YASKAWA ROBOTICS

Install and Wiring

Robot controller

User manual

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Rev. 01: Document created from the original RE-CTO-A221.2 and RE-CHO-A114

Table of contents

1 General

1.1 Notes for safe operation

DANGER!

Indicating immediate danger at high risk, hazard that can cause death or serious bodily injuries if no precautions are taken.

WARNING!

Indicating possible medium risk hazard situation which can cause death or serious bodily injuries if it is not avoided.

CAUTION!

Indicating potentially dangerous situation with low risk of minor or moderate bodily injuries result if it is not avoided. This signal word can also be used for property damage warnings.

NOTICE

Indicates important background information and application advice.

1.2 Frequently used terms

The YASKAWA robot is a product of YASKAWA Electric Corporation, and is provided by default with the robot control, the programming pendant and robot cable.

The terms are designated as follows in this manual:

Term	Description
Control	Robot control
Industrial robot	Robot
Programming pendant / teach box	Programming pendant
Supplying cable between robot and robot control	Cable
Robot, robot control and cable	Robot system
YASKAWA Electric Corporation	YEC
YASKAWA Robotics Division	YEU-R
Moving, calibrating and setting up of the robot	Teachen
Movement sequences of the robot	JOBs
Technical customer service	TCS
General purpose	GP

1.3 Target group

This manual is directed at users with the following knowledge:

- Advanced knowledge of mechanical engineering
- Advanced knowledge of electrical engineering
- System knowledge of the robot control
- Specially trained staff

NOTICE

According to the international DIN EN ISO 10218-1 standard, operators of a robot system must receive training before they operate the robot.

For optimal use of our products, we recommend our customers to take part in a training session at the YASKAWA Academy. For more detailed information on the training programs, please visit www.yaskawa.eu.com or directly get in touch with your YASKAWA branch office.

1.4 Intended use

Typical applications:

- Flange-mounting tools
- Installation of spot welding guns
- Installation of arc welding equipment
- Installation of grippers
- Machining and transporting workpieces or products

1.5 Improper use

Any use that deviates from the intended use shall be regarded as impermissible misuse. This includes:

- Transport of people and animals
- Use as ascending aid.
- Use outside the permissible operating limits.
- Use in environments with risk of explosion (except for ATEX-approved robots).
- Overload
- Use without protective equipment.

NOTICE

Modifications to the robot, e.g. drilling holes or similar modifications, can damage parts. This will be regarded as improper use (i.e. use that deviates from the intended use) and will lead to loss of warranty and liability claims as well as loss of the declaration of incorporation.

⚠ CAUTION!

The robot system is an incomplete machine.

The robot system may be put into operation only after it has been determined that the incomplete or complete machine in which the robot system is being installed:

- ▶ Corresponds to the provisions of the machinery directive.
- ▶ Complies with all relevant (harmonized) standards.
- ▶ Corresponds to the state of the art.

1.6 About this manual

- This manual explains the different components of the robot controller and the general operating functions. Be sure to read and understand this manual thoroughly before operating the robot controller.
- To ensure correct and safe operation, read the robot controller operating instructions (Basic Information, Installation and Wiring and System Setup).
- In order to illustrate details clearly, some drawings are shown with the protective covers or shields removed. All protective covers and shields must be mounted before the robot is operated.
- The drawings and figures in this manual are representative illustrations. They may differ from the product delivered.
- YEU-R reserves the right to make technical changes. These changes may include product improvements, modifications or changes in specifications
- If your copy of the operating and maintenance instructions is damaged or lost, please contact the local YASKAWA branch office to order a new copy. The official branch offices are listed on the last page. Please mention the manual number in your order.
- YASKAWA Europe GmbH is not responsible for damage caused due to unauthorized modification of the system. If any impermissible modifications are made to the system and to the robot, all warranty and liability claims as well as the declaration of incorporation will expire.

Descriptions of the programming pendant, buttons, and displays are shown as follows:

Programming pendant	Manual designation
Character keys	The keys which have characters printed on them are denoted with [ ], e. g. [ENTER]
Symbol keys	The keys which have a symbol printed on them are illustrated with a small picture. e. g.  There is no picture for the cursor key.
Mode selection switch	Three kinds of modes that can be selected by the mode key are denoted as follows: REMOTE, PLAY and TEACH
Keys	There are three keys on the programming pendant, which are referred to as follows: HOLD key; START key; Emergency stop button
Axis keys	Controlling the axes
Numeric keys	Number input
Simultaneously pressed keys	A plus sign between the keys indicates that it is necessary to press two keys simultaneously. e.g. [SHIFT]  + [COORD]  .
Display	The menu displayed is denoted with { }. e.g. {JOB}

Description of the operation procedure

In the explanation of the operation procedure, the expression "Select",

- means that the cursor is moved to the object item and the [SELECT] key is pressed.
- that the item is directly selected by touching the screen.

Registered Trademark

The names of companies and/or products used in this manual are trademarks. The indications of ® and ™ are omitted.

1.7 Safety

Fig. 1-1: Programming pendant

① Emergency stop button

⚠ WARNING!

Danger of death or injury from crushing

If the emergency stop button is not working properly, the robot cannot be stopped in the event of an emergency.

- ▶ The robot should not be used if the emergency stop button is not working.
- ▶ Before operating the robot, check the function of the EMERGENCY STOP button. The servo power must go off immediately when the EMERGENCY STOP button is pressed on the programming pendant (see Fig. 1-3: "Emergency stop button").
- ▶ When the servo power is turned off, the "SERVO ON" LED on the programming pendant goes out (see Fig. 1-2: ""SERVO ON" LED").

Fig. 1-2: "SERVO ON" LED

Fig. 1-3: Emergency stop button

⚠ WARNING!

Danger of death or injury from crushing

Before you release the emergency stop button (see Fig. 1-4: "Releasing the emergency stop button by rotating it"), note the following

- ▶ Make sure there is no one within the maximum operating range of the robot.
- ▶ Clear the cell of all items with which the robot could collide.
- ▶ Only then should you switch on the servo power by pressing the enabling switch on the programming pendant.

Fig. 1-4: Releasing the emergency stop button by rotating it

⚠ WARNING!

Danger of death or injury from crushing

If anyone enters the working area of the robot during operation or any problems occur, always press the EMERGENCY STOP button immediately. It is located on the programming pendant (see Fig. 1-1: "Programming pendant").

Take the following precautions when performing teaching operations within the robot's operating range:

- ▶ Position yourself in front of the robot whenever possible.
- ▶ Always follow the prescribed operating steps (see the instructions for the robot controller, as well as the "Handling" and "Universal Application" manuals).
- ▶ There must be a free space into which the operator can retreat in the event of an emergency.

The following test steps absolutely must be performed before you teach the robot. Deal with any problems you find immediately, and make sure that any other necessary steps have been taken.

- Check for any problems in the movements of the robot.
- Check that the connectors are well secured and none of the cables are damaged.
- Hang the programming pendant back on the robot controller after use.
- Make sure that the key for the mode selector (teach/automatic) on the programming pendant is kept by a competent person who has been specially trained by us.
- The key may only be inserted into the key switch of the programming pendant during teaching. After teaching, it must be immediately removed and kept in a safe place.

1.7.1 YASKAWA manual list

It is important to have all the manuals on the YASKAWA control or robot available and to know their contents. Please make sure you have all these manuals. If you are missing any manual, please contact the local YASKAWA branch office.

You must have the YASKAWA manuals listed below available.

- Instructions (E1102000214XX01* and higher).
- Maintenance (E1102000215XX01* and higher
- Install and Wiring (E1102000216XX01* or higher).
- Alarm list (E1102000217XX01* or higher).
- Operating and maintenance instructions for the specific robot type.

* "XX" is the language of the document.

1.7.2 Personal protection

The entire working area of the robot is potentially dangerous. The following staff must work with appropriate preparation and subject to the maxim **"Safety First"** to ensure the safety of all.

- Safety management
- Assembly staff
- Operating staff
- Maintenance staff

DANGER!

Death by electric shock; serious injury from fire hazard;

Avoid dangerous actions in the area where the robot is installed. Be sure to take safety precautions

- ▶ Unauthorised persons should not have access to the robot.
- ▶ Unauthorised persons should not have access to the peripheral equipment.
- ▶ Put up signs in the respective working area, such as **"Highly flammable"**,**"High voltage"**,**"Stop"** and **"No unauthorized access"** .

WARNING!

There is a risk of injury if there is contact with the robot or peripheral equipment.

Strictly observe the following items:

- ▶ Always wear approved work clothes (no loose-fitting clothes).
- ▶ Do not wear gloves when operating the robot.
- ▶ Personal Protective Equipment (PPE) is subject to the provisions of the 89/656/EEC guideline.
- ▶ Do not wear large jewellery, such as earrings, rings or pendants.
- ▶ Always wear protective safety equipment such as protective helmets, safety shoes (with anti-slip soles), face shields, safety goggles and gloves as necessary.

CAUTION!

Injury and material damage due to unforeseen movements.

Observe the following note:

- Never forcibly move the robot axes.
- Never sit against the robot control.
- Avoid inadvertent pressing of the keys.
- Do not allow unauthorized persons to touch the robot control during operation.

1.7.3 MOTOMAN Safety

The followings are safety functions of robot controller.

- Emergency stop SW input (controller/programming pendant)
- Enable SW input (programming pendant)
- Safeguarding interlock signal input (safety plug)
- External emergency stop SW input
- External enable SW input
- SERVO power enable input
- Overrun input (manipulator/external axis)
- General purpose safety input

These safety functions conform to the following safety standards.

- EN ISO 13849-1:2008 + AC:2009 Cat.3 / PL e
- EN 62061:2005 + AC:2010 + A1:2013 / IEC 61508 Part 1-7:2010 SIL3

The use frequency of each switch for safety functions is assumed as below.

• Emergency stop SW	500 times/year
• Enable SW (programming pendant)	2000 times/year
• External enable SW	2000 times/year

1.7.4 Safety during installation and wiring

⚠ CAUTION!

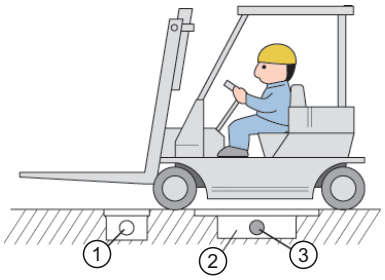
Personal injury and damage from improper connections and unforeseen movements

Operators and other personnel may stumble on exposed wiring or piping. Damaged cables may cause unexpected robot movements.

- ▶ Familiarize yourself with the wiring diagram and take notice thereof when establishing the connections.
- ▶ Take precautions when wiring and piping between the robot controller, robot, and peripheral equipment.
- ▶ Run the piping, wiring, or cables through a pit or use a protective cover, so that they are not stepped on by personnel or run over by a forklift.

Protective cover for forklift

① Piping
② Cable duct
③ Cables and tubes



For further details of the installation and the electrical connection please see Chapter 5.3.2 "Connection of the robot controller" on page 38.

⚠ DANGER due to electric current!

Death and serious injury from electrical shock and fire hazard.

Carry out earthing in accordance with all applicable electrical regulations.

- ▶ Comply with the standard "Electrical Equipment of Machines" according to IEC 60204-1:2005 (EN 60204-1:2006).

⚠ WARNING!

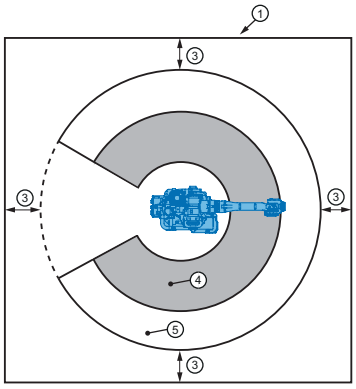
Injury and material damage due to unforeseen movements.

When planning installation, draw up easy-to-observe guidelines to ensure safety. Take safety aspects into consideration when planning the installation. Observe the following when installing the robot:

- ▶ Select an area such as that described below to install the robot
- ▶ Make sure the area is large enough so that the fully extended arm with tool does not collide with the wall, the safeguards or the robot controller.
- ▶ During installation, pay attention to the following figure "Required installation planning".

Required installation planning

① Safeguarding
② Robot controller door
③ Safety distance with respect to the stopping time of the robot type
④ Maximum P-point range of the robot
⑤ Maximum working area of the robot including tool or workpiece



1.7.4.1 Using a crane

⚠ CAUTION!

Danger of injury and material damage from improper means of transport

Crane, forklifts or slings may only be operated by authorised personnel. When lifting the robot controller, please check the following:

- As a rule, handling of robot controller must be performed using a crane with wire rope threaded through attached eyebolts.
- Be sure to use wire that is strong enough to handle the weight of the robot controller (Weight of robot controller Approx. 70 kg).
- Check that the eyebolts are securely fastened.
- To lift the robot, use a crane with wire rope threaded through the eyebolts and positioner(s). Lift the body in an upright position as described in the robot operator's manual (see 1.7.4.1 "Using a crane").
- If storing the robot temporarily before installation, make sure to place it on a stable and flat surface, and take precautions to prevent unauthorized personnel from touching it.

Using a crane

① Wire cable
② 4 x M16 eye bolts

1.7.4.2 Maintenance work

⚠ CAUTION!

Risk of injury during maintenance work

Make sure there is sufficient room for maintenance work on the robot, the robot controller and the peripheral equipment (see the following illustration).

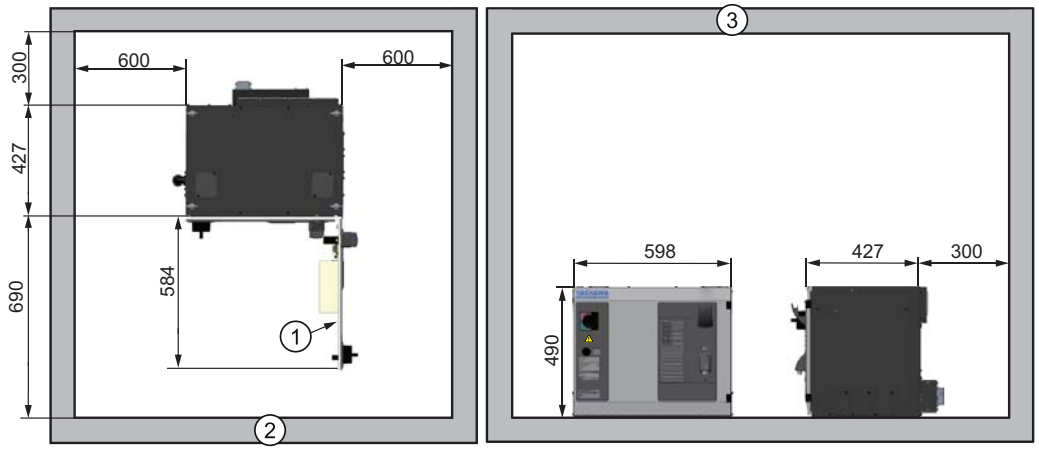


Fig. 1-5: Space for maintenance

① Door
② Robot control maintenance area
③ At least 1000 mm
All dimensions in mm

1.7.4.3 Fixing the robot controller

⚠ CAUTION!

Danger of injury and material damage in case of non-compliance with protective measures

For safe operations, the following points must be observed.

- ▶ The equipment may be operated only by persons with sufficient training.
- ▶ Install the controller only in a safe location from which the robot is visible at any time.
- ▶ Fasten the robot with the specified bolts (listed in the operating and maintenance manual for each robot model).
- ▶ Pay attention to the size and type of bolts (specified in the operation and maintenance manual for each robot model).
- ▶ Install the robot controller outside the safeguarding of the manipulator's safety enclosure.

⚠ CAUTION!

Danger of injury and material damage from falling or movements

In case of improper installation of the robot controller it may move unexpectedly or fall down (see the figure below: "Attaching the robot control").

- ▶ Secure the position of the robot controller after setting up.
- ▶ Fasten the robot controller to the ground or slot.
- ▶ Use the screw holes on the underside of the robot controller.

1.7.4.4 Safety in the work area

⚠ WARNING!

Risk of injury from movements of the robot

To ensure safety, enforce the following precautions:

- ▶ Install a safeguarding.
- ▶ Post a warning sign stating **"Off-limits During Operation"** at the entrance of the enclosure.
- ▶ The gate of the barrier must be equipped with a safety interlock.
- ▶ Make sure the interlock operates correctly before operation.

⚠ CAUTION!

Risk of injury from collisions of objects or equipment

Do not store items and equipment near the robot and robot control.

- ▶ Keep the tools at appropriate locations outside the barrier.
- ▶ Keep the equipment at appropriate locations outside the barrier.
- ▶ Tools and loose equipment must not be deposited on the floor around the robot, robot controller and other components.

1.7.4.5 Operating safety

⚠ DANGER!

Death and fire hazard caused by short circuiting

Switching on the power supply during tool installation may result in electric shock.

- ▶ Before fixing a tool (e.g. welding torch), make sure the power supply to the robot controller is turned off.
- ▶ Lock the switch, and display a warning sign.
- ▶ Never exceed the rated capacity of the robot (the robot capacity can be found in the "Technical Data" section of this manual).

⚠ WARNING!

Danger of injury and material damage caused by unforeseen movements of the robot

If possible, teach JOBs from outside the robot's maximum work area.

Take the following precautions when performing teaching operations within the robot's operating range:

- ▶ Always view the robot from the front.
- ▶ Always follow the prescribed operating steps.
- ▶ Always have an escape plan in mind in case the robot comes toward you unexpectedly.
- ▶ There must be a free space to which the operator can retreat in the event of an emergency.

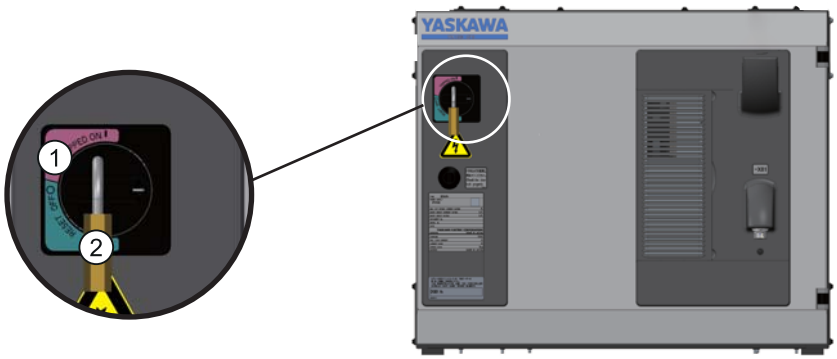


Fig. 1-6: Secure the robot controller with a padlock

① "OFF" position ② Padlock

Emergency stop function

The emergency stop circuits are designed according to category 1 (EN 418 item 4.1.5) Using power to the servo motor to achieve the stop and then removal of power when stop is achieved. If stop is not achieved after 0.8 seconds, mechanical brakes are engaged automatically to support stopping.

1.8 Manufacturer

Address:

YASKAWA ELECTRIC CORPORATION

2-1 KUROSAKISHIROISHI

YAHATANISHI-KU

KITAKYUSHU

JAPAN

1.9 Authorized representative

Address:

YASKAWA Europe GmbH

Robotics Division

Yaskawastr. 1

85391 Allershausen

Germany

2 Supply

2.1 Checking the scope of delivery

The standard delivery includes the following items:

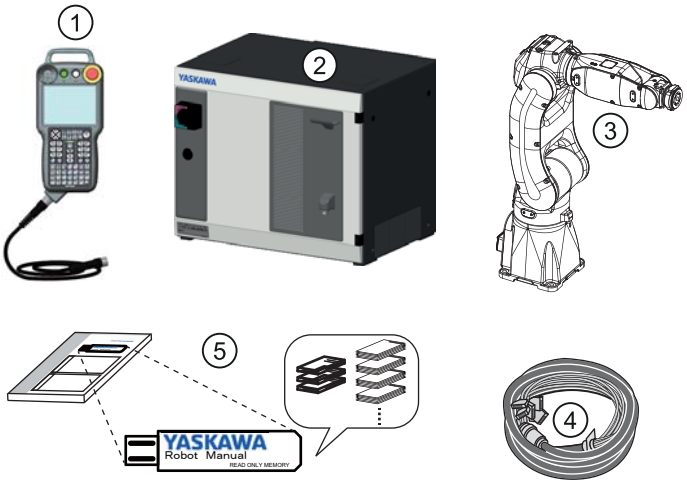


Fig. 2-1: Scope of delivery

① Programming pendant
② Robot controller
③ Robot
④ Cable
⑤ The present assembly instructions

2.2 Position type plate

Verify whether the serial number of the robot, the robot controller and the programming pendant with the delivery.

The serial number can be found on the type plate as shown below.

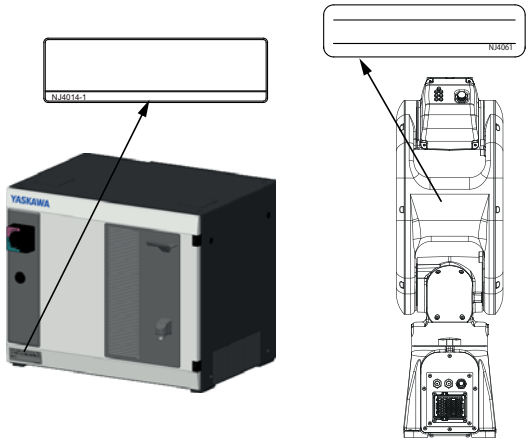


Fig. 2-2: Position type plate

NOTICE

Please contact the local YASKAWA branch office if the serial numbers do not match the information on the delivery note.

3 Transportation

⚠ CAUTION!

Personal injury or damage to property

The system consists of precision components. If this precaution is not taken, performance may be impaired.

- A crane or forklift may only be operated by authorized personnel. The same applies to the use of slings.
- Avoid strong vibrations or impacts during transportation.
- No external forces may be exerted on the robot controller, on the robot or on other components.

3.1 Transporting method

3.1.1 Using a crane

Adequate load handling devices must be used to transport the robot controller. Make sure that the robot controller is lifted as shown in the diagram "Transport by crane" below.

Fig. 3-1: Transport using a crane

3.1.2 Using a lifting truck

⚠ CAUTION!

Personal injury and material damage during transport

- ▶ Avoid jarring, dropping, or hitting the controller during handling.
- ▶ Excessive vibration or impacting the robot controller may adversely affect the performance of the robot controller.
- ▶ Lift, move, or install the robot controller by two or more persons.
- ▶ Use a lifting truck to carry the robot controller.

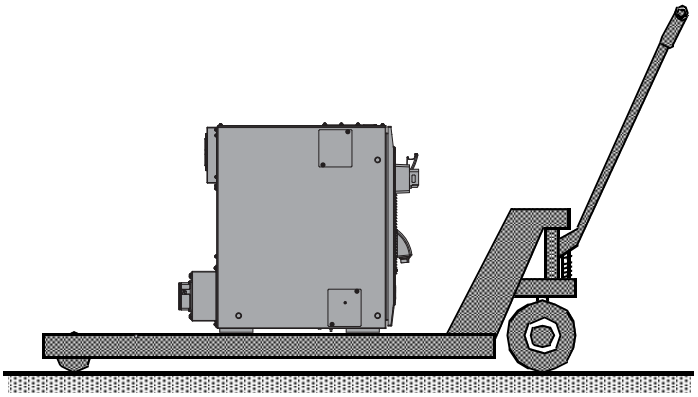


Fig. 3-2: Using a lifting truck

4 Assembly and installation

⚠ CAUTION!

Personal injury and damage to property

The following precautions must be taken.

- ▶ Check that the robot controller is complete and not damaged.
- ▶ Do not put into operation a robot controller that is damaged or incomplete.
- ▶ Check that all transport safety devices and transport screws have been removed.

4.1 Protection measures

⚠ DANGER!

Personal injury and material damage

The robot system must not be operated without protective devices. Starting up without appropriate protective measures can lead to death of people, serious bodily harm or material damage.

Implement the following protection measures

- ▶ Separating protection devices
- ▶ Non-contact protection devices
- ▶ Enclosures
- ▶ Marked areas
- ▶ Signs
- ▶ Emergency Stop button
- ▶ Display elements

NOTICE

Operator's responsibility

The operator of a robot or a robot system must ensure that all specifications and requirements of the standards DIN EN ISO 10218-1 and DIN EN ISO 10218-2 are met.

In the first instance, the following must be observed:

- ▶ Preparing a risk assessment
- ▶ The installation of protective devices
- ▶ Regular training of the employees
- ▶ Regular inspection of all protective devices
- ▶ Checking for compliance with intended use

4.2 Ambient conditions and installation location

A robot controller may only be installed in the following ambient conditions:

- Air humidity: 10% to 90% relative humidity (without condensation).
- Must be as dust-free, clean and dry as possible.
- Free of corrosive or explosive gases or liquids
- Protected against strong shocks (acceleration shock: max. 4.9 m/s² [0,5 G]).
- There must be no significant electromagnetic interference (plasma).
- Must be protected against collisions with moving equipment such as forklifts.
- Install the controller in a location where the robot is easily visible.
- Install the controller in a location where you can easily see whether the door is open.
- It is recommended that there is clearance of at least 500 mm around the controller of at least 500 mm to allow access for maintenance work. The minimum clearance at the rear of the controller is 200 mm to ensure proper cooling.
- Must comply with the requirements of Directive 2004/108/EC on electromagnetic compatibility.

Place of installation (above sea level)	Maximum ambient temperature
Up to 1000 m[1]	0° C to 45° C
maximum 2000 m[2]	0° C to 40° C

1. During transport at -10 ° C to 60 ° C, the temperature change must not exceed 0.3 ° C / min.

2. At a height of more than 1000 m, the ambient temperature is 1% per 100 m.

4.3 Installation options

⚠ WARNING!

Personal injury and damage to property

The following precautions must be taken.

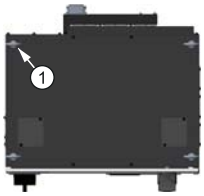
▶ Keep the robot controller lifted by the crane until the robot controller is stacked and fixed securely.

It is possible to stack the YRC1000 controllers.

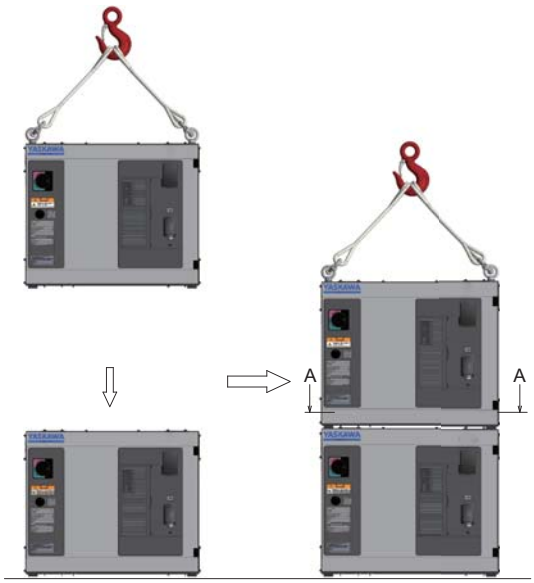
Follow the procedures below when stacking the YRC1000 controllers.

1. Remove the four eyebolts (4 places) on the top of the YRC1000 to be stacked lower level.

① 4 x 12 eyebolts



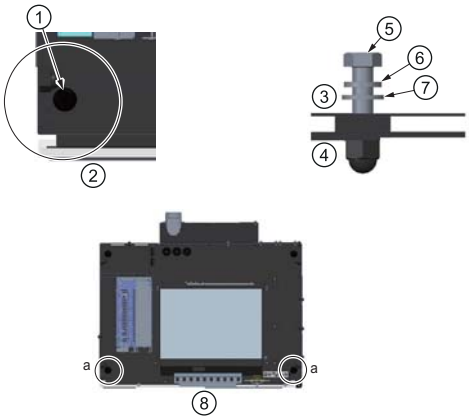
2. Lift the controller by using the crane, and stack the controllers. Refer to chapter 3.1.1 "Using a crane"", when using the crane.



3. After stacking the controllers, remove the grommets inside (A-A section “a” part) of the upper controller. Install the M12 x 35 bolts, spring washers and washers for temporally.

① 2 x Grommet
② "a" enlarged view
③ Robot controller (upper)
④ Robot controller (lower)
⑤ M12 x 35
⑥ Spring washer
⑦ Washer
⑧ A-A Section view

All dimensions in mm



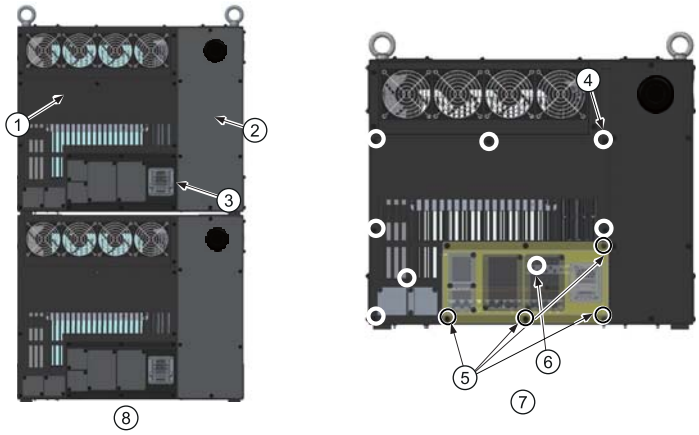
4. Remove the back board and the plate on the back of the upper controller. When remove the back board, remove the connector cover which fixed with the back board together.

   A fixing screw for the back board is also on the inside of connector cover. Refer to the following figure and remove the fixing screw.

NOTICE

Damage to the cables

- Removing the back board from the robot controller must be performed by two operators, and make sure that one of operators keep holding the removed back board with due care to prevent damage to the internal cables.



① Backboard

② Plate

③ Connector cover

④ Fixing screws for back board (8 screws)

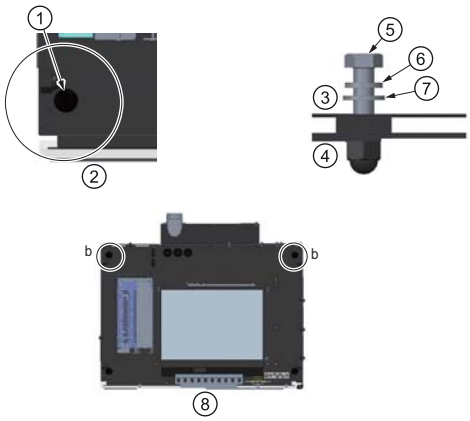
⑤ Fixing screws for back board and connector cover (4 screws)

⑥ Fixing screw for back board of inside connector cover (1 screws)

⑦ Details of fixing screws on back board

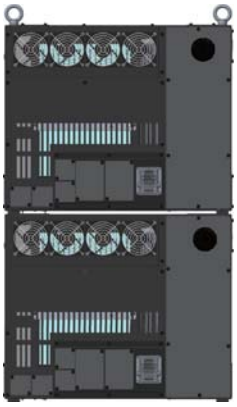
⑧ Back view

5. After stacking the controllers, remove the grommets inside (A-A section “b” part) of the upper controller. Install the M12 x 35 screws, spring washers and washers for temporally.



6. After confirming the stacking the controllers, tighten the temporally 4 x M12 bolts firmly (a, b part, tightening torque: 4.2 Nm).
7. Reinstall the removed back board and plate at procedure No.4.

8. Remove the wire lifting the controller by the crane, and stacking is completed.



4.4 Installation example

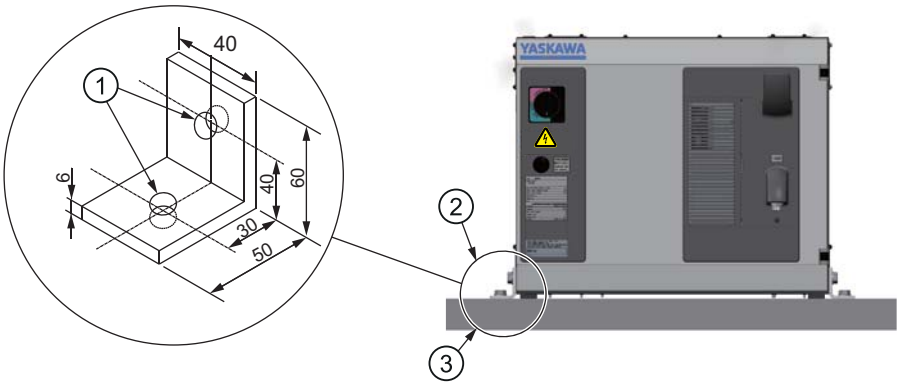


Fig. 4-1: Fixing the robot controller

① 2 holes Ø 14

② Tapped holes to M12 screws

③ Screws for the robot controller M12 x 20 (Maximum screw-in depth 14 mm, tightening torque 45 Nm), recommended plate thickness 6 mm

5 Wiring

DANGER!

Death from electrical shock, risk of fire due to short circuit.

Wiring must be performed by authorized or certified personnel.

Failure to ground equipment may result in fire or electric shock.

Capacitors inside the robot controller store electricity after power is turned OFF. Exercise caution whenever handling circuit boards.

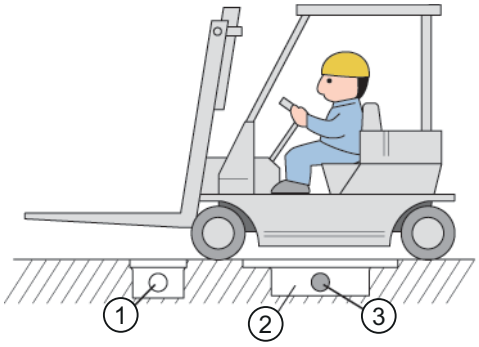
Loose power circuit wires can cause fire and electric shock.

Incorrect wiring may cause fire and electric shock.

- ▶ Make sure that the earthing resistance does not exceed 0.1 Ω.
- ▶ Turn OFF the main power supply.
- ▶ Attach the required warning sign, e.g. **"Do not energize!"**
- ▶ Install a switch-on guard as prescribed.
- ▶ Do not touch any board inside the controller for five minutes after turning OFF the power supply.
- ▶ Power cannot be turned ON unless the door is closed. Interlocks prevent power from being turned ON.
- ▶ Any occurrence during wiring while the robot controller is in the emergency stop mode is the user's responsibility. Do an operation check once the wiring is completed.
- ▶ Wiring must be performed only by authorized personnel.
- ▶ Perform wiring in accordance with the rated capacity as specified in the Instructions.
- ▶ Be sure the power circuit screws are securely tightened.
- ▶ Do not handle the circuit board directly by hand.

5.1 Notes on cable junctions

- The cables that connect the controller to peripheral device are low voltage circuits. Keep robot controller signal cables away from the primary power circuit. High voltage power lines should not be run in parallel to controller signal cables. Use metal ducts for protection against electrical interference with the signals. If cables must be crossed, run the power cables perpendicular across the signal cables.
- Confirm the connector and cable numbers to prevent misconnection and equipment damage. One connects the manipulator and robot controller. Another connects the robot controller and peripheral device. A wrong connection can cause damage to electronic equipment.
- Clear the area of all unauthorized personnel while making cable connections. Place all cables in a covered cable channel in the floor.



① Piping
② Cable duct
③ Wire

5.2 Power supply

DANGER due to electric current!

Death from electrical shock and risk of fire due to short circuit

If the robot controller for European standards is used in Japan, an electric shock may result from increase in leakage current due to differences in power supply condition.

▶ The robot controller must be grounded.

NOTICE

If the supply voltage differs, please contact the local YASKAWA branch office.

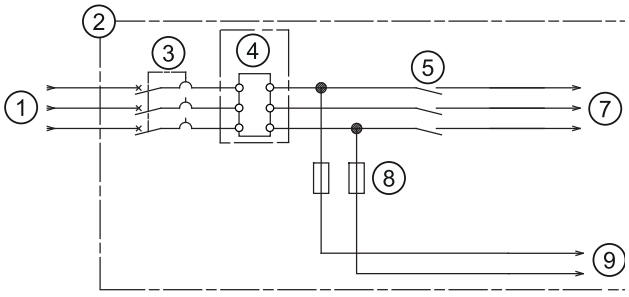
5.2.1 3-phase power supply

The three-phase power supply consists of 3-phase 380-440VAC 50/60Hz (neutral earthing).

	YRC1000 type	Power supply
For Japan	ERAR-1000-xxxxxxx-A0x	3-phase 200 to 240 VAC (+10% to -15%) at 50/60 Hz (±2%)
For Asia	ERAR-1000-xxxxxxx-A1x	3-phase 380 to 440 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing)
For Europe	ERAR-1000-xxxxxxx-E1x	
For North America	ERAR-1000-xxxxxxx-B1x	3-phase 380 to 480 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing)

A specification of connectable power supply differs depending on the controller type. Confirm the specification of power supply corresponding to the controller's model by the rated label on the door of YRC1000.

① 3-phase power supply
② Robot controller
③ Breaker
④ Noise filter
⑤ Contactor (1KM)
⑥ To converter
⑦ Fuse
⑧ To control power supply unit



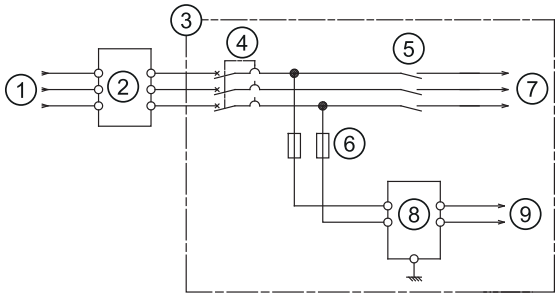
5.2.2 Leakage breaker installation

When connecting the leakage breaker to the controller power supply wiring, use a leakage breaker which can handle high frequencies from the YRC1000 inverter. Leakage breakers which cannot handle high frequencies may malfunction.

Even with a leakage breaker installed, there is still a possibility of some high frequency current leakage from the YRC1000. However, this current leakage presents no safety risks.

① 3-phase power supply
② Leakage Breaker
③ Robot controller
④ Breaker
⑤ Contactor (1KM)
⑥ To connector
⑦ Fuse
⑧ Noise filter
⑨ To controller power supply unit

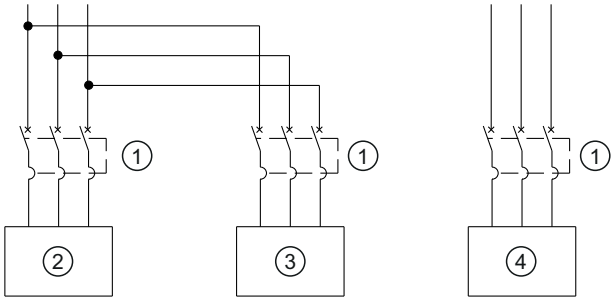
Connection of the Leakage Breaker



5.2.3 Installation of primary power supply breaker

Install the primary power supply breaker as shown.

① Breaker (protector)
② Robot controller
③ Controller for positioner
④ Power supply



Robot	Power capacity (kVA)	Cable size (Size of terminal) (In case of Cabtyre cable (three cores) (mm²)	Capacity of breaker in robot controller (A)
GP7	1.0	3.5 (M5)	15
AR900	1.0	3.5 (M5)	15
GP8	1.0	3.5 (M5)	15
AR700	1.0	3.5 (M5)	15
GP12	1.5	3.5 (M5)	15
AR1440	1.5	3.5 (M5)	15
GP25	2.0	3.5 (M5)	15
AR1700	2.0	3.5 (M5)	15

Tab. 5-1: YRC1000 Power capacity, cable sizes, and breaker capacities

The maximum load value (payload, operation speed, and frequency, etc.) is displayed.

However, the power capacity is different depending on work conditions.

Inquire at the nearest branch office listed on the back cover for information when selecting the transformer.

NOTICE

The power capacity shown above is the continuous rating value.

When the robot is rapidly accelerated, the power capacity of several times the continuous rating value may be needed instantly.

The power capacity is changed when using an external axis.

For details of the power capacity with an external axis, please contact to your YASKAWA representative or check the rated value name plate on the controller.

5.3 Connection methods

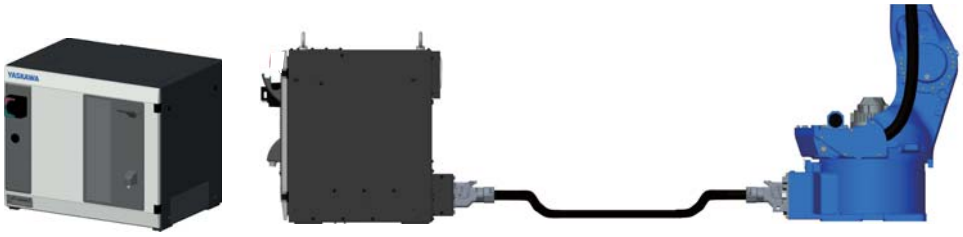


Fig. 5-1: Connecting the robot system

5.3.1 Connection to primary power supply

× Before you turn on the main power supply, first connect all other cables which are needed such as the cables between robot and robot controller.

NOTICE

▶ The grounding inside the robot controller is factory assembled (maximum grounding resistance of 0.1 Ω).

1. Turn the main switch to the OFF position.

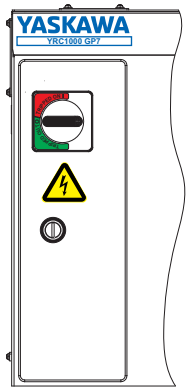
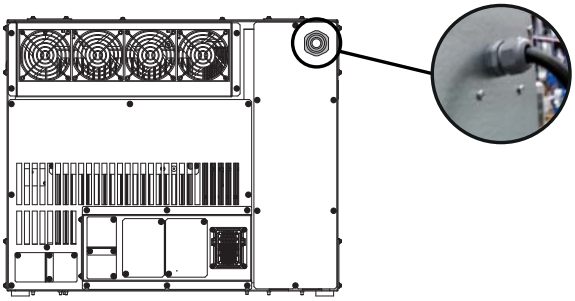
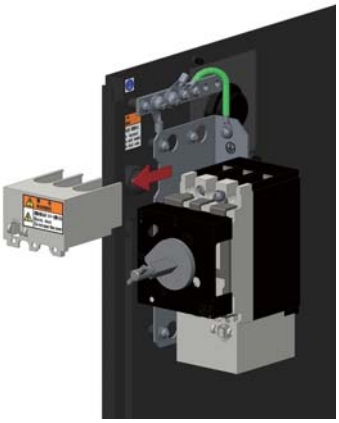


Fig. 5-2: Main switch in OFF position

2. Open the front door of the YRC1000.
3. Connect the primary power supply cable.



4. Pull off the primary cover of the switch which is on the upper left side of the YRC1000.



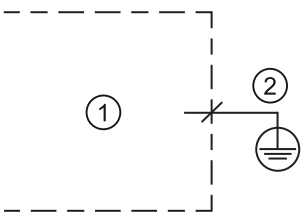
5. Connect a ground wire to reduce noise and prevent electric shock.
   Connect the ground wire to the ground terminal (screw) which is on the upper left side of YRC1000.

① Grounding terminal (M6 screws) ② Grounding wire

Perform grounding in accordance with all relevant local and national electrical codes. The size of ground wire must the same as listed on table Tab. 5-1: "YRC1000 Power capacity, cable sizes, and breaker capacities"".

① Robot controller

② Maximum earthing resistance of 0.1Ω to DIN EN ISO 60204-1



NOTICE

Observe also local regulations.

6. Connect the primary power supply cable.

7. Install the cover.
8. Close the YRC1000 door.

5.3.2 Connection of the robot controller

DANGER due to electric current!

Danger to life due to electric shock!

Danger to life and serious injuries caused by high voltage.

▶ Before carrying out the wiring, ensure that the door of the robot controller is in principle closed.

NOTICE

▶ Before you connect the robot cable to the robot, ensure that the plug connection fits together.

1. Connect the robot cable to the connector on the back side of the robot controller.

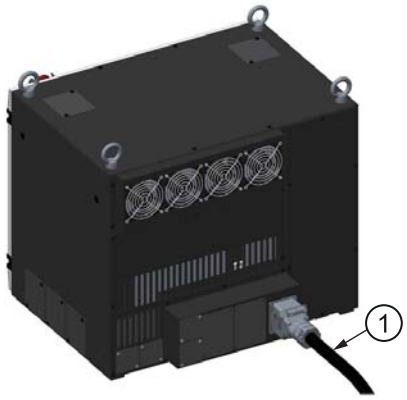


Fig. 5-3: Connection of the robot cable

① Robot cable

5.3.3 Connecting the programming pendant

Connect the programming pendant cable to the connection (X81) (see diagram "Connecting the programming pendant").

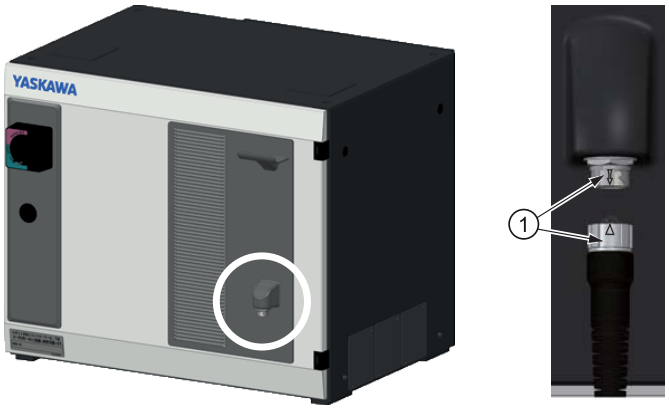


Fig. 5-4: Connection programming pendant

① Alignment marks

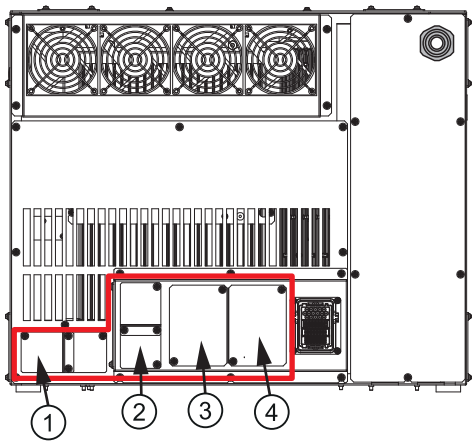
5.3.4 User I/O cable connection

User can choose one I/O cable connection method out of following three ways.

Connect user I/O signal to I/O terminal blocks (Material-No. 105507) that are connected to general-purpose I/O board (JANCD-AIO0□-E)	User connects general-purpose I/O signal through terminal blocks (Material-No. 105507), that are mounted at the back side of the controller's front door.
Connect safety plug and system external signal for external emergency stop, etc. to safety terminal block board (IM-YE250/5-80P)	Connect safety plug and system external signal for external emergency stop, etc. to safety terminal block board which is mounted on the back side of the controller's front door.
Directly connect user I/O signal to general-purpose I/O board (JANCD-AIO0□-E)	User connects user I/O signal to general-purpose I/O board (JANCD-AIO0□-E) directly.

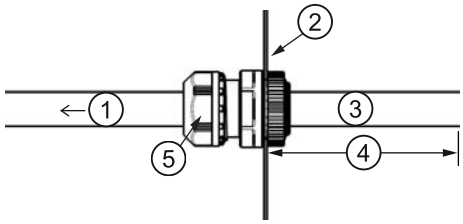
1. Remove covering plates from I/O cable openings on the back side panel of the controller.

① Reserved for Conveyor in the low budget version
② 24 DC and the bus connection in the low budget version
③ Cable set B in the low budget version
④ Cable set A in the low budget version



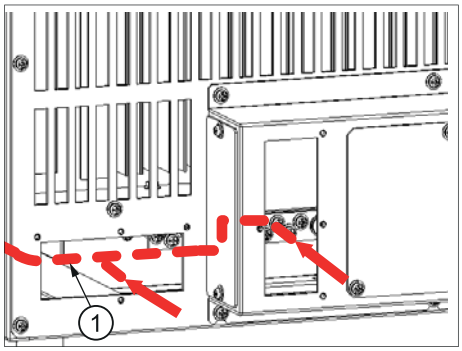
2. Make a hole on each covering plate and run the user I/O cable.
   Use a cable gland, etc. to prevent any particles from getting inside the robot controller.
   For the drawing length of the cable, the table in the next page since it varies depending on the connecting part.
3. After running the cable through the I/O cable opening, set the covering plate back to the original position.

① To user device
② Cover
③ I/O cable
④ I/O cable drawing length
⑤ Sealing plug



Connect user I/O signal to I/O terminal blocks (Material-No.: 105507) connected to general-purpose I/O board (JANCD-AIO0□-E)	Drawing length: 1.5m	Cable terminal process: Unshielded (Refer to Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)” in chapter 8.15 "General purpose I/O board").
Connect safety plug and system external signal for external emergency stop, etc. to safety terminal block board (IM-YE250/5-80P)	Drawing length: 1.3m (Cable length for terminal processing is included).	Cable terminal process: Unshielded Refer to “Wiring Procedure of the Terminal Block” in chapter: 8.7 "Safety Terminal Block Board (IM-YE250/5-80P)").
Directly connect user I/O signal to general-purpose I/O board (JANCD-AIO0□-E)	Drawing length: 1.0m (Cable length for terminal processing is included)	Cable terminal process: Connector (Refer to Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)” in chapter 8.15 "General purpose I/O board").

4. Draw the user system external signal cable and general-purpose I/O signal cable from the cable openings to the front part of the controller along its right side.



① Run the cabel through the front side of the robot controller.

5. Run the general-purpose I/O signal cable through the I/O terminal block as shown by the red line in the figure below.

NOTICE

For the details of the connection, refer to “Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)” in chapter 8.15 "General purpose I/O board".

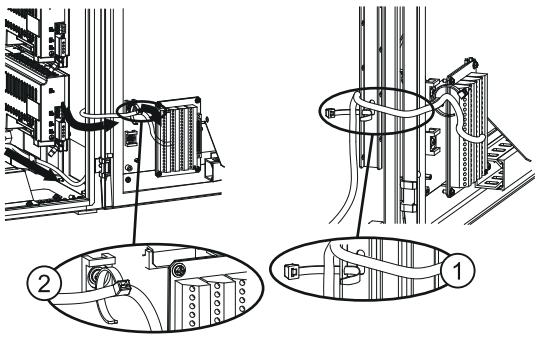
6. Run the system external signal cables such as the safety I/O signals through the safety terminal block board (IM-YE250/5-80P) as shown by the red line in the figure below.

NOTICE

For the details of the connection, refer to “Wiring Procedure of the Terminal Block” in chapter 8.7 "Safety Terminal Block Board (IM-YE250/5-80P)".

① Fixing on the door side

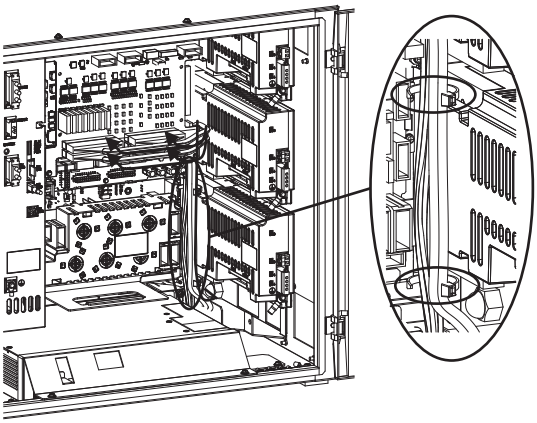
② Fixing on the right side



7. Run the general-purpose I/O signal cables through the general-purpose I/O board (JANCD-AIO0□-E) as shown by the red line in the figure below.

NOTICE

For the details of the connection, refer to “Wiring Procedure of the Terminal Block” in chapter 8.15 "General purpose I/O board"”



Fix the cable on the door and right side by using the cable ties as the figure.

Note the following two points:

- No tension is found to the cables when the door is fully opened (Cable length between fixing part of the door side and the right side: approximately 150 mm).
- Be careful not to get stuck the cables between the main body of the controller and its door when the door is closed.

6 Maintenance and inspection

6.1 Periodic inspection

DANGER!

Death from electrical shock, risk of injury and fire due to short circuit

▶ Do not touch the cooling fan or other equipment while the power is turned ON.

Carry out the following inspections.

Failure to perform the following inspections may adversely affect the performance of YRC1000, shorten the life of YRC1000, or cause the unexpected accidents.

Components	Inspection	Method	Inspection frequency
Robot controller	Check that the casing is completely closed and not damaged.	Visual inspection	Daily
	Check for gaps or damage to the sealed construction.	Visual inspection	Monthly
Backside duct fan and fan for the heat exchanger	Check operation (While power ON)	Visual inspection	Monthly
Enable switch	Check operation (In TEACH mode)	Visual inspection	When using
Battery	Confirm battery alarm or message is displayed or not.		When an alarm occurs
Power supply	Check power supply voltage is normal.	Visual inspection	Before using
Circuit breaker lead cables	Confirm that the lead cables are not falling out, loosing or breaking. Check the line voltage.	Visual inspection	Before using
Power cable	Check for damage and deterioration of leads.	Visual inspection	Daily
Heat exchanger filter	Confirm that no filter clogging or dirt.	Visual inspection	Monthly

6.2 Cooling fan inspections

Before the Cooling Fan Inspections

In principle, the door must not be opened to prevent electric shock while power is on. However, it is required to open the door if the cooling fan must be inspected. Exercise extreme care in this case.

⚠ DANGER!

Death from electrical shock, risk of injury and fire due to short circuit

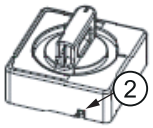
To perform this maintenance operation, the door of the YRC1000 must be opened while the power is ON.

- ▶ Since a high voltage (200 to 480 VAC) is applied inside the YRC1000, do not touch any unit in the YRC1000.
- ▶ Close the door of the YRC1000 immediately after completing a maintenance operation such as an inspection of the cooling fan.

<How to Open and Close the Door>

- Door lock mechanism
  The door of the YRC1000 cannot be opened at the ON or TRIPPED position because it is locked at these positions.
  Note that even at the ON or TRIPPED position, the door of the YRC1000 can be opened by pressing the release in the direction of the arrow by using a tool (3 mm wide, 1.8 mm thick).

① Release



NOTICE

Inspect the cooling fans as required. A defective fan can cause the YRC1000 to malfunction because of excessive high temperatures inside if the cooling fans and the heat exchanger do not operate efficiently.

The heat exchanger normally operate while the power is tuned ON, and the backside duct fan normally operate while the servo power is turned ON. Check if the fans are operating correctly by visual inspection and by feeling air moving into the air intake and from the outlet.

Clean the air outlet and air intake of plastic panel on the front door of YRC1000 as required.

Please use a diluted neutral detergent to prevent damaging the plastic panel when cleaning.

Inspect the cooling fans as required. A defective fan can cause the YRC1000 to malfunction because of excessive high temperatures inside if the cooling fans and the heat exchanger do not operate efficiently.

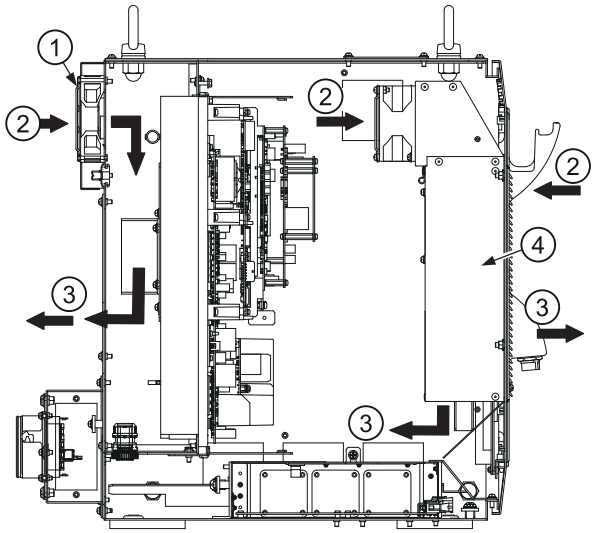
The heat exchanger normally operate while the power is tuned ON, and the backside duct fan normally operate while the servo power is turned ON. Check if the fans are operating correctly by visual inspection and by feeling air moving into the air intake and from the outlet.

Clean the air outlet and air intake of plastic panel on the front door of YRC1000 as required.

Please use a diluted neutral detergent to prevent damaging the plastic panel when cleaning.

Cooling system

① Backside duct fan
② Air inlet
③ Air outlet
④ Heat exchanger



NOTICE

When the message of the “Cooling fan in CPS power supply stopped. Exchange fan” is displayed, it may be caused by the error occurrence at the cooling fan (CSRA-CPS01KA) inside the control power supply unit (CSRA-CPS01KA-FN).

When the message of the “Cooling fan in CPS unit stopped, replace cooling fan” is displayed, carry out an inspection and the replacement of the cooling fan in the CPS unit as soon as possible.

6.3 Emergency Stop Button Inspections

The emergency stop button is located on the programming pendant. Before operating the robot, make sure the SERVO voltage is switched off. For this, press the emergency stop button after switching on the SERVO voltage.

6.4 Inspection of the enabling switch

NOTICE

If the [SERVO ON] lamp does not light in previous operation, check the following:

- The emergency stop button on the programming pendant is being pressed.
- The emergency stop signal was triggered by an external device.
- If a major alarm is occurring

The programing pendant is equipped with a 3-position enable switch. Perform the following operation to confirm the enable switch operates.

1. Set the mode switch with key on the programming pendant to "TEACH".

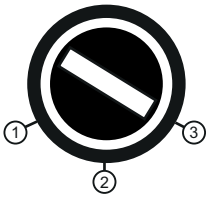


Fig. 6-1: Enabling device

① REMOTE
② PLAY
③ TEACH

2. Press [SERVO ON READY] on the programming pendant. The [SERVO ON] lamp will flashes.

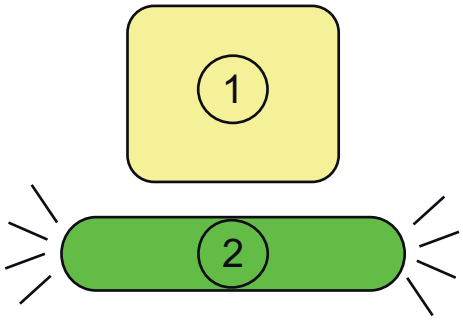


Fig. 6-2: Flashing light SERVO ON

① SERVO ON reading
② SERVO ON (flashing light)

3. When the enable switch is grasped lightly, the SERVO power is turned ON.
   When the enable switch is grasped firmly or released, the SERVO power is turned OFF.

6.5 Check battery unit

The robot controller has a battery unit that backs up the important program files for user data in the CMOS memory.

A battery alarm indicates when a battery has expired and must be replaced. The programming pendant display and the message "Memory battery weak" appears at the bottom of the display.

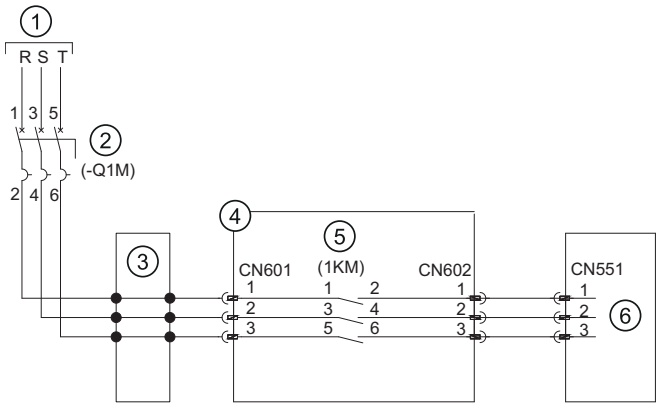
Check that the message is NOT displayed on the programming pendant.

The way to replace the battery is described (See „Maintenance manual“ with the document no.: E1102000215XX01* and higher in chapter „Replacing the battery“.

6.6 Check the phase

Check item	Contents
Lead Cable Check	Confirm if the lead cable for the power supply is wired as shown in the following without any falling out, looseness or breaking from the connecting part.
Input Power Supply Check	Check the line voltage of the input power supply by using an electric tester. The specification of power supply differs depending on the type of YRC1000. Confirm the specification of power supply by referring to the rating label on the door of YRC1000 (Normal value: 380 to 440 VAC (+10%, -15%), (neutral grounding)).
Circuit Breaker (-Q1M) Check	Turn ON the breaker and check the line voltage of “2, 4, 6” of the circuit breaker (-Q1M) by using an electric tester. If abnormal, replace the circuit breaker (-Q1M).

① 3-phase
② Breaker
③ Noise filter
④ Power supply unit
⑤ Contactor
⑥ Converter



7 Robot controller specification

⚠ WARNING!

Make sure that there is no one within the P-point maximum envelope of the robot and that you are in a safe place before turning ON the robot controller power.

Injury may result from collision with the robot to anyone entering the P-point maximum envelope of the robot.

- Always set the teach lock before starting teaching.
- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the robot:
  - View the robot from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the robot comes toward you unexpectedly.
  - Ensure that you have a place to retreat to in case of emergency.

Improper or unintentional robot operation can result in injury.

- Before operating the robot, check that the SERVO ON lamp goes out when the emergency stop buttons the programming pendant are pressed.

Injury or damage to machinery may result if the robot cannot be stopped in case of an emergency.

The emergency stop buttons are located on the right of the front door of the robot controller and the programming pendant.

⚠ CAUTION!

- Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in robot movement.
  - Check for damage to the insulation and sheathing of external wires.
- Always return the programming pendant to its specified position after use.

If the programming pendant is inadvertently left on the robot, fixture, or on the floor, the robot or a tool could collide with it during robot movement, possibly causing injuries or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant. After operation, the key should be removed and stored by the system manager.

Improper or unintended robot operation may result in injury.

Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.

7.1 Specification list

Controller	
Construction	Free-standing, enclose typed
Protection class	IP54 (The back fan is IP2X)
Weight	Approx. 70 kg
Dimension (W x H x D) in mm	598 x 490 x 427 (excluding protrusions)
Cooling system	Indirect cooling
Power supply	3-phase 380 - 440 (+10 % to -15 %) VAC 50/60 Hz (+/- 2 %) (Neutral earthing)
SCCR	5 kA
Grounding	Grounding resistance: 0,1 Ω
Noise level	Less than 60 dB
Digital I/O	PNP General signals (standard, max.), 40 inputs and 40 outputs (Transistor: 32 outputs, relay: 8 outputs)
Positioning system	By serial communication (absolute encoder)
Drive unit	SERVOPACK for AC SERVO motors
Acceleration / Deceleration	Software SERVO control
Memory capacity	200,000 steps, 10,000 instructions
CIO ladder	Max. 20,000 steps
Safety category	Safety category 3, PL e

Ambient conditions	
Ambient temperature	0° C to + 45° C (During operation) -10° C to + 60° C (During transit and storage) Temperature change: 0.3°C/min or less
Relative humidity	10% to 90% RH (non-condensing)
Allowable altitude	1000 m or less (To use the robot controller at the altitude over 1000 m, calculate the maximum ambient temperature by decreasing it by 1 % per 100 m. The maximum allowable altitude is 2000 m. When the altitude is 2000 m, the maximum ambient temperature during operation is 40° C).
Vibration Acceleration	0.5G or less
Others	Free from corrosive gas or liquid, or explosive gas. Free from dirt, dust, cutting oil (including coolant), organic solvent, oil fume, water, salt, chemicals or anti-rust oil. Free from excessive electrical noise (plasma). Free from strong microwave, UV light, X-ray or radiation.

7.2 Function list

Programming pendant operation	
Coordinate System	• Joint • Rectangular/Cylindrical • Tool • User Coordinates
Modification of Teaching Points	• Adding • Deleting • Correcting (Robot axes and external axes respectively can be corrected)
Inching Operation	Possible
Path Confirmation	• Forward/Reverse step • Continuous feeding
Speed Adjustment	Fine adjustment possible during operating or pausing
Timer Setting	Possible every 0.01 s
Short-cut Function	Direct-open function, Multi-window
Interface	• SD card slot • USB port (USB2.0) (At Programming Pendant)
Application	• Arc welding • Spot welding • Handling • Press tending • Cutting • Others
Essential Measures	JIS (Japanese Industrial Standard)
Running Speed Limit	User definable
Enable Switch	3 position type. SERVO power can be turned on at the middle position only. (Located on programming pendant)
Collision proof Frames	S-axis frame (doughnut-sector) Cubic frame
Self-Diagnosis	Classifies error and two types of alarms (major and minor) and displays the data
User Alarm Display	Possible to display alarm messages for peripheral device
Machine Lock	Test-run of peripheral devices without robot motion
Door Interlock	A door can be opened only when a circuit breaker is OFF.
Operation Time Display	• Control power-on time • SERVO power-on time • PLAYBACK time • Operation time • Work time

Programming pendant operation	
Alarm Display	• Alarm message • Troubleshooting • Previous alarm records
I/O Diagnosis	Simulated enabled/disabled output possible
T.C.P. Calibration	Automatically calibrates parameters for end effectors using a master positioner
Programming Type	Interactive programming
Language	Robot language: INFORM II
Robot Motion Control	• Joint coordinates • Linear/Circular interpolations • Tool coordinates
Speed Setting	• Percentage for joint coordinates • 0.1mm/s units for interpolations • Angular velocity for T.C.P. fixed motion
Program Control Instructions	• Jumps, Calls • Timer • Robot stop • Execution of some instructions during robot motion
Operation Instructions	Preparing the operation instructions for each application Arc (ON), Arc (OFF), etc.
Variable	• Global variable • Local variable
Variable Type	• Byte type • Integer type • Double precision type • Real type • Position type • String type
I/O Instructions	• Discrete I/O • Pattern I/O processing

Safety feature	
Essential Measures	JIS (Japanese Industrial Standard)
Running Speed Limit	User definable
Enable Switch	3 position type. SERVO power can be turned on at the middle position only. (Located on programming pendant)
Collision proof Frames	S-axis frame (doughnut-sector) Cubic frame
Self-Diagnosis	Classifies error and two types of alarms (major and minor) and displays the data
User Alarm Display	Possible to display alarm messages for peripheral device
Machine Lock	Test-run of peripheral devices without robot motion

Safety feature	
Door Interlock	A door can be opened only when a circuit breaker is OFF.
Operation Time Display	• Control power-on time • SERVO power-on time • PLAYBACK time • Operation time • Work time
Alarm Display	• Alarm message • Troubleshooting • Previous alarm records
I/O Diagnosis	Simulated enabled/disabled output possible
T.C.P. Calibration	Automatically calibrates parameters for end effectors using a master positioner
Programming Type	Interactive programming
Language	Robot language: INFORM II
Robot Motion Control	• Joint coordinates • Linear/Circular interpolations • Tool coordinates
Speed Setting	• Percentage for joint coordinates • 0.1mm/s units for interpolations • Angular velocity for T.C.P. fixed motion
Program Control Instructions	• Jumps, Calls • Timer • Robot stop • Execution of some instructions during robot motion
Operation Instructions	Preparing the operation instructions for each application Arc (ON), Arc (OFF), etc.
Variable	• Global variable • Local variable
Variable Type	• Byte type • Integer type • Double precision type • Real type • Position type • String type
I/O Instructions	• Discrete I/O • Pattern I/O processing

Maintenance function	
Operation Time Display	• Control power-on time • SERVO power-on time • PLAYBACK time • Operation time • Work time
Alarm Display	• Alarm message • Troubleshooting • Previous alarm records
I/O Diagnosis	Simulated enabled/disabled output possible
T.C.P. Calibration	Automatically calibrates parameters for end effectors using a master positioner

Programing function	
Programming Type	Interactive programming
Language	Robot language: INFORM II
Robot Motion Control	• Joint coordinates • Linear/Circular interpolations • Tool coordinates
Speed Setting	• Percentage for joint coordinates • 0.1mm/s units for interpolations • Angular velocity for T.C.P. fixed motion
Program Control Instructions	• Jumps • Calls • Timer • Robot stop • Execution of some instructions during robot motion
Operation Instructions	Preparing the operation instructions for each application Arc (ON), Arc (OFF), etc.
Variable	• Global variable • Local variable
Variable Type	• Byte type • Integer type • Double precision type • Real type • Position type • String type
I/O Instructions	• Discrete I/O • Pattern I/O processing

7.3 Programming Pendant

Type	JZRCR-YPP03-1 or JZRCR-YPP13-1
Material	Reinforced plastic housing with removable straps.
Dimensions W x H x D in mm	169 x 314.5 x 50 mm (without protruding parts)
Material	Reinforced Plastic
Displayed unit	TFT colour liquid crystal display, VGA (640 × 480)
	Touch Panel
Operating modes	• 3-step enabling button, START key, HOLD key and Key switch (with key, three modes) • Key for the key switch AS6-SK-132 (manufacturer: IDEC Corp.) * The programming pendant is supplied together with two keys.
IEC protection class	IP65
Length of cable	Standard: 8 m, Max.: 20 m (option)
Miscellaneous	• Equipped with a slot opening for CompactFlash card • USB port (USB1.1) x 1
Key sheet	General (1 sheet only)

Typ	JZRCR-APP01-1
Material	Reinforced plastic
Dimensions W x H x D in mm	152 x 299 x 53 (excluding protrusions)
Mass	0,730 kg
Protection class	IP54
Displayed unit	640 x 480 pixels color LCD (Alphanumeric characters, Chinese characters, Japanese letters, etc.)
	Touch Panel
Operating modes	Select keys Axis keys Numerical/application keys Mode select switch with a key (mode: TEACH, PLAY, and REMOTE) Emergency stop button Enable switch SD card slot (1 port) USB port (1 port)
IEC protection class	IP54
Length of cable	Standard: 8m, Max: 36m (optional)
Interface	Provided with SD card slot (SD/SDHC/SDXC type) USB connector 1 x USB2.0
Key sheet	Arc, Spot, Material handling, Jig-less, Spot + arc

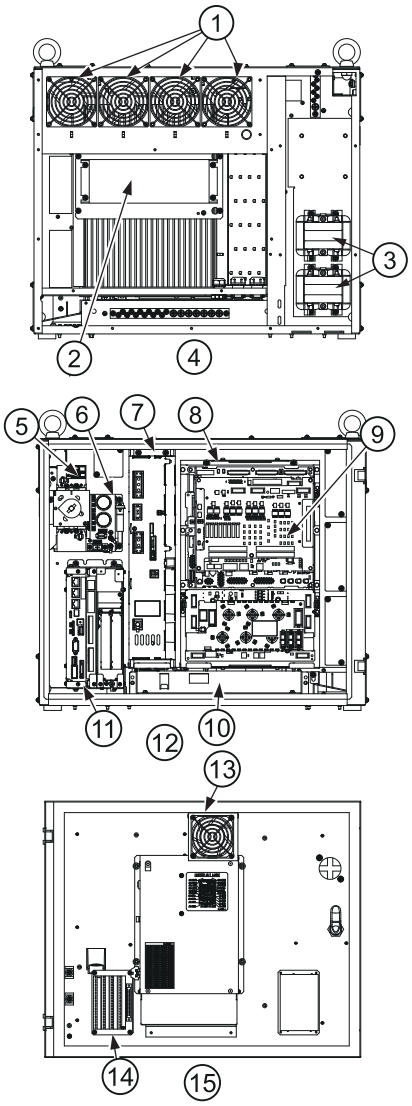
7.4 Device configuration

The robot controller is comprised of individual units and modules (circuit boards). Malfunctioning components can generally be easily repaired after a failure by replacing a unit or a module.

This section explains the configuration of the robot controller equipment.

380V to 480V AC Specification

① Backside duct fan SMVK500W260J/RO A6667
② Regenerative resistor SMVK500W7R0J/RO A6666
③ DC reactor 85R-15014A
④ Inside Controller (Back view)
⑤ Breaker
⑥ Power supply contactor unit JZRCR-APU0□-1
⑦ Converter CSRA-CV05D01A
⑧ Inverter unit CSRA-SDA□□H01A
⑨ Safety circuit board JANCD-ASF01-E
General-purpose I/O board JANCD-AIO0□-E
⑩ Control power supply unit CSRA-CPS01KA
⑪ CPU unit JZNC-ARK01-E
⑫ Inside Controller (Front view)
⑬ Heat exchanger TCMSY-310DC
⑭ Safety terminal block board IM-YE250/5-80P
⑮ Door (Inside view)



Robot model	YRC1000 controller
GP7	ERAR-1000-06VX8-E10
AR900	
GP8	
AR700	

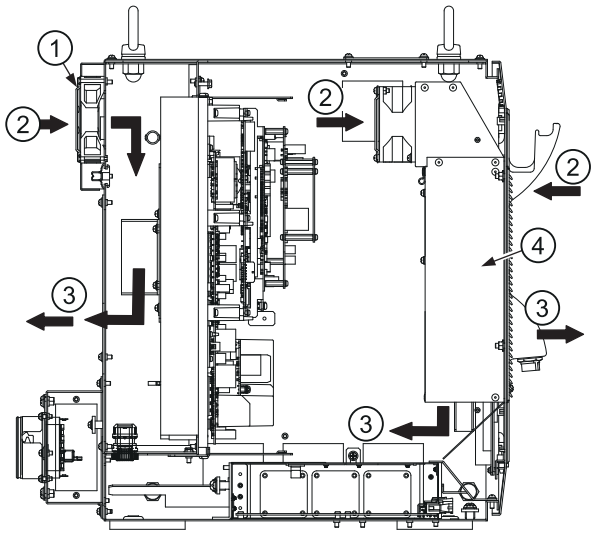
Robot model	YRC1000 controller
GP12	ERAR-1000-06VXH25-E10
AR1440	
GP25	
AR1700	

- **Cooling System of the controller interior**

The backside duct fan draws in air from the air intake and expels it from the air outlet to cool the SERVOPACK. The fan mounted inside the door circulates the air to keep temperature even throughout the interior of the robot controller. Make sure the door of the robot controller is closed when it's used to keep this cooling system effective.

Cooling system

① Backside duct fan
② Air inlet
③ Air outlet
④ Heat exchanger



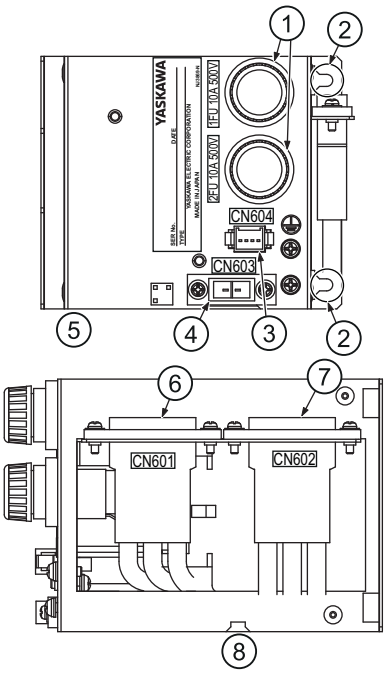
8 Description of Units and Circuit Boards

8.1 Power Supply Contactor Unit (JZRCR-APU0□-1)

The power supply contactor unit consists of the main circuit contactor. It turns the main circuit control contactor ON and OFF using the signal for the SERVO power control from the safety circuit board, and supplies power (3-phase) to the converter.

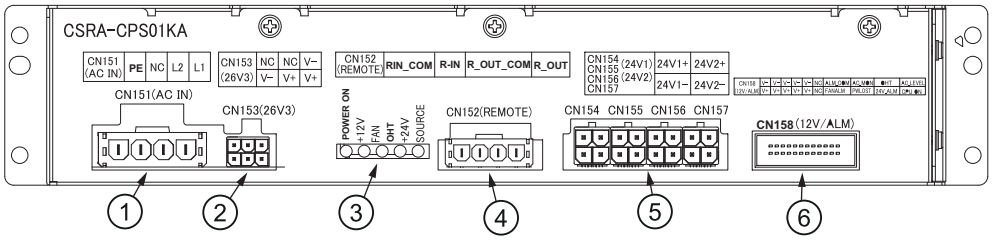
The power supply (1-phase) is supplied to the control power supply unit.

① AC control power supply fuse
② Fixing screw hole
③ Contactor control input connector
④ AC control power supply connector
⑤ Front view
⑥ Power input connector
⑦ Power output connector
⑧ Right side view



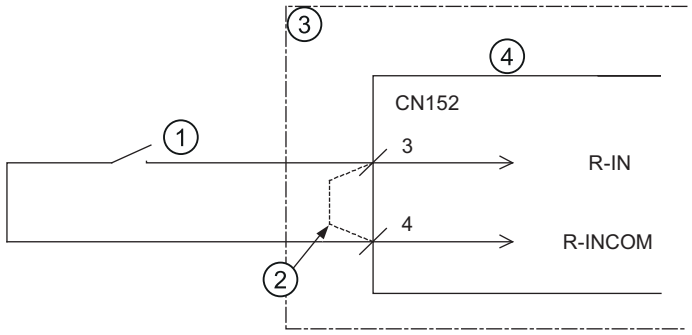
8.2 Control Power Supply Unit (CSRA-CPS01KA)

This unit (CSRA-CPS01KA) supplies the DC power (DC12V, DC24V, DC26V) for control (system, I/O, break). It is also equipped with the input function for turning the control power supply ON and OFF.



① AC input connector
② +26V3 power output connector
③ Monitor/Alarm display
④ Remote control input/output connector
⑤ +24V1/+24V2 power output connector
⑥ +12V/ALM output connector

Items	Specification		
Input	Rating input voltage:		200 to 480VAC
	Voltage Fluctuation Range:		+10% to -15% (170 to 528VAC)
	Frequency:		50/60Hz ± 2Hz (48 to 62Hz)
Output voltage	DC + 12V DC +24V (24V1: System, 24V2: I/O) DC +26V		
Indicator	**Display**	**Color**	**Status**
	POWER ON	White	Lights with +12V output (Power supply status: being output)
	+12V	Red	Lights with +12V low-voltage/over-current (ON when abnormal)
	FAN	Red	Lights when FAN error occurs.
	OHT	Red	Lights when unit interior overheats
	+24V	Red	Lights with +24V or +26V low-voltage/ over-current (ON when abnormal)
	SOURCE	White	Lights with power supply input. Lights out when internal live part completes discharge (Power supply status: being input).

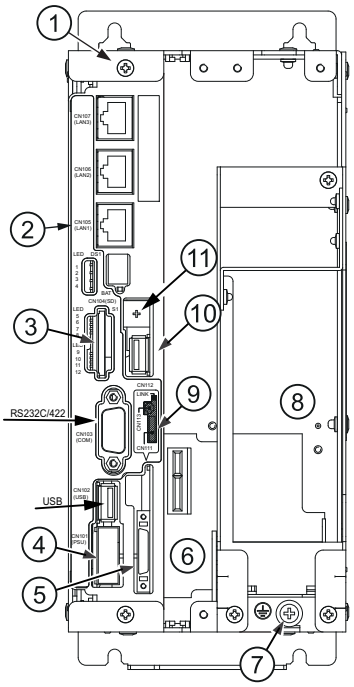
Items	Specification
Control power ON/OFF	To turn ON the YRC1000 controller power, turn ON the non-fuse breaker of the controller so that the control power supply is turned ON. If the controller is not located at the workplace, the control power supply can be turned ON/OFF by an external device, etc. after the non-fuse breaker of the controller is turned ON. It is operated by the external switch connected with CN152 of the Control power supply unit as shown in the following figure (CN152-3 and CN152-4 are short-circuited when shipment).  (1) Control Power Supply ON/OFF Switch (2) Remove the short-circuit positioner (3) YRC1000 (4) Control power supply unit (CSRA-CPS01KA) See chapter 8.16 "Assignment of universal I/O signals" for wiring of CN152 connector.

8.3 CPU Unit (JZNC-ARK01-E)

8.3.1 CPU unit configuration

CPU unit consists of circuit board racks (flame, back circuit board, PCI riser circuit board), CPU board and the robot I/F circuit board. The JZNC-ARK01-E CPU unit contains only circuit board racks and CPU boards.Be sure that it does not contain robot I/F circuit board.

① CPU board JANCD-ACP01-E
② CN105 LAN1 for programming pendant
③ SD card (CN104)
④ CPS input connector
⑤ Control communication connector (CN111)
(Communication with SERVO control board/safety circuit board)
⑥ Sensor board slot
⑦ Ground terminal
⑧ 2 PCIe Slots
⑨ Robot I/F board JANCD-AIF01-□E battery (back side)
⑩ I/O I/F (Communication with optional I/O) (CN112)
⑪ Rotary switch (S1)



8.3.2 Unit and circuit board in the CPU unit

8.3.2.1 CPU board (JANCD-ACP01-E)

This circuit board (JANCD-ACP01-E) performs to control the entire system, display to the programming pendant, control the operating keys, control operation and calculate interpolation.

8.3.2.2 Robot I/F Circuit Board (JANCD-AIF01-□E)

The robot I/F circuit board (JANCD-AIF01-□E) controls the entire robotic system. It is connected to the CPU board (JANCD-ACP01-E) with a communication connector, and to the servo control board (CSRA-SDCA01AA) with a communication cable.

NOTICE

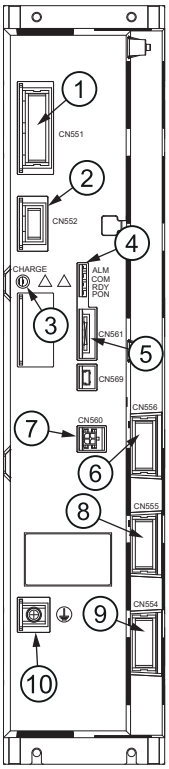
Please do not change the factory setting of S1 (Factory setting is [0]).

8.4 Converter (CSRA-CV05D01A)

The converter (CSRA-CV05D01A) exchanges the power supply supplied by the power ON unit for DC power supply and supplies the power to the inverter unit.

Input voltage:380 to 480 VAC

① Main circuit power supply input
② Regenerative resistor connection
③ Charge lamp
④ LED Monitor/alarm indicator
⑤ SERVO control board communication
⑥ Main circuit power supply output
⑦ +24V1 input
⑧ Grounding terminal

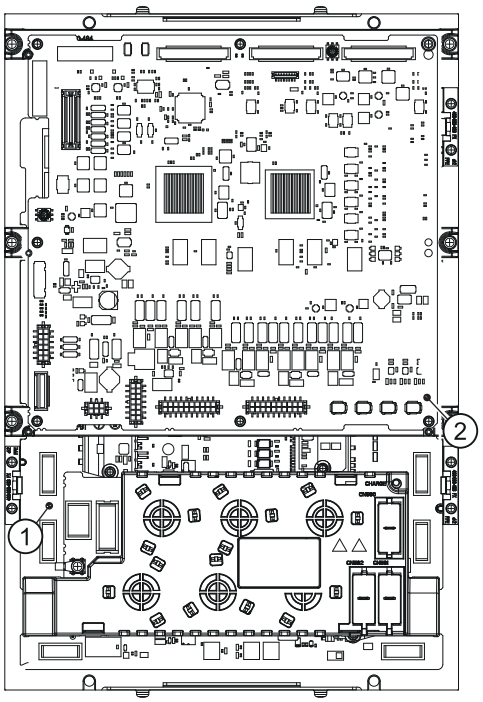


8.5 Inverter Unit (CSRA-SDA□□H01A)

8.5.1 Inverter unit configuration

The inverter unit consists of following circuit boards.

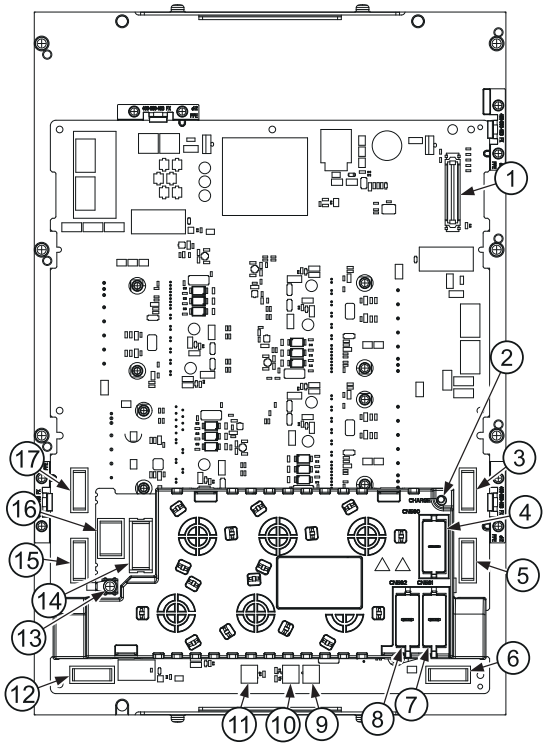
1) Inverter
2) SERVO control board (CSRA-SDCA01AA)



8.5.2 Inverter

The inverter board and capacitor board exchange the DC power supply supplied by a converter for a 3-phase motor power source and outputs to each SERVO motor.

① SERVO control board connector (CN571)
② Charge lamp
③ Motor power output 1 (CN573)
④ External axes PN output 1 (CN580)
⑤ Motor power output 3 (CN575)
⑥ Motor power output 4 (CN576)
⑦ External axes PN output 2 (CN581)
⑧ External axes PN output 3 (CN582)
⑨ Power supply output for external axes 3 (CN585)
⑩ Power supply output for external axes 2 (CN584)
⑪ Power supply output for external axes 1 (CN583)
⑫ Motor power output 5 (CN577)
⑬ Ground terminal
⑭ PN input (CN572)
⑮ Motor power output 6 (CN578)
⑯ Motor FG (CN579)
⑰ Motor power output 2 (CN574)



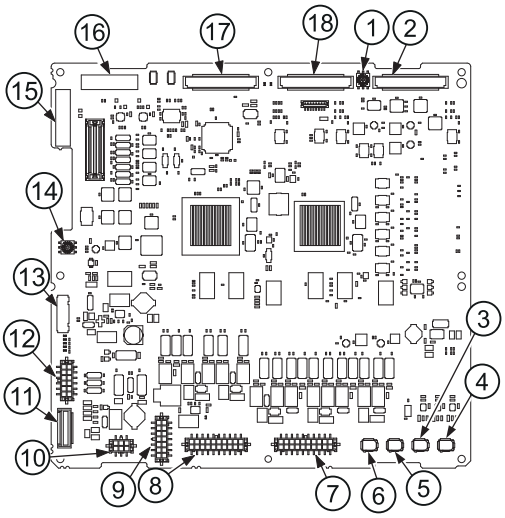
8.5.3 SERVO control board (CSRA-SDCA01AA)

The SERVO control board controls the servomotors of the robots six axes and the servomotors of the three external axes (up to nine axes).

It also controls the converter and the inverter.

The SERVO control board (CSRA-SDCA01AA) also has the following functions.

- Break power supply control circuit
- Shock sensor (shock) input circuit
- Direct-in circuit



① Rotary switch (Setting length of communication cable) (S2)
② External 3rd axis inverter I/F connector (CN533)
③ Encoder signal connector 3 (CN535)
④ Encoder signal connector 4 (CN536)
⑤ Encoder signal connector 2 (CN534)
⑥ Encoder signal connector 1 (CN508)
⑦ Handbrake release unit I/F connector (CN541)
⑧ Brake I/F connector (CN540)
⑨ External brake power supply input connector (CN543)
⑩ Brake power supply input connector (CN544)
⑪ Fan power supply connector (CN520)
⑫ Power supply input connector (CN509)
⑬ Converter I/F control connector (CN507)
⑭ Rotary switch (Setting number when operating multiple robots) (S1)
⑮ Control communication connector (CN516)
⑯ Control communication connector (CN515)
⑰ External 1st axis inverter I/F connector (CN531)
⑱ External 2nd axis inverter I/F connector (CN532)

8.6 Safety circuit board (JANCD-ASF01-E)

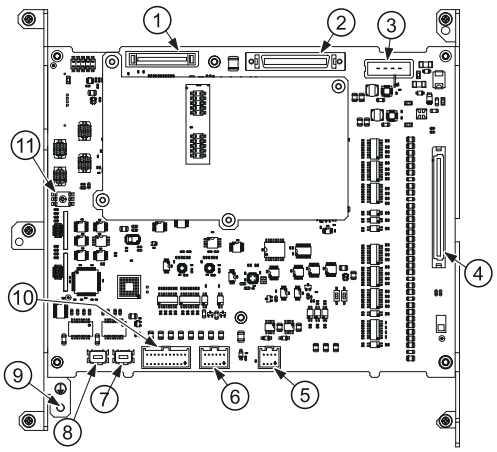
This circuit board contains dual processing circuits for safety signal and the I/O circuit for the non safe signal.

It processes external safety signals with the dual processing circuits and control ON/OFF of the main circuit control contactor of the power supply contactor unit (JZRCR-APU0□-1) according to conditions.

Followings are the main functions of Machine Safety I/O logic unit.

- System safety input circuit (dual circuits)
- User safety input circuit (dual circuits)
- User safety output circuit (dual circuits)
- Emergency stop signal input circuit (dual circuits)
- Servo power control signal output circuit (dual circuits)
- Non safe I/O circuit for the robot system
- Safety terminal block board I/F

① General-purpose I/O board I/F connector (CNAX)
② Expansion safety I/O board I/F connector (CN208)
③ Power supply input connector (CN207)
④ Terminal block board I/F connector (CN206)
⑤ Contactor control output connector (CN205)
⑥ Robot I/O connector (CN204)
⑦ I/F connector (Communication between safety circuit board when operating multiple robots) (CN202)
⑧ I/F connector (Communication between safety circuit board when operating multiple robots) (CN201)
⑨ Connection tap for the grounding
⑩ Programming pendant I/F connector (CN203)
⑪ Rotary switch (Setting number when operating multiple robots) (S1)



8.7 Safety Terminal Block Board (IM-YE250/5-80P)

The safety terminal block board (IM-YE250/5-80P) is the terminal block board to connect the external signal such as the safety I/O signals. For connection, refer to the connection diagrams for the respective unit.

NOTICE

If the length of cable between the safety terminal block board and the connected device is longer than 30m, make sure to use the shielded cable so that the electromagnetic resistant can be properly performed. Then the shield of shielded cable must come into contact with the controller's body.

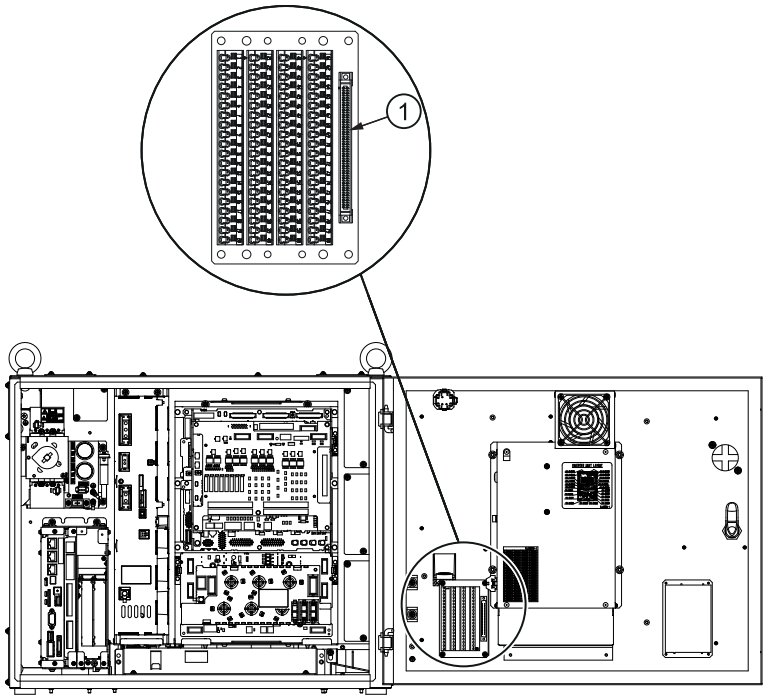


Fig. 8-1: Safety terminal block board

① Safety circuit board I/F connector (CN220)

Signal name	Connection no.:	Dual input	Function	Factory setting
SAFF_1+ SAFF_1- SAFF_2+ SAFF_2-	1 2 3 4	Applicable	Safety plug Used to turn OFF the SERVO power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is OPEN, the SERVO power turns OFF. While the signal is turned ON. The SERVO power cannot be turned ON. Note that these signals are disabled in TEACH mode.	Short-circuit with a jumper cable
EXESP_1+ EXESP_1- EXESP_2+ EXESP_2-	5 6 7 8	Applicable	External emergency stop Used to connect the emergency stop switch of an external device. If the contact is OPEN, the servo power is turned OFF and the JOB is stopped. While the signal is input, the SERVO power cannot be turned ON.	Short-circuit with a jumper cable
OT2_1+ OT2_1- OT2_2+ OT2_2-	9 10 11 12	Applicable	External axes overrun Used to input the overrun in the external axes other than the main body of the robot. If the contact is OPEN, the servo power is turned OFF and the JOB is stopped.	Open
OT3_1+ OT3_1- OT3_2+ OT3_2-	13 14 15 16			
OT4_1+ OT4_1- OT4_2+ OT4_2-	17 18 19 20			

Signal name	Connection no.:	Dual input	Function	Factory setting
ONEN1_1+	21	Applicable	SERVO ON enable	Short-circuit with a jumper cable
ONEN1_1-	22		Connected to use a function which distributes the robot system to the multiple servo systems, and turns the SERVO power ON/OFF. If the contact is OPEN, the SERVO power of corresponding system is turned OFF.	
ONEN1_2+	23			
ONEN1_2-	24			
ONEN2_1+	25			
ONEN2_1-	26			
ONEN2_2+	27			
ONEN2_2-	28			
ONEN3_1+	29			
ONEN3_1-	30			
ONEN3_2+	31			
ONEN3_2-	32			
ONEN4_1+	33			
ONEN4_1-	34			
ONEN4_2+	35			
ONEN4_2-	36			
ESPOUT1+	37	-	Emergency stop button contact output	Open
ESPOUT1-	38		Used to output a contact point of the emergency stop button on the programing pendant and the front door of the YRC1000 Control panel.	
ESPOUT2+	39			
ESPOUT2-	40			
GSIN1_1+	41	Applicable	General purpose safety input	Open
GSIN1_1-	42		The general-purpose safety output signal is used in the safety logical circuit function. Also, inputs and uses the driven connection device status as the monitoring signal by the output signal.	
GSIN1-2+	43			
GSIN1_2-	44			
GSIN2_1+	45			
GSIN2_1-	46			
GSIN2_2+	47			
GSIN2_2-	48			
GSOUT1_1+	49	-	Universal safety output	Open
GSOUT1_1-	50		The universal safety output signal is used in the safety logical circuit function. Also, inputs and uses the driven connection device status as the monitoring signal by the output signal.	
GSOUT1_2+	51			
GSOUT1_2-	52			
GSOUT2_1+	53			
GSOUT2_1-	54			
GSOUT2_2+	55			
GSOUT2_2-	56			

Signal name	Connection no.:	Dual input	Function	Factory setting
SYSRUN+ SYSRUN-	57 58	-	SYSRUN signal Use to determine the normal/abnormal condition of the YRC1000 controller by SYSRUN signal.	Open
ALMIN2+ ALMIN2-	59 60		Only for YASKAWA This signal cannot be used, because this signal is only for YASKAWA.	Open
24VAX 24VAX	61 62	-	DC +24V2 output terminal Rated current output: 150mA or less	Open
024V2 024V2	63 64	-	DC024V2 output terminal -	Open
AXDIN_COM AXDIN1 AXDIN2 AXDIN3 AXDIN4	65 66 67 68 69	-	Direct-in (SERVO) Used to input the quick responding signals in the search function etc.	Open
024VAX 024VAX	70 71	-	DC024V2 output terminal Rated current output: 150mA or less	Open
024V2 024V2	72 73	-	DC 024V2 output terminal -	Open
AIN_COM AXIN1 AXIN2	74 75 76	-	General-purpose input (SERVO) Used to input the general-purpose signal from the external device. This signal is optional. This signal cannot be used in case of standard specification.	Open
024VAX 024VAX	77 78	-	DC024V2 output terminal Rated current output: 150mA or less	Open
AXOUT1 AXOUT2	79 80	-	Only for YASKAWA This signal cannot be used, because this signal is only for YASKAWA.	Open

Tab. 8-1: M-YE250/5-80P Details for the Connection Terminal

Wiring procedure of the terminal block

For your safety, appropriate work must be done by following the instructions below.

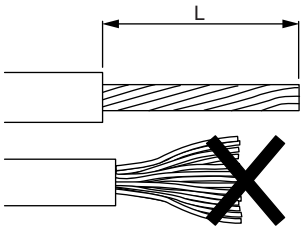
1.) Tool: Screwdriver

– For the connection, be sure to use a screwdriver of an applicable size and configuration.

WAGO standard screwdriver, WAGO 210-119, WAGO 210-119SB (short, delivered with the product).

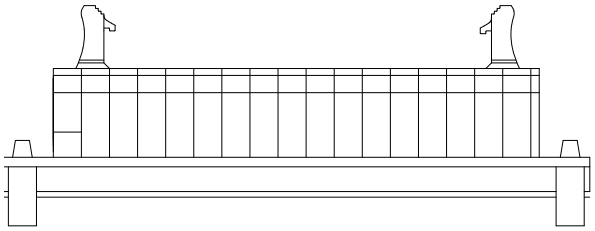
2.) Strip wires

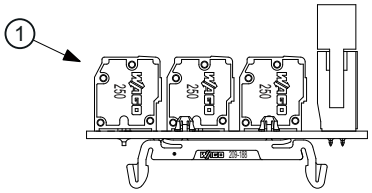
- The length of the exposed conductor (L) should be as follows.
  – The 9-10mm length of the exposed conductor for the terminal block WAGO series 250 (with 5.0 mm pitch).
  – Maximum cable with an outer diameter of Ø 3.1 mm.



- A bent or wound up conductor should be adjusted as illustrated in the figure above

3.) Wire connections



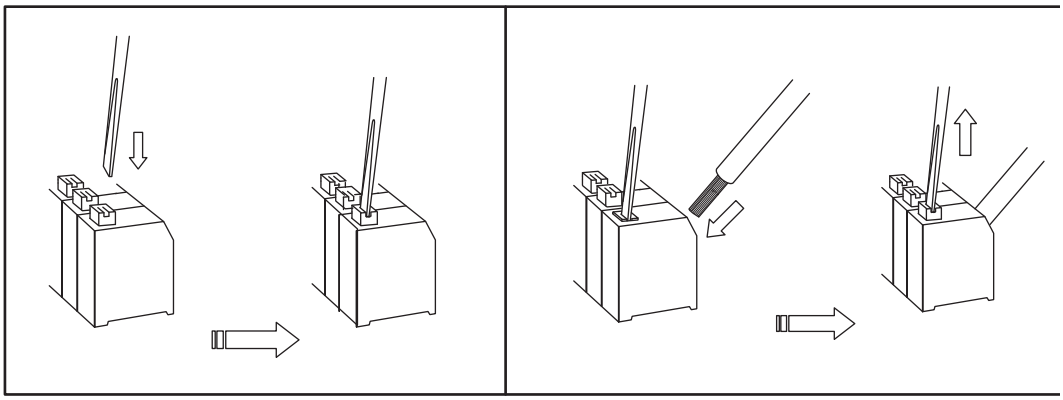


① Terminal block without screw WAGO series 250

1. Place the screwdriver on the lever upright as shown in the figure below and push straight down.

2. Insert the wire into the connection hole slowly until its leading end touches the end of the hole.

   For thin wires, never insert the wire with force, or the wire jacket may get caught in.



3. Pull out the screwdriver to clamp the conductor with a spring.
4. Check if the wire is connected firmly by pulling the wire softly.

8.8 WAGO Connector

The control power supply unit: CN152 on (CSRA-CPS01KA), and CN303 on the general-purpose I/O board (JANCD-AIO0□-E) are equipped with a connector made by WAGO.

The "wiring tool for the WAGO connector" is necessary to wire the WAGO connector.

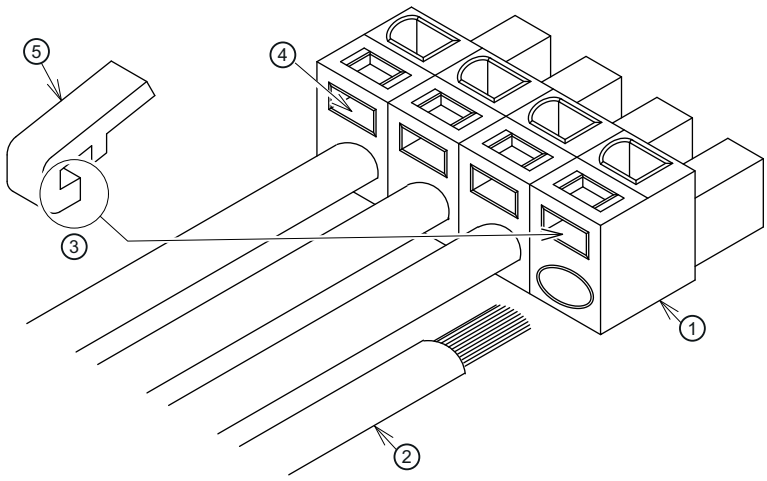
The tools (total 3, 2 types) are supplied with the robot controller.

Use them with the appropriate sizes of connectors.

The wiring procedure is described as follows:

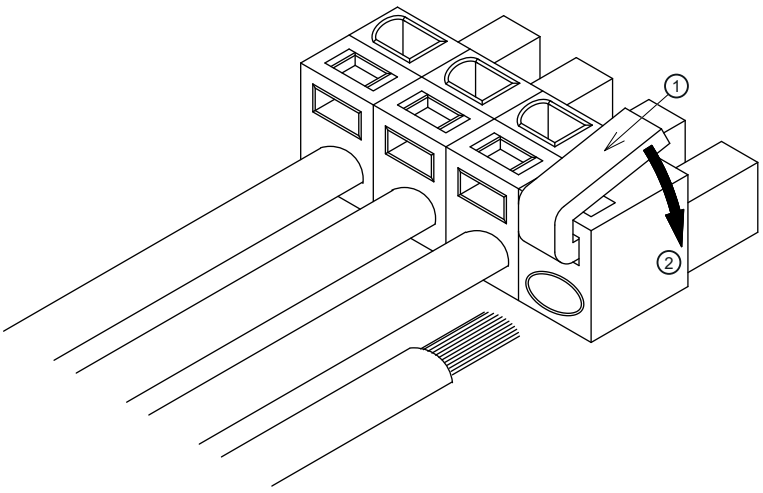
1. Insert part A of the wiring tool into one of the holes designed for the tool.

Description	Specification
CPS unit (JZNC-YPS01-E) (CN152)	Max. cable outer diameter: Ø 4.1 mm stripping length: 8-9 mm
Machine safety unit (JZNC-YSU01-1E) (CN211) Robot I/O unit (JZNC-YIU01-E) (CN303)	Max. cable ouside diameter: Ø 3.41 mm stripping length: 7 mm



① WAGO connector (e.g. 4 pins type)
② Wire
③ Part A
④ Holes for the wiring tool
⑤ Wiring tool for WAGO connector

2. Insert or pull out the wire while pushing the wiring tool downward.



① Wiring tool for WAGO connector
② Press in direction of the arrow

3. Remove the tool from the connector. Keep this tool for future use.

Wiring Procedure of the MXT Connector

For your safety, appropriate work must be done by following the instructions below.

1.) Tool: Screwdriver

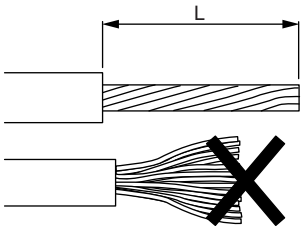
  – For the connection, be sure to use a screwdriver of an applicable size and configuration.

• .

WAGO standard screwdriver, WAGO 210-119, WAGO 210-119SB (short, delivered with the product).

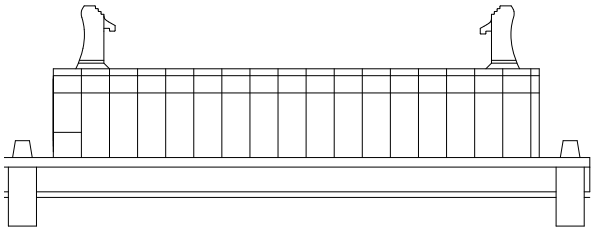
2.) Suitable wires

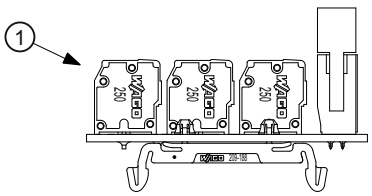
• The length of the exposed conductor (L) should be as follows.
  – The 9-10mm length of the exposed conductor for the terminal block WAGO series 250 (with 5.0 mm pitch).
  – Maximum cable with an outer diameter of Ø 3.1 mm.



• A bent or wound up conductor should be adjusted as illustrated in the figure above

3.) Wire connections



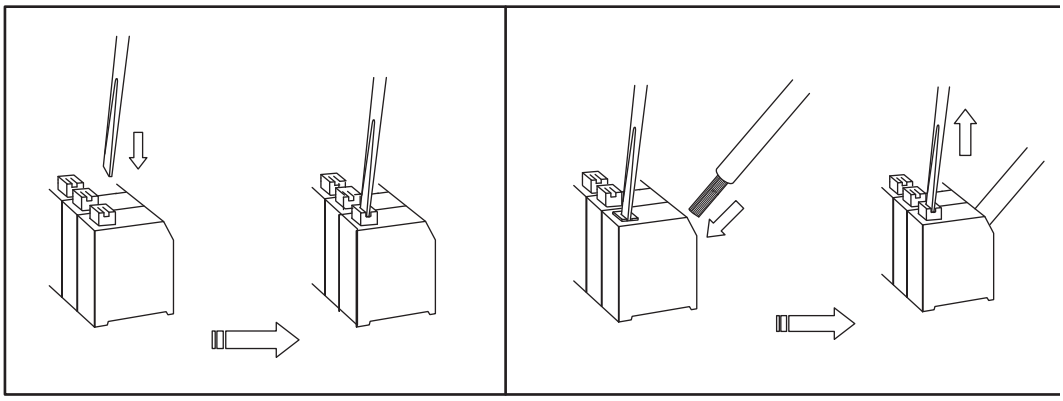


① Screwless terminal block WAGO series 250

1. Place the screwdriver on the lever upright as shown in the figure below and push straight down.

2. Insert the wire into the connection hole slowly until its leading end touches the end of the hole.

   For thin wires, never insert the wire with force, or the wire jacket may get caught in.



3. Pull out the screwdriver to clamp the conductor with a spring.
4. Check if the wire is connected firmly by pulling the wire softly.

The control power supply unit: CN152 on (CSRA-CPS01KA), and CN303 on the general-purpose I/O board (JANCD-AIO0□-E) are equipped with a connector made by WAGO.

The “wiring tool for the WAGO connector” is necessary to wire the WAGO connector.

The tools (total 3, 2 types) are supplied with the robot controller.

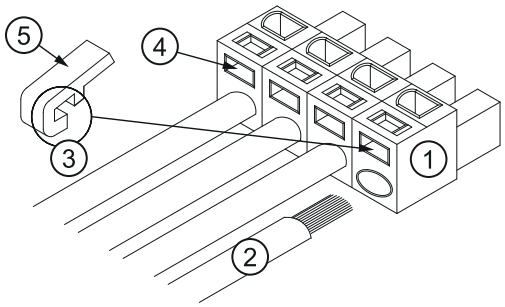
Use them with the appropriate sizes of connectors.

The wiring procedure is described as follows:

1. Insert part A of the wiring tool into one of the holes designed for the tool.

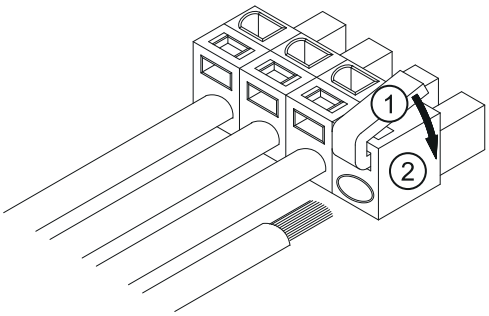
Description	Specification
Control power supply unit (CSRA-CPS01KA) CN152	Max. cable outer diameter: Ø 4.1 mm Stripping length: 8-9 mm
General-purpose I/O board (JANCD-AIO0□-E) CN303	Max. cable outside diameter: Ø 3.41 mm Stripping length: 7 mm

① WAGO connector (e.g. 4 pins type)
② Wire
③ Part A
④ Holes for the wiring tool
⑤ Wiring tool for WAGO connector



2. Insert or pull out the wire while pushing the wiring tool downward.

① Wiring tool for WAGO connector
② Push



3. Remove the tool from the connector. Keep this tool for future use.

8.9 Installation of safety plug

- **Installation of safety plug**

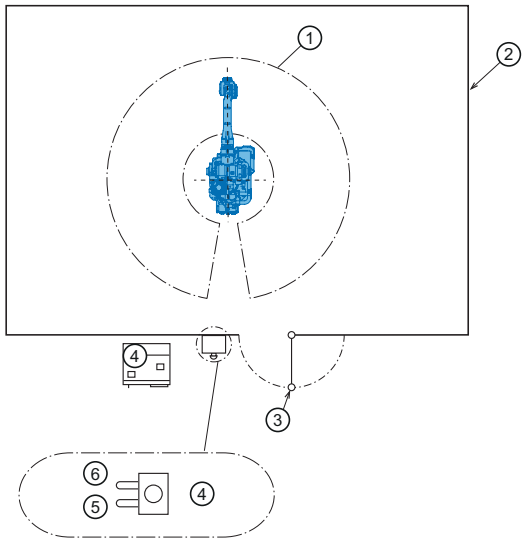
The robot must be surrounded by a safeguarding and a door protected by an interlock function. The door must be opened by the technician to enter and the interlock function stops the robot operation when the door is open. The safety plug input signal is connected to the interlock signal from the gate.

NOTICE

Observe DIN EN ISO 10218-2 with respect to the safety measures.

Installation of Saftey Plug

① Robot working area
② Safety casing
③ Service door
④ Emergency shut-off
⑤ Plug
⑥ Safety plug



If the SERVO power is ON when the interlock signal is input, the SERVO power turns OFF.

As long as the interlock signal is active, the SERVO power cannot be turned ON.

However, the servo power does not turn OFF when the door is opened only during the TEACH mode.

In this case, the SERVO power can be turned ON while the interlock signal is input.

8.10 External emergency stop

This signal is used to connect the emergency stop switch of an external device. If the signal is input, the SERVO power is turned OFF and the job is stopped. While the signal is input, the SERVO power cannot be turned ON.

DANGER due to electric current!

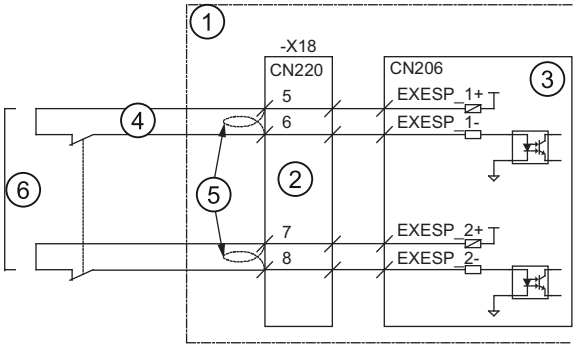
Injuries and machine damage as a result of short circuiting

Jumpers are installed at the factory. If the jumpers are not removed, the external emergency stop will not work even when the signal is received.

▶ Always remove the jumpers before operation.

Connection for external emergency stop

① Robot controller
② Safety terminal block board
③ Safety circuit board
④ External emergency stop
⑤ Remove the jumper
⑥ Turn ON/OFF at the same time



8.11 Connection for SERVO-ON enable input

DANGER due to electric current!

Injuries and machine damage as a result of short circuiting

Jumpers are installed at the factory. If the jumpers are not removed, the external emergency stop will not work even when the signal is received.

▶ Always remove the jumpers before operation.

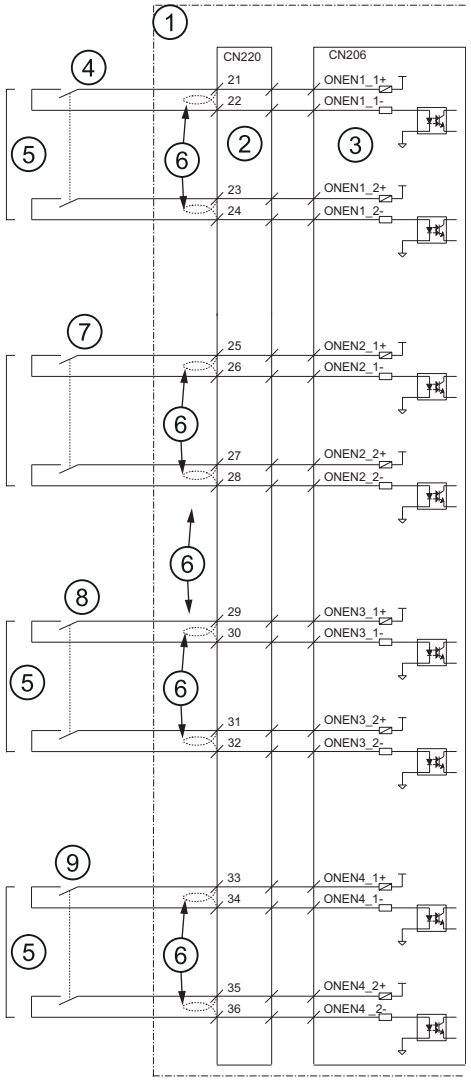
Connect the ONEN signal lines to enable the function to turn ON or OFF the SERVO power supply of an individual SERVO when a robotic system is divided into SERVO systems. Because these signals are not used for units of standard specifications, a jumper cable is connected as shown in the following figure.

For safety reasons, dual circuits are used for the SERVO-ON Enable input signals. Connect the signal so that both input signals are turned ON or OFF at the same time. If only one signal is turned ON, an alarm occurs.

Refer to “YOPTIONS INSTRUCTIONS FOR INDEPENDENT/COORDINATED CONTROL FUNCTION (Chapter: SERVO power supply individual control function” for the usage of the Servo-ON Enable signals.

Connection for SERVO-ON enable input

① YRC1000
② Safety terminal block board
③ Safety circuit board
④ SERVO-ON enable input signal (System1)
⑤ Turn ON/OFF at the same time
⑥ Remove the jumper
⑦ SERVO-ON enable input signal (System2)
⑧ SERVO-ON enable input signal (System3)
⑨ SERVO-ON enable input signal (System4)



8.12 General purpose safety input

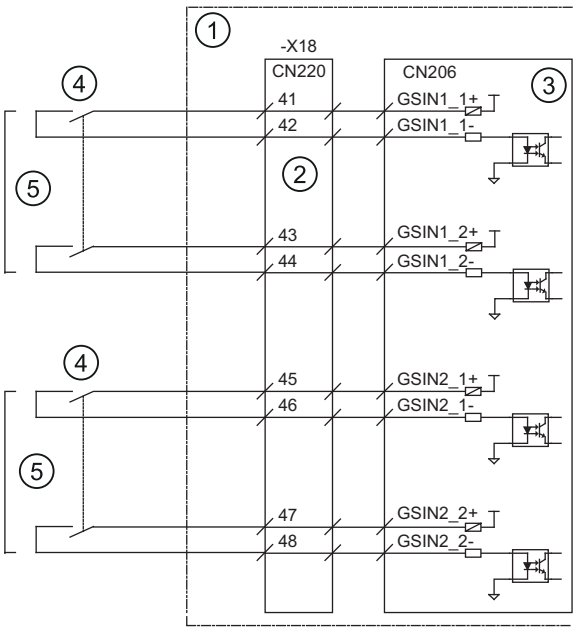
The general purpose safety input signal is used in the safety logic circuit function.

NOTICE

When use the external enable switch (EXDSW) or the full-speed test (FST), refer to chapter "Axes detachment function" to the manual Instructions with the document-no.: E1102000214XX01* and higher.

General purpose safety input

① YRC1000
② Safety terminal block board
③ Safety circuit board
④ General purpose safety input
⑤ Turn ON/OFF at the same



8.13 General purpose safety output

The general purpose safety output signal is used in the safety logic circuit function.

For example, composing the circuit to output the status signal, such as the SERVO ON signal or the emergency stop button by the safety logic circuit function enables to output the signals to the external device.

The signal is outputted as the dual signals.

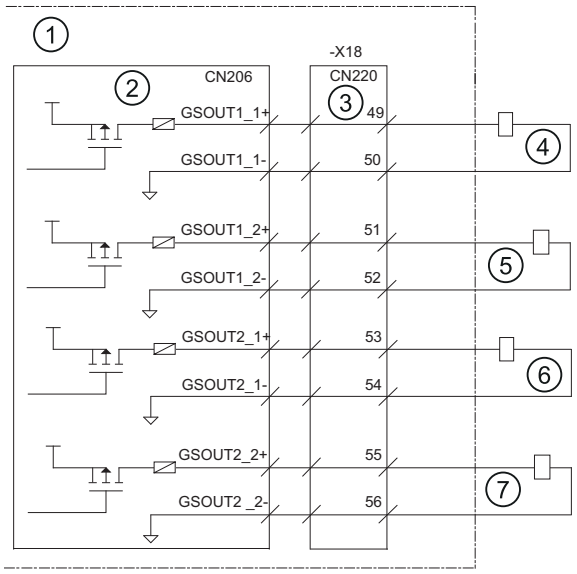
For the example of use of the general purpose safety output signal, refer to chapter "Safety logic circuit" to the manual Instructions with the document-no.: E1102000214XX01* and higher.

NOTICE

- Rated output value is DC24V and less than 50mA. Avoid excessive load when connect.
- When connect the inductive load, such as the safety relay, with the output circuit, use of the built-in protective circuit for the surge suppressor or connect the flyback diode in parallel to the inductive load to suppress the surge voltage. It may cause the damage on the output circuit.
- An error (e.g., relay contact sticking) of the device (e.g., safety relay, contactor) controlled by the general purpose safety output signal (GSOUT) must be detected (signal inconsistency) by the controlled device (e.g, by using a safety PLC).

Example of use of general purpose safety output signal

① YRC1000
② Safety circuit board
③ Safety terminal block board
④ General purpose safety output 1-1
⑤ General purpose safety output 1-2
⑥ General purpose safety output 2-1
⑦ General purpose safety output 2-2



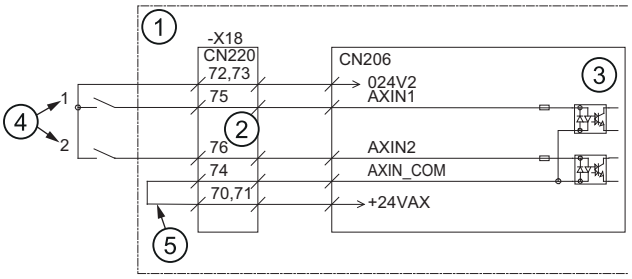
8.14 General purpose input (SERVO)

Connect when use the general purpose signal.

This signal cannot be used for standard specification because this signal is optional.

General purpose input (SERVO)

① YRC1000
② Safety terminal block board
③ Safety circuit board
④ General purpose input (SERVO)
⑤ Connect the jumper



8.15 General purpose I/O board

Four digital I/O connectors for the robot general purpose I/O are provided 40 inputs and 40 outputs.

The I/Os are divided into two types: general purpose I/O and specific I/O.The I/O assignment differs depending on the application. Specific I/O is a signal in which the part is decided in advance. Specific I/O is used when the external operation equipment such as positioner controller and centralized controller control the robot and related equipment as a system. General-purpose I/O are mainly used as timing signals for the manipulator and peripheral devices in JOBs that require robot motion.

Refer to chapter “General purpose I/O signal assignment” for more details on signal allocation.

For the connection of the robot’s general purpose I/O signal connectors, and the I/O signal related to start and stop, refer to “Connection wire with robot general purpose I/O Connector (CN306, 307, 308, 309)”and “Specific I/O signal related to start and stop”.

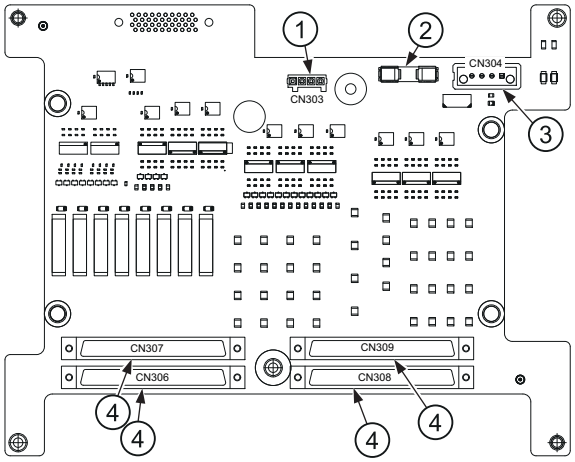
General purpose I/O board (JANCD-AIO02-E)

① For switching external power supply

② Power Supply Protective Fuse (F1) 3,15A / 250 V

③ Power Supply Output connector

④ Digital I/O connector (CN306, CN307, CN308 and CN309)



- **Connection wire with robot general purpose I/O connector (CN306, 307, 308, 309)**

Please refer to the figure below when manufacturing the cable connection with robot general purpose I/O connector (CN306, 307, 308, 309) of I/O unit. Unshielded twisted pair cable must be used (the cable side connector and the I/O terminal block are the options).

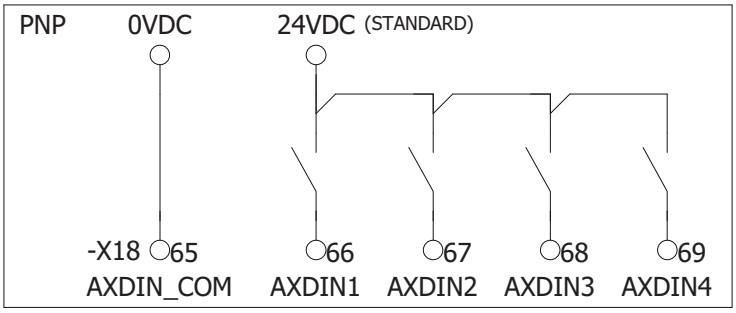
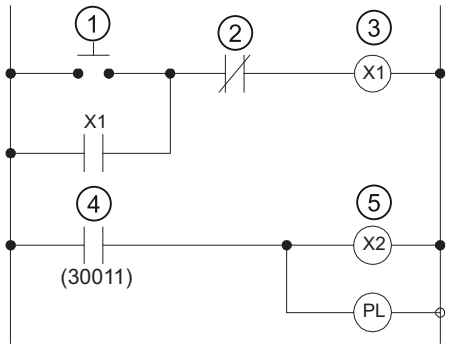


Fig. 8-2: PNP logic

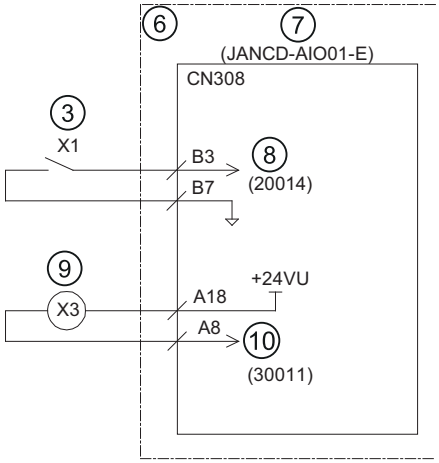
Example of the SERVO ON sequence circuit from the external device

① SERVO ON PB
② SERVO ON confirmation X2
③ SERVO ON command
④ SERVO-ON power ON X3
⑤ SERVO ON confirmation



Note:
Number in ( ) means output signal number assigned to AIO01.
PL: Pilot lamp

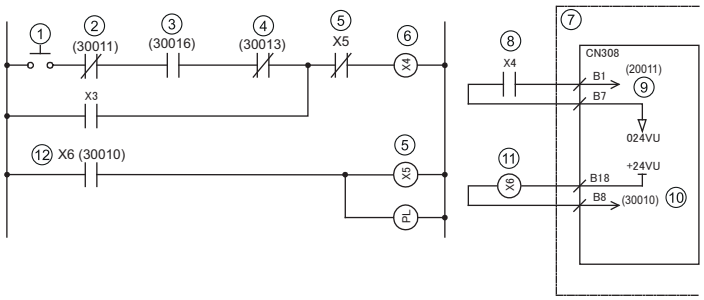
⑥ YRC1000
⑦ General purpose I/O board
⑧ External SERVO ON
⑨ SERVO-ON power ON
⑩ Output while SERVO ON



Note: This circuit is example in case of AIO01.

Only the rising edge of the SERVO ON signal is valid. This signal turns ON the robot SERVO power supply. The set and reset timings are shown in the following.

Example of start sequence circuit from the external device



Note:

Number in ( ) means output signal number assigned to AIO01.

PL: Pilot lamp

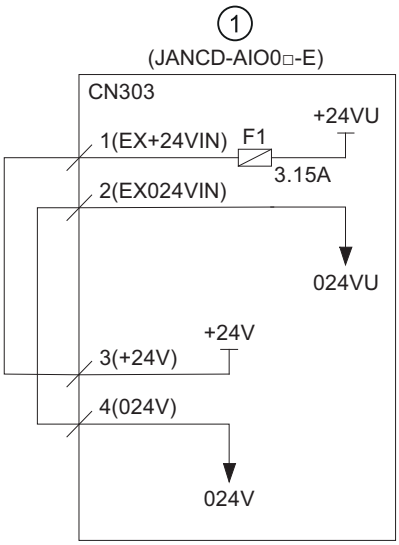
This circuit is example in case of AIO01

① Run PB
② While SERVO-ON
③ Selects PLAY mode
④ Alarm/Error occurring
⑤ Running confirmation
⑥ Start (Command)
⑦ Robot controller
⑧ External Start Command
⑨ External start input
⑩ Ongoing output
⑪ Running, etc.
⑫ Execute X6

Only the rising edge of the external start signal is valid. This signal starts the robot. Set this signal with the interlock configuration which determines whether operation can be started. The playback signal (RUNNING) confirms that the robot is actually moving.

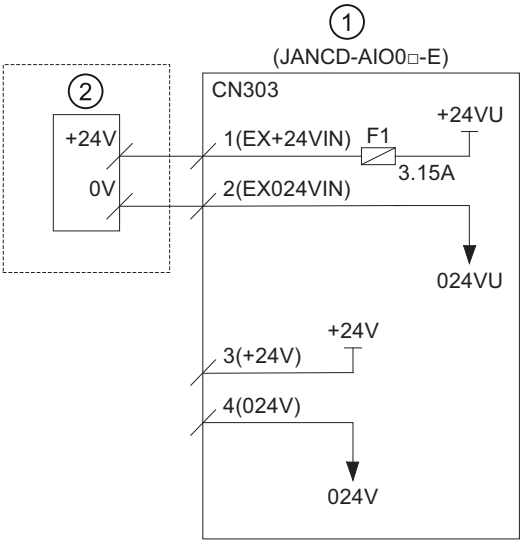
Connection of the external power supply for I/O

① General purpose I/O board



In case of using internal power supply (The factory default settings)

② External power supply (Ready by customer)



In case of using external power supply

In the factory setting, the internal power supply for I/O is used. If the external power supply for I/O will be used, connect as described below.

1. Remove the wire connected between CN303-1 to -3 and CN303-2 to -4 of the general purpose I/O circuit board.
2. Connect +24V of the external power supply to CN303-1 and 0V to CN303-2 of the robot I/O unit.

NOTICE

- The internal power supply of 24V of about 1.5A of robot control can be used for I/O. Use external 24V power supply for higher currents and to isolate the circuit inside and outside the robot controller.
- Power supply circuit for I/O (+24 VU, 024 VU) has 3.15A fuses (F1).
- Install the external power supply outside the robot control to avoid electric noise problems.
- If the internal power supply is selected and the external power supply is connected to CN303-1 to -3 and CN303-2 to -4, do not connect the external power supply line to the +24VU and 0V U terminals. The unit may malfunction if the external power supply is also connected.

8.16 Assignment of universal I/O signals

Logical number	Input name/Function
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20011	EXTERNAL HOLD The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master JOB[1]. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20014	EXTERNAL SERVO ON Only the rising edge of this signal is valid. This signal turns ON the SERVO power. Use this signal to turn ON the SERVO power from an external device.
20015	SELECT PLAY MODE The PLAY mode is selected when the mode key on the programming pendant is set at “REMOTE”. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.

Logical number	Input name/Function
20016	SELECT TEACH MODE The TEACH mode is selected when the mode key of the programming pendant is set at “REMOTE”. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the TEACH mode selection.
20020	INTERFERENCE 1 ENTRANCE PROHIBITED If the robot attempts to enter the cube 1[2] area while this signal is ON, the robot goes to wait status (with SERVO power ON). During wait status, the robot operation restarts if this signal turns OFF.
20021	INTERFERENCE 2 ENTRANCE PROHIBITED If the robot attempts to enter the cube 2[2] area while this signal is ON, the robot goes to wait status (with SERVO power ON). During wait status, the Robot operation restarts if this signal turns OFF.

1. A master job is a job (program) which can be called by CALL MASTER JOB.Other functions are the same as for normal JOBs. Normally, the parent job, which manages the child JOBs called up immediately after the power is turned ON, is set as the master JOB.

2. See chapter "Interference area" to the manual Instructions with the document-no.: E1102000214XX01* and higher

Logical number	Input name/Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the SERVO power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the SERVO power supply turns OFF. It can be used for YRC1000 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master JOB. This signal can be used to confirm that the master job has been called[1].
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.

Logical number	Input name/Function
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other robots and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 64)[2] This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.
30023	INTERMEDIATE START OK This signal turns ON when the robot operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.

1. This signal is not output during operation.

2. The work home position cube and Cube 64 are the same.

8.16.1 ARC welding

- **I/O Allocation and connection diagram for ARC welding**

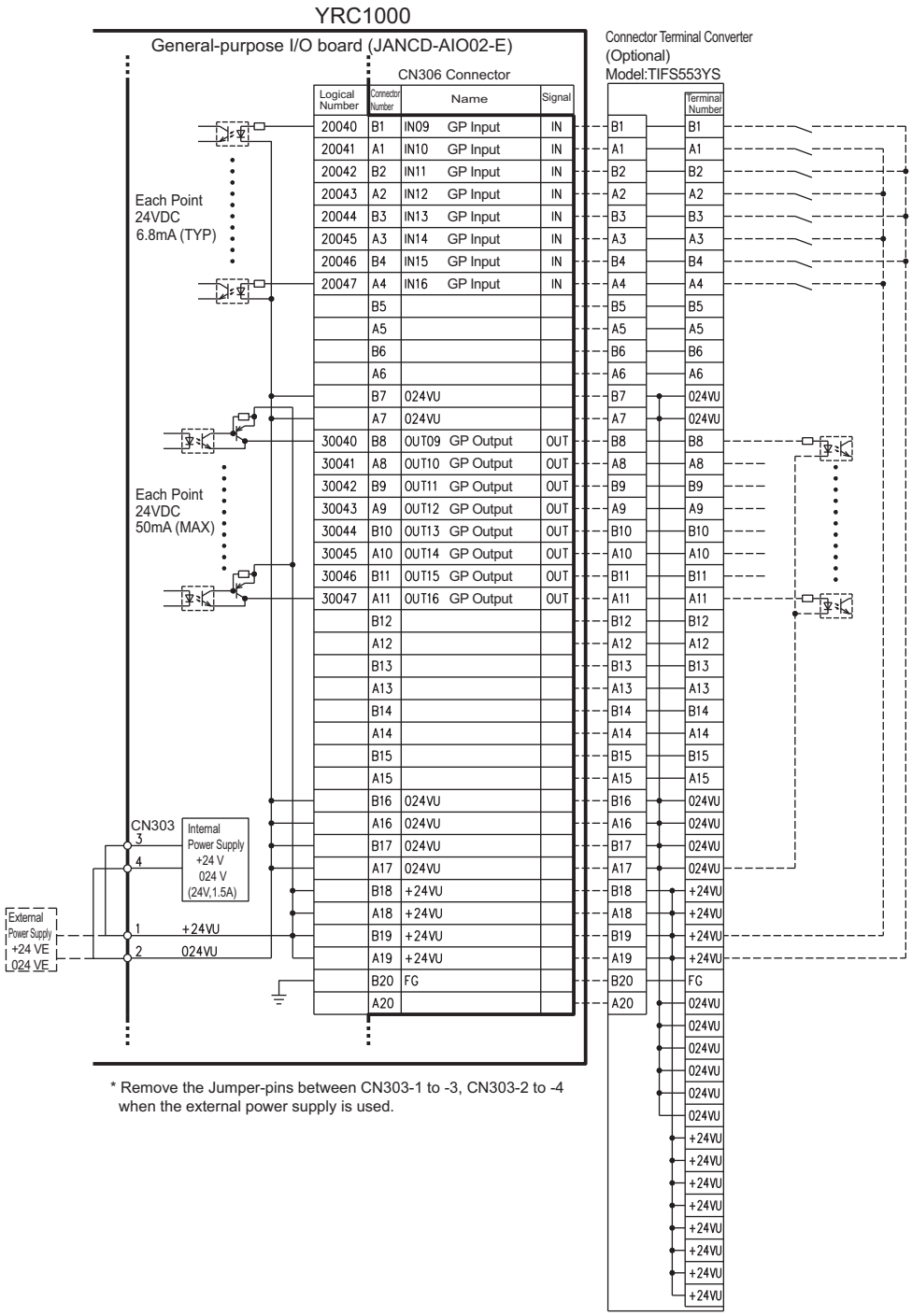


Fig. 8-3: JANCD-AIO02-E (CN306 Connector)

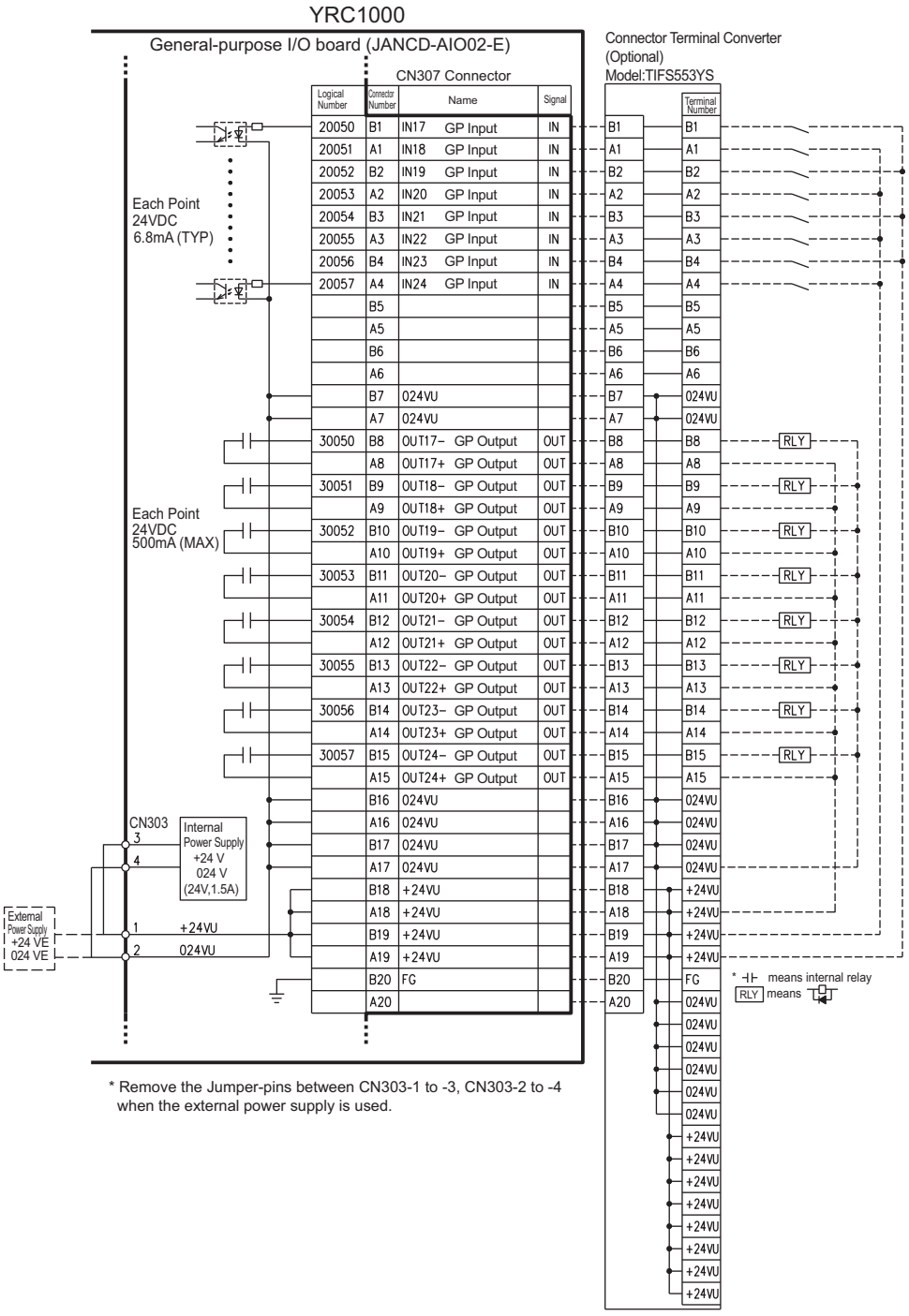


Fig. 8-4: JANCD-AIO02-E (CN307 Connector)

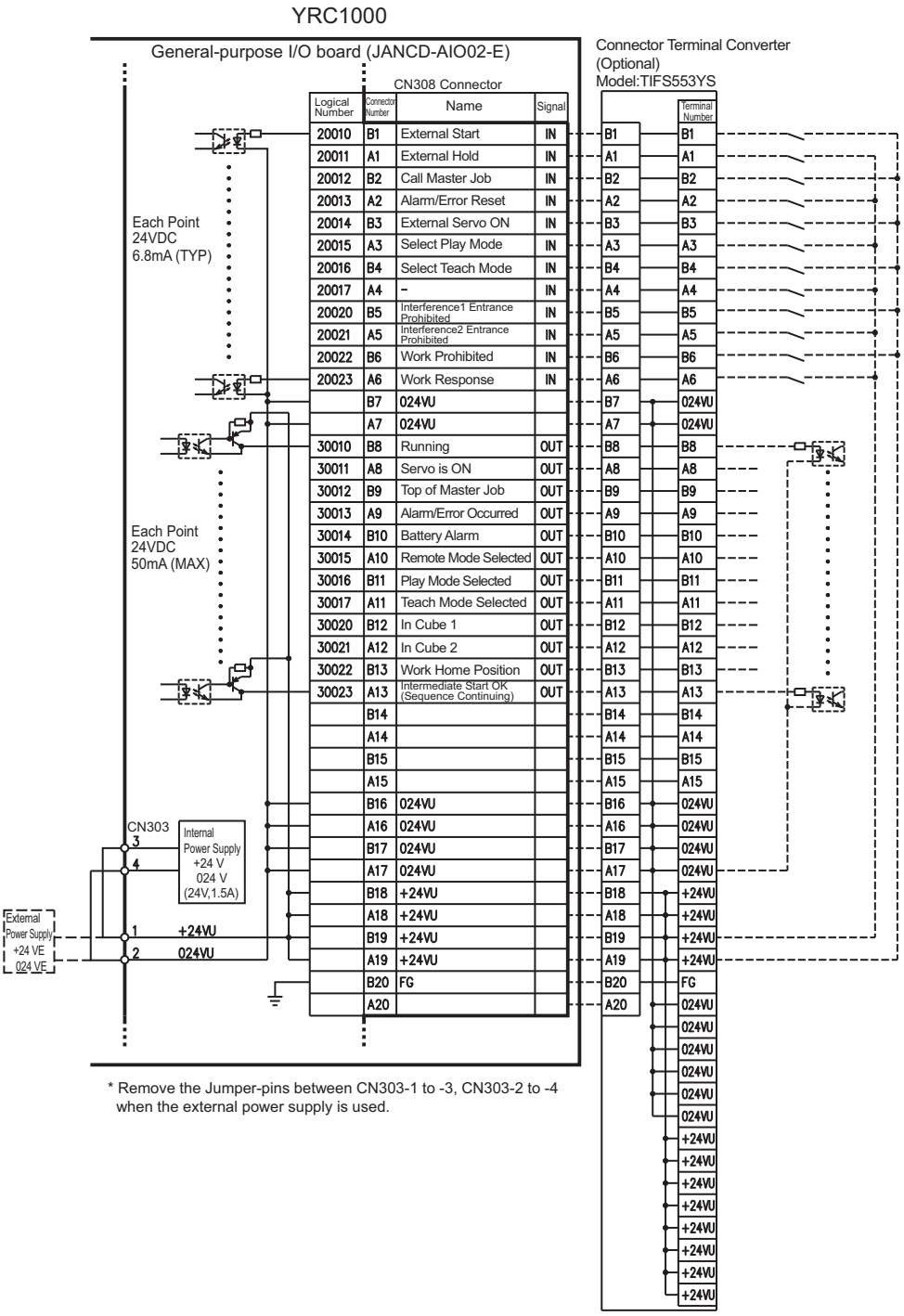


Fig. 8-5: JANCD-AIO02-E (CN308 Connector)

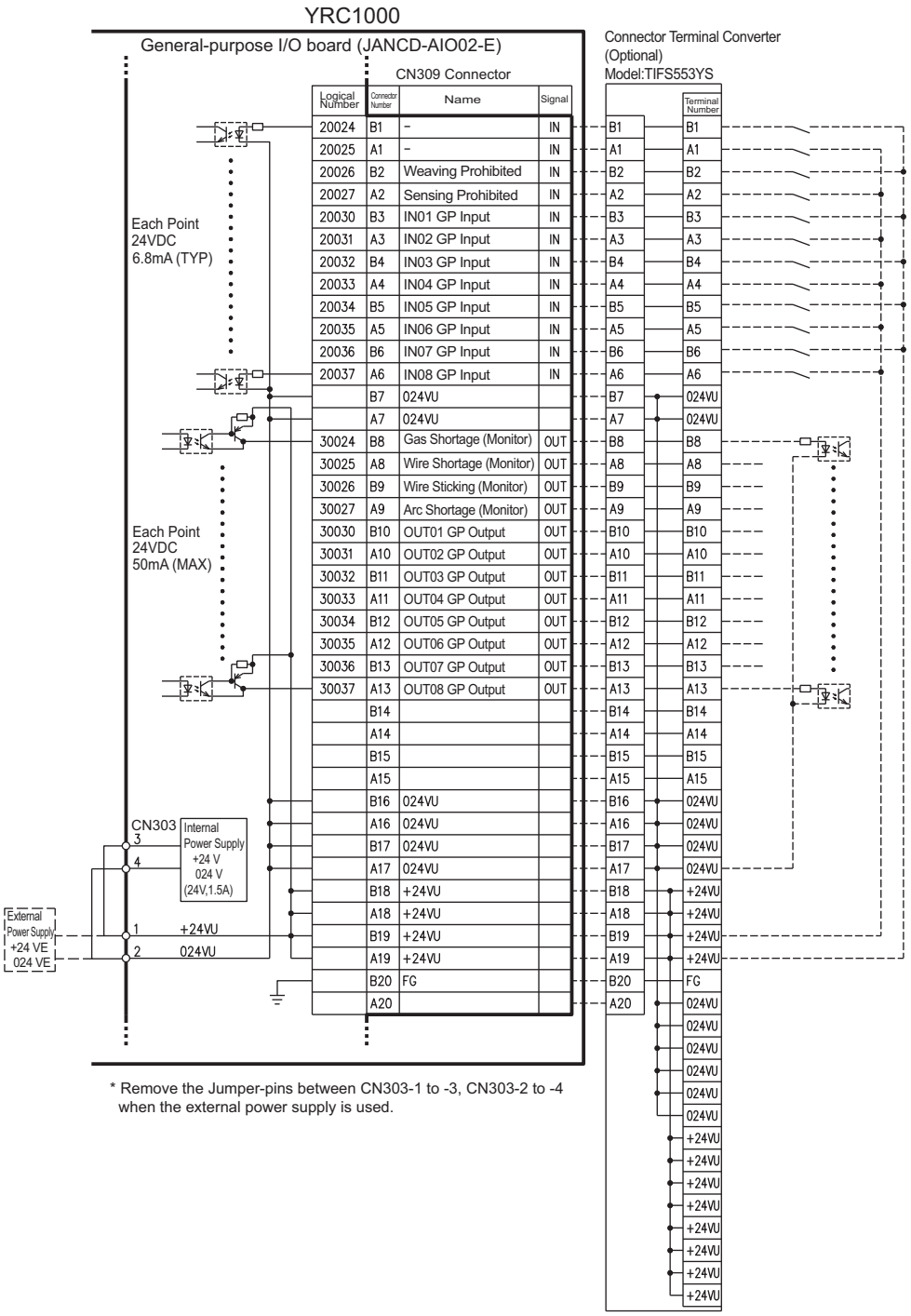


Fig. 8-6: JANCD-AIO02-E (CN309 Connector)

Logical number	Input name/Function
20022	WORK PROHIBITED (Arc Generation Prohibited) Arc generation is prohibited while this signal is ON. Arc generation starts when this signal turns OFF inside the arc-generation area. Use this signal to confirm teaching.

Logical number	Input name/Function
20023	WORK RESPONSE (Pseudo Arc ON Response) This signal is used as a pseudo signal in cases that “Arc Generation Confirmation” signal is not equipped on a welding power supply. Wire this signal ON normally (short to OV).
20026	WEAVING PROHIBITED Weaving is prohibited while this signal is ON. Use this signal to check taught steps and movements without performing the weaving operation.
20027	SENSING PROHIBITED Arc sensing is prohibited while this signal is ON. Use this signal to check taught steps and movements if an arc sensor is mounted.

Logical number	Input name/Function
30024	This signal stays ON while the gas shortage signal from the welding power supply is ON.
30025	This signal status ON while the wire shortage signal from the welding power supply is ON.
30026	The wire sticking check is conducted automatically when the arc turns OFF. If wire sticking is detected, this signal remains ON until the wire sticking is released.
30027	This signal stays ON while the arc shortage signal from the welding power supply is ON.

8.16.2 Handling

- **I/O Allocation and connection diagram for Handling**

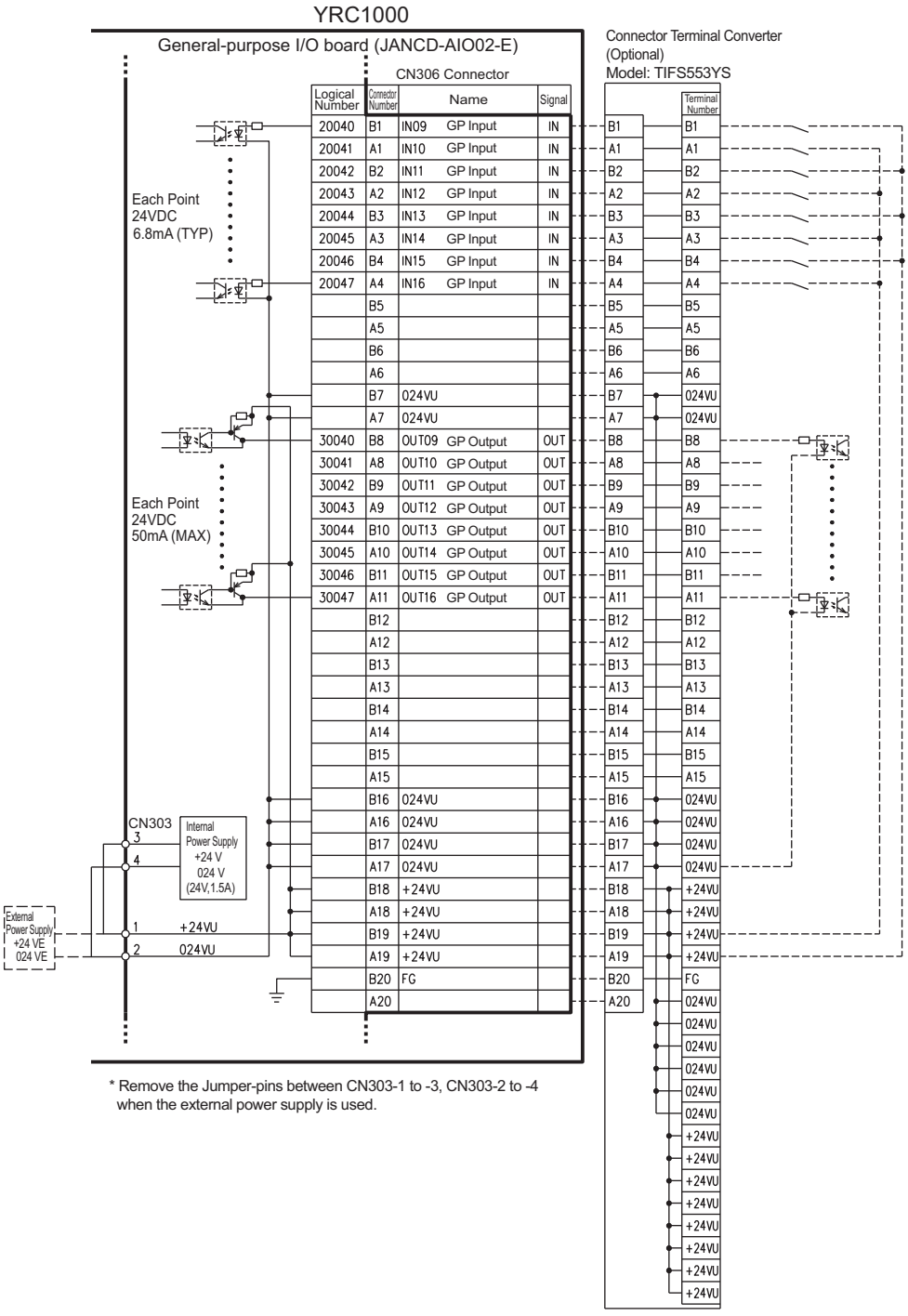


Fig. 8-7: JANCD-AIO02-E (CN306 Connector)

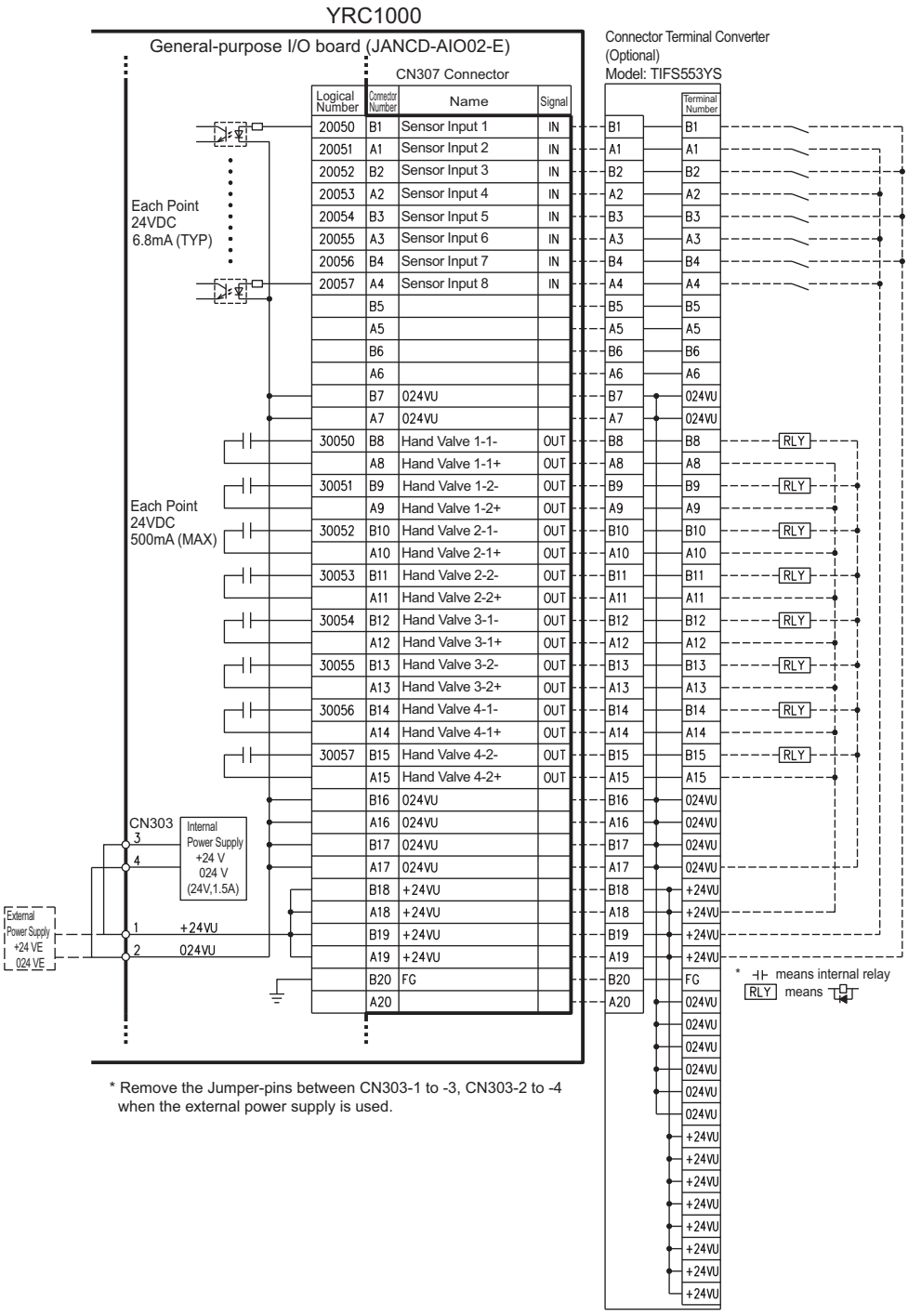


Fig. 8-8: JANCD-AIO02-E (CN307 Connector)

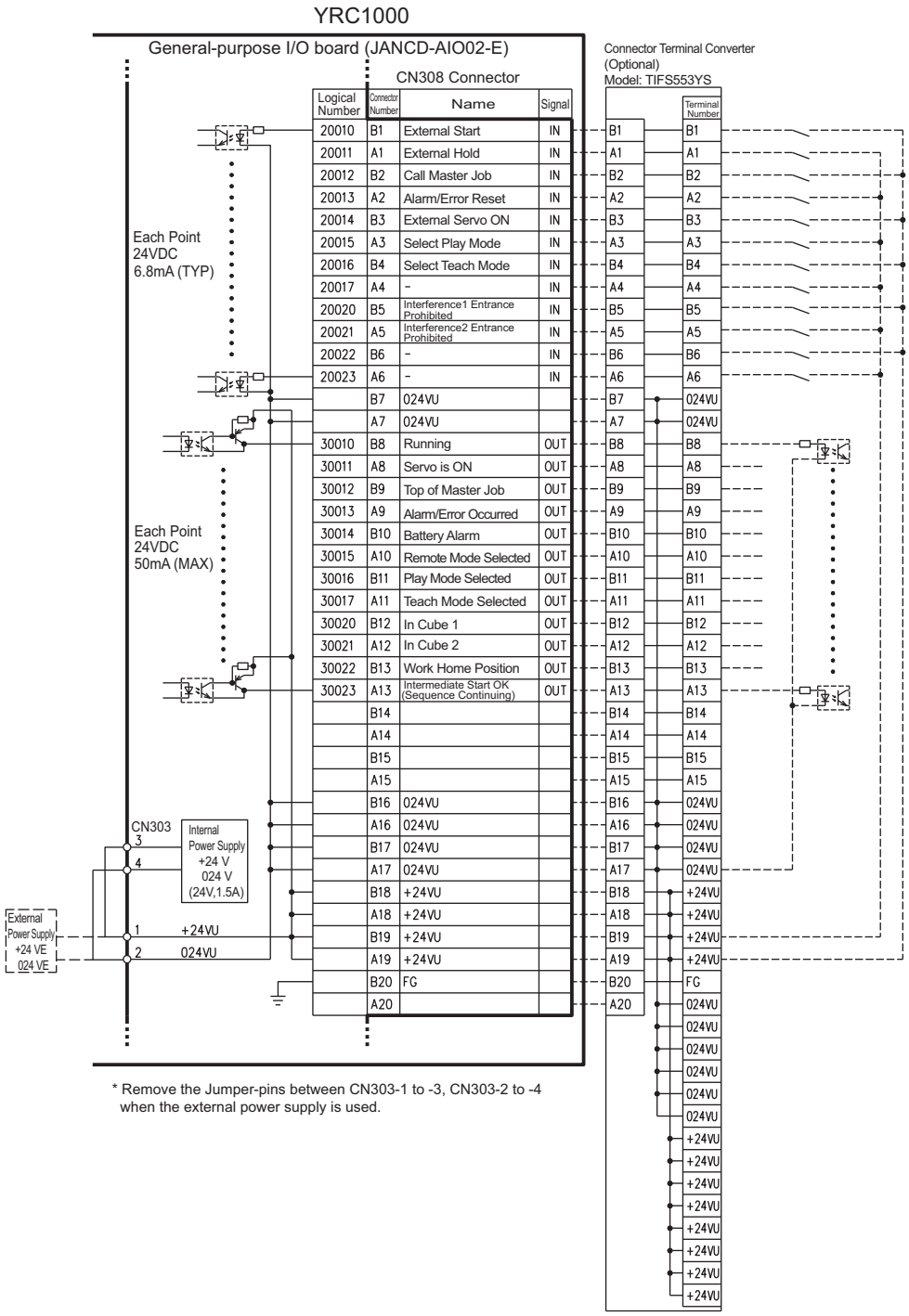


Fig. 8-9: JANCD-AIO02-E (CN308 Connector)

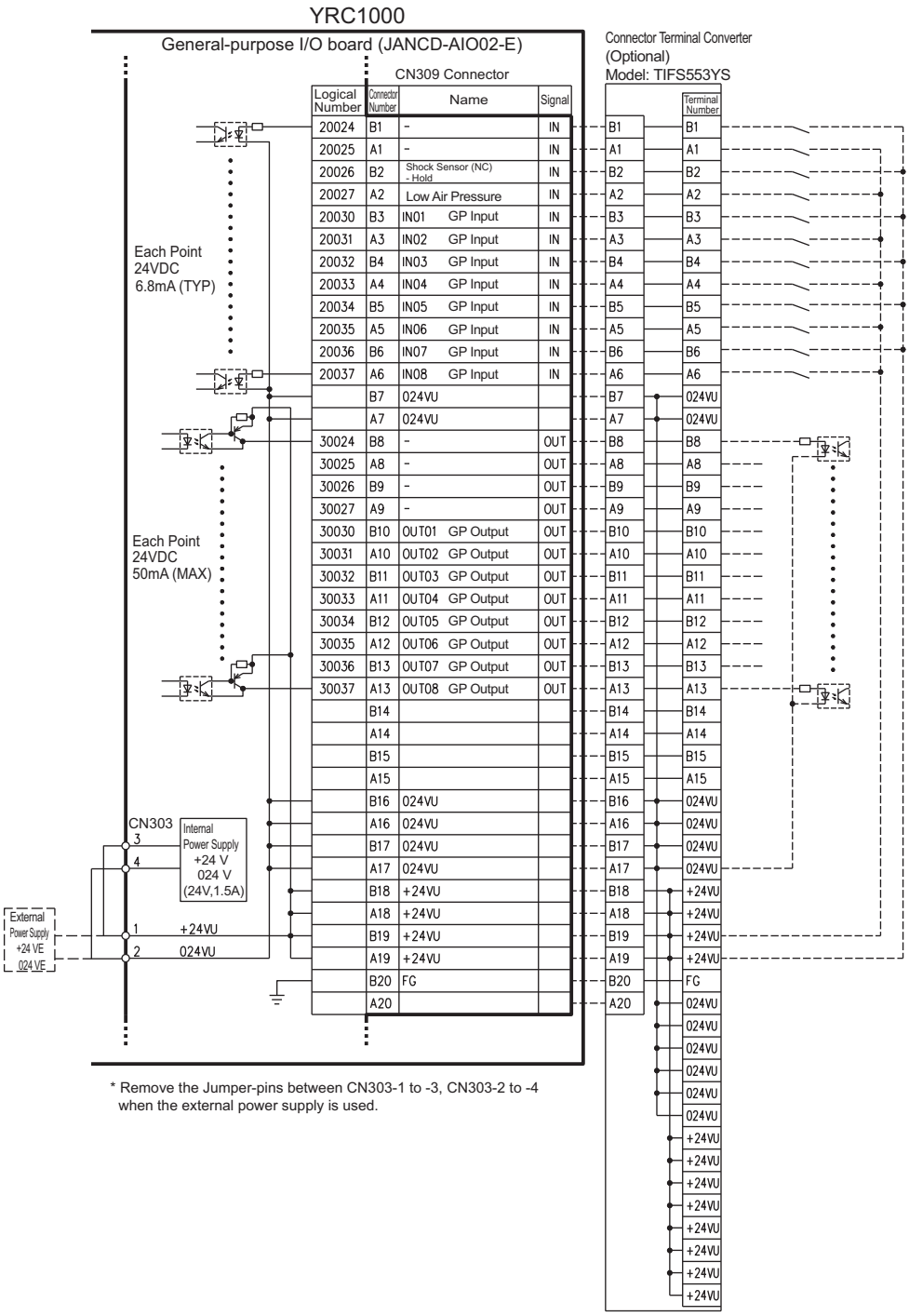


Fig. 8-10: JANCD-AIO02-E (CN309 Connector)

Logical number	Input name/Function
20026	TOOL SHOCK SENSOR This is normally ON (NC) signal input. When it turns OFF, an YRC1000 displays a message “HAND TOOL SHOCK SENSOR OPERATING” and a HOLD is applied. The releasing in TEACH mode is done on the handling application diagnostic display. Set tool shock sensor function “NOT USE” on the handling applications diagnostic display if this signal is not be used.

Logical number	Input name/Function
20027	LOW AIR PRESSURE This signal is normally OFF (NO). When it turns ON, YRC1000 displays user alarm in the PLAY mode or displays user message in the TEACH mode.
20050 to20057	SENSOR INPUT 1 - 8 Inputs 1 to 8 are monitored with the HSEN handling specific instructions. Sensor inputs 1 to 8 correspond to HSEN 1 to 8.

Logical number	Input name/Function
30050 to30057	HAND VALVE 1-4 These outputs are controlled by the HAND handling specific instructions. Hand valves 1 to 4 correspond to HAND 1 to 4.

8.16.3 General Application

- **I/O Allocation and connection diagram for allgemeine Anwendungen**

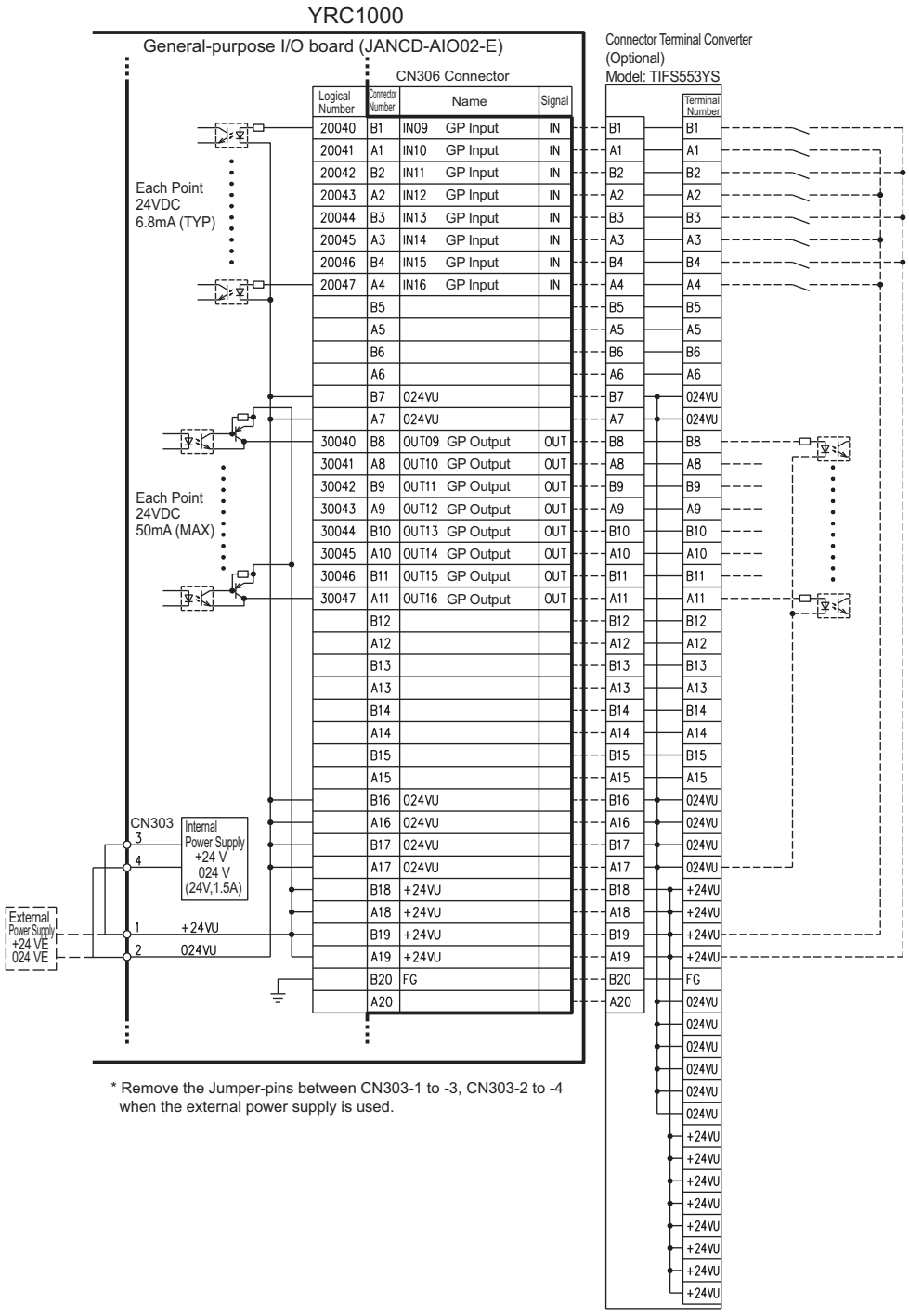


Fig. 8-11: JANCD-AIO02-E (CN306 Connector)

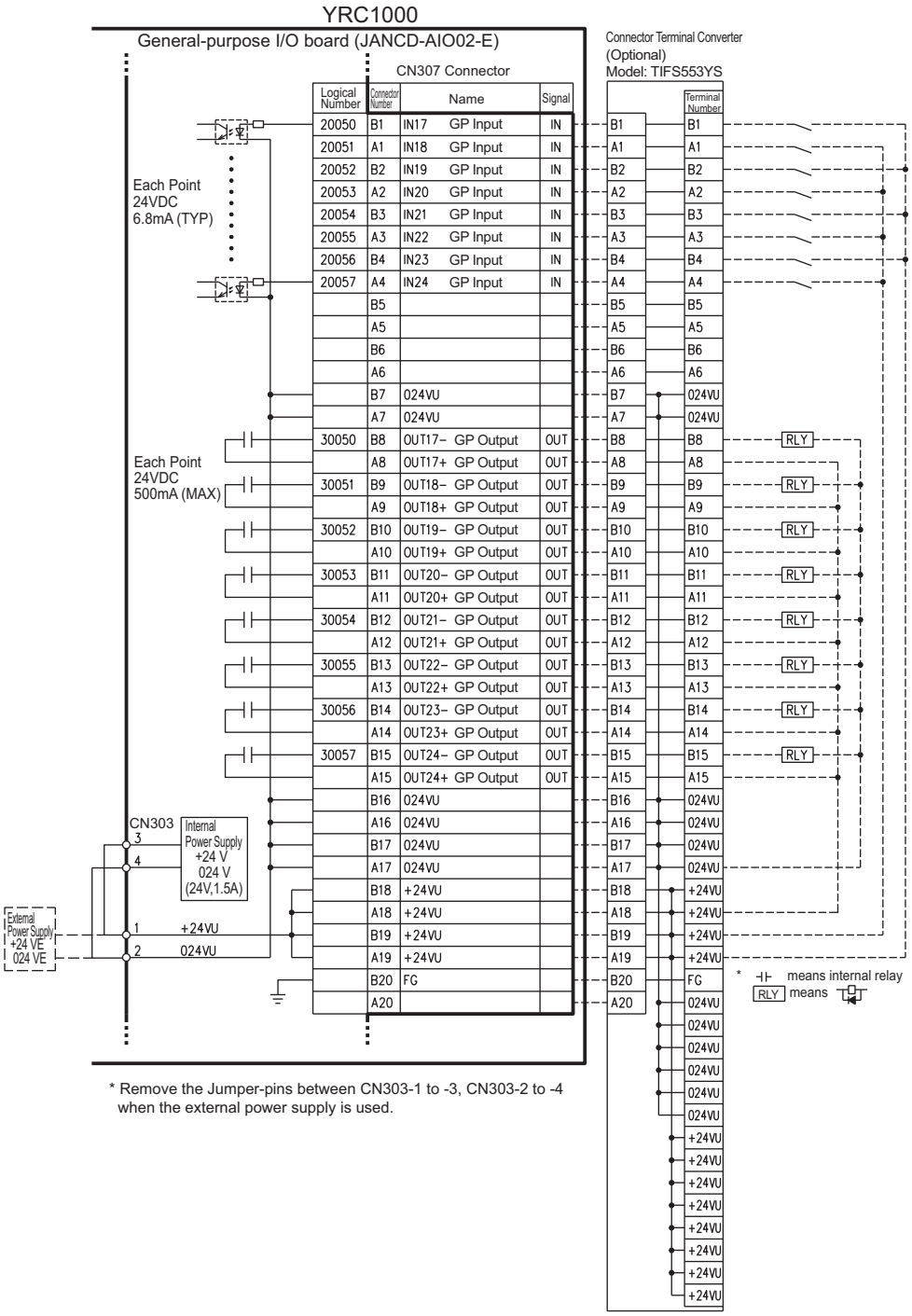


Fig. 8-12: JANCD-AIO02-E (CN307 Connector)

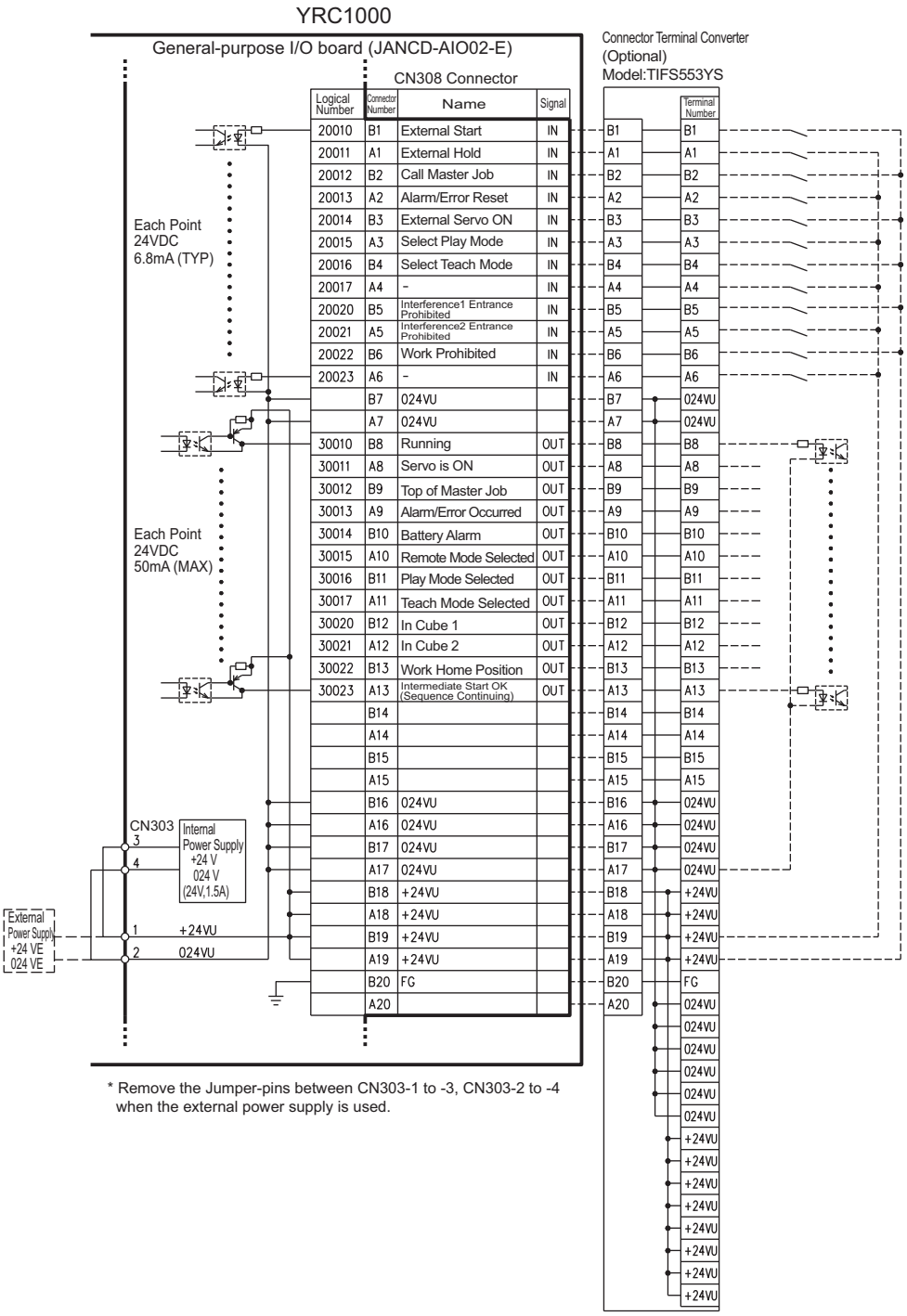


Fig. 8-13: JANCD-AIO02-E (CN308 Connector)

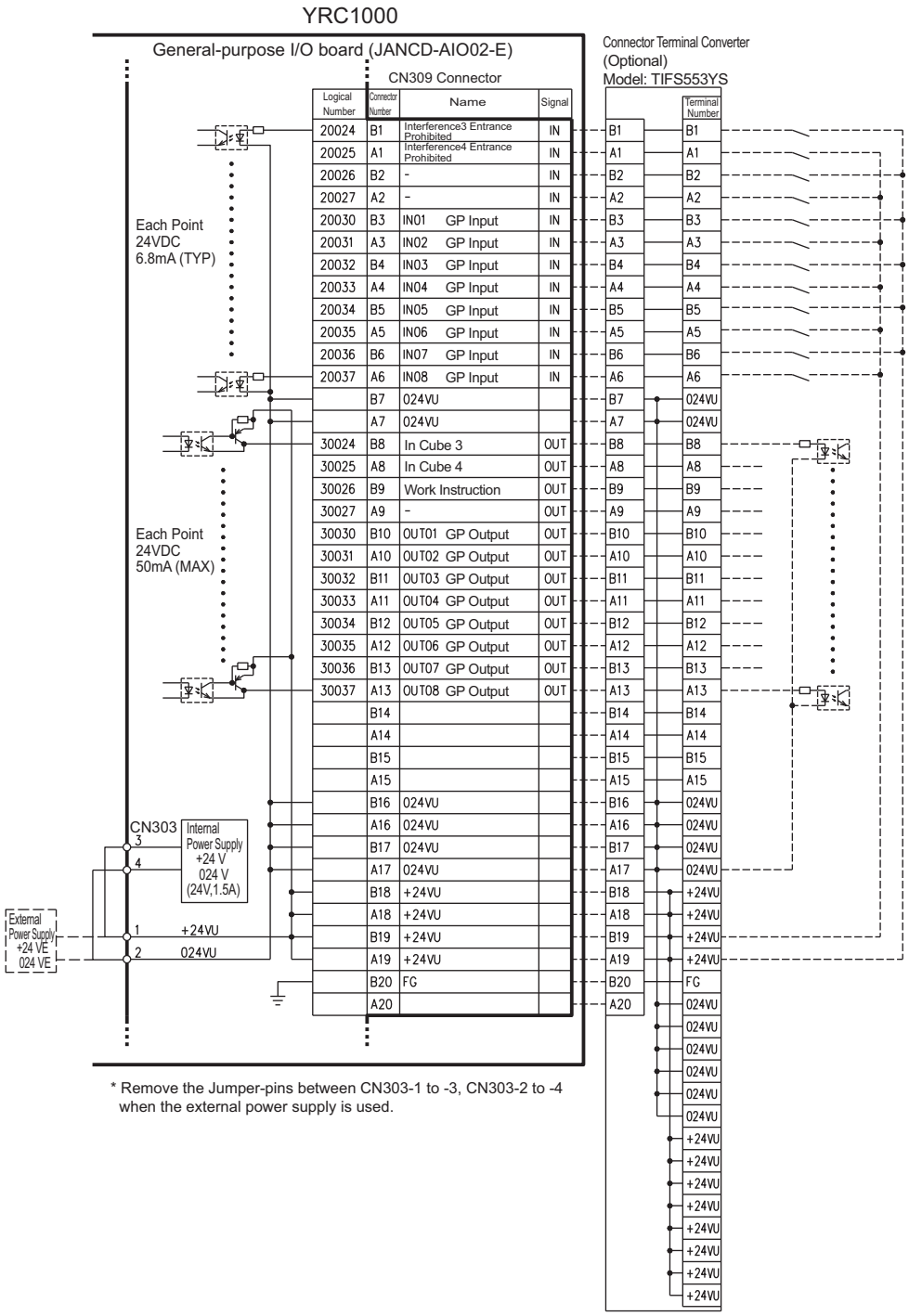


Fig. 8-14: JANCD-AIO02-E (CN309 Connector)

Logical number	Input name/Function
30024	IN CUBE 3 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other robots and positioners.

Logical number	Input name/Function
30025	IN CUBE 4 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other robots and positioners.
30026	WORK COMMAND This signal provides the command for the general tool to operate. TOOL ON instruction execution or the [TOOL ON] key in the programming pendant turns this signal ON and TOOL OFF instruction execution or the [TOOL OFF] key in the programming pendant turns it OFF. However, it remains OFF while the WORK PROHIBITED signal (20022) is input or while the robot is stopped.

Logical number	Input name/Function
20022	WORK PROHIBITED (Tool ON Prohibited)Even if TOOLON instruction is executed, YRC1000 doesn’t output to external while this signal is ON.
20024	INTERFERENCE 3 ENTRANCE PROHIBITEDIf the robot attempts to enter the cube 3[1] area while this signal is ON, the robot goes to wait status (with SERVO power ON). During wait status, the robot operation restarts if this signal turns OFF.
20025	INTERFERENCE 4 ENTRANCE PROHIBITEDIf the robot attempts to enter the cube 4[2] area while this signal is ON, the robot goes to wait status (with SERVO power ON). During wait status, the robot operation restarts if this signal turns OFF.

1. See chapter "Interference area" to the manual Instructions with the document-no.: E1102000214XX01* and higher

8.16.4 Spotwelding

8.16.5 List of device configuration depending on model

YRC1000 (ERAR-1000-xxxxxx-□□□)		E10
Input voltage		380 to 480 VAC
Dimensions H x L x W (mm)		598 x 490 x 427 (excluding protrusions)
Breaker		NF32-SVF 3P 15A
Control power supply unit		CSRA-CPS01KA
CPU unit	-	JZNC-ARK01-E
	CPU circuit board	JANCD-ACP01-E
	Back circuit board	JANCD-ABB01-E
	Raiser board (PCIe/PCIe)	JANCD-ABB02-E
Robot I/F board		JANCD-AIF01-1E
Safety terminal block board		IM-YE250/5-80P
General-purpose I/O board		JANCD-AIO02-E
Power supply contactor unit		JZRCR-APU01-1
Inverter unit	Refer to Tab. 8-3: "Capacity model"	
	SERVO control board	CSRA-SDCA01AA
Safety circuit board		JANCD-ASF01-E
Converter		JZRCR-YPU51-1
Main axis control board		SRDA-EAXA21A
Control board brake		JANCD-YBK21-3E
Converter		CSRA-CV05D01A
Capacitor module		SRDA-CUA662AA
Regeneration resistor	**Type**	SMVK500W260J/RO A6667
	Nominal value	500W
	Resistance value	26 Ω
DC reactor		2 x 85R-15014A
Heat exchanger		TCMSY-310DC
Cooling fan		4 x 09225VE-24P-CA-02
Noise filter		NF3050C-SVB

Tab. 8-2: Equipment configuration

Model	Inverter unit
GP7	CSRA-SDA01H01A
AR900	
GP8	
AR700	
GP12	CSRA-SDA02H01A
AR1440	
GP25	
AR1700	

Tab. 8-3: Capacity model

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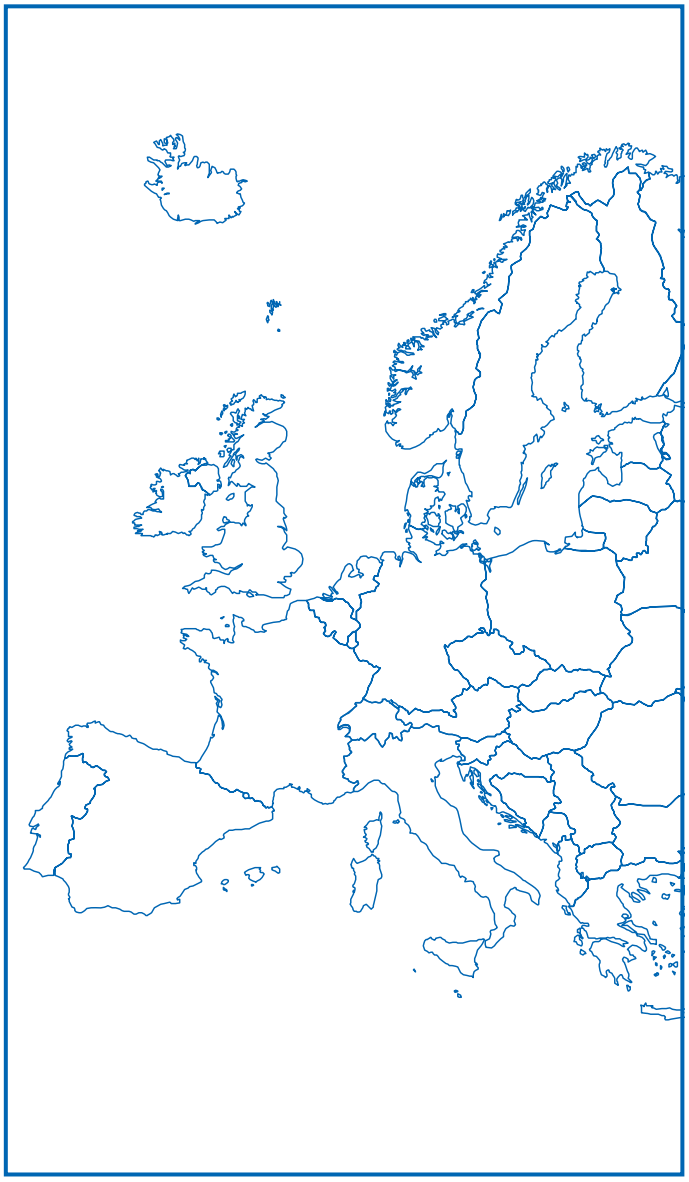

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