



Mitsubishi Industrial Robot

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

INSTRUCTION MANUAL

Controller setup, basic operation, and maintenance

MELFA
BFP-A8886-W

Safety Precautions

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

CAUTION

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

Enforcement of safety training

CAUTION

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

Preparation of work plan

WARNING

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

Setting of emergency stop switch

CAUTION

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

Indication of teaching work in progress

DANGER

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

Installation of safety fence

CAUTION

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

Signaling of operation start

CAUTION

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

Indication of maintenance work in progress

CAUTION

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

Inspection before starting work

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

DANGER

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

CAUTION

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

CAUTION

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

CAUTION

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

CAUTION

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

CAUTION

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

CAUTION

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

WARNING

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

WARNING

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

CAUTION

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

WARNING

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

CAUTION

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

CAUTION

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

CAUTION

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

CAUTION

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

Failure to observe this could lead to faults or failures.

WARNING

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

CAUTION

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

CAUTION

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

DANGER

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

DANGER

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

DANGER

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

DANGER

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

DANGER

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

CAUTION

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

CAUTION

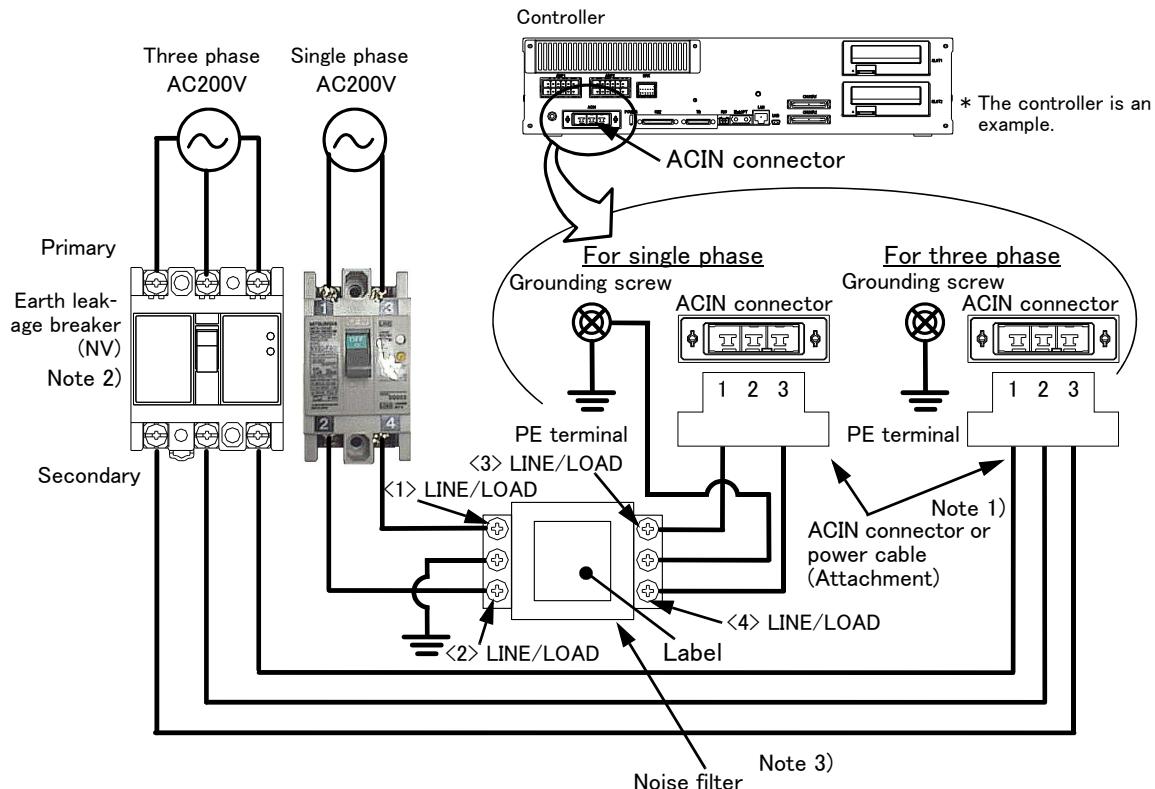
Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures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

*CR751-D or CR751-Q controller

Notes of the basic component are shown.

⚠ CAUTION

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



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

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

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

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

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

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

Revision history

Date of print	Specifications No.	Details of revisions
2012-06-05	BFP-A8886	<ul style="list-style-type: none"> First print
2012-10-03	BFP-A8886-A	<ul style="list-style-type: none"> The notes about installation of the controller and the robot arm were added. (neither direct rays nor the heat of lighting)
2012-10-15	BFP-A8886-B	<ul style="list-style-type: none"> The noise filter (for CE) was added to "Table 2-1: Standard configuration". The connecting method of the noise filter for CE specification was added to "Fig 2-6: Connecting the power cable and grounding cable" and "Fig. 2-7 : Connecting the power cable and grounding cable".
2012-11-20	BFP-A8886-C	<ul style="list-style-type: none"> The statement about trademark registration was added. The wiring example 5 of the "Examples of safety measures" was corrected. (Error in writing) The notes about the input-output connected to the controller were added. (do not ground the + side of 24V power supply prepared by customer) The fuse was added to the "Table 2-1 : Standard configuration". The note were added to the "4.3.1 Turning the control power ON".
2012-12-03	BFP-A8886-D	<ul style="list-style-type: none"> The connection method of the three phase power supply specification was added. (use by single phase power supply)
2012-12-05	BFP-A8886-E	<ul style="list-style-type: none"> Distinction of the ACIN terminal was corrected.
2013-01-09	BFP-A8886-F	<ul style="list-style-type: none"> Note of the external emergency stop were added (opens the connector terminal at factory shipping).
2013-03-21	BFP-A8886-G	<ul style="list-style-type: none"> The mass of the drive unit was shown which was divided by each robot type. The explanation about the drive unit of RV-7FLL, RV-13F and RV-20F series were added.
2013-06-17	BFP-A8886-H	<ul style="list-style-type: none"> "Fig. 2-10 : Connection between the robot CPU system and the CR750 drive unit" and "Fig. 2-11 : Connection between the robot CPU system and the CR751 drive unit" were corrected.
2013-09-14	BFP-A8886-J	<ul style="list-style-type: none"> "Fig.2-28: Limitations when connecting the relay etc. (CR750)" and "Fig.2-29: Limitations when connecting the relay etc. (CR751)" were corrected. (Error output → Emergency stop output, Contactor controleoutput for additional axes → Error output) "Table 2-1: Standard configuration" was corrected. 4A fuse was added and the numbers of cable clamp were corrected. The number of a controller in "Fig.2-26 : Example of safety measures (Wiring example 4)" was corrected. (formerly: #1) The descriptions of the ferrite core in "Table 1-2: Standard configuration", "Fig. 2-10: Connection between the robot CPU system and the CR750 drive unit" and "Fig. 2-11: Connection between the robot CPU system and the CR751 drive unit" were corrected. The noise filter (attachments) of CR751 controller was deleted. The RH-3FHR series robot is supported.
2014-01-06	BFP-A8886-K	<ul style="list-style-type: none"> "2.2.4 Installing procedures of attachments" was added. Power cable was added as attachment to the CR751 controller.
2014-03-31	BFP-A8886-M	<ul style="list-style-type: none"> Ex-T control function was added. Lists of pin assignment of connectors for exclusive input/output signals were added. LM40 fuse and HM32 fuse were added to the Controller spare parts list. The method of replacing the battery of the drive unit was added. The types of the ACIN terminal on CR750 controller were added.
2014-08-06	BFP-A8886-N	<ul style="list-style-type: none"> The cover and corporate logo mark of this manual was changed.
2014-08-20	BFP-A8886-P	<ul style="list-style-type: none"> The method of cleaning the filter inside the CR751 drive unit was modified. The note of using the Mode key switch input was added. A safety relay in "example of safety measures (wiring example 5) " both CR750 and CR751 controller were changed.
2014-12-24	BFP-A8886-R	<ul style="list-style-type: none"> The description about attachments (ACIN connector, ACIN Terminal, power cable) was modified.
2015-02-05	BFP-A8886-S	<ul style="list-style-type: none"> The chapters of "2.3.4 Emergency stop input and output etc." and "2.3.6 Mode changeover switch input" were added. The 3.2 Amp fuse (LM32) is added to "Table 2-1: Standard configuration" and "Table 5-5: Controller spare parts list".

Date of print	Specifications No.	Details of revisions
2015-10-29	BFP-A8886-T	<ul style="list-style-type: none"> • “4.3.4 Shutting OFF the drive unit power” was added. • Note1) in “Table2-9: Function of the key switch interface” was corrected. • The error about a cable clamp for robot CPU system side was corrected. • The procedure was added to “5.3.1 Replacing the battery”. • The explanation of CR760 drive unit was added.
2015-12-14	BFP-A8886-U	<ul style="list-style-type: none"> • Circuit diagrams in “2.3.5 Connecting the external emergency stop” and “2.3.7 Examples of safety measures” were modified.
2016-03-24	BFP-A8886-V	<ul style="list-style-type: none"> • Pin assignment lists of the CNUSR2 and EMG2 connectors were modified. • “Fig. 2-16: Connection between the robot CPU system and the CR760 drive unit” was modified.
2016-09-22	BFP-A8886-W	<ul style="list-style-type: none"> • CE marking specification of CR760 controller was added.

■ Introduction

Thank you for purchasing the Mitsubishi industrial robot.

This instruction manual explains the unpacking methods, installation, basic operation, maintenance and inspection of the controller.

Always read through this manual before starting use to ensure correct usage of the robot.

The optional equipments and power supply voltage are different according to connecting robot type.

Refer to separate "Standard Specifications Manual" for detail.

The information contained in this document has been written to be accurate as much as possible. Please interpret that items not described in this document "cannot be performed."

In this manual, CR750, CR751, and CR760 series controller are written together.

In CR751 controller, there are two kinds of the outside dimension different in its height.

- 98 mm height: "CR751 (Thin type)"
- 174 mm height: "CR751 (Heavy type)"

* Refer to [Page 2, "1.1.2 Symbols used in instruction manual"](#).

Installation of the emergency stop switch

To be able to stop the robot immediately at the time of the abnormalities because of safety, please install the emergency stop switch in the position which is certainly easy to operate it, and connect with the drive unit.. Refer to the [Page 34, "2.3.5 Connecting the external emergency stop"](#) for the connection method.

And, the connection method of the door switch or the enabling device is also indicated here. Please use it together with the emergency stop switch.

Synchronous connection of the addition axis servo power supply

It is building the circuit so that the output point of contact (the contactor control output for addition axes: AXMC) installed in the drive unit may be used in use of the addition axis function and the power supply of the servo amplifier for addition axes may be shut down by opening of this output,The servo ON/OFF state of the addition axis can be synchronized with the servo ON/OFF state of the robot arm. With reference to [Page 72, "2.3.8 Magnet contactor control connector output \(AXMC\) for addition axes"](#), I ask you to have synchronous connection made.

Notice

- *ONLY QUALIFIED SERVICE PERSONNEL MAY INSTALL OR SERVICE THE ROBOT SYSTEM.
- *ANY PERSON WHO PROGRAM, TEACHES, OPERATE, MAINTENANCE OR REPAIRS THE ROBOT SYSTEM IS TRAINED AND DEMONSTRATES COMPETENCE TO SAFELY PERFORM THE ASSIGNED TASK.
- *ENSURE COMPLIANCE WITH ALL LOCAL AND NATIONAL SAFETY AND ELECTRICAL CODES FOR THE INSTALLATION AND OPERATION OF THE ROBOT SYSTEM.

- No part of this manual may be reproduced by any means or in any form, without prior consent from Mitsubishi.
- The details of this manual are subject to change without notice.
- The information contained in this document has been written to be accurate as much as possible. Please interpret that items not described in this document "cannot be performed." or "alarm may occur".
- Please contact your nearest dealer if you find any doubtful, wrong or skipped point.
- This specifications is original.
- Company names and production names in this document are the trademarks or registered trademarks of their respective owners.

For users operating robots that have not been mounted with an operation panel:

Operation of robot programs such as start-up and shutdown are carried out using external signals (exclusive input/output signals). This instruction manual is based on robots that are mounted with an operation panel at the front of the controller, and these operations are explained using key operations on that panel. Using the parameter settings, please assign exclusive input/output signals that correspond with each key operation to general purpose input/output signals, and operate the robot using signal operations.

The following table details exclusive input/output signals that correspond with the key operations of the operation panel explained in this manual. Please use this as a reference to assign signals and operate the robot.

For further details regarding parameters please see the separate instruction manual "Detailed explanations of functions and operations".

Table: Conversion table of the buttons and dedicated I/O signals

Operation panel button, lamp	Parameter name	Class	Function	Default setting
START button START button lamp	START	Input	Starts a program.	3,0
		Output	Indicates that a program is being executed.	
STOP button STOP button lamp	STOP	Input	Stops a program.	0,-1
		Output	Indicates that the program is paused.	
RESET button RESET button lamp	ERRRESET	Input	Releases the error state.	2,2
		Output	Indicates that an error has occurred.	
	SLOTINIT	Input	Cancels the paused status of the program and brings the executing line to the top. Executing a program reset makes it possible to select a program.	-1,-1
		Output	Outputs that in the program selection enabled state.	
	PRGSEL	Input	Selects the value inputted into the signal assigned to the numerical input as a program number.	-1,
		Output	-	
CHNG DISP button UP/DOWN button	PRGOUT	Input	Outputs the program number selected to the signal assigned to the numerical output.	-1,-1
		Output	Indicates outputting the program number to the numerical output.	
	OVRDSEL	Input	Sets the value inputted into the signal assigned to the numerical input as a override.	-1,
		Output	-	
	OVRDOUT	Input	Outputs the override value to the signal assigned to the numerical output.	-1,-1
		Output	Indicates outputting the override value to the numerical output.	
LINEOUT	LINEOUT	Input	Outputs the current line number to the signal assigned to the numerical output.	-1,-1
		Output	Indicates outputting the current line number to the numerical output.	
	ERROUT	Input	Outputs the error number to the signal assigned to the numerical output.	-1,-1
		Output	Indicates outputting the error number to the numerical output.	
IODATA	IODATA	Input	Reads the program number and the override value as a binary value.	-1,-1, -1,-1
		Output	Outputs the program number, line number and override value as a binary value.	
	CYCLE	Input	Starts the cycle stop.	-1,-1
		Output	Outputs that the cycle stop is operating.	
SVO.ON button SVO.ON button lamp	SRVON	Input	Turns ON the servo power supply.	4,1
		Output	Indicates the servo power supply is ON.	
SVO.OFF button SVO.OFF button lamp	SRVOFF	Input	Turns OFF the servo power supply.	1,-1
		Output	This output indicates a status where the servo power supply cannot be turned ON. (Echo back)	

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1 Before starting use

This chapter explains the details and usage methods of the instruction manuals, the basic terminology and the safety precautions. Moreover, handling and operation of a teaching pendant (T/B) are described based on R32TB (R33TB) in instruction manuals. If using other T/B, such as R56TB (R57TB), refer to a supplied instruction manual of the T/B.

1.1 Using the instruction manuals

1.1.1 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.

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

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

1.1.2 Symbols used in instruction manual

The symbols and expressions shown in [Table 1-1](#) are used throughout this instruction manual. Learn the meaning of these symbols before reading this instruction manual.

Table 1-1:Symbols in instruction manual

Terminology	Item/Symbol	Meaning
Item	iQ Platform	
	Controller	Indicates the controller which controls the robot arm. It consists of the robot CPU system and the drive unit.
	The robot CPU unit or robot CPU	Indicates the CPU unit for the robots which installed to the sequencer base unit (Q3 □ DB) of MELSEC-Q series. It is connected with the drive unit by the dedicated cable.
	The robot CPU system	Multi-CPU system. It consists of MELSEC units, such as the sequencer base unit, the sequencer CPU unit, and the robot CPU unit, etc.
Symbol	Drive unit	Indicates the box which mounts the servo amplifier for robot, and the safety circuit, etc.
	 DANGER	Precaution indicating cases where there is a risk of operator fatality or serious injury if handling is mistaken. Always observe these precautions to safely use the robot.
	 WARNING	Precaution indicating cases where the operator could be subject to fatalities or serious injuries if handling is mistaken. Always observe these precautions to safely use the robot.
	 CAUTION	Precaution indicating cases where operator could be subject to injury or physical damage could occur if handling is mistaken. Always observe these precautions to safely use the robot.
	[JOG]	If a word is enclosed in brackets or a box in the text, this refers to a key on the teaching pendant.
	[RESET] + [EXE] (A) (B)	This indicates to press the (B) key while holding down the (A) key. In this example, the [RESET] key is pressed while holding down the [EXE] key.
	T/B	This indicates the teaching pendant.
	O/P	Indicates the operating panel on the front of controller or drive unit for the controller which installed the operating panel
	CR751 (Thin type) CR751 (Heavy type)	There are two kinds of CR751 controller; one is "Thin type" (the height is 98mm) and the other is "Heavy type" (the height is 174mm), each of which are different in height. Thin type: CR751-03HD/Q, CR751-06HD/Q, CR751-12HD/Q, CR751-20HD/Q, CR751-03HRD/Q, CR751-02VD/Q, CR751-04VD/Q, CR751-04VJD/Q, CR751-07VD/Q. Heavy type: CR751-13VD/Q, CR751-20VD/Q, CR751-07VLD/Q. * Refer to separate Standard Specifications Manual for the outside dimension of CR751 controller.

1.2 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

1.2.1 Precautions given in the separate Safety Manual

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.

⚠ CAUTION

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

⚠ CAUTION

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/CR760-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 failures, such as the emergency stop not being released. In order to prevent from 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.

2 Unpacking to installation

2.1 Confirming the products

Confirm that the parts shown in the standard configuration of the controller shown in [Table 2-1](#) are enclosed with the purchased product.

Users who have purchased options should refer to the separate "Standard Specifications". The primary power supply cable and grounding cable must be prepared by the customer.

Table 2-1 : Standard configuration

No.	Part name	Type	Qty.	Remarks
CR750-Q controller				
1	Controller	CR750-Q	1 unit	iQ Platform
2	Safety manual	BFP-A8006	1 copy	
3	CD-ROM (Instruction manual)	5F-R001-C00	1 pc.	iQ Platform
4	Dummy plug for T/B	2D-DP1	1 pc.	Connect, when not using T/B.
5	CNUSR connector (Connector cover)	10350-52Y0-008	1 pc.	
6	CNUSR connector (Plug)	10150-3000 PE	1 pc.	
7	CNUSR connector	BU770D007G51	3 pcs.	For the CNUSR11/12/13 connector.
8	Ferrite core	E04SR301334	3 pcs.	For emergency stop wiring and TU cable
9	Noise filter	SUP-EL20-ER6	1 pc.	CE specification only.
10	Lock cover set	HL-05FA	1 pc.	For locking the power switch.
11	1.6A fuse (reserves)	LM16	2 pcs.	
12	3.2A fuse (reserves)	HM32	2 pcs.	
13	4A fuse (reserves)	LM40	1 pc.	
14	3.2A fuse (reserves)	LM32	1 pc.	Only with a controller for the following models. RV-13F/13FL/20F series, RH-1FHR
15	Cable clamp	AL3	3 pcs.	For TU, DISP, EMI cable.
16	Guarantee Card		1 copy	
CR751-Q controller				
1	Controller	CR751-Q	1 unit	iQ Platform
2	Safety manual	BFP-A8006	1 copy	
3	CD-ROM (Instruction manual)	5F-R001-C00	1 pc.	iQ Platform
4	ACIN connector Note1)	1-179958-3	1 pc.	
5	ACIN terminal Note1)	316041-2	2 pcs.	Only with single-phase drive unit.
			3 pcs.	Only with three-phase drive unit.
6	Power cable (with the ACIN connector) Note1)	BU774D126G03	1 pc.	Only with single-phase drive unit. Length: 3m
		BU774D126G23	1 pc.	Only with three-phase drive unit. Length: 3m
7	Dummy plug for T/B	2F-DP1	1 pc.	Connect, when not using T/B.
8	CNUSR connector (Connector cover)	10350-52Y0-008	2 pcs.	
9	CNUSR connector (Plug)	10150-3000 PE	2 pcs.	
10	Ferrite core	E04SR301334	3 pcs.	For emergency stop wiring and TU cable
11	1.6A fuse (reserves)	LM16	2 pcs.	
12	3.2A fuse (reserves)	HM32	2 pcs.	
13	4A fuse (reserves)	LM40	1 pc.	
14	3.2A fuse (reserves)	LM32	1 pc.	Only with a controller for the following models. RV-13F/13FL/20F series, RH-1FHR
15	Cover plate	BU773C012G61	1 pc.	For connector protection of the drive unit.
16	Cable fixing plate	BU773C011H02	1 pc.	For fixing the cable of the drive unit.
17	Cable clamp	AB-10N AB-6N AL3	1 pc.	For fixing the machine cable (CN1) One fixing screw (M4) is attached.
			4 pcs.	For fixing TB cable, power supply and FG cable, communication cable and machine cable (CN2) Four fixing screws (M4) are attached.
			3 pcs.	For TU, DISP, EMI cable.
18	Guarantee Card		1 copy	

No.	Part name	Type	Qty.	Remarks
CR760-Q controller				
1	Controller	CR760-Q	1 unit	iQ Platform
2	Safety manual	BFP-A8006	1 copy	
3	CD-ROM (Instruction manual)	5F-RA01-C00	1 pc.	iQ Platform
4	Dummy plug for T/B	2D-DP1	1 pc.	Connect, when not using T/B.
5	Connector for EMG1	DFMC 1.5/12-ST-3.5-LR	1 pc.	
6	Connector for EMG2	DFMC 1.5/12-ST-3.5-LR	1 pc.	
7	Ferrite core	E04SR301334	7 pcs.	For emergency stop wiring, TU cable, DISP cable, and EMI cable.
8	1.6A fuse (reserves)	LM16	1 pcs.	
9	7.5A fuse (reserves)	GP75	2 pcs.	
10	Guarantee Card		1 copy	

Note1) When the power cable (with the ACIN connector) is used, the ACIN connector and the ACIN terminal are not used.
When you build a power cable suitable for your environment, the ACIN connector and the ACIN terminal are used.

2.2 Installation

2.2.1 Unpacking procedures

The controller is shipped from the factory packaged in cardboard.

2.2.2 Transportation procedures

The following shows how to transport the drive unit.

(1) Transporting CR750/CR751 drive unit

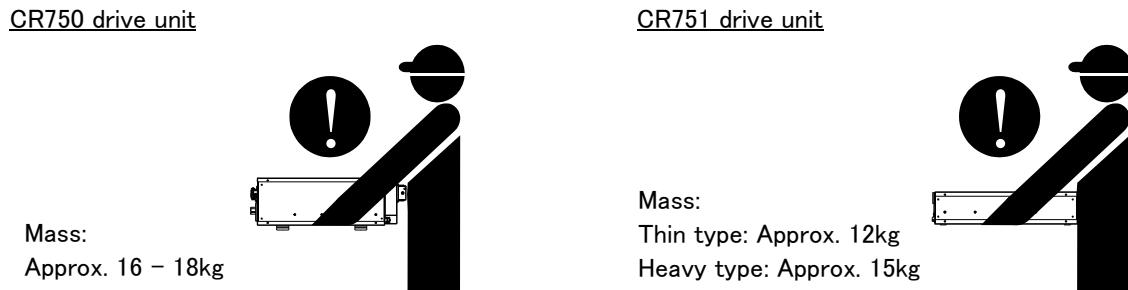


Fig. 2-1 : Transporting CR750/CR751 drive unit

- 1) Slightly tilt the drive unit and put your hands underneath. Providing steady support with both hands, lift it up and transport.
Be careful not to trap fingers when transporting the drive unit.

(2) Transporting CR760 drive unit

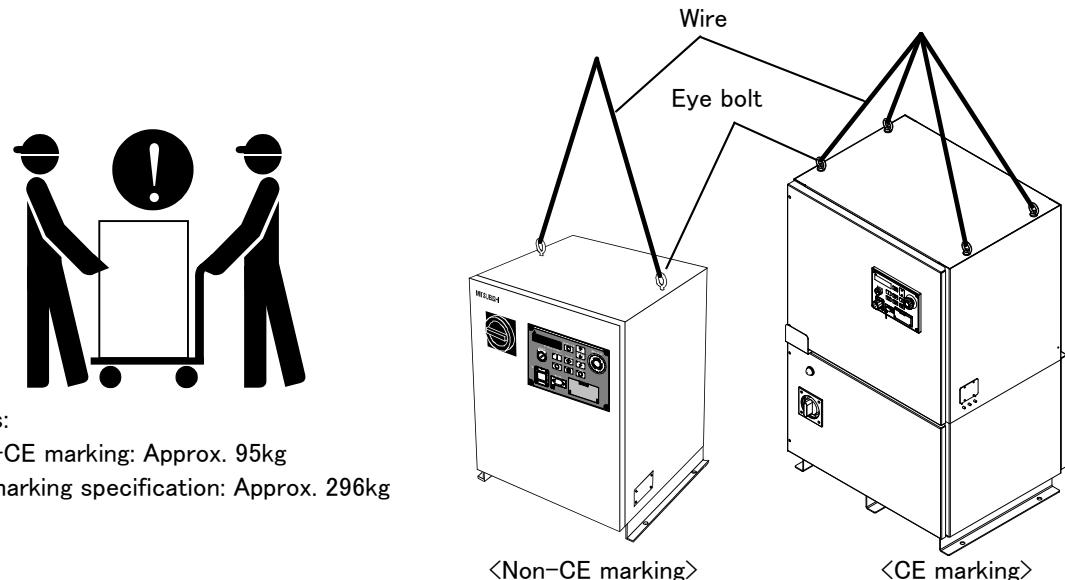


Fig. 2-2 : Transporting CR760 drive unit

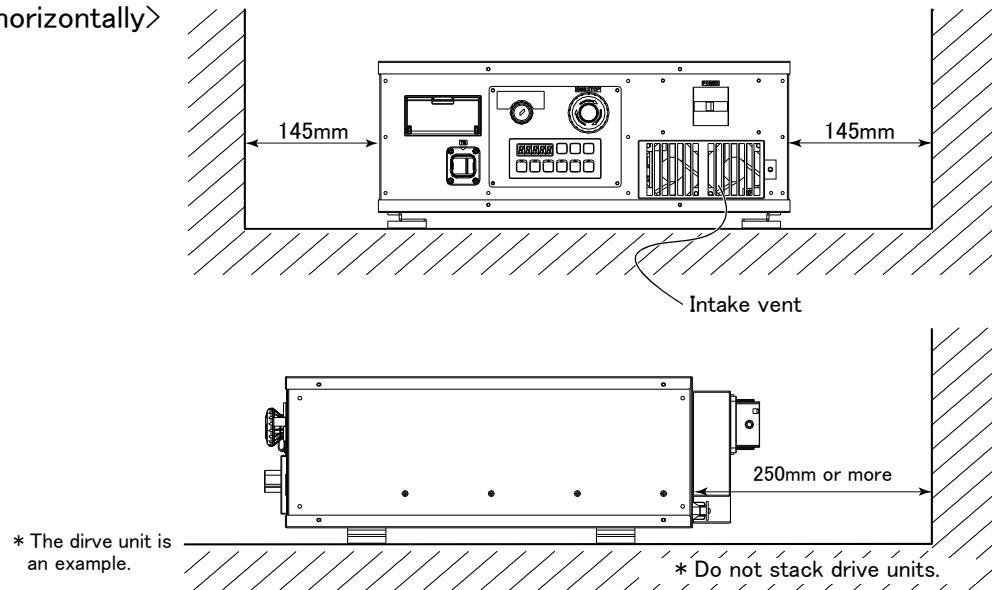
- 1) Two workers must transport the drive unit using a crane or lifter.

2.2.3 Installation procedures

The installed size is shown as follows.

(1) CR750 drive unit

<Placed horizontally>



<Placed vertically>

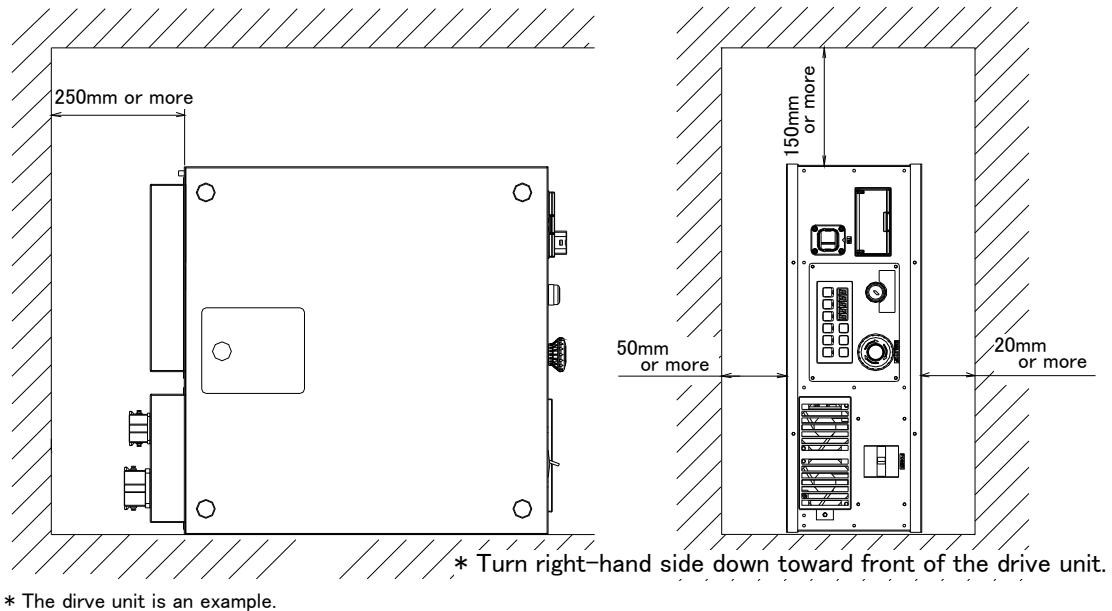


Fig. 2-3 : Installation dimensions (CR750 drive unit)

CAUTION

When using the drive unit in its upright position, please be sure to take measures to prevent toppling, such as fixing the installation section. Fig. 2-4 shows a fixing plate for upright use. Please refer to this when using the drive unit in its upright position. Please use M4 x 8 screws (or shorter) to fix the drive unit to the fixing plate. (Make sure that screws into the drive unit board's internal section (lateral board thickness of 1.2mm) stick out 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.

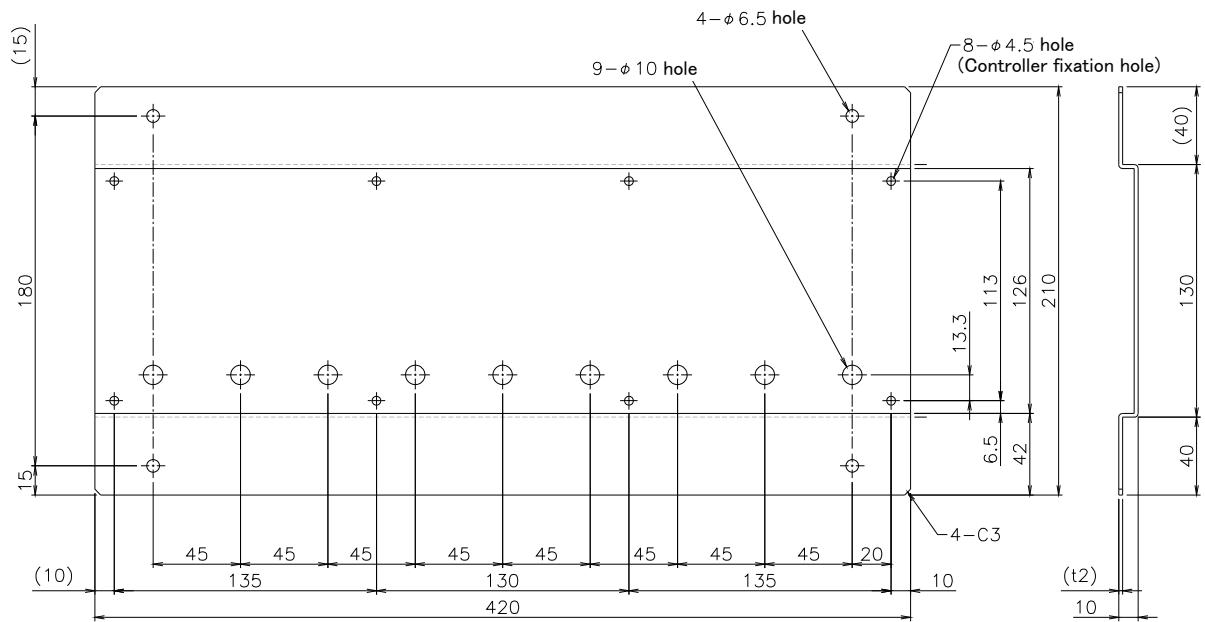
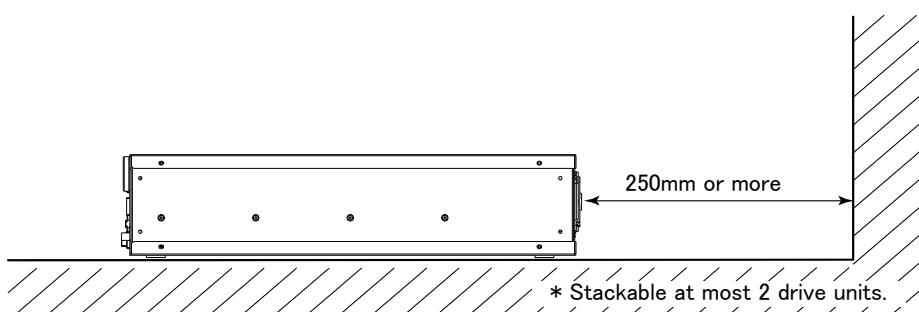
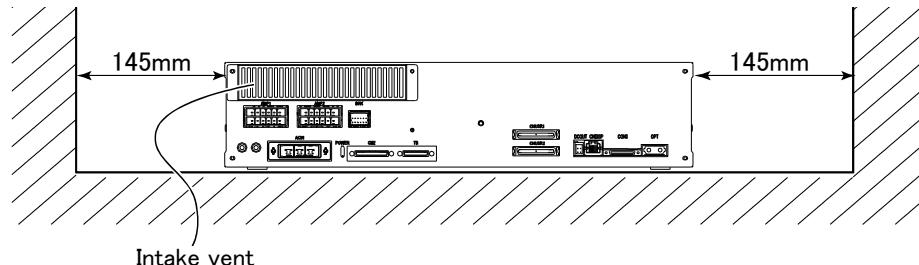


Fig. 2-4 : Metal plate for fixation to placing vertically (reference) (CR750 drive unit)

(2) CR751 drive unit: Thin type

<Placed horizontally>



<Placed vertically>

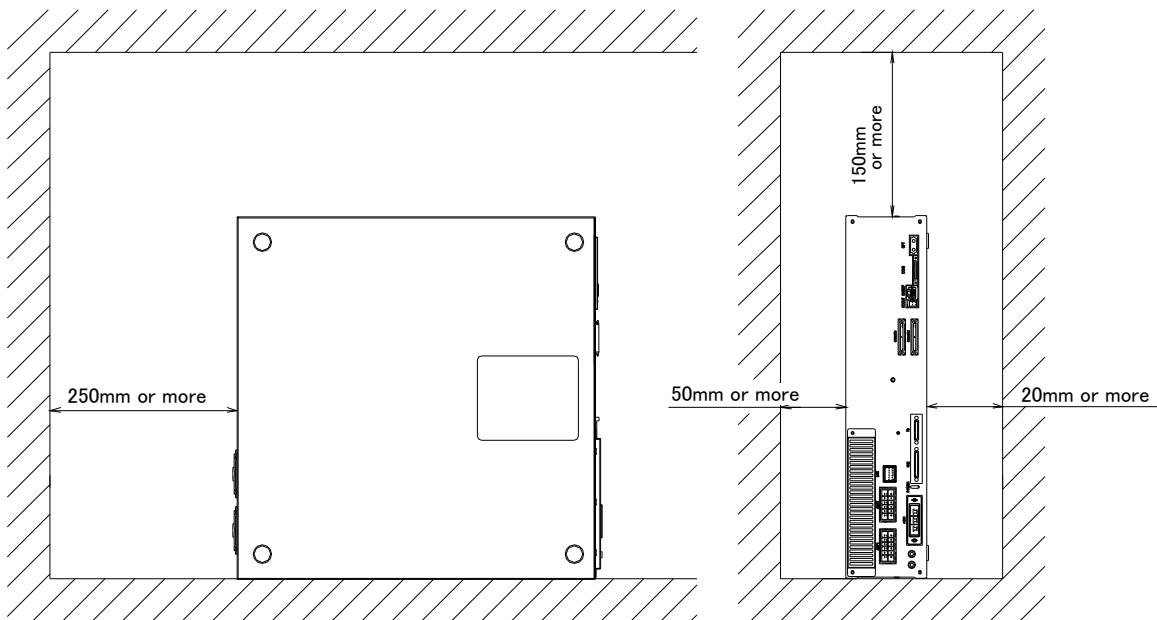


Fig. 2-5 : Installation dimensions (CR751 drive unit: Thin type)

CAUTION

When using the drive unit in its upright position, please be sure to take measures to prevent toppling, such as fixing the installation section. Fig. 2-6 shows a fixing plate for upright use. Please refer to this when using the drive unit in its upright position. Please use M4 x 8 screws (or shorter) to fix the drive unit to the fixing plate. (Make sure that screws into the drive unit board's internal section (lateral board thickness of 1.2mm) stick out 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.

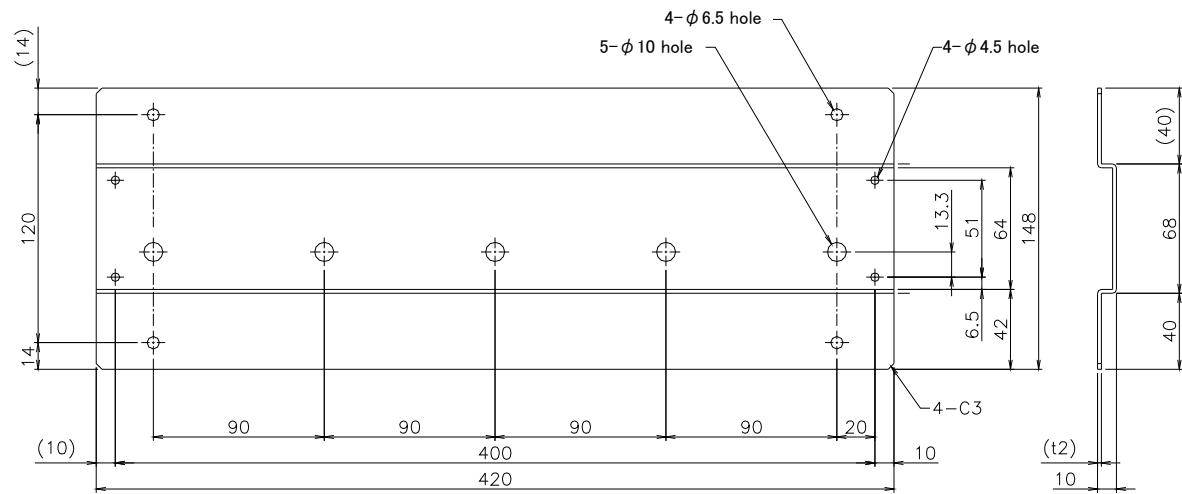
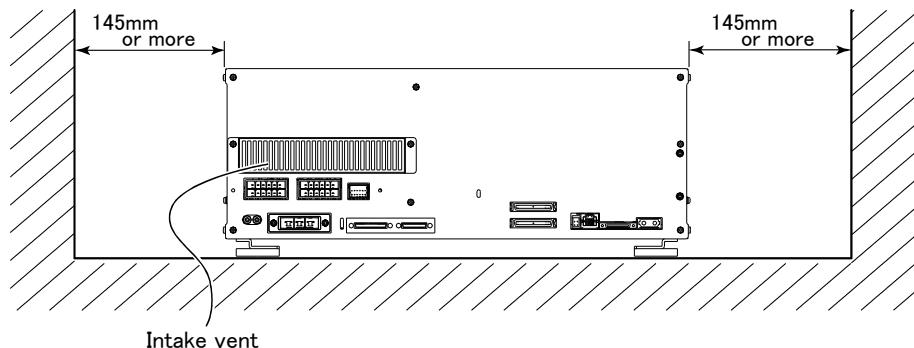


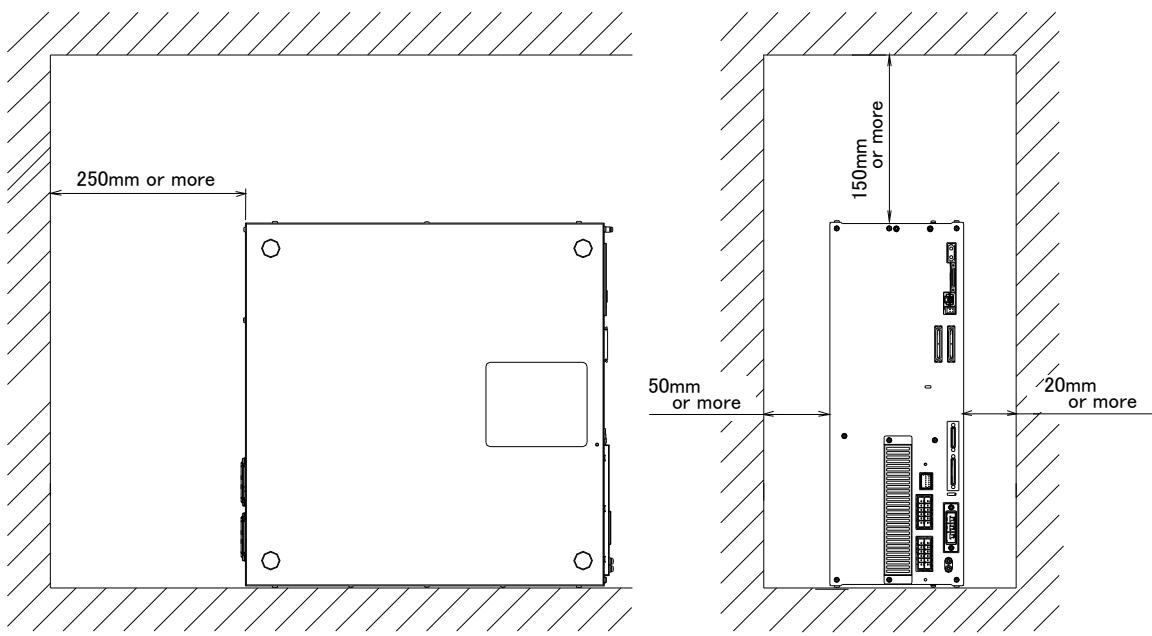
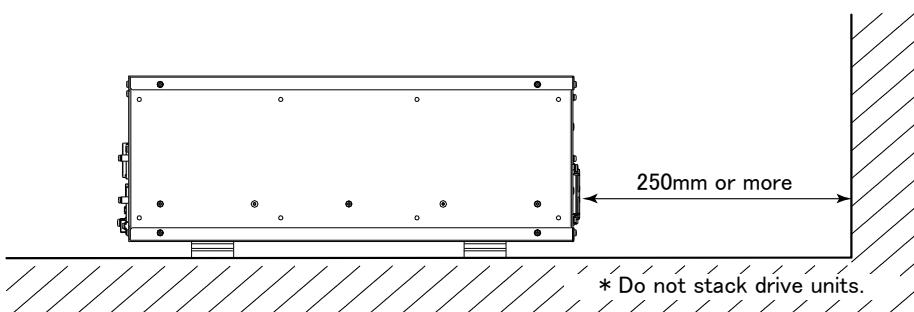
Fig. 2-6 : Metal plate for fixation to placing vertically (reference)

(3) CR751 drive unit: Heavy type

<Placed horizontally>



<Placed vertically>



* Turn right-hand side down toward front of the drive unit.

Fig. 2-7 : Installation dimensions (CR751 drive unit: Heavy type)

⚠ CAUTION

When using the drive unit in its upright position, please be sure to take measures to prevent toppling, such as fixing the installation section. Fig. 2-8 shows a fixing plate for upright use. Please refer to this when using the drive unit in its upright position. Please use M4 x 8 screws (or shorter) to fix the drive unit to the fixing plate. (Make sure that screws into the drive unit board's internal section (lateral board thickness of 1.2mm) stick out 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.

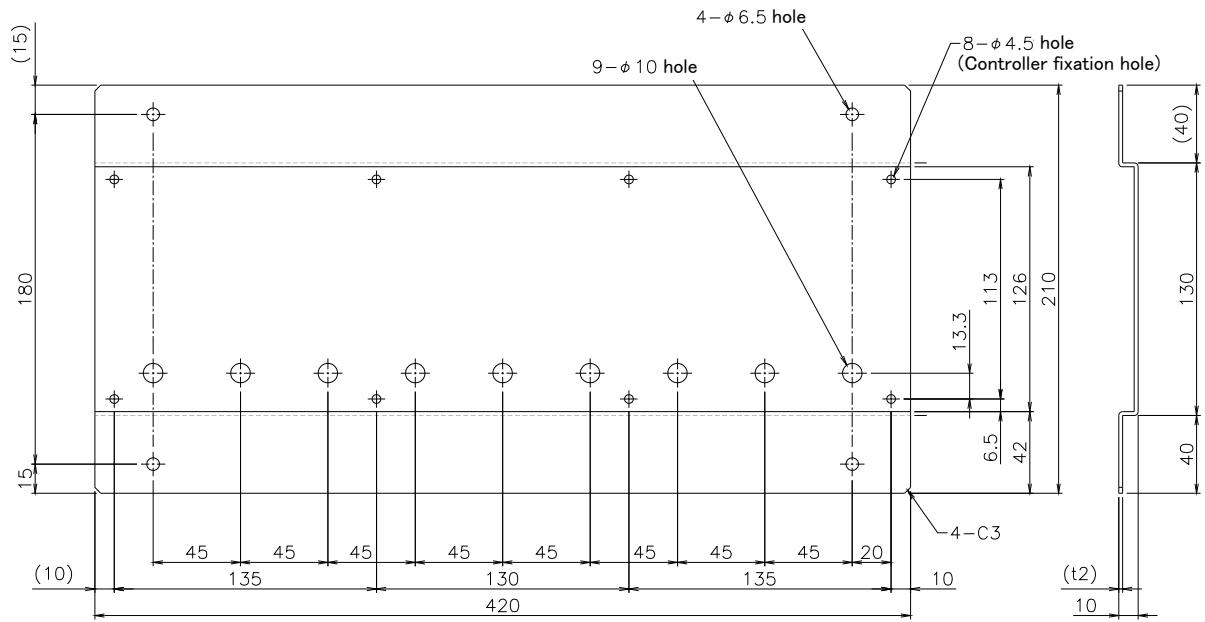


Fig. 2-8 : Metal plate for fixation to placing vertically (reference)

(4) CR760 drive unit

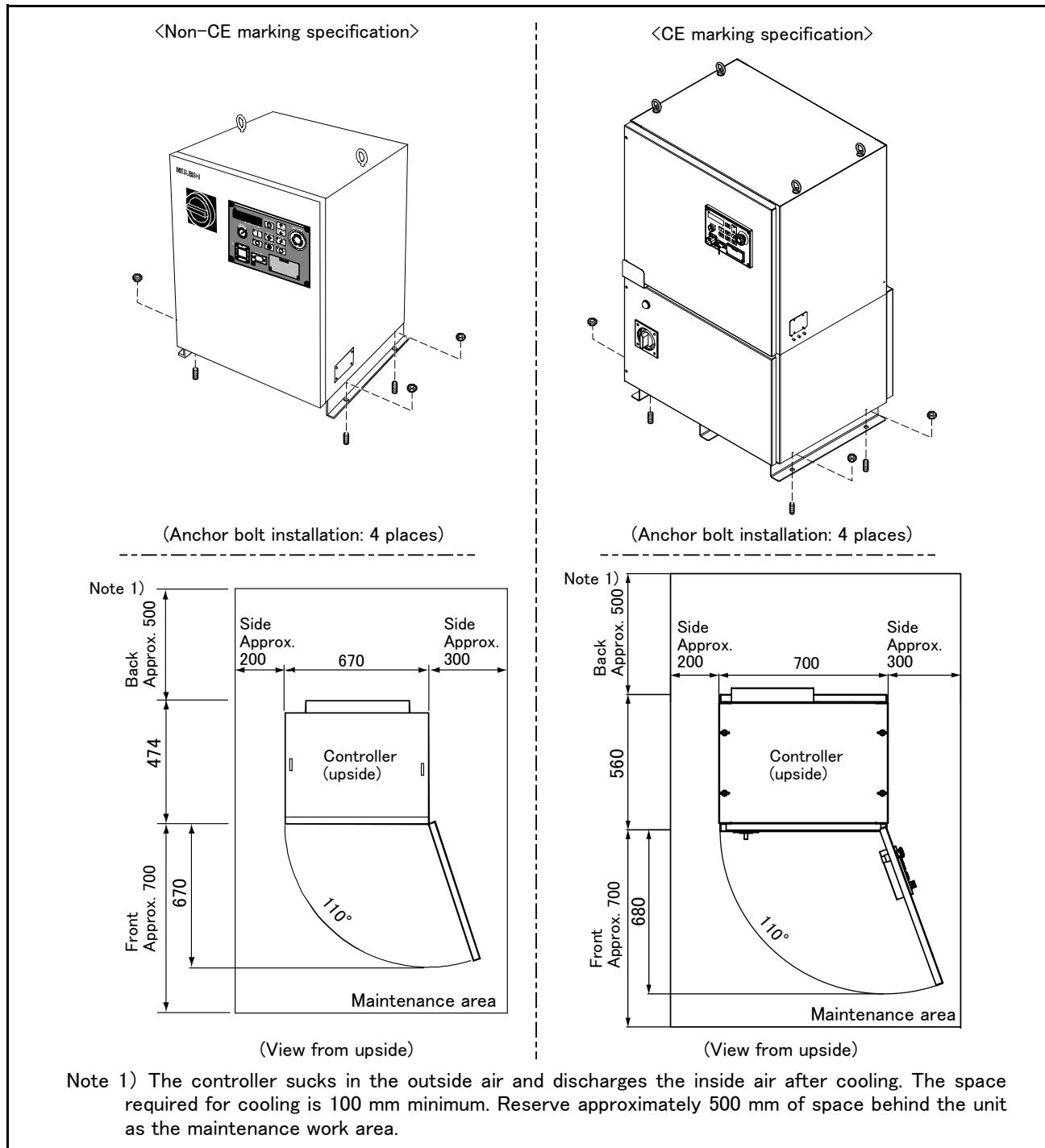


Fig. 2-9 : Installation dimensions (CR760 drive unit)



CAUTION

Install the drive unit so that it is level.



CAUTION

Do not block the ventilation holes on the side and rear surfaces of the drive unit.



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.

2.2.4 Attachments installation procedures

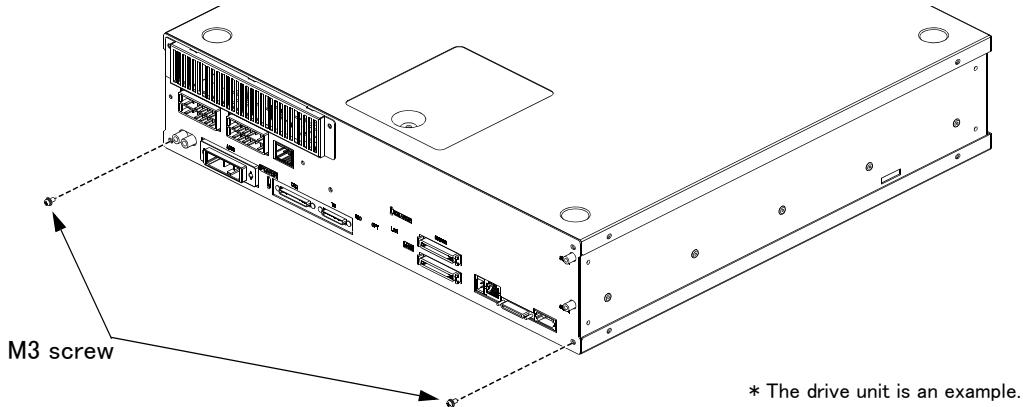
The CR751 drive unit has the cable fixation plate and cover plate to protect the cable connector connected to the drive unit.

Always use the drive unit after installing the cable fixation plate and cover plate.

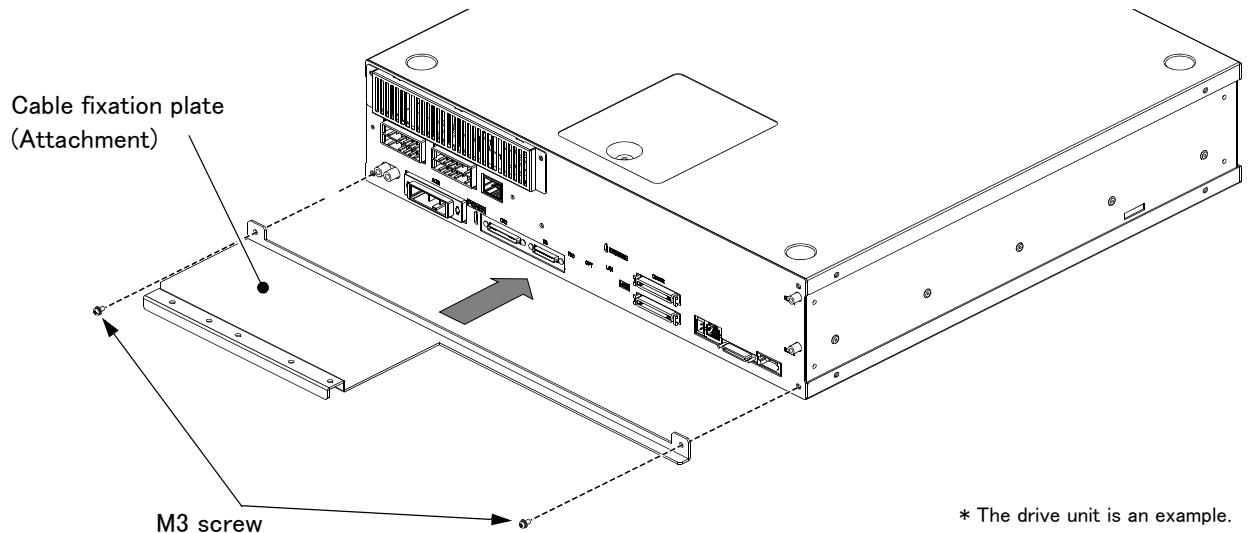
Procedures to install the cable fixation plate and cover plate are shown below.

(1) Installing the cable fixation plate

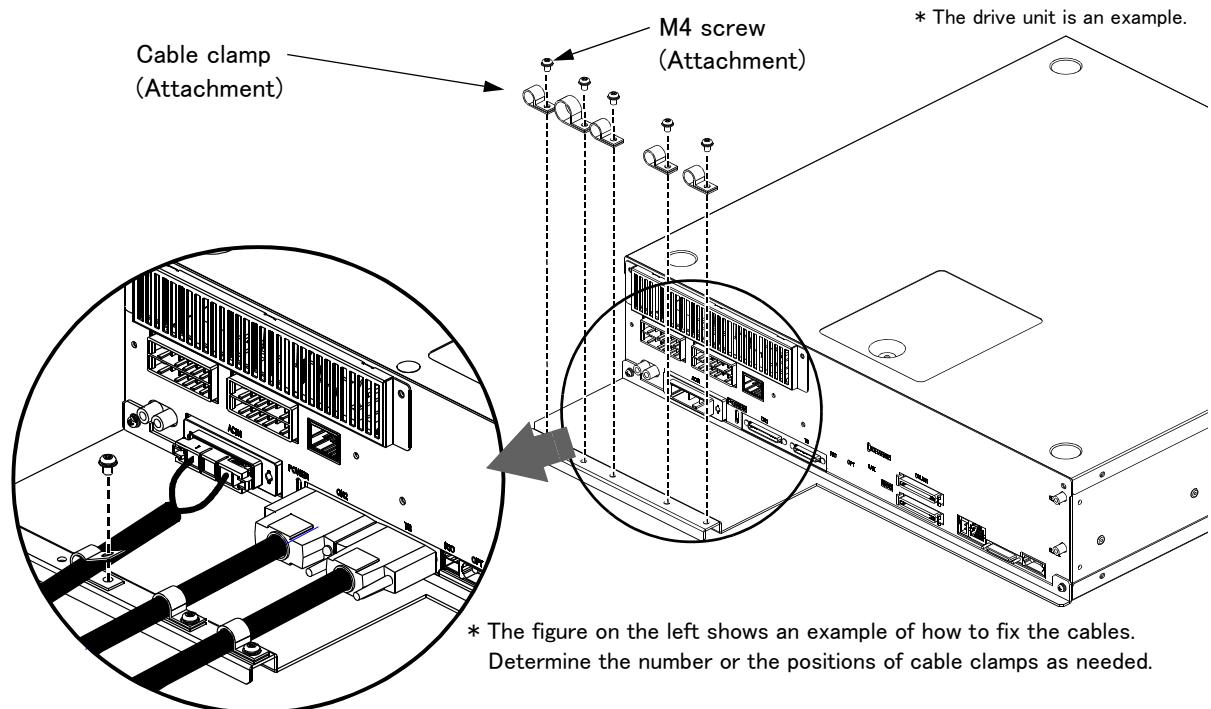
- 1) Remove two screws (M3).



- 2) Install the cable fixation plate to the drive unit with removed screws in step "1)".



3) Connect cables (machine cables, TB cable, power cable and communication cables) and hold the cables with cable clamps (attachments).



⚠ CAUTION

When installing the cable fixation plate, use the screws removed in the step "1)". Using screws other than those may cause damage of the components inside the drive unit.

⚠ CAUTION

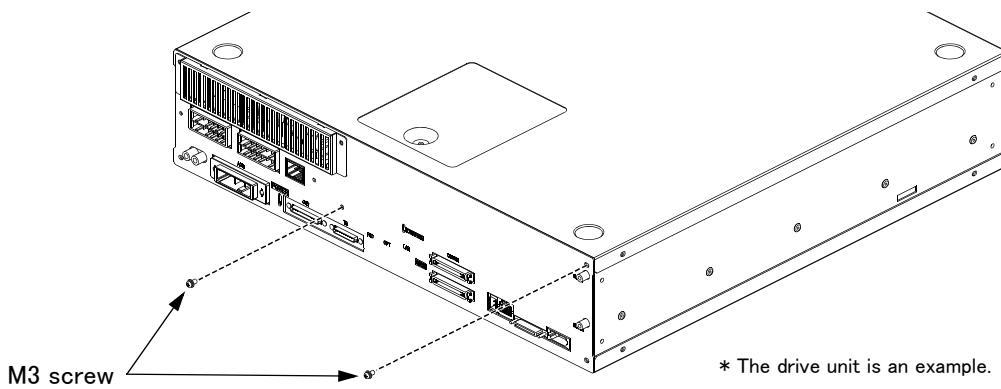
When the cable clamp cannot tighten a cable enough and the cable slips under the clamp, wrap tape around the cable to increase the diameter to be firmly fixed.

⚠ CAUTION

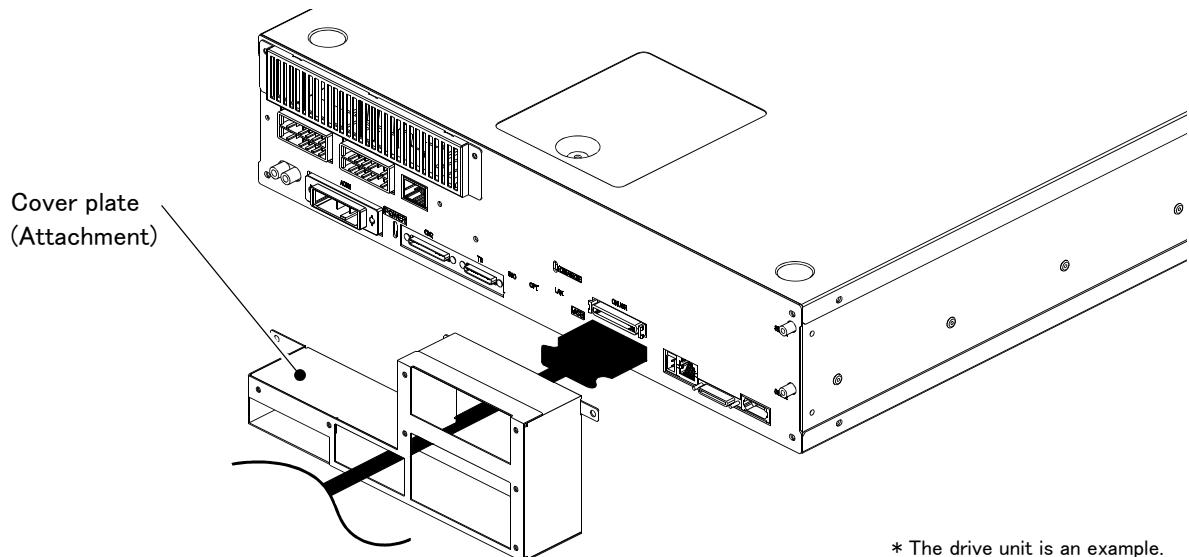
Applying force to the cable fixation plate may cause deformation of the plate or damage on the fixing screws.

(2) Installing the cover plate

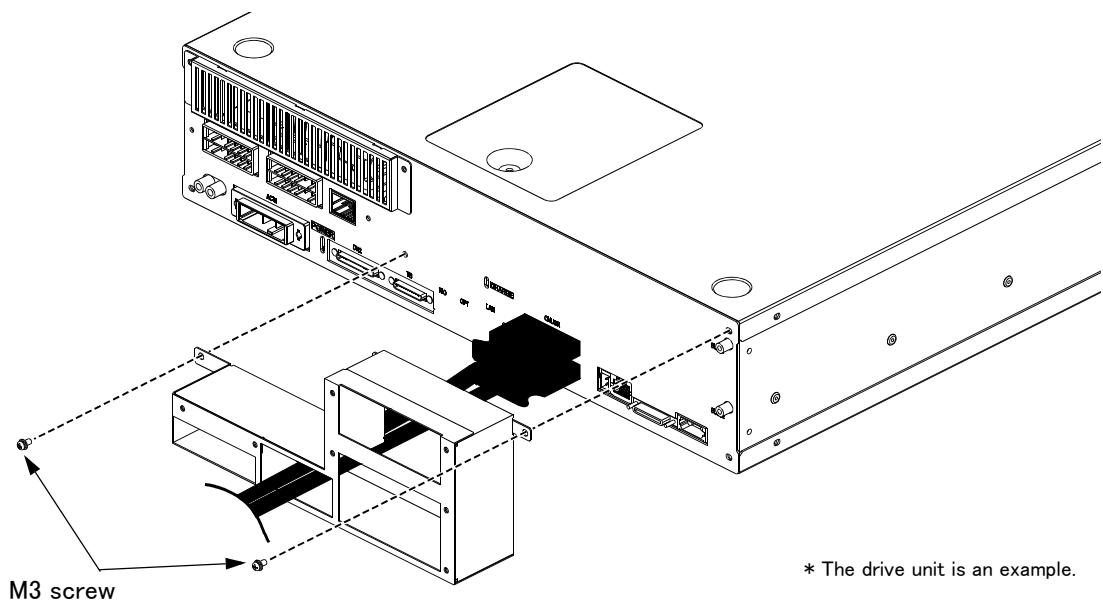
1) Remove two screws (M3).



- 2) Pass a communication cable or the like through the square hole of the cover plate, and connect it to the controller.



- 3) Install the cover plate to the drive unit with removed screws in step "1)".



⚠ CAUTION

When installing the cover plate, use the screws removed in the step "1)". Using screws other than those may cause damage of the components inside the drive unit.

⚠ CAUTION

Applying force to the cover plate may cause deformation of the plate or damage on the fixing screws.

2.3 Installation and connection

2.3.1 Installation of the robot CPU unit

(1) Notes on the handling

Explain notes on the handling of the CPU unit, the input/output unit, the intelligent functional unit, the power supply unit, the base unit, etc.

- 1) Please do not drop the unit, the terminal stand connector, and the pin connector, or do not supply a strong shock.
- 2) The printed circuit board of the unit should not remove from the case. It becomes the cause of failure.
- 3) Please carry out bolting of the unit fixing screw and the terminal stand screw in the range shown in [Table 2-2](#).

Table 2-2 : Conclusion torque of the fixing screw

Place of the screw	Bolting torque range
Robot CPU unit fixing screw (M3 × 13)	0.36 ~ 0.48N · m
Unit fixing screw (M3 × 12)	0.36 ~ 0.48N · m
Input/output unit terminal stand screw (M3)	0.42 ~ 0.58N · m
Input/output unit terminal stand attachment screw (M3.5)	0.68 ~ 0.92N · m
Terminal screw of the power supply unit (M3.5)	0.68 ~ 0.92N · m

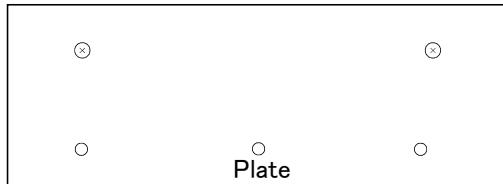
- 4) The basic base unit should equip with the power supply unit at any cost. If the load of the input/output unit and intelligent functional unit with which the base unit is equipped is low, it may operate, even if there is no power supply unit. However, since voltage becomes unstable, operation cannot be guaranteed.
- 5) Since it may malfunction by vibration if it installs the basic base unit in the plate, please be sure to fix with the screw for fixing.

⚠ CAUTION

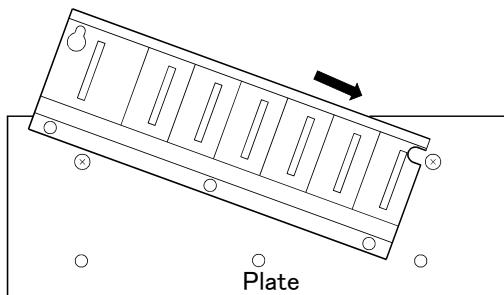
- 1) Please use the robot CPU system in the environment of general specification given in this manual. If other, it becomes the electric shock, the fire, malfunction, the damage to the product, or the cause of deterioration.
- 2) Pressing down the unit lower lever for unit wearing, insert the projection for unit fixing in the fixing hole of the base unit surely, and install with the unit fixing hole as a fulcrum. If the unit is not installed correctly, it will become the cause of malfunction, failure, and drop. If it uses it in the environment with much vibration, fix the unit with the screw. Please perform bolting of the screw in the regulation torque range. If bolting of the screw is loose, it will become the cause of drop, the short circuit, and malfunction. If the screw is tightened too much, it will become the cause of drop by breakage of the screw or the unit, the short circuit, and malfunction.
- 3) Please be sure to do the installing and removing of the unit after shutting down all phase of the external power supply currently used by the system.
- 4) The installing and removing of the unit and the base may be less than 50 times after product use. It may become the cause of malfunction if it exceeds 50 times.
- 5) Please do not touch the electric conduction section or electronic components of the unit directly. It becomes malfunction of the unit, and the cause of failure.

The installation procedure of the basic base unit is shown in the following.

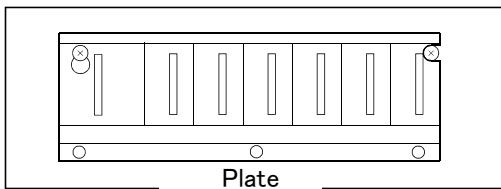
- Install the two screws for fixing for basic base unit surface to the plate.



- Hook the hollow on the right side of the basic base unit on the right side screw.



- Hook the long hole on the left side of the basic base unit on the left side screw.



- Install the fixing screw in the fixing screw hole of the basic base unit bottom, and retighten all the fixing screws securely.

Notes: In the condition that the right end slot is vacated, install the basic base unit in the plate. When you remove, remove the basic base unit after removing the unit of the right end slot.

(2) Notes on base unit installation

If it installs the robot CPU system in the plate etc., please fully take into consideration the operativity, conservativeness, and environment-proof.

1) Installation dimension

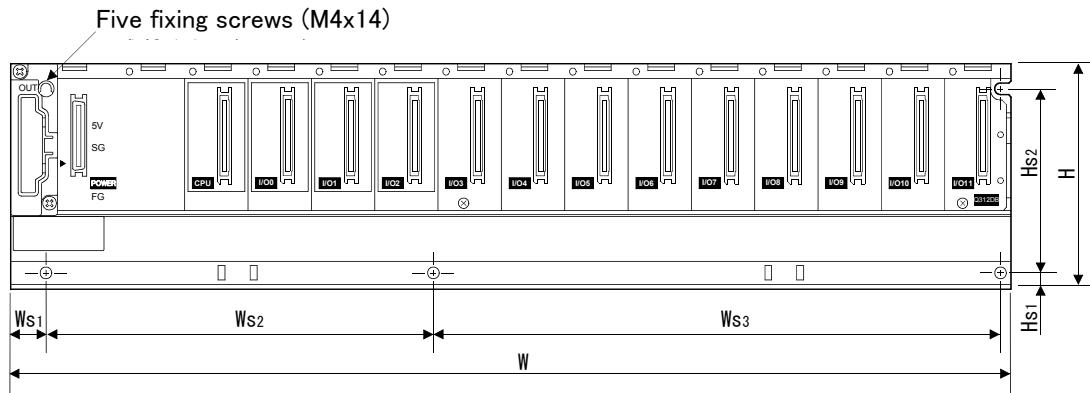


Table 2-3 : Installation dimension

Dimension place	Q38DB	Q312DB
W	328	439
Ws1	15.5	
Ws2	170±0.3	
Ws3	138±0.3	249±0.3
H	98	
Hs1	7	
Hs2	80±0.3	

2) Unit installation position

Secure the following distance for the unit up-and-down section, and the structure and the parts, and breathability and the convertibility of the unit are upgraded.

<Q172DRCPU>

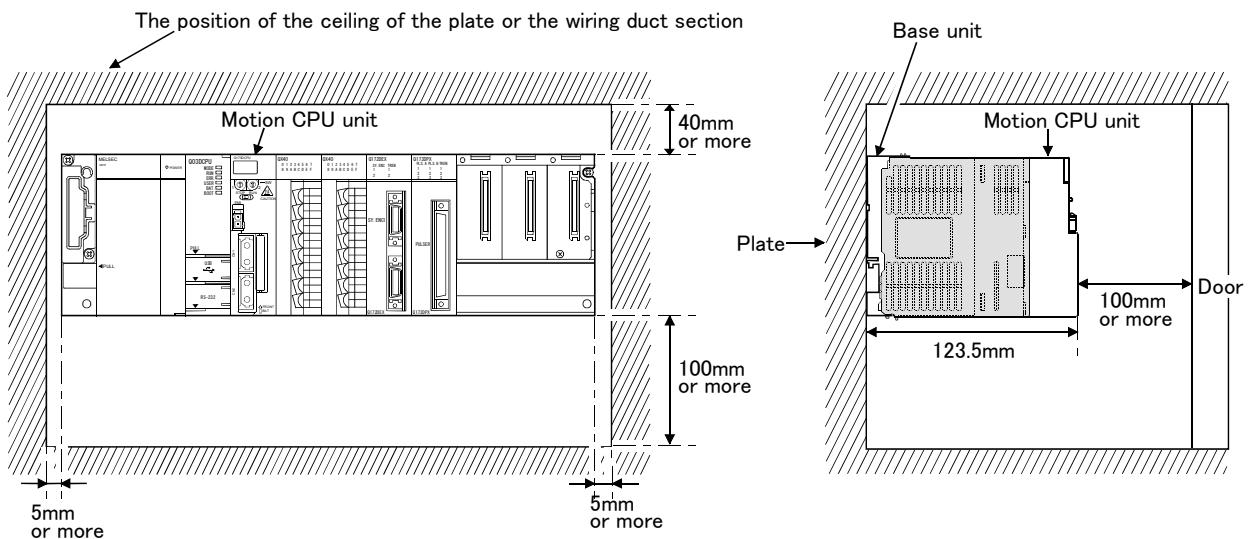
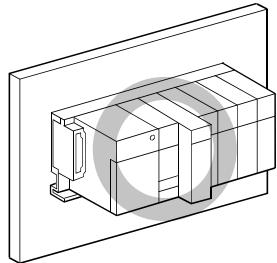


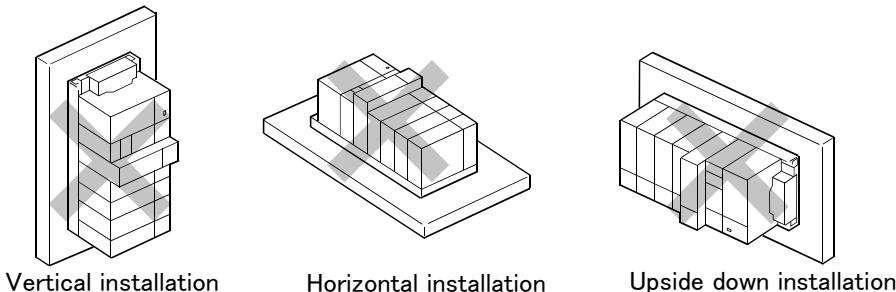
Fig. 2-10 : Installing dimensions of the robot CPU unit

3) Unit installation direction

- a) Use the robot CPU system in the installation direction of the figure because of heat dissipation.



- b) Don't use it in the installation direction of the following figure.



4) Installation surface

Install the base unit in the flat field. If the installation surface has unevenness, impossible force is applied to printed circuit board , and it will become the cause of fault.

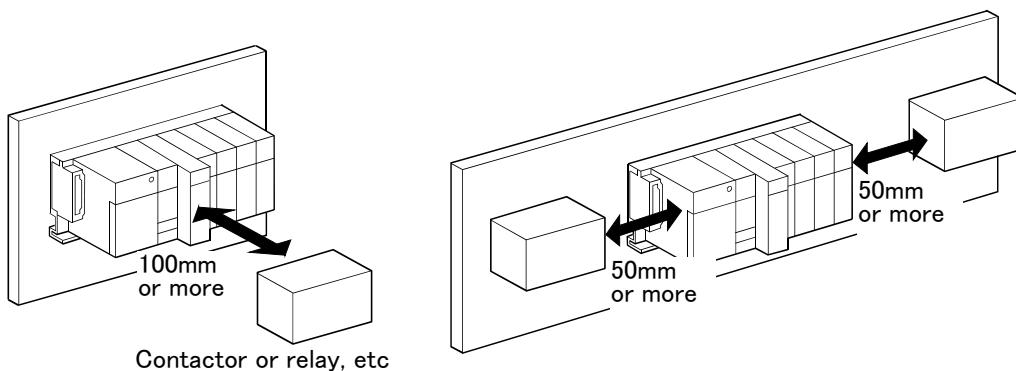
5) Mixture with other equipment

Mixture with the sources of vibration, such as large-sized magnetic contact and the no fuse breaker, is avoided, and make it another panel, or detach and install.

6) Distance with other equipment

Because of to avoid the effect of the radiation noise or the heat, please secure the following distance for the robot CPU system and the equipment (the contactor and relay).

- Front of the robot CPU system100mm or more
- Horizontal direction of the robot CPU system50mm or more

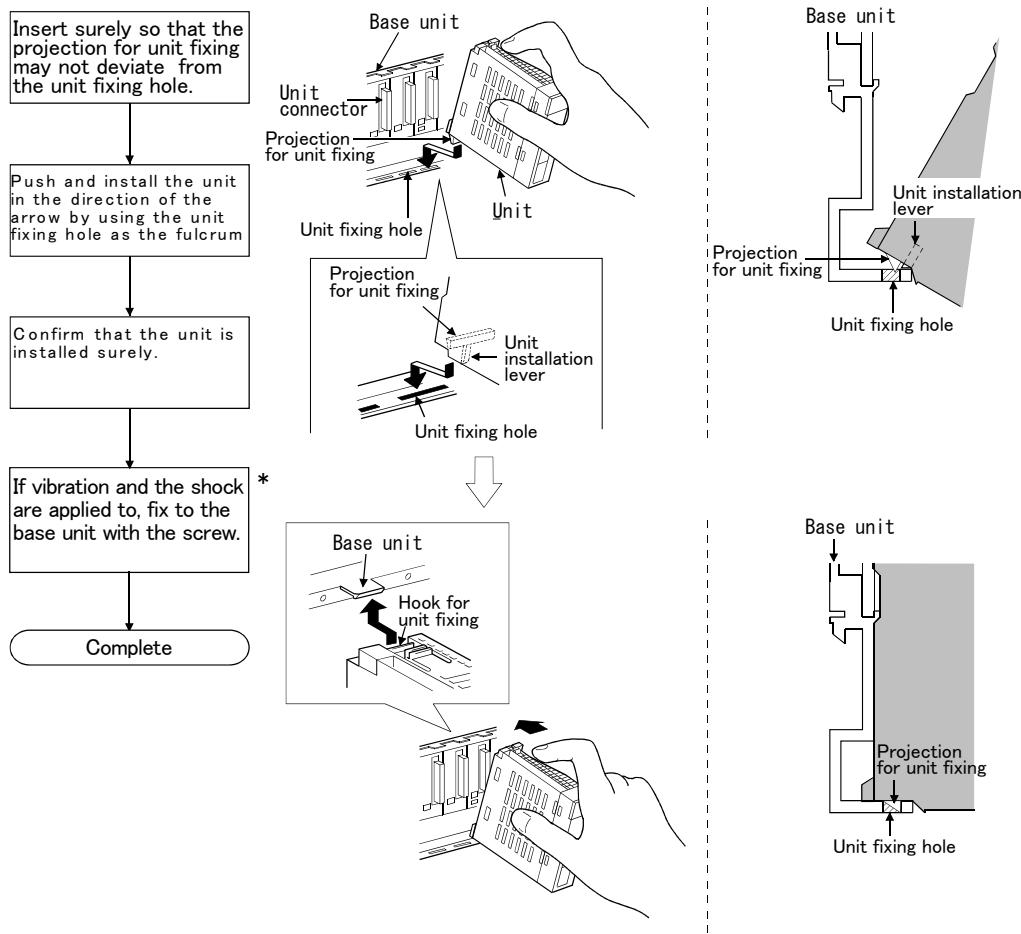


(3) Installation and removal of the unit

The installing-and-removing procedure to base units, such as the power supply unit, the sequencer CPU unit, the robot CPU unit, the input-and-output unit, and the intelligent functional unit, is shown in the following.

1) Installing and removing of the unit to the base unit "Q3 □ DB"

a) Installation to "Q3 □ DB"



*: Please be sure to fix the robot CPU unit to the base unit with the screw.

<Point>

- The unit should insert the projection for unit fixing in the unit fixing hole always. In that case, insert surely so that the projection for unit fixing may not deviate from the unit fixing hole. If it installs forcibly, without inserting, the unit connector and the unit will be damaged.
- If it uses it at the place which is applied to of vibration and the shock, fix the unit to the base unit with the screw. Unit fixing screw: M3x12 (prepare by the customer) Always fix the robot CPU unit to the base unit with the screw with the attached unit fixing screw (M3x13).
- The installing and removing of the unit and the base may be less than 50 times after product use. It may become the cause of malfunction if it exceeds 50 times.

CAUTION

Pressing down the unit lower lever for unit wearing, insert the projection for unit fixing in the fixing hole of the base unit surely, and install with the unit fixing hole as a fulcrum. If the unit is not installed correctly, it will become the cause of malfunction, failure, and drop. If it uses it in the environment with much vibration, fix the unit with the screw. Please perform bolting of the screw in the regulation torque range. If bolting of the screw is loose, it will become the cause of drop, the short circuit, and malfunction. If the screw is tightened too much, it will become the cause of drop by breakage of the screw or the unit, the short circuit, and malfunction.

b) Removing from "Q3 □ DB"

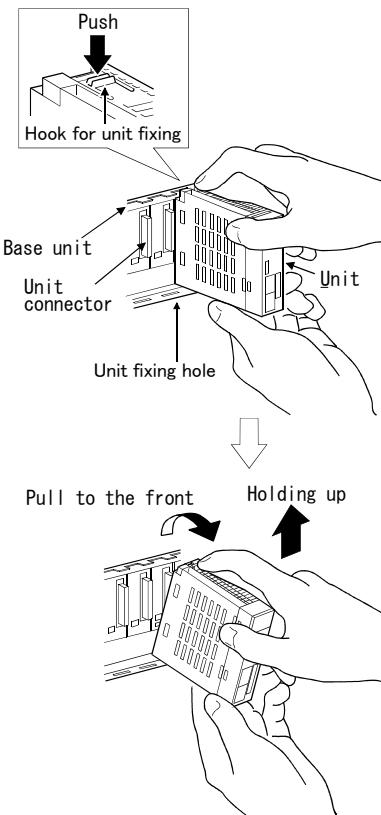
Remove the screw, if the unit fixing screw is being used.

Hold the unit with both hands and push the upside hook for fixing, until it stops.

Push the hook for unit fixing, use lower part as the fulcrum and pull it to the front.

Holding up the unit, and remove the projection section for fixing from the hole

Complete



<Point>

- Remove the screw, if the unit fixing screw is being used. Next, remove the projection for unit fixing from the unit fixing hole. If it tries to remove the unit by force, the projection for unit fixing will be damaged.

⚠ CAUTION

Since the heat dissipation fin of the robot CPU unit may become the high temperature for a power supply on, and after power supply off, please do not touch. It becomes the cause of the burn. When you remove the unit, be careful of the handling.

(4) Notes on the installation of the battery holder unit

When you install the battery holder unit (Q170DBATC) in the plate etc., please take care in the installation position and the direction.

1) Unit installation position

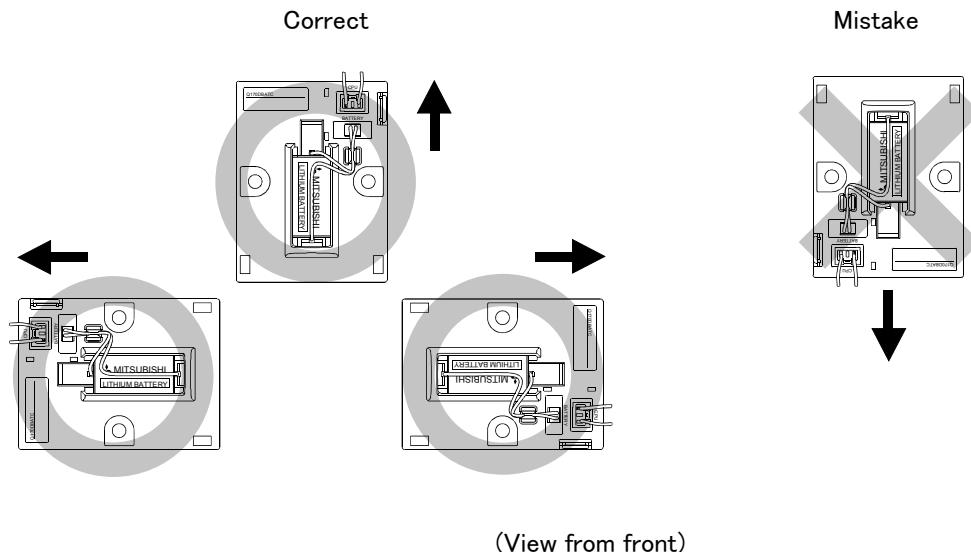
Please install the battery holder unit in less than (battery cable length: 50cm) 50cm from the robot CPU system.

2) Installation surface

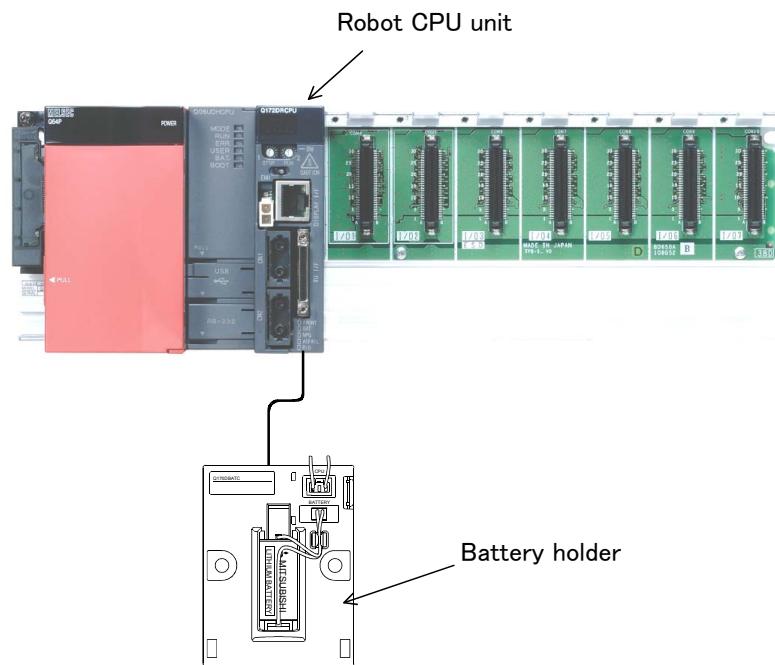
Please install the battery holder unit in the flat field.

3) Unit installation direction

Please do not install the battery holder unit downward. If it installs downward, battery liquid may leak at the time of battery breakdown.



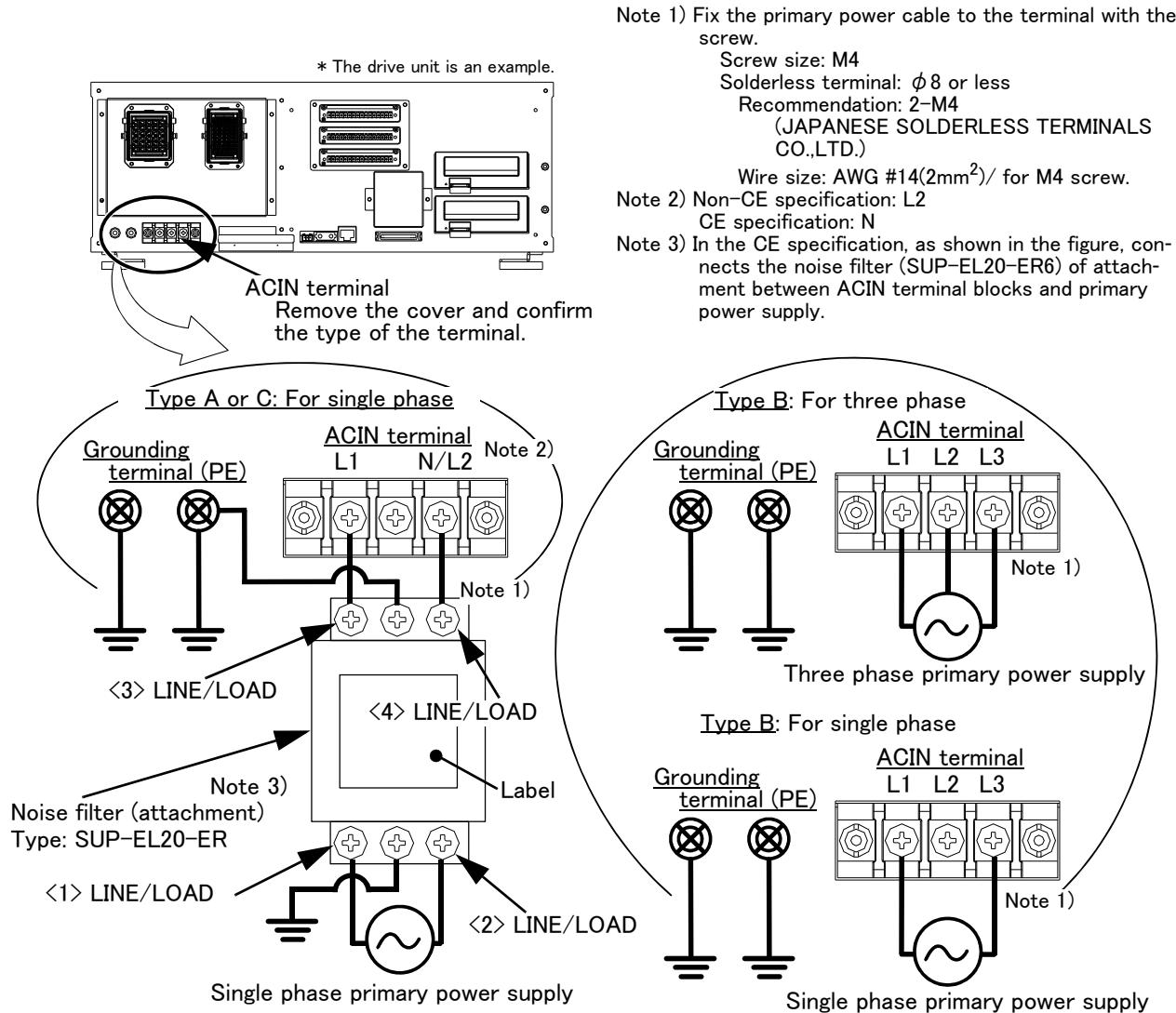
(View from front)



2.3.2 Connecting the power cable and grounding cable

The following shows how to connect the power cables and grounding cables.

(1) CR750 drive unit



Note) When fixing the power cable to the ACIN terminal block with screws, be sure to hold the crimp terminal with your hand to ensure that it does not rotate while fastening screws.
The dividers between terminals of the ACIN terminal block are fragile and may break if pressed.

Fig. 2-11 : Connecting the power cable and grounding cable (CR750)

- 1) Prepare the power cable (AWG#14 (2mm²) or more).
- 2) Loosen the two screws fixing the terminal cover, and remove the cover. Then refer to [Page 78, "\(1\) CR750 drive unit"](#) and confirm the type of the terminal.
- 3) Confirm that the primary power matches the specifications.
- 4) Confirm that the primary power is OFF and that the drive unit power switch is OFF.
- 5) Connects the cable for the primary power supply connection to the ACIN terminal block of the drive unit.
When the Type A or C terminal, connect the primary power supply to L1 and L2/N terminal. When Type B is attached, connect the primary power supply to L1, L2, and L3 terminal when using the three phase primary power supply, and connect the primary power supply to L1 and L3 terminal when using the single phase primary power supply.
- 6) Connect a cable of a primary power supply grounding to the ground terminal of the drive unit.
- 7) Install the power terminal cover as before.

This completes the connection of the power and grounding cables.

(2) CR751 drive unit

!CAUTION

Use an earth leakage breaker (customer preparation) in the primary power supply circuit of the drive unit to prevent short circuit.

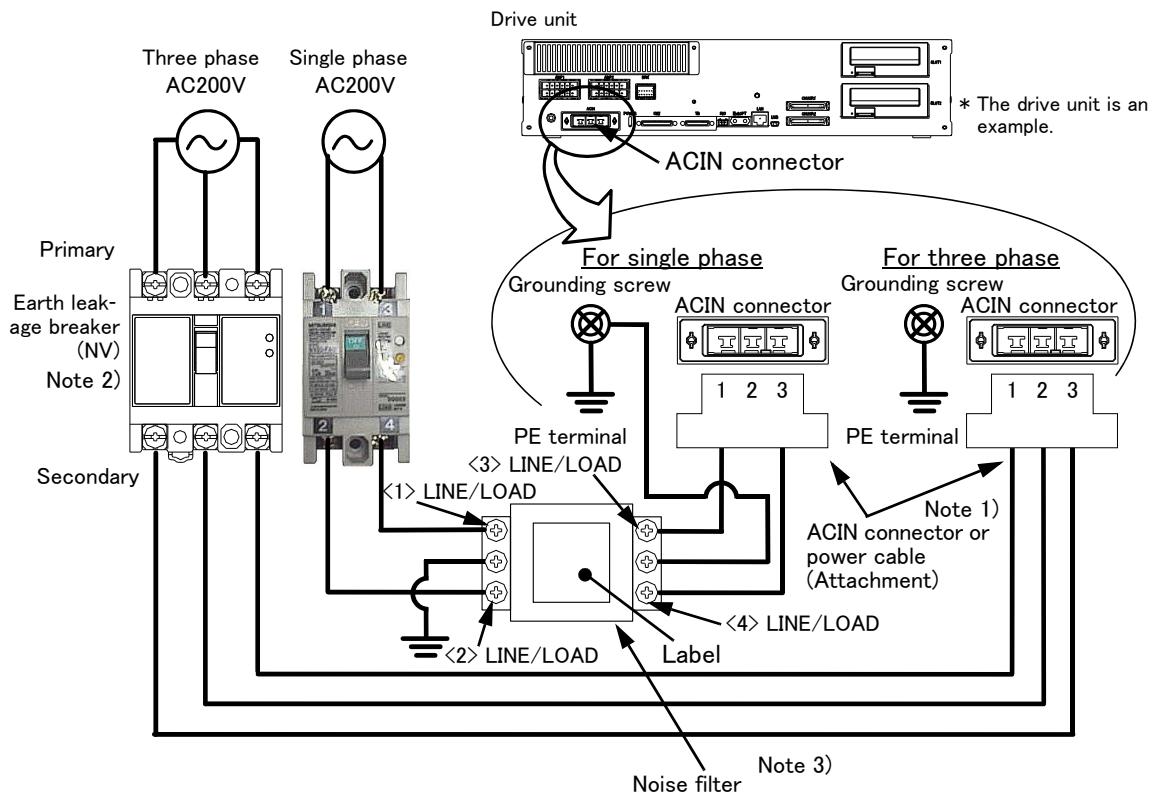


Fig. 2-12 : Connecting the power cable and grounding cable (CR751)

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

This completes the connection of the power and grounding cables.

(3) CR760 drive unit

<Non-CE marking specification>

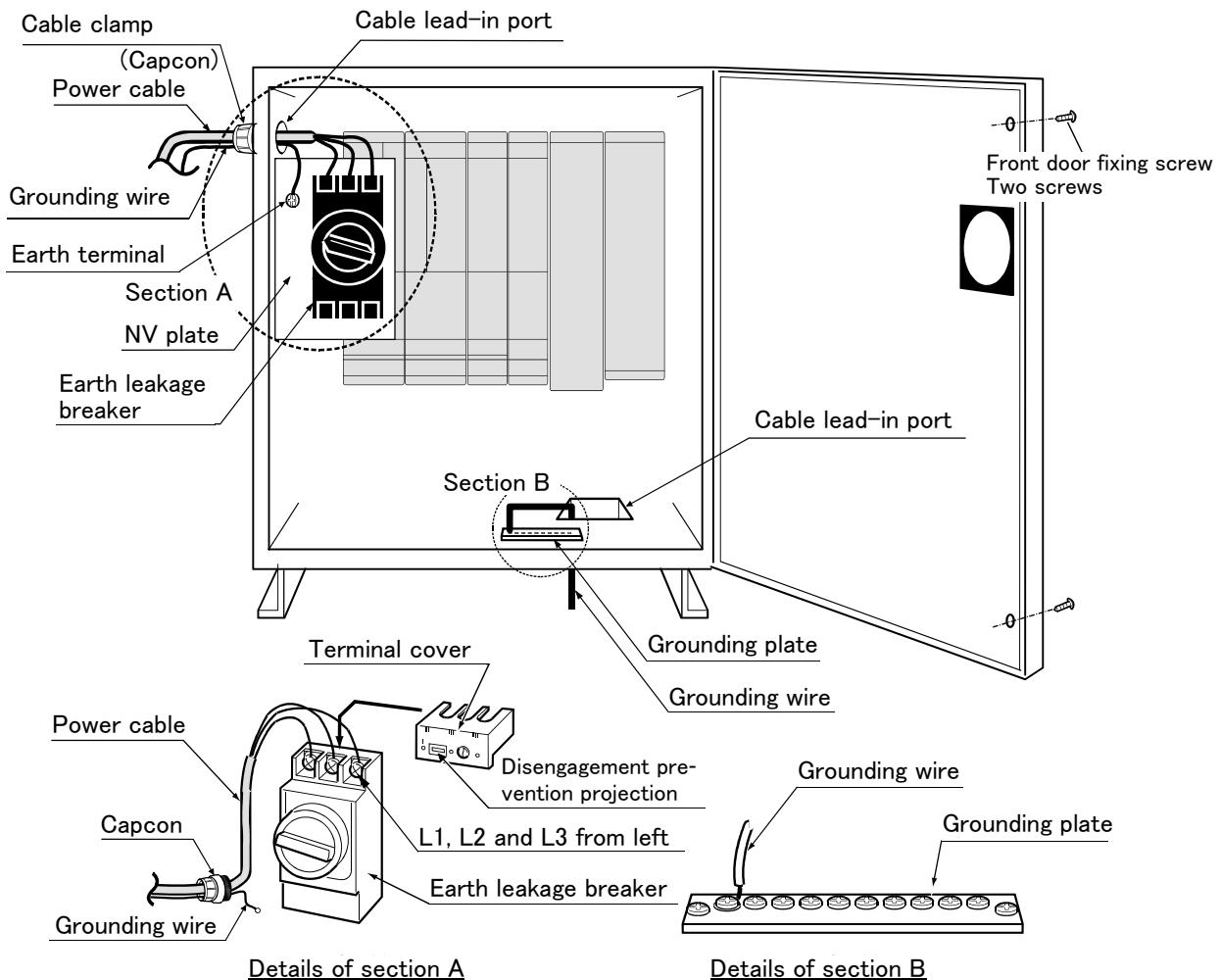


Fig. 2-13 : Connecting the power cable and grounding cable (CR760 non-CE marking)

- 1) Prepare the power cable (AWG#8 (8mm²) or more) and grounding cable (AWG#6 (14mm²) or more).
- 2) Loosen the two screws fixing the drive unit front door, and open the front door.
- 3) Pull out the disengagement prevention projection on the terminal cover surface of the earth leakage breaker by disengaging it with your finger.
- 4) Confirm that the primary power matches the specifications.
- 5) Confirm that the primary power is OFF and that the drive unit power switch is OFF.
- 6) Insert both the power cable and ground cable from the cable inlet hole located on the side of the drive unit, and fix them using a power cable clamp (Capcon).
- 7) Connect the power cable to the earth leakage breaker terminal (M8 screw). (L1, L2 and L3 from left)
- 8) Connect the grounding cable to the NV plate terminal (M6 screw).
- 9) Insert the earth leakage breaker terminal cover removed in step "3)" until a "click" is heard.
- 10) Close the drive unit front door, and fix with the fixing screws.

This completes the connection of the power and grounding cables.

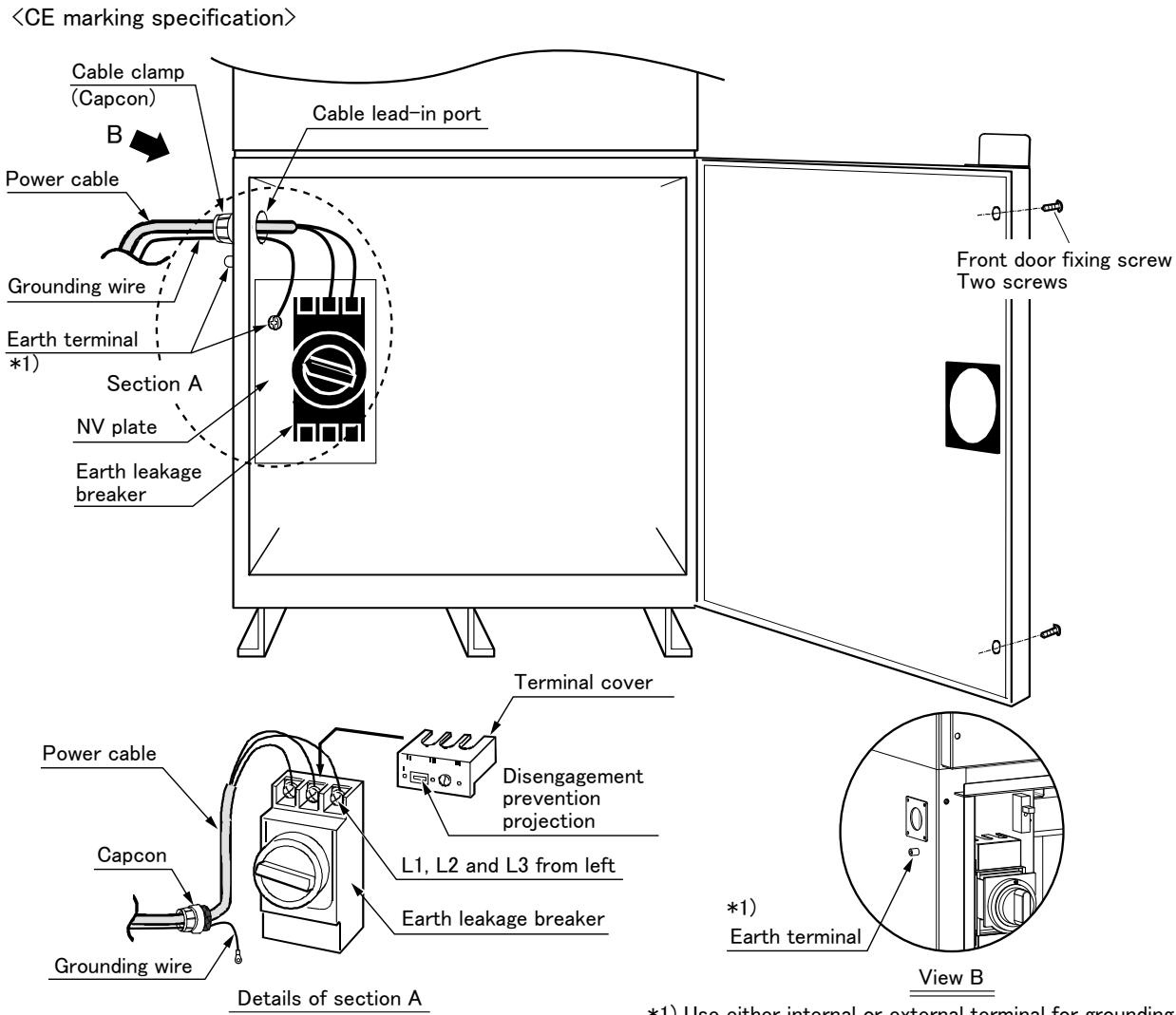


Fig. 2-14 : Connecting the power cable and grounding cable (CR760 CE marking)

- 1) Prepare the power cable (AWG#8 (8mm²) or more) and grounding cable (AWG#6 (14mm²) or more).
- 2) Loosen the two screws fixing the drive unit front door, and open the front door.
- 3) Pull out the disengagement prevention projection on the terminal cover surface of the earth leakage breaker by disengaging it with your finger.
- 4) Confirm that the primary power matches the specifications.
- 5) Confirm that the primary power is OFF and that the drive unit power switch is OFF.
- 6) Insert both the power cable and ground cable from the cable inlet hole located on the side of the drive unit, and fix them using a power cable clamp (Capcon).
- 7) Connect the power cable to the earth leakage breaker terminal (M5 screw). (L1, L2 and L3 from left)
- 8) Connect the grounding cable to the NV plate terminal (M6 screw).
- 9) Insert the earth leakage breaker terminal cover removed in step "3)" until a "click" is heard.
- 10) Close the drive unit front door, and fix with the fixing screws.

This completes the connection of the power and grounding cables.

2.3.3 Connection between the robot CPU system and the drive unit

The connection method of the robot CPU system and the drive unit is shown each controller. Connect with reference to the figure.

(1) Connection between the robot CPU system and the CR750 drive unit

The cable connection figure is shown in Fig. 2-15. Connect with reference to the figure.

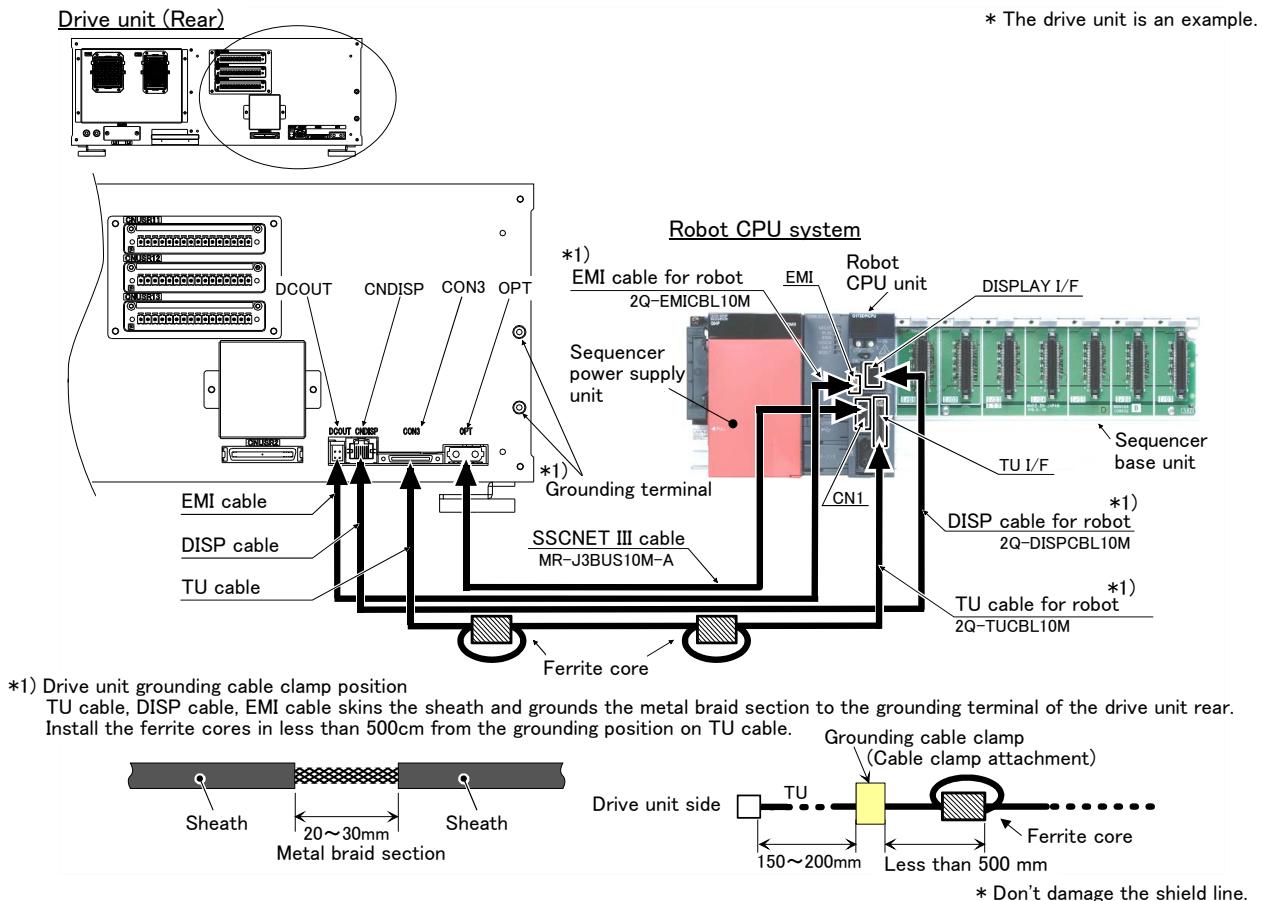


Fig. 2-15 : Connection between the robot CPU system and the CR750 drive unit



- 1) If the cap is not installed in the SSCNET III connector after removing the SSCNET III cable, there is a possibility that the characteristic may deteriorate and malfunction by adhesion of garbage and the dust
- 2) Don't remove the SSCNET III cable, when the power supply of the multi-CPU system or servo amplifier is turned on. Don't face squarely the light emitted from motion CPU or the tip of the SSCNET III connector of servo amplifier, and the SSCNET III cable. If light hits to the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNET III is equivalent to the class 1 specified to JISC6802 and IEC60825-1.)
- 3) To inhibit the effect of the noise, TU cable for the robots skins some cable sheaths, and connects the metal braid section (plaited cord section) to the grounding section of the case.
For drive unit side, fix to the cable grounding clamp screw prepared at back side.
For the robot CPU system side, fix to the cable grounding clamp prepared by customer.
(Please prepare a cable clamp by customer.)
Depending on the uneven shape of the cable clamp, the cable may not be securely fixed. In such a case, crush a little clamp section using pliers etc. and ground the shield section securely.
For the CE Marking specification, the EMI cable and the DISP cable should also use grounding and install ferrite cores (each two ferrite cores) in the same way.
When you skin the cable sheath, please be careful not to cut the internal cable.
- 4) Install the SSCNET III cable in the larger radius than minimum flexed radius shown in the following sure.
Type: MR-J3BUS*M-A..... Reinforcement skin section: 50mm, code section: 25mm
Type: MR-J3BUS30M-B..... Reinforcement skin section: 50mm, code section: 30mm
(*" of the type shows cable length)

(2) Connection between the robot CPU system and the CR751 drive unit

The cable connection figure is shown in Fig. 2-16. Connect with reference to the figure.

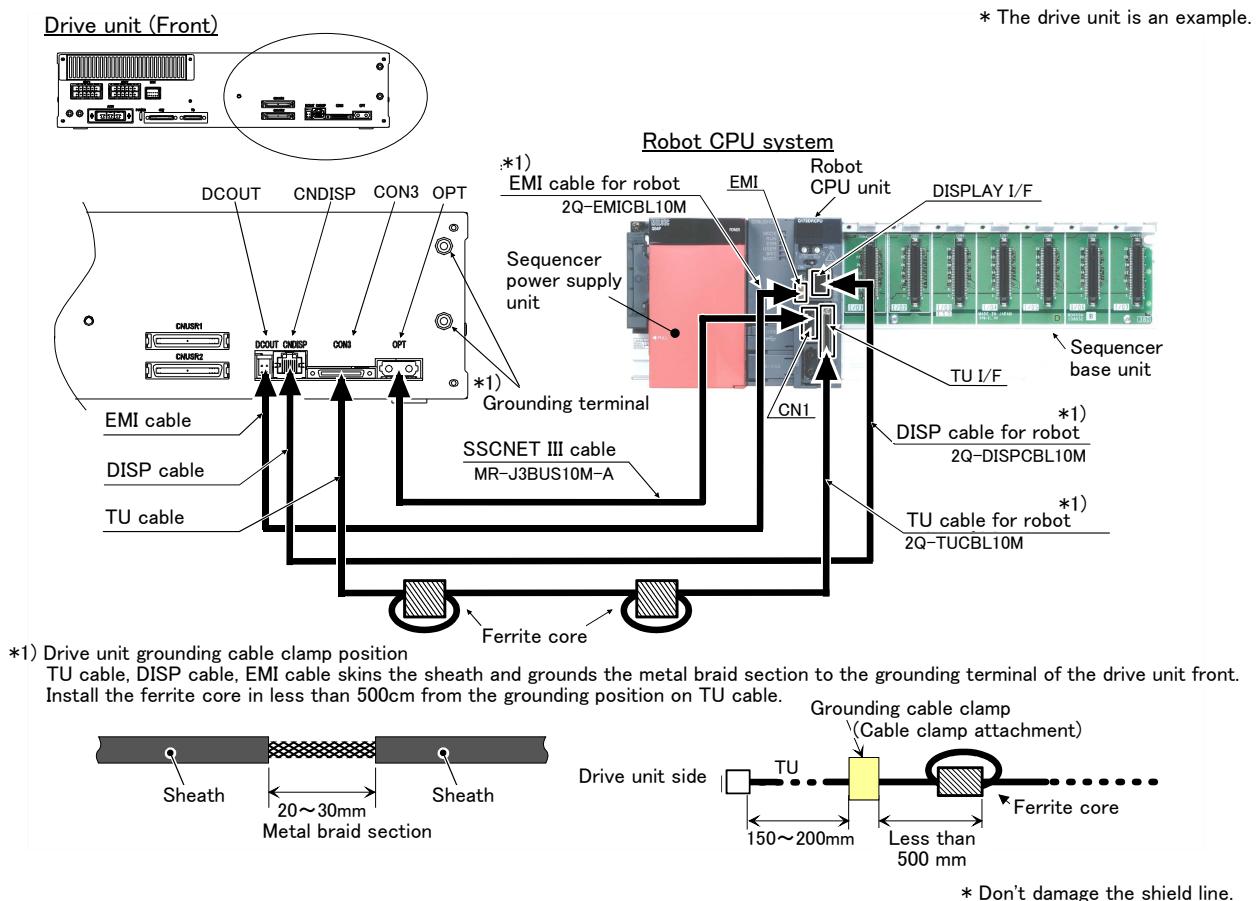


Fig. 2-16 : Connection between the robot CPU system and the CR751 drive unit

CAUTION

- 1) If the cap is not installed in the SSCNET III connector after removing the SSCNET III cable, there is a possibility that the characteristic may deteriorate and malfunction by adhesion of garbage and the dust
- 2) Don't remove the SSCNET III cable, when the power supply of the multi-CPU system or servo amplifier is turned on. Don't face squarely the light emitted from motion CPU or the tip of the SSCNET III connector of servo amplifier, and the SSCNET III cable. If light hits to the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNET III is equivalent to the class 1 specified to JISC6802 and IEC60825-1.)
- 3) To inhibit the effect of the noise, TU cable for the robots skins some cable sheaths, and connects the metal braid section (plaited cord section) to the grounding section of the case.
For drive unit side, fix to the cable grounding clamp screw prepared at front side.
For the robot CPU system side, fix to the cable grounding clamp prepared by customer.
(Please prepare a cable clamp by customer.)
Depending on the uneven shape of the cable clamp, the cable may not be securely fixed. In such a case, crush a little clamp section using pliers etc. and ground the shield section securely.
For the CE Marking specification, the EMI cable and the DISP cable should also use grounding and install ferrite cores (each two ferrite cores) in the same way.
When you skin the cable sheath, please be careful not to cut the internal cable.
- 4) Install the SSCNET III cable in the larger radius than minimum flexed radius shown in the following sure.
Type: MR-J3BUS*M-A.....Reinforcement skin section: 50mm, code section: 25mm
Type: MR-J3BUS30M-BReinforcement skin section: 50mm, code section: 30mm
(* of the type shows cable length)

(3) Connection between the robot CPU system and the CR760 drive unit

The cable connection figure is shown in Fig. 2-17 (non-CE marking specification) or Fig. 2-18 (CE marking specification). Connect with reference to the figure.

<Non-CE marking specification>

Drive unit (Inside)

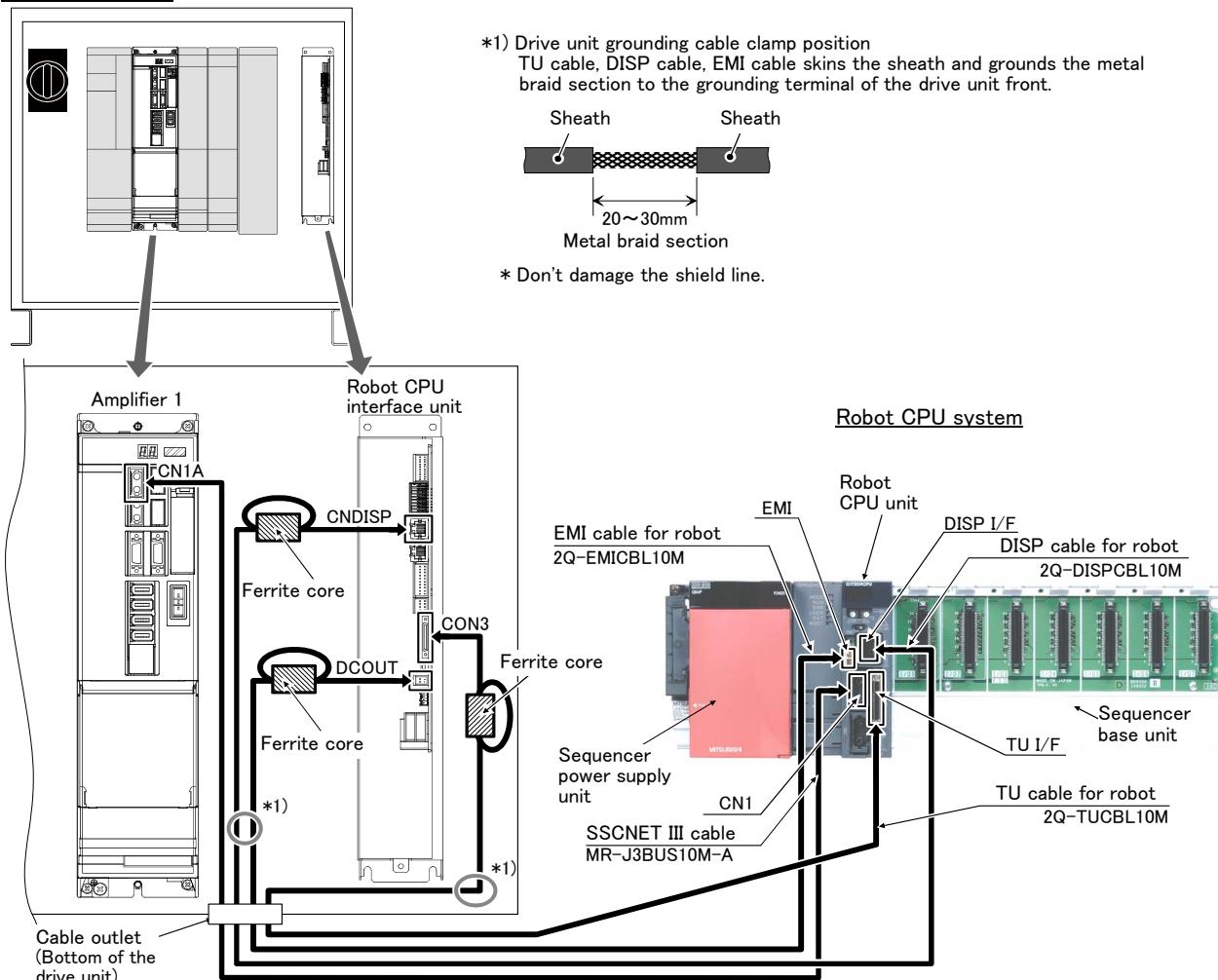


Fig. 2-17 : Connection between the robot CPU system and the CR760 drive unit (non-CE marking)

CAUTION

- If the cap is not installed in the SSCNET III connector after removing the SSCNET III cable, there is a possibility that the characteristic may deteriorate and malfunction by adhesion of garbage and the dust.
- Don't remove the SSCNET III cable, when the power supply of the multi-CPU system or servo amplifier is turned on. Don't face squarely the light emitted from motion CPU or the tip of the SSCNET III connector of servo amplifier, and the SSCNET III cable. If light hits to the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNET III is equivalent to the class 1 specified to JISC6802 and IEC60825-1.)
- To inhibit the effect of the noise, TU cable for the robots skins some cable sheaths, and connects the metal braid section (plaited cord section) to the grounding section of the case.
For drive unit side, fix to the grounding plate prepared at the inside of the drive unit.
For the robot CPU system side, fix to the cable grounding clamp prepared by customer.
(Please prepare a cable clamp by customer.)
Depending on the uneven shape of the cable clamp, the cable may not be securely fixed. In such a case, crush a little clamp section using pliers etc. and ground the shield section securely.
- Install the SSCNET III cable in the larger radius than minimum flexed radius shown in the following sure.
Type: MR-J3BUS*M-A..... Reinforcement skin section: 50mm, code section: 25mm
Type: MR-J3BUS30M-B..... Reinforcement skin section: 50mm, code section: 30mm
(*" of the type shows cable length)

<CE marking specification>

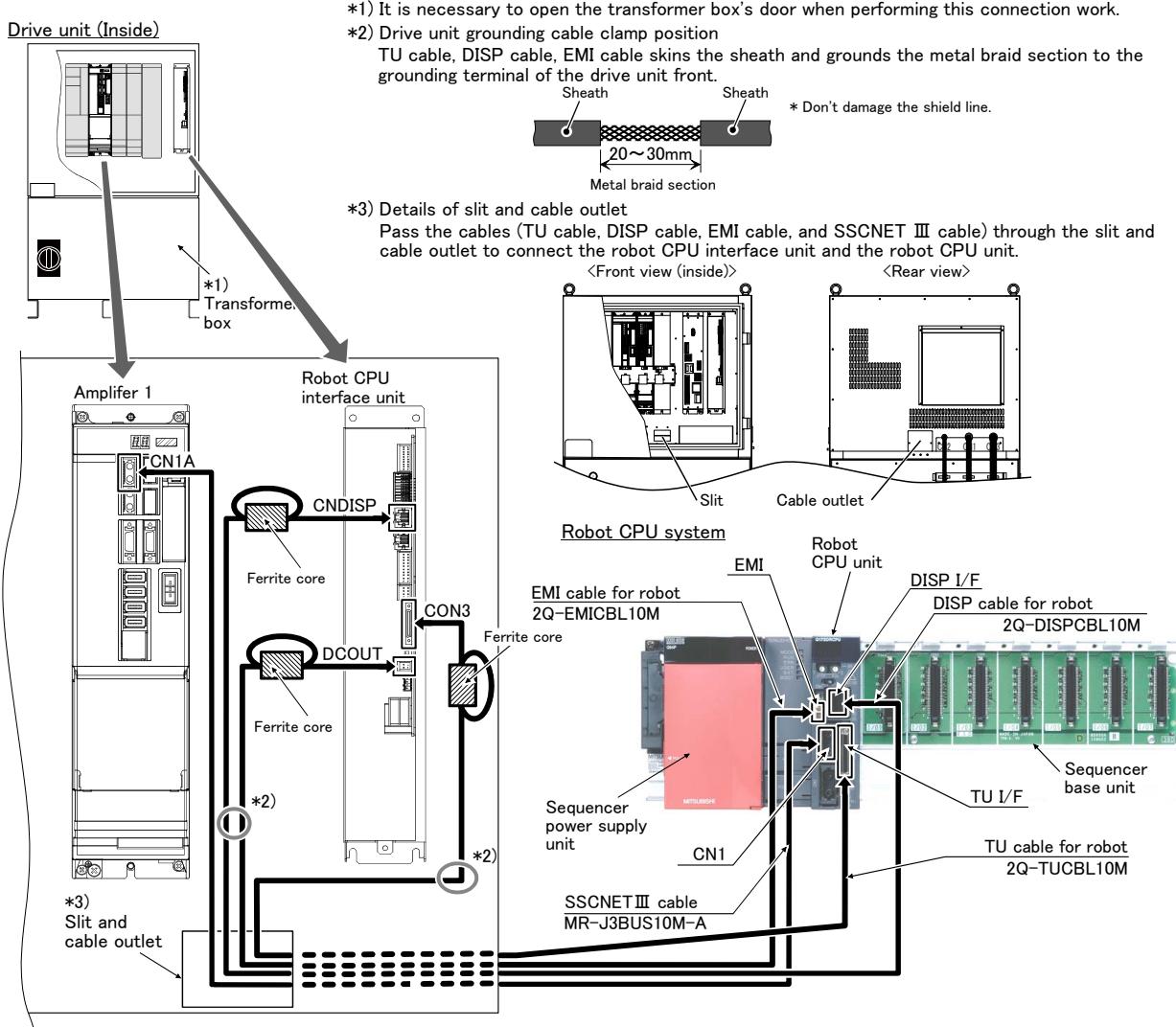


Fig. 2-18 : Connection between the robot CPU system and the CR760 drive unit (CE marking)

⚠ CAUTION

- If the cap is not installed in the SSCNET III connector after removing the SSCNET III cable, there is a possibility that the characteristic may deteriorate and malfunction by adhesion of garbage and the dust.
- Don't remove the SSCNET III cable, when the power supply of the multi-CPU system or servo amplifier is turned on. Don't face squarely the light emitted from motion CPU or the tip of the SSCNET III connector of servo amplifier, and the SSCNET III cable. If light hits to the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNET III is equivalent to the class 1 specified to JISC6802 and IEC60825-1.)
- To inhibit the effect of the noise, TU cable for the robots skins some cable sheaths, and connects the metal braid section (plaited cord section) to the grounding section of the case.
For drive unit side, fix to the grounding plate prepared at the inside of the drive unit.
For the robot CPU system side, fix to the cable grounding clamp prepared by customer.
(Please prepare a cable clamp by customer.)
Depending on the uneven shape of the cable clamp, the cable may not be securely fixed. In such a case, crush a little clamp section using pliers etc. and ground the shield section securely.
- Install the SSCNET III cable in the larger radius than minimum flexed radius shown in the following sure.
Type: MR-J3BUS*M-A.....Reinforcement skin section: 50mm, code section: 25mm
Type: MR-J3BUS30M-BReinforcement skin section: 50mm, code section: 30mm
(*" of the type shows cable length)

2.3.4 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.

Connection of the external emergency stop is explained in "[2.3.5 Connecting the external emergency stop](#)". And about wiring of the others, refer to separate "Standard Specifications Manual".

Table 2-4 : 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 "Special stop input (SKIP)" in separate "Standard Specifications Manual".)
Input	Door switch	Servo-off. Dual line, normal close. (Refer to "Door switch function" in separate "Standard Specifications Manual".)
Input	Enabling device	Servo-off. Dual line, normal close. (Refer to "Enabling device function" in separate "Standard Specifications Manual".)
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. (Refer to Page 72, "2.3.8 Magnet contactor control connector output (AXMC) for addition axes" .)

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

[Note] The contact capacity of each input/output terminal is DC24V/10mA – 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.

2.3.5 Connecting the external emergency stop

The following shows how to connect the external emergency stop. The example is shown in "[2.3.7 Examples of safety measures](#)".

For external emergency stop, connect to the connector at the front of the drive unit (reference [Fig. 2-19](#)). When shipped from the factory, external emergency stop input, door switch input, and the enabling device terminal, are opened (contacts not shorted) as shown on [Fig. 2-20](#) (CR750 drive unit), [Fig. 2-24](#) (CR751 drive unit), and [Fig. 2-27](#) (CR760 drive unit). Customers should be sure to prepare the external emergency stop, door switch and enabling device, etc. and use the robot while these are connected. Connection procedures are shown below.

[Caution] The emergency stop circuit is duplicated inside the controller. For the emergency stop switch, use a double contact-type switch, and be sure to connect both of the contacts to the connector pins as shown below in order to ensure the wiring is duplicated. An error cannot be reset if only one of the pins is connected.

- 1) Please prepare the emergency stop switch, door switch and enabling device.
- 2) Connect the contacts of each switch to the contacts as shown below:
 - a) External emergency switch
 - CR750 drive unit.....CNUSR11 connector "between 3 and 4" and CNUSR12 connector "between 3 and 4"
 - CR751 drive unit.....CNUSR1 connector "between 2 and 27" and "between 7 and 32"
 - CR760 drive unit.....EMG1 connector "between 3 and 15" and "between 4 and 16"
 - b) Door switch
 - CR750 drive unit.....CNUSR11 connector "between 7 and 8" and CNUSR12 connector "between 7 and 8"
 - CR751 drive unit.....CNUSR1 connector "between 4 and 29" and "between 9 and 34"
 - CR760 drive unit.....EMG1 connector "between 9 and 21" and "between 10 and 22"
 - c) Enabling device
 - CR750 drive unit.....CNUSR11 connector "between 9 and 10" and CNUSR12 connector "between 9 and 12"
 - CR751 drive unit.....CNUSR1 connector "between 5 and 30" and "between 10 and 35"
 - CR760 drive unit.....EMG1 connector "between 7 and 19" and "between 8 and 20"

[Caution] Be sure to use a shield cable for the emergency stop wiring cable. And when operating in an environment that is easily affected by noise, be sure to install the included ferrite core (model number: E04SR301334, manufacturer: Seiwa Electric Mfg. Co., Ltd.). Be sure to place the ferrite core in 300mm or less from the connecting terminal section.

CAUTION

Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in failures, such as the emergency stop not being released. In order to prevent from 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

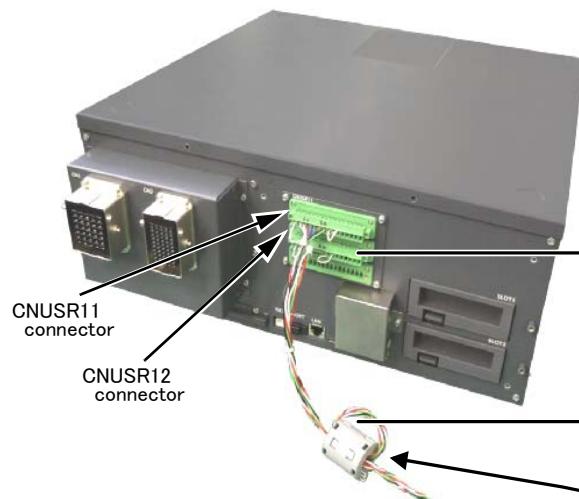
You should always connect doubly connection of the emergency stop, the door switch, and the enabling switch. In connection of only one side, if the relay of customer use should break down, it may not function correctly.

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

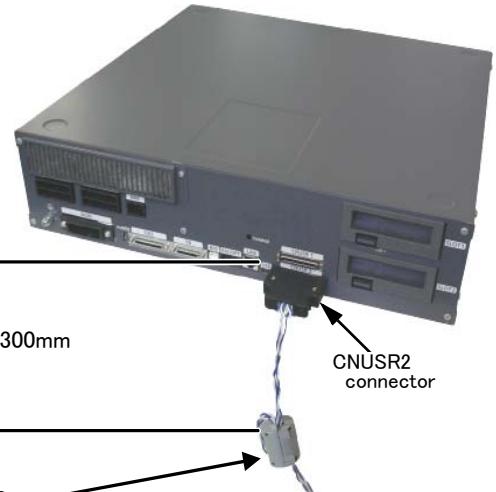
When using several emergency stop switches, perform wiring carefully to make sure that each emergency stop switch functions independently. Check and make sure that the emergency stop does not function under an AND condition (when multiple emergency stop switches are ON at the same time).

<CR750 drive unit (Rear side)>



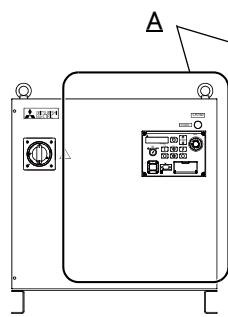
* The drive unit is an example.

<CR751 drive unit(Front side)>

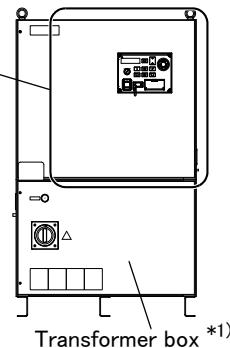


<CR760drive unit>

Non-CE marking specification



CE marking specification



*1) It is necessary to open the transformer box's door when performing this connection work.

Ferrite core (attachments)
Pass once

View A: Inside of CR760 drive unit

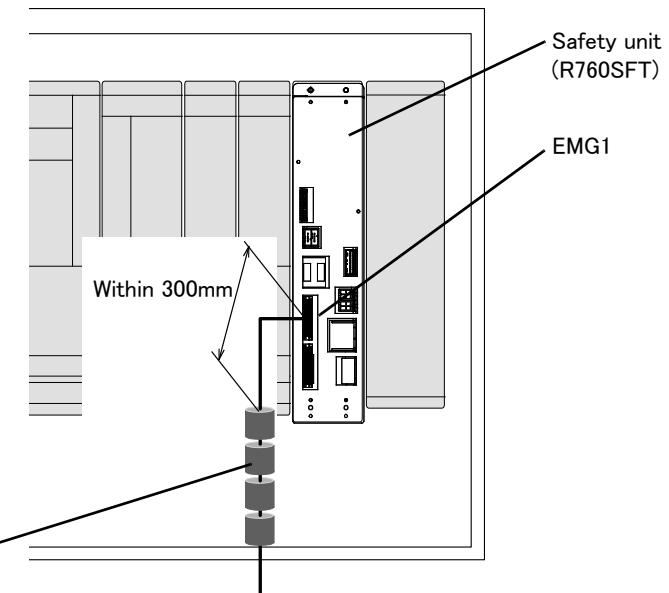


Fig. 2-19 : Emergency stop cable connection

(1) CR750 drive unit

An example of external emergency stop connection is shown below. Details of arrangement of connectors for exclusive input/output signals and the pin assignments are shown in the following pages.

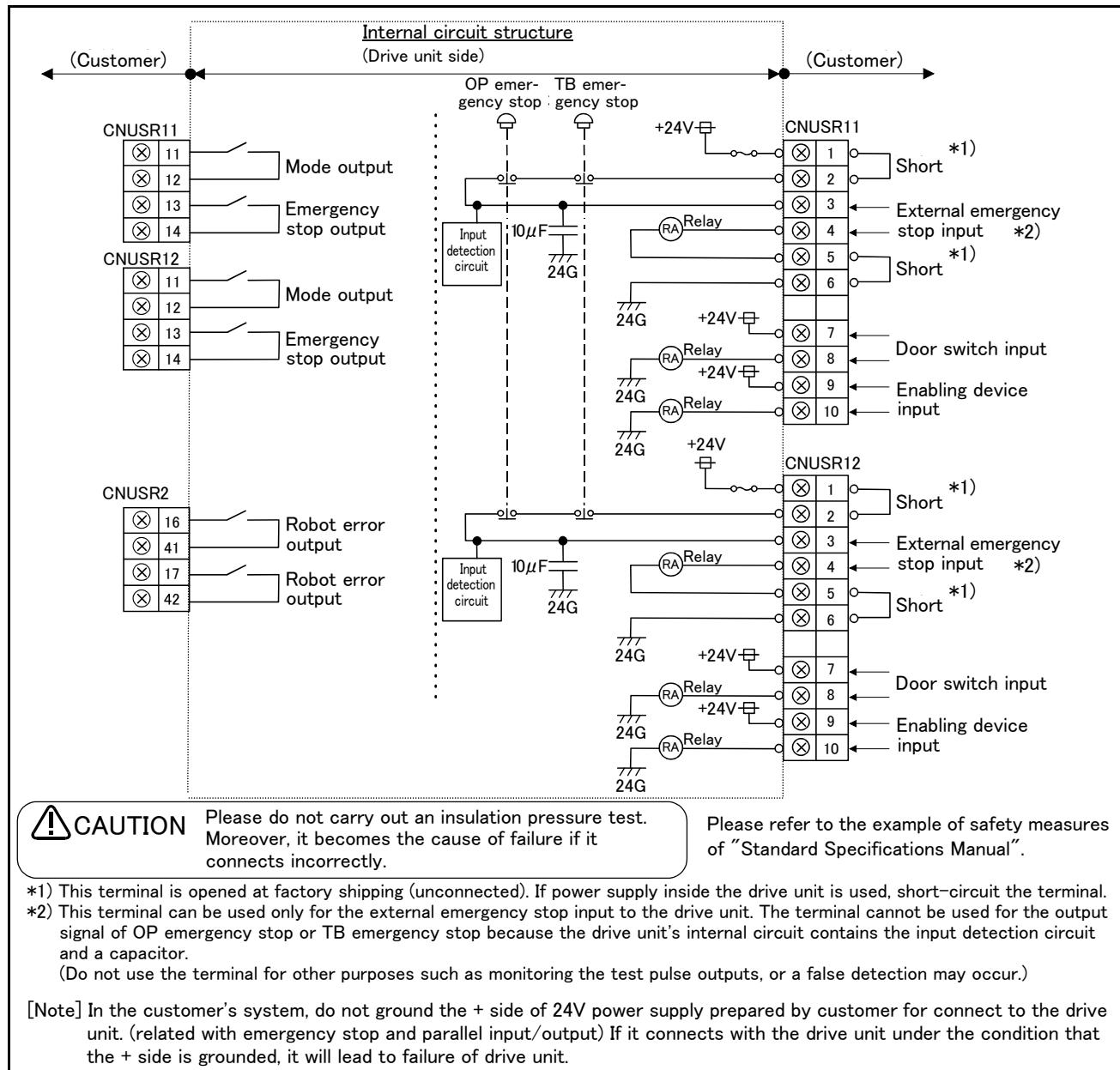


Fig. 2-20 : External emergency stop connection (CR750 drive unit)



Place the emergency stop switch in an easily operable position, and be sure to wire it to the emergency stop correctly by refer to [Page 53, "2.3.7 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.

Arrangement of connectors for exclusive input/output signals are shown in Fig. 2-21. The pin assignments of the connectors for exclusive input/output signals are shown in Table 2-5 to Table 2-8.

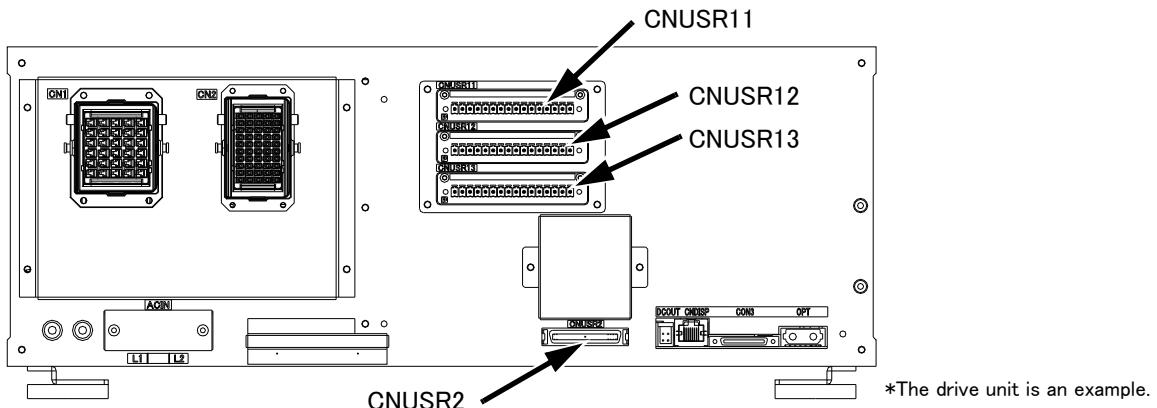


Fig. 2-21 : Arrangement of connectors for exclusive input/output signals

Table 2-5 : Pin assignment (CNUSR11)

Pin No.	Name	Function	Remarks	Pin No.	Name	Function	Remarks
1	EMGIN24V1	Constructing of external emergency stop input circuit Common pin (SG)	Constructing an external emergency stop function. Common pin (SG)	9	24V1 for GRIP	Enabling device connection	Safety measures at teaching. (Servo OFF)
2	EXTEMG11			10	GRIP1		
3	EXTEMG12			11	MODEOUT11	Mode output	Confirming the controller operation mode.
4	EXTEMG13			12	MODEOUT12		
5	EXT-GND1			13	EMGOUT11	Emergency stop output	Confirming the presence/absence of an emergency stop.
6	SG			14	EMGOUT12		
7	24V1 for DOOR	Connection of door switch	Detecting the opening and closing of a door.	15	OPKEY1COM(24V)	Mode key switch input Note1)	Switching an operation mode of a controller.
8	DOOR1			16	OPKEY1		

Note1) The mode key switch input can be used to change the mode of a controller with external command, but never connect the mode key switch input when a key switch on the operation panel is used. When using 15 and 16 pins, the key switch on the operation panel must be set to the MANUAL mode. If the key switch is set to the AUTOMATIC mode, the mode is fixed to AUTOMATIC, which disables the mode selector switch.

Table 2-6 : Pin assignment (CNUSR12)

Pin No.	Name	Function	Remarks	Pin No.	Name	Function	Remarks
1	EMGIN24V2	Constructing of external emergency stop input circuit Common pin (SG)	Constructing an external emergency stop function. Common pin (SG)	9	24V2 for GRIP	Enabling device connection	Safety measures at teaching. (Servo OFF)
2	EXTEMG21			10	GRIP2		
3	EXTEMG22			11	MODEOUT21	Mode output	Confirming the controller operation mode.
4	EXTEMG23			12	MODEOUT22		
5	EXT-GND2			13	EMGOUT21	Emergency stop output	Confirming the presence/absence of an emergency stop.
6	SG			14	EMGOUT22		
7	24V2 for DOOR	Connection of door switch	Detecting the opening and closing of a door.	15	OPKEY2COM(24V)	Mode key switch input Note1)	Switching an operation mode of a controller.
8	DOOR2			16	OPKEY2		

Note1) The mode key switch input can be used to change the mode of a controller with external command, but never connect the mode key switch input when a key switch on the operation panel is used. When using 15 and 16 pins, the key switch on the operation panel must be set to the MANUAL mode. If the key switch is set to the AUTOMATIC mode, the mode is fixed to AUTOMATIC, which disables the mode selector switch.

Table 2-7 : Pin assignment (CNUSR13)

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
1	Reserved			9		Reserved	
2	Reserved			10		Reserved	
3	Reserved			11		Reserved	
4	Reserved			12		Reserved	
5	Reserved			13		Reserved	
6	Reserved			14		Reserved	
7	Reserved			15		Reserved	
8	Reserved			16		Reserved	

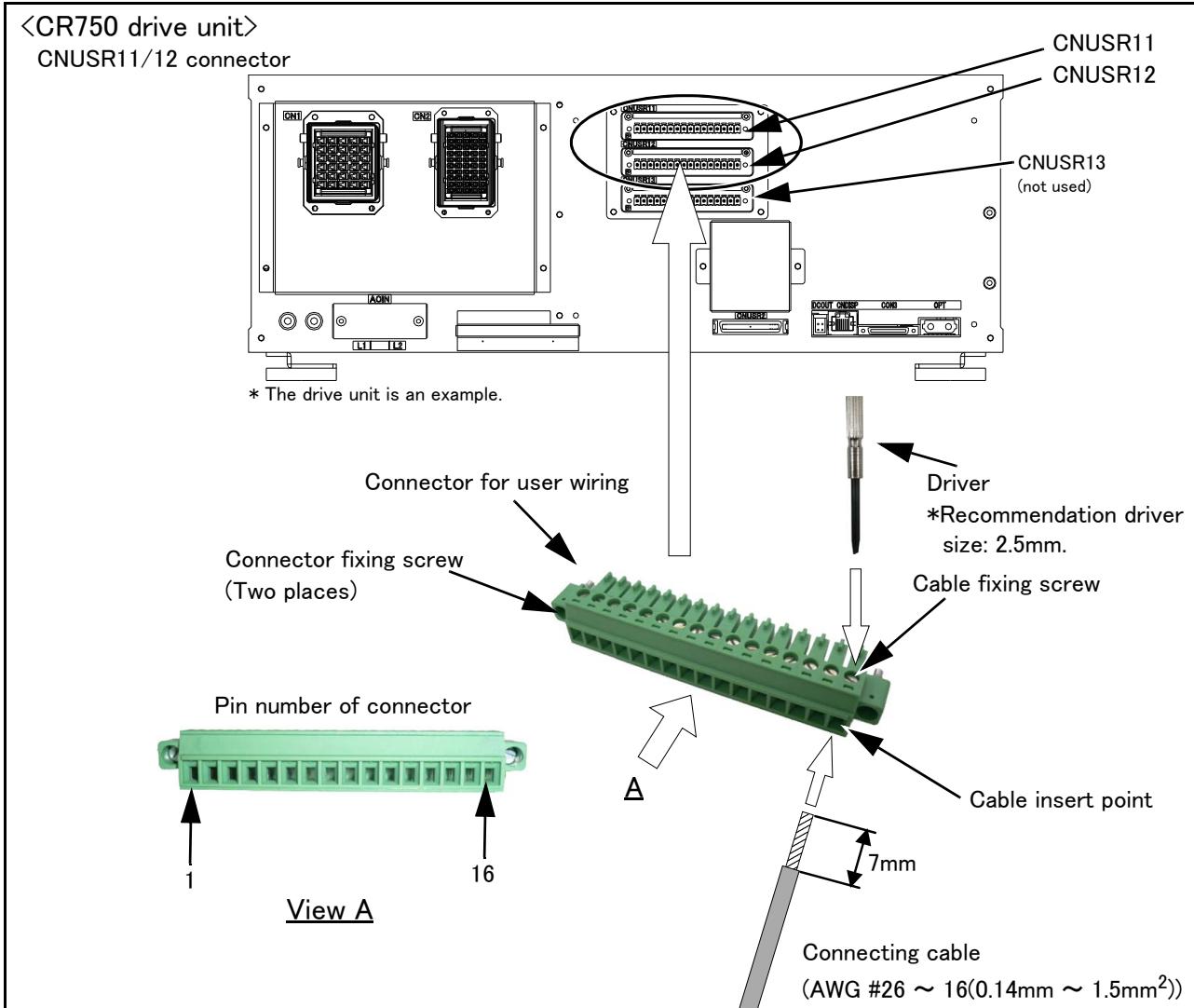
Note1) The reserved pins cannot be used. Do not wire the pins.

Table 2-8 : Pin assignment (CNUSR2)

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
1	MPI11 (850)	Servo digital input 1		26	MPI14 (851)	Servo digital input 2	
2	MPICOM1	MPI input common (COM)		27	MPI16 (852)	Servo digital input 3	
3	Reserved			28		Reserved	
4	Reserved			29		Reserved	
5	Reserved			30		Reserved	
6	Reserved			31		Reserved	
7	Reserved			32		Reserved	
8	Reserved			33		Reserved	
9	SKIP11	Dedicated stop input common (COM)	This pin and pin 34 is a pair.	34	SKIP12	Dedicated stop input	This pin and pin 9 is a pair.
10	SKIP21	SKIP21 common (COM)	This pin and pin 35 is a pair.	35	SKIP22 (801)	SKIP2 input	This pin and pin 10 is a pair.
11	SKIP31	SKIP31 common (COM)	This pin and pin 36 is a pair.	36	SKIP32 (802)	SKIP3 input	This pin and pin 11 is a pair.
12	SKIP41	SKIP41 common (COM)	This pin and pin 37 is a pair.	37	SKIP42 (803)	SKIP4 input	This pin and pin 12 is a pair.
13	Reserved			38		Reserved	
14	Reserved			39		Reserved	
15	SG	Common pin	Common pin (SG)	40	SG	Common pin	Common pin (SG)
16	ROBOTERR11	Robot error output	This pin and pin 41 is a pair.	41	ROBOTERR12	Robot error output	This pin and pin 16 is a pair.
17	ROBOTERR21	Robot error output	This pin and pin 42 is a pair.	42	ROBOTERR22	Robot error output	This pin and pin 17 is a pair.
18	Reserved			43		Reserved	
19	AXMC21	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 44 is a pair.	44	AXMC22	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 19 is a pair.
20	AXMC11	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 45 is a pair.	45	AXMC12	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 20 is a pair.
21	Reserved			46		Reserved	
22	Reserved			47		Reserved	
23	Reserved			48		Reserved	

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
24		Reserved		49		Reserved	
25		Reserved		50		Reserved	

Note1) The reserved pins cannot be used. Do not wire the pins.

**Connection procedure**

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

Please use an AWG #26 to 16 (0.14 to 1.5mm²) connector cable.

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

This concludes the connection procedure.

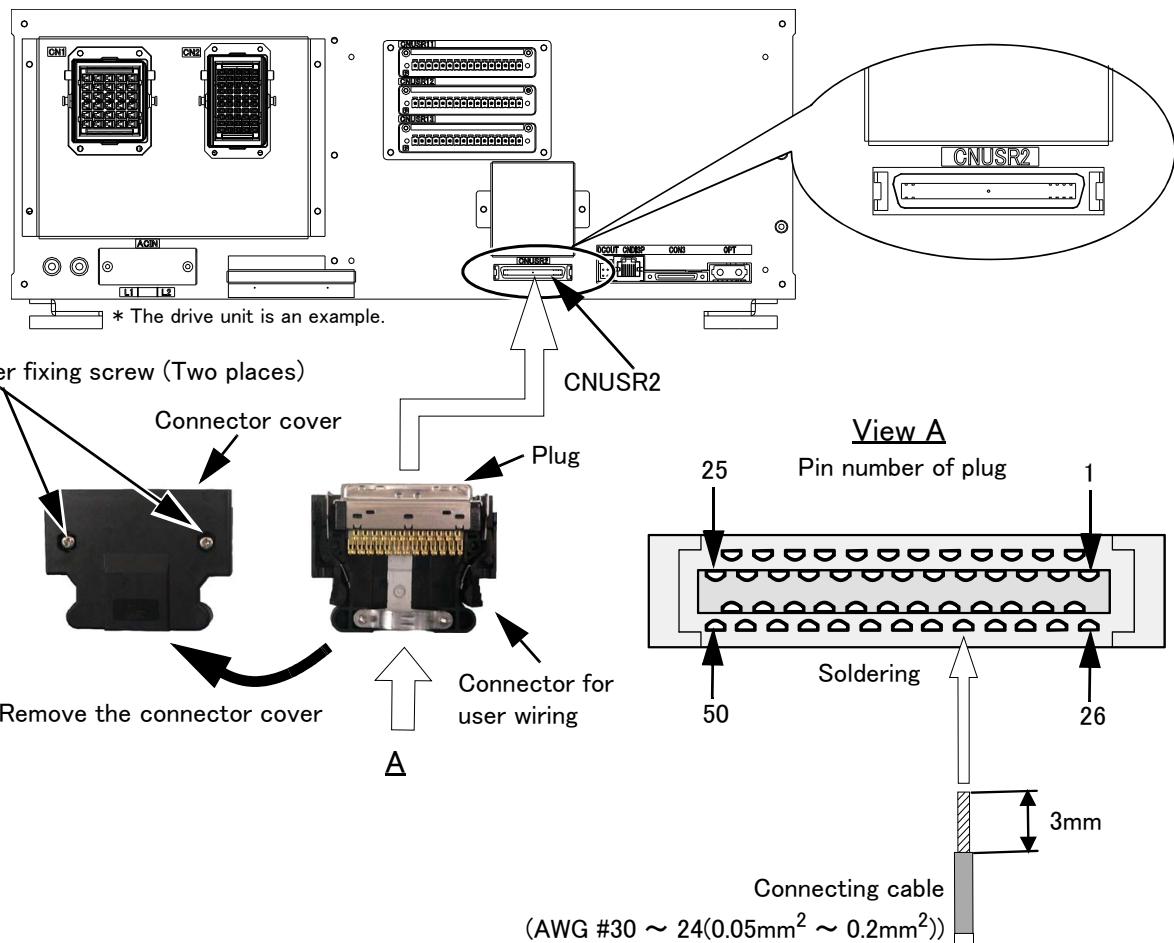
Fig. 2-22 : Method of wiring for external emergency stop connection (CR750 drive unit (CNUSR11/12))



CAUTION The connector on the controller side that connects to the user wiring connector is CNUSR11 or CNUSR12. Be careful not to connect to CNUSR13 as the robot will not operate properly.

<CR750 drive unit>

CNUSR2 connector

**Connection procedure**

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

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

This concludes the connection procedure.

Fig. 2-23 : Method of wiring for external emergency stop connection (CR750 drive unit (CNUSR2))



CAUTION When soldering please take care to only connect to the specified pin number. Connecting to a different pin number or short-circuiting with another pin will result in the robot breaking down or malfunctioning.

(2) CR751 drive unit

An example of external emergency stop connection is shown below. Details of arrangement of connectors for exclusive input/output signals and the pin assignments are shown in the following pages.

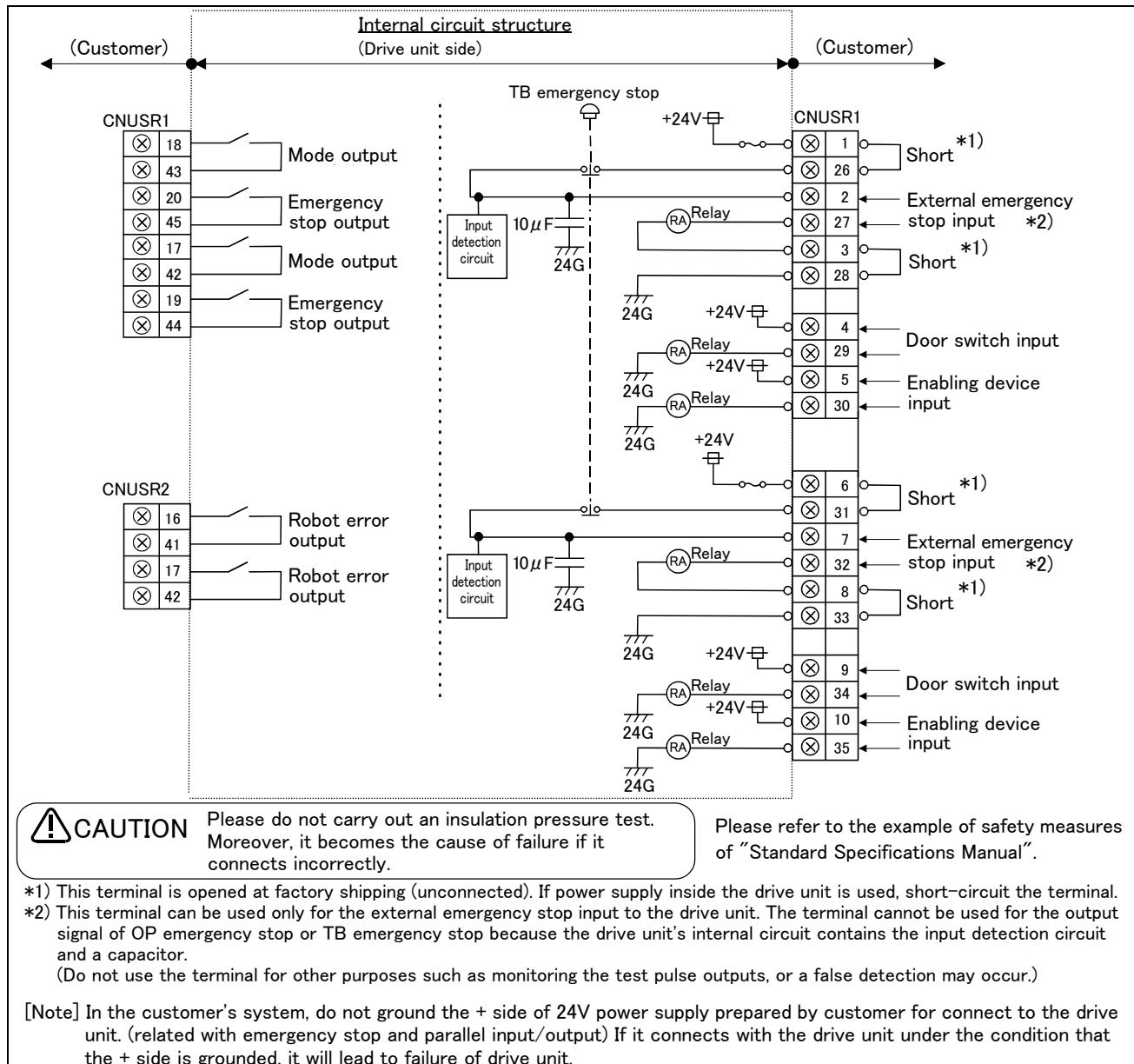


Fig. 2-24 : External emergency stop connection (CR751 drive unit)



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 53, "2.3.7 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.

Arrangement of connectors for exclusive input/output signals are shown in Fig. 2-25. The pin assignments of the connectors for exclusive input/output signals are shown in Table 2-9 to Table 2-10.

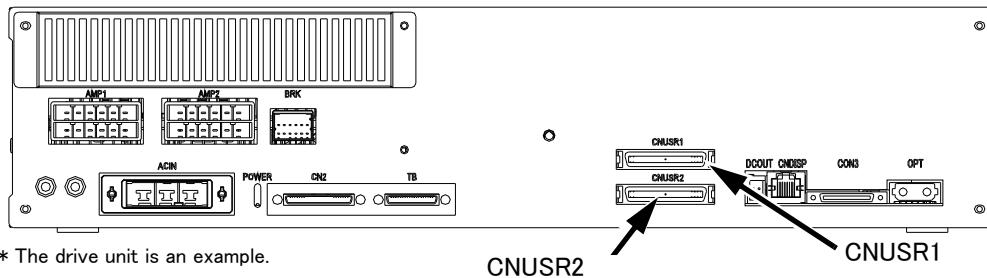


Fig. 2-25 : Arrangement of connectors for exclusive input/output signals

Table 2-9 : Pin assignment (CNUSR1)

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
1	EMGIN24V1	Construction of external emergency stop input circuit	Constructing an external emergency stop function.	26	EXTEMG11	Construction of external emergency stop input circuit	Constructing an external emergency stop function.
2	EXTEMG12			27	EXTEMG13		
3	EXT-GND1			28	SG		
4	24V1 for DOOR	Connection of door switch	Detecting the opening and closing of a door. This pin and pin 29 is a pair.	29	DOOR1	Connection of door switch	Detecting the opening and closing of a door. This pin and pin 4 is a pair.
5	24V1 for GRIP	Enabling device connection	Safety measures at teaching (Servo OFF) This pin and pin 30 is a pair.	30	GRIP1	Enabling device connection	Safety measures at teaching (Servo OFF) This pin and pin 5 is a pair.
6	EMGIN24V2	Construction of external emergency stop input circuit	Constructing an external emergency stop function.	31	EXTEMG21	Construction of external emergency stop input circuit	Constructing an external emergency stop function.
7	EXTEMG22			32	EXTEMG23		
8	EXT-GND2			33	SG		
9	24V2 for DOOR	Connection of door switch	Detecting the opening and closing of a door. This pin and pin 34 is a pair.	34	DOOR2	Connection of door switch	Detecting the opening and closing of a door. This pin and pin 9 is a pair.
10	24V2 for GRIP	Enabling device connection	Safety measures at teaching (Servo OFF) This pin and pin 35 is a pair.	35	GRIP2	Enabling device connection	Safety measures at teaching (Servo OFF) This pin and pin 10 is a pair.
11		Reserved		36		Reserved	
12		Reserved		37		Reserved	
13		Reserved		38		Reserved	
14		Reserved		39		Reserved	
15		Reserved		40		Reserved	
16		Reserved		41		Reserved	
17	MODEOUT21	Mode output	Confirming the controller operation mode. This pin and pin 42 is a pair.	42	MODEOUT22	Mode output	Confirming the controller operation mode. This pin and pin 17 is a pair.
18	MODEOUT11	Mode output	Confirming the controller operation mode. This pin and pin 43 is a pair.	43	MODEOUT12	Mode output	Confirming the controller operation mode. This pin and pin 18 is a pair.

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
19	EMGOUT21	Emergency stop output	Confirming the presence/absence of an emergency stop. This pin and pin 44 is a pair.	44	EMGOUT22	Emergency stop output	Confirming the presence/absence of an emergency stop. This pin and pin 19 is a pair.
20	EMGOUT11	Emergency stop output	Confirming the presence/absence of an emergency stop. This pin and pin 45 is a pair.	45	EMGOUT12	Emergency stop output	Confirming the presence/absence of an emergency stop. This pin and pin 20 is a pair.
21		Reserved		46		Reserved	
22		Reserved		47		Reserved	
23		Reserved		48		Reserved	
24	OPKEY1COM(24V) Note2)	Mode key switch input	Switching an operation mode of a controller. This pin and pin 49 is a pair.	49	OPKEY1 Note2)	Mode key switch input	Switching an operation mode of a controller. This pin and pin 24 is a pair.
25	OPKEY2COM(24V) Note2)	Mode key switch input	Switching an operation mode of a controller. This pin and pin 50 is a pair.	50	OPKEY2 Note2)	Mode key switch input	Switching an operation mode of a controller. This pin and pin 25 is a pair.

Note1) The reserved pins cannot be used. Do not wire the pins.

Note2) Refer to [Page 51, "2.3.6 Mode changeover switch input"](#) about the specifications of mode change over switch input.

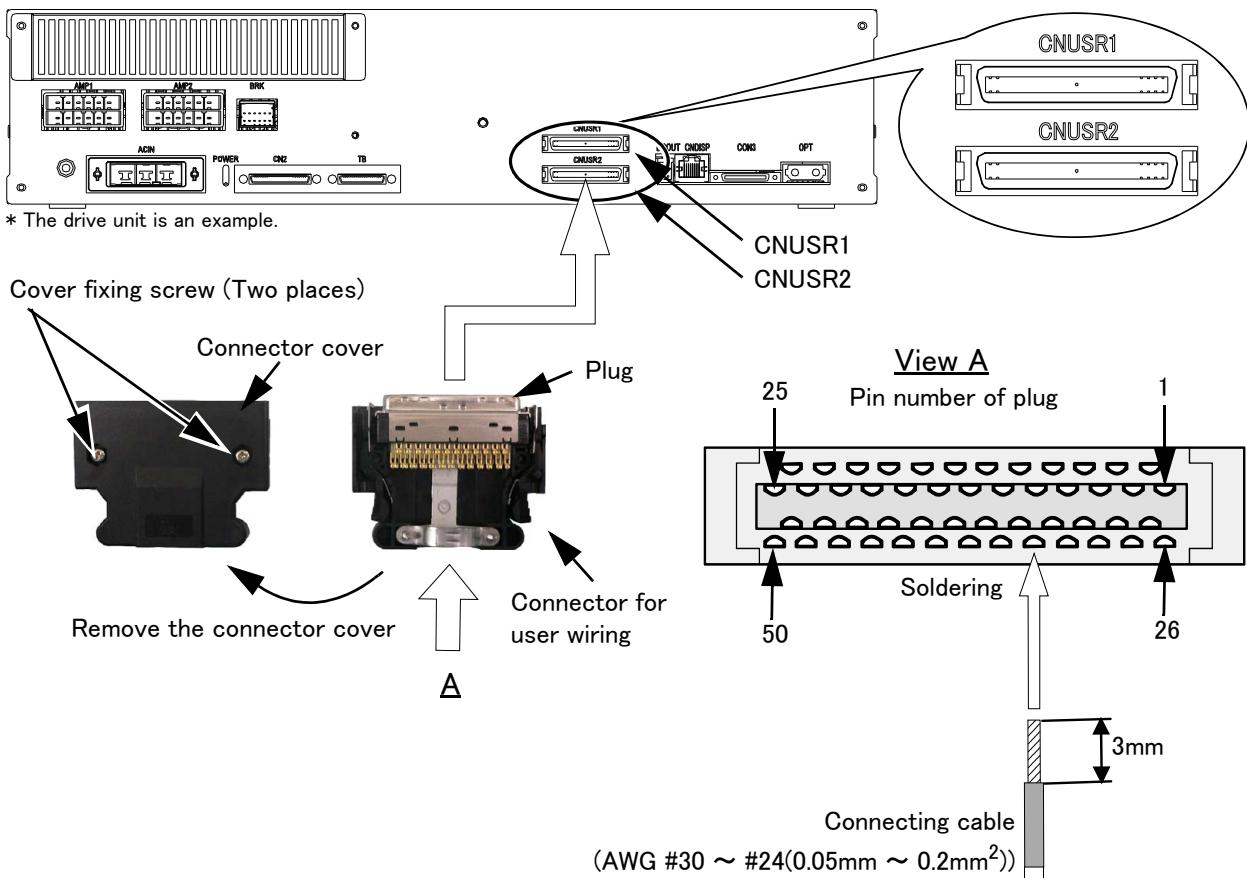
Table 2-10 : Pin assignment (CNUSR2)

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
1	MPI11 (850)	Servo digital input 1		26	MPI14 (851)	Servo digital input 2	
2	MPICOM1	MPI input common (COM)		27	MPI16 (852)	Servo digital input 3	
3		Reserved		28		Reserved	
4		Reserved		29		Reserved	
5		Reserved		30		Reserved	
6		Reserved		31		Reserved	
7		Reserved		32		Reserved	
8		Reserved		33		Reserved	
9	SKIP11	Dedicated stop input common (COM)	This pin and pin 34 is a pair.	34	SKIP12	Dedicated stop input common	This pin and pin 9 is a pair.
10	SKIP21	SKIP21 common (COM)	This pin and pin 35 is a pair.	35	SKIP22 (801)	SKIP2 input	This pin and pin 10 is a pair.
11	SKIP31	SKIP31 common (COM)	This pin and pin 36 is a pair.	36	SKIP32 (802)	SKIP3 input	This pin and pin 11 is a pair.
12	SKIP41	SKIP41 common (COM)	This pin and pin 37 is a pair.	37	SKIP42 (803)	SKIP4 input	This pin and pin 12 is a pair.
13		Reserved		38		Reserved	
14		Reserved		39		Reserved	
15	SG	Common pin	Common pin (SG)	40	SG	Common pin	Common pin (SG)
16	ROBOTERR11	Robot error output	This pin and pin 41 is a pair.	41	ROBOTERR12	Robot error output	This pin and pin 16 is a pair.
17	ROBOTERR21	Robot error output	This pin and pin 42 is a pair.	42	ROBOTERR22	Robot error output	This pin and pin 17 is a pair.
18		Reserved		43		Reserved	
19	AXMC21	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 44 is a pair.	44	AXMC22	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 19 is a pair.
20	AXMC11	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 45 is a pair.	45	AXMC12	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 20 is a pair.
21		Reserved		46		Reserved	
22		Reserved		47		Reserved	
23		Reserved		48		Reserved	
24		Reserved		49		Reserved	
25		Reserved		50		Reserved	

Note1) The reserved pins cannot be used. Do not wire the pins.

<CR751 drive unit>

CNUSR1/2 connector

Connection procedure

Solder the user wiring connector that accompanies the product to the corresponding pin, and connect it to the CNUSR1 or CNUSR2 connector at the back of the 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 or CNUSR2) on the drive unit. With pin number 1 facing to the upper right, insert firmly until you hear the connector's latch click in to place.

This concludes the connection procedure.

Fig. 2-26 : Method of wiring for external emergency stop connection (CR751 drive unit (CNUSR1/2))

CAUTION

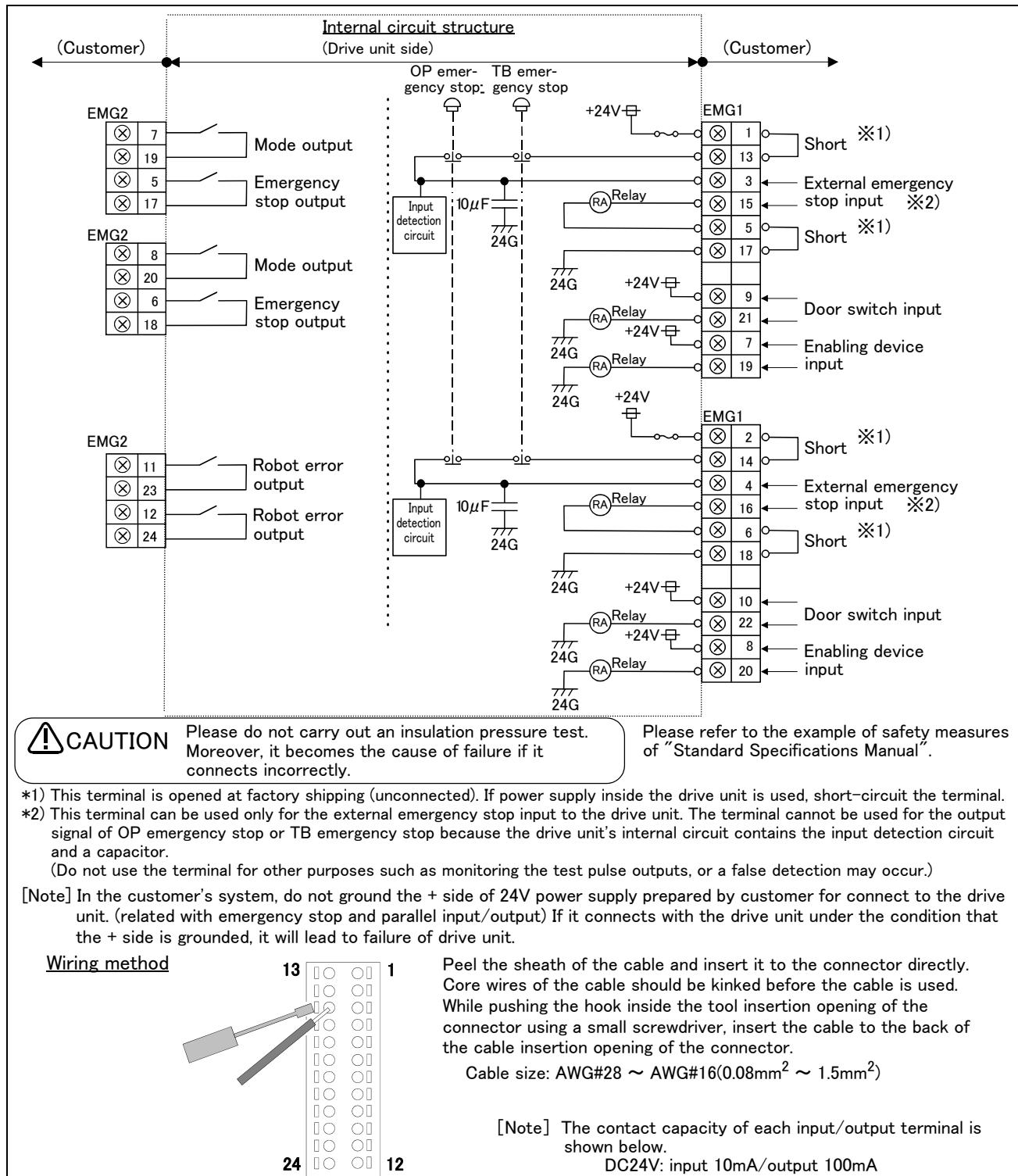
When soldering please take care to only connect to the specified pin number.

Connecting to a different pin number or short-circuiting with another pin will result in the robot breaking down or malfunctioning.

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

(3) CR760 drive unit

An example of external emergency stop connection is shown below. Details of arrangement of connectors for exclusive input/output signals and the pin assignments are shown in the following pages.



⚠ 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 53, "2.3.7 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.

⚠ CAUTION

When connecting the power line to the EMG1 connector, be careful not to cause a short circuit with wires sticking out from adjacent poles. And please do not apply a solder coating to core wires to be inserted in the power line. In some cases solder coating can result in contact failure.

Arrangement of connectors for exclusive input/output signals are shown in [Fig. 2-28](#). The pin assignments of the connectors for exclusive input/output signals are shown in [Table 2-11](#) to [Table 2-12](#).

<CR760drive unit>

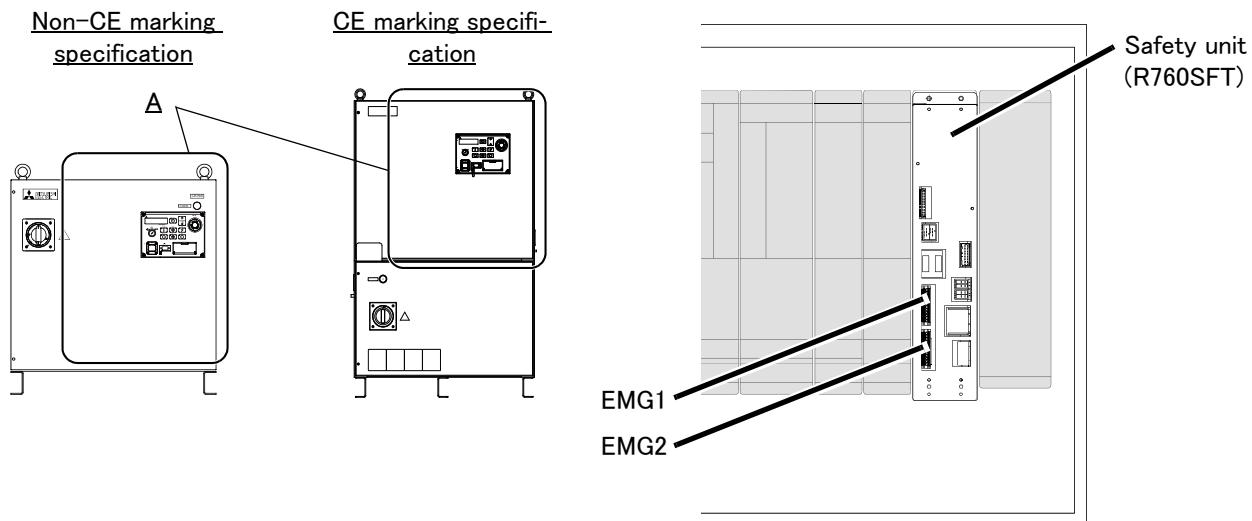


Fig. 2-28 : Arrangement of connectors for exclusive input/output signals

Table 2-11 : Pin assignment (EMG1)

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
1	EMGIN24V1	Construction of external emergency stop input circuit	Constructing an external emergency stop function.	13	EMGIN24V12	Construction of external emergency stop input circuit	Constructing an external emergency stop function.
2	EMGIN24V21			14	EMGIN24V22		
3	EMG11			15	EMG12		
4	EMG21			16	EMG22		
5	EXT-GND1			17	SG		
6	EXT-GND2			18	SG		
7	ENA11	Enabling device connection	Safety measures at teaching (Servo OFF) This pin and pin 19 is a pair.	19	ENA12	Enabling device connection	Safety measures at teaching (Servo OFF) This pin and pin 7 is a pair.
8	ENA21	Enabling device connection	Safety measures at teaching (Servo OFF) This pin and pin 20 is a pair.	20	ENA22	Enabling device connection	Safety measures at teaching (Servo OFF) This pin and pin 8 is a pair.
9	DOOR11	Connection of door switch	Detecting the opening and closing of a door. This pin and pin 21 is a pair.	21	DOOR12	Door switch input	Detecting the opening and closing of a door. This pin and pin 9 is a pair.

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
10	DOOR21	Connection of door switch	Detecting the opening and closing of a door. This pin and pin 22 is a pair.	22	DOOR22	Door switch input	Detecting the opening and closing of a door. This pin and pin 10 is a pair.
11	AXMC11	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 23 is a pair.	23	AXMC12	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 11 is a pair.
12	AXMC21	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 24 is a pair.	24	AXMC22	Magnet contactor control connector output for additional axes	To synchronize an additional axis to a robot's servo ON/OFF. This pin and pin 12 is a pair.

Note1) The reserved pins cannot be used. Do not wire the pins.

Table 2-12 : Pin assignment (EMG2)

Pin No.	Name	Function Note1)	Remarks	Pin No.	Name	Function Note1)	Remarks
1	SKIP11	Dedicated stop input common (COM)	This pin and pin 13 is a pair.	13	SKIP12	Dedicated stop input common	This pin and pin 1 is a pair.
2	SKIP21	SKIP21 common (COM)	This pin and pin 14 is a pair.	14	SKIP22 (801)	SKIP2 input	This pin and pin 2 is a pair.
3	SKIP31	SKIP31 common (COM)	This pin and pin 15 is a pair.	15	SKIP32 (802)	SKIP3 input	This pin and pin 3 is a pair.
4	SKIP41	SKIP41 common (COM)	This pin and pin 16 is a pair.	16	SKIP42 (803)	SKIP4 input	This pin and pin 4 is a pair.
5	EMGOUT11	Emergency stop output	Confirming the presence/absence of an emergency stop. This pin and pin 17 is a pair.	17	EMGOUT12	Emergency stop output	Confirming the presence/absence of an emergency stop. This pin and pin 5 is a pair.
6	EMGOUT21	Emergency stop output	Confirming the presence/absence of an emergency stop. This pin and pin 18 is a pair.	18	EMGOUT22	Emergency stop output	Confirming the presence/absence of an emergency stop. This pin and pin 6 is a pair.
7	MODEOUT11	Mode output	Confirming the controller operation mode. This pin and pin 19 is a pair.	19	MODEOUT11	Mode output	Confirming the controller operation mode. This pin and pin 7 is a pair.
8	MODEOUT21	Mode output	Confirming the controller operation mode. This pin and pin 20 is a pair.	20	MODEOUT21	Mode output	Confirming the controller operation mode. This pin and pin 8 is a pair.
9		Reserved		21		Reserved	
10		Reserved		22		Reserved	
11	ERR11	Robot error output	This pin and pin 23 is a pair.	23	ERR12	Robot error output	This pin and pin 11 is a pair.
12	ERR21	Robot error output	This pin and pin 24 is a pair.	24	ERR22	Robot error output	This pin and pin 12 is a pair.

Note1) The reserved pins cannot be used. Do not wire the pins.

Examples of Safety Measures are shown in [Page 53, "2.3.7 Examples of safety measures"](#).

2.3.6 Mode changeover switch input

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

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

<Right of operation (mode)>

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

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

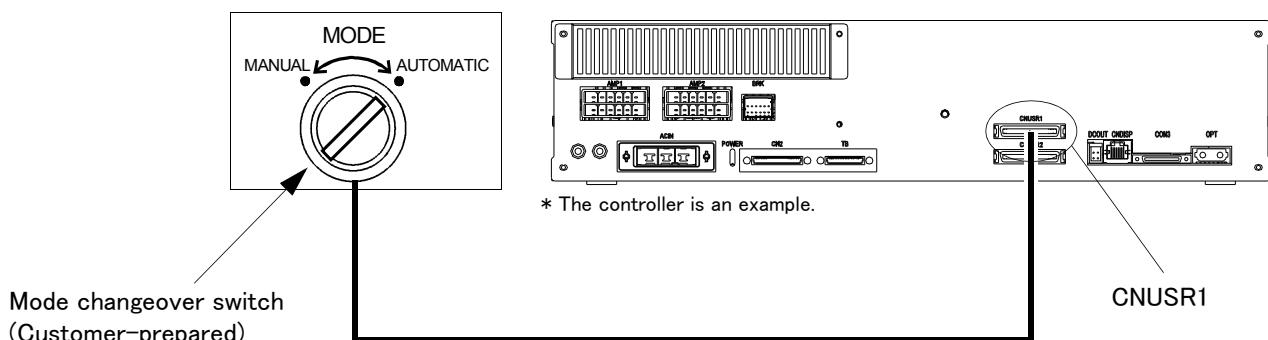


Fig.2-29 : Mode changeover switch image figure (CR751)

(1) Specification of the key switch interface

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

Table 2-13 : Function of the key switch interface

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

Note1) The mode changes by both opening or both closing between 49–24 pin and between 50–25 pin.

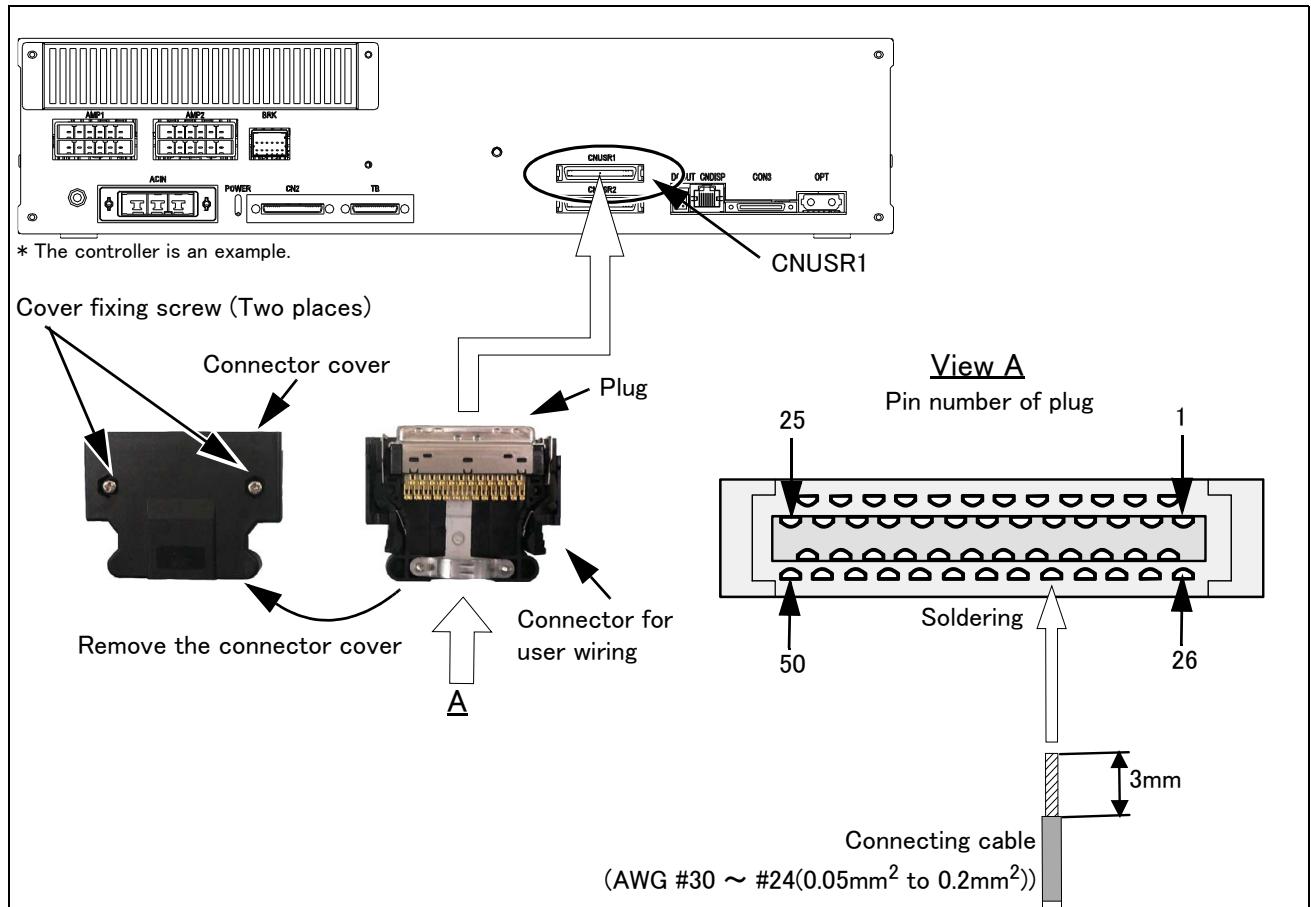
When input states differ between two lines, error H0044 (OP Mode key line is faulty) will occur.

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

Table 2-14 : 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. 2.2k Ω	
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.2-30 : Connection of the mode changeover switch input (CR751)

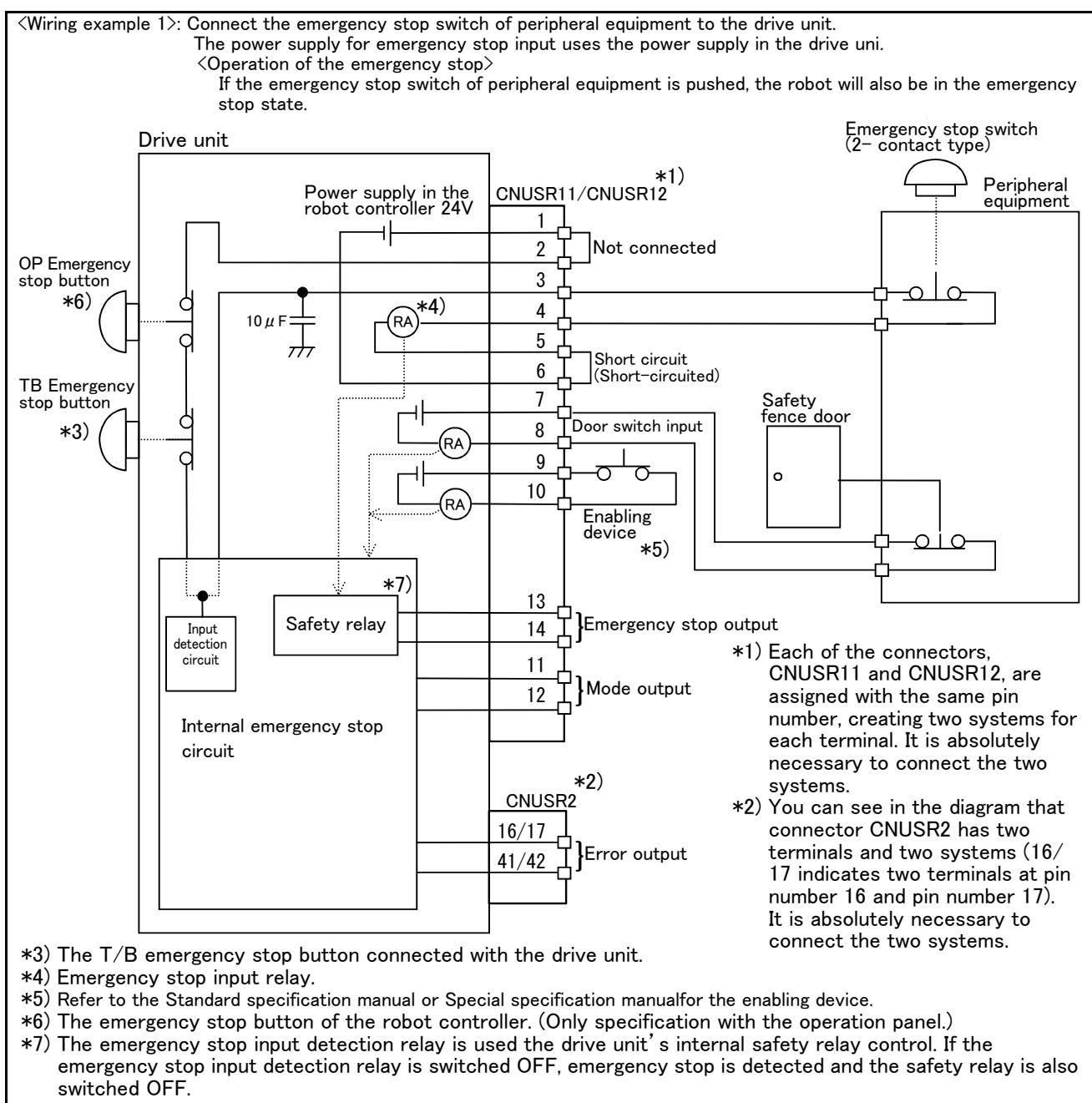
2.3.7 Examples of safety measures

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

[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to [Page 68, "\(4\) External emergency stop connection \[supplementary explanation\]](#)" and [Page 34, "2.3.5 Connecting the external emergency stop"](#).

- [Note]
- In the emergency-stop related wiring by the customer, if the coil (is not the contact points) of the relay prepared by the customer is connected to the controller, please be sure to implement the measure against the noise by the customer in the coil section. And, please also take the lifetime of noise suppression parts into consideration.
 - Electric specification of the emergency-stop-related output terminal: 100mA/24V or less.
 - In the customer's system, do not ground the + side of 24V power supply prepared by customer for connect to the controller. (related with emergency stop and parallel input/output) If it connects with the controller under the condition that the + side is grounded, it will lead to failure of controller.

(1) CR750 drive unit



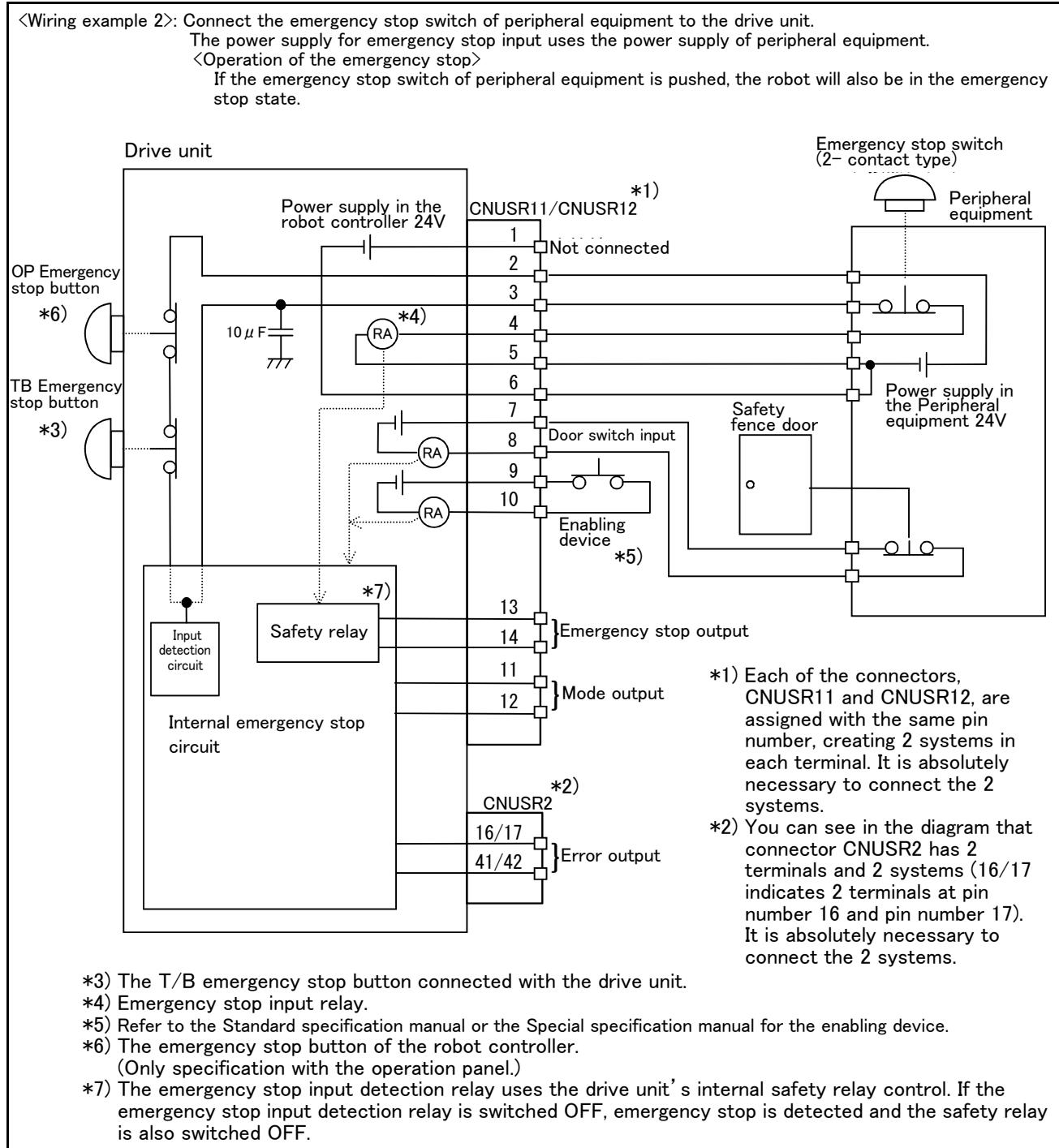
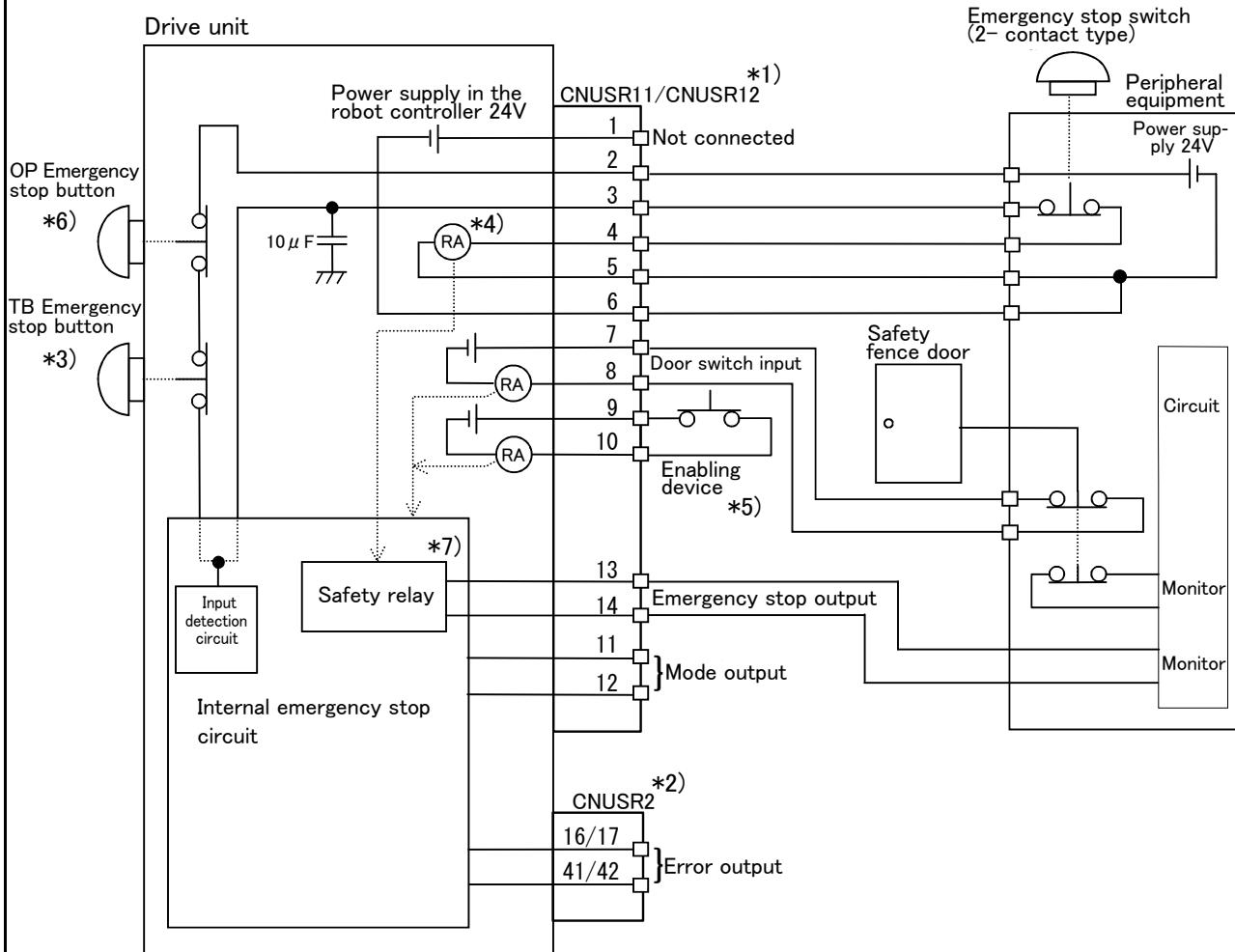


Fig.2-32 : Example of safety measures (Wiring example 2)

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

<Operation of the emergency stop>

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



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

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

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

*4) Emergency stop input relay.

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

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

(Only specification with the operation panel.)

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

Fig.2-33 : Example of safety measures (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.

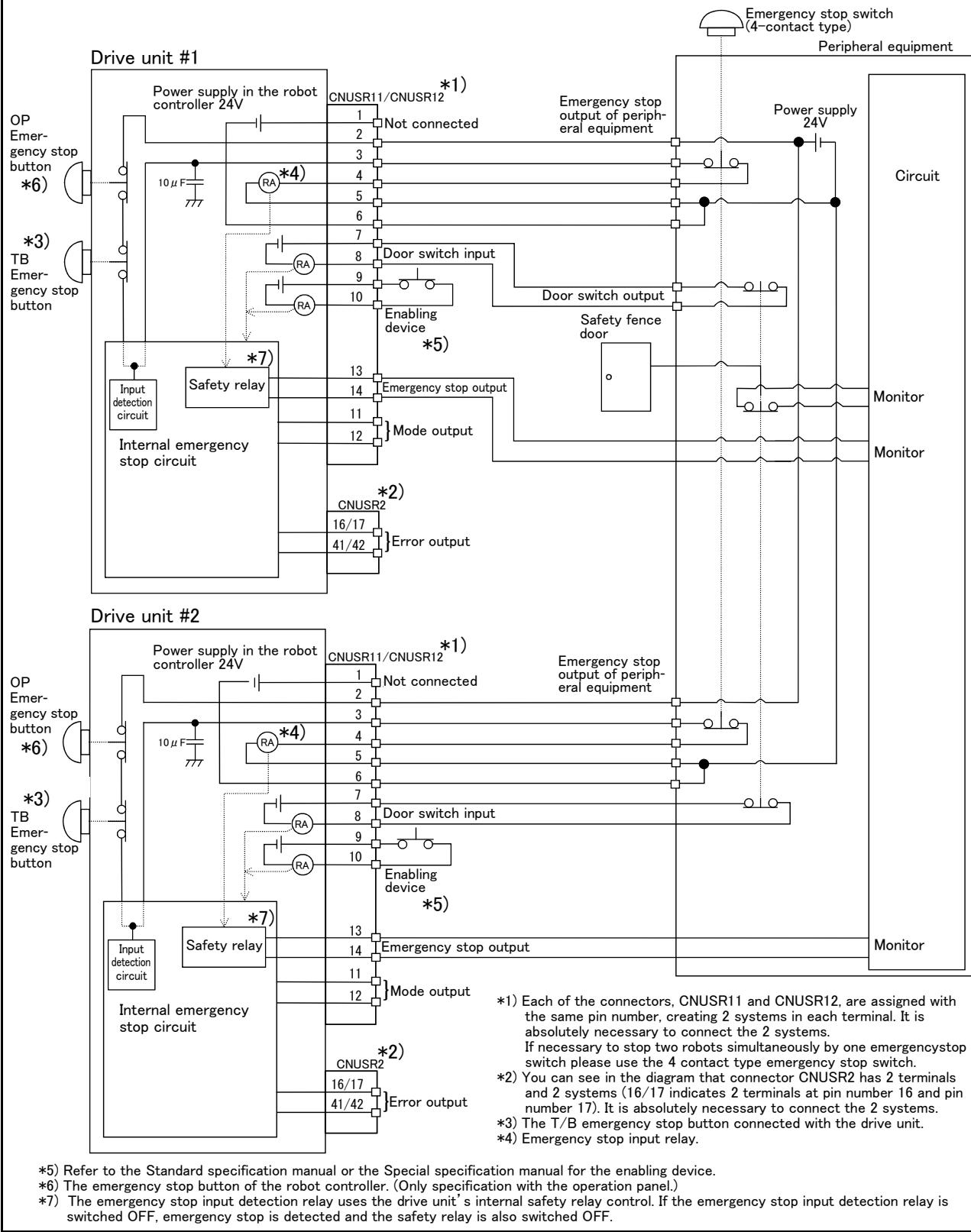
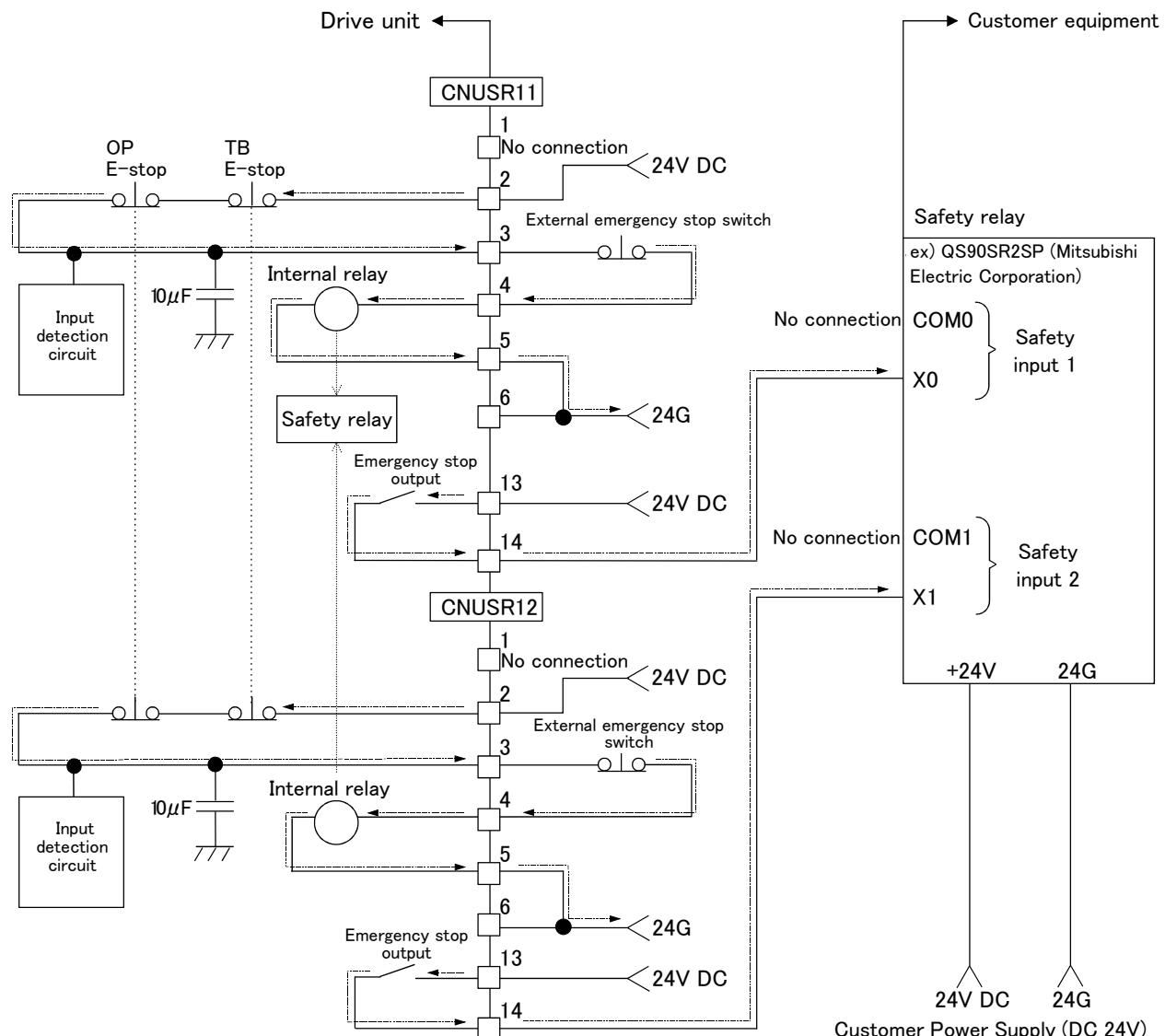


Fig.2-34 : Example of safety measures (Wiring example 4)

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



[Caution]

- 1) This product has category 3 functionality and therefore the robot's whole unit cannot be set to category 4.
- 2) The controller's internal circuit has polarity. Please adhere to the polarity as detailed in the wiring examples, particularly for emergency stop button output when using user equipment. Connect the positive side of the user equipment (24V DC) to the terminal 2 of CNUSR11/12, then connect the emergency stop button (or contact points) in the user equipment to across the terminals 3 and 4 of CNUSR11/12, and ultimately connect the negative side (24G).
- 3) When installing a safety relay to use it as an input point of the controller's emergency stop button command, use a safety relay that is activated by an input from one of the two systems (i.e. QS90SR2SP (Manufacture: Mitsubishi Electric Corporation)).
- 4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
- 5) When connecting emergency stop button output to an external safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly, this function will not operate correctly. Please connect the terminal 13 of CNUSR11/12 to 24V.

Fig.2-35 : Example of safety measures (Wiring example 5)

(2) CR751 drive unit

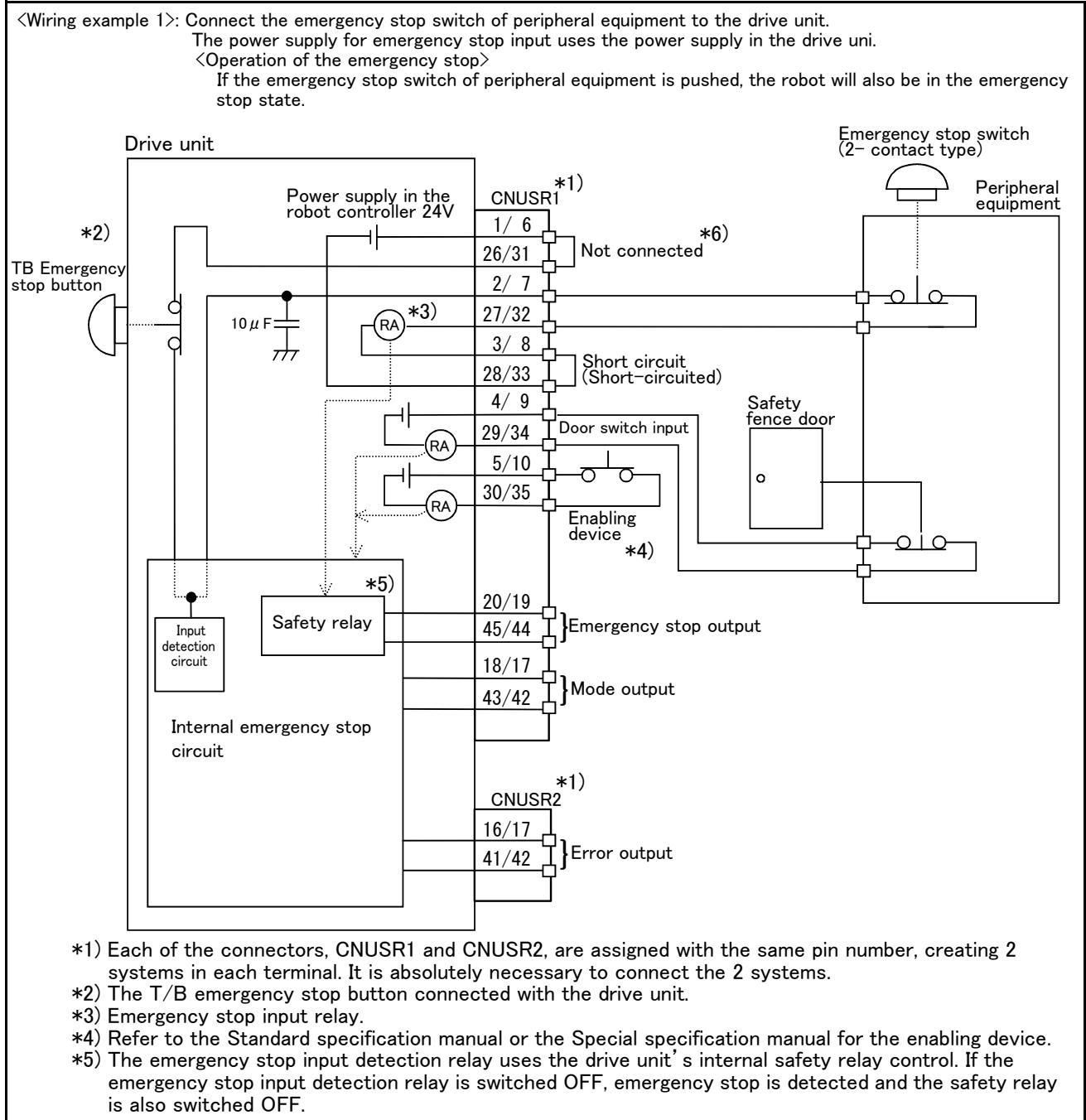


Fig.2-36 : Example of safety measures (Wiring example 1)

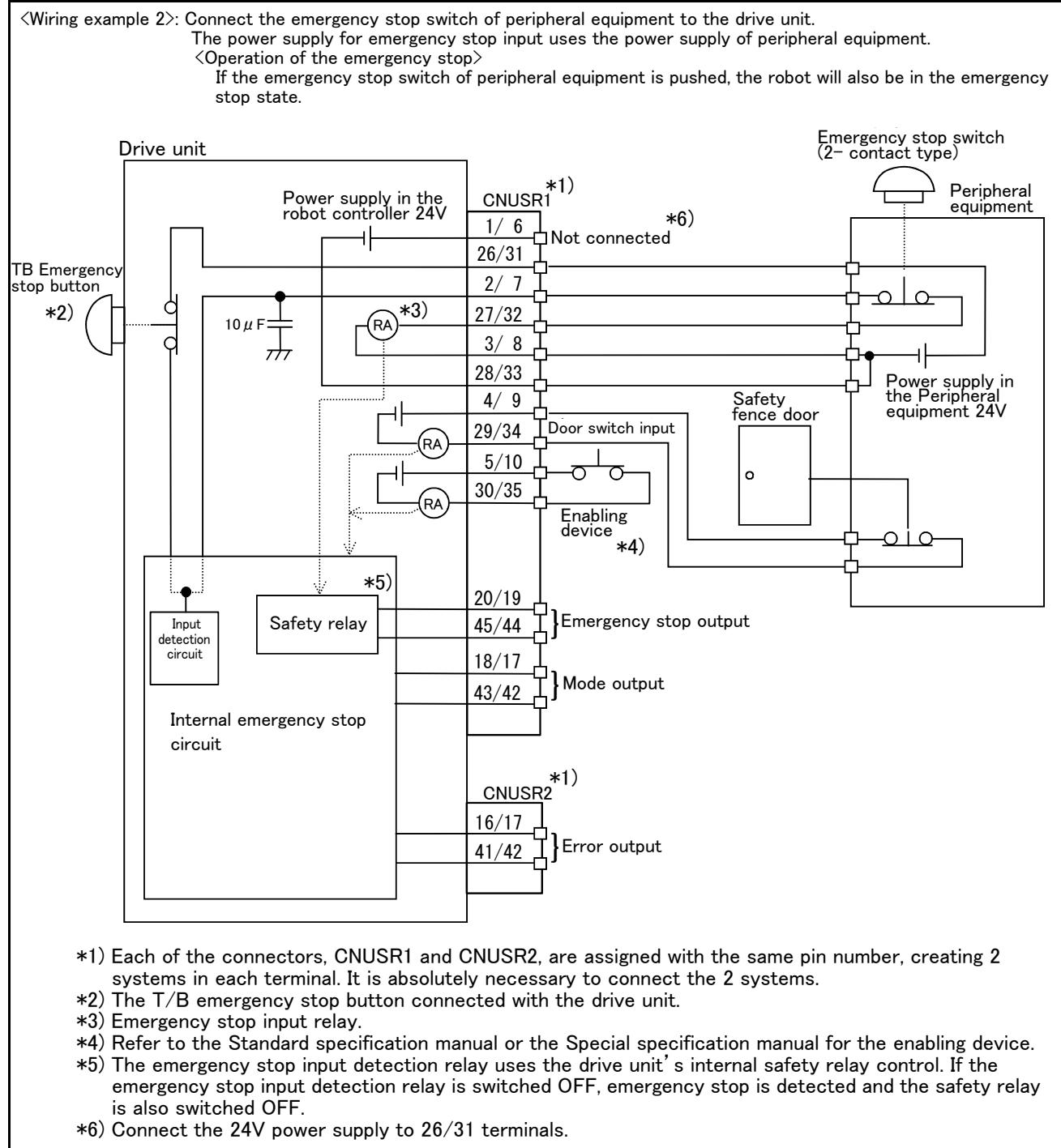


Fig.2-37 : Example of safety measures (Wiring example 2)

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

<Operation of the emergency stop>

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

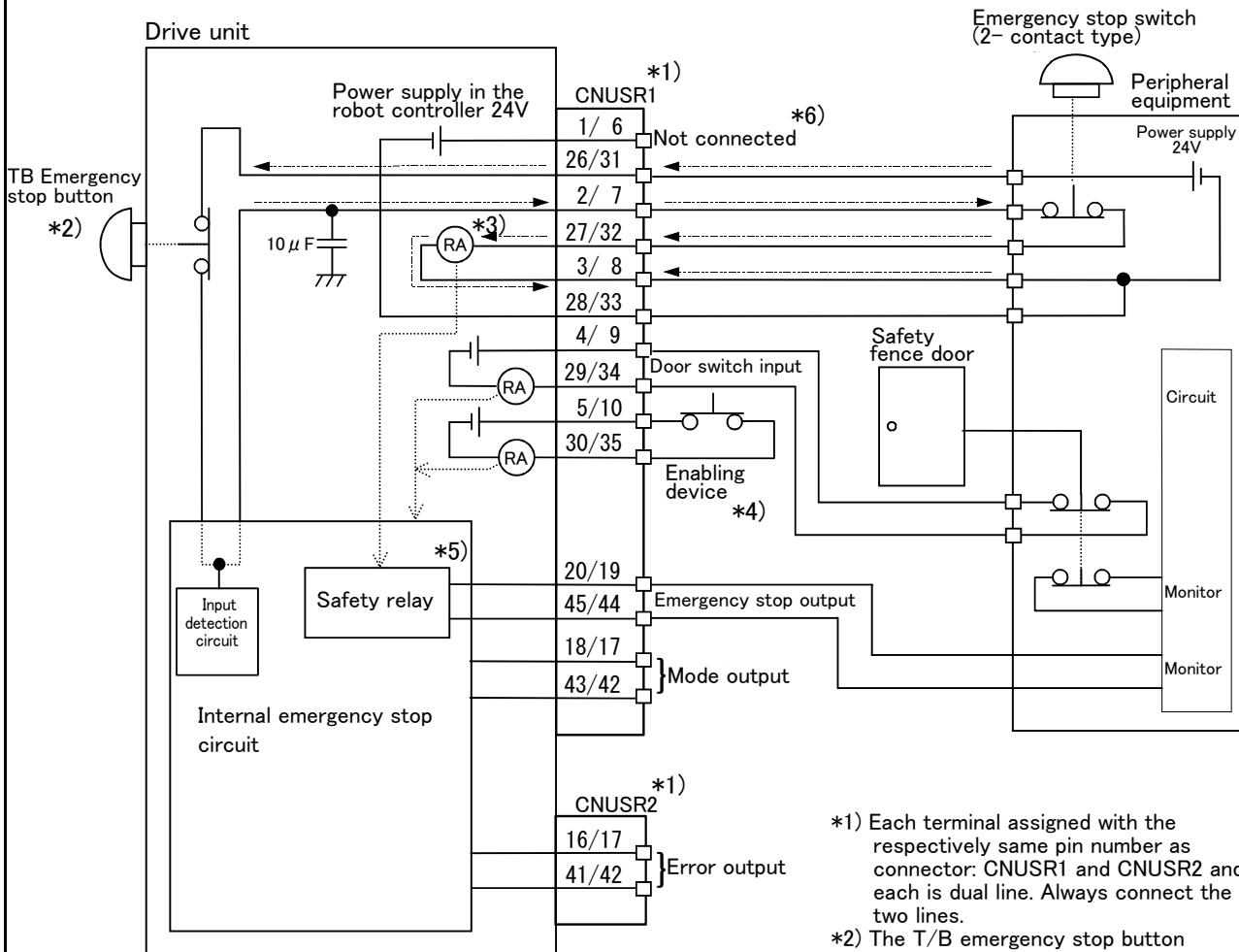


Fig.2-38 : Example of safety measures (Wiring example 3)

<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.

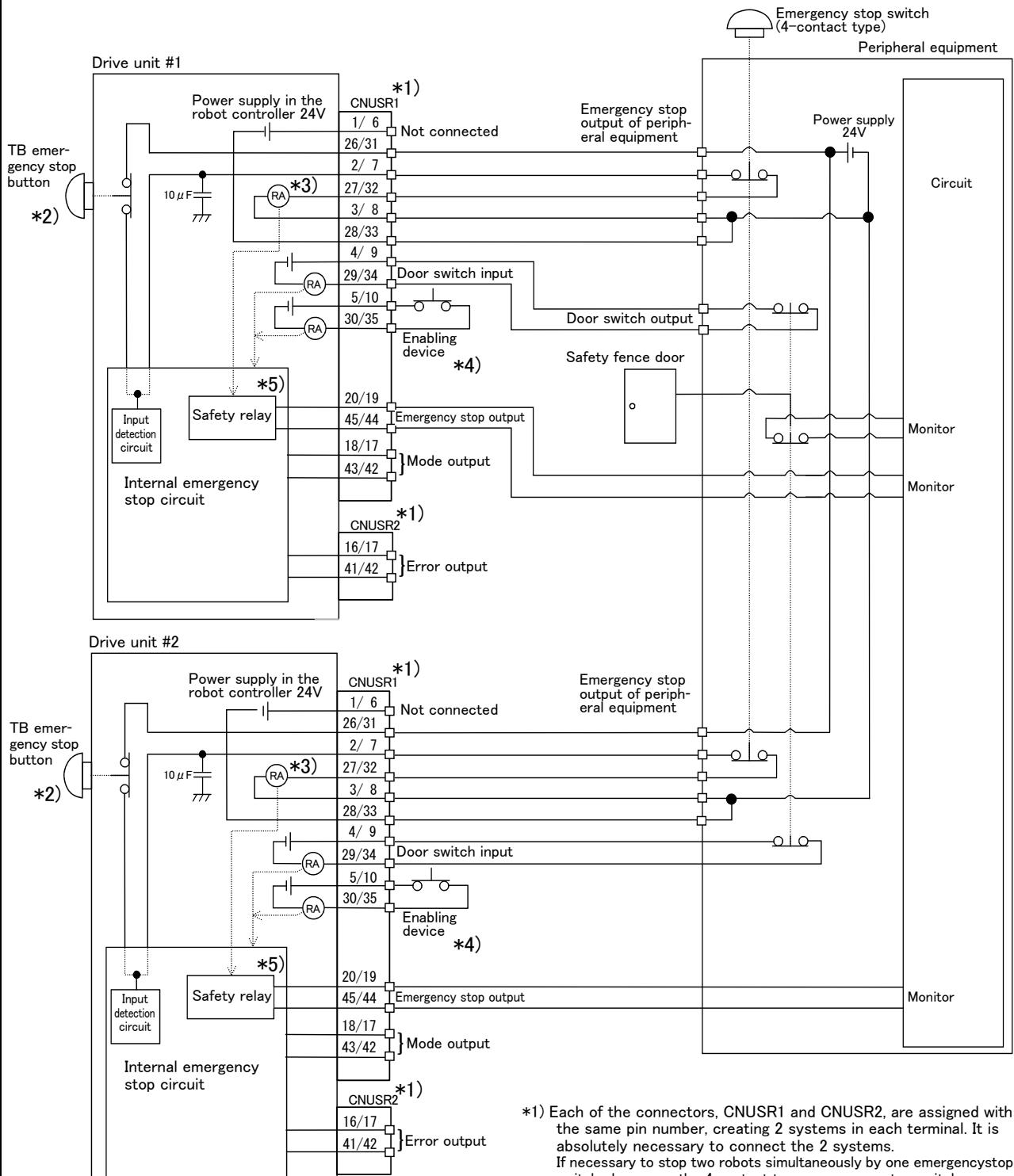
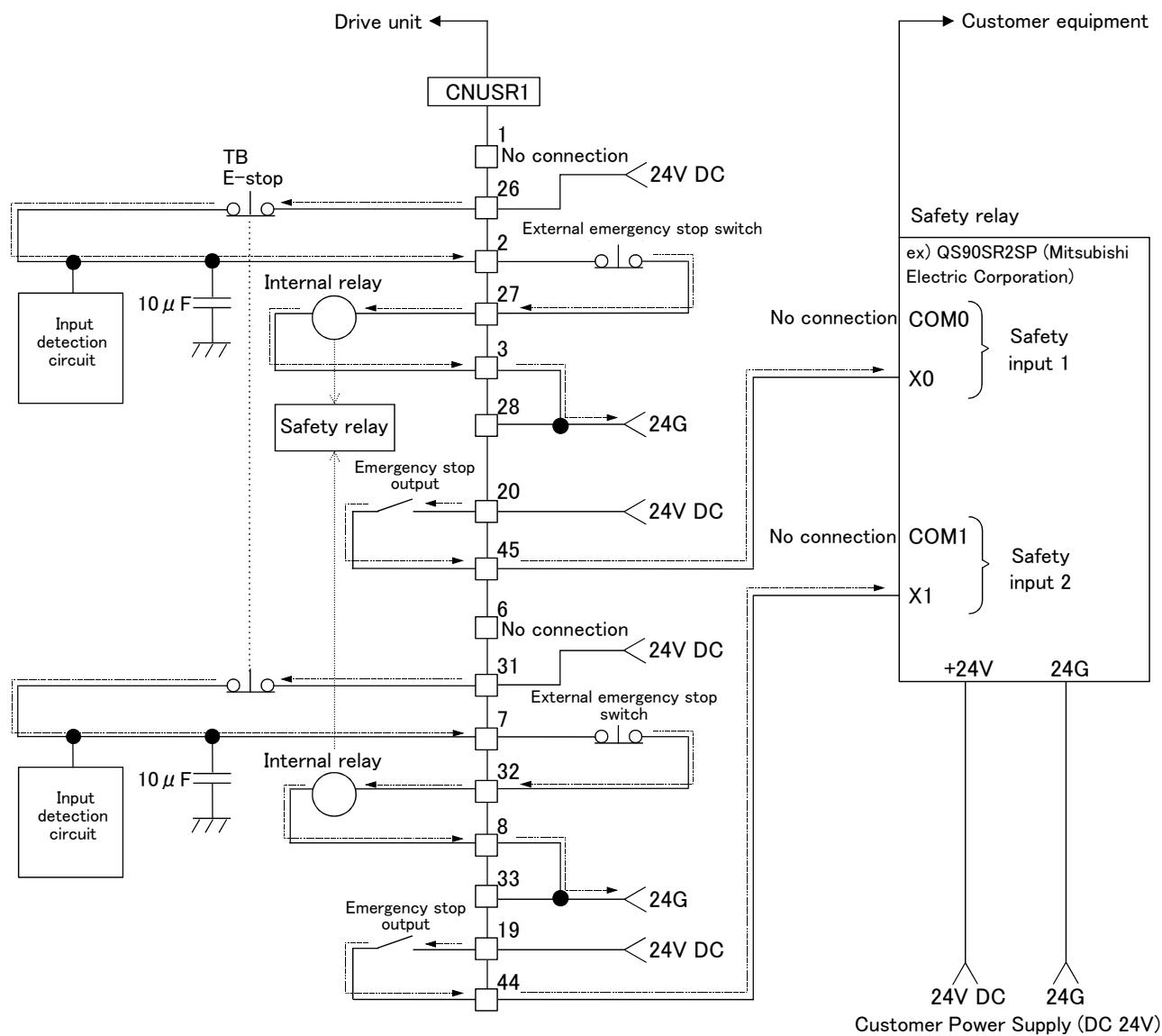


Fig.2-39 : Example of safety measures (Wiring example 4)

<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.2-40 : Example of safety measures (Wiring example 5)

(3) CR760 drive unit

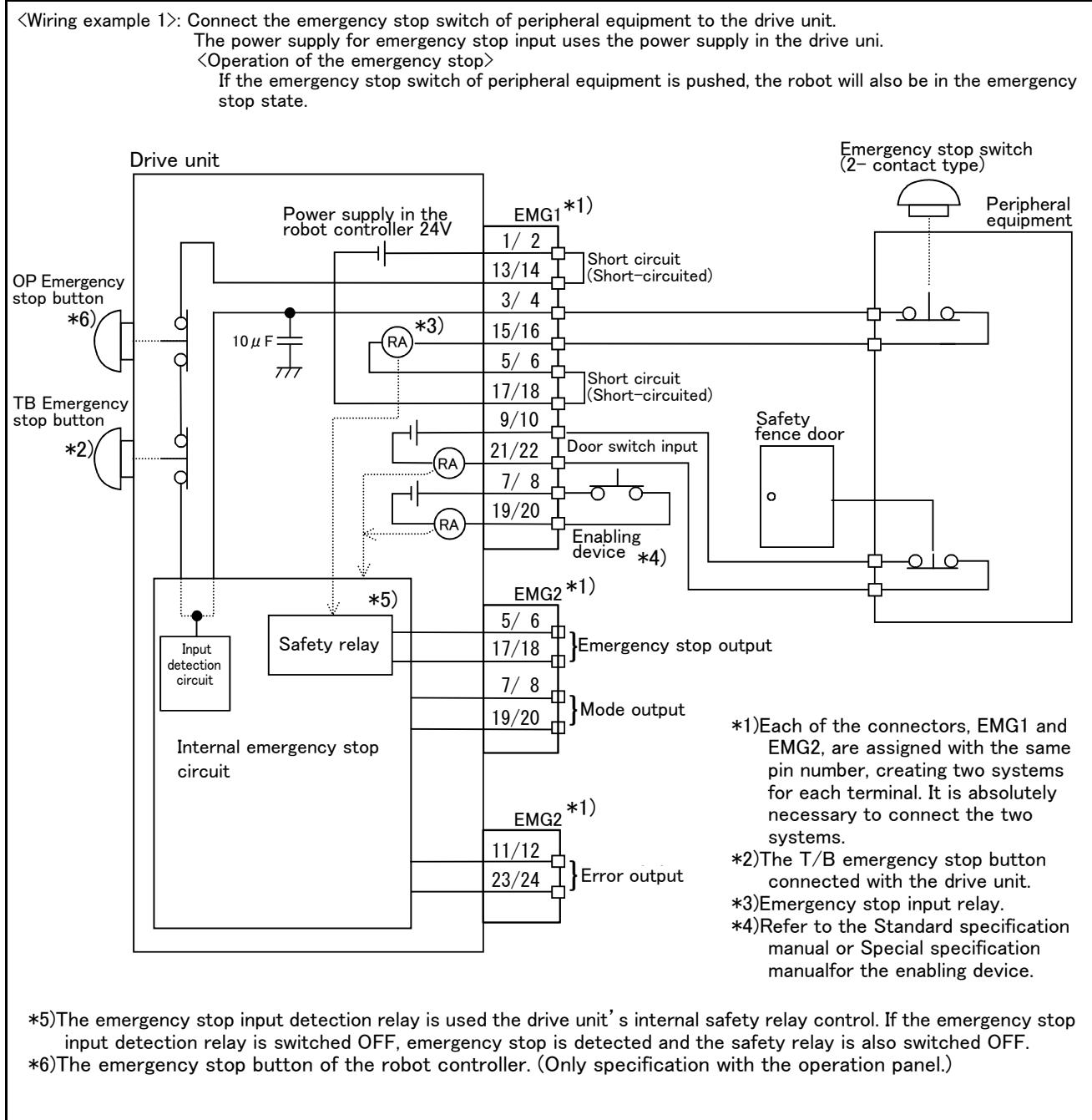


Fig.2-41 : Example of safety measures (Wiring example 1)

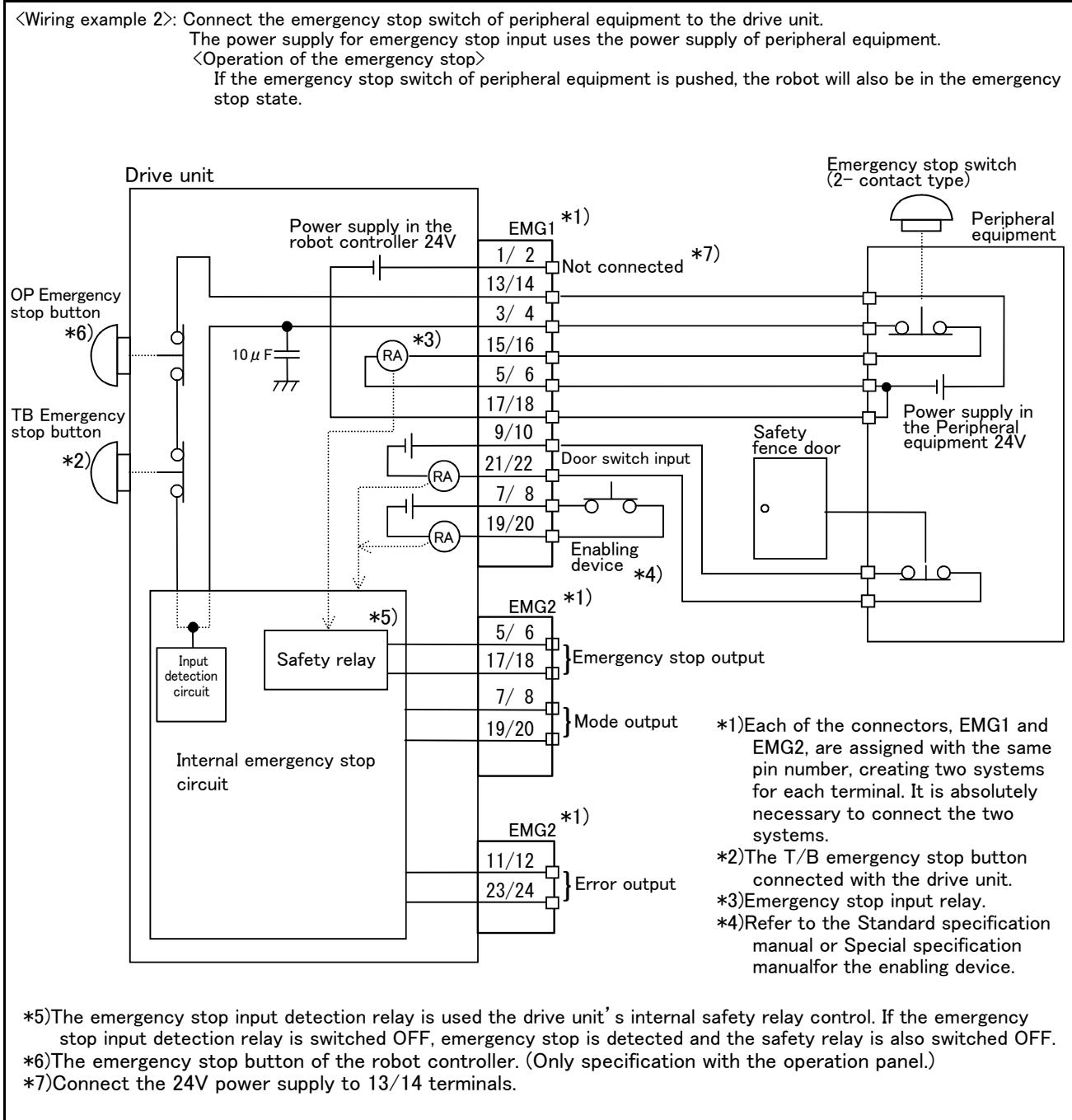


Fig.2-42 : Example of safety measures (Wiring example 2)

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

<Operation of the emergency stop>

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

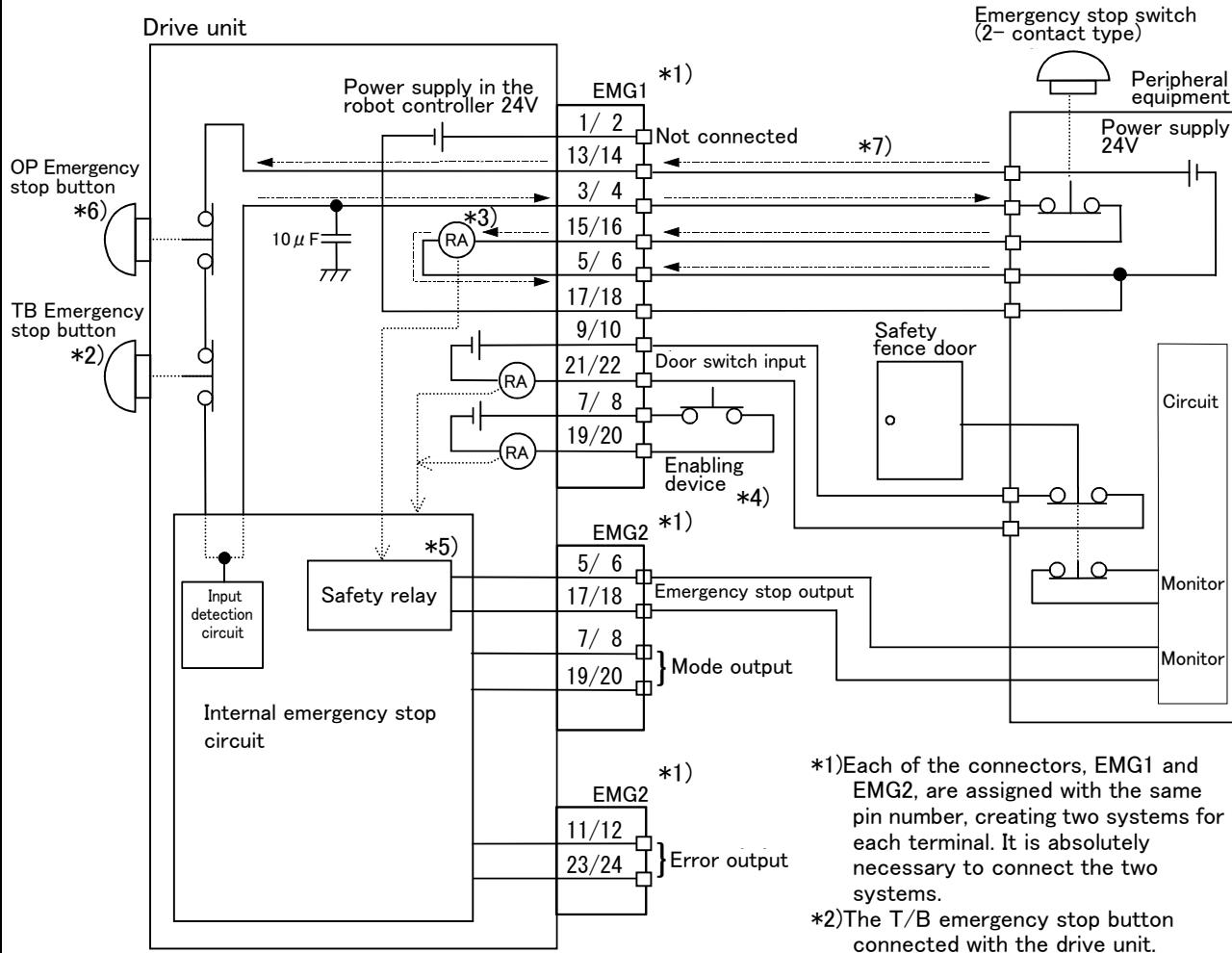
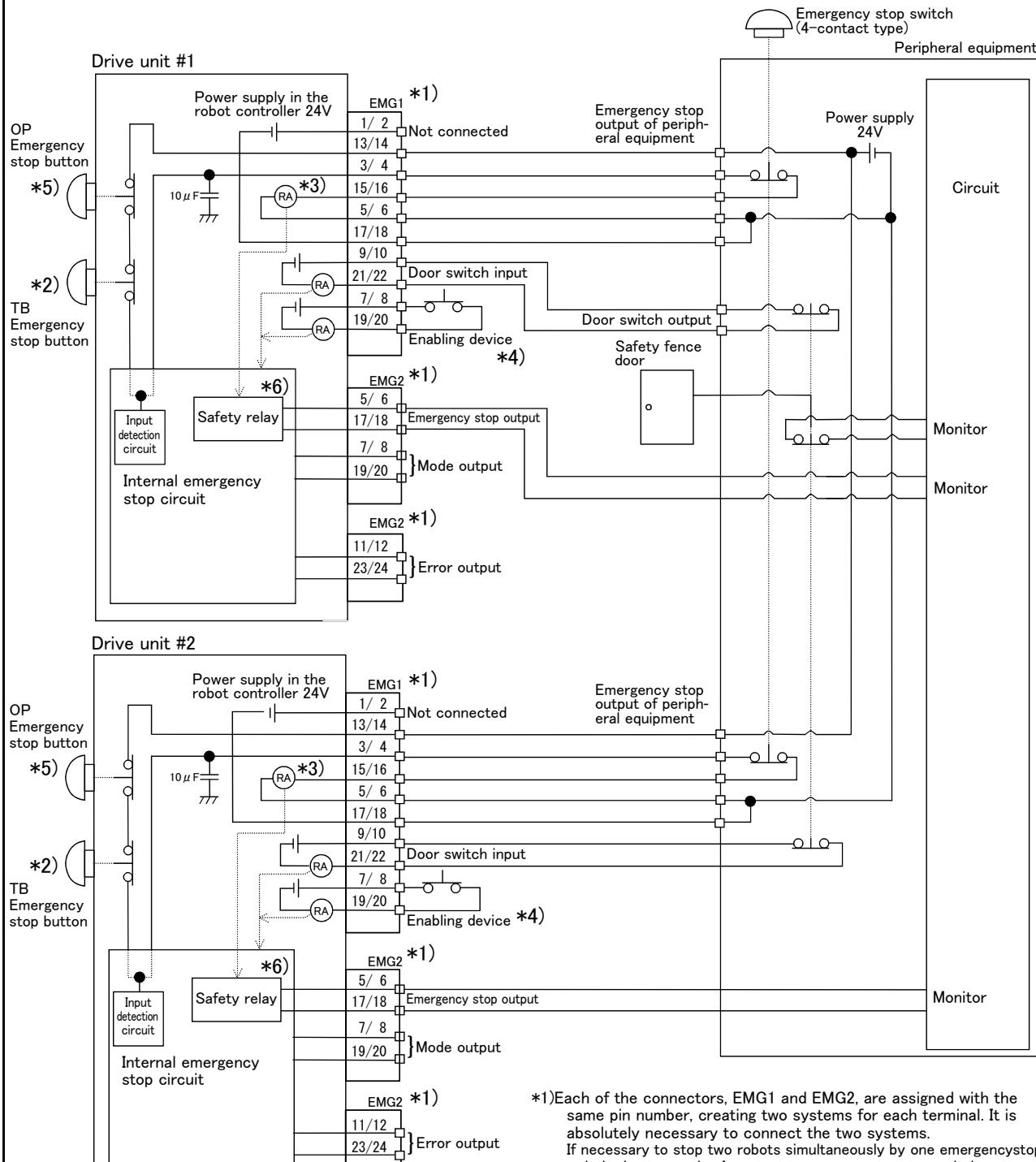


Fig.2-43 : Example of safety measures (Wiring example 3)

<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.



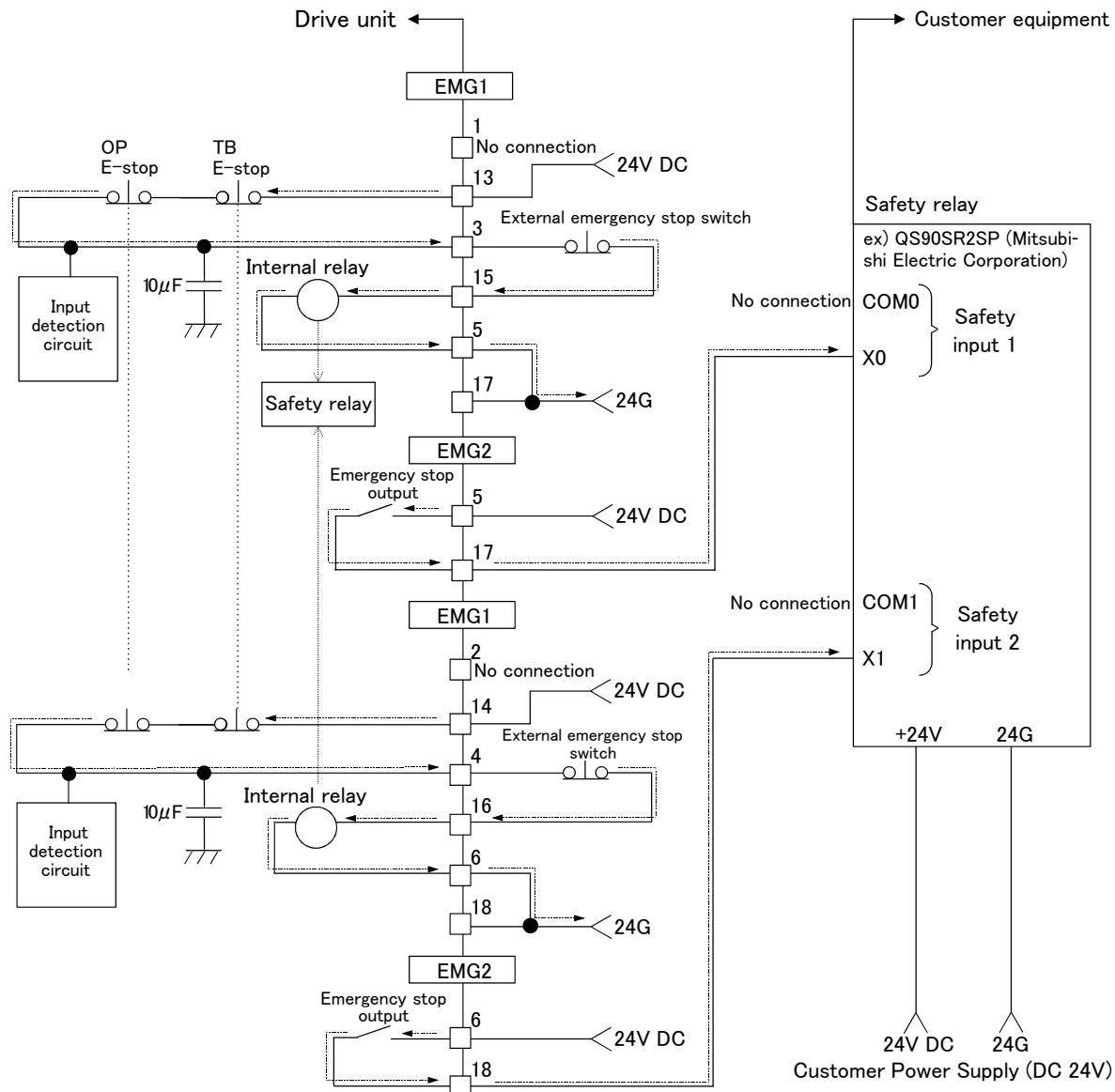
*4) Refer to the Standard specification manual or the Special specification manual for the enabling device.

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

*6) 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.2-44 : Example of safety measures (Wiring example 4)

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



[Caution]

- 1) This product has category 3 functionality and therefore the robot's whole unit cannot be set to category 4.
- 2) The controller's internal circuit has polarity. Please adhere to the polarity as detailed in the wiring examples, particularly for emergency stop button output when using user equipment. Connect the positive side of the user equipment (24V DC) to the two terminals 13/14 of EMG1, then connect the emergency stop button (or contact points) in the user equipment to the 3-15 and 4-16 terminals of EMG1, and ultimately connect the negative side (24G).
- 3) When installing a safety relay to use it as an input point of the controller's emergency stop button command, use a safety relay that is activated by an input from one of the two systems (i.e. QS90SR2SP (Manufacture: Mitsubishi Electric Corporation)).
- 4) The emergency stop input detection relay (internal relay) uses the controller's internal safety relay control. If the emergency stop input detection relay is switched OFF, emergency stop is detected and the safety relay is also switched OFF.
- 5) When connecting emergency stop button output to an external safety relay, please take note of the polarity and make sure that the electrical current flows in the same direction as indicated by the dotted arrows in the two places in the diagram. If the polarity is setup incorrectly, this function will not operate correctly. Please connect the two terminals 5/6 of EMG2 to 24V.

Fig.2-45 : Example of safety measures (Wiring example 5)

(4) External emergency stop connection [supplementary explanation]

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

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

- Switch contact Prepare a 2-contact type.*¹)
- Switch contact capacity..... Use a normal open contact that operates with a switch contact capacity of approx. 1mA to 100mA/24V.*¹)
If you connect the relay etc., rated current of the coil should use the relay which is 100mA/24V or less. (Refer to Fig. 2-47, Fig. 2-46, Fig. 2-48)
- Cable length..... The length of the wire between the switch and terminal block must be max. 15m or less. Please use the shield line, in case of the cable may receive the noise etc. by other equipment, such as servo amplifier. And, since the ferrite core is attached as noise measures parts, please utilize.
The size of the wire that fits to use is shown below.
 - CR750 drive unit..... CNUSR11/12/13 connector:
AWG #26 to #16 (0.14mm² to 1.5mm²)
 - CR750 drive unit..... CNUSR2 connector:
AWG #30 to #24 (0.05mm² to 0.2mm²)
 - CR751 drive unit..... CNUSR1/2 connector:
AWG #30 to #24 (0.05mm² to 0.2mm²)
 - CR760 drive unit..... EMG1/2 connector:
AWG #28 to #16 (0.08mm² to 1.5mm²)

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

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

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

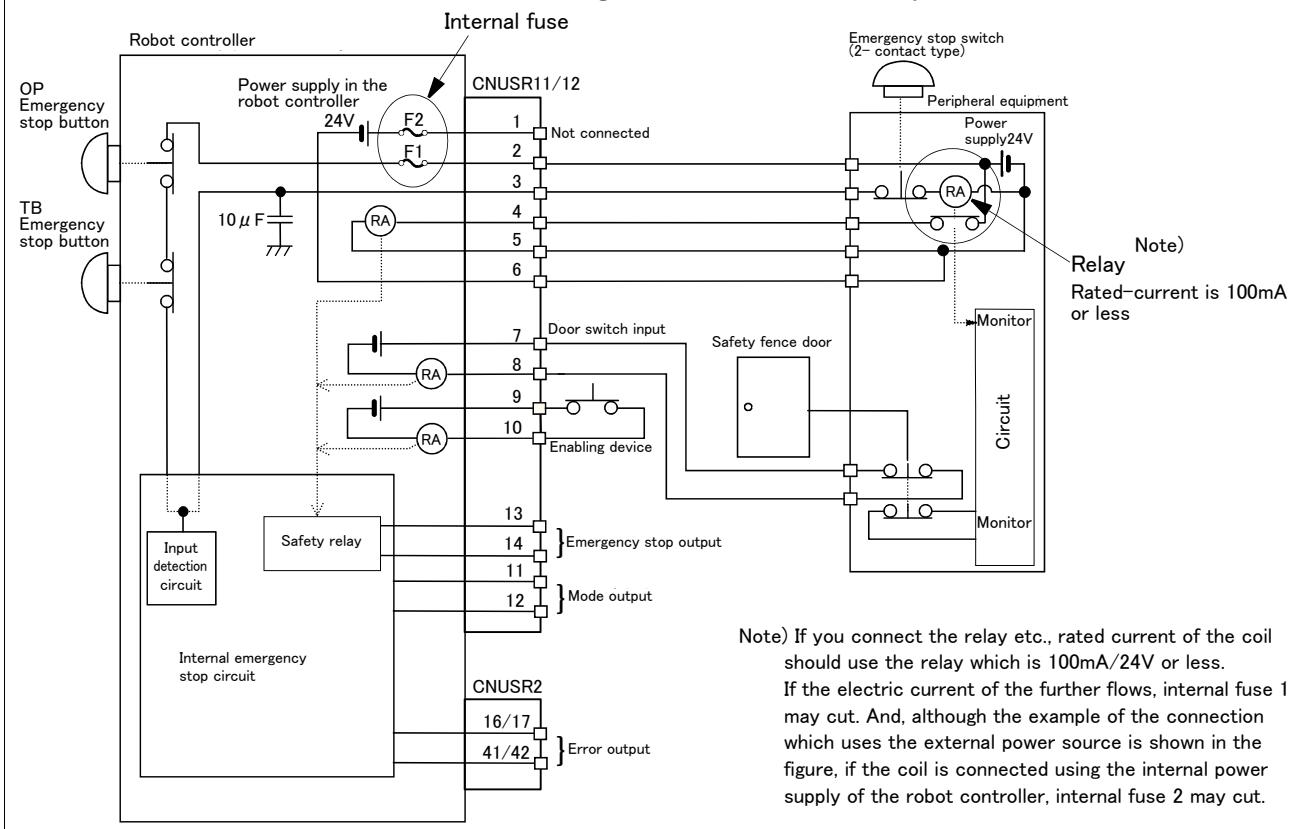


Fig.2-46 : Limitations when connecting the relay etc. (CR750)

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

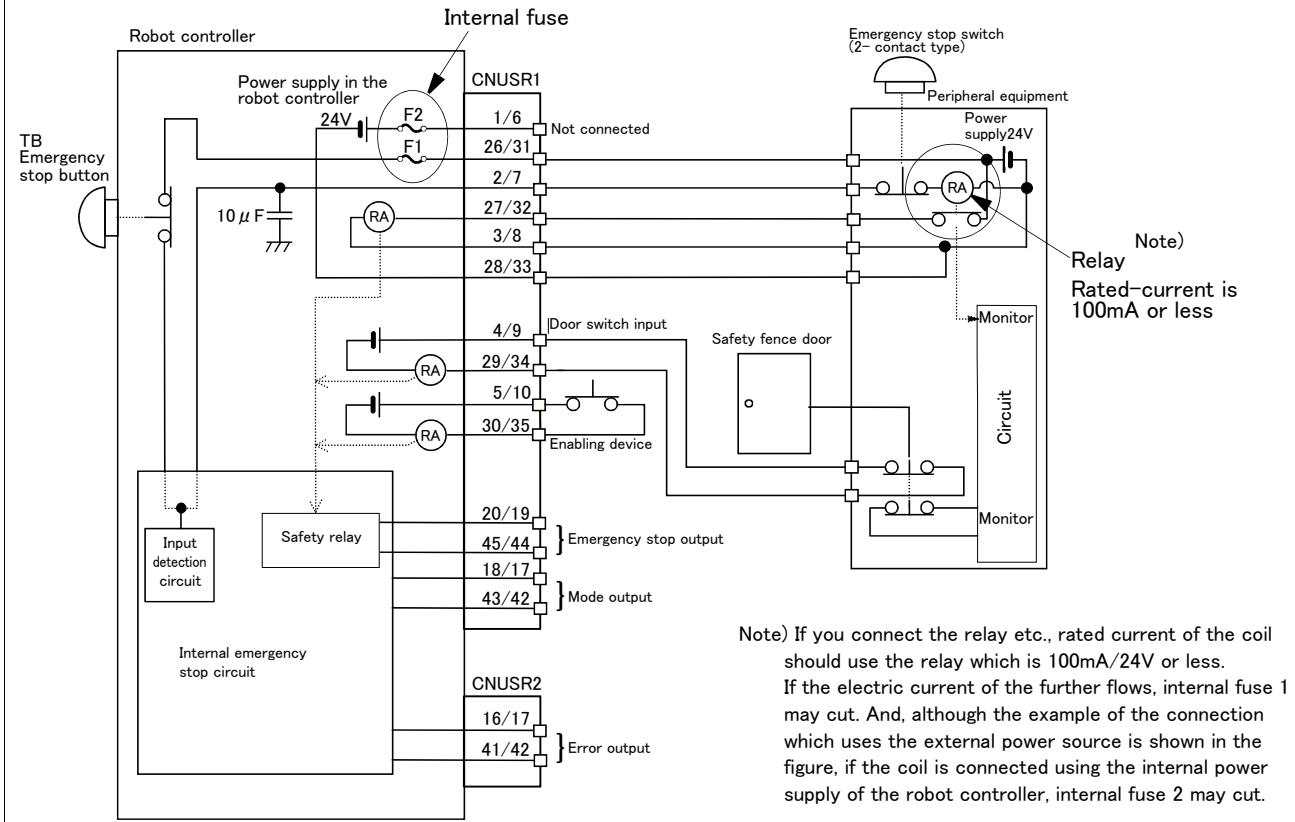


Fig.2-47 : Limitations when connecting the relay etc. (CR751)

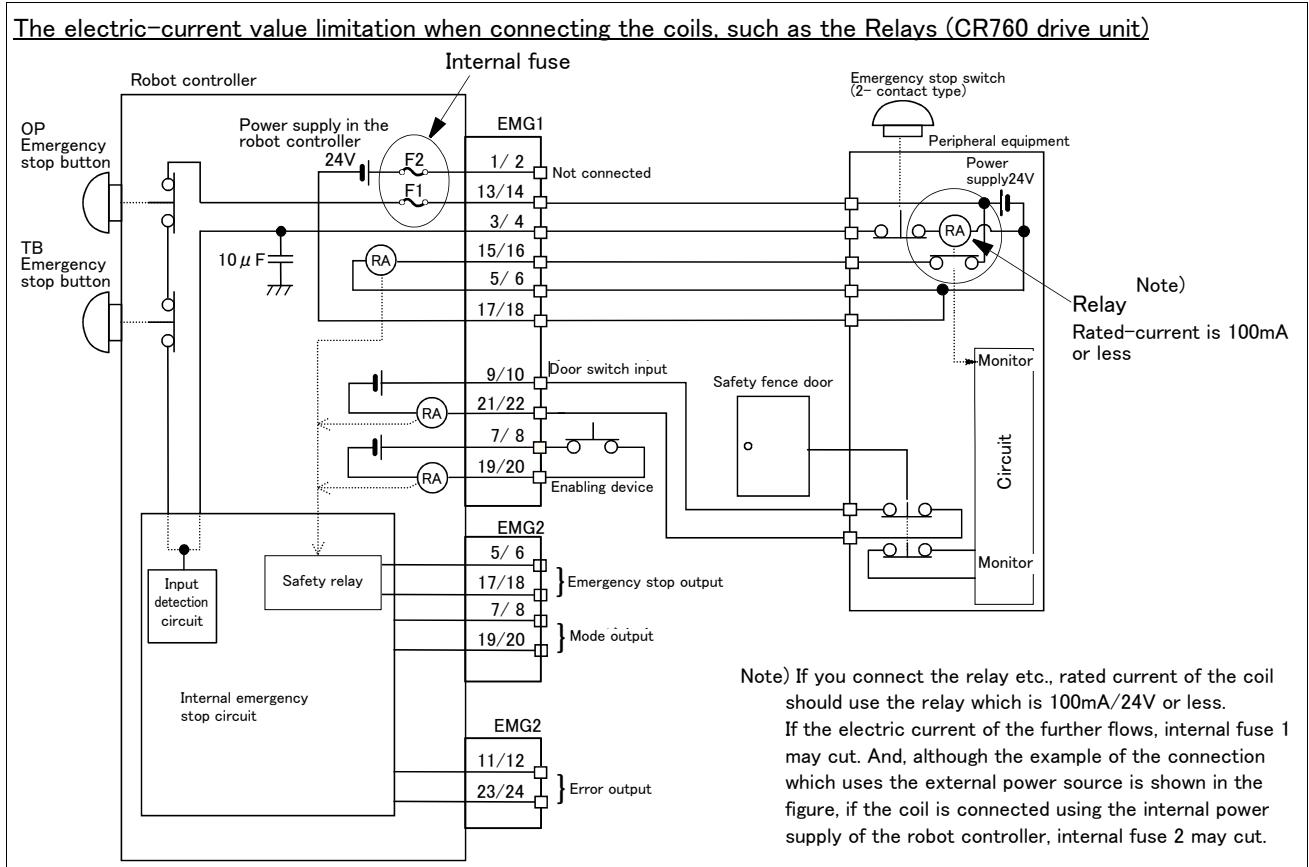


Fig.2-48 : Limitations when connecting the relay etc. (CR760)

[Supplementary explanation regarding emergency stop circuit]

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

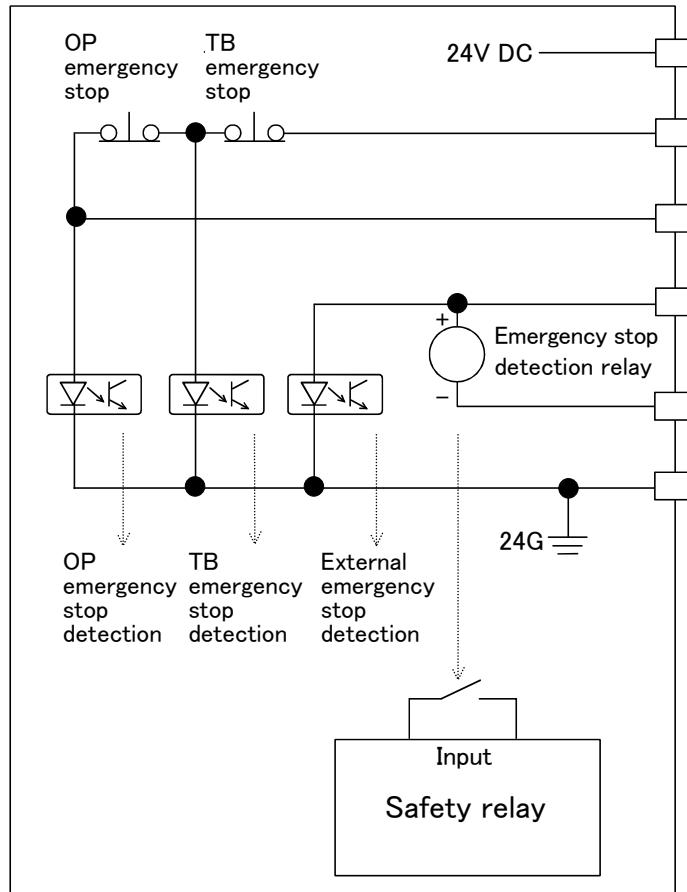


Fig.2-49 : Internal circuit of controller

⚠ CAUTION

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

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

⚠ CAUTION

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

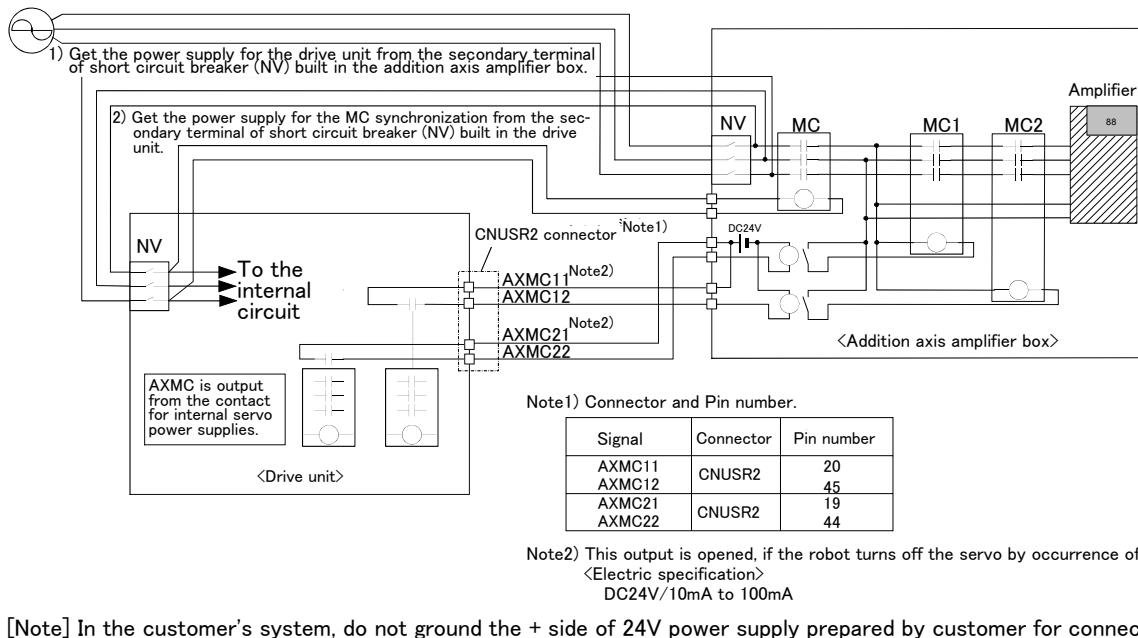
2.3.8 Magnet contactor control connector output (AXMC) for addition axes

When an additional axis is used, the servo ON/OFF status of the additional axis can be synchronized with the servo ON/OFF status of the robot itself by using the output contact (AXMC) provided on the rear or inside of the 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.

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.

(1) Example circuit

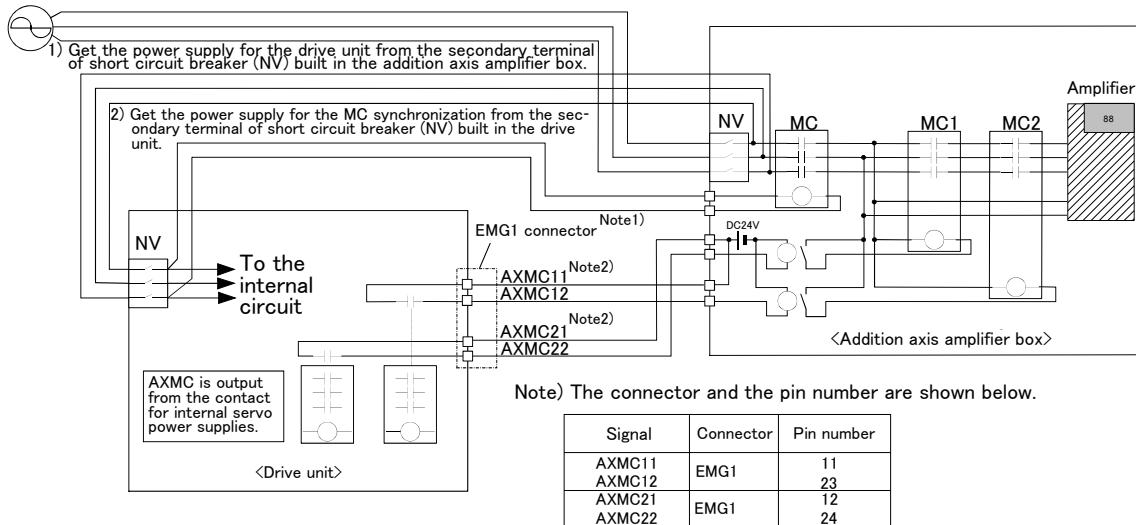
■ CR750/CR751 drive unit



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

Fig. 2-50 : Example of circuit for addition axes of Magnet contactor control output (CR750/CR751 dirve unit)

■ CR760 drive unit



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

Fig. 2-51 : Example of circuit for addition axes of Magnet contactor control output (CR760 drive unit)

(2) Image of how to connect the controller connector

■ CR750 drive unit

<CR750 drive unit>

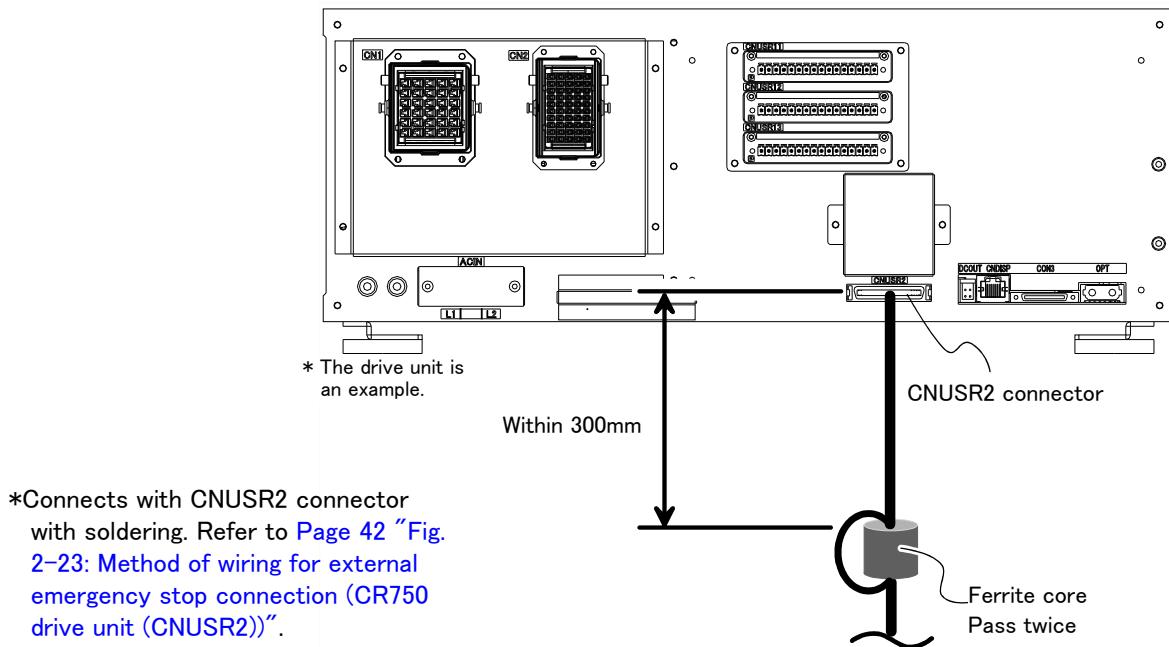
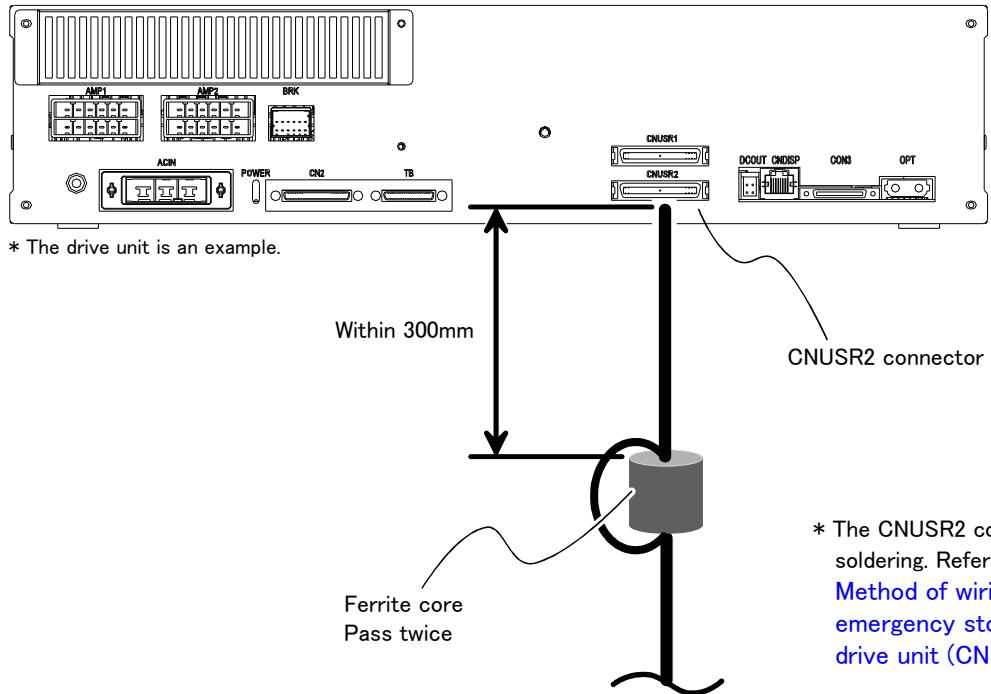


Fig. 2-52 : AXMC terminal connector (CR750)

■ CR751 drive unit

<CR751 drive unit>

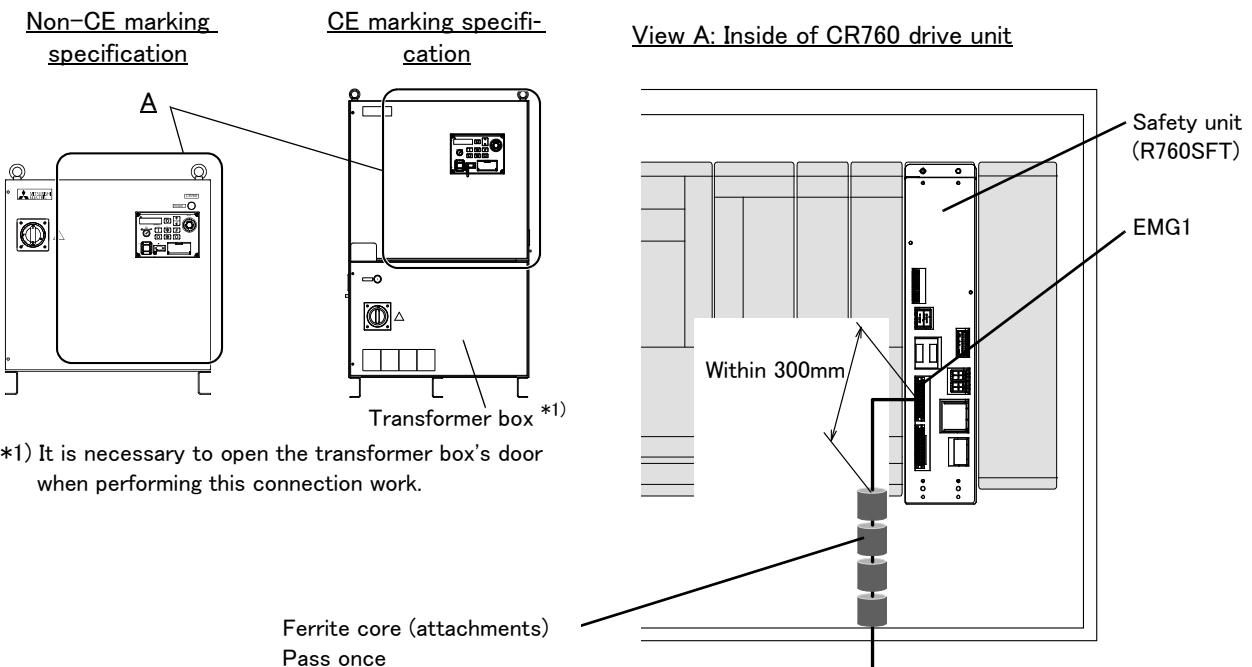


* The CNUSR2 connector is connected by soldering. Refer to [Page 47 "Fig. 2-26: Method of wiring for external emergency stop connection \(CR751 drive unit \(CNUSR1/2\)\)"](#).

Fig. 2-53 : AXMC terminal connector (CR751)

■ CR760 drive unit

<CR760drive unit>



* Connection method is the same as the connection of emergency stop.
Refer to [Page 48 "Fig. 2-27: External emergency stop connection \(CR760\)"](#).

Fig.2-54 : AXMC terminal connector (CR760)

2.3.9 Connecting to the robot arm

Refer to the separate manual "Robot arm setup and maintenance", and connect the drive unit and robot arm with machine cables.

2.3.10 Noise suppression for the CR760 CE marking specification

An example of noise suppression for the CR760 CE marking specification is shown below.

Perform noise suppression around the robot controller (if necessary).

- 1) Insert the six ferrite cores in both end of the CN1 and CN3 cable.

Recommended ferrite core: GTFC-41-27-16 (Manufacturer: KITAGAWA INDUSTRIES Co., Ltd.)

- 2) Insert the three ferrite cores in both end of the CN2 cable.

Recommended ferrite core: E04SR401938 (Manufacturer: Seiwa Electric Mfg. Co., Ltd.)

- 3) Add FG cable to the robot controller.

Recommended cable: ZSK-12HF (Manufacturer Zippertubing (Japan),Ltd.)

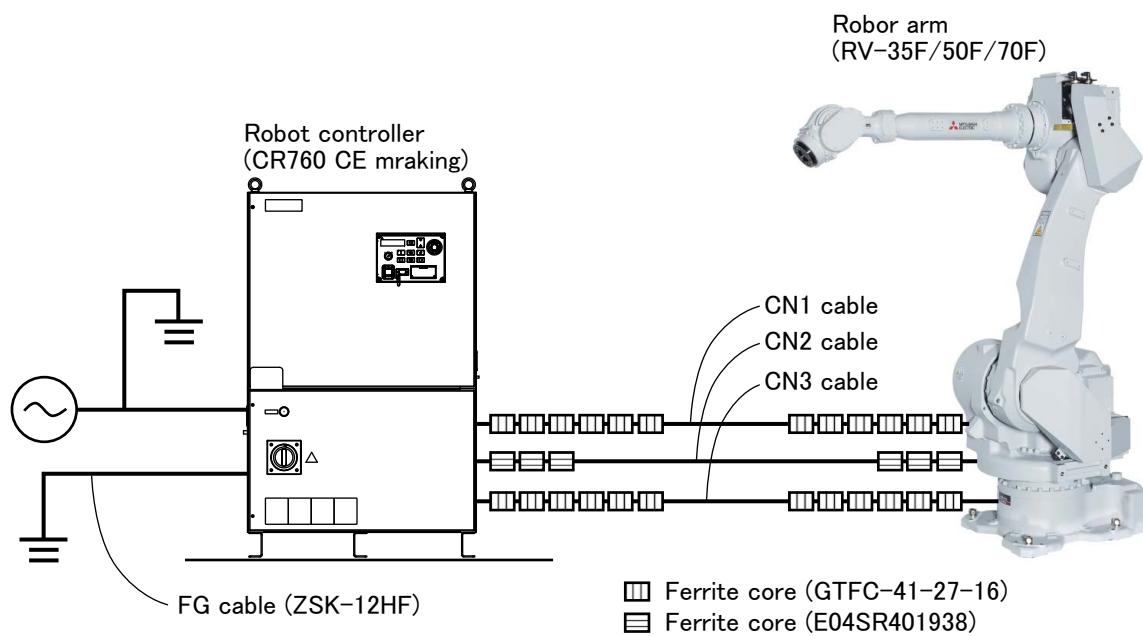


Fig.2-55 : Noise suppression for CR760 CE marking specification

2.4 Setting the origin

Refer to the separate manual "Robot arm setup and maintenance", and set the origin.

2.5 Confirming the operation

Refer to the separate manual "Robot arm setup and maintenance", and confirm the robot operation with jog operation.

3 Installing the option devices

Refer to [Page 86, “4.2.1 Installing and removing the T/B”](#) for installing method of T/B. Refer to the separate “Standard Specifications” or each option’s manual for the optional devices other than those described in this manual.

4 Basic operations

In this chapter, the following items will be explained regarding the basic operations for handling the robot.

Handling the drive unit

The functions of the various keys on the drive unit are explained.

Handling the teaching pendant

The methods of installing/removing the T/B, and the functions of the various keys are explained.

Turning the power ON/OFF

The items to confirm before turning on the controller power, and the methods of turning the power ON and OFF are explained.

Operating the robot with jog operation

The methods for manually operating the robot arm using the teaching pendant are explained. This is mainly used for teaching work.

Opening and closing the hand

The methods of opening and closing the hand using the teaching pendant are explained.

Program creation to automatic operation

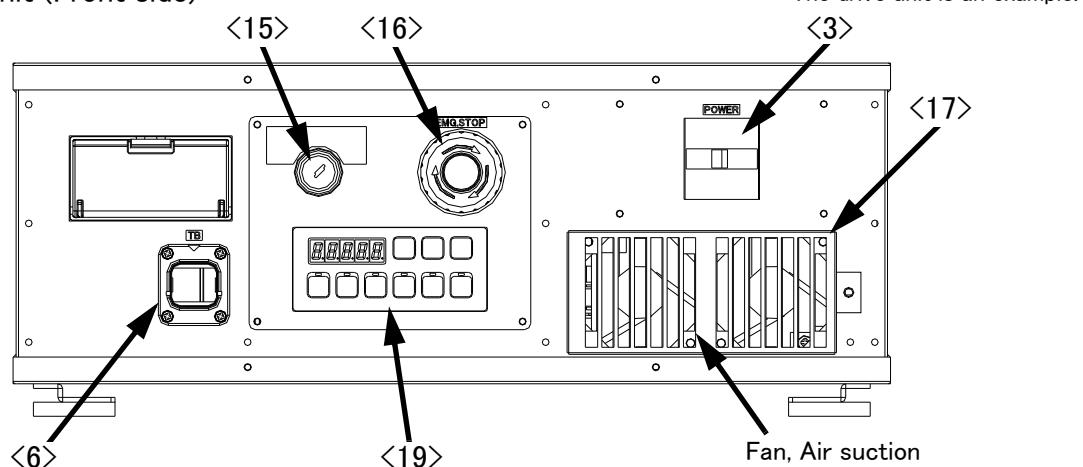
The procedures of creating the program are explained in order.

4.1 Handling the drive unit

4.1.1 Names of each parts

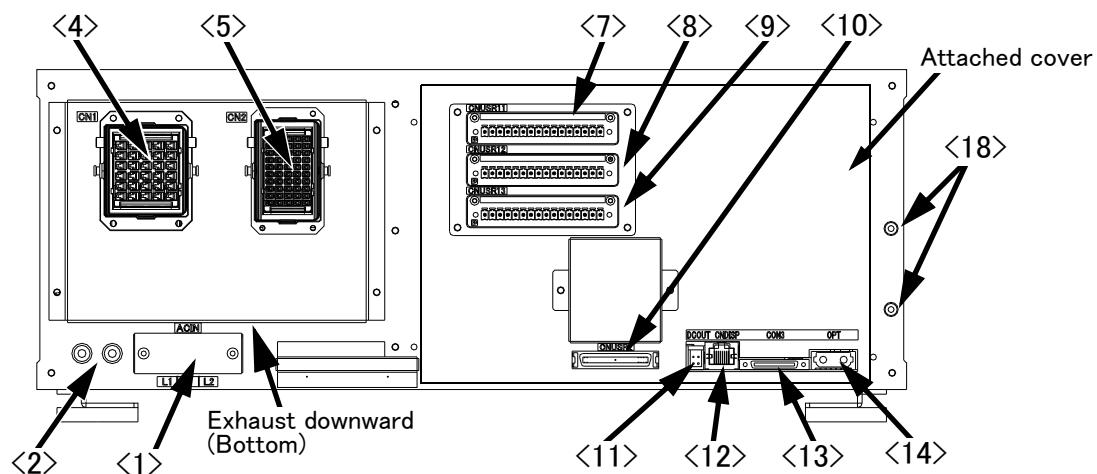
(1) CR750 drive unit

Drive unit (Front side)

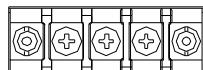


* The drive unit is an example.

Drive unit (Rear side)



<1>: ACIN terminal



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

<19>: The operation panel

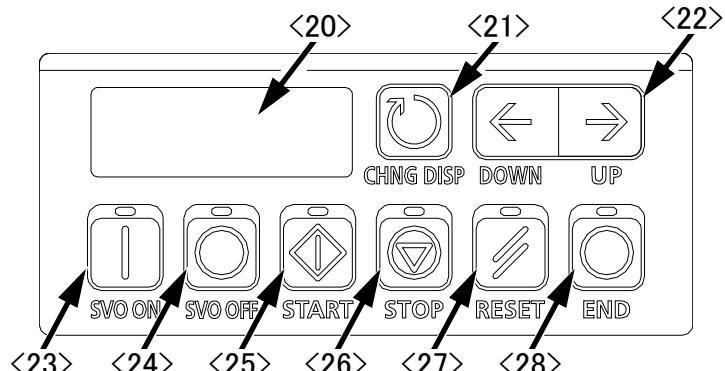
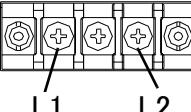
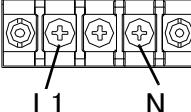
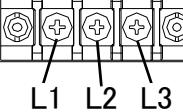


Fig.4-1 : Names of drive unit parts (CR750)

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

Model	Non-CE specification	CE specification
RV-2F series RV-4F/4FL series RV-4FJL series RH-3FH series RH-6FH series RH-3FHR series	<u>Type A:</u> For single phase  Connect the primary power supply to L1 and L2 terminal.	<u>Type C:</u> For single phase  Connect the primary power supply to L1 and N terminal.
RV-7F/7FL series RV-7FLL series RV-13F/13FL series RV-20F series RH-12FH series RH-20FH series	<u>Type B:</u> For single phase/three phase  When using the three phase primary power supply, connect to L1, L2, and L3 terminal. When using the single phase primary power supply, connect to L1 and L3 terminal.	

Refer to [Page 26, "\(1\) CR750 drive unit"](#) for how to connect a power cable.

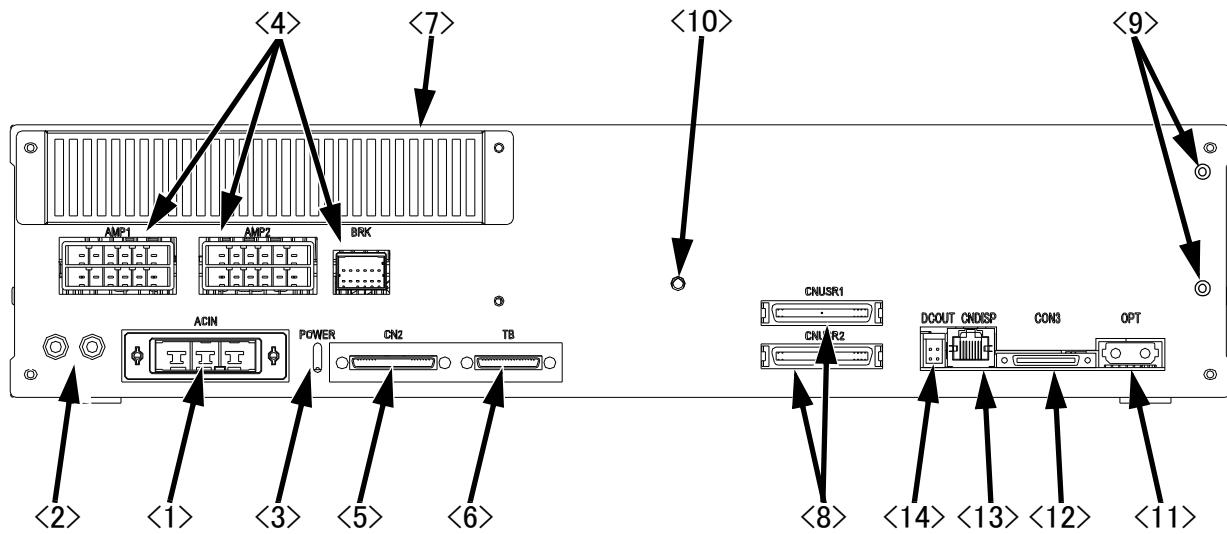
- <2> PE terminalThe screw for grounding of the cable. (M4 screw x 2 place)
- <3> Power switchThis turns the control power ON/OFF
- <4> Machine cable connector (motor signal) (CN1)
Connect with the CN1 connector of the robot arm.
- <5> Machine cable connector (motor power) (CN2)
Connect with the CN2 connector of the robot arm.
- <6> T/B connection connector (TB)This is a dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.
- <7><8><9><10> CNUSR connectorThe connector for input/ output connection dedicated for robot. (a plug connector attached)
<7>; CNUSR11, <8>; CNUSR12, <9>; CNUSR13, <10>; CNUSR2
Refer to [Page 37, "\(1\) CR750 drive unit"](#) for the connection method and the further description of pin assign.
Note) <9>; CNUSR13 connector is not used in this controller.
- <11> DCOUT connector (DCOUT)For emergency stop
- <12> CNDISP connector (CNDISP)For LAN of T/B connection
- <13> CON3 connector (CON3)For RS422 of T/B connection
- <14> OPT connector (OPT)For SSCNETIII connection
- <15> Mode key switchThis key switch changes the robot's operation mode.
AUTOMATICOperations from the controller or external equipment are valid. Operations for which the operation mode must be at the external device or T/B are not possible. (Exclude the start of automatic operation.)
MANUALWhen the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device or controller are not possible.
- <16> Emergency stop switchThis switch stops the robot in an emergency state. The servo turns OFF.
- <17> Filter coverThere is an air filter inside the cover.
- <18> Grounding terminalThe grounding terminal for connecting cables of option card. (M3 screw x 2 places)
- <19> Operation panelThe operation panel for servo ON/OFF, START/STOP the program etc.
- <20> Display panel (STATUS.NUMBER)The alarm No., program No., override value (%), etc., are displayed.
- <21> CHNGDISP buttonThis button changes the details displayed on the display panel in the order of "Override" → "Program No." → "Line No."
- <22> UP/DOWN buttonThis scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.

- <23> SVO.ON button This turns ON the servo power. (The servo turns ON.)
- <24> SVO.OFF button..... This turns OFF the servo power. (The servo turns OFF.)
- <25> START button..... This executes the program and operates the robot. The program is run continuously.
- <26> STOP button This stops the robot immediately. The servo does not turn OFF.
- <27> RESET button This resets the error. This also resets the program's halted state and resets the program.
- <28> END button This stops the program being executed at the last line or END statement.

(2) CR751 drive unit

Drive unit (Front side)

* The drive unit is an example.



Controller (Rear side)

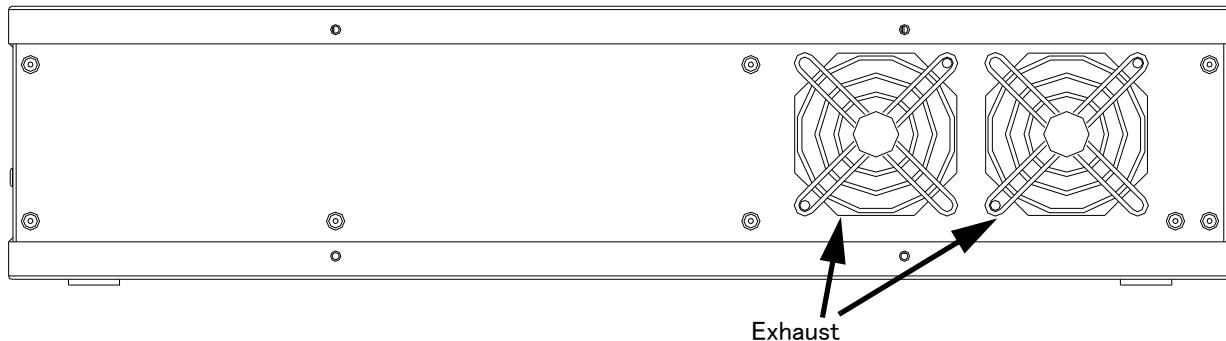


Fig.4-2 : Names of drive unit parts (CR751)

- <1> ACIN connectorThe connector for AC power source (single phase, AC200V) input (a socket housing and a terminal are attached)
Refer to [Page 27, "\(2\) CR751 drive unit"](#) for how to connect a power cable.
- <2> PE terminalThe screw for grounding of the cable. (M4 screw x 2 place)
- <3> POWER lampLamp of control power source
- <4> Machine cable connector (motor power)
AMP1, AMP2: Motor power, BRK: Motor brake
- <5> Machine cable connector (motor signal)
CN2: Motor signal
- <6>T/B connection connector (TB)This is a dedicated connector for connecting the R33TB. When not using T/B, connect the attached dummy plug.
- <7>Filter coverThere is an air filter inside this cover.
- <8>CNUSR connector.....The connector for input/ output connection dedicated for robot.
(CNUSR1、CNUSR2)
Refer to [Page 43, "\(2\) CR751 drive unit"](#) for the connection method and the further description of pin assign.
- <9>Grounding terminalThe grounding terminal for connecting cables of option card. (M3 screw x 2 places)
- <10>Power supply charge lamp (CRARGE)
The lamp is to ensure safe timing (prevent electric shocks) when removing the cover (users are not normally required to remove the cover).
This lamp is illuminated (red) when electrical energy accumulates on the

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

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

(3) CR760 drive unit

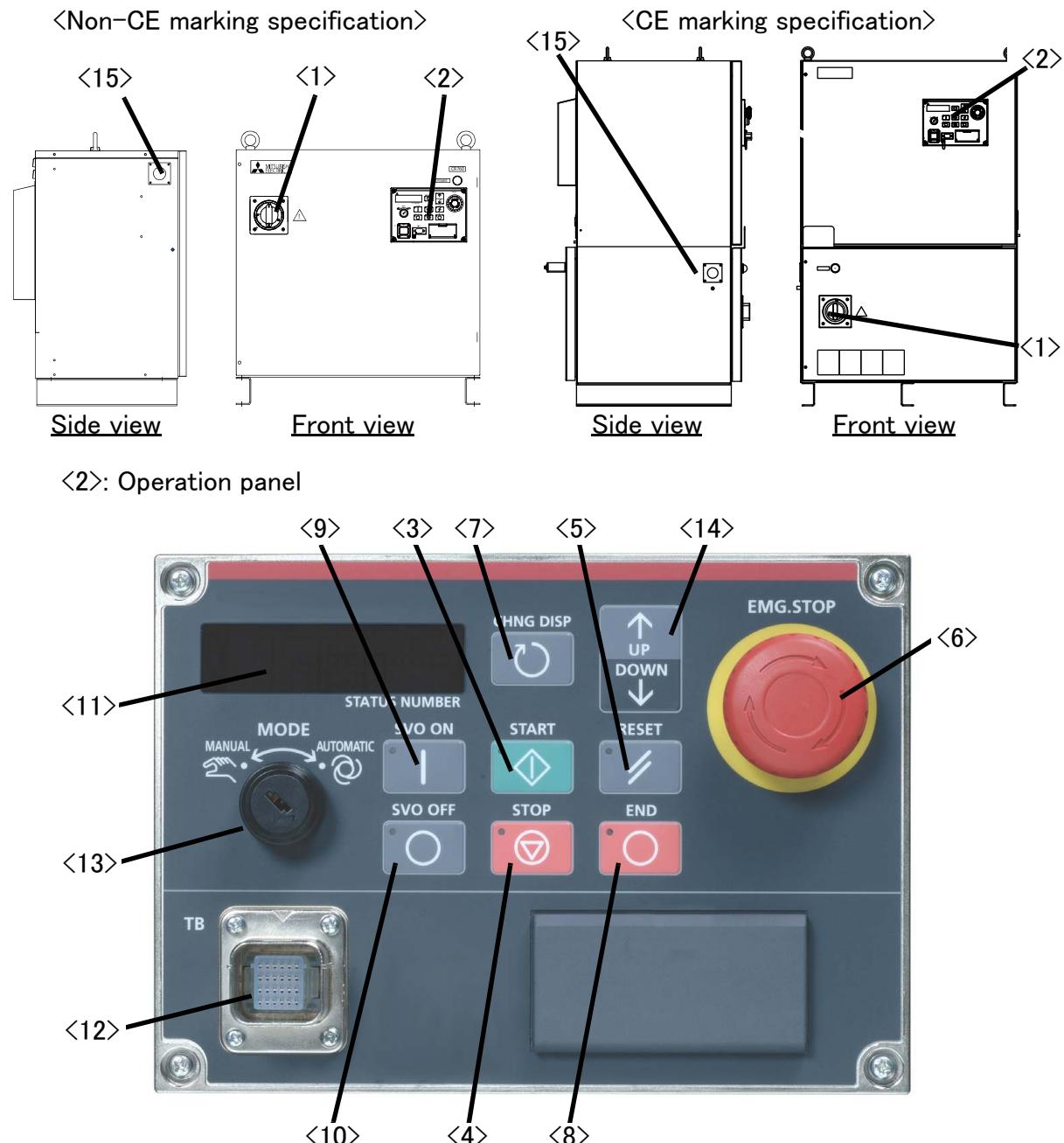


Fig.4-3 : Names of drive unit parts (CR760)

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

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

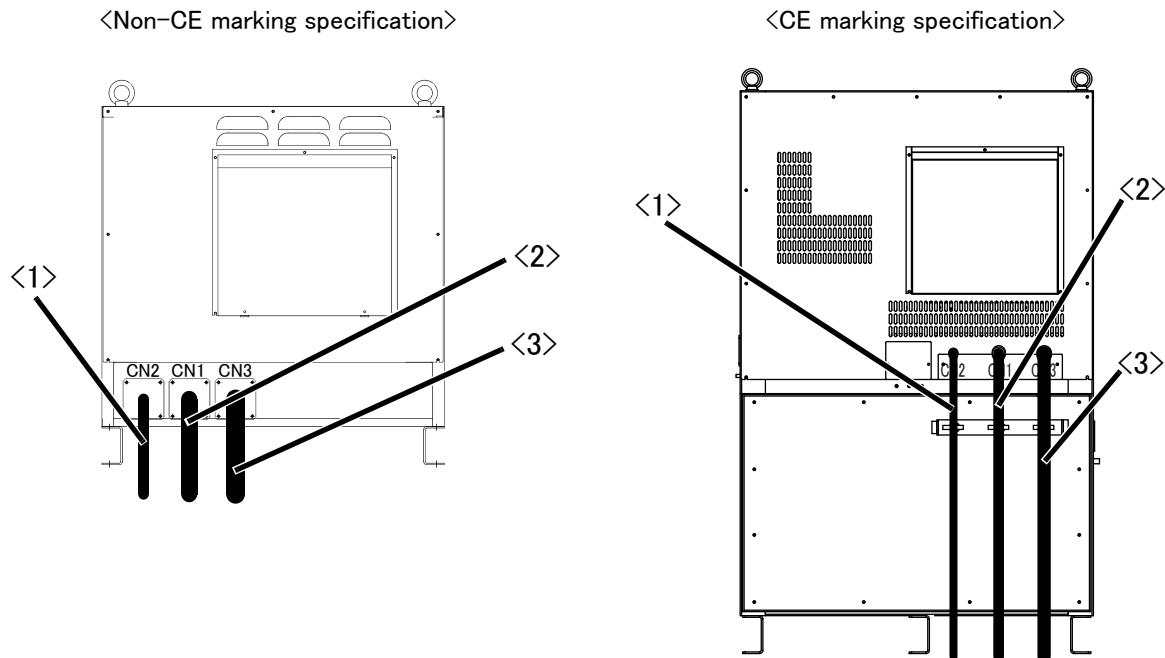


Fig.4-4 : Names of drive unit parts (Rear of CR760)

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

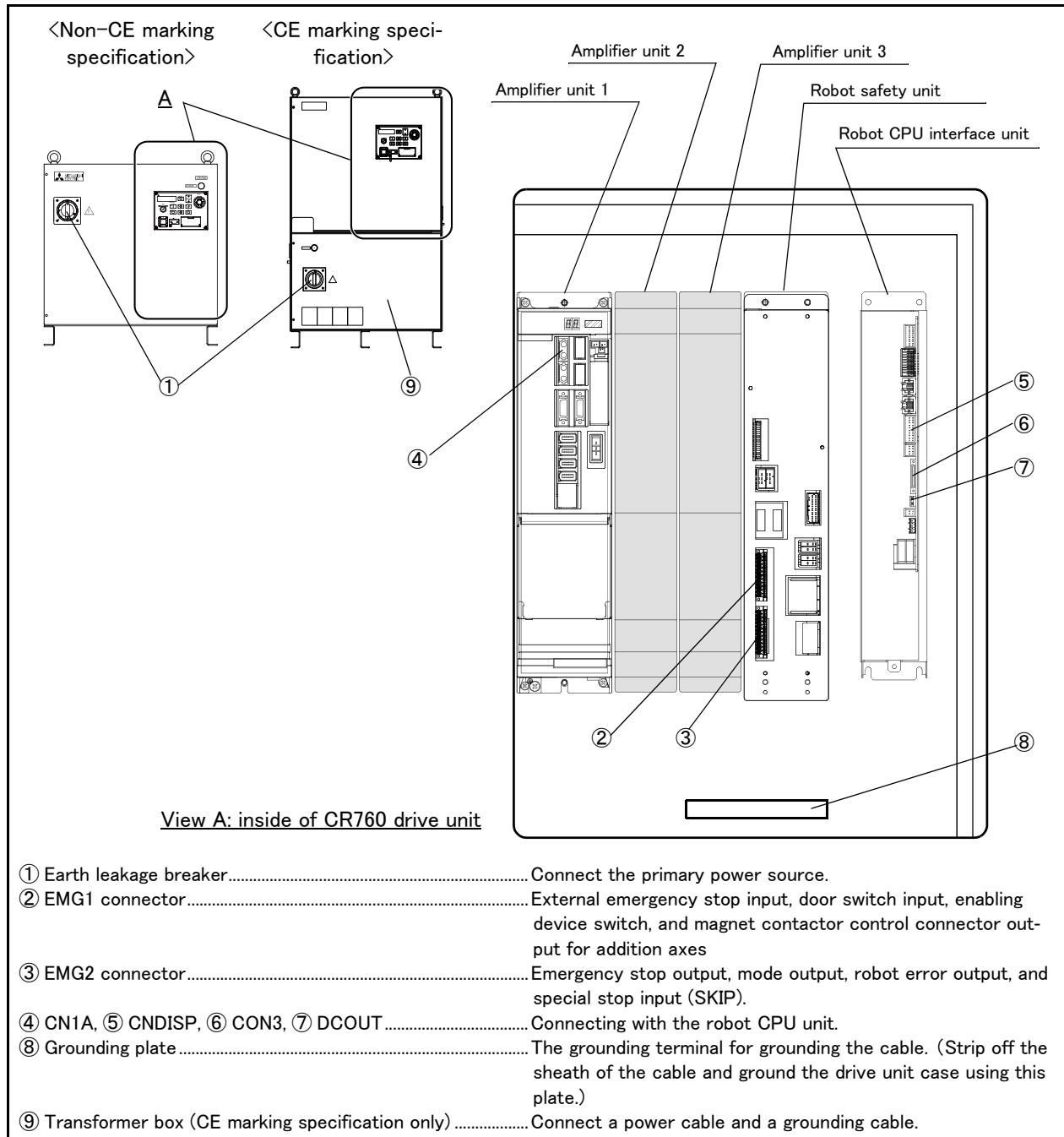


Fig.4-5 : Names of drive unit parts (inside of CR760)

◇◆◇ What are the operation rights? ◇◆◇

Even when multiple devices, such as a T/B and personal computer, are connected to the controller, the operation at one time is limited to one device. This limited device (has the operation rights)

◇◆◇ What operations require the operation rights? ◇◆◇

Operations that start the robot, such as program start and alarm reset, and operations that can cause starting require the operation rights. Conversely, operation that stop the robot, such as stopping and servo OFF, can be used without the operation rights for safety purposes. Refer to the separate manual "Explanation of functions and operations" for details on the functions related to operation rights.

4.2 Handling the T/B

4.2.1 Installing and removing the T/B

Installing and removing the T/B, with turning off the drive unit power. If T/B is Installed and removed in the state of control source ON, emergency stop alarm will be occurred.

If you use the robot wherein T/B is removed, install the dummy connector of attachment for the product instead of T/B. Take out and insert the dummy connector with the connector itself.



CAUTION

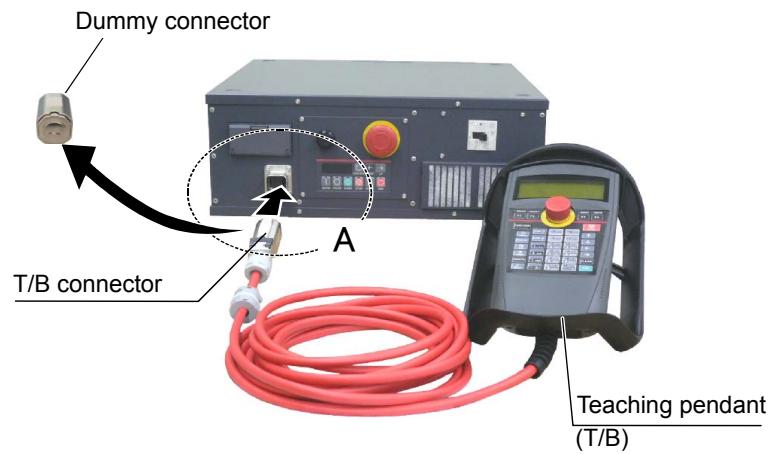
Please do not pull the cable of T/B strongly or do not bend it too much.
It becomes the breaking of a wire of the cable and the cause of breakage of the connector. Please installing and removing so that stress does not start the cable with the connector itself.

(1) Installing the T/B (CR750/CR760 drive unit)

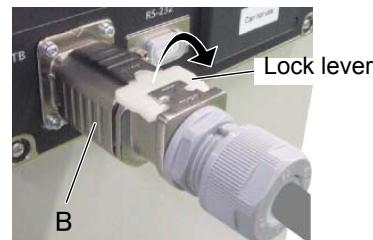
Explain the installation method of T/B below.

- 1) Check that the POWER (power supply) switch of the robot drive unit is OFF.
- 2) Connects T/B connector to the robot drive unit. Use as the upper surface the lock lever shown in Fig. 4-6, and push in until there is sound.

<CR750 drive unit>



Details of the A section



When removing the connector for T/B connection, use lock release (state which raised the lock lever to the up side), make the case of the B section slide to the front, and remove and pull up out the latch.

<CR760 drive unit> Note)



Note) As for CE marking specification of CR760, the transformer box is installed in the controller bottom. Refer to Fig. 4-5.

Fig. 4-6 : Installing and removing the T/B (CR750/CR760 drive unit)

The installation of T/B is finished.

(2) Installing the T/B (CR751 drive unit)

Explain the installation method of T/B below.

- 1) Check that the POWER (power supply) switch of the robot drive unit is OFF.
- 2) Connect the T/B connector to the drive unit's T/B connector. Make sure to fix it securely by fastening the hand locks (in 2 places), as shown in Fig. 4-7.

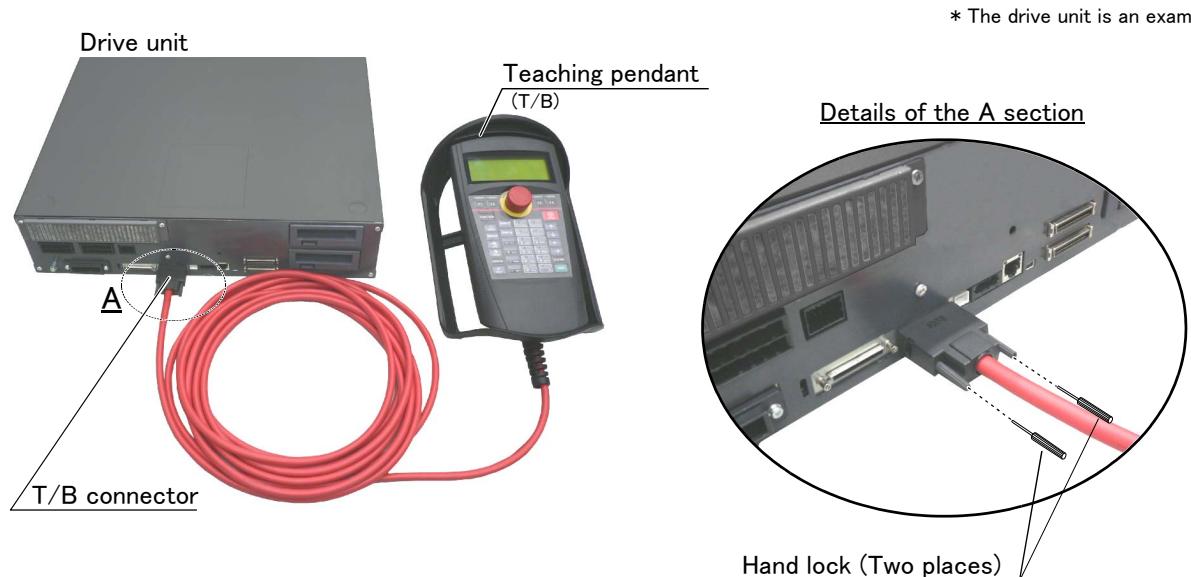


Fig. 4-7 : Installing and removing the T/B (CR751 drive unit)

The installation of T/B is finished.

(3) Removing the T/B (CR750/CR760 drive unit)

Explain the removing method of T/B below.

- 1) Check that the POWER (power supply) switch of the robot drive unit is OFF.
- 2) Raise up the lock lever in the connector upper part, and pull up the connector.
Please install the dummy connector, if you use the robot, without connecting T/B.

The removing of T/B is finished.

(4) Removing the T/B (CR751 drive unit)

Explain the removing method of T/B below.

- 1) Check that the POWER (power supply) switch of the robot drive unit is OFF.
- 2) Loosen the handle locks (two places) of a connector, and pull up the connector.
Please install the dummy connector, if you use the robot, without connecting T/B.

The removing of T/B is finished.

4.2.2 Functions of each key

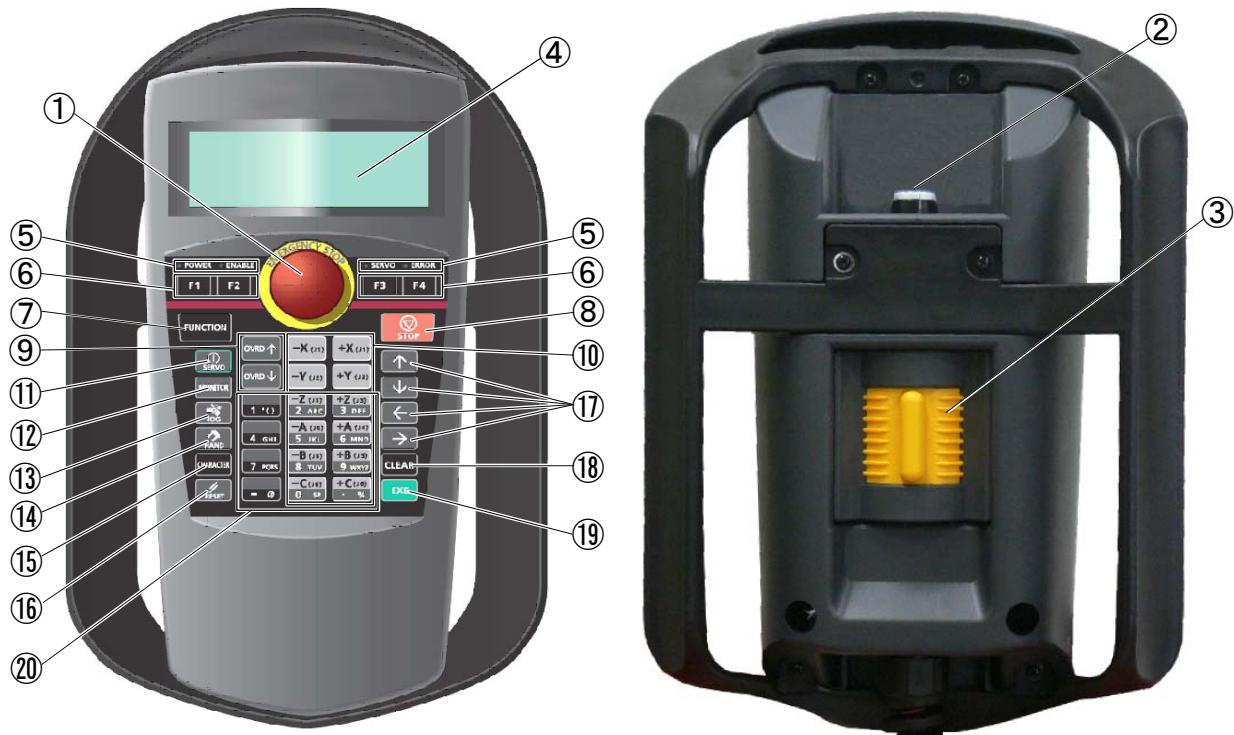


Fig. 4-8 : Teaching pendant

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

◆◆◆ Remove the protection seal of the teaching pendant before using ◆◆◆

Installed the protection seal on the teaching pendant to prevent the damage of the display LCD and the key seat when shipping. Remove the protection seal when using. The operation of the key and the confirmation of the display is possible without removing the protection seal, however the adhesive may be left on the teaching pendant as the time passes.

4.3 Turning the power ON and OFF

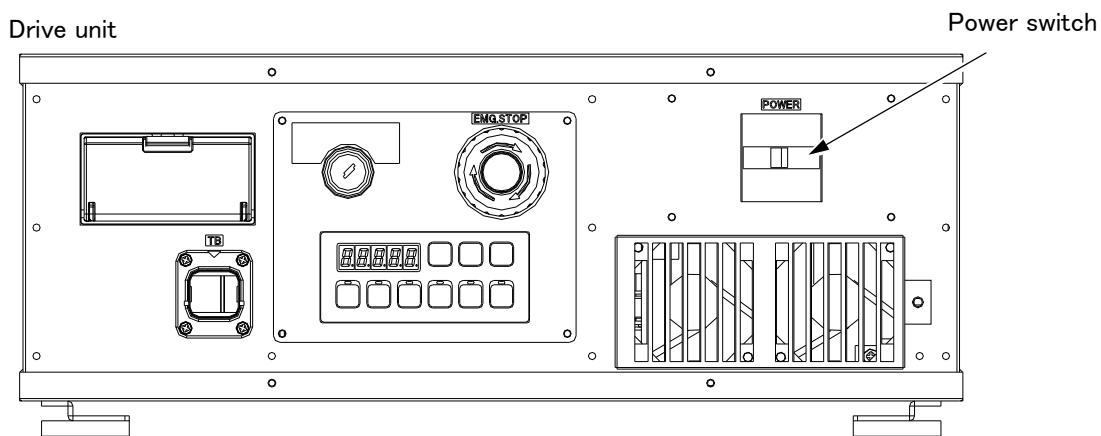
4.3.1 Turning the control power ON

CAUTION

Always confirm the following items before turning the drive unit power ON.

- 1) Make sure that there are no operators in the robot operation range.
- 2) Make sure that the drive unit and robot arm are securely connected with the machine cable.
- 3) Make sure that the external emergency stop switch is connected to the drive unit.
- 4) Make sure that the drive unit power cable and grounding cable are correctly connected.
- 5) Make sure that the grounding cable is connected to the robot arm.
- 6) Make sure that there are no obstacles, such as tools, in the robot operation range.

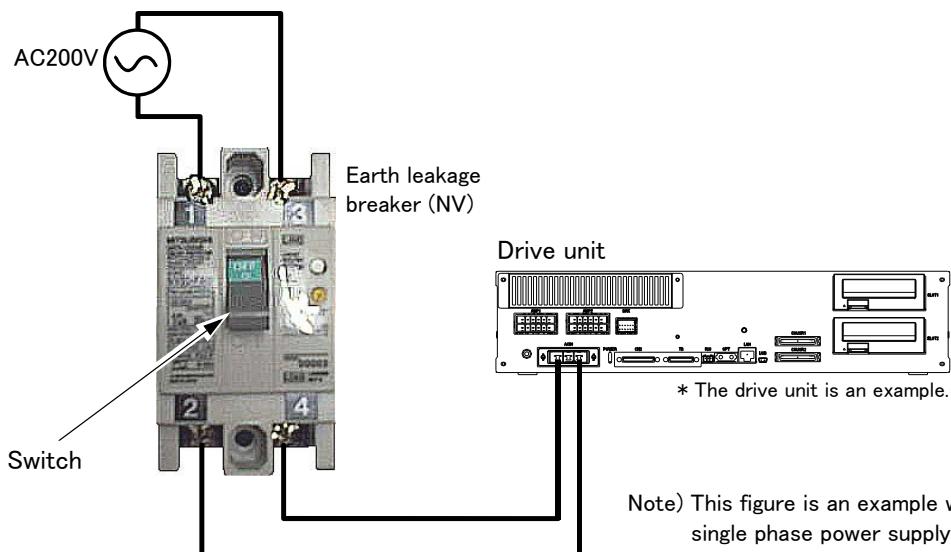
(1) CR750 controller



First, turn the drive unit [POWER] switch ON. The drive unit power turn on, and the STATUS NUMBER display lights up. Then, the robot CPU unit power on.

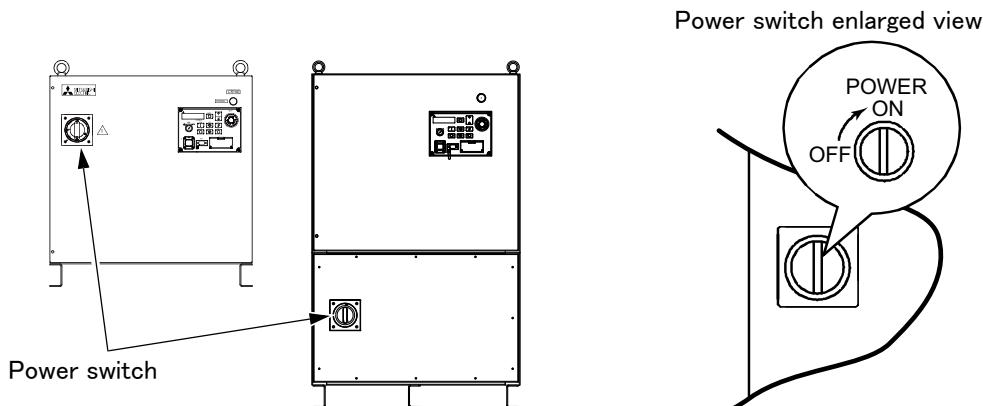
(2) CR751 controller

Note) Although the figure shows the CR751 (Thin type), it is the same also in a CR751 (Heavy type).



Operate the earth leakage breaker of installation outside to do the drive unit's power supply ON/OFF. Turns ON the switch of the earth leakage breaker of installation outside. The drive unit power turn on, and the power lamp lights up. Then, the robot CPU unit power on..

(3) CR760 controller



First, turn the drive unit [POWER] switch ON. The drive unit power turn on, and the STATUS NUMBER display lights up. Then, the robot CPU unit power on.

[Note] If the following issue occur with the power supply ON of the drive unit, please contact to the dealer.

- Although the FAN of the drive unit is operating, the operation panel does not light up and the operation of the robot cannot be done.
- Although the T/B has got the electricity, the operation of T/B cannot be done.

◆◆◆ What is the main power, control power and servo power? ◆◆◆

Main power ----- This supplies power to the controller. (Primary power)

Control power --- This supplies power to the control sections (PCB, etc.) in the controller.

Servo power ----- This supplies power to the motor that drives the robot.

When energized, this is called servo ON, and when shut off, this is called servo OFF.

◆◆◆ Error: It is if C0150 occurs. ◆◆◆

At the time of the first power supply on, error:C0150 (the serial number of the robot arm has not been set up) occur the robot after purchase.

Please input the serial number of the robot arm into Parameter: RBSERIAL. The input method is shown in next page. (Refer to [Page 90, "4.3.2 Input the serial number"](#).)

4.3.2 Input the serial number

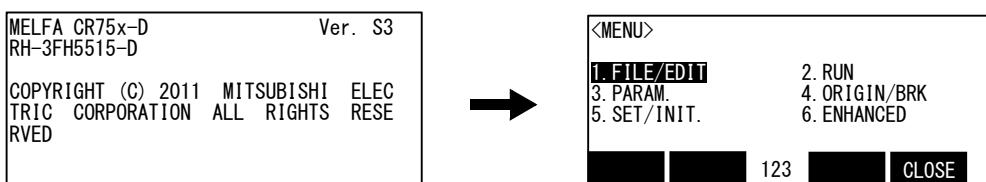
At the time of the first power supply on, error: C0150 (the serial number of the robot arm has not been set up) occur the robot after purchase.

Please input the serial number of the robot arm into Parameter: RBSERIAL.

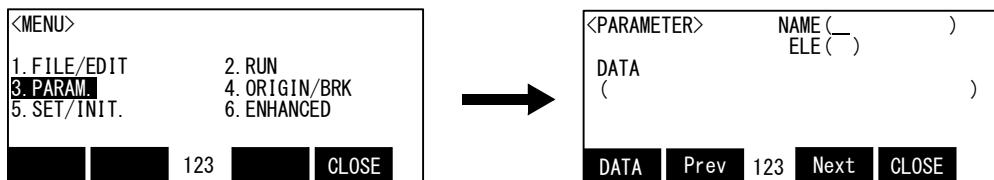
The serial number is printed to the rating name board on the back of the robot arm.

1) Press the [RESET] key of T/B and cancel the error of T/B.

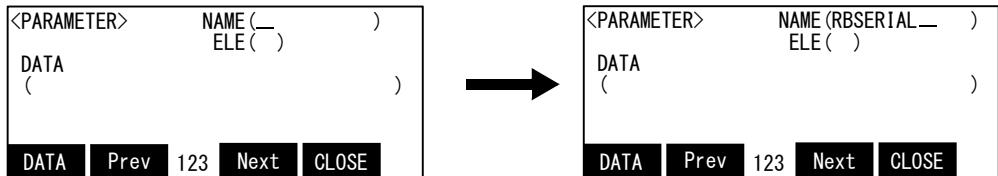
2) Press the [EXE] key of T/B and display the menu panel.



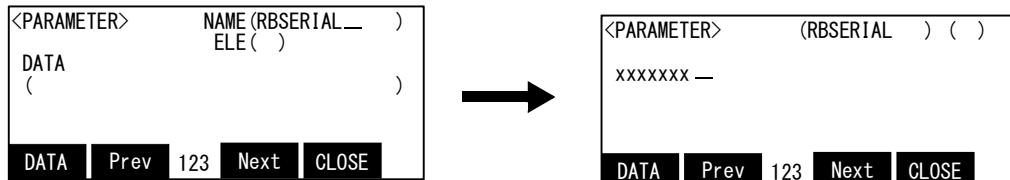
3) Press the [3] key of T/B and display the parameter.



4) Input "RBSERIAL" into the name.



5) Press the function key ([F1]) corresponding to the "data", and input the serial number of the robot arm.

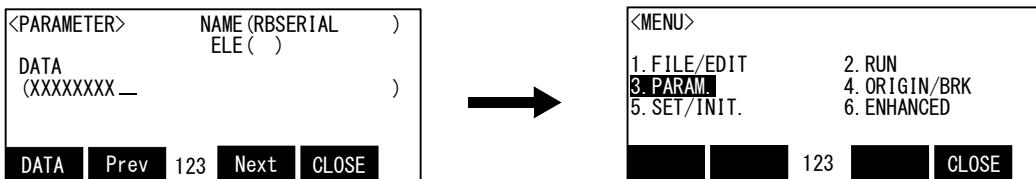


Press the [EXE] key, and fix the value with sound, and return to the parameter screen.

◆◆◆ The input of the number/character ◆◆◆

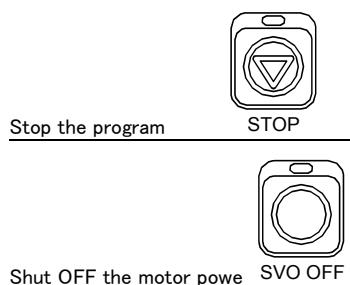
Each time the [CHARACTER] key is pressed, the number input mode and the character input mode change. The current input mode is displayed in the center under the screen, and the display of "123" shows that the number input mode and "ABC" is the character input mode.
For details, please refer to "INSTRUCTION MANUAL/ Detailed explanations of functions and operations" of the separate volume.

6) Press the function key ([F1]) corresponding to the "close", and return to the menu screen.



4.3.3 Shutting OFF the control power

* Following figures are CR750 drive unit's switch.



1) If the robot is operating, press the drive unit [STOP] switch, and stop the robot.

2) After the robot has stopped, press the drive unit [SVO OFF] switch, and turn the servo OFF.

3) Turns off the robot CPU system first. After that,

* CR750/CR760 drive unit: turn OFF a front power switch.

* CR751 drive unit: turn OFF the switch of the earth leakage breaker installed outside.

The control power will be shut off.

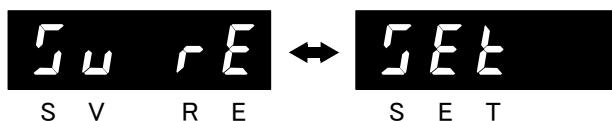
4.3.4 Shutting OFF the drive unit power

If the drive unit power is shut off while the robot CPU system is ON, the errors shown in [Table 4-1](#) occurs. To recover from the error, reset the error after turning on the drive unit power. Error resetting operation requires about 4 seconds, and then "SV RESET" is displayed on the display panel of the CR750 drive unit as shown in [Fig. 4-9](#).

When the robot CPU system was turned off, turn on the robot CPU system after turning on the drive unit. Refer to [Page 89, "4.3.1 Turning the control power ON"](#) for details.

Table 4-1 : List of errors

Error No.	Error message
H0050	EMG signal is input. (external)
H0060	EMG signal is input. (O.Panel)
H0070	EMG signal is input. (T.Box)
H0082	Fuse is broken (air hand I/F)
H0083	Fuse is broken (hand input power)
H0088	Service I/F fuse error
H0090	DC24V fuse is blown
H0093	Safety relay fuse is blown.
H0094	The overcurrent in the T/B line
H0141	Wiring error of CNUSR connector
H092*	Power module overcurrent
H2370	SF monitoring mode inconsistency
	SF process error (MCPU)
H8800	ASIC communication error

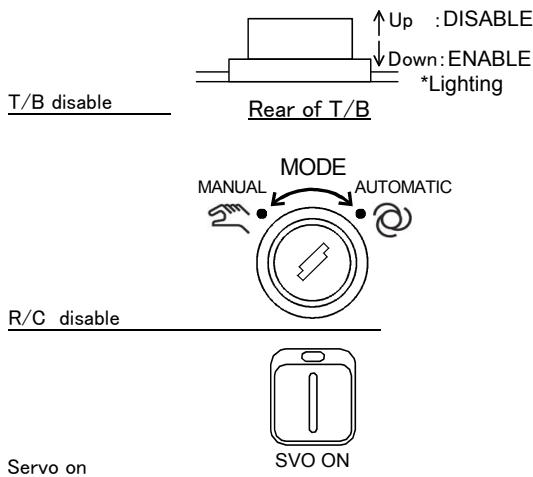


* The figures are CR750 drive unit's display panel.

Fig. 4-9 : "SV RESET" on the display panel

4.4 Turning the servo power ON/OFF

4.4.1 Turning the servo power ON (servo ON)



1) Confirm that the T/B [ENABLE] switch is set to "DISABLE".

2) Confirm that the mode of the drive unit is set to "AUTOMATIC".

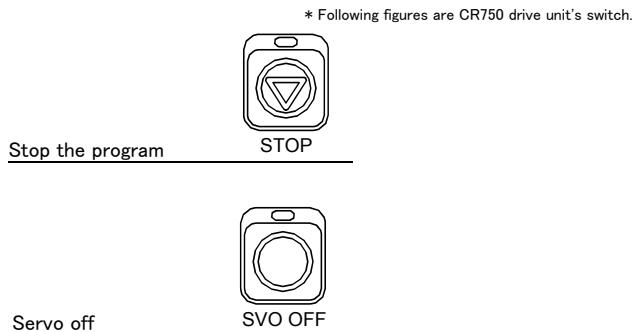
3) Press the [SVO ON] switch on the front of the drive unit.
The switch's lamp will light indicating that the servo is ON.

* Figures above are CR750 drive unit's switch.



Make sure that there are not operators in the robot operation range before turning ON the servo.

4.4.2 Shutting OFF the servo power (servo OFF)



1) If the robot is operating, press the drive unit [STOP] switch on the front of the drive unit, and stop the robot.

2) After the robot has stopped, press the drive unit [SVO OFF] switch on the front of the drive unit, and turn the servo OFF. The switch's lamp will light indicating that the servo is OFF.

◆◆◆ Operation rights not required ◆◆◆

This operation does not require the operation rights, so the servo can be turned OFF at any time by pressing the [SVO OFF] switch.

4.5 Jog operation

Refer to the separate manual "Robot arm setup and maintenance" when carrying out jog operation.

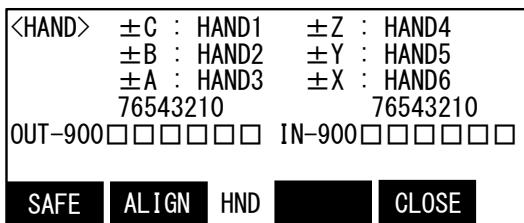
The following jog operation modes are available. Use these according to the purpose.

Table 4-2 : Jog modes

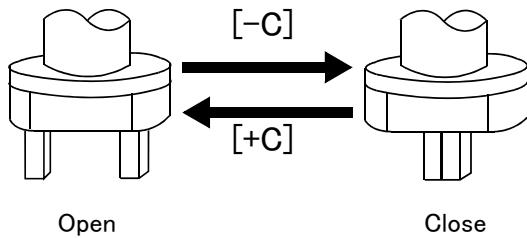
Jog mode	Main application	Explanation
JOINT JOG	<ul style="list-style-type: none"> ▪ Moves each joint. ▪ Moves the robot arm largely. ▪ Changes the robot posture. 	
XYZ JOG	<ul style="list-style-type: none"> ▪ Accurately sets the teaching position. ▪ Moves the axis straight along the XYZ coordinate system. ▪ Moves the axis straight while maintaining the robot posture. ▪ Changes the posture while maintaining the hand position. 	
TOOL JOG	<ul style="list-style-type: none"> ▪ Accurately sets the teaching position. ▪ Moves the axis straight along the hand direction. ▪ Changes the posture while maintaining the hand position. ▪ Rotates the hand while maintaining the hand position. 	
3-AXIS XYZ JOG	<ul style="list-style-type: none"> ▪ When the axis cannot be moved with XYZ JOG that maintains the posture. ▪ When the tip is to be moved linearly but the posture is to be changed. 	Separate manual "Robot arm setup and maintenance"
CYLINDER JOG	<ul style="list-style-type: none"> ▪ Moves in a cylindrical shape centering on the Z axis while maintaining the posture. ▪ Moves linearly in a radial shape centering on the Z axis while maintaining the posture. 	Separate manual "Detailed explanations of functions and operations"
WORK JOG (Work jog mode)	<ul style="list-style-type: none"> ▪ Accurately sets the teaching position. ▪ Moves the axis straight along the coordinates system (work coordinates system) defined in accordance with a workpiece, pallet, etc. ▪ Changes the posture along the work coordinates system. 	
WORK JOG (Ex-T jog mode)	<ul style="list-style-type: none"> ▪ Accurately sets the teaching position. ▪ Moves the axis straight along the work coordinates system (Ex-T coordinates system) defined in accordance with an installed grinder, dispenser, etc. ▪ Changes the posture along the work coordinates system (Ex-T coordinates system). 	

4.6 Opening and closing the hand

Hands 1 to 6 can be opened and closed with the T/B.



Press the [HAND] key, and display the hand screen.



Opening and closing hand 1

Open: Press [+C] key

Close: Press [-C] key

Opening and closing hand 2

Open: Press [+B] key

Close: Press [-B] key

Opening and closing hand 3

Open: Press [+A] key

Close: Press [-A] key

Opening and closing hand 4

Open: Press [+Z] key

Close: Press [-Z] key

Opening and closing hand 5

Open: Press [+Y] key

Close: Press [-Y] key

Opening and closing hand 6

Open: Press [+X] key

Close: Press [-X] key

4.7 Programming

The procedures from creating the program to automatic operation are explained in order using a simple procedure as an example.

(1) Creation procedures

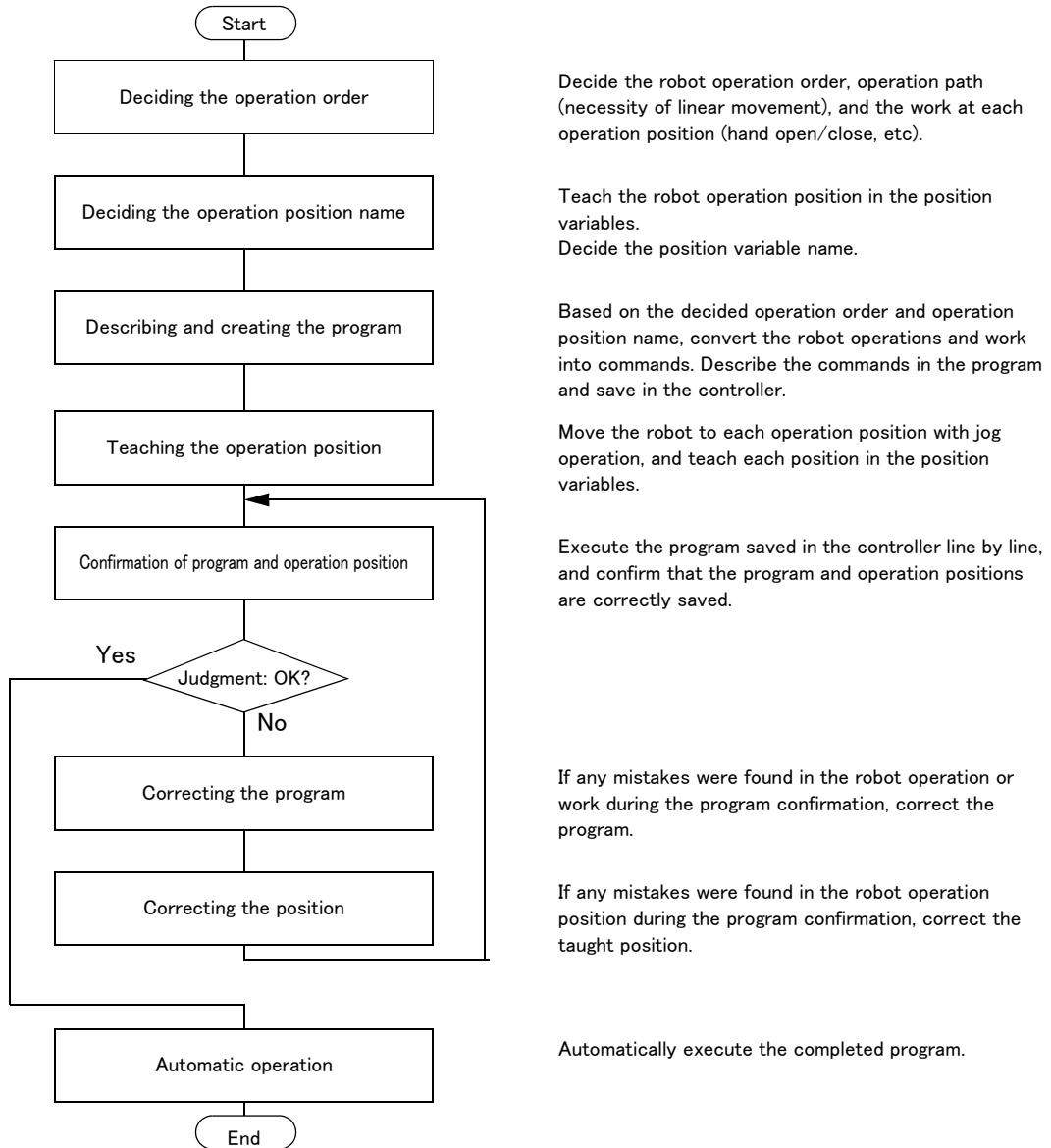


Fig.4-10 : Program creation procedures

(2) Robot work

Assume that the robot is going to carry the workpiece from the left to the right.

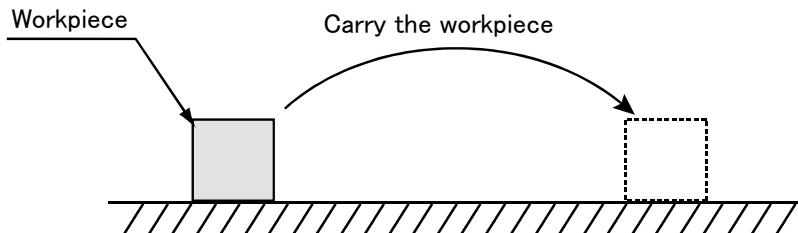


Fig.4-11 : Example of work

4.7.1 Creating the program

(1) Deciding the operation order

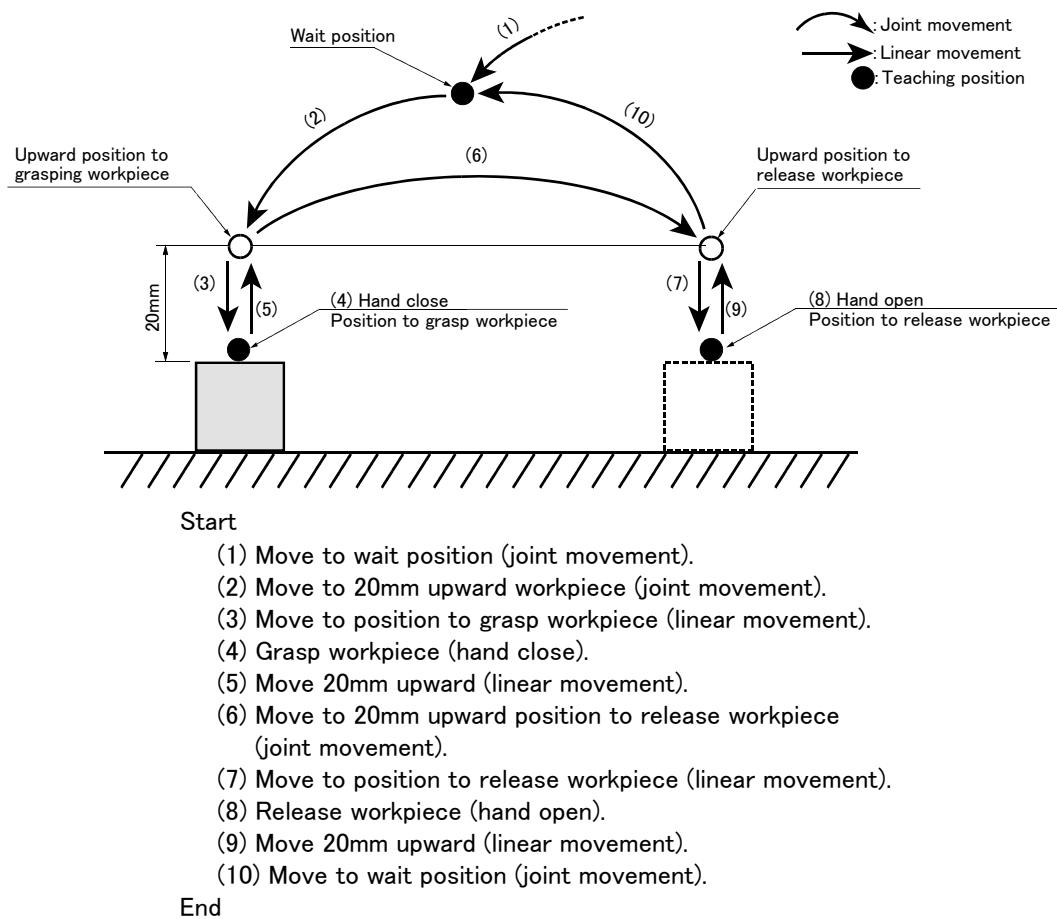


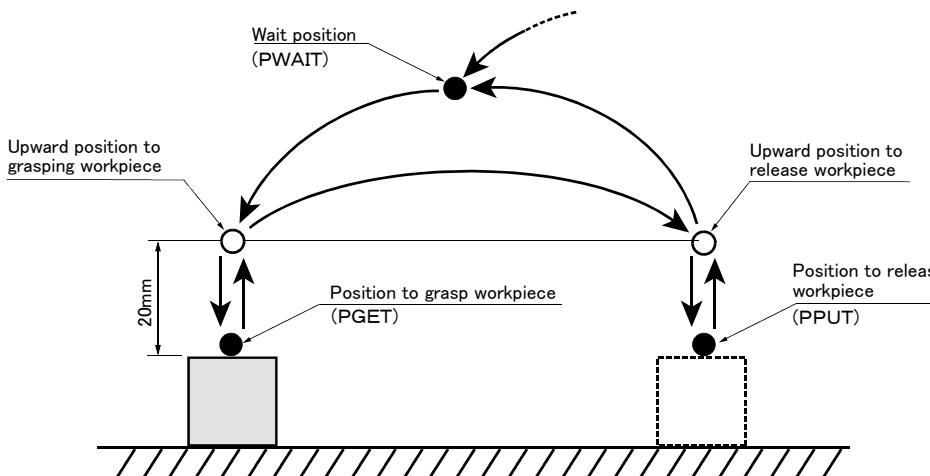
Fig.4-12 : Deciding the operation order

◇◆◇ Joint movement and linear movement ◇◆◇

The operation for which the robot movement path is not designated in particular is the "joint movement". The operation for which the movement path is designated as linear is "linear movement".

If the robot could interfere with the peripheral devices, such as the workpiece, when moving to grasp or release the workpiece, designate "linear movement" to prevent any interference.

(2) Deciding the operation position name



Name	Position variable name	Teaching	Remarks
Wait position	PWAIT	Required	
Upward position to grasping workpiece	—	Not required	Designate with commands.
Position to grasp workpiece	PGET	Required	
Upward position to release workpiece	—	Not required	Designate with commands.
Position to release workpiece	PPUT	Required	

Position variable name ···· Designate a random character string starting with "P".
Up to eight characters can be designated.

Fig.4-13 : Deciding the operation position name

◆◆◆◆ Teaching the operation position ◆◆◆◆

The operation position does not necessarily need to be taught.

The positions shown with white circles in Fig. 4-13 can be designated with commands as "position 20mm away from target position". Refer to [Page 99, "\(3\)Describing and creating the program"](#).

CAUTION

The designation of the direction separated from the target position differs according to the robot type.

The position is along the Z axis of the TOOL coordinate system, and the direction is designated with the + and - signs.

Refer to the section on the TOOL JOG operation in the separate "Instruction Manual/Robot arm setup and maintenance", and confirm the Z axis direction of the TOOL coordinate system. Then, designate the correct sign (direction) that matches the robot being used.

Designating the reverse direction could lead to interference with the peripheral devices and damage.

Generally (in the default state), the hand retract direction is the “-” sign with the vertical articulate type robot, and the “+” sign is the robot's upward direction with the other robots.

(3) Describing and creating the program

- Convert the target robot operations and work into commands.

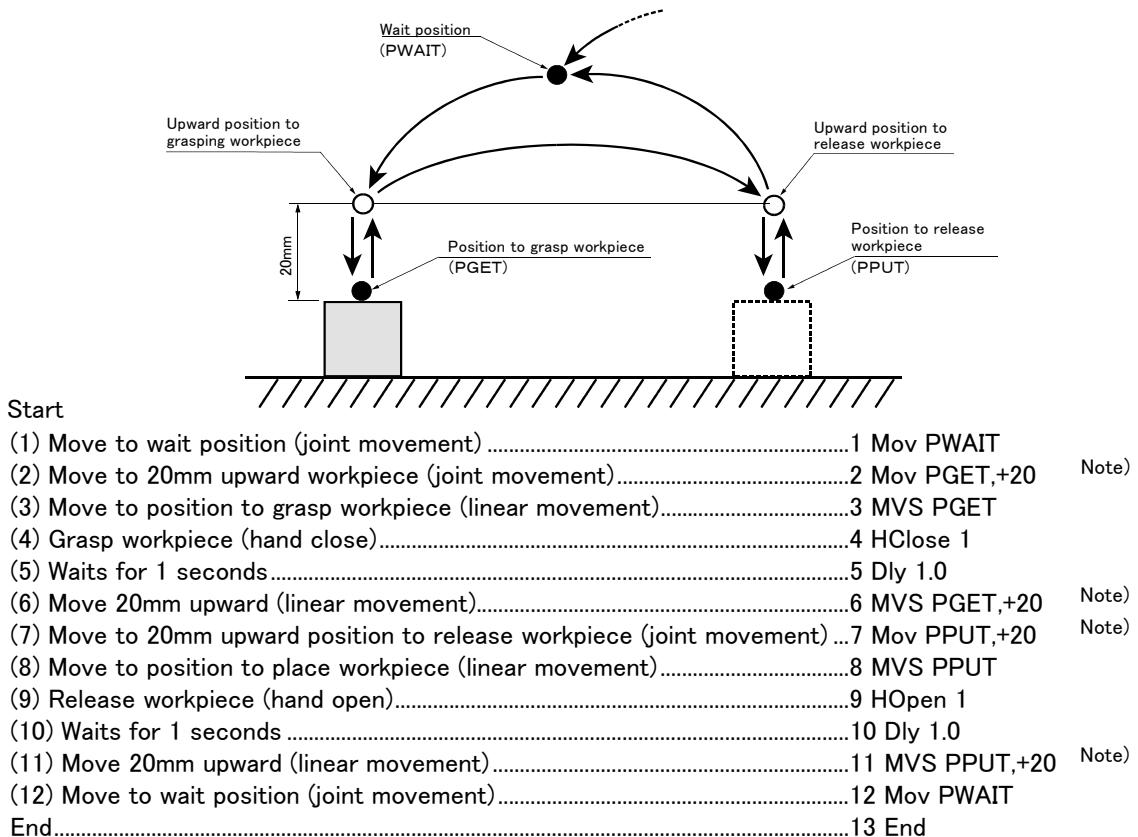
Refer to the separate manual "Instruction Manual: Detailed explanations of functions and operations" for details on the commands.

Table 4-3 : Commands used

Target operation and work	Command	Example of designation	
Joint movement	Mov	Move to position variable PWAIT	Mov PWAIT
		Move to 20mm upward position variable PGET	Mov PGET,+20 Note)
Linear movement	Mvs	Move to position variable PGET	Mvs PGET
		Move to 20mm upward position variable PGET	Mvs PGET,+20 Note)
Hand open	Hopen	Open hand 1	Hopen 1
Hand close	Hclose	Close hand 1	Hclose 1
Wait	Dly	Wait 1 second	Dly 1.0
End	End	End the program	End

Note) Upward movement is designated at a position along the Z axis of the TOOL coordinate system, and the direction is designated with the + and - signs. Confirm the Z axis direction of the TOOL coordinate system. Then, designate the correct sign (direction) that matches the robot being used. The example of designation above is an example using a horizontal multiple-joint type robot.

- Program the converted commands



Hand ··· Up to four hands can be installed. However, in the above program, the 1st hand connected to hand 1 is the target.

Fig. 4-14 : Describing the program

⚠ CAUTION

Note) Upward movement is designated at a position along the Z axis of the TOOL coordinate system, and the direction is designated with the + and - signs. Refer to the section on the TOOL JOG operation in the separate "Installation Manual/ Robot arm setup and maintenance", and confirm the Z axis direction of the TOOL coordinate system. Then, designate the correct sign (direction) that matches the robot being used. Designating the reverse direction could lead to interference with the peripheral devices and damage. Generally (in the default state), the hand retract direction is the “-” sign with the vertical articulate type robot, and the “+” sign is the robot's upward direction with the other robots. “+20” in the command line is a example in horizontal multiple-jointed type robot.

◆◆◆ Program format ◆◆◆

The program format is configured of the "step No. command parameter affixed to command" as shown in Fig. 4-14.

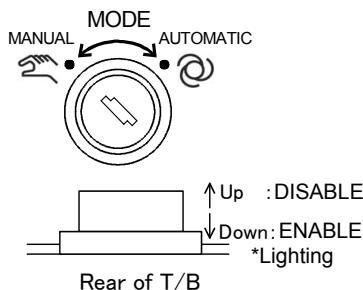
Example) 1 Mov PWAIT

step No. Command Parameter affixed to command

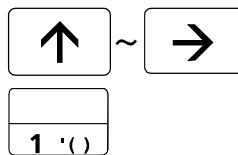
The program is executed in order from the step No. with the smallest number.

- Input the described program into the controller.
The T/B is used for this operation.

Preparing the T/B



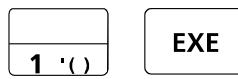
<MENU>	
1. FILE/EDIT	2. RUN
3. PARAM.	4. ORIGIN/BRK
5. SET/INIT.	6. ENHANCED
123 CLOSE	



<FILE/EDIT>		1/20	Rem	136320
1	08-04-24	17:20:32	22490	
2	08-04-24	14:56:08	694	
A1	08-04-24	13:05:54	2208	
B1	08-04-24	13:05:54	1851	
EDIT	POSI.	123	NEW	COPY →



<NEW PROGRAM>	
PROGRAM NAME	(1)
ABC CLOSE	



<PROGRAM>		1	100%
EDIT	DELETE	123	INSERT TEACH →



◇◆◇ Using the T/B ◇◆◇

Set the drive unit mode to "MANUAL" and the T/B [ENABLE] switch to "ENABLE". Operations from the T/B are not possible unless the drive unit mode is set to "MANUAL".

◇◆◇ Inputting numbers ◇◆◇

Each time the [CHARACTER] key is pressed, the number input mode and the character input mode change. The current input mode is displayed in the center under the screen, and the display of "123" shows that the number input mode. The number currently written to the lower left of each key in this state can be inputted.

◇◆◇ Correcting incorrect numbers ◇◆◇

Press the [CLCLEAR] key to delete the character, and then input it again. And, if the long pushing [CLEAR] key, all the data in the parenthesis can be deleted.

If the cursor is returned by pressing the [←] key, and a character is input, it will be inserted.

1) Set the drive unit mode to "MANUAL".

2) Set the T/B [ENABLE] switch to "ENABLE".

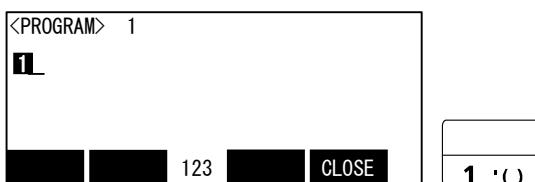
3) In the <MENU> screen, press the arrow keys ("↑", "↓", "←", "→") and move the cursor to "1. Management and edit", and then press the [EXE] key. The <Management and edit> screen will appear.

4) Press the [F3](New) key, and display the new program screen.

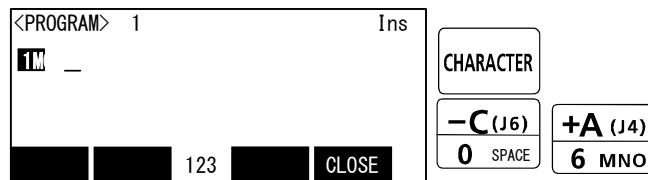
5) Press [1], [EXE] key, and display the edit screen of program No1.



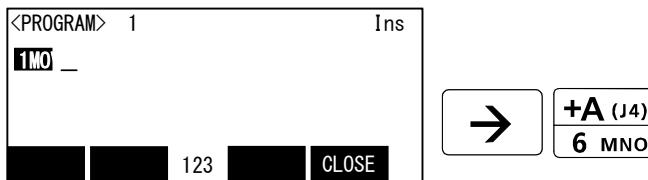
- 6) Press the [F3] key.
The cursor will move to the command editing line.



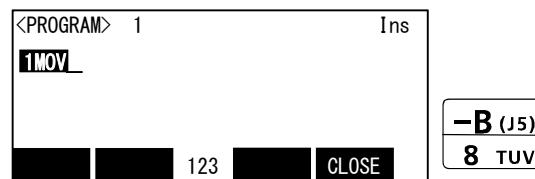
- 7) Confirm that the number input mode and press the [1] key.
"1" of the step number is inputted.



- 8) Press the [CHARACTER] key, and set to the character input mode, then press [SP], [MNO] key. Display the space and "M."



- 9) Press the [→] key, and the cursor is moved. Then press the [MNO] key 3 times, and input "o".



- 10) Press the [TUV] key 3 times, and input "v".

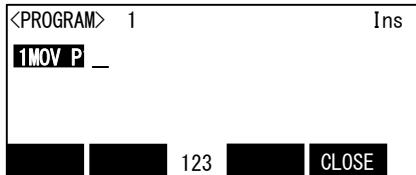
◆◆◆ Inputting characters and space ◆◆◆

Each time the [CHARACTER] key is pressed, the number input mode and the character input mode change. The current input mode is displayed in the center under the screen, and the display of "ABC" shows that the character input mode. The character currently written to the lower right of each key in this state can be inputted. When you continue and input the character in the same key, once press the [→] key and advance the cursor. The space is assigned to the [SP] key.

◆◆◆ The input method of the mark ◆◆◆

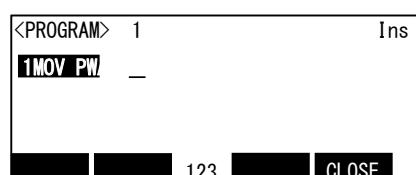
It comes out to input the character which is not displayed on the key. The character currently assigned to the key is shown below.

- a) [' ()] key ' → (→) → " → ^ → : → ; → ¥ → ?
- b) [@ =] key @ → = → + → - → * → / → < → >
- c) [, %] key , → % → # → \$ → ! → & → _ → .



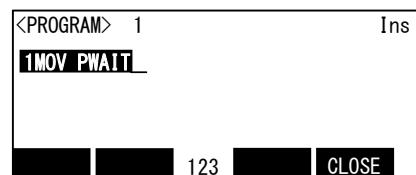
-C (J6)
0 SPACE

11) Press the [SP], [PQRS] key, and input the space and "P".



+B (J5)
9 WXYZ

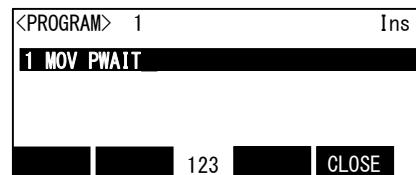
12) Press the [WXYZ] key, and input the space and "W".



-Z (J3)
2 ABC

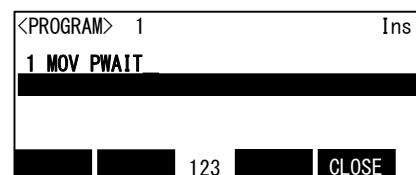
-B (J5)
4 GHI

13) Input "A", "I" and "T" in the same manner.



EXE

14) Press the [EXE] key.
"1 Mov PWAIT" will be set.



15) Input the program from step 2 to line 13 in the same manner.

This completes the inputting of the program.

◆◆◆ Displaying the previous and next command step ◆◆◆

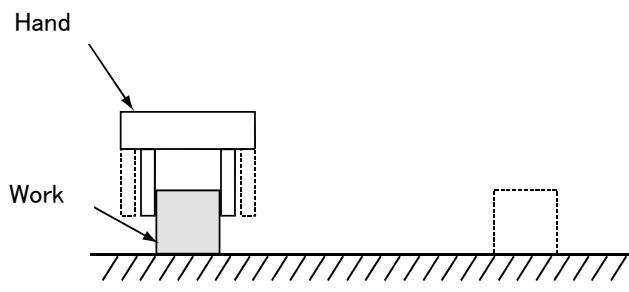
Display the four lines on the screen of T/B. For moving the cursor to the front line, the [↑] key is pressed, for moving the cursor to the next line, press the [↓] key, and select.

◆◆◆ Displaying a specific line ◆◆◆

Press the [FUNCTION] key, and change the function display, and press the [F2] key. The display changes to the JUMP screen. The specification line can be displayed, if the step number to display in the parenthesis is inputted and the [EXE] key is pressed.

■ Teach the robot operation position.

Set the position with jog operation (Teaching PGET)



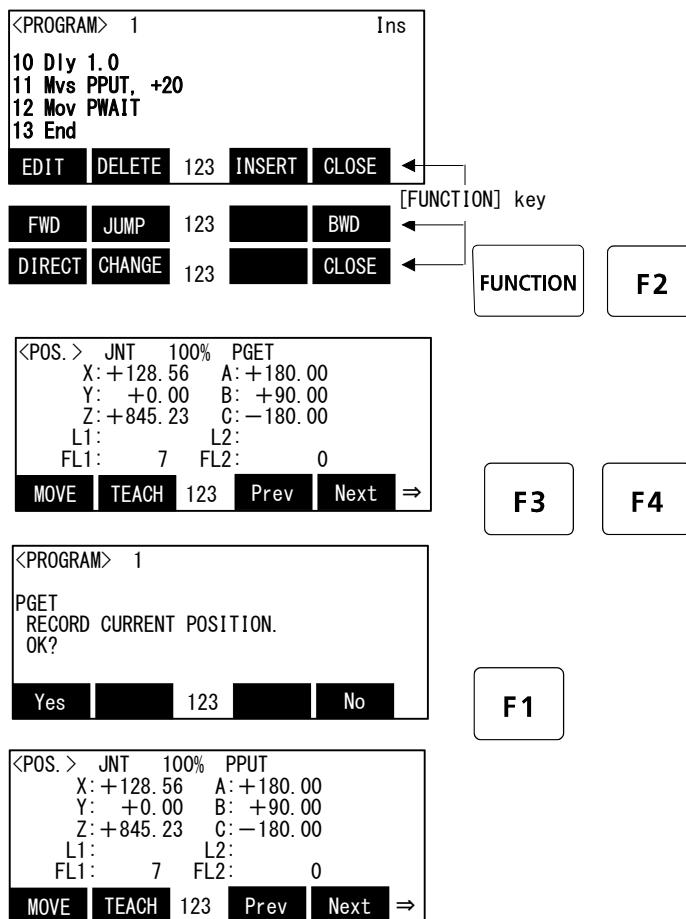
- 1) Move the robot with jog operation, and set the end of the hand to the position for grasping the workpiece. When the position has been set, open and close the hand to confirm that the workpiece can be grasped.

Refer to [Page 94, "4.5Jog operation"](#) for details on the jog operation, and section [Page 95, "4.6Opening and closing the hand"](#) for details on opening and closing the hand.

◆◆◆ Effective use of jog mode ◆◆◆

When the robot's current position is greatly separate from the target position, move the robot in axis units with the "JOINT JOG mode", to approach the position.

If the target position is nearby, move linearly with the "XYZ JOG mode", and finely adjust the position. The position can be set accurately by delaying the override (operation speed) at this time.



- 2) In the program edit screen, press the [FUNCTION] key twice and change the function display. [F2](change) Press the key and display the position edit screen.
- 3) Press the [F3](Next) or the [F4](Prev) key, and display "PGET" on the screen upper right.
The current registration coordinate value of the position variable name PGET is displayed.
- 4) Press the [F2] (teaching) key.
The teaching confirmation screen is displayed.
- 5) Press the [F1] (being) key and register the position.
- 6) Teach PPUT (position to place workpiece) and PWAIT (wait position) in the same manner.

This completes teaching of the robot operation positions.

◆◆◆ Changing between the command editing screen and position editing screen. ◆◆◆

The commands are edited on the command editing screen, and the positions are edited on the position editing screen.

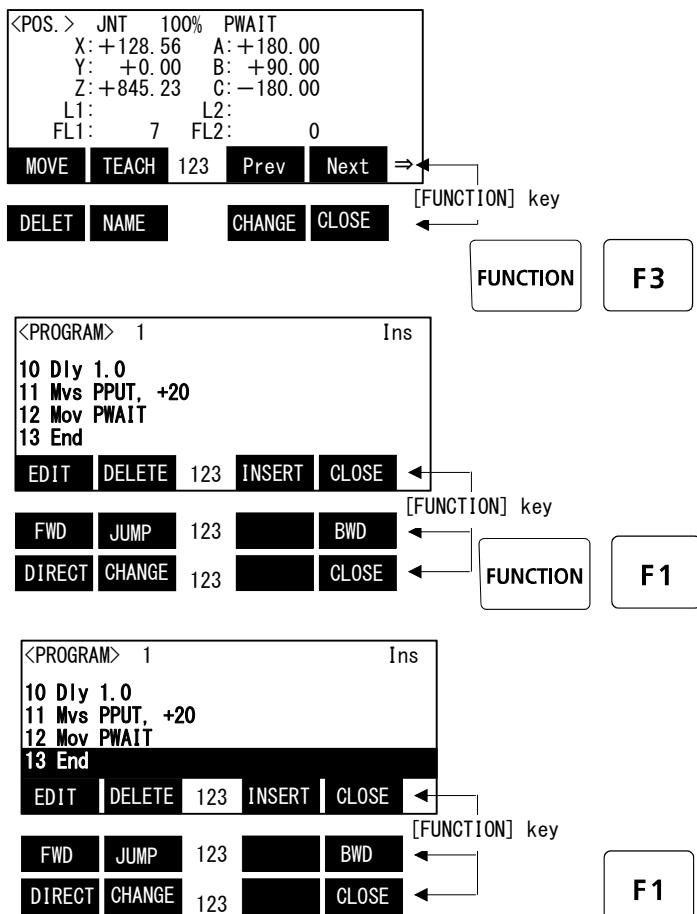
To change from the command editing screen to the position editing screen, press the [F3] (Cange) keys.

To change from the position editing screen to the command editing screen, press the [F2] (Cange) keys.

(4) Confirming the program

Using the T/B execute the program line by line (step operation), and confirm the operation.

Following operations are operated with lightly pressing the enabling switch on the T/B.



1) Press the [FUNCTION] key and change the function display. Press the [F3](change) and display the command edit screen.

2) Press the [FUNCTION] key and change the function display. Pressing the [F1] (FWD) key is kept, and the robot will start moving.

When the execution of one line is completed, the robot will stop, and the next line will appear on the screen.

If [F1] (FWD) is released during this step, the robot will stop.

3) By the same operation as the above-mentioned, carry out step operation to the END command of the 13 lines, and confirm movement.

If movement of the robot and the position are wrong, correct with reference to the following operations.



CAUTION

Take special care to the robot movements during operation. If any abnormality occurs, such as interference with the peripheral devices, release the [F1] (FWD) key and stop the robot.

◆◆◆ Step operation ◆◆◆

"Step operation" executes the program line by line. The operation speed is slow, and the robot stops after each line, so the program and operation position can be confirmed.

During execution, the lamp on the drive unit [START] switch will light.

◆◆◆ Immediately stopping the robot during operation ◆◆◆

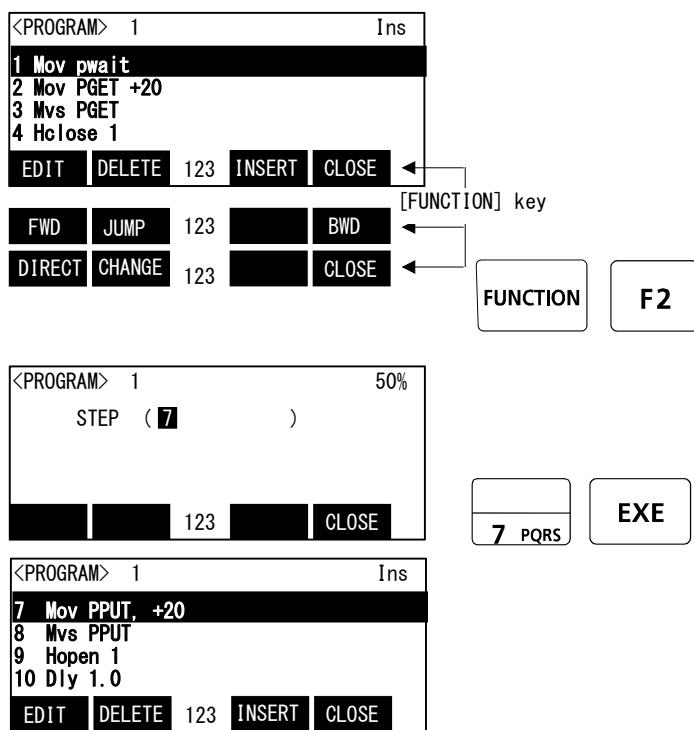
- Press the [EMG.STOP] (emergency stop) switch.
The servo will turn OFF, and the moving robot will immediately stop.
To resume operation, reset the alarm, turn the servo ON, and start step operation.
- Release or forcibly press the "enable" switch.
The servo will turn OFF, and the moving robot will immediately stop.
To resume operation, lightly press the "enable" switch, and start step operation.
- Release the [F1] (FWD)key.
The step execution will be stopped. The servo will not turn OFF.
To resume operation, press the [F1] (FWD)key.

(5) Correcting the program

■ Correcting the commands

As an example, the joint movement at line No.7 will be changed to linear movement.

(Change 7 Mov PPUT, +20 to 7 Mvs PPUT, +20) Note)



1) Press the [FUNCTION] key and change the function display. Press the [F2](Jump) key and display the command edit screen.

2) Press the [7], [EXE] key and display the 7th step.

⚠ CAUTION

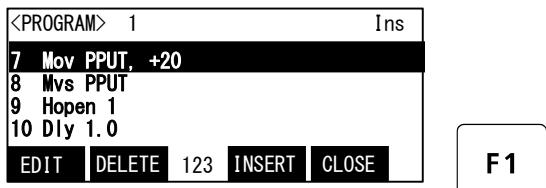
Note) Upward movement is designated at a position along the Z axis of the TOOL coordinate system, and the direction is designated with the + and - signs. Refer to the section on the TOOL JOG operation in the separate "Installation Manual/ Robot arm setup and maintenance", and confirm the Z axis direction of the TOOL coordinate system. Then, designate the correct sign (direction) that matches the robot being used. Designating the reverse direction could lead to interference with the peripheral devices and damage. Generally (in the default state), the hand retract direction is the “-” sign with the vertical articulate type robot, and the “+” sign is the robot's upward direction with the other robots.

◆◆◆ Displaying a specific line ◆◆◆

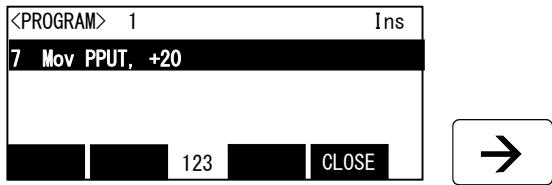
Press the [FUNCTION] key, and change the function display, and press the [F2] key. The display changes to the JUMP screen. The specification line can be displayed, if the step number to display in the parenthesis is inputted and the [EXE] key is pressed.

◆◆◆ Displaying the previous and next command step ◆◆◆

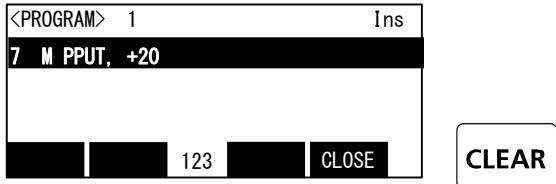
Display the four lines on the screen of T/B. For moving the cursor to the front line, the [↑] key is pressed, for moving the cursor to the next line, press the [↓] key, and select.



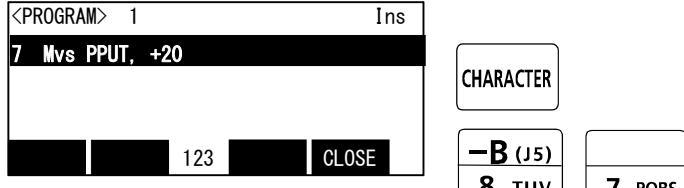
- 3) Press the [F1] (Edit) key and display command edit screen.



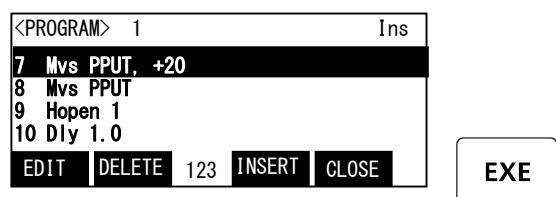
- 4) Press the [→] key 3 times. Move the cursor to "o."



- 5) Press the [CLEAR] key twice and delete "ov". Leave "M."



- 6) Press the [CHARACTER] key and set to the character input mode. Press the [TUV] key 3 times (input "v"), the [→] key, the [PQRS] key 4 times (input "s").



- 7) Press the [EXE] key and the 7th step is fixed. It returns to the program edit screen of the four-line display.

Step No. 7 has been changed to linear movement with the above operation.

◆◆◆ Correcting incorrect numbers ◆◆◆

Press the [CLREAR] key to delete the character, and then input it again. And, if the long pushing [CLEAR] key, all the data in the parenthesis can be deleted.

If the cursor is returned by pressing the [←] key, and a character is input, it will be inserted.

◆◆◆ After correcting a program ◆◆◆

After correcting the program, carry out step operation, and confirm that the program has been corrected.

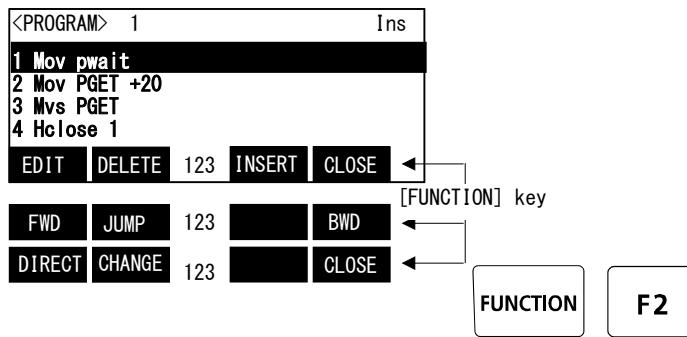
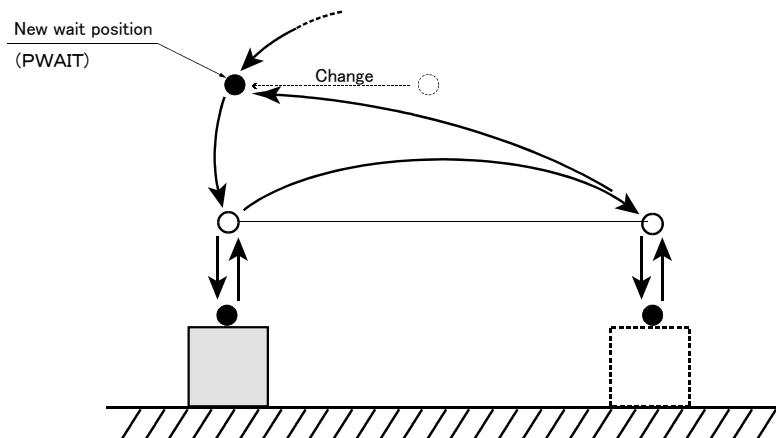
◆◆◆ Inputting characters and space ◆◆◆

Each time the [CHARACTER] key is pressed, the number input mode and the character input mode change.

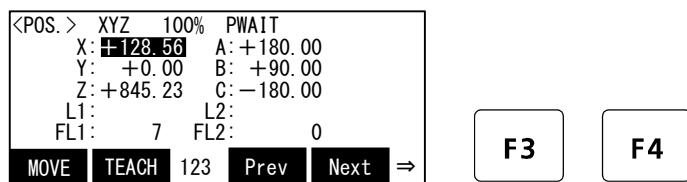
The current input mode is displayed in the center under the screen, and the display of "ABC" shows that the character input mode. The character currently written to the lower right of each key in this state can be inputted. When you continue and input the character in the same key, once press the [→] key and advance the cursor. The space is assigned to the [SP] key.

■ Correcting the taught position

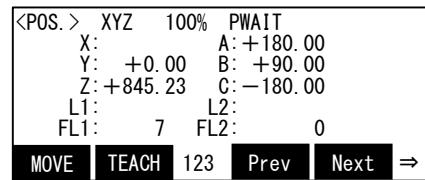
As an example, the wait position (PWAIT) will be corrected.



- 1) In the program edit screen, press the [FUNCTION] key twice and change the function display. [F2](change) Press the key and display the position edit screen.



- 2) The current registration coordinate value of the position variable name PWAIT is displayed.

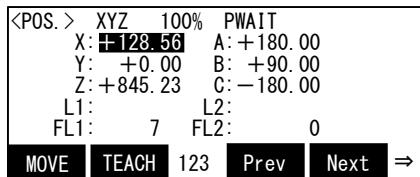


Move the robot to the new standby position by jog operation.

Refer to [Page 94, "4.5Jog operation"](#) for details on the jog operation, and section [Page 95, "4.6Opening and closing the hand"](#) for details on opening and closing the hand.

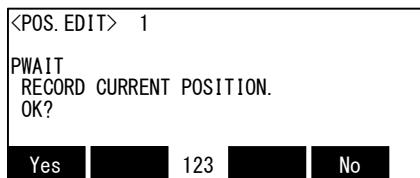
◆◆◆ Calling out a position variable ◆◆◆

The displayed position variable can be scrolled up or down by pressing the [F3] (Next) or [F4] (Prev) key.



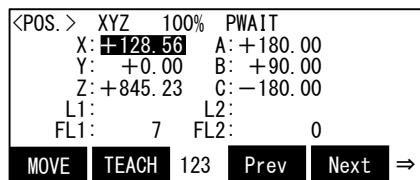
F2

- 3) Press the [F2] (Teaching) key.
 The teaching confirmation screen is displayed.



F1

- 4) Press the [F1] (Yes) key and register the position.



This completes correction of the standby position.

◇◆◇ After correcting a program ◇◆◇

After correcting the program, carry out step operation, and confirm that the program has been corrected.

(6) Saving the program

If creation of the program or correction finishes, the program will certainly be saved.

If the [F4 (close)] key is pressed in the command edit screen or the position edit screen, the confirmation message "the program was saved" is displayed and the details of edit are saved.

◇◆◇ Attention about the edit save ◇◆◇

Please keep in mind that the details of edit including teaching data will be canceled if the power supply is shut down with the program edit screen.

(7) Start automatic operation.



CAUTION

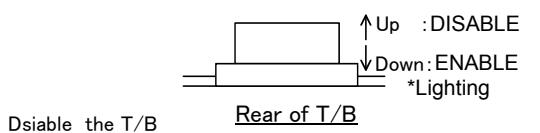
Before starting automatic operation, always confirm the following item. Starting automatic operation without confirming these items could lead to property damage or physical injury.

- Make sure that there are no operators near the robot.
- Make sure that the safety fence is locked, and operators cannot enter unintentionally.
- Make sure that there are no unnecessary items, such as tools, inside the robot operation range.
- Make sure that the workpiece is correctly placed at the designated position.
- Confirm that the program operates correctly with step operation.

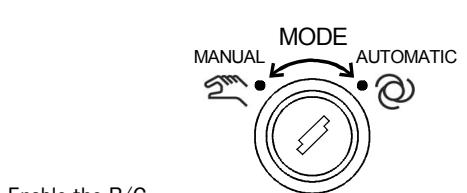
In the following explanation, automatic operation will be carried out with the drive unit.

Starting the automatic operation by T/B is available in the version of T/B 1.7 or later. Refer to separate "Instruction Manual/Detailed Explanation of Functions and Operations" for details.

Prepare the controller



- 1) Set the T/B [ENABLE] switch to "DISABLE".



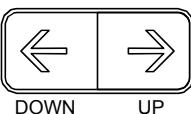
- 2) Set the drive unit mode to "AUTOMATIC".

Set override

* Following figures are CR750 drive unit's switch and display panel.



Display override



Set override

- 3) Press the drive unit [CHNG DISP] switch twice, and display the "OVERRIDE" on the STATUS NUMBER display panel. (A "o" will appear at the lower left.)

Press the [DOWN] key several times, and display "10".

The operation speed will be set to 10%.



CAUTION

The servo will turn OFF when the drive unit mode is changed.

Note that axes not provided with brakes could drop with their own weight.

Select the program number

* Following figures are CR750 drive unit's switch and display panel.

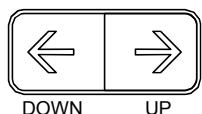


Display the program number CHNG DISP



- 4) Press the [CHNG DISP] switch, and display the "program No." on the STATUS NUMBER display panel.
(A "P" will appear at the head.)

Confirm that the program number targeted for automatic operation is displayed.



Select the program number



If the correct program number is not displayed, press the [UP] and [DOWN] keys to display the correct program No.

Start automatic operation

Servo on

SVO ON



Start START End with one cycle END

- 5) Push the [SVO ON] switch of the drive unit, and servo power turn on.

- 6) After pressing the drive unit [START] switch, press the [END] switch.
The robot operation will start and will stop after one cycle.

⚠ CAUTION

When executing the work example given in [Page 96, "Fig.4-11 : Example of work"](#), always press the [END] switch and end the program after one cycle. If the [END] switch is not pressed, the hand will interfere with the existing workpiece when it goes to pale the workpiece in the second cycle.

⚠ CAUTION

Before starting automatic operation, always confirm that the target program No. is selected.

⚠ CAUTION

Take special care to the robot movements during automatic operation. If any abnormality occurs, press the [EMG. STOP] switch and immediately stop the robot.

◆◆◆ Operating from the drive unit ◆◆◆

Set the T/B [ENABLE] switch to "DISABLE" and the drive unit mode to "AUTOMATIC". Operations from the drive unit are not possible unless the drive unit mode is set to "AUTOMATIC".

◆◆◆ Operation speed ◆◆◆

The operation speed for automatic operation with the drive unit can be set.

When the override is displayed on the STATUS NUMBER display panel (with a "o" displayed on the lower left), the override display will increment or decrement each time the [UP] or [DOWN] key is pressed. The max. speed is 100%.

Initially set a low speed, and gradually increase it.

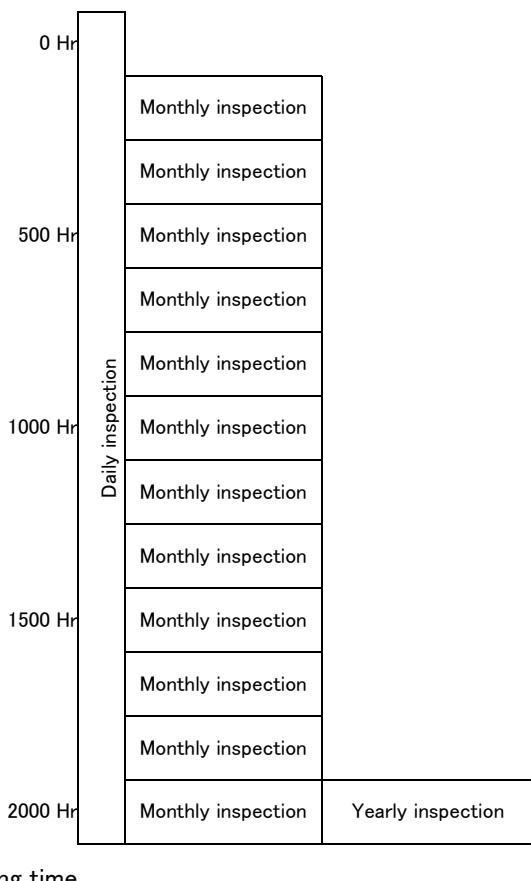
5 Maintenance and Inspection

The maintenance and inspection procedures to be carried out to use the robot for a long time without trouble are described in this chapter. The types and replacement methods of consumable parts are also explained.

5.1 Maintenance and inspection interval

Maintenance and inspection are divided into the inspections carried out daily, and the periodic inspections carry out at set intervals. Always carry these out to prevent unforeseen trouble, to maintain the product for a long time, and to secure safety.

(1) Inspection schedule



⟨Guideline for inspection period⟩

For one shift

$$8 \text{ Hr/day} \times 20 \text{ days/month} \times 12 \text{ months} = \text{approx. } 1800 \text{ Hr}$$

$$10 \text{ Hr/day} \times 20 \text{ days/month} \times 12 \text{ months} = \text{approx. } 2400 \text{ Hr}$$

For two shifts

$$15 \text{ Hr/day} \times 20 \text{ days/month} \times 12 \text{ months} = \text{approx. } 3600 \text{ Hr}$$

[Caution] According to the schedule on the above, when using the double shift, you should make the inspections at half the regular intervals.

Fig. 5-1 : Inspection schedule

5.2 Inspection items

The controller inspection items are shown below.

Refer to section "Maintenance and Inspection" in the separate manual "Robot arm setup and maintenance", and inspect the robot arm at the same time.

5.2.1 Daily inspection items

Carry out daily inspections following the procedures given in [Table 5-1](#).

Table 5-1 : Daily inspection items (details)

Procedure	Inspection items (details)	Remedies
Before turning the power ON (Check the following inspection items before turning the power ON.)		
1	Is the power cable securely connected? (Visual)	Securely connect.
2	Are the machine cables between the robot arm and drive unit securely connected? (Visual)	Securely connect.
3	Is the drive unit cover cracked, has any foreign matter adhered, or is there any interference?	Replace with a new part, or take remedial measures.
After turning the power ON (Turn the power ON while monitoring the robot.)		
1	Is there any abnormal movement or noise when the power was turned ON?	Refer to the Troubleshooting section and remedy.
During operation (Try moving with an original program.)		
1	Check that the operation point is not deviated. If deviated, check the following items. 1) Are any of the installation bolts loose? 2) Are the bolts at the hand installation section loose? 3) Is the position of the jigs, other than the robot, deviated? 4) If the positional deviation cannot be eliminated, refer to "Troubleshooting", and remedy.	Refer to the Troubleshooting section and remedy.
2	Is there any abnormal movement or noise? (Visual)	Refer to the Troubleshooting section and remedy.

5.2.2 Periodic inspections

Carry out periodic inspections following the procedures given in [Table 5-2](#).

Table 5-2 : Periodic inspection items (details)

Procedure	Inspection items (details)	Remedies
Monthly inspection items		
1	Are any of the connector fixing screws or terminal block terminal screws loose?	Securely tighten the screws.
2	Is the drive unit filter dirty? (Visual)	Clean or replace with a new part. Inspect, clean and replace the filter by refer to Page 116, "5.3.2 The check of the filter, cleaning, exchange." .
Yearly inspection items		
1	Replace the backup battery in the robot CPU unit.	Exchange it referring to Page 114, "5.3.1 Replacing the battery" .

5.3 Maintenance and inspection procedures

The procedures for carrying out periodic maintenance and inspection are described below. Thoroughly comprehend the procedures, and follow the instructions. This work can be commissioned to the Mitsubishi Service Dept. for a fee. (Never disassemble, etc., any of the parts not described in this section.)

The maintenance parts required for the maintenance and inspection are shown in [Page 118, "5.4 Maintenance parts"](#). Contact your dealer for these parts when required.

5.3.1 Replacing the battery

While power of controller is turned off, the programs must be saved by the backup battery. The robot arm also uses backup batteries to save the position data of an encoder. The batteries are installed when the robot is shipped from the factory, but as these are consumable parts, they must be replaced periodically by the customer.

The guideline for replacing the lithium battery is one year, but this will differ according to the robot's usage state. There are the kind of the errors about the battery shown in [Table 5-3](#). If error 7500 occurs, please exchange the batteries of the robot arm and the robot CPU unit simultaneously.

Table 5-3 : The error about the battery

Section	Error number	Description	Disposition
Controller	7520	The exhausting time is over.	Exchange the batteries.
	7510	Voltage is falling.	
	7500	Voltage fell.	Backup data cannot be secured.
Robot arm	7520	The exhausting time is over.	Exchange the batteries.
	133n ^{Note1)}	Voltage is falling.	
	112n	The absolute position data of the encoder disappeared.	Backup data cannot be secured.

Note1) "n" shows the axial number.

The method of replacing the battery of the controller is shown below. Refer to the separate "ROBOT ARM SETUP & MAINTENANCE" about robot arm's battery.

About the purchase of the battery, refers to [Page 118, "5.4 Maintenance parts"](#).



If error No. 7500 or 112n occurs, the program data and other data in the controller is lost and it becomes necessary to load the data again.



Replace the batteries for the drive unit and robot arm at the same time. Replace the controller battery within 3 minutes after removing the old battery.
It is also recommended to save programs and position data on the personal computer side via the RT ToolBox 2 and so forth in advance.

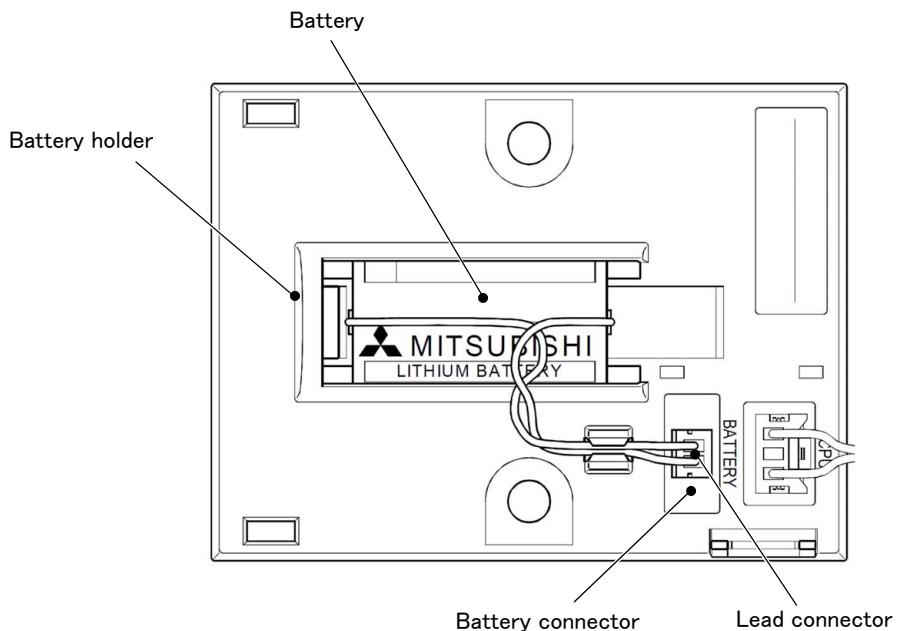


Fig. 5-2 : Exchange of the battery

- 1) Turn on the robot CPU system power supply for 10 minutes or longer.
- 2) Turn off the robot CPU system power supply.
- 3) Disconnect the lead connector from the battery connector. Remove the old battery from its holder.
- 4) Install a new battery into the holder in the correct direction. Connect the lead connector to the connector (BATTERY). Complete the work within 3 minutes after removing the old battery.
- 5) Turn on the robot CPU system power supply.
- 6) Refer to the separate manual "Detailed Explanation of Functions and Operations", and reset the battery cumulative time over alarm.

[Caution] If the old battery is replaced because it has been used up, it is necessary to set the origin again. Refer to the separate "Robot arm setup, basic operation, and maintenance" and reset the origin.

This completes the replacement of the battery.

5.3.2 The check of the filter, cleaning, exchange.

The filter is installed in the CR750/CR751 drive unit.

The following shows the procedure for inspecting, cleaning and replacing the filter:

(1) CR750 drive unit

- 1) Loosen the M4 x 6 screws and remove the filter cover from the front of the drive unit. Remove the claw on the left side of the filter cover as it is inserted in the front face of the drive unit.
- 2) Remove the filter from the filter cover and remove dust and other dirt that has built up on it.
* If the filter is particularly dirty then wash it in water and detergent and then dry fully before re-fixing. In the event that the surface of the washed filter has become fluffy, please replace it with a new filter.
- 3) Attach the cleaned or new filter to the drive unit, and install the filter cover to drive unit with the M4 x 6 screw (1 pcs.).

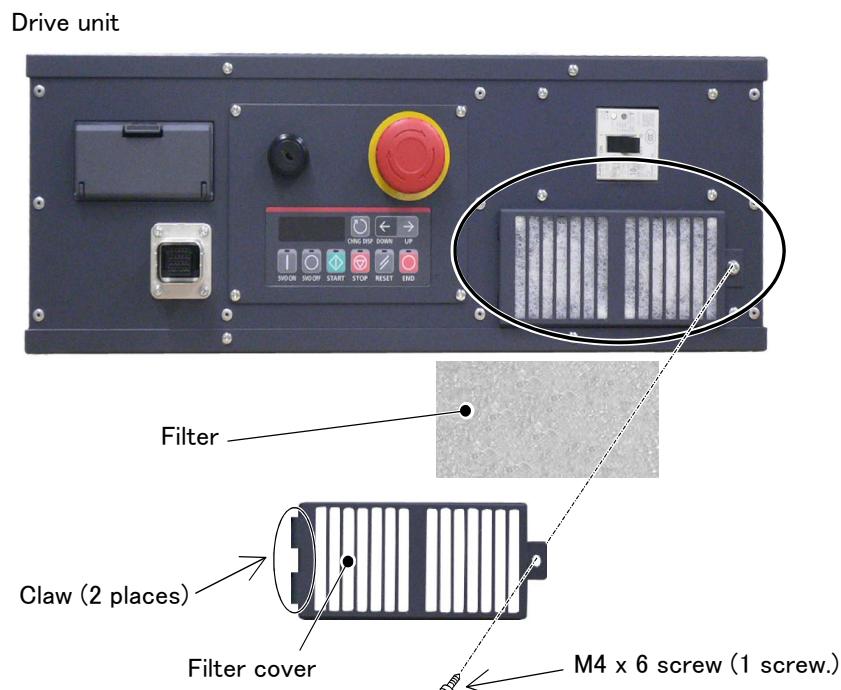
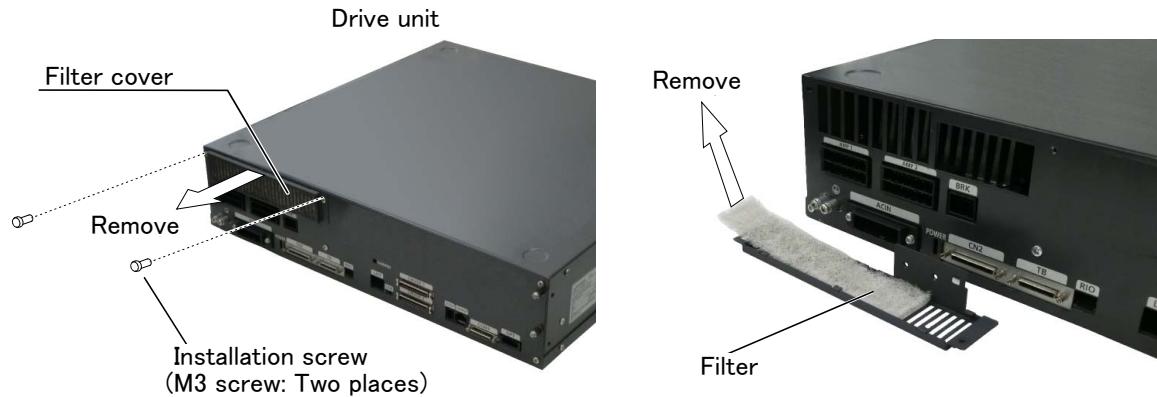


Fig. 5-3 : Cleaning, exchanging the filter (CR750 drive unit)

This completes the inspection, cleaning and replace of the filter for the drive unit.

(2) CR751 drive unit

- 1) Loosen the M3 screws and remove the filter cover from the front of the drive unit. Remove the claw on the left side of the filter cover as it is inserted in the front face of the drive unit.
- 2) Remove the filter from the filter cover and remove dust and other dirt that has built up on it.
* If the filter is particularly dirty then wash it in water and detergent and then dry fully before re-fixing. In the event that the surface of the washed filter has become fluffy, please replace it with a new filter.
- 3) Attach the cleaned or new filter to the filter plate
- 4) Make sure that the filter is not separated from the cover, and re-fix the filter cover on to the front of the controller, fixing securely. When doing this take care not to trap the battery cable.



* The drive unit is an example.

Fig. 5-4 : Cleaning, exchanging the filter (CR751 drive unit)

This completes the inspection, cleaning and replace of the filter for the drive unit.

5.4 Maintenance parts

The consumable parts that must be replaced periodically are shown in [Table 5-4](#), and spare parts that may be required during repairs are shown in [Table 5-5](#). Purchase these parts from the 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 5-4 : Controller consumable parts list

No.	Part name	Type ^{Note1)}	Qty.	Usage section	Maker
1	Lithium battery	Q6BAT	1	Inside the battery unit which connected to robot CPU unit.	Mitsubishi Electric System & Service;Co.,Ltd.
2	Filter	BKOFA0773H42	1	CR750 drive unit: Inside the filter cover	
		BKOFA0773H41	1	CR751 drive unit: 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.

Table 5-5 : Controller spare parts list

No.	Part name	Type ^{Note1)}	Qty.	Usage section	Maker
1	1.6A fuse	LM16	1		Mitsubishi Electric System & Service;Co.,Ltd.
2	3.2A fuse	HM32	1		
3	4A fuse	LM40	1		
4	3.2A fuse	LM32	1		
5	7.5A fuse	GP75	1		

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

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