Panasonic

Arc Welding Robot Controller

Operating Instructions

Model No. YA-1QAR series

Controller code
YA-1QCR41T**
YA-1QCR41Y**
YA-1QCR61T**
YA-1QCR61Y**
YA-1QCR61E**
YA-1QCR61R**
YA-1QCR61U**
YA-1QCR81T**
YA-1QCR81Y**
YA-1QCR81E**
YA-1QCR81R**
YA-1QCR81U**

TAWERS
- The Arc Welding Robotic Solution -

Before operating this product, please read the instructions carefully and save this manual for future use.

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♦Introduction

Thank you for purchasing our Panasonic industrial robot TAWERS series. This manual is the Operating Instructions of YA-1QC series controllers.

For operation of the controller, please refer to the basic operation and advanced operation manuals.

♦Safety

Please read and understand separately provided "Safety Manual" thoroughly for proper and safe operation of our robots.
Prior to operation, read this manual for proper operation. Keep this manual in an easily accessible place and re-read as necessary.

The installation shall be made by qualified installation personnel and should conform to all national and local codes.

♦Registered trade mark

- Microsoft Windows and Windows CE are registered trade marks of Microsoft corporation in the United States and/or other countries.
- PS/2 is a registered trade mark of International Business Machines Corporation.
- Other names of company and products are generally trade marks or registered trade marks of each company.

♦Safety symbols

Read this manual carefully to use the machine properly. The cautions mentioned in this manual and on the product are important to operate the machine properly and prevent hazardous situation and damage to you and other personnel.
This document classifies all of these hazardous conditions into three levels, namely Danger, Warning or Caution, and indicates these levels by using symbols. Those Dangers, Warnings, Cautions as well as Mandatory Actions and Prohibitions mentioned must be followed without fail. It is also important to ensure that equipment functions correctly at all times. * The warning symbols and signal phrases are also used on the warning labels attached on the machine.

Warning symbol	Signal phrase	Description	Warning symbol	Signal phrase	Description
	**Danger**	A hazardous accident including death or serious personal injury is imminent, if directions are not followed carefully.		**Mandatory Action**	Action which MUST be performed without fail, such as grounding.
	**Warning**	The potential for a hazardous accident including death or serious personal injury is high, if directions are not followed carefully.		**Prohibition**	Action which MUST NOT be performed.
	**Caution**	The potential for hazardous accident including medium-level or light personal injury and/or the potential for property damage to the equipment are high if, directions are not followed carefully.	The above warning symbols are commonly used.		

"Serious personal injury" refers to loss of eyesight, burns (high-temperature and low-temperature burn), electrical shock, bone fractures and gas poisoning, as well as those that leave after-effects, which require hospitalization or necessitate medical treatment for an extended period of time. "Medium-level and light personal injury" refers to burns, electrical shock and injuries which do not require hospitalization or necessitate medical treatment for an extended period of time. "Property damage" refers to extensive damage to the surrounding items and equipment.

- The description of this manual is based on the contents as of **January, 2008**.
- The contents of this manual are subject to change without further notice.

♦About Model No.

Controller group	Model number	Code number	Basic design policy
T & Y	YA-1QAR42**T**∗∗ YA-1QAR42**Y**∗∗ YA-1QAR61**T**∗∗ YA-1QAR61**Y**∗∗ YA-1QAR81**T**∗∗ YA-1QAR81**Y**∗∗	YA-1QCR41**T**∗∗ YA-1QCR41**Y**∗∗ YA-1QCR61**T**∗∗ YA-1QCR61**Y**∗∗ YA-1QCR81**T**∗∗ YA-1QCR81**Y**∗∗	The robot is designed as standard specification for the use in T for the Japanese market and Y for overseas markets in general. This product does not meet the requirements specified in the EC Directives which are the EU safety ordinance. Please bear in mind that this product may not be brought as is into the EU. The same restriction also applies to any country which has singed the EEA accord. Please be absolutely sure to consult with us before attempting to relocate or resell this product to or in any EU member state or any other country which has signed the EEA accord. **<Note>** If you are intended to use the robots in US, Canada or EU member states (including countries signed the EEA accord), please purchase the robots designed for those countries. (See the following models.)
E	YA-1QAR61**E**∗∗ YA-1QAR81**E**∗∗	YA-1QCR61**E**∗∗ YA-1QCR81**E**∗∗	The robot is designed in accordance with the applicable European directive: Machine Directive 98/37/EC, Low Voltage Directive 73/23/EEC (as last amended) and EMC Directive 89/336/EEC (as last amended). Before put into service the Robot manipulator in the European market the Robot system shall be designed in accordance with the manufactures specification described in this manual and Instruction manual. Remodeling and/or modifying this product not in accordance with the manufacturers specification then this declaration will loose its validity.
R	YA-1QAR61**R**∗∗ YA-1QAR81**R**∗∗	YA-1QCR61**R**∗∗ YA-1QCR81**R**∗∗	The robot is basically designed in accordance with safety regulations and standard applied in the US market only. This product does not meet the requirements specified in the EC Directives which are the EU safety ordinance. Please bear in mind that this product may not be brought as is into the EU. The same restriction also applies to any country which has singed the EEA accord. Please be absolutely sure to consult with us before attempting to relocate or resell this product to or in any EU member state or any other country which has signed the EEA accord. The installation shall be made by qualified installation personnel and should conform to all national and local codes.
U	YA-1QAR61**U**∗∗ YA-1QAR81**U**∗∗	YA-1QCR61**U**∗∗ YA-1QCR81**U**∗∗	The robot is designed in accordance with the following safety regulations and standard applied in the US and Canadian markets. UL1740:1998 ANSI/RIA R15.06-1999 NFPA79-1997 CAN/CSA Z434-1994 This product does not meet the requirements specified in the EC Directives which are the EU safety ordinance. Please bear in mind that this product may not be brought as is into the EU. The same restriction also applies to any country which has singed the EEA accord. Please be absolutely sure to consult with us before attempting to relocate or resell this product to or in any EU member state or any other country which has signed the EEA accord. The installation shall be made by qualified installation personnel and should conform to all national and local codes. **Notice: Exporting the machine into Canada** Please bear in mind that exporting this product to Quebec, Canada requires all name plates and manuals of the product shall be written in French.

"∗∗": Represent the last two alphanumeric characters of Model and Code numbers, which vary with specifications. As for T and Y controller groups, if those two alphanumeric characters are "A*", the controller is switching multiple-output (200V and 220V) type.

♦ Table of Contents

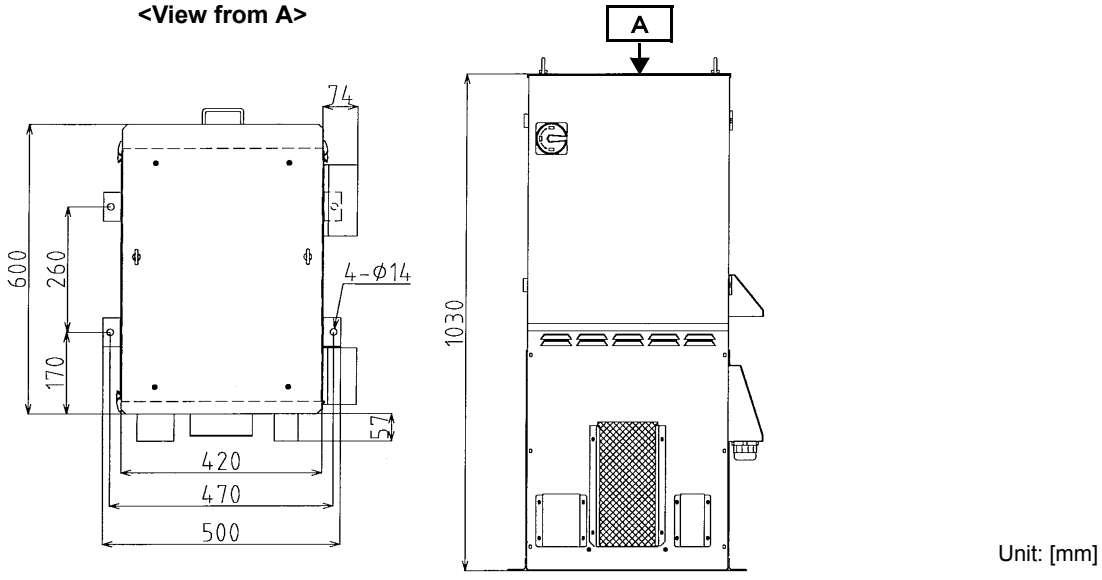
1. Specifications

1.1 Technical data

1.1.1 Structure and control method

Item		Specifications
Structure and IP class		Closed box type, IP22 or equivalent
Cooling method		Indirect air cooling (Circulating internal air), Direct air cooling (Welding power supply)
Input power source		3-phase, 200VA ±20V, 23kVA, 50/60Hz
Grounding		Protective Earth (PE) grounding is required. Functional Earth (TE) is required depending on applied system. **Note)** For Power capacity, see section “Connection”.
Body color		Munsell color system 5Y8/1
Teaching method		Teaching playback
Path control		PTP and CP (Linear and circular interpolation)
The number of control axes		6 axes simultaneously (Max. 14 axes)
The number of external axes		Limiting to manipulator + 2 built-in external axes + 6 exterior type axes.
Position detection method		Electronic type absolute pulse resolver
Position control method		Software servo control
Speed control method		Constant linear velocity control (during CP control)
Speed range	at teaching operation	Max. speed can be controlled within the safety speed range from 0.01 to 15 m/min (Default setting: 15 m/min)
	at playback operation	0.01 to 180 m/min (Direct input method)
Memory system		IC memory (Battery back-up system)
Memory capacity and software		See the operating instructions “Operation”
Connecting cable		4m
Communication interface		Optional RS-232C and RS-422
Dimensions (W x D x H)		420 x 600 x 1030 (mm)
Mass		110 kg (242 lbs.), (Including the Teach pendant and connecting cable.)

Dimensions



Unit: [mm]

1.2 Inputs, outputs and communications

Items	Input and output		Specifications
Status I/O	Input		1. Start 2. Hold 3. Error release 4. Teaching mode 5. Operating mode 6. Servo ON
	Output		1. Running 2. Hold status 3. Error 4. Operating mode 5. Teaching mode 6. Servo ON 7. Ready 8. Alarm
Common I/O	Input		40 points (Option: expandable to max. 504 points)
	Output		40 points (Option: expandable to max. 504 points)
	I/O allocation		Program select input, other status I/O.
Other I/O	Input		Safety Holder input and Installation input
	Input specs.		Photo-coupler (ON/OFF of 24 VDC, 12 mA)
	Output specs.	T/RY/R/U spec.	Open Collector
		E spec.	Open emitter
Safety circuit	Dual circuit input		1. Emergency stop for Teach Pendant 2. Spare emergency stop(Note 1) 3. External emergency stop 4. Door stop 5. Deadman switch 6. External deadman switch 7. Hand input
	Output		Emergency stop output (system 4)
	Input specs.		Double contacts (Dual circuit)
	Output specs,		Double contacts (Dual circuit)
External memory, Communication Interface	Controller		Optional RS-232C and RS-422
	Teach Pendant		2 slots for PCMCIA card, PS/2

(Note 1)
For the controllers of E, R and U specifications, the “Emergency stop” of the operation box (standard accessory) is factory connected to the “Spare emergency stop” input at shipment.

1.3 Specifications of digital welding

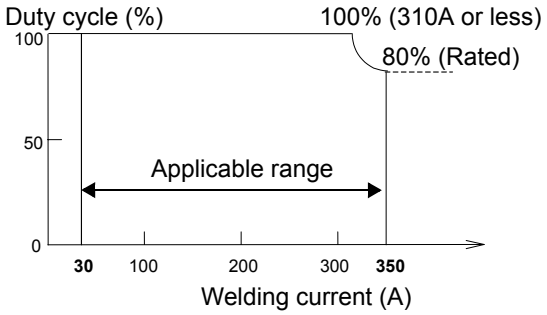
Item	Specifications	
Built-in welding power source type	T / Y / R spec.	YA-1QD351T00 (200 V specification)
		YA-1QD351T01 (200/220 V specification) (Note 2)
	E spec.	YA-1QD351E00
	U spec.	YA-1QD351U00
Welding method	CO_2, MAG, Stainless steel MIG, Pulsed MAG/MIG	
Control method	IGBT inverter	
Max. no-load voltage	65VDC	
Output current adjustable range	30 - 350 ADC	
Output voltage adjustable range	12 – 36 VDC	
Rated duty cycle (10 min. interval)	80% for GMAW and 60% for pulsed GMAW	
Output terminal	Connection with M8 bolt and nut	

(Note 2)
This model (200/220 V specification) is applicable only to T and Y specifications.

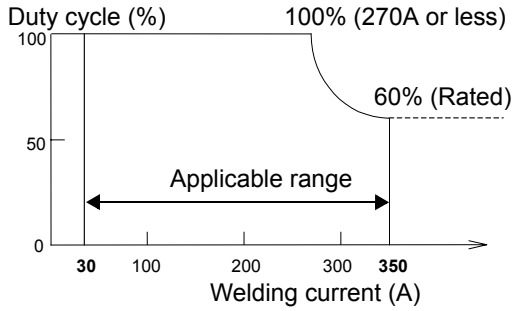
Note **About “Duty cycle”**

Duty cycles are based on a ten minutes time interval.
If the duty cycle is 80 % at rated output. That means for 80 percent of the ten-minute period (8 minutes), the power source can maintain operation at the rated welding current without overheating. The remaining two minutes must be operated at no-load to allow proper cooling.
(8 min. / 10 min.) x 100 % = 80 %
Using the machine at beyond the rated duty cycle causes rise in temperature of the machine beyond the max. allowable temperature, and deterioration or burning of the machine may be the result.
In case of using the machine in combination with other products, such as welding torch, please apply the lowest rated duty cycle among the applied products.

(GMAW)



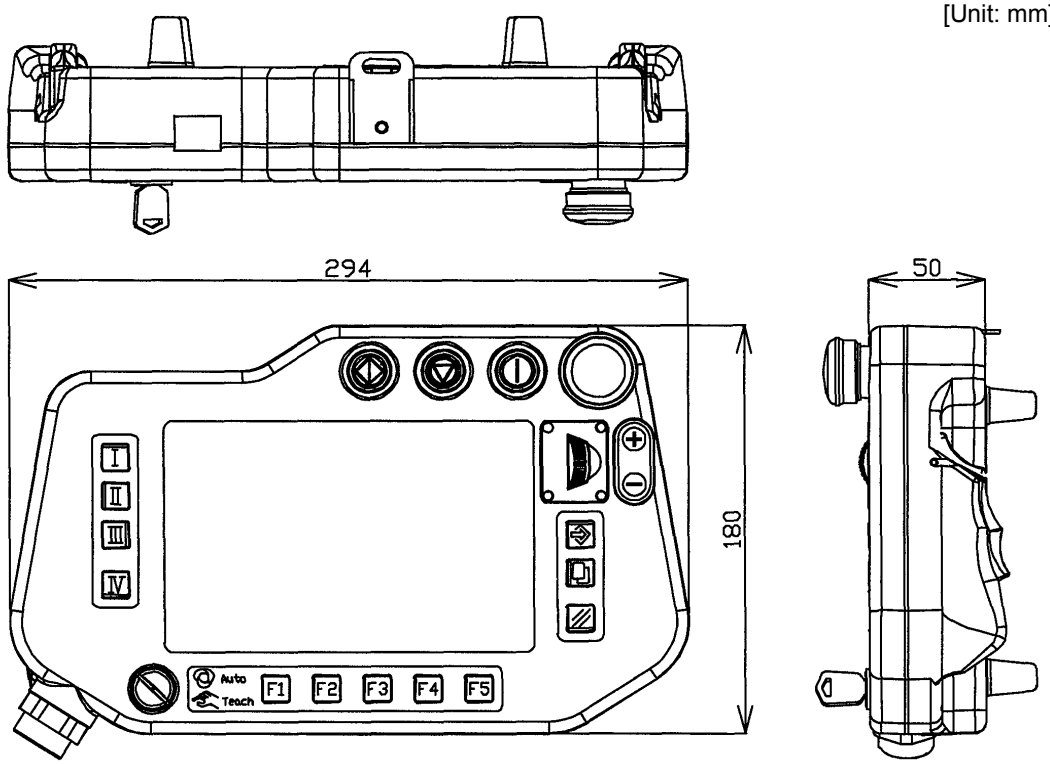
(Pulsed GMAW)



1.4 Teach Pendant

Item	Specifications
Environmental protection class	IP42 or equivalent
Display	7 inches TFT color graphic LCD (Note 1)
Memory in TP	IC memory (Lithium battery backup)
PC card slot	2 slots (conform to PCMCIA Type 2) * A memory card for scheduled backup has been factory installed into one of those slots. (The scheduled backup is factory set to start at twelve noon everyday at shipment. The setting can be changed.)
PS/2 port	1
Deadman switch	3 points action
Emergency stop switch	1 (Mechanical self-hold type)
Connecting cable	10 m

[Unit: mm]



Note

Do not use the cable or cable connection point as a handle. Undue force applied at this connection can cause damage to the teach pendant.

(Note 1)

This product has a fluorescent lamp that contains mercury. Disposal may be regulated in your community due to environmental considerations. For disposal or recycling information, please contact your local authorities, or the Electronic Industries Alliance: http://www.eiae.org. (U.S.A. only)

1.5 Operation Box

T / Y spec.	Optional
E / R / U spec.	Standard

Item	Specifications
Environmental protection class	IP54 or equivalent
“AUTO mode” switch	1 (It is connected to the Status I/O and other connection terminals.)
Emergency stop switch	1 (It is connected to the “Spare emergency stop” input hold type.)
Software	An optional software is required for operation of the Operation Box.
Connecting cable	6 m

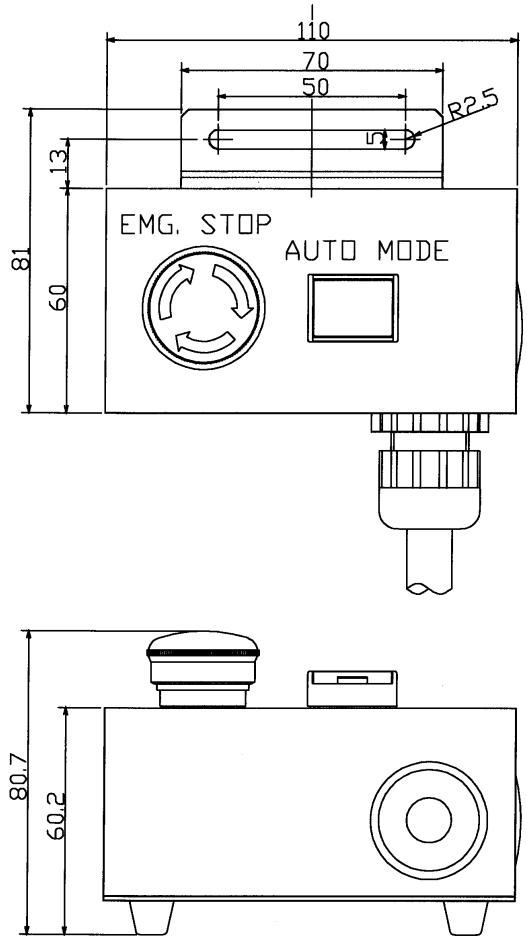
The “AUTO” mode operation is functioned by

(1) Changing the Mode switch of the Teach Pendant to “AUTO”

or

(2) Restarting after door stop input in “AUTO” mode, and then the “AUTO mode” button of the Operation Box is pressed.

The connection wires are connected to the Status I/O and other connection terminals.



1.6 Accessories for the controller

Description		Part number	Q'ty	Note
Teach Pendant		AUR01047 or AUR01053	1	
TP hook		AKC41013PA	1	For Teach Pendant
Ball chain (*)		TM14-1L500	1	
Mode select switch key (*)		YAW20	2	2 pcs/set
Fuse		ST4-8AN1	1	8A anti-rush type
Fuse		ST4-5AN1	2	5A anti-rush type
Fuse		ST4-6AN1	1	6A anti-rush type
Fuse		ST4-3AN1	1	3A anti-rush type
Fuse		ST4-2AN1	2	2A anti-rush type
Fuse		ST4-1AN1	2	1A anti-rush type
Fuse		ST4-0.5A	2	0.5A anti-rush type
Fuse	T / Y spec.	250VTLLC15A	3	15A
	E / R / U spec.	FNW15	3	15A
Fuse	T / Y spec.	250VTLLC5A	3	5A
	E / R / U spec.	SKM10-5A	3	5A
Fastener key		-	6	Fastener attachment
Connector		FCN361J040AU	2	for the Sequencer card
Connector cover		FCN360C040B	2	for the Sequencer card
Harness		AWC42038	4	(For external emergency stop and door stop)
Label for Key switch		ANS31017	1	
Saddle		SP30	1	
Rubber sheet		AFQ41158	1	
Rubber cover		AWK41012	2	
Ground cable (5m)		AWC42164LN	2	
Bolt		XVGZ8+F20FJ	2	
Washer		XWE8FJ	2	
Nut		XNG8GFJ	2	

(*): They are fitted with the TP hook.

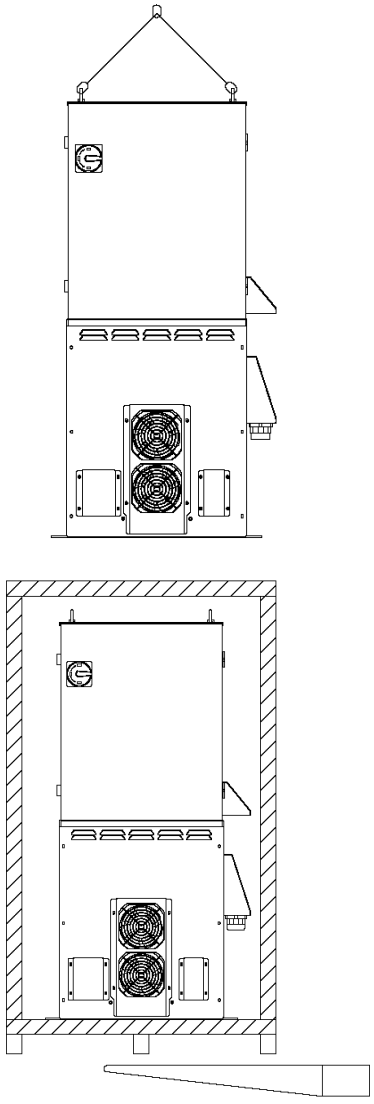
2. Transportation

2.1 Transportation methods

CAUTION	In case of using a crane, be sure not to stand under or near the lifted controller. In case of using forklift, be sure no personnel shall hold the controller.

In principle, use a crane to transport a robot controller for installation or re-installation. When a crane is used, hang the robot controller with double-wire through the attached two eyebolts as illustrated in the following figure.
Any transportation method that may apply any shock to the controller shall be avoided.

(1) Double-wire hanging method.
Hook the wire to the provided eyebolts.



3. Installation

CAUTION	The installation shall be made by qualified installation personnel and should conform to all national and local codes.

3.1 Choosing an installation site

- A site where ambient temperature ranging from 0 to 40ºC and free from exposure directly to the sun.
- Be sure to locate the controller close to but outside of the work envelope of a manipulator.
- A site relatively free of dust or oil mist.
- A site free of inflammable or corrosive gas.
- A site where no obstructions are present within the work envelope of the manipulator.
- A site easily accessible in case of inspection or disassemble work.
- A site relatively free of shock and vibration.
- A site where no electrical noise source exists.

Note

- If a significant noise source (plasma or high frequency etc.) exists at or around the installation site, please consult us in advance.
- Refer to the environmental protection class (IP class) of each machine. (See “Specifications”).

3.2 Installation site

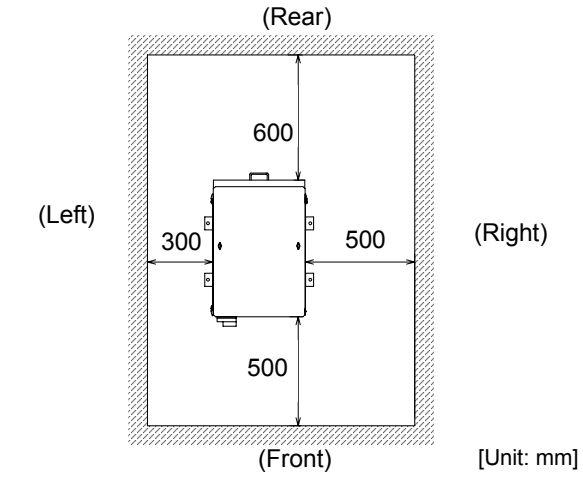
(1) Locate the controller outside of the work envelope of a manipulator and also outside the safety fenced area. Make sure to maintain space from any wall or peripheral equipment (see the figure on the right) from any wall or peripheral equipment for maintenance and inspection work and to control temperature inside of the controller.
Note: Do not place anything above and below the controller unless otherwise specified.
If places, an abnormal temperature error may occur due to increase in temperature inside the controller.

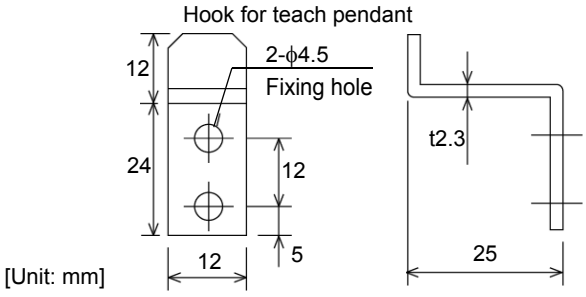
(2) Teach pendant
Hook the teach pendant on the provided TP hook.
TP hook should be installed outside of both the safety fence and the work envelope of the manipulator so as to prevent possible danger due to mode change inside the safety fenced area. A mode switch key is chained with ball chain to the TP hook. Length of the cable between the teach pendant and the controller is 10 m.

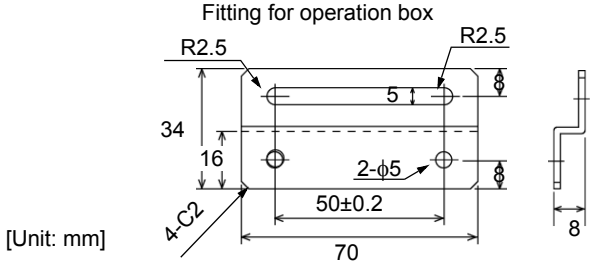
(3) Operation box

T / Y spec.	Optional
E / R / U spec.	Standard

The panel fixture is provided with the operation box to station the operation box during operation or to store it. To use the panel fixture, please prepare a hook at customers’ end. Make sure to locate it outside of the work envelope of a manipulator and also outside the safety fenced area. It shall be placed where the operator can check inside of safe guard area easily. Length of the cable between the operation box and the controller is 6 m.







4. Connection

CAUTION	The installation shall be made by qualified installation personnel and should conform to all national and local codes.

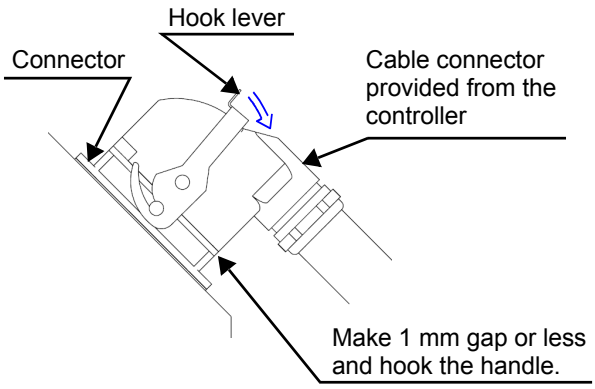
4.1 Connecting the controller to the manipulator

The absolute origin of the robot manipulator (robot position control origin), which forms a pair with the controller, is stored in the memory element of the controller. For that reason, a production number of the corresponding controller is labeled on the robot controller.
Make sure to use the designated pair.

4.1.1 Connecting cable for the manipulator

(1) Insert the plug into the receptacle of the manipulator and push it.
- **Note**: Wide gap between the plug and the receptacle may cause bent pin of the connector.

(2) Push down the hook lever to the arrow direction and lock the plug.

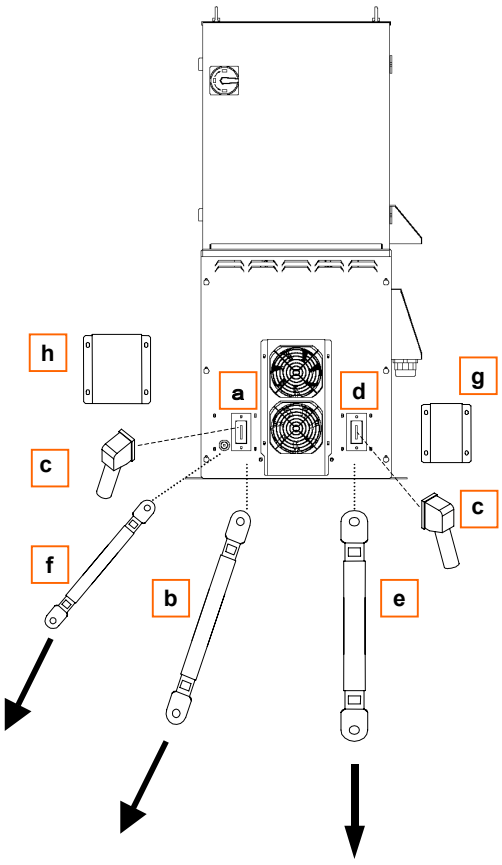


4.1.2 Connecting cables for the built-in welding power source

(1) Through the Rubber cover, connect a welding cable from a base metal to the output terminal (-) for “BASE METAL”. Then cover the terminal with the rubber cover to insulate the terminal.
(2) Through the Rubber cover, connect the power cable to the output terminal (+) for welding torch, and then cover the terminal with the rubber cover to insulate the terminal. Connect the other end of the cable to the welding terminal on the rear of the manipulator.
(3) Connect the base metal detection cable to the terminal in left side of the BASE METAL output if required.
(4) Attach the Cover L and the Cover R for protection of the terminals.

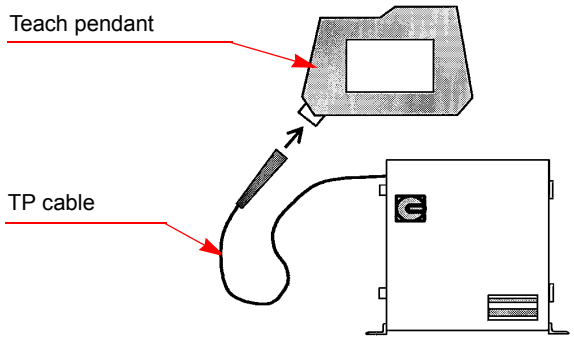
No.	Name	Remarks
a	Output (-)	For base metal
b	Output cable	*Customer preparation article
c	Rubber cover	For terminal insulation
d	Output (+)	For welding torch
e	Power cable*1	5 m (standard)
f	Base metal detecting cable *1	10 m
g	Cover R	
h	Cover L	

*1: Provided as incidental equipment.

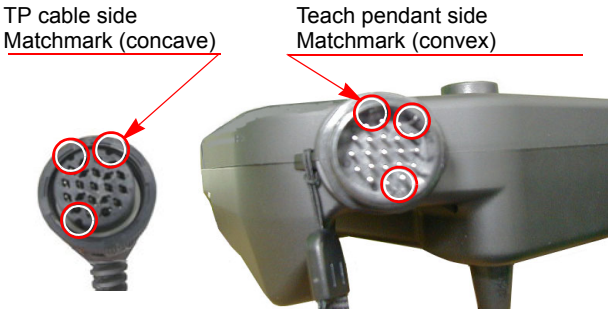


4. 2 Connecting teach pendant

Connect the TP cable to the connector of the teach pendant.



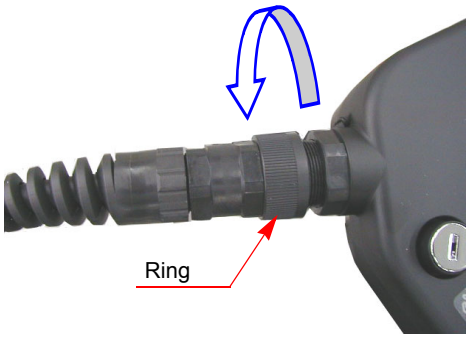
- Match the matchmarks (concave) at the connector of the TP cable with the matchmarks (convex) at the connector of the teach pendant, and then fasten the cable ring.



Match three matchmarks of
TP cable with that of Teach pendant

Note When fastening the cable ring

Do not fasten the ring tight at one time and forcedly.
Turn the ring a little and push the cable in and repeat the procedure until the ring is set completely.
Fastening the ring forcedly may cause damage or malfunction of the machine.



Fasten the cable ring.

4. 3 Confirming the installation of the memory card

A memory card for scheduled backup has been factory installed into a PC card slot at shipment.
Make sure to confirm if the memory card is placed correctly as the memory card may be come off due to the vibration during transportation.

Note

The memory card is placed in the PC card adapter to insert into the PC card slot.

Open the cover to access
the memory card.

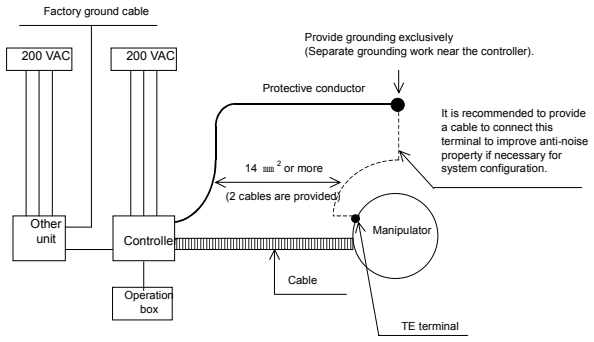
4.4 Connection of ground cable

CAUTION	Provide grounding to the protective earth terminal (PE) of the robot controller exclusively. Check the grounding work before operation.

4.4.1 Grounding

Two 14 mm^2 (AWG6) Green/yellow wires are provided for grounding as accessory.(2 cables are provided)

Countries	Grounding resistance	Additional protective conductor
Japan	100 ohm or less	14 mm^2 or more.
EU	100 ohm or less	14 mm^2 or more.
USA	0.1 ohm or less	AWG6 or more
Others	Conform to all national and local codes	

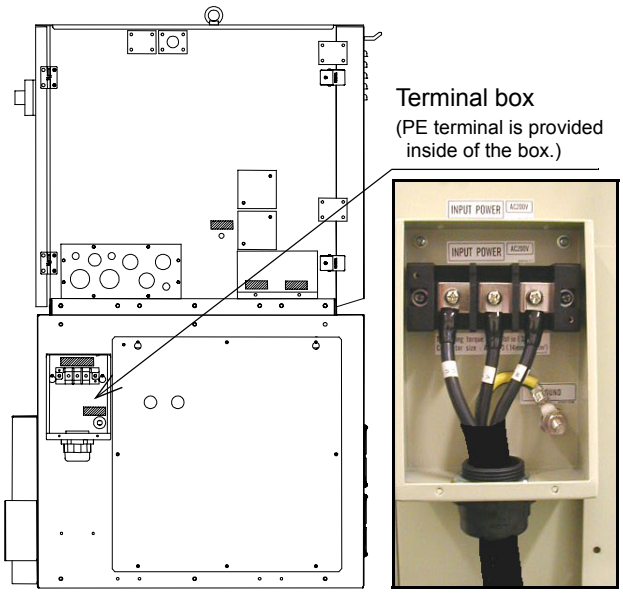


Note

Size of the protective conductor for other devices shall be according to the corresponding instruction.

4.4.2 Connection of grounding cable

(1) Remove the cover of the terminal box.
Pass the protective conductor through the cord lock and then connect it to the PE terminal.
(2) Put the cover of the terminal box back in place.
(3) Fix the input cable with a rubber sheet and a saddle.



4.5 Connecting primary power source

4.5.1 Wiring primary power cable

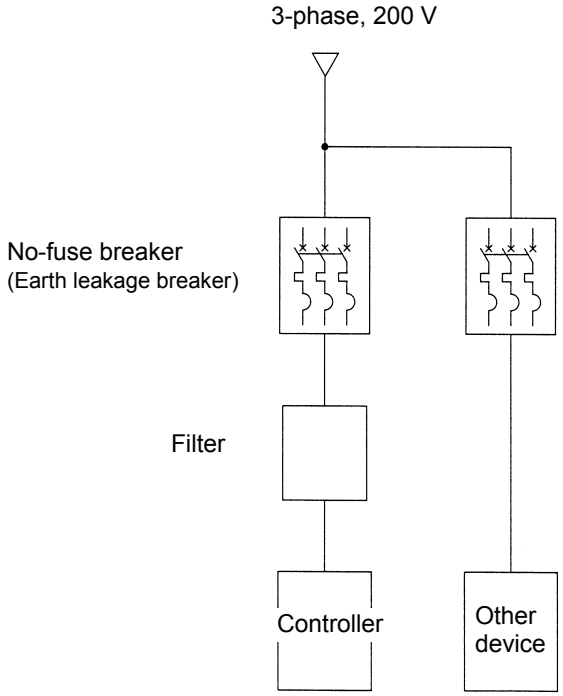
Cable size	14 mm^2 or more AWG6 or more

(1) Be sure to provide no-fuse breaker (earth leakage breaker) or switch with fuse of specified capacity for each controller separately.

(2) To prevent noise from entering from the power cable, if it is the case, install a filter before the primary input.

Note

- Remarks on “Earth leakage breakers”
  Use of earth leakage breakers with medium sensed current and high-speed type, if applied, is recommended to prevent malfunction of the breaker.
- The rated sensed current to prevent malfunction of the earth leakage breaker is about 100 mA in case of using a robot only and 200 mA in case of using an external axis together with a robot. For details and grounding work, please consult your local electrical engineers.



4.5.2 Wiring primary cables

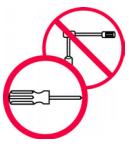
(1) Remove the cover of the terminal box. Pass input cables through the cord lock and then connect it to the input terminals.

(2) Put the cover of the terminal box back in place.

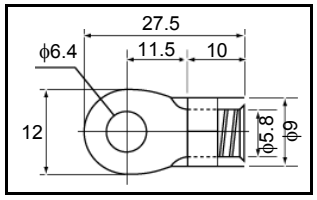
(3) Fix the input cable with a rubber sheet and a saddle.

Caution

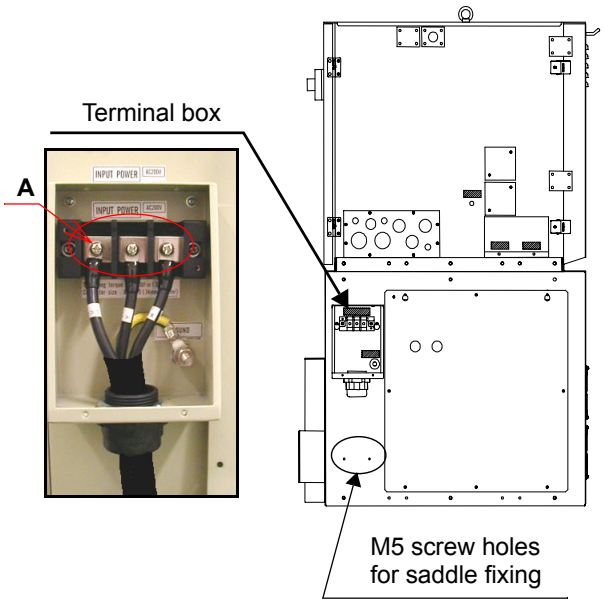
Connecting screw “A”
- Do not use a wrench
- Tightening torque: 3.0N•m



Recommended clamp terminal at “**A**”.
(14mm^2 for M6)



* Input power cable is a customer preparation item.



4.5.3 Using at 220VAC (For TA*/YA* specification)

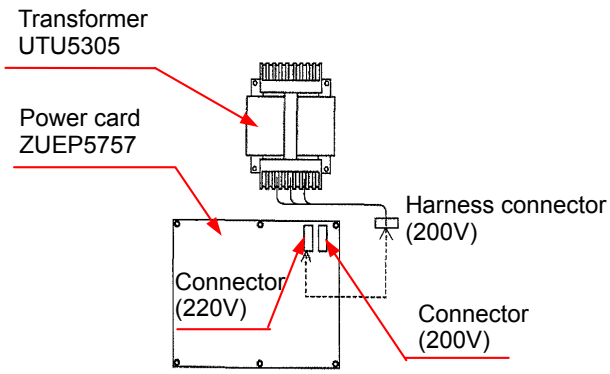
In case of using the controller at 220 VAC, it is necessary to switch the voltage of the controller and also built-in welding power source.

<Controller side>

(1) Unlock the fastener keys at the lower sides of the back of both sides panels (2 pcs. each). Then open the rear side panel.

(2) Disconnect the primary side harness connector “200V” of the transformer (UTU5305) located at the center board of the controller from the connector “200V” on top of the power card (ZUEP5757).
Then connect it to the connector “220V”.

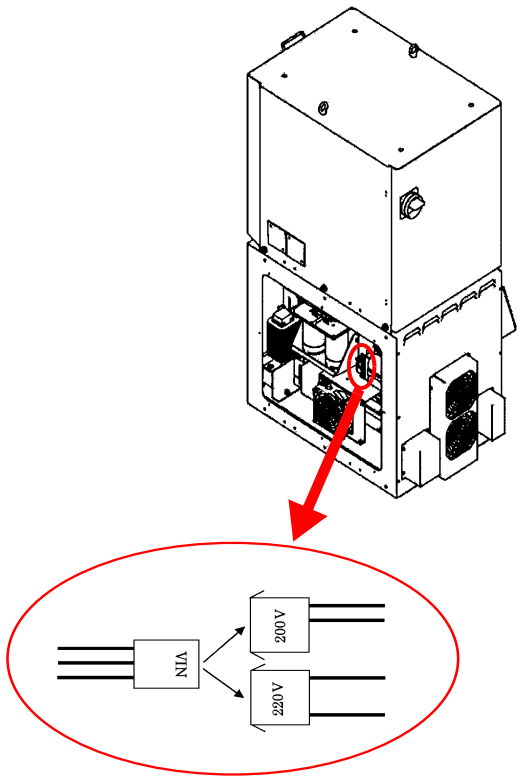
(3) Re-install the rear side panel, and then connect the power cable.



<Built-in welding power source>

Open the panel at the bottom of the left side panel of the controller, and change the harness connections of the built-in welding power source.

- Using at 200V: Connect “VIN” and “200V”.
- Using at 220V: Connect “VIN” and “220V”.



Change harness connection

Note

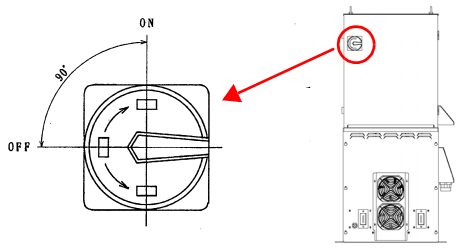
- Applicable models:
  YA-1QCR41TA*/YA-1QCR41YA*
  YA-1QCR61TA*/YA-1QCR61YA*
  YA-1QCR81TA*/YA-1QCR81YA*

Controllers other than the above models are not switchable to 220V input as components of such controllers do not support the use at 220V input.

4.5.4 Door handle

CAUTION	The product is delivered in emergency stop state. (Open Installation input) Confirm total safety of robot system and then short-circuit the external emergency stop input after the completion of the installation and start-up of the system.

Normally the door handle is in the ON state during operation. The door handle is used to turn ON/OFF the switch.



Note

- Please allow 3 to 5 minutes of cooling down inside the built-in welding power source after welding operation before turning power off the door handle.
- Allow 3 seconds interval after turning off the door handle and before back ON again.

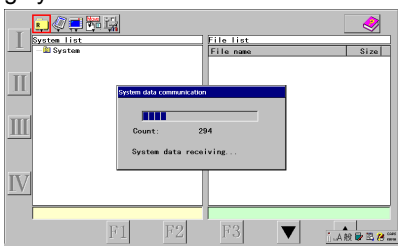
< Operation >

(1) Turn the handle clockwise to turn ON the switch, and counter-clockwise to turn it off.

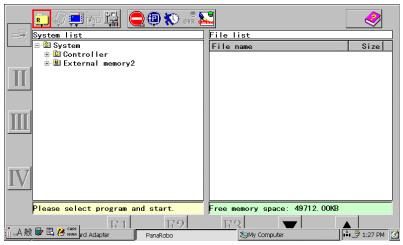
(2) Turn OFF the switch before closing the door.
When the power is turned on, the controller automatically transfers the system data. Soon the controller goes in the ready state.

- To change the settings of the controller, it is necessary to input USER ID. Refer to the operating instructions (Basic operation" and "Advanced operation" for details.

Transferring system data



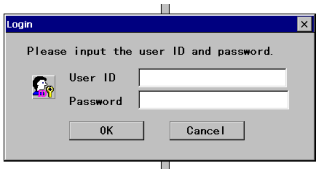
Operable state



Note

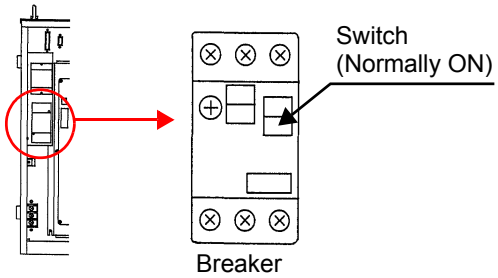
The "USER ID" and "PASSWORD" input box appears if "Dialog display at power ON" of the "USER registration" settings is set to effective.

<Input screen for USER ID>



Note

Keep the breaker switch in the ON position at all-times. Open the front door to access the breaker at bottom of the switch on the left side.



5. Safety I/O specifications

5.1 I/O for safety circuit

Dual circuit is applied to the safety circuit in order to ensure safety.
Use the safety I/O of the safety card on the sequencer card located on the right side panel of the controller.
Please observe the specifications of the safety I/O as follows.

Note For safe operation

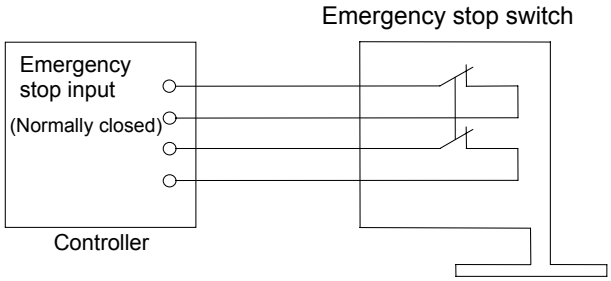
- Apply an independent normally-closed contact and do not connect in parallel.
- Capacity of the safety input contact should be 5 A or more so as to prevent fusion of the contact.

5.1.1 External emergency stop input

(1) An input terminal to turn off the servo power of the manipulator from an external device.
(2) Prepare a switch with two normally closed contacts. Connect one set of contacts between “EXTEMG1+” and “EXTEMG1-”, and the other set between “EXTEMG2+” and “EXTEMG2-” of the external emergency stop input.

Note

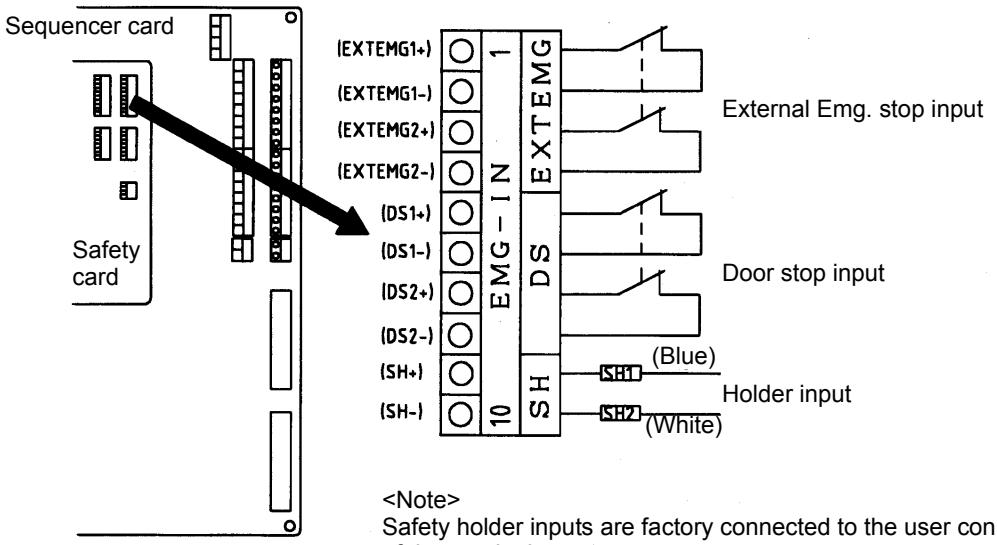
Make sure to wire the emergency stop input cable carefully so as to minimize the resistance value of the emergency stop input cable path.
If the resistance of the path becomes 10 Ω or more due to poor connection or other reasons, an emergency stop alarm may go off for no reason or an alarm may not be able to reset.



5.1.2 Door stop input

An input terminal to input door status (open/closed) of robot safety fence.
Use a switch with two normally closed contacts.

The robot goes into an emergency stop state when the switch is switched to “OPEN” and the door stop input is input.
* Please note that the door stop input does not function in “TEACH” mode.



<Note>
Safety holder inputs are factory connected to the user connector of the manipulator.
* For TA series robots, “SH+” and “SH-” do not have polarity.

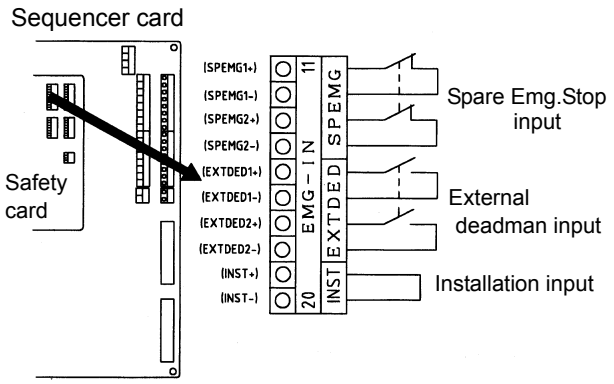
5.1.3 Spare emergency stop input

An emergency stop input terminal provided as the most significant level of safety circuit. Apply it when an emergency stop input from an external device is so connected that the output of which takes first priority over all other emergency stop push-button switches on the teach pendant.
Use one normally closed 2-contact switch.

- Connect one set of contacts between “SPEMG1+” and “SPEMG1-”, and the other set between “SPEMG2+” and “SPEMG2-”.
- If this input terminal is not to be used, short terminals between “SPEMG1+” and “SPEMG1-”, and also “SPEMG2+” and “SPEMG2-” without fail. (They are factory shorted at shipment.)

Note

For the controller of E, R and U specifications, the “Spare emergency stop input” is connected to emergency stop of the operation box, therefore, it is not available for other uses.



5.1.4 External Dead Man’s input

An input terminal used to make the Dead Man’s function effective from an external input.
Servo power is turned ON when both the Dead Man’s switch on the teach pendant and the external Dead Man’s input are ON.
Uses one normally open 2-contact switch.

In case that the external Dead Man’s input is not used, set the terminals in the following state:

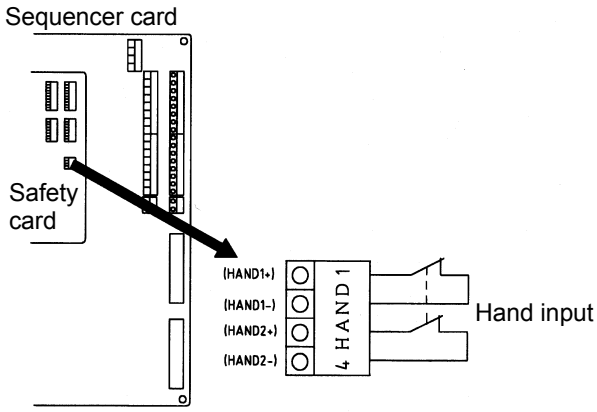
Note

Short the terminals “ENBL1+” and “ENBL1-”, and terminals “ENBL2+” and “ENBL2-”. (They are factory shorted at shipment.)

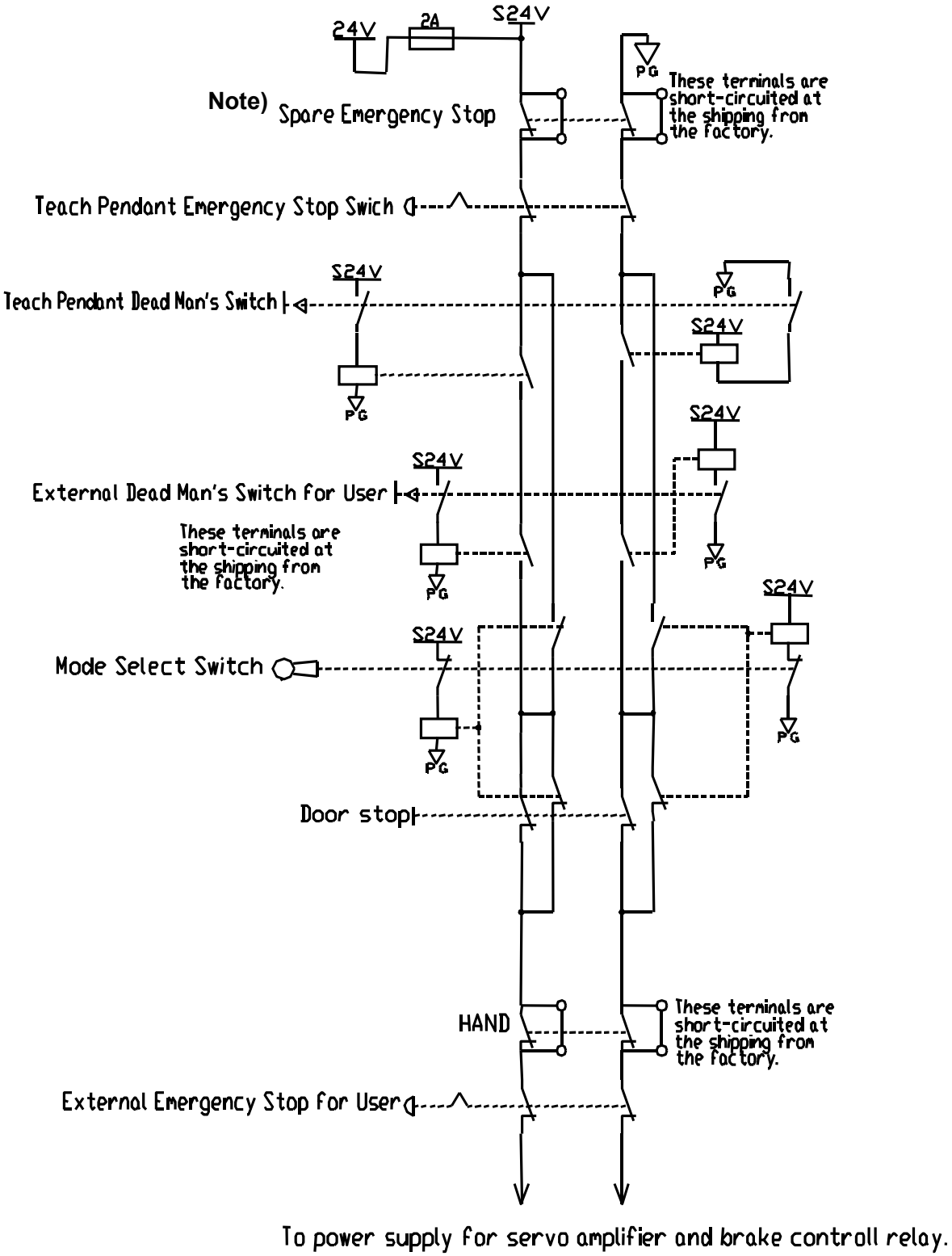
5.1.5 Hand input

An input terminal to be used if input signals from the end effector need to be added to the safety circuit.
Use a pair of normally closed contacts.

- One set of contacts is connected between “HAND1+” and “HAND1-” and another set are connected between “HAND2+” and “HAND2-”.
- When this input is not used, short the terminals between”HAND1+” and “HAND1-”, and between “HAND2+” and “HAND2-2”. (They are factory shorted at shipment.)



5.2 Input of the safety circuit



Note)

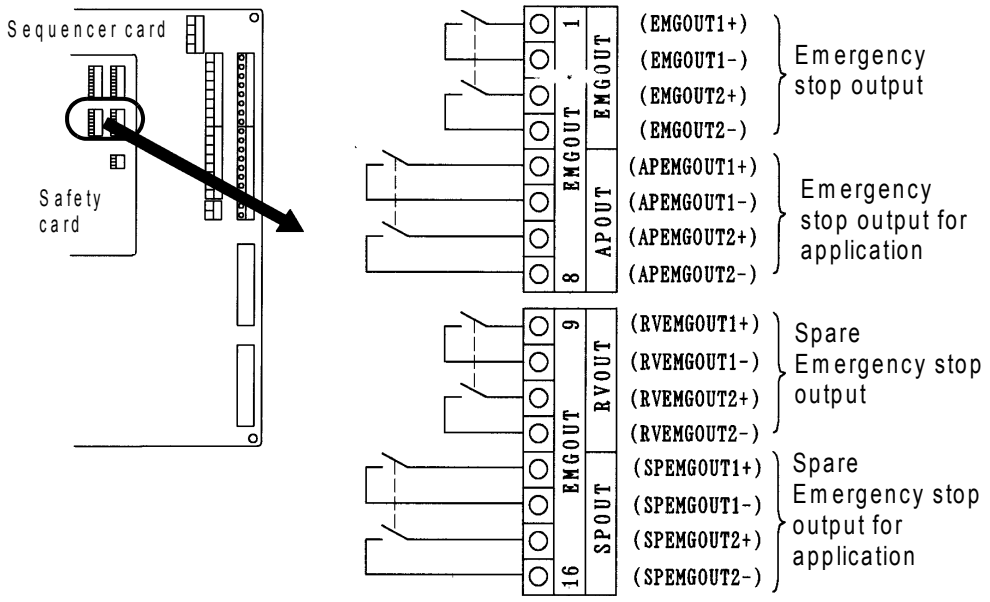
The “Spare Emergency Stop” terminals are used for the Operation box Emergency Stop if it is provided.

5.2.1 Emergency stop output

An output terminal to output the emergency stop state. (No-voltage relay contact output, Contact ratings: 3A, DC30V) Open the terminals in an emergency state.

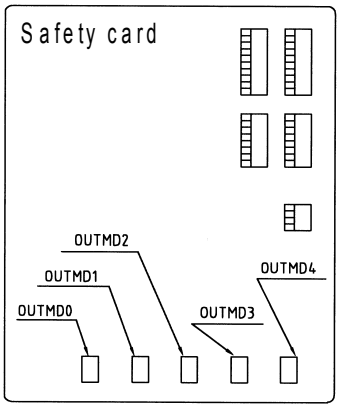
There are four kinds of emergency stop outputs as follows

1. Emergency stop output	How connectors “OUTMD0” to “OUTMD4” of the Safety card are shorted determines its output conditions.
2. Reserve emergency stop output	
3. Application emergency stop output	How connectors “OUTMD0” to “OUTMD4” of the Safety card are shorted does NOT change its output conditions.
4. Spare application emergency stop output	



♦Short connectors and emergency stop

The followings show the relationships between emergency stop input type and emergency stop output when each connector is shorted.



Note

OUTMD1 is factory shorted at shipment.

Emergency stop output / Shorted connector / Emergency stop input type	"Emergency stop output" and "Reserve emergency stop output					"Application emergency stop output and "Spare application emergency stop output"
	OUTMD0	OUTMD1	OUTMD2	OUTMD3	OUTMD4	Not related
Spare emergency stop input (E/R/U models: Emergency stop of the operation box.)	C	A	A	A	A	A
Teach pendant Emergency stop input	C	A	A	A	B	A
Teach pendant Dead Man's switch	C	A	A	B	B	A
External Dead Man's input	C	A	A	B	B	A
Door stop	C	A	A	B	B	A
Hand input	C	A	A	B	B	A
Overrun input	C	A	A	B	B	A
External emergency stop input	C	A	B	B	B	A

A:	The emergency stop output terminal goes open when the emergency stop input is input. The emergency stop output terminal is closed when the emergency stop input is released.
B:	The emergency stop output terminal stays closed regardless of the state of the emergency stop input.
C:	The emergency stop output terminal goes open when the emergency stop input is input. The emergency stop output terminal is closed when the emergency stop input is released and the servo power is turned on.

5.3 Other safety input/output

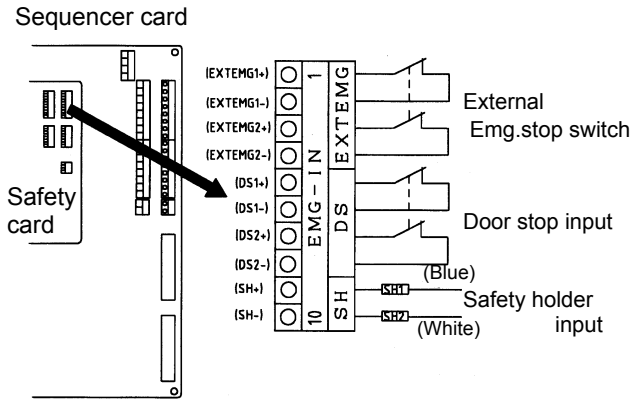
Ensure a safe work environment by using the safety I/O equipped with the safety card.

5.3.1 Safety holder input

Input terminals for safety holder cable, which is not included in the safety circuit. The input is always monitored by software.
They (SH terminals) are factory connected to the safety holder cable as shipment as follows.

Note

For TA series robots, “SH+” and “SH-” do not have polarity.

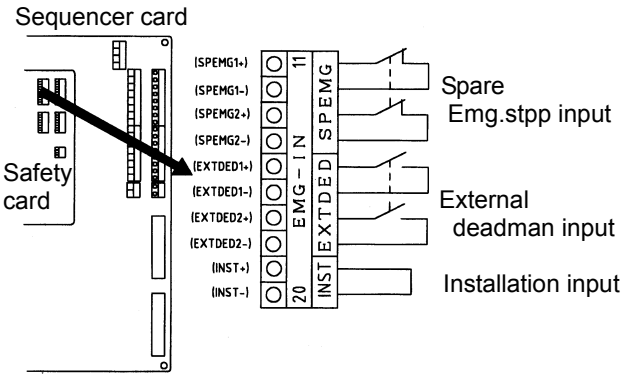


5.3.2 Installation input

Set the input open to indicate the warning message “Now installing. Check wire connections. Short INST.” on the screen of the teach pendant every time the controller is turned ON and mode change (operation mode/teaching mode) is executed so as to warn the operator of the robot system that the safety I/O setting of the robot system has not competed.

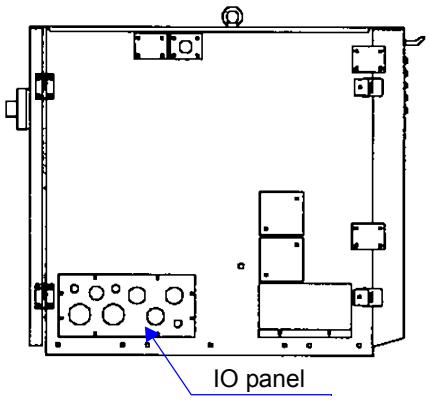
Note

Short this input after the completion of the installation and start-up of the system or in normal operation.



5.4 Connecting to safety I/O

- To connect cables from an external device to the safety I/O circuit, draw the cables into the controller through the wiring ports on the IO panel located at the lower right of the right side panel of the controller (see the figure on the right).
- At the time of drawing a cable through the wire port, make sure to fix the cable with a cord lock or the like so as to prevent dust from getting into the controller.
  (* Remove the hole plug of the wiring port when drawing a cable.)



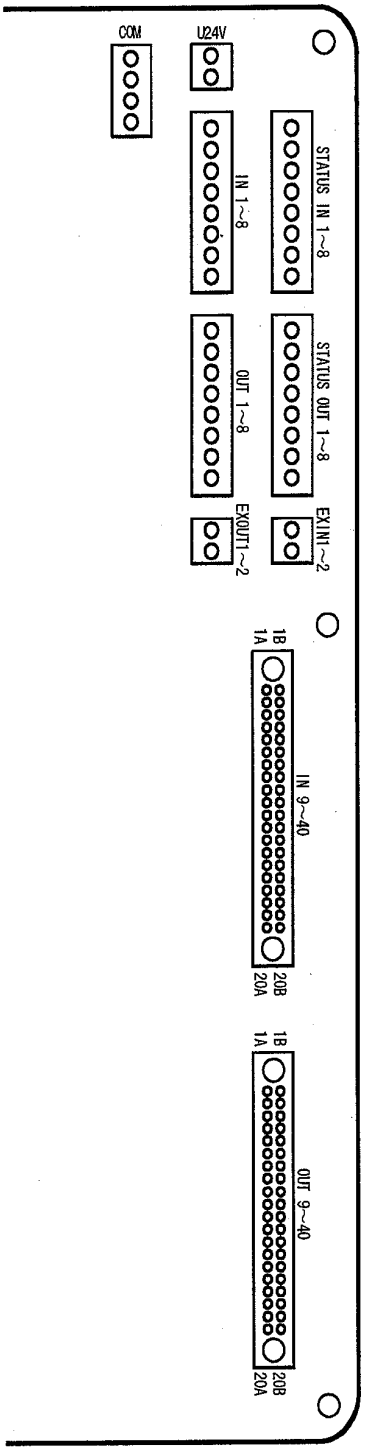
6. External control signal connection

6.1 Terminal location of the sequencer card

Specifications	Circuit board #	Output type
T / Y / R / U	ZUEP5711	Open collector
E	ZUEP5725	Open emitter

Note

- Allocation of User I/O terminals vary with start method.
- Terminals marked with
  *: Connect wires from the operation box
  **: Functions vary with the circuit board (see left table).



IN 1-8		
	1	User-IN001
	2	User-IN002
	3	User-IN003
	4	User-IN004
	5	User-IN005
	6	User-IN006
	7	User-IN007
	8	User-IN008

STATUS IN		
	1	Servo ON
	2	(Not in use)*
	3	Operating mode
	4	Teaching mode
	5	(Not in use)
	6	Error release
	7	Start
	8	Hold

OUT 1-8		
	1	User-OUT001
	2	User-OUT002
	3	User-OUT003
	4	User-OUT004
	5	User-OUT005
	6	User-OUT006
	7	User-OUT007
	8	User-OUT008

STATUS OUT		
	1	Alarm
	2	Error
	3	Operating mode*
	4	Teaching mode
	5	Ready
	6	Servo ON
	7	Running
	8	Hold status

EX OUT 1-2		
	1	(Not in use)
	2	(Not in use)

EXIN 1-2		
	1	(Not in use)
	2	(Not in use)

IN 9-40 (Line A)			
	1**	<T, Y, U, R>	<E>
	2**	(Not in use)	COM
	3	(Not in use)	
	4	(Not in use)	
	5	User-IN009	
	6	User-IN010	
	7	User-IN011	
	8	User-IN012	
	9	User-IN013	
	10	User-IN014	
	11	User-IN015	
	12	User-IN016	
	13	User-IN017	
	14	User-IN018	
	15	User-IN019	
	16	User-IN020	
	17	User-IN021	
	18	User-IN022	
	19	User-IN023	
	20	User-IN024	

IN 9-40 (Line B)			
	1**	< T, Y, U, R>	<E>
	2**	COM	U24V
	3	(Not in use)	
	4	(Not in use)	
	5	User-IN025	
	6	User-IN026	
	7	User-IN027	
	8	User-IN028	
	9	User-IN029	
	10	User-IN030	
	11	User-IN031	
	12	User-IN032	
	13	User-IN033	
	14	User-IN034	
	15	User-IN035	
	16	User-IN036	
	17	User-IN037	
	18	User-IN038	
	19	User-IN039	
	20	User-IN040	

OUT 9-40 (Line A)		
	1	COM
	2	COM
	3	(Not in use)
	4	(Not in use)
	5	User-OUT009
	6	User-OUT010
	7	User-OUT011
	8	User-OUT012
	9	User-OUT013
	10	User-OUT014
	11	User-OUT015
	12	User-OUT016
	13	User-OUT017
	14	User-OUT018
	15	User-OUT019
	16	User-OUT020
	17	User-OUT021
	18	User-OUT022
	19	User-OUT023
	20	User-OUT024

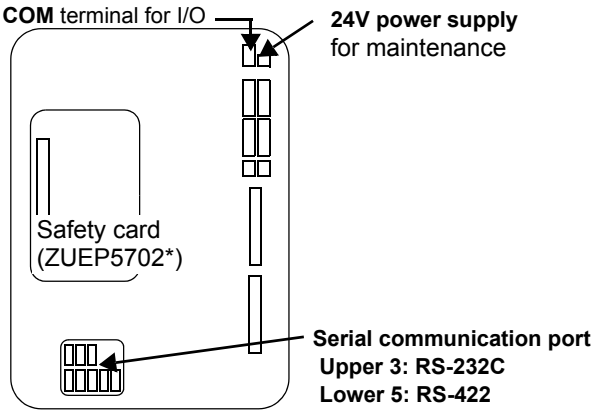
OUT9-40 (Line B)			
	1**	<T, Y, U, R>	<E>
	2**	(Not in use)	U24V
	3	(Not in use)	
	4	(Not in use)	
	5	User-OUT025	
	6	User-OUT026	
	7	User-OUT027	
	8	User-OUT028	
	9	User-OUT029	
	10	User-OUT030	
	11	User-OUT031	
	12	User-OUT032	
	13	User-OUT033	
	14	User-OUT034	
	15	User-OUT035	
	16	User-OUT036	
	17	User-OUT037	
	18	User-OUT038	
	19	User-OUT039	
	20	User-OUT040	

Note

- Allocation of User I/O terminals vary with start method.
- The terminals marked with (*) are to connect wires from the operation box.

- **Sequencer card**

Terminal or connector		Application
COM		Pin 1 is used in case the operation box is in use.
U24V	ZUEP5711	Maintenance use. (T/Y/R/U spec.)
	ZUEP5725	24 VDC input for I/O (E spec.)
RS-232C, RS-422		For option units



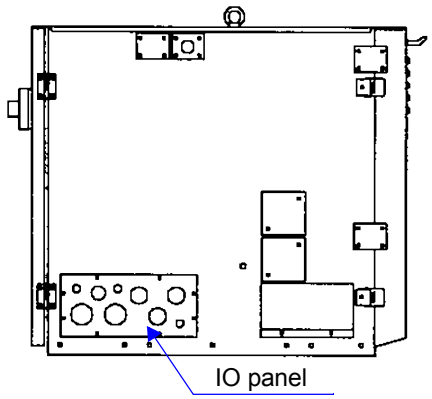
6.2 Connecting and control method of external device

CAUTION	• Apply a radio shield wire as I/O connecting cable between an external device and robot I/O circuit in order to protect the controller from noise. • Connect the shield wire to the TE terminal (⏚) on the right side of the controller. • The TE terminal is provided to prevent noise. • If a system comprises a machine which generates high frequency (such as TIG, plasma), the robot I/O circuit may be damaged by the high frequency noise. Be sure to design so that any external input to the system should use a no-voltage contact signal and any output to an external device should be converted into relay contact output.

It is applicable by teaching sequence commands editing user inputs/outputs which are provided on the sequencer card.

6.2.1 Connecting to an external device

- To connect cables from an external device to the robot I/O circuit, draw the cables into the controller through the wiring ports on the IO panel located at the lower right of the right side panel of the controller (see the figure on the right).
- At the time of drawing a cable through the wire port, make sure to fix the cable with a cord lock or the like so as to prevent dust from getting into the controller.
  (* Remove the hole plug of the wiring port when drawing a cable.)

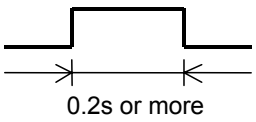


6.2.2 I/O terminal equivalent circuit

<table>
<tr><td>Spec.</td><td colspan="2"></td></tr>
<tr><td>T
Y
R
U</td><td>

● **Input terminal equivalent circuit**

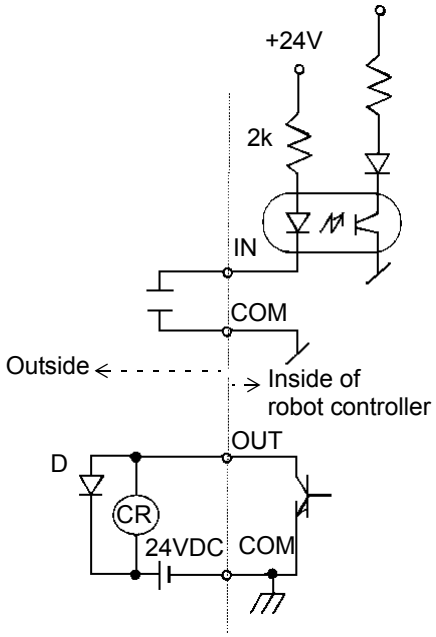
• To receive no-voltage ON/OFF contact signal from an external equipment.
• External relay contact to be connected... 1 ohm or less, Chattering .....10 ms or less
• Pulse amplitude of an input signal should be 0.2s or more.



● **Output terminal equivalent circuit**

• Open collector output.
• Rated output is 24 VDC, 75 mA.
• Use a relay whose coil voltage is 24 VDC and coil current is 75 mA DC or less, and attach a noise adsorbing diode: D (100 V, 1 A).
• Capacity of the emergency stop output contact: 3A, 30 VDC.

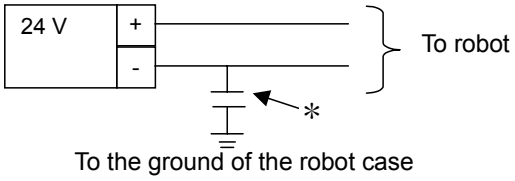
</td><td>



</td></tr>
<tr><td>E</td><td>

● **Power to activate input/output**

• It is necessary to apply 24 VDC of supply voltage between 24 V input and COM. Turn ON/OFF the power synchronous to the control power of the robot controller.
• The power to be provided by customer:
  • Voltage: 24 VDC +10%/-0%
  • Capacity: 75 W or more
• Make sure that noiseless power is applied.
It is recommended to use a capacitor to remove especially the common-mode noise (see below figure). Recommended capacitor: Film capacitor 0.1μF, 50 V.



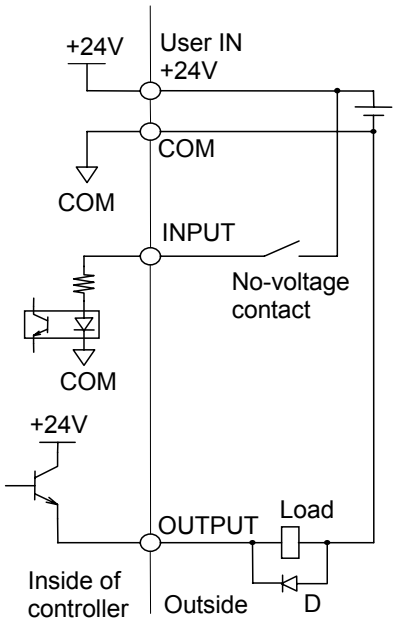
● **Input terminal equivalent circuit:**

• To receive no-voltage ON/OFF contact signal from an external equipment.
• External relay contact to be connected 1 ohm or less
• Chattering 10 ms or less
• Pulse amplitude of an input signal should be 0.2s or more.

● **Output terminal equivalent circuit**

• Open emitter output.
• Rated output is 24 VDC, 75 mA
• Use a relay whose coil voltage is 24 VDC and coil current is 75 mA DC or less, and attach a noise adsorbing diode: D (100 V, 1 A).
• Capacity of the emergency stop output contact: 3A, 30 VDC.

</td><td>



</td></tr>
</table>

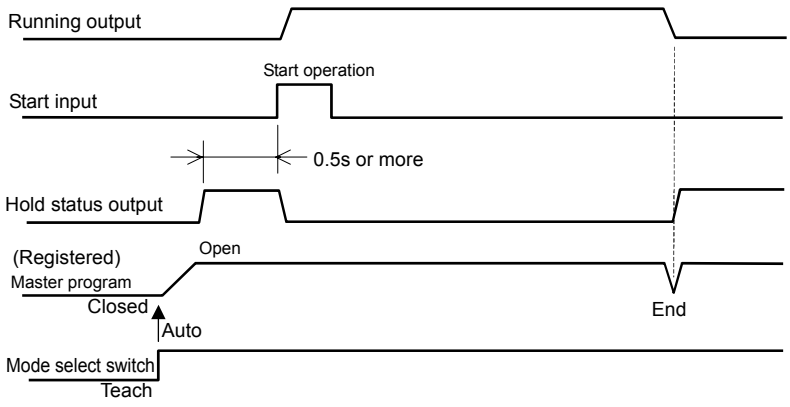
6.3 Auto start settings

To set the start method, the terminal to which the external signal to start robot operation is transferred to needs to be allocated to the user I/O terminal.
There are two types of start methods; 'Manual' and 'Auto'. And in Auto-start method, there are two different select methods; 'Program select method' and 'Master method'. With Auto start method, it is not possible to start the robot by pressing the Start button on the teach pendant.

Start method	Select method	Description
Manual		Use the Start button on the teach pendant to operate a program. **<Note>** Please refer to the operating instructions (basic operation).
Auto		Use an external signal input to operate a program.
	Master	To start the specified program when the start signal is received from an external device.
	Program select	To start the program whose program number is equal to the total of the user input terminal Nos. you specified.

6.3.1 Master method

- It starts the program registered as a master program automatically.
- Place the mode select switch in "Auto" position, then the master program you specified will be ready to start automatically.



- The input signal must be kept ON for 0.2 seconds or more.
- 'Start input' may not be received if it is input in less than 0.5 seconds after the Hold output is ON.
- The transition time to AUTO mode with the MODE switch depends on the condition of TEACH mode, and opening time of the master program depends on the program size.
- After the completion of the master program, it is ready to start the master program from the beginning automatically.
- This master method is good for complex start conditions (interlock etc.) as you can edit start conditions within the master program using the teach pendant, such as interlocking method or criteria of the start conditions.
- Starting and interlocking conditions of each individual program can be programmed in the master program and edited with the teach pendant.
- After hold state, it is possible to call the master program by turning on "Re-open" input or "Top of file open" input.

6.3.2 Program select

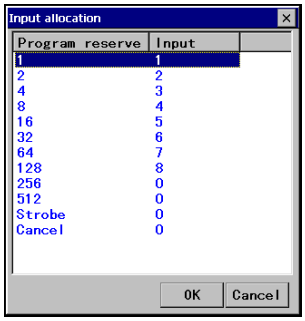
Number type	Description
Signal	It is possible to start programs whose program numbers are 1, 2, 4, 8, 16, 32,64, 128,256 and 512.
Binary	To start the program whose program number is equal to the sum of the numbers you specified. It is possible to start programs of program numbers from 1 to 999.
BCD	A set of four terminals is used to specify each digit of the program number you want to start. It is possible to start programs of program numbers from 1 to 399.

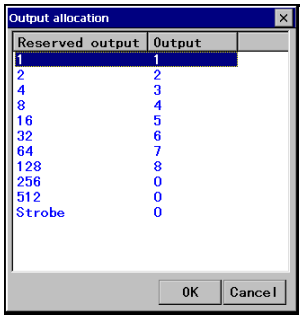
<Program name>
Program name is indicated “**ProgXXXX.prg**” where **XXXX** is the program number. The result of the specified calculation is applied.
(Example: If the result is 16, then the program name is “Prog0016.prg”.)

6.3.3 Start method and I/O allocation

(1) On the Set menu, click Controller and Start condition to display the setting dialog box.
(2) Specify the start method you want and then allocate user I/O terminals to be used to specify the program number and to start a program.

<Input allocation box><Output allocation Box>





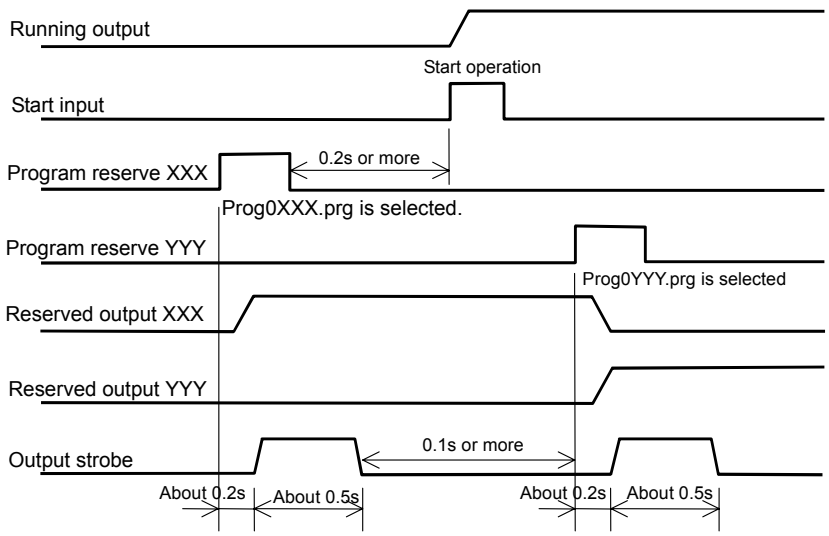
6.3.4 Program select method (common specifications)

(1) If a program is reserved while running another program, the reserved program will be started automatically after the completion of the current program.
(2) If the result exceeds the set range (from 1 to 999), then the program reservation is disregarded.
(3) It is possible to reserve up to 16 programs. (Programs on and after 17th program will be disregarded.)
(4) The programs already reserved and the running program are not acceptable to reserve.
(5) When the program select is disregarded, no select response will be output.
(6) Input 'Cancel' clears all selected programs except currently running program.
(7) To check program select status, click on **Display change** (**View** menu) and then click **Operate state**.
(8) It is possible to clear all selected programs during operation (except in override) by switching the mode select switch to the 'TEACH' position.

6.3.5 Signal method

When the start input is turned ON, the same numbered program is selected and executed.

With this method, you can only program numbers 1, 2, 4, 8,16, 32, 64, 128, 256 and 512.

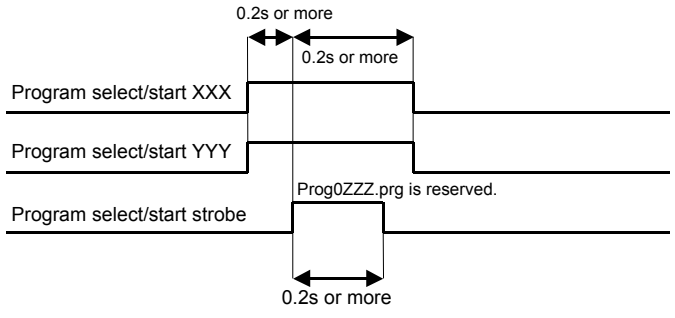


- "XXX" and "YYY" indicate 'program reserve' numbers you specified (001, 002, 004, 008, 016, 032, 064, 128, 256 or 512).
- The input signal must be kept ON for 0.2 seconds or more.
- 'Start input' may not be received if it is input in less than 0.2 seconds after the previous input is received.
- It requires at least 0.1 second after the 'output strobe' signal is turned OFF to reserve the next program select input.
- After the completion of the current program, the robot automatically starts the next reserved program if any.

6.3.6 Program select and Start Strobe

Binary and BCD methods use Program select and start strobe signal.

Program select and start signals and program select and start strobe signal are required to meet following conditions.



- Program select and start signals should be retained for 0.2 seconds or more before accepting ON signal of Program select and start strobe signal.
- Program select and start strobe signal should be retained for 0.2 seconds or more.

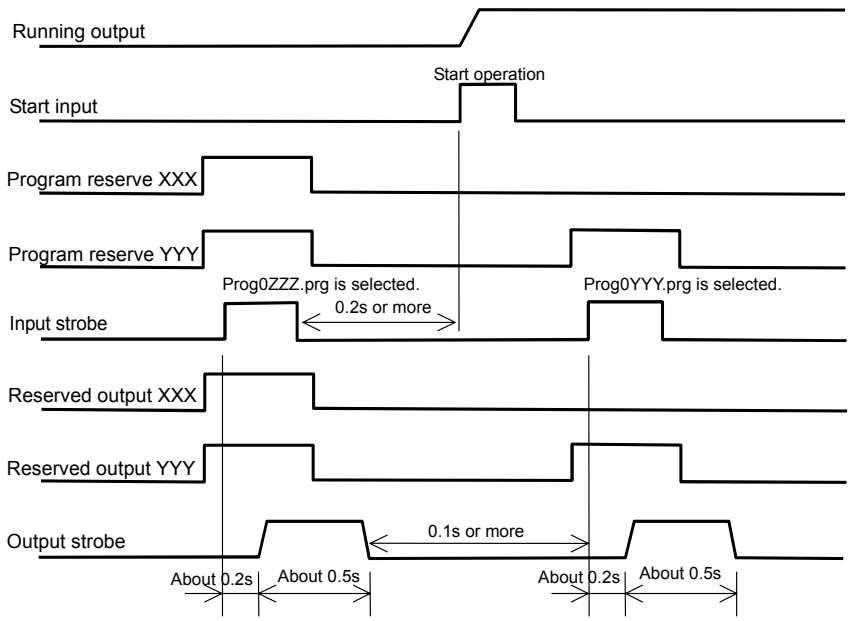
6.3.7 Binary method

It calculates the sum of 'Program reserve input' numbers having been in ON state when the 'Input strobe' is turned ON, and then reserves the corresponding program.

Example:

Program reserve input										Sum	Program name
512	256	128	64	32	16	8	4	2	1		
O	O	O	O	O			O	O	O	999	Prog0999.prg
O				O			O	O		550	Prog0550.prg
				O	O			O		50	Prog0050.prg
					O				O	17	Prog0017.prg
									O	1	Prog0001.prg

O…Input is ON, (Blank)…Input is OFF



- “XXX” and “YYY” indicate ‘program reserve’ numbers you specified (001, 002, 004, 008, 016, 032, 064, 128, 256 or 512).
- “ZZZ” is the sum of “XXX” and “YYY”. The above example is of 2 ‘program reserve’ inputs which are turned ON, however, ON/OFF status of all ‘program reserve’ inputs (001,002,004,008,016,032,064,128, 256 and 512) are checked for calculation.
- The input signal must be kept ON for 0.2 seconds or more.
- ‘Start input’ may not be received if it is input in less than 0.2 seconds after the previous input is received.
- It requires at least 0.1 second after the ‘Output strobe’ signal is turned OFF to reserve the next ‘program reserve’ input.
- After the completion of the current program, the robot automatically starts the next reserved program if any.

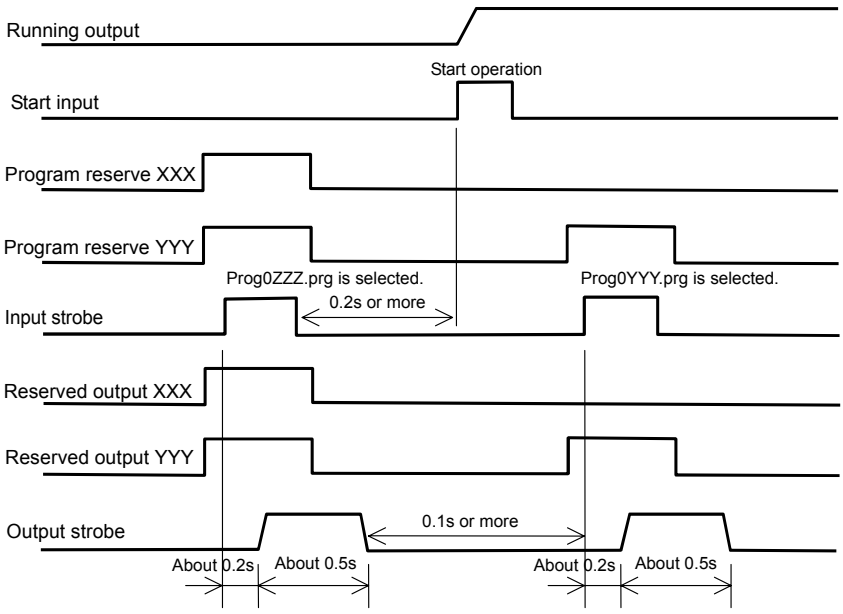
6.3.8 BCD method

- BCD is the abbreviation for binary-coded decimal code.
- It specifies each digit of a number as a binary number using program reserve inputs 1, 2, 4 and 8 for the 1st digit, 16, 32, 64 and 128 for the 2nd digit and 256 and 512 for the 3rd digit.
- It calculates the sum of 'Program reserve input' numbers having been in ON state when the 'Input strobe' is turned ON, and then reserves the corresponding program.
- You can use the rotary switch of BCD specification sold at a store for easy operation.

Example:

Program reserve input										Sum	Program name
512	256	128	64	32	16	8	4	2	1		
3rd digit		2nd digit				1st digit					
200	100	80	40	20	10	8	4	2	1		
O	O	O			O	O			O	399	Prog0399.prg
O				O			O	O		226	Prog0226.prg
				O	O			O		32	Prog0032.prg
					O				O	11	Prog0011.prg
									O	1	Prog0001.prg

O…Input is ON, (Blank)…Input is OFF

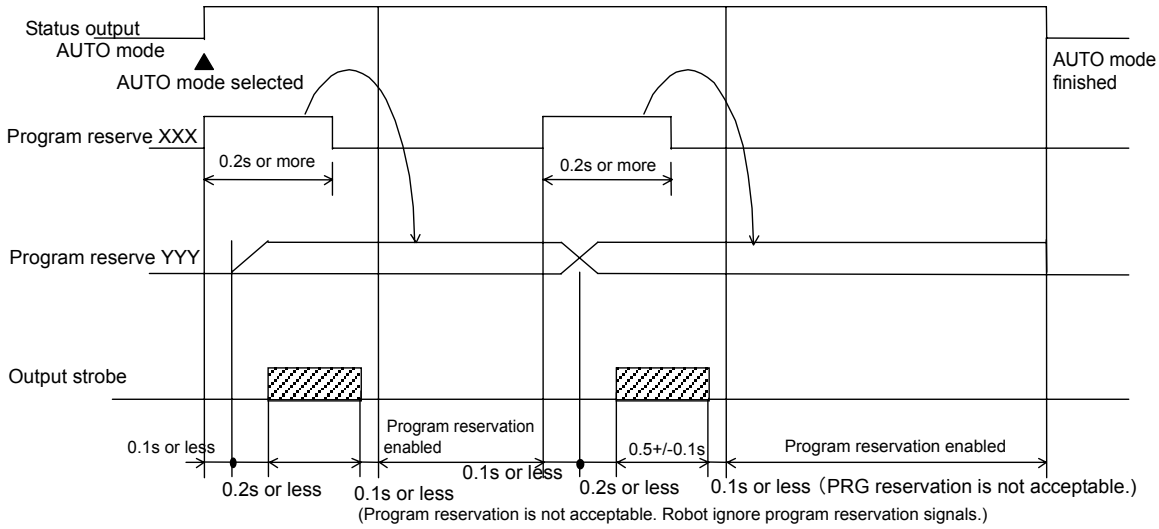


- "XXX" and "YYY" indicate 'program reserve' numbers you specified (001, 002, 004, 008, 016, 032, 064, 128, 256 or 512).
- "ZZZ" is the sum of "XXX" and "YYY". The above example is of 2 'program reserve' inputs which are turned ON, however, ON/OFF status of all 'program reserve' inputs (001, 002, 004, 008, 016, 032, 064, 128, 256 and 512) are checked for calculation.
- The input signal must be kept ON for 0.2 seconds or more.
- 'Start input' may not be received if it is input in less than 0.2 seconds after the previous input is received.
- It requires at least 0.1 second after the 'Output strobe' signal is turned OFF to reserve the next 'program reserve' input.
- After the completion of the current program, the robot automatically starts the next reserved program if any.

6.4 Timing of program selection response

6.4.1 Program reservation in Signal method

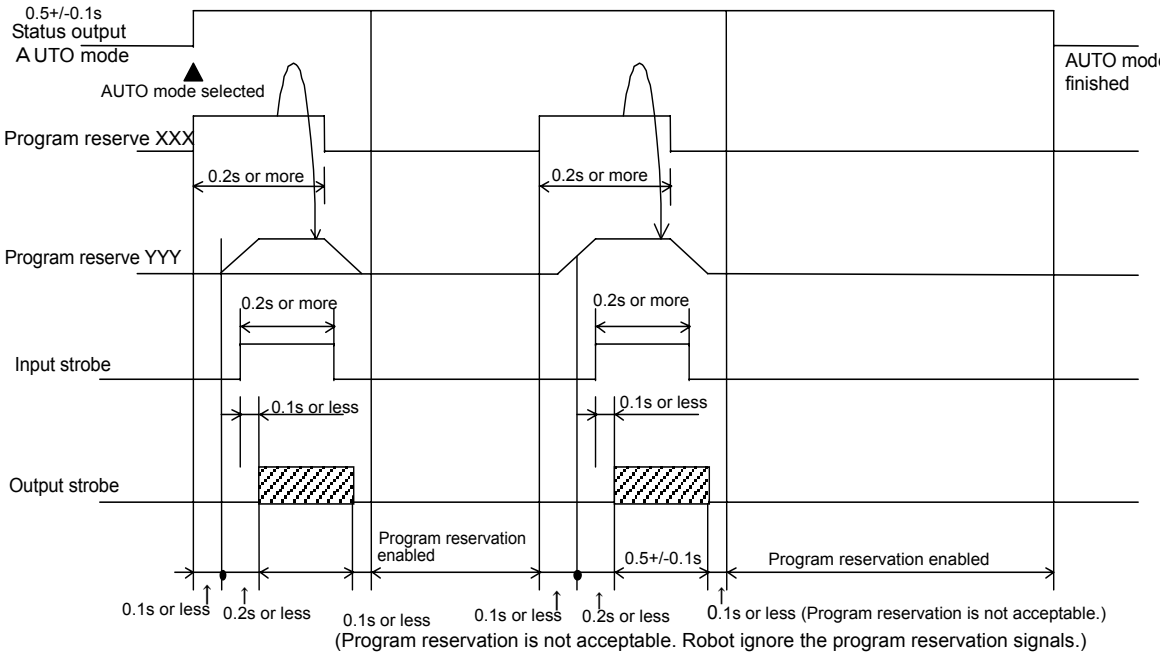
Reserved program in AUTO mode answers the program number to the outputs.



- "XXX" and "YYY" indicate 'program reserve' numbers you specified (001, 002, 004, 008, 016, 032, 064, 128, 256 or 512).
- The 'Reserved output' is effective only in AUTO mode. It is not available in manual start operation.

6.4.2 Program reservation in Binary and BCD methods

Reserved program in AUTO mode answers the program number to the outputs.



- "XXX" and "YYY" indicate 'program reserve' numbers you specified (001, 002, 004, 008, 016, 032, 064, 128, 256 or 512).
- The 'Reserved output' is effective only in AUTO mode. It is not available in manual start operation.

6.5 Status IN/OUT

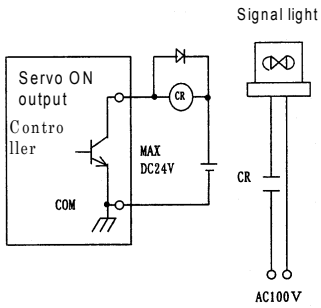
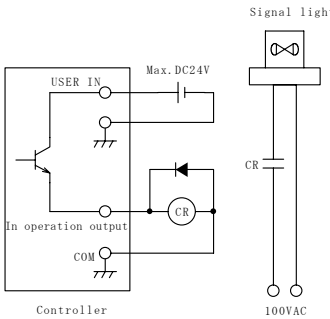
Dedicated input/output terminals to send signals when the robot is in specified state or to change robot status according to the signal received.

6.5.1 Status INPUT

- Dedicated input terminals

Status INPUT	Description
External servo ON input	Turn ON to enable servo power ON if the following conditions are all satisfied. Condition 1: Status output signal 'Ready' output signal is ON. Condition 2: Mode select switch is set to operation mode ('AUTO' position) and not in Mode error state. Condition 3: Mode select is set to auto-operation (in operation mode) Condition 4: Mode select switch is not switched to 'TEACH' position due to override in operation. Condition 5: The 'Emergency stop' input is not ON. The input signal must satisfy the following conditions. The input signal must be ON in 0.2 seconds after the 'Ready' output signal goes ON. The input signal must be kept ON for 0.2 seconds or more.
Error release input	When the robot is in an error state and the error dialog box is displayed, turn ON this input to close the dialog box. At that time, the error output goes off if it is in ON state. Input signal is effective when the signal state is switched and kept for 0.2 seconds or more.
Start input	Turn ON this input signal to run a program. In a hold state, turn on to restart. The input signal is ignored under the following conditions. • The servo power is OFF. • Auto-operation is not set. • In error condition. • Stop input is ON. • In override state.
Stop input	• Turn ON this input signal to bring the operating robot into a hold state. • While the signal is ON, re-start, manual operation and trace operation are not operable. • The robot remains in a hold state even if this signal is turned OFF. • To restart operation, turn ON the start input signal.
Operating mode input	• It is to switch the mode from teaching mode to operation mode. • Use this input when the robot is in teaching mode and operation mode is desired. • When the input signal is turned ON, a message to switch the mode select switch to operation mode appears. • Switch the mode select switch to 'AUTO' or turn OFF the operating mode input to close the message box. Please be advised that while the message box is displayed, the robot is in the error state.
Teaching mode input	• It is to switch the mode from operation mode to teaching mode. • Use this input when the robot is in operation mode and teaching mode is desired. • When the input signal is turned ON, a message to switch the mode select switch to teaching mode appears. • Switch the mode select switch to 'TEACH' or turn OFF the teaching mode input to close the message box. Please be advised that while the message box is displayed, the robot is in the error state.

6.5.2 Status OUTPUT

Status OUTPUT	Description
Alarm output	• The signal is output when the robot goes into an alarm condition. (At that time servo power is turned OFF) • Unless power is turned OFF, the output signal remains in ON state.
Error output	• The signal is output while the robot is in an error condition. • The signal is turned OFF when the error is released.
Operating mode output	• The signal is output in operation mode (including override.) • While the message box to switch to teaching mode is displayed (by turning on the 'Teaching mode' input), if the operation mode is selected, this signal remains ON. **Note** In case of using an operation box, allocate this "Operating mode" output to a user output and use it to connect to the operation box.
Teaching mode output	• The signal is output in teaching mode (excluding override.) • While the message box to switch to operation mode is displayed (by turning on the 'Operating mode' input), if the teaching mode is selected, this signal remains ON.
Ready output	• The signal is output when the robot is ready to receive a status input signal. • It goes OFF when the robot is in an alarm condition or when the 'Emergency stop' input is ON.
Servo ON output	• The signal is output when the servo power is ON. <Examples of installing a signal light> **T / Y / R / U spec.** Connection to the Open collector circuit  **E spec.** Connection to the Open emitter circuit 
Running output	• The signal is output while running a program (including override.) • It is turned OFF when the robot goes in hold or emergency stop state, and turned ON again when the robot is re-started.
Hold status output	• The signal is output when the running program is stopped in operation mode. • The signal is output while the robot is in a hold state due to an error or emergency stop input, and is turned OFF when re-started. • The signal is turned OFF when the mode select switch is placed in 'TEACH' position. When the mode select switch is placed in operation mode and the robot is ready to restart after turning on servo power, the signal is turned ON.

6.5.3 Status I/O to be allocated to user terminals

Status output	Description
Emergency stop Output	• The signal is output when the emergency stop is ON. It is turned OFF when the emergency stop goes OFF. If the emergency stop select connector is set to OUTMD0, the signal is turned OFF after the servo power is turned ON. **Note:** In teaching mode, if the Deadman switch is OFF, the 'Emergency stop' output of the safety card and the 'Emergency stop' output of the status output do not correspond to each other. In such case, the 'Emergency stop' output of the safety card goes open, and the 'Emergency stop' output of the status output goes OFF. In either operation mode or teaching mode, those output signals correspond if the Deadman switch is in ON state.
Pre-set complete Output	The signal is output to indicate completion of preset procedure after the initial servo ON when the main power (200 V) is turned ON. (The preset is executed only after the initial servo power ON.) **Note:** The setting is applied the next time you turn ON the power.
Weld off	It brings the robot in the weld off state when the specified input is received, and then outputs the signal. It is turned OFF when the weld off is reset. **Note:** While the weld off input is ON, it is not possible to reset the weld off state using the teach pendant. The weld off input state has priority over the resume function. The output goes ON when the teach pendant is used to set to the weld off state.
Individual error output	It outputs the signal when the specified error occurs. It is turned OFF when the error release input is input or when the error dialog box is closed.
Start mode output	It closes the running program file when the input is received. **Note:** It accepts the input while the operation is in hold or emergency stop state. It accepts the input when the start method is set to "AUTO".
Program reset input	It outputs the signal when the mode select switch is switched to AUTO mode in manual start method. It is turned OFF when the robot goes in Teach mode. (The signal remains ON during override operation.)
Output reset input	It is an input to reset all target output terminals to their initial power on state. The target output terminals are user outputs, program reserve outputs and output strobes. • The input is accepted when no file is open in AUTO mode except when a file is open in offline edit mode. (for Teach mode) • The input accepts the OFF to ON change. • The input is ignored when the override is ON.
Home return output	It outputs the signal when the robot reaches the home position while GOHOME command is ON. The signal goes OFF when the robot moves out of the home position. If the output is ON, the output remains ON even if the robot goes in the emergency stop state. If the robot or an external axis that is a part of mechanism of the program "GOHOME" command is executed moves out of the home position while the output is in ON state, the output is turned OFF. This "Home return Output" has priority over the "I/O lock", that is, when this output is set valid, the output is turned ON although I/O lock is set effective in the "Limitation of operation". In case that the "Robot lock" is set effective in the "Limitation of operation", the GOHOME command is executed and then the home return output goes ON when the robot reaches its home position in internal processing if the output is set valid.

Status output	Description
OPR Hold output	It outputs when the robot goes in a hold state (including error stop) while running a program. It is different from “Hold status output” as this output does not turn on at File open. See Foot note. The “OPR Hold output” is turned OFF if the file is closed in the hold state. The “OPR Hold output” is turned OFF if the mode select switch is switched to Teach mode in the hold state. If the mode select switch is switched to Teach and then back to Auto mode, the “OPR Hold output” remains OFF state when - the program in the hold state is closed (including re-opening of the program.) - the cursor is not located on the program in the hold state.
External re-start input	It is an input that limits the re-start input after the robot goes in the hold state effective only from a specified external re-start input. When this “Ext. re-start input” is set effective, the “Start input” of the Status input cannot be used at re-start. This setting is effective only in Auto start. The setting is ignored in manual start. Re-start won’t be executed when the “Stop input” is ON. Re-start won’t be executed during override in TEACH mode. Re-start won’t be executed if the file in hold state is closed. If a parallel processing program exists, a reserved program may be re-started by this input. (See the following figure for details.)

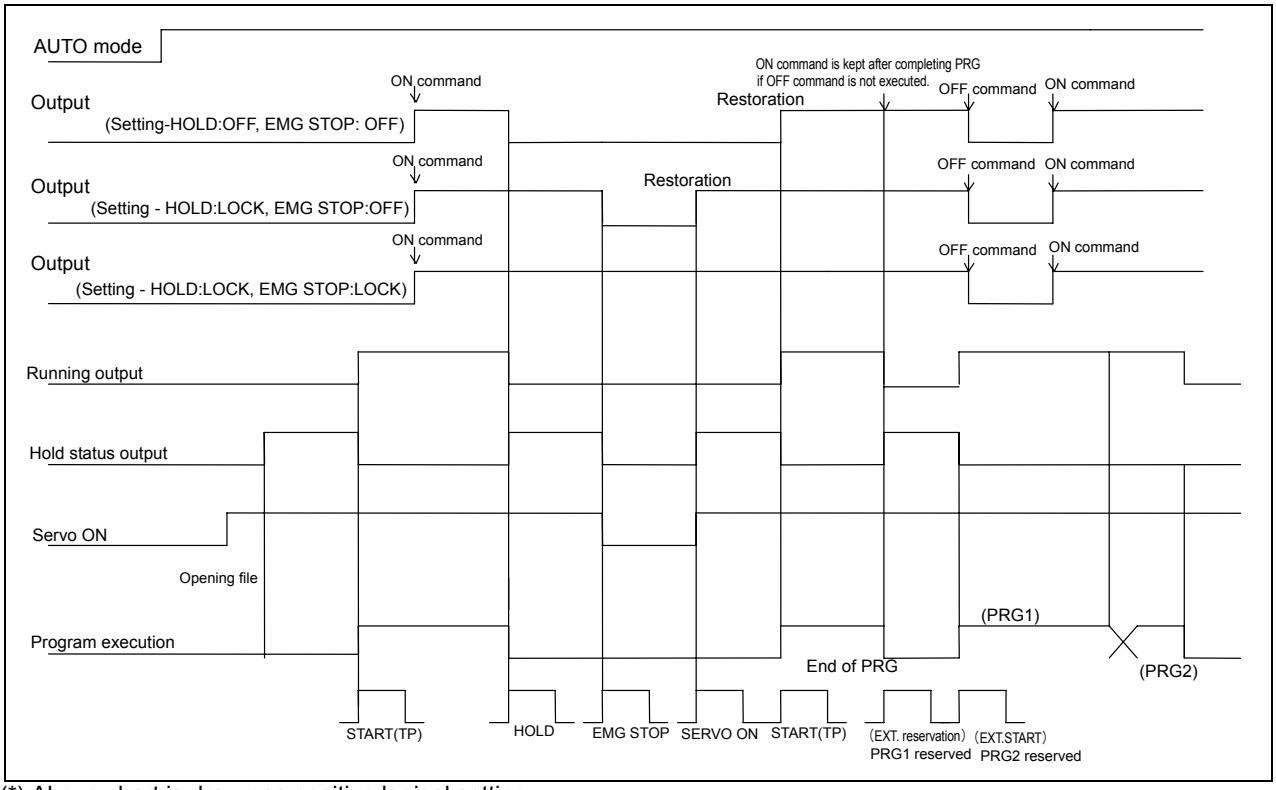
<Foot Note>

Difference between “OPR Hold output and “Hold status output”

	Auto mode All files closed	File open	In operation	In hold (error stop)	After re-started	End of operation
OPR Hold output	OFF	OFF	OFF	ON	OFF	OFF
Hold status output	OFF	ON	OFF	ON	OFF	OFF

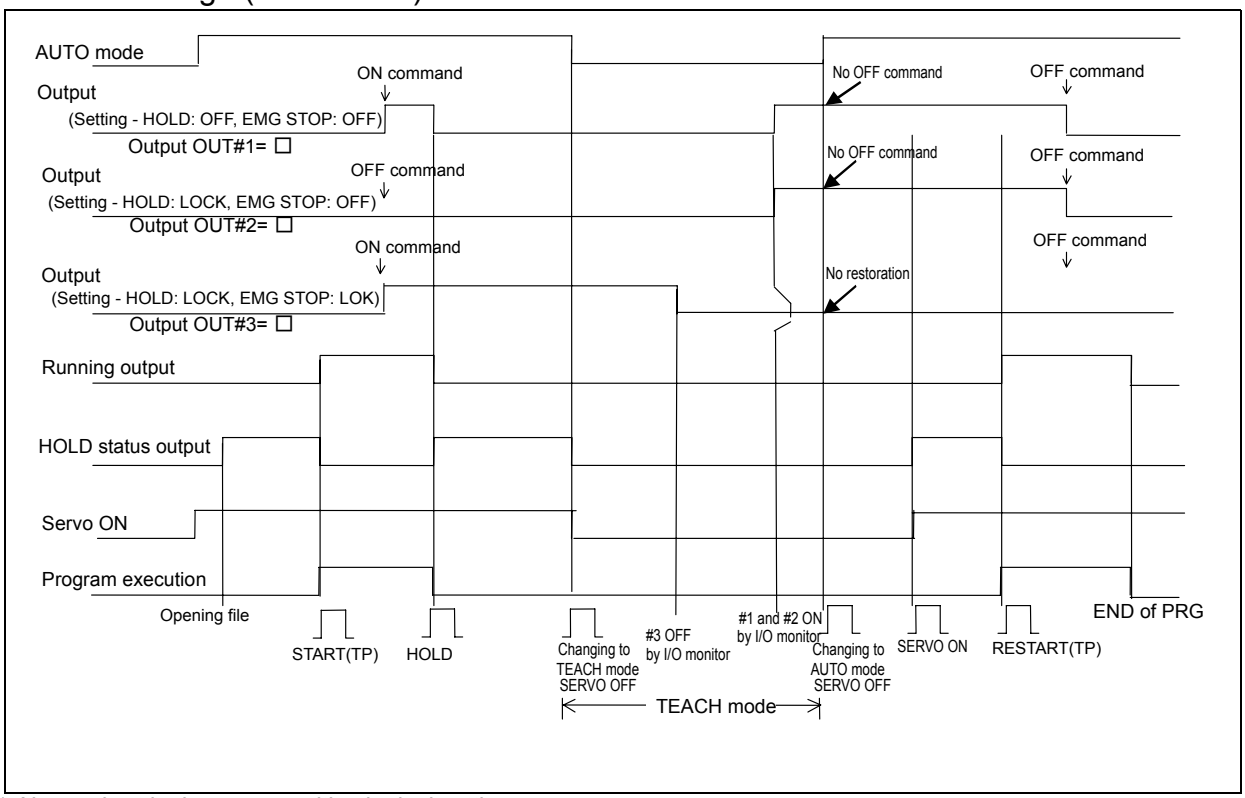
6.6 Flowchart of Status Outputs

6.6.1 Operating and Holding output



* (*) Above chart is drawn as positive logical setting.

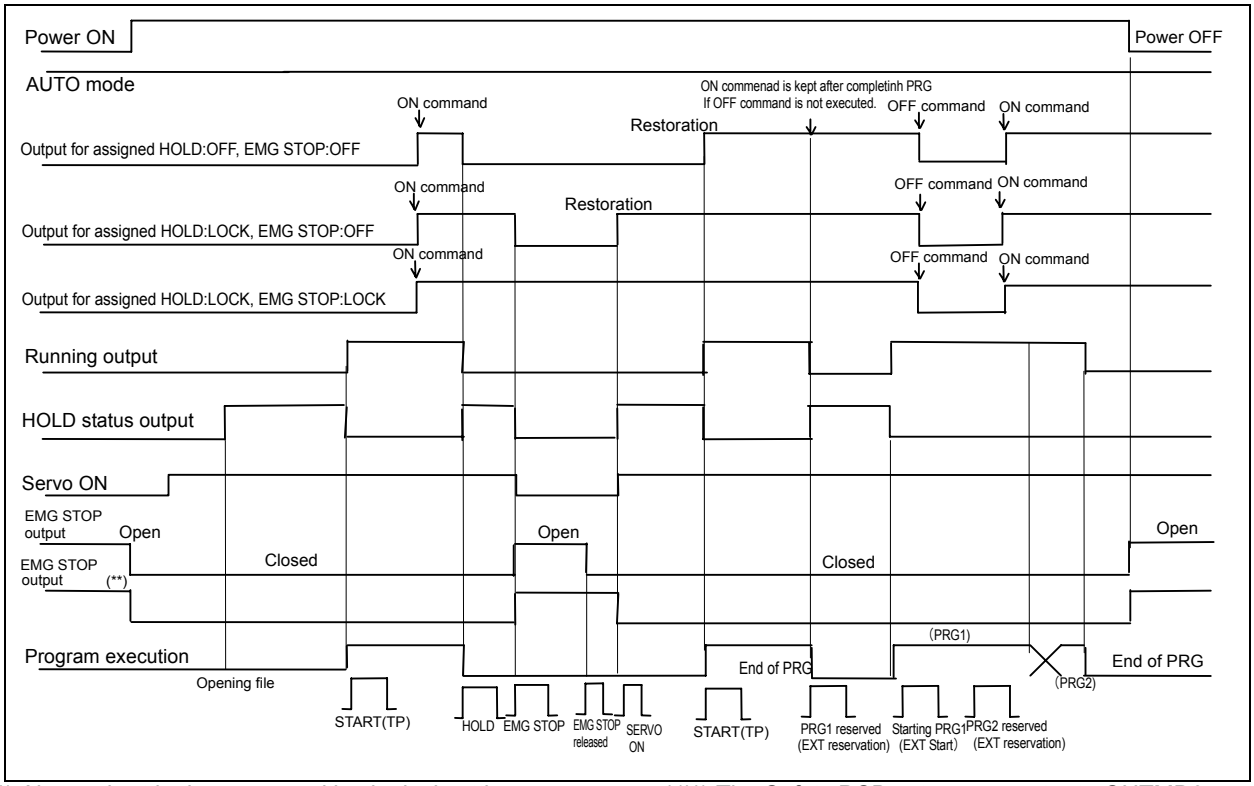
6.6.2 Mode change (I/O monitor)



* (*) Above chart is drawn as positive logical setting.

6.6.3 Emergency stop 1

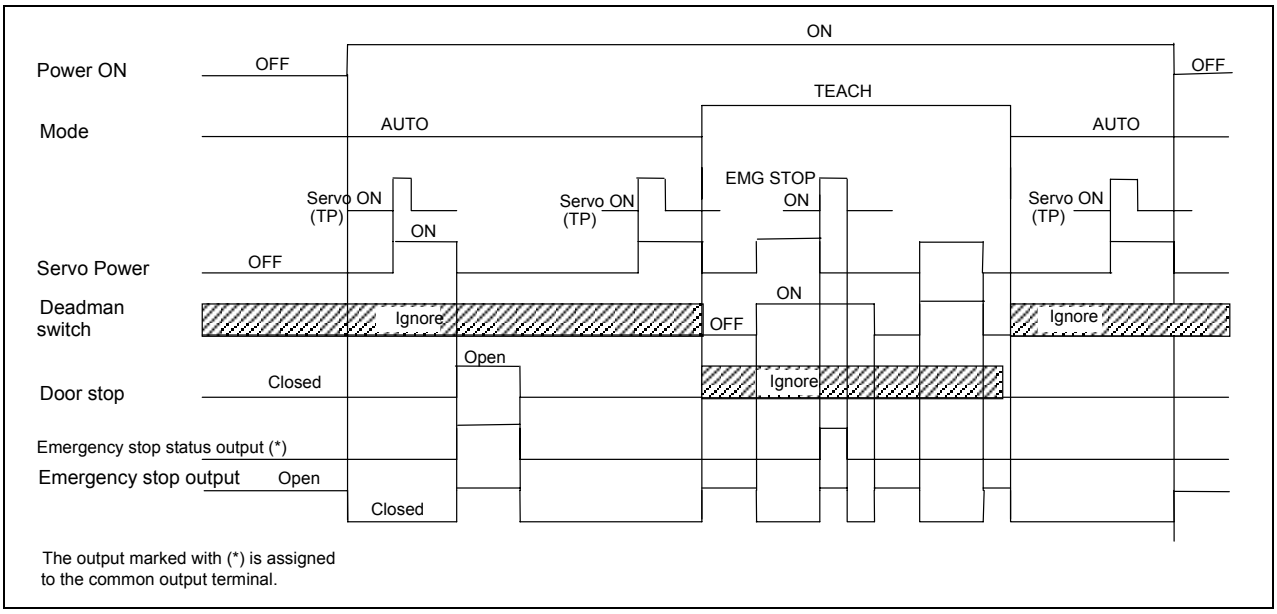
The following chart shows output terminal status to the emergency stop operation when the safety PCB connector is set.



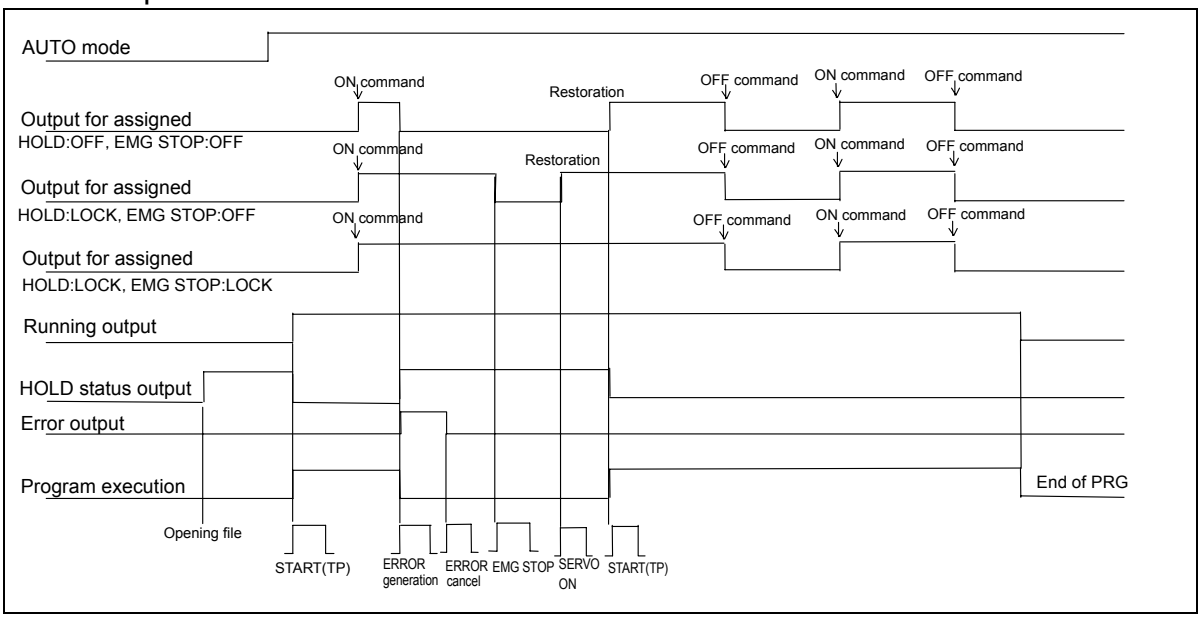
* (*) Above chart is drawn as positive logical setting. *(**) The Safety PCB sets a connector to OUTMD0.

6.6.4 Emergency stop 2

Operation of the emergency stop output and Emergency stop status output vary with mode setting.



6.6.5 Error output



6.7 Connecting to the sequencer card

- Terminal part
  - Since connector terminals are employed, they can be removed from the board.
  - Peel off lead wire cover from **about 7 mm** from the end and wire it to the terminal with precision negative (-) driver.
  - Overall diameter of lead wire(s) to be connected to terminals should be **1.5 mm^2 (AWG16) or less**.

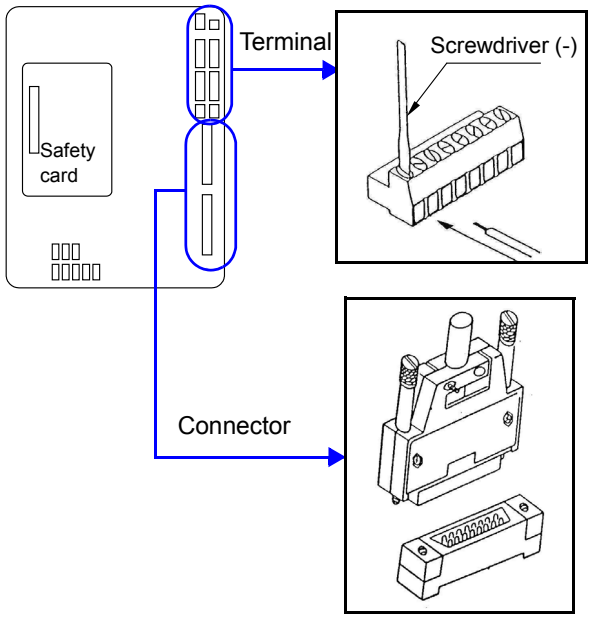
- Connector part

  Soldering type connector is equipped.

Applicable connectors

Connection method	INPUT, OUTPUT
Soldering (Provided)	FCN361J040AU (connector) FNC360C040B (cover)
Clamping *	FCN363J040 (housing) FCN363J-AU (contact) FCN360C040B (cover)
Pressure welding *	FCN367J040-AU/F

Sequencer card



Note

If clamping or pressure welding type is applied, special tools need to be prepared.

6.8 External interface of Teach Pendant

- PC Card slot

The Teach pendant provides 2 PC Card slot complied with type 2 of PCMCIA specifications. The slots are in the side panel of the Teach Pendant and protected with a cover.
By connecting a memory card and a memory card adaptor (customer's preparation), it is used as the interface for external memory.

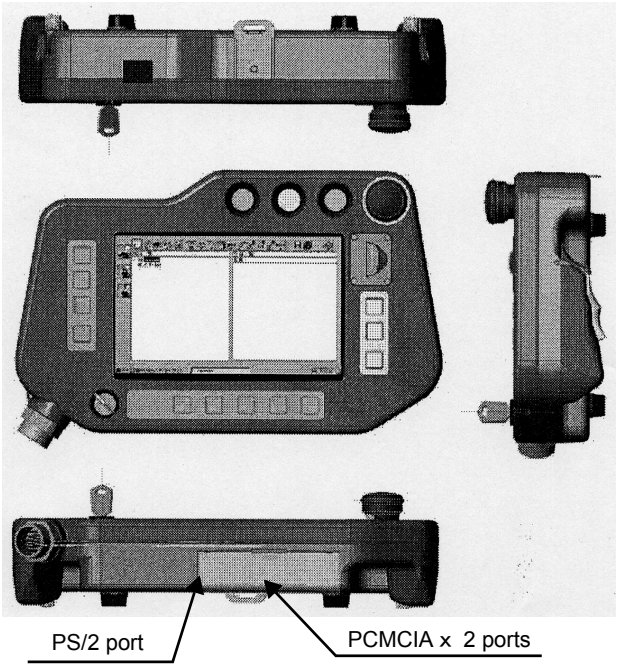
Note

One of the PC card slots is used for the memory card for the scheduled backup.

- PS/2 port

One PS/2 port is provided to the left side of PC Card slots. It is possible to connect mouse corresponding to PS/2 in case of using Windows CE.
To use keyboard etc. together with the mouse for Windows CE for alphanumeric input, use PS/2 splitter.

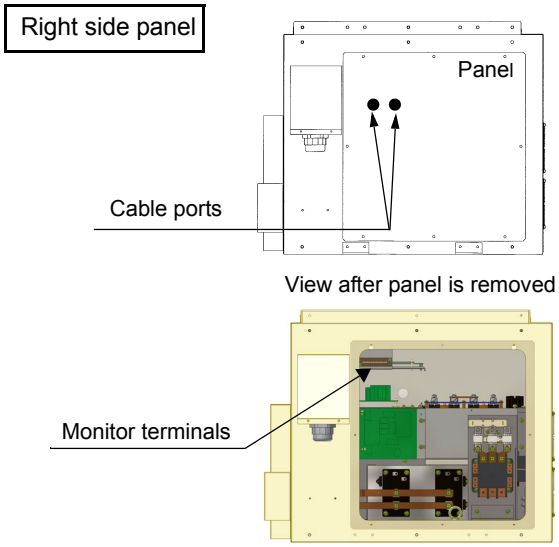
Note	About PS/2 port
• Connect PS/2 port before turning on the robot controller. • Disconnection of PS/2 port in operation kills the function of interface. After re-connection of PS/2 port, reset the controller power.	



PC card adaptor (For SD memory card)
Recommended product: (Product of Panasonic) Part No.: BN-SDAGP3 * It is not possible to use PC card adapters that are high-speed extended standards compliant. (For example: "BN-SDDAP3")
SD memory card
Recommended product: (Product of Panasonic) Part No.: RP-SD series RP-SDH series RP-SDK series (Applicability of memory cards of 1 GB or larger are not confirmed.)
PS/2 splitter
Part No.: KB-PSY02K2 (Product of Sanwa Supply) AA842 (Product of Arvel)

6.9 Welding voltage/current monitor

In case of using welding voltage/current monitor function, use the provided welding voltage/current monitor terminals.



- Connecting to the monitor terminals

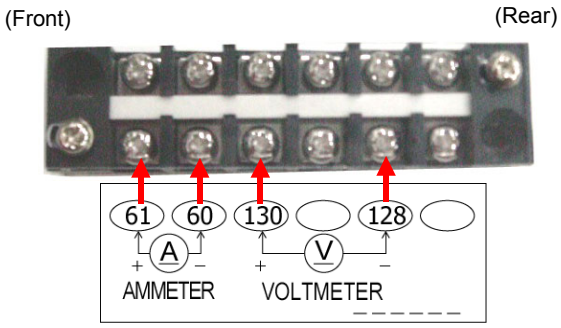
(1) Remove the right side panel of the controller to access the monitor terminal located at the upper left side inside the panel.

(2) Draw the cable to connect an external equipment and the monitor terminal through the cable port in the panel.
At that time, make sure to fix the cable with cord lock or the like so as to prevent dust to get in the controller through the cable port into the controller.
(Remove the hole plug at the panel to draw a cable through the cable port.)

(3) Re-install the panel.

- Layout and functions of the monitor terminals

Terminal name	Function
+ Ⓐ – Welding current monitor terminal	Connect a DC ammeter to between these terminals to monitor welding amperage. (Output terminal from the shunt resistor 600 A/ 60 mV.)
+ Ⓥ – Welding voltage monitor terminal	Connect a DC voltmeter to between these terminals to monitor welding voltage.



Note

Make sure to connect a DC ammeter and DC voltmeter individually.

6.10 End User License Agreement of software

The Teach Pendant is using “Windows CE” as operating software.

❖You have acquired a device (“DEVICE”) which includes software licensed by [Matsushita Welding Systems Co., Ltd.] from one or more software licensors (“[Matsushita Welding Systems Co., Ltd.] Software Suppliers”). Such software products, as well as associated media, printed materials, and “online” or electronic documentation (“SOFTWARE”) are protected by international intellectual property laws and treaties. The SOFTWARE is licensed, not sold. All rights reserved.

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GRANT OF SOFTWARE LICENSE. This EULA grants you the following license:
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NO WARRANTIES FOR THE SOFTWARE. THE SOFTWARE is provided “AS IS “ and with all faults. THE ENTIRE RISK AS TO SATISFACTORY QUALITY, PERFORMANCE, ACCURACY, AND EFFORT (INCLUDIING LACK OF NEGLIGENCE) IS WITH YOU. ALSO, THERE IS NO WARRANTY AGAINST INTERFERENCE WITH YOUR ENJOYMENT OF THE SOFTWARE OR AGAINST INFRINGEMENT. IF YOU HAVE RECEIVED ANY WARRANTIES REGARDING THE DEVICE OR THE SOFTWARE, THOSE WARRANTIES DO NOT ORIGINATE FROM, AND ARE NOT BINDING ON, MS.

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7. Maintenance and inspection

CAUTION	Maintenance and inspection work must be performed by qualified personnel who have completed the appropriate training programs and also well understand the contents.

7.1 Inspection schedule

Maintenance and inspection works are inevitable to ensure full functions and performance of the robot and at the same time to ensure safety during operation.

(1) Refer to the table in the next page for the check items.

(2) Since the inspection intervals are set according to standard operation hours, apply either months or hours whichever is shorter as the standard. In case of operation on two shifts, the every 500-hour inspection shall normally be performed every 1.5 months. Hours correspond to time while the controller is in the ON state.

(3) It is recommended to have the overall inspection including overhauls specified by us at the time of every 2000-hour inspection. If you enter into a periodical inspection contract with our company, our periodical inspections will start with a 2000-hour (yearly) inspection.

Inspection schedule
● Daily inspection
● Every 500 hours (or every third month)
● Every 2,000 hours (or every year)
● Every 4,000 hours (or every second year)
● Every 6,000 hours (or every third year)
● Every 8,000 hours (or every forth year)
● Every 10,000 hours (or every fifth year)

7.2 Daily check

♦Inspections before turning on the power

	Parts	Item	Service	Remarks
1	Ground cable Cables	• Looseness • Breaking or damage of wire	• Re-tightening. • Replacement	
2	Manipulator	Attachment of spatter or dust.	Removal of spatter or dust	Do not blow them off with compressed air. Dust or spatter may enter the clearance or inside of the cover, resulting in damage to the robot.
		Looseness	Re-tightening	Consult our service section if causes are not clear.
3	Safety fence	Damage	Repair	
4	Welding torch nozzle, tip	• Attachment of spatter. • Wear at the tip hole	• Removal of spatter. • Replacement	Be sure to replace with genuine parts.
5	Controller	Attachment of spatter/dust.	Removal of spatter/dust.	
		Clogged filter.	Clean/replace filter(*)	
6	Working area	Tidiness		

Note

(*): **About filter at the air inlet fan**

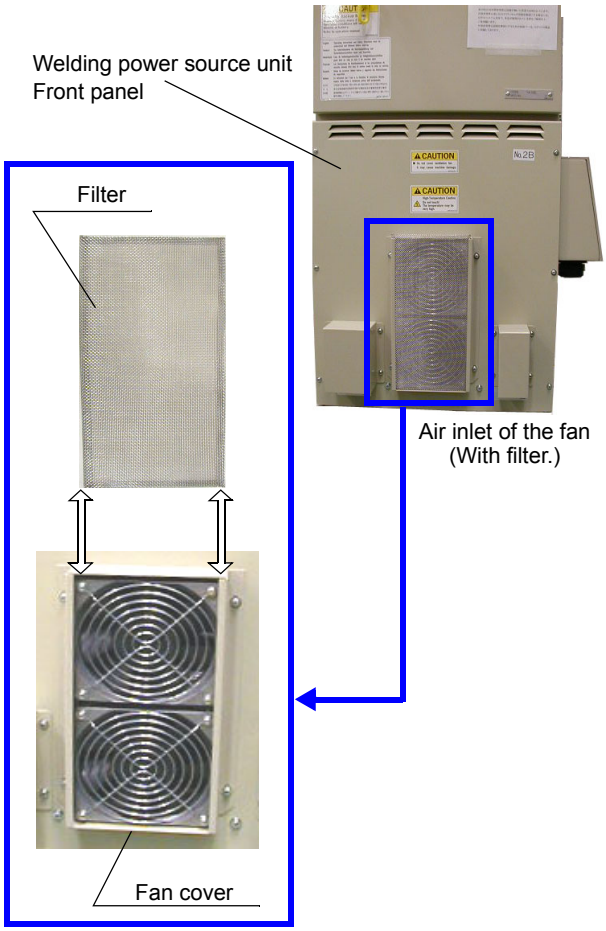
The air inlet fan at the front panel of the welding power source unit is covered with a filter.

- Clean the filter periodically. And remove dust and/or spatter attached to the filter. Using the controller with clogged filter may degrade its cooling performance of the fan, and performance of the robot will be deteriorated, as a result, the “Temperature error” may occurs.
- In case of “Temperature error”, check the filter and clean or replace it as necessary.

● Filter replacing procedure

(1) Hold the upper part of the filter, and then pull upward to remove it from the fan cover.

(2) Insert the new one from the top of the fan cover.
Make sure to insert the filter completely until the bottom part of the filter touches the bottom part of the fan cover.



♦Inspections after turning on the power

CAUTION	Check to confirm that no personnel are present within the robot work envelope before turning on the power.

	Parts	Item	Service	Remarks
1	Emergency stop switch	Turn off the servo power immediately.	• Repair • Consult us if causes are not clear.	Do not use the robot unless the switch is repaired.
2	Origin marks	When the home return is completed, the origin marks coincide with each other.	Consult us if they do not match.	To approach the robot to check the marks, press the emergency stop switch to turn off the servo power.
3	Manipulator	Each axis of the robot makes steady and smooth motions (no abnormal vibration, noise or looseness) in manual and operation mode.	Consult us if causes are not clear.	Do not use the robot unless the manipulator is repaired.
4	Fan	• Cooling air inlet fan of the controller rotates. • Attachment of dust on the fan.	Clean the fan.	Be sure to turn off the power to the controller before cleaning the fan.
5	Controller	Abnormal vibration, noise or odor from the built-in welding power source	Consult us if causes are not clear.	Do not use the robot unless the manipulator is repaired.

Note

The fan for the built-in welding power source (located 2 pcs. on the front panel side and 1 pc. on the rear panel side) may not rotate immediately after power on. It starts rotation with rise in temperature of the built-in welding power source after starting actual operation. It stops rotation when the temperature of the built-in welding power source decreases after stopping actual operation.

7.3 Periodical check

Interval						Item	Inspection and service
3 mth	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.		
○						Screws at covers	Check for tightness and re-tighten if necessary.
○						Connecting cable connectors	Check for tightness and re-tighten if necessary.
	○					Motor mount bolts	Check for tightness and re-tighten if necessary.
		○				Batteries (Controller)	Exchange with new one
				○		Batteries (Teach pendant)	Exchange with new one
○						Other consumable components	Exchange with new one if necessary

Note

- Electromagnetic contactors or cooling fans:
  Please treat them as consumable when performing periodical check and maintenance work. Those components have a certain life cycle electrically and mechanically.
- For details, please consult our service section. If you have a periodical inspection contract with our company, our periodical inspections will start with a 2000-hour (yearly) inspection. Replacement of parts found to be replaced at the inspection will be charged.

7.4 Battery replacement

7.4.1 Teach Pendant

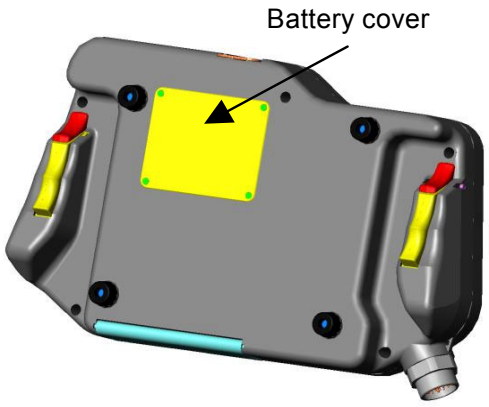
The Teach Pendant has 2 back-up batteries for teaching program memory.

- Replacement of the batteries is required every 4 years under normal usage, which is 8 hours a day and 5 working days a week. Any installation environment worse than that may cause shorter life time of the batteries.
- The message “Change back-up batteries” appears when the batteries are in low level.
  Once the message appeared, the batteries will be exhausted in approximately 7 days in normal usage.

Exhausted batteries may cause data crash when power is disconnected by accidental power failure or so.

Replacing procedure

(1) Prepare 2 new batteries.
(2) Turn off all input power of the robot system.
(3) Remove the Battery Cover on rear side of the Teach Pendant.
(4) Remove old batteries from the Battery Holder.
(5) Place new batteries to the Battery Holder.
(6) Reassemble the Battery Cover.



Battery type
Model: CR2450 (coin-shape lithium battery)
Quantity: 2 pcs.

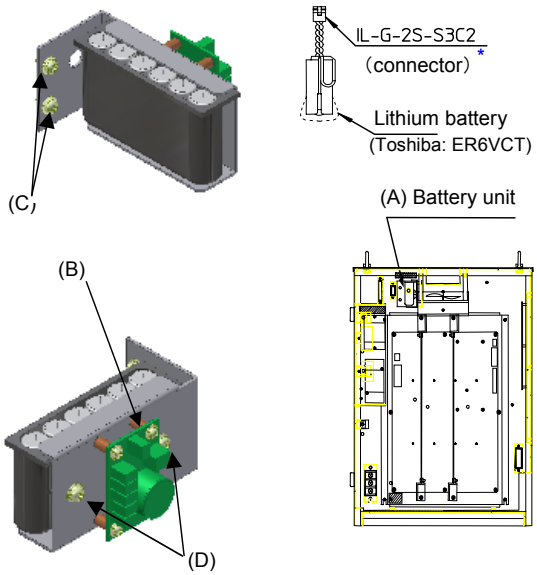
7.4.2 Controller

WARNING	Turn off all input power before operation.

The robot uses backup batteries to keep position data of resolvers. The controller has 6 pieces and the manipulator has 6 pieces of batteries.
The battery is replaced the following standard as reference.

- Every two years.
- When the following error message (battery error message) is displayed.

E8001 Encoder battery is consumed: The battery in the controller.



(* Product of Japan aviation electronic Industry Ltd.)

● Replacing procedure

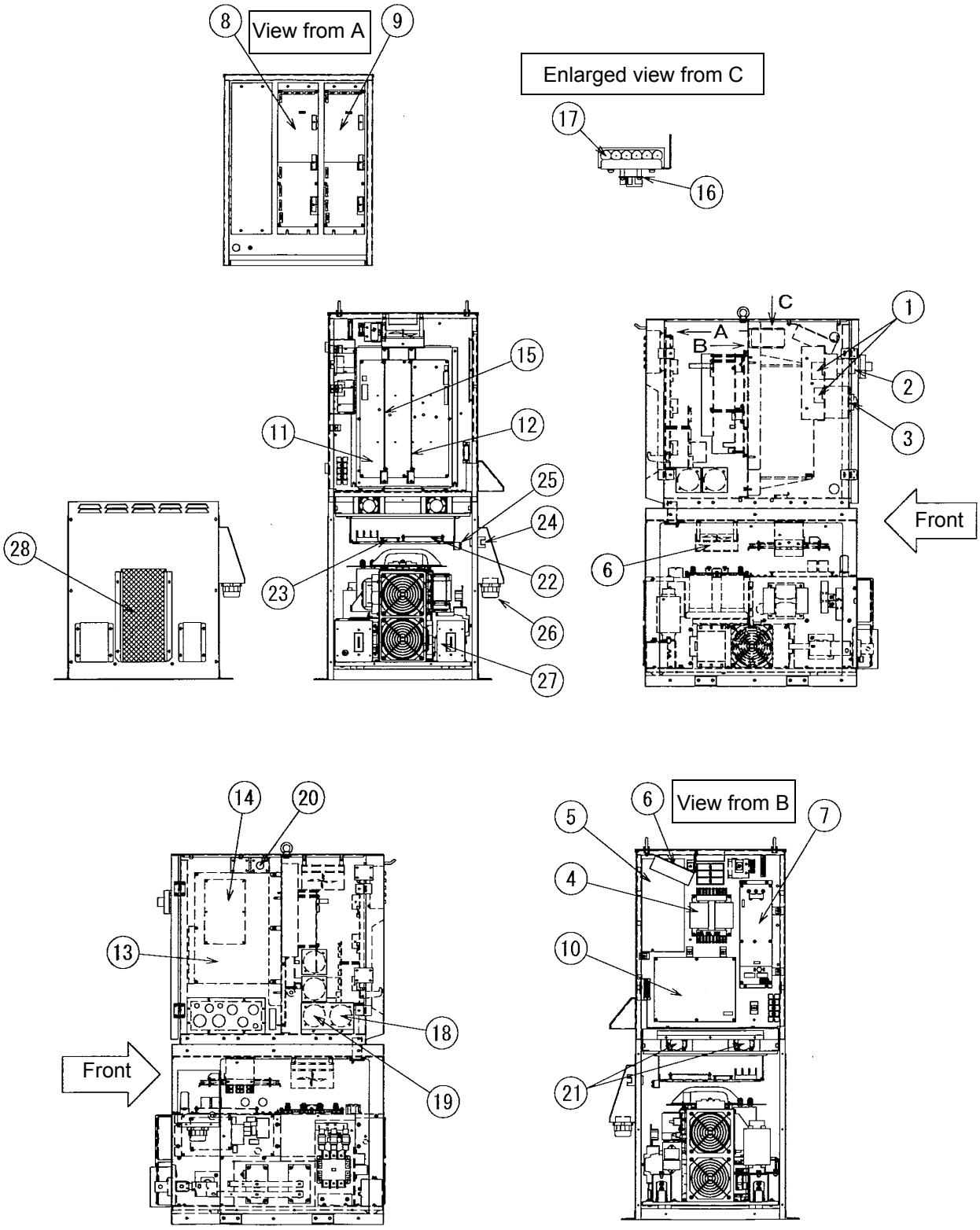
(1) Back up all operation data and parameters to external memory.
(2) Open the controller door and disconnect a connector from (B) of the battery unit located in (A). And remove 2 screws in (C).
(3) Remove the battery unit and disconnect a battery connector from the battery unit.
(4) Remove 2 screws (D) of the battery unit and change all batteries with new one.
(5) Return the battery unit to original position and fix it. Connect the connector to (B) of the battery unit.

Note

- Weakened battery power can not keep position data of the resolver. If the data has been lost, dedicated servicing by authorized serviceman is required.
- While the battery error message is displayed, the start input won't be accepted. Clear the error message to start the robot or the like.

8. Parts layout drawings

8.1 Robot controller



<Class>
A: Consumable parts, rather short replacement cycle.
B: Assemblies and parts of high frequency in motion.
C: Important electric parts.
D: Parts rather long replacement cycle.

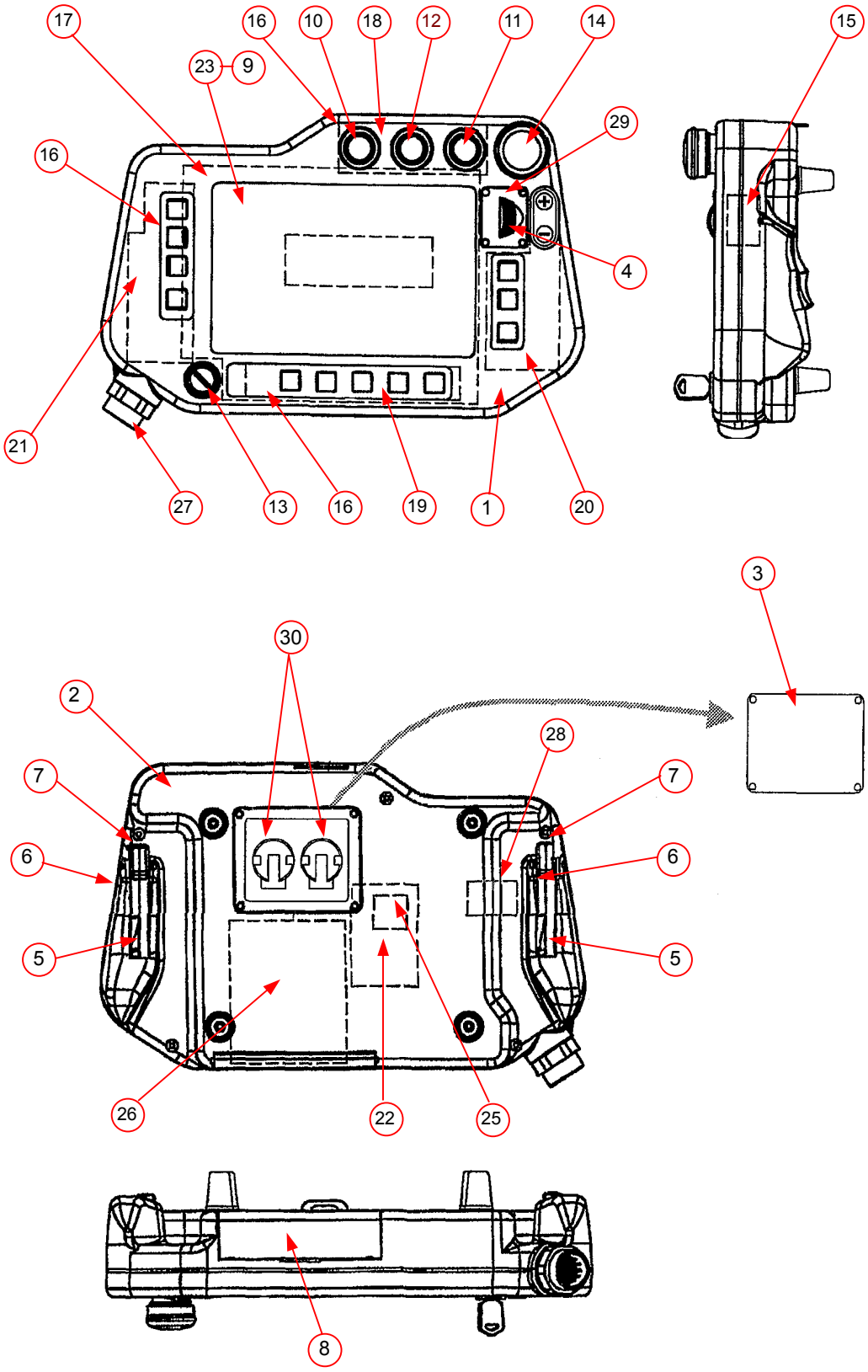
No.	Description			Part number	Q'ty	Note	Class
1	Anti-surge Parts			AEB40054	1		D
2	Switch			P132/V/SVBSW	1		C
3	Breaker			GV2MF22	1		C
4	Transformer			UTU5305	1		D
5	DC Power Supply			ZWG1305225LW	1		C
6	Cooling Fan			CN60B3	5		B
7	Servo Power			AED00130	1		C
8	Amplifier 1	YA-1QCR41***	T / Y spec. (TB-1400)	AED01229	1		C
			T / Y spec. (TB-1800)	AED01233	1		C
		YA-1QCR61***	T / Y / R / U spec.	AED01229	1		C
			E spec.	AED01250	1		C
		YA-1QCR81***	T / Y / R / U spec.	AED01233	1		C
			E spec.	AED01251	1		C
9	Amplifier 2	YA-1QCR41***		AED01258	1		C
		YA-1QCR61***		AED01228	1		C
		YA-1QCR81***		AED01232	1		C
10	Power Card			ZUEP5757	1		C
11	Main CPU Card			ZUEP5585	1		C
12	Servo CPU Card			ZUEP5587	1		C
13	Sequencer Card		T / Y / R / U spec.	ZUEP5711	1	Open collector output	C
			E spec.	ZUEP5725	1	Open emitter	C
14	Safety Card			ZUEP5702	1		C
15	Welding Control Card			ZUEP5750	1		C
16	BAT Relay Card			ZUEP5765	1		C
17	Lithium Battery			ER6VCT	6		A
18	Connecting Cable			AWC25029LN	1	5 m	C
19	Motor Cable			AWC32770LN	1	5 m	C
20	TP Cable			AWC32693LT	1	10 m	B
21	Fan			TUDC24H4MATU	2		A
22	Welding Power Card			ZUEP5754	1		C
23	DC Power Supply			ZWS75AF15/J	1		C
24	Terminal		T / Y / R spec.	UF2056E3P	1		D
			E / U spec.	OTB4883P	1	UF2087NEM63P is also applicable	D
25	Terminal			UF13-20A6PCA	1		D
26	Cord lock			EBG2836BK	1		D
27	Welding Power Unit(Note1)		T / Y / R spec.	YA-1QD351T00(Note2)	1	(200V spec.)	C
				YA-1QD351T01(Note3)		(200V/220V spec.)	
			E spec.	YA-1QD351E00	1	(200V spec.)	C
			U spec.	YA-1QD351U00	1	(200V spec.)	C
28	Filter			AKC41124	1		B

<Note1> Replacement of the welding power unit is available only by unit.

<Note2> Not applicable to YA-1QCR61TA*, YA-1QCR61YA*, YA-1QCR81TA* and YA-1QCR81YA*.

<Note3> In order to apply this part to YA-1QCR61T**, YA-1QCR61Y**, YA-1QCR81T** or YA-1QCR81Y**, the software version of the robot needs to be "R" or higher.

8.2 Teach pendant



<Class> A: Consumable parts, rather short replacement cycle.
B: Assemblies and parts of high frequency in motion.
C: Important electric parts.
D: Parts rather long replacement cycle.

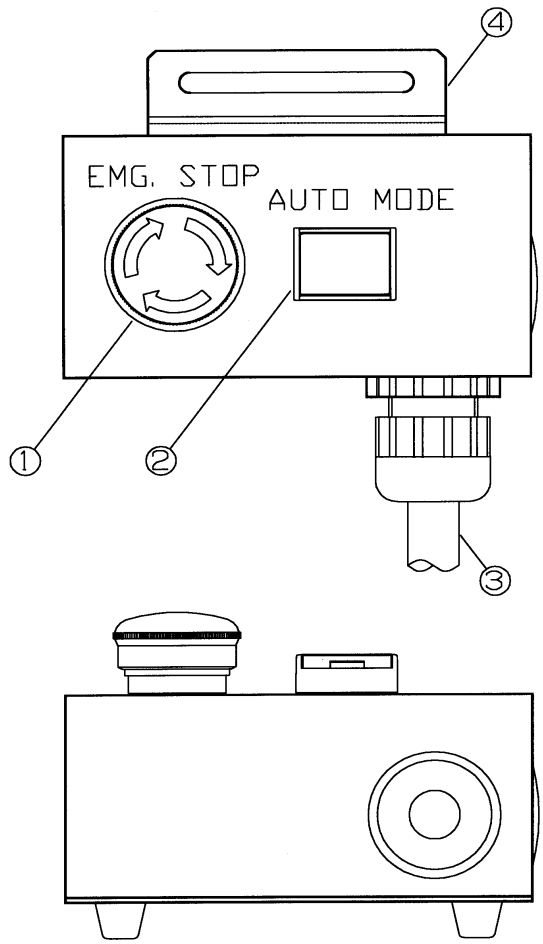
No.	Description	Part number	Q'ty	Note	Class
-	Teach pendant(Note 2)	AUR01047	1	(*3)	D
		AUR01053	1	(*4)	D
1	Upper Case	AKC21002	1		D
2	Lower Case	AKC21003	1		D
3	Battery Cover	AKC31004	1		D
4	Dial	AKC31006	1		D
5	Lever 1	AKC31002	2		B
6	Lever 2	AKC31003	2		B
7	Trigger	AKC31009	2		B
8	Cover	AKC31005	1		D
9	LCD Cover	AKK32004	1		B
10	Push button switch	A165LTGYMMA1	1		B
11	Push button switch	A165LTGYMMA2	1		B
12	Push button switch	A165LTWMMA3	1		B
13	Key Switch	A165KT2M2	1	With key	B
14	Emergency Stop Switch	A165ES02	1		B
15	Encoder	RE21BARE185	1		B
16	Key Sheet	AKP32003	1	1 set (3 sheets)	B
17	TP CPU Card(Note 1)	ZUEP5769	1	(*1)	C
		ZUEP5712	1	(*2)	C
18	TP UP card	ZUEP5716	1		C
19	TP Low Card	ZUEP5717	1		C
20	TP Right Card	ZUEP5718	1		C
21	TP Left Card	ZUEP5719	1		C
22	SH Card(Note 1)	ZUEP5766	1	(*1)	D
		SCE8700C02	1	(*2)	D
23	LCD Display (Note 2) (Note 3)	EDTCB23QAF	1	(*3)	C
		LTA070B790F	1	(*4)	C
24	Inverter	CXAL0612AVJL	1		D
25	Compact Flash(Note 1)	CF1-032MRR	1	(*1)	B
		SDCFJ32-388	1	(*2)	B
26	PCMCIA Connector	62236-22PR0	1		D
	Memory card unit	AEU01464	1		B
27	TP Panel Cable	AWC32694	1		B
28	Flat Cable (Note 2)	QCNM1493ACZZ	1	(*3)	D
		ASCU40F676S4	1	(*4)	D
29	Jog Cover	AKC31007	1		D
30	Battery	CR2450	2		A

(Note 1) As for TP CPU card, SH card and Compact flash, a set of either (*1) or (*2) are applied.
(Note 2) As for Teach pendant, LCD display and Flat cable, a set of either (*3) or (*4) are applied.

(Note 3)
This product has a fluorescent lamp that contains mercury. Disposal may be regulated in your community due to environmental considerations. For disposal or recycling information, please contact your local authorities, or the Electronic Industries Alliance: http://www.eiae.org. (U.S.A. only)

8.3 Operation Box

T / Y spec.	Optional
E / R / U spec.	Standard



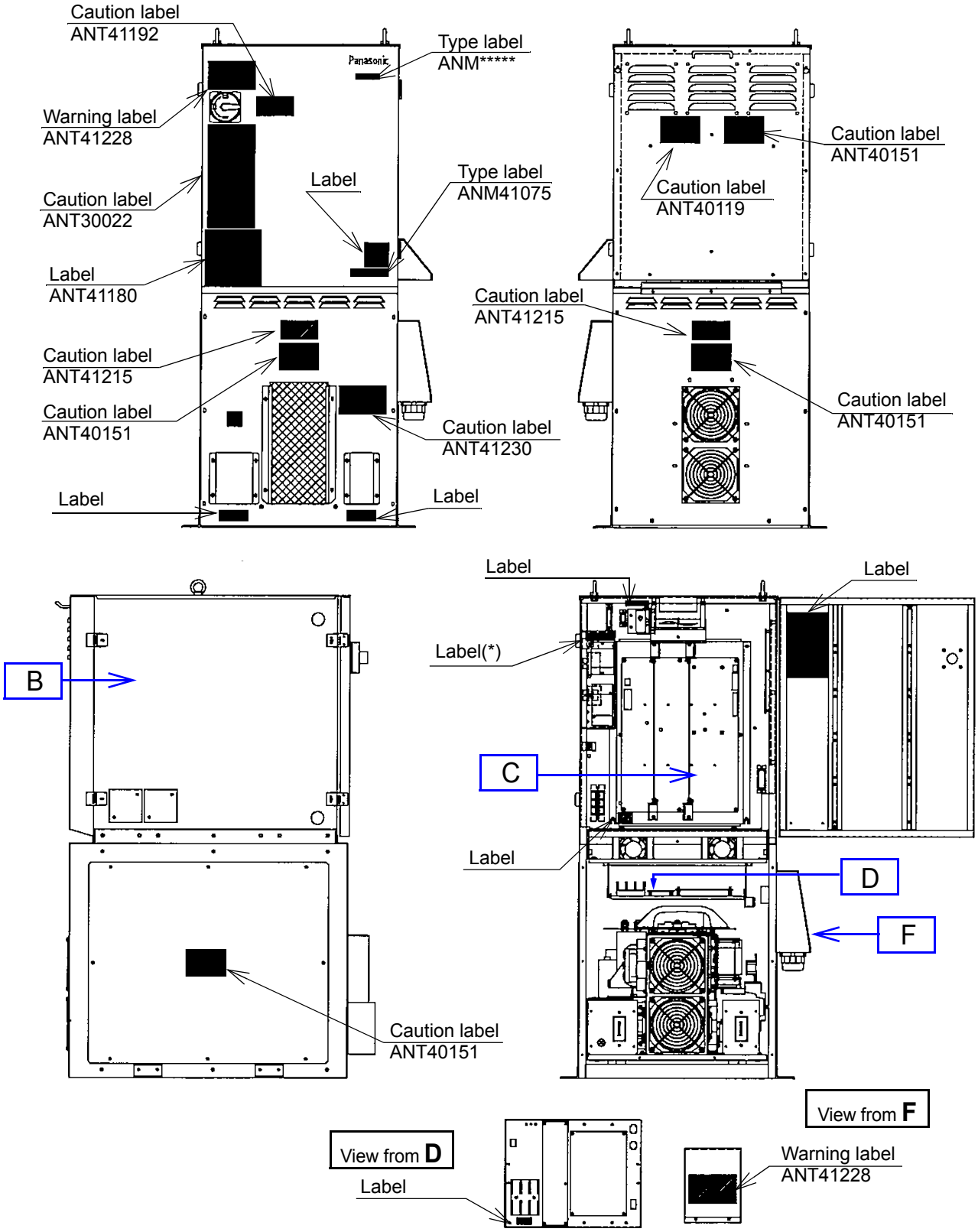
<Class>
A: Consumable parts, rather short replacement cycle.
B: Assemblies and parts of high frequency in motion.
C: Important electric parts.
D: Parts rather long replacement cycle.

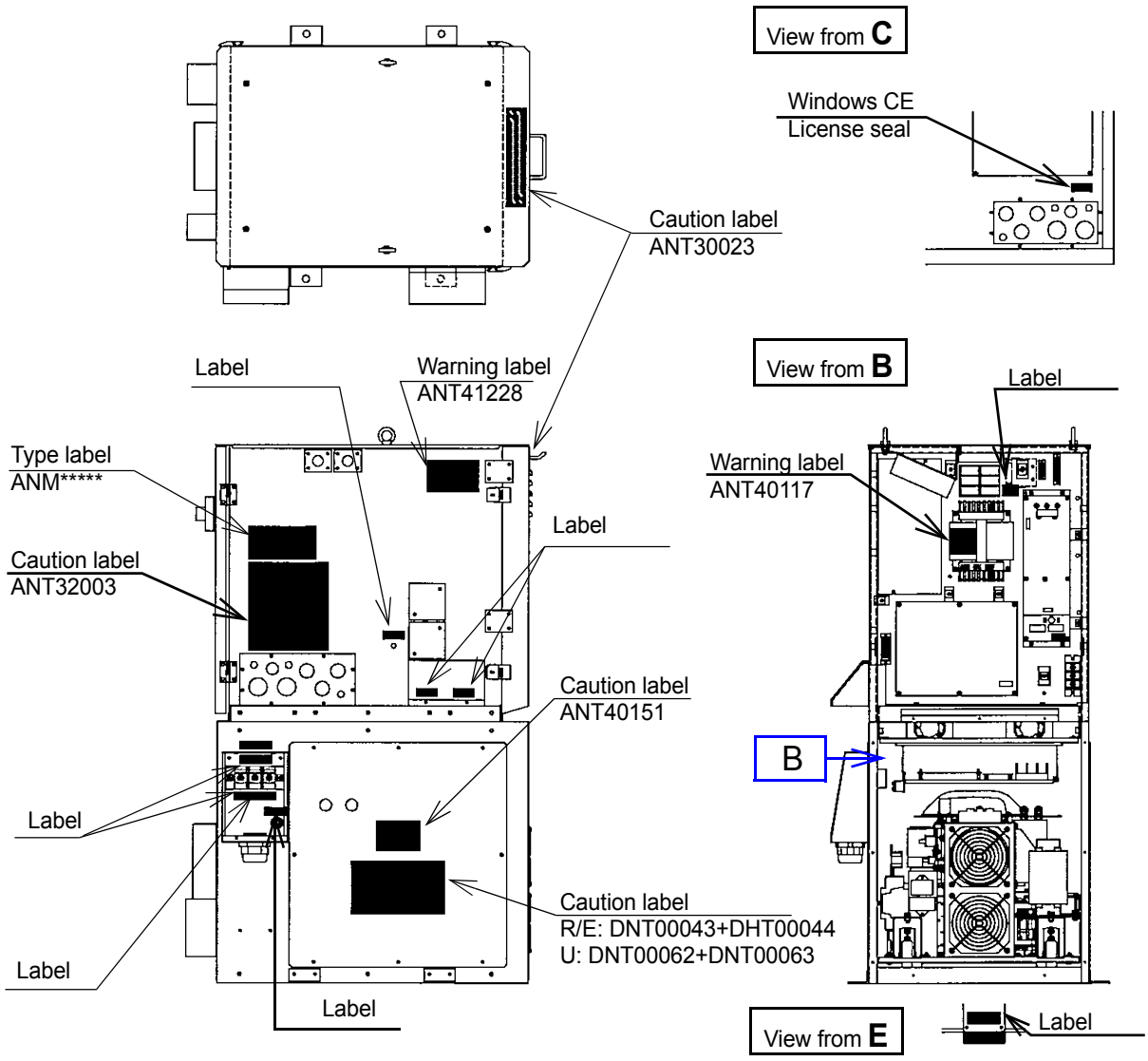
No.	Description		Part number	Q'ty	Note	Class
-	Operation box	R / U spec.	AEU01282	1		D
		E spec.	AEU01293	1		D
1	Emergency Stop Switch		A165ES02	1		B
2	Push Button Switch		A165LJWM24D1	1		B
3	Cable	R / U spec.	AWC32714LP	1	6 m	B
		E spec.	AWC32723LP	1	6 m	B
4	Fixing Metal		AKC41016PA	1		D

<Note> Optional software is required to use the Operation Box.

9. Location of Warning labels

9.1 Location of labels





9.2 Labels

CODE YA-1QCR61Y00
MFD. No. G0001C

< Type label -ANM41075 >

Panasonic
ROBOT CONTROLLER
Model No. YA-1QAR61Y00 Mass 110 kg
RATED INPUT 3-PHASE AC200V 50/60Hz 23kVA MFD. IN 2004
Interrupting Current Rating 25 kA (Robot controller)
Interrupting Current Rating 100 kA (Power source)
Matsushita Welding System Co., LTD.
1-1, 3-chome, Inazu-cho, Toyonaka, Osaka 561-0854 Japan
Made in Japan ANM*****

< Type label - ANM***** >

CAUTION
AT POWER ON
After turing power switch off, allow at least
3 seconds allowance for next power on.

< Caution label - ANT41192 >

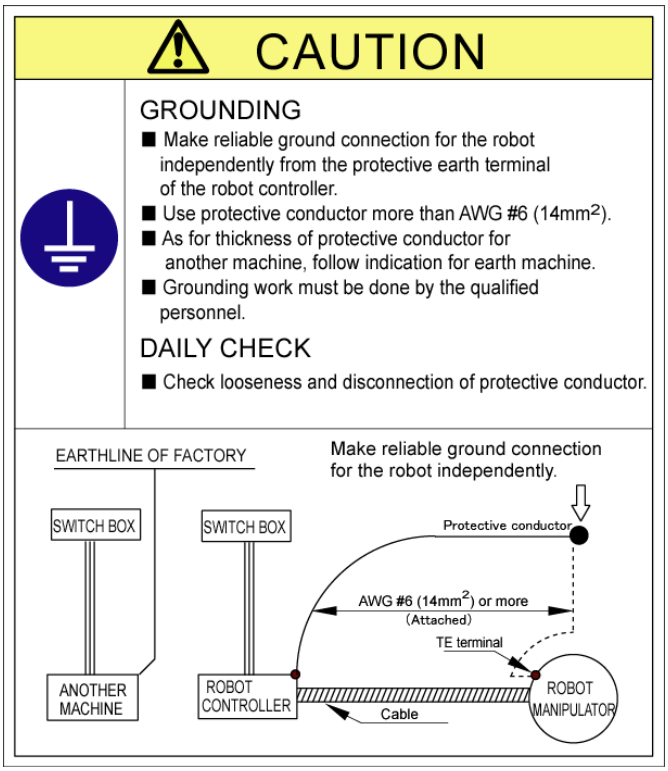
CAUTION
High-Temperature Caution
Do not touch !
The temperature may be
very high.

< Caution label - ANT40151 >

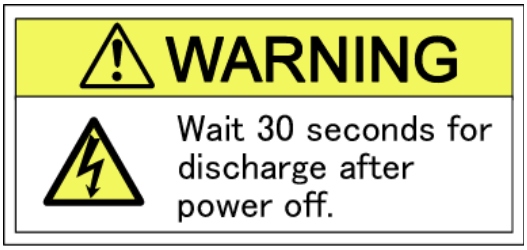
CAUTION
■ Do not cover ventilation fan.
It may cause machine damage.
■ Do not place anything on top
of controller.
It may cause the machine to overheat.

< Caution label - ANT40119 >

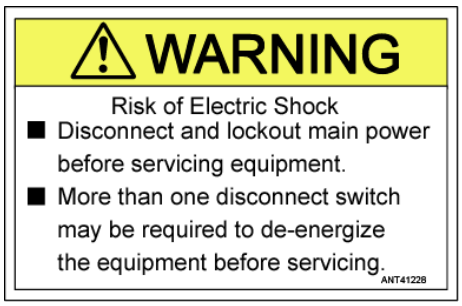
< Warning label - ANT30022 >



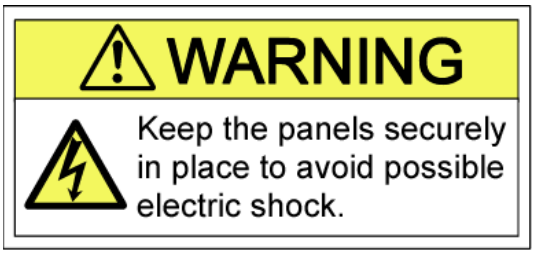
< Caution label - ANT32003 >



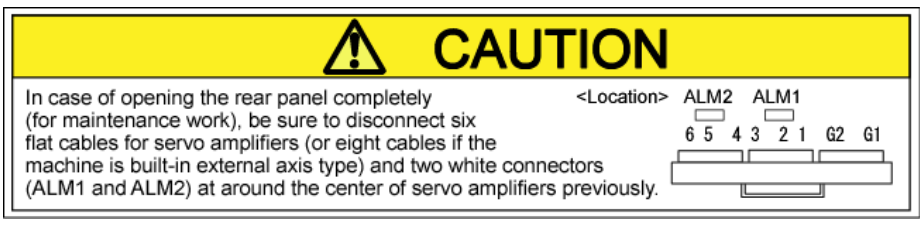
< Warning label - ANT40117 >



< Warning label - ANT41228 >



< Warning label - ANT41187 >

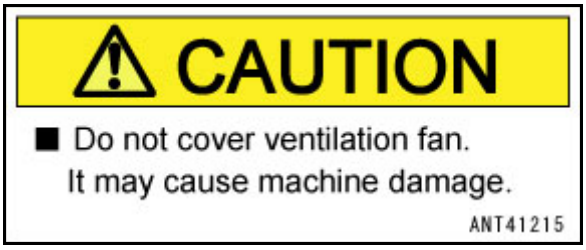


< Caution label - ANT30023 >

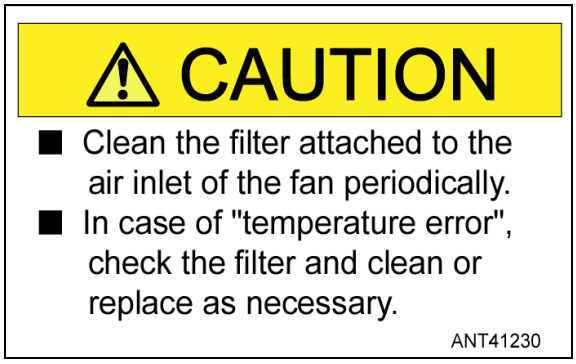
English	Operating instructions and Safety Directions must be understood and followed before start-up.
Deutsch	Vor Inbetriebnahme die Betriebsanleitung und Sicherheitsvorschriften lesen und beachten.
Nederlands	Lees de bedieningsinstructies en Veiligheidsvoorschriften goed door en volg ze voor u de machine start.
Francais	Les instructions de fonctionnement et les prescriptions de securite doivent être lues et suivies avant la mise en service.
Espanol	Antes de arrancar deben leerse y segnirse las Instrucciones de seguridad.
Italiano	Le istruzioni per l' uso e le Direttive di sicurezza devono essere state lette e comprese prima dell' avviamento.
한국어	조작설명서 및 메뉴얼에 기록된 안전에 관한 지침을 충분히 읽은 후 조작을 시작하십시오.
中 文	务必在熟读操作说明和手册中记载的安全注意事项后进行操作
日本語	操作説明書およびマニュアルに記載された安全に関する指示をよく読んでから操作を開始してください。

ANT41180

< Caution label-ANT41180 >



< Caution label - ANT41215>



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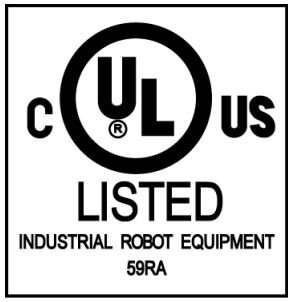

< UL mark - ANH35002 >

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