MITSUBISHI

Mitsubishi Industrial Robot

SQ Series

CR1QA/CR2QA/CR3Q Controller

INSTRUCTION MANUAL

Controller setup, basic operation, and maintenance

MELFA

BFP-A8688-R

⚠ Safety Precautions

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

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

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

⚠ CAUTION

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

⚠ CAUTION

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

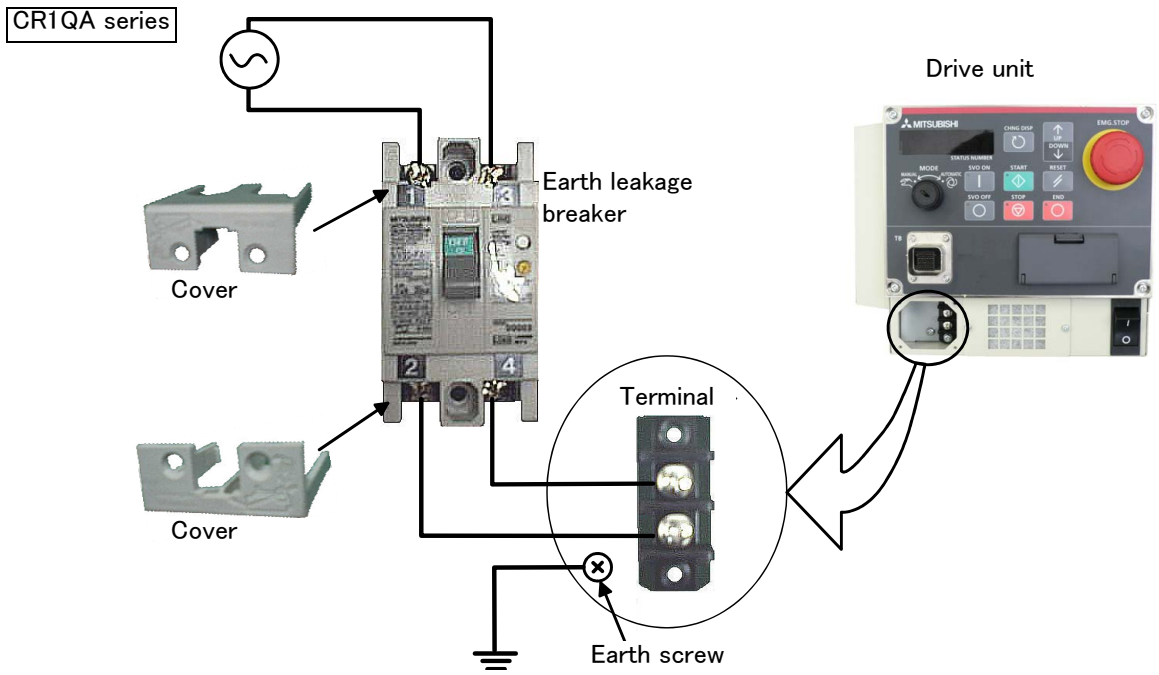
⚠ CAUTION

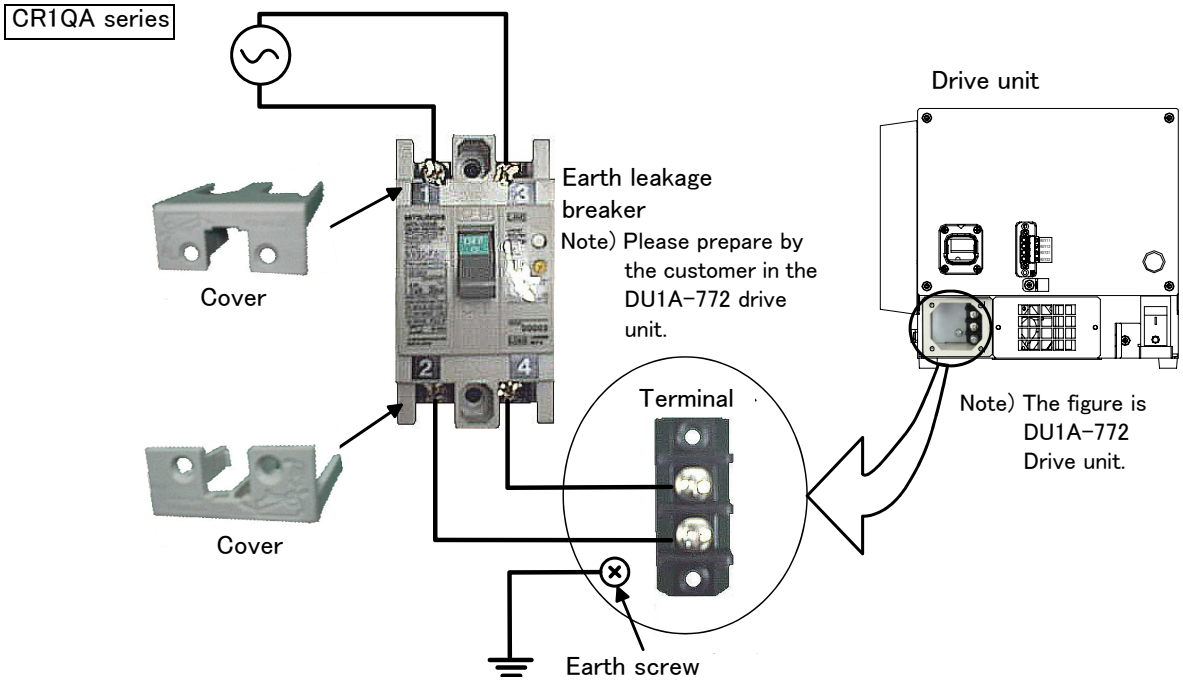
Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB, RS-232 or LAN. When using network equipment, measures against the noise,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

C.Notes of the basic component are shown.
*SQ series: CR1QA-772/CR1QA-700 series

⚠ CAUTION

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




CR1QA series
Drive unit
Earth leakage breaker
Note) Please prepare by the customer in the DU1A-772 drive unit.
Cover
Cover
Terminal
Note) The figure is DU1A-772 Drive unit.
Earth screw

■ Revision history

Date of print	Specifications No.	Details of revisions
2008-07-24	BFP-A8688	・First print.
2008-11-04	BFP-A8688-A	・Pneumatic interface of source type optional was added.
2009-06-09	BFP-A8688-B	・Expression was corrected.(2.3.4 Connecting the external emergency stop)
2009-08-05	BFP-A8688-C	・CE　marking specification was added.
2009-09-12	BFP-A8688-D	・The examples of safety measures (Wiring example 3 ～ 5) were corrected.
2009-10-23	BFP-A8688-E	・The EC Declaration of Conformity was changed. (Correspond to the EMC directive; 2006/42/EC)
2009-12-24	BFP-A8688-F	・The examples of safety measures (Wiring example 3 ～ 5) were corrected.(connect the enabling device) ・The wiring example 3 of safety measures was deleted.(same as wiring example 4)
2010-02-05	BFP-A8688-G	・The explanation of CR1QA-700 series was added.
2010-03-01	BFP-A8688-H	・The "power switch" of CR2 controller was corrected to the "earth leakage breaker". (Error in writing)
2010-04-21	BFP-A8688-I	・CE specification of the CR1QA controller was added.
2010-07-04	BFP-A8688-J	・The type of controller was changed. (CR1Q to CR1QA, CR2Q to CR2QA)
2010-10-13	BFP-A8688-K	・The position for grounding the cable of DU1A-700 series drive unit (standard specification) was changed.
2011-01-12	BFP-A8688-L	・The installation position of the SINK/SOURCE setting pin of pneumatic hand interface was changed. (DU2A drive unit)
2011-02-02	BFP-A8688-M	・The rear cover of the DU1A drive unit was made unnecessary.
2011-05-09	BFP-A8688-N	・Fuse LM10 was added to the attachments of the CR1QA controller.
2011-07-01	BFP-A8688-P	・The note about the connection of the emergency stop was added.
2012-07-03	BFP-A8688-R	・The note about the connection of the emergency stop was added. ・The notes about frequent installation and removal of TB and the dummy connector were added. ・Description of Power cable connection of robot CPU system power supply unit 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.
The optional equipments and power supply voltage are different according to connecting robot type.
Refer to separate "Standard Specifications Manual" for detail.
Always read through this manual before starting use to ensure correct usage of the robot.
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."

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 controller. Refer to the Page 30, "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 39, "2.3.7 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.

Contents

Page

1 Before starting use 1-1
1.1 Using the instruction manuals 1-1
1.1.1 The details of each instruction manuals 1-1
1.1.2 Terminological definition 1-2
1.1.3 Symbols used in instruction manual 1-2
1.2 Safety Precautions 1-3
1.2.1 Precautions given in the separate Safety Manual 1-4

2 Unpacking to installation 2-6
2.1 Confirming the products 2-6
2.2 Installation 2-8
2.2.1 Unpacking procedures 2-8
2.2.2 Transportation procedures 2-8
(1) DU1A-700 series 2-8
(2) DU2A-700 series 2-8
(3) DU3-700 series 2-8
2.2.3 Installation procedures 2-9
(1) DU1A-700 series 2-9
(2) DU2A-700 series 2-11
(3) DU3-700 series 2-12
2.3 Installation and connection 2-13
2.3.1 Installation of the robot CPU unit 2-13
(1) Notes on the handling 2-13
(2) Notes on base unit installation 2-15
(3) Installation and removal of the unit 2-17
(4) Notes on the installation of the battery holder unit 2-19
2.3.2 Connecting the power cable and grounding cable 2-20
(1) DU1A-700 series 2-20
(2) DU2A-700 series 2-21
(3) DU3-700 series 2-22
2.3.3 Power cable connection of robot CPU system power supply unit 2-23
(1) The connection between the drive unit and the sequencer power supply unit (CR3Q-700 series) 2-23
2.3.4 Connection between the robot CPU system and the drive unit 2-24
(1) Connection between the robot CPU system and the drive unit (CR1QA-700 series) 2-24
(2) Connection between the robot CPU system and the drive unit (CR2QA-700 series) 2-26
(3) Connection between the robot CPU system and the drive unit (CR3Q-700 series) 2-28
2.3.5 Connecting the external emergency stop 2-30
2.3.6 Examples of safety measures 2-34
(1) External emergency stop connection [supplementary explanation] 2-38
2.3.7 Magnet contactor control connector output (AXMC) for addition axes 2-39
2.3.8 Connecting to the robot arm 2-39
2.4 Setting the origin 2-39
2.5 Confirming the operation 2-39

3 Installing the option devices 3-40
3.1 Iinstalling the pneumatic hand interface 3-40
3.1.1 Installing 3-40
3.1.2 SINK/SOURCE setting 3-42

4 Basic operations 4-44
4.1 Handling the controller 4-45
4.1.1 Functions of each key 4-45
(1) Front of the DU1A-772 drive unit 4-46
(2) Padlock specification(DU1A-772) 4-47
4.2 Handling the T/B 4-51

Contents

Page

4.2.1 Installing and removing the T/B 4-51
(1) Installing the T/B 4-51
(2) Removing the T/B 4-51
4.2.2 Functions of each key 4-52
4.3 Turning the power ON and OFF 4-53
4.3.1 Turning the control power ON 4-53
4.3.2 Input the serial number 4-54
4.3.3 Shutting OFF the control power 4-56
4.4 Turning the servo power ON/OFF 4-56
4.4.1 Turning the servo power ON (servo ON) 4-56
4.4.2 Shutting OFF the servo power (servo OFF) 4-56
4.5 Jog operation 4-57
4.6 Opening and closing the hand 4-57
4.7 Programming 4-58
(1) Creation procedures 4-58
(2) Robot work 4-58
4.7.1 Creating the program 4-59
(1) Deciding the operation order 4-59
(2) Deciding the operation position name 4-60
(3) Describing and creating the program 4-61
(4) Confirming the program 4-67
(5) Correcting the program 4-68
(6) Saving the program 4-71
(7) Start automatic operation. 4-72

5 Maintenance and Inspection 5-74
5.1 Maintenance and inspection interval 5-74
5.2 Inspection items 5-75
5.2.1 Daily inspection items 5-75
5.2.2 Periodic inspections 5-75
5.3 Maintenance and inspection procedures 5-76
5.3.1 Replacing the battery 5-77
5.3.2 The check of the filter, cleaning, exchange 5-78
(1) DU1A-700 5-78
(2) DU2A-700 5-79
(3) DU3-700 5-80
5.4 Maintenance parts 5-81

1 Before starting use

This chapter explains the details and usage methods of the instruction manuals, the basic terminology and the safety precautions.

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

Extended Function Instruction Manual	Explains the detailed description of data configuration of shared memory, monitoring, and operating procedures. SQ series only.

1.1.2 Terminological definition

Explain the term currently used in this manual.

Robot controller ..... The controller which controls the robot arm
It consists of the robot CPU system and the drive unit.(SQ series)

Robot CPU (Unit) ..... The CPU unit for the robots which installed to the sequencer base unit. (Q3*DB) (SQ series)

Robot CPU system ..... Multi-CPU system. (SQ series)
It consists of MELSEC units, such as the sequencer base unit, the sequencer CPU unit, and the robot CPU unit, etc.

Drive unit ..... The box which mounts the servo amplifier for the robots, the safety circuit, etc. (SQ series)

1.1.3 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	The "Robot controller" or the "Controller"	Indicates the controller which controls the robot arm. Indicates the box which arranged control parts, such as robot CPU, servo amplifier, and the safety circuit.
Symbol	⚠ 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	This indicates the operating panel on the front of the (drive unit).

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
If the automatic operation of the robot is operated by two or more control equipment, design the right management of operation of each equipment of 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.
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.

⚠ DANGER

When the SSCNETIII cable is removed, install the cap in the connector.
If the cap is not installed, there is a possibility of malfunctioning by adhesion of the dust etc.

⚠ DANGER

Don't remove the SSCNETIII cable, when the power supply of the robot controller is turned on. Don't face squarely the light emitted from the tip of the SSCNETIII connector or the cable. If light strikes the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNETIII is equivalent to the class 1 specified to JISC6802 and IEC60825-1.)

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
CR1QA-700 controller				
1	Robot CPU unit	Q172DRCPU	1 unit	Attachments Machine cable, TU cable(10m), DISP cable(10m), EMI cable(10m), SSCNET Ⅲ cable(10m)
	Drive unit	DU1A-7xx	Each 1 unit	
2	Safety Manual	BFP-A8682	1 copy	
3	CD-ROM (Instruction manual)	5S-Q***-C**	1 pc.	
4	Dummy connector for T/B		1 pc.	Connect, when not using T/B.
5	Ferrite core Note1)		4 pc.	Non-CE specification: For emergency stop wiring, and TU cable, remote I/O.
			10 pc.	CE specification: For emergency stop wiring, and TU, DISP, EMI cable, special input/output terminal
6	Fuse (reserves)	LM16	2 pc.	1.6A
7		LM10	1 pc.	For the fuse F3 on TZ801A card.
8	Earth leakage breaker Note2)	NV30FAU-2P-10A	1 pc.	The terminal cover, two fixing screw attachment
9	Cable clamp Note1)	AL3	1 pc.	Non-CE specification: For TU cable shield grounding
		AL5	2 pc.	CE specification: For TU, DISP, EMI cable shield grounding
10	Filter		1 pc.	46 x 41 For front filter reserves
11	Guarantee Card		1 copy	
CR2QA-700 controller				
1	Robot CPU unit	Q172DRCPU	1 unit	Attachments Machine cable, TU cable(10m), DISP cable(10m), EMI cable(10m), SSCNET Ⅲ cable(10m)
	Drive unit	DU2A-7xx	1 unit	
2	Safety Manual	BFP-A8682	1 copy	
3	CD-ROM (Instruction manual)	5S-Q***-C**	1 pc.	
4	Dummy connector for T/B		1 pc.	Connect, when not using T/B.
5	Ferrite core Note1)		4 pc.	Non-CE specification: For emergency stop wiring, and TU cable.
			8 pc.	CE specification: For emergency stop wiring, and TU, DISP, EMI cable, special input/output terminal
6	Cable clamp Note1)	AL3	1 pc.	Non-CE specification: For TU cable shield grounding
		AL5	2 pc.	CE specification: For TU, DISP, EMI cable shield grounding
7	Fuse (reserves)	LM16	2 pc.	1.6A
		LM32	1 pc.	3.2A
		MF60NRF-1.6A	1 pc.	For the hand 1.6A
8	Union band	T30R	2 pc.	For primary power cable fixing
9	Filter mat		1 pc.	356 x 32 For bottom filter reserves
10	Knob locking device	HL-05FA	1 pc.	For the lock of the power switch
11	Guarantee Card		1 copy	
CR3Q-700 controller				
1	Robot CPU unit	Q172DRCPU	1 unit	Attachments Machine cable, TU cable(10m), DISP cable(10m), EMI cable(10m), SSCNET Ⅲ cable(10m)
	Drive unit	DU3-7xx	1 unit	
2	Safety Manual	BFP-A8682	1 copy	
3	CD-ROM (Instruction manual)	5S-Q***-C**	1 pc.	

No.	Part name	Type	Qty.	Remarks
4	Connector for power supply unit connecting cables and connector pin	2-178128-3 1-175218-5	1 pc 2 pc	For connection with the sequencer power supply unit
5	Dummy connector for T/B		1 pc.	Connect, when not using T/B.
6	Ferrite core Note1)		4 pc.	Non-CE specification: For emergency stop wiring, and TU cable.
			8 pc.	CE specification: For emergency stop wiring, and TU, DISP, EMI cable, special input/output terminal
7	Cable clamp	AL5	1 pc.	For TU, DISP, EMI cable shield grounding
8	Fuse (reserves)	LM16	2 pc.	
		LM32	1 pc.	
9	Filter mat		1 pc.	For the protection specification drive unit 337 x 57 For rear filter reserves
10	Guarantee Card		1 copy	

Note1) The attachments in which "CE specification" is written to the remarks column are attached to CE specification only. "Non-CE specification" is attached only to non-CE specification in the same way.
Note2) It is not attached to non-CE specification of RV-2SQ.

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) DU1A-700 series

Mass : Approx.10kg

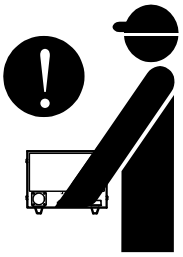


Fig. 2-1 : Transporting the drive unit (DU1A-700)

1) Insert, raise and transport the hand in the crevice between the lower of the drive unit side. Do not hold switch or connector.

(2) DU2A-700 series

The drive unit must always be transported by two workers.

Mass : Approx.21kg

Fig. 2-2 : Transporting the drive unit (DU2A-700)

(3) DU3-700 series

Mass : Approx.60kg

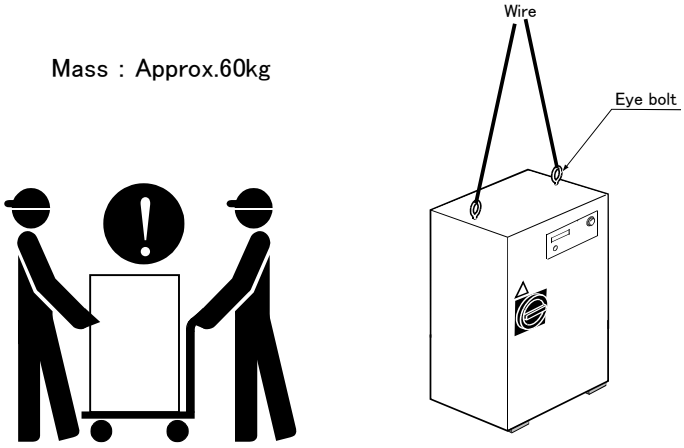


Fig. 2-3 : Transporting the drive unit (DU3-700/700M)

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

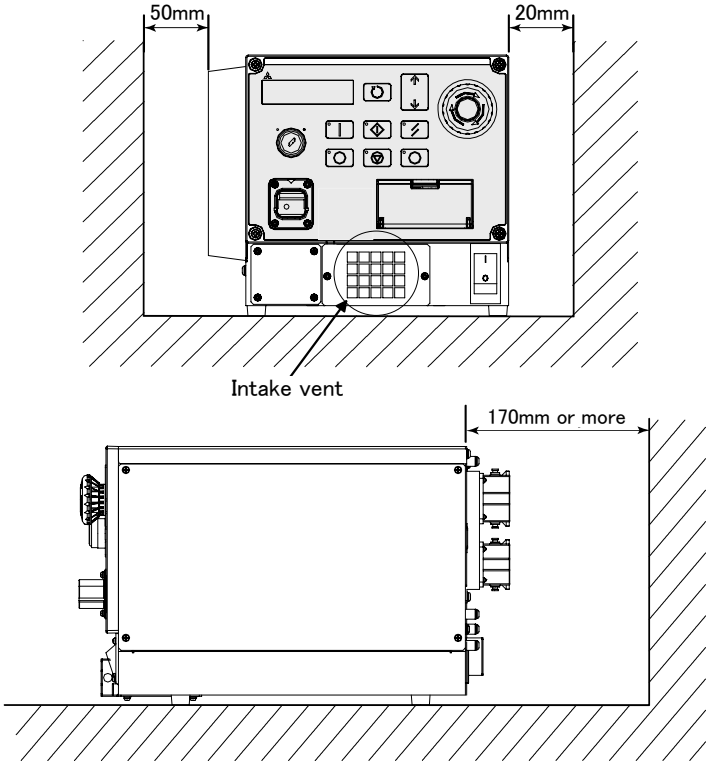
2.2.3 Installation procedures

The installed size is shown as follows.

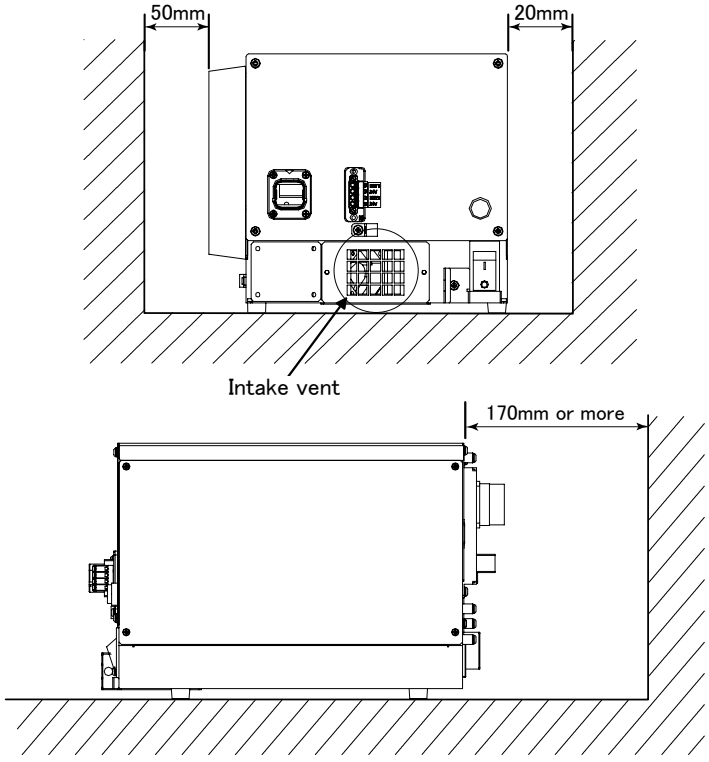
(1) DU1A-700 series

Standard specification

DU1A-700 series



DU1A-772 series



CE marking specification

DU1A-700 series

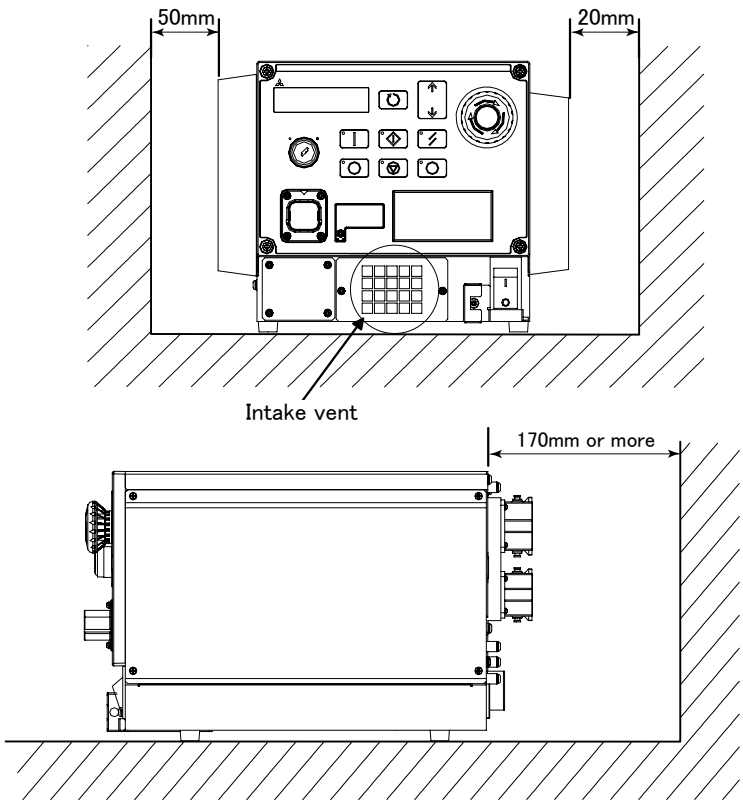
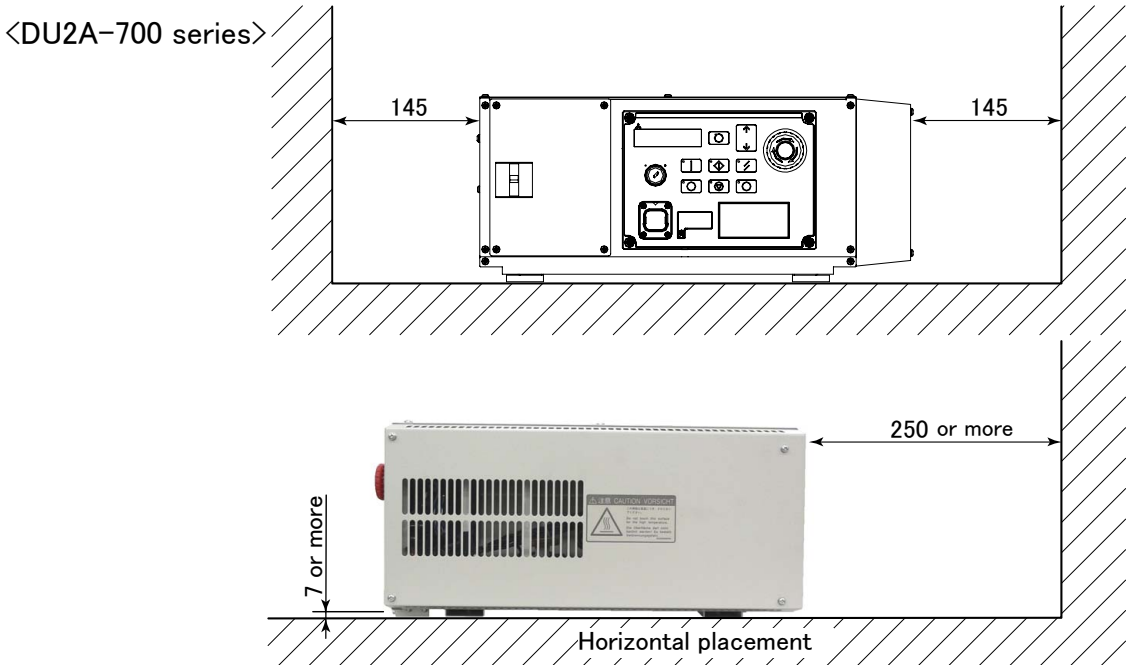


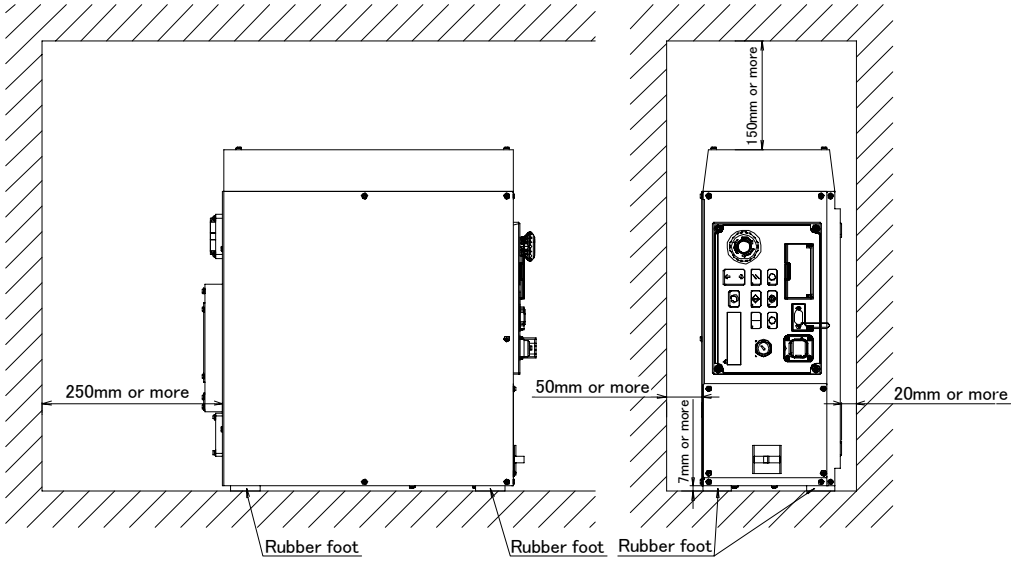
Fig. 2-4 : Installation dimensions (DU1A-700 series)

[Caution] A suction port is installed on the bottom of the drive unit, so do not remove the rubber foot and install the drive unit flat on a surface.

(2) DU2A-700 series



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



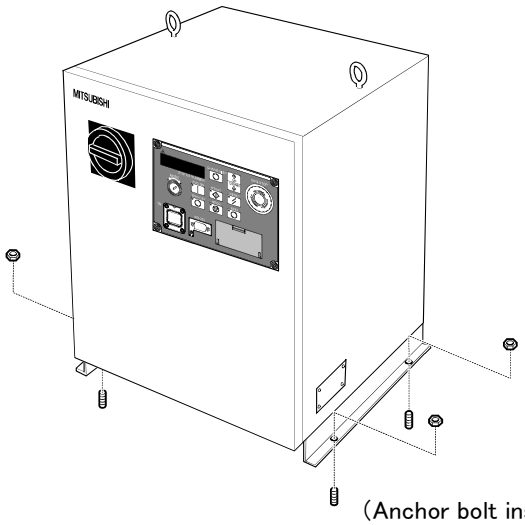
⚠CAUTION The installation section needs to be fixed so that the drive unit may not fall. When fixing the drive unit with the bolt, please use the bolt of the length which does not protrude 5mm or more into the drive unit case.

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

Fig. 2-5 : Installation dimensions (DU2A-700)

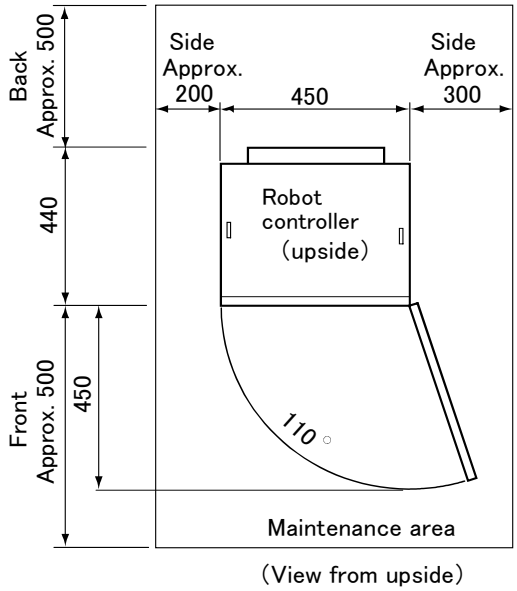
⚠CAUTION When storing the drive unit in a cabinet, etc., take special care to the heat radiating properties and ventilation properties so that the ambient temperature remains within the specification values.

(3) DU3-700 series



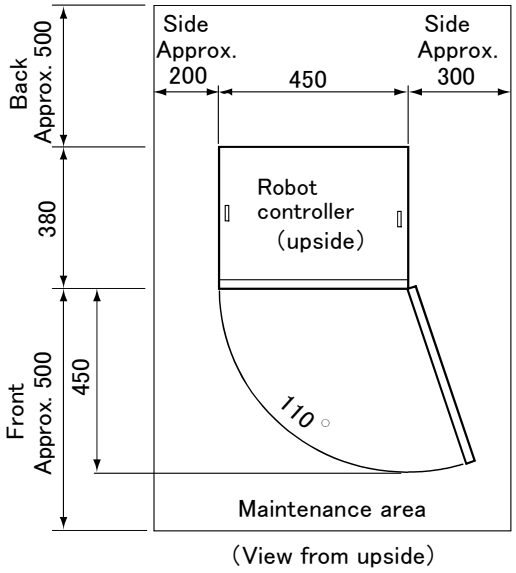
(Anchor bolt installation: 4 places)

<DU3-700M>



(View from upside)

<DU3-700>



(View from upside)

Fig. 2-6 : Installation dimensions (DU3-700)

1) Install the drive unit so that it is level.
2) Do not block the ventilation holes on the side and rear surfaces of the drive unit.
3) When storing the drive unit in a cabinet,etc., take special care to the heat dissipation and ventilation properties so that the ambient temperature is within the specification values.

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

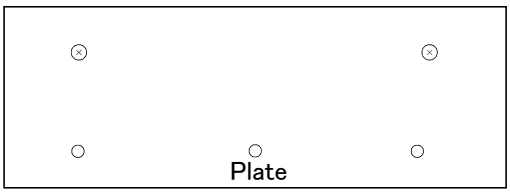
4) The basic base unit should equip with the power supply unit at any cost. If the load of the input/output unit and intelligent functional unit with which the base unit is equipped is low, it may operate, even if there is no power supply unit. However, since voltage becomes unstable, operation cannot 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

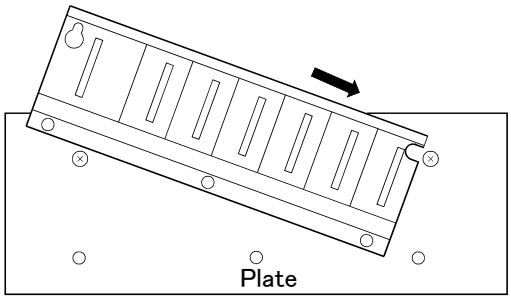
1) Please use the robot CPU system in the environment of general specification given in this manual. If other, it becomes the electric shock, the fire, malfunction, the damage to the product, or the cause of deterioration.
2) Pressing down the unit lower lever for unit wearing, insert the projection 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.

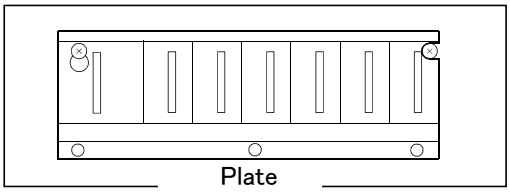
a) Install the two screws for fixing for basic base unit surface to the plate.



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



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



d) 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

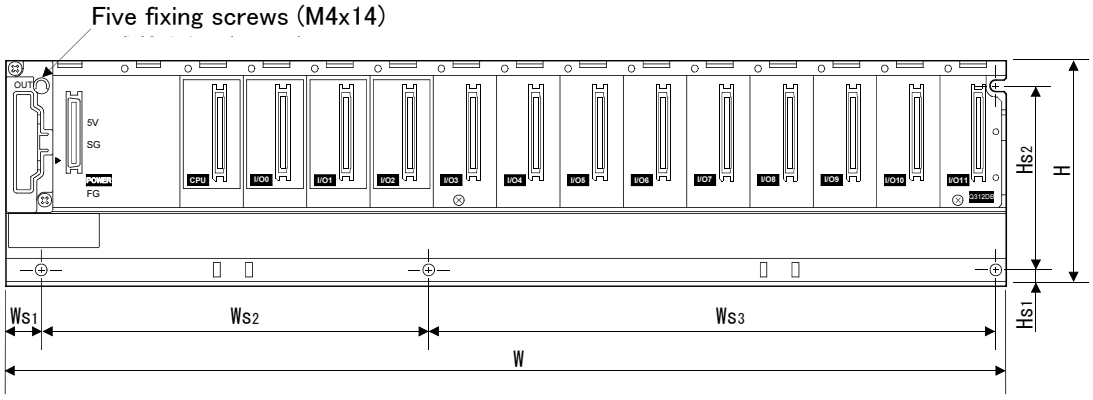


Table 2-3 : Installation dimension

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>

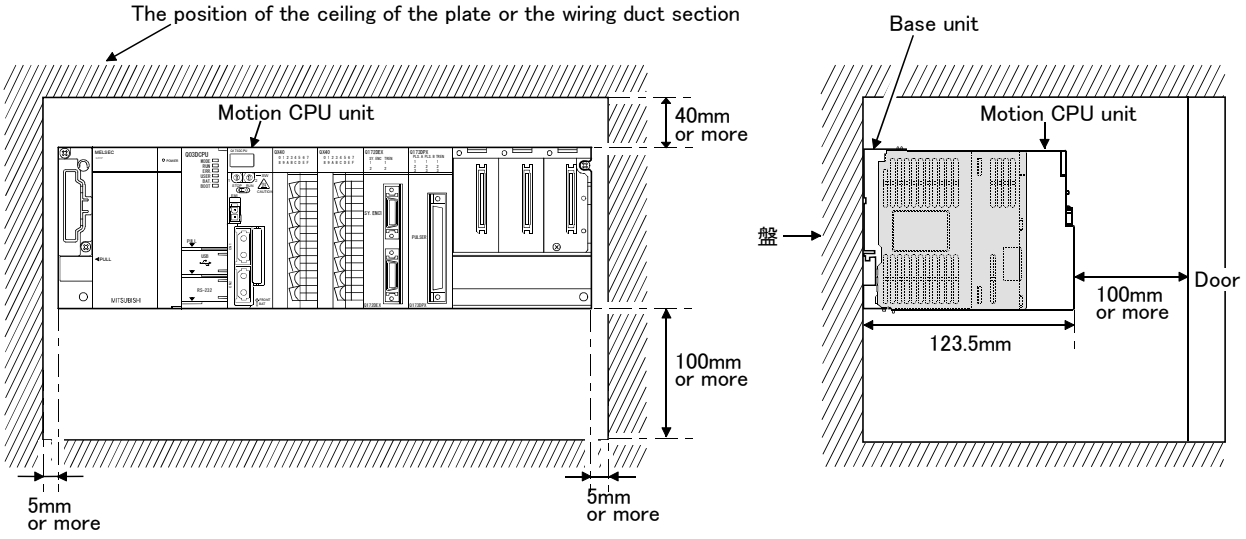
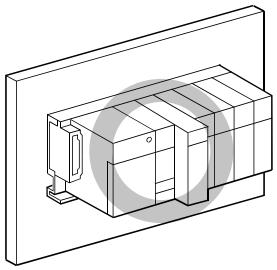


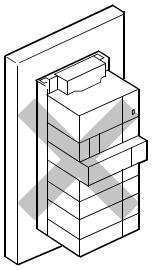
Fig. 2-7 : Installing dimensions of the robot CPU unit

3) Unit installation direction

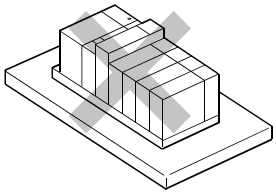
a) Use the robot CPU system in the installation direction of the airy following figure because of heat dissipation.



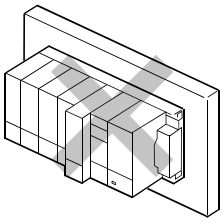
b) Don't use it in the installation direction of the following figure.



Vertical installation



Horizontal installation



Upside down installation

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.

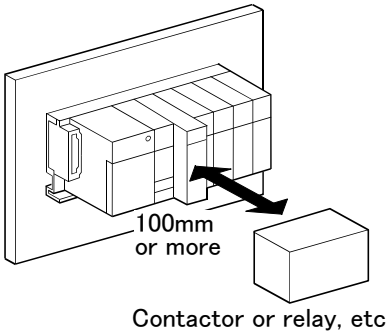
5) Mixture with other equipment

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.

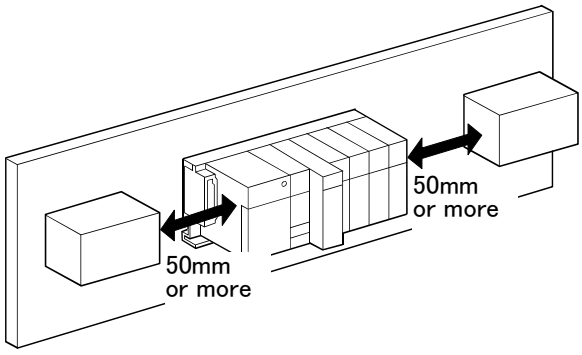
6) Distance with other equipment

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 system .....100mm or more
- Horizontal direction of the robot CPU system .....50mm or more



Contactor or relay, etc

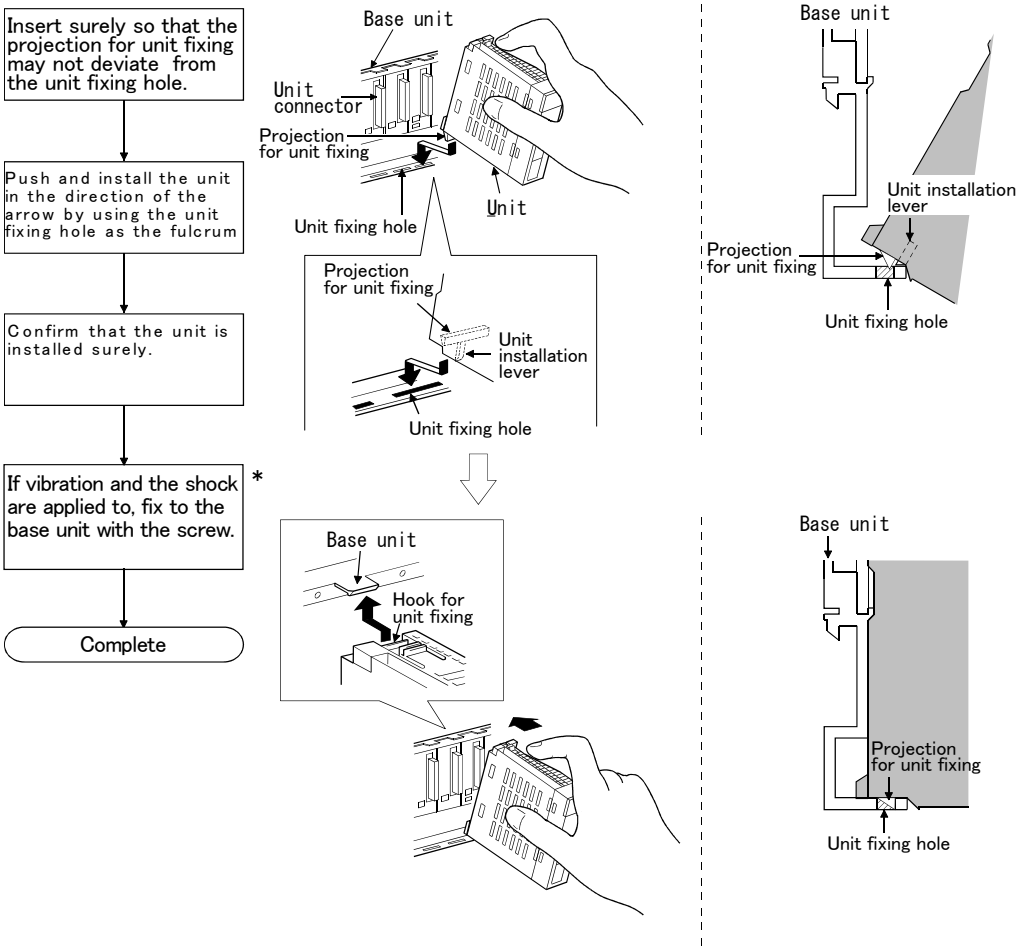


(3) Installation and removal of the unit

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.

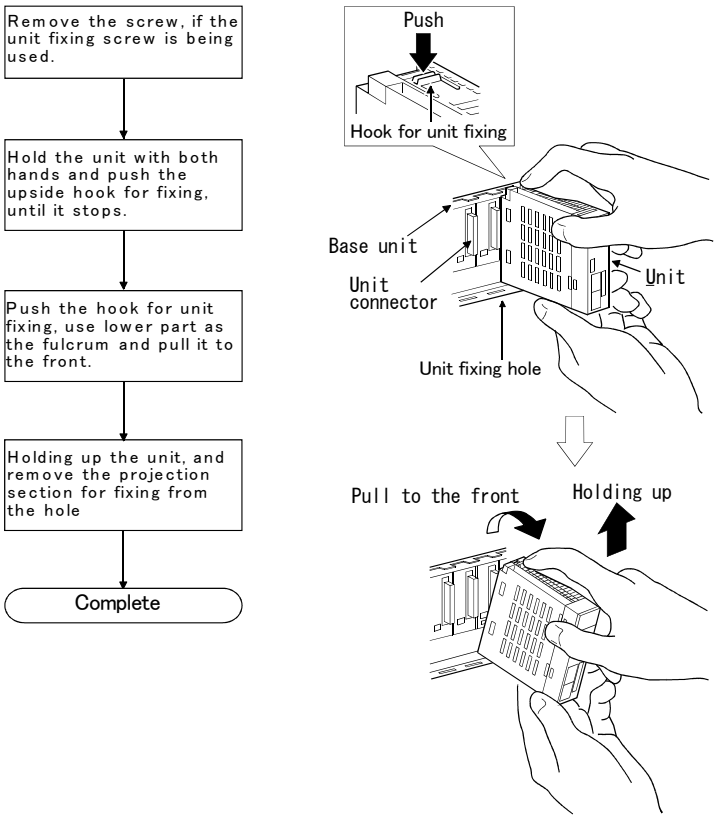
<Point>

- 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"



<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

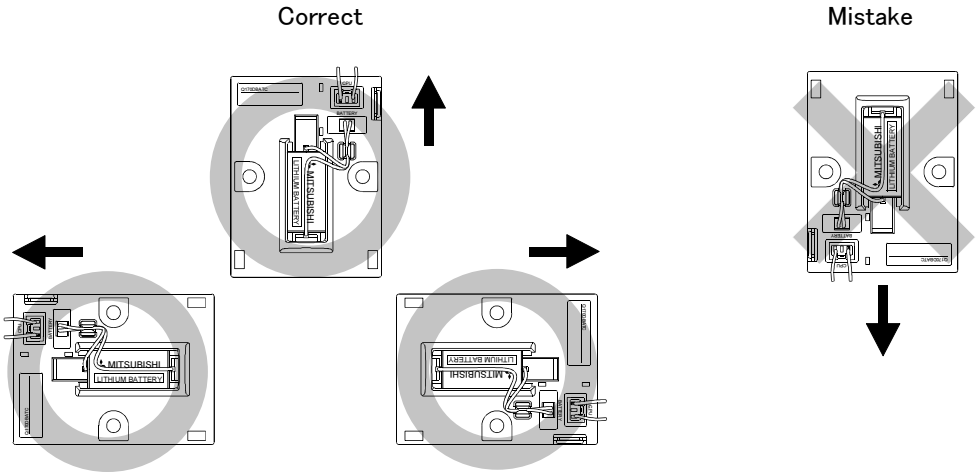
Please install the battery holder unit in less than (battery cable length: 50cm) 50cm from the robot CPU system.

2) Installation surface

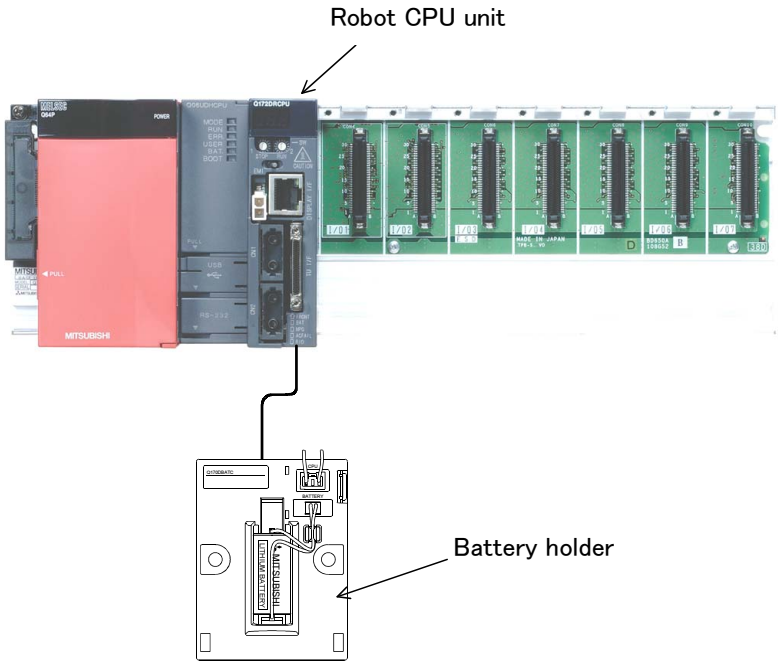
Please install the battery holder unit in the flat field.

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) DU1A-700 series

⚠CAUTION Provide an earth leakage breaker in the primary power supply circuit of the drive unit to prevent short circuit. Failure to do so may result in electric shock.

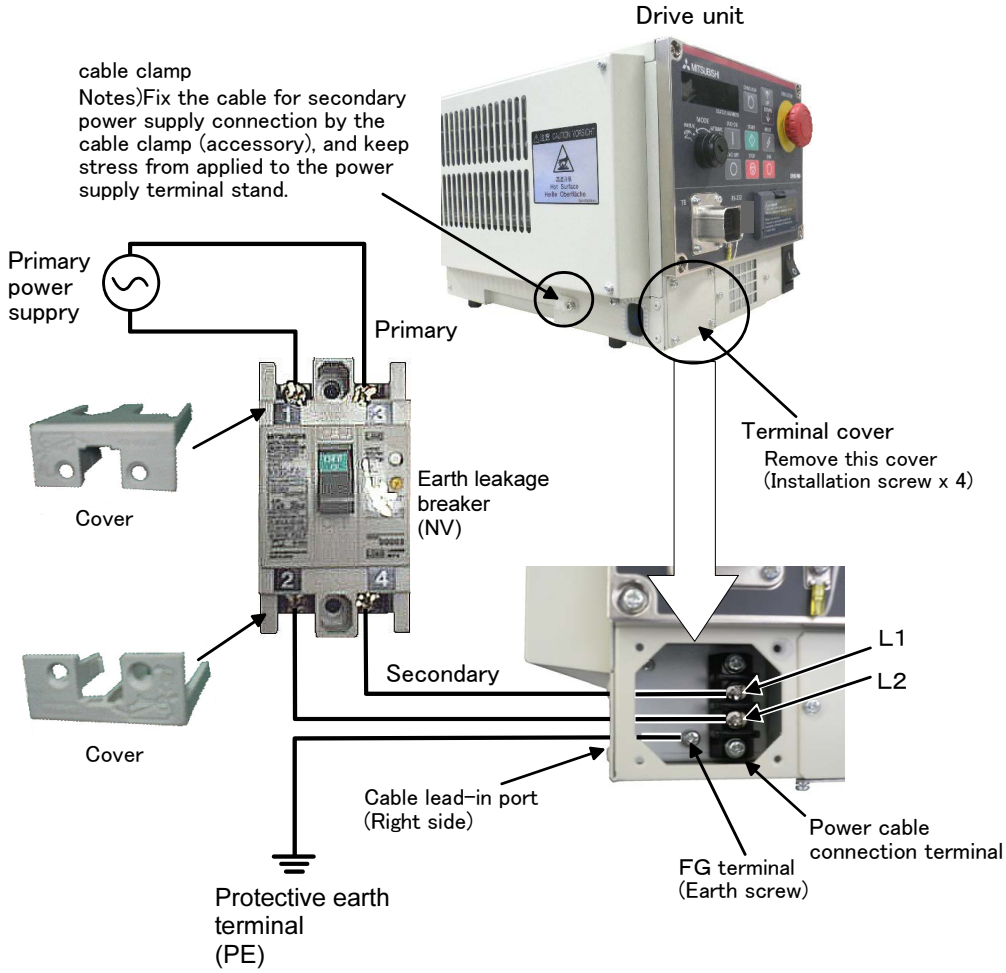


Fig. 2-8 : Connecting the power cable and grounding cable (DU1A-700)

1) Prepare the power cable and grounding cable (both must be AWG#14 or more thickly).
2) Loosen the four screws fixing the terminal cover, and remove the cover.
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) Connect the secondary power cable to L1,L2 of drive unit terminal and earth leakage breaker.
6) Connect the grounding cable to the FG terminal.
7) Connect the cable for primary power supplies to the primary side terminal (upper terminal) of the earth leakage breaker.
8) Install the power terminal cover as before.

This completes the connection of the power and grounding cables.

[Note] Please do installation of the earth leakage breaker attached of the customer. The length of the power cable changes according to the distance for the setting position and the drive unit.

(2) DU2A-700 series

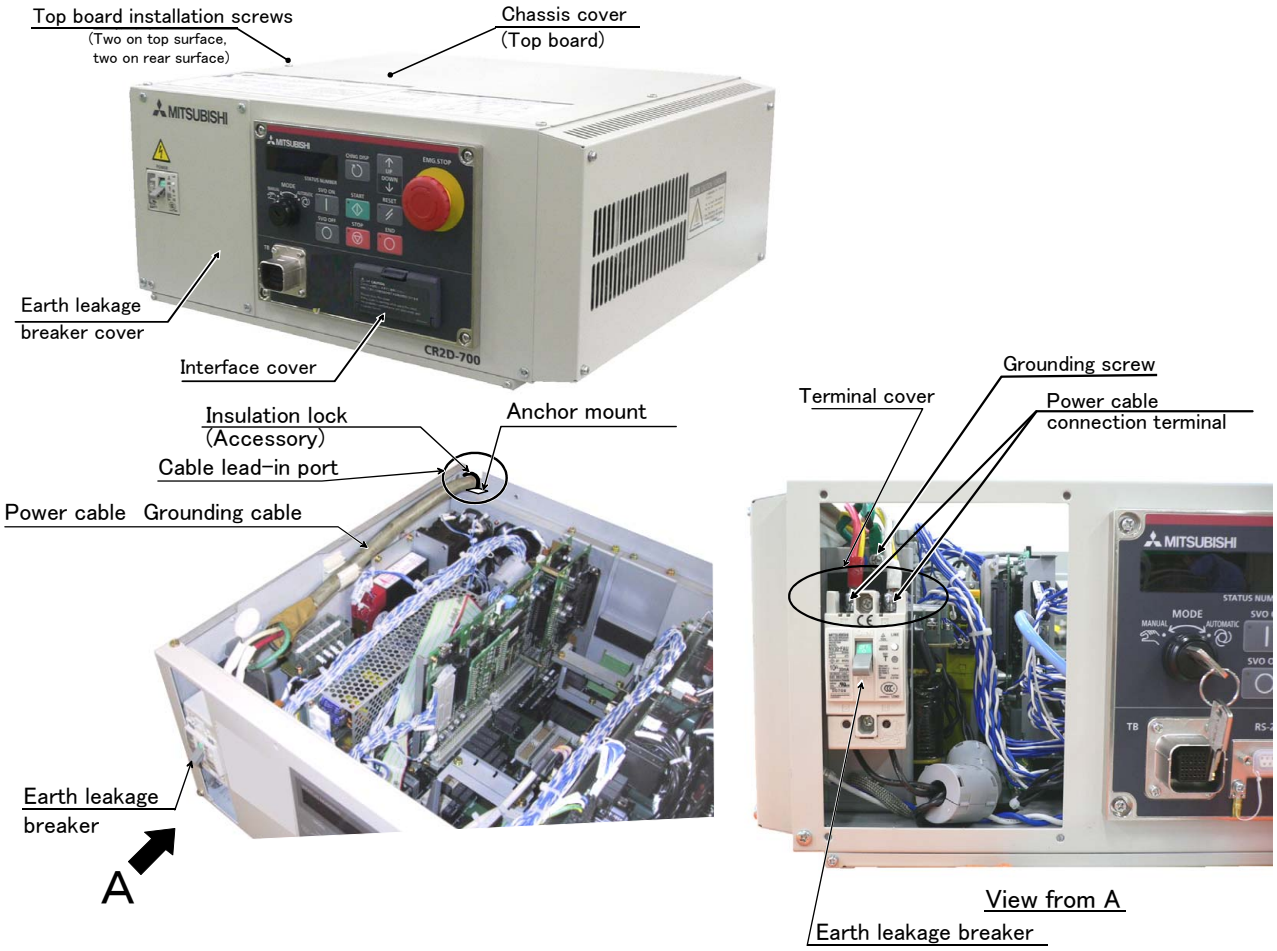
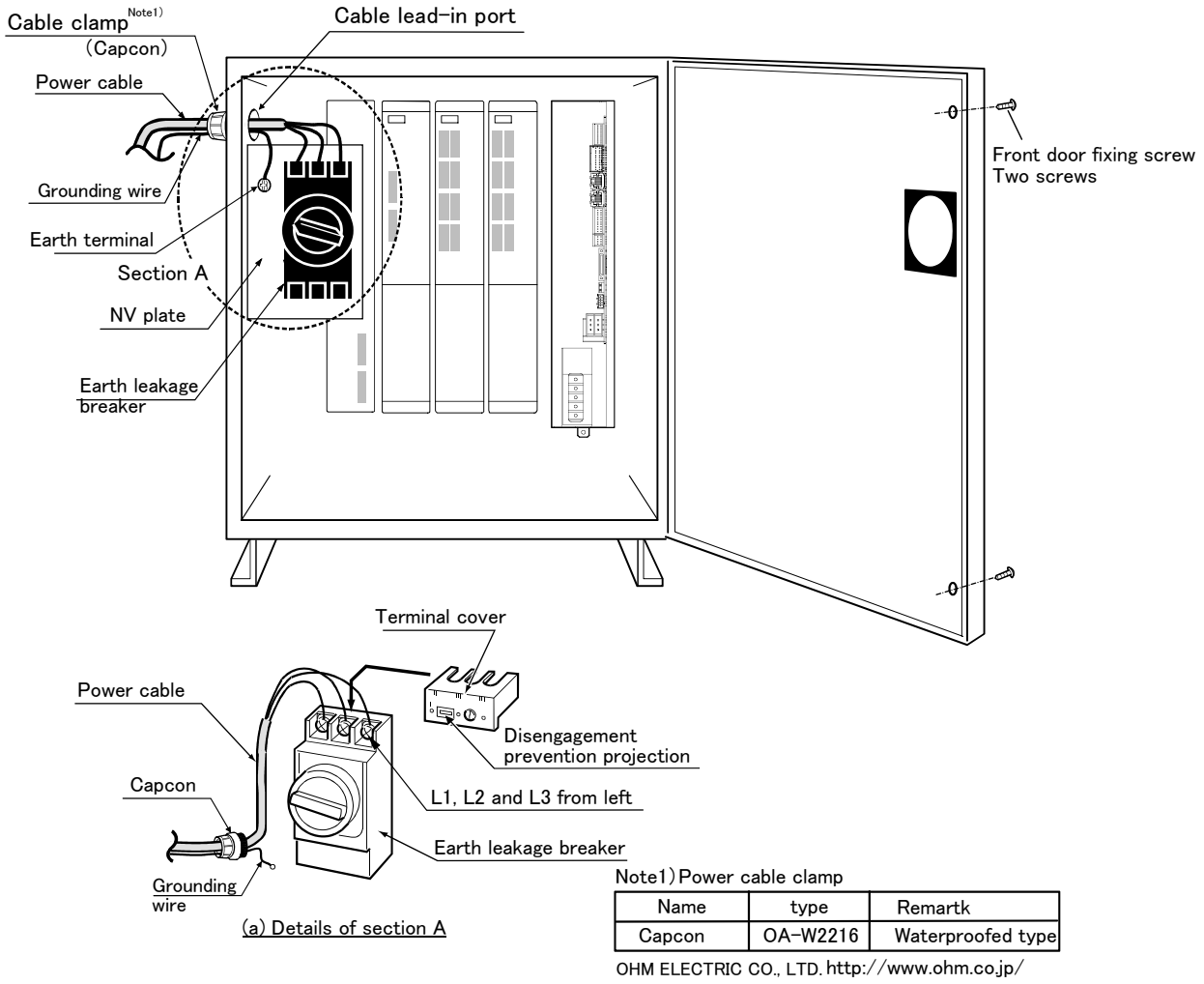


Fig. 2-9 : Connecting the power cable and grounding cable (DU2A-700)

1) Prepare the power cable and grounding cable (both must be AWG#14 or more thickly).
2) Remove the drive unit chassis cover (top board) by removing the four installation screws. To remove the chassis cover, slide it to the rear and then lift it. Remove the four fixing screws which are fixing the earth leakage breaker cover, and remove that cover.
3) Confirm that the primary power supply matches the specifications.
4) Confirm that the primary power supply is OFF and that the earth leakage breaker on the drive unit is OFF.
5) Pull out the terminal cover of the earth leakage breaker.
6) Insert the power cable and grounding cable from the cable lead-in port on the side or rear of the drive unit.
7) Connect the power cable to the earth leakage breaker terminals (M5 screw).
8) Connect the grounding cable with the screw hole on the drive unit's chassis, located above the earth leakage breaker (PE marking).
9) Press in the earth leakage breaker terminal cover, until a "click" is heard.
10) Re-install both the drive unit's chassis and the earth leakage breaker cover back.

This completes the connection of the power and grounding cables of the DU2A-700 series drive unit.

(3) DU3-700 series



Note1) Power cable clamp

Name	type	Remartk
Capcon	OA-W2216	Waterproofed type

OHM ELECTRIC CO., LTD. http://www.ohm.co.jp/

Fig. 2-10 : Connecting the power cable and grounding cable (DU3-700)

1) Prepare the power cable and grounding cable (both must be AWG#14 or more for 3-phase).
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 (M5 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 of the DU3-700 series drive unit.

⚠CAUTION Uses earth leakage breaker of corresponding to inverter products and working by leak current of the commercial frequency domain (50-60Hz). It will become the cause of malfunction if the thing sensitive to the high frequency ingredient is used.

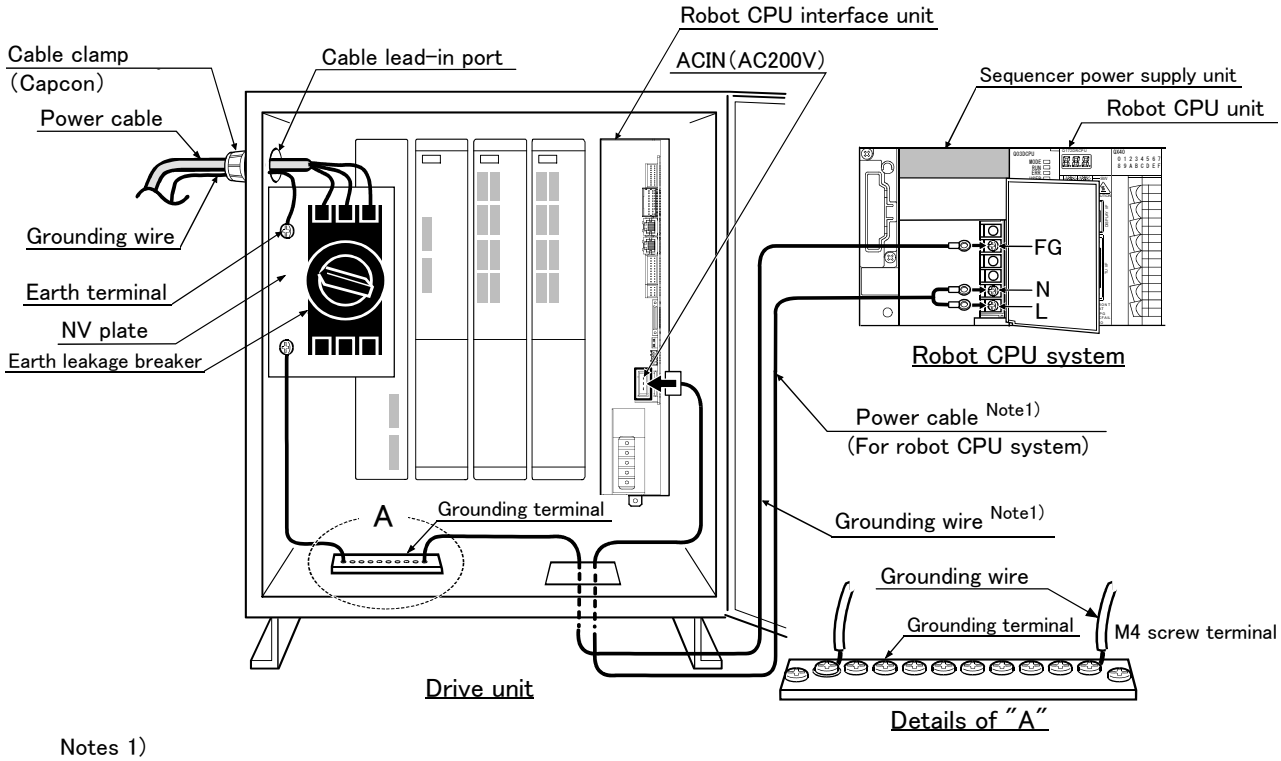
2.3.3 Power cable connection of robot CPU system power supply unit

CR3Q-700 series supplies the power supply to the robot CPU system power supply unit from the drive unit by the attached power-supply connection cable. CR1QA/CR2QA-700 series connects the power supply prepared by the customer. Please prepare the power supply (AC200V), the power cable, and the grounding wire.

⚠CAUTION The power supply of the drive unit should turn on at first, and the sequencer (robot CPU) should turn on after that.

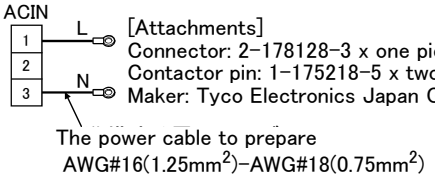
The power cable connection method to the sequencer power supply unit of "CR3Q-700" series is shown below.

(1) The connection between the drive unit and the sequencer power supply unit (CR3Q-700 series)



Notes 1)
Please prepare the power cable and grounding wire for robot CPU system by the customer.
The power cable connection of the robot CPU interface unit side should use the attached connector for the power supplies. Pin assignment of the connector for the power supplies is shown below.
* You may connect with the power supply prepared by the customer.

<Pin assignment of the connector for the power supplies>



Note) If it connects the AC200V to the sequencer with ACIN connector, you should make it only the one set.

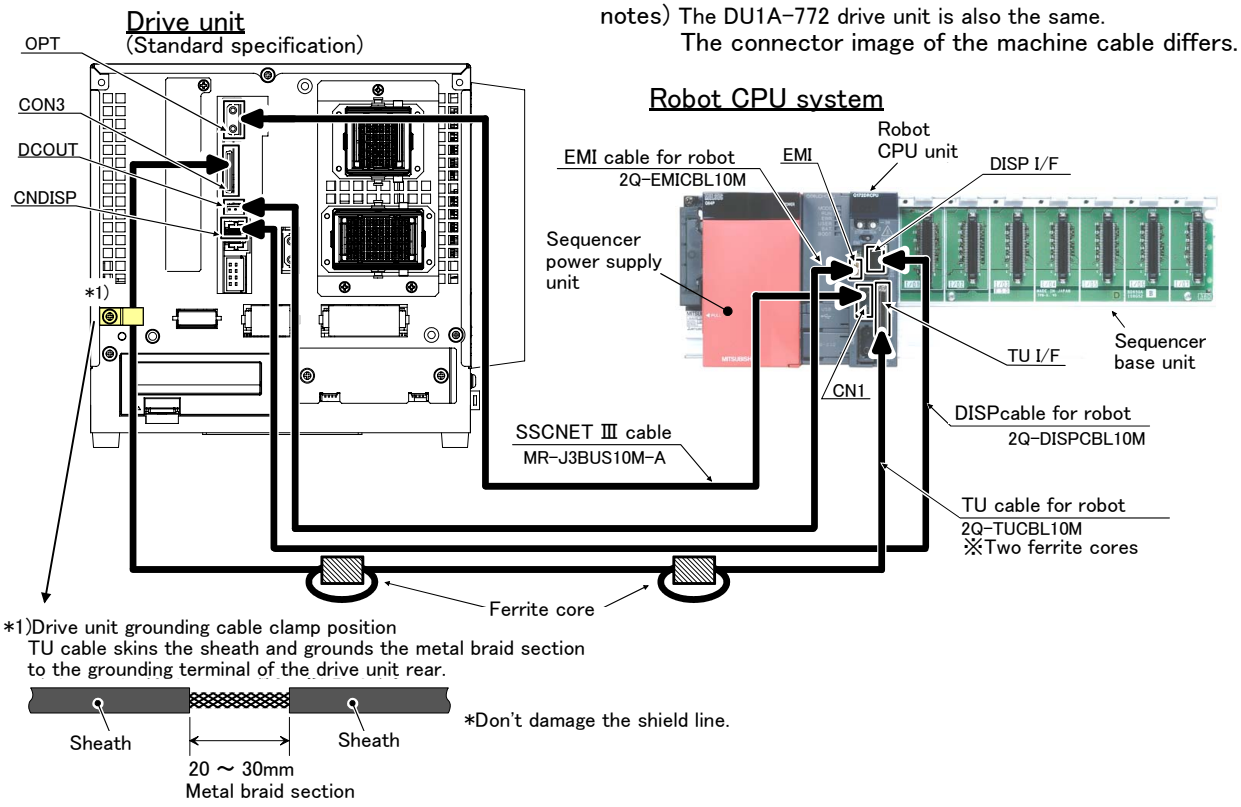
The power supply of the drive unit should turn on at first, and the sequencer (robot CPU) should turn on after that.

Fig. 2-11 : Connection between the drive unit and the sequencer power supply unit (CR3Q-700 series)

2.3.4 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 drive unit (CR1QA-700 series)



Grounding and ferrite core installation of TU cable

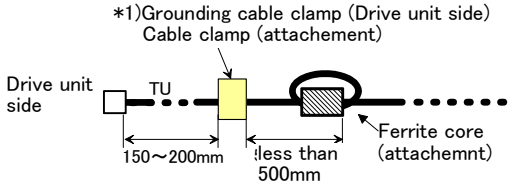


Fig. 2-12 : Connection between the robot CPU system and the drive unit (CR1QA-700 series)

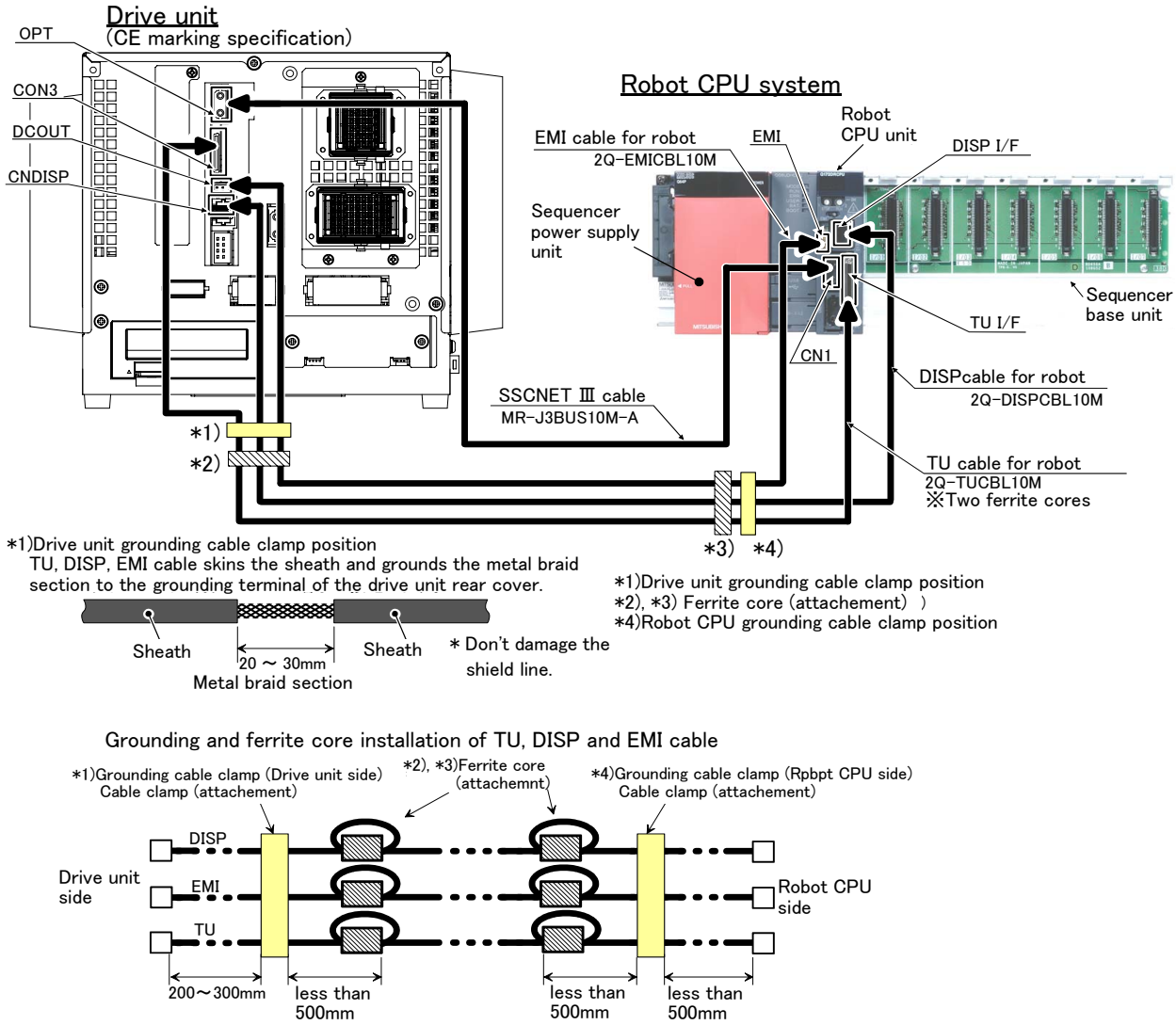


Fig. 2-13 : Connection between the robot CPU system and the drive unit (CR1QA-700 series CE marking specification)

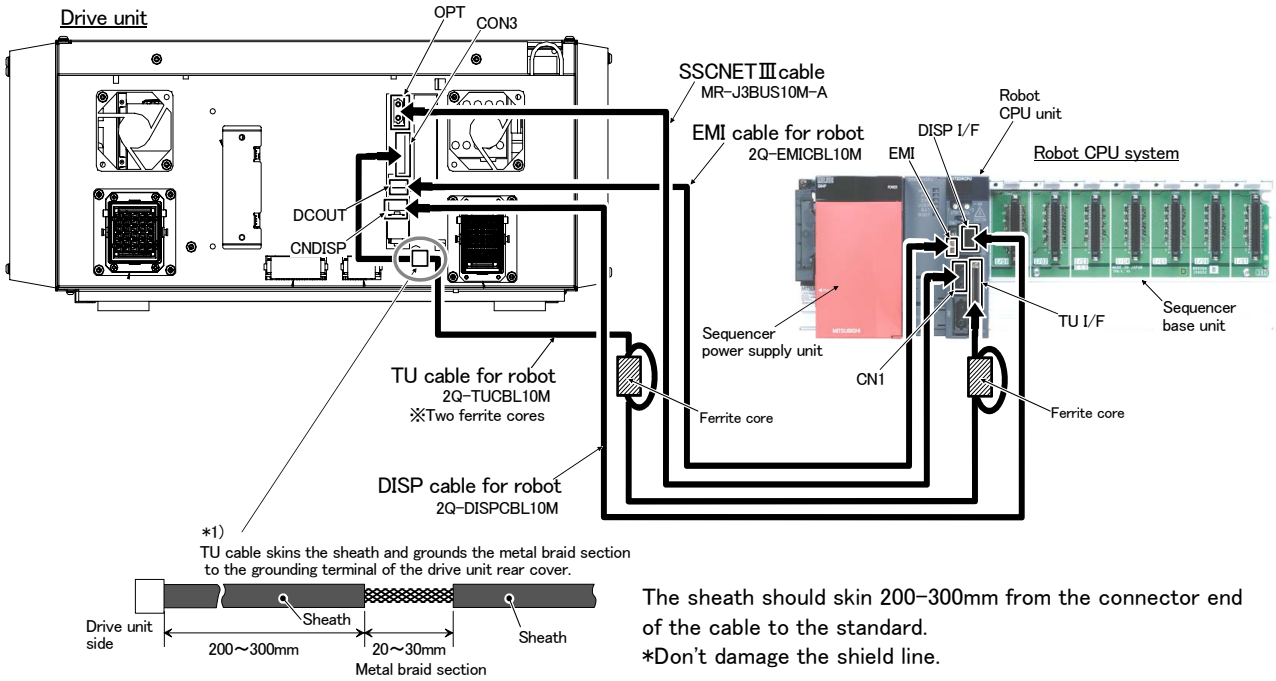
⚠CAUTION

1) If the cap is not installed in the SSCNETIII connector after removing the SSCNETIII cable, there is a possibility that the characteristic may deteriorate and malfunction by adhesion of garbage and the dust
2) Don't remove the SSCNETIII 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 SSCNETIII connector of servo amplifier, and the SSCNETIII cable. If light hits to the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNETIII 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.
(Cable clamp attachment)
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 SSCNETIII 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 drive unit (CR2QA-700 series)

The cable connection figure of standard specification is shown in Fig. 2-14, and CE Marking specification is shown in Fig. 2-15 Please connect the cable, corresponding to the specification of the robot.

CR2QA-700 standard



The sheath should skin 200-300mm from the connector end of the cable to the standard.
*Don't damage the shield line.

Fig. 2-14 : Connection between the robot CPU system and the drive unit (CR2QA-700 series)

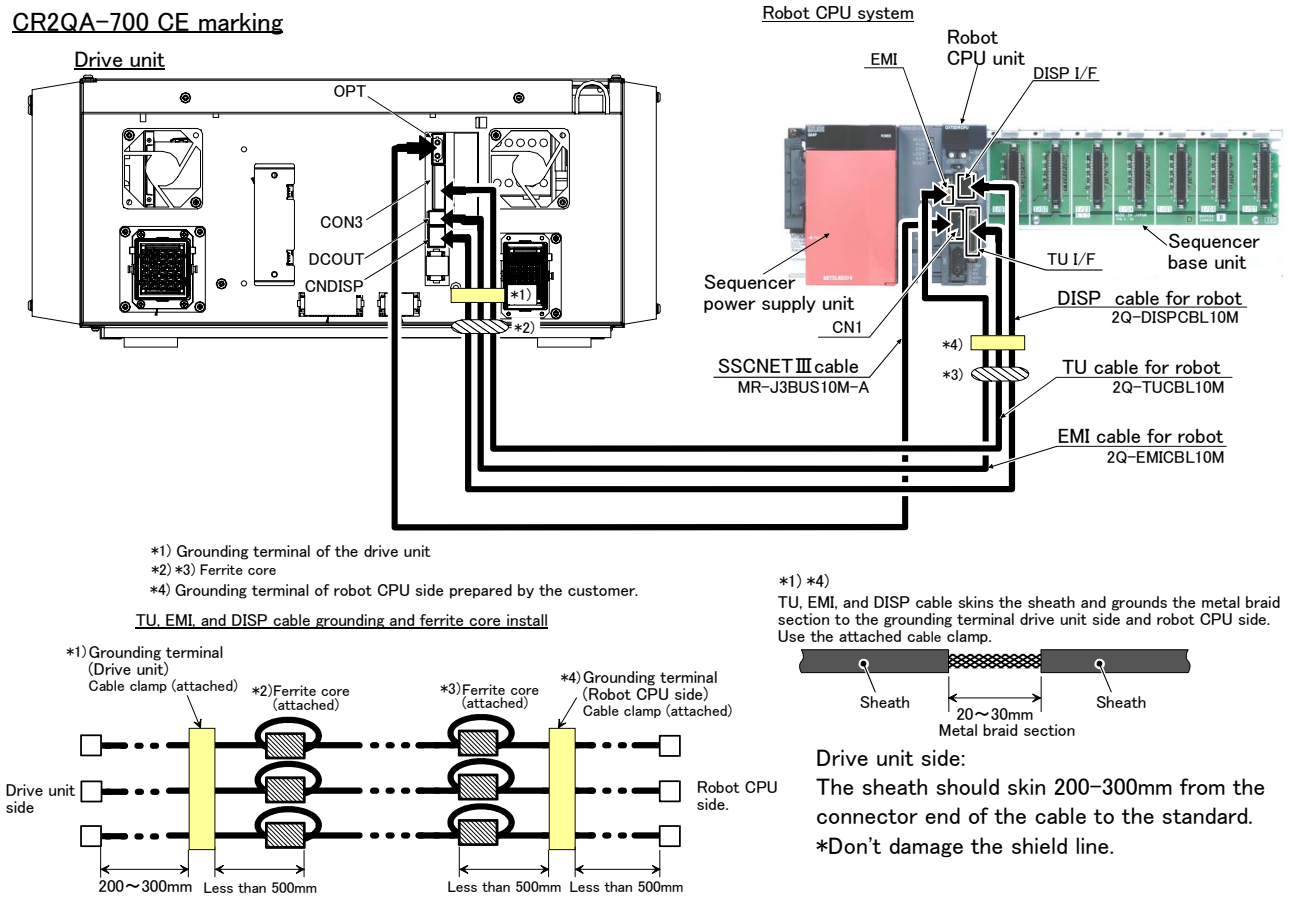


Fig. 2-15 : Connection between the robot CPU system and the drive unit (CR2QA-700 CE marking)

⚠CAUTION

1) If the cap is not installed in the SSCNETIII connector after removing the SSCNETIII cable, there is a possibility that the characteristic may deteriorate and malfunction by adhesion of garbage and the dust
2) Don't remove the SSCNETIII 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 SSCNETIII connector of servo amplifier, and the SSCNETIII cable. If light hits to the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNETIII 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. (Cable clamp attachment)
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 SSCNETIII cable in the larger radius than minimum flexed radius shown in the following sure.
Type: MR-J3BUS*M-AReinforcement 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 drive unit (CR3Q-700 series)

The cable connection figure of standard specification is shown in Fig. 2-16, and CE Marking specification is shown in Fig. 2-17 Please connect the cable, corresponding to the specification of the robot.

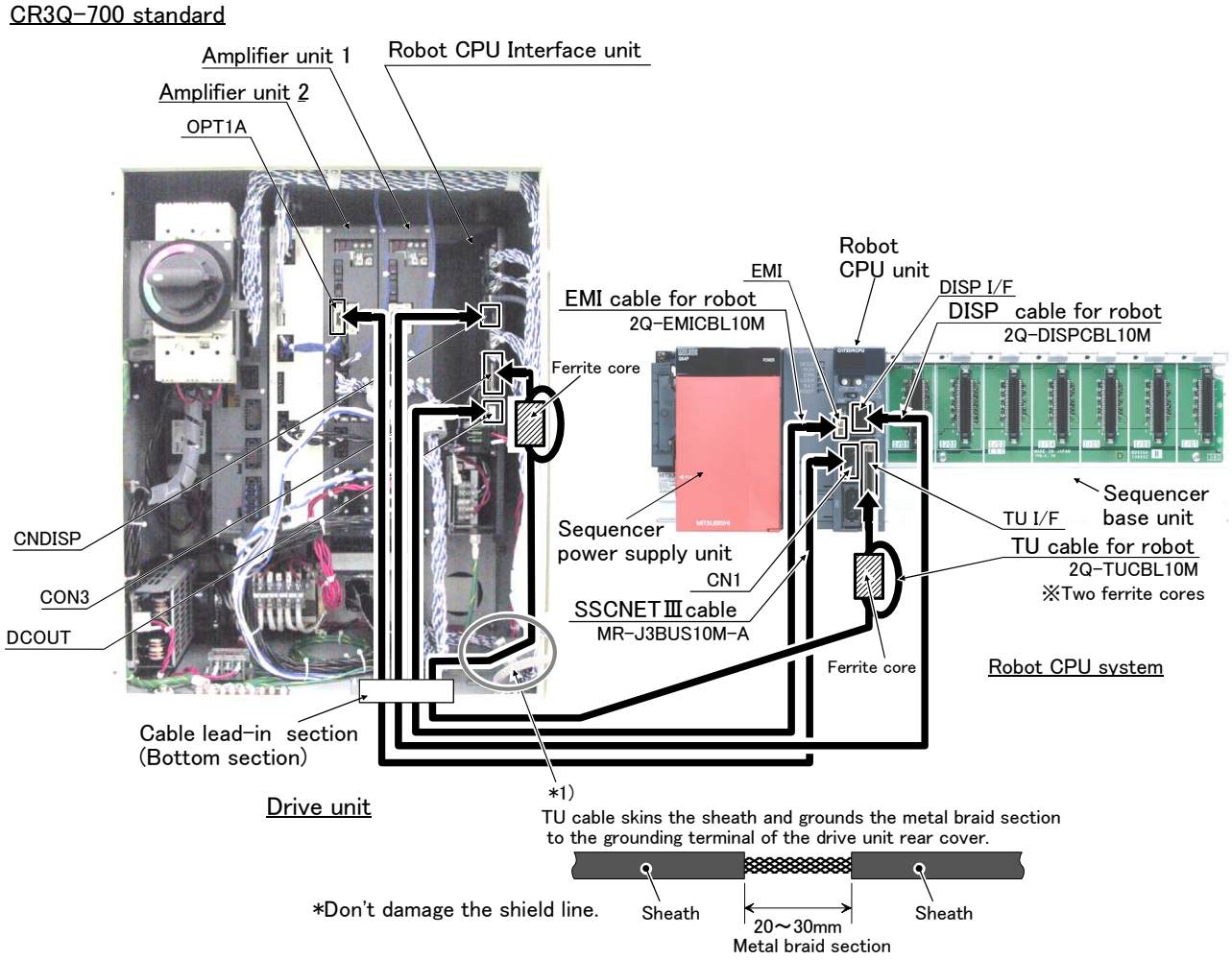


Fig. 2-16 : Connection between the robot CPU system and the drive unit (CR3Q-700 series)

CR3Q-700 CE marking

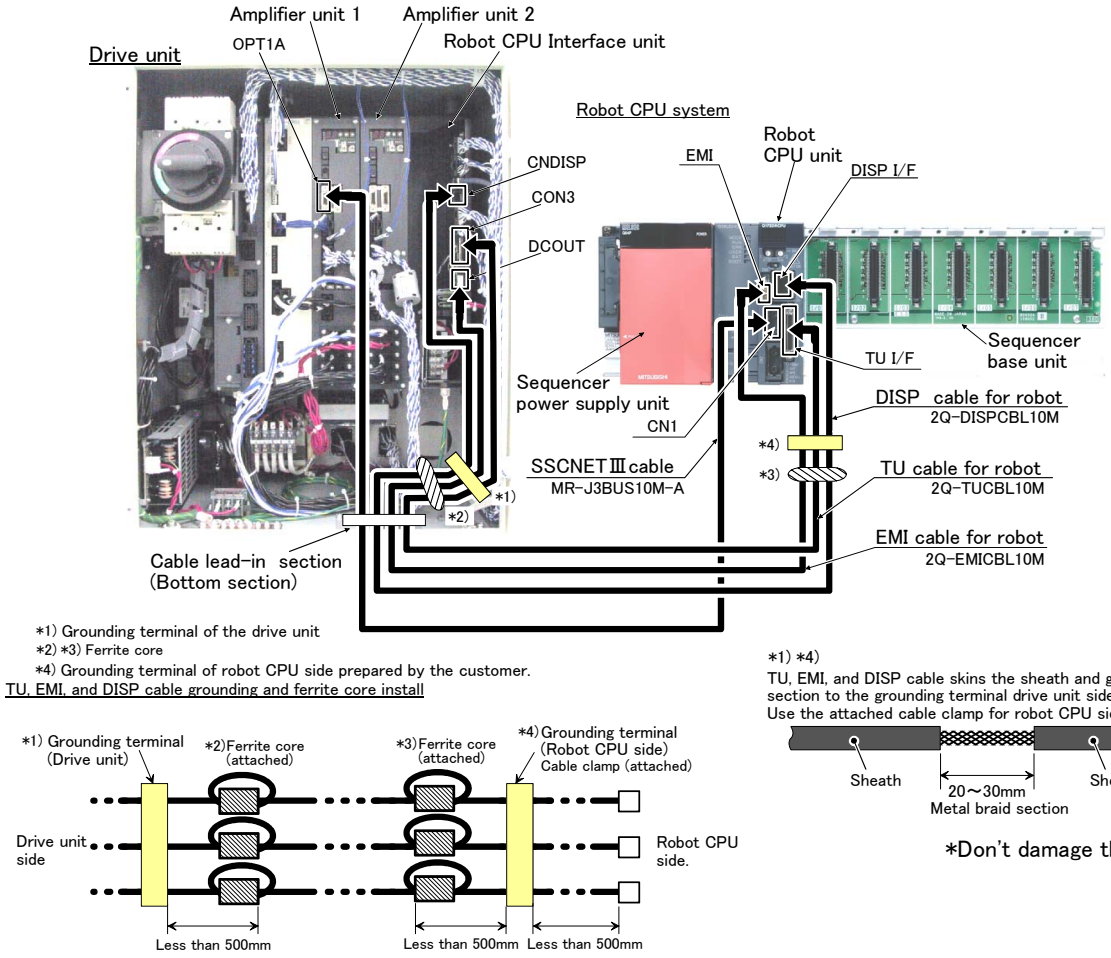


Fig. 2-17 : Connection between the robot CPU system and the drive unit (CR3Q-700 CE marking)

⚠CAUTION

1) If the cap is not installed in the SSCNETIII connector after removing the SSCNETIII cable, there is a possibility that the characteristic may deteriorate and malfunction by adhesion of garbage and the dust

2) Don't remove the SSCNETIII 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 SSCNETIII connector of servo amplifier, and the SSCNETIII cable. If light hits to the eyes, there is a possibility of feeling the sense of incongruity for the eyes. (The light source of SSCNETIII 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 plate prepared inside.
For the robot CPU system side, fix to the cable grounding clamp prepared by customer (Cable clamp attachment)
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 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 SSCNETIII 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)

2.3.5 Connecting the external emergency stop

The following shows how to connect the external emergency stop.

External emergency connection (Refer to Fig. 2-18)

a)DU1A-700/DU2A-700 : Rear side connector

b)DU3-700 : Safety unit

The external emergency stop input and door switch input and enabling device input are opened at shipment as shown in Page 32 "Fig. 2-19External emergency stop connection". Please be sure to prepare the external emergency stop, the door switch, the enabling device, etc. of the customer, and to use the robot in the state where it connected. Below, the procedure of connection is shown.

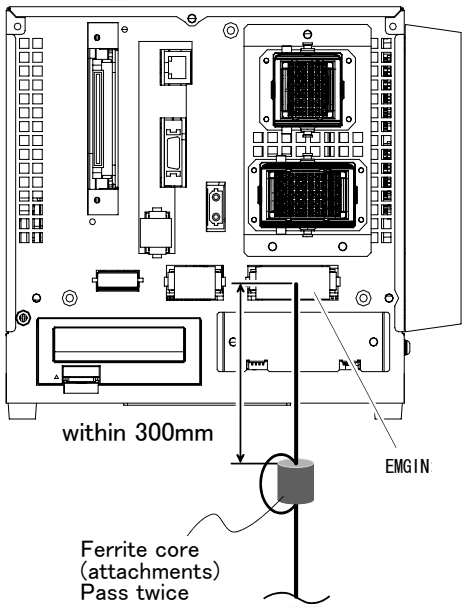
[Caution] When wiring the emergency stop switch (double emergency line type), wire both contacts to the two terminal blocks on the drive unit.

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

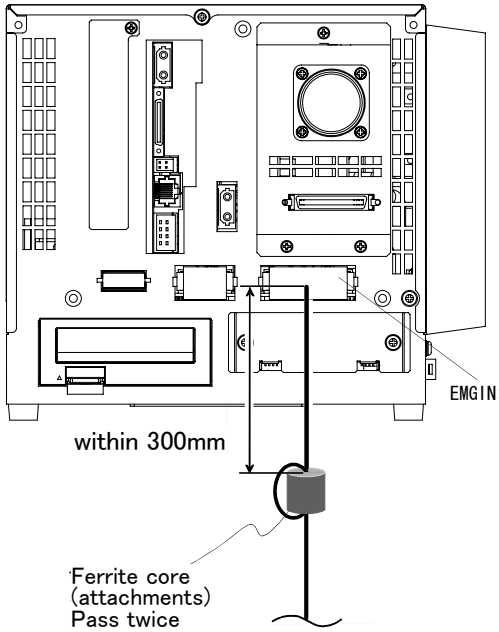
[Caution] When wiring the emergency stop switch (double emergency line type), wire both contacts to the two terminal blocks on the drive unit. If both contacts are wired to only one of the terminal blocks, errors cannot be cancelled.

[Caution] The cable uses the shielded cable and installs the ferrite core. Install the ferrite core in less than 30cm from the contact button.

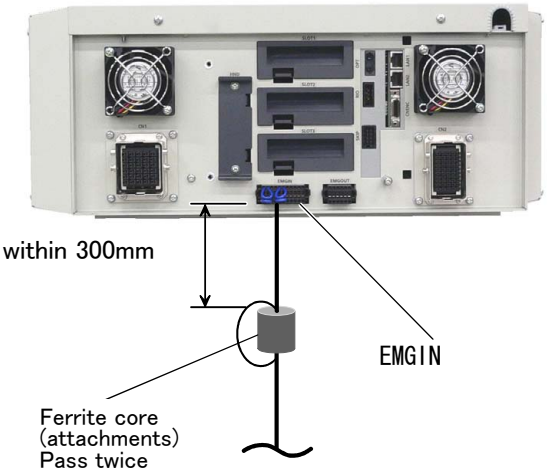
<DU1A-700 series>



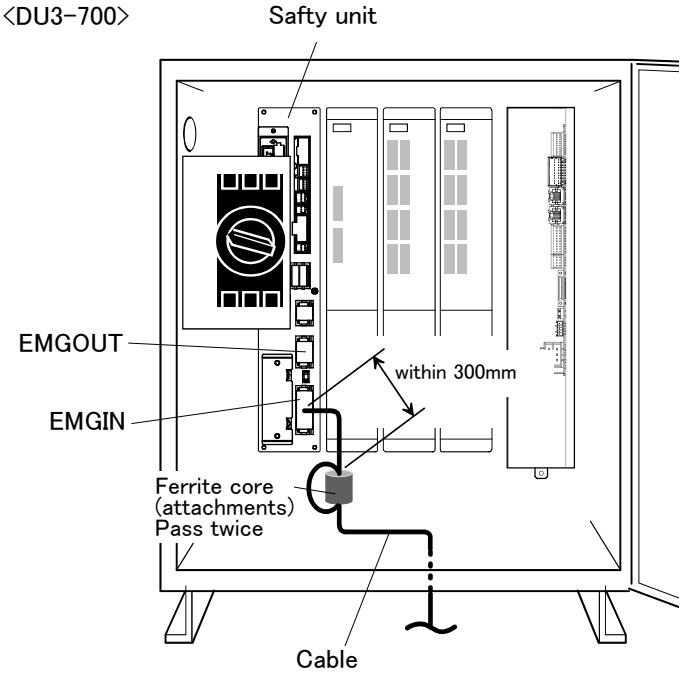
<DU1A-772/DU1A-771-S16>



<DU2A-700>

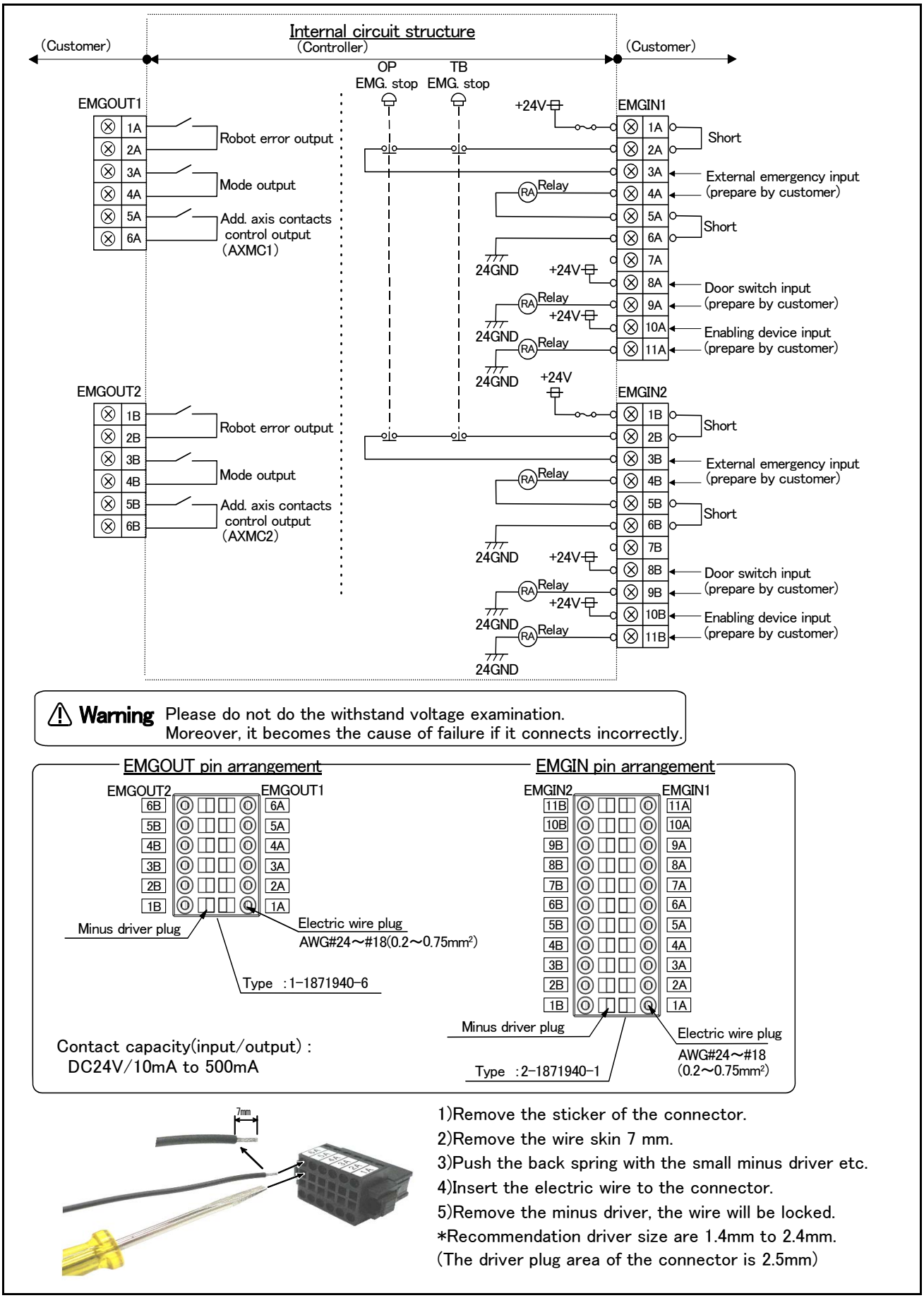


<DU3-700>



Pin allotment of EMGIN and the EMGOUT connector is shown in Page 32, "Fig. 2-19 : External emergency stop connection".

Fig. 2-18 : Emergency stop cable connection



1)Remove the sticker of the connector.
2)Remove the wire skin 7 mm.
3)Push the back spring with the small minus driver etc.
4)Insert the electric wire to the connector.
5)Remove the minus driver, the wire will be locked.
*Recommendation driver size are 1.4mm to 2.4mm.
(The driver plug area of the connector is 2.5mm)

Fig. 2-19 : External emergency stop connection

⚠CAUTION Please install the emergency stop switch in a accesable location where it is easy to operate.

⚠CAUTION Be careful not to short circuit with the next terminal while connecting the wires to the EMGIN connector. The use of plated wires is not recommended.
The example of safety measures is shown in the following. Please refer to the figure and build safety measures.

2.3.6 Examples of safety measures

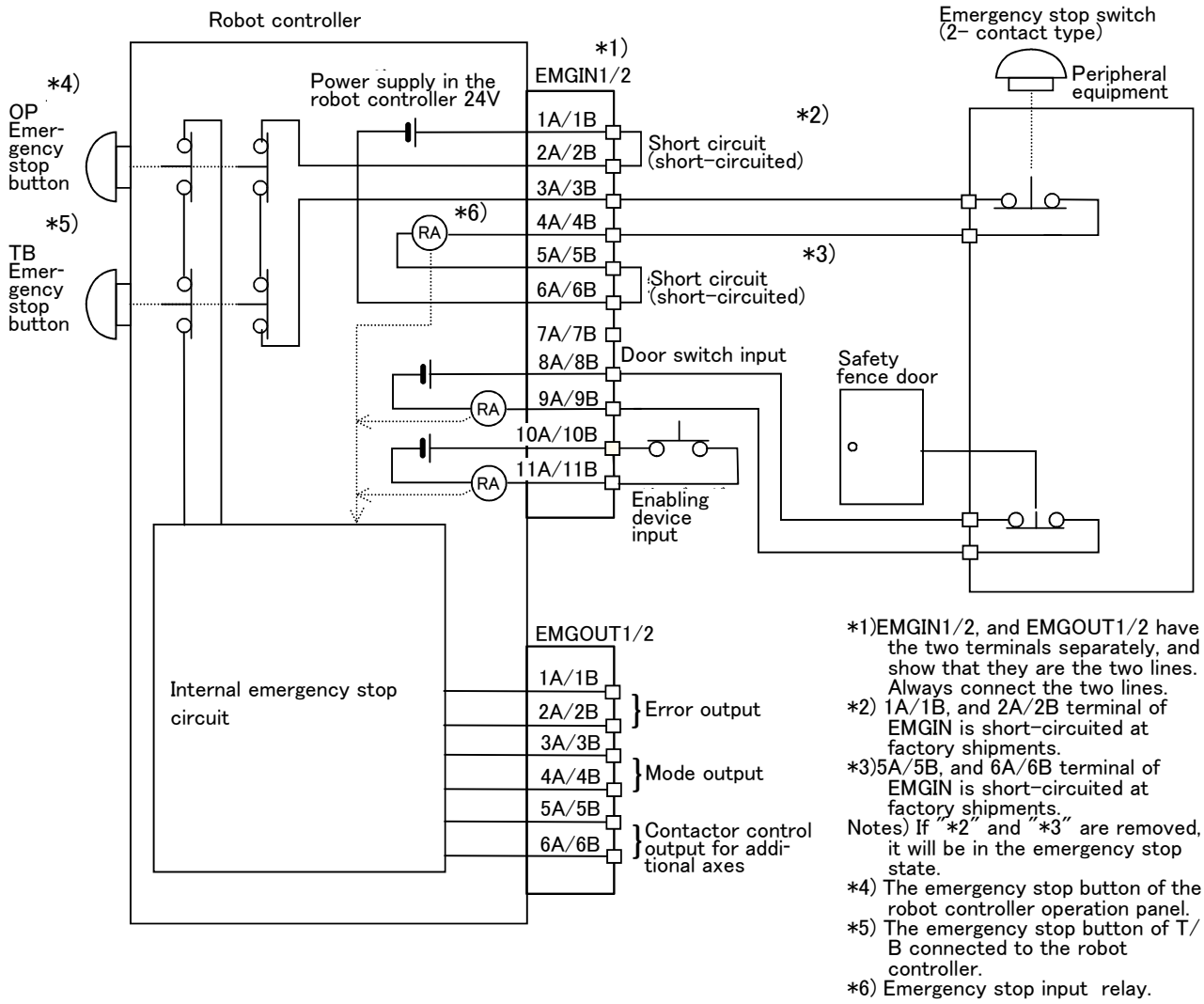
Two emergency-stop input circuits are prepared on the user wiring terminal block of the controller. Create a circuit as shown below for safety measures. In addition, the figure shows the normal state which is not in the emergency stop state.

[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 38, "(1) External emergency stop connection [supplementary explanation]" and Page 30, "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.

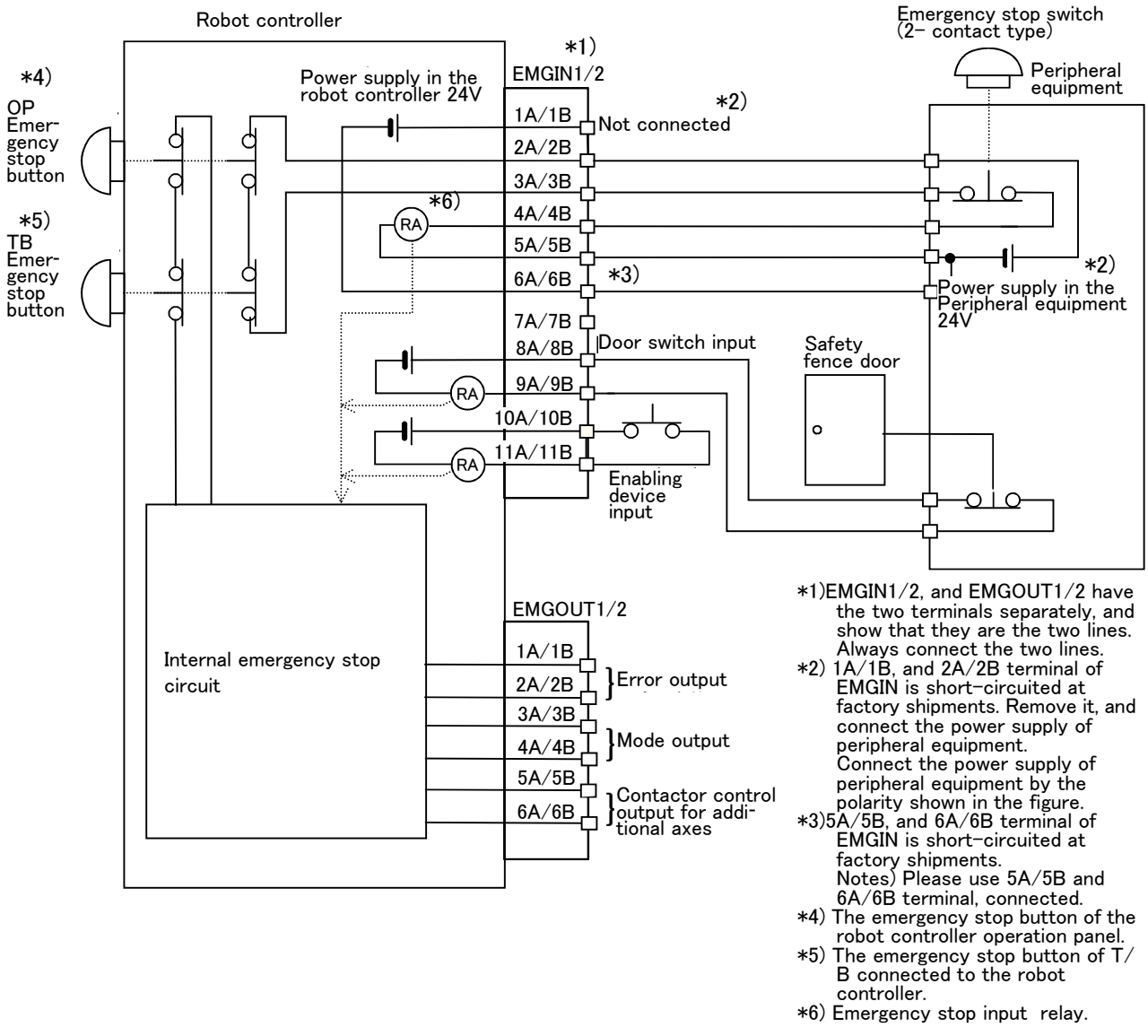
<Wiring example 1>: Connect the emergency stop switch to peripheral equipment to the robot controller.
The power supply for emergency stop input uses the power supply in the robot controller.
<Operation of the emergency stop>
If the emergency stop switch of peripheral equipment is pushed, the robot will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



[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 32, "Fig. 2-19 : External emergency stop connection".

Fig.2-20 : Example of safety measures (Wiring example 1)

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



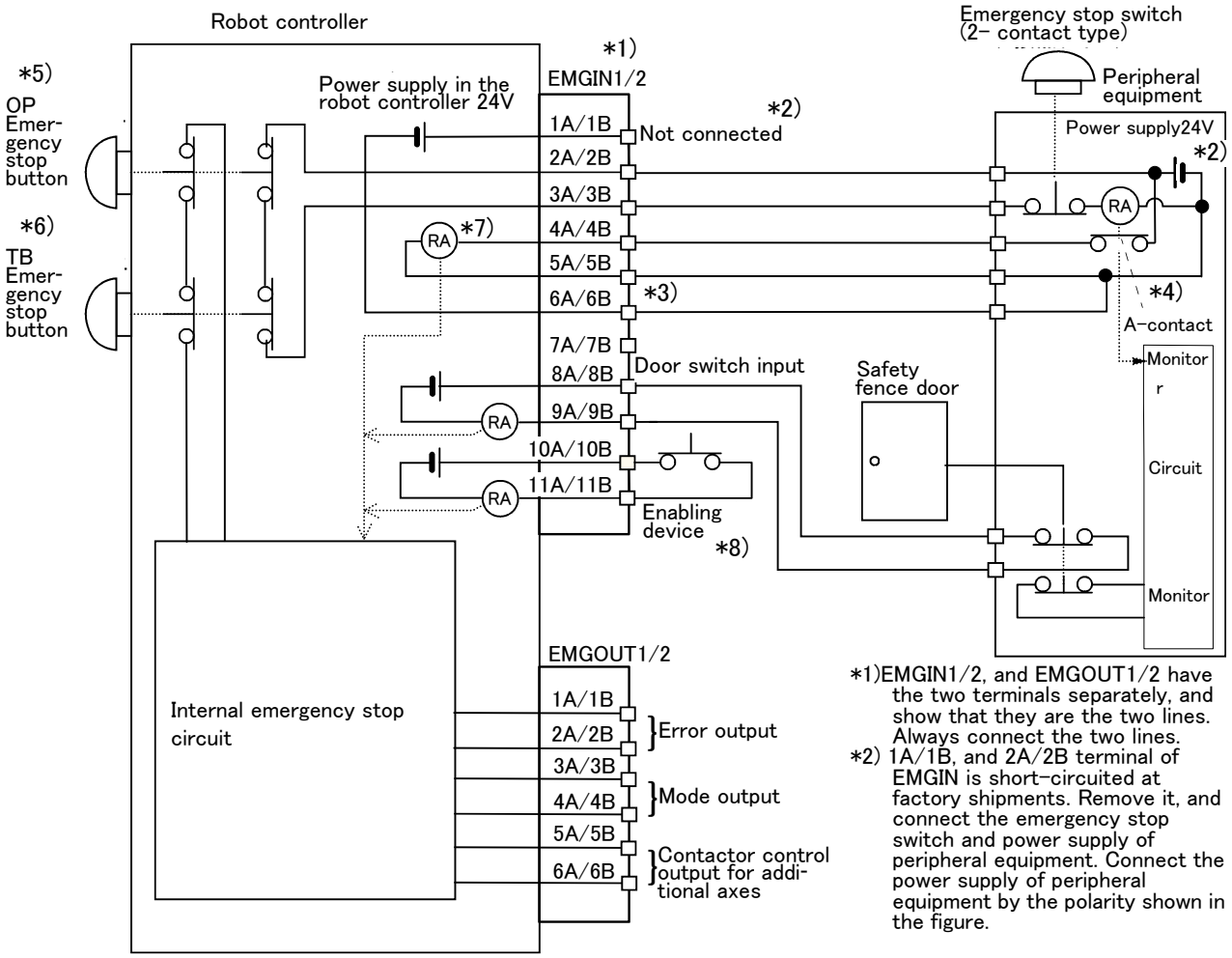
[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 32, "Fig. 2-19 : External emergency stop connection".

Fig.2-21 : Example of safety measures (Wiring example 2)

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

<Operation of the emergency stop>

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



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

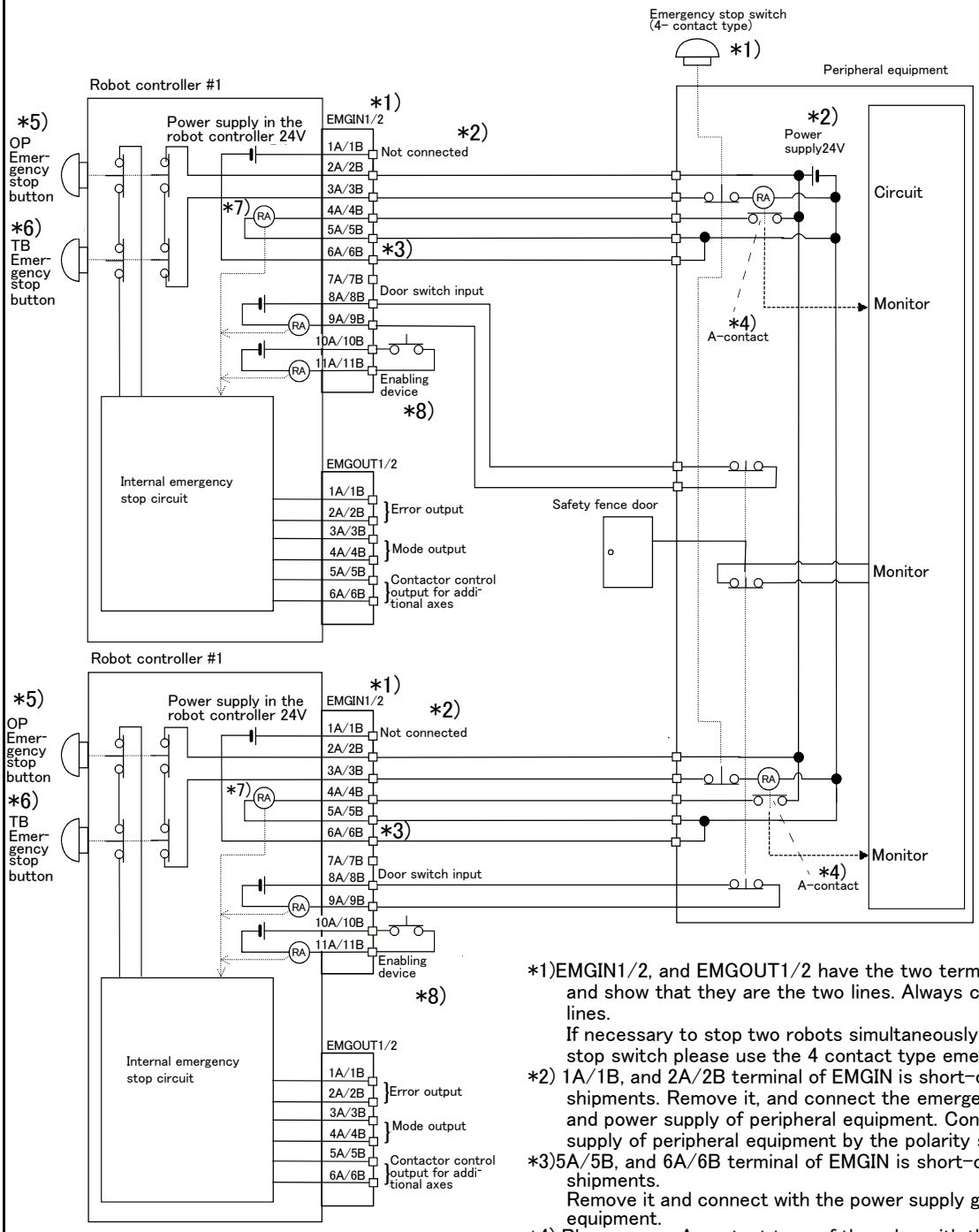
[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 32, "Fig. 2-19 : External emergency stop connection".

Fig.2-22 : Example of safety measures (Wiring example 3)

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

<Operation of the emergency stop>

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



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

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

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

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

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

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

*7) Emergency stop input relay.

*8) Refer to the separate manual "Standard Specifications Manual"for the enabling device.

[Caution] Since we have omitted the information in part because of explanation, there is the section different from the product. Also refer to Page 32, "Fig. 2-19 : External emergency stop connection".

Fig.2-23 : Example of safety measures (Wiring example 4)

(1) External emergency stop connection [supplementary explanation]

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

[Caution] The emergency stop input (terminal block) on the user wiring in the controller can be used for safety measures as shown in Fig. 2-20 to Fig. 2-23. Note that there are limits to the No. of switch contacts, capacity and cable length, so refer to the following and install.

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

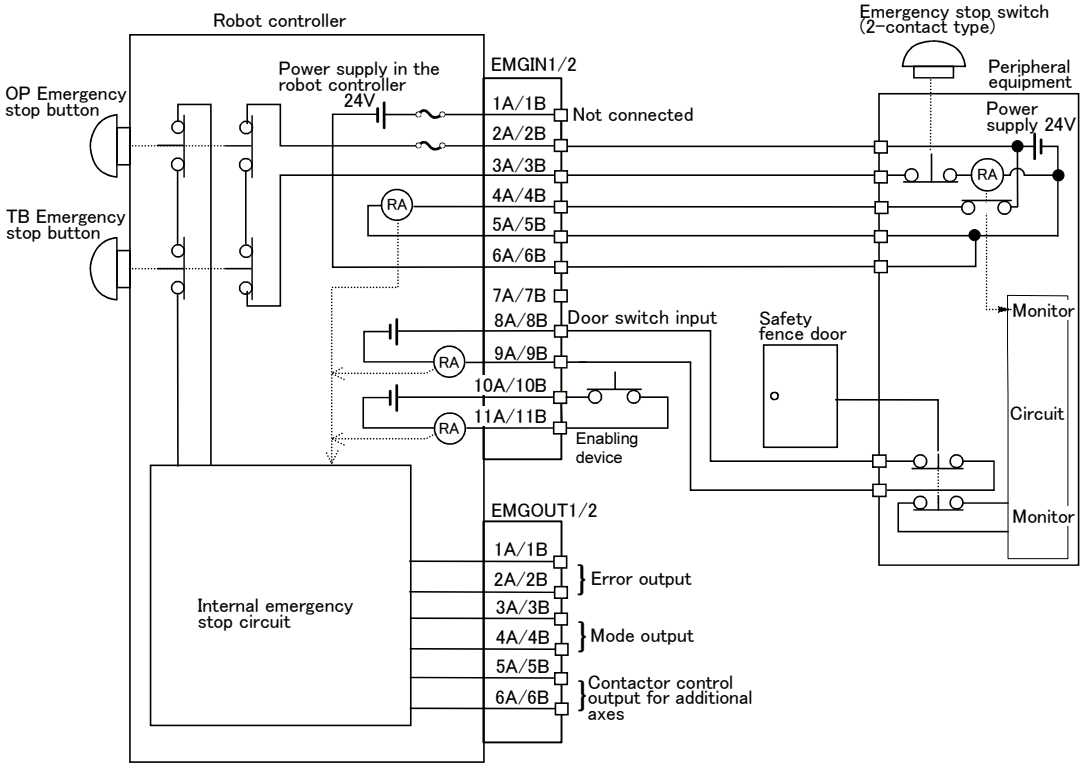


Fig. 2-24 : Limitations when connecting the relay etc.

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

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

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

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

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

When an additional axis is used, the servo ON/OFF status of the additional axis can be synchronized with the servo ON/OFF status of the robot itself by using the output contact (AXMC) provided on the rear or inside of the controller and configuring a circuit so that the power to the servo amplifier for the additional axis can be turned off when this output is open. Fig. 2-25 shows an example of its circuit, and show the layout drawings of the output contact (AXMC1). When you are using an additional axis, please perform appropriate circuit connections by referring to these drawings.

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

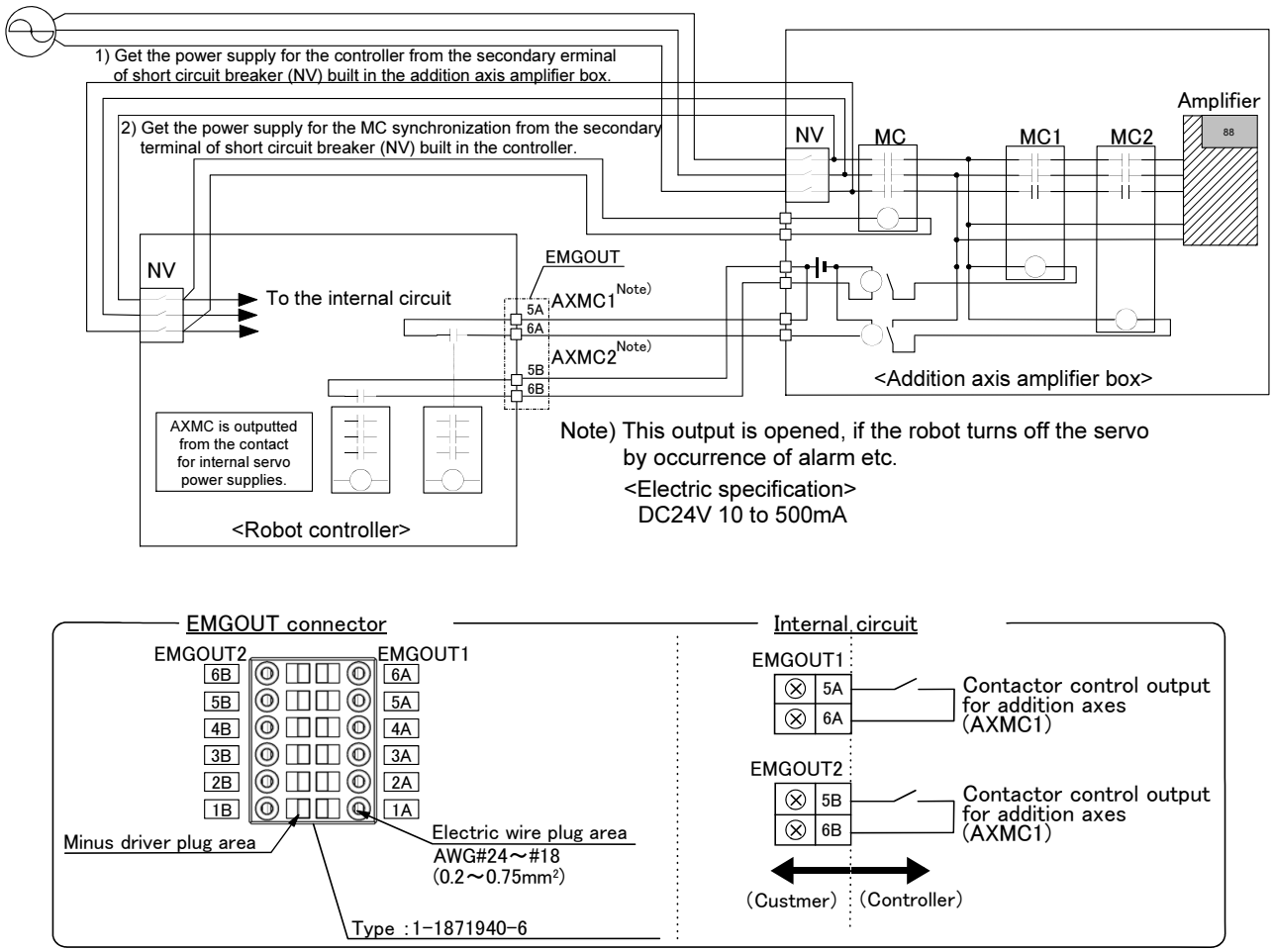


Fig. 2-25 : Example of circuit for addition axes of Magnet contactor control output

2.3.8 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.

2.4 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 51, "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.

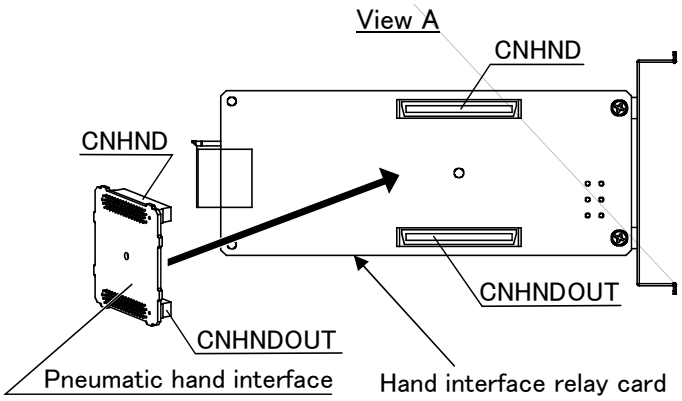
3.1 Iinstalling the pneumatic hand interface

3.1.1 Installing

The following shows the installing procedure of pneumatic hand interface which is installed inside the drive unit.

⚠CAUTION Confirm that the supplying power supply to the controller and the power switch of the drive unit are off before doing this work.

[Note] Confirm that the pneumatic hand interface is installed securely. If not installed certainly, opening and closing of the hand cannot be done.



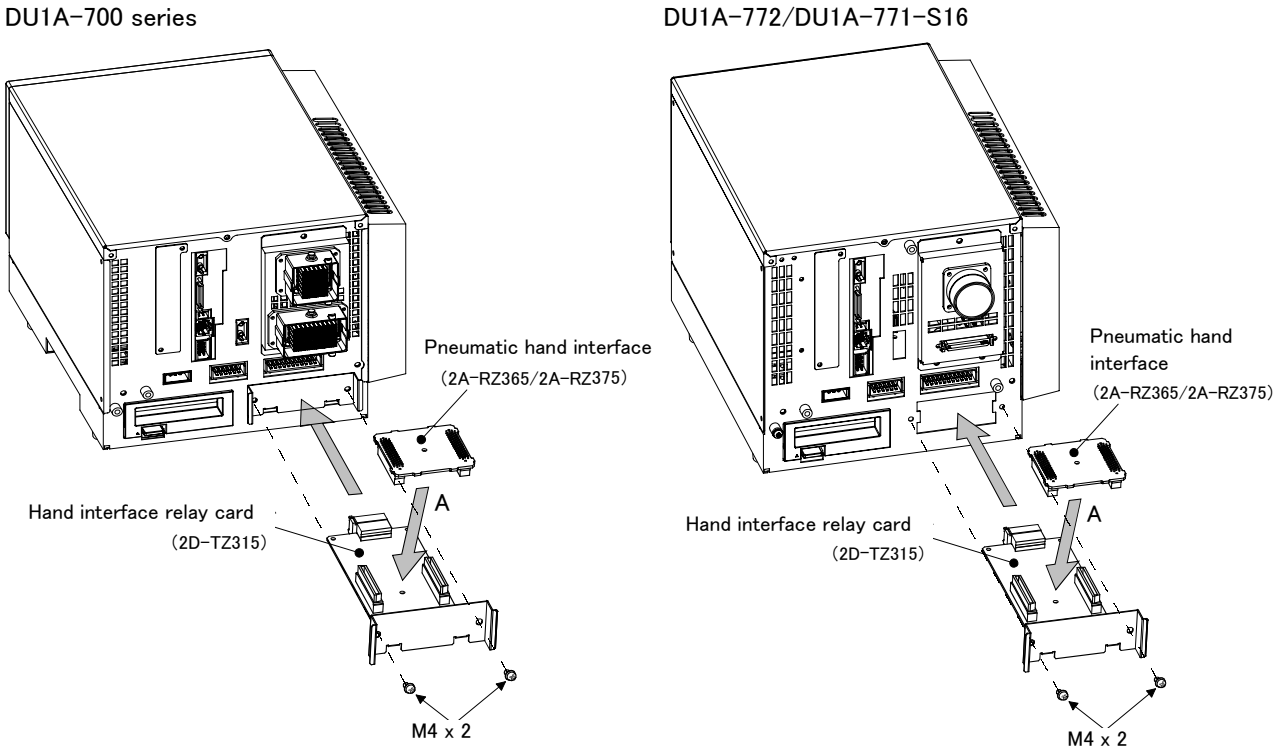
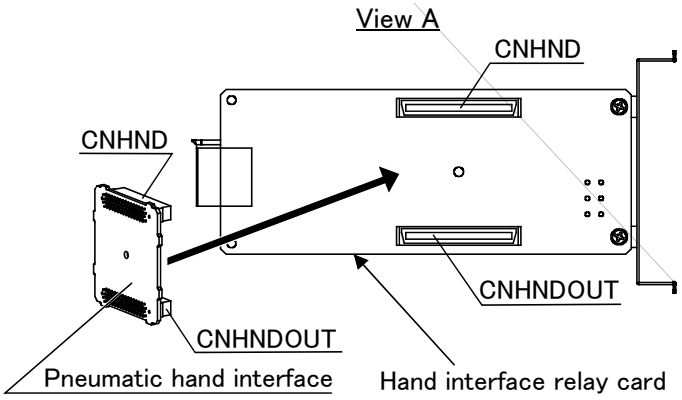
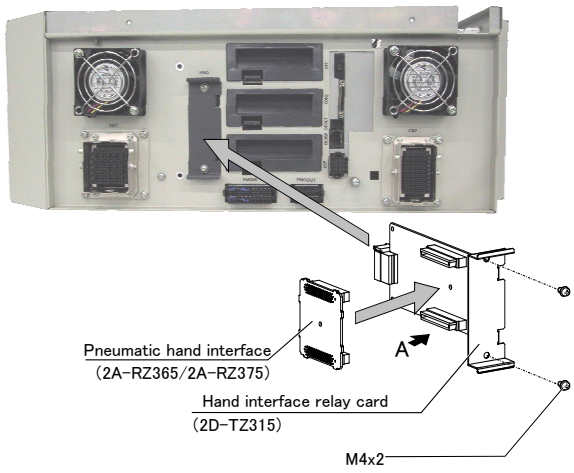


Fig. 3-1 : Installing the pneumatic hand interface (DU1A-700)



DU2A-700



DU3-700

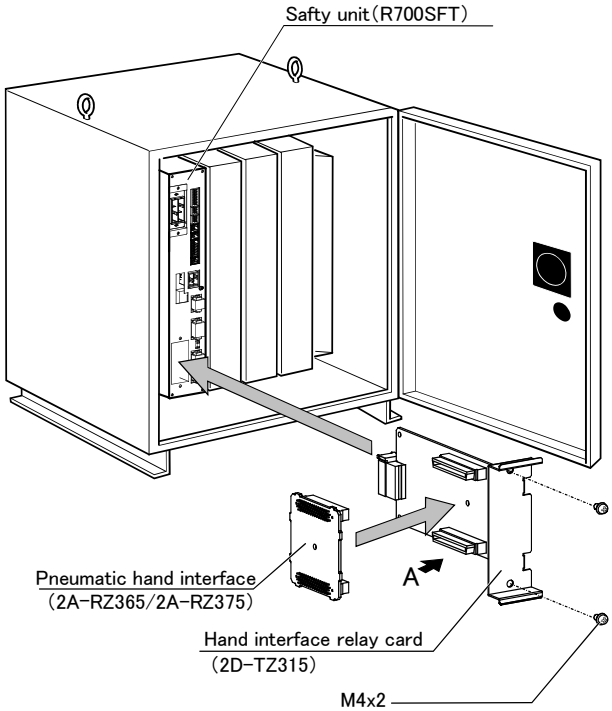


Fig. 3-2 : Installing the pneumatic hand interface (DU2A-700/DU3-700)

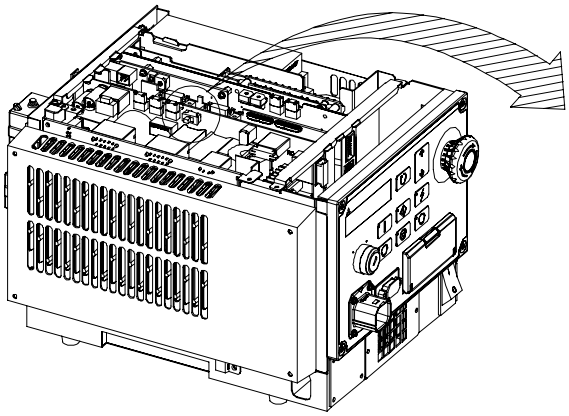
1) Shut off the power of the supply source.
2) Remove the M4 screw (two places) and pull out the hand interface relay card (2D-TZ315).
3) Install the pneumatic hand interface (2A-RZ365/2A-RZ375) in the hand interface relay card (2D-TZ315).
4) Insert the hand interface relay card (2D-TZ315) to the drive unit, and fix with M4 screw (two places).

3.1.2 SINK/SOURCE setting

Please switch the SINK/SOURCE setting switch or set pin according to the option specification when you use the option pneumatic interface. The following shows the procedure of setting the SINK/SOURCE switch or set pin

(1) CR1QA-700 series controller

1) Confirm that the primary power is OFF and that the controller power switch is OFF, please remove the controller's cover.
2) Please pick up the switch at the position shown in figure, and switch the SINK/SOURCE setting.
3) Please install the controller's cover as before.



notes)The DU1A-772 drive unit is also the same.

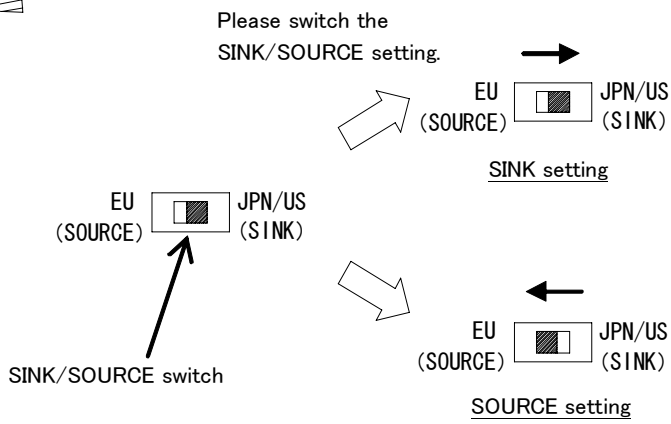


Fig. 3-3 : SINK/SOURCE setting(CR1QA)

(2) CR2QA-700 series controller

1) Confirm that the primary power is OFF and that the controller power switch is OFF, please remove the controller's cover.
2) Please pick up the set pin at the position shown in figure, and switch the SINK/SOURCE setting.
3) Please install the controller's cover as before.

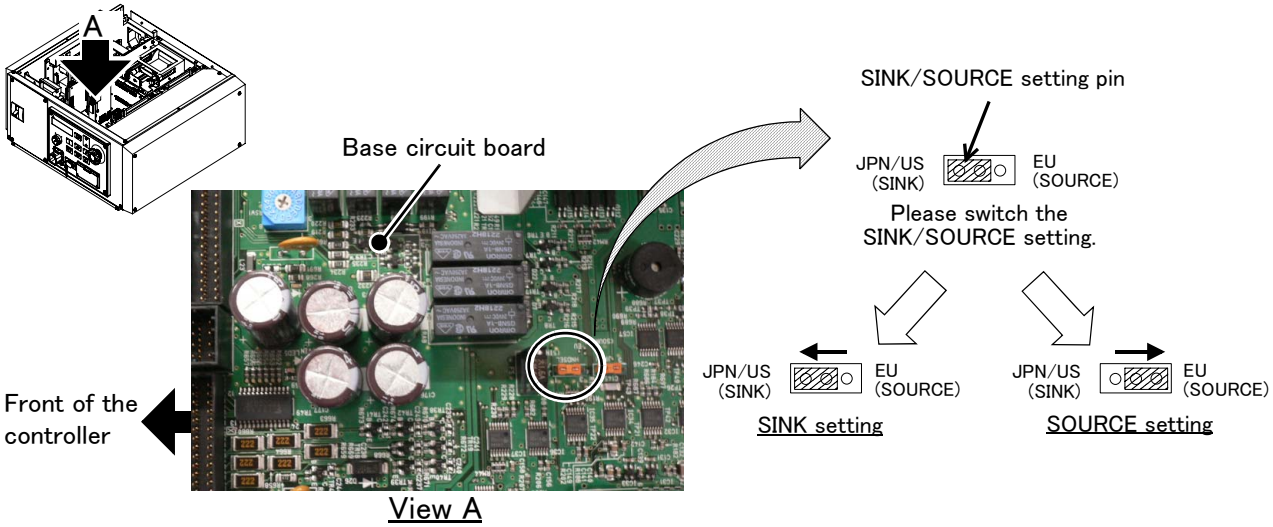


Fig. 3-4 : SINK/SOURCE setting(CR2QA)

(3) CR3Q-700 series controller

1) Confirm that the primary power is OFF and that the controller power switch is OFF, please open the controller's door.
2) Please pick up the switch at the position shown in figure, and switch the SINK/SOURCE setting.
3) Please close the controller's door as before.

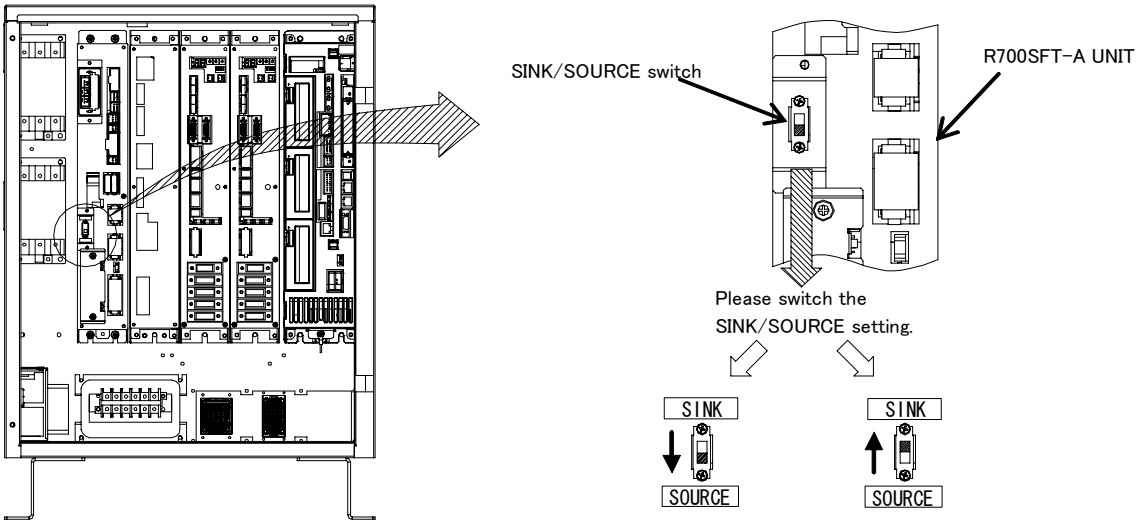


Fig. 3-5 : SINK/SOURCE setting(CR3Q)

This completes the installation of the pneumatic hand interface.

4 Basic operations

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

Handling the controller	The functions of the various keys on the controller 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 controller

4.1.1 Functions of each key

Explain the name and function of each key of the operation panel which the front of the drive unit has. About the DU1A-772 drive unit, the front is shown in Fig. 4-2. This drive unit not installed the operation panel shown in Fig. 4-1. Operate each of these functions with the external signal.

[Notes] Please transpose each key operation to the external signal operation

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

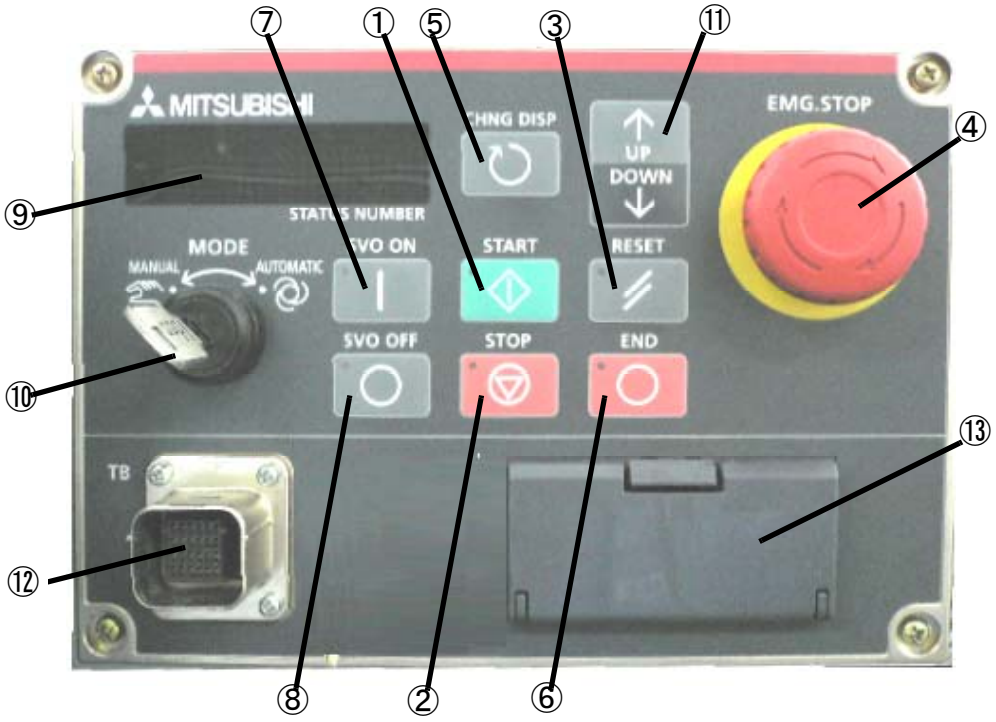


Fig. 4-1 : Operation panel

① START button.....This executes the program and operates the robot. The program is run continuously.
② STOP button.....This stops the robot immediately. The servo does not turn OFF.
③ RESET button.....This resets the error. This also resets the program's halted state and resets the program.
④ Emergency stop switch.....This stops the robot in an emergency state. The servo turns OFF.
⑤ CHNGDISP button.....This changes the details displayed on the display panel in the order of "Override" → "Program No." → "Line No.".
⑥ END button.....This stops the program being executed at the last line or END statement.
⑦ SVO.ON button.....This turns ON the servo power. (The servo turns ON.)
⑧ SVO.OFF button..... This turns OFF the servo power. (The servo turns OFF.)
⑨ STATUS NUMBER
(display panel).....The alarm No., program No., override value (%), etc., are displayed.
⑩ MODE key switch.....This changes the robot's operation mode.
AUTOMATIC.....operations from the drive unit or external equipment are valid. Operations for which the operation mode must be at the external device or T/B are not possible. It is necessary to set the parameter for the rights of operation to connection between the operation panel and external equipment. For details, please refer to "INSTRUCTION MANUAL/Detailed explanations of functions and operations" of the separate volume.
MANUAL.....When the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device or drive unit are not possible.
⑪ UP/DOWN button.....This scrolls up or down the details displayed on the "STATUS. NUMBER" display panel.
⑫ T/B connection connector .....This is a dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.
⑬ Interface cover.....Unused in this drive unit. Please use closing this cover, because of to prevent deterioration of protection performance.

(1) Front of the DU1A-772 drive unit

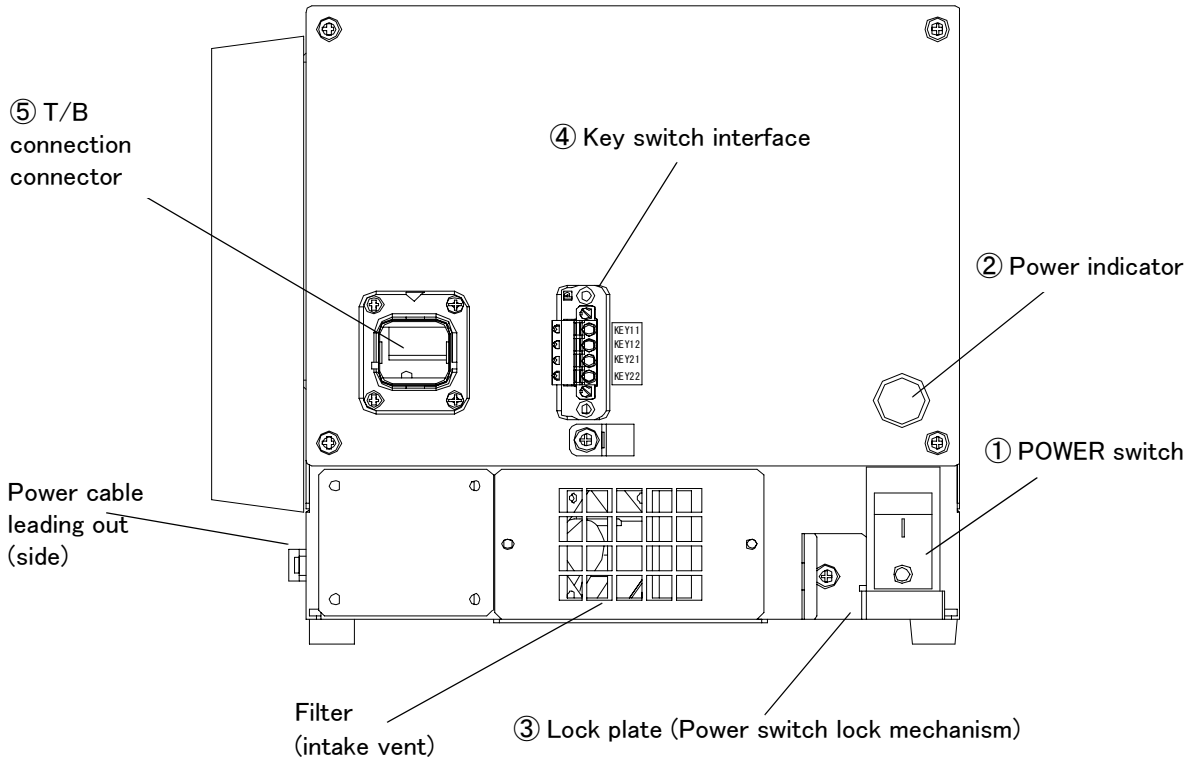


Fig. 4-2 : Front of the drive unit (DU1A-772)

① Power switch .....This turns the control power ON/OFF
② Power indicator.....Turned on with the control power supply ON.
③ Lock plate .....The power switch can be locked by installing the padlock etc. Please prepare the padlock by the customer. Specification is shown in Page 47, "(2) Padlock specification(DU1A-772)"
④ Key switch interface.....This changes the robot's operation mode. Same as " ⑩ " of Fig. 4-1.
AUTOMATIC.....Operations from the external equipment is valid. Operations for which the operation mode must be at the external device or T/B are not possible. It is necessary to set the parameter for the rights of operation to connection between the operation panel and external equipment. For details, please refer to "INSTRUCTION MANUAL/Detailed explanations of functions and operations" of the separate volume.
MANUAL.....When the T/B is valid, only operations from the T/B are valid. Operations for which the operation mode must be at the external device is not possible.
⑤ T/B connection connector.....This is a dedicated connector for connecting the T/B. When not using T/B, connect the attached dummy connector.

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

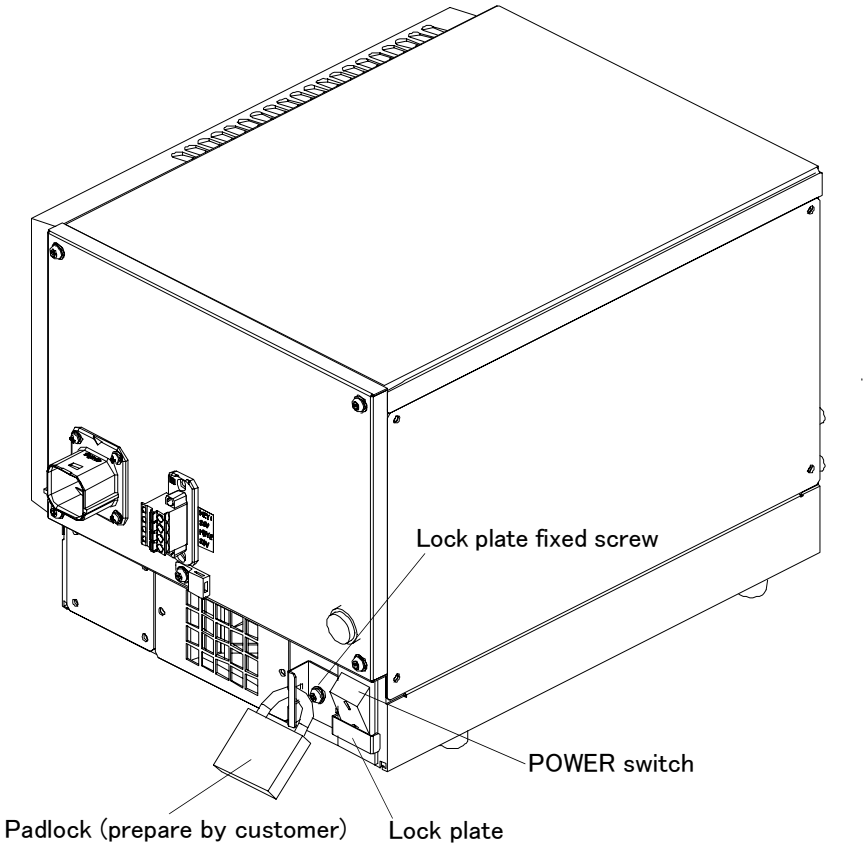
Even when multiple devices, such as a T/B and personal computer, are connected to the controller, the operation at one time is limited to one device. This limited device (has the operation rights)

◇◆◇ 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.

(2) Padlock specification(DU1A-772)

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



<The operation method>

(1) The lock method (power supply OFF)

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

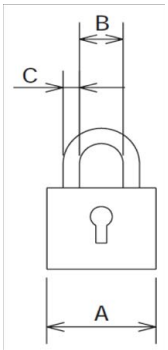
The lock is completion

(2) The release method (power supply ON)

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

Lock release is completion.

The lock device which can be used

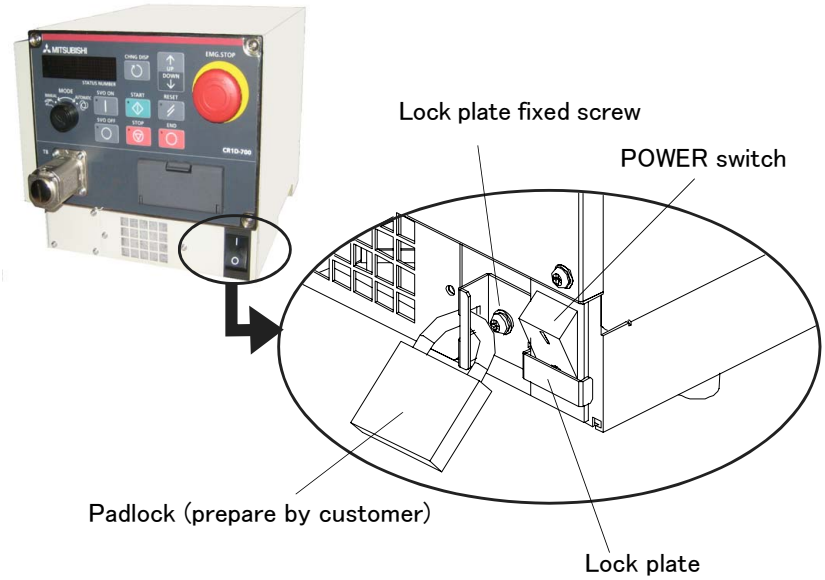


Dimension of the padlock

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

Fig.4-3 : Operation lock of the power switch(DU1A-772)

< DU1A-700 series >



<The operation method>

(1) The lock method (power supply OFF)

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

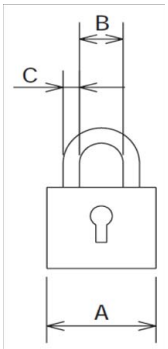
The lock is completion

(2) The release method (power supply ON)

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

Lock release is completion.

The lock device which can be used

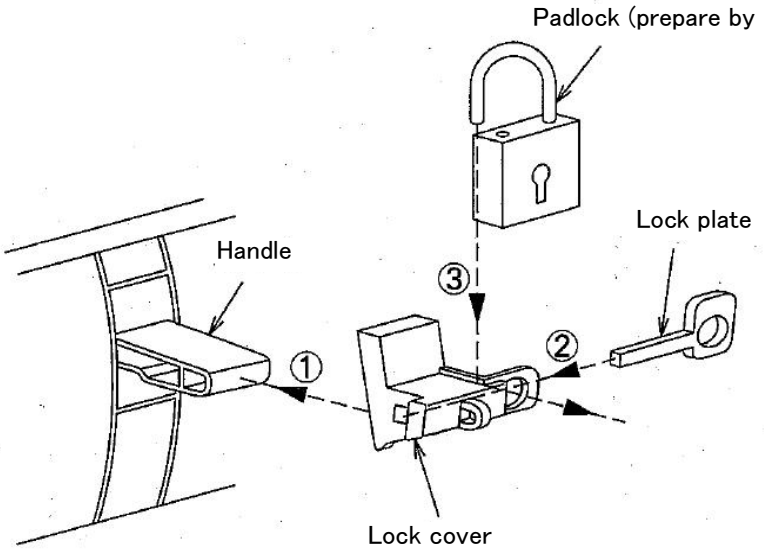


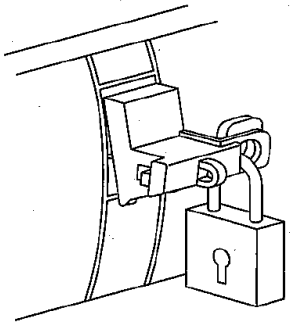
Dimension of the padlock

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

Fig.4-4 : Operation lock of the power switch

< DU2A-700 >



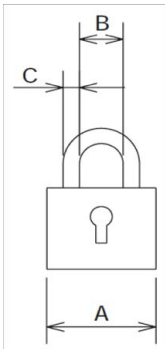


⚠CAUTION

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

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

The lock device which can be used

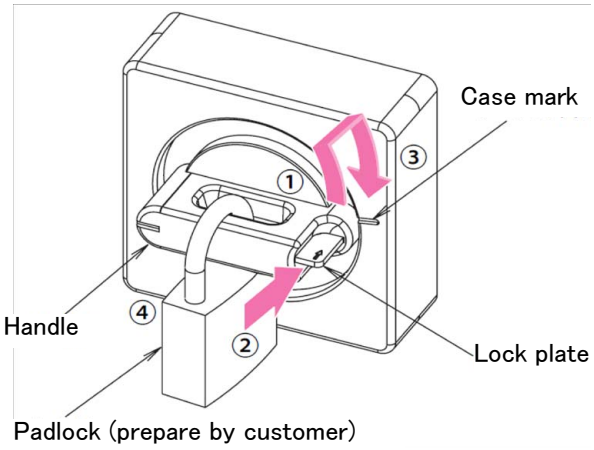


Dimension of the padlock

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

Fig.4-5 : operation lock of the power switch(DU2A-700)

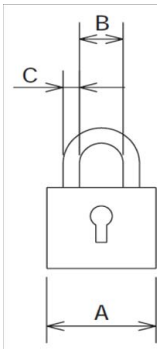
＜ DU3-700 ＞



Usage of lock function

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

The lock device which can be used



Dimension of the padlock

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

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

Fig.4-6 : Operation lock of the power switch(DU3-700)

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.

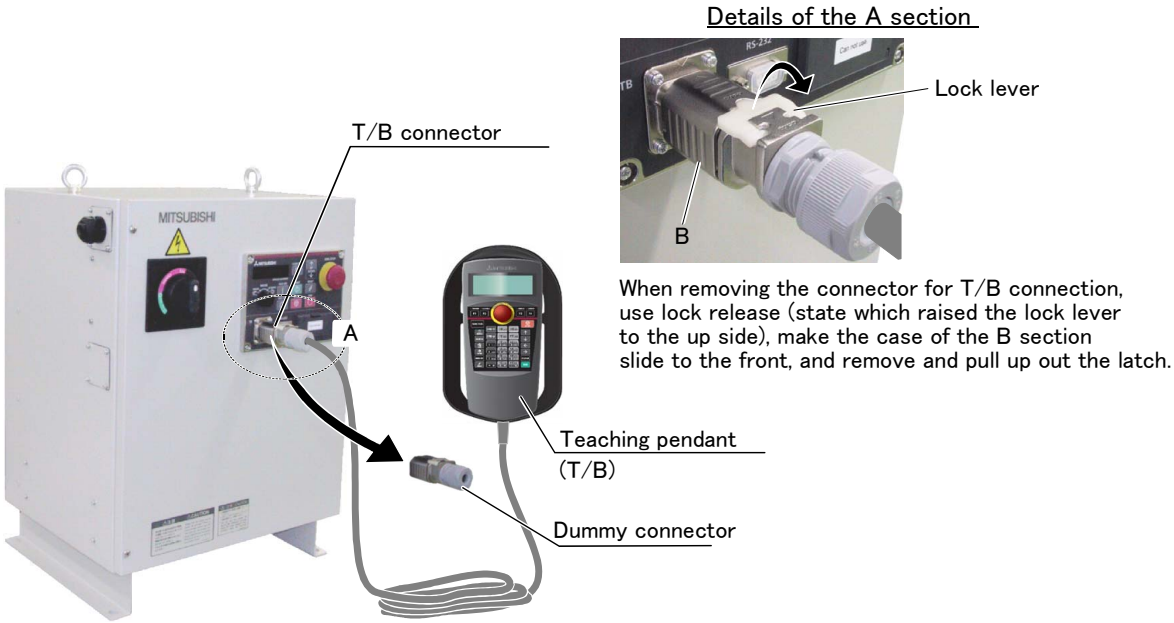
⚠ CAUTION

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

(1) Installing the T/B

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. 4-7, and push in until there is sound.



＊ The figure is the example of the DU3-700 series.

Fig. 4-7 : Installing and removing the T/B

The installation of T/B is finished.

(2) Removing the T/B

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.
3) 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

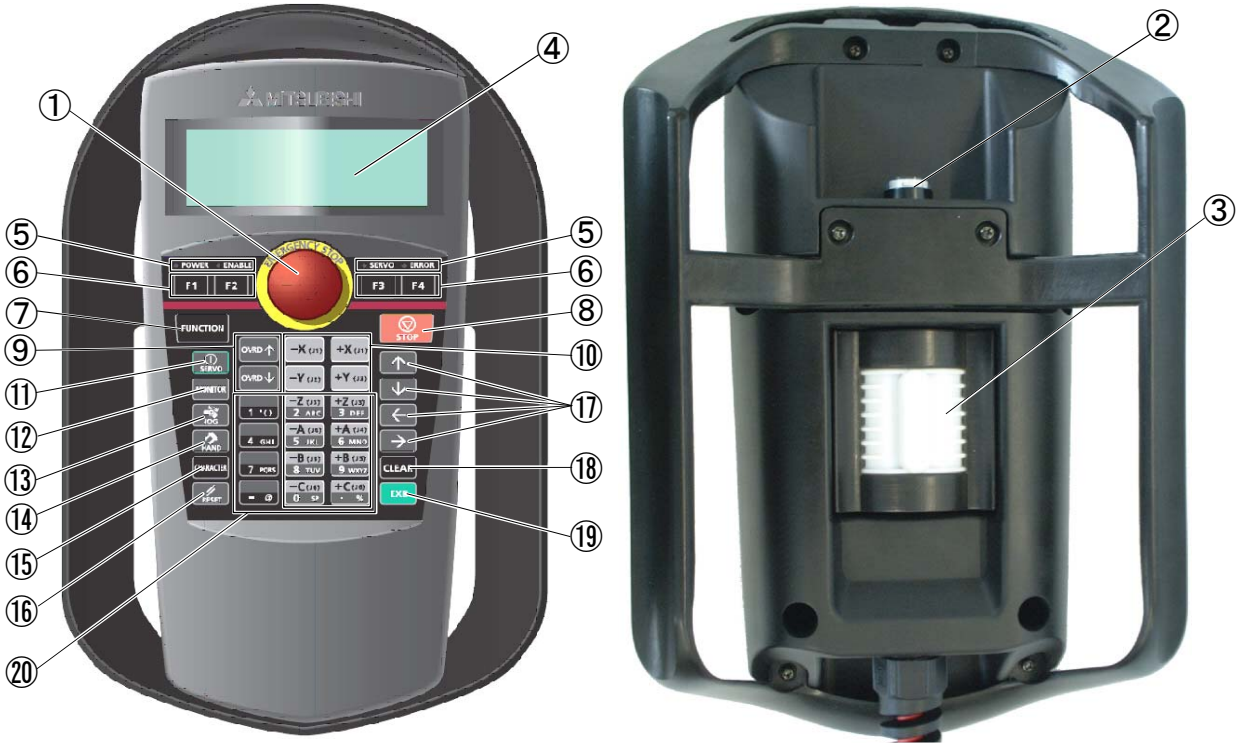


Fig. 4-8 : Teaching pendant (R32TB)

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.

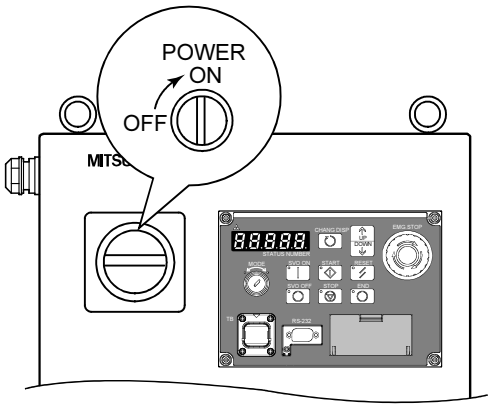
1) Make sure that there are no operators in the robot operation range.
2) Make sure that the drive unit and robot arm are securely connected with the machine cable.
3) Make sure that the external emergency stop switch is connected to the drive unit.
4) Make sure that the drive unit power cable and grounding 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.

<DU1A-700>

<DU2A-700>

[POWER] switch

<DU3-700>



Turn the drive unit [POWER] switch ON.
"o. 100" will appear on the STATUS NUMBER display.
This completes the turning ON of the control power.

◇◆◇ 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.

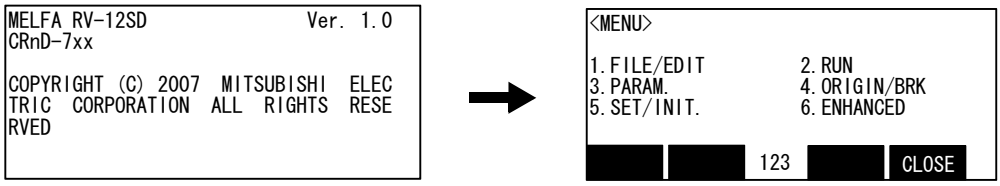
◇◆◇ Error: It is if C0150 occurs. ◇◆◇

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.

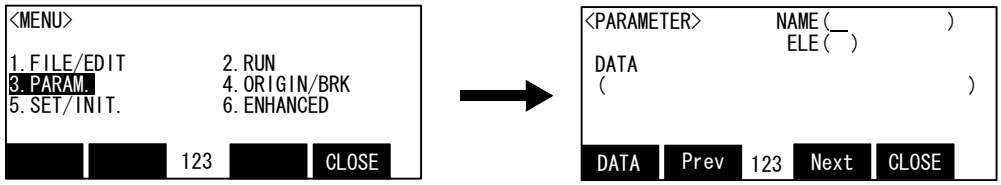
4.3.2 Input the serial number

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.

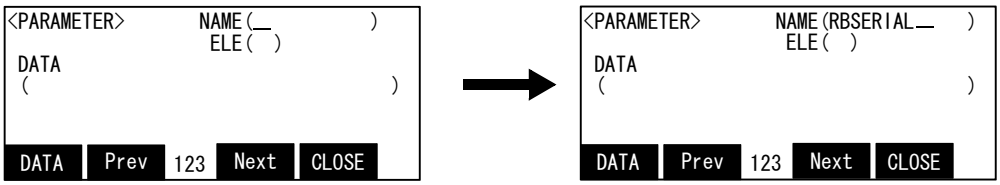
1) Press the [RESET] key of T/B and cancel the error of T/B.
2) Press the [EXE] key of T/B and display the menu panel.



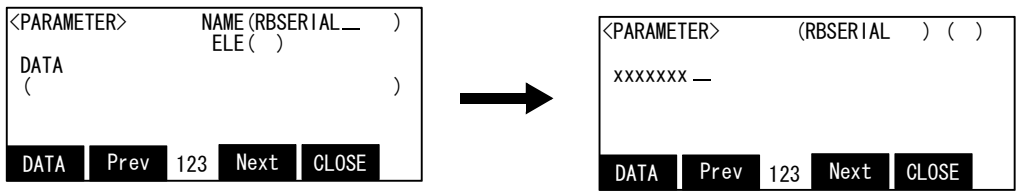
3) Press the [3] key of T/B and display the parameter.



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.

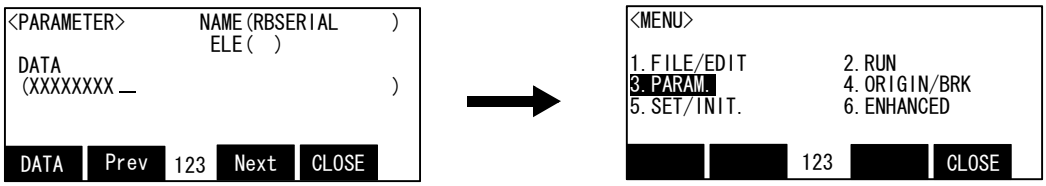


Press the [EXE] key, and fix the value with sound, and return to the parameter screen.

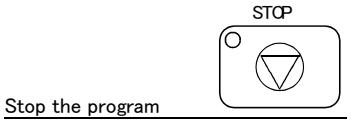
◇◆◇ The input of the number/character ◇◆◇

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.

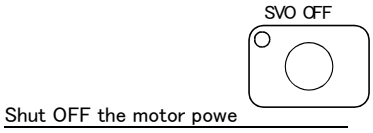
6) Press the function key ([F1]) corresponding to the "close", and return to the menu screen.



4.3.3 Shutting OFF the control power



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



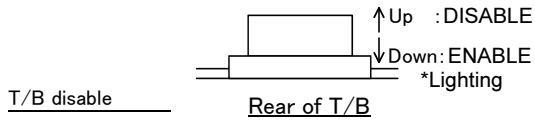
2) After the robot has stopped, press the drive unit [SVO OFF] switch, and turn the servo OFF.

3) Turn the drive unit [POWER] switch OFF.

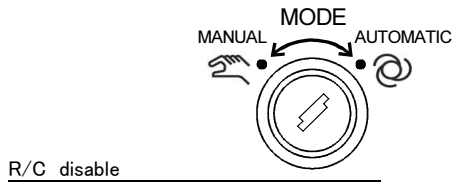
The control power will be shut OFF.

4.4 Turning the servo power ON/OFF

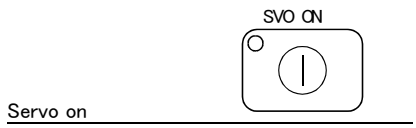
4.4.1 Turning the servo power ON (servo ON)



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



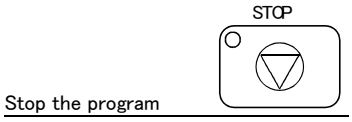
2) Confirm that the [MODE] switch on the front of the drive unit is set to "AUTOMATIC".



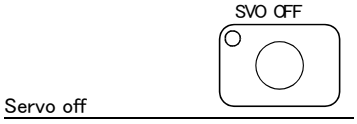
3) Press the [SVO ON] switch on the front of the drive unit.
The switch's lamp will light indicating that the servo is ON.

⚠ CAUTION 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.

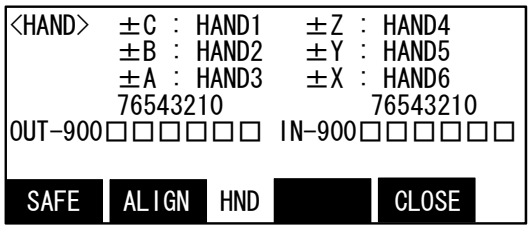
4.5 Jog operation

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 4-1 : Jog modes

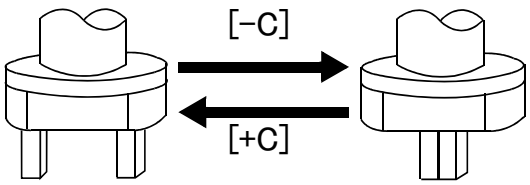
Jog mode	Main application	Explanation
JOINT JOG	・Moves each joint. ・Moves the robot arm largely. ・Changes the robot posture.	Separate manual "Robot arm setup and maintenance"
XYZ JOG	・Accurately sets the teaching position. ・Moves the axis straight along the XYZ coordinate system. ・Moves the axis straight while maintaining the robot posture. ・Changes the posture while maintaining the hand position.	
TOOL JOG	・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	・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.	
CYLINDER JOG	・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.	

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.

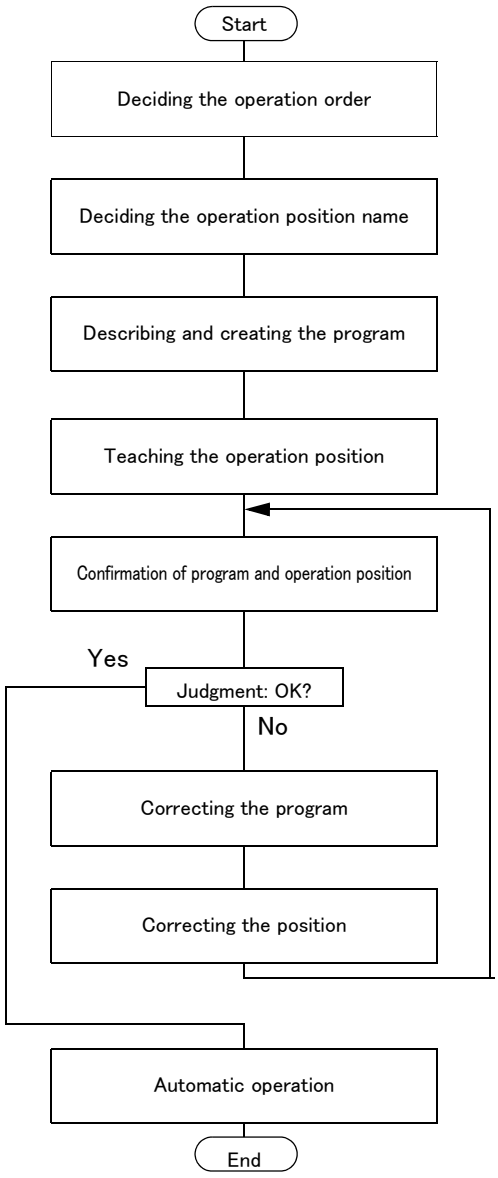


Opening and closing hand 1
Open: Press [+C] key
Close: Press [-C] key
Opening and closing hand 2
Open: Press [+B] key
Close: Press [-B] key
Opening and closing hand 3
Open: Press [+A] key
Close: Press [-A] key
Opening and closing hand 4
Open: Press [+Z] key
Close: Press [-Z] key
Opening and closing hand 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



Decide the robot operation order, operation path (necessity of linear movement), and the work at each operation position (hand open/close, etc).

Teach the robot operation position in the position variables.
Decide the position variable name.

Based on the decided operation order and operation position name, convert the robot operations and work into commands. Describe the commands in the program and save in the controller.

Move the robot to each operation position with jog operation, and teach each position in the position variables.

Execute the program saved in the controller line by line, and confirm that the program and operation positions are correctly saved.

If any mistakes were found in the robot operation or work during the program confirmation, correct the program.

If any mistakes were found in the robot operation position during the program confirmation, correct the taught position.

Automatically execute the completed program.

Fig.4-9 : Program creation procedures

(2) Robot work

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

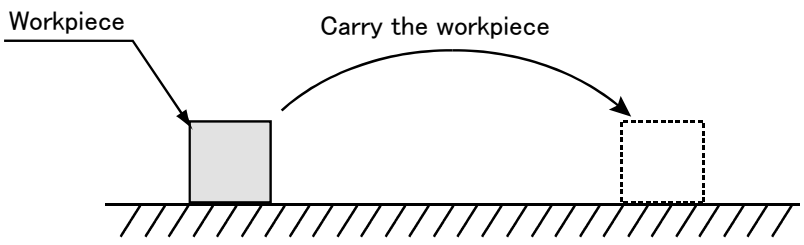
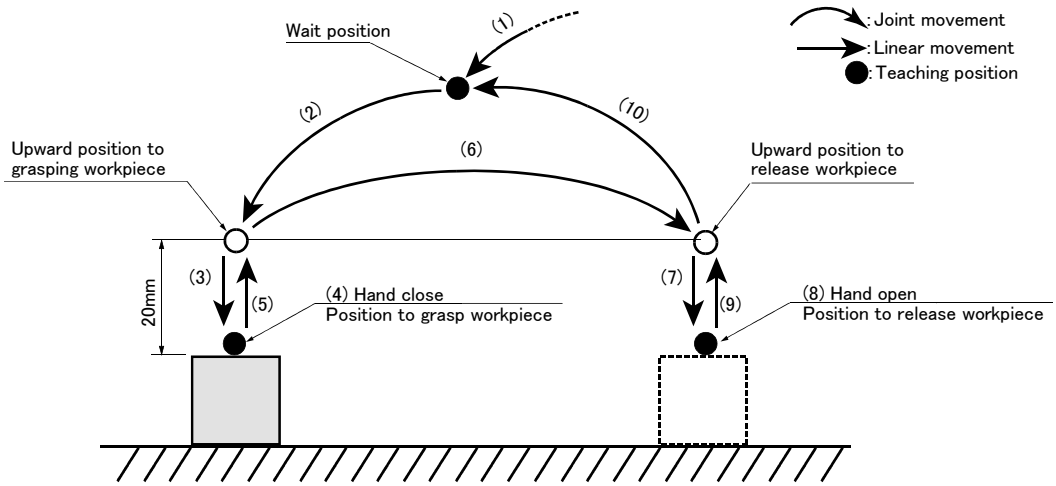


Fig.4-10 : Example of work

4.7.1 Creating the program

(1) Deciding the operation order



Start

(1) Move to wait position (joint movement).
(2) Move to 20mm upward workpiece (joint movement).
(3) Move to position to grasp workpiece (linear movement).
(4) Grasp workpiece (hand close).
(5) Move 20mm upward (linear movement).
(6) Move to 20mm upward position to release workpiece (joint movement).
(7) Move to position to release workpiece (linear movement).
(8) Release workpiece (hand open).
(9) Move 20mm upward (linear movement).
(10) Move to wait position (joint movement).

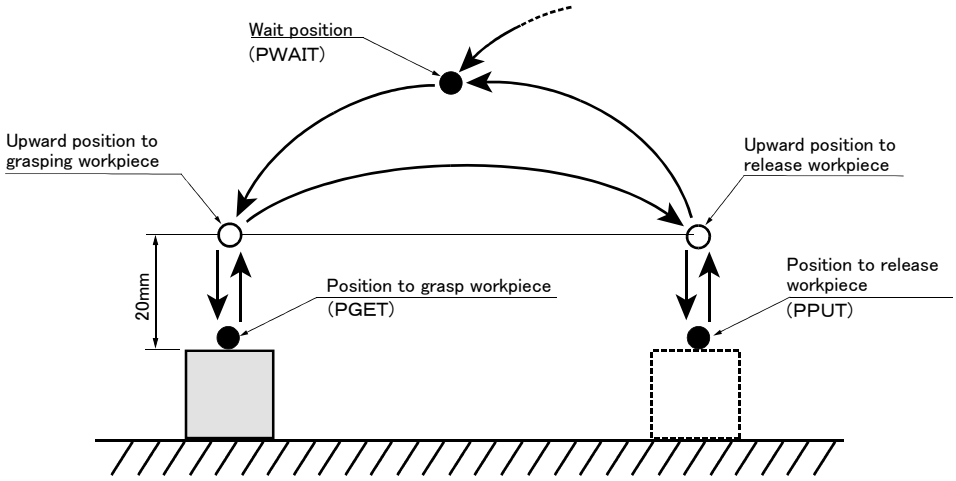
End

Fig.4-11 : 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.4-12 : 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. 4-12 can be designated with commands as "position 20mm away from target position". Refer to Page 61, "(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

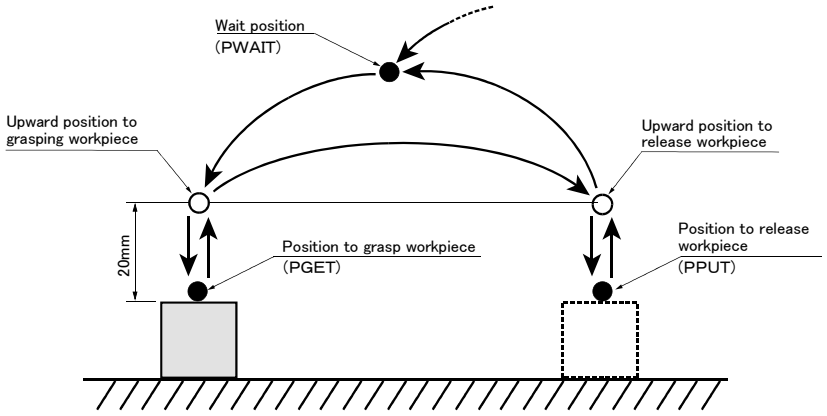
■ Convert the target robot operations and work into commands.

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

Table 4-2 : 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

■ Program the converted commands



Start

(1) Move to wait position (joint movement) .....1 Mov PWAIT

(2) Move to 20mm upward workpiece (joint movement).....2 Mov PGET,+20 Note)

(3) Move to position to grasp workpiece (linear movement).....3 MVS PGET

(4) Grasp workpiece (hand close).....4 HClose 1

(5) Waits for 1 seconds.....5 Dly 1.0

(6) Move 20mm upward (linear movement).....6 MVS PGET,+20 Note)

(7) Move to 20mm upward position to release workpiece (joint movement) ...7 Mov PPUT,+20 Note)

(8) Move to position to place workpiece (linear movement).....8 MVS PPUT

(9) Release workpiece (hand open).....9 HOpen 1

(10) Waits for 1 seconds .....10 Dly 1.0

(11) Move 20mm upward (linear movement).....11 MVS PPUT,+20 Note)

(12) Move to wait position (joint movement).....12 Mov PWAIT

End.....13 End

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

Fig. 4-13 : 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. 4-13.

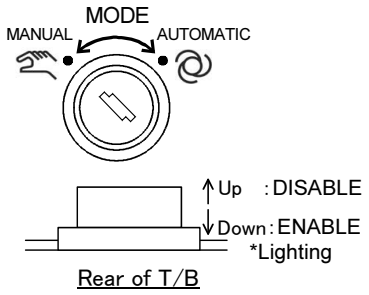
Example) 1　　Ｍｏｖ　　ＰＷＡＩＴ

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.

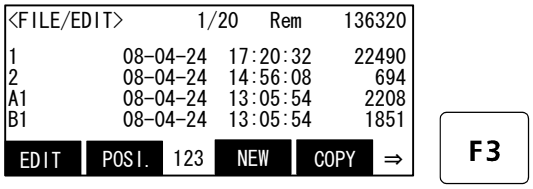
Preparing the T/B



1) Set the drive unit [MODE] switch to "MANUAL".

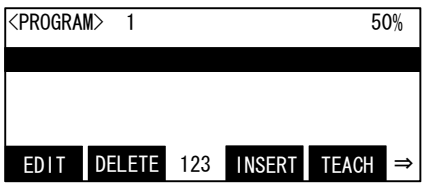
2) Set the T/B [ENABLE] switch to "ENABLE".

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.



◇◆◇ Using the T/B ◇◆◇

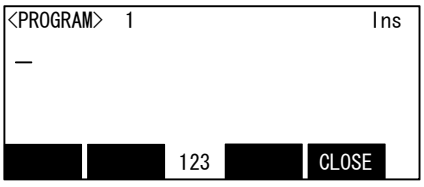
Set the drive unit [MODE] switch to "MANUAL" and the T/B [ENABLE] switch to "ENABLE". Operations from the T/B are not possible unless the drive unit [MODE] switch is set to "MANUAL".

◇◆◇ 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.

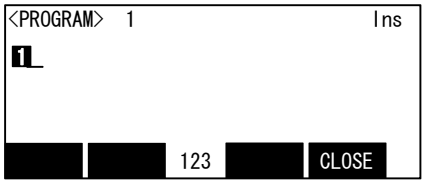
◇◆◇ Correcting incorrect numbers ◇◆◇

Press the [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.



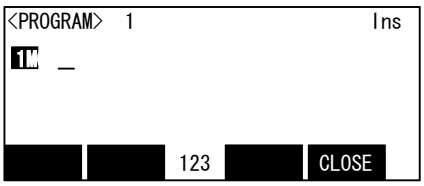
F3

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



1 '( )

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

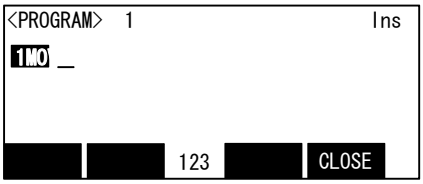


CHARACTER

−C (J6) 0 SPACE

+A (J4) 6 MNO

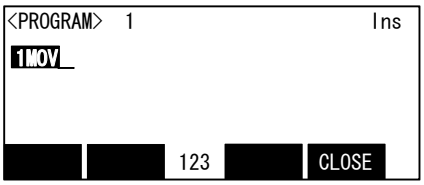
8) Press the [CHARACTER] key, and set to the character input mode, then press [SP], [MNO] key. Display the space and "M."



→

+A (J4) 6 MNO

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



−B (J5) 8 TUV

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

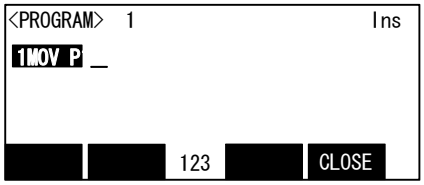
◇◆◇ Inputting characters and space ◇◆◇

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.

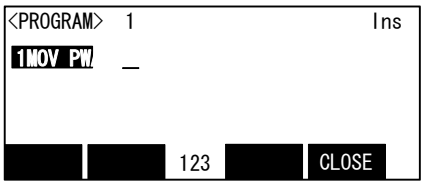
a) [' ( )] key..... ' → (→) → " → ^ → : → ; → ¥ → ?
b) [@ =] key..... @ → = → + → − → * → / → < → >
c) [, %] key..... , → % → # → $ → ! → & → _ → .



−C (J6) 0 SPACE

7 PQRS

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

4 GHI

−B (J5) 8 TUV

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 ◇◆◇

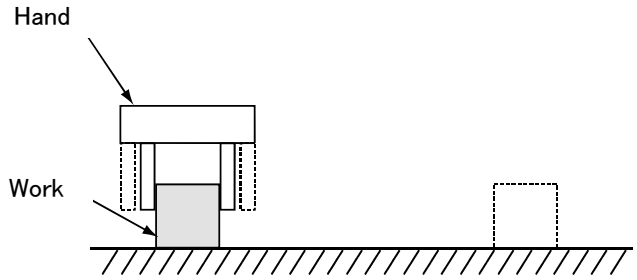
Display the four lines on the screen of T/B. For moving the cursor to the front line, the [↑] key is pressed, for moving the cursor to the next line, press the [↓] key, and select.

◇◆◇ Displaying a specific line ◇◆◇

Press the [FUNCTION] key, and change the function display, and press the [F2] key. The display changes to the JUNP 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)

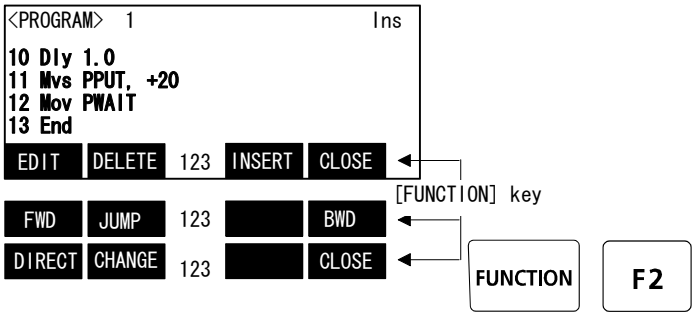


1) Move the robot with jog operation, and set the end of the hand to the position for grasping the workpiece. When the position has been set, open and close the hand to confirm that the workpiece can be grasped.

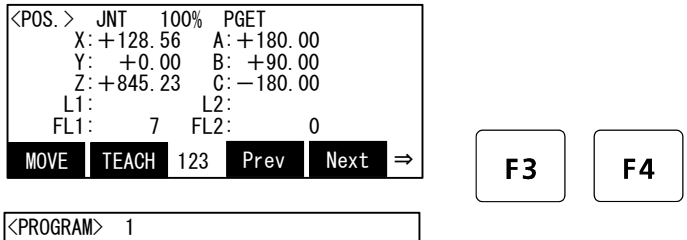
Refer to Page 57, "4.5 Jog operation"for details on the jog operation, and section Page 57, "4.6 Opening and closing the hand" for detains on opening and closing the hand.

◇◆◇ Effective use of jog mode ◇◆◇

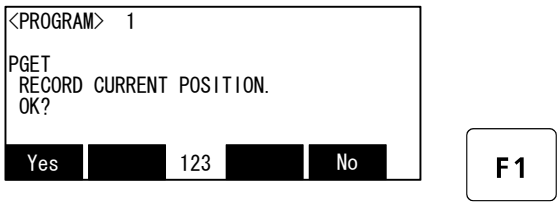
When the robot's current position is greatly separate from the target position, move the robot in axis units with the "JOINT JOG mode", to approach the position.
If the target position is nearby, move linearly with the "XYZ JOG mode", and finely adjust the position. The position can be set accurately 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.

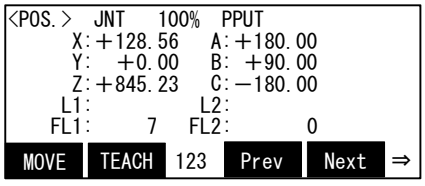


3) Press the [F3](Next) or the [F4](Prev) key, and display "PGET" on the screen upper right.
The current registration coordinate value of the position variable name PGET is displayed.



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.

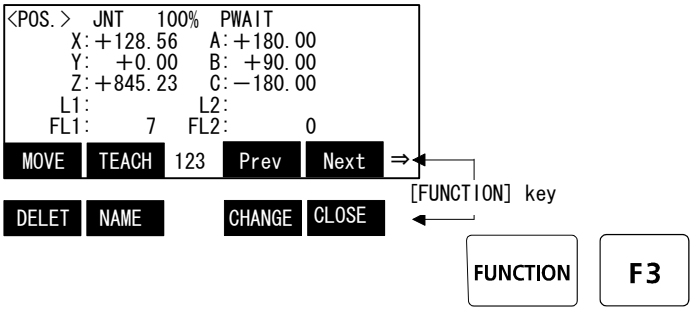
This completes teaching of the robot operation positions.

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

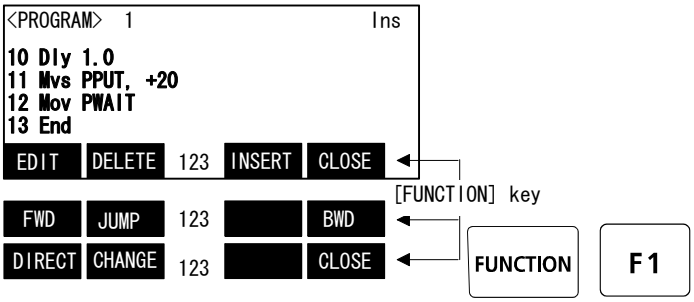
The commands are edited on the command editing screen, and the positions are edited on the position editing screen.
To change from the command editing screen to the position editing screen, press the [F3] (Cange) keys.
To change from the position editing screen to the command editing screen, press the [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.

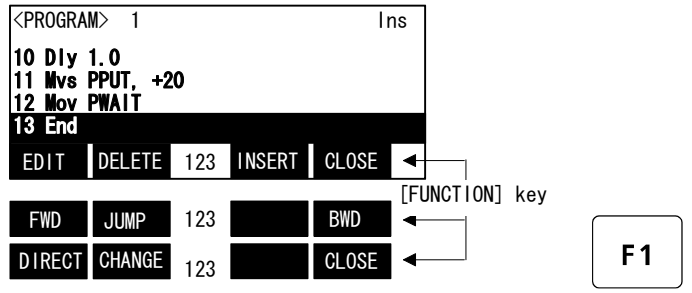


1) Press the [FUNCTION] key and change the function display. Press the [F3](change) and display the command edit screen.



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) i 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 ◇◆◇

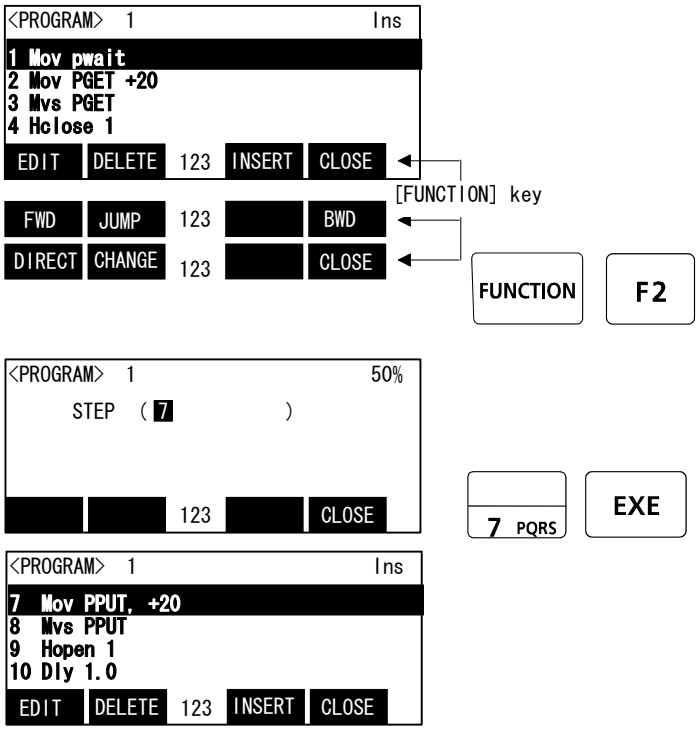
- Press the [EMG.STOP] (emergency stop) switch.
  The servo will turn OFF, and the moving robot will immediately stop.
  To resume operation, reset the alarm, turn the servo ON, and start step operation.
- Release or forcibly press the "enable" switch.
  The servo will turn OFF, and the moving robot 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.

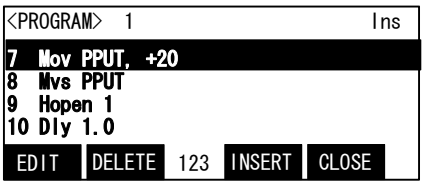
⚠ CAUTION Note) Upward movement is designated at a position along the Z axis of the TOOL coordinate system, and the direction is designated with the + and − signs.
Refer to the section on the TOOL JOG operation in the separate "Installation Manual/ Robot arm setup and maintenance", and confirm the Z 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 JUNP screen. The specification line can be displayed, if the step number to display in the parenthesis is inputted and the [EXE] key is pressed.

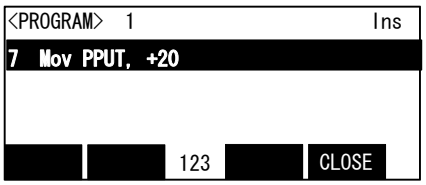
◇◆◇ Displaying the previous and next command step ◇◆◇

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.



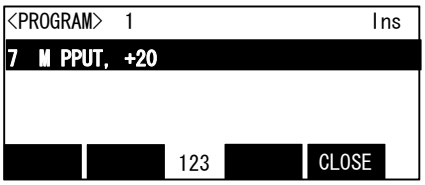
F1

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



→

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



CLEAR

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

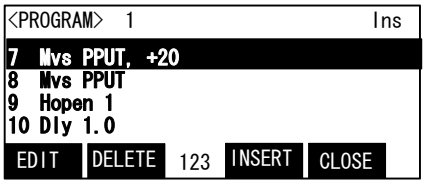
CHARACTER

−B (J5) 8 TUV

7 PQRS

6) Press the [CHARCTER] 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.



EXE

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 ◇◆◇

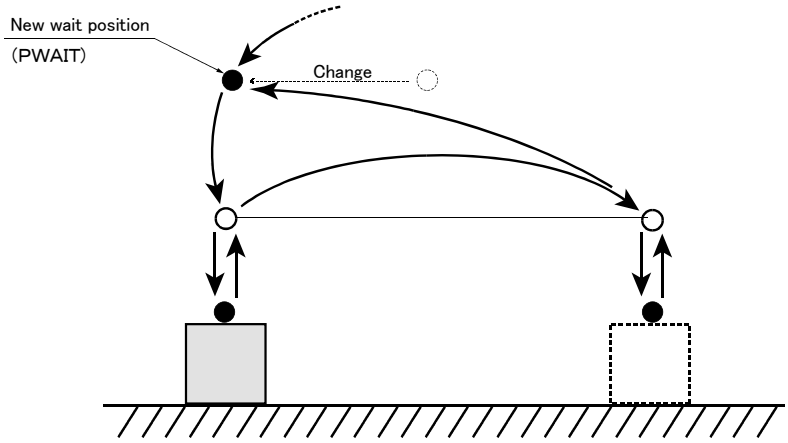
After correcting the program, carry out step operation, and confirm that the program has been corrected.

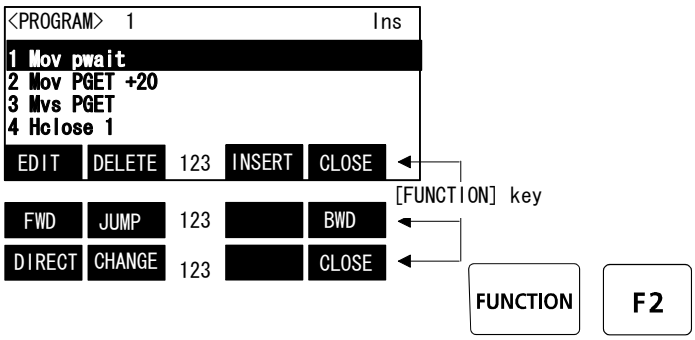
◇◆◇ Inputting characters and space ◇◆◇

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.

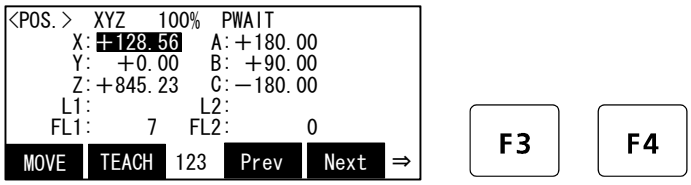
■ Correcting the taught position

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



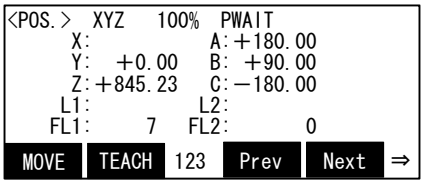


1) In the program edit screen, press the [FUNCTION] key twice and change the function display. [F2](change) Press the key and display the position edit screen.



Press the [F3](Next) or the [F4](Prev) key, and display "PWAIT" on the screen upper right.

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

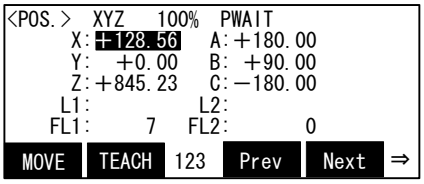


Move the robot to the new standby position by jog operation.

Refer to Page 57, "4.5 Jog operation" for details on the jog operation, and section Page 57, "4.6 Opening and closing the hand" for detains on opening and closing the hand.

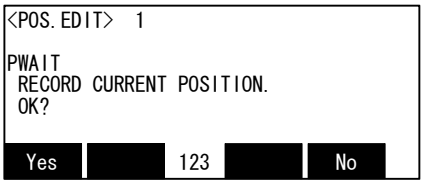
◇◆◇ Calling out a position variable ◇◆◇

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



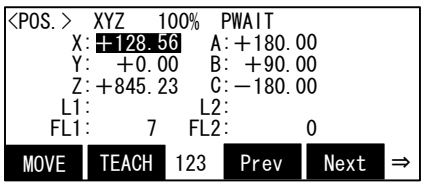
F2

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



F1

5) 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.

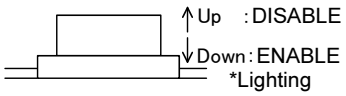
(7) Start automatic operation.

⚠ 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.

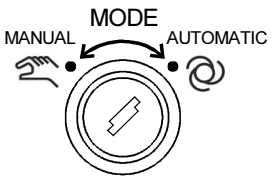
Prepare the controller



Dsiable the T/B

Rear of T/B

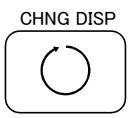
1) Set the T/B [ENABLE] switch to "DISABLE".



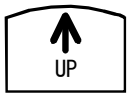
Enable the R/C

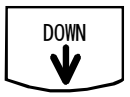
2) Set the drive unit [MODE] switch to "AUTOMATIC".

Set override



Dsiplay override



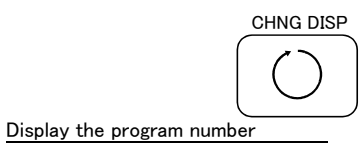


Set override

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] switch is changed.
Note that axes not provided with brakes could drop with their own weight.

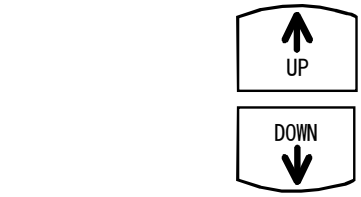
Select the program number



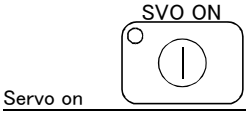
4) Press the [CHNG DISP] switch, and display the "program No." on the STATUS NUMBER display panel.
(A "P" will appear at the head.)

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

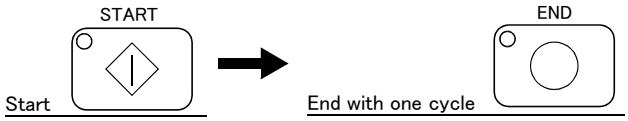
If the correct program number is not displayed, press the [UP] and [DOWN] keys to display the correct program No.



Start automatic operation



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.
7) The robot operation will start and will stop after one cycle.

⚠ CAUTION

When executing the work example given in Page 58, "Fig.4-10 : 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] switch to "AUTOMATIC". Operations from the drive unit are not possible unless the drive unit [MODE] switch 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.

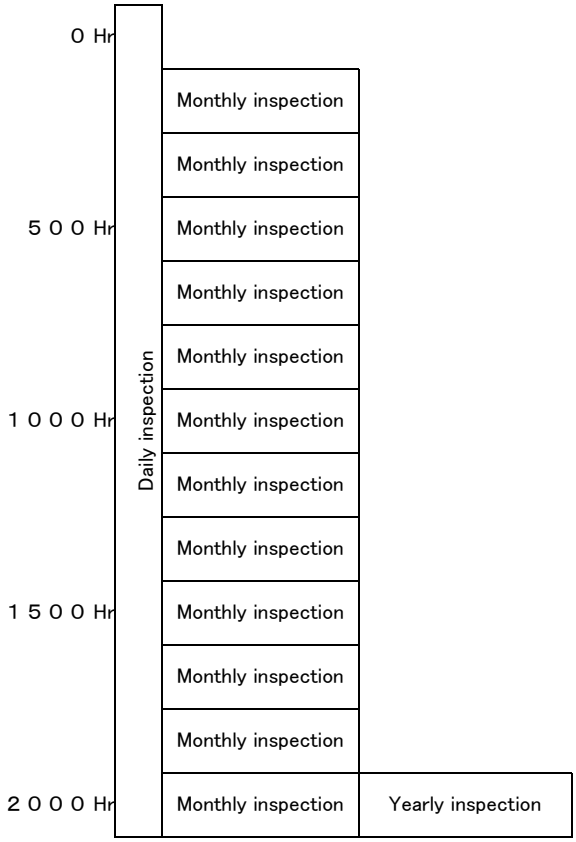
5 Maintenance and Inspection

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 Hr/day x 20 days/month x 12 months = approx. 1800 Hr

10 Hr/day x 20 days/month x 12 months = approx. 2400 Hr

For two shifts

15 Hr/day x 20 days/month x 12 months = approx. 3600 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 78, "5.3.2 The check of the filter, cleaning, exchange".
Yearly inspection items		
1	Replace the backup battery in the controller.	Exchange the battery connected to the robot CPU.

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 section "5.4 Maintenance parts" on page 40. Contact your dealer for these parts when required.

5.3.1 Replacing the battery

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 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 controller 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.

⚠ CAUTION

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.

⚠ CAUTION

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.

5.3.2 The check of the filter, cleaning, exchange

The filter is installed in the drive unit.

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

(1) DU1A-700

1) Remove the filter cover in the bottom of the front side of the drive unit by unscrewing the M3 screws (2 pcs.).
2) Remove the filter from the drive unit, and then remove dust and particles accumulated on the filter.
   *If the filter is heavily soiled, wash it using neutral a detergent diluted with water, dry it completely, and then mount it to the drive unit.
3) Attach the cleaned or new filter to the drive unit, and install the filter cover to drive unit with the M3 screws (2 pcs.).

Notes) The DU1A-772 drive unit is also the same.

Fig. 5-2 : Cleaning, exchanging the filter(DU1A-700)

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

(2) DU2A-700

1) Remove the filter plate in the bottom of the front side of the drive unit by unscrewing the M3 screws (2 pcs.).
2) Remove the filter from the filter plate, and then remove dust and particles accumulated on the filter.
*If the filter is heavily soiled, wash it using neutral a detergent diluted with water, dry it completely, and then mount it to the drive unit.
3) Attach the cleaned or new filter to the filter plate, and install it to the drive unit with the M3 screws (2 pcs.).

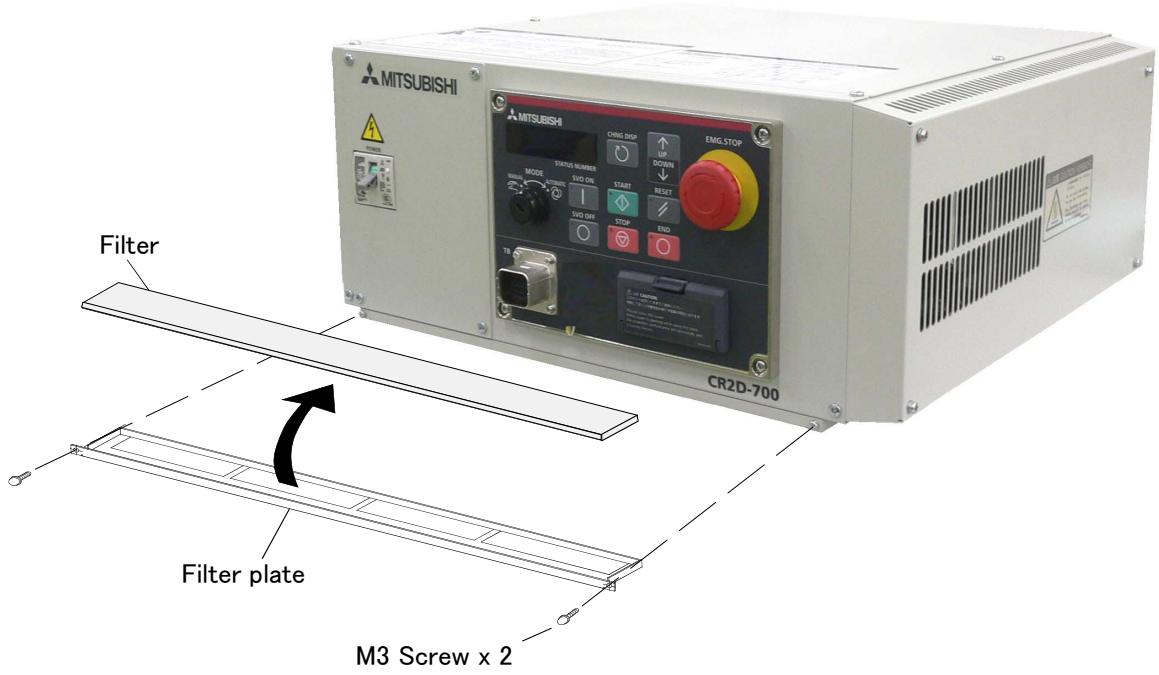


Fig. 5-3 : Cleaning, exchanging the filter(DU2A-700)

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

(3) DU3-700

1) Remove the filter plate in the bottom of the rear cover of the drive unit by unscrewing the screws (2 pcs.).
2) Remove the filter from the filter plate, and then remove dust and particles accumulated on the filter.
   *If the filter is heavily soiled, wash it using neutral a detergent diluted with water, dry it completely, and then mount it to the drive unit.
3) Attach the cleaned or new filter to the filter plate, and install it to the rear cover of drive unit with the screws (2 pcs.).

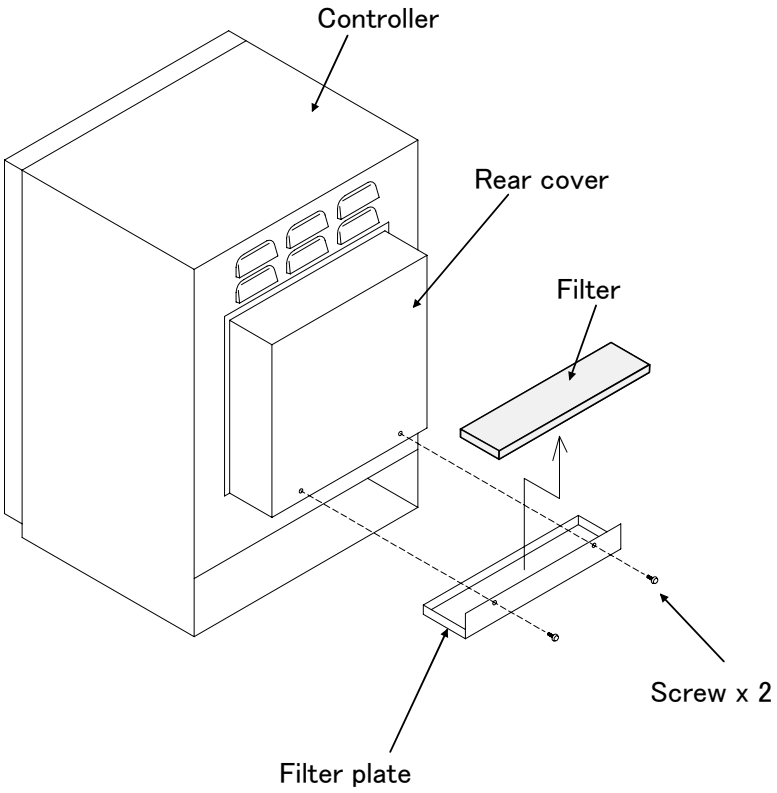


Fig. 5-4 : Cleaning, exchanging the filter(DU3-700)

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 part list

No.	Part name	Type Note1)	Qty.	Usage section	Maker
All the controller commonness					
1	Lithium battery	Q6BAT	1	Connect with robot CPU.	Mitsubishi Electric System & Service;Co.,Ltd.
DU1A-700					
1	Filter		1	Front of the drive unit	Mitsubishi Electric System & Service;Co.,Ltd.
DU2A-700					
1	Filter		1	Under the front of the drive unit	Mitsubishi Electric System & Service;Co.,Ltd.
DU3-700					
1	Fan (40 square)		5	Amplifier unit Converter unit	Mitsubishi Electric System & Service;Co.,Ltd.
2	Filter		1	Rear of the drive unit	

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 part list

No.	Part name	Type Note1)	Qty.	Usage section	Maker
DU1A-700					
1	Fuse	LM16	2		Mitsubishi Electric System & Service;Co.,Ltd.
DU2A-700					
1	Fuse	LM32	1		Mitsubishi Electric System & Service;Co.,Ltd.
2		LM16	2		
3		MF60NRF-1.6A	1	Inside of the drive unit Glass tube fuse)	
DU3-700					
1	Fuse	LM32	4	CPU unit (R700CPU)	Mitsubishi Electric System & Service;Co.,Ltd.
2		LM16	6	Safty unit (R700SFT)	
3		LM32	3	Amplifier unit	

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

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BUILDING, 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS: 5-1-14, YADA-MINAMI, HIGASHI-KU, NAGOYA 461-8670, JAPAN

Authorised representative:
MITSUBISHI ELECTRIC EUROPE B.V. GERMANY
Gothaer Str. 8, 40880 Ratingen / P.O. Box 1548, 40835 Ratingen, Germany

Jul., 2012 MEE Printed in Japan on recycled paper.