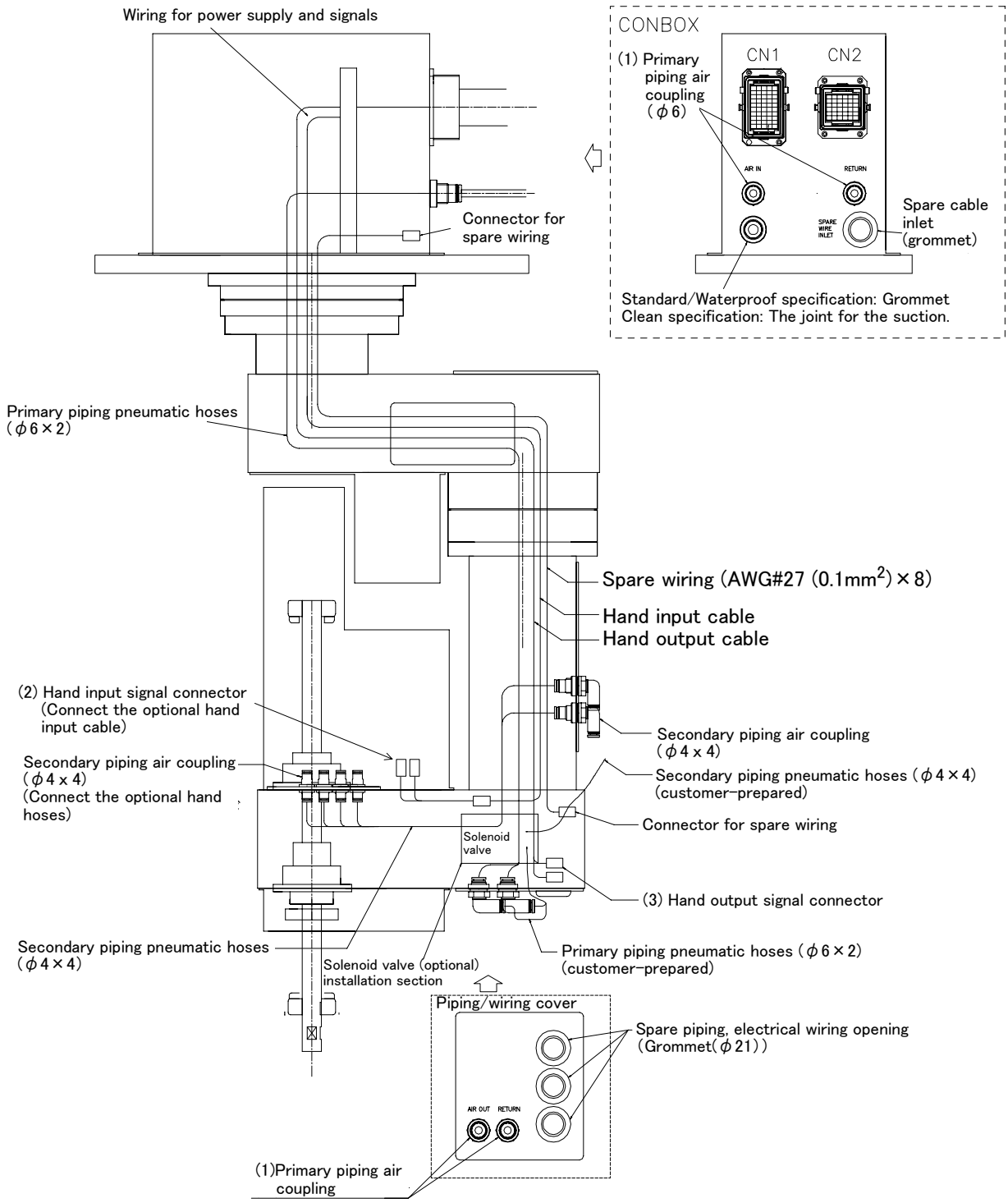
Connector and pneumatic coupling

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 air purge or internal suction .

Fig.2-53 : Wiring and piping for hand (Floor installation type)

<Hanging type>



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)	Connector	2	1-1717834-3	1318108-1	1-1318115-3	1318112-1	Tyco Electronics AMP
(3)	Connector	2	1-1717834-4	1318108-1	1-1318115-4	1318112-1	Tyco Electronics AMP

Fig.2-54 : Wiring and piping for hand (Hanging installation type)

2.5.2 Internal air piping

(1) Floor installation type

1) Standard specification/Oil mist specifications

- The robot has two φ6 x 4 urethane hoses from the pneumatic entrance on the base section to the shoulder cover.

The base and No.2 arm sides of the hose end are two air joints for φ6 hoses.

The solenoid valve set (optional) can be installed to the side on No.2 arm.

- Refer to Page 102, "(3) Solenoid valve set" for details on the electronic valve set (optional).
- Protection performance can be improved by pressurizing the inside of the robot arm. Since the joint (AIR PURGE) of phi 8 is prepared at the rear of the base section, please supply the dry air for pressurization from this joint. Refer to Page 35, "2.2.8 Protection specifications" for the details of dry air.

2) Clean specification

- The clean type basically includes the same piping as the standard type.
- With the clean specification, a φ8 coupling is provided in the base section for suction inside the machine. For use, connect it to the suction port of the vacuum pump or the coupling on the "VACUUM" side of the vacuum generating valve. Moreover, to clean the exhaust from the vacuum pump or vacuum generator, use the exhaust filter (prepared by the customer).
- Refer to Page 38, "2.2.9 Clean specifications" for details of the vacuum for suction.
- Use clean air as the air supplied to the vacuum generator.

(2) Hanging installation type

1) Standard/Waterproof (IP65) specification

- The robot has two φ6 x 4 urethane hoses from the pneumatic entrance on the base section to the No.2 arm.
- The base and No.2 arm sides of the hose end are two air joints for φ6 hoses.
- The solenoid valve set (optional) can be installed to the side on No.2 arm.
- Refer to Page 28, "(2) Solenoid valve set" for details on the electronic valve set (optional).
- The four air hoses (φ4) are piped as the secondary from the No.2 arm back end to near the shaft.

2) Clean specification

- The clean type basically includes the same piping as the standard type.
- With the clean specification, a φ8 coupling is provided in the base section for suction inside the machine. For use, connect it to the suction port of the vacuum pump or the coupling on the "VACUUM" side of the vacuum generating valve. Moreover, to clean the exhaust from the vacuum pump or vacuum generator, use the exhaust filter (prepared by the customer).
- Refer to Page 38, "2.2.9 Clean specifications" for details of the vacuum for suction.
- Use clean air as the air supplied to the vacuum generator.

2.5.3 Internal wiring for the pneumatic hand output cable

When the controller uses the optional pneumatic hand interface (2A-RZ365/2A-RZ375), the hand output signal works as the pneumatic hand cable.

(1) Floor installation type

- The hand output primary cable extends from the connector PCB of the base section to the back side of the no.2 arm. (AWG#24(0.2mm^2)x 2 : 8 cables) The cable terminals have connector bridges for eight hand outputs.The connector names are GR1 and GR2.

  The separate cable (optional "hand output cable 1S-GR35S-02") is necessary, to extend the cable to outside of the arm.

  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 protection specifications, fill the fringe of the grommet with silicon rubber.

(2) Hanging installation type

- The hand output primary cable extends from the connector PCB of the base section to the back side of the no.2 arm. (AWG#24(0.2mm^2)x 2 : 8 cables) The cable terminals have connector bridges for eight hand outputs.The connector names are GR1 and GR2. The separate cable (optional "hand output cable 1S-GR35S-02") is necessary, to extend the cable to outside of the arm.

2.5.4 Internal wiring for the hand check input cable

(1) Floor installation type

- The hand input cable extends from the connector PCB of the base section to the No.2 arm. (AWG#24(0.2mm^2)x 2 : 12 cables) The cable terminals have connector bridges for eight hand inputs. The connector names are HC1 and HC2.
- 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) Hanging installation type

- The hand input cable extends from the connector PCB of the base section to the No.2 arm. (AWG#24(0.2mm^2)x 2 : 6 cables) The cable terminals have connector bridges for four hand inputs. The connector names are HC1 and HC2.
- The hand check signal of the pneumatic hand is input by connecting this connector.

2.5.5 Spare Wiring

(1) Standard type

As spare wiring, four pairs of cab tire cables (RH-6SQH/12SQH/18SQH/20SQH series: AWG#24(0.2mm^2), RH-3SQHR series: AWG#27(0.1mm^2), total is eight cores both) are preinstalled between the base section and the No.2 arm rear section. Customer can utilize it. 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.)

Reference) Pin assignment of the connector, and the matching connector

Pin assignment

Pin	Color
A1	Red
A2	Brown
A3	Green
A4	Black
B1	Orange
B2	White
B3	Yellow
B4	Blue

Robot side connector

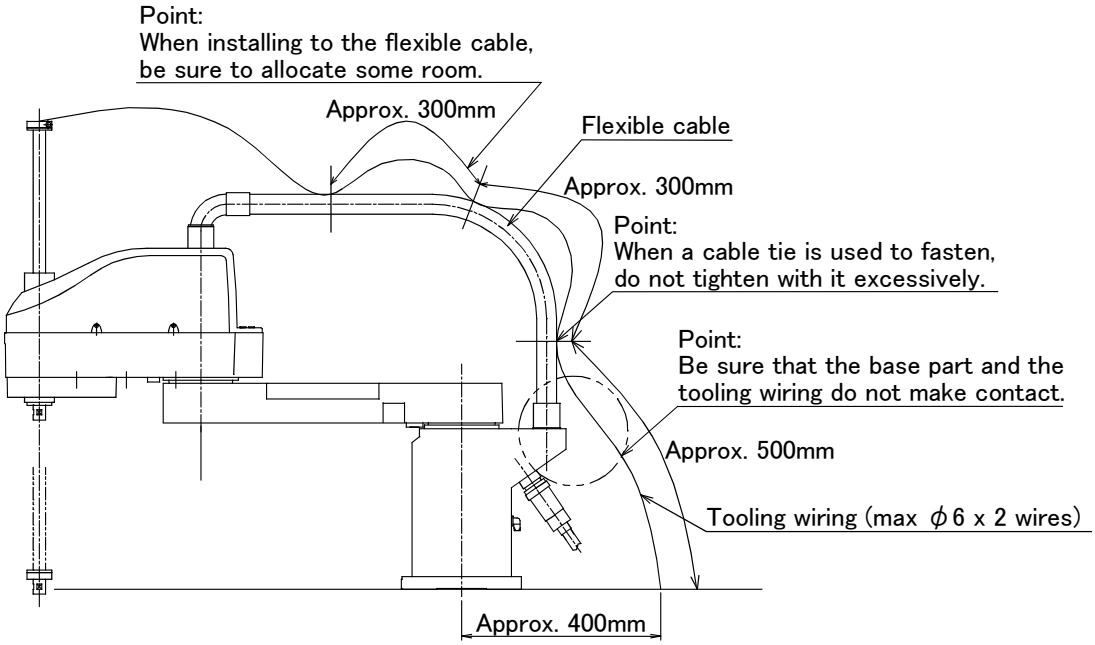
Connection place	Connector	Contactor	Maker
Base portion	2-1318115-4	-	Tyco Electronics AMP K.K.
Fore arm portion	2-1717834-4	-	

Other party connector (recommendation)

Connection place	Connector	Contactor	Maker
Base portion	2-1717834-4	1318108-1	Tyco Electronics AMP K.K.
Fore arm portion	2-1318115-4	1318112-1	

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.



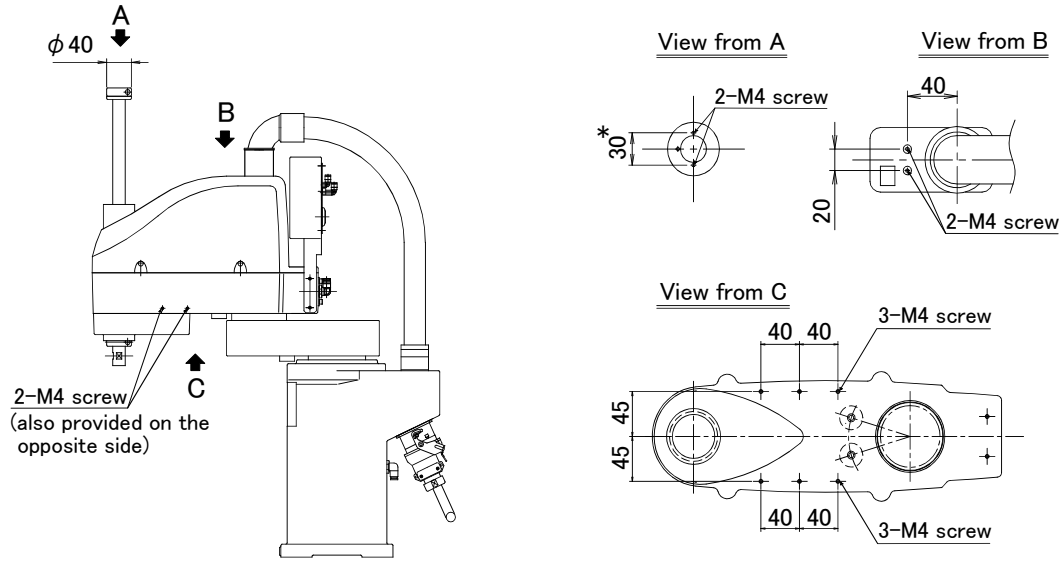
If many hand cables are installed to the flexible cable and depending on the manner of installation, excessive force may be applied to the flexible cable and the life span of the flexible cable may be shortened and also the mounting nuts of the flexible cable may come loose.

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 2-55, Table 2-56, Table 2-57 and Table 2-58.)
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.

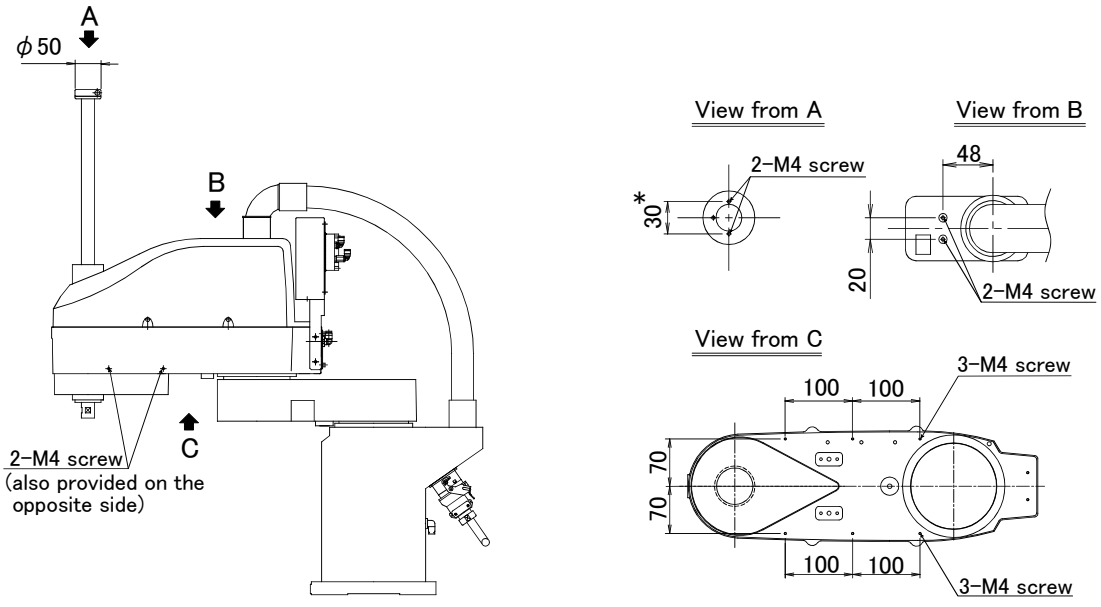
RH-6SQH series



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

Fig.2-55 : Location of screw holes for fixing wiring/piping (RH-6SQH series)

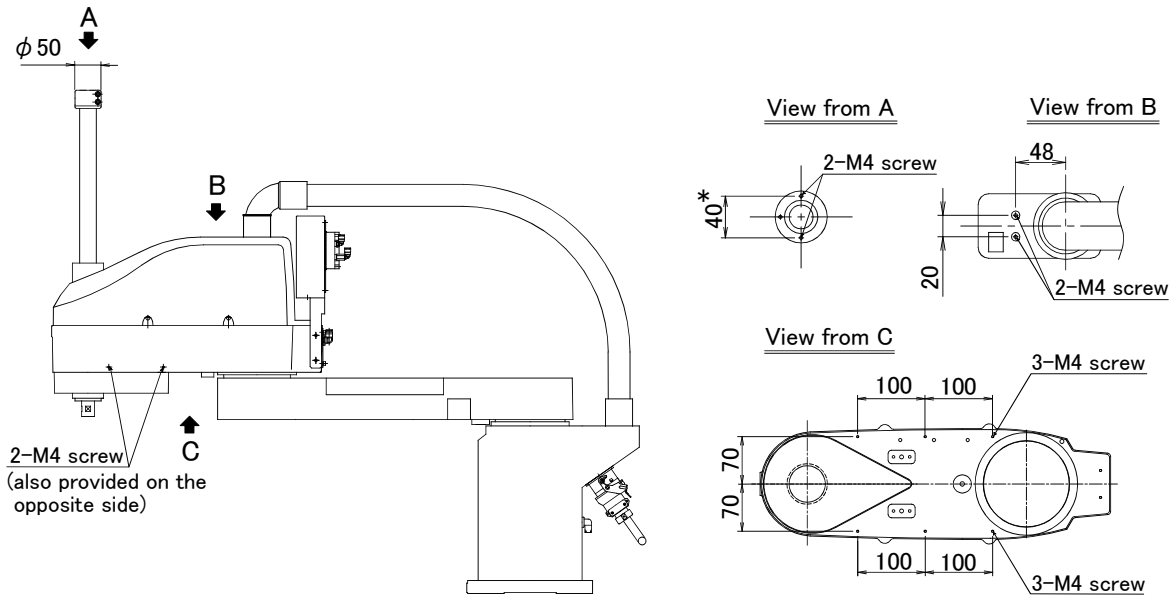
RH-12SQH series



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

Fig.2-56 : Location of screw holes for fixing wiring/piping (RH-12SQH series)

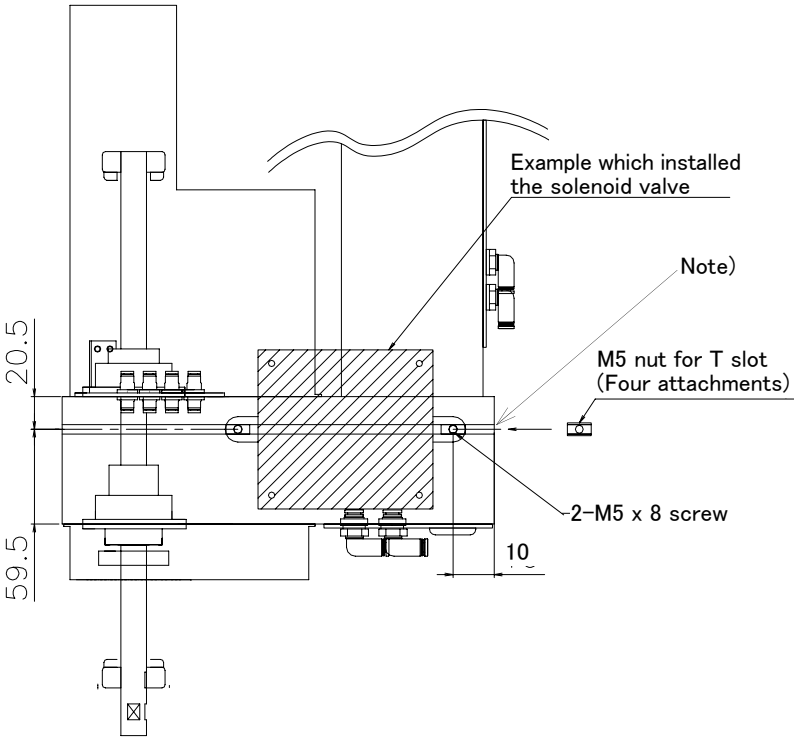
RH-18SQH/20SQH series



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

Fig.2-57 : Location of screw holes for fixing wiring/piping (RH-18SQH/20SQH series)

RH-3SQHR series



Note) T slot
The T slot is on the side of the No.2 arm. (Two of right and left)
Utilize the M5 screw and T slot for fixing the hose or wire.
Refer to "Page 68, "Fig.2-44 : Outside dimensions, Operating range diagram of RH-3SQHR series" or Page 69, "Fig.2-45 : Outside dimensions, Operating range diagram of RH-3SQHR series (Clean/Waterproof specification)" for detail of T slot.
Clean specification:
In the clean specification, packing is stuffed into the T slot.
Removes packing, when wiring and piping are fixed.

Fig.2-58 : Location of screw holes for fixing wiring/piping (RH-3SQHR 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.

<Floor installation type>

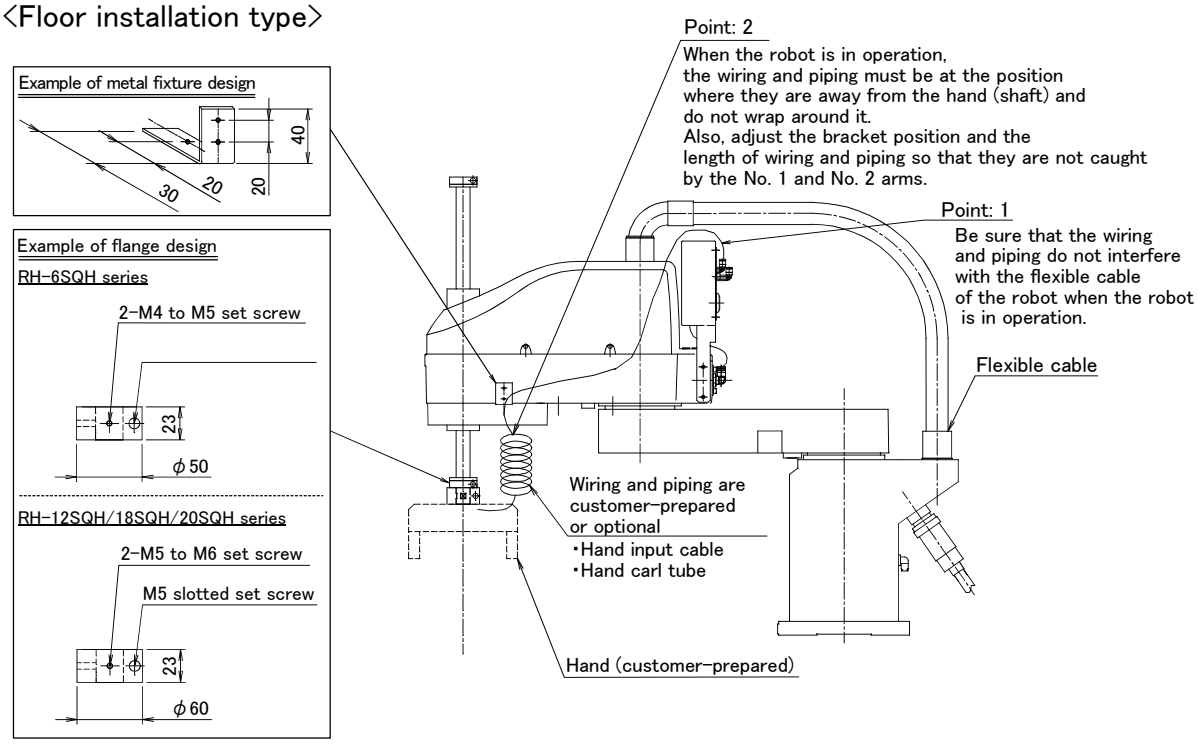
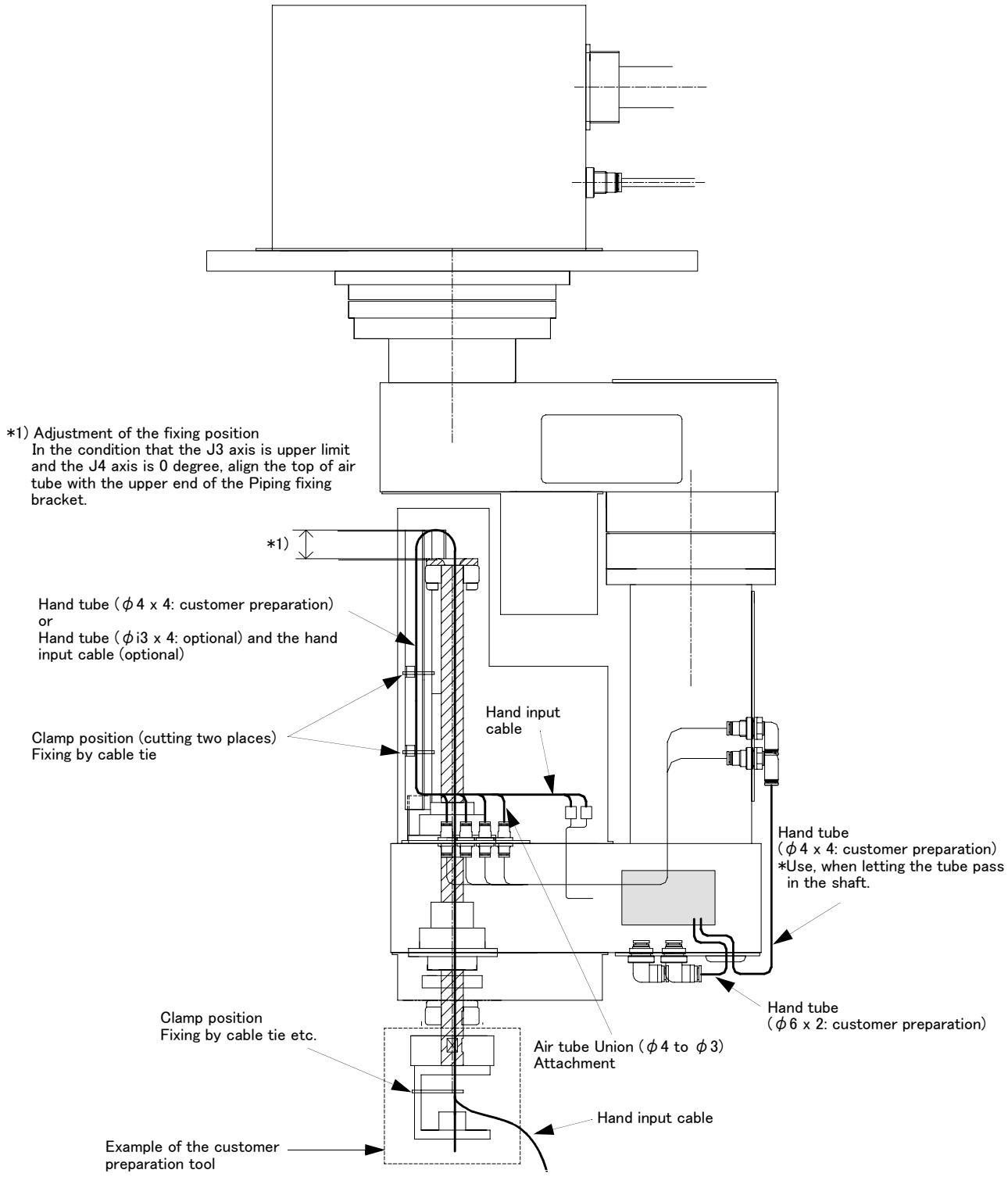


Fig.2-59 : Example of wiring and piping <1> (Floor installation type)

<Hanging type>

Example) How to pass the φ4 air hose into the shaft



Notes in wiring

1. The air hose which can be passed in the shaft is four φ4 hoses maximum. (Customer preparations)
2. Wire the cable and piping the tube without interference with ball screw and cover.
3. Because to prevent the bend of the air tube, secure the minimum radius with which tube can be bent.
4. Add the mass of solenoid valve to mass of hand and set to parameter: HNDDAT. (RH-3SQHR series only)
5. The hand tube (four φ3 tubes) and the hand input cable (4 point) are prepared optional.
   Please confirm that there is no rubbing or crack etc per six months.

Fig.2-60 : Example of wiring and piping <1> (Hanging installation type)

(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.

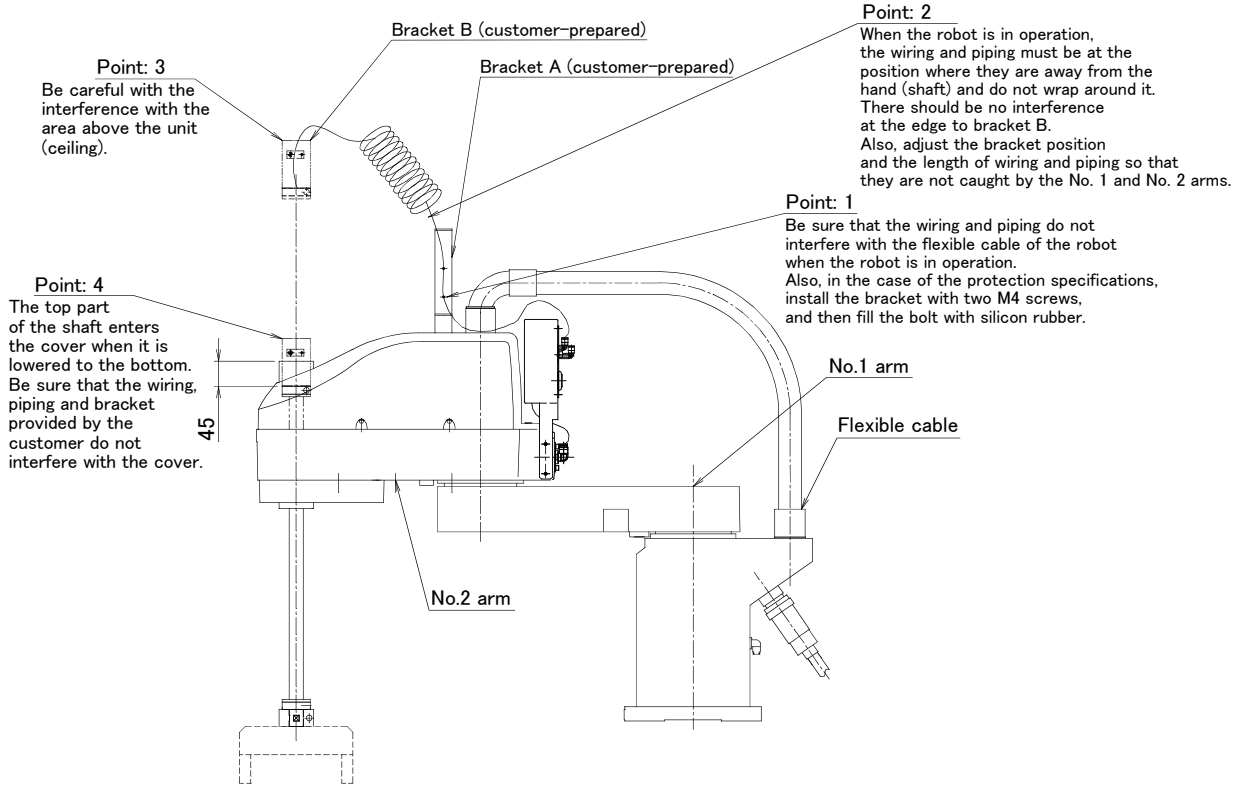
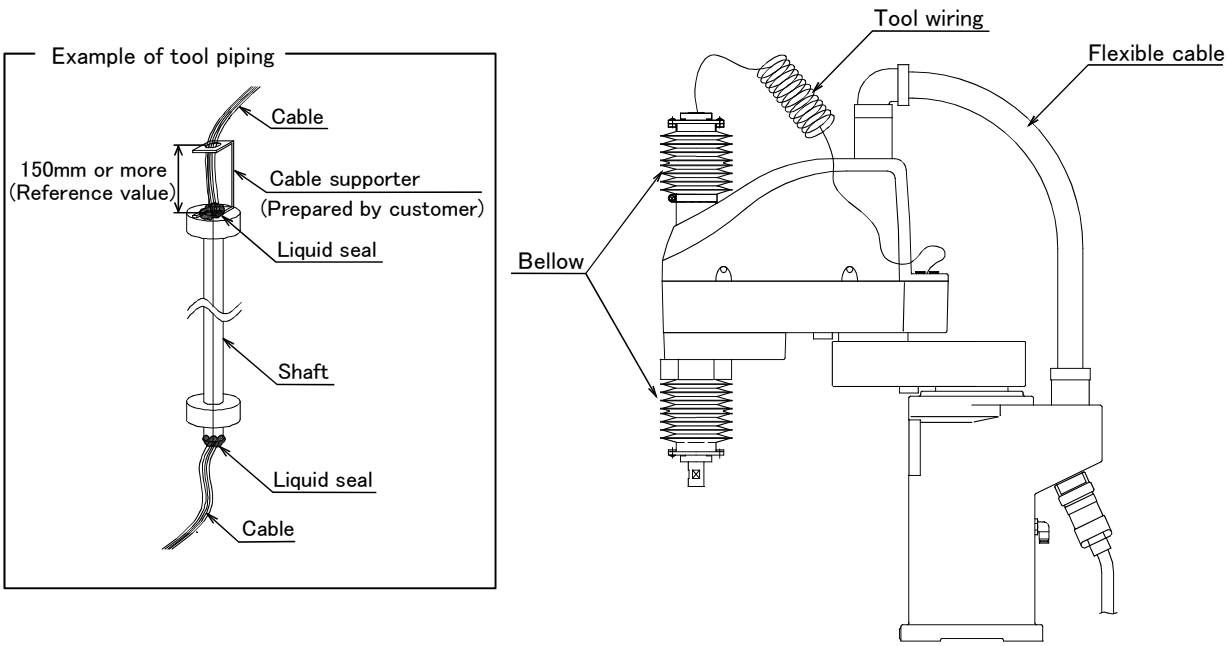


Fig.2-61 : Example of wiring and piping <2>

(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.

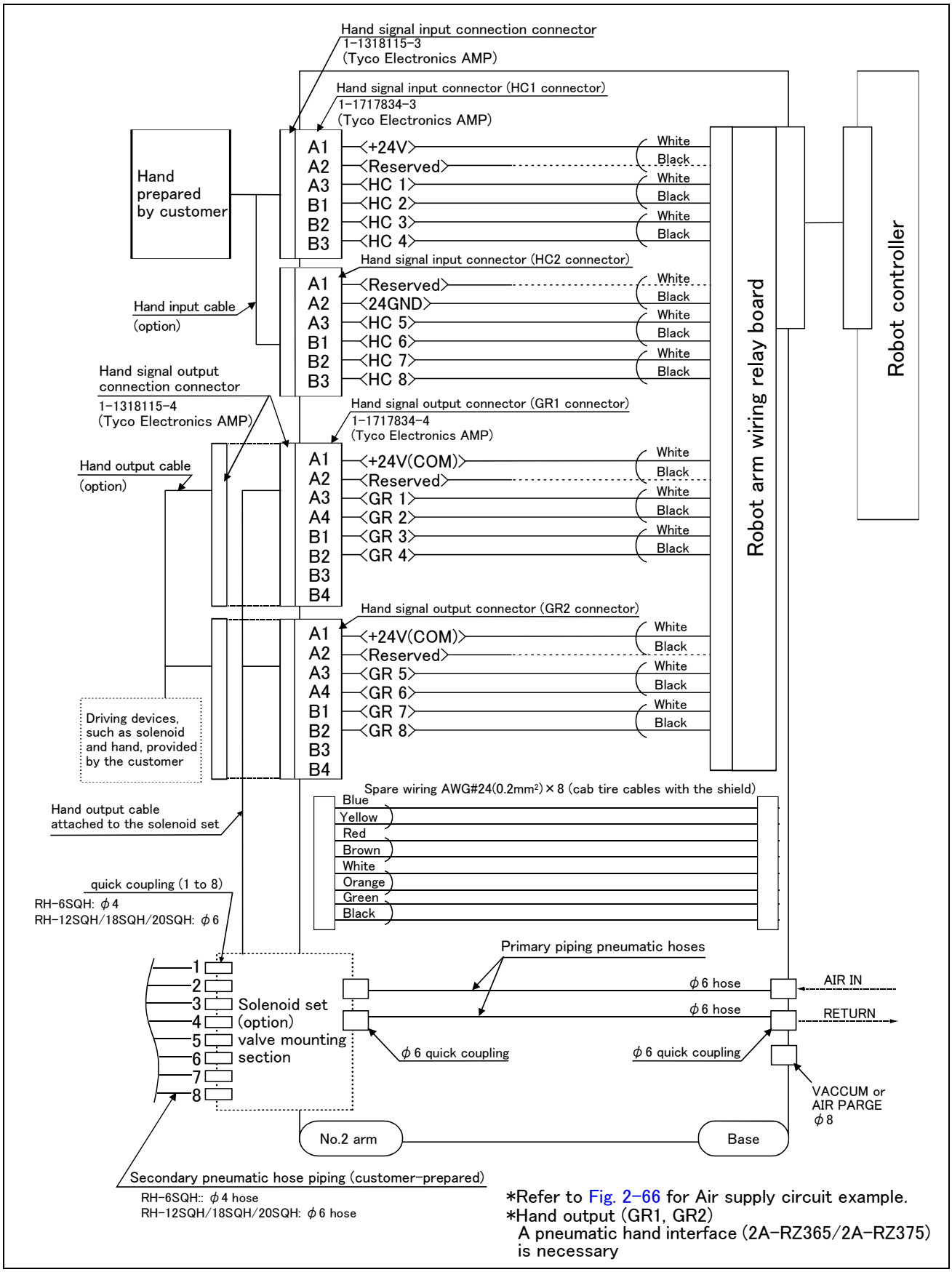


Fig.2-62 : Wiring and piping system diagram for hand and example the solenoid valve installation (RH-6SQH/12SQH/18SQH/20SQH series: Sink type)

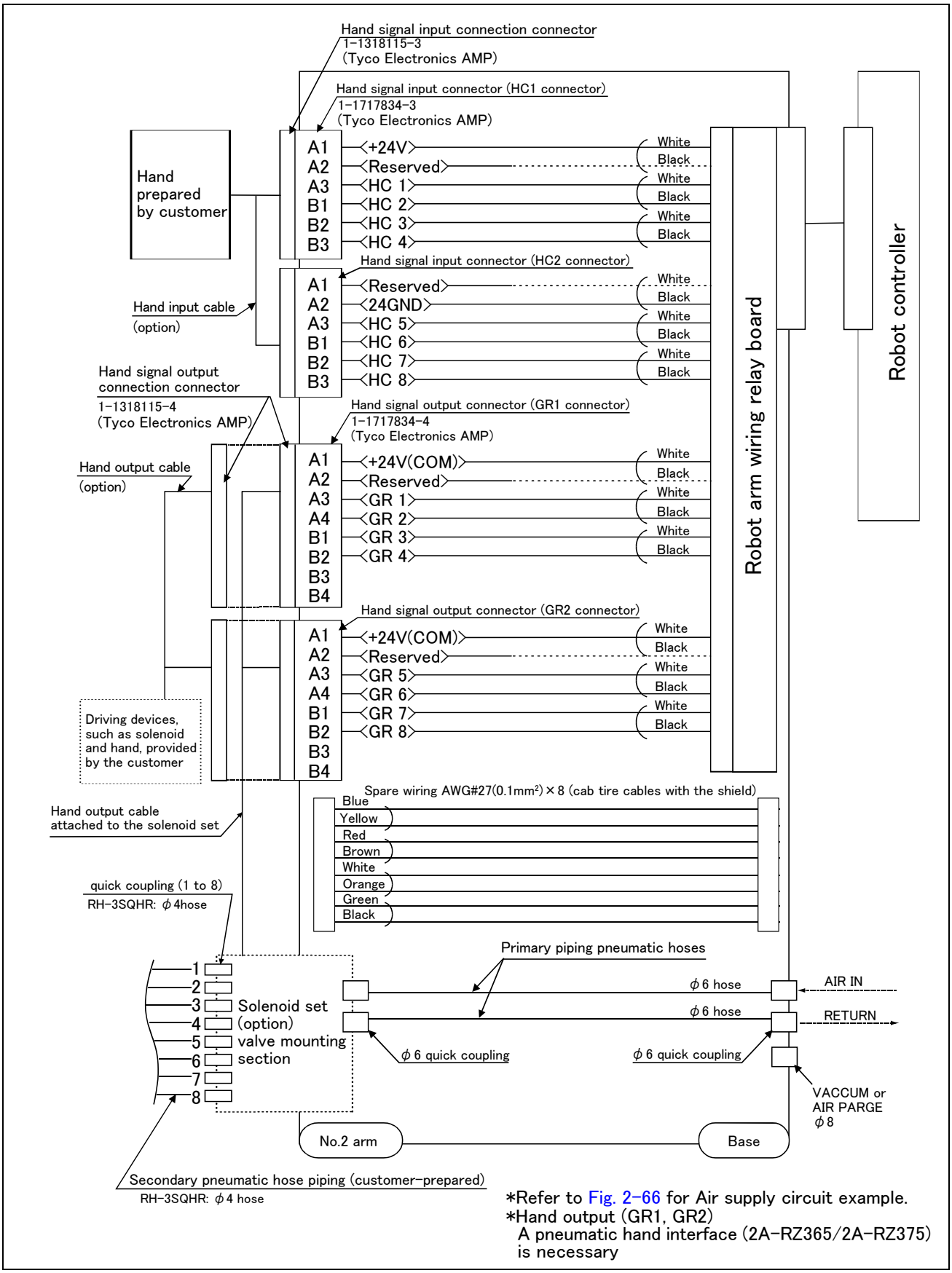


Fig.2-63 : Wiring and piping system diagram for hand and example the solenoid valve installation (RH-3SQHR series: Sink type)

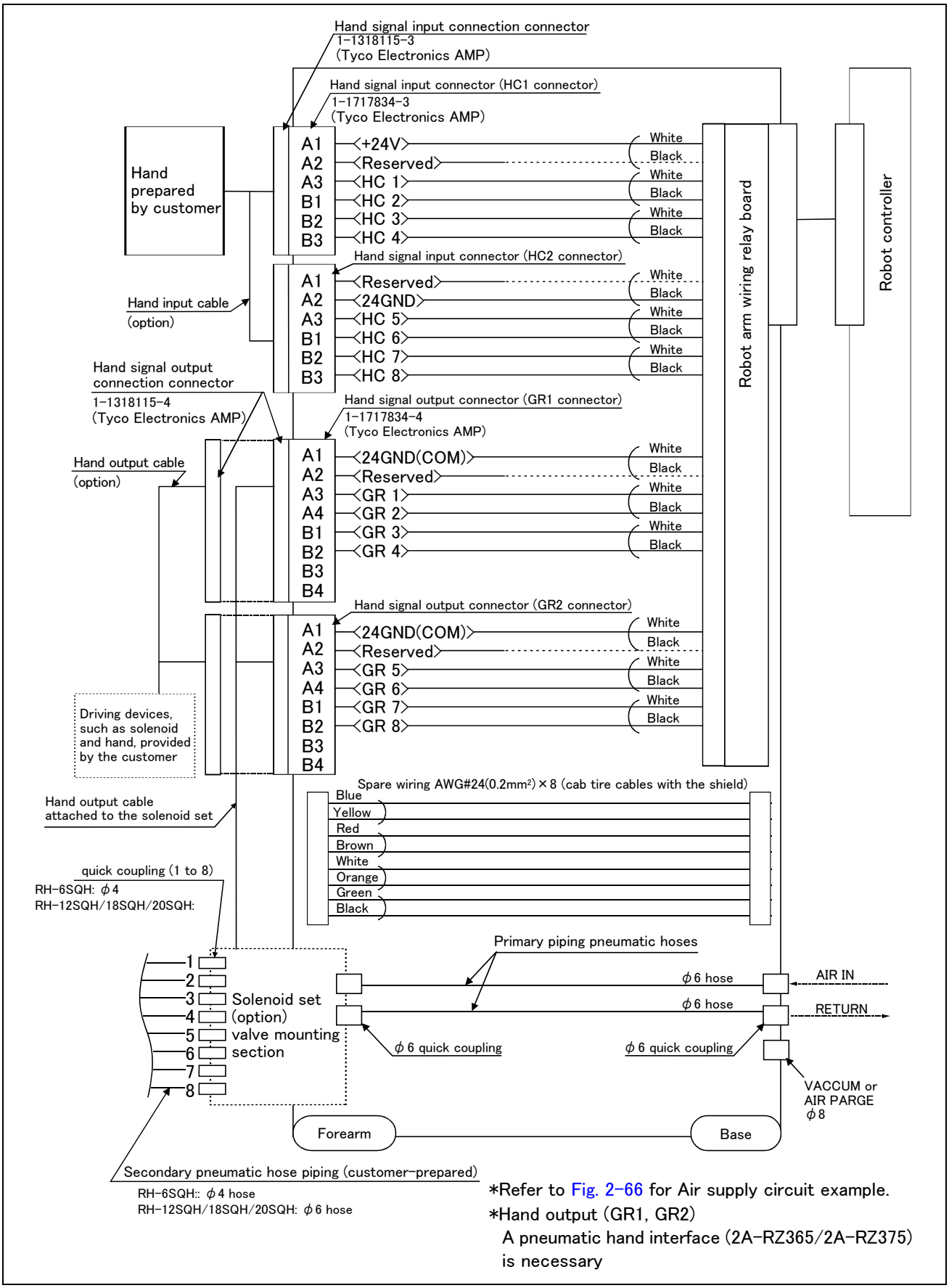


Fig.2-64 : Wiring and piping system diagram for hand and example the solenoid valve installation (RH-6SQH/12SQH/18SQH/20SQH: Source type)

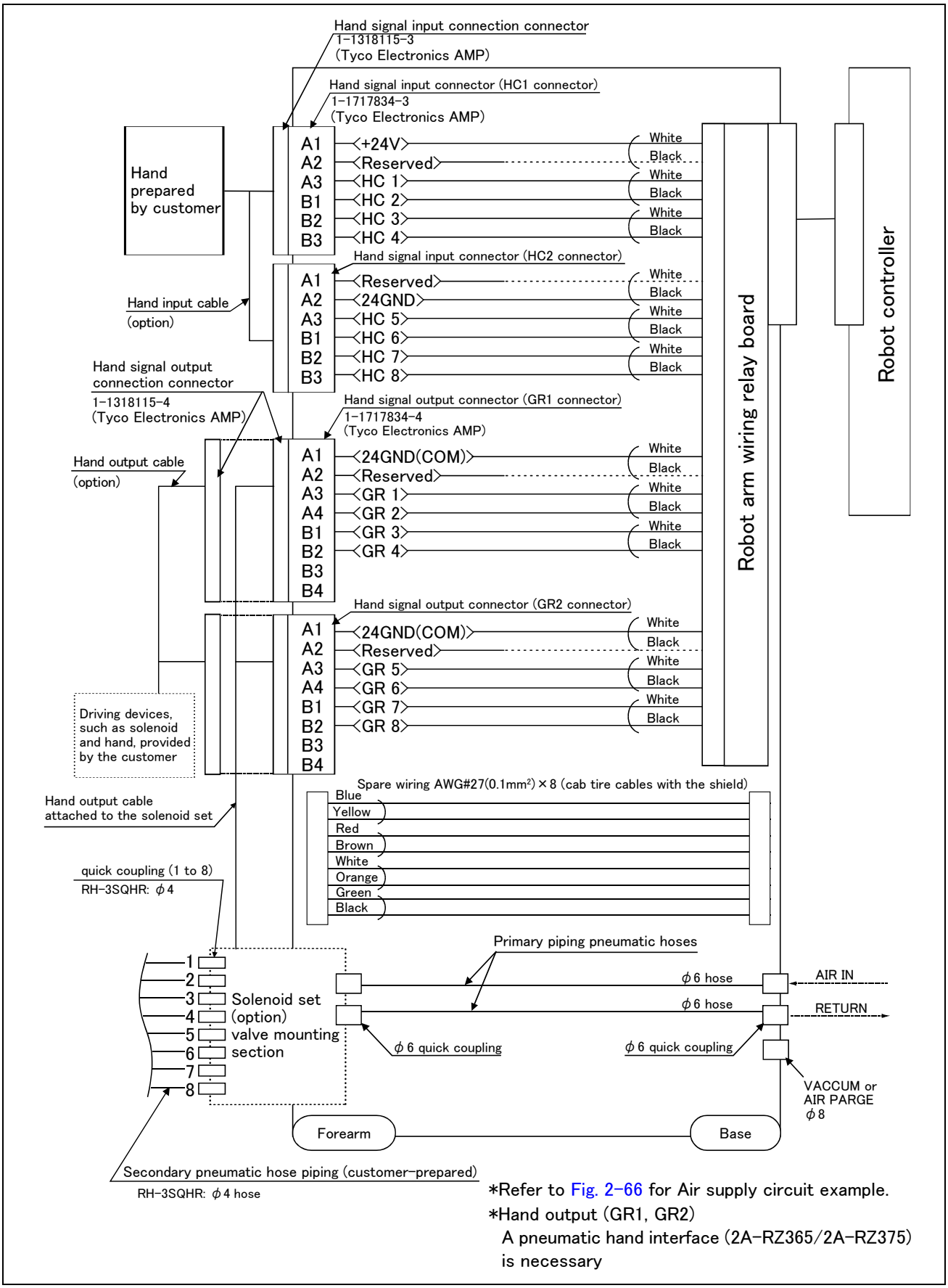


Fig.2-65 : Wiring and piping system diagram for hand and example the solenoid valve installation (RH-3SQHR series: Source type)

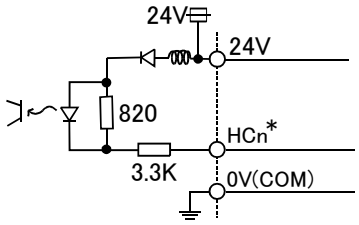
2.5.9 Electrical specifications of hand input/output

Table 2-22 : Electrical specifications of input circuit

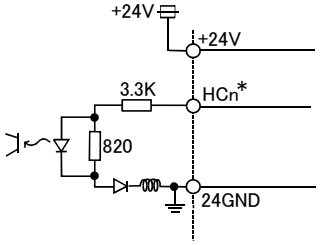
Item		Specifications
Type		DC input
No. of input points		8
Insulation method		Photo-coupler insulation
Rated input voltage		12VDC/24VDC
Rated input current		Approx. 3mA/approx. 7mA
Working voltage range		DC10.2 to 26.4V(ripple rate within 5%)
ON voltage/ON current		8VDC or more/2mA or more
OFF voltage/OFF current		4VDC or less/1mA or less
Input resistance		Approx. 3.3kΩ
Response time	OFF-ON	10ms or less(DC24V)
	ON-OFF	10ms or less(DC24V)

Internal circuit

<Sink type>



<Source type>



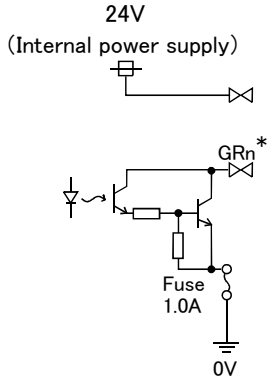
* HCn = HC1 ~ HC8

Table 2-23 : Electrical specifications of output circuit

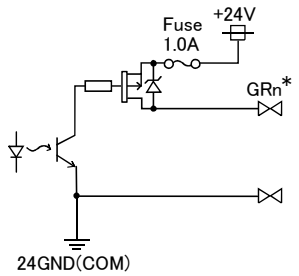
Item		Specification
Type		Transistor output
No. of output points		8
Insulation method		Photo coupler insulation
Rated load voltage		DC24V
Rated load voltage range		DC21.6 to 26.4VDC
Max. current load		0.1A/ 1 point (100%)
Current leak with power OFF		0.1mA or less
Maximum voltage drop with power ON		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		1.0A (each one common) Cannot be exchanged

Internal circuit

<Sink type>



<Source type>



* GRn = GR1 ~ GR8

Note) An optional pneumatic hand interface (2A-RZ365/2A-RZ375) is required to use hand output.

2.5.10 Air supply circuit example for the hand

Fig. 2-66 shows an example of pneumatic supply circuitry for the hand.

(1) Place diodes parallel to the solenoid coil.

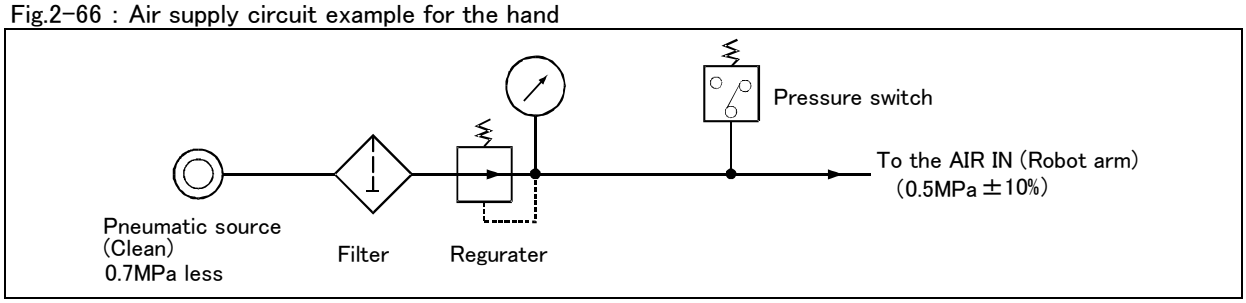
(2) When the factory pneumatic pressure drops, as a result of the hand clamp strength weakening, there can be damage to the work. To prevent it, install a pressure switch to the source of the air as shown in Fig. 2-66 and use the circuit described so that the robot stops when pressure drops. Use a hand with a spring-pressure clamp, or a mechanical lock-type hand, that can be used in cases where the pressure switch becomes damaged.

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

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

(5) If the air supply temperature (primary piping) used for the tool etc. is lower than ambient air temperature, the dew condensation may occur on the coupling or the hose surface.

Fig.2-66 : Air supply circuit example for the hand



2.6 Shipping special specifications, options, and maintenance parts

2.6.1 Shipping special specifications

■ What are sipping special specifications?

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

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

■ How to order

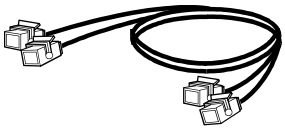
(1) Confirm beforehand when the factory special specifications can be shipped, because they may not be immediately available.

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

(1) Machine cable

■ Order type: RH-6SQH series ..... ● Fixed type 1S-02UCBL-03 (2m)
RH-12SQH/18SQH/20SQH series, RH-3SQHR series..... ● Fixed type 1S-02UCBL-01 (2m)

■ 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 2-24 : Configuration equipments and types

Part name		Type	Qty.	Mass(kg)[Note1)]	Qty.
RH-6SQH series					
Fixed	Set of signal and power cables	1S-02UCBL-03	1set	2.6	2m
	Motor signal cable	BKO-FA0741H02	(1 cable)	-	
	Motor power cable	BKO-FA0768H02	(1 cable)	-	
RH-12SQH/18SQH/20SQH series, RH-3SQHR series					
Fixed	Set of signal and power cables	1S-02UCBL-01	1set	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.

2.7 Options

■ What are options?

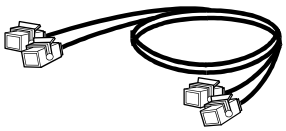
There are a variety of options for the robot designed to make the setting up process easier for customer needs. customer installation is required for the options. Options come in two types: ″set options″ and ″single options″.

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-6SQH series ..... ● Fixed type 1S- □□ CBL-03
● Flexed type 1S- □□ LCBL-03
RH-12SQH/18SQH/20SQH series, RH-3SQHR series.... ● Fixed type 1S- □□ CBL-01
● Flexed type 1S- □□ LCBL-01
Note) The numbers in the boxes □□ refer the length.

■ Outline



The distance between the robot controller and the robot arm is extensible by this option. This cable is extended to the machine cable attached as standard. (5m for fix type)
A fixed type and flexible type are available.The fix and flexible types are both configured of the motor signal cable and motor power cable.

■ Configuration

Table 2-25 : Configuration equipments and types

Part name		Type[Note1]	Qty.		Mass(kg) [Note2]	Remarks
			Fixed	Flexed		
RH-6SQH 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-12SQH/18SQH/20SQH series, RH-3SQHR 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) The numbers in the boxes □□ refer the length.
Note2) Mass indicates one set.

■ Specifications

The specifications for the fixed type cables are the same as those for standard cables.
Shows usage conditions for flexed type cables in Table 2-26.

Table 2-26 : Conditions for the flexed type cables

Item		Specifications
Minimum flexed radius		100R or more
Cableveyor, 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 x 5, ϕ8.5 x 1 and ϕ1.7 x 1
	Motor power cable	ϕ6.5 x 10: RH-6SQH ϕ8.9 x 3 and ϕ6.5 x 6: RH-12SQH/18SQH/20SQH, RH-3SQHR series

[Caution] The guidance of life count may greatly differ according to the usage state (items related to Table 2-26 and to the amount of silicon grease applied in the cable conduit.
[Caution] This option can be installed on clean-type, but its cleanliness is not under warranty.

■ Cable configuration

The configuration of the flexible cable is shown in Table 2-27. Refer to this table when selecting the cable bare.

Table 2-27 : Cable configuration (Flexed type: RH-6SQH)

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 cable
No. in total	7 cables			10 cables

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

Table 2-28 : Cable configuration (Flexed type: RH-12SQH/18SQH/20SQH, RH-3SQHR)

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 cable	6 cable
No. in total	7 cables			9 cables	

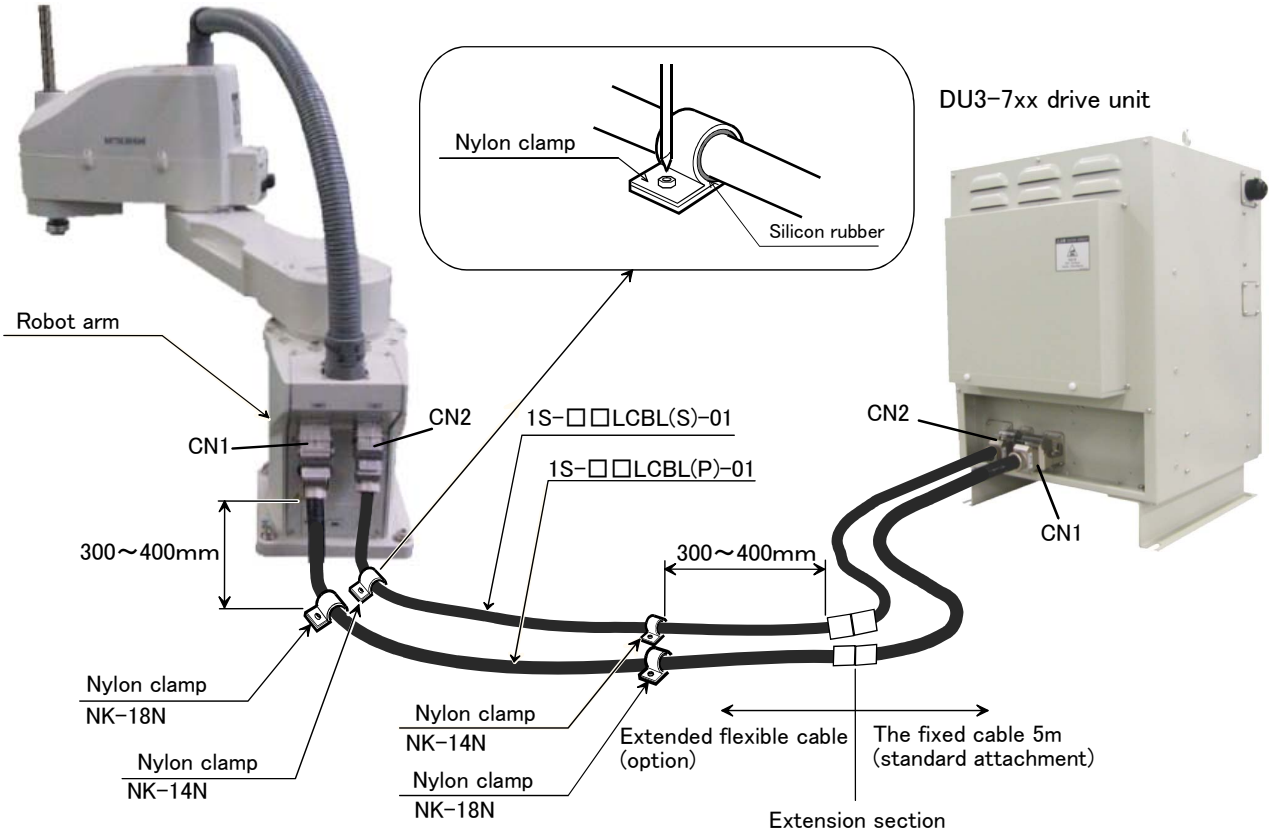
Note) The square in the cable name indicates the cable length.

■ Fixing the flexible cable

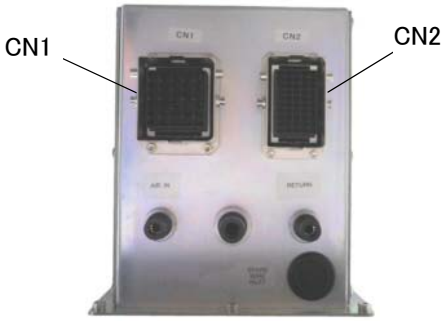
(1) Connect the connector to the robot arm .

(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. 2-67, and fix with the nylon clamp to protect the cable from external stress.

Note) The figure of the robot arm is the example of RH-12SDH. Connect other types in same way also.

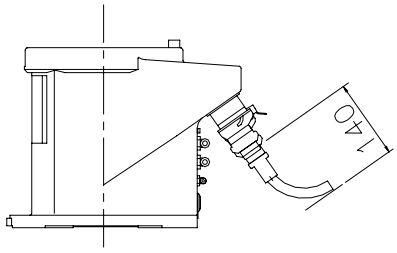


The base section of RH-3SQHR series



⚠ CAUTION

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



The cable shall bend and size shall be 140mm or more.

DU1A-700 series Driveunit

DU2A-700 series Driveunit

＊ The figure is the standard specification.
(The CE marking specification is the same)

Fig.2-67 : Fixing the flexible cable

(2) Changing the operating range

■ Order type RH-3SQHR series..... J1 axis: 1S-DH-05J1
J2 axis: 1S-DH-05J2

■ Outline

The operating range of J1 axis or J2 axis is limited by the robot arm's mechanical stopper and the controller parameters.
If the axis could interfere with the peripheral devices, etc., and the operating range need to be limited, use this.

■ Configuration

Table 2-29 : Configuration devices

Part name	Type	Qty.	Mass(kg)	Remarks
Stopper for changing the operating range	1S-DH-05J1	1 set	0.1	Pin (φ10 x 2) Installation bolt (M4 x 12) : two attachments
	1S-DH-05J2	1 set	0.1	Pin (φ8 x 2) Installation bolt (M4 x 12) : two attachments

■ Specifications

Table 2-30 : Specifications

Axis		Standard	Changeable angle Note1)
J1	+/- side	+/- 225°	+/- 90°
J2	+/- side	+/- 225°	+/- 60°

Note1) Although the J1 axis and the J2 axis can be changed independently (independent per axis), each axis changes plus side /minus side both simultaneously per axis.

(1) The changeable angle shown in Table 2-30 indicates the operation range by the software.
The limit by the mechanical stopper is positioned 3 degrees outward from that angle, so take care when designing the layout.
(2) The operating range is changed with robot arm settings (insertion of the pin) and parameter settings. Refer to the separate "Instruction Manual/ROBOT ARM SETUP & MAINTENANCE" or "Instruction Manual/ Detailed Explanation of Functions and Operations" for details.
(3) If the arm collides with mechanical stopper for operating range change at the automatic operation, replacement of the mechanical stopper is necessary.

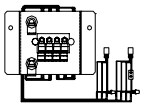
(3) Solenoid valve set

■ Order type

Four sets: 1S-VD04M-04(Sink type)/1S-VD04ME-04(Source type): RH-6SQH series
Four sets: 1S-VD04M-03(Sink type)/1S-VD04ME-03(Source type): RH-12SQH/18SQH/20SQH series
Four sets: 1S-VD04-05(Sink type)/1S-VD04E-05(Source type): RH-3SQHR series (Standard/Clean specification)
Four sets: 1S-VD04W-05(Sink type)/1S-VD04WE-05(Source type): RH-3SQHR series (Waterproof specification)

■ Outline


1S-VD04M-03/04
1S-VD04ME-03/04


1S-VD04-05
1S-VD04E-05


1S-VD04W-05
1S-VD04WE-05

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.
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 (1S-VD04M-04 and 1S-VD04ME-04 only), among other things.
When using the robot arm's hand output signal, the pneumatic hand interface option*1) must be installed on the separate controller.

■ Configuration

Table 2-31 : Configuration equipment

Part name	Type	Q'ty	Mass(kg) Note1)	Remark
RH-6SQH series				
Solenoid valve set (4 sets)	1S-VD04M-04/ 1S-VD04ME-04	Either one pc.	1.0	M4 x 8 Four screws (Installation screws) Hand output junction cable attachment
RH-12SQH/18SQH/20SQH series				
Solenoid valve set (4 sets)	1S-VD04M-03/ 1S-VD04ME-03	Either one pc.	1.8	M4 x 8 Four screws (Installation screws) Hand output junction cable attachment
RH-3SQHR series				
Solenoid valve set (4 sets)	1S-VD04-05/ 1S-VD04E-05	Either one pc.	0.6	For standard/clean specification M5 x 8 Two screws (Installation screws) Fixing nut for T slot : Two nuts 1S-VD04-05 (Sink type), 1S-VD04E-05(Source type)
Solenoid valve set (4 sets)	1S-VD04W-05/ 1S-VD04WE-05	Either one pc.	0.6	For waterproof specification M5 x 8 Two screws (Installation screws) Fixing nut for T slot : Two nuts Cable clamp (for hand output cable fixing) is attached. 1S-VD04W-05 (Sink type), 1S-VD04WE-05(Source type)

Note1) Mass indicates one set.

*1) Use "2A-RZ365" for sink type and use "2A-RZ375" for source type.

■ Specifications

Table 2-32 : Valve specifications

Item	Specifications
Number of positions	2
Port	5 Note1)
Valve function	Double solenoid
Operating fluid	Clean air Note2)
Operating method	Internal pilot method
Effective sectional area (CV value)	0.64mm
Oiling	Unnecessary
Operating pressure range	0.1 ～ 0.7MPa
Response time	22msec or less (at 0.5 MPa)
Max. operating frequency	5Hz
Ambient temperature	−10 to 50 ℃ (However, there must be no condensation.)

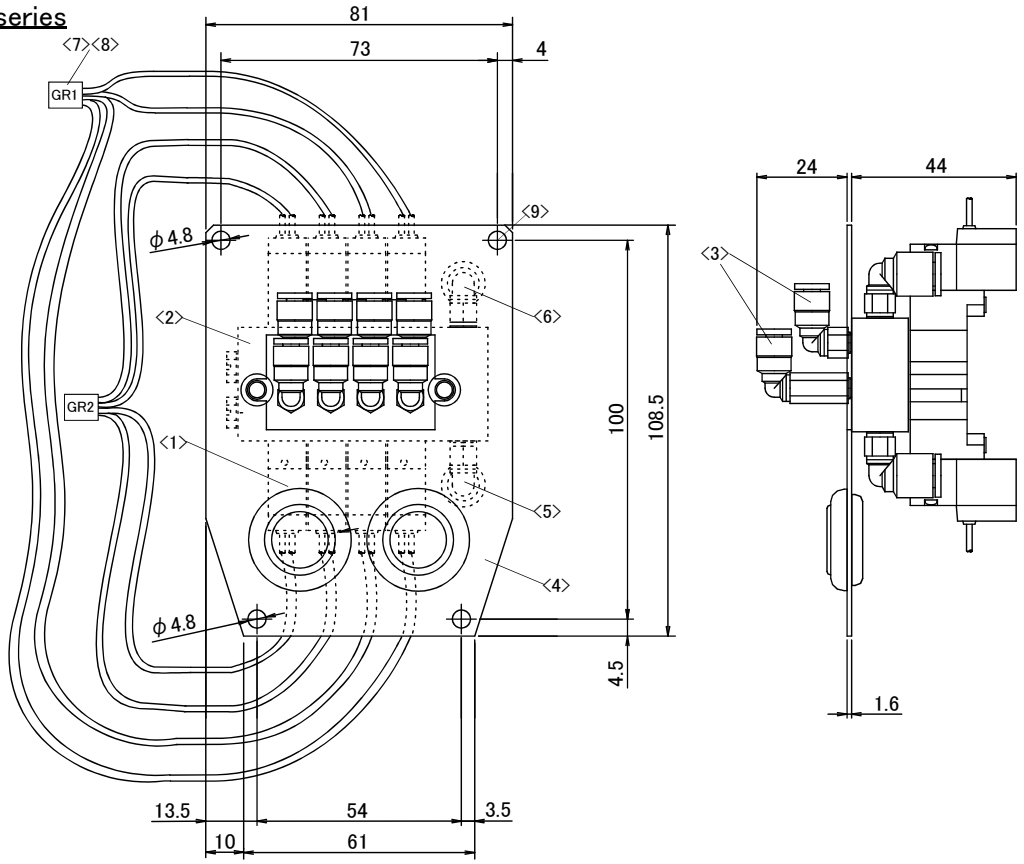
Note1) Couplings of unused solenoid valves must be blocked with plugs. If they are not blocked, supplied air will blow out from the couplings, lowering the air pressure of the solenoid valves being used and making them nonfunctional
(recommended plugs: KQ2P-04 plugs made by SMC).

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

Table 2-33 : Solenoid specifications

Item	Specifications
Coil rated voltage	DC24V ±10%
Power consumption	0.55W
Voltage protection circuit with power surge protection	Diode

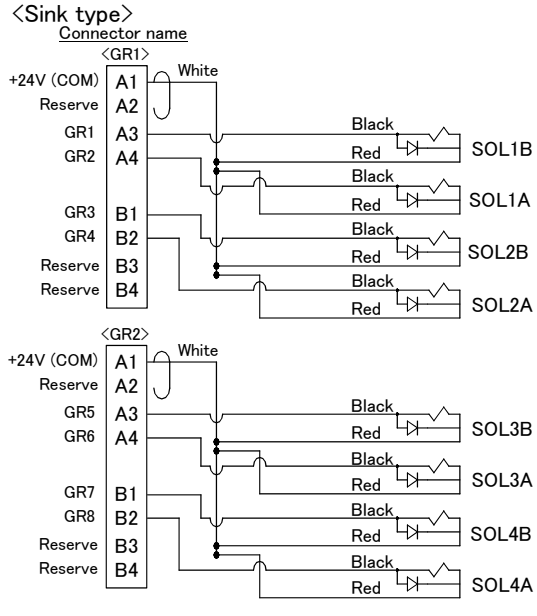
RH-6SQH series



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

Note) The optional hand output cable (1S-GR35S-02) is unnecessary.

<Sink type>



<Source type>

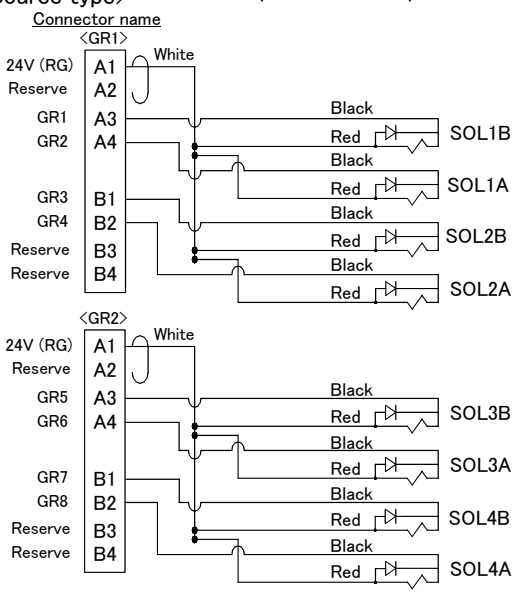


Fig.2-68 : Outline dimensional drawing (RH-6SQH series)

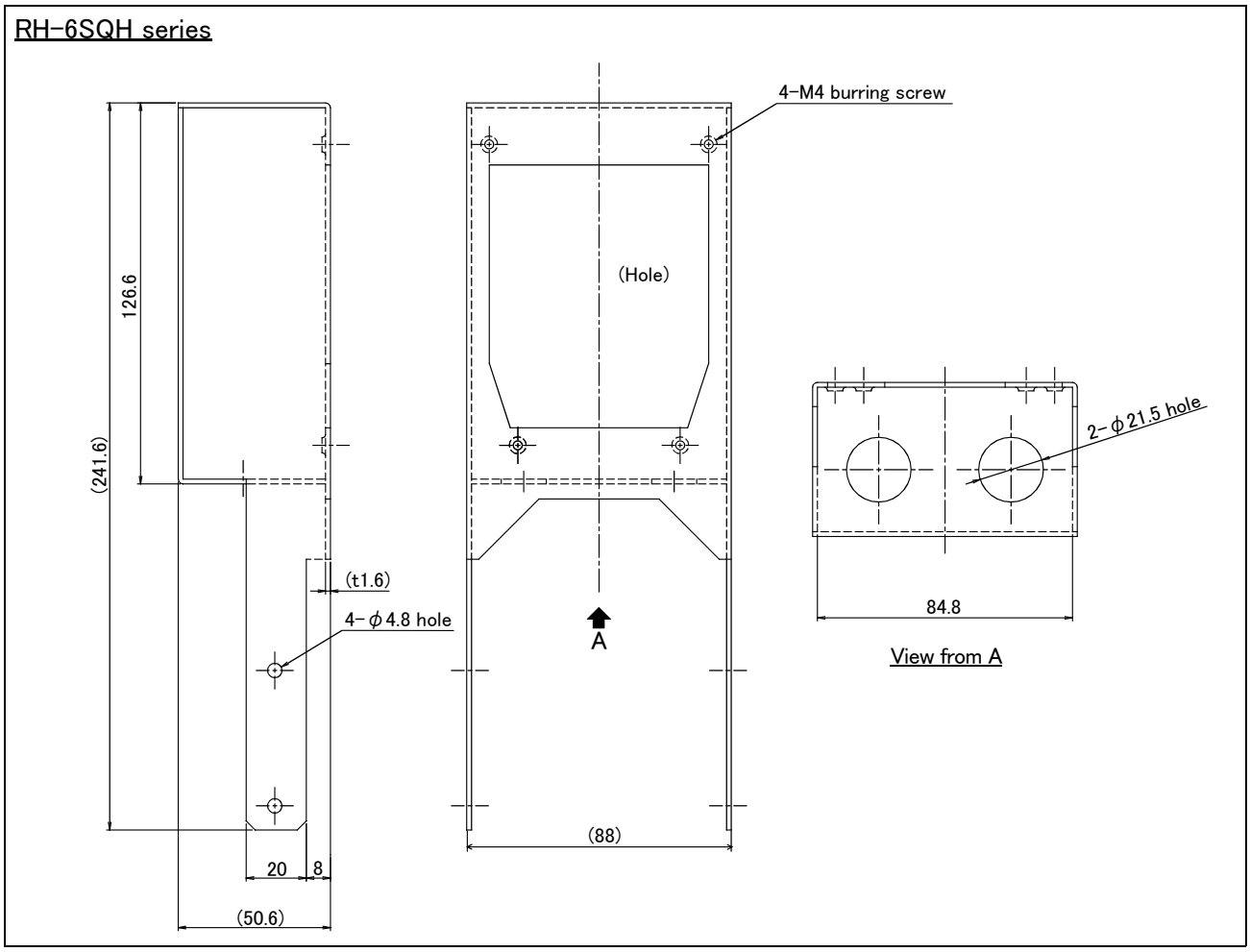


Fig.2-69 : Outside dimensions of solenoid valve box (RH-6SQH series)

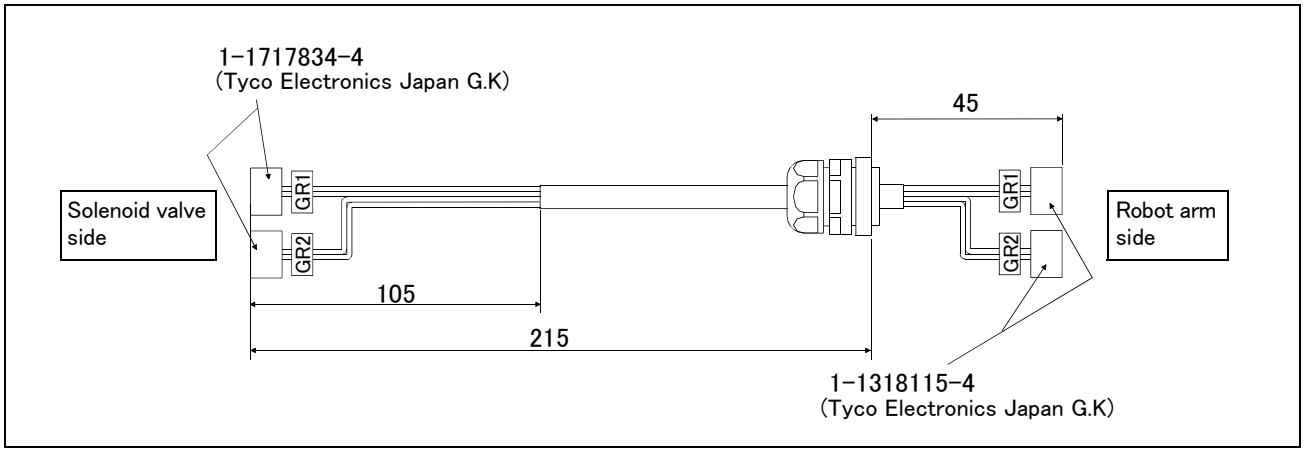
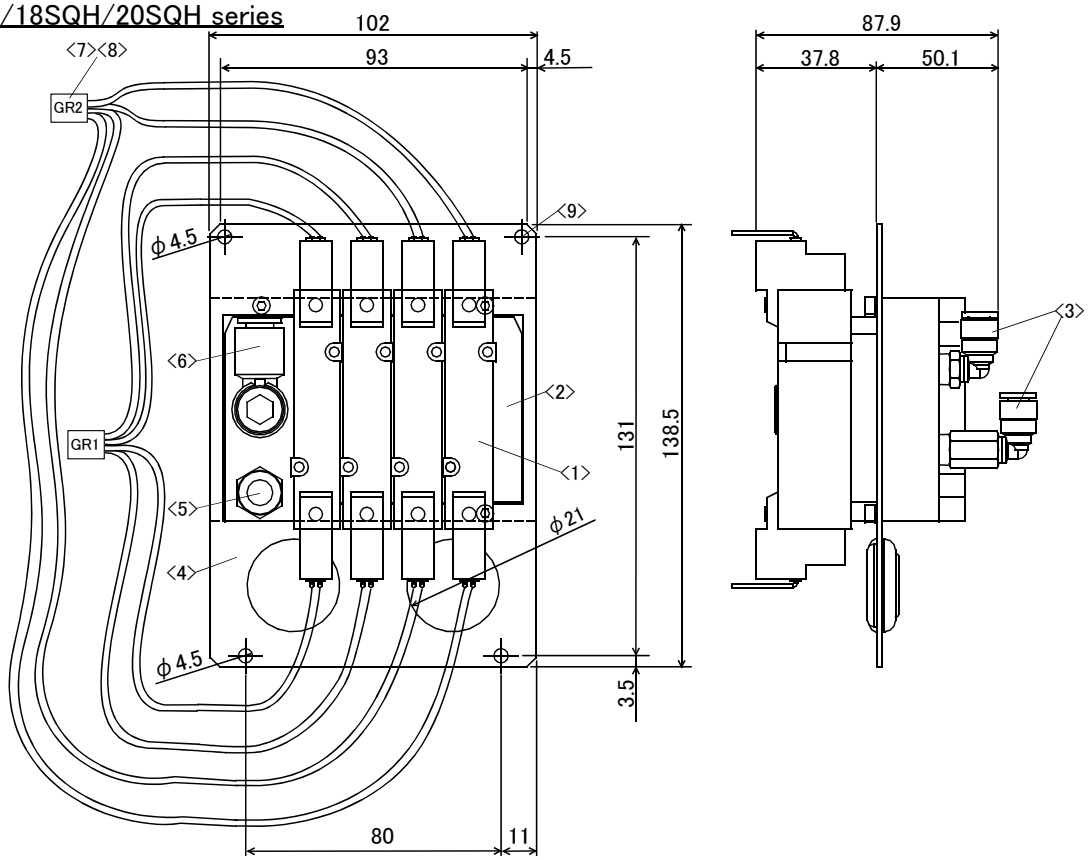


Fig.2-70 : Outside dimensions of hand output junction cable (RH-6SQH series)

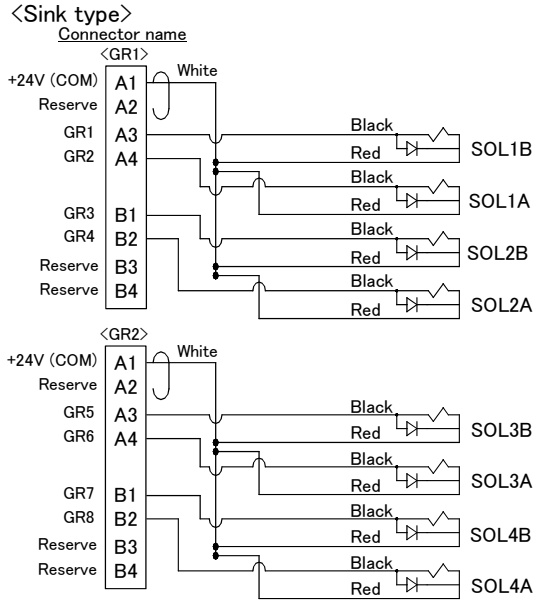
RH-12SQH/18SQH/20SQH series



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

Note) The optional hand output cable (1S-GR35S-02) is unnecessary.

<Sink type>



<Source type>

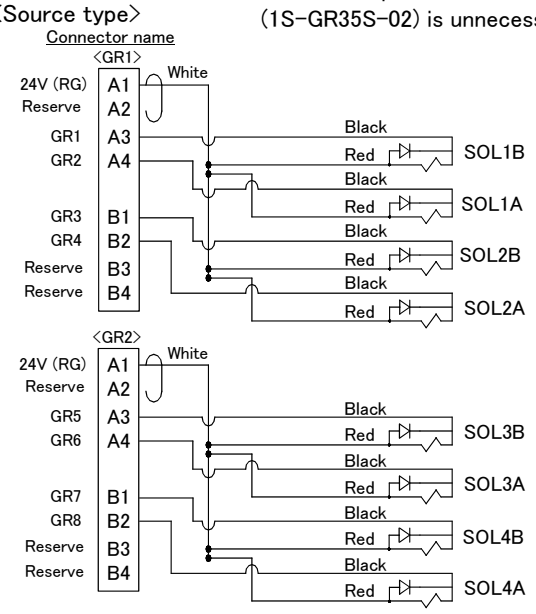


Fig.2-71 : Outline dimensional drawing (RH-12SQH/RH-18SQH/RH-20SQH series)

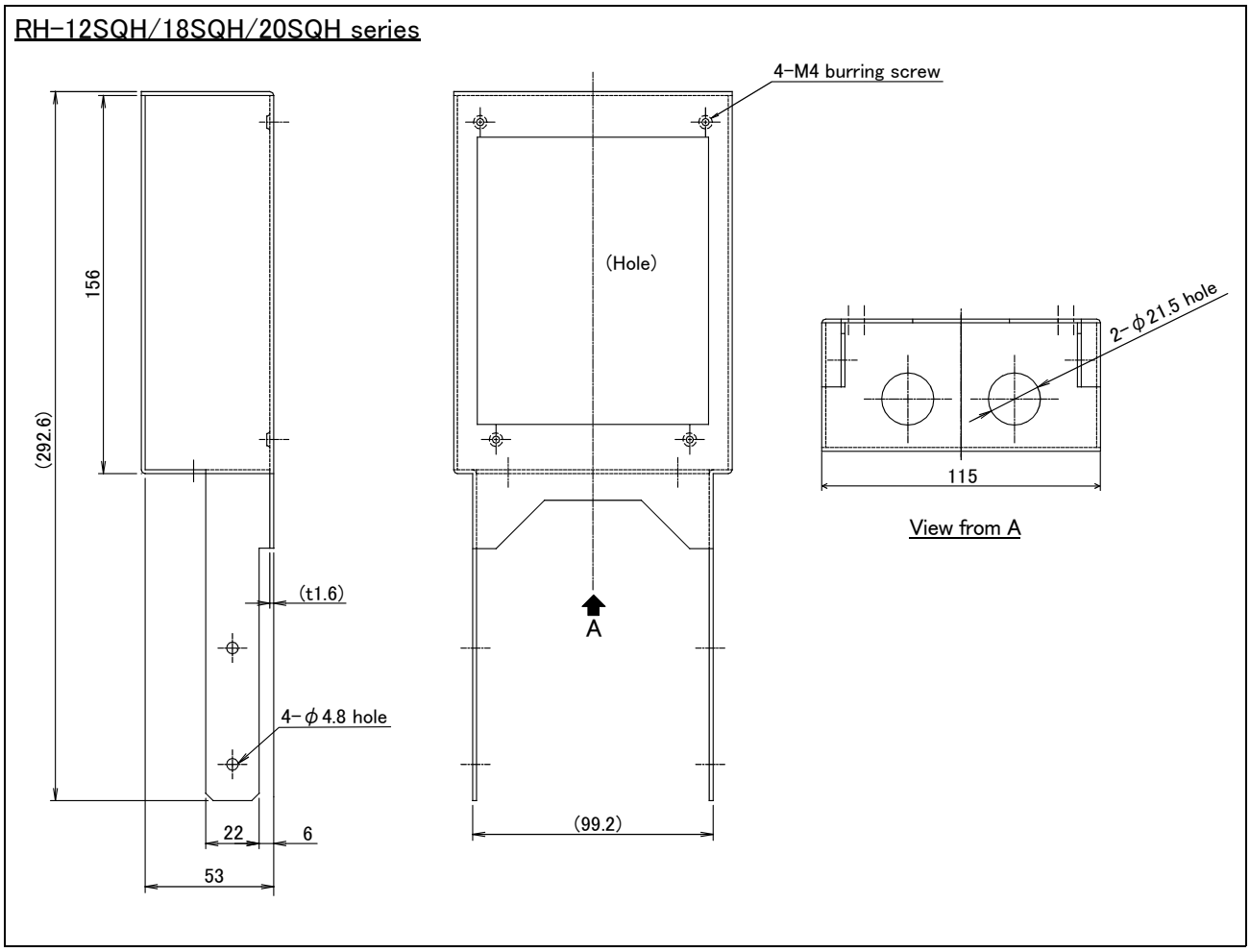


Fig.2-72 : Outside dimensions of solenoid valve box (RH-12SQH/18SQH/20SQH series)

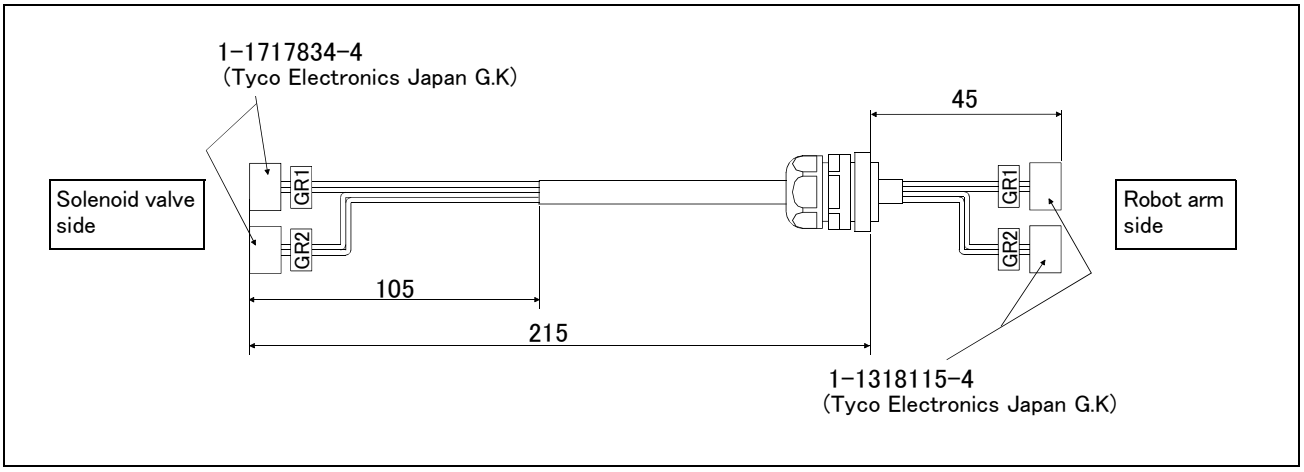
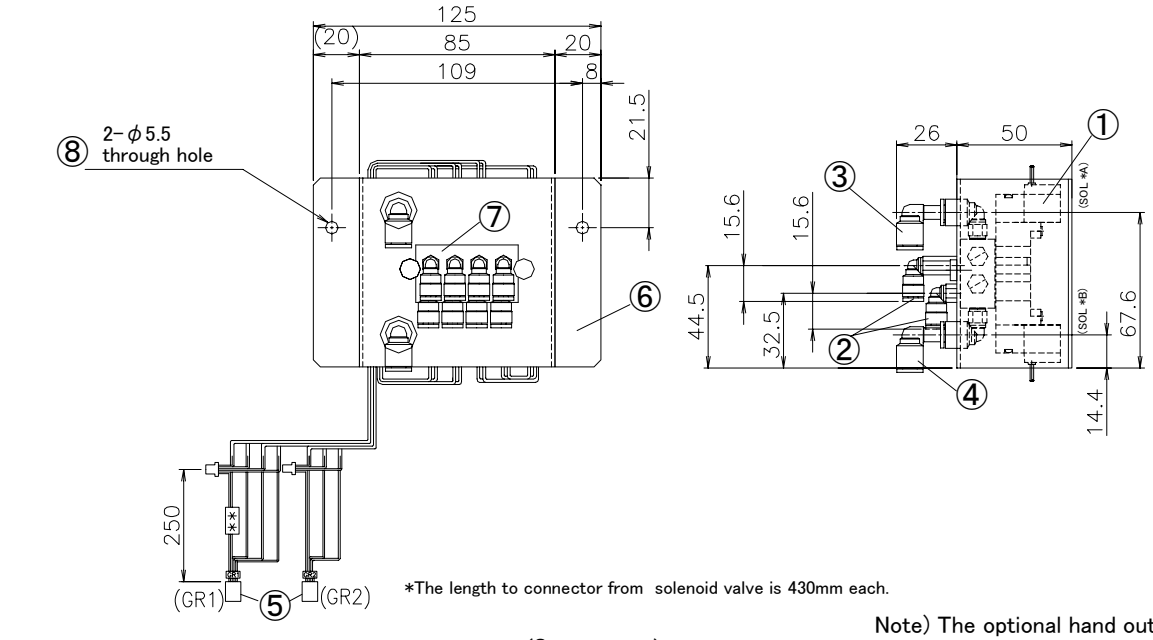
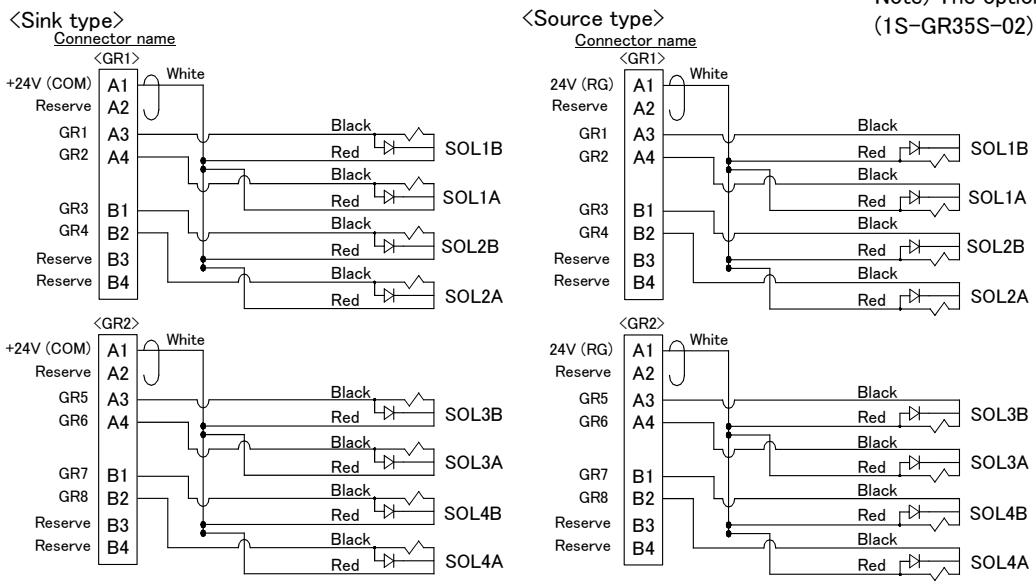


Fig.2-73 : Outside dimensions of hand output junction cable (RH-12SQH/18SQH/20SQH series)

RH-3SQHR3515/3512C (Standard/Clean specification)



Note) The optional hand output cable (1S-GR35S-02) is unnecessary.

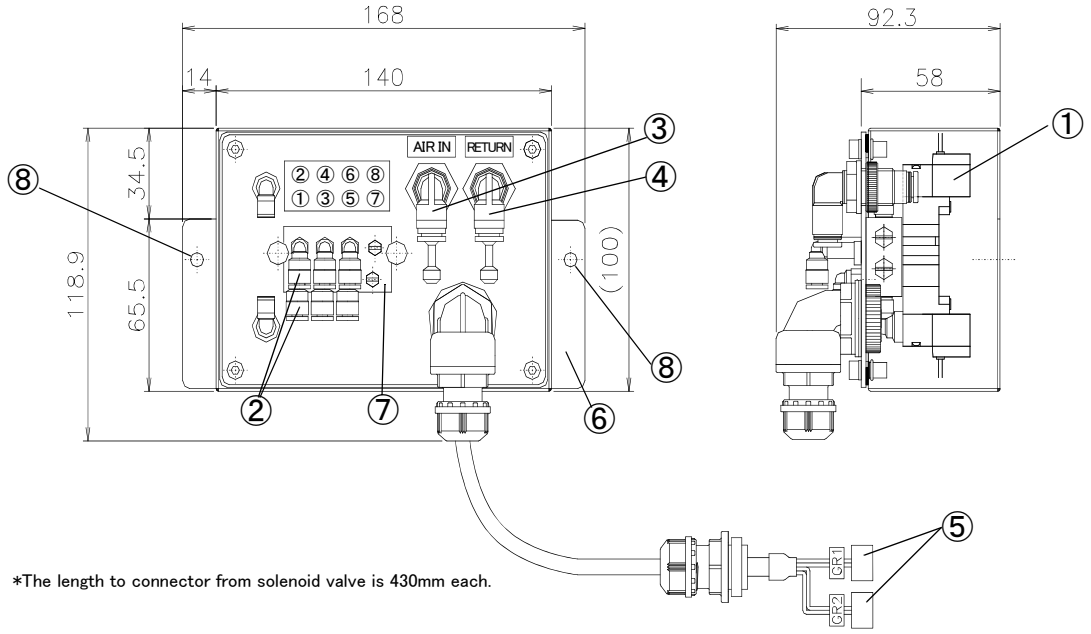


Part no.	Part name	Qty.	Specifications
①	Solenoid valve	4	
②	Quick coupling	8	φ4 (Elbow)
③	Quick coupling	1	φ6 (Elbow)
④	Quick coupling	1	φ6 (Elbow)
⑤	Connector	2	1-1318115-4
	Contact	1 2	1318112-1
⑥	Solenoid valve cover	1	
⑦	Manifold block	1	
⑧	Installation screw	2	Fixing screw M5x8, spring washer, plain washer (attachments)

Fig.2-74 : Outline dimensional drawing (RH-3SQHR series: Standard/Clean specification)

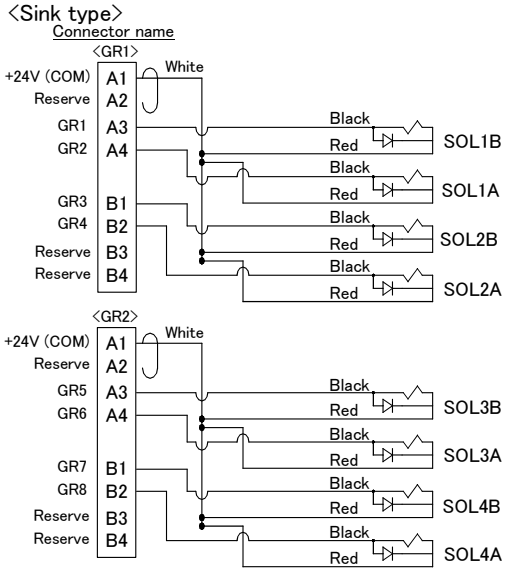
RH-3SQHR3512W (Waterproof specification)

Note) The optional hand output cable (1S-GR35S-02) is unnecessary.

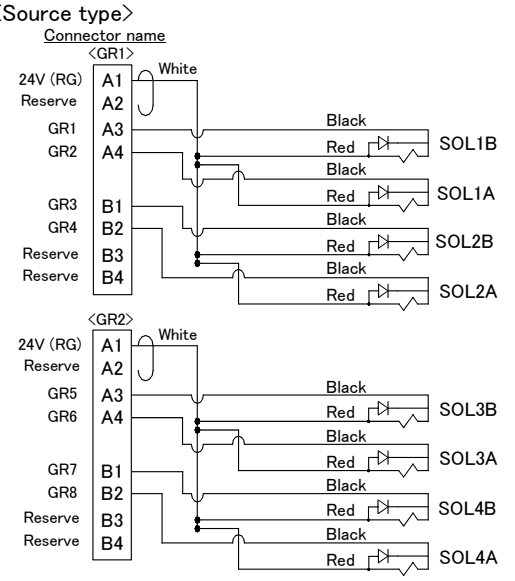


*The length to connector from solenoid valve is 430mm each.

<Sink type>



<Source type>



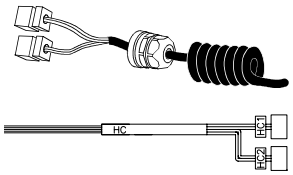
Part no.	Part name	Qty.	Specifications
①	Solenoid valve	4	
②	Quick coupling	8	φ4 (Elbow)
③	Quick coupling	1	φ6 (Elbow)
④	Quick coupling	1	φ6 (Elbow)
⑤	Connector	2	1-1318115-4
	Contact	1 2	1318112-1
⑥	Solenoid valve cover	1	
⑦	Manifold block	1	
⑧	Installation screw	2	Fixing screw M5x8, spring washer, plain washer (attachments)

Fig.2-75 : Outline dimensional drawing (RH-3SQHR series: Waterproof specification)

(4) Hand input cable

■ Order type: 1S-HC35C-02(RH-6SQH/12SQH/18SQH/20SQH85** series)
1S-HC35C-03(RH-20SQH100** series)
1S-HC00S-01(RH-3SQHR series)

■ Outline



The hand input cable is used for customer-designed pneumatic hands.
It is necessary to use this to receive the hand's open/close confirmation signals and grasping confirmation signals, at the controller.
One end of the cable connects to the connector for hand input signals, which is in the wrist section of the hand. The other end of the cable connects to the sensor inside the hand customer designed.

■ Configuration

Table 2-34 : Configuration equipment

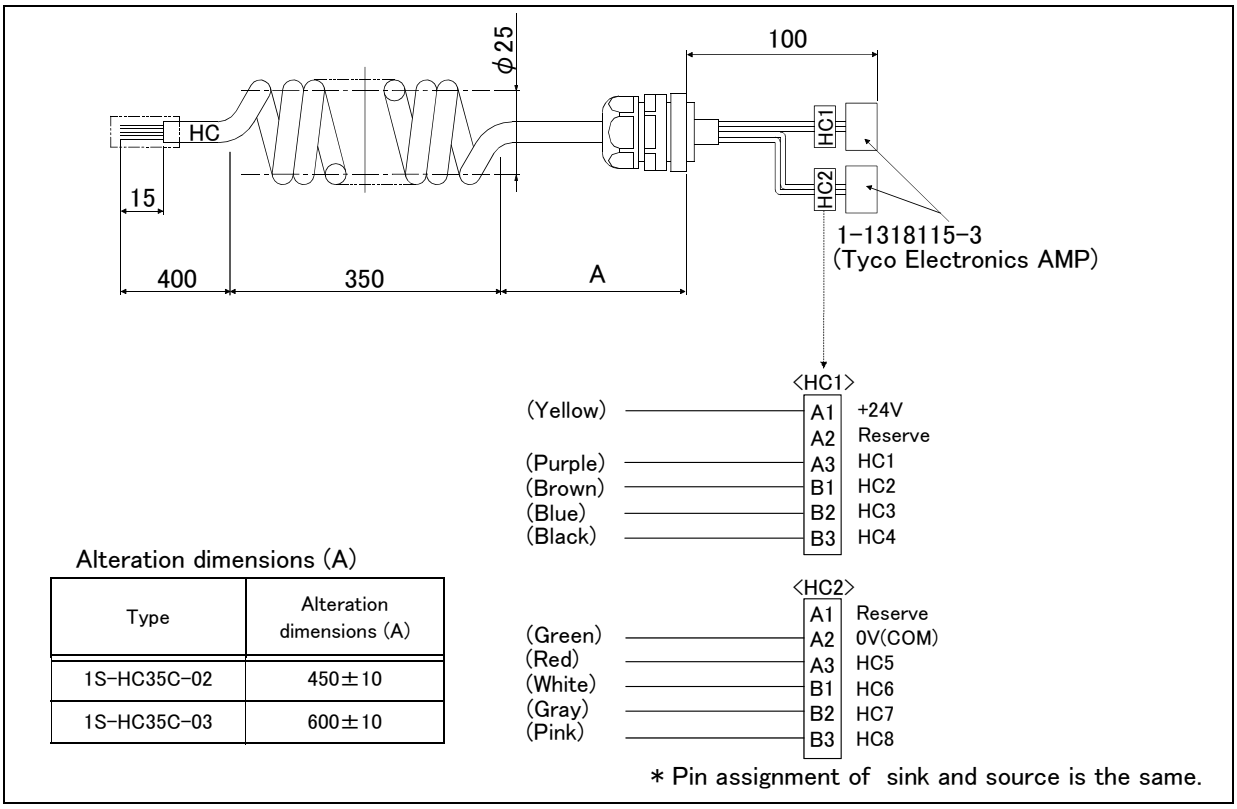
Part name	Type	Qty.	Mass(kg)[Note1)]	Remarks
Hand input cable	1S-HC35C-02	1 cable	0.2	RH-6SQH/12SQH/18SQH/20SQH85** series
	1S-HC35C-03	1 cable	0.2	RH-20SQH100** series
	1S-HC00S-01	1 cable	0.1	RH-3SQHR series Three rubber sheets, seven cable clamp attachment

Note1) Mass indicates one set.

■ Specifications

Table 2-35 : Specifications

Item		Specifications	Remarks
RH-6SQH/12SQH/18SQH/20SQH85** series			
	Size x cable core	AWG#24 (0.2mm^2) × 12	One-sided connector, one-sided cable bridging
	Total length	1300mm (Including the curl section, which is 350mm long)	
RH-20SQH100** series			
	Size x cable core	AWG#24 (0.2mm^2) × 12	One-sided connector, one-sided cable bridging
	Total length	1450mm (Including the curl section, which is 350mm long)	
RH-3SQHR series			
	Size x cable core	AWG#24 (0.2mm^2) × 6	One-sided connector, one-sided cable bridging
	Total length	1210mm (Including the curl section, which is 350mm long)	



Alteration dimensions (A)

Type	Alteration dimensions (A)
1S-HC35C-02	450±10
1S-HC35C-03	600±10

Fig.2-76 : Outside dimensional drawing and pin assignment (RH-6SQH/12SQH/18SQH/20SQH series)

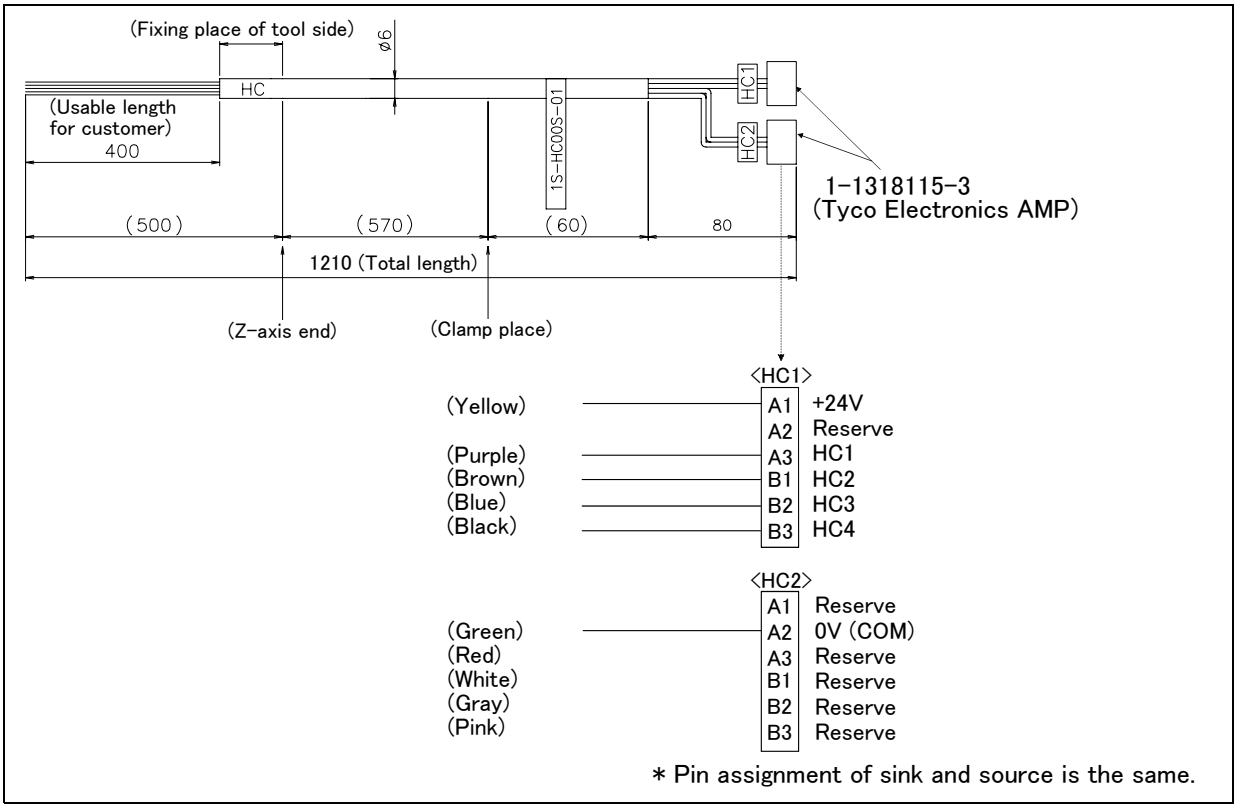


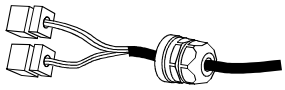
Fig.2-77 : Outside dimensional drawing and pin assignment (RH-3SQHR series)

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

(5) Hand output cable

■ Order type: 1S-GR35S-02 (RH-6SQH/12SQH/18SQH/20SQH series, RH-3SQHR series)

■ 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 2-36 : Configuration equipment

Part name	Type	Qty.	Mass(kg)[Note1]	Remarks
Hand output cable	1S-GR35S-02	1 cable	0.2	RH-6SQH/12SQH/18SQH/20SQH series, RH-3SQHR series

Note1) Mass indicates one set.

■ Specifications

Table 2-37 : 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	450mm	

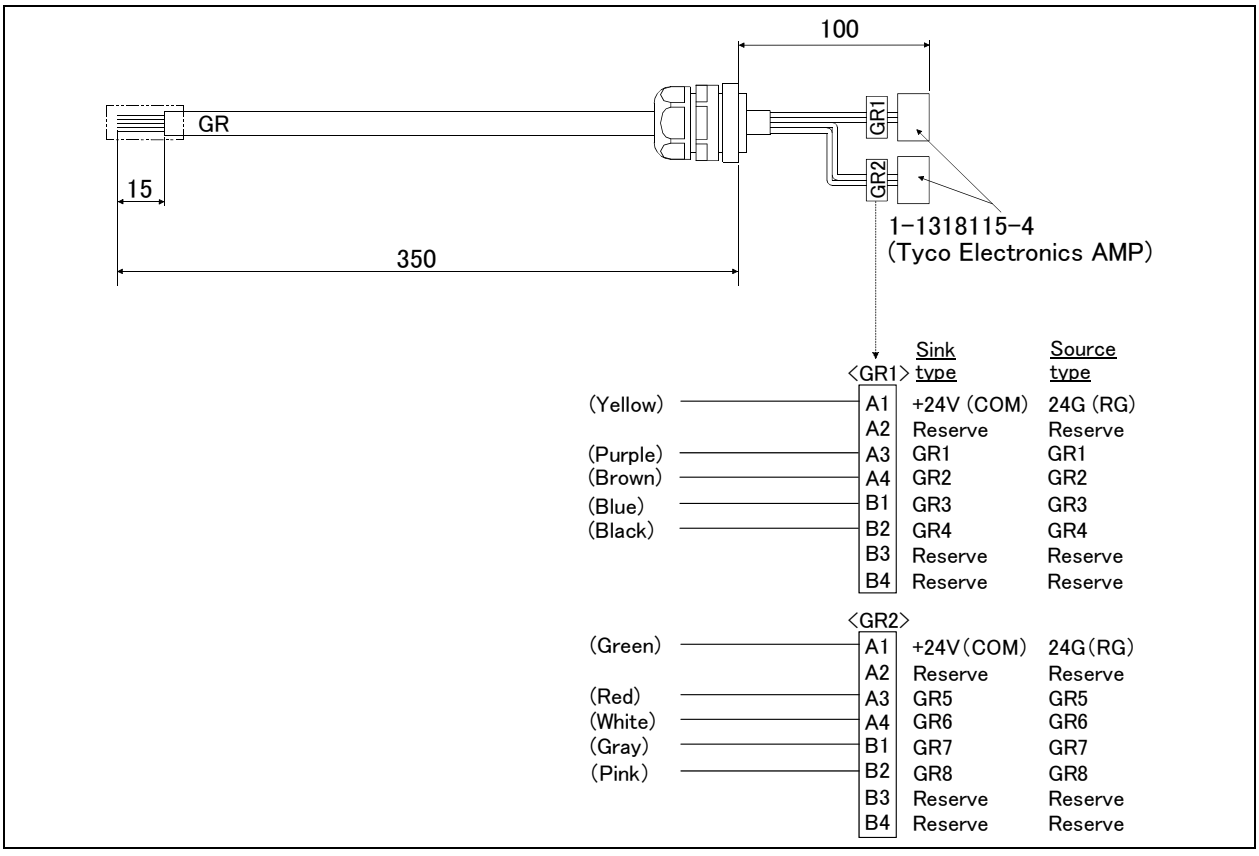


Fig.2-78 : Outline dimensional drawing and pin assignment

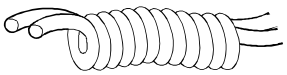
[Cautions] When you install this optional one in the protection specification type, please seal the fixing section of the robot with silicon rubber by the customer.

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

(6) Hand curl tube

■ Order type: RH-6SQH series.....1E-ST0408C-300
RH-12SQH/18SQH/20SQH85** series 1N-ST0608C
RH-20SQH100** series.....1N-ST0608C-01

■ Outline



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

■ Configuration

Table 2-38 : Configuration equipment

Part name	Type	Qty.	Mass(kg)[Note1]	Remarks
RH-6SQH series				
Hand curl tube (Four set: 8 pcs.)	1E-ST0408C-300	1 pc.	0.1	Φ4 tube, 8pcs
RH-12SQH/18SQH/20SQH85** series				
Hand curl tube (Four set: 8 pcs.)	1N-ST0608C	1 pc.	0.4	Φ6 tube, 8pcs
RH-20SQH100** series				
Hand curl tube (Four set: 8 pcs.)	1N-ST0608C-01	1 pc.	0.4	Φ6 tube, 8pcs

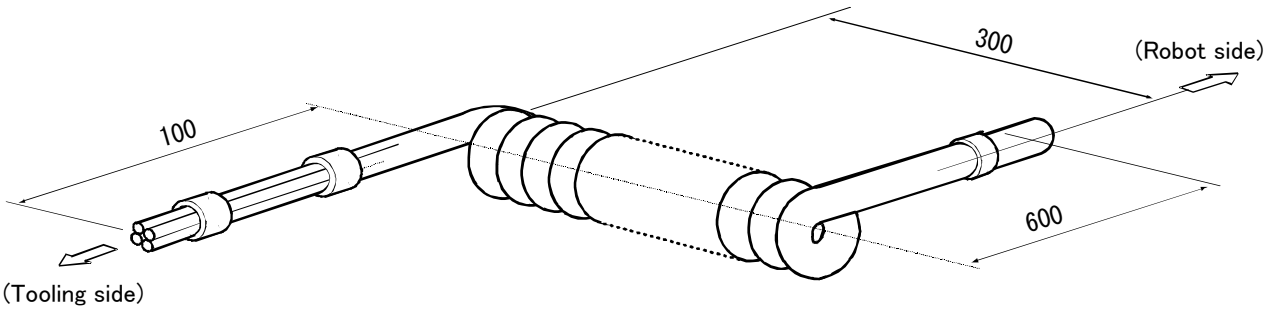
Note1) Mass indicates one set.

■ Specifications

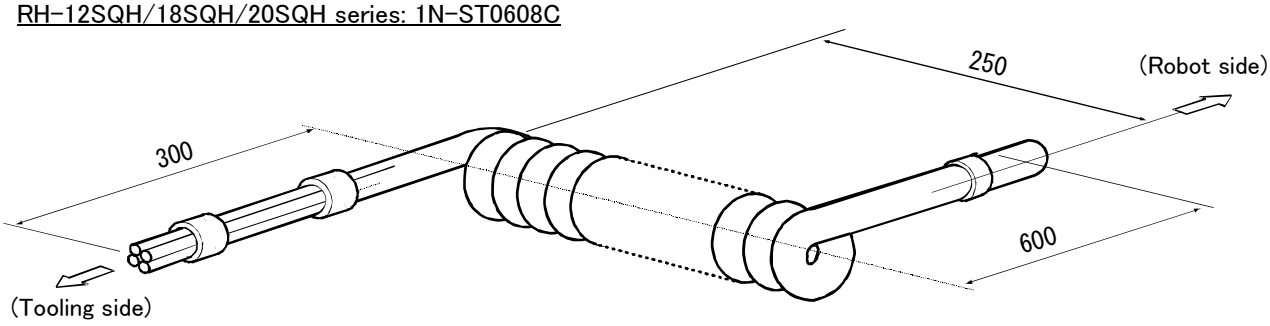
Table 2-39 : Specifications

Item	Specifications	
	RH-6SQH series	RH-12SQH/18SQH/20SQH series
Material	Urethane	Urethane
Size	Outside diameter: Φ4 x Inside diameterΦ2.5	Outside diameter: Φ6 x Inside diameterΦ4

RH-6SQH series: 1E-ST0408C-300



RH-12SQH/18SQH/20SQH series: 1N-ST0608C



RH-20SQH series: 1N-ST0608C-01

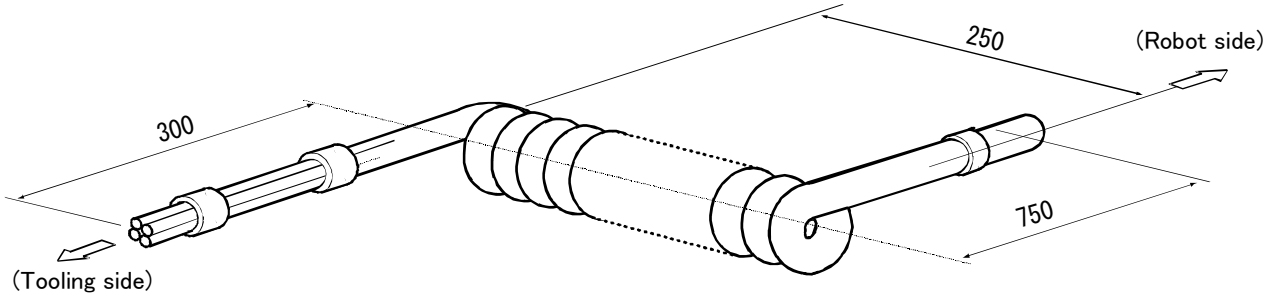


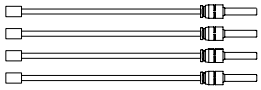
Fig.2-79 : Outline dimensional drawing

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

(7) Hand tube

■ Order type: RH-3SQHR series..... 1E-ST0304S

■ Outline



The hand tube is a tube for the pneumatic hand.

■ Configuration

Table 2-40 : Configuration equipment

Part name	Type	Qty.	Mass(kg)[Note1]	Remarks
RH-3SQHR series				
Hand tube (4 pcs.)	1E-ST0408C-300	1 pc.	0.1	Union (φ4 to φ3) : Eight piece attachment (Four of them is installing at shipping) Three rubber sheets, six cable clamp attachment

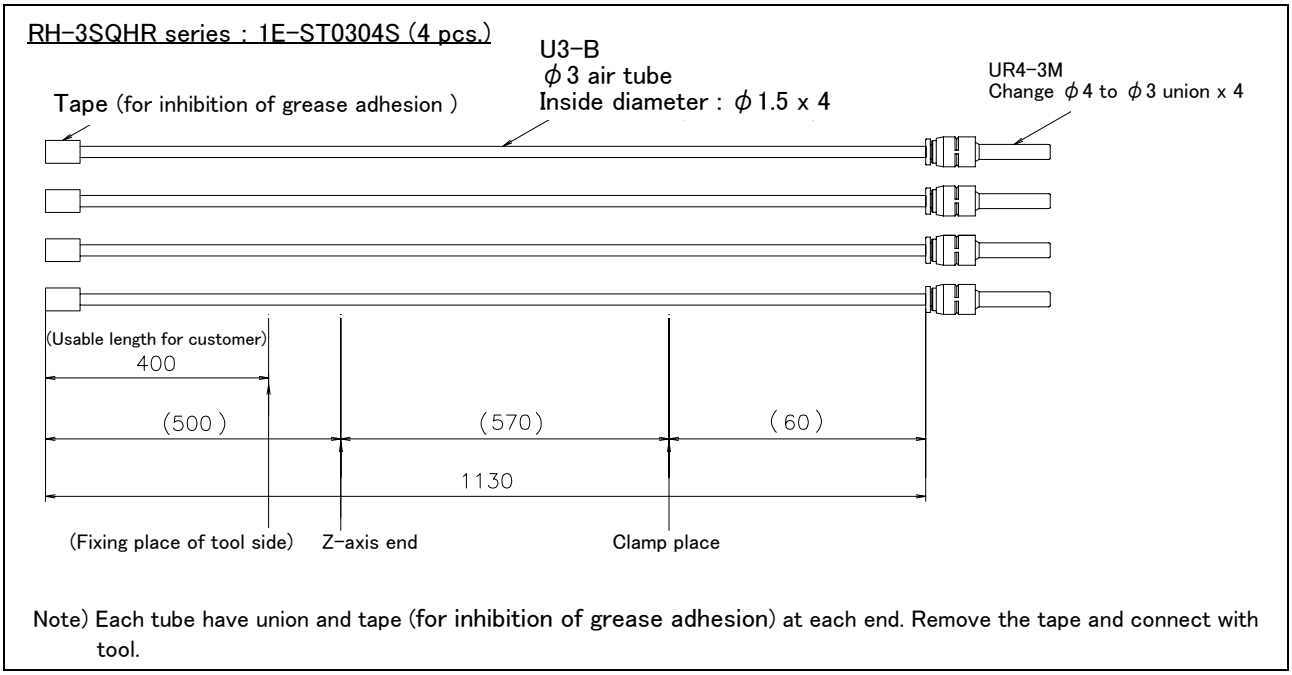
Note1) Mass indicates one set.

■ Specifications

Table 2-41 : Specifications

Item	Specifications	
Material	Urethane	One side is with the tape.
Size	Outside diameter: Φ3 x Inside diameter Φ1.5: 4 pcs.	

* We recommend confirming of the wear and tear and the rub in the cycle of the six months and please prepare as service parts.



Note) Each tube have union and tape (for inhibition of grease adhesion) at each end. Remove the tape and connect with tool.

Fig.2-80 : Outline dimensional drawing

2.8 About Overhaul

Robots which have been in operation for an extended period of time can suffer from wear and other forms of deterioration. In regard to such robots, we define overhaul as an operation to replace parts running out of specified service life or other parts which have been damaged, so that the robots may be put back in shape for continued use. Overhaul interval for robots presumably varies with their operating conditions and thus with the degree of the equipment's wear and loss of performance. As a rule of thumb, however, it is recommended that overhaul be carried out before the total amount of servo-on time reaches the predetermined levels (24,000 hours for the robot body and 36,000 hours for the controller). (See Fig. 2-81.) For specific information about parts to be replaced and timing of overhaul, contact your local service representative.

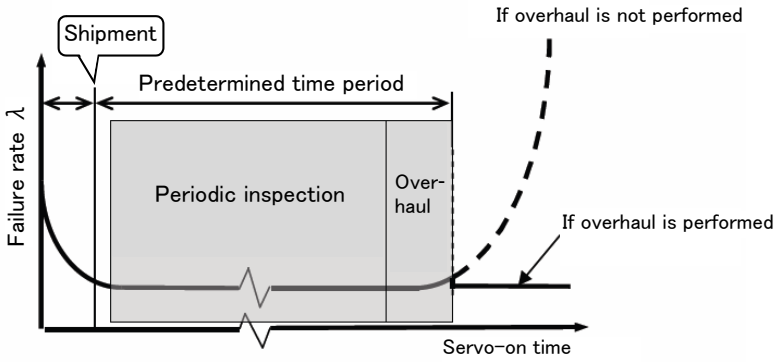


Fig.2-81 : Periodic inspection/overhaul periods

2.9 Maintenance parts

The consumable parts used in the robot arm are shown in Table 2-42. 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 2-42 : 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
2		Marutenpu PS No.2	Shaft	As needed	
3	Lithium battery	A6BAT	Rear section of the base	5	
RH-6SQH series					
4	Timing belt		J3 axis	1	Mitsubishi Electric
5			J4 axis motor side	1	
6			J4 axis shaft side	1	
RH-12SQH/18SQH series					
7	Timing belt		J3 axis	1	Mitsubishi Electric
8			J4 axis motor side	1	
9			J4 axis shaft side	1	
RH-20SQH series					
10	Timing belt		J3 axis	1	Mitsubishi Electric
11			J4 axis motor side	1	
12			J4 axis shaft side	1	

No.	Part name	Type Note1)	Usage place	Qty.	Supplier
RH-3SQHR series					
13	Timing belt		J1 axis	1	Mitsubishi Electric
14			J2 axis	1	
15			J3 axis	1	
16			J4 axis motor side	1	
17			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.

Table 2-43 : Consumable part (packing) list

No.	part name	Details of configuration		Usage place		
		Packing name	Qty.	Cover name	Qty.	Sticking side
RH-6SQH standard specification						
1	PackingC Part Cord : K07S16433901	PackingC	1	J1 cover	1	Robot arm side
				No.2 arm cover U	2	Cover side
2	Solenoid valve box packing Part Cord : K07S24334001	Solenoid valve box packing	1	Solenoid valve box	1	Cover side
RH-6SQH clean or oil mist specification						
3	PackingA Part Cord : K07S24409801	PackingA	1	J1 cover	1	Robot arm side
				No.2 arm cover U	2	Cover side
				Bottom plate	1	Cover side
				CON plate G	1	Robot arm side
				No.2 arm cover L	1	Cover side
4	No.2 arm cover U packing Part Cord : K07S24329601	No.2 arm cover U packing	1	No.2 arm cover U (CBL bracket F)	1	Cover side
5	No.2 arm cover U packing B Part Cord : K07S24336601	No.2 arm cover U packing B	1	No.2 arm cover U (CON plate F)	1	Cover side
6	Base packing top Part Cord : K07S24336501	Base packing top	1	CONBOX cover	1	Robot arm side
7	Base packing bottom Part Cord : K07S24333951	Base packing bottom A	1		1	Robot arm side
		Base packing bottom B	1		1	Robot arm side
8	Battery bracket packing Part Cord : K07S24412401	Battery bracket packing	1	Battery cover	1	Cover side
9	PackingB Part Cord : K07S24417001	PackingB	1	Base cover	1	Robot arm side
10	Solenoid valve box packing Part Cord : K07S24334001	Solenoid valve box packing	1	Solenoid valve box	1	Cover side
RH-12SQH /18SQH/20SQH standard specification						
11	PackingC Part Cord : K07S16433901	PackingC	1	J1 cover	1	Robot arm side
				No.2 arm cover U	3	Cover side
12	Solenoid valve box packing Part Cord : K07S24333501	Solenoid valve box packing	1	Solenoid valve box	1	Cover side
RH-12SQH /18SQH/20SQH clean or oil mist specification						
13	PackingA Part Cord : K07S24409801	PackingA	1	J1 cover	1	Robot arm side
				No.2 arm cover U	2	Cover side
				Bottom plate	2	Cover side
				CON plate G	1	Robot arm side
				No.2 arm cover L	2	Cover side
14	No.2 arm cover U packing Part Cord : K07S24329701	No.2 arm cover U packing	1	No.2 arm cover U (CBL bracket F)	1	Cover side
15	No.2 arm cover U packing B Part Cord : K07S24336701	No.2 arm cover U packing B	1	No.2 arm cover U (CON plate F)	1	Cover side
16	Base packing top Part Cord : K07S24333101	Base packing top	1	CONBOX cover	1	Robot arm side
17	Base packing bottom Part Cord : K07S24333251	Base packing bottom A	1		1	Robot arm side
		Base packing bottom A	1		1	Robot arm side
18	Battery bracket packing Part Cord : K07S24412401	Battery bracket packing	1	Battery cover	1	Cover side
19	PackingB Part Cord : K07S24417001	PackingB	1	Base cover	1	Robot arm side
20	Solenoid valve box packing Part Cord : K07S24333501	Solenoid valve box packing	1	Solenoid valve box	1	Cover side

3 Controller

3.1 Standard specifications

3.1.1 Standard specifications

Table 3-1 : Standard specifications of controller

Item		Unit	Specification	Remarks
Type			CR1QA-700 series, CR2QA-700 series or CR3Q-700M series	Note1) RH-6SQH series: CR1QA-761/CR2QA-761 RH-12SQH series: CR2QA-741 RH-18SQH/20SQH series: CR2QA-751 RH-3SQHR series: CR2QA-781 RH-12SQH-SM series: CR3Q-741 RH-18SQH/20SQH-SM series: CR3Q-751
Number of control axis			Simultaneously 4(Maximum)	
CPU			６４ bit ＲＩＳＣ／ＤＳＰ	
Memory capacity	Programmed positions and No. of steps	point step	１３，０００ ２６，０００	
	Number of programs		２５６	
Robot language			ＭＥＬＦＡ－ＢＡＳＩＣⅤ or ＭＥＬＦＡ－ＢＡＳＩＣⅣ Note2)	
Teaching method			Pose teaching method, MDI method Note3)	
External input and output	input and output	point	Input 0 point/Output 0 point	Multi-CPU share device Input 8192/Output 8192 (Max.)
	Dedicated input/output		Assign to the multi-CPU share device.	
	Special stop input	point	1	
	Hand open/close input/output	point	Input 8 point/Output 0 point	Up to 8 output points can be added as an option Note4)
	Emergency stop input	point	1	Dual line, normal close
	Door switch input	point	1	Dual line, normal close
	Enabling device input	point	1	Dual line, normal close
	Mode output	point	1	Dual line
	Robot error output	point	1	Dual line
	Addition axis synchronization	point	1	Dual line
Interface	RS-422	port	1	Only for the teaching pendant
	Ethernet	port	1 : Only for the teaching pendant	100BASE-TX
	Hand dedicated slot	slot	1	Dedicated for pneumatic hand interface
	Additional axis interface	Channel	1	SSCNET Ⅲ

Note1) The RH-6SQH controller of CE Marking specification
*"-S12" specification: the controller is CR1QA-700 series.
*"-S312" specification: the controller is CR2QA-700 series.
Note2)The program of MELFA-BASIC Ⅳ can be used by MELFA-BASIC V, if program is converted by RT ToolBox2 (option).
Note3)Pose teaching method: The method to register the current position of the robot arm.
MDI method: The method to register by inputting the numerical value Immediate.
Note4)It is when an pneumatic hand interface (2A-RZ365/2A-RZ375) is installed.

Table 3-2 : Standard specifications of drive unit

Item		Unit	Specification			Remarks
Type[Note1]			DU1A-761	DU2A-761 DU2A-741 DU2A-751	DU3-741M DU3-751M	RH-6SQH series: DU1A-761, DU2A-761 RH-12SQH series: DU2A-741 RH-18SQH/20SQH series: DU2A-751 RH-12SQH-SM series: DU3-741M RH-18SQH/20SQH-SM series: DU3-751M:
External input and output	input and output	point	0／0			Multi-CPU share device Input 8192/Output 8192 (Max.)
	Dedicated input/output		Assign to the multi-CPU share device.			
	Special stop input	point	1			
	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 line, normal close
	Door switch input	point	1			Dual line, normal close
	Enabling device input	point	1			Dual line, normal close
	Mode output	point	1			Dual line
	Robot error output	point	1			Dual line
	Addition axis synchronization	point	1			Dual line
Interface	ＲＳ－４２２	port	1			Only for the teaching pendant
	Ethernet	port	1 : Only for the teaching pendant			100BASE-TX
	Hand dedicated slot	slot	1			icated for pneumatic hand interface
Power source	Input voltage range	V	1-phase AC180 ～ 253		3-phase AC180 ～ 253	[Note3]
	Power capacity	kVA	１．０	２．０	３．０	Does not include rush current[Note4] [Note5]
	Power supply frequency	Hz	５０／６０			
Outline dimensions		mm	Standard specification: 240(W) x 290(D) x 200(H) CE marking specification: 270(W) x 290(D) x 200(H)	468(W) x 400(D) x 200(H)	450(W) x 440(D) x 625(H)[Note6]	Does not include rush current
Mass		kg	Approx. ９	Approx. ２０	Approx. ６０	
Construction			Opened type (IP20)[Note7]		Self-contained floor type, Closed type(IP54)[Note8]	
Operating temperature range		℃	０～４０			
Ambient humidity		%RH	４５～８５			Without dew drops
Grounding		Ω	１００ or less			D class grounding earth[Note9]
Paint color			Light gray			Munsell 0.08GY7.64/0.81

Note1) The RH-6SQH controller of CE Marking specification
*"-S12" specification: the drive unit is DU1A-761 series.
*"-S312" specification: the drive unit is DU2A-761 series.

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

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

Note4)The power capacity is the rating value for normal operation. The power capacity does not include the rush current when the power is turned ON. The power capacity is a guideline and the actual operation is affected by the input power voltage. Operate by the current leakage under the commercial frequency domain (50-60Hz). If sensitive to the high frequency ingredient, it will become the cause in which below the maximum leak current value carries out the trip.

Note5)If the earth leakage breaker is installed in the primary side power supply circuit of the controller, please select the earth leakage breaker of the specification of the amperage rating 20A and 10mA of sensed current.
(The leak current of the drive unit is set to about 7.5mA)

Note6)Becomes 615(H) at the caster specification.

Note7)DU1A-761/DU2A-700 series drive unit are a general environment specification. (Refer to Page 121, "3.1.2 Protection specifications and operating supply") For use in an oil-mist environment or in an environment with excess dust, use the protection specification controller instead.
DU1A-700 series: Please order the controller protection box (CR1D-MB). (Standard specification only.)
DU2A-700 series: Please order the protection specification drive unit (DU3-7xxM).

Note8)The DU3-7xxM drive unit 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. And, has the protection structure which fitted IP54. (Refer to Page 121, "3.1.2 Protection specifications and operating supply")

Note9) The robot must be grounded by the customer.

Table 3-3 : Robot CPU unit standard specification

Item		Unit	Specification	Remarks
Type			Q172DRCPU	
Interface	Addition axis synchronization	port	1	
Power source	Power capacity (DC5V)	A	1．25	
Outline dimensions		mm	27．4 (W) x 98 (D) x 119．3 (H)	
Mass		kg	0．33	
Operating temperature range		℃	0～55	
Ambient humidity		%RH	5～95	Without dew drops

3.1.2 Protection specifications and operating supply

The standard drive unit has used the protection method which fitted IP20 (open type) of the IEC standard.
Oil mist environment also prepares the drive unit (IP54 of the IEC standard (encapsulated type)) of the protection specification which can be used.

The IEC IP symbols refer only to the degree of protection between the solid and the fluids, and don't indicated that any special protection has been constructed for the prevention against oil and water.

【Information】

・The IEC IP20

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

・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 193, "6.2 Working environment" for details on the working environment.

⚠CAUTION

If the robot is used in an oil mist environment, use the optional controller protection box (CR1D-MB) to protect the controller from the oil mist environment(DU1A-700 drive unit only).

3.2 Names of each part

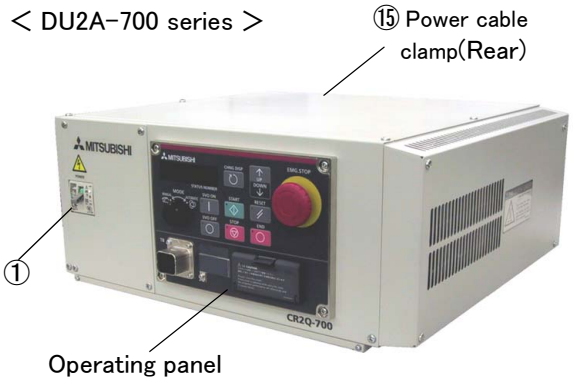
3.2.1 Names of each part of the drive unit

＜ DU1A-700 series ＞

＊ The figure is standard specification.
The CE marking specification is the same.

＜ DU3-700M ＞

＜ DU2A-700 series ＞



＜ Operating panel ＞

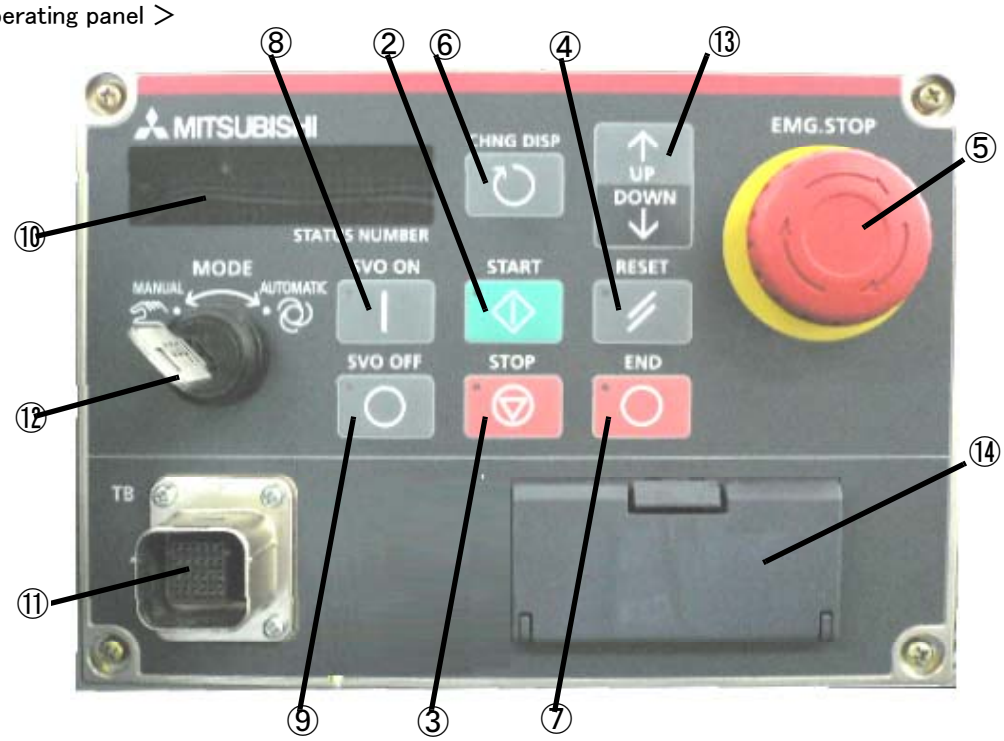


Fig.3-1 : Names of drive unit parts

① POWER switch..... This turns the control power ON/OFF. (With earth leakage breaker function) ＊1)
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 CHNGDISP button..... This changes the details displayed on the display panel in the order of "Override" → "Program No." → "Line No.".
⑦ END button..... This stops the program being executed at the last line or END statement.
⑧ SVO.ON button..... This turns ON the servo power. (The servo turns ON.)
⑨ SVO.OFF button..... This turns OFF the servo power. (The servo turns OFF.)
⑩ STATUS NUMBER
(display panel)..... The alarm No., program No., override value (%), etc., are displayed.
⑪ T/B connection connector ..... This is a dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.
⑫ MODE key switch..... This changes the robot's operation mode.
AUTOMATIC.....operations from the controller or external equipment are valid. Operations for which the operation mode must be at the external device or T/B are not possible. It is necessary to set the parameter for the rights of operation to connection between the operation panel and external equipment. For details, please refer to "INSTRUCTION MANUAL/Detailed explanations of functions and operations" of the separate volume.
MANUAL.....When the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device or controller are not possible.
⑬ UP/DOWN button..... This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.
⑭ Interface cover .....Unused in this drive unit. Please use closing this cover, because of to prevent deterioration of protection performance.
⑮ Terminal cover (CR1QA-700 series)
.....The terminal which connects the primary power cable.
Cable lead-in port (CR2Q-700 series)
.....Draw in the primary power cable.
Power cable clamp(CR3Q-700 series)
.....Fix the primary power cable.
⑯ Filter (intake vent).....The intake vent of the recirculating air for internal cooling.

*1)The power switch of DU1A-700/DU2A-700/DU3-700 series can be locked by installing the padlock etc. Please prepare the padlock by the customer. Padlock specification is shown in Page 124, "(1) Padlock specification"

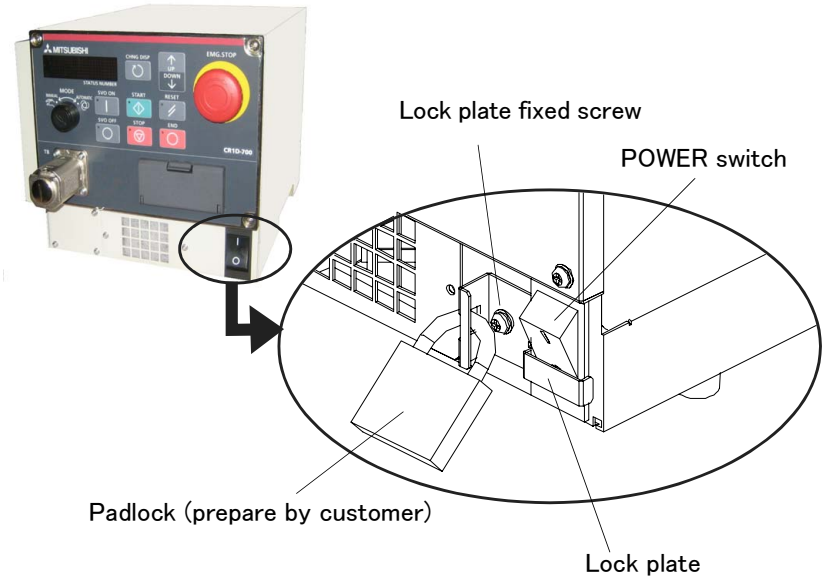
[Note] The RS232 connection connector is not prepared by this controller. If you use it, please prepare sequencer CPU or the unit corresponding to the sequencer

(1) Padlock specification

If the robot is not used, the power switch can be locked with the padlock so that power supply ON cannot be done easily. The specification is shown in the following.

＜ DU1A-700 ＞

CE marking specification



<The operation method>

(1) The lock method (power supply OFF)

1) Turn OFF the power switch.
2) Loosen the lock plate fixing screw and make it slide upwards (cover the power switch). Tighten the fixing screw certainly in that position.
3) Install the padlock (customer preparation) to the hole of the lock plate, and lock it.

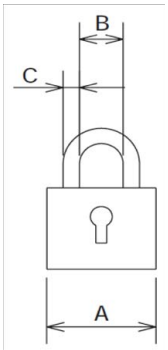
The lock is completion

(2) The release method (power supply ON)

1) Remove the padlock.
2) Loosen the lock plate fixing screw and make it slide downward (position which does not cover the power switch). Tighten the fixing screw certainly in that position.

Lock release is completion.

The lock device which can be used

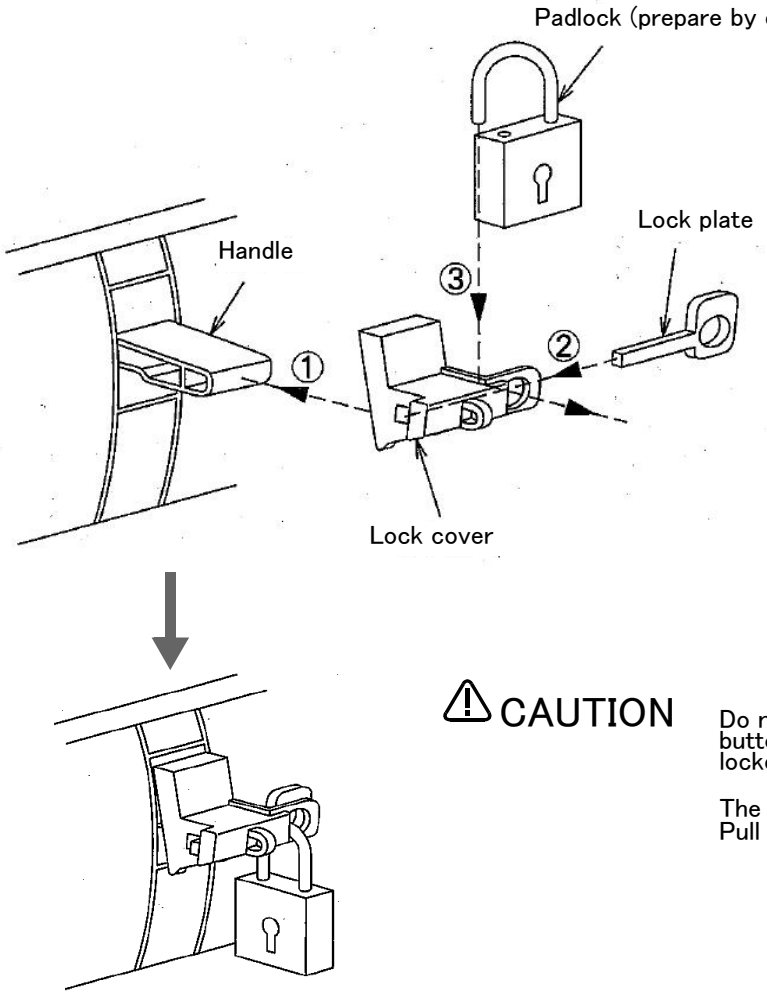


Dimension of the padlock

Dimension (mm)		
A	B	C
25	14	4mm or less

Fig.3-2 : Operation lock of the power switch

＜ DU2A-700 ＞

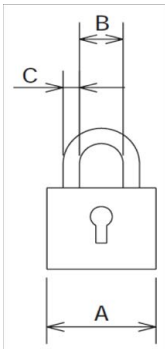


⚠CAUTION

Do not operate the trip test by the trip button in the state of the power switch locked at OFF position.

The Lock plate is installed strongly.
Pull up strongly and remove.

The lock device which can be used

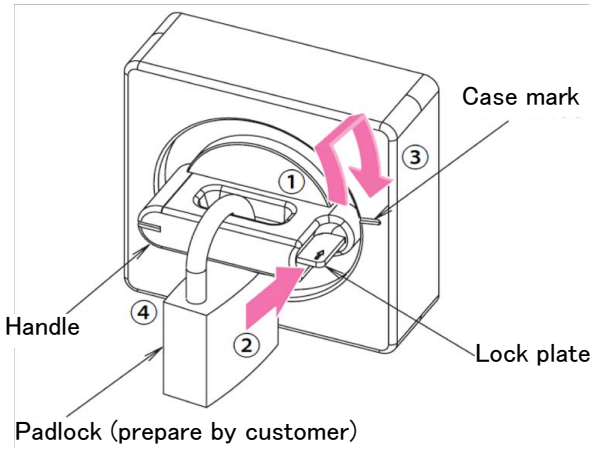


Dimension of the padlock

Dimension (mm)		
A	B	C
25	14	4mm or less

Fig.3-3 : operation lock of the power switch(DU2A-700)

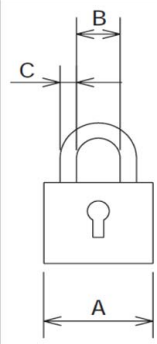
＜ DU3-700 ＞



Usage of lock function

① Turn the handle to the reset direction until the mark of the lock plate and the case mark is in match.
② Push in the lock plate.
③ Return the handle to the OFF position, with pushing the lock plate.
④ Lock the handle with the padlock.

The lock device which can be used



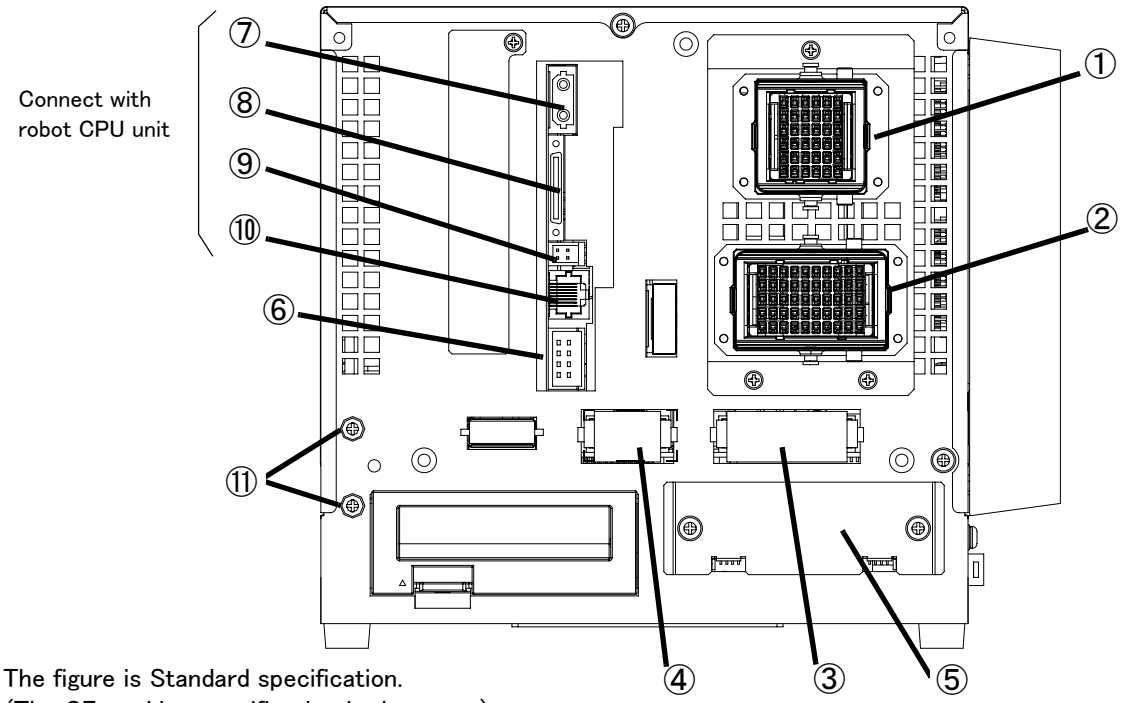
Dimension of the padlock

Dimension (mm)		
A	B	C
35(0.11)	19	5
40(0.13)	22 or 23	5.5

The maximum size of "C" which can be installed is 8mm.

Fig.3-4 : Operation lock of the power switch(DU3-700)

DU1A-700 series

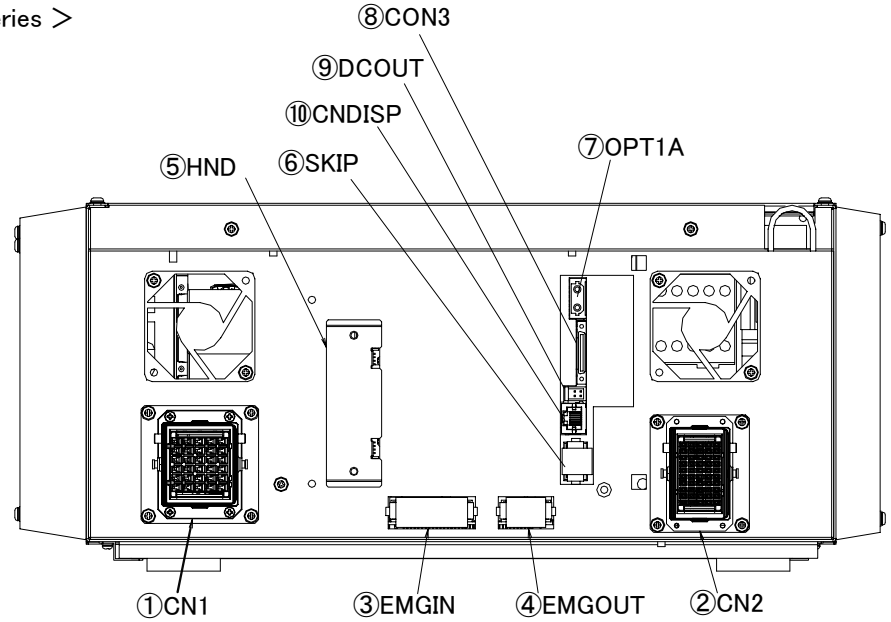


＊ The figure is Standard specification.
(The CE marking specification is the same.)

① Machine cable connector (motor power)(CN1) ..... Connects to the robot arm base. (CN1 connector)
② Machine cable connector (motor signal)(CN2) ..... Connects to the robot arm base. (CN2 connector)
③ Emergency stop input(EMGIN) ..... Connect the emergency stop switch to the robot.
④ Emergency stop output(EMGOUT) ..... The robot's error condition is outputted.
⑤ Hand slot(HND) ..... Install the pneumatic hand interface optional.
⑥ Special stop input(SKIP) ..... Stops the robot immediately.
⑦ OPT1A、⑧ CON3、⑨ DCOUT、⑩ CNDISP ..... Connecting with the robot CPU unit.
⑪ Grounding terminal (2 places) ..... The screw for grounding of the cable
(Peel the sheath of the cable, and fix with cable clamp attached.)

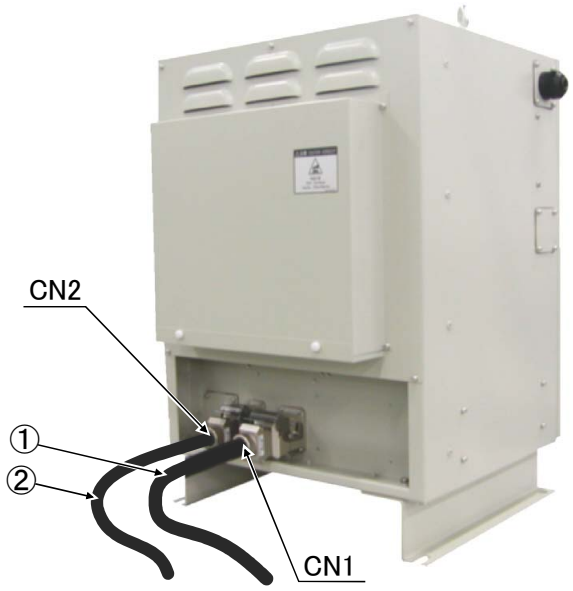
Fig.3-5 : Names of each part (Rear side DU1A-700 series)

＜ DU2A-700 series ＞



① Machine cable connector (motor power)(CN1) .....Connects to the robot arm base. (CN1 connector)
② Machine cable connector (motor signal)(CN2) .....Connects to the robot arm base. (CN2 connector)
③ Emergency stop input(EMGIN) .....Connect the emergency stop switch to the robot.
④ Emergency stop output(EMGOUT).....The robot's error condition is outputted.
⑤ Hand slot(HND)..... Install the pneumatic hand interface optional.
⑥ Special stop input(SKIP).....Stops the robot immediately.
⑦ OPT1A、⑧ CON3、⑨ DCOUT、⑩ CNDISP.....Connecting with the robot CPU unit.

Fig.3-6 : Names of each part (Rear side DU2A-700 series)

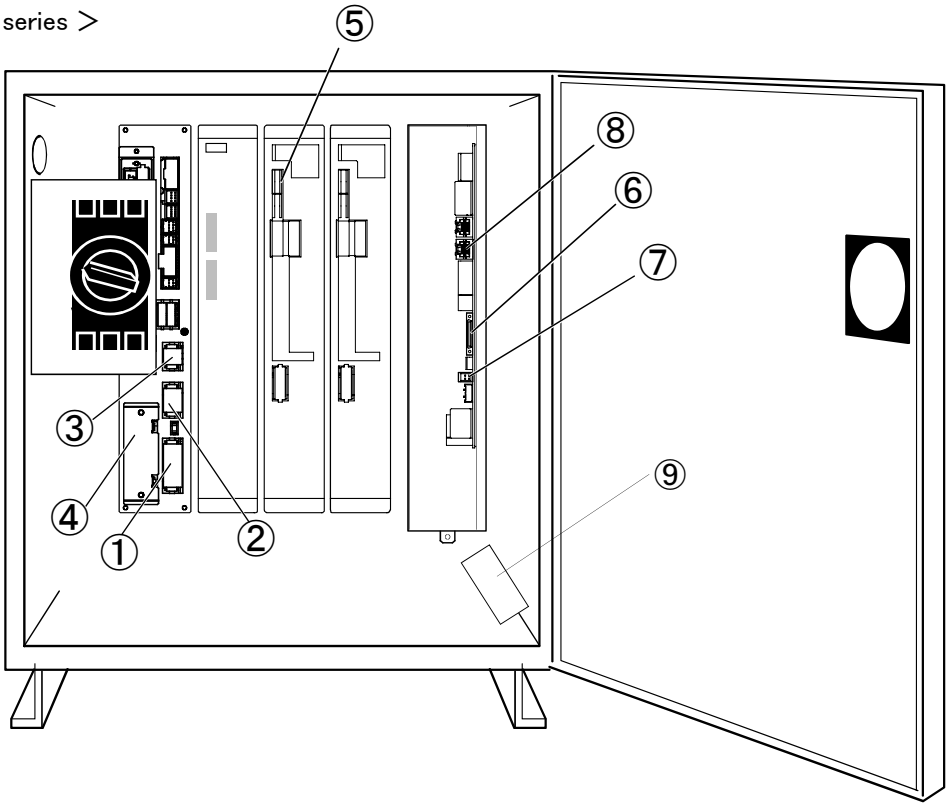


<figure is DU3-711M>

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

Fig.3-7 : Names of each part (Rear side DU3-700 series)

< DU3-700 series >



① Emergency stop input(EMGIN)..... Connect the emergency stop switch to the robot.
② Emergency stop output(EMGOUT)..... The robot's error condition is outputted.
③ Special stop input(SKIP)..... Stops the robot immediately.
④ Hand slot(HND)..... Install the pneumatic hand interface optional.
⑤ OPT1A、⑥ CON3、⑦ DCOUT、⑧ CNDISP ..... Connecting with the robot CPU unit.
⑨ Grounding plate..... The grounding terminal for grounding the cable.

Fig.3-8 : Names of each part (Rear side DU3-700 series)

3.2.2 Names of each part of the robot CPU

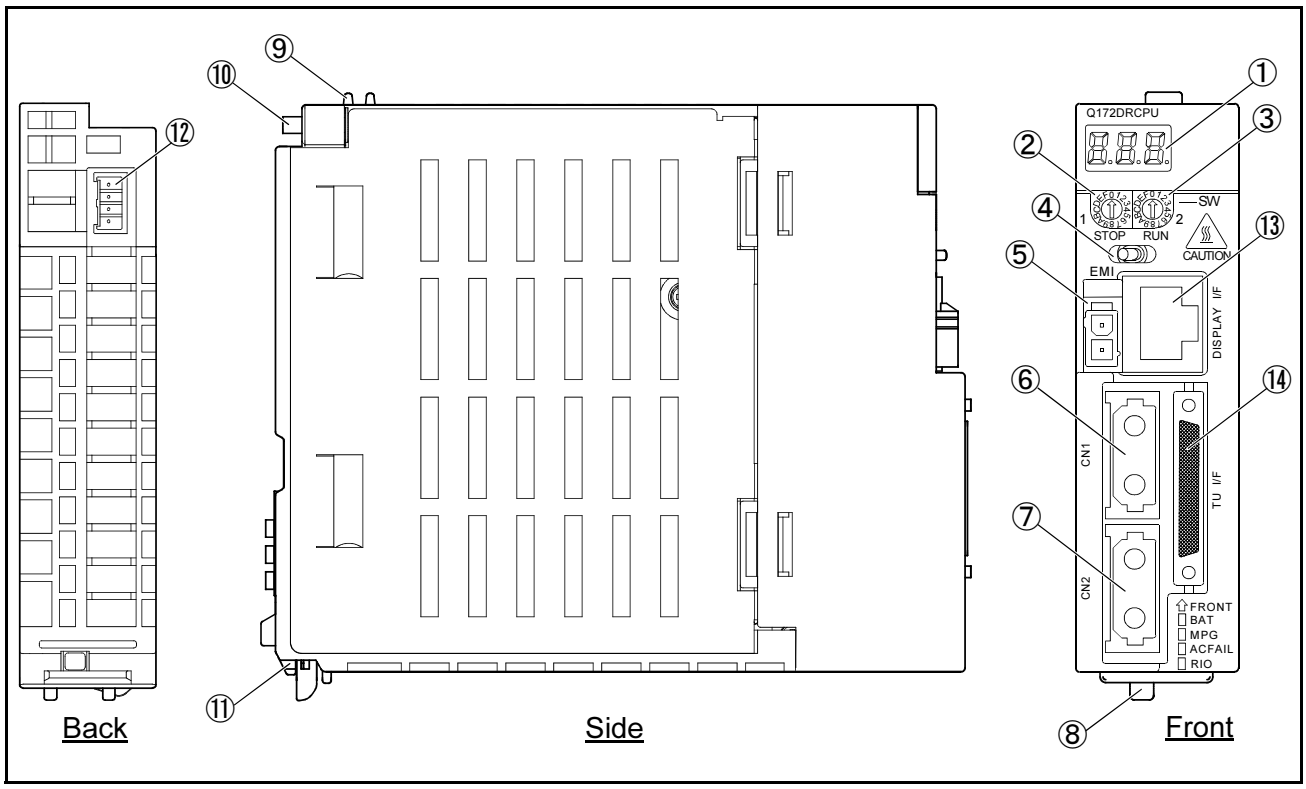


Fig.3-9 : Names of each part of the robot CPU

① Seven segments LED.....Indicates operational status and error information
② Rotary switch(SW1).....Set up operation mode. Always set it as "0."
③ Rotary switch(SW2).....Set up operation mode. Always set it as "0."
④ RUN/STOPswitch.....Unused
⑤ Emergency stop input(EMI)*1) ....The input connector which makes the servo amplifier of all the axes the emergency stop at once.
EMI ON (open) : Emergency stop
EMI OFF (Supply DC24V.) : Emergency stop release
⑥ CN1 connector*2) .....Connect to the drive unit
⑦ CN2 connector*2) .....Connect to the servo amplifier of the addition axis(Eight axes)
⑧ Lever for unit installation.....Use this lever, when installing the unit in the base unit.
⑨ Hook for unit fixing*3) .....The hook which fixes the unit to the base unit (For the support at installation)
⑩ Unit fixing screw.....The screw for fixing to the base unit (M3×13)
⑪ The projection for unit fixing .....The projection for fixing to the base unit
⑫ Battery connector(BAT)*4) .....The connector for connection with battery holder unit Q170DBATC
⑬ The connector for the networks (DISPLAY I/F)
The connector of the LAN access for T/B (For R56TB).
⑭ RS-422 connector(TU I/F).....The connector for RS-422 connection with the drive unit

*1) Please be sure to use the emergency stop input cable. The emergency stop cannot be canceled if it does not use. If it manufactures the emergency stop input cable in the customer, cable length should use 30m or less.
*2) Please store in the duct or fix the cable section near robot CPU with the bunch wire rod so that prudence of the cable is not applied to CN1 and CN2 connector section.
*3) It is equipment for the support when installing the unit in the basic base unit. Please be sure to fix the unit to the basic base unit with the attached fixing screw.
*4) Please be sure to use the external battery. Unless the battery cable is connected surely, the program in SRAM with a built-in robot CPU, the parameter, origin position data, etc. are not held.

3.3 Outside dimensions/Installation dimensions

3.3.1 Outside dimensions

(1) Drive unit outside dimension

<DU1A-700 series>
Standard specification

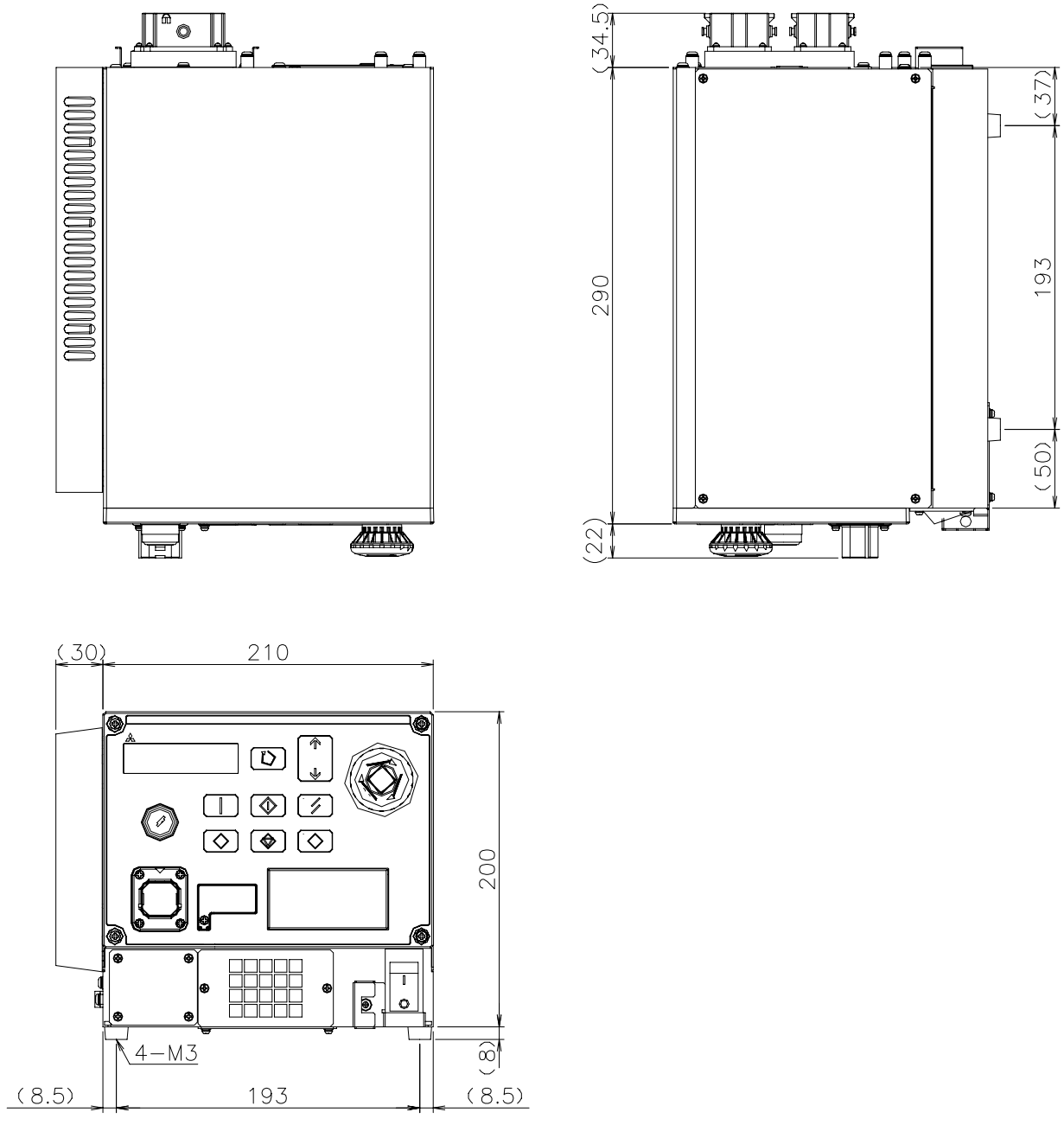


Fig.3-10 : Outside dimensions(DU1A-700 series)

<DU1A-700 series>
CE marking specification

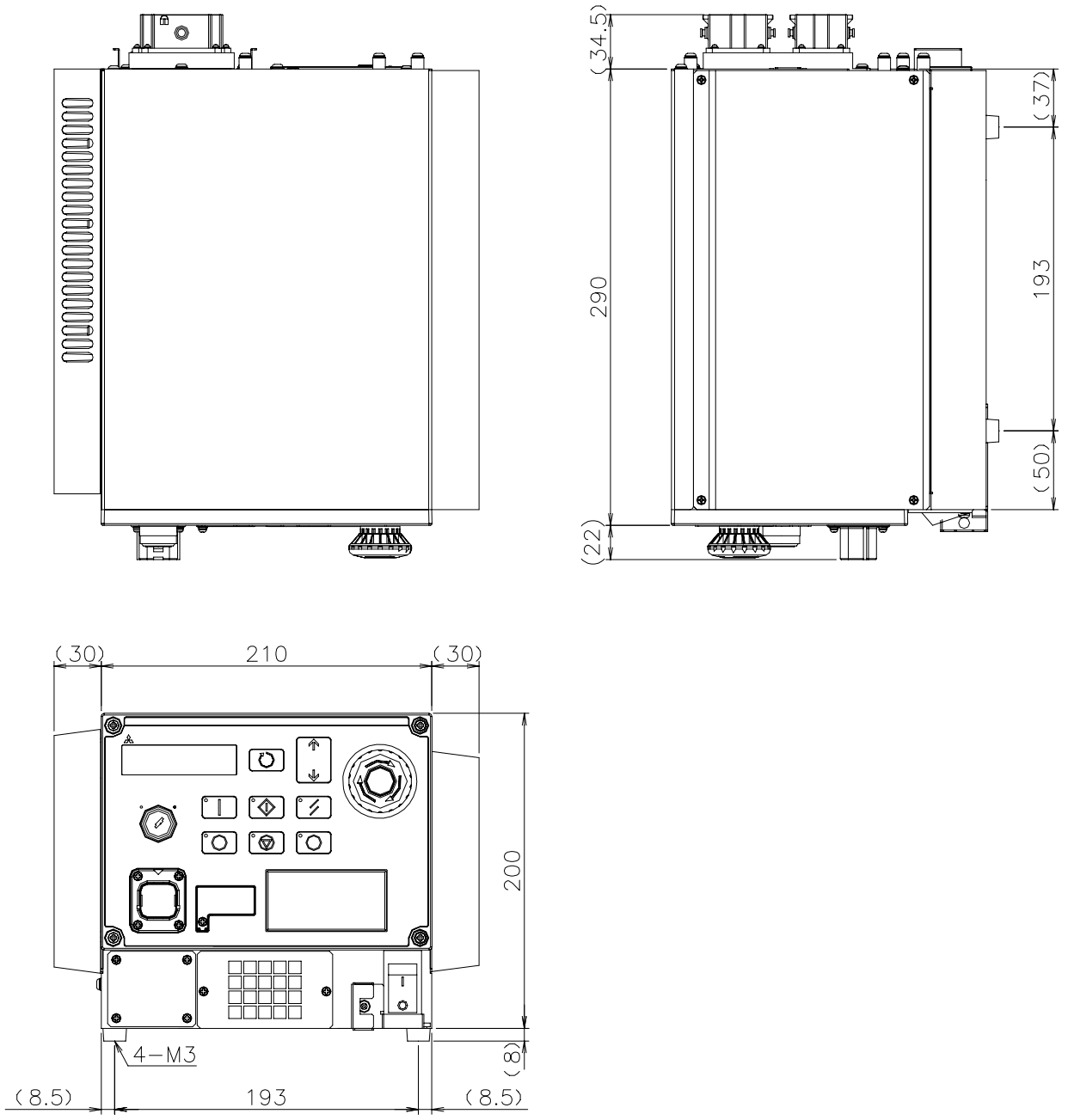


Fig.3-11 : Outside dimensions of controller (DU1A-700 series)

<DU2A-700 series>

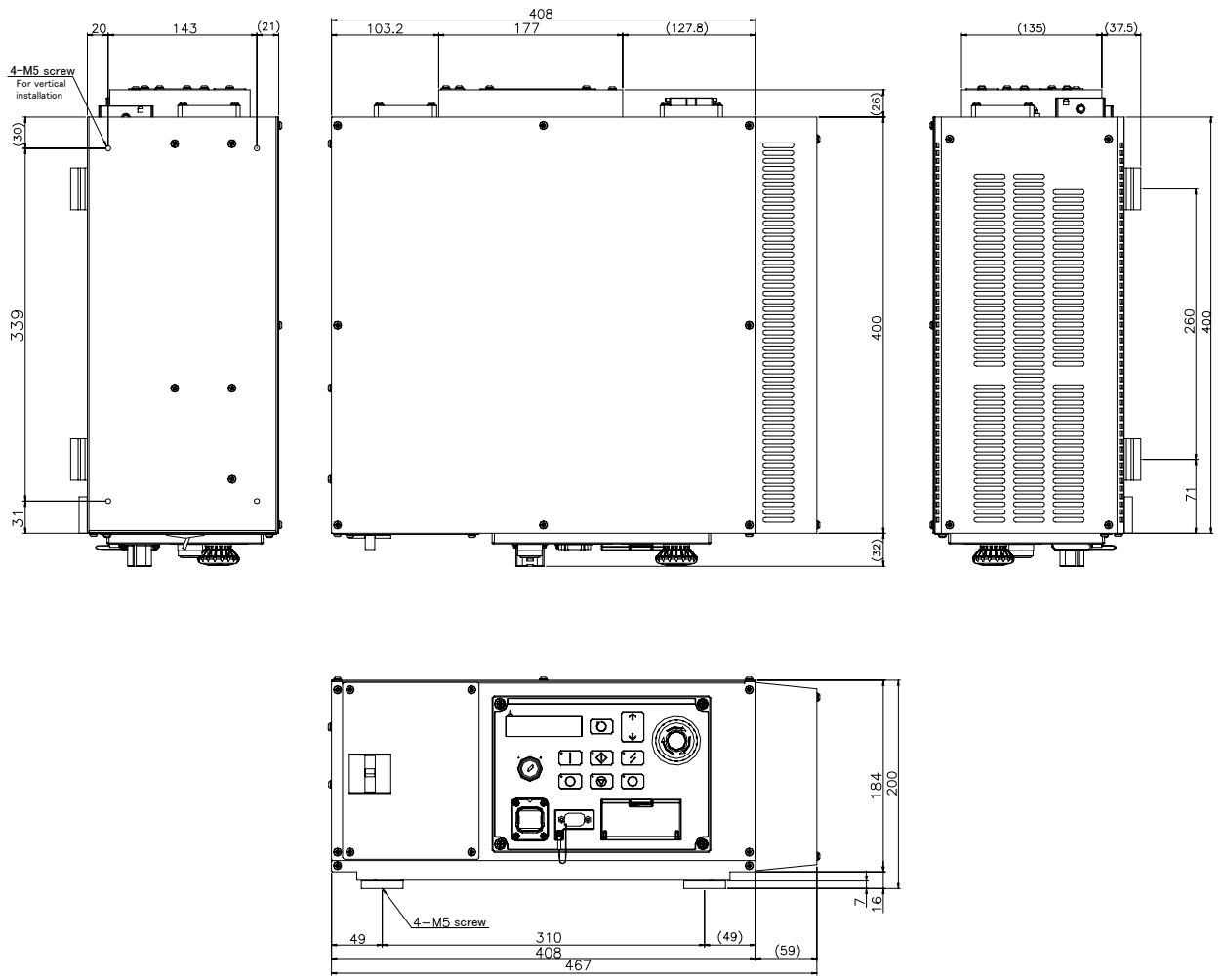


Fig.3-12 : Outside dimensions(DU2A-700 series)

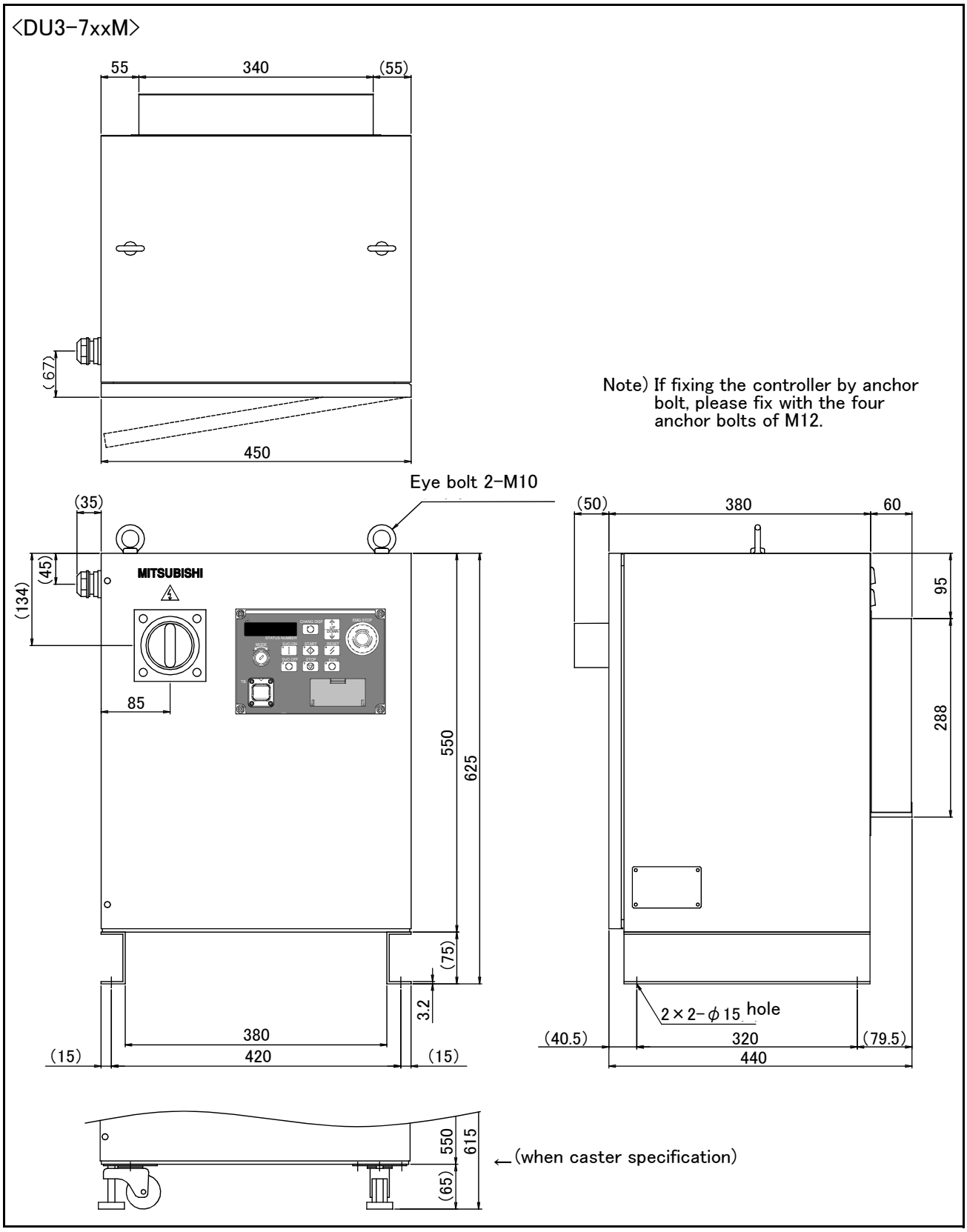


Fig.3-13 : Outside dimensions(DU3-7xxM)

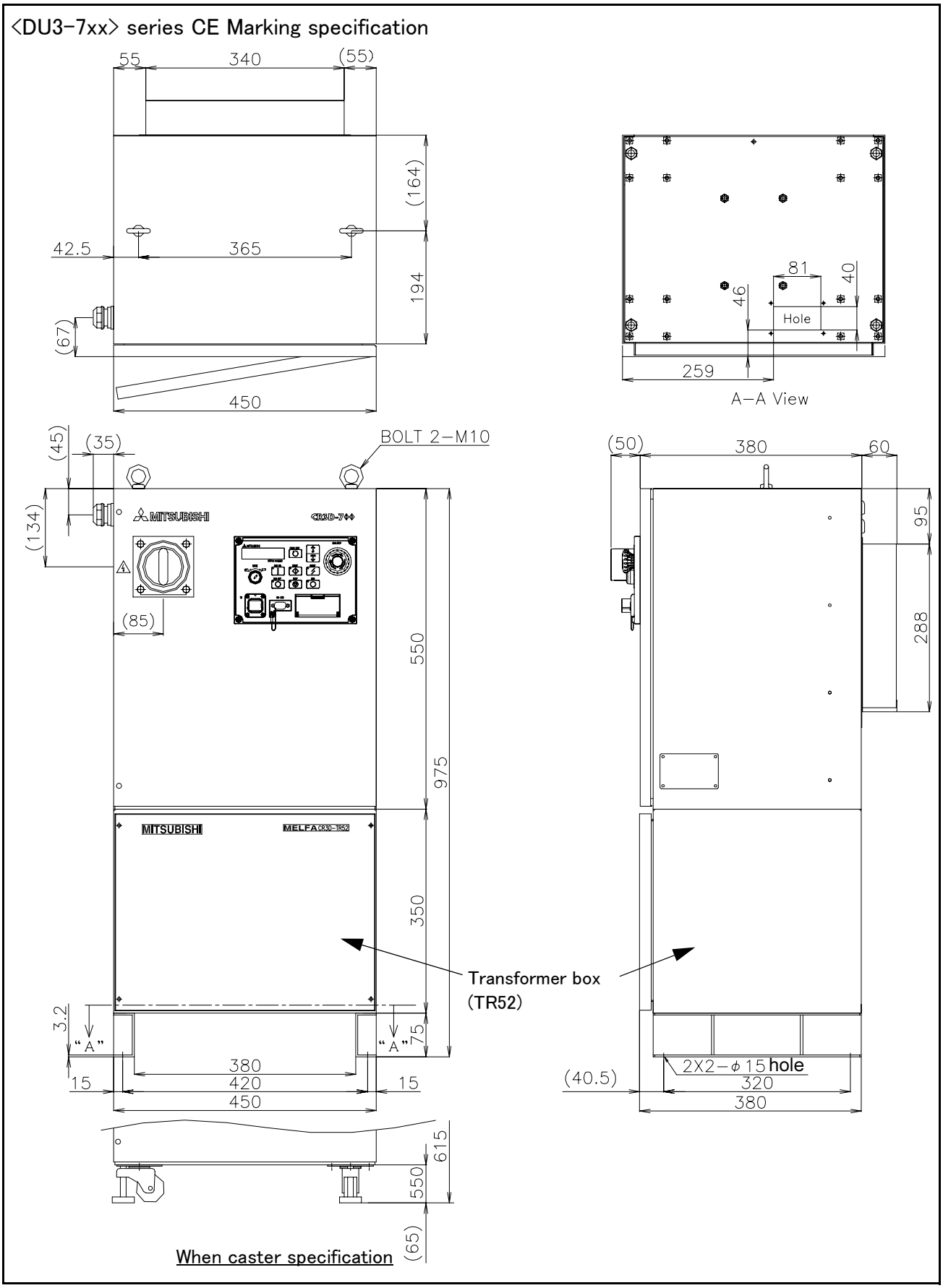
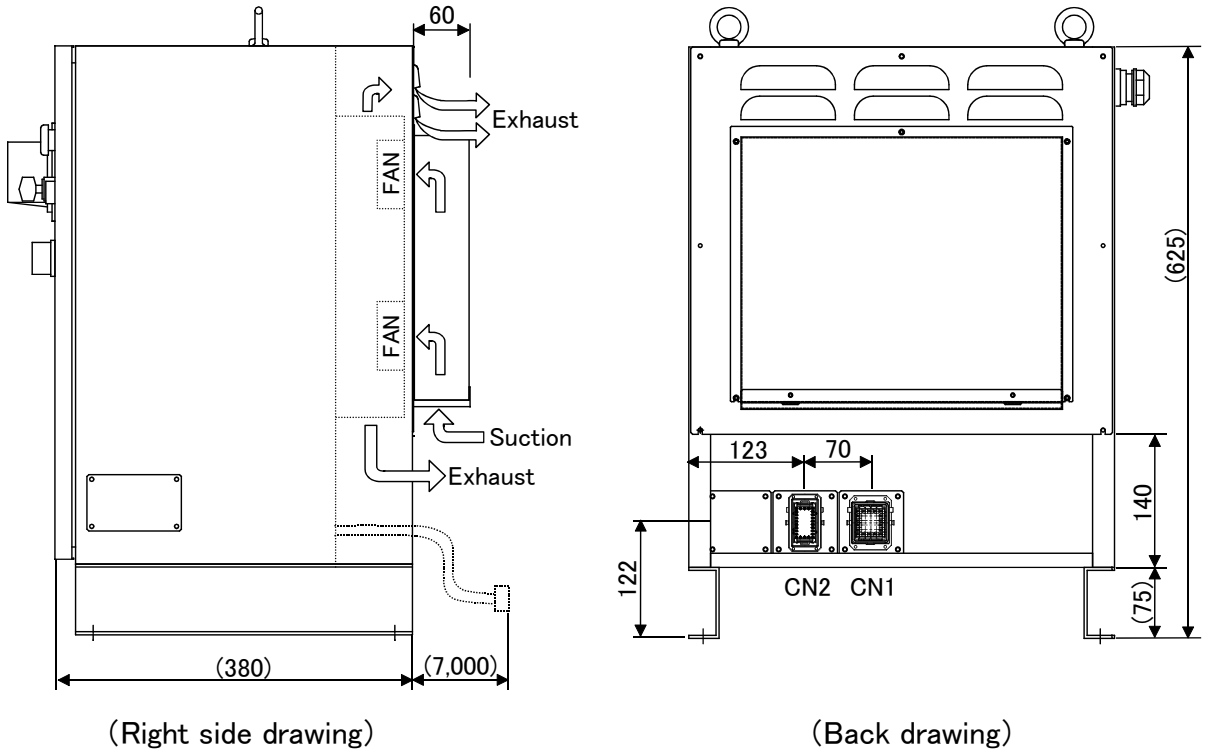


Fig.3-14 : Outside dimensions of controller(DU3-7xx CE Marking)

<DU3-700M series>

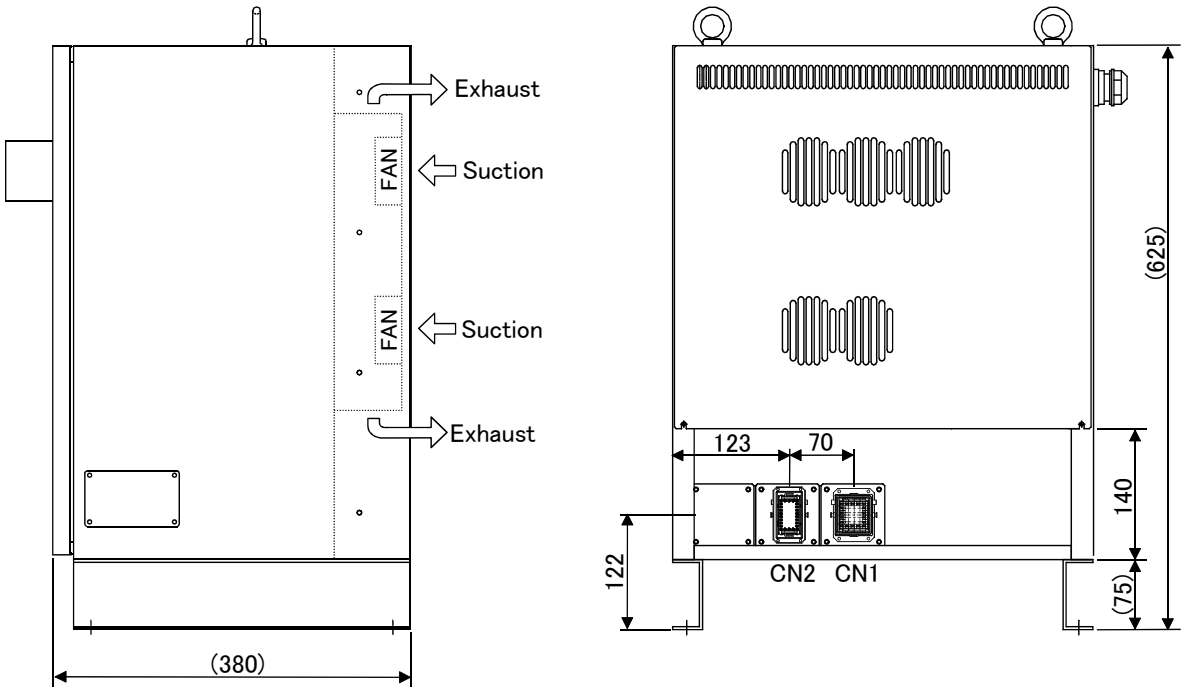


(Right side drawing) (Back drawing)

Note) As for CE specification, the transformer box is installed in the controller bottom. Refet toFig. 3-14

Fig.3-15 : Outside dimensions of controller DU3-700M Supplement)

<DU3-700 series>



(Right side drawing) (Back drawing)

Fig.3-16 : Outside dimensions of controller (DU3-700 Supplement)

(2) Outside dimensions of robot CPU unit

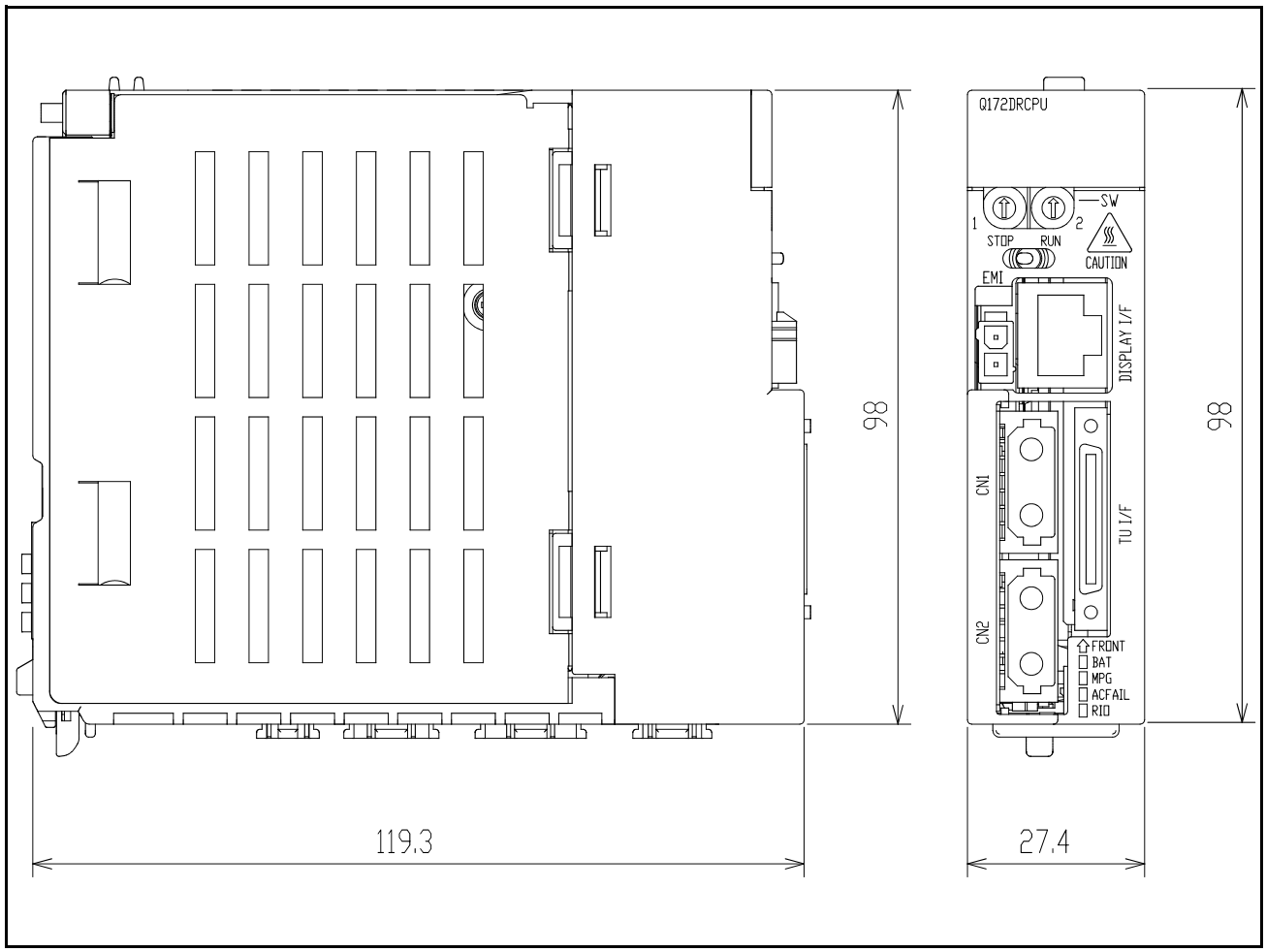


Fig.3-17 : Outside dimensions of robot CPU

(3) Battery unit outside dimension

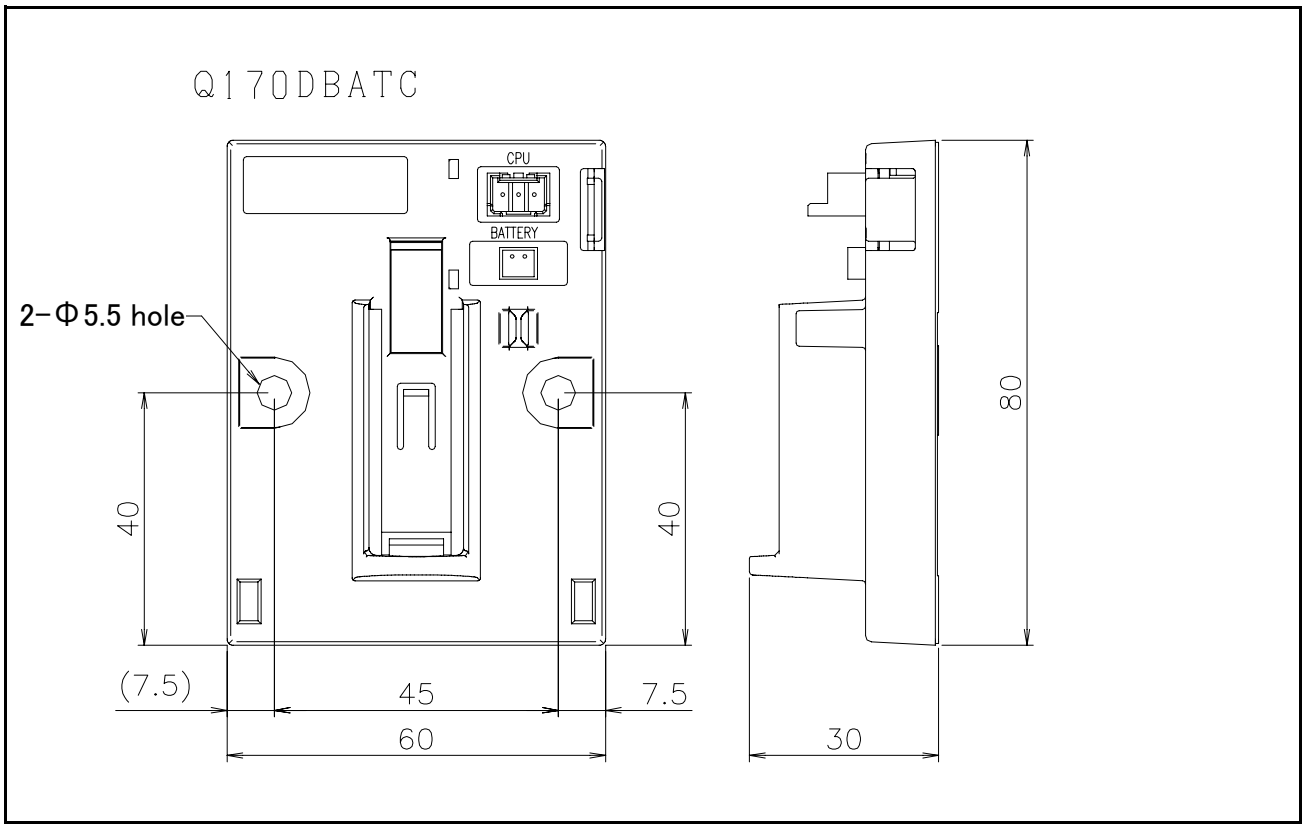


Fig.3-18 : Outside dimensions of battery unit

3.3.2 Installation dimensions

(1) Installation dimensions of drive unit

<DU1A-700 series>
Standard specification

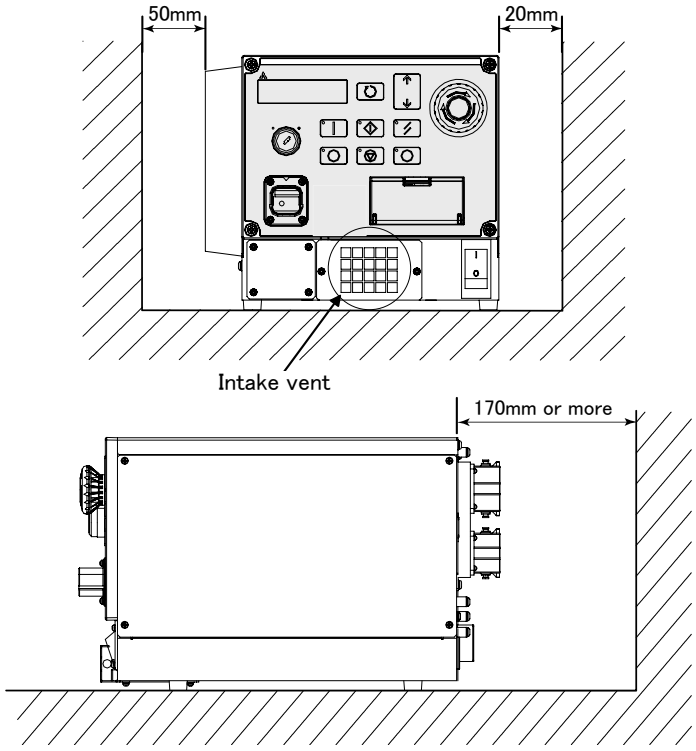


Fig.3-19 : Installation of controller(DU1A-700 series)

<DU1A-700 series>
CE marking specification

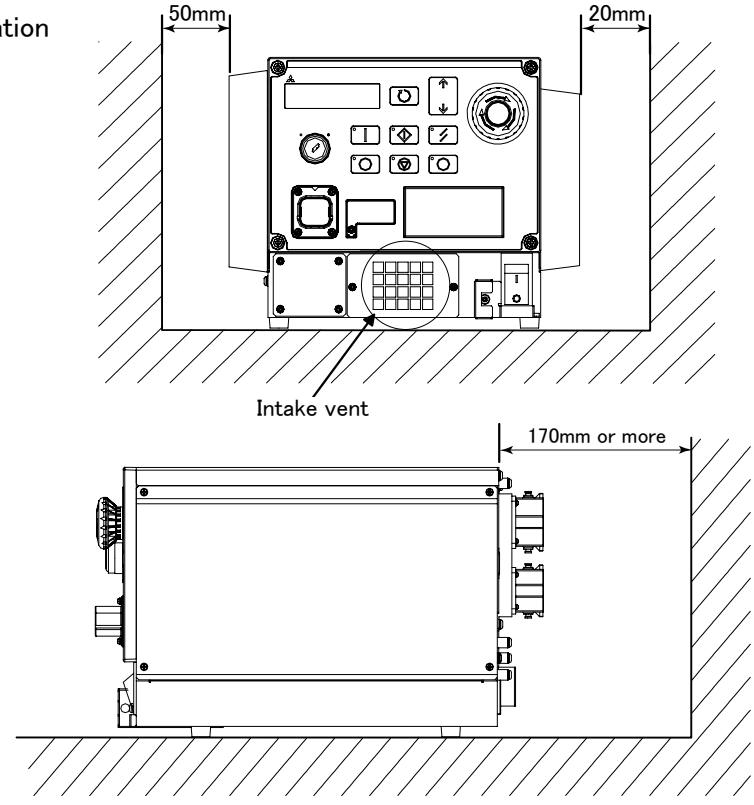
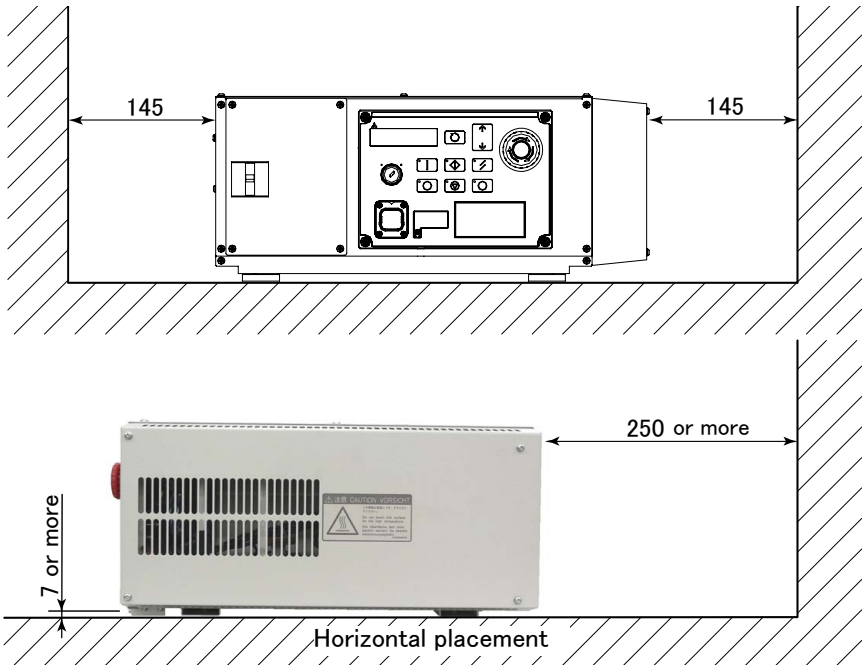
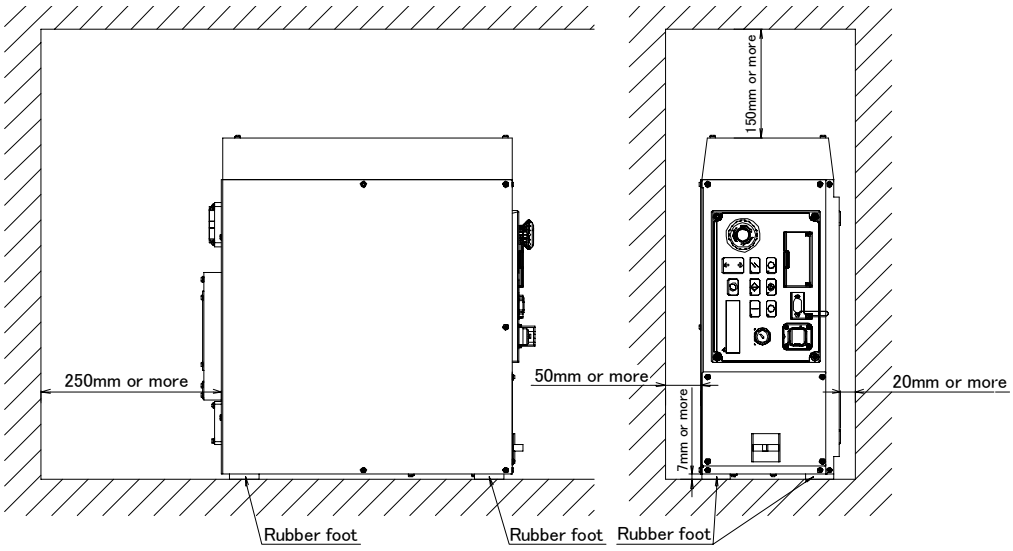


Fig.3-20 : Installation of controller(DU1A-700 series)

<DU2A-700 series>



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



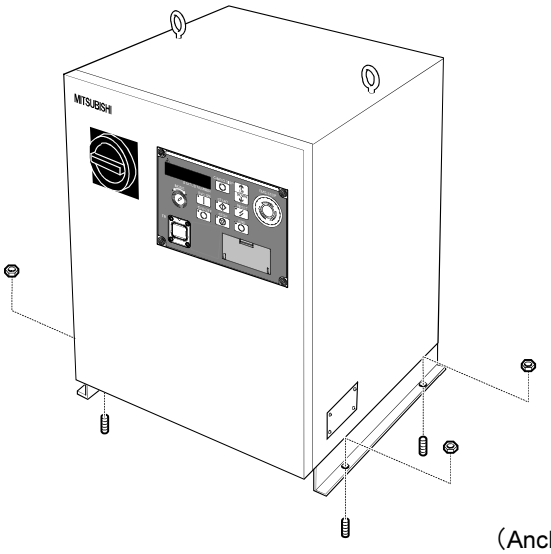
⚠CAUTION The installation section needs to be fixed so that the drive unit may not fall. When fixing the drive unit with the bolt, please use the bolt of the length which does not protrude 5mm or more into the drive unit case.

(1) Remove the rubber foot at the bottom of the drive unit (four places, M5 x 10 screws).
(2) Remove the drive unit side white round seal (four places).
(3) Use the rubber foot and the 5xM10 screw which were removed by above-mentioned (1), and fix the rubber foot to the screw hole of the seal pasting place of (2).

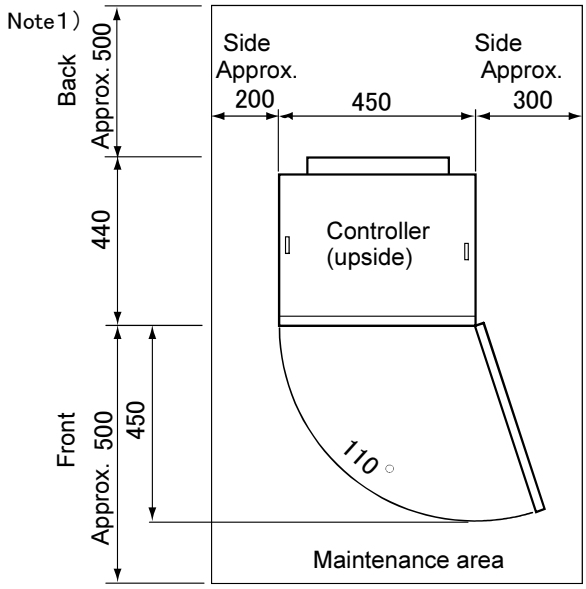
Fig.3-21 : Installation of drive unit(DU2A-700 series)

⚠CAUTION When storing the drive unit in a cabinet, etc., take special care to the heat radiating properties and ventilation properties so that the ambient temperature remains within the specification values.

<DU3-700M series>



(Anchor bolt installation: 4 places)



(View from upside)

Note1) The controller sucks in the outside air and discharges the inside air after cooling (Fig. 3-15). The space required for cooling is 100 mm minimum. Reserve approximately 500 mm of space behind the unit as the maintenance work area.

Fig.3-22 : Installation of controller (DU3-700M series)

(2) Robot CPU Unit installation dimensions

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

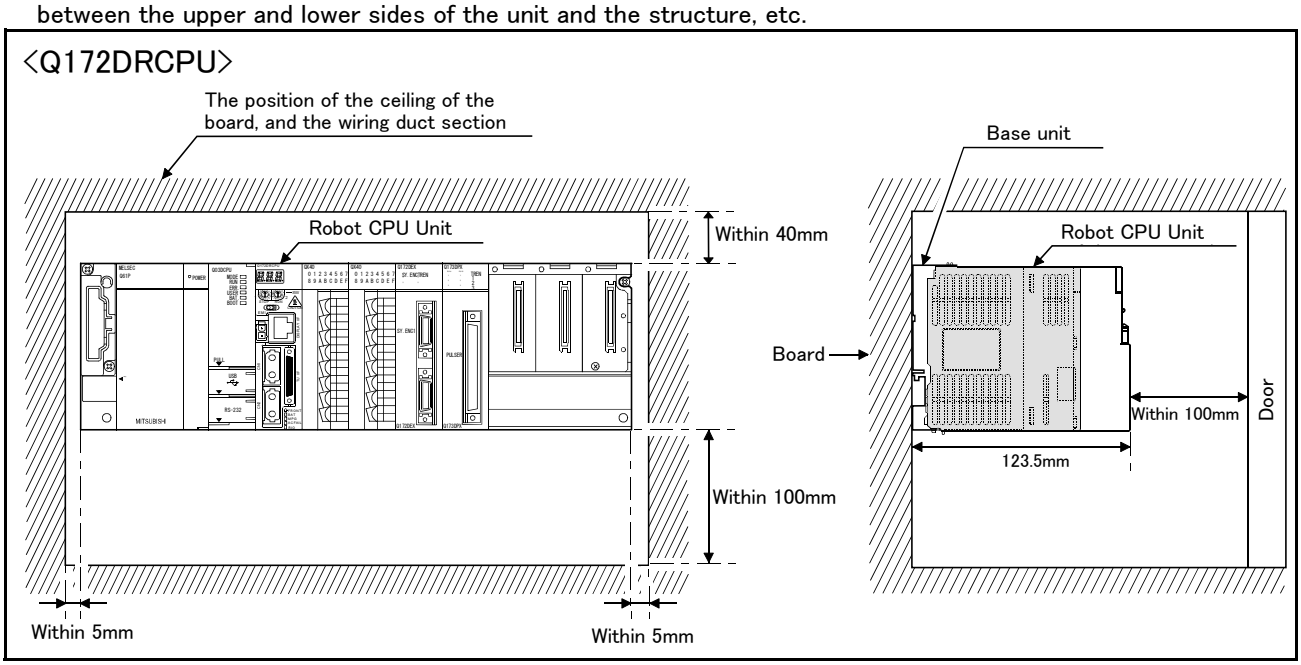


Fig.3-23 : Installation of robot CPU Unit

3.3.3 Cable lead-in and dimension

The controller has the openings parts for pulling out the cable as shown in Fig. 3-24, Fig. 3-25 and Fig. 3-26.

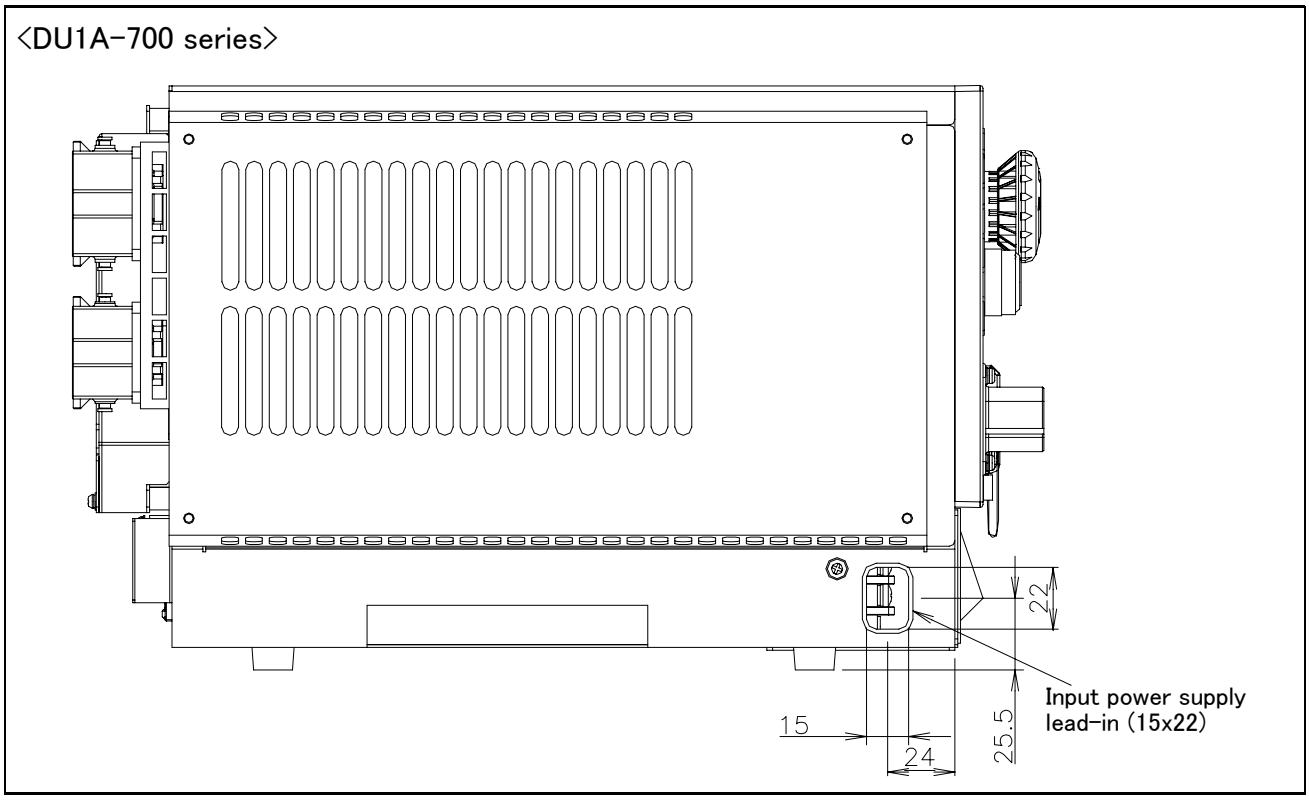


Fig.3-24 : Cable lead-in and dimension of the controller (DU1A-700 series)

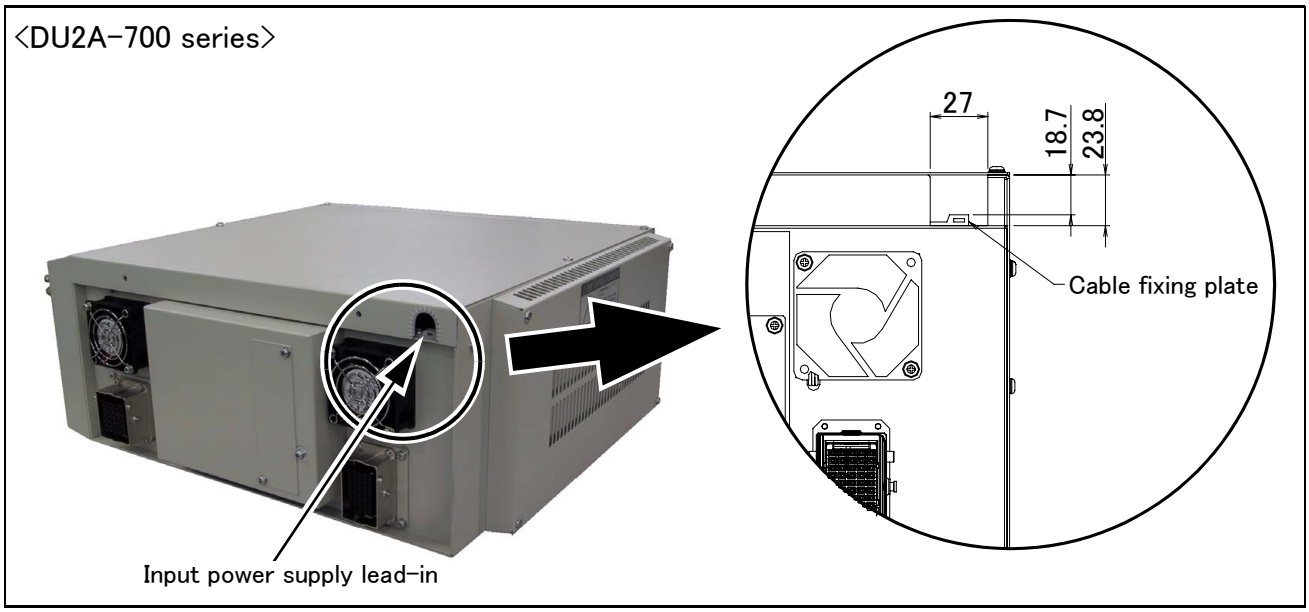
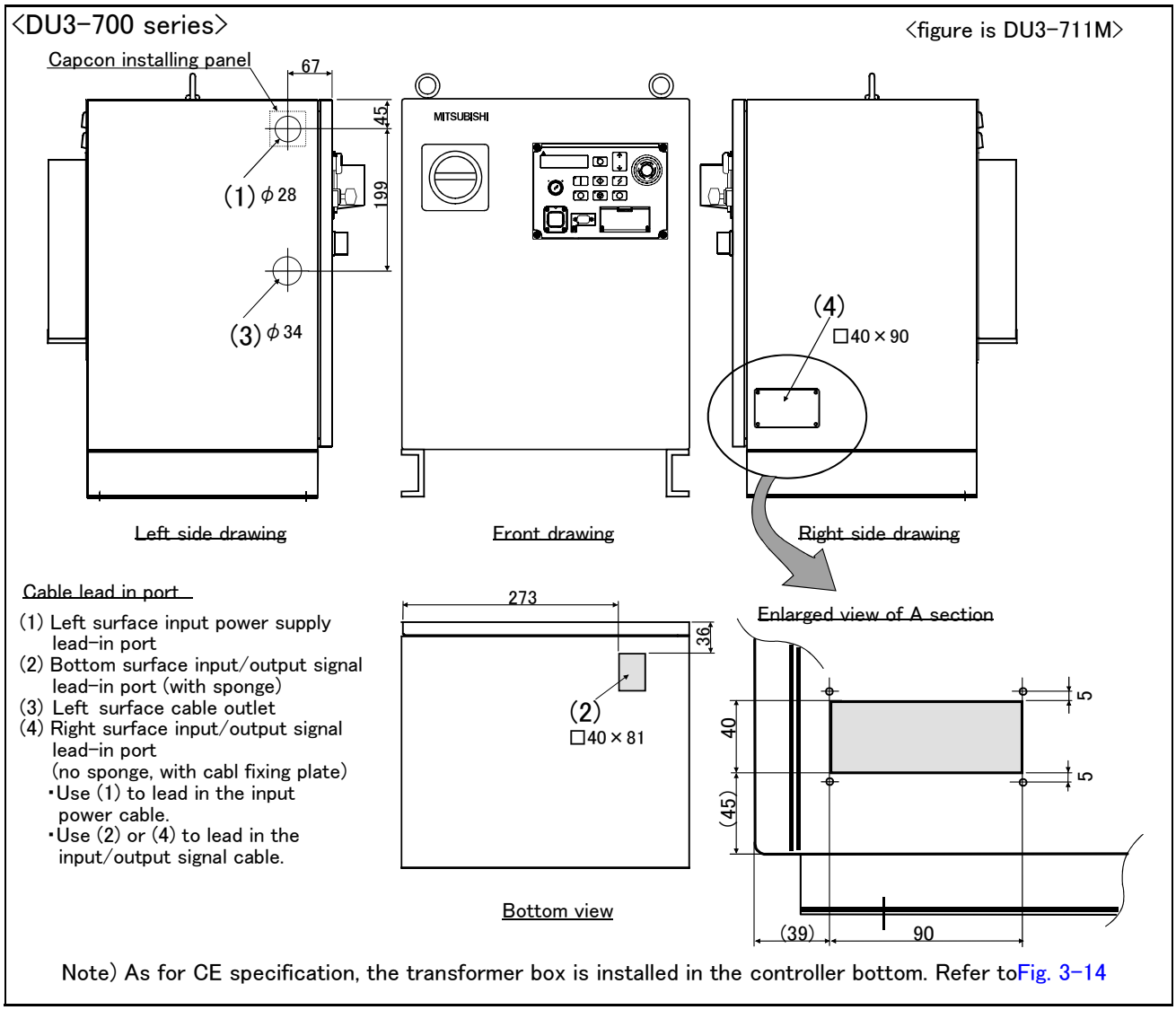


Fig.3-25 : Cable lead-in and dimension of the controller (CDU2A-700 series)



Note) As for CE specification, the transformer box is installed in the controller bottom. Refer toFig. 3-14

Fig.3-26 : Cable lead-in and dimension of the controller (DU3-700 Series)

3.4 External input/output

3.4.1 Types

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

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

(3) Hand input/output ..... These are inputs and outputs related to the hand that the customer can program. (The hand output is an option. The Page 170, "(2) Pneumatic hand interface" is required.)

(4)Emergency stop/Door switch input..... The wiring for the safe security of the emergency stop etc. is shown in on Page 148, "3.6 Emergency stop input and output etc." and on Page 188, "6.1.7 Examples of safety measures".

<For Reference>

Linking our GOT1000 Series (GT15) display equipment to the robot controller over the Ethernet permits you to control robot controller's input/output from a GOT (graphic operation terminal). Refer to the examples of the use of GOT1000 Series display equipment given in a separate document titled "Detail Description of Functions and Operation."

3.5 Dedicated input/output

Show the main function of dedicated input/output in the Table 3-4. Refer to attached instruction manual "Detailed explanations of functions and operations" in the product for the other functions. Each parameter indicated with the parameter name is used by designated the signal No., assigned in the order of input signal No. and output signal No.

Table 3-4 : Dedicated input/output list

Parameter name	Input		Note1)	Output	
	Name	Function	Level	Name	Function
TEACHMD	None			Teaching mode output signal	Outputs that the teaching mode is entered.
ATTOPMD	None			Automatic mode output signal	Outputs that the automatic mode is entered.
ATEXTMD	None			Remote mode output signal	Outputs that the remote mode is entered.
RCREADY	None			Controller power ON complete signal	Outputs that external input signals can be received.
AUTOENA	Automatic operation enabled input signal	Allows automatic operation.	L	Automatic operation enabled output signal	Outputs the automatic operation enabled state.
START	Start input signal	Starts all slots.	E	Operating output signal	Outputs that the slot is operating.
STOP	Stop input signal	Stops all slots. The input signal No. is fixed to 0. Note) Use the emergency stop input for stop inputs related to safety.	L	Wait output signal	Outputs that the slot is temporarily stopped.
STOP2	Stop input signal	The program during operation is stopped. Unlike the STOP parameter, change of the signal number is possible. Notes) specification is the same as the STOP parameter.	L	Wait output signal	Outputs that the slot is temporarily stopped.
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.

Parameter name	Input		Note1)	Output	
	Name	Function	Level	Name	Function
PRGSEL	Program selection input signal	Designates the setting value for the program No. with numeric value input signals.	E	None	
OVRDSEL	Override selection input signal	Designates the setting value for the override with the numeric value input signals.	E	None	
IODATA Note2)	Numeric value input (start No., end No.)	Used to designate the program name, override value., mechanism value.	L	Numeric value output (start No., end No.)	Used to output the program name, override value., mechanism No.
PRGOUT	Program No. output request	Requests output of the program name.	E	Program No. output signal	Outputs that the program name is being output to the numeric value output signal.
LINEOUT	Line No. output request	Requests output of the line No.	E	Line No. output signal	Outputs that the line No. is being output to the numeric value output signal.
OVRDOUT	Override value output request	Requests the override output.	E	Override value output signal	Outputs that the override value is being output to the numeric value output signal.
ERROUT	Error No. output request	Requests the error No. output.	E	Error No. output signal	Outputs that the error No. is being output to the numeric value output signal.
JOGENA	Jog valid input signal	Validates jog operation with the external signals	E	Jog valid output signal	Outputs that the jog operation with external signals is valid.
JOGM	Jog mode input 2-bit	Designates the jog mode.	L	Jog mode output 2-bit	Outputs the current jog mode.
JOG+	Jog feed + side for 8-axes	Requests the + side jog operation.	L	None	
JOG-	Jog feed - side for 8-axes	Requests the - side jog operation.	L	None	
HNDCNTL1 : HNDCNTL3	None			Mechanism 1 hand output signal status : Mechanism 3 hand output signal status	Mechanism 1: Outputs the status of general-purpose outputs 900 to 907. Mechanism 2: Outputs the status of general-purpose outputs 910 to 917. Mechanism 3: Outputs the status of general-purpose outputs 920 to 927.
HNDSTS1 : HNDSTS3	None			Mechanism 1 hand input signal status : Mechanism 3 hand input signal status	Mechanism 1: Outputs the status of hand inputs 900 to 907. Mechanism 2: Outputs the status of hand inputs 910 to 917. Mechanism 3: Outputs the status of hand inputs 920 to 927.
HNDERR1 : HNDERR3	Mechanism 1 hand error input signal : Mechanism 3 hand error input signal	Requests the hand error occurrence.	L	Mechanism 1 hand error output signal : Mechanism 3 hand error output signal	Outputs that a hand error is occurring.
AIRERR1 : AIRERR3	Pneumatic pressure error 1 input signal : Pneumatic pressure error 3 input signal	Request the pneumatic pressure error occurrence.	L	Pneumatic pressure error 1 output signal. : Pneumatic pressure error 3 output signal.	Outputs that a pneumatic pressure error is occurring.
M1PTEXC : M3PTEXC	None		L	Maintenance parts replacement time warning signal	Outputs that the maintenance parts have reached the replacement time.
USERAREA Note3)	None			User-designated area 8-points	Outputs that the robot is in the user-designated area.

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

3.6 Emergency stop input and output etc.

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

Table 3-5 : Special input/output terminal

Item	Name	Function
Input	Emergency stop	Applies the emergency stop. Dual emergency line
Input	Special stop input	Applies the stop. (Refer to Page 152, "3.6.2 Special stop input(SKIP)")
Input	Door switch	Servo-off. Dual line, normal close (Page 154, "3.6.3 Door switch function")
Input	Enabling device	Servo-off. Dual line, normal close (Page 154, "3.6.4 Enabling device function")
Output	Robot error output	Contactor is opening during error occurrence
Output	Mode output	MANUAL mode: contactor is opening, AUTO mode: contactor is closing.
Output	Magnet contactor control connector output for addition axes	When an additional axis is used, the servo ON/OFF status of the additional axis can be synchronized with the robot arm. (Page 162, "3.8 Magnet contactor control connector output (AXMC) for addition axes")

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

[Note] The contact capacity of each input/output terminal is DC24V/10mA - 500mA. Don't connect the equipment except for this range. The use exceeding contact capacity causes failure.

Pin number assignment of each terminal and the circuit diagram are shown in Fig. 3-30.

3.6.1 Connection of the external emergency stop

The external emergency stop input and door switch input and enabling device input are opened at shipment as shown in Fig. 3-30.
Connect the external emergency stop switch and door switch with the following procedure.

[Caution] Since the emergency stop, the enabling device, and the door switch circuits are made dual circuits inside the controller, all the emergency stop switches should use dual contact type. Remove the contact capacity sticker stuck on the connector (EMGIN, EMGOUT, SKIP) and connect the emergency switch.

1) Prepare the "emergency stop switch", "enabling device" and "door switch".
2) Securely connect the external emergency stop's contacts across 3A-4A, 3B-4B, and the door switch's contacts across 8A-9A, 8B-9B, and the enabling device switch's contacts across 10A-11A, 10B-11B, on the terminal block.

[Caution] When wiring the emergency stop switch (double emergency line type) and SKIP input signal, 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. The cable uses the shielded cable and installs the ferrite core. Install the ferrite core in less than 30cm from the contact button.

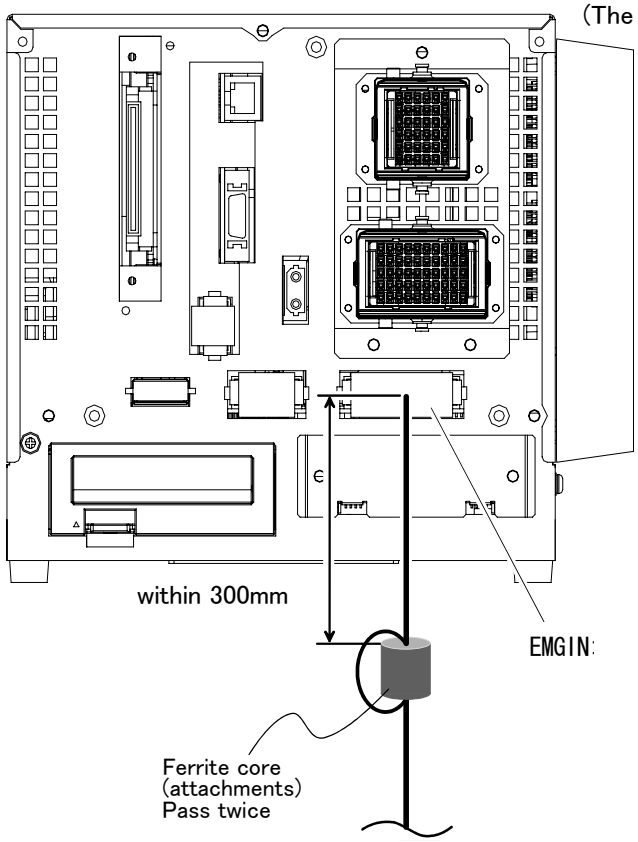
⚠CAUTION You should always connect doubly connection of the emergency stop, the door switch, and the enabling switch. (Connect with both of side-A and side-B of the controller rear connector) In connection of only one side, if the relay of customer use should break down, it may not function correctly.

⚠CAUTION Please be sure to check that each function operates normally for the prevention of malfunction. Surely check that the operation of the emergency stop of the robot controller, the emergency stop of the teaching pendant, the customer's emergency stop, etc are normally.

⚠CAUTION Be sufficiently careful and wiring so that two or more emergency stop switches work independently. Don't function only on AND conditions (Two or more emergency stop switch status are all ON).

<DU1A-700 series>

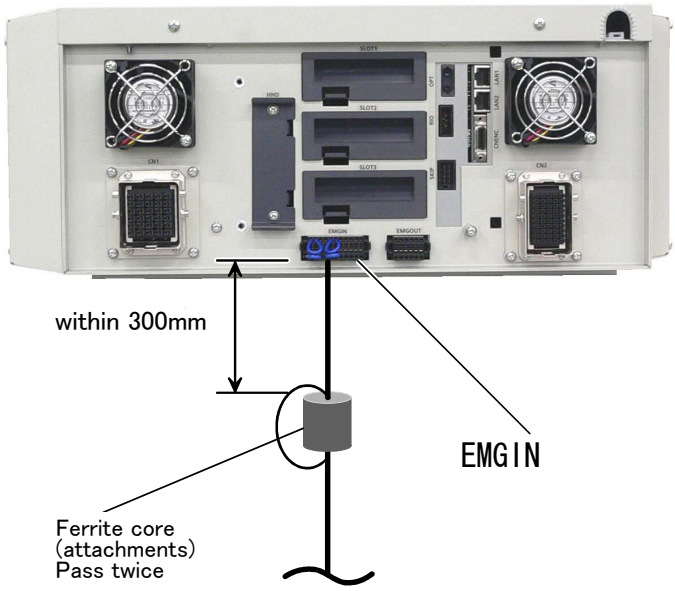
* The figure is standard specification.
(The CE marking specification is the same.)



Pin allotment of EMGIN and the EMGOUT connector is shown in Fig. 3-30.

Fig.3-27 : emergency stop cable connection (DU1A-700)

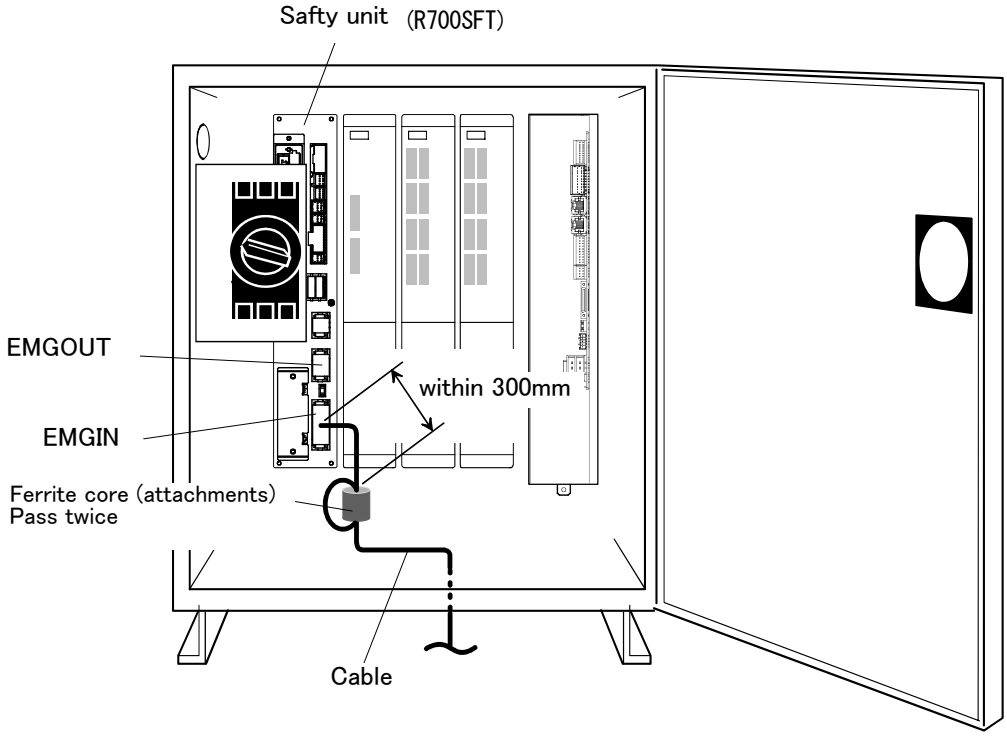
<DU2A-700>



Pin allotment of EMGIN and the EMGOUT connector is shown in Fig. 3-30.

Fig.3-28 : emergency stop cable connection(DU2A-700)

<DU3-700/700M>



Pin allotment of EMGIN and the EMGOUT connector is shown in Fig. 3-30.

Fig.3-29 : Emergency stop cable connection(DU3-700)

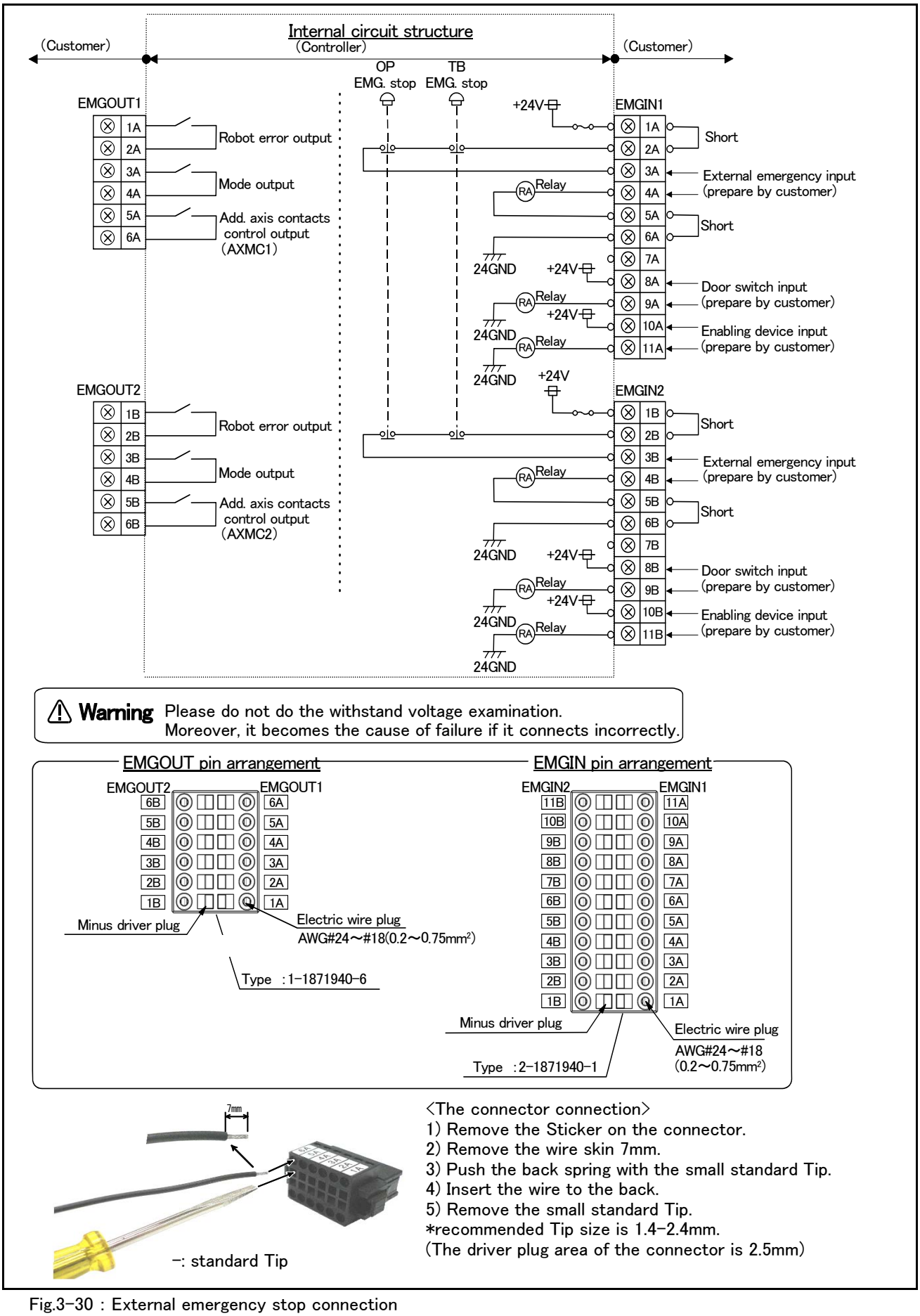


Fig.3-30 : External emergency stop connection

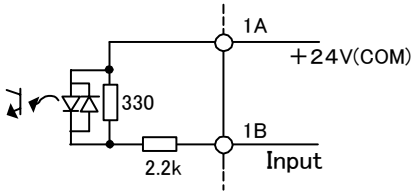
⚠CAUTION Please be sure to install the emergency stop switch and it is connection to the controller, to stop the robot immediately at emergency

⚠CAUTION Be careful of the short circuit at cable connection.
And, don't give plating solder to the electric wire. Loose connection may occur.

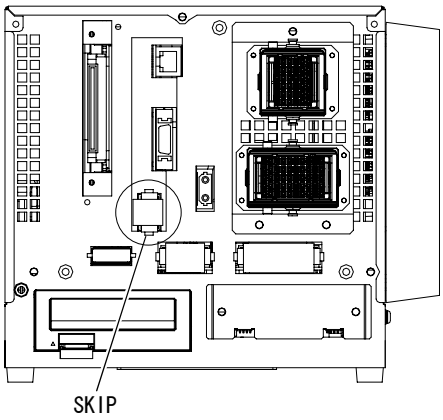
3.6.2 Special stop input(SKIP)

The skip is the input signal to stop the robot. Wire 1A-1B of the special stop connector (SKIP) shown in Page 153, "Fig.3-31 : Connection of the special-stop-input".

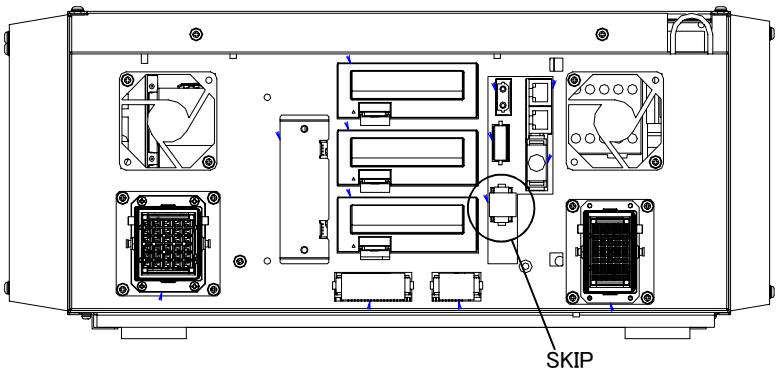
Table 3-6 : Special stop input electric specification

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

<DU1A-700>

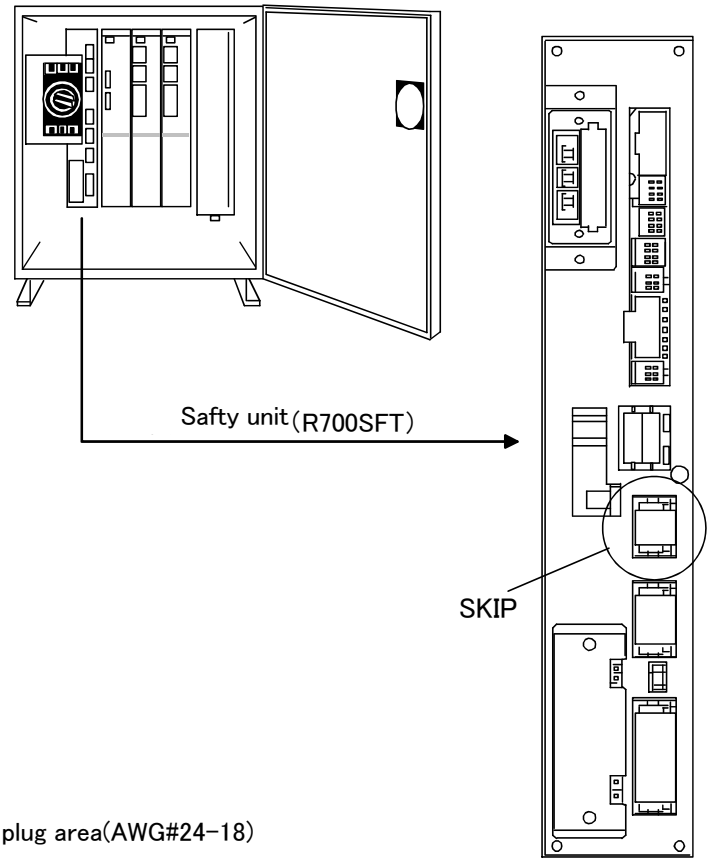


<DU2A-700>

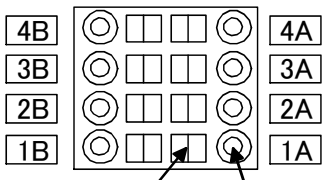


* The figure is standard specification.
(The CE marking specification is the same.)

<DU3-700>



Special stop connector (SKIP)



Minus driver plug area

Electric wire plug area(AWG#24-18)

<The connector connection method>
The electric wire skins covering 7mm.
In the condition that the minus driver is inserted, insert the electric wire, and remove the minus driver.
The electric wire is locked by the connector.

Fig.3-31 : Connection of the special-stop-input

3.6.3 Door switch function

This function retrieves the status of the switch installed on the door of the safety fence, etc., and stops the robot when the door is opened. This differs from an emergency stop in that the servo turns OFF when the door is opened and an error does not occur. Follow the wiring example shown in Fig. 3-30, 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.

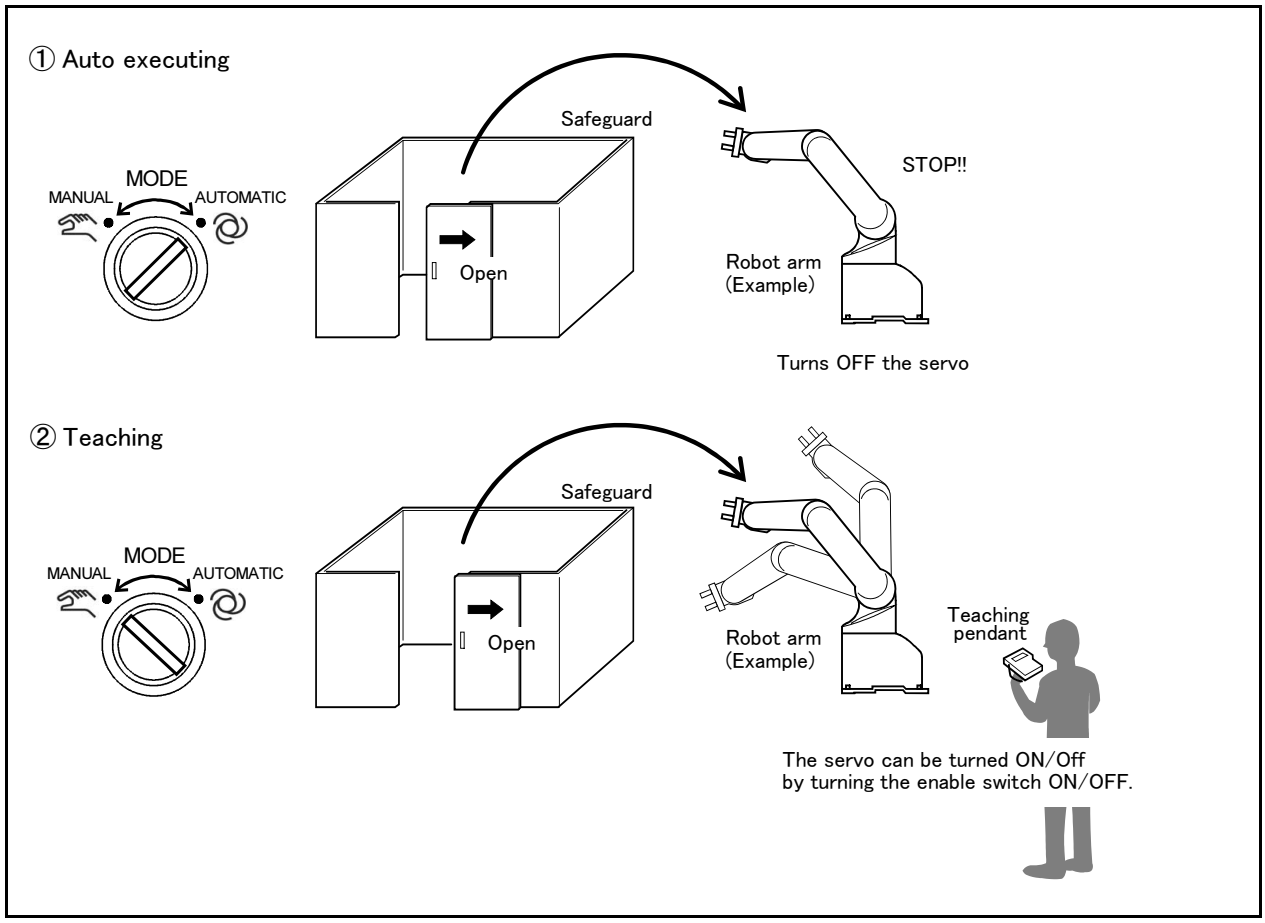


Fig.3-32 : Door switch function

3.6.4 Enabling device function

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

(1) When door is opening

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

(2) When door is closing

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

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

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

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

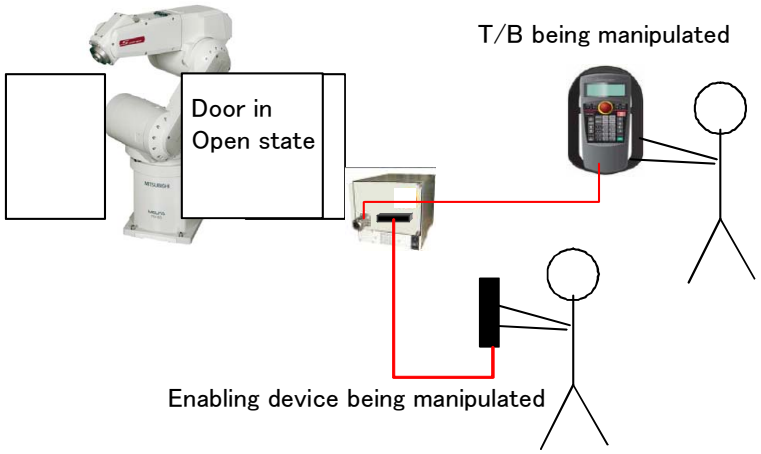
Table 3-7 : Various operations and necessary switch settings

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

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

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

Note3) It is imperative that brake release operation be carried out by two persons. One person turns on the enabling device ("Close" on the enabling device input terminal) while the other manipulates the T/B. Brake release can be effected only when both of the enabling switch device and the T/B enable switch are placed in intermediate position (lightly gripped position). At this point, the state of door switch input does not matter.



⚠CAUTION

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

Fig.3-33 : Brake release operation

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-J3-B series) that supports Mitsubishi's SSC Net Ⅲ .
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 3-8 shows the connectors for additional axes inside the controller and Fig. 3-34, Fig. 3-35, Fig. 3-36 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 be sure to install the noise filter in the power supply line of addition axis servo amplifier and to use the robot safely. The example of the installation of the noise filter is shown in Page 160, "(1) Example of the installation of the noise filter". Install by one of the methods.
Please implement the appropriate circuit connection by refer to Page 162, "3.8 Magnet contactor control connector output (AXMC) for addition axes".

Table 3-8 : Dedicated Connectors inside the Controller

Name	Connector name	Details
Connector for additional axes	CN2[Note1)]	The connector for connecting robot CPU with general-purpose servo amplifier.
Magnet contactor control connector for additional axes	EMGOUT	This contact output is used to turn ON/OFF the motor power by connecting to general-purpose servo amplifiers.

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

<DU1A-700>

* The figure is Standard specification.
(The CE marking specification is the same.)

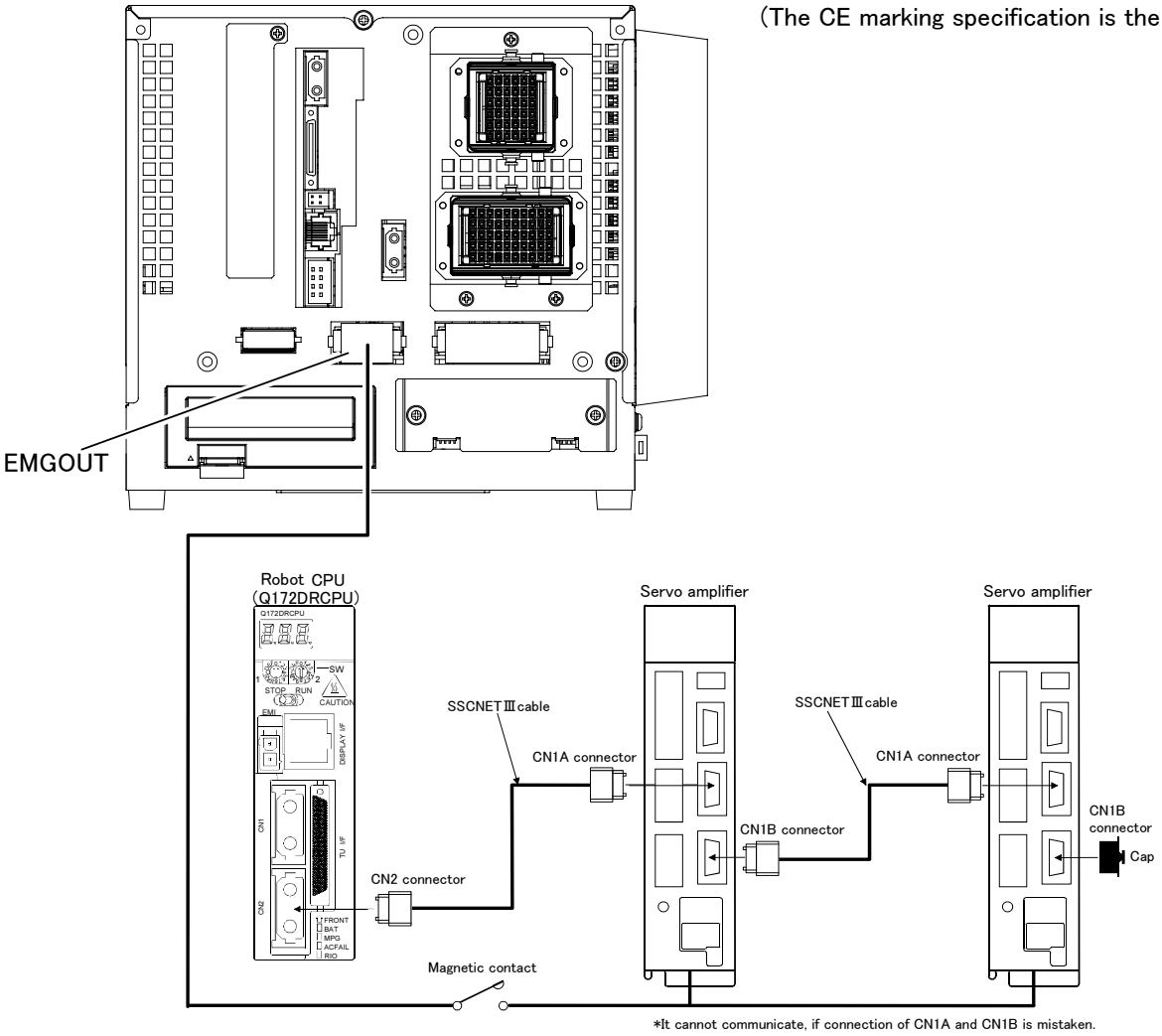


Fig.3-34 : Example of addition axis connection (DU1A-700)

<DU2A-700>

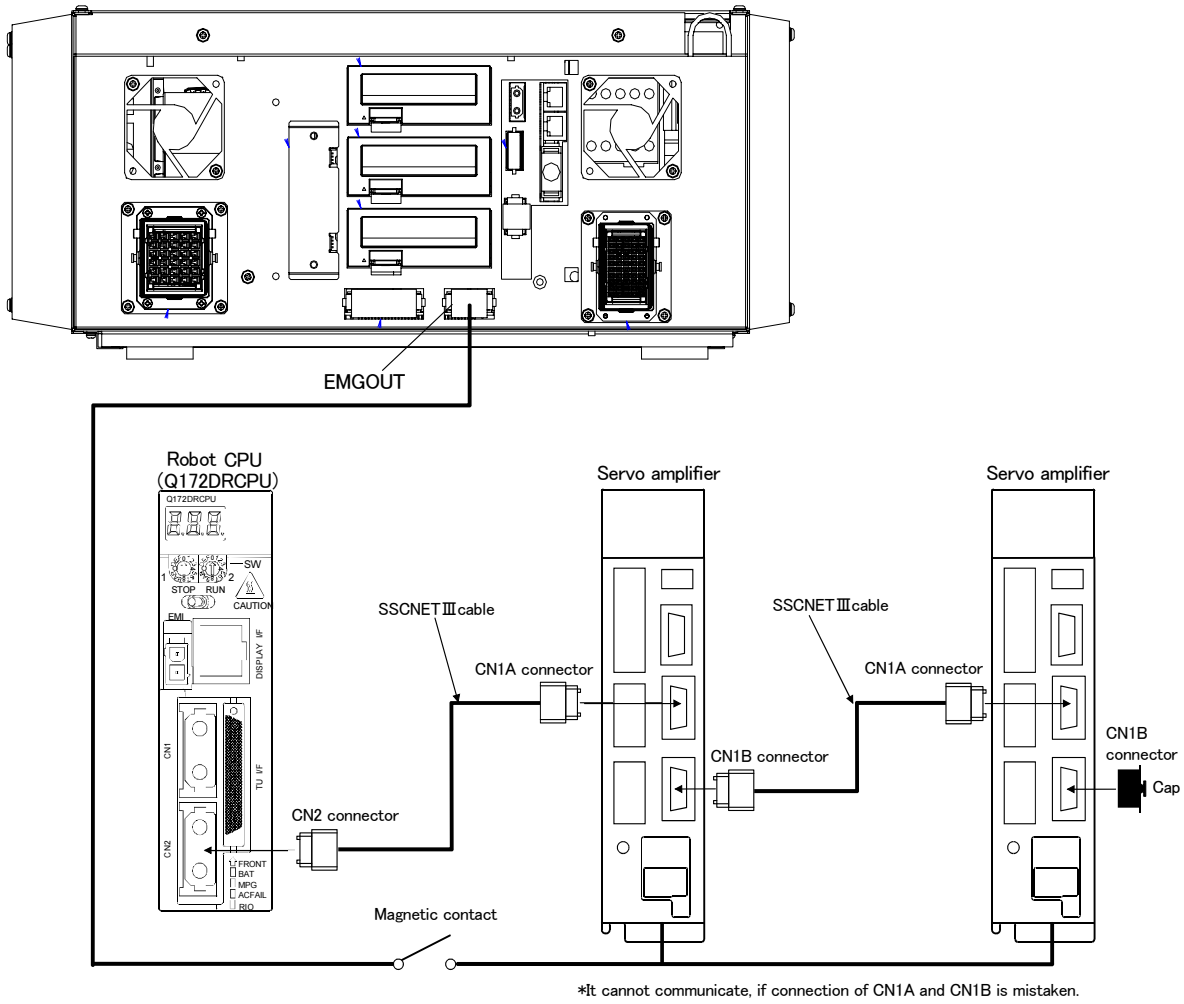
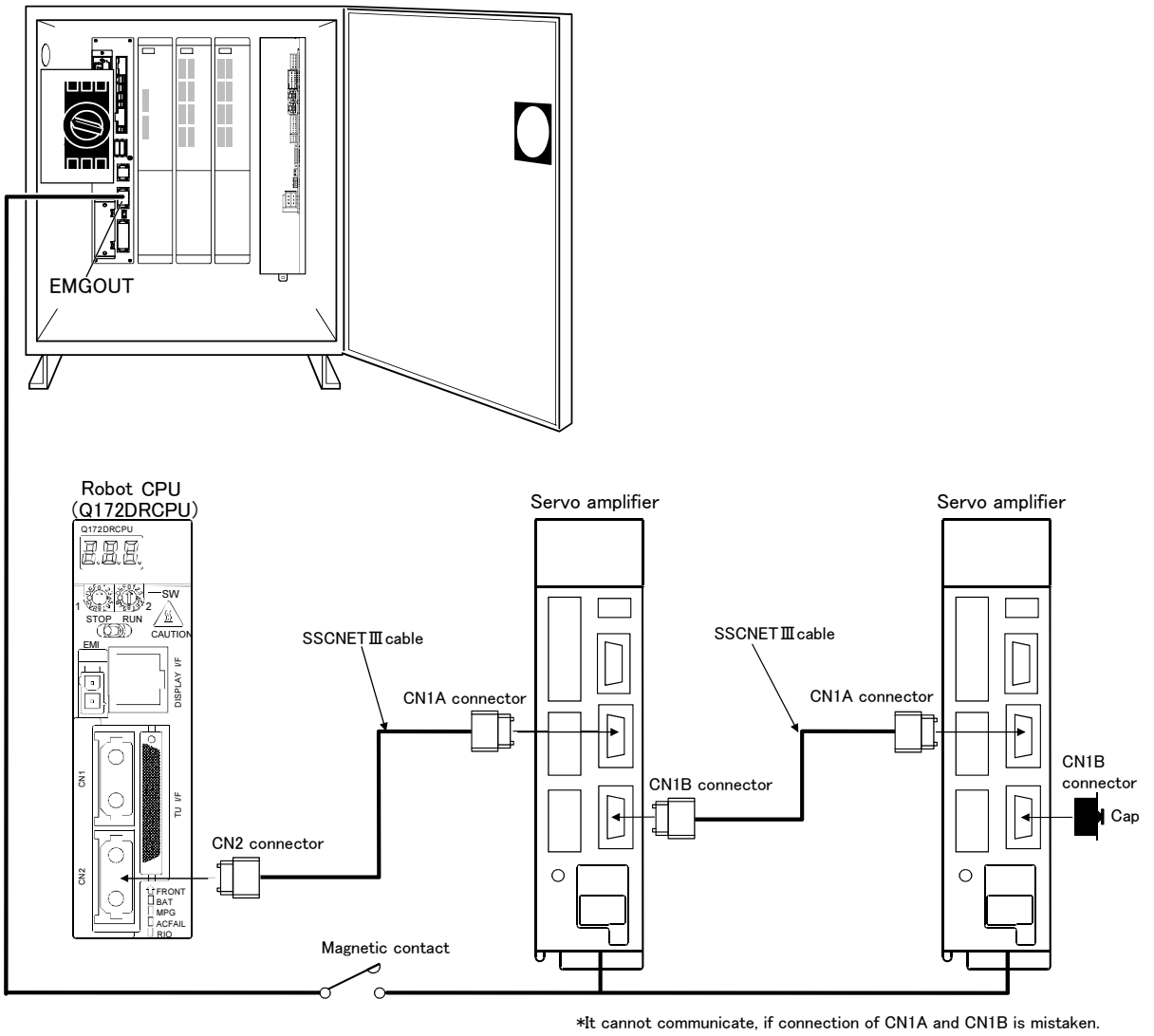


Fig.3-35 : Example of addition axis connection (DUA2-700)

<DU3-700/700M>



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

Fig.3-36 : Example of addition axis connection (DU3-700/700M)

(1) Example of the installation of the noise filter

1) EMC filter (recommended)

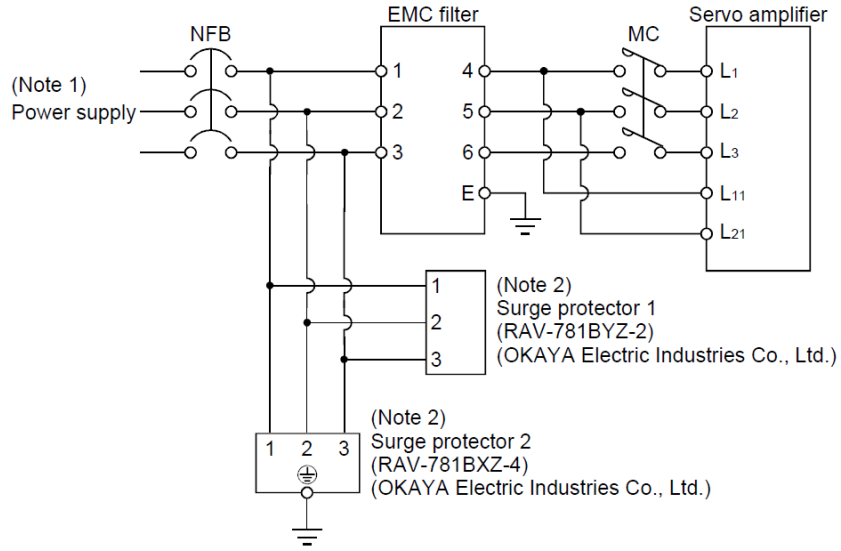
Please install the recommendation filter shown below according to the example of connection.

1) Combination with the servo amplifier

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

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

2) Connection example



Note 1. For 1-phase 200V to 230VAC power supply, connect the power supply to L_1,L_2 and leave L_3 open.
There is no L_3 for 1-phase 100 to 120VAC power supply. Refer to section 1.3 for the power supply specification.
2. The example is when a surge protector is connected.

Fig.3-37 : Example of EMC noise filter installation

2) Line noise filter

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

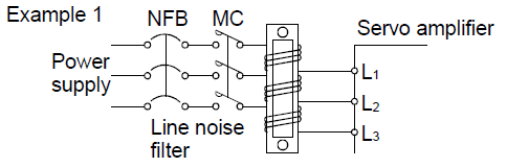
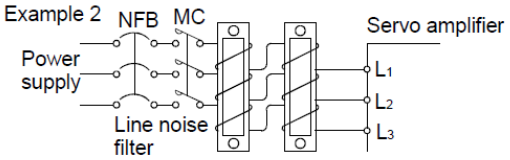
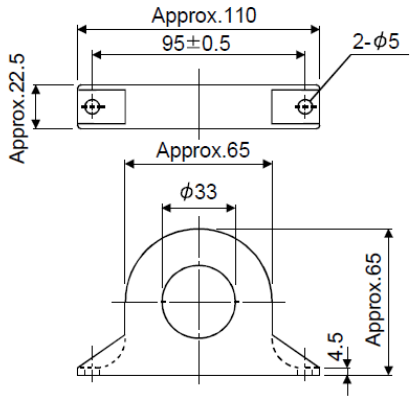
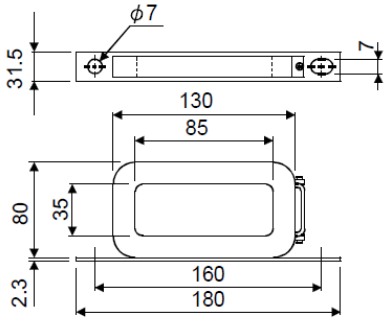
Connection diagram	Outline drawing [Unit: mm]
Use the line noise filters for wires of the main power supply (L_1 • L_2 • L_3) and of the motor power supply (U • V • W). Pass each of the 3-phase wires through the line noise filter an equal number of times in the same direction. For the main power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the motor power supply, passes must be four times or less. Do not pass the grounding (earth) wire through the filter, or the effect of the filter will drop. Wind the wires by passing through the filter to satisfy the required number of passes as shown in Example 1. If the wires are too thick to wind, use two or more filters to have the required number of passes as shown in Example 2. Place the line noise filters as close to the servo amplifier as possible for their best performance.  (Number of turns: 4)  Two filters are used (Total number of turns: 4)	FR-BSF01 (for wire size 3.5mm^2 (AWG12) or less))  FR-BLF(for wire size 5.5mm^2 (AWG10) or more)) 

Fig.3-38 : Example of noise filter installation

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

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

Fig. 3-39 shows an example of its circuit, and Fig. 3-40、Fig. 3-41、Fig. 3-42 show the layout drawings of the output contact (EMGOUT). When you are using an additional axis, please perform appropriate circuit connections by referring to these drawings.

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

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

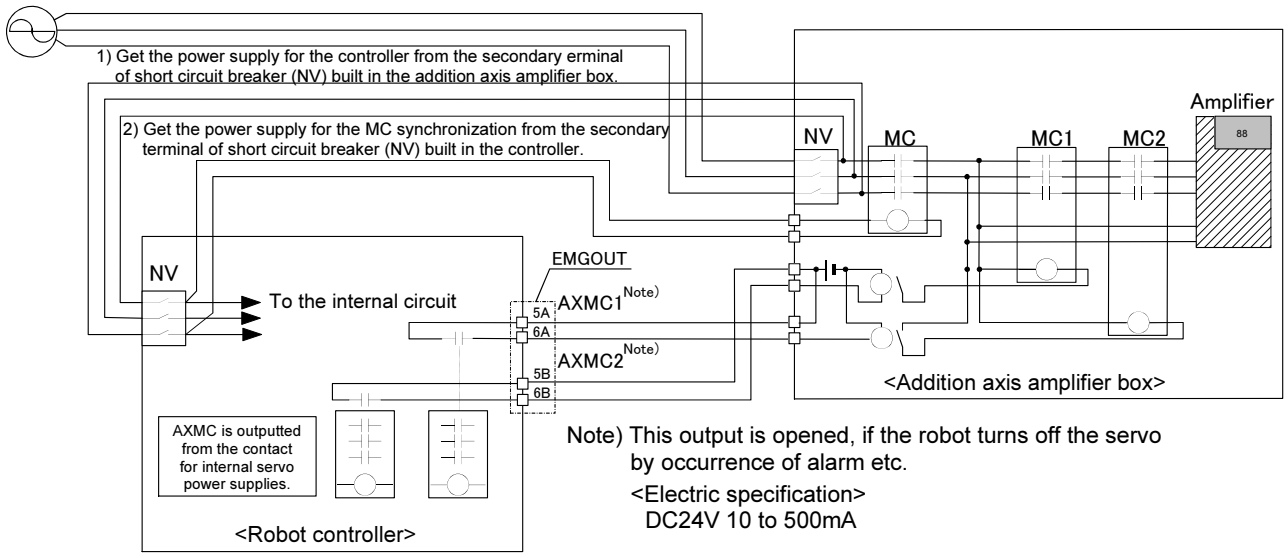
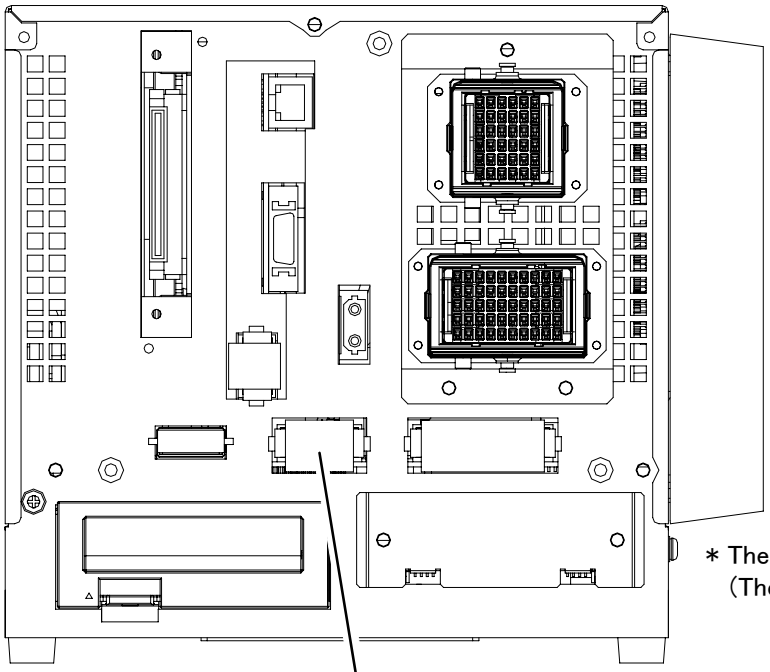


Fig.3-39 : Example of circuit for addition axes of Magnet contactor control output

<DU1A-700>



* The figure is Standard specification.
(The CE marking specification is the same.)

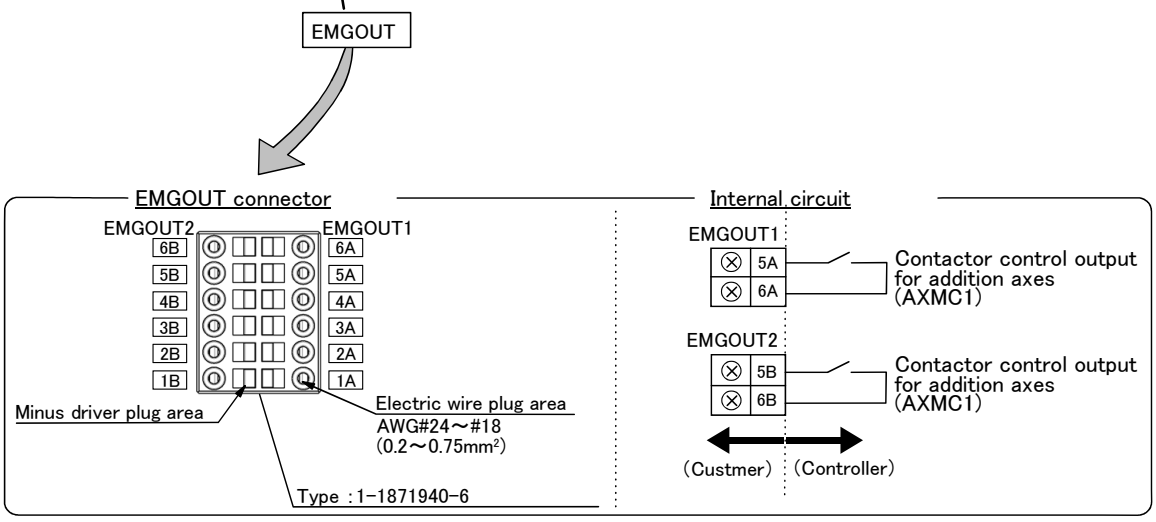


Fig.3-40 : EMGOUT connector (DU1A-700)

<DU2A-700>

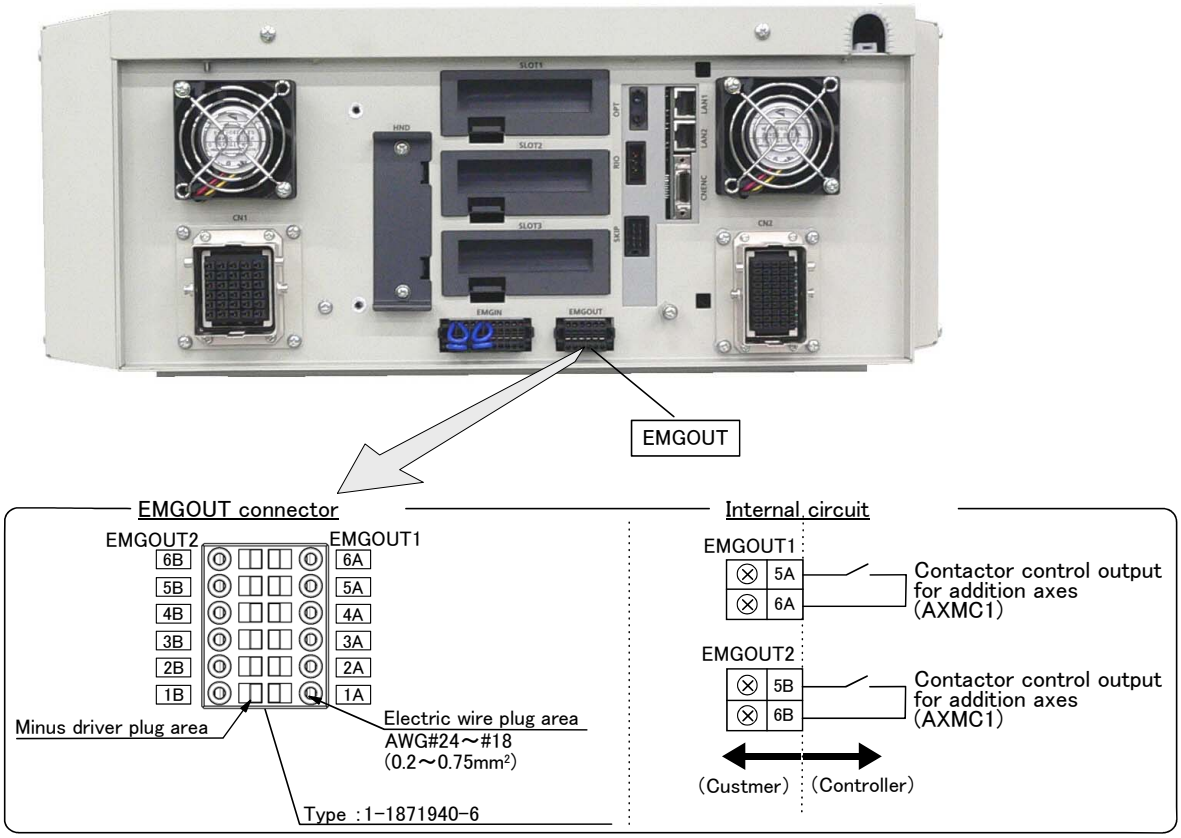


Fig.3-41 : EMGOUT connector (DU2A-700)

<DU3-700/700M>

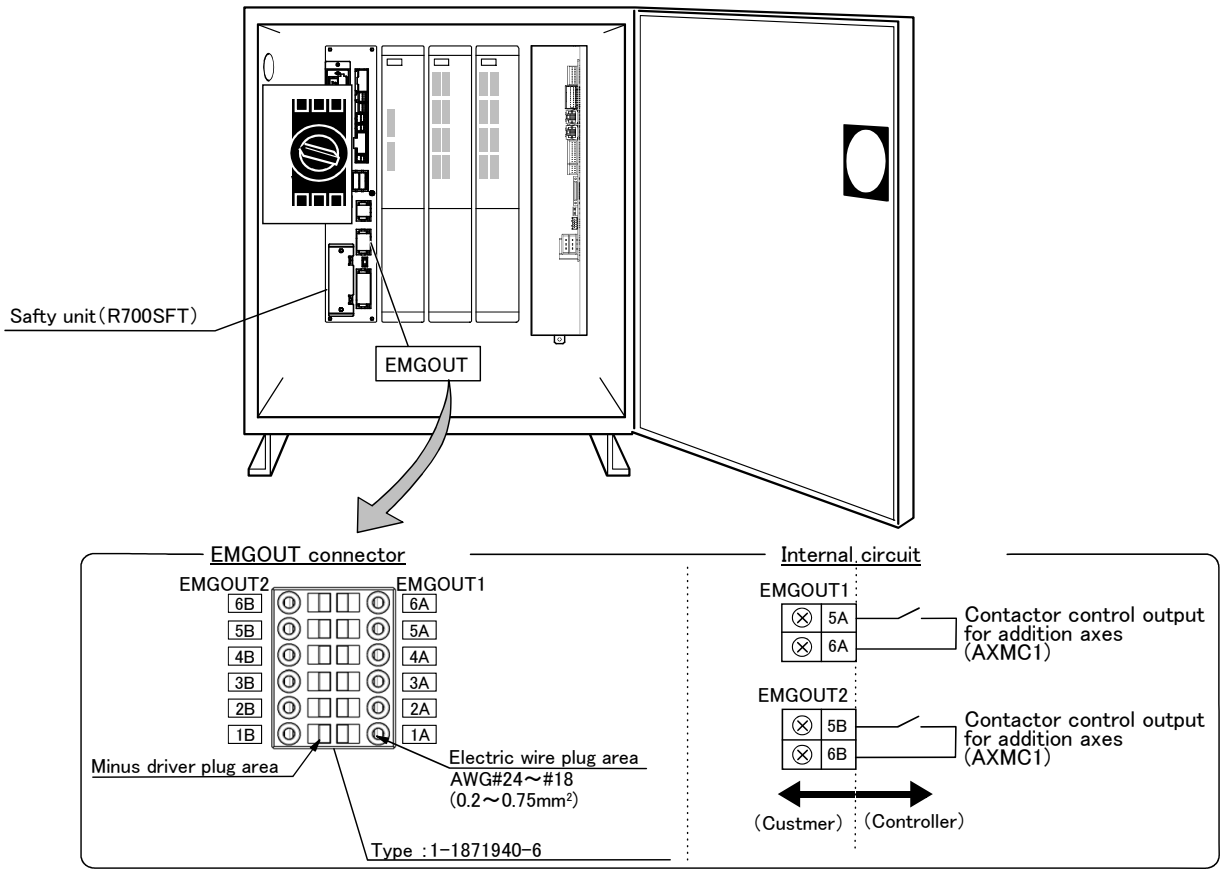


Fig.3-42 : EMGOUT connector (DU3-700/700M)

3.9 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: R32TB :Cable length 7m
R32TB-15 :Cable length 15m

■ Outline

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

■ Configuration

Table 3-9 : Configuration device

Part name	Type	Qty.	Mass(kg)Note1)	Remarks
Teaching pendant	R32TB	Either one pc.	1.7	Cable length is 7m. Hand strap is attached.
	R32TB-15		2.8	Cable length is 15m. Hand strap is attached.

Note1) Mass indicates one set.

■ Specifications

Table 3-10 : Specifications

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

*1) <3-position enable switch>
In ISO/10218 (1992) and JIS-B8433 (1993), this is defined as an "enable device". These standards specify that the robot operation using the teaching pendant is enabled only when the "enable device" is at a specified position.
With the Mitsubishi Electric industrial robot, the above "enable device" is configured of an "Enable/Disable switch" and "Deadman switch".
The 3-position deadman switch has three statuses. The following modes are entered according to the switch state.

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

*) Operations, such as program editing and status display, other than robot operation are possible.
Safety is secured as the servo power is turned OFF simultaneously with the input of the emergency stop.

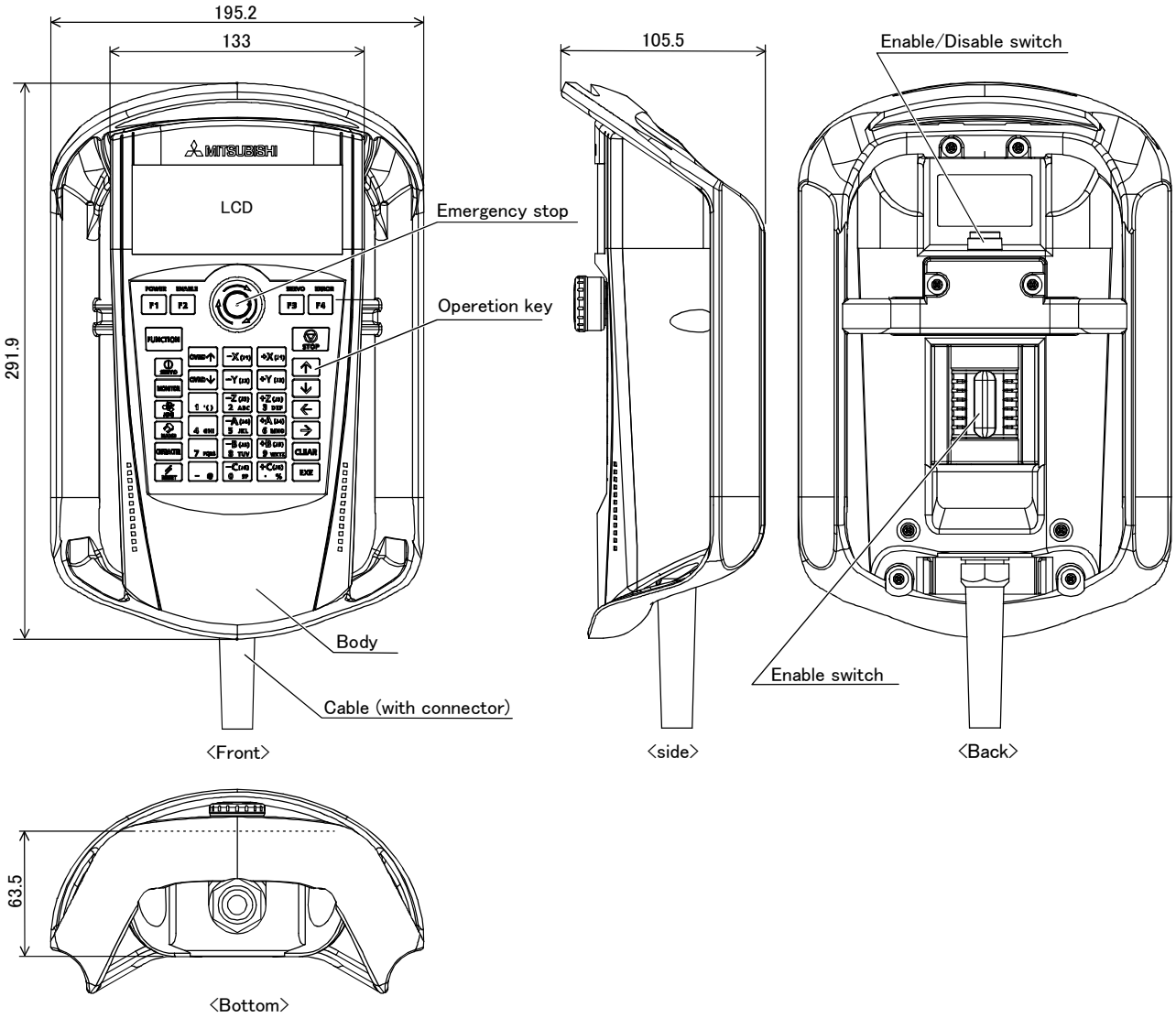


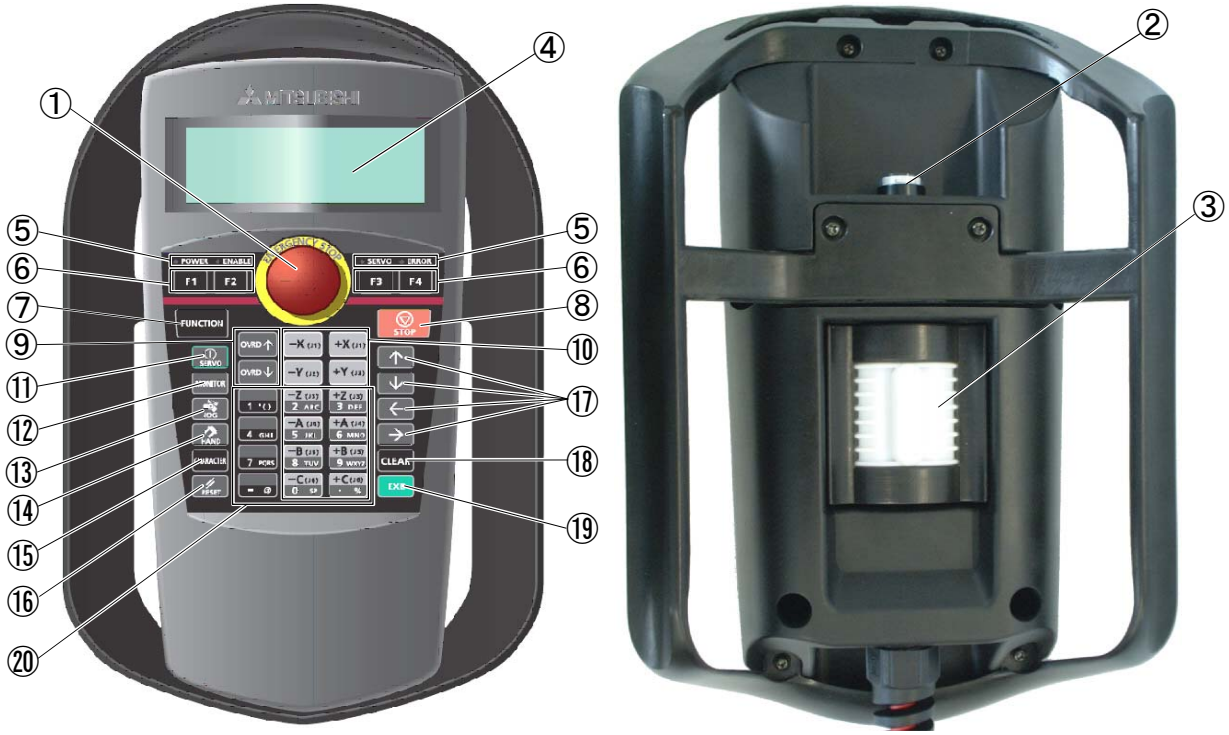
Fig.3-43 : Outside dimensions of teaching pendant

■ Installation method

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

Note) The connector may be felt hard if installation and removal of the teaching pendant or the dummy plug is repeated to the frequent.

■ Key layout and main functions



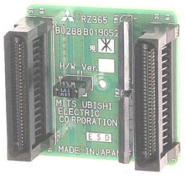
1) : [Emergency stop] switch..... The robot servo turns OFF and the operation stops immediately.
2) : [Enable/Disable] switch..... This switch changes the T/B key operation between enable and disable.
3) : [Enable] switch..... When the [Enable/Disable] switch "2)" is enabled, and this key is released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

Fig.3-44 : 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.

- Up to eight hand output points can be used with this interface.
- The eight hand input points can be used without this interface.
- The previous pneumatic hand interface can be used.

■ Configuration

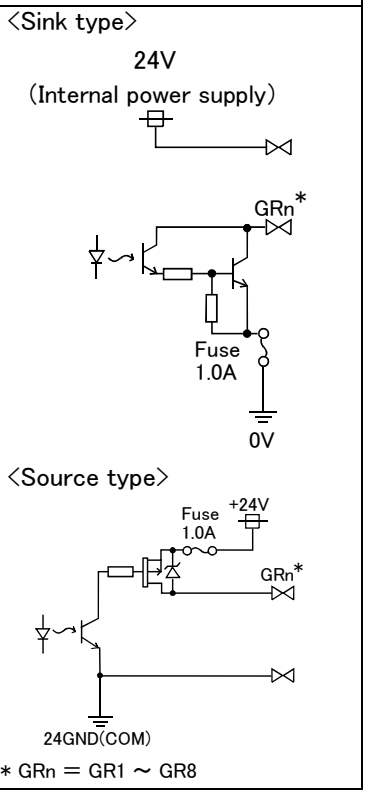
Table 3-11 : Configuration device

Part name	Type	Qty.	Mass(kg)Note1)	Remarks
Pneumatic hand interface	2A-RZ365(Sink type)	Either one pc.	0.1	Output 8 points expansion.
	2A-RZ375(Source type)		0.1	

Note1) Mass indicates one set.

■ Specifications

Table 3-12 : 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.) Note1)	
Response time	OFF-ON	2ms or less (hardware response time)	
	ON-OFF	2 ms or less (resistance load) (hardware response time)	
Fuse rating		Fuses 1.0A (each one common)	
Common method		8 points, 1 common	

Note1) The drop voltage maximum value at turning on the signal.
The available solenoid valve is that the specification of rated voltage is DC24V±10%

■ Installation method

This is mounted in the controller.

Attach the pneumatic hand interface (2A-RZ365/2A-RZ375) to the CNHNDOUT/CNHND connector of the hand interface relay card (2D-TZ315) securely. Refer to separate "Instruction Manual/ Controller setup, basic operation, and maintenance" for details on the installing method.

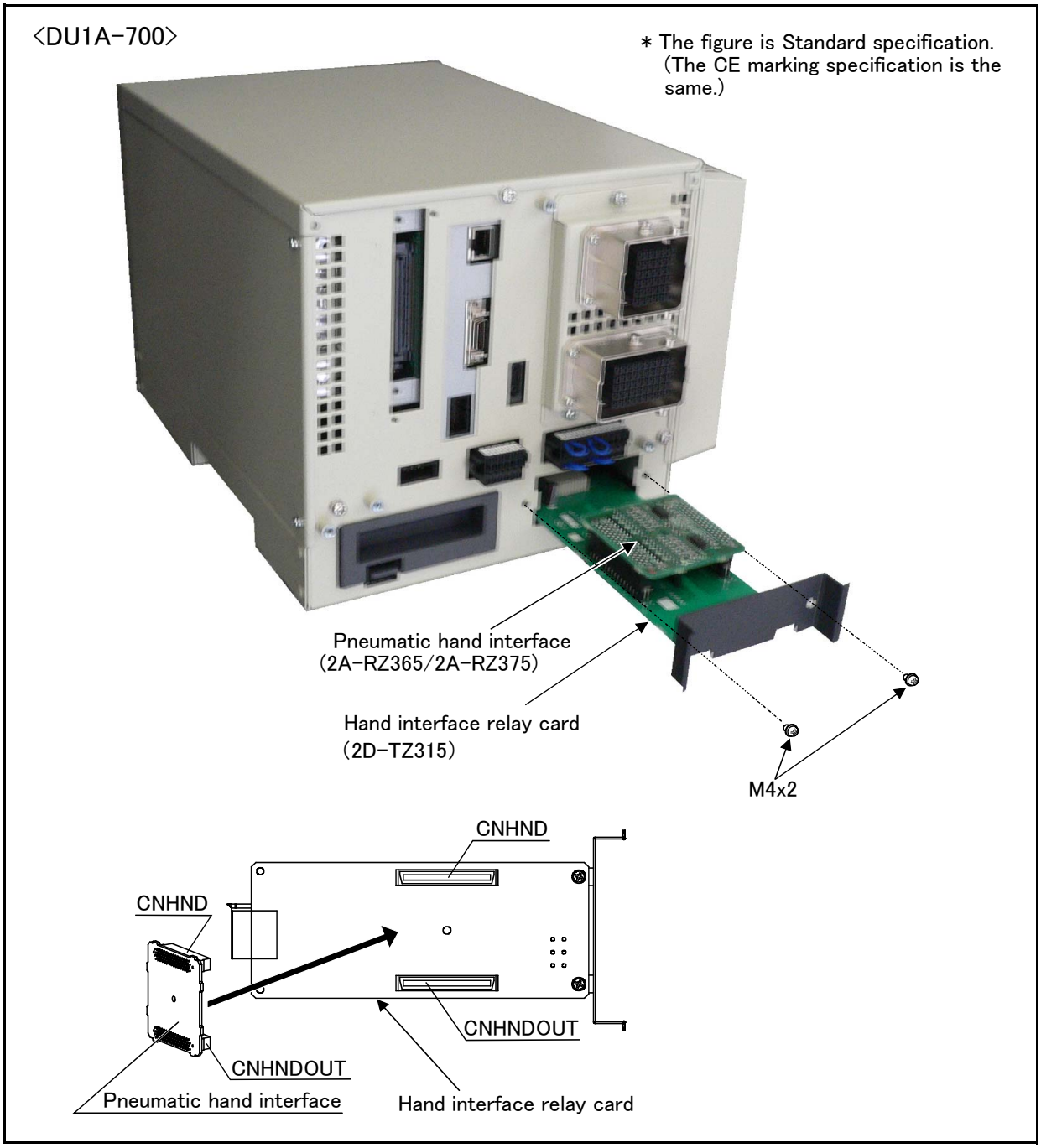


Fig.3-45 : Installation of the pneumatic hand interface (DU1A-700)

<DU2A-700>

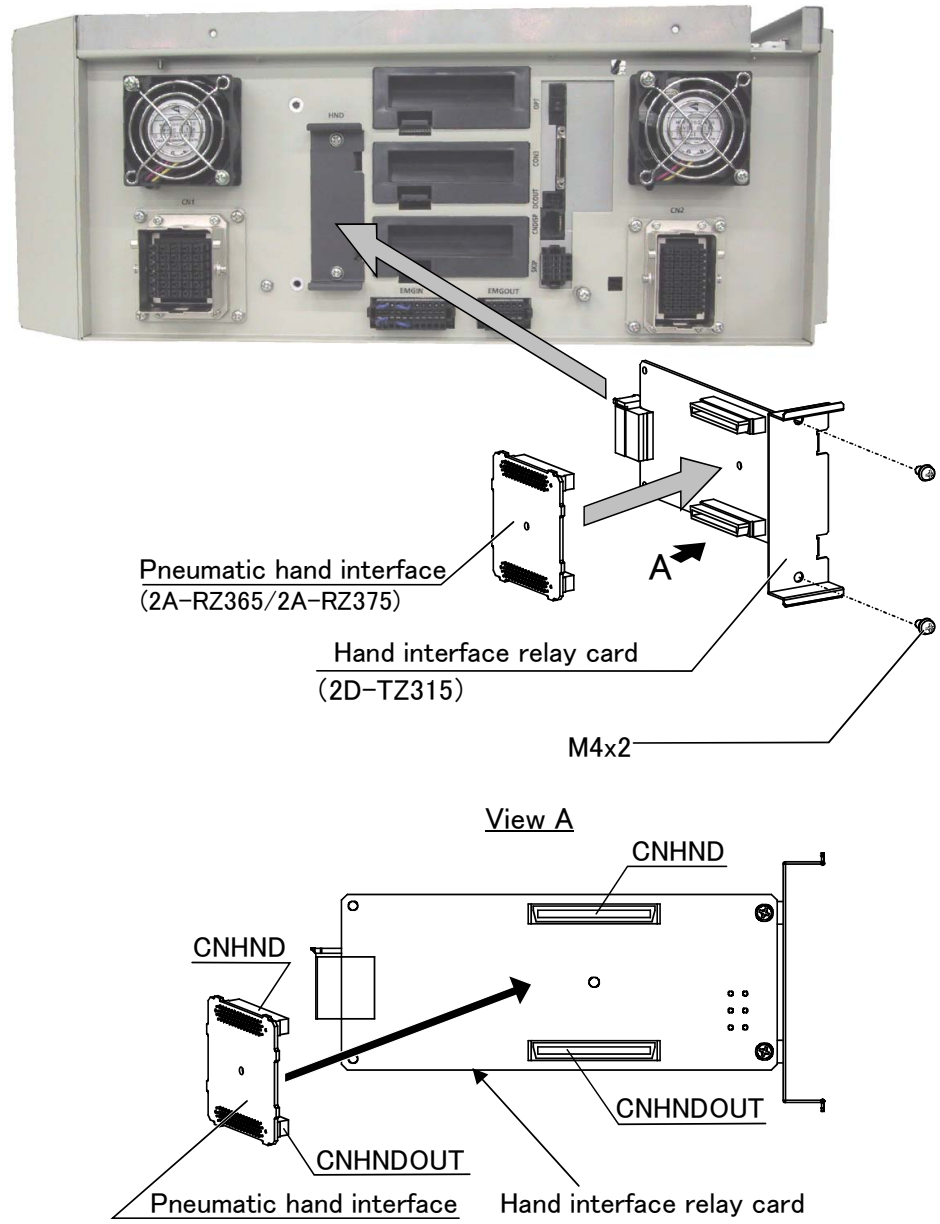


Fig.3-46 : Installation of the pneumatic hand interface (DU2A-700)

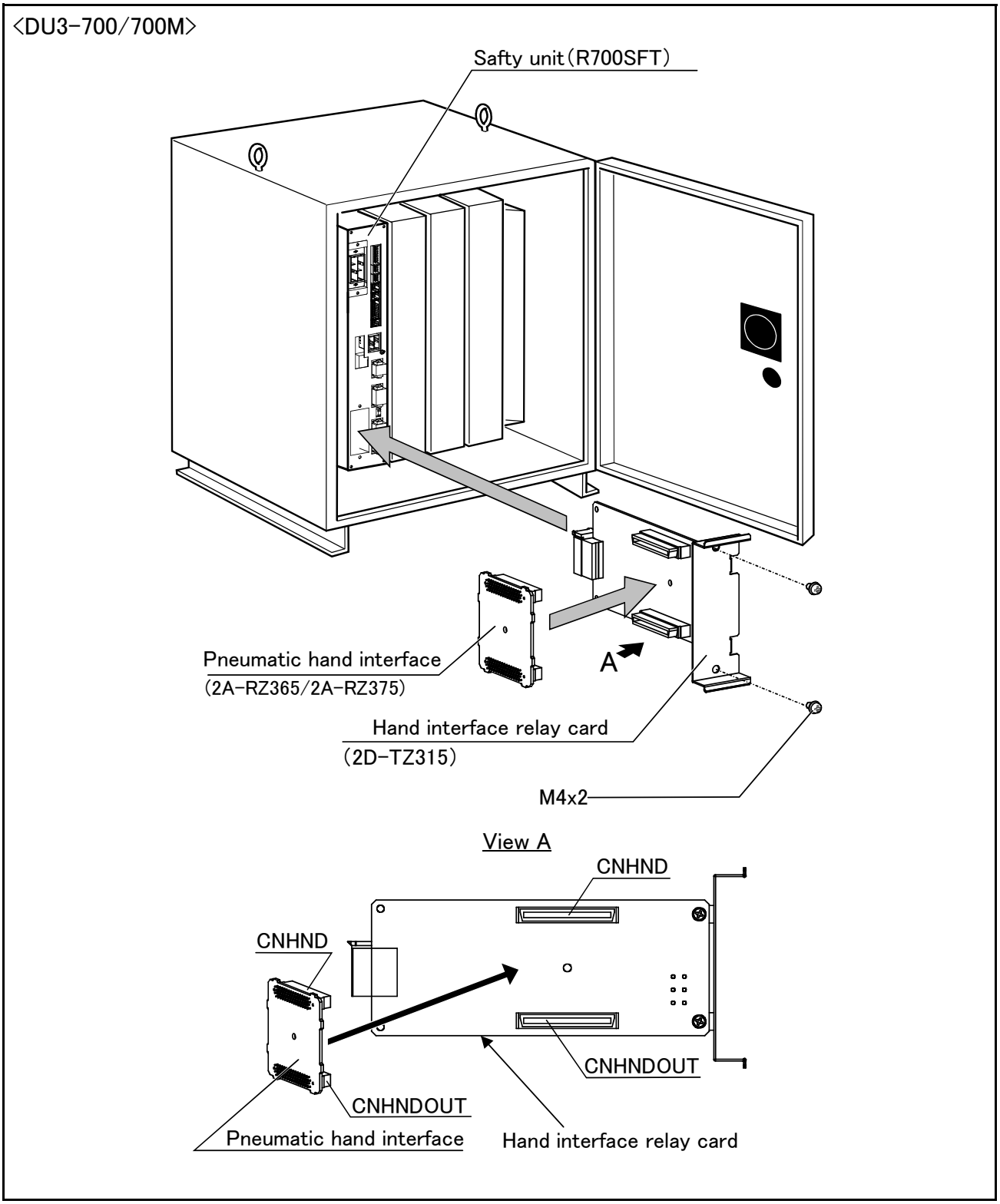


Fig.3-47 : Installation of the pneumatic hand interface (DU3-700/700M)

(3) RT ToolBox2/RT ToolBox2 mini

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

■ Outline

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

■ Configuration

Table 3-13 : Product configuration

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

Note1) Mass indicates one set.

■ Features

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

(2) Increased work efficiency with ample support functions
The work efficiency is greatly improved with the multi-window method that carries out multiple steps and displays in parallel. The renumbering function, and copy, search, syntax check and step execution are especially sufficient, and are extremely useful when editing or debugging the program.
With the simulation function support, the program can be debugged and the tact checked before starting the machine at the site. This allows the on-site startup work efficiently to be greatly improved.

(3) The maintenance forecast function increases the efficiency of maintenance work. Analyze the load condition while the robot is actually operating. Based on this analysis, calculate the time for maintenance, such as lubrication and belt replacement. By utilizing this information, the line stop time as well as the maintenance costs can be reduced.

(4) The position recovery support function increases the recovery efficiency in the event of origin position displacement. This function compensates the origin settings and position data by just reproducing several previous teaching points when hand and/or arm displacement occurs, when replacing the motor and the belts, or when reloading the robot. This function can reduce the time required for recovery.

■ Functions

Table 3-14 : Functions

Function		Functional existence[Note1)]		Details
Compatible model		○	○	Personal computer running Microsoft Windows2000/XP/Vista.
Program editing functions	Editing functions	○	○	・MELFA BASIC V language compatible ・Multiple editing screen simultaneously display ・Command input, comment writing ・Position data editing ・File operation (writing to controller, floppy disk, personal computer) ・Search and replace function (using characters, line Nos., labels) ・Copy, cut, paste, insert (per character, line), undo (per command statement, position conversion) ・Line No. automatic generation, renumbering ・Batch syntax check ・Command template ・Position conversion batch editing ・Position variable template ・Print, print preview
	Control functions	○	○	・Program file control (list, copy, movement, delete, content comparison, name change, protect)
	Debugging functions	○	○	・Direct editing of program in controller ・Confirmation of robot program operation (step execution, direct execution)
Simulation function		○	×	・Off-line simulation of robot program operation using CG (computer graphics) ・Tact time calculation
Monitor functions		○	○	・Robot operation monitor (robot operation state, stop signal, error monitor, program monitor (execution program, variables), general-purpose input/output signals (forced output possible), dedicated input/output signals, operation confirmation (operation range, current position, hand, etc.) ・Operation monitor (working time statistics, production information, robot version) ・Servo monitor (load)
Maintenance function		○	○	・Parameter setting ・Batch, divided backup

RT ToolBox2 mini (3D-12C-WINE)

RT ToolBox2 (3D-11C-WINE)

Note1) The functions included with the RT ToolBox2 and the RT ToolBox2 mini are shown below.
○ : Function provided ×: Function not provided

(4) Instruction Manual(bound edition)

■ Order type : ● 5S-QD00-PE01 (RH-6SQH/12SQH/18SQH/20SQH series)
● 5S-QL00-PE01 (RH-3SQHR series)

■ Outline

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

■ Configuration

Table 3-15 : Product configuration (RH-6SQH/12SQH/18SQH/20SQH series)

Name	Type	Mass(kg)Note1)	Specifications
Instruction Manual	5S-QD00-PE01	2.4	
Safety Manual	BFP-A8006	-	Items relating to safety in handling the robot
Standard Specifications	BFP-A8694	-	Specification of the robot arm and controller
Robot Arm Setup & Maintenance	BFP-A8695	-	Installation method of the robot arm, jog operation, and maintenance and inspection procedures
Controller Setup, Basic Operation and Maintenance		-	Installation method of the controller, basic operation, and maintenance and inspection procedures
Detailed Explanation of Functions and Operations	BFP-A8586	-	Functions of the controller and T/B, operation method, and explanation of MELFA-BASIC V
Troubleshooting	BFP-A8588	-	Causes of errors occurred and their countermeasures
Additional axis function	BFP-A8663	-	Function of the additional axis, operation method.
Tracking Function Manual	BFP-A8664	-	Function of the Tracking, operation method.
Extended Function Instruction Manual	BFP-A8787	-	Function of the Extended, operation method.

Note1) Mass indicates one set.

Table 3-16 : Product configuration (RH-3SQHR series)

Name	Type	Mass(kg)Note1)	Specifications
Instruction Manual	5S-QL00-PE01	2.4	
Safety Manual	BFP-A8006	-	Items relating to safety in handling the robot
Standard Specifications	BFP-A8694	-	Specification of the robot arm and controller
Robot Arm Setup & Maintenance	BFP-A8840	-	Installation method of the robot arm, jog operation, and maintenance and inspection procedures
Controller Setup, Basic Operation and Maintenance		-	Installation method of the controller, basic operation, and maintenance and inspection procedures
Detailed Explanation of Functions and Operations	BFP-A8586	-	Functions of the controller and T/B, operation method, and explanation of MELFA-BASIC V
Troubleshooting	BFP-A8588	-	Causes of errors occurred and their countermeasures
Additional axis function	BFP-A8663	-	Function of the additional axis, operation method.
Tracking Function Manual	BFP-A8664	-	Function of the Tracking, operation method.
Extended Function Instruction Manual	BFP-A8787	-	Function of the Extended, operation method.

Note1) Mass indicates one set.

3.10 Maintenance parts

The consumable parts used in the controller are shown in Table 3-17. 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 3-17 : Controller consumable parts list

No.	Name	Type Note1)	Qty.	Usage place	Supplier
CR1QA-700 series controller					
1	Lithium battery	Q6BAT	1	Robot CPU unit	Mitsubishi Electric System Service;Co.,Ltd
2	Filter		1	Front of the controller	
CR2QA-700 controller					
1	Lithium battery	Q6BAT	1	Robot CPU unit	Mitsubishi Electric System Service;Co.,Ltd
2	Filter		1	Front of the controller	
CR3Q-700 controller					
1	Lithium battery	Q6BAT	1	Robot CPU unit	Mitsubishi Electric System Service;Co.,Ltd
2	Fan (40 square)		5	Amplifier unit Converter unit	
3	Fan (90 square)		1	Control unit	
4	Filter		1	Controller rear	

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

4 Software

4.1 List of commands

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

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

Type	Class	Function	Input format (example)
Position and operation control	Joint interpolation	Moves to the designated position with joint interpolation.	Mov P1
	Linear interpolation	Moves to the designated position with linear interpolation.	Mvs P1
	Circular interpolation	Moves along a designated arc (start point → passing point → start point (end point)) with 3-dimensional circular interpolation (360 degrees).	Mvc P1,P2,P1
		Moves along a designated arc (start point → passing point → end point) with 3-dimensional circular interpolation.	Mvr P1,P2,P3
		Moves along the arc on the opposite side of a designated arc (start point → reference point → end point) with 3-dimensional circular interpolation.	Mvr2 P1,P9,P3
		Moves along a set arc (start point → end point) with 3-dimensional circular interpolation.	Mvr3 P1,P9,P3
	Speed designation	Designates the speed for various interpolation operations with a percentage (0.1% unit).	Ovrd 100
		Designate the speed for joint interpolation operation with a percentage (0.1% unit).	JOvrd 100
		Designates the speed for linear and circular interpolation with a numerical value (mm/s unit).	Spd 123.5
		Designates the acceleration/deceleration time as a percentage in respect to the predetermined maximum acceleration/deceleration. (1% unit)	Accel 50,80
		Automatically adjusts the acceleration/deceleration according to the parameter setting value.	Oadl ON
		ets the hand and work conditions for automatic adjustment of the acceleration/deceleration.	LoadsetT 1,1
	Operation	Performance of movement is upgraded corresponding to the application.	MvTune 4
		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
		Designates the positioning completion conditions with a joint interpolation.	Fine 0.5, J, 2
		Designates the positioning completion conditions with a distance in a straight line	Fine 1, P
		Turns the servo power ON/OFF for all axes.	Servo OFF
		Limits the operation of each axis so that the designated torque is not exceeded.	Torq 4,10
	Position control	Designates the base conversion data.	Base P1
		Designates the tool conversion data.	Tool P1
	Float control	The robot arm rigidity is lowered and softened. (XYZ coordinate system)	Cmp Pos ,&B00000011
		The robot arm rigidity is lowered and softened. (JOINT coordinate system)	Cmp Jnt ,&B00000011
		The robot arm rigidity is lowered and softened. (TOOL coordinate system)	Cmp Tool ,&B00000011
		The robot arm rigidity is returned to the normal state.	Cmp Off
		The robot arm rigidity is designated.	Cmpg 1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0
	Pallet	Defines the pallet.	Def Plt 1,P1,P2,P3,P4,5,3,1
		Operates the pallet grid point position.	Plt 1,M1
	Singular point passage	Move to a specified position using linear interpolation passing through a singular point.	Mvs P1 TYPE 0,2

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

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

4.2 List of parameters

show the main parameter in the Table 4-2.

Table 4-2 : List of parameters

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

Parameter		Details
Hand type	HANDTYPE	Set the hand type of the single/double solenoid, and the signal No. (Single/double = S/D) Set the signal No. after the hand type. Example) D900
Stop input B contact designation	INB	Change the dedicated input (stop) 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.	LNG	Change the language to display on the LCD display of teaching pendant.

5 Instruction Manual

5.1 The details of each instruction manuals

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

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

Extended Function Instruction Manual	Explains the detailed description of data configuration of shared memory, monitoring, and operating procedures, about the PLC (CRnD-700 series controller).

6 Safety

6.1 Safety

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

6.1.1 Self-diagnosis stop functions

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

Table 6-1 : Self-diagnosis stop functions

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

Table 6-2 : List of stop functions

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

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

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

	Signal	Connection point	Parameter	Functions	Usage method
Input	External emergency stop	Terminal (EMG IN)	–	This servo power is shut off, and the robot stops immediately.	Externally installed emergency stop switch. Door switch on safety protection fence. Stopping at high-level error occurrence.
	Door switch		–		The door switch of the safe protection fence
	Enabling device input		–		Enabling device. The safety switch during teaching work
	Stop	Sequencer unit	STOP	The program execution is stopped, and the robot stops. The servo power is not shut off.	The robot is stopped when a peripheral device fault occurs. The servo power is not shut off.
	Servo OFF		SRVOFF	The servo power can be shut off.	The robot is stopped when a peripheral device fault occurs. The servo power is not shut off.
	Automatic operation enable		AUTOENA	Disables automatic operation when inactive.	Door switch on safety protection fence
Output	In servo ON	Sequencer unit	SRVON	The servo power ON/OFF state is output.	The servo power ON/OFF state is shown and alerted with the display lamps.
	Waiting		STOP	Outputs that the robot is temporarily stopped.	The temporary stop state is shown and alerted with the display lamps.
	In alarm		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 Page 188, "6.1.7 Examples 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.

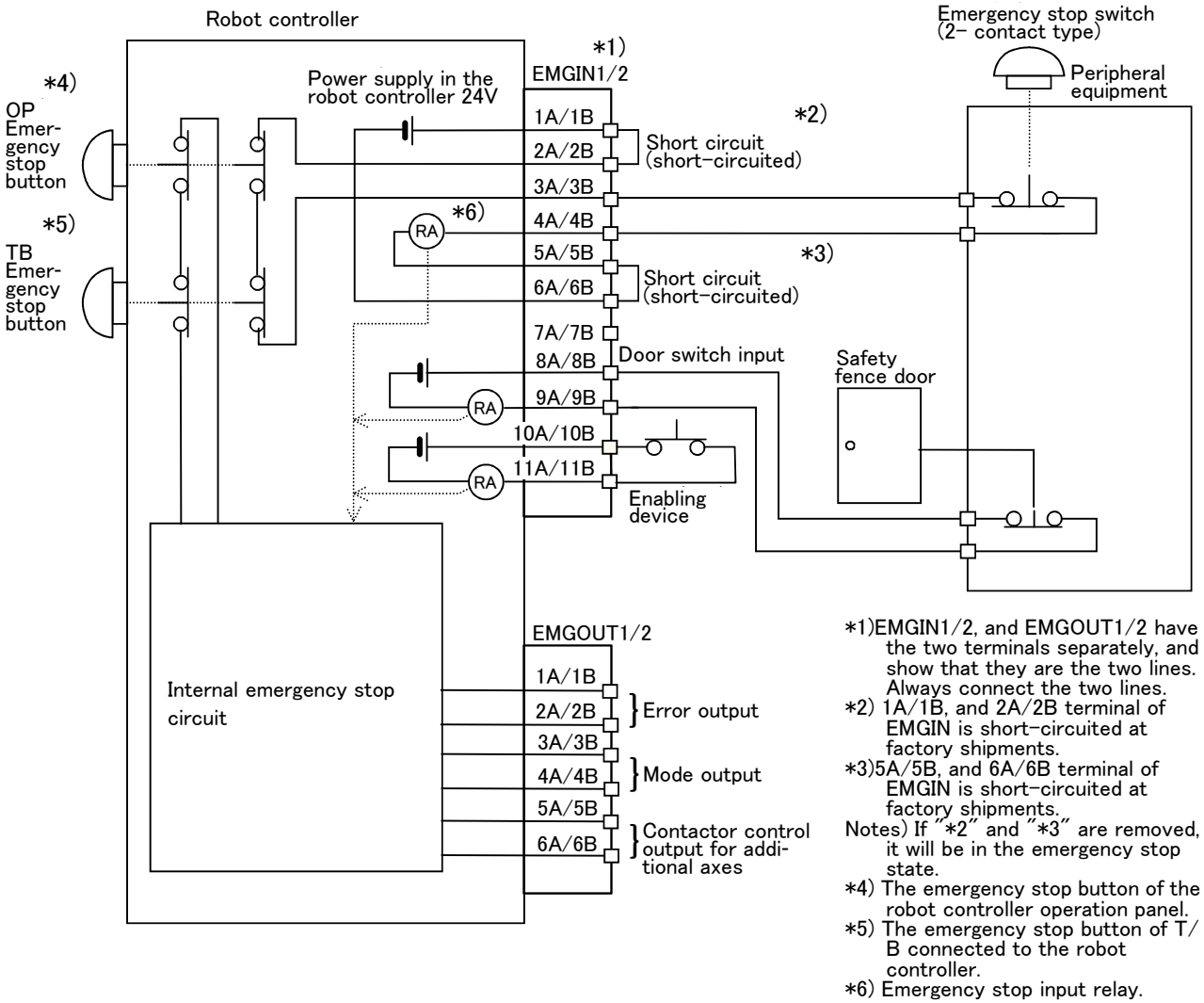
6.1.7 Examples of safety measures

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

[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 192, "(1) External emergency stop connection [supplementary explanation]" and Page 148, "3.6.1 Connection of the external emergency stop".

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

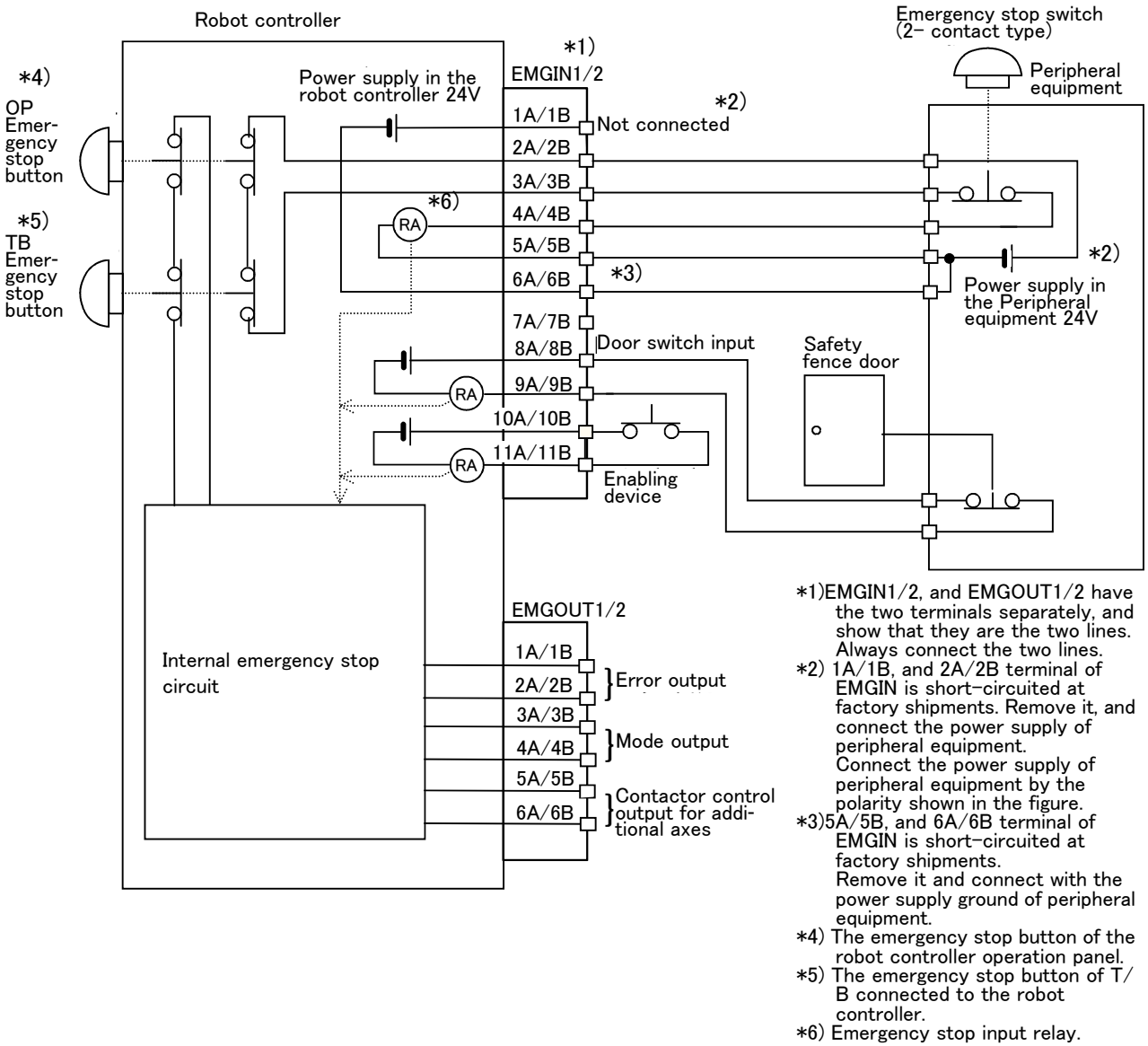
<Wiring example 1>: Connect the emergency stop switch of peripheral equipment to the robot controller.
The power supply for emergency stop input uses the power supply in the robot controller.
<Operation of the emergency stop>
If the emergency stop switch of peripheral equipment is pushed, the robot will also be in the emergency stop state.



[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 151, "Fig.3-30 : External emergency stop connection".

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

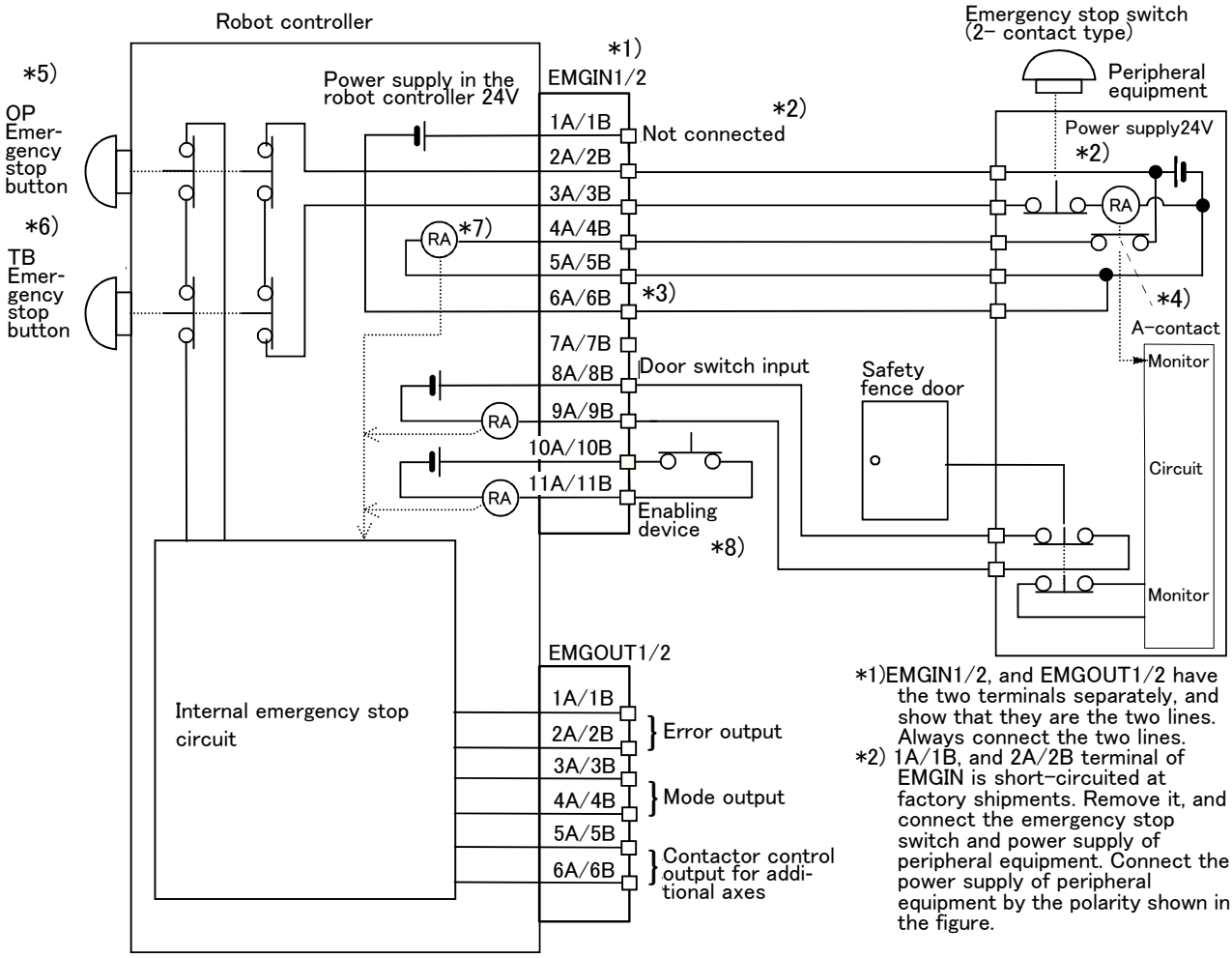
<Wiring example 2>: Connect the emergency stop switch of peripheral equipment to the robot controller.
The power supply for emergency stop input uses the power supply of peripheral equipment.
<Operation of the emergency stop>
If the emergency stop switch of peripheral equipment is pushed, the robot will also be in the emergency stop state.



[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 151, "Fig.3-30 : External emergency stop connection".

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

<Wiring example 3>: Connect the emergency stop switch, door switch, and enabling device of peripheral equipment to the robot controller. The power supply for emergency stop input uses the power supply of peripheral equipment. Monitor the emergency stop state by the peripheral equipment side.
<Operation of the emergency stop>
If the emergency stop switch of peripheral equipment is pushed, the robot will also be in the emergency stop state. And, if the emergency stop switch of OP or T/B is pushed in the state of the power of robot controller OFF, peripheral equipment state can be the emergency stop also.



*1)EMGIN1/2, and EMGOUT1/2 have the two terminals separately, and show that they are the two lines. Always connect the two lines.
*2) 1A/1B, and 2A/2B terminal of EMGIN is short-circuited at factory shipments. Remove it, and connect the emergency stop switch and power supply of peripheral equipment. Connect the power supply of peripheral equipment by the polarity shown in the figure.

*3)5A/5B, and 6A/6B terminal of EMGIN is short-circuited at factory shipments. Remove it and connect with the power supply ground of peripheral equipment.
*4) Please use a A contact type of the relay with the compulsive guide.
*5) The emergency stop button of the robot controller operation panel.
*6) The emergency stop button of T/B connected to the robot controller.
*7) Emergency stop input relay.
*8) Refer to Page 154, "3.6.4 Enabling device function"for the enabling device.

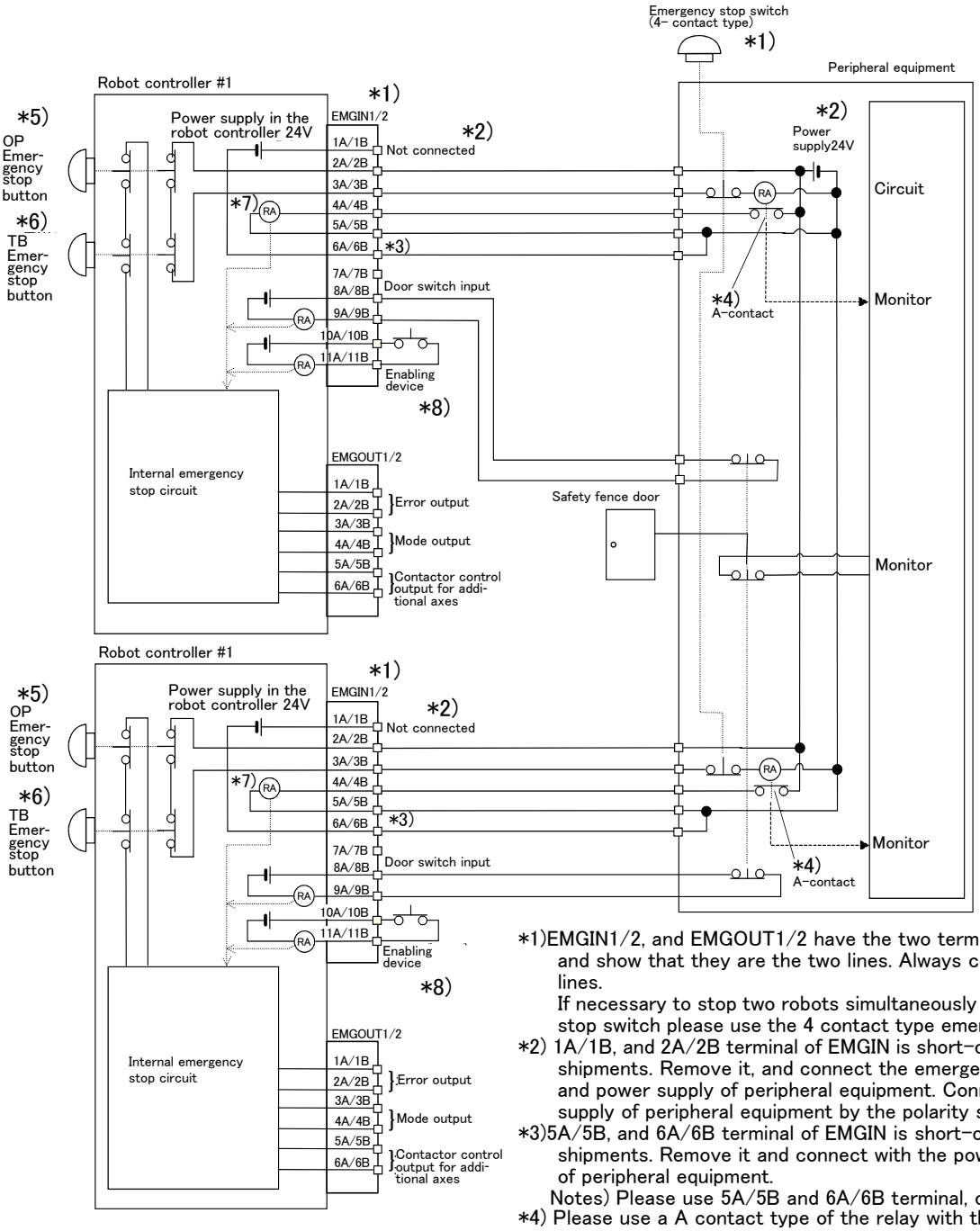
[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 151, "Fig.3-30 : External emergency stop connection".

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

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

<Operation of the emergency stop>

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



*1)EMGIN1/2, and EMGOUT1/2 have the two terminals separately, and show that they are the two lines. Always connect the two lines.
If necessary to stop two robots simultaneously by one emergency stop switch please use the 4 contact type emergency stop switch.

*2) 1A/1B, and 2A/2B terminal of EMGIN is short-circuited at factory shipments. Remove it, and connect the emergency stop switch and power supply of peripheral equipment. Connect the power supply of peripheral equipment by the polarity shown in the figure.

*3)5A/5B, and 6A/6B terminal of EMGIN is short-circuited at factory shipments. Remove it and connect with the power supply ground of peripheral equipment.
Notes) Please use 5A/5B and 6A/6B terminal, connected.

*4) Please use a A contact type of the relay with the compulsive guide.

*5) The emergency stop button of the robot controller operation panel.

*6) The emergency stop button of T/B connected to the robot controller.

*7) Emergency stop input relay.

*8) Refer to Page 154, "3.6.4 Enabling device function"for the enabling device.

[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 151, "Fig.3-30 : External emergency stop connection".

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

(1) External emergency stop connection [supplementary explanation]

(1) Use a 2-contact type switch for all switches.

(2) Install a limit switch on the safety fence's door. With a constantly open contact (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 2b-contact 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 to Fig. 6-4. Note that there are limits to the No. of switch contacts, capacity and cable length, so refer to the following and install.

- Switch contact.....Prepare a 2-contact type.*1)
- Switch contact capacity.....Use a contact that operates with a switch contact capacity of approx. 1mA to 100mA/24V. *1)
  If you connect the relay etc., rated current of the coil should use the relay which is 100mA/24V or less. (Refer to Fig. 6-5)
- Cable length.....The length of the wire between the switch and terminal block must be max. 15m or less. Please use the shield line, in case of the cable may receive the noise etc. by other equipment, such as servo amplifier. And, since the ferrite core is attached as noise measures parts, please utilize.

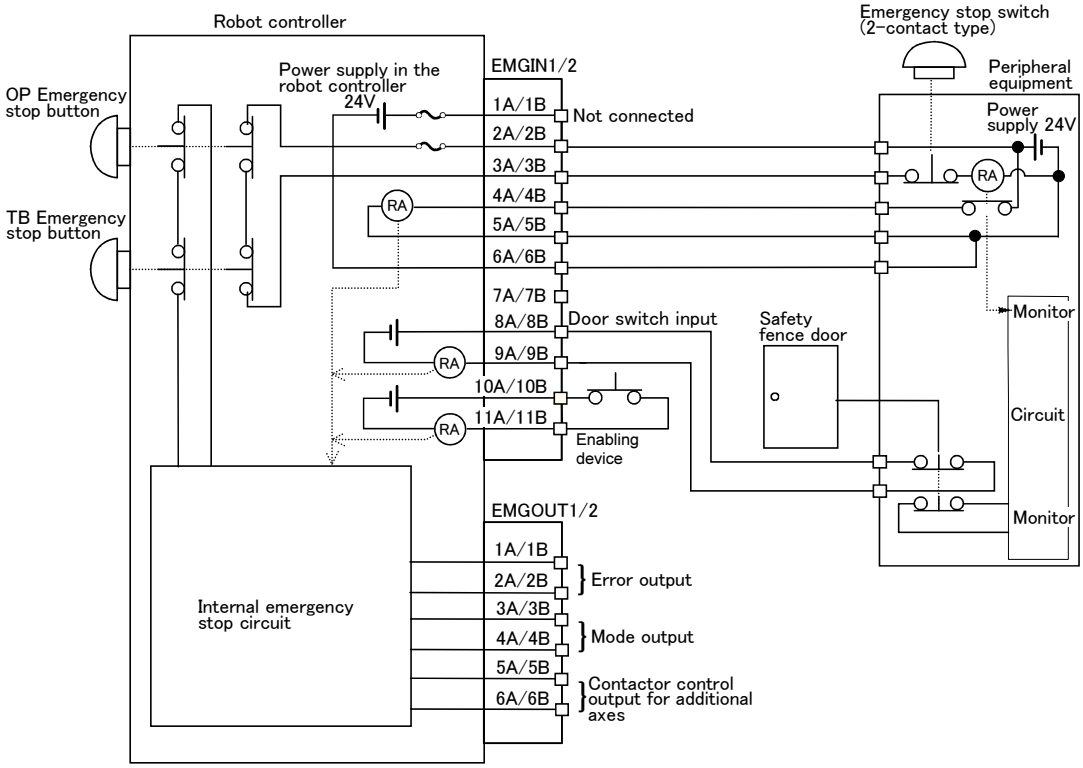


Fig.6-5 : Limitations when connecting the relay etc.

⚠CAUTION You should always connect doubly connection of the emergency stop, the door switch, and the enabling switch. (Connect with both of side-A and side-B of the controller rear connector) In connection of only one side, if the relay of customer use should break down, it may not function correctly.

⚠CAUTION Be sufficiently careful and wiring so that two or more emergency stop switches work independently. Don't function only on AND conditions (Two or more emergency stop switch status are all ON).

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

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.)
- Where there is heavy powder dust and oil mist present.

6.3 Precautions for handling

(1) The RH-6SQH/12SQH series has brakes on J3 axis. The RH-18SQH/20SQH series has brakes on J3 axis 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 shaft section could interfere with the base section. Take care to prevent interference during jog. *1)

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

(5) RH-3SQHR series robot shaft (J3 axis) is made into the structure which can let the optional hand tube and hand input cable pass through. The grease is applied to the contact sections of inside of the shaft, and the piping fixing bracket because to reduce these frictions. Although this grease and worn-out dust may stain at end of the shaft during robot movement, it does not have effect on robot movement. Please wipe off the grease if necessity.

(6) The robot arm and controller must be grounded with Class D grounding to secure the noise resistance and to prevent electric shocks.

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

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

(8) When using the robot arm on a mobile axis or elevating table, the machine cables enclosed as standard configuration may break due to the fixed installation specifications. In this case, use the machine cable extension (for flexed)" factory shipment special specifications or options.
(9) If this robot interferes with the workpiece or peripheral devices during operation, the position may deviate, etc. Take care to prevent interference with the workpiece or peripheral devices during operation.
(10) Do not attach a tape or a label to the robot arm and the controller. If a tape or a label with strong adhesive power, such as a packaging tape, is attached to the coated surfaces of the robot arm and controller, the coated surface may be damaged when such tape or label is peeled off.
(11) If the robot is operated with a heavy load and at a high speed, the surface of the robot arm gets very hot. It would not result in burns, however, it may cause secondary accidents if touched carelessly.
(12) Do not shut down the input power supply to stop the robot. If the power supply is frequently shut down during a heavy load or high-speed operation, the speed reducer may be damaged, backlash may occur, and the program data may be destroyed.
(13) 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.
(14) Do not conduct an insulated voltage test. If conducted by mistake, it may result in a breakdown.
(15) Fretting may occur on the axis which moving angle or moving distance move minutely, or not moves. Fretting is that the required oil film becomes hard to be formed if the moving angle is small, and wear occurs. The axis which not moved is moving slightly by vibration etc. To make no fretting recommends to move these axes about once every day the 30 degree or more, or the 30mm or more.
(16) The United Nations' Recommendations on the Transport of Dangerous Goods must be observed for trans-border transportation of lithium batteries by air, sea, and land. The lithium batteries (Q6BAT,A6BAT) used in Mitsubishi industrial robots contain less than 1 g of lithium and are not classified as dangerous goods. However, if the quantity of lithium batteries exceeds 24 batteries for storage, etc., they will be classified as Class 9: Miscellaneous dangerous substances and articles. Shipping less than 24 batteries is recommended to avoid having to carry out transport safety measures as the customer's consignor. Note that some transportation companies may request an indication that the batteries are not dangerous goods be included on the invoice. For shipping requirement details, please contact your transportation company.
(17) If the air supply temperature (primary piping) used for the tool etc. is lower than ambient air temperature, the dew condensation may occur on the coupling or the hose surface.
(18) Collision detection function is valid condition for both of automatic and jog operation at shipping.
So, the robot stops immediately if the robot's tool or arm interferes with a peripheral device, minimizing damage. Therefore, please use in the valid condition.

⚠CAUTION To the users of the RH-A series
The coordinate system of axis J3 of the RH-SQ series has been changed from the conventional RH-A series.*1) 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-SQ series robot. Please be sure to check the robot operation position via step operation and teach the robot again if the position is wrong.

*1) 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-SQH series.....JOINT coordinate value = XYZ coordinate value

7 Appendix

Appendix 1 : Specifications discussion material (Floor installation specification)

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased mode (Floor installation specification)

Item	Specification															
Load	☐ 6kg				☐ 12kg				☐ 18kg				☐ 20kg			
Environment Note1)	☐ General	☐ C	☐ M	☐ SM	☐ General	☐ C	☐ M	☐ SM	☐ General	☐ C	☐ M	☐ SM	☐ General	☐ C	☐ M	☐ SM
Arm length	☐ 350 ☐ 450 ☐ 550				☐ 550 ☐ 700 ☐ 850				☐ 850				☐ 850 ☐ 1000			
Stroke	☐ 200 ☐ 320	☐ 170 ☐ 270			☐ 350 ☐ 450	☐ 300 ☐ 380			■ 350	■ 300			☐ 350 ☐ 450	☐ 300 ☐ 380		
Robot type name	RH- ☐☐ SQH ☐☐☐☐☐ - ☐☐☐															
CE Marking	☐ Not provided	☐ "-S12" ☐ "-S15" ☐ "-S312"			☐ Not provided	☐ "-S12"			☐ Not provided	☐ "-S12"			☐ Not provided			

Note1) C: Clean、M: Oil mist、SM: Protection specification controller
Refer to the Page 2, "1.2 Model type name of robot" 2-page for the details of the robot arm type name.

■ 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(RH6SQH series)/ 1S-02UCBL-01(RH-12SQH/18SQH/20SQH series)

■ Options (Installable after shipment)

Item		Type	Provision, and specifications when provided.
Robot arm	Machine cable extention	1S- ☐☐ CBL-03	RH-6SQH Fixing : ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
		1S- ☐☐ LCBL-03	RH-6SQH Bending : ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
		1S- ☐☐ CBL-01	RH-12SQH/18SQH/20SQH Fixing : ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
		1S- ☐☐ LCBL-01	RH-12SQH/18SQH/20SQH Bending : ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
	Solenoid valve set	1S-VD04M-04	RH-6SQH : ☐ Not provided ☐ Provided
		1S-VD04ME-04	RH-6SQH : ☐ Not provided ☐ Provided
		1S-VD04M-03	RH-12SQH/18SQH/20SQH : ☐ Not provided ☐ Provided
		1S-VD04ME-03	RH-12SQH/18SQH/20SQH : ☐ 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-6SQH : ☐ Not provided ☐ Provided
		1N-ST0608C	RH-12SQH/18SQH/20SQH85** : ☐ Not provided ☐ Provided
		1N-ST0608C-01	RH-20SQH100** : ☐ Not provided ☐ Provided
Controller	Teaching pendant	R32TB- ☐☐	☐ Not provided ☐ 7m ☐ 15m
		R56TB- ☐☐	☐ Not provided ☐ 7m ☐ 15m
	Pneumatic hand interface	2A-RZ365/2A-RZ375	☐ Not provided ☐ 2A-RZ365(Sink) ☐ 2A-RZ375(Source)
	Controller protection box	CR1D-MB	☐ Not provided ☐ Provided
	The set of cable between drive unit and robot CPU Note1)	2Q-RC-CBL ☐☐ M	☐ Not provided ☐ 5m ☐ 10m ☐ 20m ☐ 30m
	RT ToolBox2	3D-11C-WINE	☐ Not provided ☐ Windows2000/XP/Vista English CD-ROM
	RT ToolBox2 mini	3D-12C-WINE	☐ Not provided ☐ Windows2000/XP/Vista English CD-ROM
	Instructions manual	5S-QD00-PE01	☐ Not provided ☐ Provided ( ) set

Note1) The four type cables shown in below are contained.
1)2Q-TUCBL ☐☐ M, 2)2Q-DISPCBL ☐☐ M, 3)2QEMICBL ☐☐ M,
4)MR-J3BUS ☐☐ M-A (5m, 20m) or MR-J3BUS ☐☐ M-A (30m)

■ Maintenance parts (Consumable parts)

Maintenance parts	☐ Backup batteries A6BAT ( ) pcs. ☐ Backup batteries Q6BAT ( ) pcs. ☐ Grease ( ) cans

■ Robot selection check list

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

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Appendix 2 : Specifications discussion material (Hanging installation specification)

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased mode (Hanging installation specification)

Item	Specification		
Load	■ 3kg		
Environment	☐ General	☐ Clean	☐ Waterproof
Arm length	■ 350		
Stroke	■ 150	■ 120	
Robot type name	RH-3SQHR3515	RH-3SQHR3512C	RH-3SQHR3512W

■ 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-01(RH-3SQHR series)

■ Options (Installable after shipment)

Item		Type	Provision, and specifications when provided.
Robot arm	Operating range change	1S-DH-05J1	☐ Not provided ☐ Provided
		1S-DH-05J2	☐ Not provided ☐ Provided
	Machine cable extension	1S- ☐☐ CBL-01	Fixing : ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
		1S- ☐☐ LCBL-01	Bending : ☐ Not provided ☐ 5m ☐ 10m ☐ 15m
	Solenoid valve set	1S-VD04-05 (Sink) 1S-VD04E-05(Source)	Standard/Clean specification: ☐ Not provided ☐ 1S-VD04-05 ☐ 1S-VD04E-05
		1S-VD04W-05 (Sink) 1S-VD04WE-05(Source)	Waterproof specification ☐ Not provided ☐ 1S-VD04W-05 ☐ 1S-VD04WE-05
	Hand input cable	1S-HC00S-01	☐ Not provided ☐ Provided
	Hand output cable	1S-GR35S-02	☐ Not provided ☐ Provided
	Hand tube	1E-ST0304S	☐ Not provided ☐ Provided
Controller	Teaching pendant	R32TB- ☐☐	☐ Not provided ☐ 7m ☐ 15m
		R56TB- ☐☐	☐ Not provided ☐ 7m ☐ 15m
	Pneumatic hand interface	2A-RZ365/2A-RZ375	☐ Not provided ☐ 2A-RZ365(Sink) ☐ 2A-RZ375(Source)
	The set of cable between drive unit and robot CPU[Note1)]	2Q-RC-CBL ☐☐ M	☐ Not provided ☐ 5m ☐ 10m ☐ 20m ☐ 30m
	RT ToolBox2	3D-11C-WINE	☐ Not provided ☐ Windows2000/XP/Vista Englishi CD-ROM
	RT ToolBox2 mini	3D-12C-WINE	☐ Not provided ☐ Windows2000/XP/Vista Englishi CD-ROM
	Instructions manual	5S-QL00-PE01	☐ Not provided ☐ Provided ( ) set

Note1) The four type cables shown in below are contained.
1)2Q-TUCBL ☐☐ M, 2)2Q-DISPCBL ☐☐ M, 3)2QEMICBL ☐☐ M,
4)MR-J3BUS ☐☐ M-A (5m, 20m) or MR-J3BUS ☐☐ M-A (30m)

■ Maintenance parts (Consumable parts)

Maintenance parts	☐ Backup batteries A6BAT ( ) pcs. ☐ Backup batteries Q6BAT ( ) pcs. ☐ Grease ( ) 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 ☐ Waterproof ☐ Other( )
Remarks		

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

Product Service

EC-Statement of Compliance

No. E6 12 03 25554 042

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

Name of Object: **Industrial, Scientific and Medical equipment**
Industrial Robot

Model(s): **SQ series**
(See Attachment for Nomenclature)

Description of Object:

Rated Voltage:	230 VAC (1 phase)/ 230 VAC, 400 VAC (3 phase)
Rated Power:	0.6 kW (230 VAC)/ 1.7 kW (230 VAC)/ 3.4 kW (230 VAC, 400 VAC)
Protection Class:	I

Tested according to:
EN 61000-6-4:2007
EN 61000-6-2:2005

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

Technical report no.: 73536415

Date, 2012-03-05 (Johann Roidt)

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

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

TÜV®

Attachment
Statement No.

E6 12 03 25554 042

Product Service

SQ series Grouping Items

1. AC 400V /230V 3 phase 3.4kW

1. RV-12SQ(-S**)
2. RV-12SQL(-S**)
3. RV-12SQC(-S**)
4. RV-12SQLC(-S**)
5. RV-12SQ-SUL**
6. RV-12SQL-SUL**
7. RV-12SQC-SUL**
8. RV-12SQLC-SUL**
9. RV-18SQ(-S**)
10. RV-18SQC(-S**)
11. RV-18SQ-SUL**
12. RV-18SQC-SUL**
13. RV-6SQ-SM6**
14. RV-6SQL-SM6**
15. RV-6SQ-SULM6**
16. RV-6SQL-SULM6**
17. RV-3SQ-SM6**
18. RV-3SQB-SM6**
19. RV-3SQB-SULM6**
20. RV-3SQJ-SM6**
21. RV-3SQJB-SM6**
22. RV-3SQJB-SULM6**
23. RH-6SQH4517M-SM6**
24. RH-6SQH3517M-SM6**
25. RH-6SQH5517M-SM6**
26. RH-6SQH4517M-SULM6**
27. RH-6SQH3517M-SULM6**
28. RH-6SQH5517M-SULM6**
29. RH-12SQH7030M-SM6**
30. RH-12SQH5530M-SM6**
31. RH-12SQH8530M-SM6**
32. RH-18SQH8530M-SM6**
33. RH-12SQH7030M-SULM6**
34. RH-12SQH5530M-SULM6**
35. RH-12SQH8530M-SULM6**
36. RH-18SQH8530M-SULM6**
37. RH-6SQH4527M-SM6**
38. RH-6SQH3527M-SM6**
39. RH-6SQH5527M-SM6**
40. RH-6SQH4527M-SULM6**
41. RH-6SQH3527M-SULM6**
42. RH-6SQH5527M-SULM6**
43. RH-12SQH7038M-SM6**
44. RH-12SQH5538M-SM6**
45. RH-12SQH8538M-SM6**
46. RH-12SQH7038M-SULM6**
47. RH-12SQH5538M-SULM6**
48. RH-12SQH8538M-SULM6**
49. RH-20SQH8538M-SM6**
50. RH-20SQH8530M-SM6**
51. RH-20SQH10038M-SM6**
52. RH-20SQH10030M-SM6**
53. RH-20SQH8538M–SULM6**
54. RH-20SQH8530M–SULM6**
55. RH-20SQH10038M–SULM6**
56. RH-20SQH10030M–SULM6**
57. RH-3SQHR3512MW-SM6**
58. RH-3SQHR5512MW-SM6**
59. RH-3SQHR3512MW-SULM6**
60. RH-3SQHR5512MW-SULM6**
61. RH-3SQHR3512M-SM6**
62. RH-3SQHR5512M-SM6**
63. RH-3SQHR3512M-SULM6**
64. RH-3SQHR5512M-SULM6**

A1 / 04.11

Attachment
Statement No.

Product Service

E6 12 03 25554 042

65. RH-3SQHR3512W-SM6**
66. RH-3SQHR5512W-SM6**
67. RH-3SQHR3512W-SULM6**
68. RH-3SQHR5512W-SULM6**

2. AC 230V 1 phase 1.7kW

1. RV-6SQ(-S**)
2. RV-6SQL(-S**)
3. RV-6SQC(-S**)
4. RV-6SQLC(-S**)
5. RV-6SQ-SUL**
6. RV-6SQL-SUL**
7. RV-6SQC-SUL**
8. RV-6SQLC-SUL**
9. RV-3SQ-S3**
10. RV-3SQC-S3**
11. RV-3SQB-S3**
12. RV-3SQBC-S3**
13. RV-3SQB-SUL3**
14. RV-3SQBC-SUL3**
15. RV-3SQJ-S3**
16. RV-3SQJC-S3**
17. RV-3SQJB-S3**
18. RV-3SQJBC-S3**
19. RV-3SQJB-SUL3**
20. RV-3SQJBC-SUL3**
21. RH-6SQH4520-S3**
22. RH-6SQH3520-S3**
23. RH-6SQH5520-S3**
24. RH-6SQH4517M-S3**
25. RH-6SQH3517M-S3**
26. RH-6SQH5517M-S3**
27. RH-6SQH4517C-S3**
28. RH-6SQH3517C-S3**
29. RH-6SQH5517C-S3**
30. RH-6SQH4520-SUL3**
31. RH-6SQH3520-SUL3**
32. RH-6SQH5520-SUL3**
33. RH-6SQH4517M-SUL3**
34. RH-6SQH3517M-SUL3**
35. RH-6SQH5517M-SUL3**
36. RH-6SQH4517C-SUL3**
37. RH-6SQH3517C-SUL3**
38. RH-6SQH5517C-SUL3**
39. RH-12SQH7035(-S**)
40. RH-12SQH5535(-S**)
41. RH-12SQH8535(-S**)
42. RH-18SQH8535(-S**)
43. RH-12SQH7030M(-S**)
44. RH-12SQH5530M(-S**)
45. RH-12SQH8530M(-S**)
46. RH-18SQH8530M(-S**)
47. RH-12SQH7030C(-S**)
48. RH-12SQH5530C(-S**)
49. RH-12SQH8530C(-S**)
50. RH-18SQH8530C(-S**)
51. RH-12SQH7035-SUL**
52. RH-12SQH5535-SUL**
53. RH-12SQH8535-SUL**
54. RH-18SQH8535-SUL**
55. RH-12SQH7030M-SUL**
56. RH-12SQH5530M-SUL**
57. RH-12SQH8530M-SUL**
58. RH-18SQH8530M-SUL**

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59. RH-12SQH7030C-SUL**
60. RH-12SQH5530C-SUL**
61. RH-12SQH8530C-SUL**
62. RH-18SQH8530C-SUL**
63. RV-12SQ-S3**
64. RV-12SQL-S3**
65. RV-12SQC-S3**
66. RV-12SQLC-S3**
67. RV-12SQ-SUL3**
68. RV-12SQL-SUL3**
69. RV-12SQC-SUL3**
70. RV-12SQLC-SUL3**
71. RH-20SQH8538M(-S**)
72. RH-20SQH8530M(-S**)
73. RH-20SQH10038M(-S**)
74. RH-20SQH10030M(-S**)
75. RH-20SQH8538C(-S**)
76. RH-20SQH8530C(-S**)
77. RH-20SQH10038C(-S**)
78. RH-20SQH10030C(-S**)
79. RH-20SQH8545 –SUL**
80. RH-20SQH8535–SUL**
81. RH-20SQH10045–SUL**
82. RH-20SQH10035–SUL**
83. RH-20SQH8538M–SUL**
84. RH-20SQH8530M–SUL**
85. RH-20SQH10038M–SUL**
86. RH-20SQH10030M–SUL**
87. RH-20SQH8538C–SUL**
88. RH-20SQH8530C–SUL**
89. RH-20SQH10038C–SUL**
90. RH-20SQH10030C–SUL**
91. RH-12SQH8538M-SUL**
92. RH-12SQH7038C-SUL**
93. RH-12SQH5538C-SUL**
94. RH-12SQH8538C-SUL**
95. RH-20SQH8545 (-S**)
96. RH-20SQH8535(-S**)
97. RH-20SQH10045(-S**)
98. RH-20SQH10035(-S**)
99. RH-6SQH4532-S3**
100. RH-6SQH3532-S3**
101. RH-6SQH5532-S3**
102. RH-6SQH4527M-S3**
103. RH-6SQH3527M-S3**
104. RH-6SQH5527M-S3**
105. RH-6SQH4527C-S3**
106. RH-6SQH3527C-S3**
107. RH-6SQH5527C-S3**
108. RH-6SQH4532-SUL3**
109. RH-6SQH3532-SUL3**
110. RH-6SQH5532-SUL3**
111. RH-6SQH4527M-SUL3**
112. RH-6SQH3527M-SUL3**
113. RH-6SQH5527M-SUL3**
114. RH-6SQH4527C-SUL3**
115. RH-6SQH3527C-SUL3**
116. RH-6SQH5527C-SUL3**
117. RH-12SQH7045(-S**)
118. RH-12SQH5545(-S**)
119. RH-12SQH8545(-S**)
120. RH-12SQH7038M(-S**)
121. RH-12SQH5538M(-S**)
122. RH-12SQH8538M(-S**)
123. RH-12SQH7038C(-S**)
124. RH-12SQH5538C(-S**)
125. RH-12SQH8538C(-S**)
126. RH-12SQH7045-SUL**
127. RH-12SQH5545-SUL**
128. RH-12SQH8545-SUL**

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129. RH-12SQH7038M-SUL**
130. RH-12SQH5538M-SUL**
131. RH-3SQHR3515W(-S**)
132. RH-3SQHR5515W(-S**)
133. RH-3SQHR3512MW(-S**)
134. RH-3SQHR5512MW(-S**)
135. RH-3SQHR3515W-SUL**
136. RH-3SQHR5515W-SUL**
137. RH-3SQHR3512MW-SUL**
138. RH-3SQHR5512MW-SUL**
139. RH-3SQHR3515W(-S**)
140. RH-3SQHR5515W(-S**)
141. RH-3SQHR3512MW(-S**)
142. RH-3SQHR5512MW(-S**)
143. RH-3SQHR3515W-SUL**
144. RH-3SQHR5515W-SUL**
145. RH-3SQHR3512MW-SUL**
146. RH-3SQHR5512MW-SUL**
147. RH-3SQHR3512W (-S**)
148. RH-3SQHR5512W (-S**)
149. RH-3SQHR3512C (-S**)
150. RH-3SQHR5512C(-S**)
151. RH-3SQHR3512W-SUL**
152. RH-3SQHR5512W-SUL**
153. RH-3SQHR3512C-SUL**
154. RH-3SQHR5512C-SUL

3. AC 230V 1 phase 0.6kW

1. RV-2SQ(-S**)
2. RV-2SQB(-S**)
3. RV-2SQ-S12
4. RV-2SQB-S12
5. RV-3SQ-S**
6. RV-3SQC-S**
7. RV-3SQB-S**
8. RV-3SQBC-S**
9. RV-3SQJ-S**
10. RV-3SQJC-S**
11. RV-3SQJB-S**
12. RV-3SQJBC-S**
13. RH-6SQH4520-S**
14. RH-6SQH3520-S**
15. RH-6SQH5520-S**
16. RH-6SQH4517M-S**
17. RH-6SQH3517M-S**
18. RH-6SQH5517M-S**
19. RH-6SQH4517C-S**
20. RH-6SQH3517C-S**
21. RH-6SQH5517C-S**
22. RH-6SQH4532(-S**)
23. RH-6SQH3532(-S**)
24. RH-6SQH5532(-S**)
25. RH-6SQH4527M(-S**)
26. RH-6SQH3527M(-S**)
27. RH-6SQH5527M(-S**)
28. RH-6SQH4527C(-S**)
29. RH-6SQH3527C(-S**)
30. RH-6SQH5527C(-S**)
31. RH-3SQHR3515N(-S**)
32. RH-3SQHR5515N(-S**)

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Nomenclature

Group A, B Model name description is shown as follows.

R V - x SQ x - x

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

(1) V: Vertical Robot

(2) Maximum Payload specification:

6 : 6kg

12 : 12kg

18 : 18kg

(3) **SQ** : **SQ** series robot

(4) **L** : Arm extension model

C : Clean room model

LC : Clean room arm extension model

(5) Dimension and Ambient specification:

[none] : driven by R/C

CR3Q-7*1M (for RV-12SQ/18SQ)

CR2Q-7*1/ CR2QA-7*1 (for RV-6SQ)

SM6xx: Oil mist model driven by R/C

CR3Q-7*1M-SM6xx (only RV-6SQ)

SULxx:UL specification/driven by R/C

CR3Q-7*1M-SULxx (for RV-12SQ/18SQ)

CR2Q-7*1-SULxx (for RV-6SQ)

SULM6xx:UL specification/

Oil mist model driven by R/C

CR3Q-7*1M-SULM6xx(only RV-6SQ)

S3xx: driven by R/C CR2Q-7*1-S3xx/ CR2QA-7*1-S3xx(only RV-12SQ)

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Group C Model name description is shown as follows.

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

(1) V: Vertical Robot

(2) Rated Payload specification:

3 : 3kg

(3) **SQ** : **SQ** 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

Sxx : driven by R/C CR1QA-7*1-Sxx

S3xx : driven by R/C CR2Q-7*1-S3xx/ CR2QA-7*1-S3xx

SM6xx : R/C Oil mist model
driven by R/C CR3Q-7*1M-SM6xx

SUL3xx: UL specification and R/C Oil mist model
driven by R/C CR2Q-7*1-SUL3xx

SULM6xx: UL specification R/C Oil mist model
driven by R/C CR3Q-7*1M-SULM6xx

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Group D Model name description is shown as follows.

RH-x SQH 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
20	: 20kg

(3) **SQ** : **SQ** series robot

(4) Arm length(No1 and No2 arm) specification:

35	: 350 mm arm	**70**	: 700 mm arm
45	: 450 mm arm	**85**	: 850 mm arm
55	: 550 mm arm	**100**	: 1000 mm arm

(5) Z axis working area specification:

17	: 170 mm arm	**32**	: 320 mm arm
20	: 200 mm arm	**35**	: 350 mm arm
27	: 270 mm arm	**38**	: 380 mm arm
30	: 300 mm arm	**45**	: 450 mm arm

(6) Dimension and Ambient specification:

M	: Oil mist model
C	: Clean room model
[none]	: Basic model

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(7) Optional specification:

Sxx : RH-6SQH driven by R/C CR1QA-7*1-Sxx
RH-12/18/20SQH driven by R/C CR2Q-7*1-Sxx/ CR2QA-7*1-Sxx

S3xx : driven by R/C CR2Q-7*1-S3xx/ CR2QA-7*1-S3xx
(only RH-6SQH)

SM6xx: Oil mist model driven by R/C
CR3Q-7*1-SM6xx

SULxx: UL specification driven by R/C
CR3Q-7*1M-SULxx
(only RH-12 / 18SQH)

SUL3xx: UL specification driven by R/C
CR2Q-7*1-SUL3xx (only RH-6SQH)

SULM6xx:UL specification /
Oil mist model driven by R/C
CR3Q-7*1M-SULM6xx
(only RV-12 / 18SQH)

Group E Model name description is shown as follows.

RV-2	**SQ**	**B**	**- x**
(1) (2)	(3)	(4)	(5)

(1) V: Vertical Robot

(2) Rated Payload specification:

2 : 2kg

(3) **SQ** : **SQ** series robot

(4) **B** : All axes are equipped with brake

[none] : Basic model
J4 axis and J6 axis are not equipped with brake.

(5) Special specification number

Pilot number and specification as follows

Sxx : driven by R/C CR1QA-77*-Sxx

S12 : machine cable connectors (between Robot arm and Robot controller) are original square type.
driven by R/C CR1QA-77*-S12

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Group F Model name description is shown as follows.

RH-3 SQHR xx xx x x - xx
(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1)H: Horizontal Robot

(2) Maximum Payload specification:

3 : 3kg

(3) **SQ** : **SQ** series robot

(4) **R** : Reverse mount model

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

35 : 350 mm arm

55 : 550 mm arm

(6) Z axis working area specification:

12 : 120 mm arm

15 : 150 mm arm

(7) Dimension and Ambient specification:

[none] : Basic model

M : Oil mist model

W : Water proof model

C : Clean room model

(8) Special specification:

W : Basic model

N : the special machine cable model driven by CR1QA-781-Sxx

[none] : Basic model ,regular type (same with "**W**")

(9) Optional specification:

Sxx : RH-3SQHRxxxxN driven by R/C, CR1DA-781-Sxx
RH-3SQHRxxxxW
and RH-3SQHRxxxx driven by R/C, CR2QA-781-Sxx

SM6xx: Oil mist model driven by R/C, CR3Q-781M-SM6xx

SULxx: UL specification driven by R/C, CR3Q-781M-SULxx

SULM6xx:UL specification /Oil mist model driven by R/C, CR3Q-781M-SULM6xx

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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.	SQ 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	N/A
Machinery(2006/42/EC)	Type A:Fundamental safety standards EN ISO12100-1:2003 EN ISO12100-2:2003 EN 1050:1997 Type B:Group safety standards B1:Safety aspects EN60204-1:2006, EN294:1992, EN349:1993 ISO13849-1:2006 Type C:Machine Safety standard ISO10218-1:2011	N/A

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

Directive.

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
Fax number	+49 2102 486 1120

Date	February 20, 2012
Name and position of person binding the manufacturer	Tomoyuki Kobayashi Tomoyuki Kobayashi Senior Manager Robot Manufacturing Department MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS

■ Declaration Type of models

Table 1 : The list of RV-12SQ series for grouping certification. ;A group

No.	Classification	Model name 12/18kg-Load	Robot Controller
1	Oil mist basic model	**RV-12SQ(-S**)**	**CR3Q-701M(-S**)**
2	Oil mist arm extension model	**RV-12SQL(-S**)**	
3	Clean room basic model (Class 10)	**RV-12SQC(-S**)**	**CR3Q-701(-S**)**
4	Clean room arm extension model (Class 10)	**RV-12SQLC(-S**)**	
5	Oil mist basic model , 1Phase Power model Robot controller	**RV-12SQ-S3****	**CR2Q-701-S3**/ CR2QA-701-S3****
6	Oil mist arm extension model, with 1Phase Power model Robot controller	**RV-12SQL-S3****	
7	Clean room basic model (Class 10) 1Phase Power model Robot controller	**RV-12SQC-S3****	
8	Clean room arm extension model (Class 10) with 1Phase Power model Robot controller	**RV-12SQLC-S3****	
9	UL specification oil mist basic model with 1Phase Power model Robot controller	**RV-12SQ-SUL3****	**CR2Q-701-SUL3****
10	UL specification oil mist arm extension model with 1Phase Power model Robot controller	**RV-12SQL-SUL3****	
11	UL specification oil mist basic model with 1Phase Power model Robot controller	**RV-12SQC-SUL3****	
12	UL specification oil mist arm extension model with 1Phase Power model Robot controller	**RV-12SQCL-SUL3****	
13	UL specification oil mist basic model including oil mist model robot controller	**RV-12SQ-SUL****	**CR3Q-701M-SUL****
14	UL specification oil mist arm extension model including oil mist model robot controller	**RV-12SQL-SUL****	
15	UL specification clean room basic model (Class 10)	**RV-12SQC-SUL****	**CR3Q-701-SUL****
16	UL specification clean room arm extension model (Class 10)	**RV-12SQLC-SUL****	
17	Oil mist basic model	**RV-18SQ(-S**)**	**CR3Q-709M(-S**)**
18	Clean room basic model (Class 10)	**RV-18SQC(-S**)**	
19	UL specification oil mist basic model including oil mist model robot controller	**RV-18SQ-SUL****	**CR3Q-709-SUL****
20	UL specification clean room basic model (Class 10)	**RV-18SQC-SUL****	

Table 2 : The list of RV-6SQ series for grouping certification. B group

No.	Classification	Model name	Robot Controller
		6kg-Load	
1	Oil mist basic model	**RV-6SQ(-S**)**	**CR2Q-711(-S**)/ CR2QA-711(-S**)**
2	Oil mist arm extension model	**RV-6SQL(-S**)**	
3	Clean room basic model (Class 10)	**RV-6SQC(-S**)**	
4	Clean room arm extension model (Class 10)	**RV-6SQLC(-S**)**	
5	Oil mist basic model including oil mist model robot controller	**RV-6SQ-SM6****	**CR3Q-711M(-S**)**
6	Oil mist arm extension model including oil mist model robot controller	**RV-6SQL-SM6****	
7	UL specification oil mist basic model	**RV-6SQ-SUL****	**CR2Q-711-SUL****
8	UL specification oil mist arm extension model	**RV-6SQL-SUL****	
9	UL specification clean room basic model (Class 10)	**RV-6SQC-SUL****	
10	UL specification clean room arm extension model (Class 10)	**RV-6SQLC-SUL****	
11	UL specification oil mist basic model including oil mist model robot controller	**RV-6SQ-SULM6****	**CR3Q-711M-SULM6****
12	UL specification oil mist arm extension model including oil mist model robot controller	**RV-6SQL-SULM6****	

Table 3 : The list of RV-3SQseries robots for grouping certification; C group-1.

No.	Classification	Model name	Robot Controller
		6-axis	
1	Basic model (standard) *1	**RV-3SQ-S3****	**CR2Q-721-S3**/ CR2QA-721-S3****
2	Clean room basic model (standard) *1	**RV-3SQC-S3****	
3	Basic model with brakes on all axis (standard)	**RV-3SQB-S3****	
4	Clean room basic model with brakes on all axis (standard)	**RV-3SQBC-S3****	
5	Oil mist basic model including robot controller *1	**RV-3SQ-SM6****	**CR3Q-721M-SM6****
6	Oil mist basic model with brakes on all axis including robot controller	**RV-3SQB-SM6****	
7	UL specification and basic model with brakes on all axis (standard)	**RV-3SQB-SUL3****	**CR2Q-721-SUL3****
8	UL specification clean room basic model with brakes on all axis (standard)	**RV-3SQBC-SUL3****	
9	UL specification oil mist basic model with brakes on all axis including robot controller	**RV-3SQB-SULM6****	**CR3Q-721M-SULM6****

Table 4 : The list of RV-3SQseries robots for grouping certification; C group-2.

No.	Classification	Model name	Robot Controller
		6-axis	
10	Basic model (standard) *1	**RV-3SQ(-S**)**	**CR1QA-721(-S**)**
11	Clean room basic model (standard) *1	**RV-3SQC(-S**)**	
12	Basic model with brakes on all axis (standard)	**RV-3SQB(-S**)**	
13	Clean room basic model with brakes on all axis (standard)	**RV-3SQBC(-S**)**	

Table 5 : The list of RV-3SQseries robots for grouping certification; C group -3.

No.	Classification	Model name	Robot Controller
		5-axis	
14	Basic model (standard) *1	**RV-3SQJ-S3****	**CR2Q-731-S3**/ CR2QA-731-S3****
15	Clean room basic model (standard) *1	**RV-3SQJC-S3****	
16	Basic model with brakes on all axis (standard)	**RV-3SQJB-S3****	
17	Clean room basic model with brakes on all axis (standard)	**RV-3SQJBC-S3****	
18	Oil mist basic model including robot controller *1	**RV-3SQJ-SM6****	**CR3Q-731M-SM6****
19	Oil mist basic model with brakes on all axis including robot controller	**RV-3SQJB-SM6****	
20	UL specification basic model with brakes on all axis (standard)	**RV-3SQJB-SUL3****	**CR2Q-731-SUL3****
21	UL specification clean room basic model with brakes on all axis (standard)	**RV-3SQJBC-SUL3****	
22	UL specification oil mist basic model with brakes on all axis including robot controller	**RV-3SQJB-SULM6****	**CR3Q-731M-SULM6****

Table 6 : The list of RV-3SQseries robots for grouping certification;C group -4.

No.	Classification	Model name	Robot Controller
		5-axis	
23	Basic model (standard) *1	**RV-3SQJ(-S**)**	**CR1QA-731(-S**)**
24	Clean room basic model (standard) *1	**RV-3SQJC(-S**)**	
25	Basic model with brakes on all axis (standard)	**RV-3SQJB(-S**)**	
26	Clean room basic model with brakes on all axis (standard)	**RV-3SQJBC(-S**)**	

Table 7 : The list of RH-xSQH series robots for grouping certification; D group-1.

No.	Classification	Model name	Robot Controller
		6kg-Load	
1	Basic model	**RH-6SQH4520-S3****	**CR2Q-761 -S3**/ CR2QA-761 -S3****
2	Short arm model	**RH-6SQH3520-S3****	
3	Long arm model	**RH-6SQH5520-S3****	
4	Oil mist model	**RH-6SQH4517M-S3****	
5	Short arm/Oil mist model	**RH-6SQH3517M-S3****	
6	Long arm/Oil mist model	**RH-6SQH5517M-S3****	
7	Clean room model (Class 10)	**RH-6SQH4517C-S3****	
8	Short arm/Clean room model	**RH-6SQH3517C-S3****	
9	Long arm/Clean room model	**RH-6SQH5517C-S3****	
10	Oil mist model including R/C	**RH-6SQH4517M-SM6****	**CR3Q-761M -SM6****
11	Short arm/Oil mist model including R/C	**RH-6SQH3517M-SM6****	
12	Long arm/Oil mist model including R/C	**RH-6SQH5517M-SM6****	
13	UL specification basic model	**RH-6SQH4520-SUL3****	**CR2Q-761 -SUL3****
14	UL specification short arm model	**RH-6SQH3520-SUL3****	
15	UL specification long arm model	**RH-6SQH5520-SUL3****	
16	UL specification oil mist model	**RH-6SQH4517M-SUL3****	
17	UL specification short arm/Oil mist model	**RH-6SQH3517M-SUL3****	
18	UL specification long arm/Oil mist model	**RH-6SQH5517M-SUL3****	
19	UL specification clean room model (Class 10)	**RH-6SQH4517C-SUL3****	
20	UL specification short arm/Clean room model	**RH-6SQH3517C-SUL3****	
21	UL specification long arm/Clean room model	**RH-6SQH5517C-SUL3****	
22	UL specification oil mist model including R/C	**RH-6SQH4517M-SULM6****	**CR3Q-761M -SULM6****
23	UL specification short arm/Oil mist model including R/C	**RH-6SQH3517M-SULM6****	
24	UL specification long arm/Oil mist model including R/C	**RH-6SQH5517M-SULM6****	

Table 8 : The list of RH-xSQH series robots for grouping certification; D group-2

No.	Classification	Model name	Robot Controller
		6kg-Load	
25	Basic model	**RH-6SQH4520-S****	**CR1QA-761 -S****
26	Short arm model	**RH-6SQH3520-S****	
27	Long arm model	**RH-6SQH5520-S****	
28	Oil mist model	**RH-6SQH4517M-S****	
29	Short arm/Oil mist model	**RH-6SQH3517M-S****	
30	Long arm/Oil mist model	**RH-6SQH5517M-S****	
31	Clean room model (Class 10)	**RH-6SQH4517C-S****	
32	Short arm/Clean room model	**RH-6SQH3517C-S****	
33	Long arm/Clean room model	**RH-6SQH5517C-S****	

Table 9 : The list of RH-xSQH series robots for grouping certification; D group -3.

No.	Classification	Model name 12／18kg-Load	Robot Controller
34	Basic model	**RH-12SQH7035(-S**)**	**CR2Q-741(-S**)/ CR2QA-741(-S**)**
35	Short arm model	**RH-12SQH5535(-S**)**	
36	Long arm model	**RH-12SQH8535(-S**)**	
37	Long arm and heavy load model	**RH-18SQH8535(-S**)**	**CR2Q-751(-S**)/ CR2QA-751(-S**)**
38	Oil mist model	**RH-12SQH7030M(-S**)**	**CR2Q-741(-S**)/ CR2QA-741(-S**)**
39	Short arm／Oil mist model	**RH-12SQH5530M(-S**)**	
40	Long arm／Oil mist model	**RH-12SQH8530M(-S**)**	
41	Long arm and heavy load／Oil mist model	**RH-18SQH8530M(-S**)**	**CR2Q-751(-S**)/ CR2QA-751(-S**)**
42	Clean room model (Class 10)	**RH-12SQH7030C(-S**)**	**CR2Q-741(-S**)/ CR2QA-741(-S**)**
43	Short arm／Clean room model	**RH-12SQH5530C(-S**)**	
44	Long arm／Clean room model	**RH-12SQH8530C(-S**)**	
45	Long arm and heavy load／Clean room model (Class 10)	**RH-18SQH8530C(-S**)**	**CR2Q-751(-S**)/ CR2QA-751(-S**)**
46	Oil mist model including R/C	**RH-12SQH7030M-SM6****	**CR3Q-741M -SM6****
47	Short arm／Oil mist model including R/C	**RH-12SQH5530M-SM6****	
48	Long arm／Oil mist model including R/C	**RH-12SQH8530M-SM6****	
49	Long arm and heavy load／Oil mist model including R/C	**RH-18SQH8530M-SM6****	**CR3Q-751M -SM6****
50	UL specification basic model	**RH-12SQH7035-SUL****	**CR2Q-741-SUL****
51	UL specification short arm model	**RH-12SQH5535-SUL****	
52	UL specification long arm model	**RH-12SQH8535-SUL****	
53	UL specification long arm and heavy load model	**RH-18SQH8535-SUL****	**CR2Q-751-SUL****
54	UL specification oil mist model	**RH-12SQH7030M-SUL****	**CR2Q-741-SUL****
55	UL specification short arm／Oil mist model	**RH-12SQH5530M-SUL****	
56	UL specification long arm／Oil mist model	**RH-12SQH8530M-SUL****	
57	UL specification long arm and heavy load／Oil mist model	**RH-18SQH8530M-SUL****	**CR2Q-751-SUL****
58	UL specification clean room model (Class 10)	**RH-12SQH7030C-SUL****	**CR2Q-741-SUL****
59	UL specification short arm／Clean room model	**RH-12SQH5530C-SUL****	
60	UL specification long arm／Clean room model	**RH-12SQH8530C-SUL****	
61	UL specification long arm and heavy load／Clean room model (Class 10)	**RH-18SQH8530C-SUL****	**CR2Q-751-SUL****
62	UL specification oil mist model including R/C	**RH-12SQH7030M -SULM6****	**CR3Q-741M -SULM6****
63	UL specification short arm／Oil mist model including R/C	**RH-12SQH5530M -SULM6****	
64	UL specification long arm／Oil mist model including R/C	**RH-12SQH8530M -SULM6****	
65	UL specification long arm and heavy load／Oil mist model including R/C	**RH-18SQH8530M -SULM6****	**CR3Q-751M -SULM6****

Table 10 : The list of robots for grouping certification; D group -4 .

No.	Classification	Model name	Robot Controller
		6kg-Load	
57	Z-Stroke variation , Basic model	**RH-6SQH4532(-S**)**	**CR1QA-761 (-S**)**
58	Z-Stroke variation , Short arm model	**RH-6SQH3532(-S**)**	
59	Z-Stroke variation , Long arm model	**RH-6SQH5532(-S**)**	
60	Z-Stroke variation , Oil mist model	**RH-6SQH4527M(-S**)**	
61	Z-Stroke variation , Short arm/Oil mist model	**RH-6SQH3527M(-S**)**	
62	Z-Stroke variation , Long arm/Oil mist model	**RH-6SQH5527M(-S**)**	
63	Z-Stroke variation , Clean room model (Class 10)	**RH-6SQH4527C(-S**)**	
64	Z-Stroke variation , Short arm/Clean room model	**RH-6SQH3527C(-S**)**	
65	Z-Stroke variation , Long arm/Clean room model	**RH-6SQH5527C(-S**)**	

RV-3SQ is the test models.

Table 11 : The list of robots for grouping certification; D group-5.

No.	Classification	Model name 6kg-Load	Robot Controller
75	Z-Stroke variation , Basic model	**RH-6SQH4532-S3****	**CR2QA-761 -S3****
76	Z-Stroke variation , Short arm model	**RH-6SQH3532-S3****	
77	Z-Stroke variation , Long arm model	**RH-6SQH5532-S3****	
78	Z-Stroke variation , Oil mist model	**RH-6SQH4527M-S3****	
79	Z-Stroke variation , Short arm／Oil mist model	**RH-6SQH3527M-S3****	
80	Z-Stroke variation , Long arm／Oil mist model	**RH-6SQH5527M-S3****	
81	Z-Stroke variation , Clean room model (Class 10)	**RH-6SQH4527C-S3****	
82	Z-Stroke variation , Short arm／Clean room model	**RH-6SQH3527C-S3****	
83	Z-Stroke variation , Long arm／Clean room model	**RH-6SQH5527C-S3****	
84	Z-Stroke variation , Oil mist model including R/C	**RH-6SQH4527M-SM6****	**CR3Q-761M -SM6****
85	Z-Stroke variation , Short arm／Oil mist model including R/C	**RH-6SQH3527M-SM6****	
86	Z-Stroke variation , Long arm／Oil mist model including R/C	**RH-6SQH5527M-SM6****	
87	Z-Stroke variation , UL specification basic model	**RH-6SQH4532-SUL3****	**CR2Q-761 -SUL3****
88	Z-Stroke variation , UL specification short arm model	**RH-6SQH3532-SUL3****	
89	Z-Stroke variation , UL specification long arm model	**RH-6SQH5532-SUL3****	
90	Z-Stroke variation , UL specification oil mist model	**RH-6SQH4527M-SUL3****	
91	Z-Stroke variation , UL specification short arm ／Oil mist model	**RH-6SQH3527M-SUL3****	
92	Z-Stroke variation , UL specification long arm ／Oil mist model	**RH-6SQH5527M-SUL3****	
93	Z-Stroke variation , UL specification clean room model (Class 10)	**RH-6SQH4527C-SUL3****	
94	Z-Stroke variation , UL specification short arm ／Clean room model	**RH-6SQH3527C-SUL3****	
95	Z-Stroke variation , UL specification long arm ／Clean room model	**RH-6SQH5527C-SUL3****	
96	Z-Stroke variation , UL specification oil mist model including R/C	**RH-6SQH4527M-SULM6****	**CR3Q-761M -SULM6****
97	Z-Stroke variation , UL specification short arm ／Oil mist model including R/C	**RH-6SQH3527M-SULM6****	
98	Z-Stroke variation , UL specification long arm ／Oil mist model including R/C	**RH-6SQH5527M-SULM6****	

RV-12SQL-SUL** and **RV-6SQL-SUL**** are the tested models.

Table 12 : The list of RH-xSQH robots for grouping certification; D group -6.

No.	Classification	Model name	Robot Controller
		12／18kg-Load	
99	Z-Stroke variation , Basic model	**RH-12SQH7045(-S**)**	**CR2QA-741(-S**)**
100	Z-Stroke variation , Short arm model	**RH-12SQH5545(-S**)**	
101	Z-Stroke variation , Long arm model	**RH-12SQH8545(-S**)**	
102	Z-Stroke variation , Oil mist model	**RH-12SQH7038M(-S**)**	
103	Z-Stroke variation , Short arm／Oil mist model	**RH-12SQH5538M(-S**)**	
104	Z-Stroke variation , Long arm／Oil mist model	**RH-12SQH8538M(-S**)**	
105	Z-Stroke variation , Clean room model (Class 10)	**RH-12SQH7038C(-S**)**	
85	Z-Stroke variation , Short arm／Clean room model	**RH-12SQH5538C(-S**)**	
86	Z-Stroke variation , Long arm／Clean room model	**RH-12SQH8538C(-S**)**	
87	Z-Stroke variation , Oil mist model including R/C	**RH-12SQH7038M-SM6****	**CR3Q-741M -SM6****
88	Z-Stroke variation , Short arm／Oil mist model including R/C	**RH-12SQH5538M-SM6****	
89	Z-Stroke variation , Long arm／Oil mist model including R/C	**RH-12SQH8538M-SM6****	
90	Z-Stroke variation , UL specification basic model	**RH-12SQH7045-SUL****	**CR2Q-741-SUL****
91	Z-Stroke variation , UL specification short arm model	**RH-12SQH5545-SUL****	
92	Z-Stroke variation , UL specification long arm model	**RH-12SQH8545-SUL****	
93	Z-Stroke variation , UL specification oil mist model	**RH-12SQH7038M-SUL****	
94	Z-Stroke variation , UL specification short arm ／Oil mist model	**RH-12SQH5538M-SUL****	
95	Z-Stroke variation , UL specification long arm／ Oil mist model	**RH-12SQH8538M-SUL****	
96	Z-Stroke variation , UL specification clean room model (Class 10)	**RH-12SQH7038C-SUL****	
97	Z-Stroke variation , UL specification short arm ／Clean room model	**RH-12SQH5538C-SUL****	
98	Z-Stroke variation , UL specification long arm／ Clean room model	**RH-12SQH8538C-SUL****	
99	Z-Stroke variation , UL specification oil mist model including R/C	**RH-12SQH7038M -SULM6****	**CR3Q-741M -SULM6****
100	Z-Stroke variation , UL specification short arm ／Oil mist model including R/C	**RH-12SQH5538M -SULM6****	
101	Z-Stroke variation , UL specification long arm／ Oil mist model including R/C	**RH-12SQH8538M -SULM6****	

Table 13 : The list of RH-xSQH robots for grouping certification; D group -7.

No.	Classification	Model name	Robot Controller
		20kg-Load	
102	Heavy load variation , Basic model	**RH-20SQH8545 (-S**)**	**CR2QA-751(-S**)**
103	Heavy load variation , Short Z-Stroke model	**RH-20SQH8535(-S**)**	
104	Heavy load variation , Long arm model	**RH-20SQH10045(-S**)**	
105	Heavy load variation , Long arm and Short Z-Stroke model	**RH-20SQH10035(-S**)**	
106	Heavy load variation / Oil mist model	**RH-20SQH8538M(-S**)**	
107	Heavy load variation , Short Z-Stroke /Oil mist model	**RH-20SQH8530M(-S**)**	
108	Heavy load variation , Long Arm /Oil mist model	**RH-20SQH10038M(-S**)**	
109	Heavy load variation , Long arm and Short Z-Stroke /Oil mist model	**RH-20SQH10030M(-S**)**	
110	Heavy load variation /Clean room model	**RH-20SQH8538C(-S**)**	
111	Heavy load variation , Short Z-Stroke /Clean room model	**RH-20SQH8530C(-S**)**	
112	Heavy load variation, Long arm /Clean room model	**RH-20SQH10038C(-S**)**	
113	Heavy load variation , Long arm and Short Z-Stroke /Clean room model	**RH-20SQH10030C(-S**)**	
114	Heavy load variation / Oil mist model including R/C	**RH-20SQH8538M-SM6****	**CR3Q-751M -SM6****
115	Heavy load variation , Short Z-Stroke /Oil mist model including R/C	**RH-20SQH8530M-SM6****	
116	Heavy load variation , Long Arm /Oil mist model including R/C	**RH-20SQH10038M-SM6****	
117	Heavy load variation , Long arm and Short Z-Stroke /Oil mist model including R/C	**RH-20SQH10030M-SM6****	
118	Heavy load variation , Basic model	**RH-20SQH8545 -SUL****	**CR2Q-751 -SUL****
119	Heavy load variation , Short Z-Stroke model	**RH-20SQH8535-SUL****	
120	Heavy load variation , Long arm model	**RH-20SQH10045-SUL****	
121	Heavy load variation , Long arm and Short Z-Stroke model	**RH-20SQH10035-SUL****	
122	Heavy load variation / Oil mist model	**RH-20SQH8538M-SUL****	
123	Heavy load variation , Short Z-Stroke /Oil mist model	**RH-20SQH8530M-SUL****	
124	Heavy load variation , Long Arm /Oil mist model	**RH-20SQH10038M-SUL****	
125	Heavy load variation , Long arm and Short Z-Stroke /Oil mist model	**RH-20SQH10030M-SUL****	
126	Heavy load variation /Clean room model	**RH-20SQH8538C-SUL****	
127	Heavy load variation , Short Z-Stroke /Clean room model	**RH-20SQH8530C-SUL****	
128	Heavy load variation, Long arm /Clean room model	**RH-20SQH10038C-SUL****	
129	Heavy load variation , Long arm and Short Z-Stroke /Clean room model	**RH-20SQH10030C-SUL****	
130	Heavy load variation / Oil mist model including R/C	**RH-20SQH8538M-SULM6****	**CR3Q-751M -SULM6****
131	Heavy load variation , Short Z-Stroke /Oil mist model including R/C	**RH-20SQH8530M-SULM6****	
132	Heavy load variation , Long Arm /Oil mist model including R/C	**RH-20SQH10038M-SULM6****	
133	Heavy load variation , Long arm and Short Z-Stroke /Oil mist model including R/C	**RH-20SQH10030M-SULM6****	

Table 14 : The list of RV-2SQ series robots for grouping certification; E group.

No.	Classification	Model name	Robot Controller
		6-axis	
1	Basic model (standard) *1	**RV-2SQ(-S**)**	**CR1QA-771(-S**)** **CR1QA-772(-S**)**
2	Basic model with brakes on all axis	**RV-2SQB(-S**)**	
3	Special machine cable model *1	**RV-2SQ-S12**	**CR1QA-771-S12** **CR1QA-772-S12**
4	Special machine cable model with brakes on all axis	**RV-2SQB-S12**	

Table 15 : The list of RH-3SQHR series robots for grouping certification; F group -1.

No.	Classification	Model name	Robot Controller
		4-axis	
1	Basic model (standard)	**RH-3SQHR3515W(-S**)**	**CR2QA-781(-S**)**
2	Special machine cable model	**RH-3SQHR3515N (-S**)**	**CR1QA-781(-S**)**
3	Oil mist model	**RH-3SQHR3512MW (-S**)**	**CR2QA-781(-S**)**
4	Oil mist model including R/C	**RH-3SQHR3512MW -SM6****	**CR3Q-781M-SM6****
5	Long arm model	**RH-3SQHR5515W(-S**)**	**CR2QA-781(-S**)**
6	Special machine cable model, Long arm type	**RH-3SQHR5515N (-S**)**	**CR1QA-781(-S**)**
7	Oil mist model , Long arm type	**RH-3SQHR5512MW (-S**)**	**CR2QA-781(-S**)**
8	Oil mist model including R/C, Long arm type	**RH-3SQHR5512MW -SM6****	**CR3Q-781M-SM6****
9	UL specific type	**RH-3SQHR3515W-SUL****	**CR2QA-781-SUL****
10	Oil mist model, UL specific type	**RH-3SQHR3512MW-SUL****	**CR2QA-781-SUL****
11	Oil mist model including R/C,UL specific model	**RH-3SQHR3512MW -SULM6****	**CR3Q-781M-SULM6****
12	Long arm model ,UL specific type	**RH-3SQHR5515W-SUL****	**CR2QA-781-SUL****
13	Oil mist model , Long arm and UL specific type	**RH-3SQHR5512MW -SUL****	**CR2QA-781-SUL****
14	Oil mist model including R/C, Long arm and UL specific type	**RH-3SQHR5512MW -SULM6****	**CR3Q-781M-SULM6****
15	Basic model, regular type	**RH-3SQHR3515(-S**)**	**CR2QA-781(-S**)**
16	Oil mist model , regular type	**RH-3SQHR3512M (-S**)**	**CR2QA-781(-S**)**
17	Oil mist model including R/C, regular type	**RH-3SQHR3512M -SM6****	**CR3Q-781M-SM6****
18	Long arm model, regular type	**RH-3SQHR5515(-S**)**	**CR2QA-781(-S**)**
19	Oil mist model , Long arm type, regular type	**RH-3SQHR5512M (-S**)**	**CR2QA-781(-S**)**
20	Oil mist model including R/C, Long arm type regular type	**RH-3SQHR5512M -SM6****	**CR3Q-781M-SM6****
21	UL specific type, regular type	**RH-3SQHR3515-SUL****	**CR2QA-781-SUL****
22	Oil mist model, UL specific type regular type	**RH-3SQHR3512M-SUL****	**CR2QA-781-SUL****
23	Oil mist model including R/C,UL specific model regular type	**RH-3SQHR3512M-SULM6****	**CR3Q-781M-SULM6****
24	Long arm model ,UL specific type	**RH-3SQHR5515-SUL****	**CR2QA-781-SUL****
25	Oil mist model , Long arm and UL specific type regular type	**RH-3SQHR5512M-SUL****	**CR2QA-781-SUL****
26	Oil mist model including R/C, Long arm and UL specific type regular type	**RH-3SQHR5512M-SULM6****	**CR3Q-781M-SULM6****
27	Water proof model , regular type	**RH-3SQHR3512W (-S**)**	**CR2QA-781(-S**)**
28	Clean room model (ISO Class 5), regular type	**RH-3SQHR3512C (-S**)**	**CR2QA-781(-S**)**
29	Water proof model including R/C, regular type	**RH-3SQHR3512W -SM6****	**CR3Q-781M-SM6****

Table 16 : The list of RH-3SQHR series robots for grouping certification; F group -2.

No.	Classification	Model name	Robot Controller
		4-axis	
30	Water proof model, UL specific type regular type	**RH-3SQHR3512W -SUL****	**CR2QA-781-SUL****
31	Clean room model (ISO Class 5), UL specific type regular type	**RH-3SQHR3512C-SUL****	**CR2QA-781-SUL****
32	Water proof model including R/C,UL specific model regular type	**RH-3SQHR3512W-SULM6****	**CR3Q-781M-SULM6****
33	Water proof model , Long arm type, regular type	**RH-3SQHR5512W (-S**)**	**CR2QA-781(-S**)**
34	Clean room model (ISO Class 5), Long arm type, regular type	**RH-3SQHR5512C (-S**)**	**CR2QA-781(-S**)**
35	Water proof model including R/C, Long arm type, regular type	**RH-3SQHR5512W -SM6****	**CR3Q-781M-SM6****
36	Water proof model, Long arm and UL specific type regular type	**RH-3SQHR5512W -SUL****	**CR2QA-781-SUL****
37	Clean room model (ISO Class 5), Long arm and UL specific type regular type	**RH-3SQHR5512C-SUL****	**CR2QA-781-SUL****
38	Water proof model including R/C, Long arm and UL specific model regular type	**RH-3SQHR5512W-SULM6****	**CR3Q-781M-SULM6****

Revision history

Date	Specifications No.	Details of revisions	Rev.
July 1, 2009		First print	*
October 13, 2009	P1	Standards update(2006/42/EC)	A
April 7, 2010	P7	RV-2SQseries added	B
May 11, 2010	P4, P5	RV-3SQ-Sxx series added RH-6SQH-Sxx series added	C
July 2, 2010	P3 P3-P7	Added RV-12SQ-S3** series Added CR2QA-7** controller	D
September 3, 2010	P8-11	Added RH-xSQH series ,Arm length,Z-Stroke,and Heavy load models	E
October 1, 2010	P12	Added RH-3SQHR series	F
November 9, 2010	P13	Added RH-3SQHR series No.15-No.25	G
January 26, 2012	P1	Changed ISO10218-1 from 2006 version to 2011 version	H
February 20, 2012	P13, 14	Added variation models(No.27 to 38) to RH-3SQHR series	J

사용자안내문
User's Guide

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

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