



Mitsubishi Industrial Robot

CR751-Q Controller

RH-2FH-Q Series

Special Specifications Manual

MELFA
BFP-A8965-E

Safety Precautions

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

CAUTION

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

Enforcement of safety training

CAUTION

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

Preparation of work plan

WARNING

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

Setting of emergency stop switch

CAUTION

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

Indication of teaching work in progress

DANGER

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

Installation of safety fence

CAUTION

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

Signaling of operation start

CAUTION

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

Indication of maintenance work in progress

CAUTION

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

Inspection before starting work

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

DANGER

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

CAUTION

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

CAUTION

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

CAUTION

Always use the robot installed on a secure table. Use in an instable posture could lead to positional deviation and vibration.

CAUTION

Wire the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.

CAUTION

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

CAUTION

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

WARNING

Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

WARNING

Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.

CAUTION

Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.

WARNING

When carrying out teaching work in the robot's movement range, always secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

CAUTION

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

CAUTION

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

CAUTION

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

CAUTION

Never carry out modifications based on personal judgments, or use non-designated maintenance parts.

Failure to observe this could lead to faults or failures.

WARNING

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

CAUTION

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

CAUTION

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

DANGER

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

DANGER

Do not connect the Handy GOT to a programmable controller when using an iQ Platform compatible product with the CR750-Q/CR751-Q controller. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.

DANGER

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

DANGER

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

DANGER

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

CAUTION

Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in errors, such as the emergency stop not being released. In order to prevent errors occurring, please be sure to check that all functions (such as the teaching box emergency stop, customer emergency stop, and door switch) are working properly after the wiring setup is completed.

CAUTION

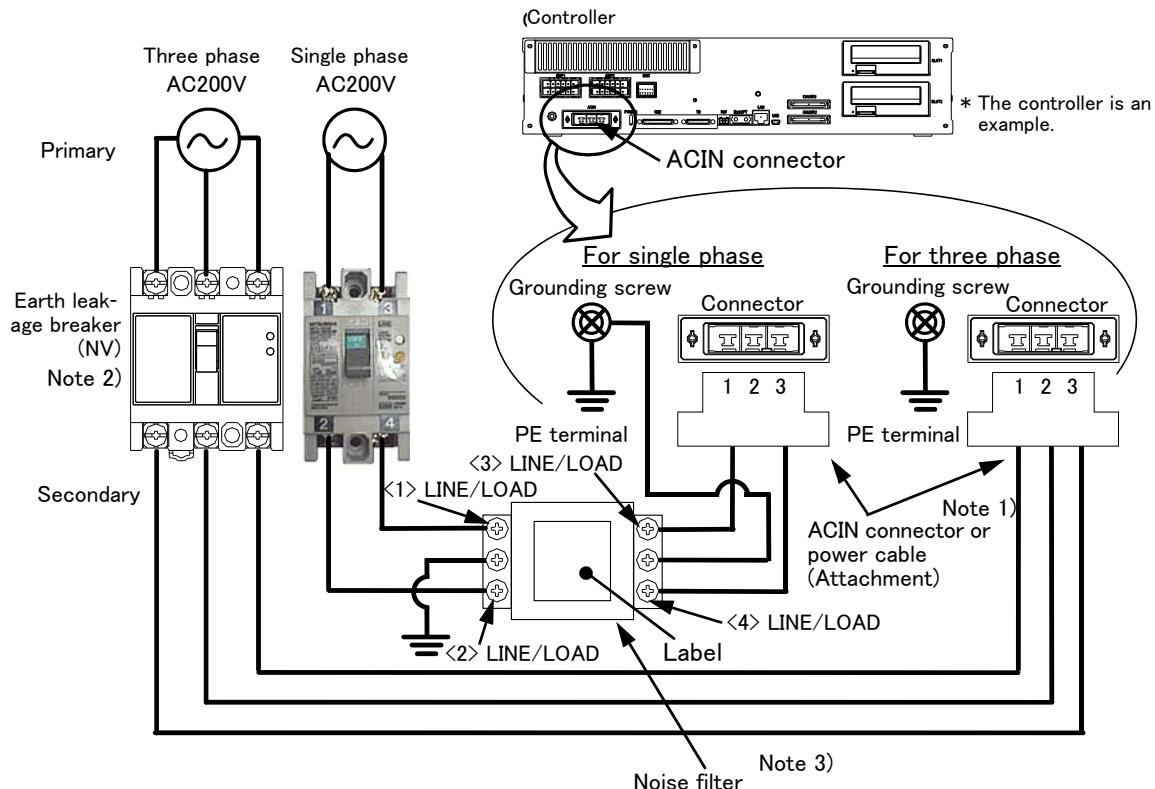
Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures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

*CR751-D or CR751-Q controller

Notes of the basic component are shown.

⚠ CAUTION

Please install the earth leakage breaker in the primary side supply power supply of the controller of CR751-D or CR751-Q because of leakage protection.



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

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

Recommendation:

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

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

Note 3) If necessary, as shown in the figure, connects the noise filter between ACIN terminal blocks and primary power supply.

(Recommended noise filter: SUP-EL20-ER6 *OKAYA ELECTRIC INDUSTRIES)

- 1) Please prepare the following: Leakage current breaker (with terminal cover), cable for connecting the primary power supply, cable for connecting the secondary power supply (both AWG #14 (2mm²)), cables to ground the primary power supply (AWG #12 (3.5mm² or above)).
- 2) Confirm that the primary power matches the specifications.
- 3) Confirm that the primary power is OFF and that the earth leakage breaker power switch is OFF.
- 4) Connect the secondary power cable to secondary terminal (lower terminal) of earth leakage breaker.
Connect the opposite side of this cable with following pin numbers of the ACIN connector attached.
For single phase: 1 and 3
For three phase: 1, 2, and 3
Recommends connection by the Solderless terminal.
Or, connect by the attachment power cable.
- 5) Connect this connector to the ACIN connector on the controller.
- 6) Connect the grounding cable to the PE terminal. (M4 screw)
- 7) Connect the primary power cable to the primary side terminal (upper terminal) of the earth leakage breaker.

⚠ CAUTION

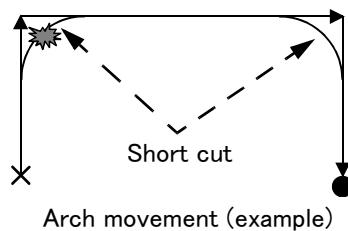
Be careful of interference with peripheral equipment.

Especially don't give a shock to the shaft (J3 axis). When you install the hand, be careful not to knock at the shaft end by the hammer etc. The shaft may be damaged.

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.



- (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.

■ Revision history

Date of print	Specifications No.	Details of revisions
2013-02-26	BFP-A8965	<ul style="list-style-type: none"> ▪ First print.
2013-06-07	BFP-A8965-A	<ul style="list-style-type: none"> ▪ "Table 3-2: Robot CPU unit standard specification" was added. ▪ "Declaration of Incorporation" and "EC-Statement of Compliance" were updated.
2013-11-05	BFP-A8965-B	<ul style="list-style-type: none"> ▪ The cautions of operating in a low temperature environment or after a prolonged stop in "6.3 Precautions for handling" were modified. ▪ The caution about fumigation of wood packing was added to "6.3 Precautions for handling". ▪ "Fig.6-6: Limitations when connecting the relay etc. (CR751)" was corrected. (Error output → Emergency stop output, Contactor control output for additional axes → Error output) ▪ The cable fixation plate was added to "Fig.3-3: Outside dimensions of drive unit (CR751)".
2014-05-28	BFP-A8965-C	<ul style="list-style-type: none"> ▪ The description of "MELFA BASIC IV" was added to "Table 3-1: Specifications of controller". ▪ The type name of the SSCNET III cable (5m) was corrected to MR-J3BUS5 M-A. ▪ The grounding representation was corrected. ▪ Type of Instructions manual (5F-RN01-PE01) is corrected to 5F-RM01-PE01. ▪ A size of the pilot holes were changed into ϕ 8 from ϕ 6.
2014-06-20	BFP-A8965-D	<ul style="list-style-type: none"> ▪ Painting color of the robot was changed. (formerly: Light gray (Equivalent to Munsell: 0.6B7.6/0.2)) ▪ Correction of errors. ▪ The cover and corporate logo mark of this manual was changed.
2014-10-20	BFP-A8965-E	<ul style="list-style-type: none"> ▪ The statement about trademark registration was modified. ▪ A safety relay in "example of safety measures (wiring example 5)" both CR750 and CR751 controller were changed. ▪ "Declaration of Incorporation" and "EC-Statement of Compliance" were updated. ▪ Documentation of Insulation test certification, Protective earth continuity test certificate, and General quality test were added.

■ Introduction

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 6, "2 Robot arm"](#), the specifications related to the controller [Page 26, "3 Controller"](#), and software functions and a command list [Page 62, "4 Software"](#) separately.

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

*RH-2FH (CR751-Q controller) series

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1 General configuration

1.1 Structural equipment

Structural equipment consists of the following types.

1.1.1 Standard structural equipment

The following items are enclosed as a standard.

- (1) Robot arm
- (2) Controller (CPU unit + Drive unit)
- (3) The connecting cable for the CPU unit and the drive unit
- (4) Machine cable
- (5) Robot arm installation bolts
- (6) Safety manual, CD-ROM (Instruction manual)
- (7) Documentation
 - 1) Insulation test certification
 - 2) Protective earth continuity test certificate
 - 3) General quality test

1.1.2 Special specifications

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

1.1.3 Options

User can install options after their delivery.

1.1.4 Maintenance parts

Materials and parts for the maintenance use.

1.2 Model type name of robot

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

1.2.1 How to identify the robot model

RH - 2 FH 25 15 - 1 Q 1 -Sxx

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

(a). RH Indicates the horizontal multiple-joint robot.
Ex.)

RV: Vertical multiple-joint type.
RH: Horizontal multiple-joint type.

(b). 2 Indicates the maximum load.
Ex.)
2: 2kg

(c). FH Indicates the FH series.

(d). 25 Indicates the arm length.
25: 250mm

(e). 15 Indicates the vertical stroke length.
15: 150mm stroke

(f). 1 Indicates the controller series.
Ex.)
Omitted: CR750 controller
1: CR751 controller

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

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

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

1.2.2 Combination of the robot arm and the controller

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

Protection specification	Robot arm	Arm length (mm)	J3-axis stroke (mm)	Controller
General-purpose environment	RH-2FH2515-1Q1	250	150	CR751-02HQ1-0

1.3 Indirect export

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

1.4 Instruction manuals

The instruction manuals supplied in CD-ROM, except for the Safety Manual.

1.5 Contents of the structural equipment

1.5.1 Robot arm

The list of structural equipment is shown in below.

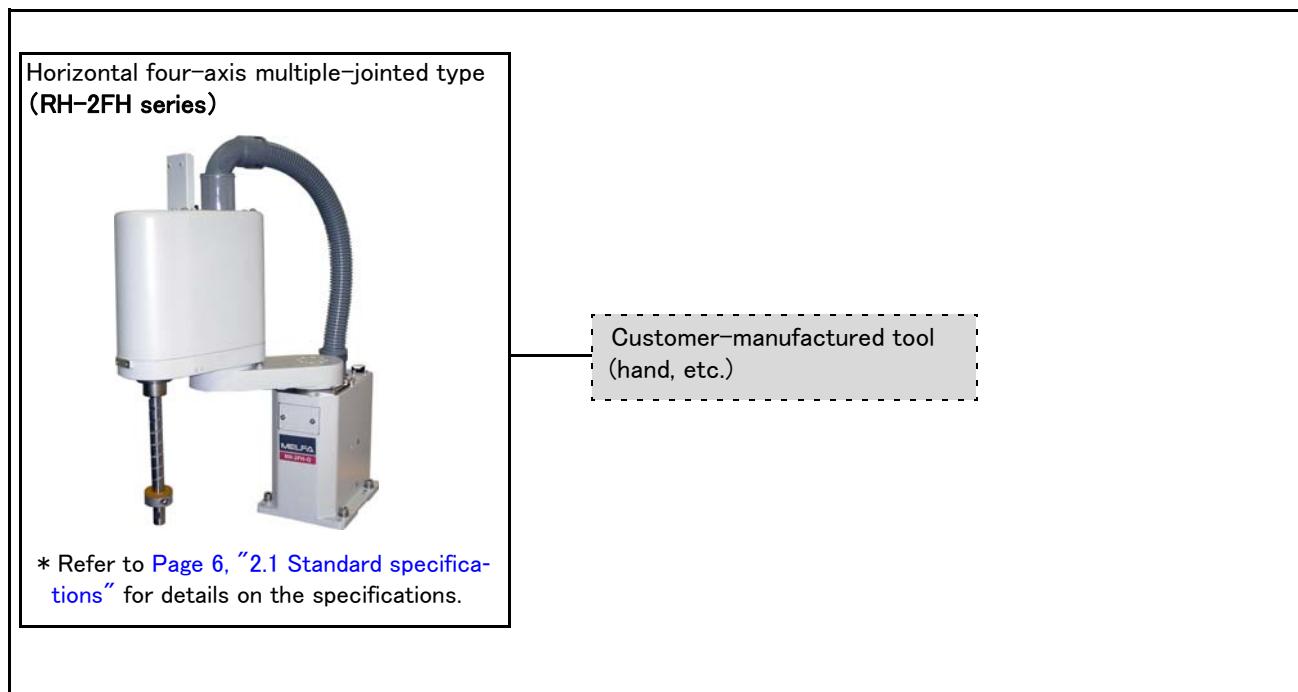


Fig.1-1 : Structural equipment

1.5.2 Controller

The devices shown below can be installed on the controller.

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

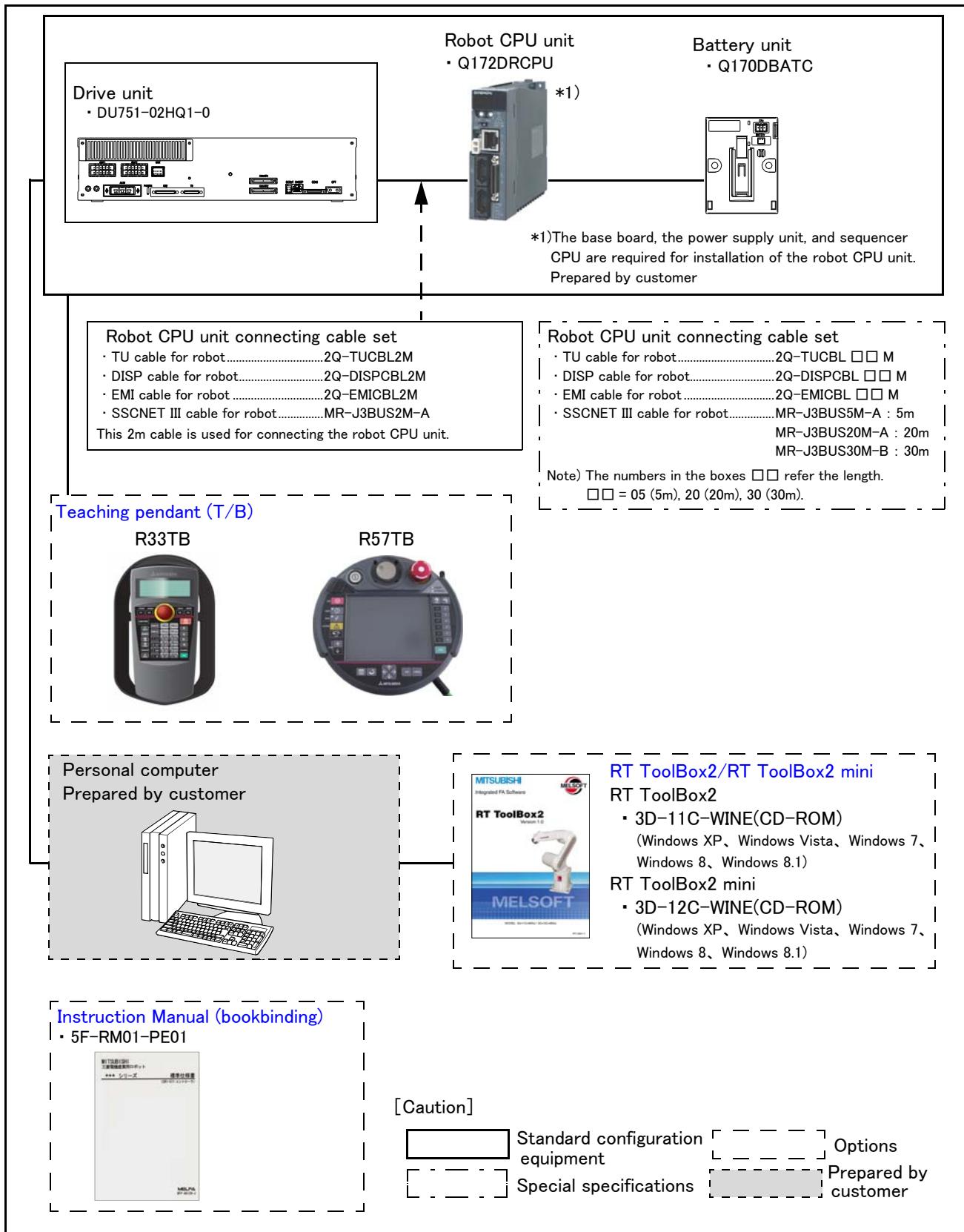


Fig.1-2 : Structural equipment

1.6 Contents of the Option equipment and special specification

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

Table 1-2 : The list of drive unit option equipment and special specification

Item	Type	Specifications	Classification Note1)	Description
			CR751	
Simple teaching pendant	R33TB	Cable length 7m	<input type="radio"/>	With 3-position enable switch IP65
	R33TB-15	Cable length 15m	<input type="radio"/>	
Highly efficient teaching pendant	R57TB	Cable length 7m	<input type="radio"/>	
	R57TB-15	Cable length 15m	<input type="radio"/>	
RT ToolBox2 (Personal computer Support software)	3D-11C-WINE	CD-ROM	<input type="radio"/>	Windows XP、Windows Vista、Windows 7、Windows 8、Windows 8.1 (With the simulation function)
RT ToolBox2 mini (Personal computer Support software mini)	3D-12C-WINE	CD-ROM	<input type="radio"/>	Windows XP、Windows Vista、Windows 7、Windows 8、Windows 8.1
Robot CPU unit connection cable set	2Q-RC-CBL □□ M	Cable length 05, 20, 30m	<input type="checkbox"/>	This option include TU, DISP, EMI and SSCNET cables.
TU cable for robot	2Q-TUCBL □ M	Cable length 05, 20, 30m	<input type="checkbox"/>	For communication between robot CPU and DU.
DISP cable for robot	2Q-DISPCBL □ M	Cable length 05, 20, 30m	<input type="checkbox"/>	For communication between robot CPU and DU.
EMI cable for robot	2Q-EMICBL □ M	Cable length 05, 20, 30m	<input type="checkbox"/>	For a robot CPU emergency stop input.
SSCNET III cable for robot	MR-J3BUS □ M-A	Cable length 05, 20m	<input type="checkbox"/>	For the servo communication between robot CPU and DU.
	MR-J3BUS30M-B	Cable length 30m	<input type="checkbox"/>	
Instruction Manual	5F-RM01-PE01	RH-2FH-Q series	<input type="radio"/>	

Note1) Distinction of (is option) and (is special specification at shipping) is shown for each pair with the drive unit.

2 Robot arm

2.1 Standard specifications

2.1.1 Basic specifications

(1) Standard specification

Table 2-1 : Standard specifications of robot arm

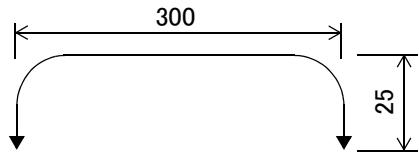
Item		Unit	Specifications
Type			RH-2FH2515
Environment			Standard specification
Installation posture			On floor
Degree of freedom			4
Structure			Horizontal, multiple-joint type
Drive system			AC servo motor
Position detection method			Absolute encoder
Motor capacity	J1	W	100
	J2	W	50
	J3 (Z)	W	100
	J4 (θ axis)	W	50
Brake			J1, J2, J4: no brake, J3: with brake
Arm length	No. 1 arm	mm	135
	No. 2 arm	mm	115
Max.reach radius(No. 1+ No. 2)		mm	250
Operating range	J1	deg	±120
	J2	deg	±140
	J3 (Z)	mm	150
	J4 (θ axis)	deg	±360
Speed of motion ^{Note1)}	J1	deg/s	540
	J2	deg/s	540
	J3 (Z)	mm/s	1,120
	J4 (θ axis)	deg/s	1,200
Maximum horizontal composite speed		mm/s	3,630
Cycle time ^{Note3)}		sec	0.50
Load	Rating	kg (N)	1
	Maximum		2
Allowable inertia	Rating	kg · m ²	0.005
	Maximum		0.017
Pose repeatability ^{Note4)}	X-Y direction	mm	±0.010
	J3 (Z)	mm	±0.010
	J4 (θ axis)	deg	±0.004
Ambient temperature		°C	0 to 40
Mass		kg	12
Tool wiring			Hand cable (AWG #22, total 20 cores)
Tool pneumatic pipes			-
Supply pressure		MPa	-
Protection specification			IP20
Painting color			Pure white (RAL 9010)

Note1) The maximum speed is the value which applied MvTune2 (high-speed movement mode).

Note2) At the maximum speed on the X-Y flat surface in the robot's control point, it is obtained with each speed of J1, J2, and J4. The control point is the position offset by the rated inertia from the flange.

Note3) The value of the following movement which applied MvTune2 (high-speed movement mode) with the carrying mass of 2kg.

- The cycle time may increase with the case where the positioning accuracy of the work etc. is necessary, or by the moving position.



Note4) The pose repeatability details are given in [Page 8, "2.2.1 Pose repeatability"](#).

2.2 Definition of specifications

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

2.2.1 Pose repeatability

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

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

[1] Operation pattern factors

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

[2] Load fluctuation factor

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

[3] Disturbance factor during operation

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

[4] Temperature factors

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

[5] Factors due to differences in accuracy definition

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

2.2.2 Rated load (mass capacity)

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

- (1) The tooling should have the value less or equal than the smaller of the tolerable inertia and the tolerable moment found in [Page 6, "2.1.1 Basic specifications"](#).
 - (2) [Fig. 2-1](#) shows the distribution dimensions for the center of gravity in the case where the volume of the load is relatively small. Use this figure as a reference when designing the tooling.
- Please use the robot in the allowable moment of inertia of maximum moment of inertia shown in [Fig. 2-1](#), when loading mass is maximum (2kg).

[Caution] The mass capacity is greatly influenced by the operating speed of the robot and the motion posture.

Even if you are within the allowable range mentioned previously, an overload or generate an overcurrent alarm could occur. In such cases, it will be necessary to change the time setting for acceleration/deceleration, the operating speed, and the motion posture.

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

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.

[Caution] This robot will restrict speed automatically by internal controls when the load center-of-gravity position separates from the shaft center. Refer to [Page 10, "2.2.3 Relationships Among Mass Capacity, Speed, and Acceleration/Deceleration Speed"](#) in detail.

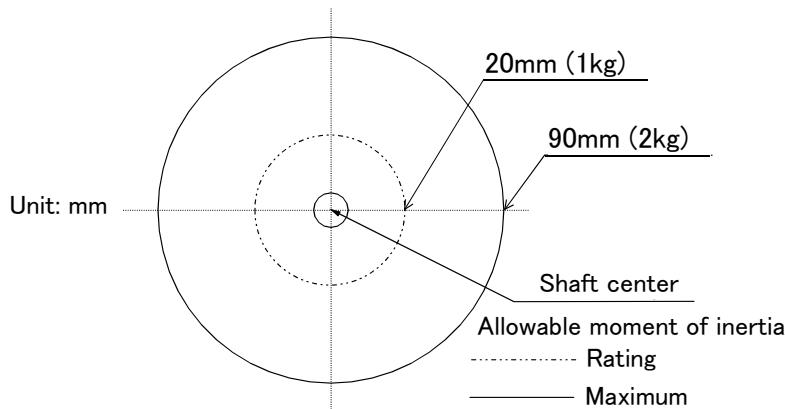


Fig.2-1 : Position of center of gravity for loads (for loads with comparatively small volume)

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 this case, reduce the speed and the acceleration and deceleration rate before continuing to use. This is done by accessing the robot program and adjusting the speed settings (Ovrd) and the acceleration and deceleration settings (Accel).

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
HNDDAT*	2.0	122.0	122.0	17.0	0.0	0.0	8.5
WRKDAT*	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note) The position of the center of gravity is located at the center of the surface at the bottom of the shaft. Set the X, Y and Z center of gravity positions for the tool coordinate directions (the Z center of gravity position will be a plus for downward directions).

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) Change the robot's operating speed by using the Ovrd command.
- 2) Change and move the teaching points of the robot.
- 3) Change the hand mass and hand inertia.

2.2.5 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 [Page 10, "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. 2-2](#)).

However, this function does not work with the setting of 1kg or lighter load mass. When the setting of the load mass is changed to 1kg 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.

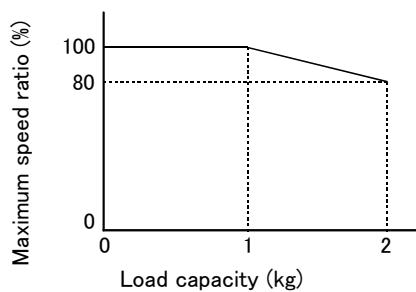


Fig.2-2 : Automatic compensation of speed

(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. 2-3, Fig. 2-4) will be activated. This function is invalid if the shaft (axis J3) operates at a position above P3 in Fig. 2-3. Acceleration/deceleration is compensated for at a position below P3 in Fig. 2-3 if the position of the center of gravity of the load is located at the front edge of the shaft.

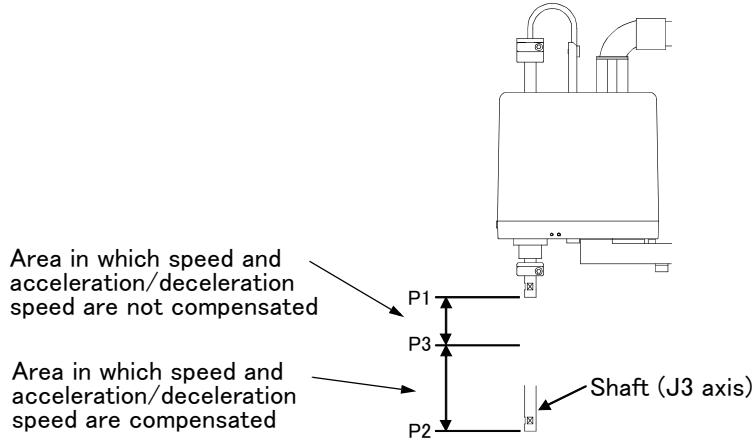


Fig.2-3 : Area in which acceleration/deceleration speed is compensated

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

J3 axis stroke (mm)			Compensation area (P2 to P3)
Stroke length	P1 (Upper end)	P2 (Lower end)	
150	155	5	5 ~ 95

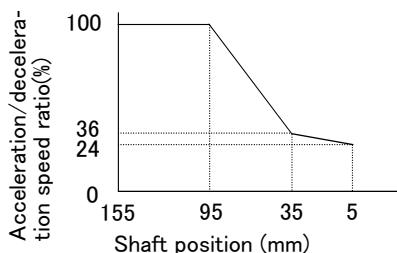


Fig.2-4 : Automatic compensation of acceleration/deceleration speed

[Supplementary explanation 1]: 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 command.
- 2) Control the optimum acceleration/deceleration using the Oadl command.
- 3) Control the optimum speed using the Spd command.
- 4) Setting a larger value in the optimum acceleration/deceleration adjustment rate parameter: JADL. (Maximum 100)

The moving time can be shortened by setting a larger value in the optimum acceleration/deceleration adjustment rate parameter (JADL). In this robot, the acceleration/deceleration speed is initialized to allow continuous moving with a short wait time (setting of B in the [Fig. 2-5](#)).

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. 2-5](#)).

However, please note that some setting values of acceleration/deceleration speed tend to cause overload and overheat errors. In such a case, extend the wait time, reduce the acceleration/deceleration speed, or decrease the moving speed.

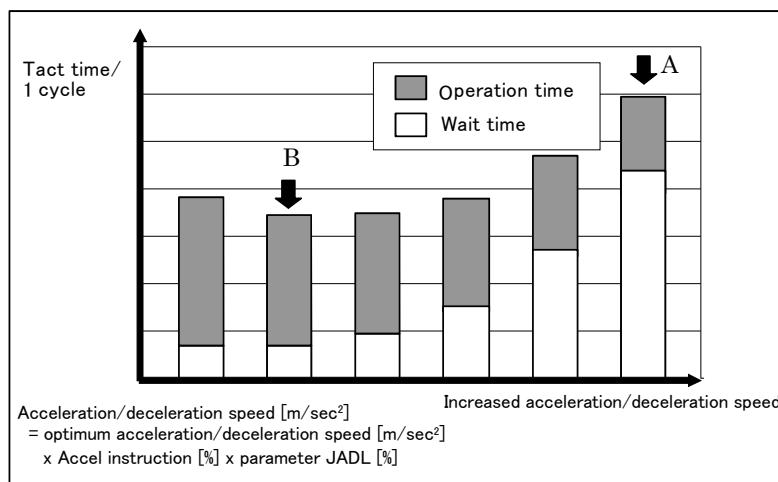


Fig.2-5 : Relationship between Acceleration/deceleration Speed and Tact Time (Conceptual Drawing)

(3) Time to reach the position repeatability

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. 2-6.)

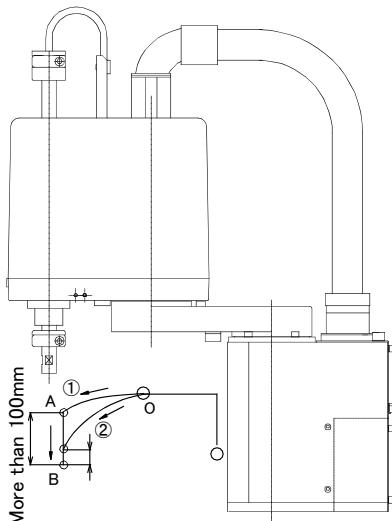


Fig.2-6 : Recommended path when positioning at the bottom edge of the Z axis

2.2.6 Collision detection

This series have the "collision detection function" which detects the abnormalities by the collision of the robot arm, and the initial setting has set this function as the enable to suppress damage to the minimum.

Although the enable/disable of this function can be changed by parameter: COL and command: ColChk, you should use in valid condition of this function for protection of the robot and of the peripheral equipment.

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

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

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

Table 2-3 : Factory-shipments condition

	JOG operation	Automatic
RH-2FH series	Valid	Invalid

2.2.7 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 2-4](#).

Table 2-4 : Protection specifications and applicable fields

Type	Protection specifications (IEC Standards value)	Classification	Applicable field	Remarks
RH-2FH2515	Robot arm: IP20	General-purpose environment specifications	General assembly Slightly dusty environment	

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

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

【Information】

• The IEC IP20

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

2.3 Names of each part of the robot



Fig.2-7 : Names of each part of the robot

2.4 Outside dimensions • Operating range diagram

2.4.1 Outside dimensions • Operating range diagram

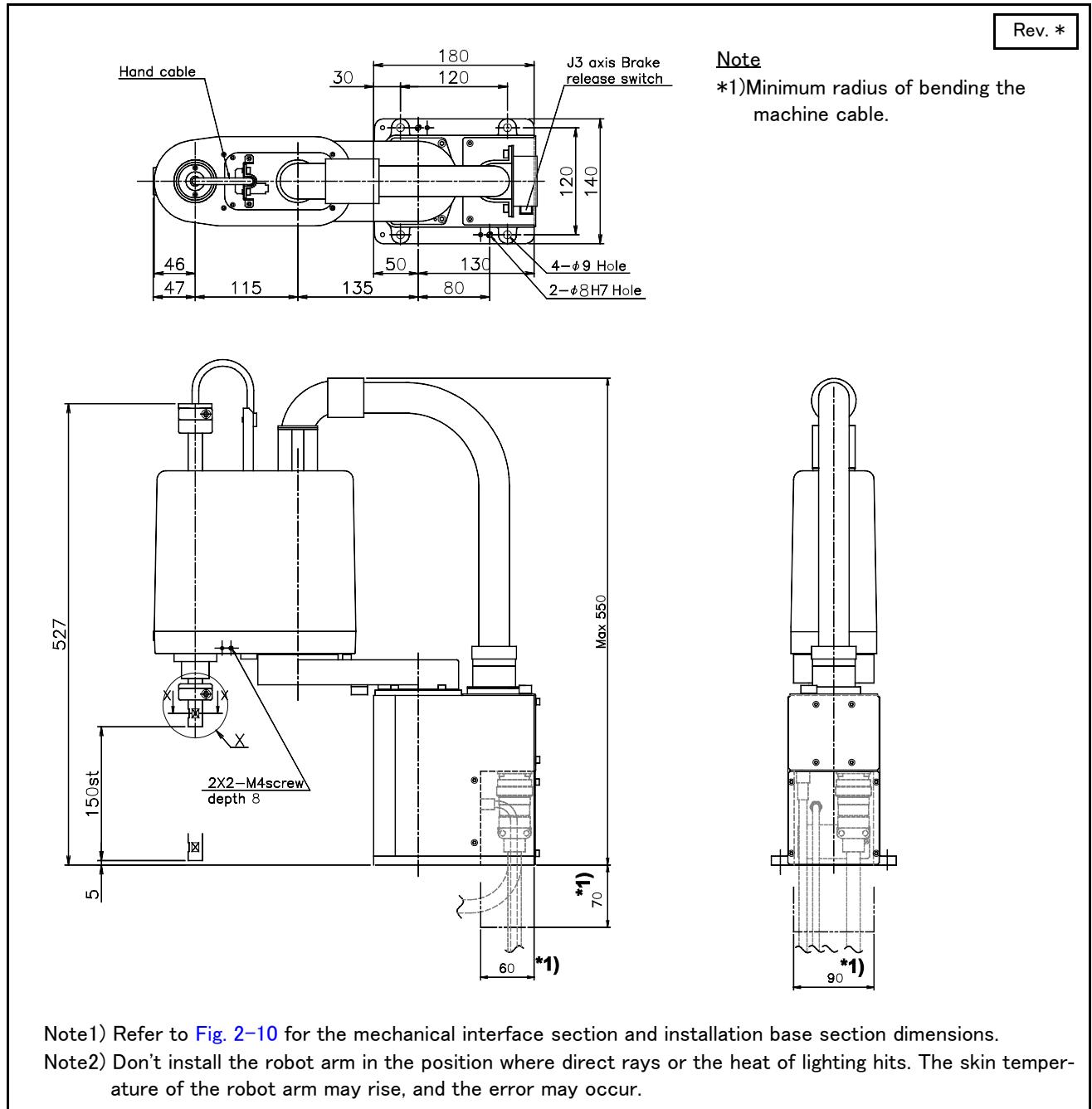


Fig.2-8 : Outside dimensions of RH-2FH2515

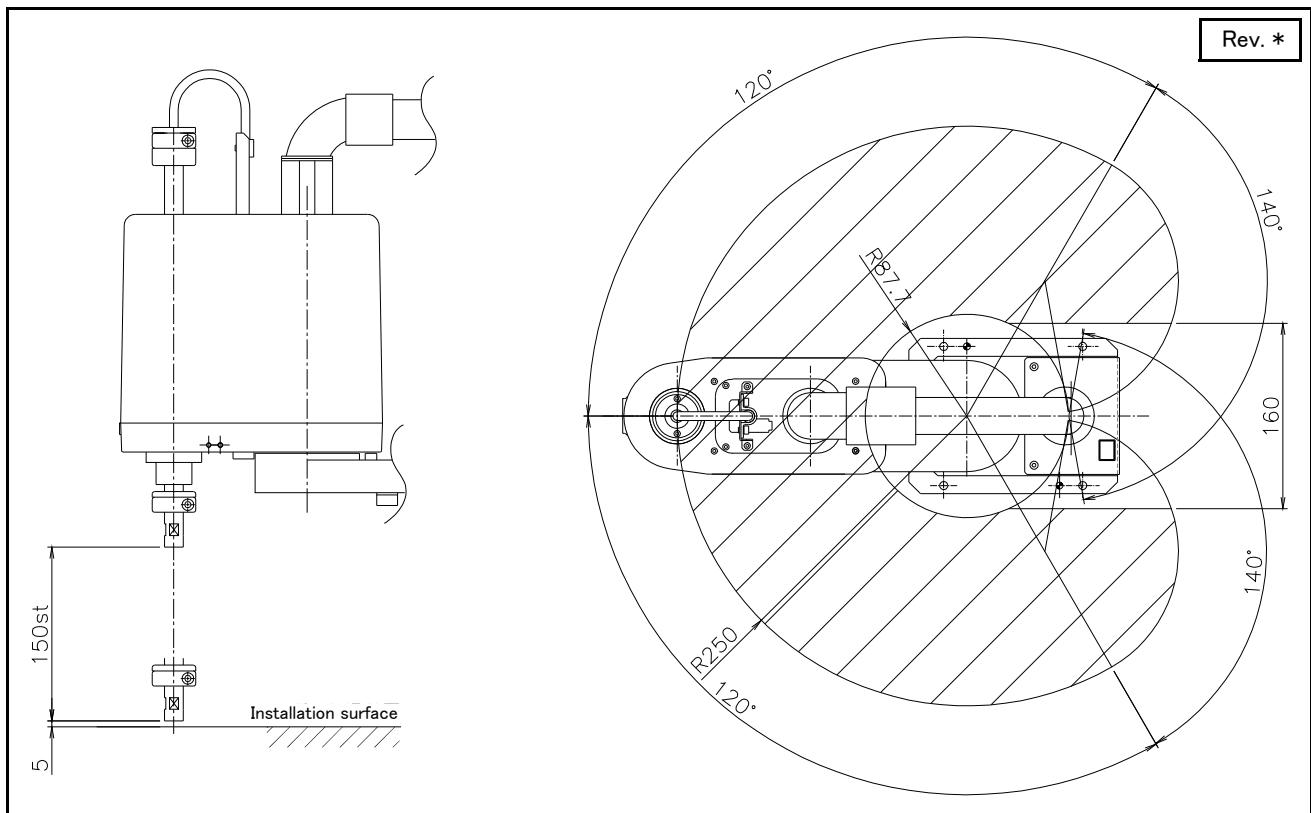


Fig.2-9 : Operating range diagram of RH-2FH2515

2.4.2 Mechanical interface

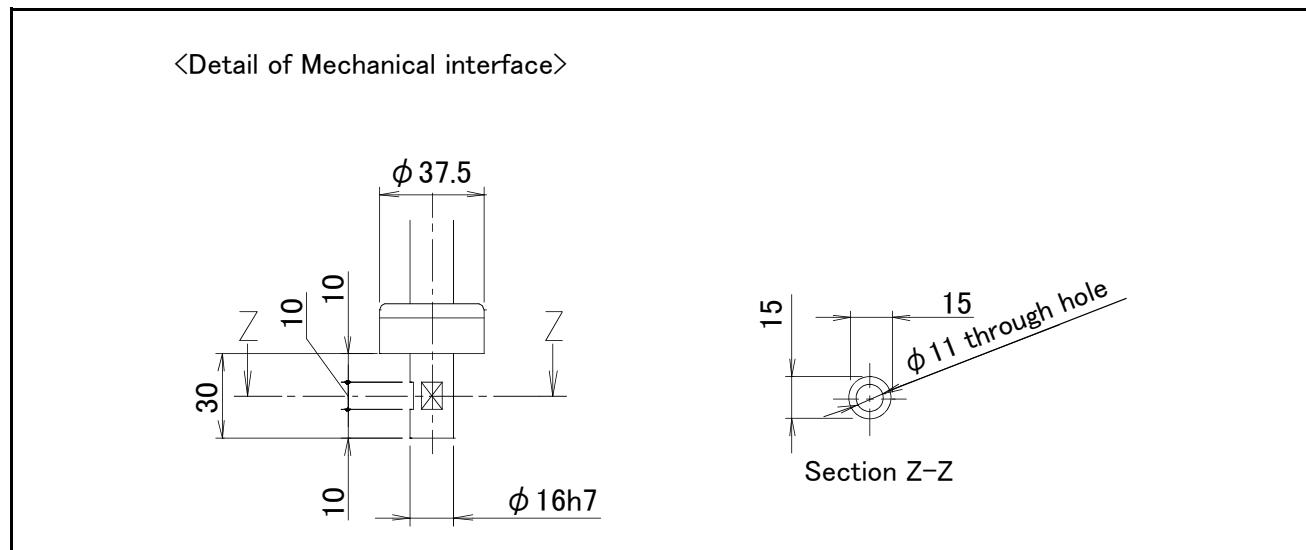


Fig.2-10 : Mechanical interface

2.5 Tooling

2.5.1 Wiring and piping for hand

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

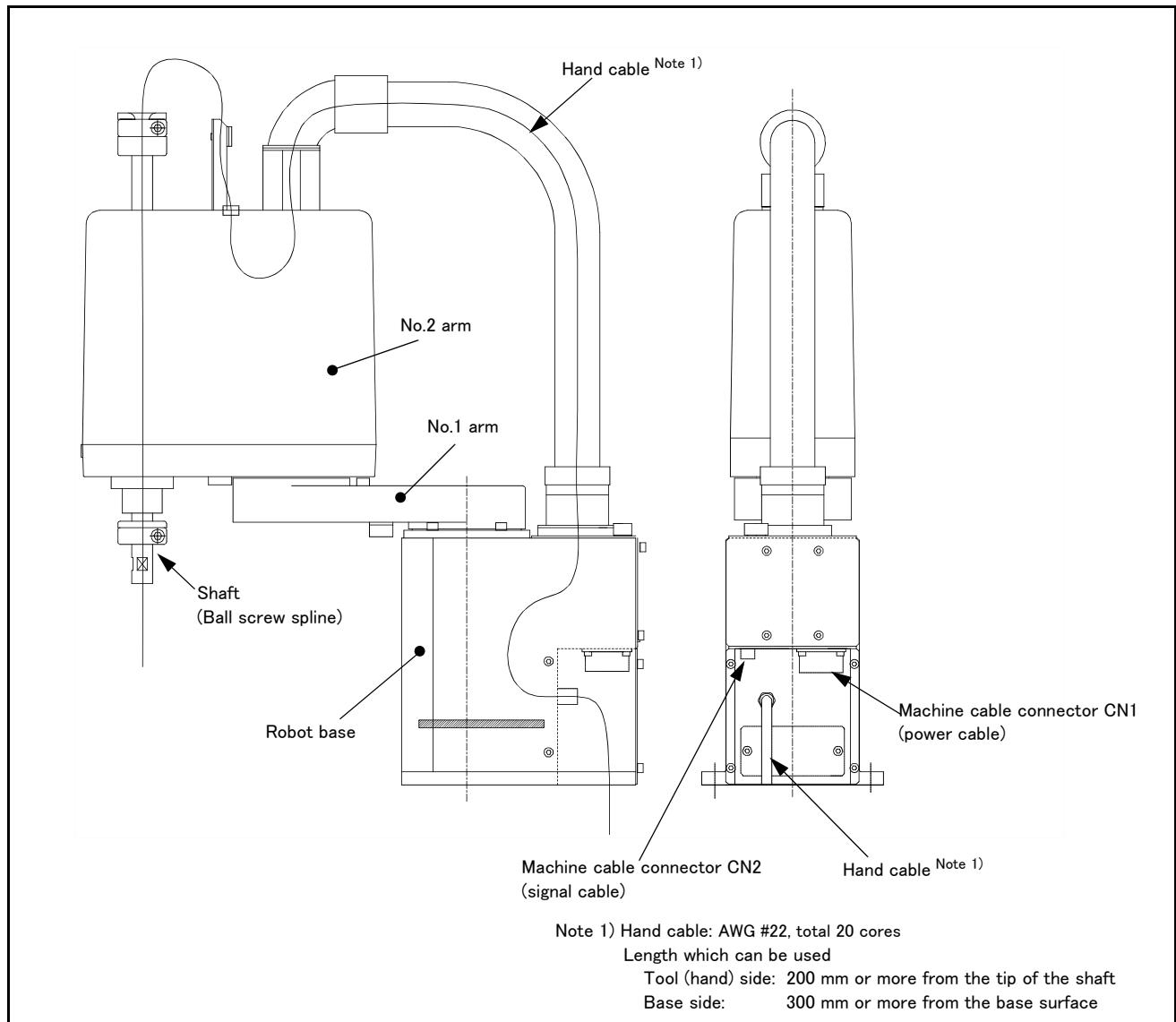


Fig.2-11 : Wiring and piping for hand

2.5.2 Internal wiring for the hand

The hand cable extends from the rear of base section to the tip of shaft. (AWG #22, total 20 cores)

2.5.3 Wiring system diagram for hand

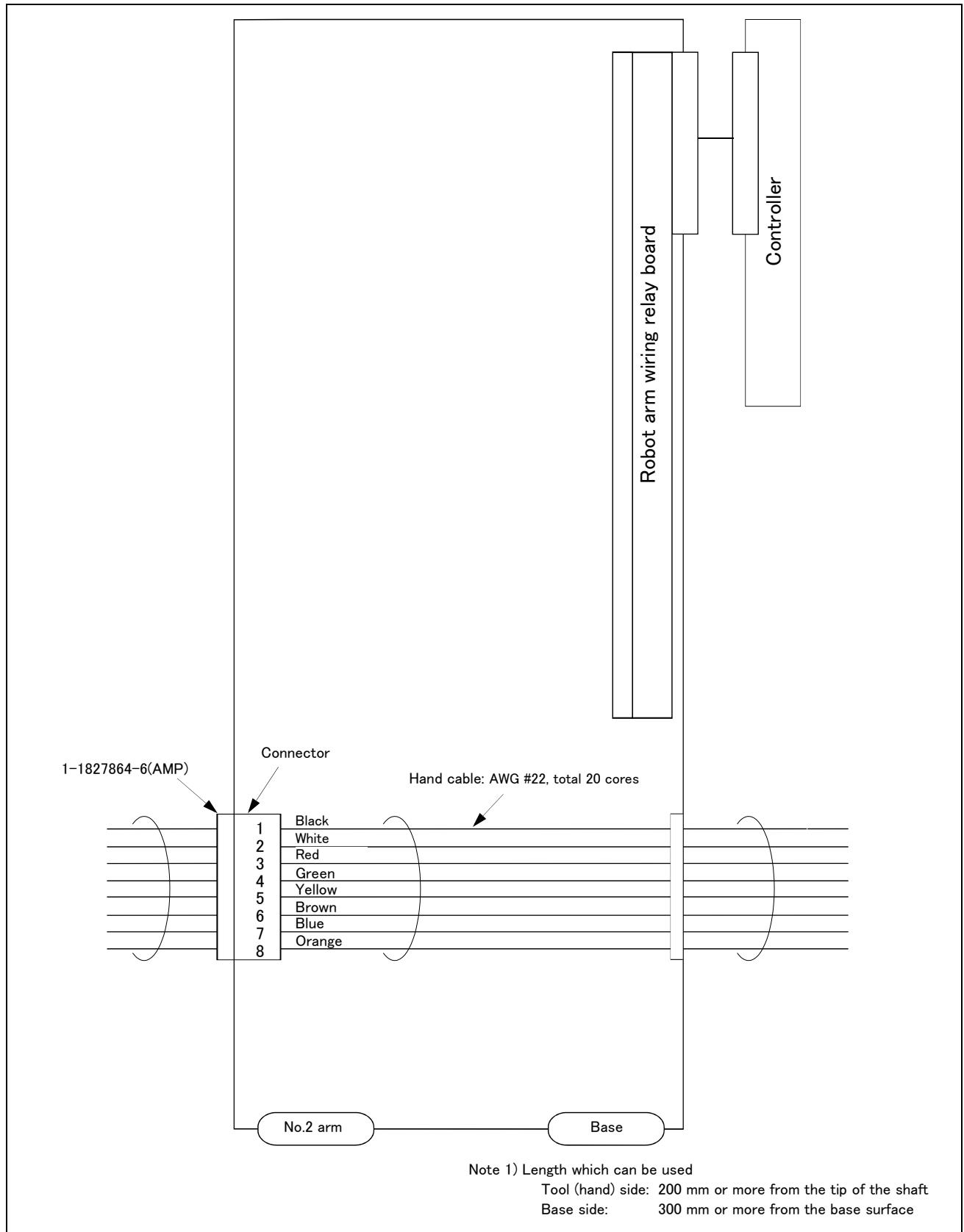


Fig.2-12 : Wiring system diagram for hand and example the solenoid valve installation

2.5.4 Electrical specifications of hand input/output

Table 2-5 : Electrical specifications of input circuit

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

* HCn = HC1 to HC8

Table 2-6 : Electrical specifications of output circuit

Item		Specification	Internal circuit
Type	Transistor output		<Sink type>
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 ON-OFF	2ms or less (hardware response time) 2 ms or less (resistance load) (hardware response time)	<Source type>
Protects	Protects the over-current (0.9A)		

* GRn = GR1 to GR8

2.5.5 Air supply circuit example for the hand

Fig. 2-13 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. 2-13 and use the circuit described so that the robot stops when pressure drops. Use a hand with a spring-pressure clamp, or a mechanical lock-type hand, that can be used in cases where the pressure switch becomes damaged.
- (3) The optional hand and solenoid valve are of an oilless type. If they are used, don't use any lubricator.
- (4) If the air supply temperature (primary piping) used for the tool etc. is lower than ambient air temperature, the dew condensation may occur on the coupling or the hose surface.

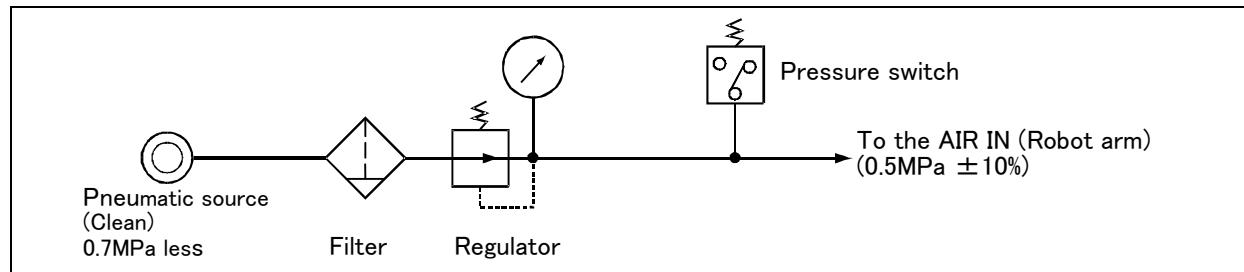


Fig.2-13 : Air supply circuit example for the hand

2.6 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. 2-14](#).) For specific information about parts to be replaced and timing of overhaul, contact your local service representative.

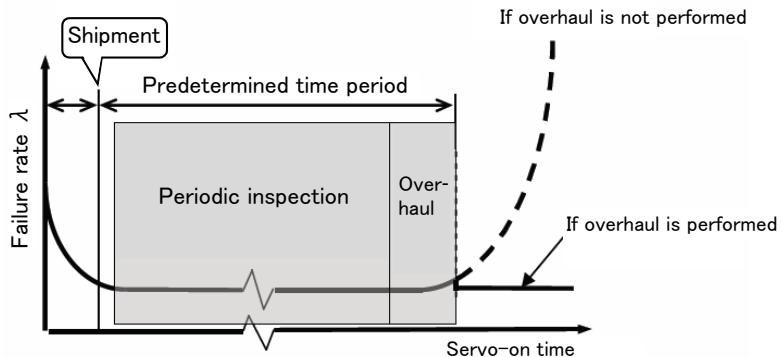


Fig.2-14 : Periodic inspection/overhaul periods

2.7 Maintenance parts

The consumable parts used in the robot arm are shown in [Table 2–7](#). 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 2–7 : Consumable part list

No.	Part name	Type <small>Note1)</small>	Usage place	Qty.	Supplier
1	Grease		Reduction gears of each axis	As needed	Mitsubishi Electric
2			Ball screw spline	As needed	
3	Lithium battery	ER6		Front section of the base	3
4	Timing belt		J3 axis	1	Mitsubishi Electric
5			J4 axis	1	

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

3 Controller

3.1 Standard specifications

3.1.1 Basic specifications

Use the robot CPU unit which consists of CR751-Q controllers, equipping the base unit of the sequencer of the MELSEC-Q series of our company. Specifications such as the power supply and outside dimension of the robot CPU unit are the same as the sequencer's specification. Refer to [Page 30 "Fig. 3-2"](#) (Names of each part), [Page 32 "Fig. 3-4"](#) and [Page 33 "Fig. 3-5"](#) (Outside dimensions)

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

Table 3-1 : Specifications of controller

Item		Unit	Specification	Remarks
Type			CR751-02HQ1-0	
Number of control axis			Simultaneously 4	
Memory capacity	Programmed positions	point	13,000	
	No. of steps	step	26,000	
	Number of program		256	
Robot language			MELFA-BASIC IV, V	
Teaching method			Pose teaching method, MDI method Note1)	
External input and output	Input and output	point	0/0	Multi-CPU shared device Input 8192/Output 8192 (Max.)
	Dedicated input/output		Assign to the multi-CPU shared device.	
	Hard open/close input/output	point	8/8	Built-in
	Emergency stop input	point	1	Dual line
	Door switch input	point	1	Dual line
	Enabling device input	point	1	Dual line
	Emergency stop output	point	1	Dual line
	Mode output	point	1	Dual line
	Robot error output	point	1	Dual line
	Addition axis synchronization	point	1	Dual line
	Mode changeover switch input	point	1	Dual line
Interface	RS-422	port	1	Only for T/B
	Ethernet	port	1	10BASE-T/100BASE-Tx
	Additional axis interface	Channel	1	SSCNET III (Connects with MR-J3-BS, MR-J4-B series)
Power source	Input voltage range	V	Single phase, AC180 to 253	
	Power capacity	kVA	0.5	Does not include rush current Note2)
	Power supply frequency	Hz	50/60	
Outline dimensions Note3)		mm	430(W) x 425(D) x 98(H)	Excluding protrusions
Construction			Self-contained floor type, Opened type. Installation vertically or horizontally	IP20 Note4)
Operating temperature range		°C	0 to 40	
Ambient humidity		%RH	45 to 85	Without dew drops
Grounding		Ω	100 or less	100Ω or less (class D grounding) Note5)
Paint color			Dark gray	Equivalent to Munsell: 3.5PB3.2/0.8

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

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

Note2) The power capacity is the rating value for normal operation. The power capacity does not include the rush current when the power is turned ON. The power capacity is a guideline and the actual operation is affected by the input power voltage. The short circuit breaker should use the following.

* Operate by the current leakage under the commercial frequency domain (50–60Hz). If sensitive to the high frequency ingredient, it will become the cause in which below the maximum leak current value carries out the trip.

Note3) Refer to [Page 31, "3.3 Outside dimensions/Installation dimensions"](#) for details.

Note4) This controller is standard specification. (Refer to [Page 27, "3.1.2 Protection specifications and operating supply"](#).)

Note5) The robot must be grounded by the customer.

Table 3-2 : Robot CPU unit standard specification

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

3.1.2 Protection specifications and operating supply

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

【Information】

- The IEC IP20

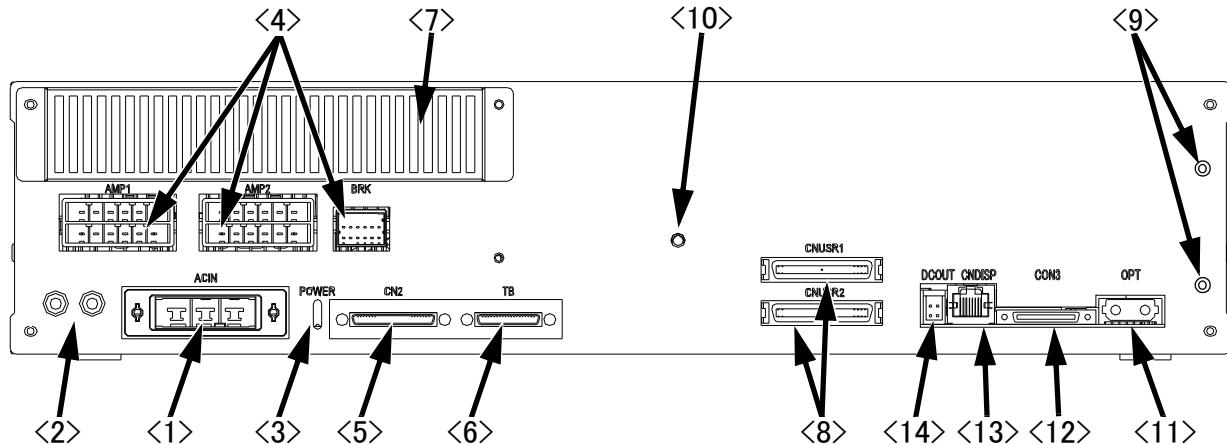
It indicates the protective structure that prevents an iron ball $12^{+0.05}_0$ mm diameter, which is being pressed with the power of $3.1 \text{ kg} \pm 10\%$, from going through the opening in the outer sheath of the supplied equipment.

Refer to the section [Page 78, "6.2 Working environment"](#) for details on the working environment.

3.2 Names of each part

3.2.1 Drive unit

Drive unit (Front side)



Controller (Rear side)

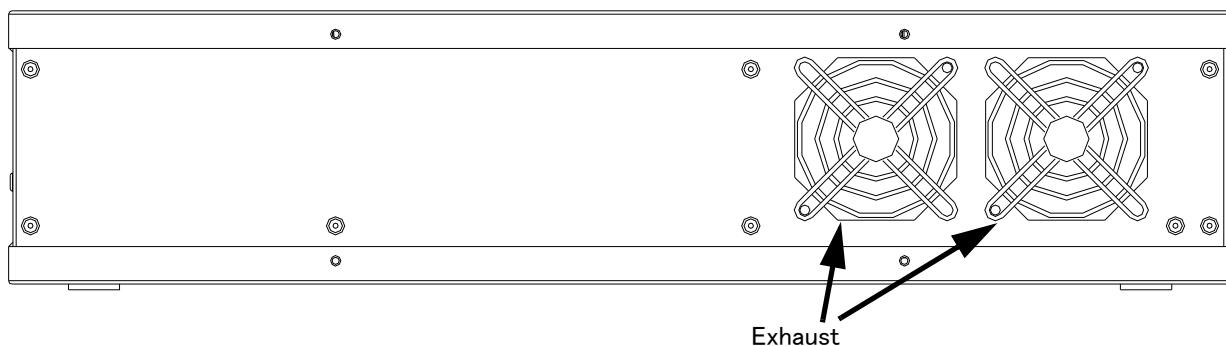


Fig.3-1 : Names of drive unit parts (CR751)

- <1> ACIN connector The connector for AC power source (single phase, AC200V) input (a socket housing and a terminal are attached).
Refer to a separate manual “INSTRUCTION MANUAL/Controller setup, basic operation, and maintenance” for how to connect a power cable.
- <2> PE terminal The screw for grounding of the cable. (M4 screw x 2 place)
- <3> POWER lamp Lamp of control power source
- <4> Machine cable connector (motor power)
AMP1, AMP2: Motor power, BRK: Motor brake
- <5> Machine cable connector (motor signal)
CN2: Motor signal
- <6> T/B connection connector (TB) This is a dedicated connector for connecting the R33TB. When not using T/B, connect the attached dummy plug.
- <7> Filter cover There is an air filter inside this cover.
- <8> CNUSR connector The connector for input/ output connection dedicated for robot.
(CNUSR1, CNUSR2)
Refer to a separate manual “INSTRUCTION MANUAL/Controller setup, basic operation, and maintenance” for the connection method and the further description of pin assign.
- <9> Grounding terminal The grounding terminal for connecting cables of option card. (M3 screw x 2 places)
- <10> Power supply charge lamp (CRARGE)
The lamp is to ensure safe timing (prevent electric shocks) when removing the cover (users are not normally required to remove the cover).
This lamp is illuminated (red) when electrical energy accumulates on the

controller's power supply circuit board due to the robot's servo being ON.
After turning the control power OFF and allowing a few minutes to pass,
the lamp will go out.

- <11>OPT connector (OPT)For SSCNETIII connection
- <12>CON3 connector (CON3)For RS422 of T/B connection
- <13>CNDISP connector (CNDISP)For LAN of T/B connection
- <14>DCOUT connector (DCOUT)For emergency stop

3.2.2 Robot CPU

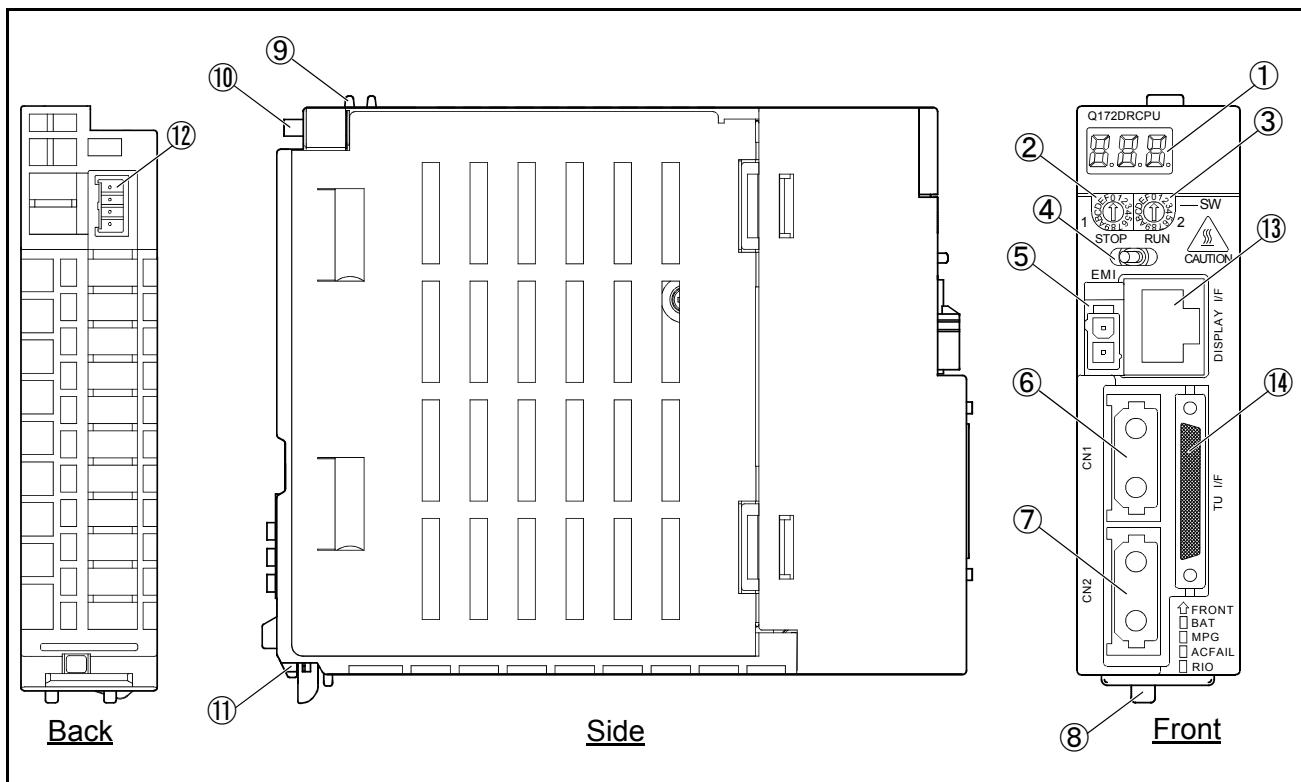


Fig.3-2 : Names of each part of the robot CPU

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

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

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

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

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

3.3 Outside dimensions/Installation dimensions

3.3.1 Outside dimensions

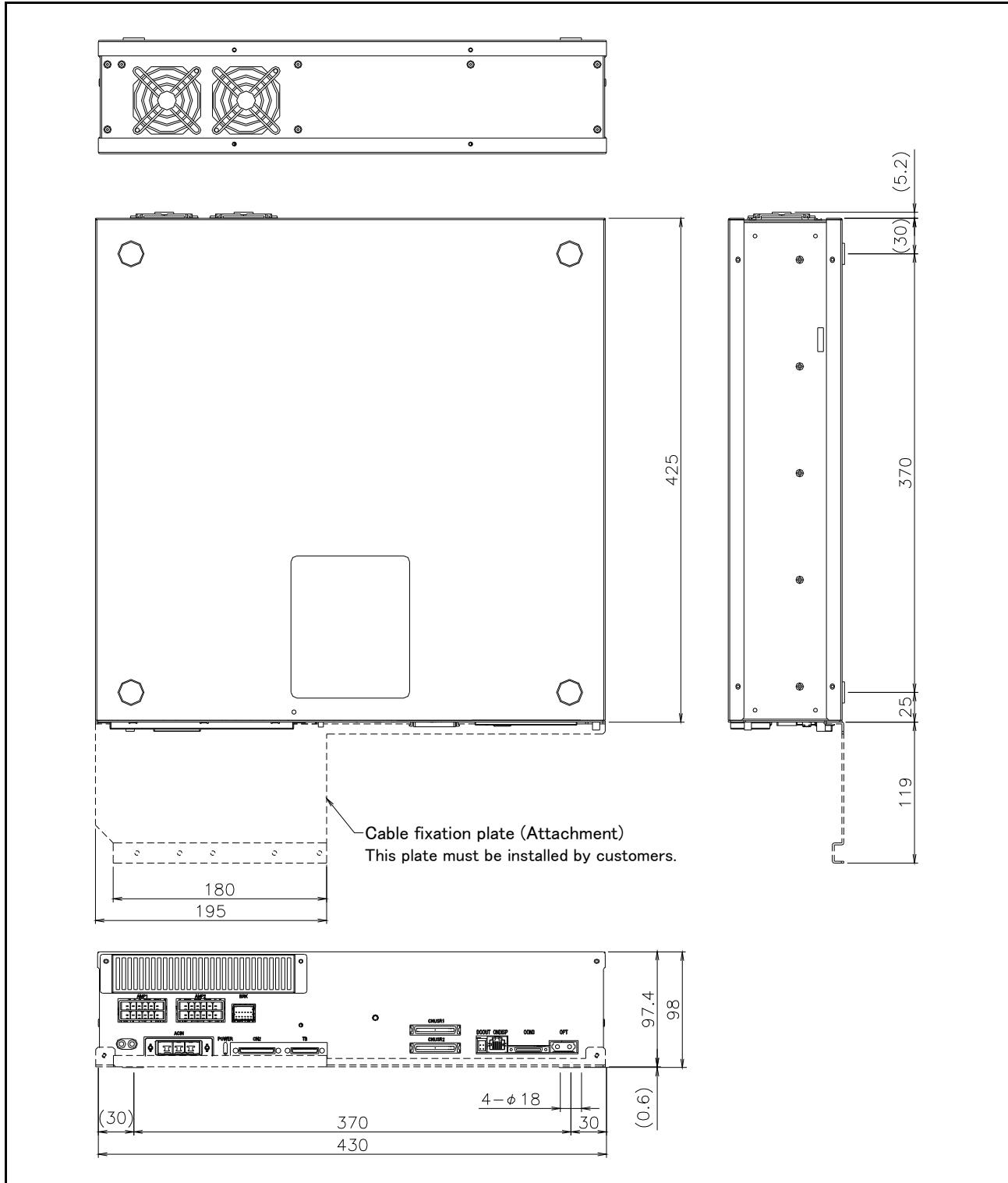


Fig.3-3 : Outside dimensions of drive unit (CR751)

(1) Outside dimensions of robot CPU unit

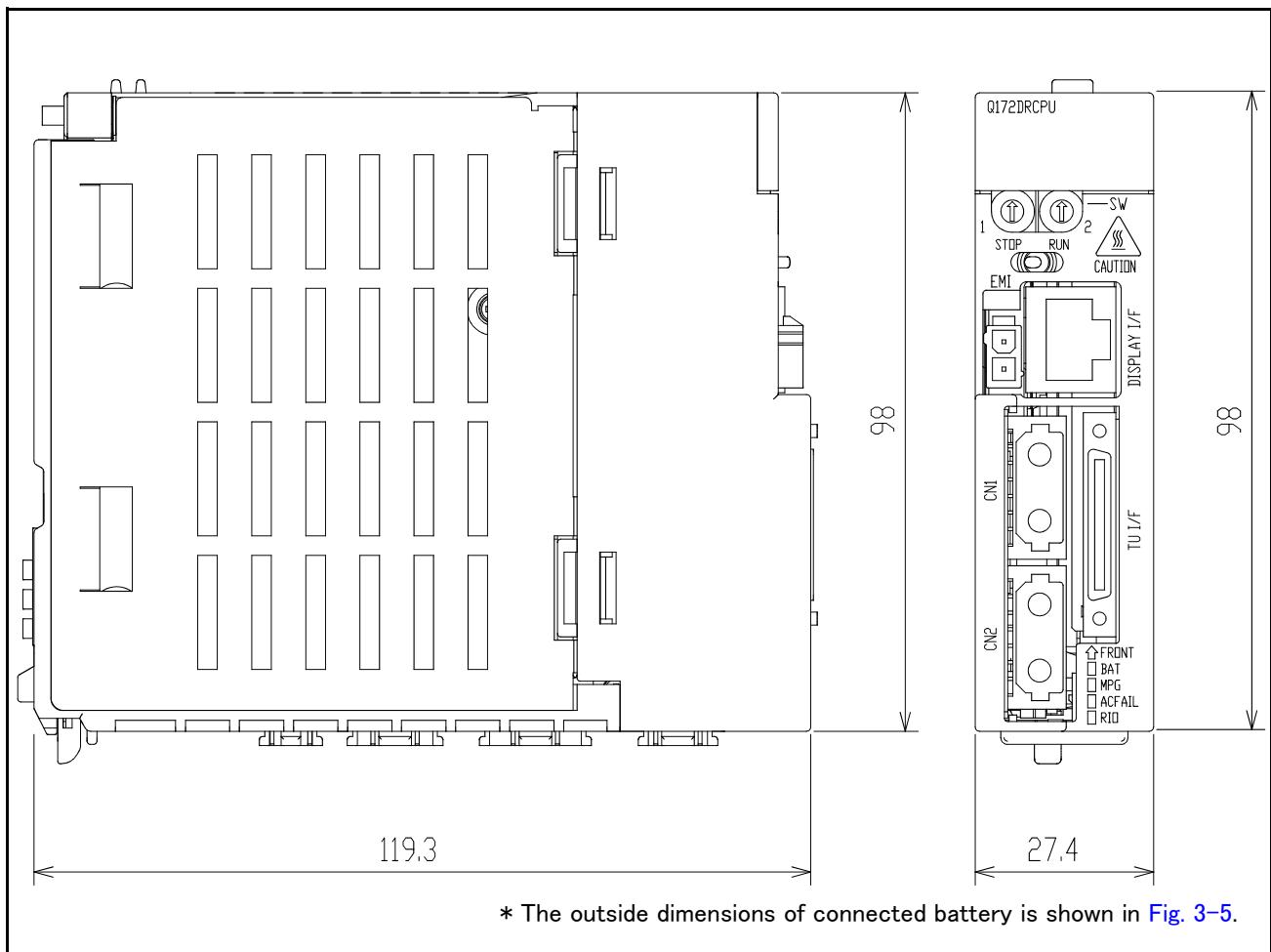


Fig.3-4 : Outside dimensions of robot CPU

(2) Battery unit outside dimension

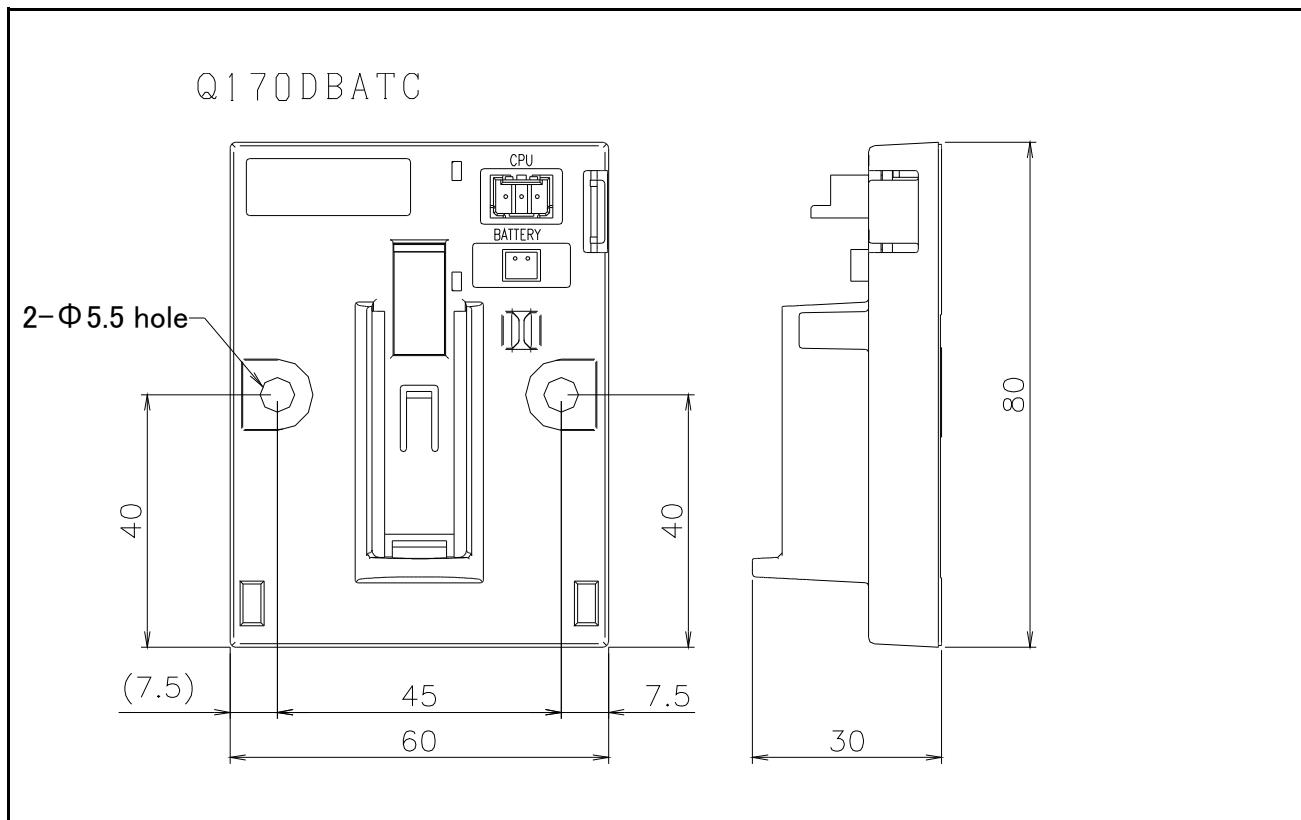
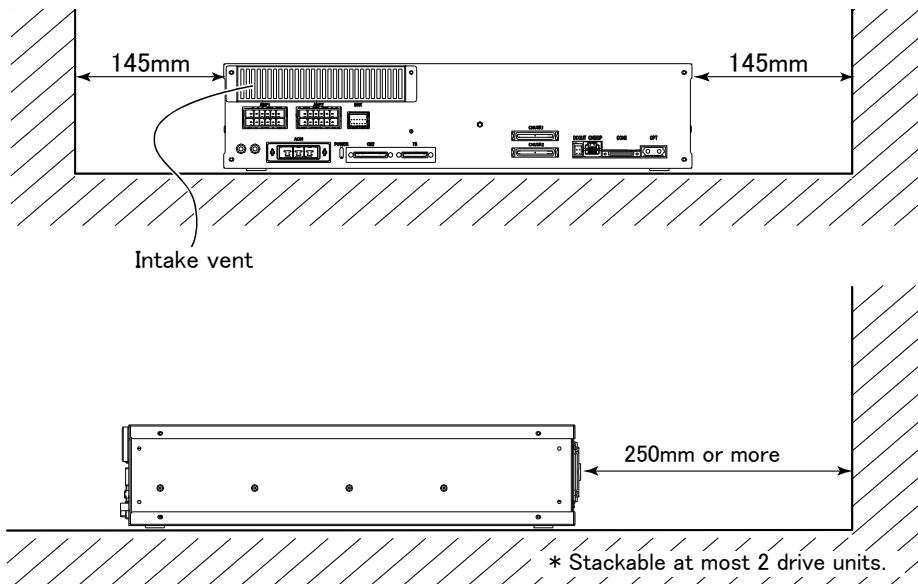


Fig.3-5 : Outside dimensions of battery unit

3.3.2 Installation dimensions

<Placed horizontally>



<Placed vertically>

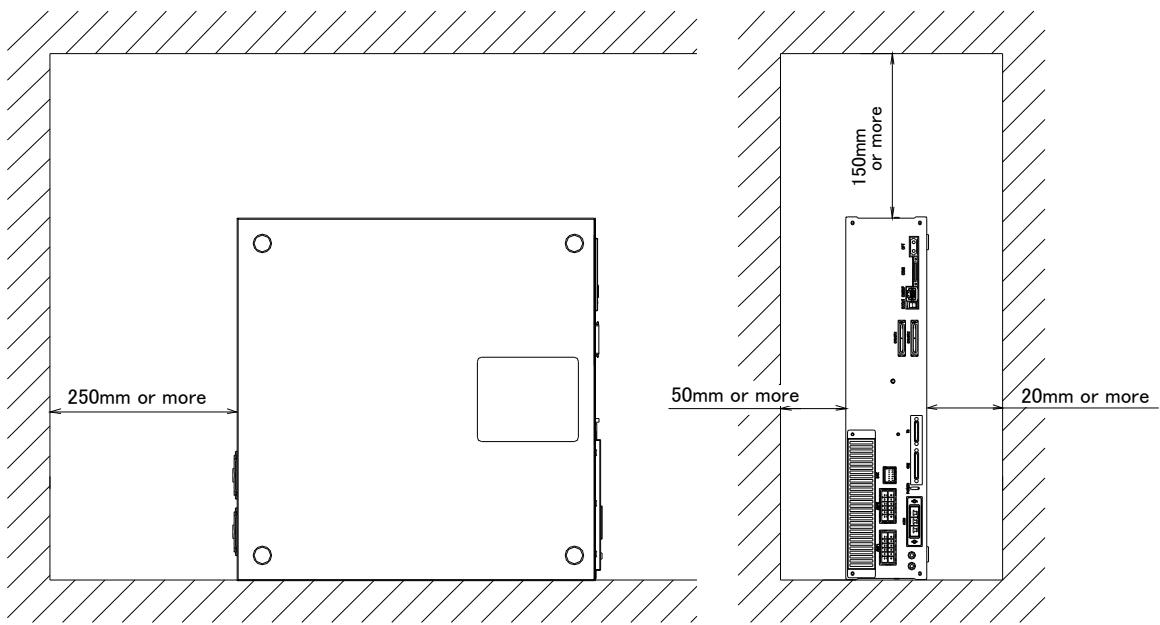


Fig.3-6 : Installation of controller (CR751)



CAUTION

Fixing installation section sure for prevention from the fall, when using the drive unit placing vertically. The reference figure of the metal plate for fixing is shown in Fig. 3-7. You should install the metal plate for fixation to the controller with M4 x 8 or the shorter screw. The screw projection length inside the drive unit (side board thickness is 1.2mm) surely makes 6.8mm or less.



CAUTION

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

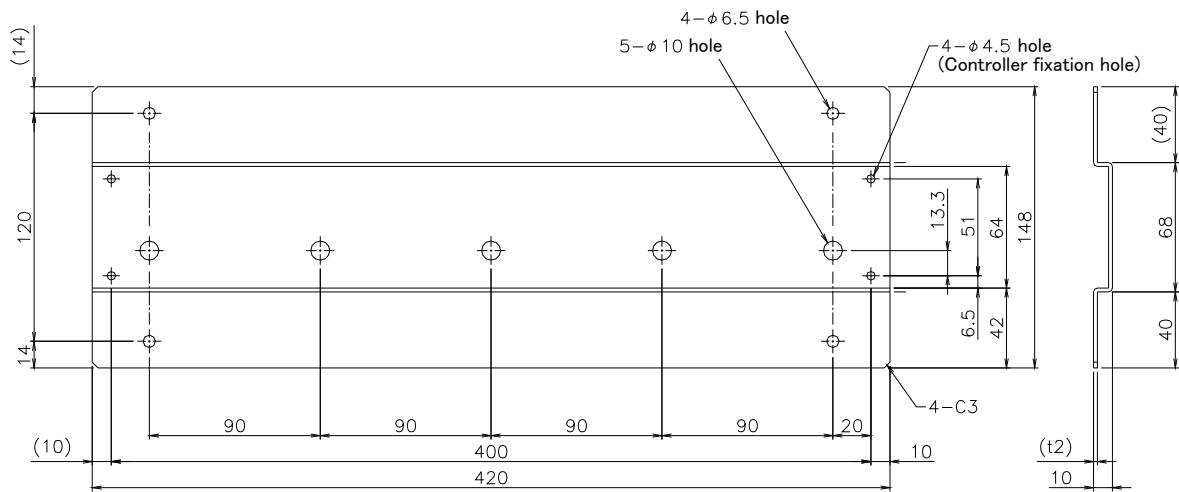


Fig.3-7 : Metal plate for fixation to placing vertically (Reference for CR751)

(1) Robot CPU Unit installation dimensions

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

<Q172DRCPU>

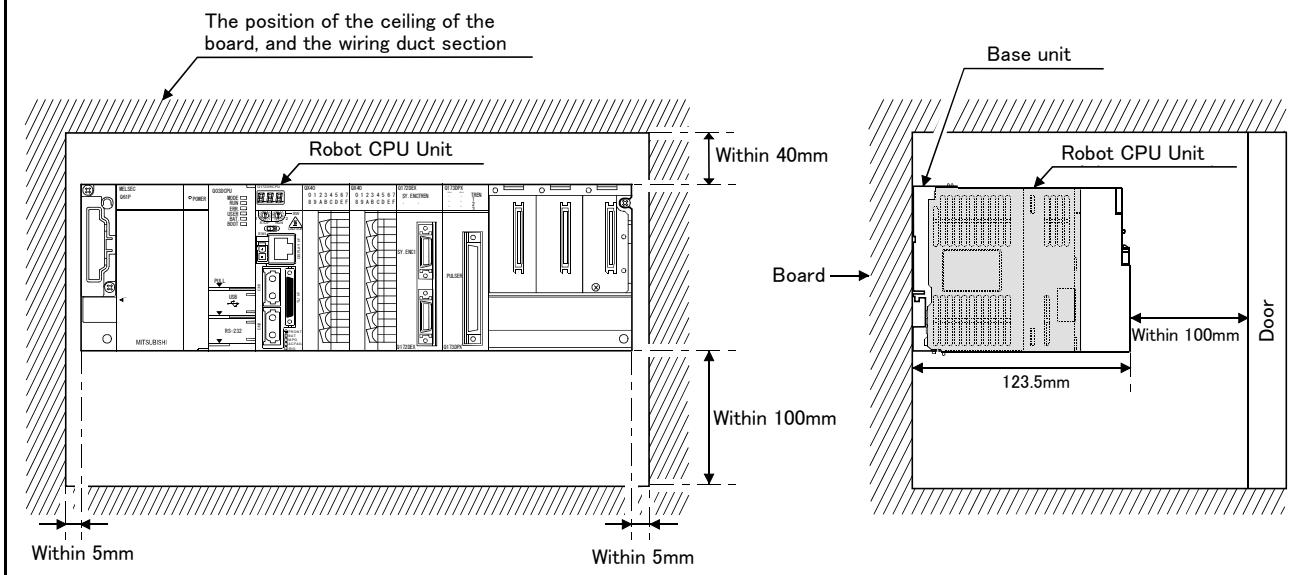


Fig.3-8 : Installation of robot CPU Unit

3.4 External input/output

3.4.1 Types

- (1) Dedicated input/output.....These inputs and outputs carry out the robot remote operation and status display.
- (2) General-purpose input/output.....These are inputs and outputs that the customer can program for peripheral device control.
- (3) Hand input/output.....These are inputs and outputs related to the hand that the customer can program.
- (4)Emergency stop/Door switch input.....The wiring for the safe security of the emergency stop etc. is shown in on [Page 41, "3.6 Emergency stop input and output etc."](#) and on [Page 71, "6.1.7 Examples of safety measures"](#).

<For Reference>

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

3.5 Dedicated input/output

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

Table 3-3 : Dedicated input/output list

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

Parameter name	Input			Output	
	Name	Function	Level	Name	Function
S1STOP : S32STOP	Stop input	Stops each slot.	L	In wait output	Outputs that each slot is temporarily stopped.
PRGSEL	Program selection input signal	Designates the setting value for the program No. with numeric value input signals.	E		None
OVRDSEL	Override selection input signal	Designates the setting value for the override with the numeric value input signals.	E		None
IODATA Note2)	Numeric value input (start No., end No.)	Used to designate the program name, override value., mechanism value.	L	Numeric value output (start No., end No.)	Used to output the program name, override value., mechanism No.
PRGOUT	Program No. output request	Requests output of the program name.	E	Program No. output signal	Outputs that the program name is being output to the numeric value output signal.
LINEOUT	Line No. output request	Requests output of the line No.	E	Line No. output signal	Outputs that the line No. is being output to the numeric value output signal.
OVRDOUT	Override value output request	Requests the override output.	E	Override value output signal	Outputs that the override value is being output to the numeric value output signal.
ERROUT	Error No. output request	Requests the error No. output.	E	Error No. output signal	Outputs that the error No. is being output to the numeric value output signal.
JOGENA	Jog valid input signal	Validates jog operation with the external signals	E	Jog valid output signal	Outputs that the jog operation with external signals is valid.
JOGM	Jog mode input 2-bit	Designates the jog mode.	L	Jog mode output 2-bit	Outputs the current jog mode.
JOG+	Jog feed + side for 8-axes	Requests the + side jog operation.	L		None
JOG-	Jog feed - side for 8-axes	Requests the - side jog operation.	L		None
HNDCTL1 : HNDCTL3	None			Mechanism 1 hand output signal status : Mechanism 3 hand output signal status	Mechanism 1: Outputs the status of general-purpose outputs 900 to 907. Mechanism 2: Outputs the status of general-purpose outputs 910 to 917. Mechanism 3: Outputs the status of general-purpose outputs 920 to 927.
HNDSTS1 : HNDSTS3	None			Mechanism 1 hand input signal status : Mechanism 3 hand input signal status	Mechanism 1: Outputs the status of hand inputs 900 to 907. Mechanism 2: Outputs the status of hand inputs 910 to 917. Mechanism 3: Outputs the status of hand inputs 920 to 927.
HNDERR1 : HNDERR3	Mechanism 1 hand error input signal : Mechanism 3 hand error input signal	Requests the hand error occurrence.	L	Mechanism 1 hand error output signal : Mechanism 3 hand error output signal	Outputs that a hand error is occurring.

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

Note1) The level indicates the signal level.

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

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

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

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

3.6 Emergency stop input and output etc.

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

Table 3-4 : Special input/output terminal

Item	Name	Function
Input	Emergency stop	Applies the emergency stop. Dual emergency line
Input	Special stop input	Applies the stop. (Refer to Page 45, "3.6.2 Special stop input (SKIP)")
Input	Door switch	Servo-off. Dual line, normal close (Page 46, "3.6.3 Door switch function")
Input	Enabling device	Servo-off. Dual line, normal close (Page 46, "3.6.4 Enabling device function")
Output	Robot error output	Contactor is opening during error occurrence.
Output	Emergency stop output	The point of contact opens under occurrence of emergency stop of external input signal, emergency stop of OP, emergency stop of T/B.
Output	Mode output	MANUAL mode: contactor is opening, AUTOMATIC mode: contactor is closing.
Output	Magnet contactor control connector output for addition axes	When an additional axis is used, the servo ON/OFF status of the additional axis can be synchronized with the robot arm. (Page 53, "3.9 Magnet contactor control connector output (AXMC) for addition axes")

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

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

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

Pin number assignment of each terminal and the circuit diagram are shown in [Fig. 3-9](#).

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. 3-9](#).

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

And, the example of the connection and notes of the emergency stop are described in [Page 71, "6.1.7 Examples of safety measures"](#) Refer to it together

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

1) Please prepare the emergency stop switch, door switch and enabling device.

a) External emergency switch

• CR751 drive unit.....CNUSR1 connector "between 2 and 27" and "between 7 and 32".

b) Door switch

• CR751 drive unit.....CNUSR1 connector "between 4 and 29" and "between 9 and 34".

c) Enabling device

• CR751 drive unit.....CNUSR1 connector "between 5 and 30" and "between 10 and 35".

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



Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in errors, such as the emergency stop not being released. In order to prevent errors occurring, please be sure to check that all functions (such as the teaching box emergency stop, customer emergency stop, and door switch) are working properly after the wiring setup is completed.

⚠ CAUTION

You should always connect doubly connection of the emergency stop, the door switch, and the enabling switch. In connection of only one side, if the relay of customer use should break down, it may not function correctly.

And, the output contacts from the robot controller (robot error output, emergency stop output, mode output, addition axis contactor control output) are dual contacts (synchronizes). You should connect surely by dual line with the customer's equipment as well as connection of the emergency stop and the door switch.

⚠ CAUTION

Please make sure to wire the multiple emergency stop switches so that they each function independently. Check and make sure that the emergency stop doesn't only function under an AND condition (when multiple emergency stop switches are ON at the same time).

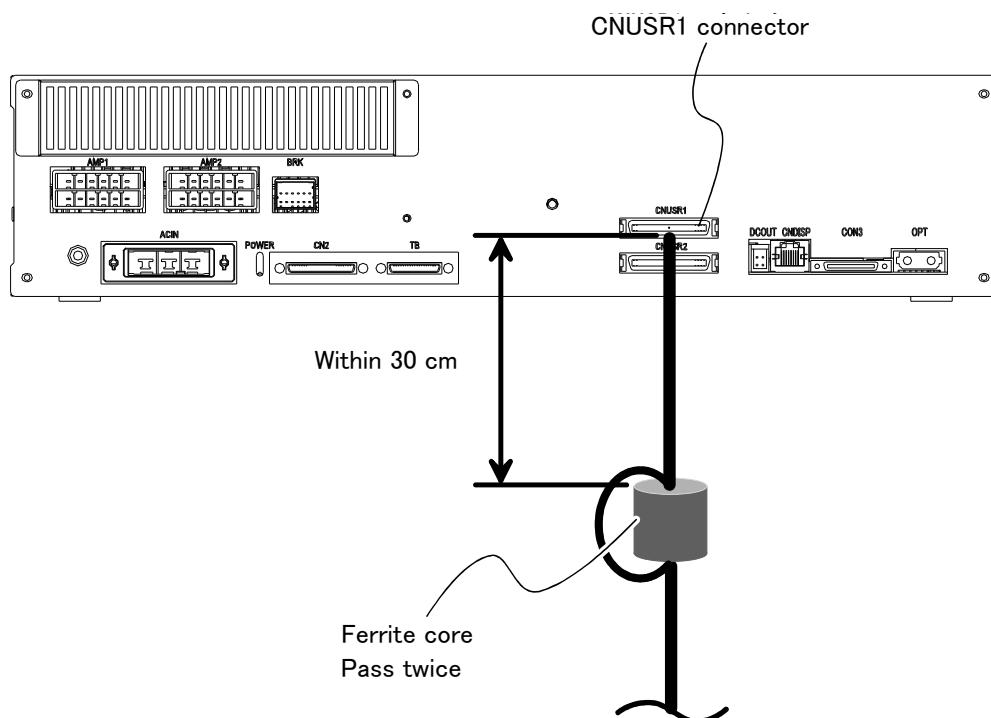


Fig.3-9 : Emergency stop cable connection (CR751)

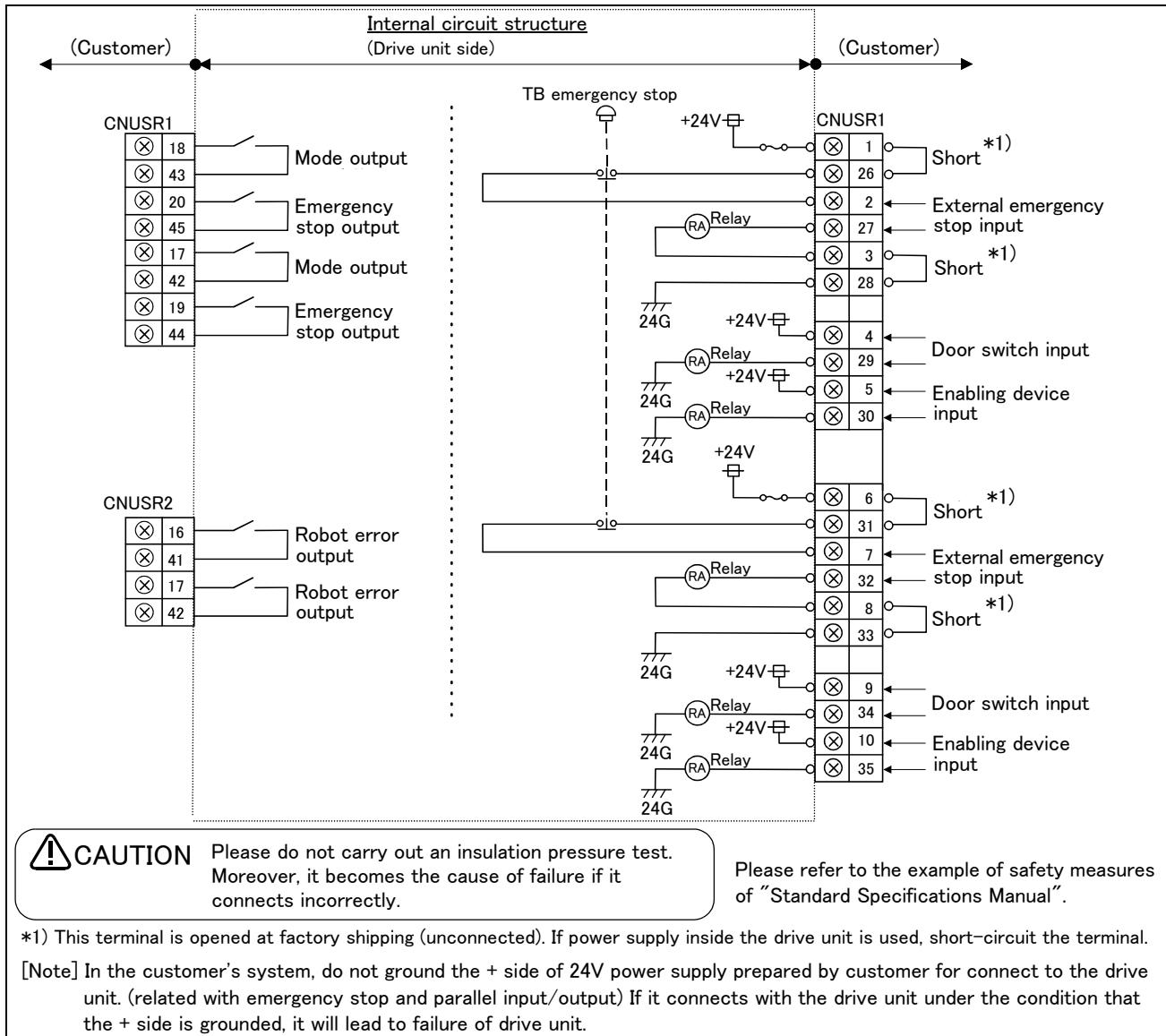


Fig.3-10 : External emergency stop connection (CR751)

CAUTION

Place the emergency stop switch in an easily operable position, and be sure to wire it to the emergency stop correctly by referencing [Page 71, "6.1.7 Examples of safety measures"](#).

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

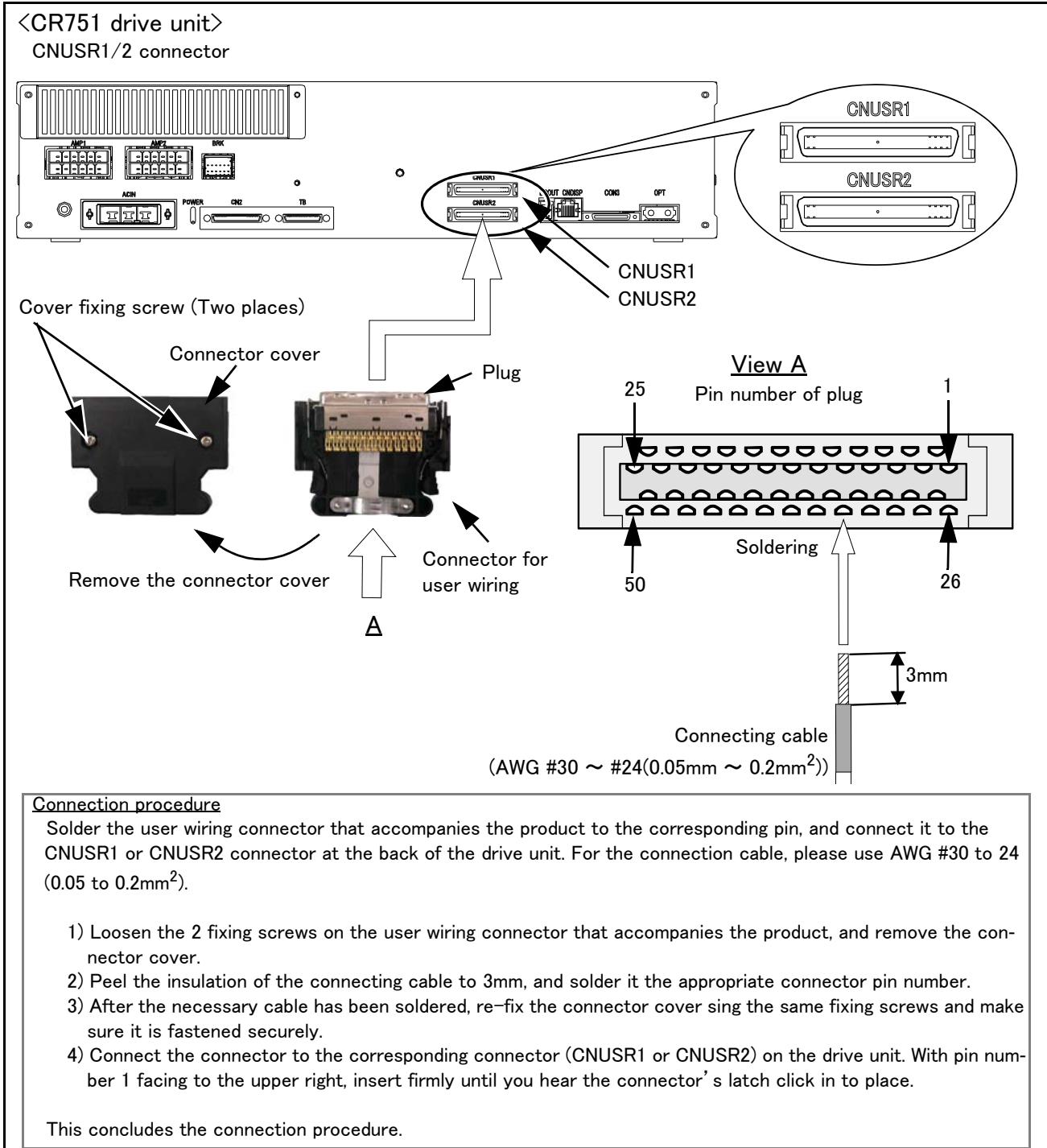


Fig.3-11 : Method of wiring for external emergency stop connection (CR751 (CNUSR1/2))

⚠ CAUTION

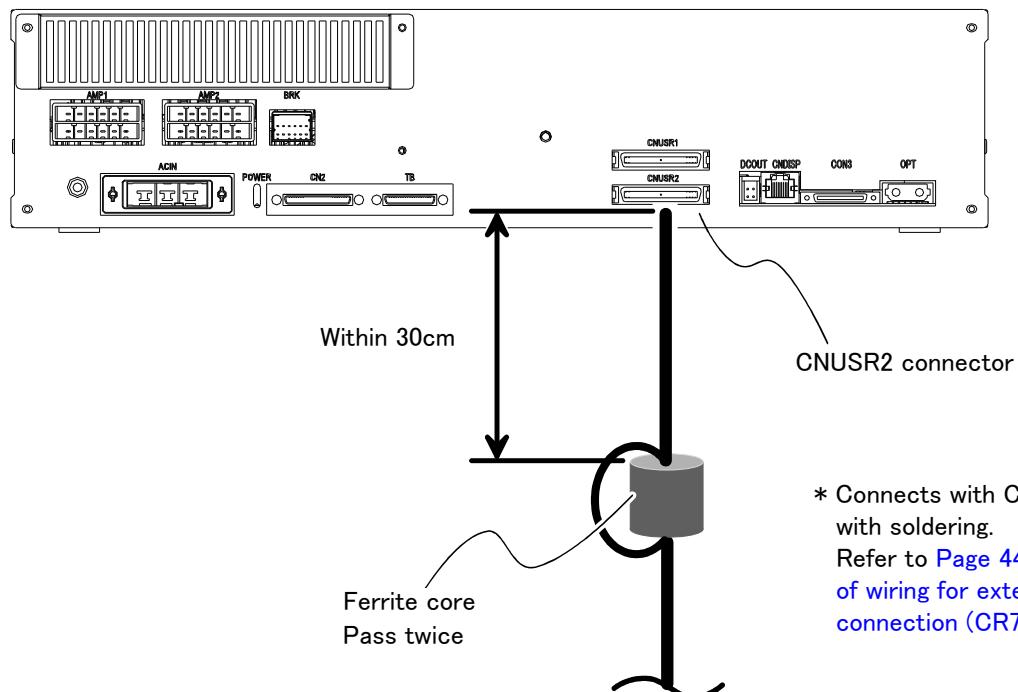
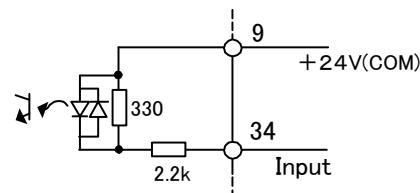
When soldering please take care to only connect to the specified pin number. Connecting to a different pin number or short-circuiting with another pin will result in the robot breaking down or malfunctioning. The connectors on the drive unit side are CNUSR1 (upper side) and CNUSR2 (lower side). Make sure that there is no mistake when connecting to the target connectors. Connecting incorrectly will result in the robot breaking down or malfunctioning.

3.6.2 Special stop input (SKIP)

The skip is the input signal to stop the robot. The pin 9, 34 of the CNUSR2 connector shown in Fig. 3-12.

Table 3-5 : Special stop input electric specification

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



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

Fig.3-12 : Connection of the special-stop-input (CR751)

3.6.3 Door switch function

This function retrieves the status of the switch installed on the door of the safety fence, etc., and stops the robot when the door is opened. This differs from an emergency stop in that the servo turns OFF when the door is opened and an error does not occur. Follow the wiring example shown in [Page 42 "Fig. 3-9: Emergency stop cable connection \(CR751\)"](#) and [Page 71, "6.1.7 Examples of safety measures"](#). Those figure explains the wire is contact closes when the door is closed. Details of this function according to the robot status are shown below.

*During automatic operation When the door is opened, the servo turns OFF and the robot stops. An error occurs.

The process of the restoration: Close the door, reset the alarm, turn on the servo, and restart

*During teaching..... Even when the door is opened, the servo can be turned ON and the robot moved using the teaching pendant.

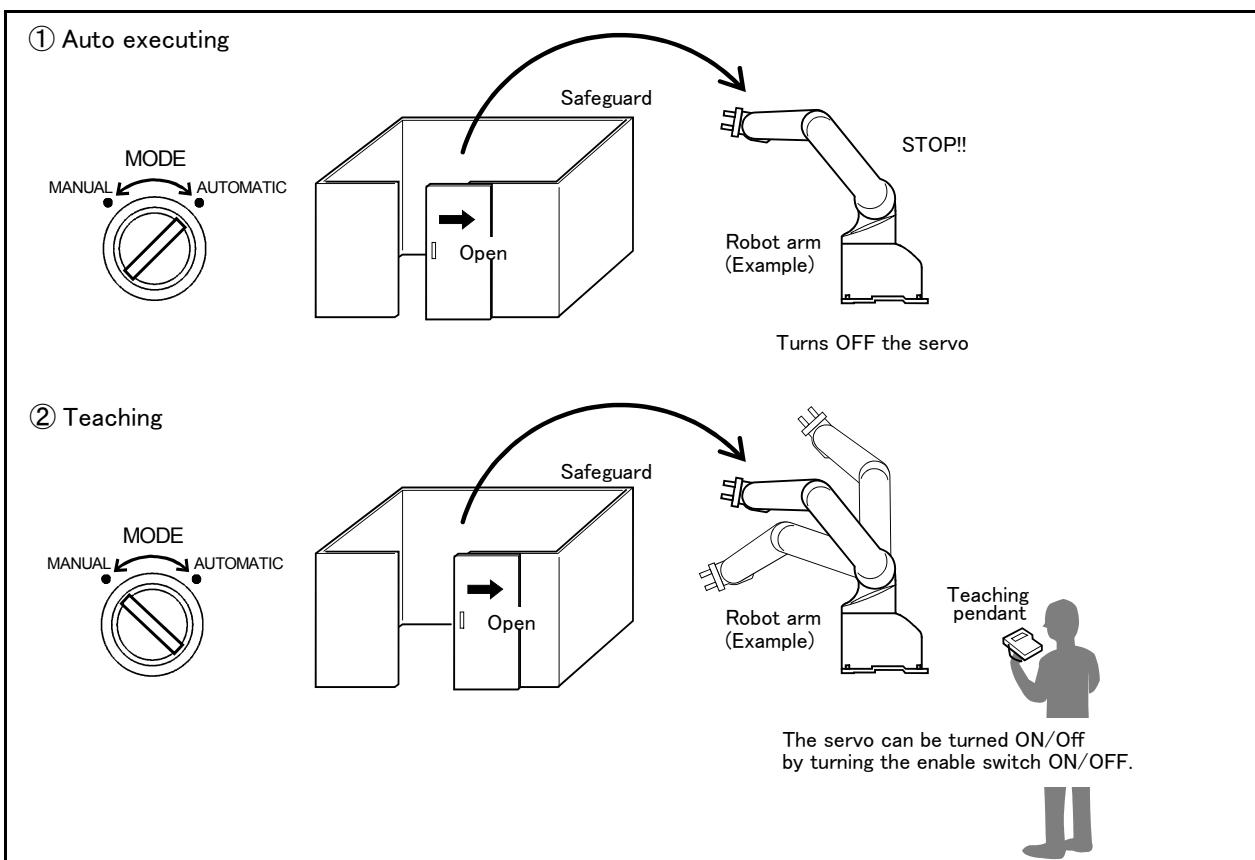


Fig.3-13 : Door switch function

3.6.4 Enabling device function

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

(1) When door is opening

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

(2) When door is closing

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

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

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

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

Table 3-6 : Various operations and necessary switch settings

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

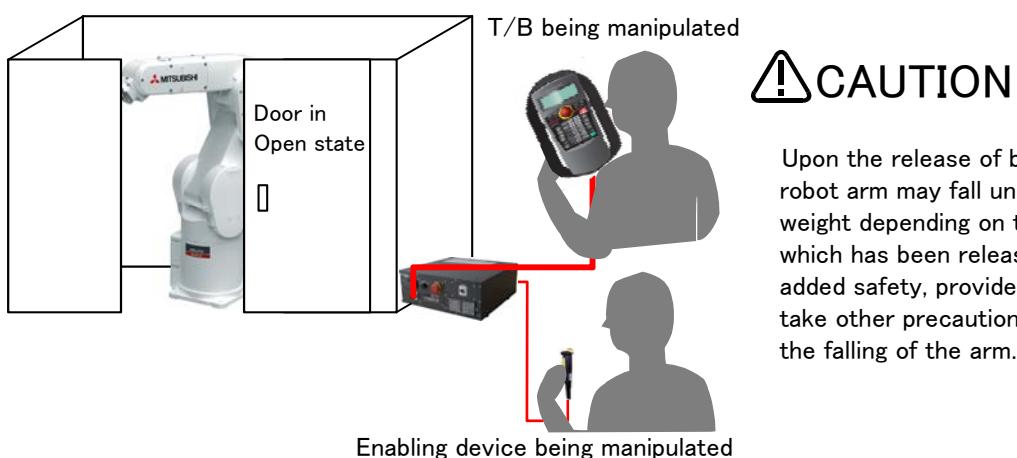
Note1) “—” in the table indicates that the state of switch concerned does not matter.

Refer to the following for operation of each switch.

- Mode of controller: [Page 48, "3.7 Mode changeover switch input"](#)
- T/B enable/disable: [Page 55, "\(1\) Teaching pendant \(T/B\)"](#)
- T/B enable switch: [Page 55, "\(1\) Teaching pendant \(T/B\)"](#)
- Enabling device input terminal: [Page 71, "6.1.7 Examples of safety measures"](#)
- Door switch input terminal: [Page 71, "6.1.7 Examples of safety measures"](#)

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

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



CAUTION

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

Fig.3-14 : Brake release operation

3.7 Mode changeover switch input

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

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

<Right of operation (mode)>

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

MANUALWhen T/B is available, only the operation from T/B becomes available. Operation which needs the right of operation from external equipment cannot be performed.

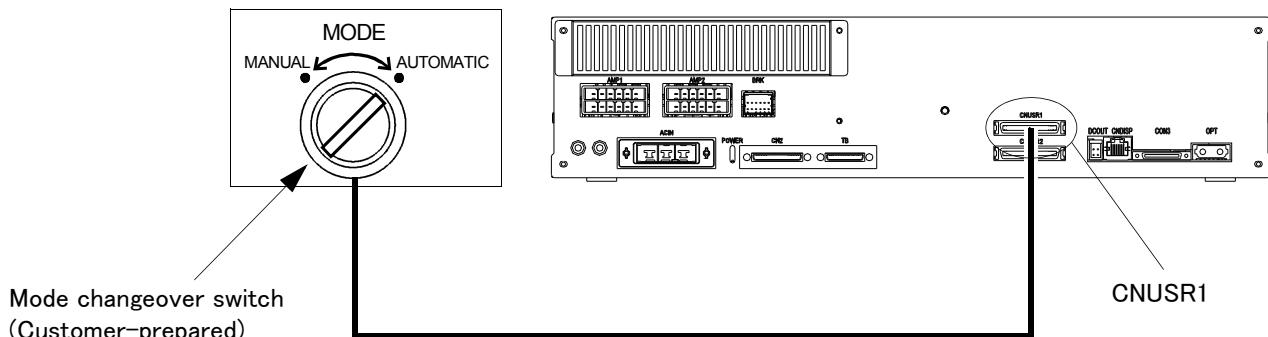


Fig.3-15 : Mode changeover switch image figure (CR751)

(1) Specification of the key switch interface

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

Table 3-7 : Function of the key switch interface

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

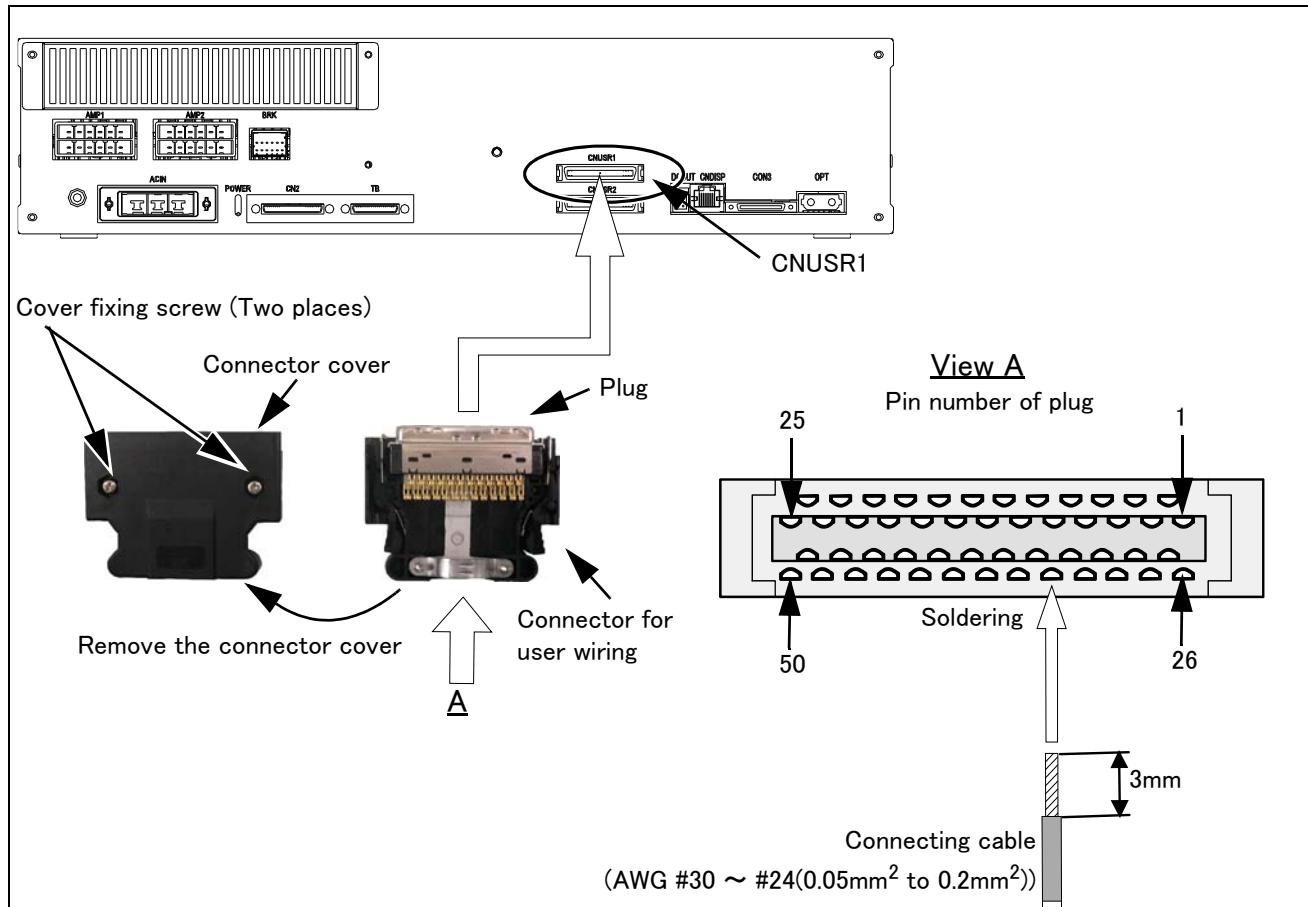
Note1) The mode changes by both opening or both closing between 30–5 pin and between 35–10 pin. Maintain the current mode except it.

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

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

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

(2) Connection of the mode changeover switch input

Connection procedure

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

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

This concludes the connection procedure.

Fig.3-16 : Connection of the mode changeover switch input (CR751)

3.8 Additional Axis Function

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

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

3.8.1 Wiring of the Additional Axis Interface

Table 3-9 shows the connectors for additional axes inside the drive unit. [Fig. 3-17](#) shows a connection example (configuration example).

Table 3-9 : Dedicated connectors inside the drive unit

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

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

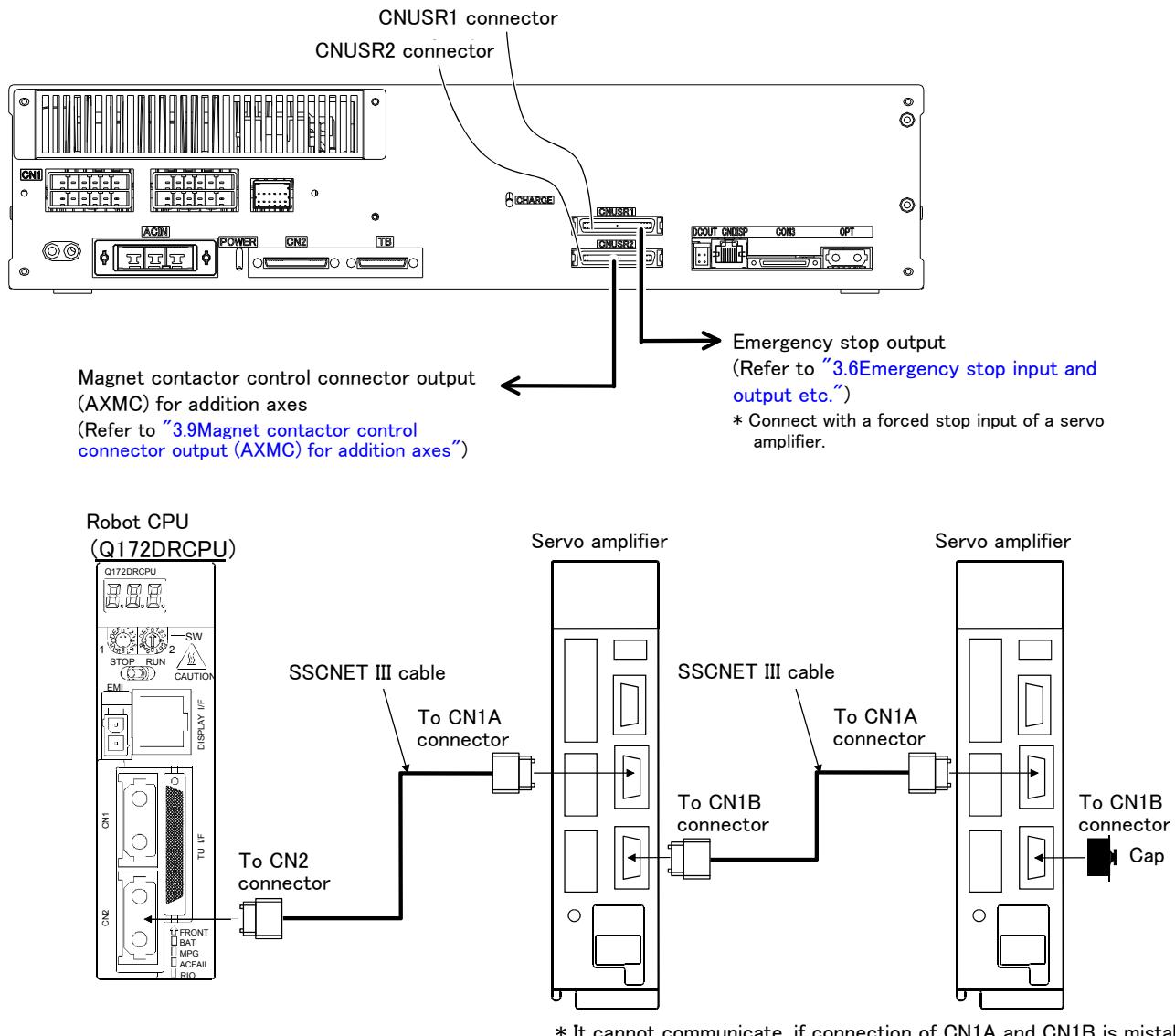


Fig.3-17 : Example of addition axis connection (CR751)

(1) Example of the installation of the noise filter

1) EMC filter (recommended)

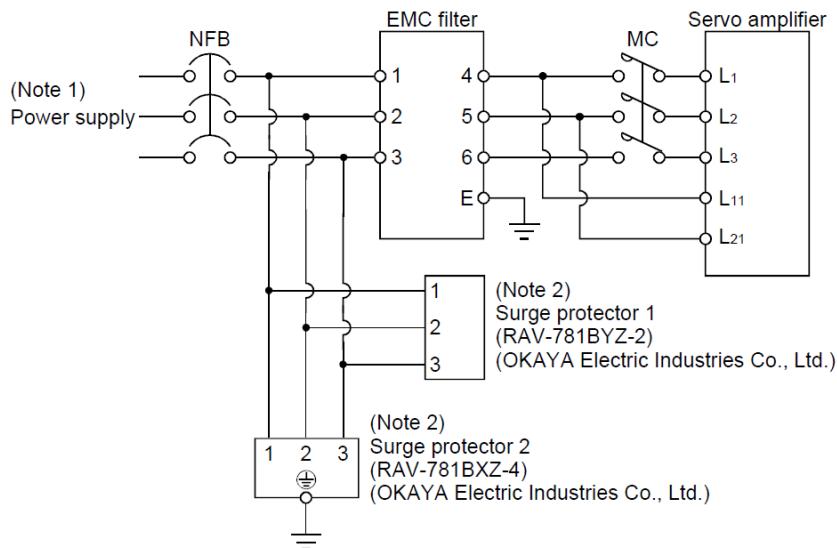
Please install the recommendation filter shown below according to the example of connection.

1) Combination with the servo amplifier

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

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

2) Connection example



Note1) For 1-phase 200V to 230VAC power supply, connect the power supply to L1, L2 and leave L3 open.

There is no L3 for 1-phase 100 to 120 VAC power supply.

Note2) The example is when a surge protector is connected.

Fig.3-18 : Example of EMC noise filter installation

2) Line noise filter

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

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

Fig.3-19 : Example of noise filter installation

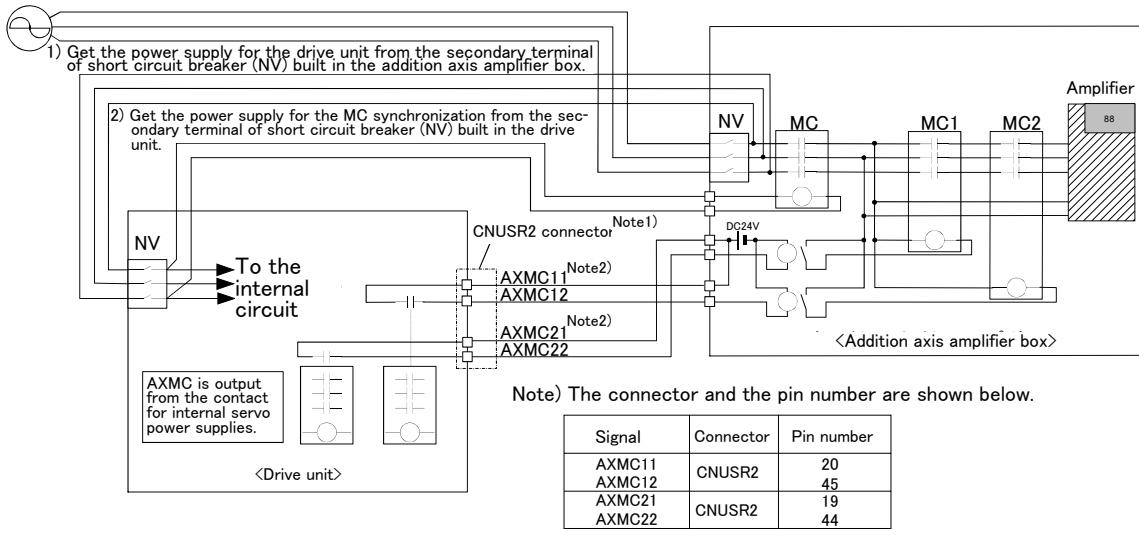
3.9 Magnet contactor control connector output (AXMC) for addition axes

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

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

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

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



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

Fig.3-20 : Example of circuit for addition axes of Magnet contactor control output

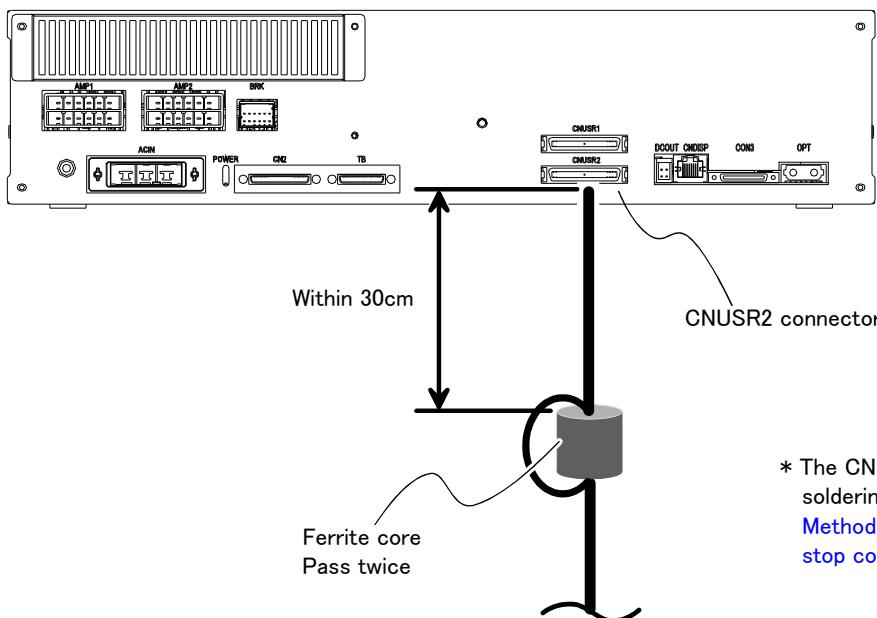


Fig.3-21 : AXMC terminal connector (CR751)

3.10 Options

■ What are options?

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

User installation is required for the options.

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

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

(1) Teaching pendant (T/B)

- Order type: R33TB :Cable length 7m
- R33TB-15 :Cable length 15m

■ Outline



This is used to create, edit and control the program, teach the operation position and for jog feed, etc.

For safety proposes, a 3-position enable switch is mounted.*¹⁾

■ Configuration

Table 3-10 : Configuration device

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

Note1) Mass indicates one set.

■ Specifications

Table 3-11 : Specifications

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

*1) <3-position enable switch>

In ISO/10218 (1992) and JIS-B8433 (1993), this is defined as an "enable device". These standards specify that the robot operation using the teaching pendant is enabled only when the "enable device" is at a specified position.

With the Mitsubishi Electric industrial robot, the above "enable device" is configured of an "Enable/Disable switch" and "Enable switch".

The 3-position enable switch has three statuses. The following modes are entered according to the switch state.

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

*) Operations, such as program editing and status display, other than robot operation are possible.

Safety is secured as the servo power is turned OFF simultaneously with the input of the emergency stop.

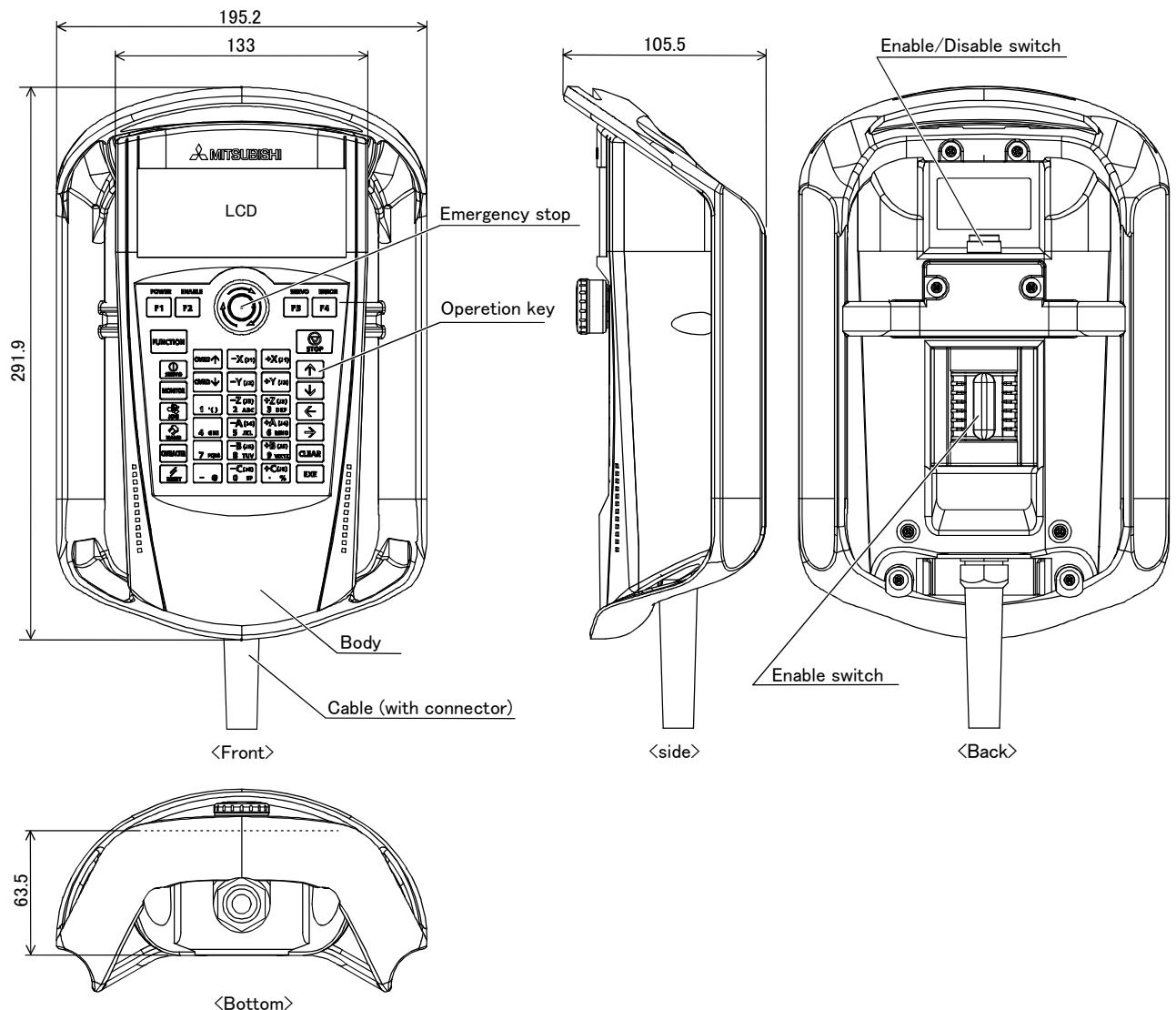


Fig.3-22 : Outside dimensions of teaching pendant

■ Installation method

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

■ Key layout and main functions

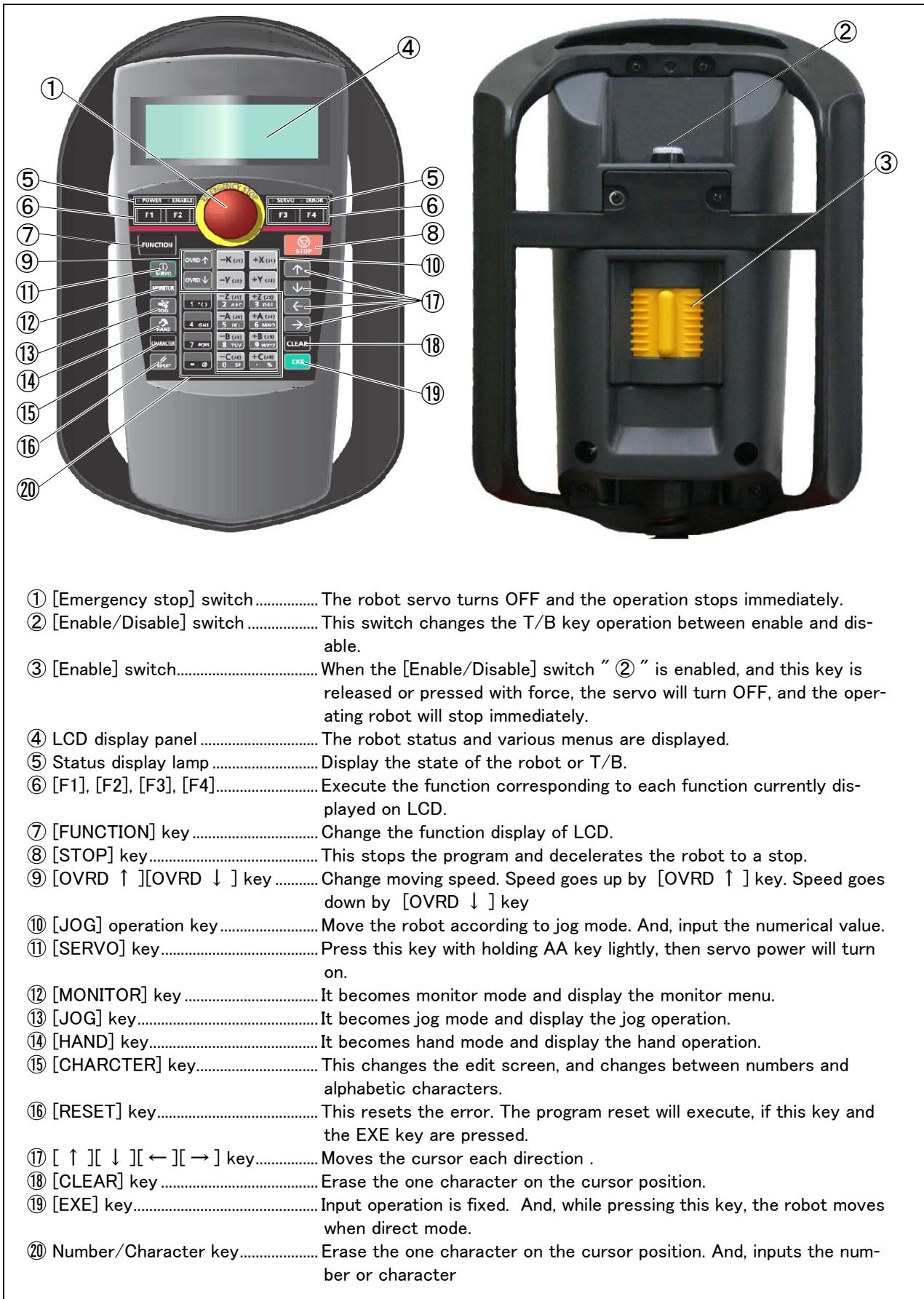


Fig.3-23 : Teaching pendant key layout and main functions

(2) RT ToolBox2/RT ToolBox2 mini

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

■ Outline



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

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

■ Configuration

Table 3-12 : Product configuration

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

Note1) Mass indicates one set.

■ Features

(1) Simple operation with guidance method and menu method

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

(2) Increased work efficiency with ample support functions

The work efficiency is greatly improved with the multi-window method that carries out multiple steps and displays in parallel. The renumbering function, and copy, search, syntax check and step execution are especially sufficient, and are extremely useful when editing or debugging the program.

With the simulation function support, the program can be debugged and the tact checked before starting the machine at the site. This allows the on-site startup work efficiently to be greatly improved.

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

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

■ Functions

Table 3-13 : Functions

Function		Functional existence ^{Note1)}		Details
Compatible model		○	○	Personal computer running Windows XP, Windows Vista, Windows 7, Windows 8, or Windows 8.1. <small>Note2)</small>
Program editing functions	Editing functions	○	○	<ul style="list-style-type: none"> ▪ MELFA BASIC V language compatible ▪ Multiple editing screen simultaneously display ▪ Command input, comment writing ▪ Position data editing ▪ File operation (writing to controller, floppy disk, personal computer) ▪ Search and replace function (using characters, line Nos., labels) ▪ Copy, cut, paste, insert (per character, line), undo (per command statement, position conversion) ▪ Line No. automatic generation, renumbering ▪ Batch syntax check ▪ Command template ▪ Position conversion batch editing ▪ Position variable template ▪ Print, print preview
	Control functions		○	<ul style="list-style-type: none"> ▪ Program file control (list, copy, movement, delete, content comparison, name change, protect)
	Debugging functions	○	○	<ul style="list-style-type: none"> ▪ Direct editing of program in controller ▪ Confirmation of robot program operation (step execution, direct execution)
Simulation function		○	×	<ul style="list-style-type: none"> ▪ Off-line simulation of robot program operation using CG (computer graphics) ▪ Tact time calculation
Monitor functions		○	○	<ul style="list-style-type: none"> ▪ Robot operation monitor (robot operation state, stop signal, error monitor, program monitor (execution program, variables), general-purpose input/output signals (forced output possible), dedicated input/output signals, operation confirmation (operation range, current position, hand, etc.) ▪ Operation monitor (working time statistics, production information, robot version) ▪ Servo monitor (load)
Maintenance function		○	○	<ul style="list-style-type: none"> ▪ Parameter setting ▪ Batch, divided backup

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

RT ToolBox2
(3D-11C-WINE)

Note1) The functions included with the RT ToolBox2 and the RT ToolBox2 mini are shown below.

○ : Function provided × : Function not provided

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

(3) Instruction Manual (bookbinding)

■ Order type: ● 5F-RM01-PE01RH-2FH-Q series

■ Outline



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

■ Configuration

Table 3-14 : Product configuration

Name	Type	Mass (Kg) Note1)	Specifications
Instruction Manual	5F-RM01-PE01	2.6	The instructions manual set of "RH-2FH-Q series".
Safety Manual	BFP-A8006	-	Items relating to safety in handling the robot
Standard Specifications	BFP-A8965	-	Specification of the robot arm and controller
Robot Arm Setup & Maintenance	BFP-A8967	-	Installation method of the robot arm, jog operation, and maintenance and inspection procedures
Controller Setup, Basic Operation and Maintenance	BFP-A8886	-	Installation method of the controller, basic operation, and maintenance and inspection procedures
Detailed Explanation of Functions and Operations	BFP-A8869	-	Functions of the controller and T/B, operation method, and explanation of MELFA-BASIC V
Troubleshooting	BFP-A8871	-	Causes of errors occurred and their countermeasures
Additional axis function	BFP-A8663	-	Function of the additional axis, operation method.
Tracking Function Manual	BFP-A8664	-	Function of the Tracking, operation method.
Extended Function	BFP-A8787	-	Function of the Extended, operation method.

Note1) Mass indicates one set.

3.11 Maintenance parts

The consumable parts used in the controller are shown in [Table 3-15](#). Purchase these parts from your dealer when required. Some Mitsubishi-designated parts differ from the maker's standard parts. Thus, confirm the part name, robot arm and controller serial No. and purchase the parts from your dealer.

Table 3-15 : Controller consumable parts list

No.	Name	Type <small>Note1)</small>	Qty.	Usage place	Supplier
1	Lithium battery	Q6BAT	1	The battery unit connected to the robot CPU unit	Mitsubishi Electric
2	Filter	BKOFA0773H41	1	Inside the filter cover	

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

4 Software

4.1 List of commands

The available new functions in MELFA-BASIC V are given in [Table 4-1](#).

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

Type	Class	Function	Input format (example)
Position and operation control	Joint interpolation	Moves to the designated position with joint interpolation.	Mov P1
	Linear interpolation	Moves to the designated position with linear interpolation.	Mvs P1
	Circular interpolation	Moves along a designated arc (start point → passing point → start point (end point)) with 3-dimensional circular interpolation (360 degrees).	Mvc P1,P2,P1
		Moves along a designated arc (start point → passing point → end point) with 3-dimensional circular interpolation.	Mvr P1,P2,P3
		Moves along the arc on the opposite side of a designated arc (start point → reference point → end point) with 3-dimensional circular interpolation.	Mvr2 P1,P9,P3
		Moves along a set arc (start point → end point) with 3-dimensional circular interpolation.	Mvr3 P1,P9,P3
	Speed designation	Designates the speed for various interpolation operations with a percentage (0.1% unit).	Ovrd 100
		Designate the speed for joint interpolation operation with a percentage (0.1% unit).	JOvrd 100
		Designates the speed for linear and circular interpolation with a numerical value (mm/s unit).	Spd 123.5
		Designates the acceleration/deceleration time as a percentage in respect to the predetermined maximum acceleration/deceleration. (1% unit)	Accel 50,80
Operation		Automatically adjusts the acceleration/deceleration according to the parameter setting value.	Oadl ON
		Sets the hand and work conditions for automatic adjustment of the acceleration/deceleration.	Loadset 1,1
	Operation	Adds a process unconditionally to the operation.	Wth
		Adds a process conditionally to the operation.	WthIf
		Designates smooth operation.	Cnt 1,100,200
		Performance of movement is upgraded corresponding to the application.	MvTune 4
		Designates the positioning completion conditions with a No. of pulses.	Fine 200
		Designates the positioning completion conditions with a distance in a straight line	Fine 1, P
		Designates the positioning completion conditions with a joint interpolation.	Fine 0.5, J, 2
Position control		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
Float control	Position control	Designates the base conversion data.	Base P1
		Designates the tool conversion data.	Tool P1
		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
Pallet		The robot arm rigidity is returned to the normal state.	Cmp Off
		The robot arm rigidity is designated.	CmpG 1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0
Singular point passage	Defines the pallet.	Def Plt 1,P1,P2,P3,P4,5,3,1	
	Operates the pallet grid point position.	Plt 1,M1	
	Singular point passage	Move to a specified position using linear interpolation passing through a singular point.	Mvs P1 Type 0,2

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

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

4.2 List of parameters

Show the main parameter in the [Table 4-2](#).

Table 4-2 : List of parameters

Parameter	Details	
Standard tool coordinates.	MEXTL	Set the default value for the tool data. Unit: mm or deg.
Standard base coordinates	MEXBS	Set the relation of the world coordinate system and robot coordinate system. Unit: mm or deg.
XYZ operation range	MEPAR	Designate the overrun limit value for the world coordinate system.
JOINT operation range	MEJAR	Set the overrun limit value for each joint axis.
Free plane limit	SFC1P : SFC8P	This is the overrun limit set with the free plane. Create a plane with the three coordinates x1, y1, z1 to x3, y3, z3, and set the outer side of the plane as the outside operation range (error). The following three types of parameters are used. Eight types of free plane limits can be set in SFC1P to SFC8P. There are nine elements, set in the order of x1, y1, z1, x2, y2, z2, x3, y3, z3.
	SFC1ME : SFC8ME	Designate which mechanism to use eight types of set free plane limits. The mechanism No. to use is set with 1 to 3.
	SFC1AT : SFC8AT	Set the validity of the eight types of set free plane limits. (Valid 1/Valid 2/invalid = 1/-1/0)
User-defined area	AREA1CS : AREA32CS	An area (cube) defined with two XYZ coordinate points can be designated and that area set as the outside operation range. Furthermore, a signal can be output when the axis enters that area. Up to 32 types of area can be designated. Specify the coordinate system of the user definition area *. 0: Base coordinate system (conventional compatibility) 1: Robot coordinate system
	AREA1P1 : AREA32P1	Designated the 1st point of the area. There are eight elements, set in the order of x, y, z, a, b, c, L1, L2. (L1 and L2 are the additional axes.)
	AREA1P2 : AREA32P2	Designated the 2nd point of the area. There are eight elements, set in the order of x, y, z, a, b, c, L1, L2. (L1 and L2 are the additional axes.)
	AREA1ME : AREA32ME	Designate which mechanism to use the 32 types of set area. The mechanism No. to use is set with 1 to 3.
	AREA1AT : AREA32AT	Designate the area check type. (Invalid/zone/interference = 0/1/2) Zone: The dedicated output signal USRAREA turns ON. Interference: An error occurs..
Automatic return setting	RETPATH	Set to restart the program after returning to the interrupt position when resuming operation after an interruption.
Buzzer ON/OFF	BZR	Designate whether to turn the buzzer ON or OFF.
Jog setting	JOGJSP	Designate the joint jog and step operation speed. (Set dimension H/L amount, max. override.)
	JOGPSP	Designate the linear jog and step operation speed. (Set dimension H/L amount, max. override.)
Jog speed limit value	JOGSPMX	Limit the operation speed during the teaching mode. Max. 250[mm/s]
Hand type	HANDTYPE	Set the hand type of the single/double solenoid, and the signal No. (Single/double = S/D) Set the signal No. after the hand type. Example) D900
Stop input B contact designation	INB	Change the dedicated input (stop) to either of normal open or normal close.

Parameter		Details
User-designated origin	USERORG	Designate the user-designated origin position.
Program selection memory	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)
Multi CPU system setting	QMLTCPU N	At the multi CPU system, set the number of CPU units with which the standard base unit is equipped.
	QMLTCPU n	At the multi CPU system, set the number of points performing transmission and receipt between each CPU unit for the high speed communication function between multi CPU nos. 1 to 4.
	QMLTCPU S	At the CR750-Q/CR751-Q series controller, set the robot input signal offset for the multi CPU.
Select the function of singular point adjacent alarm	MESNGLS W	Designate the valid/invalid of the singular point adjacent alarm. (Invalid/Valid = 0/1) When this parameter is set up "VALID", this warning sound is buzzing even if parameter: BZR (buzzer ON/OFF) is set up "OFF".
Display language.	LNG	Change the language to display on the LCD display of teaching pendant.

5 Instruction Manual

5.1 The details of each instruction manuals

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

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

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

Safety Manual	Explains the common precautions and safety measures to be taken for robot handling, system design and manufacture to ensure safety of the operators involved with the robot.
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(CR750-Q/CR751-Q controller) and the GOT(CR750-D/CR751-D controller).

6 Safety

6.1 Safety

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

6.1.1 Self-diagnosis stop functions

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

Table 6-1 : Self-diagnosis stop functions

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

Table 6-2 : List of stop functions

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

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

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

	Signal	Connection point	Parameter	Functions	Usage method
Input	External emergency stop Note1)	Connector (CNUSR1)	–	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	Emergency stop output	Connector (CNUSR1)	–	Outputs the input signal of external emergency stop or emergency stop switch of T/B turned on.	Display and warn the pilot lamp, the input signal of external emergency stop or the emergency stop switch of T/B turned on.
	In servo ON	Sequencer unit	SRVON	The servo power ON/OFF state is output.	The servo power ON/OFF state is shown and alerted with the display lamps.
	Waiting		STOP	Outputs that the robot is temporarily stopped.	The temporary stop state is shown and alerted with the display lamps.
	In alarm	Connector (CNUSR2)	ERRRESET	Outputs when an alarm occurs in the robot.	The alarm state is shown and alerted with the display lamps.

Note1) The external emergency stop input is prepared as a normal close for safety proposes. Thus, if the emergency stop input circuit is opened when the robot is started up, the robot will not operate. Refer to [Page 71, "6.1.7 Examples of safety measures"](#) for details.

And, refer to [Page 47, "\(3\) Automatic Operation/Jog Operation/Brake Release and Necessary Switch Settings](#)" for the function of the door switch input and the enabling device input.

6.1.3 Precautions for using robot

The safety measures for using the robot are specified in the "Labor Safety and Sanitation Rules". An outline of the rules is given below.

(1) Robot installation

- Secure sufficient work space required to safely perform work such as teaching and maintenance related to the robot.
- Install the controller outside the robot's motion space. (If a safety fence is provided, install outside the fence.)
- Install the controller where the entire robot operation can be viewed.
- Install display lamps, etc., to indicate the robot's operation state.
- Securely fix the robot arm onto the fixing table with the designated bolts.

(2) Prevention of contact with operator

- Install a safety fence or enclosure so that the operator cannot easily enter the robot's motion space.
- Install an interlock function that will stop the robot if the safety fence or enclosure door is opened.

(3) Work procedures

- Create and observe work procedures for the robot teaching, operation, inspection and emergencies.
- Create hand signals to be followed when several operators are working together.
- Create displays such as "Teaching in Progress" and "Inspection in Progress" to be put up when an operator is in the robot's motion space so that other operators will not operate the operation panel (controller, control panel).

(4) Training

- Train the operators about the operations, maintenance and safety required for the robot work.
 - Only trained and registered operators must operate the robot.
- Participation in the "Special training for industrial robots" sponsored by the Labor Safety and Sanitation Committee, etc., is recommended for safety training.

(5) Daily inspection and periodic inspection

- Always inspect the robot before starting daily operations and confirm that there are no abnormalities.
- Set the periodic inspection standards in view of the robot's ambient environment and operation frequency, and perform periodic inspections.
- Make records when periodic inspections and repairs have been done, and store the records for three or more years.

6.1.4 Safety measures for automatic operation

- (1) Install safety fences so that operators will not enter the operation area during operation and indicate that automatic operation is in progress with lamps, etc.
- (2) Create signals to be given when starting operation, assign a person to give the signal, and make sure that the operator follows the signals.

6.1.5 Safety measures for teaching

Observe the following measures when teaching, etc., in the robot's operation range.

- (1) Specify and follow items such as procedures related to teaching work, etc.
- (2) Take measures so that operation can be stopped immediately in case of trouble, and measures so that operation can be restarted.
- (3) Take measures with the robot start switch, etc., to indicate that teaching work is being done.
- (4) Always inspect that stop functions such as the emergency stop device before starting the work.
- (5) Immediately stop the work when trouble occurs, and correct the trouble.
- (6) Take measures so that the work supervisor can immediately stop the robot operation when trouble occurs.
- (7) The teaching operator must have completed special training regarding safety. (Training regarding industrial robots and work methods, etc.)
- (8) Create signals to be used when several operators are working together.

6.1.6 Safety measures for maintenance and inspections, etc.

Turn the power OFF and take measures to prevent operators other than the relevant operator from pressing the start switch when performing inspections, repairs, adjustments, cleaning or oiling.

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

- (1) Specify and follow items such as procedures related to maintenance work, etc.
- (2) Take measures so that operation can be stopped immediately in case of trouble, and measures so that operation can be restarted.
- (3) Take measures with the robot start switch, etc., to indicate that work is being done.
- (4) Take measures so that the work supervisor can immediately stop the robot operation when trouble occurs.
- (5) The operator must have completed special training regarding safety. (Training regarding industrial robots and work methods, etc.)
- (6) Create signals to be used when several operators are working together.

6.1.7 Examples of safety measures

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

[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to [Page 76, "\(1\) External emergency stop connection \[supplementary explanation\]](#).

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

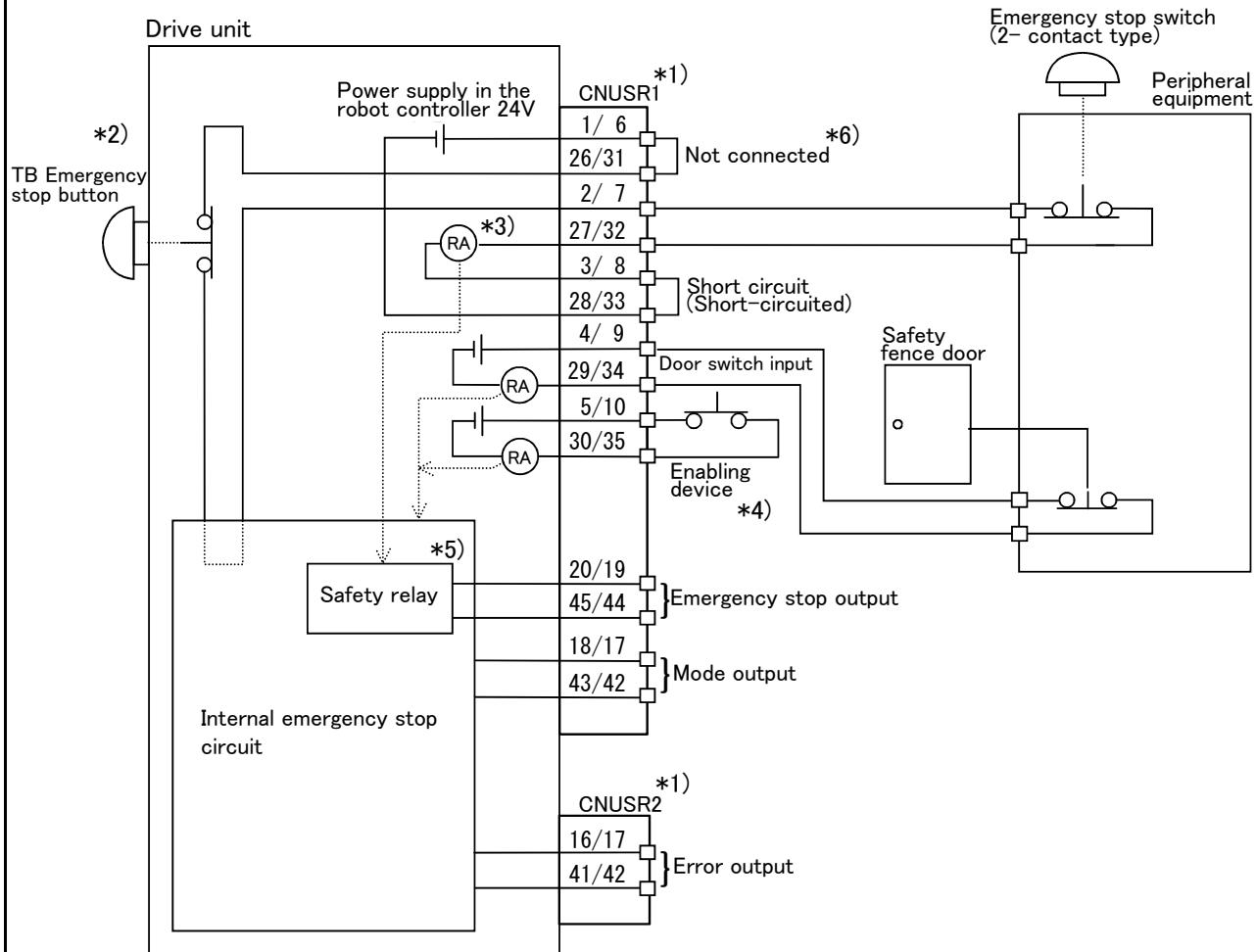
- Electric specification of the emergency-stop-related output terminal: 100mA/24V or less
- In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

<Wiring example 1>: Connect the emergency stop switch of peripheral equipment to the drive unit.

The power supply for emergency stop input uses the power supply in the drive uni.

<Operation of the emergency stop>

If the emergency stop switch of peripheral equipment is pushed, the robot will also be in the emergency stop state.



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

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

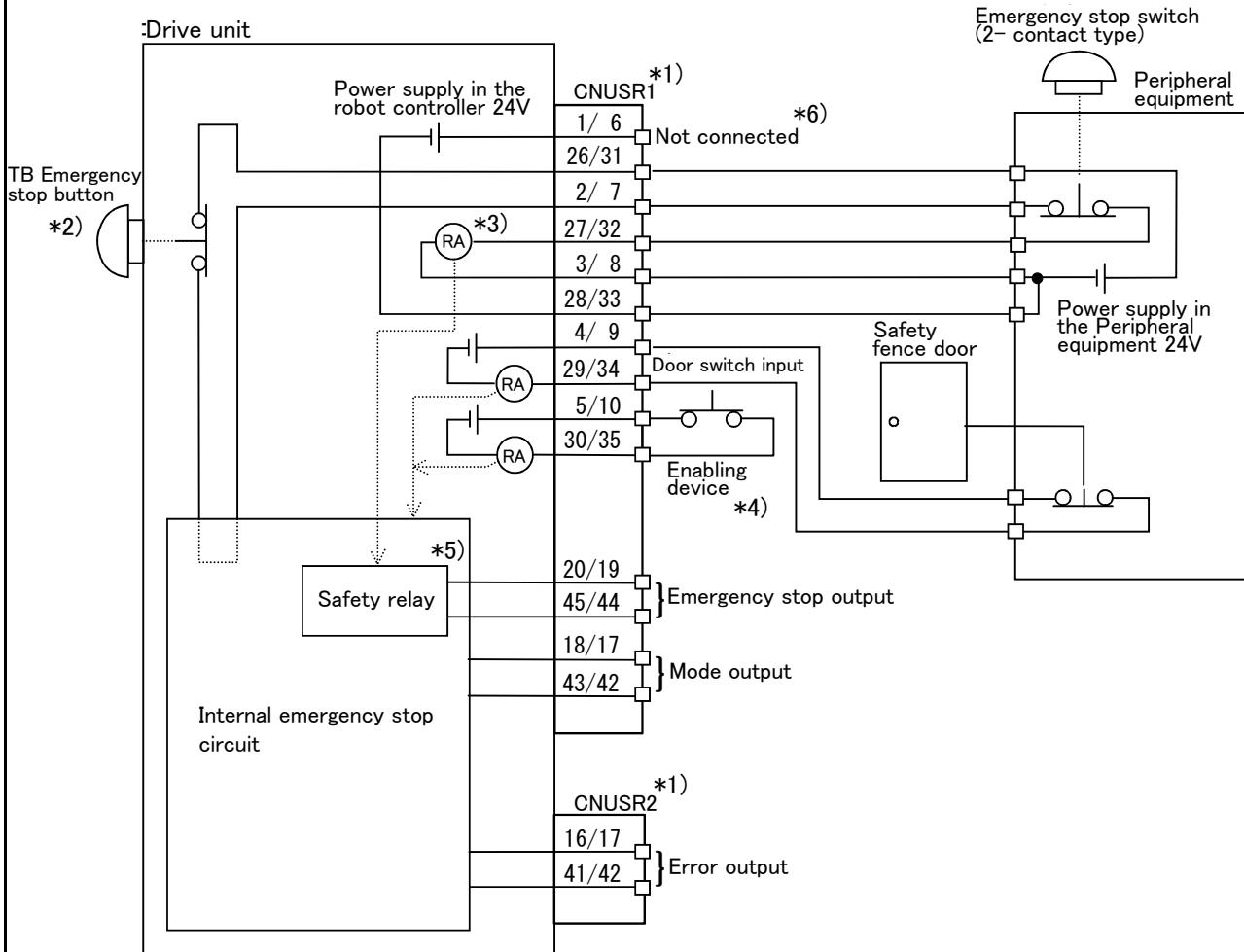
*3) Emergency stop input relay.

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

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

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

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



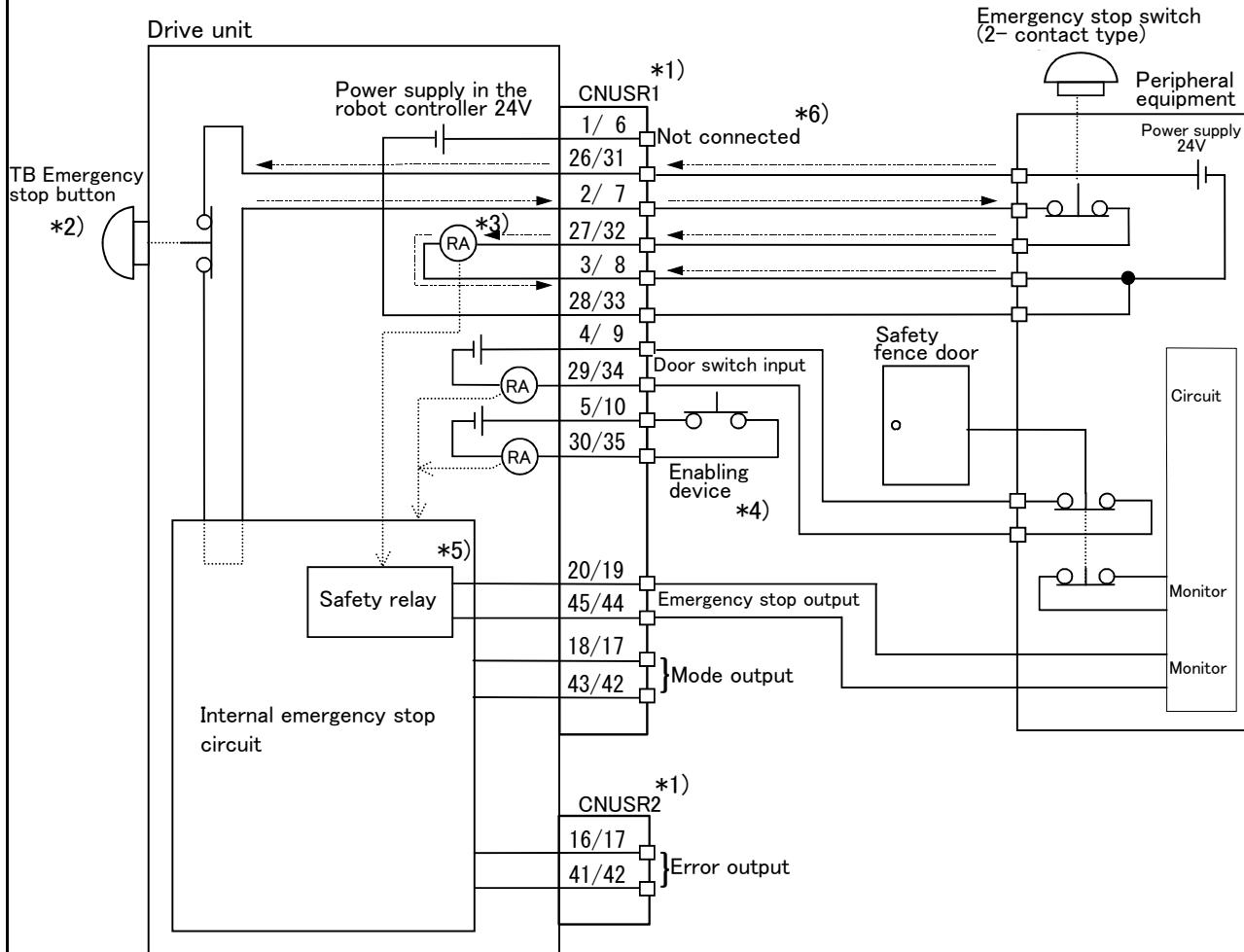
- *1) Each of the connectors, CNUSR1 and CNUSR2, are assigned with the same pin number, creating 2 systems in each terminal. It is absolutely necessary to connect the 2 systems.
- *2) The T/B emergency stop button connected with the drive unit.
- *3) Emergency stop input relay.
- *4) Refer to the Standard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

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

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

<Operation of the emergency stop>

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



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

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

*3) Emergency stop input relay.

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

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

*6) Connect the 24V power supply to 26/31 terminals.

Fig.6-3 : Example of safety measures (CR751 wiring example 3)

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

<Operation of the emergency stop>

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

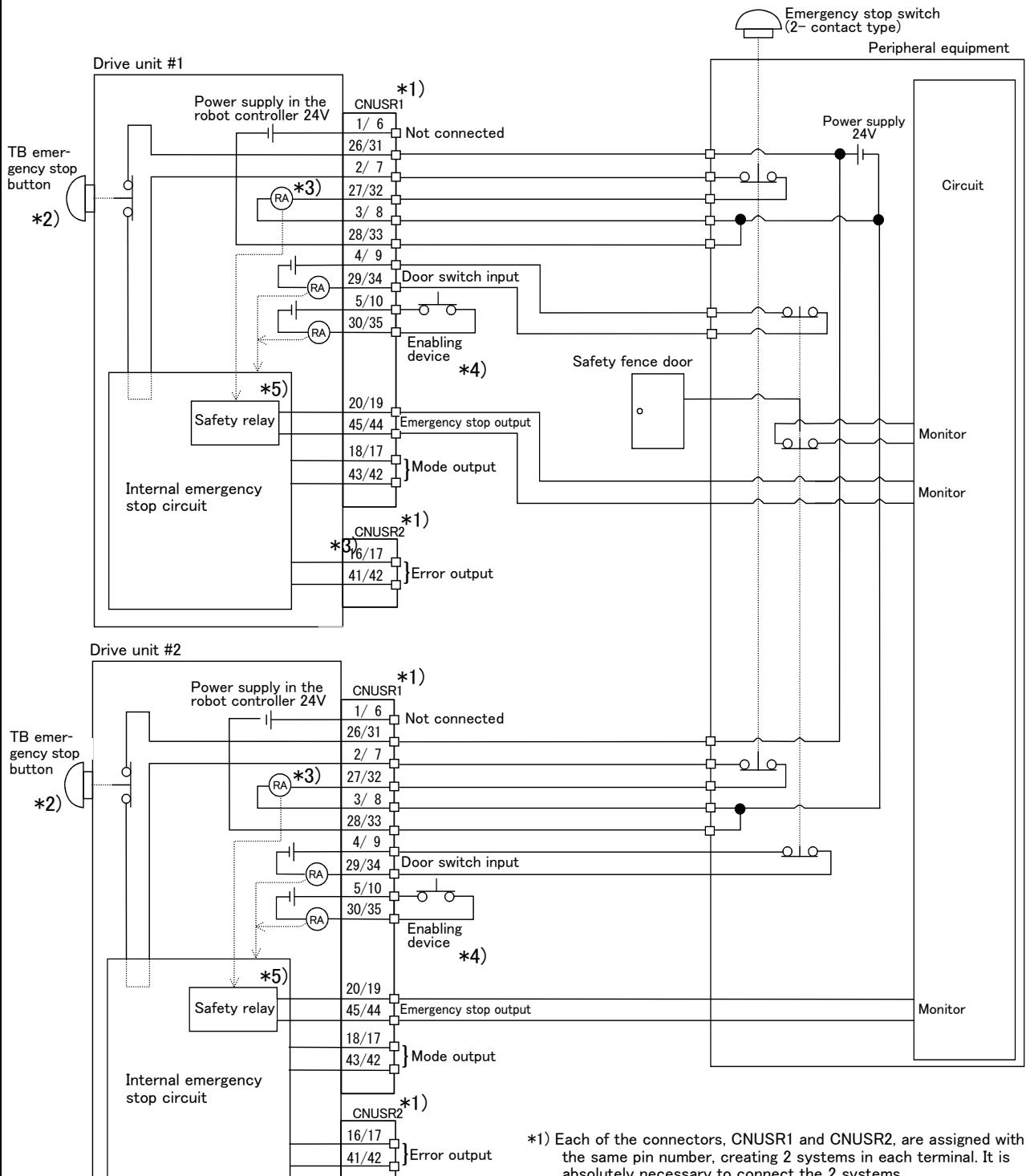
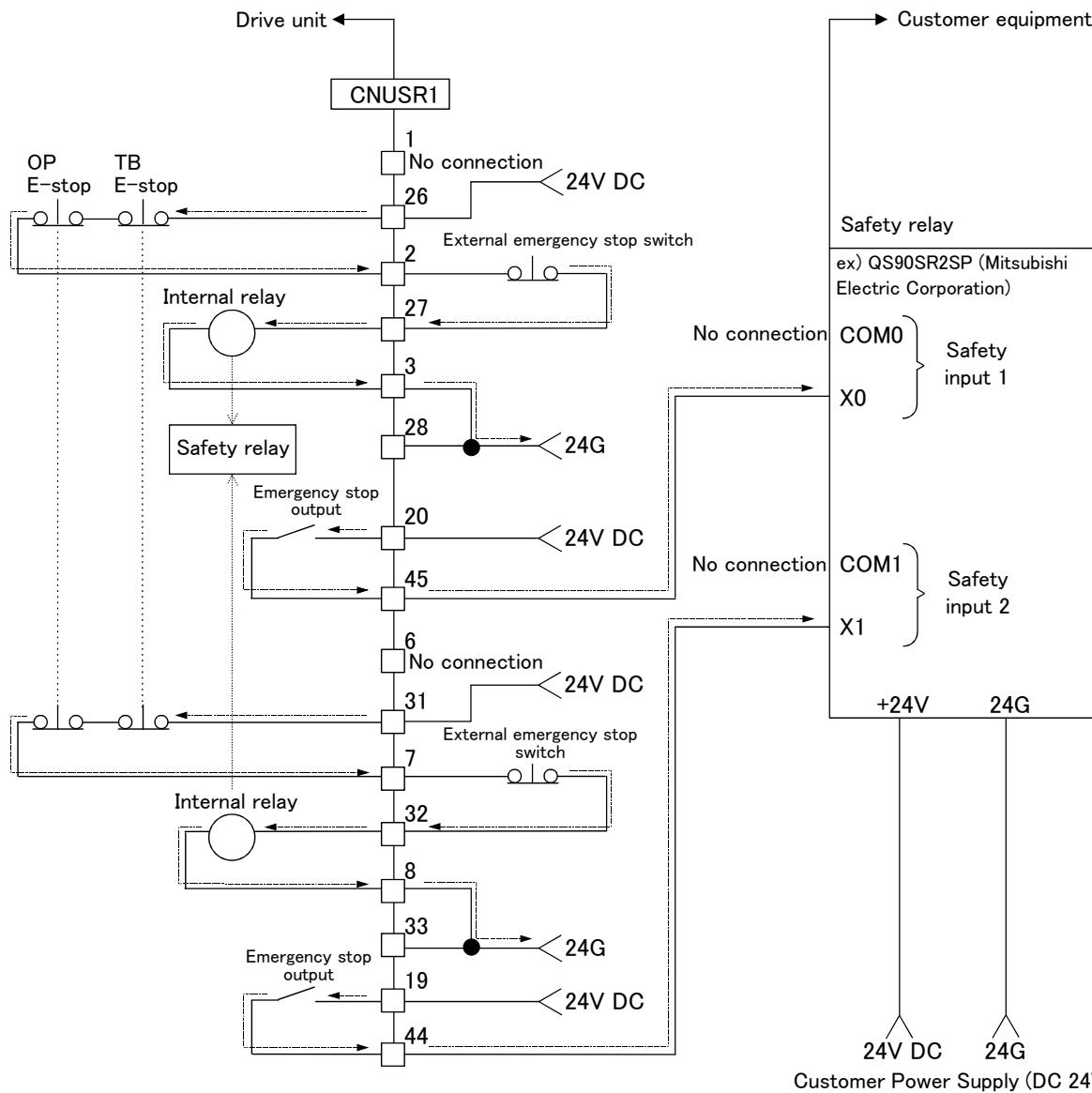


Fig.6-4 : Example of safety measures (CR751 wiring example 4)

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



[Caution]

- 1) This product has category 3 functionality and therefore the robot's whole unit cannot be set to category 4.
- 2) The controller's internal circuit has polarity. Please adhere to the polarity as detailed in the wiring examples, particularly for emergency stop button output when using user equipment. Connect the positive side of the user equipment (24V DC) to the two terminals 26/31, then connect the emergency stop button (or contact points) in the user equipment to the 2-27 and 7-32 terminals, and ultimately connect to the negative side (24G).
- 3) Setup a safety relay on the user equipment, and when using to input the emergency stop button on the controller, please only use a safety relay that functions when connecting the input to the one end of the 2 systems (i.e. QS90SR2SP (Manufacture: Mitsubishi Electric Corporation)).
- 4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
- 5) When connecting emergency stop button output to an exterior safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly this function will not operate correctly. Please connect 20/19 terminal to 24V.

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

(1) External emergency stop connection [supplementary explanation]

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

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

- Switch contact..... Prepare a 2-contact type.*1)
- Switch contact capacity..... Use a normal open contact that operates with a switch contact capacity of approx. 1mA to 100mA/24V.*1)
If you connect the relay etc., rated current of the coil should use the relay which is 100mA/24V or less. (Refer to Fig. 6-6)
- Cable length..... The length of the wire between the switch and terminal block must be max. 15m or less. Please use the shield line, in case of the cable may receive the noise etc. by other equipment, such as servo amplifier. And, since the ferrite core is attached as noise measures parts, please utilize.
The size of the wire that fits to use is shown below.
- CR751 drive unit CNUSR1/2 connector:
AWG #30 to #24 (0.05mm² to 0.2mm²)

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

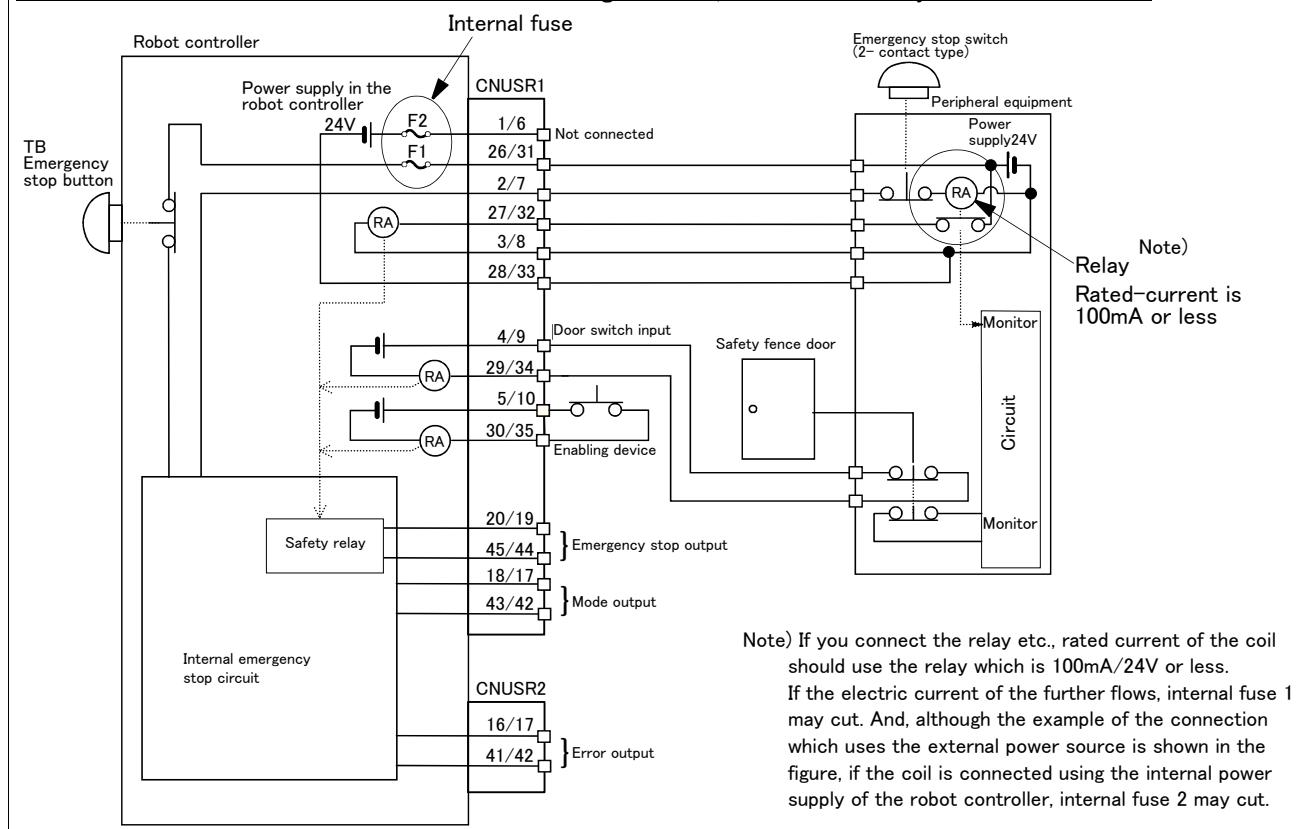
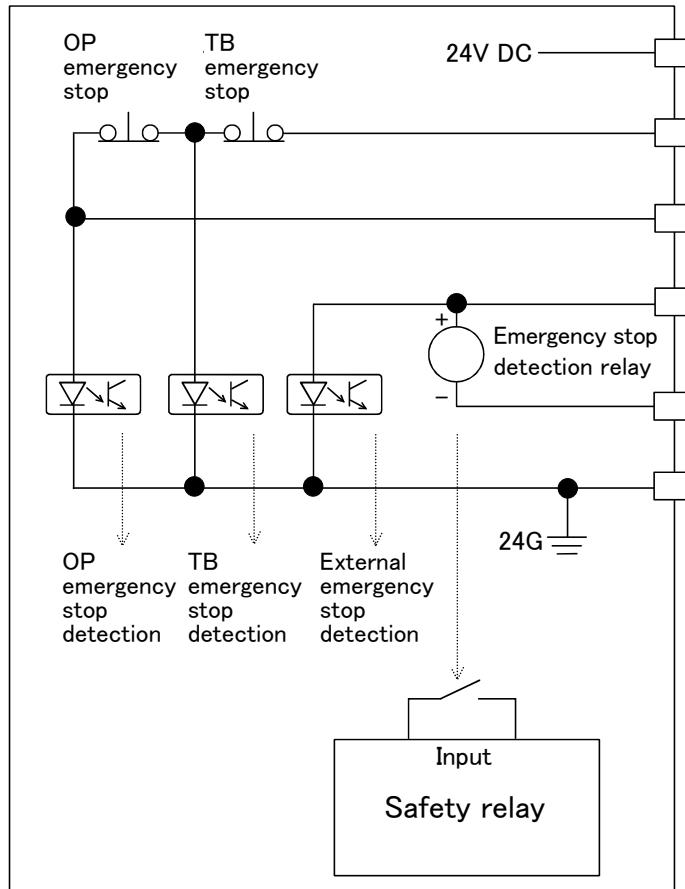
The electric-current value limitation when connecting the coils, such as the Relays (CR751 drive unit)

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

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

[Supplementary explanation regarding emergency stop circuit]

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



⚠ CAUTION

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

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

⚠ CAUTION

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

6.2 Working environment

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

(1) Power supply

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

CAUTION

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

(2) Noise

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

(3) Temperature and humidity

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

(4) Vibration

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

(5) Installation environment

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

6.3 Precautions for handling

- (1) This robot has brakes on J3 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 consists of precision parts such as bearing. Lubricants such as grease are also applied on the moving parts to keep the mechanical accuracy. In a cold start under low temperature or in the first start after being stored for one month or longer, lubricants may not be spread enough. Such condition may lower the positioning accuracy, cause servo and overload alarms, and early wearing of the moving parts. To avoid such situation, perform warm-up operation of the machine at a low speed (at about 20% of normal operation speed). Move the robot arm from the lower to the upper limit of the movable range with the 30 degree joint angle or more for about 10 minutes. After that, speed up the operation gradually.
Please use the warm-up operation. (About the details of the warm-up operation, refer to "INSTRUCTION MANUAL/Detailed explanations of functions and operations".)
- (5) The robot arm and controller must be grounded with 100Ω or less (class D grounding) to secure the noise resistance and to prevent electric shocks.

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

- (6) The items described in these specifications are conditions for carrying out the periodic maintenance and inspections described in the instruction manual.
- (7) 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.
- (8) 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.
- (9) 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.
- (10) 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.
- (11) 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.
- (12) Do not conduct an insulated voltage test. If conducted by mistake, it may result in a breakdown.
- (13) When the sequencer system becomes large too much, the robot's locus may deteriorate uncommonly. If this phenomenon occurs, inform to the dealer. And, when it turns out that the system is enlarged in advance, please inform our company.
- (14) Fretting may occur on the axis which moving angle or moving distance move minutely, or not moves. Fretting is that the required oil film becomes hard to be formed if the moving angle is small, and wear occurs. The axis which not moved is moving slightly by vibration etc. To make no fretting recommends to move these axes about once every day the 30 degree or more, or the 20mm or more.
- (15) The United Nations' Recommendations on the Transport of Dangerous Goods must be observed for trans-border transportation of lithium batteries by air, sea, and land. The lithium batteries (ER6, Q6BAT) used in Mitsubishi industrial robots contain less than 1 g of lithium and are not classified as dangerous goods. However, if the quantity of lithium batteries exceeds 24 batteries for storage, etc., they will be classified as Class 9: Miscellaneous dangerous substances and articles. Shipping less than 24 batteries is recommended to avoid having to carry out transport safety measures as the customer's consignor. Note that some transportation companies may request an indication that the batteries are not dangerous goods be included on the invoice. For shipping requirement details, please contact your transportation company.
- (16) If the air supply temperature (primary piping) used for the tool etc. is lower than ambient air temperature, the dew condensation may occur on the coupling or the hose surface.
- (17) 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.
- (18) When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigation do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

6.4 EMC installation guideline

6.4.1 Outlines

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

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

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

6.4.2 EMC directive

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

- (1) Emission (EMI : Electromagnetic Interference) The capacity not to generate the disturbance noise which has a bad influence outside.
- (2) Immunity (EMS : Electromagnetic Susceptibility)..... The capacity which does not malfunction for the disturbance noise from the outside.

Each contents are shown below.

Item	Name	Contents	Testing technical-standard number
Emission (EMI)	Radiative noise disturbance	The electromagnetic noise etc. which are emitted to environs.	EN61000-6-2 : 2005 EN61000-6-4 : 2007 EN62061:2005(Annex E)
	Electrical-conduction noise disturbance	The electromagnetism noise etc. which flow out of the power-supply line.	
Immunity (EMS)	Electrostatic discharge immunity test	The noise from the electrified human body.	
	Radiated, radio-frequency, electromagnetic field immunity test susceptibility test	The electromagnetism noise from the transceiver, the broadcasting station, etc.	
	Electrical fast transient burst immunity test	The relay noise or the electromagnetism noise etc. which are caused in power-supply ON/OFF.	
	Immunity to conducted disturbances induced radio-frequency fields	The electromagnetism noise etc. which flow in through the power source wire and the grounding wire.	
	Power frequency magnetic field immunity test	The electromagnetism noise with a power supply frequency of 50/60 Hz etc.	
	Voltage dips, short interruptions and voltage variations immunity test	The noise in the variation of the source voltage of the power dispatching, etc.	
	Surge immunity test	The electromagnetism noise by the thunderbolt, etc.	

6.4.3 EMC measures

There are mainly following items in the EMC measures.

- (1) Store into the sealed metal board.
- (2) Grounding all the conductor that have floated electrically (makes the impedance low).
- (3) Wiring so that the power source wire and signal wire are separated.
- (4) Use the shield cable for the cable which wired outside of the metal board.
- (5) Install the noise filter.

To suppress the noise emitted out of the board, be careful of the following item.

- (1) Ensure grounding of the equipment.
- (2) Use the shield cable.
- (3) Separate the metal board electrically. Narrows the distance/hole.

The strength of electromagnetic noise emitted to environment is changed a lot by the shielding efficiency of cable and the distance of metal board, so it should be careful.

6.4.4 Component parts for EMC measures

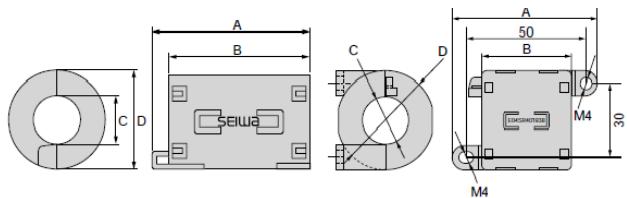
(1) Ferrite core

The ferrite core is mounted by the plastics case as one. It can attach by the one-touch, without cutting the cable. This has the effect in the common-mode noise. The measures against the noise are made not influential in the quality of the signal.

There are the following as an example.

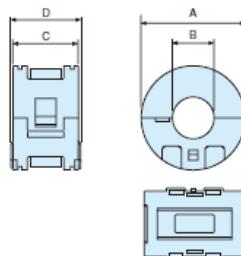
Maker: SEIWA ELECTRIC MFG. Co.,Ltd.

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



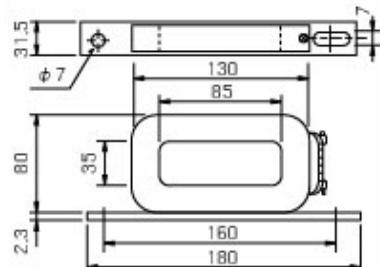
Maker: TAKACHI ELECTRONICS ENCLOSURE CO., LTD.

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



(2) Line noise filter

Type : FR-BLF (Mitsubishi Electric Corp.)



7 Appendix

Appendix 1 : Specifications discussion material

■ Customer information

Company name		Name	
Address		Telephone	

■ Purchased model

Item	Type	Arm length	Stroke	Controller
General specification	RH-2FH2515-1Q1	■ 250	■ 150	CR751-02HQ1-0

■ Shipping special specifications

Item		Standard specification	Special shipping specifications			
Controller	Robot CPU unit connecting cable set <small>Note1)</small>	□ 10m	□ Not provided □ 5m □ 20m □ 30m: 2Q-RC-CBL □ □ M			

Note1) The four type cables shown in below are contained. (Each cable length is the same.)

1)2Q-TUCBL □ □ M, 2)2Q-DISPCBL □ □ M, 3)2Q-EMICBL □ □ M,

4)MR-J3BUS □ □ M-A (5m, 20m) or MR-J3BUS □ □ M-B (30m)

■ Options (Installable after shipment)

Item		Type	Provision, and specifications when provided.		
Controller	Simple teaching pendant	R33TB- □ □	□ Not provided	□ 7m	□ 15m
	Highly efficient teaching pendant	R57TB- □ □	□ Not provided	□ 7m	□ 15m
	RT ToolBox2	3D-11C-WINE	□ Not provided	□ Windows XP/Vista/7/8/8.1 English CD-ROM	
	RT ToolBox2 mini	3D-12C-WINE	□ Not provided	□ Windows XP/Vista/7/8/8.1 English CD-ROM	
	Network vision sensor	4D-2CG5***-PKG	□ Not provided	□ Provided	
	Instructions manual	5F-RM01-PE01	□ Not provided	□ Provided () sets	

■ Maintenance parts (Consumable parts)

Maintenance parts	□ Backup batteries ER6 () pcs.	□ Backup batteries Q6BAT () pcs.	□ Grease () cans
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■ Robot selection check list

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



Product Service

EC-Statement of Compliance

No. E6 14 07 25554 052

Holder of Certificate: Mitsubishi Electric Corporation

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

Name of Object: Industrial, Scientific and Medical equipment
Industrial Robot**Model(s):** F series
(See Attachment for Nomenclature)**Description of Object:** Rated Voltage: 230 VAC
Rated Power: 1.7 kW
Protection Class: I**Tested according to:** EN 61000-6-4/A1:2011
EN 61000-6-2:2005

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

Technical report no.: 73549408

Date, 2014-07-30 (Johann Roidt)



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

Page 1 of 8

Attachment

Statement No.

E6 14 07 25554 052

Nomenclature

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

A1:RH-3FH,RH6FH,RH-2FH series 1.7kW

RH-x FH xx xx x - x x x-Sxx

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

(1)**RH**: Horizontal Robot

(2) Maximum Payload specification:

3	:	3kg	2	:	2kg
6	:	6kg			

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

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

35	:	350 mm arm	15	:	150 mm arm
45	:	450 mm arm			
55	:	550 mm arm			

(6) Z stroke length specification:

12	:	120 mm arm	25	:	250 mm arm
15	:	150 mm arm			
20	:	200 mm arm			
34	:	340 mm arm			

(7) Dimension and Ambient specification:

M	:	Oil mist model(IP65)
C	:	Clean room model(ISO5)

[none]: Basic model(IP54)

(8) Type of Robot controller cabinet

[none]	:	CR750 controller
1	:	CR751 controller

(9)Robot controller type:

D	:	Stand alone type
Q	:	iQ platform type

(10)Standard:

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

(11)Optional Specification:

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

Attachment

Statement No.

E6 14 07 25554 052

A2:RH-12FH,RH-20FHseries 1.7kW

RH-x FH xx xx x - x x x-Sxx

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

(1) **RH**: Horizontal Robot

(2) Maximum Payload specification:

12 : 12kg**20** : 20kg(3) **F** : F series robot(4) **H** :4 joints

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

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

(6) Z stroke length specification:

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

(7) Dimension and Ambient specification:

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

[none]: Basic model(IP20)

(8) Type of Robot controller cabinet

[none] :CR750 controller

1 :CR751 controller

(9) Robot controller type:

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

(10) Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(11) Optional Specification:

1 :normal type

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

Sxx :Mechanical option

Attachment

Statement No.

E6 14 07 25554 052

A3:RV-2Fseries 1.7kW

RV-x F x - x x x-Sxx

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

(1) **RV**: Vertical Robot

(2) Maximum Payload specification:

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

(4) Robot Joint type

B : All axes have brake units.

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

(5) Type of Robot controller cabinet

[none] : CR750 controller

1 : CR751 controller

(6) Robot controller type:

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

(7) Standard:

0: normal type

1: CE marking model

2: CE marking and UL model

(8) Optional Specification:

1 : normal type

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

Sxx : Mechanical option

Attachment

Statement No.

E6 14 07 25554 052

A4:RV-4F,7Fseries 1.7kW

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

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

(1) **RV**: Vertical Robot

(2) Maximum Payload specification:

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

(4) Robot axes:

J : 5 axes model

[none] : normal model

(5) Robot arm length:

L : Long arm model

[none]: normal model

(6) Dimension and Ambient specification:

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

[none] : Basic model(IP40)

(7) Type of Robot controller cabinet

[none] :CR750 controller

1 :CR751 controller

(8) Robot controller type:

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

(9) Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(10) Optional Specification:

1 :normal type

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

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

Sxx :Mechanical option

Attachment

Statement No.

E6 14 07 25554 052

A5:RV-13F,20F,7FLLseries 1.7kW

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

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

(1) **RV**: Vertical Robot

(2) Maximum Payload specification:

13 : 13kg **20** : 20kg
7 : 7kg

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

(4) Robot arm length:

L : Long arm model
LL : Long reach(1503mm) model (for only RV-7FLL series)
[none]: normal model

(5) Dimension and Ambient specification:

M : Oil mist model(IP67)
C : Clean room model(ISO3)
[none] : Basic model(IP40)

(6) Type of Robot controller cabinet

[none] :CR750 controller
1 :CR751 controller

(7) Robot controller type:

D :Stand alone type
Q :iQ platform type

(8) Standard:

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

(9) Optional Specification:

1 :normal type
SM :added cabinet box over Robot controller for oil mist resist
SH :Internal tube and wires are extended to J6 axis.
Sxx :Mechanical option

Attachment

Statement No.

E6 14 07 25554 052

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

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

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

(1) **RH**: Horizontal Robot

(2) Maximum Payload specification:

1 : 1kg
3 : 3kg

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

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

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

(6) Z stroke length specification:

12 : 120 mm arm
15 : 150 mm arm

(7) Dimension and Ambient specification:

W : Water proof model
M : Oil mist model
C : Clean room model(ISO5)
[none] : Basic model(IP54)

(8) Type of Robot controller cabinet

[none] :CR750 controller

1 :CR751 controller

(9) Robot controller type:

D :Stand alone type
Q :iQ platform type

(10) Standard:

0: normal type

1:CE marking model

2:CE marking and UL model

(11) Optional Specification:

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

Attachment

Statement No.

E6 14 07 25554 052B: Model name of **F** series Robot controller description is shown as follows.**CR750- xx x x x - x - x - Sxx**

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

(1) **CR750**: CR750 controller**CR751**: CR751 controller

(2) Maximum Payload specification:

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

(3) Robot type

H : Horizontal robot**HR** : Horizontal robot(reverse mount)**V** : Vertical robot**VJ** : 5 axes Vertical robot**VL** : for only RV-7FLL series

(4) Robot controller type

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

(5) Standard

1 : CE marking model

2 : CE marking and UL model

(6) Operation Panel

[none] : No panel type

1 : Panel type

(7) Power input connector type

[none] : normal type

P2 : Added cable with a connector and a terminal

P3 : Added cable with a connector and a terminal block

(8) Optional Specification

[none] : normal

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

Sxx : mechanical option

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

We,

Manufacturer: MITSUBISHI ELECTRIC Corporation Nagoya Works
 Address: 1-14 Yada-Minami 5-Chome Higashi-Ku, Nagoya 461-8670, Japan

(Place of Declare):

Declare under our sole responsibility that the Product

Description: Industrial Robot

Type of Model: F series

Notice: Details of Serial number are as per attached Nomenclature.

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)	EN 61000-6-4:2007+A1:2011 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 IEC61326-3-1:2008 ISO13849-1:2006 (Category 3 and Performance level "d") Type C: Machine Safety standard ISO10218-1:2011	N/A

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

<Partly completed Machinery>

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

Issue Date (Date of Declaration): 29. 7. 2018

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

(signature)

[Tomoyuki Kobayashi]

Senior Manager
 Robot Manufacturing Department
 MITSUBISHI ELECTRIC Corporation Nagoya
 Works

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

(signature)

[Hartmut Putz]

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

■ Declaration Type of models

RH - xFH xx xx x - xxx - Sxx

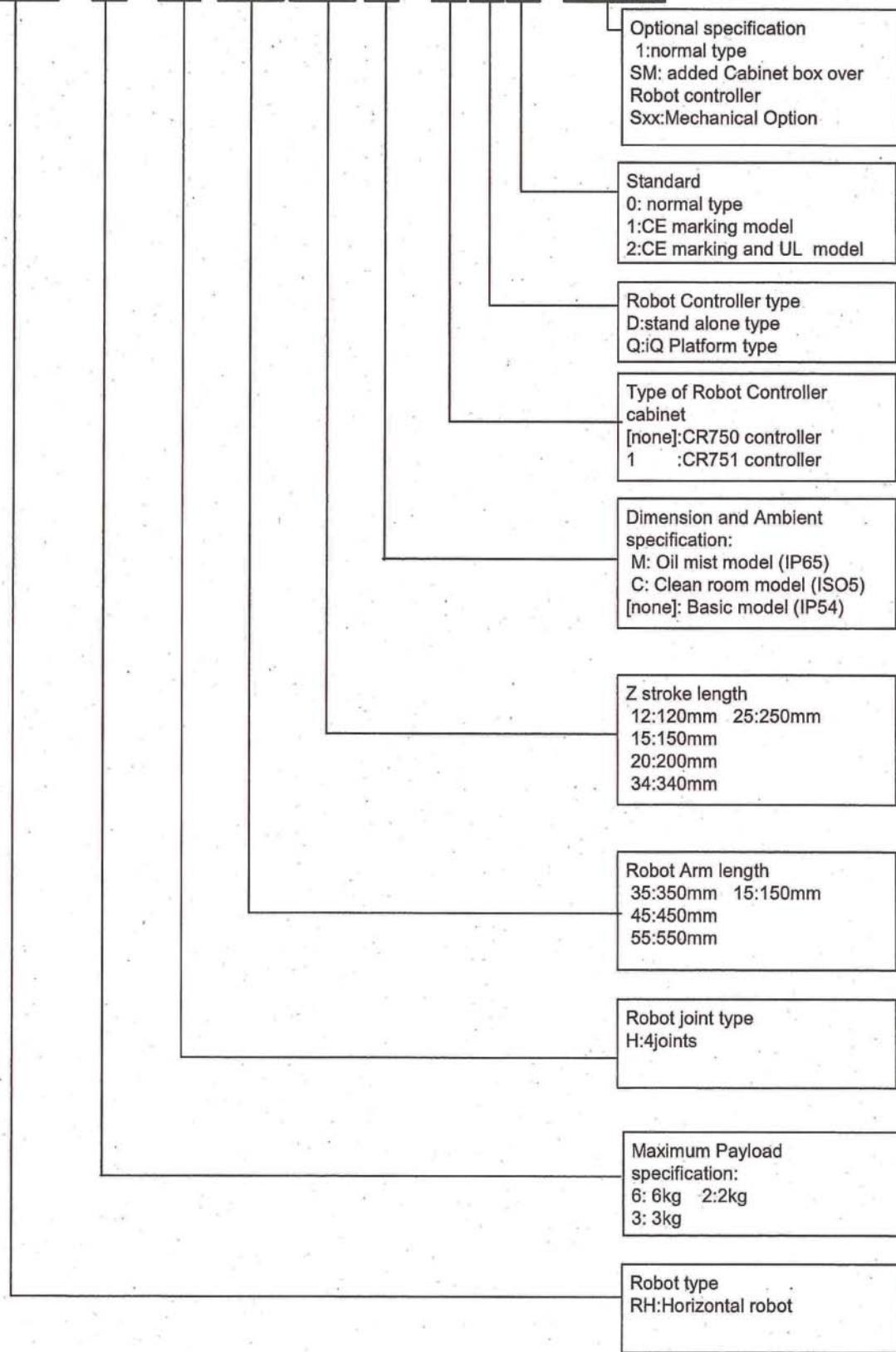


Fig.1-1 Nomenclature of F-series robot of RH-6FH,3FH ,2FH series.

RH - xFH xx xx x - xxx- Sxx

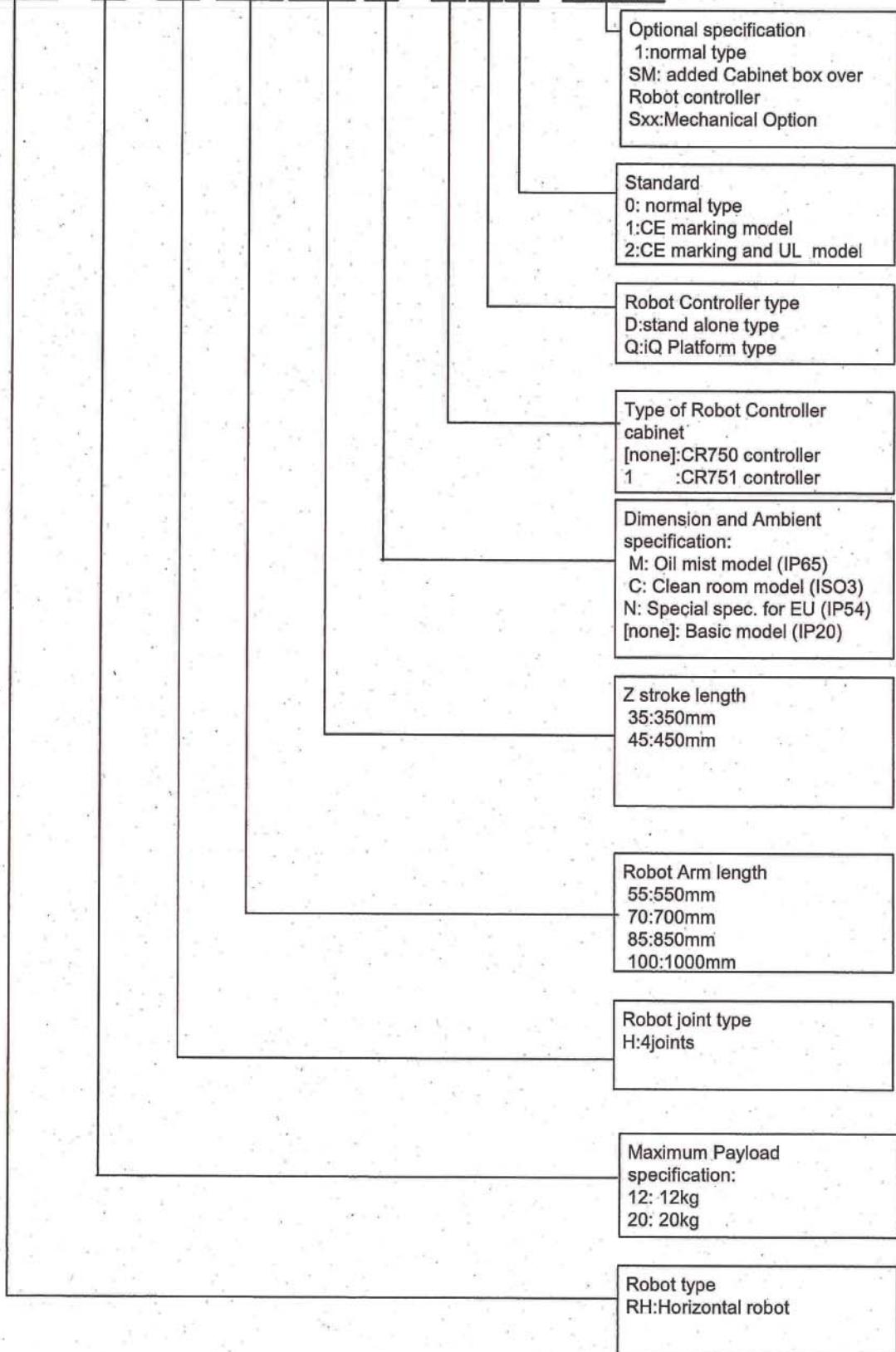


Fig.1-2 Nomenclature of F series robot of RH-12FH,20FH series

RV -xF x-xxx-Sxx

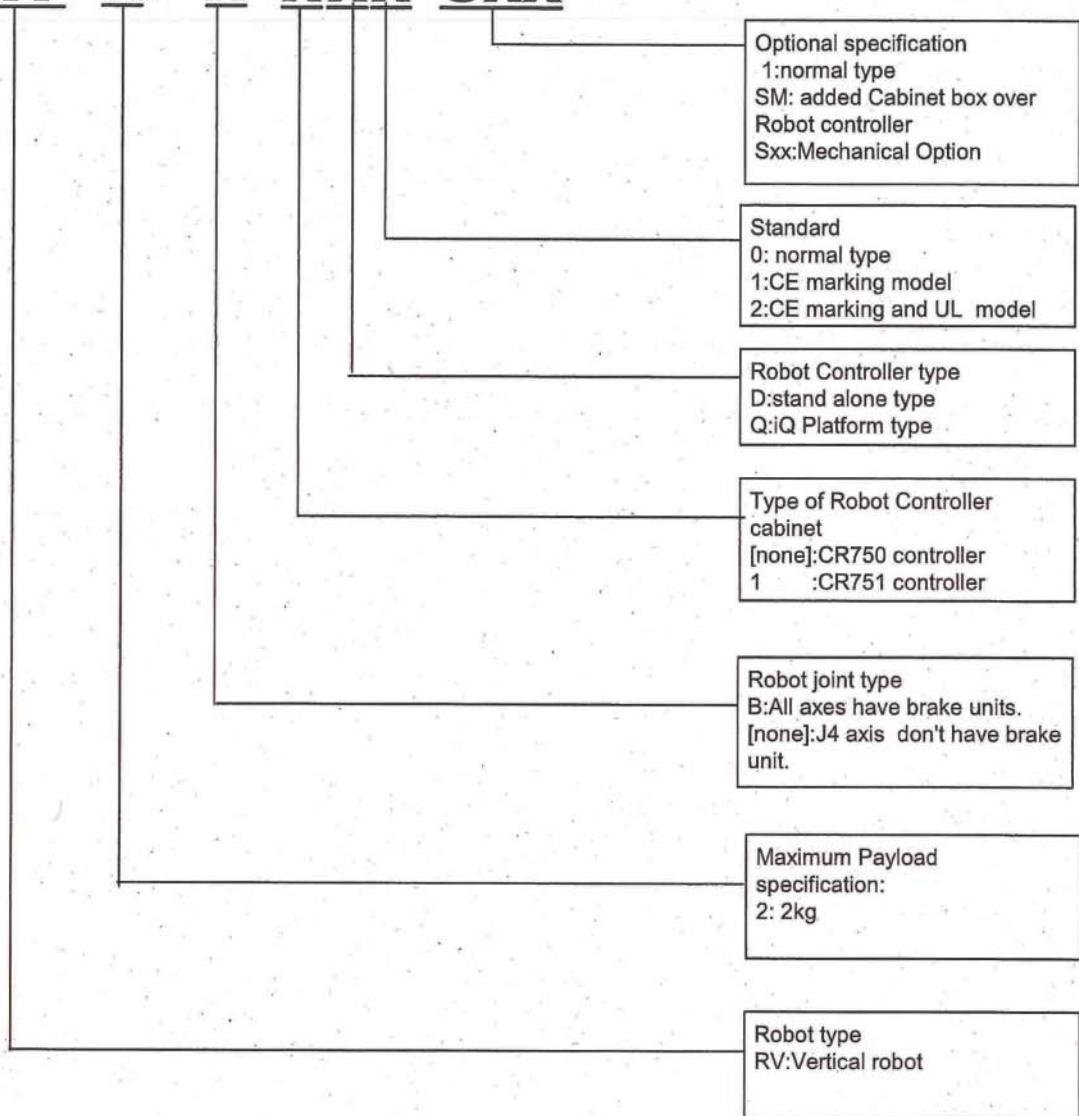


Fig.1-3 Nomenclature of F series robot of RV-2F series

RV-xFxxx-xxx-Sxx

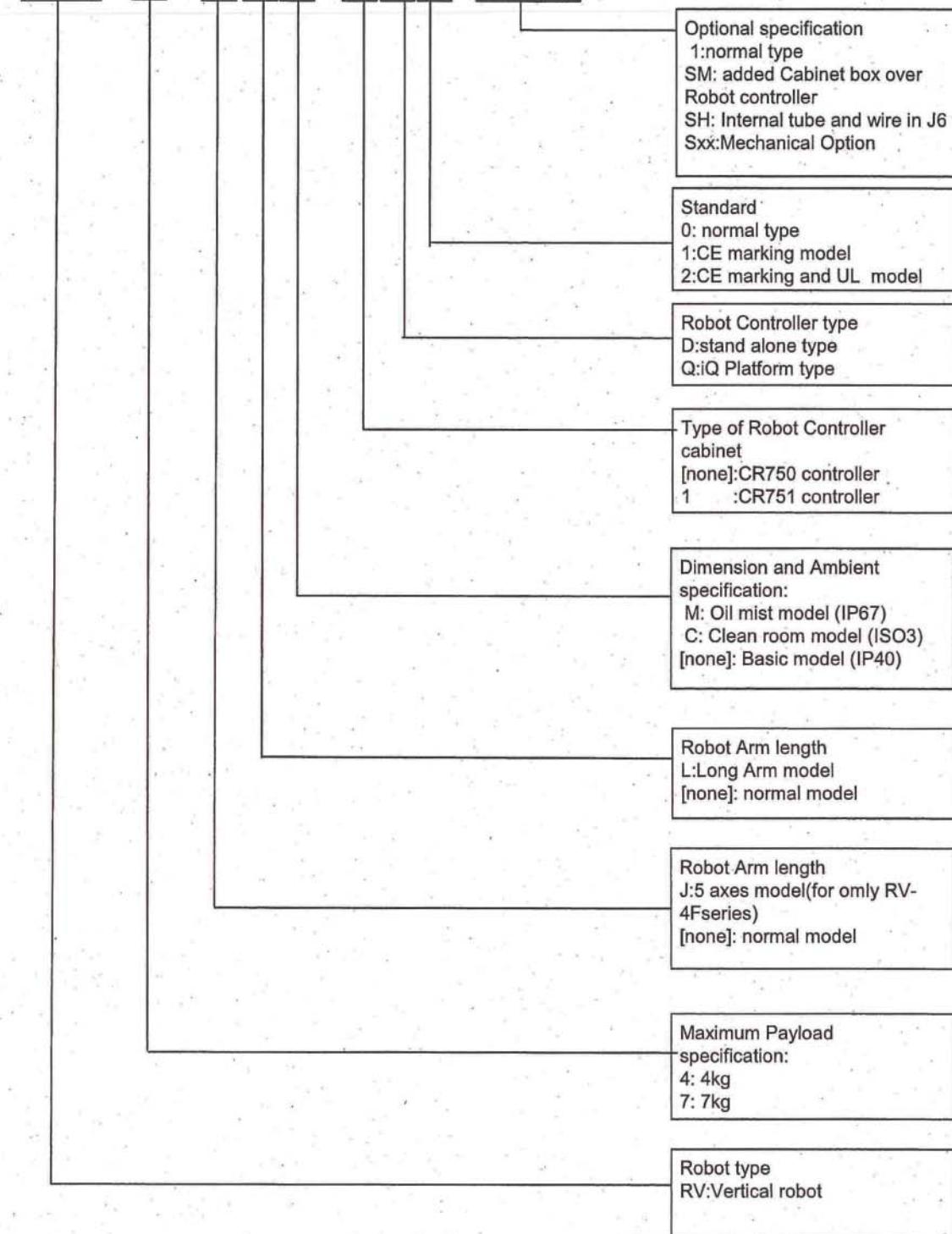


Fig.1-4 Nomenclature of F series robot of RV-4F,7F series

RV-xFx x-XXX-Sxx

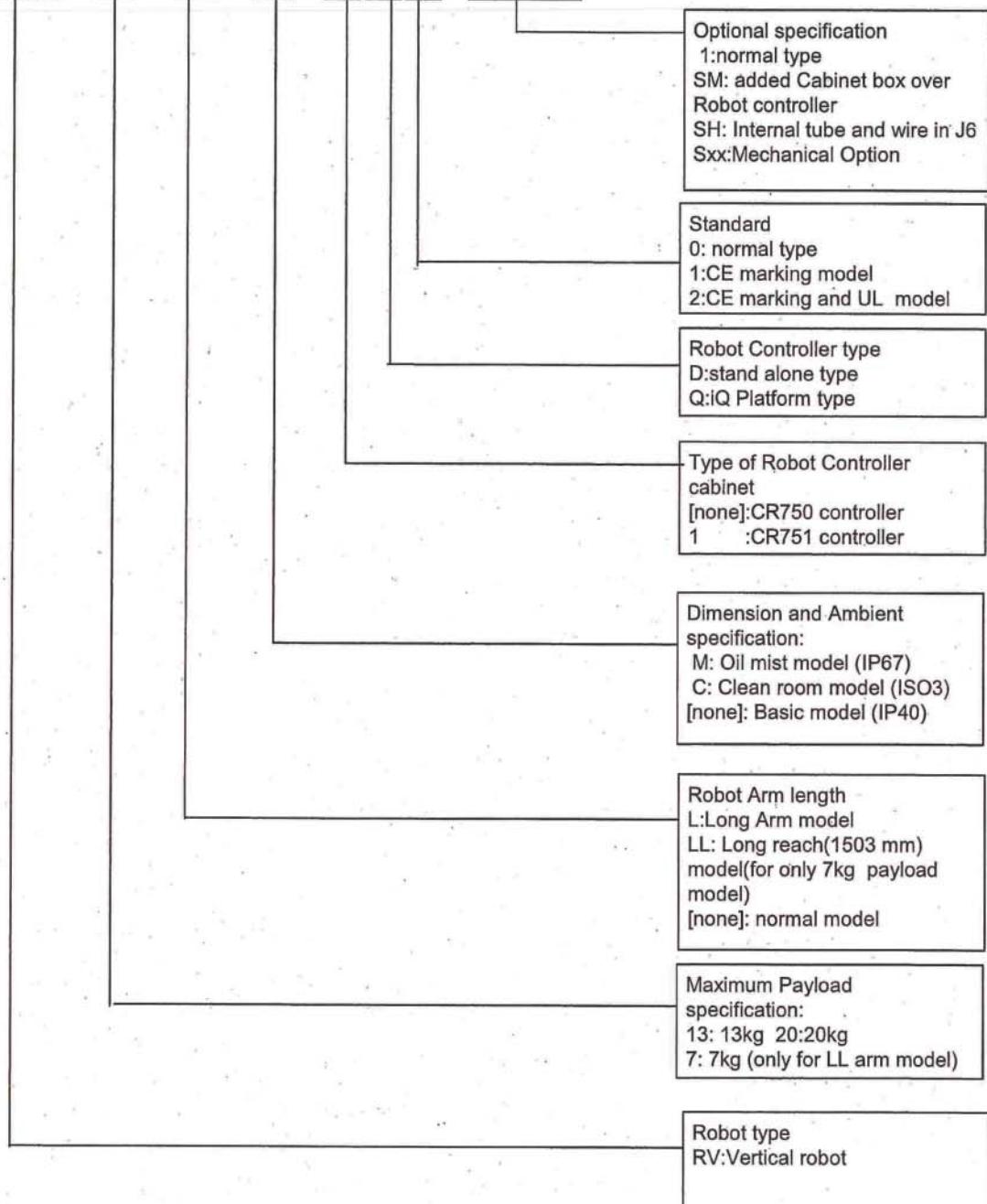


Fig.1-5 Nomenclature of F series robot of RV-13F,20F,7FLL series

RH-xFHRxxxxx -xxx-Sxx

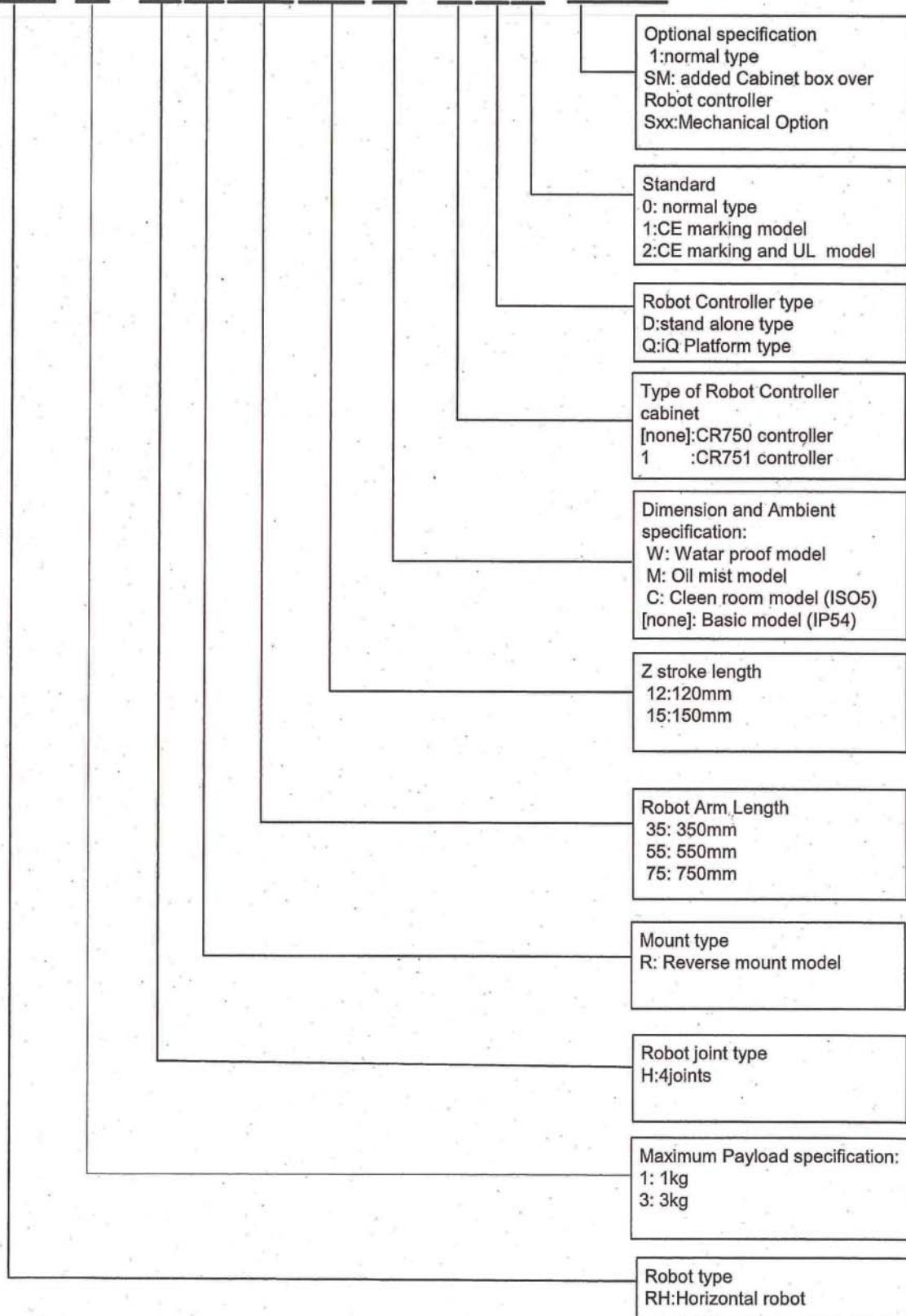


Fig.1-6 Nomenclature of F series robot of RH-1FHR, RH-3FHR series

CR750 - XX X X X-X-X-Sxx

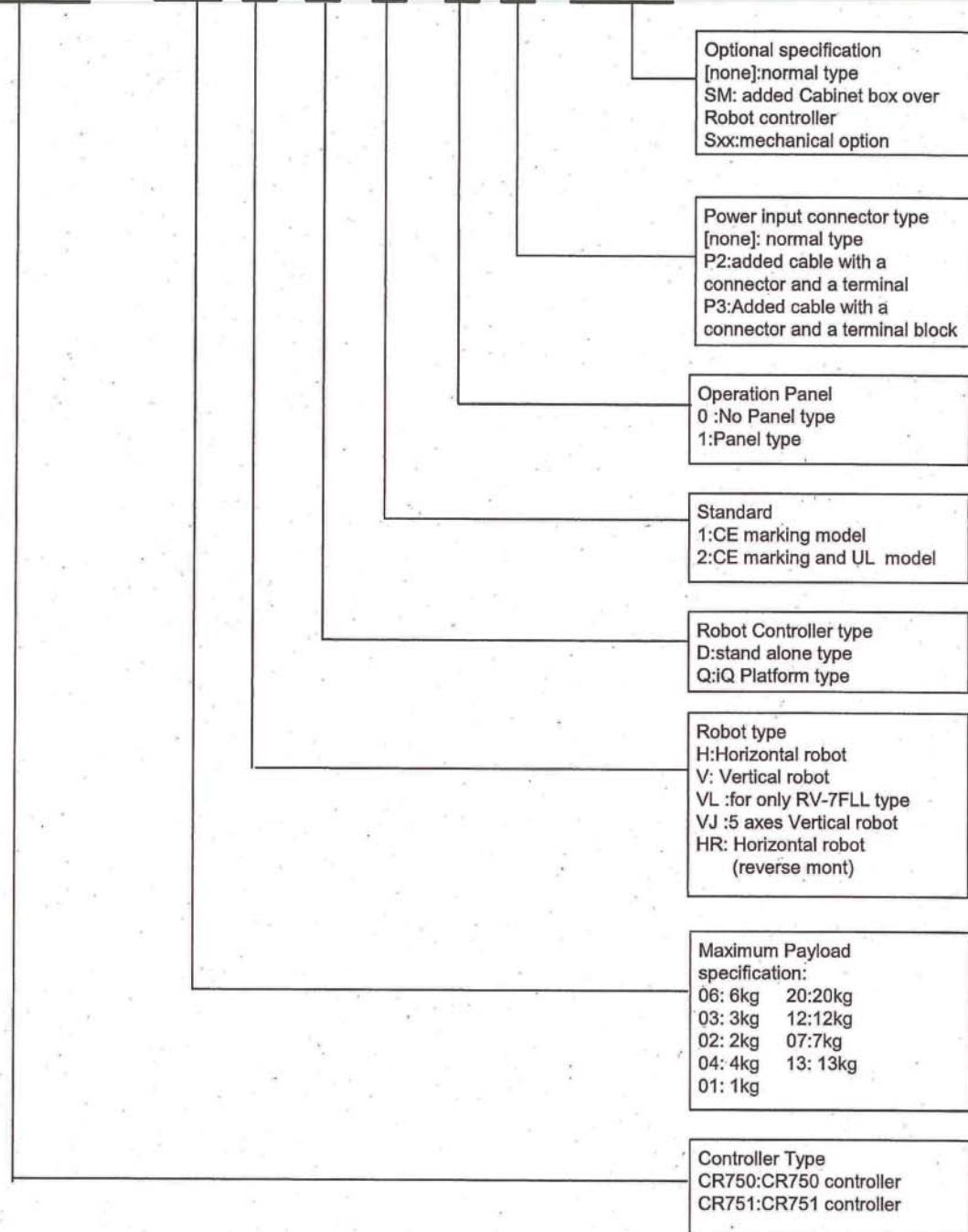


Fig.2-1 Nomenclature of F series robot controller

■ Details of serial number

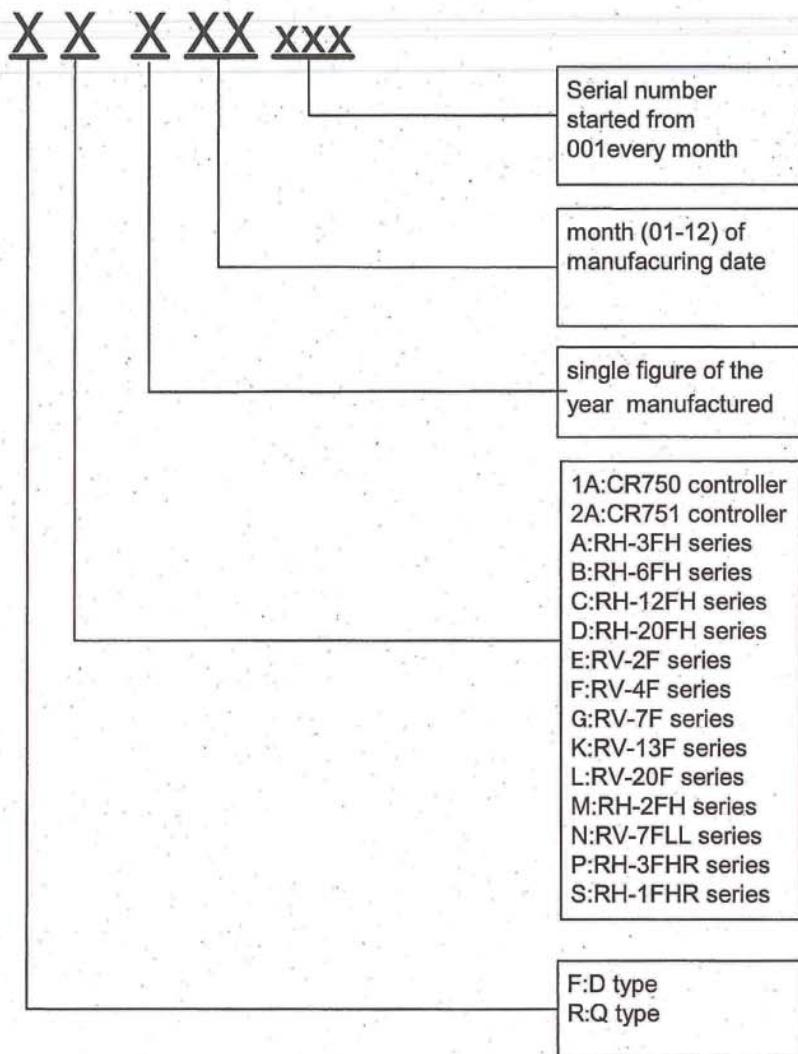


Fig.3.1 Nomenclature of serial number about F series Robot and robot controller

Revision history

Date	Specifications No.	Details of revisions	Rev.
April 16, 2012		First print	*
May 25, 2012		Q type are added.	A
Oct 1, 2012	Fig.1-2,1-3,1-4 added	RH-12/20FH-D series,RV-2F-D series,RV-4F/7F-D series are added.	B
Nov 1, 2012	P1 P3-P7	Form is changed. RH-12/20FH-Q series,RV-2F-Q series,RV-4F/7F-Q series are added "Details of serial No." is added	C
Apr 15, 2013	P2,P6,P7,P8	RH-2FH series,RV-13F,20FH,7FLL series are added	D
Mar 12, 2014	P1 P5	Standards are updated. "J"option added (RV-4FJseries added)	E
Apr 24, 2014	P1	Standards are updated.	F
Jul 9 2014	P7	RH-3FHR series.and RH-1FHR series are added.	

MITSUBISHI ELECTRIC CORPORATION

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