YASKAWA ROBOTICS

Installation and Wiring

Robot controller

User manual

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Changes made in revision:

Rev. 01: Revised in YEU-R style
Rev. 02: Revision of the entire manual
Rev. 03: Revision of chapter “Recommended Spare Parts“ (2013-11)
Rev. 04: Addition to the chapter “Specifications of the Robot Controller”, revised version of the original document RE-CTO-A220.5 (2015-01)
Rev: 05: Revised version of the section "Wiring"
Rev. 06: Correction of the chapter “Connection to the Mains Power Supply” and “Robot Control Connection”/ new cover page for all languages (2015-10)
Rev. 07: Revision of the entire manual (2016-08)
Rev. 08: Revised version of the section "Wiring"

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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 GmbH. The robot is normally supplied with the robot controller, programming pendant, and robot cable.

The terms are designated as follows in this manual:

Terms	Designation
Controller	Robot controller
Industrial robot	Robot
Programming pendant (teach box)	Programming pendant or PP
Cable between the robot and the robot controller	Cable
Robot, robot controller, and cable	Robot system
Yaskawa Electric Corporation	YEC
YASKAWA Europe “Robotics Division”	YEU-R
Movement, calibration, and setup of the robot	Teach
Sequence of movements of the robot	JOB
Technical Customer Service	TCS
Personal Computer	PC

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

NOTICE

- 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, carefully read the operating instructions of the robot controller ("Basic Information," "Setup," and "Connection 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 unauthorised 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

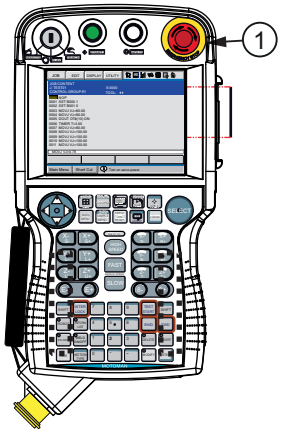


Fig. 1-1: Programming pendant

① Emergency Stop button

⚠ WARNING!

Death or injury because of danger of crushing

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

- ▶ The robot should not be used if the emergency stop button does not function.
- ▶ Before operating the robot check the function of the emergency stop button. The SERVO power has to immediately go off once the emergency stop button on the programming pendant has been pressed (seeFig. 1-3: "Emergency Stop button").
- ▶ When the SERVO power is turned OFF, the SERVO ON LED on the programming pendant goes off (see Fig. 1-2: "LED SERVO ON").

Fig. 1-2: LED SERVO ON

Fig. 1-3: Emergency Stop button

⚠ WARNING!

Death or injury because of danger of crushing

Before you release the emergency stop button (see Fig. 1-4: "Release of emergency stop button by turning") note the following:

- ▶ Make sure that there is no one within the maximum working range of the robot.
- ▶ Clear the cell of all items which could collide with the robot.
- ▶ Now you can switch ON the SERVO power by pressing the enable switch on the programming pendant.

Fig. 1-4: Release of emergency stop button by turning

⚠ WARNING!

Death or injury because of danger of crushing

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

Observe the following precautions when performing teaching operations within the robot's working range:

- ▶ View the Robot from the front whenever possible.
- ▶ Always follow the prescribed operating procedure (see the instructions on robot control as well as the operating instructions on "Handling" or "Universal Application").
- ▶ An area must be left clear so that the operator can retreat to it in case of emergency.

The following inspection procedures must be performed prior to teaching the robot. If problems are found, correct them immediately, and be sure that all other necessary measures have been performed.

- Check for problems in robot movement.
- Check the connectors for tight fit and all cables for damage.
- Hang the programming pendant back on the robot control after use.
- Make sure that the key for the key switch (Teach/Automatic) of the programming pendant is kept by a skilled person who has been specially trained.
- The key may be inserted in the key switch of the programming pendant only during teach operation; after the teach operation it must be immediately removed and kept in a safe place.

1.7.1 For your safety

Different requirements in general apply for robots than is the case for other production facilities. Among those are for example larger workspaces, high speed operation, speedy arm movements etc., which can pose risks.

Please read through the handbook and related documents carefully. Please observe all precautionary measures to avoid personal injuries and damage to the plant.

The owner is responsible for ensuring that all applicable standards, ordinances, regulations, and legal provisions for safety are observed and that the operating conditions are safe.

⚠ CAUTION!

According to the German Occupational Safety and Health Protection Act, teaching and maintaining the robot are considered to be "dangerous activities" and must be performed under the observance of the following provisions and regulations:

– German Occupational Safety and Health Protection Act.
– Implementation Order for the German Occupational Safety and Health Protection Act.
– Ordinance Regarding the German Occupational Safety and Health Protection Act.

Other pertinent provisions are as follows

– U.S.-American laws governing occupational safety and health protection.
– EC Machinery Directive 2006/42/EC

CE

Fig. 1-5: CE mark

Observe international standard EN ISO 10218-1 for a safe operation of the robot or robot equipment.

Increase the efficiency of your safety management system by determining authorised employees and safety managers and performing regular training.

NOTICE

In reference to international standard EN ISO 10218-1, an operator of a robot system must be trained before using 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 programme, please visit www.yaskawa.eu.com or directly get in touch with your YASKAWA branch office.

1.7.2 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.

- Beginner's Reference (E1102000144XX01* or higher).
- Install and Wiring (E1102000143XX01* or higher).
- Basic programming (E1102000147XX01* or higher).
- System Setup (E1102000145XX01* or higher).
- Alarm list (E1102000146XX01* or higher).
- Operating and maintenance instructions for the specific robot type.

* "XX" is the language of the document.

1.7.3 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:

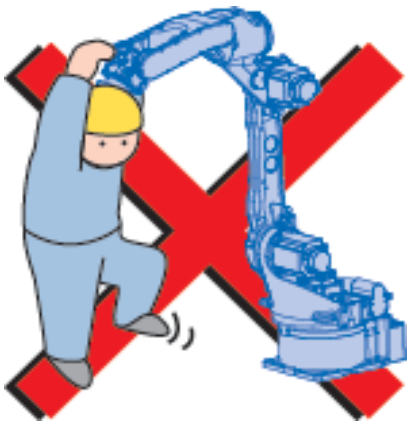
- ▶ Always wear approved work clothes (no loose-fitting clothes).
- ▶ Do not wear gloves when operating the robot.
- ▶ Personal Protective Equipment (PPE) is subject to the provisions of the 89/656/EEC guideline.
- ▶ Do not wear large jewellery, such as earrings, rings or pendants.
- ▶ Always wear protective 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 lean against the robot control.
- Avoid inadvertent pressing of the keys.
- Do not allow unauthorised persons to touch the robot control during operation.

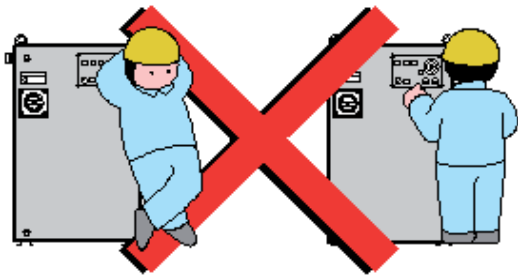


Fig. 1-6: Do not lean on

1.7.4 Safety during installation and wiring

⚠ CAUTION!

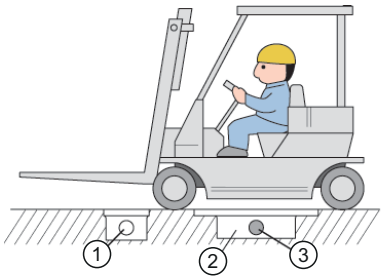
Personal injury and damage from improper connections and unforeseen movements

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!

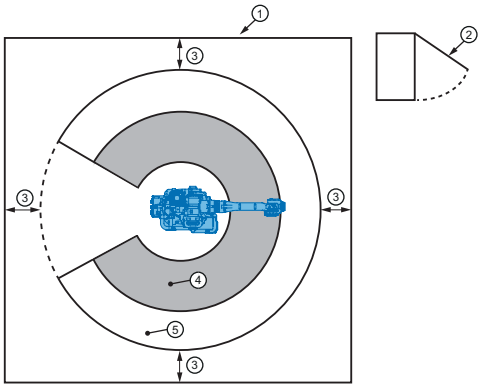
Injury and material damage due to unforeseen movements.

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

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).

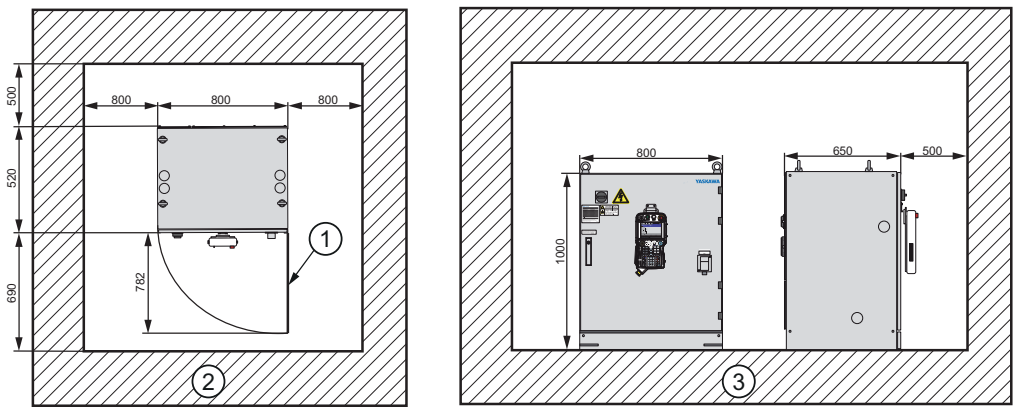


Fig. 1-7: Space for maintenance

① Door
② Robot controller maintenance area
③ At least 1,000 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!

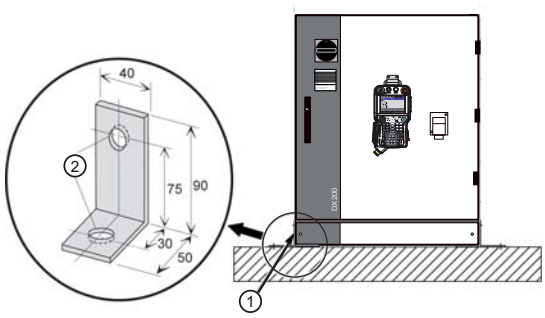
Danger of injury and material damage from falling or movements

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.

Anchor the controller to the ground. To this purpose, use the bolts as shown below.

① 2 holes Ø 12
② Holes for M10 screws



NOTICE

For more information about the installation of the robot please refer to the operating and maintenance manual for each robot type.

1.7.4.4 Safety in the work area

⚠ WARNING!

Risk of injury from movements of the robot

- When the power supplies of the robot and the DX200are turned ON at start-up, be sure to confirm the following:
  - Safety protection devices such as the emergency stop circuit, the safety plug, etc. operate normally.
  - Each axis operates normally in the TEACH mode.
  - The robot operates normally at the speed limit or less in the TEACH mode (Speed limit: 250 mm/s at the TCP or the flange).
  - The teaching function and the playback function operate normally.
- The manipulator may stop its movement while waiting for a condition to be satisfied during operation. In this case, the robot starts its movement again immediately after the condition is satisfied, thus it is dangerous to come close to the robot even if it is not moving. Make sure to clearly indicate that the robot is in operation by using a pilot lamp and/or an audible alert so that the operator does not come close to the robot, or make sure that the robot stops its operation if the operator comes close to it.
- Install safety fences around the robot to prevent any accidental contact with the robot while the power is ON.Display a warning sign stating “Off-Limits During Operation” at the entrance of the safety fence.

  The gate of the safety fence must be equipped with a safety interlock (safety plug) to turn the servo power OFF when the gate opens. Make sure that the interlock operates properly before use.

  For details of installation, refer to chapter 1.7 "Safety".
- For areas not enclosed by safety fences, use a photoelectric sensor, a safety light curtain, etc. to make sure that the robot stops its operation if the operator enters its operating range.

⚠ 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 of 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.

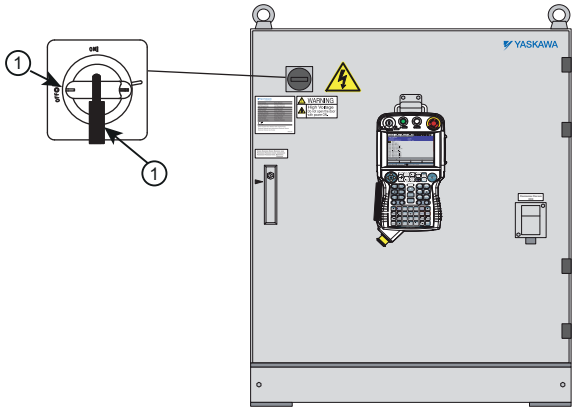


Fig. 1-8: Secure the robot controller with a padlock

① "OFF" position ② Padlock

External safety

The robot and its auxiliary equipment must be surronded by a safetyguard. Entrances (doors, gates, etc.) must be protected by interlockings, electro-sensitive devices or similar. Opening of the gates or entrance to the robot working area must stop all motions inside the cell. Before taking the robot into operation, the complete machine must fulfill the "Essential health and safety requirements relating to the design and construction of machinery" according to the EU Machinery Directive.

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:

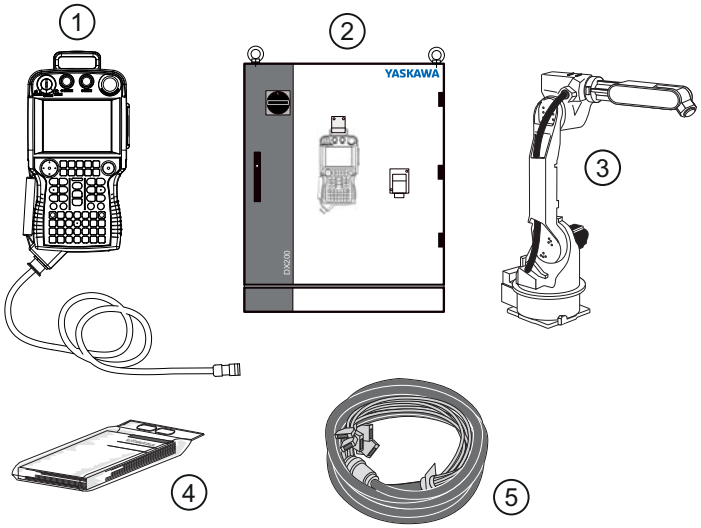


Fig. 2-1: Scope of delivery

① Programming pendant
② Robot controller
③ Robot
④ Assembly instruction
⑤ Cable

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.

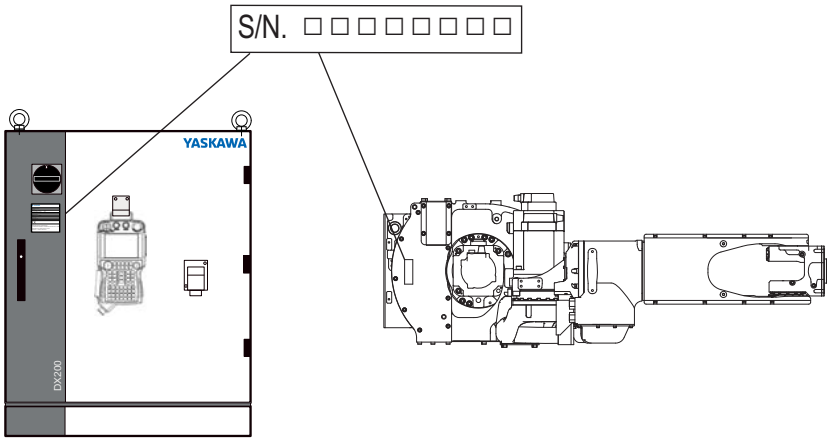


Fig. 2-2: Position type plate

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 material damage

The system consists of precision components. Failure to observe this caution may adversely affect performance.

- ▶ Crane and forklift trucks must be performed only by authorised personnel. The same applies to the application of loops.
- ▶ Avoid excessive vibration or shock during transportation.
- ▶ No external forces may be exercised on the robot control, the robot or other components.

3.1 Transporting method

- Check that the eyebolts are securely fastened.
- The robot controller weighs approximately 140 - 180 kg. Use load-carrying devices strong enough to withstand the weight.

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.

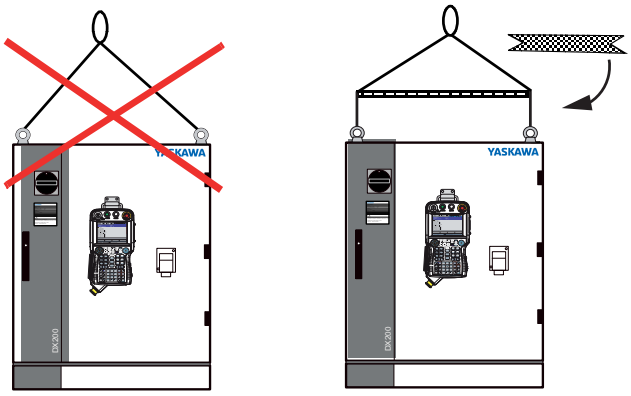


Fig. 3-1: Transport using a crane

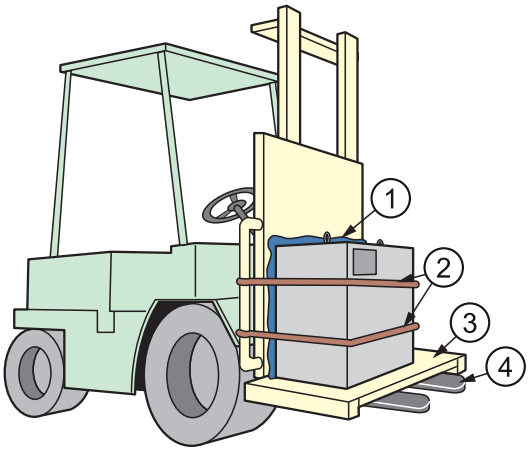
3.1.2 Using a forklift

If the robot controller is to be transported by forklift, it must be secured with safety belts, as shown in the figure "Transport by forklift" below. Make sure that the forklift and the transportation route have sufficient bearing capacity.

Always take due care when transporting the robot controller.

Using a forklift

① Protective padding
② Safety rope
③ Palette
④ Forklift tines



3.1.3 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.

By removing the lower front cover you will access to a tunnel under the cabinet. Normally cables are led through this opening. However, it can also be used to lift the control cabinet.

1. Remove the lower front cover by grabbing it at left and right side.
2. Pull it straight out.

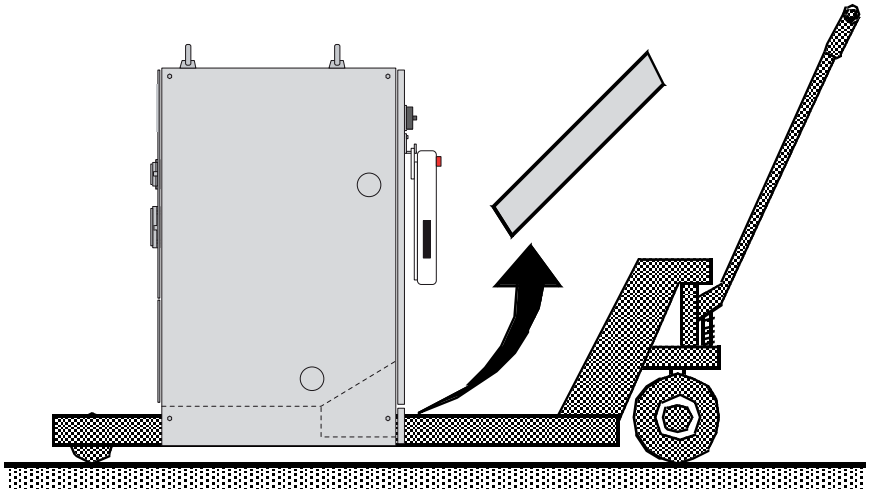


Fig. 3-2: Using a lifting truck

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

When installing a robot controller, it is necessary to satisfy the undermentioned environmental conditions:

- Ambient temperature: 0° C to 45° C.
- Air humidity: 20% to 80% relative humidity (non-condensing).
- Must be as dust-free, clean and dry as possible.
- Free from corrosive gas or liquid, or explosive gas or liquid
- Free from excessive vibration (Vibration acceleration: 4.9 m/s² [0.5 G] or less).
- Free from large electrical noise (plasma).
- Must be protected against collisions with moving equipment such as forklifts.
- Install the controller in a location from which the robot is easily visible.
- Install the controller in a location from which you can easily inspect it when the door is open.
- It is recommended to have a free area around the controller of at least 500 mm to allow maintenance acces. Minimum is 200 mm on the controllers backside for proper cooling.
- Must comply with the requirements of Directive 2004/108/EC on Electromagnetic Compatibility.

4.3 Installation options

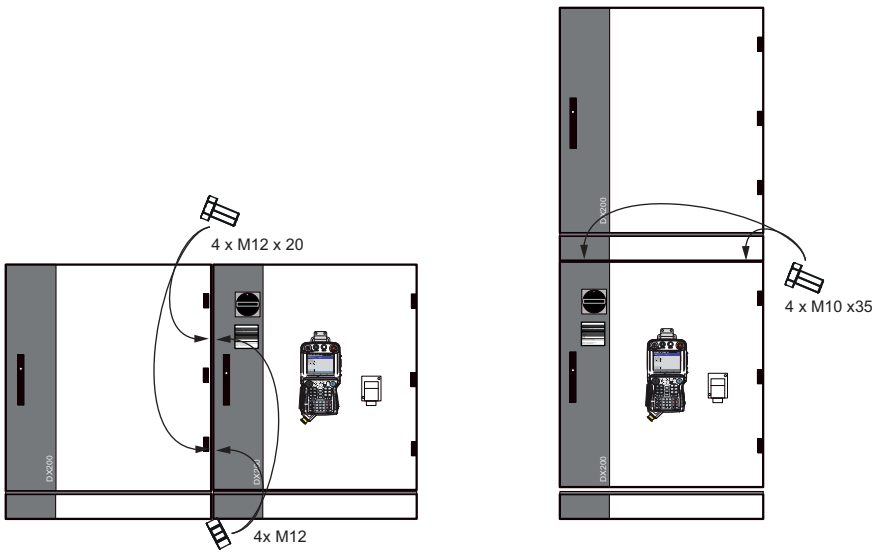


Fig. 4-1: Connecting two cabinets

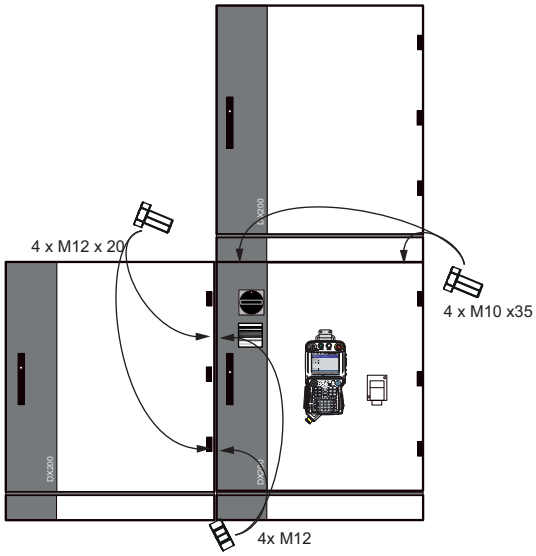
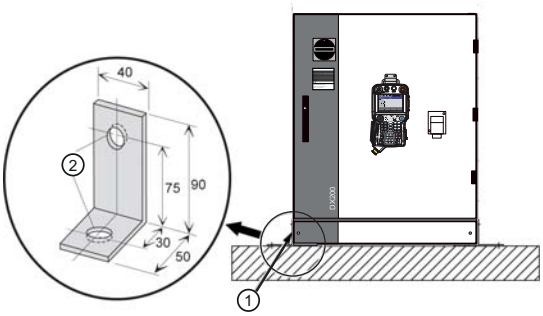


Fig. 4-2: Connecting three cabinets

4.4 Installation example

Anchor the controller to the ground. To this purpose, use the bolts as shown below.

① 2 holes Ø 12
② Holes for M10 screws



NOTICE

For more information about the installation of the robot please refer to the operating and maintenance manual for each robot type.

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.

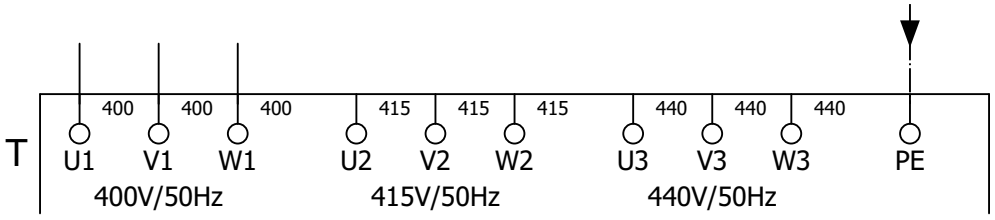
Capacitors inside the robot controller store electricity after power is turned OFF. Exercise caution whenever handling circuit boards.

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.

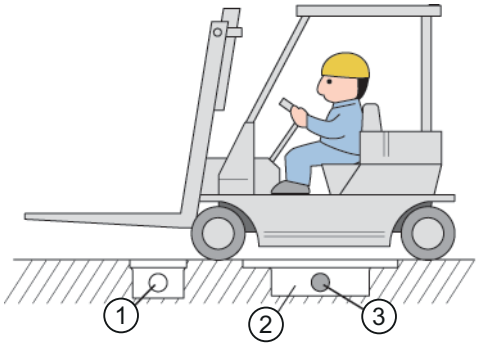
Power supply
400/415/440V 50Hz +10%/-15%



5.1 Notes on cable junctions

- The cables that connect the controller to peripheral device are low voltage circuits. Do not lay the signal cables of the robot controller together with the main power cable. 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. A wrong connection can cause damage to electronic equipment.
- During wiring, only authorized persons may be present in this area.
- Lay all cables in the floor in a covered cable duct.

① Piping
② Cable duct
③ Cable



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

NOTICE

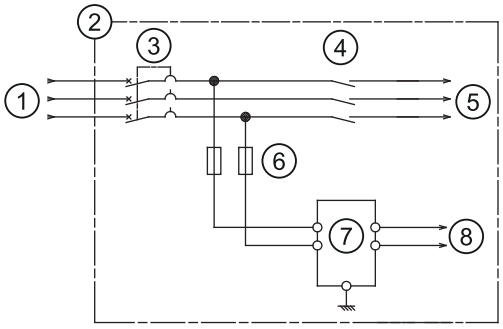
The power failure processing circuit operates when there is a black out or drop in voltage, and the SERVO power turns OFF.

Connect the power supply to a stable power source that is not prone to power fluctuations.

The 3-phase power supply consists of 3-phase 400/415/440 VAC at 50Hz.

① 3-phase 400/415/440 VAC at 50 Hz
② Robot controller
③ Breaker
④ Contactor (1KM)
⑤ To the converter
⑥ Fuse
⑦ Noise filter
⑧ To control power supply unit

Input power connection



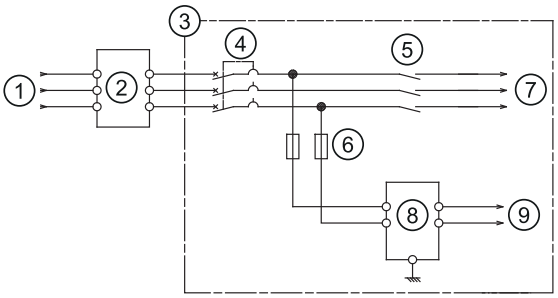
5.2.2 Noise filter installation

Insert the 3-phase noise filter into the primary station of the non-fuse breaker filter if you hear noise coming from the power source.

Seal up each cable opening so that dust does not enter.

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

Connection of 3-Phase noise filter



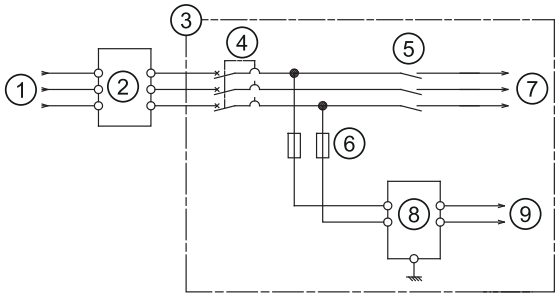
5.2.3 Leakage breaker installation

When connecting the leakage breaker to the controller power supply wiring, use a leakage breaker which can handle high frequencies from the DX200 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 DX200. 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 Fuse
⑦ To connector
⑧ Noise filter
⑨ To controller power supply unit

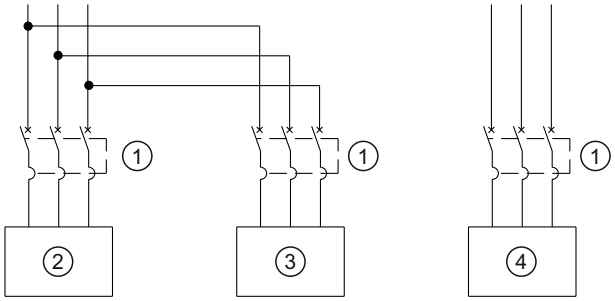
Connection of the Leakage Breaker



5.2.4 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)
MA1440	1.5	3.5 (M5)	15
MH12	1.5	3.5 (M5)	15
MS210	5.0	5.5 (M5)	30

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.

5.3 Connection methods

Outline connection diagram

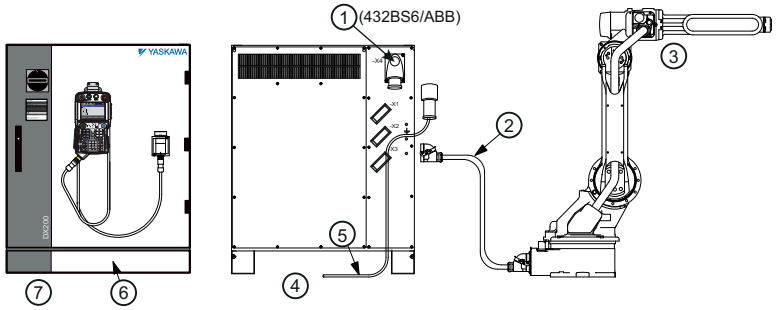


Fig. 5-1: Cable connection

① Power supply connection
② Robot cable
③ Robot
④ Rear view
⑤ Primary power supply cable
⑥ Programming pendant cable
⑦ Front view

All dimensions in mm

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

▶ To connect the robot controller to the main power supply, a CEE connector must be prepared (type: 432C6).

▶ 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.

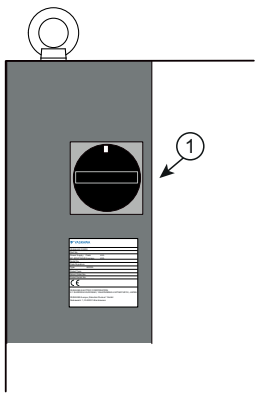
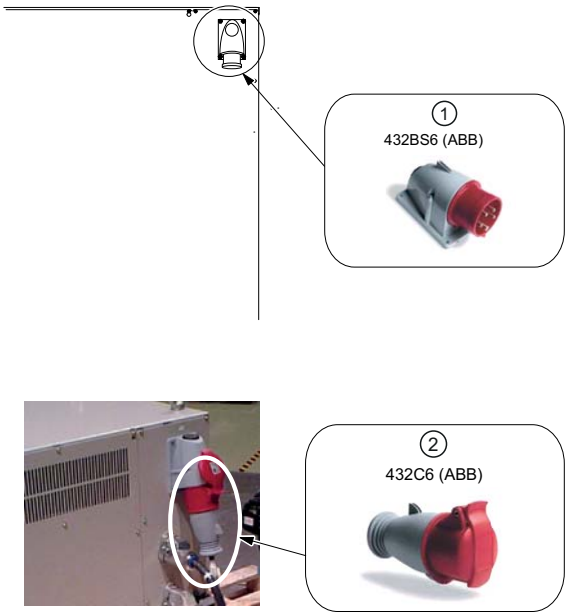


Fig. 5-2: Main switch in OFF position

① Main switch at the front side of the robot controller

2. Connect the power supply cable to the CEE connector on the back of the robot controller.



① Connector type (back side of robot controller)

② Connector type (cable side)

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.

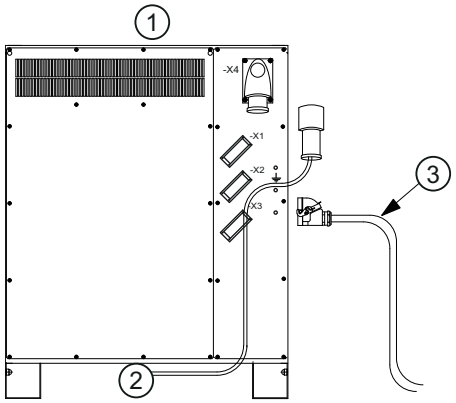


Fig. 5-3: Connection of the robot cable

① Robot controller (back side)
② Power supply cable for the connection to the main power supply
③ Robot cable

5.3.3 Connecting the programming pendant

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

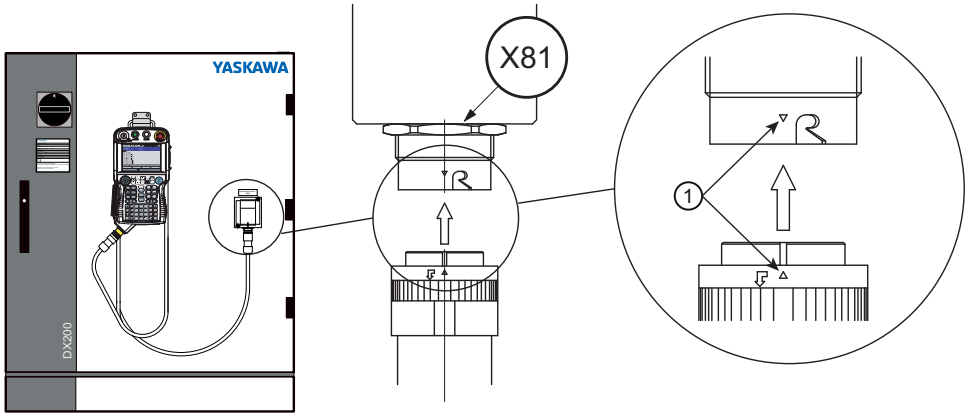


Fig. 5-4: Connection programming pendant

① Alignment marks

6 Maintenance and inspection

6.1 Regular 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.

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
Power cable	Check for damage and deterioration of leads.	Visual inspection	as required
Interior circulation fan and backside duct fan.	Check the function (while power ON).	Visual inspection	as required
Emergency stop button	Check the function (while servo power ON).	By pressing the keys	Before the robot is put into operation.
Enabeling device	Check the function (in teach mode).		as required
Battery	Confirm battery alarm or message is displayed or not.		as required
Power supply	Check power supply voltage is normal	Visual inspection	as required

6.2 Inspection of robot controller

6.2.1 Checking If the doors are firmly closed

The robot controller is hermetically sealed to prevent external air containing oil mist from getting in. Be sure to keep the robot controller doors fully closed at all times, even when the controller is not operating.

Prior to this, the power supply must be turned off:

For opening or closing the maintenance doors, use the key provided.

To close, press the door shut and turn the key until you hear a click.

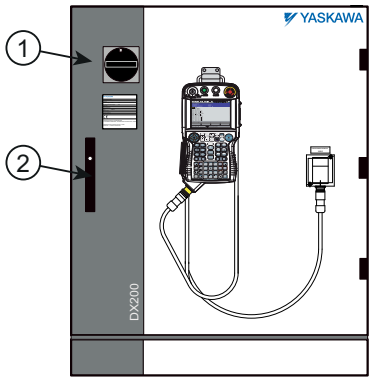


Fig. 6-1: Robot controller from the front

① Main switch ② Door interlock

6.2.2 Check for gaps or damage to the sealed construction.

- Open the door and check that the seal around the door is undamaged.
- Check that the inside of the controller is not stained badly. If it is, determine the cause, take measures and immediately clean it.
- Firmly lock each door and check that no excessive gaps exist around the edge of the door.

6.3 Cooling fan inspections

Inspect the cooling fans as required. A defective fan can cause the robot controller to malfunction because of excessive high temperatures inside.

The interior circulation fan and rear duct fan operate while the power is turned on.

Check the following,

- that the fan is working properly.
- that there is a noticeable draught (air intake, air outlet).

NOTICE

▶ When the message “Cooling fan in YPS power supply stopped. Exchange fan” is shown: The cause can be a failure of the CPU’s internal fan.

▶ When the message “Cooling fan in YPS unit stopped, replace cooling fan” is shown: Check and replace the defective fan in the CPU unit.

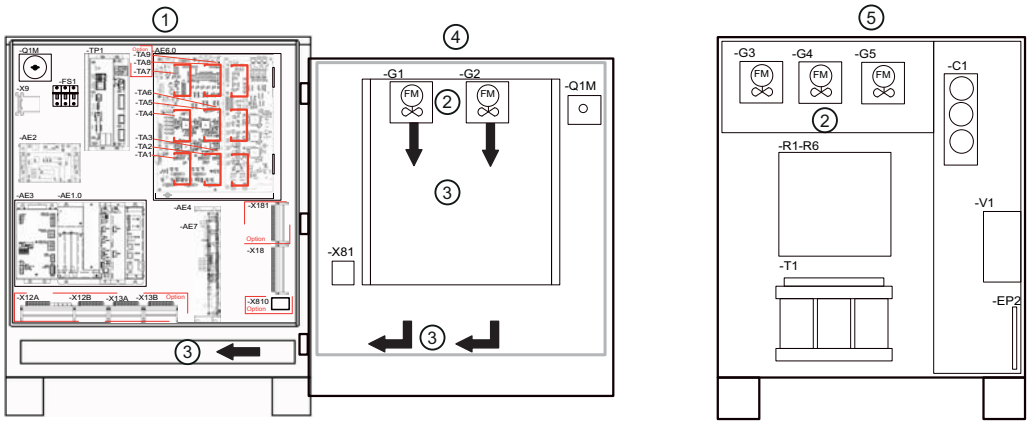


Fig. 6-2: Ventilation system

① Front view
② Internal fan
③ Air outlet
④ Door
⑤ Rear view

6.4 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.

6.5 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".

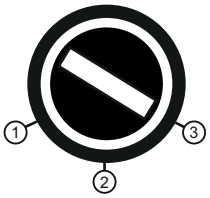


Fig. 6-3: Enabling device

① REMOTE
② PLAY
③ TEACH

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

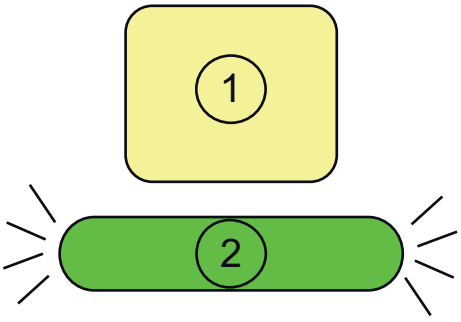


Fig. 6-4: Flashing light SERVO ON

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.

6.6 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.

6.7 Check the power supply

Use an electric tester to check the voltage on terminals 1, 3 and 5 of the main switch (Q1M).

Items to be checked	Terminals	Correct value
Correlated voltage	between 1 and 3 (R-S), 3 and 5 (S-T) 1 and 5 (R-T)	400/415/440V +10%/-15%
Voltage between earth (phase ground)	between 1 and E (R-E), 5 and E (R-E)	230/240/255V +10%/-15%
	between 3 and E (S-G)	Approximately 0V

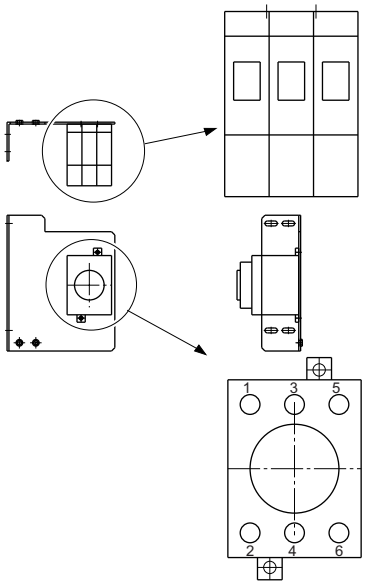


Fig. 6-5: Main switch

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 on 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 of 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	
Dimension (W x H x D)	800 x 1000 x 600
Weight	approx. 180 kg
Protection class	IP54 (The back fan is IP2X.)
Cooling system	Indirect cooling
Ambient temperature	0°C to + 45°C (During operation) -10°C to + 60°C (During transit and storage)
Relative humidity	10% to 90% RH (non-condensing)
Vibration Acceleration	0.5G or less
Power supply	3-phase 400/415/440 VAC at 50/60 Hz
Grounding	Grounding resistance: 0,1 Ω
Noise Level	Less than 62 dB
Digital I/O	General signals (standard, max.): 40 inputs and 40 outputs (Transistor: 32 outputs, Relay: 8 outputs) Specific signal (hardware): 25 inputs and 7 outputs
Positioning system	Absolute encoder / serial interface
Drive unit	SERVOPACK for AC SERVO motors
Acceleration / Deceleration	Software SERVO control
Program memory	200,000 steps, 10,000 instructions and 15.000 PLC steps
Interface	Ethernet
Color	RAL 7024, Graphite Grey, RAL 7026, Granite Grey, RAL 7043, Traffic Grey B
Others	Free from corrosive gas or liquid, or explosive gas. Free from exposure to water, oil, or dust. Free from excessive electrical noise (plasma).

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

Programming pendant operation	
Timer Setting	Possible every 0.01 s
Short-cut Function	Direct-open function, Multi-window
Interface	• CF card slot • USB port (USB1.1) (At Programming Pendant) • RS-232C, RS-232C/RS-422 (Exclusion use) • USB port (USB1.1): 2 ports • LAN (100 BASE-TX/10BASE-T): 2 ports (At CPU circuit board)
Application	• Arc welding • Spot welding • Handling • General • 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 (user coordinate)
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
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

Programming pendant operation	
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)
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)

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.

- **Arrangement of units and circuit boards**

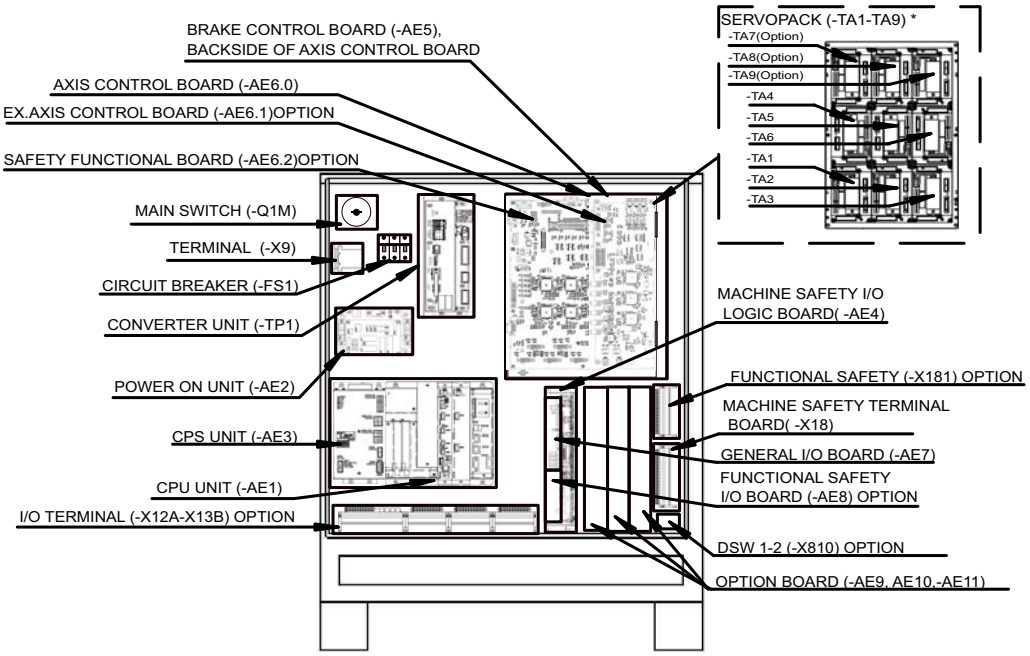


Fig. 7-1: Configuration robot controller (master)

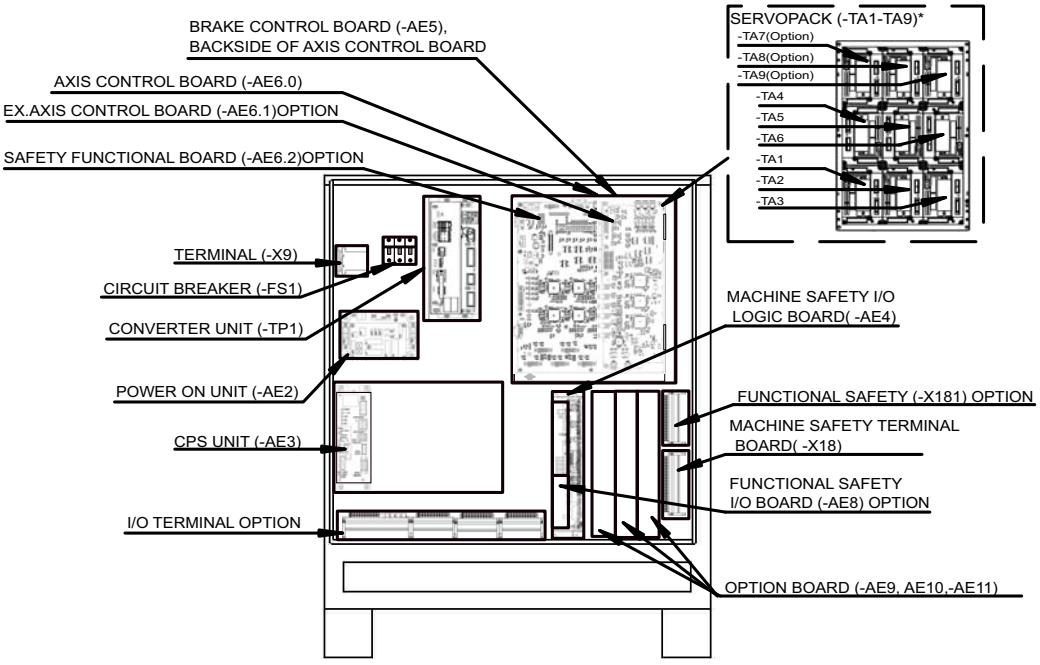


Fig. 7-2: Configuration robot controller (slave)

* The SERVOPACK types is different depending on robot model

- **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.

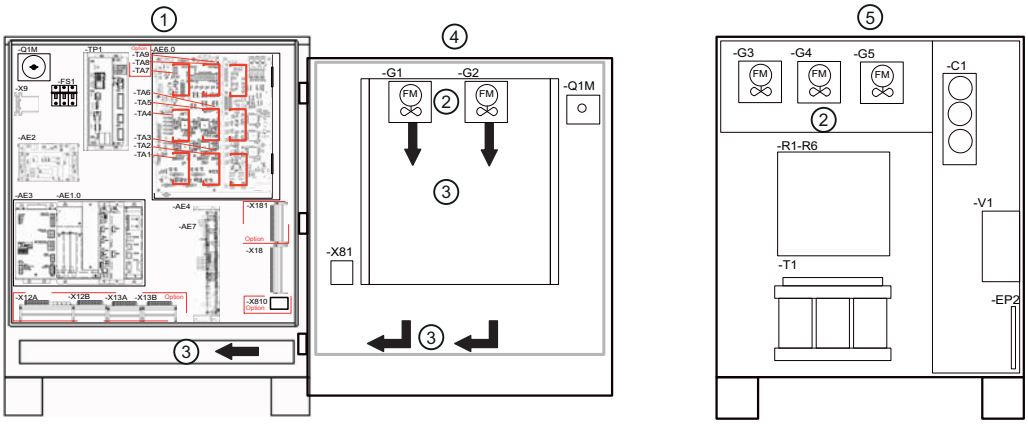


Fig. 7-3: Cooling System

① Front view
② Interior circulation fan
③ Air outlet
④ Door
⑤ Back View

8 Description of Units and Circuit Boards

- **Cautions for connection of dual input signals.**

Please follow the safety instructions in chapter 1.7 "Safety" on page 10.

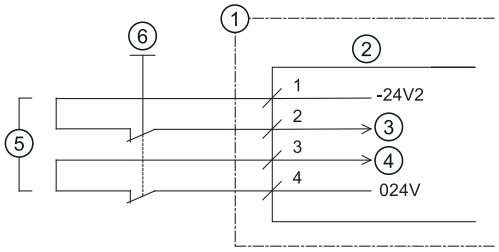
⚠ CAUTION!

Connect the switch (contact), which at the same time switches the 2-channel signals ON and OFF.

If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs.

① Robot controller
② Input for the robot system
③ Turn ON/OFF at the same time
④ Input signal 1
⑤ Input signal 2
⑥ Switch

Connection of 2-channel inputs



⚠ CAUTION!

Damage to property caused by short-circuit

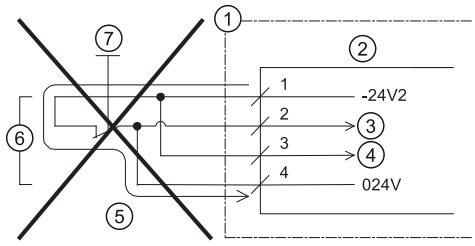
As power supply is reversed for each signal, a short-circuit and thus a possible a robot control failure occurs.

Do not connect the two signals to the same contact (use two separate contacts).

An alarm occurs due to the judgment of the safety circuit

① Robot controller
② Input for the robot system
③ Input signal 1
④ Input signal 2
⑤ Short circuit current
⑥ The same contact
⑦ Switch

Connecting 2-channel inputs to the same contact



8.1 Starting device

The starting device consists of:

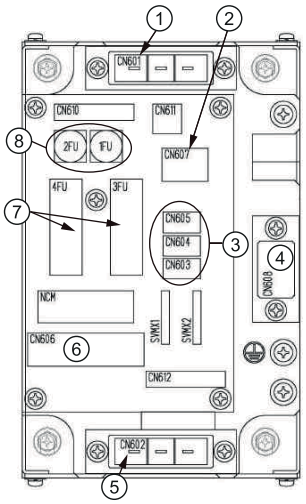
- the control board
- the connector switch for the main current
- the line filter

The starting device turns the control circuit ON and OFF and uses the signal from the SERVO-control to do this. At the same time the transducer is supplied with three-phase current (AC200/220V).

Power (single phase AC200/220V) is supplied to the controller via the line filter.

① Main power supply output (601) (601)
② Input connector contactor
③ AC power supply (CN603, CN604, CN605)
④ Brake interlock output (CN608)
⑤ Main power supply output (CN602)
⑥ AC Cooling Fan (CN606)
⑦ Fuse for AC cooling fan (2.5A 250V)(3FU), (4FU)
⑧ Fuse for AC power supply 0215010MXP (10A 250V) (1FU, 2FU)

Configuration of the starting device



8.2 Control board of the axes

8.2.1 Control board of the main axes

The control board of the main axes

- controls the servo motors of the six robot axes.
- controls the converter unit and the PWM amplifier modules.

A control board can be optionally used for the external axes.

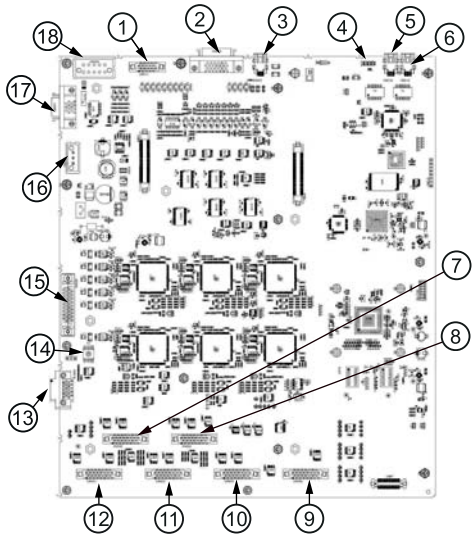
This option enables you to control a servomotor of nine axes including the robot axis.

The control board of the main axis has the following functions:

- Brake voltage control circuit
- Collision sensor (SHOCK) input circuit
- Direct input circuit

① Machine safety I/O I/F (CN511)
② Brake control signal (CN513)
③ STO control signal I/F (CN521)
④ LED
⑤ Communication monitor (CN515)
⑥ Communication monitor (CN516)
⑦ PWM amplifier 2 I/F (CN502)
⑧ PWM amplifier 4 I/F (CN504)
⑨ PWM amplifier 5 I/F (CN505)
⑩ PWM amplifier 3 I/F (CN503)
⑪ PWM amplifier 1 I/F (CN501)
⑫ Analogue monitor I/F (CN519)
⑬ Rotary switch (S1)
⑭ Encoder Signal (CN508)
⑮ DC control power supply (CN510)
⑯ Converter I/F (CN507)

Main axis control board

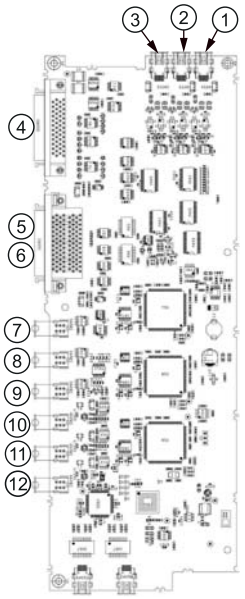


8.2.2 Control board of the external axes

A control board for the external axis can optionally be installed to control three additional axes. These can be inserted on the external axis control board.

① STO control signal I/F (CN524)
② STO control signal I/F (CN523)
③ STO control signal I/F (CN522)
④ PWM amplifier 9 I/F (CN533)
⑤ PWM amplifier 7 I/F (lower) (CN531)
⑥ PWM amplifier 8 I/F (lower) (CN532)
⑦ Encoder distribution for the machine safety systems (9 axes) (CN542)
⑧ Encoder distribution for the machine safety systems (8 axes) (CN541)
⑨ Encoder distribution for the machine safety systems (7 axes) (CN540)
⑩ Encoder I/F (9 axes) (CN536)
⑪ Encoder I/F (8 axes) (CN535)
⑫ Encoder I/F (7 axes) (CN534)

Control board of the external axes



8.3 CPU unit configuration

The CPU consists of:

- Rack (flame, rear board, PCI add-on board)
- CPU Circuit Board
- Robot I/F board
- CPU board (machine safety)

The CPU unit contains only circuit board racks and CPU circuit boards (machine safety).

Ensure that the robot I/F circuit board and the (machine safety) CPU circuit board are not attached.

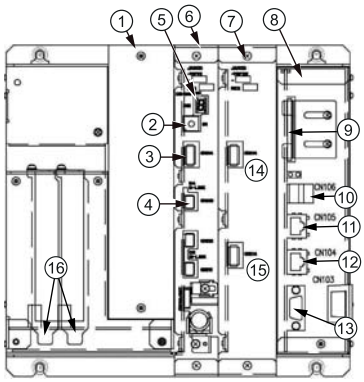


Fig. 8-1: CPU unit configuration

①	PCI slot for sensor board x 1	⑨	CompactFlash (CN107)
②	Rotary switch (S1)	⑩	USB (CN106)
③	I/O I/F (Communication with the optional I/O) (CN114)	⑪	Programming pendant (CN105)
④	Drive I/F (communication with control board of base axis) (CN113)	⑫	LAN (CN104)
⑤	LED	⑬	Serial port (RS232C) (CN103)
⑥	Robot I/F board (JANCD-YIF01-2E)	⑭	I/O I/F (communication with the functional safety circuit board) (CN203)
⑦	CPU board (machine safety)	⑮	I/O I/F (Communication with the machine safety I/O logic circuit board: dual-channel side) (CN202)
⑧	CPU board (JANCD-YCP21-E)	⑯	PCI slot X2

8.3.1 Unit and circuit board in the CPU unit

8.3.1.1 CPU board

The control of the entire equipment occurs via this board. The circuit board controls the display on the hand-held programming unit, the control keys and the movements, and it calculates the interpolation. This control circuit board has a serial interface for RS-232C/ RS-422 and a LAN connection (100Base-TX/10Base-T), USB (USB2.0).

8.3.1.2 Robot I/O control board

The control of the entire robot system occurs via the robot I/F circuit board. The robot system is connected to the control board via a PCI-Bus-interface on the rear. Connection with the basic axis control board for high transmission speed.

NOTICE

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

8.3.1.3 CPU board (machine safety)

This board is used for the E/A processing or for diagnosis for the safety sequences.

It is connected:

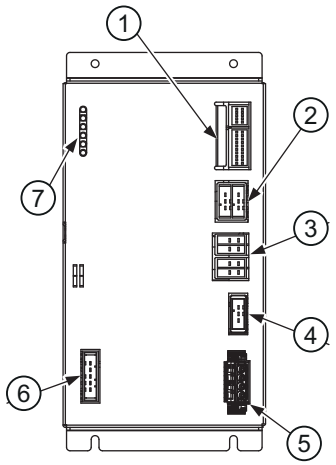
- via the PCI express bus I/F on the rear circuit board with the CPU circuit board.
- with the E/A logic (machine safety) circuit board via a fast serial connection (2 lines).

8.4 CPS unit

This unit (JZNC-YPS21-E) supplies the DC power (DC5V, DC24V) for control (system, I/O, brake). It is also equipped with the input function for turning the control power supply ON and OFF.

① Connection with CPU 1 (CN158)
Connection with CPU 2 (CN159)
② +24V2 Power supply output (CN156/ CN157)
③ +24V1/+24V2 Power supply output (CN154/CN155)
④ +24V3 Power supply output (CN153)
⑤ Remote control (CN152)
⑥ AC power input (CN151)
⑦ Monitor alarm display

Control power supply unit



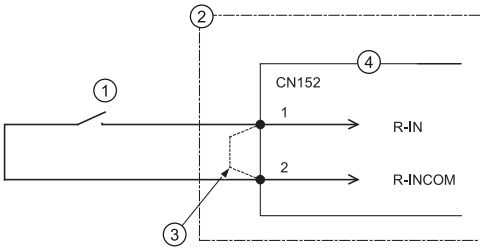
- Input
  Rated input voltage: 200/240VAC
  Voltage fluctuation range: +10% to -15% (170 to 242V AC)
  Frequency: 50/60Hz ± 2Hz (48 to 62Hz)
- Output voltage
  DC +5V
  DC +24V (24V1: System, 24V2: I/O, 24V3: brake)
- Indicator

Display	Colour	Status
SOURCE	Green	Lights up when supplied with power. Goes out when live internal parts are completely drained (power supply status: is supplied).
POWER ON	Green	Lights up when PWR_OK output signal is ON (power supply status: is supplied).
+5V	Red	Lights up on overload of more than +5V (ON during malfunction).
+24V	Red	Lights up on overload of more than +24 V (ON during malfunction).
FAN	Red	Lights up when fan malfunctions
OHT	Red	Lights up when unit interior overheats.

- Control Power ON/OFF
  To turn ON the robot controller voltage, turn the circuit breaker of the controller to the ON position. 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 circuit breaker of the controller is turned ON. This is operated by an external switch which is connected to the CN152 connector of the control power supply unit (when delivered, CN152-1 and CN152-2 are bypassed: for connecting the CN152 connector see figure below).

① Robot controller
② Control power supply unit
③ Remove the position controller
④ Control power supply ON/OFF switch

Connection to the control power supply unit



Refer to chapter for wiring of the CN152- connector 8.24 "Brake control circuit board (JANCD-YBK21-3E)" on page 92.

8.5 Board (machine safety)

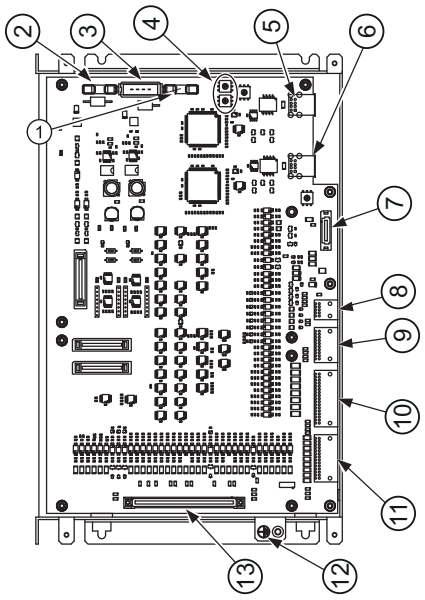
8.5.1 Machine safety I/O logic circuit board

The main functions of machine safety I/O logic unit are described below.

It processes external safety signals via the dual processing circuits and controls the ON/OFF signal on the main circuit of the starting device depending on the circumstances.

The main functions of machine safety I/O logic unit are described below.

- 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)
- Voltage control signal output circuit (double circuits)
- Anti Safety I/O circuit for the robot system
- Machine safety terminal block circuit board I/F



① Fuse for protecting the power supply 1A/250V (F1)

② Fuse for protecting the power supply 2A/250V (F2)

③ Power supply input connector (CN213)

④ Rotary switch (S1/S2)

⑤ (Communication with the CPU unit: 2-channel side) I/O I/F (CN211)

⑥ (Communication with the CPU unit: 1-channel side) I/O I/F (CN211)

⑦ Control board of the main axes I/F connector (CN214)

⑧ OT, SHOCK, LAMP (CN215)

⑨ FANALM, FANCTL (CN216)

⑩ Output connector of the contactor control (CN217)

⑪ I/F connector programming pendant (CN209)

⑫ Connecting terminal for the earth connection

⑬ Connector board machine safety I/F connector (CN219)

NOTICE

If fuse F1 blows, it damages the inner board. Therefore replace the complete board instead of replacing the fuse (no spare fuse is included in the delivery).

8.5.2 Connection tool shock sensor (SHOCK)

Direct connection to tool shock sensor signal line

1. The minus SHOCK (-) pin is connected to the +24V2 pin on the inside of DX200 door. Remove the minus SHOCK (-) pin from the +24V2 pin.
2. Connect the minus SHOCK (-) and +24V2 pin terminals to the signal lines of the tool shock sensor. Use the following pin terminals for preparing the end of the signal line:

Terminal name	Terminal model	Signal line terminal model
SHOCK-	TMEDN-630809-MA	TMEDN-630809-FA (manufacturer: NICHIFU Co., Ltd.)
+24V2	TMEDN-630809-MA	TMEDN-630809-MA (manufacturer: NICHIFU Co., Ltd.)

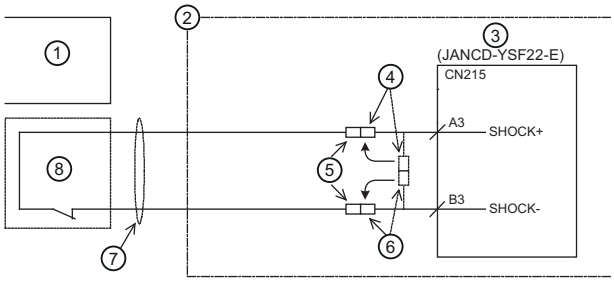
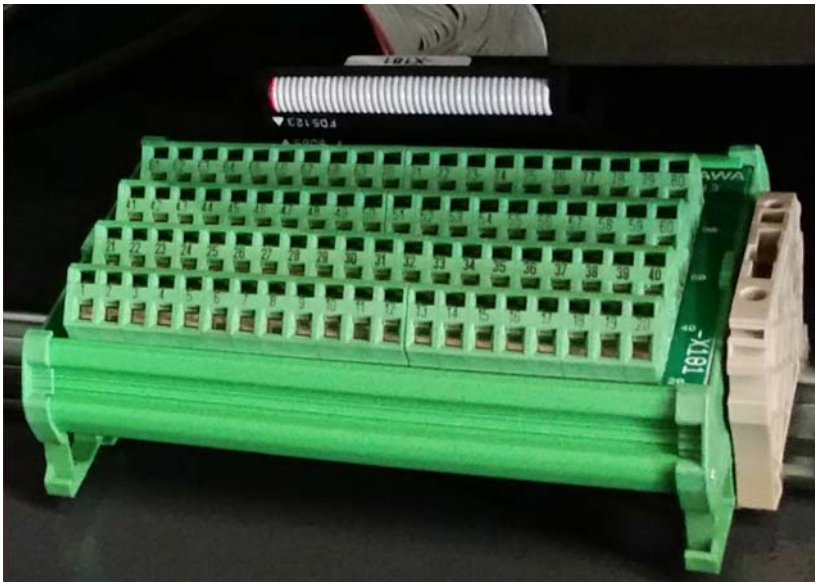


Fig. 8-2: Direct connection to tool shock sensor signal line

①	Robot	⑤	TMEDN-630809-MA (NICHIFU) TMEDN-630809-FA (NICHIFU)
②	Robot controller	⑥	SHOCK- TMEDN-630809-MA (NICHIFU)
③	Machine safety I/O logic circuit board	⑦	Shock sensor signal cable
④	TMEDN-630809-FA (NICHIFU) +24V2	⑧	Contact sensor (option)

The pin terminal for the shock sensor is attached on the right side of the controller.



With the cable that is built in to the robot

1. Disconnect the minus SHOCK (-) and +24V2 pin terminal from the DINAMIC connector, the machine safety I/O logic circuit board (YSF22-CN214). The pin terminal for the shock sensor is attached on the right side of the controller.
2. Connect the SHOCK (-) plug-in terminal to the SHOCK (+) plug-in terminal of the robot.

NOTICE

The cable installed on the robot is not connected to the shock sensor because the tool shock sensor is an option. For connecting the tool shock sensor, refer to the wiring diagrams in the INSTRUCTIONS for the robot.

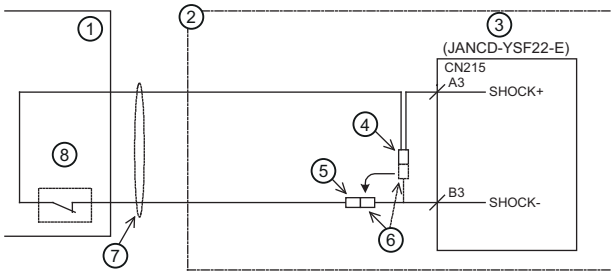


Fig. 8-3: Connection with robot cable

①	Robot	⑤	TMEDN-630809-FA (NICHIFU)
②	Robot controller	⑥	SHOCK- TMEDN-630809-MA (NICHIFU)
③	Machine safety I/O logic circuit board	⑦	Supply cables (PG)
④	TMEDN-630809-FA (NICHIFU) +24V2	⑧	Contact sensor (option)

NOTICE

If you use tool shock sensor input signal, you can specify the method for stopping the robot. The following two stop methods can be set: Stop and switch off the power supply. Selection of the stopping method is set in the display of the programing pendant. Refer to explanations in chapter Variable "Manual Instruction System Setup" not defined..

8.5.3 Machine safety terminal block circuit board (JANCD-YFC22-E)

The machine safety terminal block circuit board (JANCD-YFC22-E) is for the system external signal to connect with the safety I/O signals. For connection, refer to the connection diagrams for the respective unit.

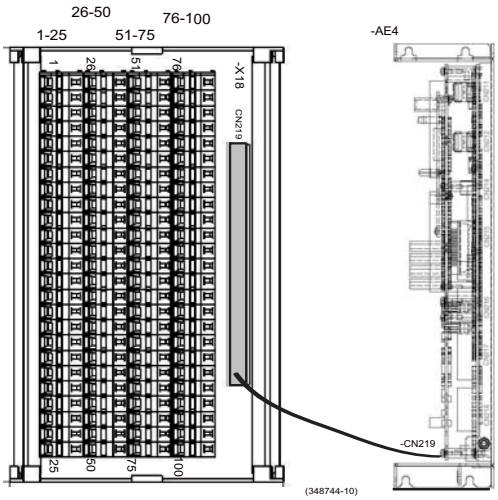


Fig. 8-4: Machine safety terminal block (X18)

① Machine safety I/O logic circuit board I/F connector (CN219)

Signal name	Connection no.:	two-channel	function	Factory setting
SAFF_1+ SAFF_1- SAFF_2+ SAFF_2-	1 2 3 4	Possible	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 input, the servo voltage is turned ON. As long as the signal is ON. The servo power cannot be turned ON. Note that these signals are disabled in teach mode.	Bypass using a jumper cable
EXESP_1+ EXESP_1- EXESP_2+ EXESP_2-	5 6 7 8	Possible	External emergency stop signal Used to connect the emergency stop switch of an external device. If the signal is input, the servo power will be turned OFF and the JOB will be stopped. As long as the signal input is present, the servo voltage should not be switched on.	Bypass using a jumper cable
EXDSW_1+ EXDSW_1- EXDSW_2+ EXDSW_2-	9 10 11 12	Possible	External enable switch Used to connect a enable switch other than the one on the programming pendant when two people are teaching.	Bypass using a jumper cable

Signal name	Connection no.:	two-channel	function	Factory setting
FST_1+ FST_1- FST_2+ FST_2-	13 14 15 16	Possible	Full speed test Is used to reset the speed limit for the test run in TEACH mode. If this signal input circuit is short-circuited, the speed of the test run becomes full speed in the teach mode. If this signal's circuit is open, the status SSP input signal determines the safety speed: The first slow speed (16%) or second slow speed (2%).	Open
SSP+ SSP-	17 18	-	Slow speed mode selection Used to determine the speed of the test run when the FST (full-speed test) signal input circuit is open. Open: Second slow speed (2%) Short circuit: First slow speed (16%)	Bypass using a jumper cable
EXHOLD+ EXHOLD-	19 20	-	External stop Used to connect the temporary stop switch of an external device. If the signal is input, the job is stopped. As long as the signal is ON, starting and axis movements cannot be enabled.	Bypass using a jumper cable
EXSVON+ EXSVON-	21 22	-	External servo-on Use to connect the servo ON switch of an external operation device. Upon entry of this signal, the SERVO power supply is turned ON.	Open
SYSRUN+ SYSRUN-	23 24	-	SYSRUN signal Use to determine the normal/abnormal condition of the robot controller by SYSRUN signal.	Open
+24V2U3	25			

Signal name	Connection no.:	two-channel	function	Factory setting
ONEN1_1+ ONEN1_1- ONEN1_2+ ONEN1_2-	26 27 28 29	Possible	SERVO-ON agree connected to using a function for distribution of the robot system in the different SERVO areas and to turning on and off the SERVO power supply.	Bypass using a jumper cable
ONEN2_1+ ONEN2_1- ONEN2_2+ ONEN2_2-	30 31 32 33			
ONEN3_1+ ONEN3_1- ONEN3_2+ ONEN3_2-	34 35 36 37			
ONEN4_1+ ONEN4_1- ONEN4_2+ ONEN4_2-	38 39 40 41			
OT2_1+	42		External axis overrun	Open
OT2_1- OT2_2+ OT2_2-	43 44 45		Used to input the overrun in the external axes other than the main body of the robot.	
OT3_1+ OT3_1- OT3_2+ OT3_2-	46 47 48 49	-		
024V2	50			
OT4_1+	51	-	External axis overrun	Open
OT4_1- OT4_2+ OT4_2-	52 53 54		Used to input the overrun in the external axes other than the main body of the robot.	
PBESP_3+ PBESP_3-	55 56	-	Contact output of the emergency stop button	Open
PBESP_4+ PBESP_4-	57 58		Used to output a contact point of the emergency stop button on the programming pendant.	
PBESP_3+ PBESP_3- PBESP_4+ PBESP_4-	59 60 61 62	-	Used to output a contact point of the emergency stop button on the front door of the robot electrical cabinet.	

Signal name	Connection no.:	two-channel	function	Factory setting
GSIN1_1+	63	Possible	Universal safety input	Open
GSIN1_1-	64		The universal safety input signal is used in the safety logical circuit function.	
GSIN1-2+	65			
GSIN1_2-	66			
GSIN2_1+	67	Possible		
GSIN2_1-	68			
GSIN2_2+	69			
GSIN2_2-	70			
GSOUT11+	71	-	Universal safety output	Open
GSOUT11-	72		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.	
GSOUT12+	73			
GSOUT12-	74			
24V2U3	75			
GSOUT2_1+	76	-	Universal safety output	Open
GSOUT2_1-	77		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.	
GSOUT2_2+	78			
GSOUT2_2-	79			
GSEDM1+	80	-	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.	Open
GSEDM1-	81			
GSEDM2+	82	-		
GSEDM2-	83			
AXDIN_COM	84	-	Direct input (SERVO)	Open
AXDIN1	85		Used to input the quick responding signals in the search function etc.	
AXDIN2	86			
AXDIN3	87			
AXDIN4	88			
AXDIN5	89			
AXDIN6	90			
+24V2U3	91		DC +24V2 output terminal	Open
+24V2U3	92		DC +24V2 output terminal	Open
024V2	93		DC +24V2 output terminal	Open
024V2	94		DC +24V2 output terminal	Open

Signal name	Connection no.:	two-channel	function	Factory setting
AIN_COM	95	-	Universal input (SERVO)	Open
AXIN1 AXIN2	96 97		Used to input the universal signal from the external device.	
AXOUT1	98	-	Universal output (SERVO)	Open
AXOUT2	99		Used to output the universal signal to the external device.	
024V2	100		DC +24V2 output terminal	Open

Tab. 8-1: JANCD-YFC22-E Details terminal (-X18)

Wiring procedure

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

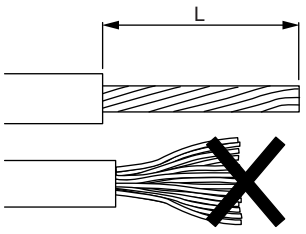
1.) Tool: Screwdriver

– 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).

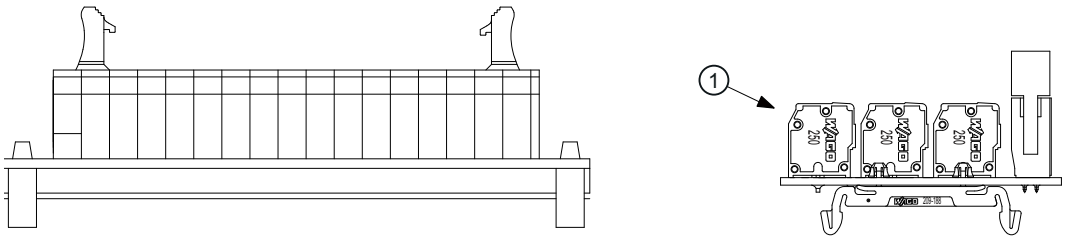
2.) Suitable wires

- 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

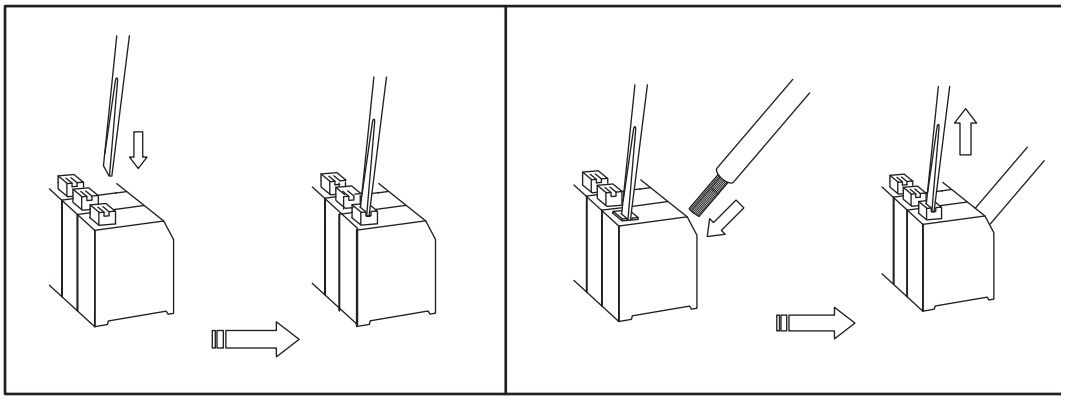
3.) Wire connections



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.

8.6 External emergency stop signal

This signal is used to connect an emergency stop button of an external device. If the signal is input, the SERVO power is turned OFF and the JOB is stopped. As long as the signal is present, the servo voltage cannot be switched on.

⚠ CAUTION!

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 with incoming signal.

▶ Always remove the jumpers before operation.

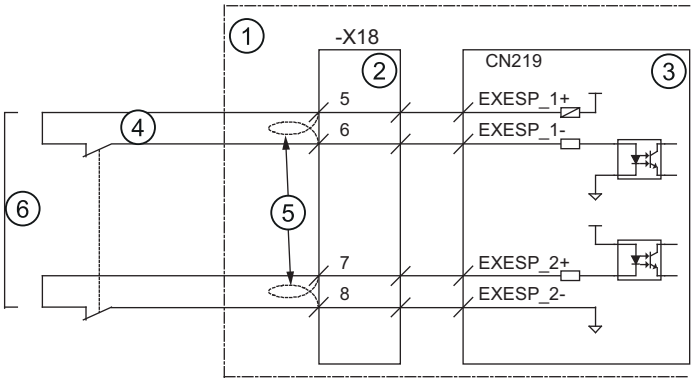


Fig. 8-5: Connection of external emergency stop signal

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ External emergency stop signal
⑤ Remove jumper
⑥ Switch on/off at the same time

8.7 Safety plug

This signal is 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 input, 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. Make sure that no person go inside the safeguarding.

DANGER!

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.

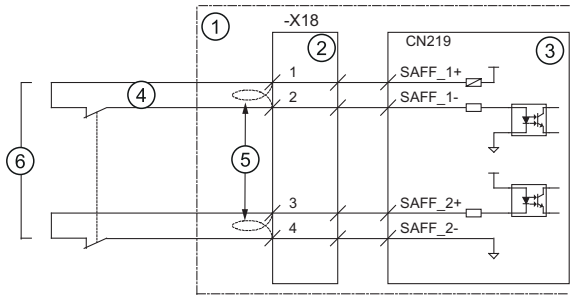
▶ Always remove the jumpers before operation.

NOTICE

Because of the its dual circuits signal to input, the alarm occurs if the signal does not much. However, in the TEACH mode, even though the signal does not much, the alarm is not detected. The alarm is detected only in the PLAY mode.

Connection for safety plug

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



8.8 Installation of safety plug

- **Installation of safety plug**

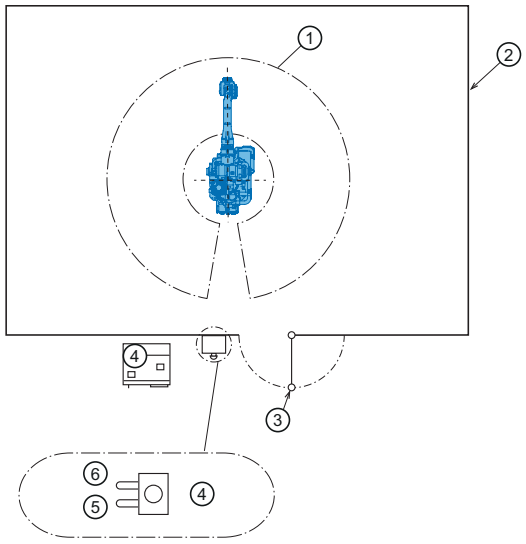
The robot must be surrounded by a safeguarding and a door protected by an interlock function. The door must be opened by the technician to enter and the interlock function stops the robot operation when the door is open. The safety plug input signal is connected to the interlock signal from the gate.

NOTICE

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

Installation of safety 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.

8.9 External enable switch

This signal is used if using a different enabling switch than the one on the hand-held programming unit.

For example: During a TEACH-IN with two operators.

⚠ CAUTION!

Injuries and machine damage as a result of short circuiting

The 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.

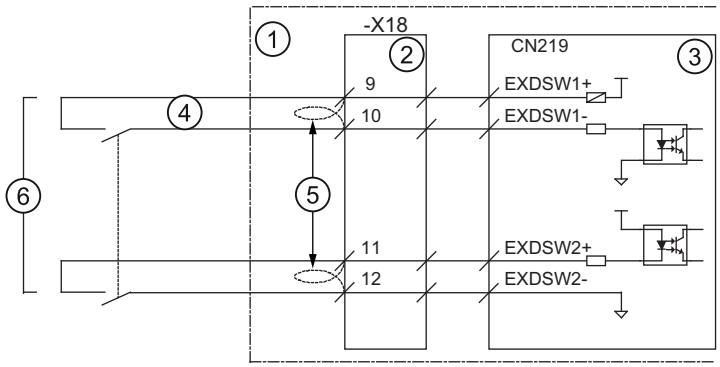


Fig. 8-6: Connection of external emergency stop signal

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ External enable switch
⑤ Remove jumper
⑥ Switch on/off at the same time

8.10 Full speed test

This signal is used to reset the slow speed limit for the test run in the teach mode.

If this signal input circuit is short-circuited, the speed of the test run becomes 100% in the play mode.

If this signal's circuit is open, the status SSP input signal determines the slow speed: The first slow speed (16%) or second slow speed (2%).

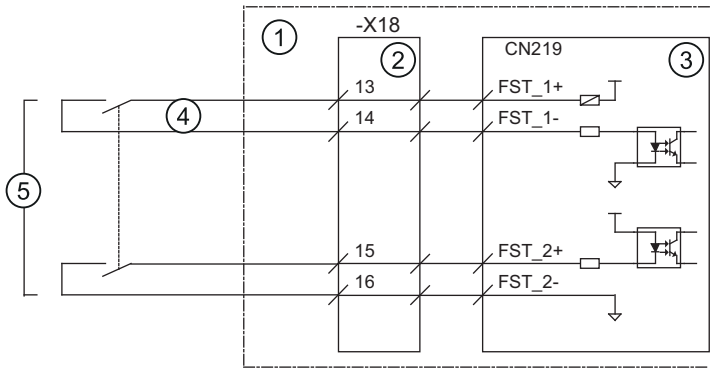


Fig. 8-7: Connection for Full-speed Test

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ External enable switch
⑤ Full-speed Test

8.11 Slow speed mode

This signal is used to define the speed of the test run. The signal input switch is open for a test run at full speed.

Open: 2. low speed (2 %)

Short circuit: 1. low speed (16 %)

⚠ CAUTION!

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.

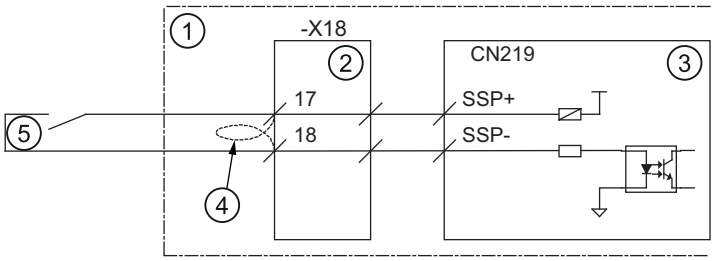


Fig. 8-8: Connection for low speed

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ Remove jumper
⑤ Mode low speed

8.12 External SERVO-ON

This signal is used to connect a SERVO-ON switch of an external device. The servo voltage is switched on if this signal is present.

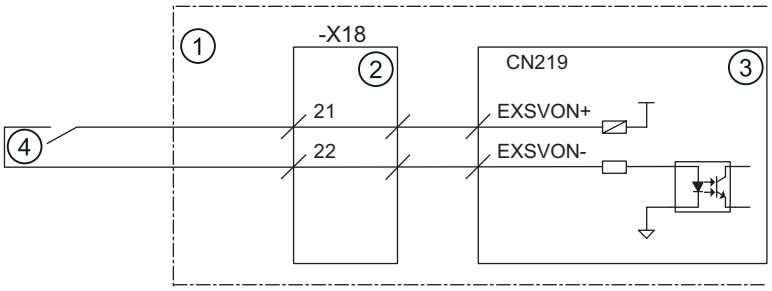


Fig. 8-9: Connection for external SERVO-ON

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ External SERVO-ON

8.13 SYSRUN signal output

This signal is used to check whether the robot control status is normal or abnormal.

This signal is output on the following conditions.

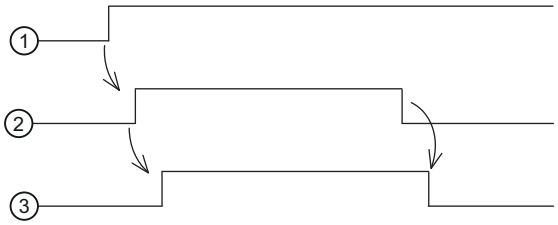


Fig. 8-10: (1) Connection for SYSRUN signal output

① Main power supply ON/OFF
② Robot control status normal/abnormal
③ SYSRUN ON/OFF

The pulse signal is output every 100ms by the specific output signal (#50911) to the external equipment. The pulse signal can be tested to see whether the robot control circuit board is running normally or abnormally (see instructions: "Instructions for Concurrent I/O").

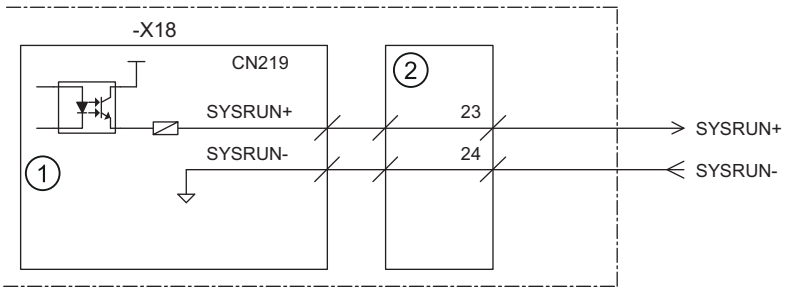


Fig. 8-11: (2) Connection for SYSRUN signal output

① I/O board (machine safety)
② I/O terminal (machine safety)

8.14 External axes overrun

⚠ WARNING!

Danger of injury and damage to property if the signal is not working

The settings must be performed to activate the external axis overrun. If not, this function will not be activated even if the signal is input, thus personal injury and/or equipment damage may result.

▶ Before use, make sure to perform the settings of the external axis overrun. After that, confirm that the overrun alarm occurs by turning OFF the external axis overrun signal.

In units with standard specifications without an external axis, the input signal for overrunning of an external axis is not used. In this case, a jumper cable is installed (refer to the following figure).

If an input signal overspeed is necessary for an external axis, connect the signal input circuits as described below.

For safety reasons, redundant = two-channel switches have to be used for the overrun signal input for external axes. Connect the signal input of the external axis this way that both input signals are turned ON or OFF at the same time.

If only one signal is turned ON, the machine safety signal error occurs. For the setting of the external axis overrun, refer to chapter Variable "Manual Instruction Addition of Base and Station Axes" not defined..

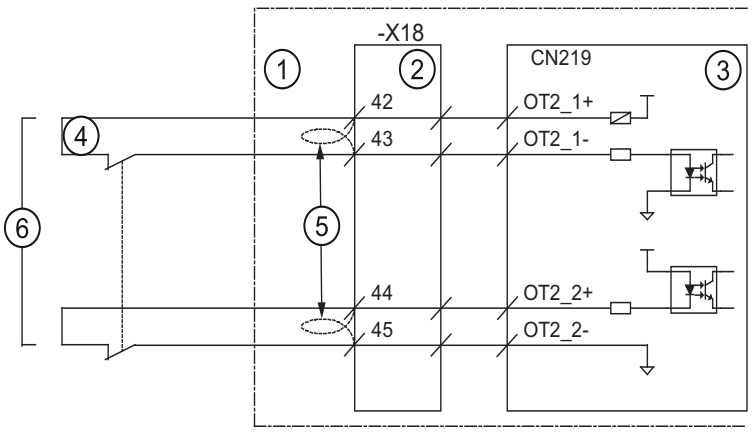


Fig. 8-12: Connection for external axis overrun

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ External axis overrun
⑤ Remove the jumper
⑥ Switch on/off at the same time

The figure below shows the factory standard wiring, where all external axes are connected to the DX200.

Please refer to the following figure to connect the external axes overrun signal to wire in the another route. On that occasion, confirm the external axes overrun setting to connect (Refer to chapter Variable "Manual Instruction Addition of Base and Station Axes" not defined.).

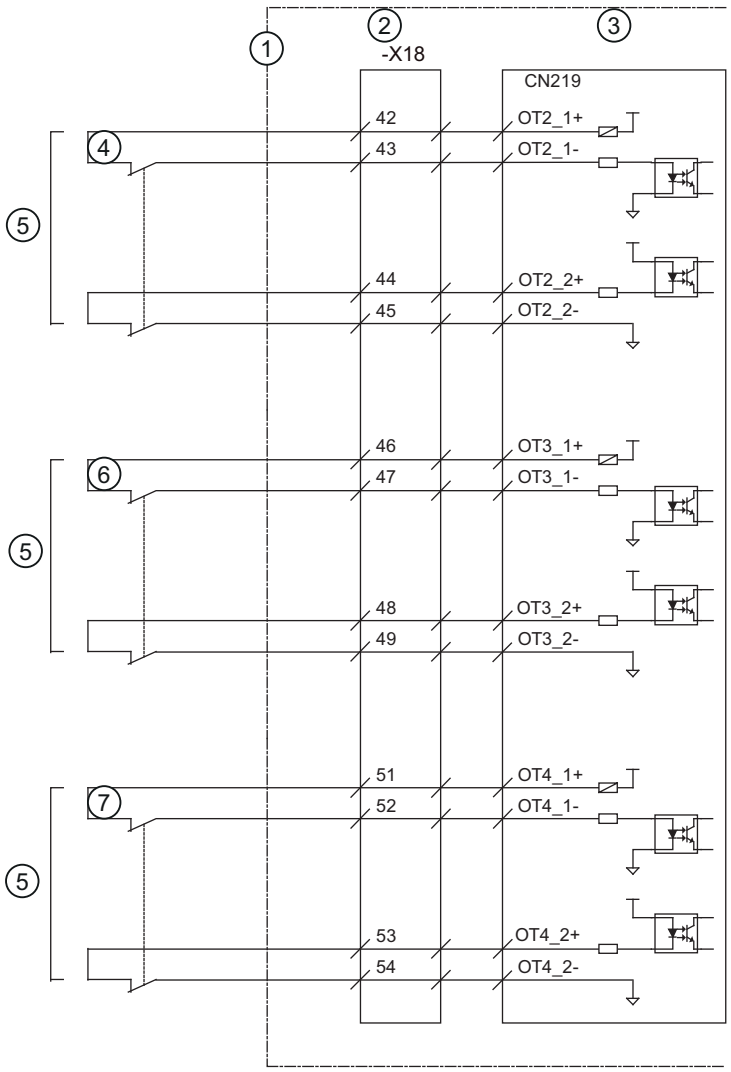


Fig. 8-13: Connection for overspeed of an external axis (several lines)

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ Overspeed external axis 1st line
⑤ Turn on/off at the same time
⑥ Overspeed external axis second line
⑦ Overspeed external axis 3rd line

8.15 General purpose safety input

The GP safety input signal will be used in the safety logical circuit function.

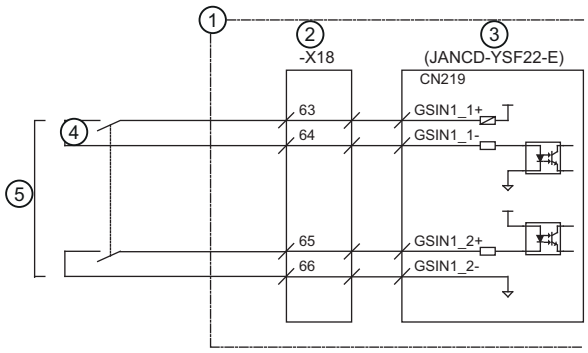


Fig. 8-14: Universal safety input

① Robot controller
② Machine safety terminal block board
③ Machine safety I/O logic circuit board
④ Universal safety input
⑤ Turn on/off at the same time

8.16 General purpose safety output

The universal safety output signal will be used in the safety logical circuit function.

For instance: The establishment of the circuit for status signal output, like the SERVO ON signal or the emergency stop button via the safety logic function, transmits the appropriate signal to the external equipment.

The signal is transmitted as a dual signal, and receives the status of the controlled equipment via the output signal as a supervision signal.

NOTICE

- Nominal capacity values are 24V DC and less than 50mA. Avoid excessive loads when connecting.
- When connecting the inductive load on the output circuit, such as the safety relay, for example, the built-in safety circuit for the peak constraints or the flyback diode is switched parallel to the inductive circuit to suppress voltage spikes. This can damage the output circuit.
- The feedback signal must be entered in the robot controller when the universal safety input signal is used.

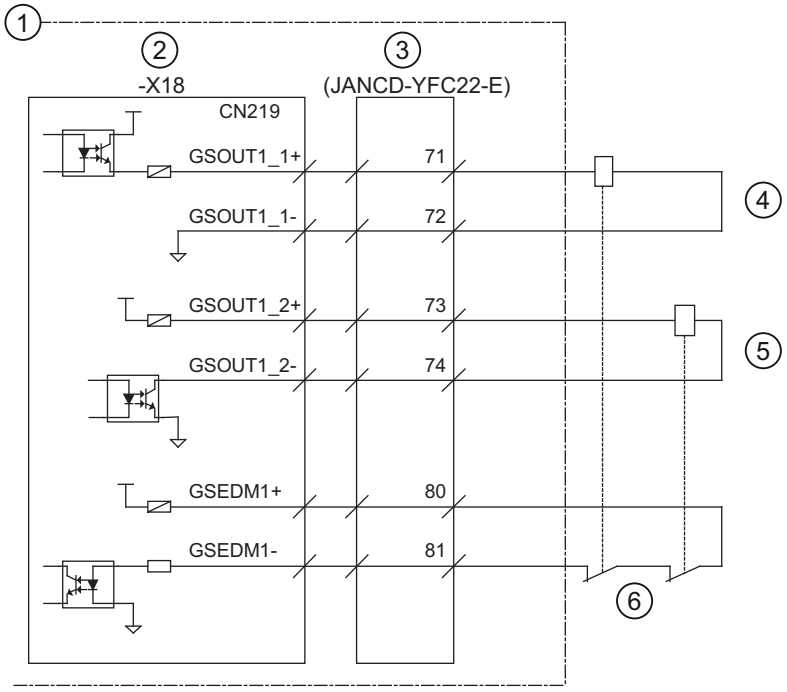


Fig. 8-15: Universal safety output

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ Universal safety output 1
⑤ Universal safety output 2
⑥ Monitoring signal

8.17 SERVO-ON enable input

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 areas.

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 switch so that both input signals are turned ON or OFF at the same time. If only one signal is turned ON, an alarm occurs.

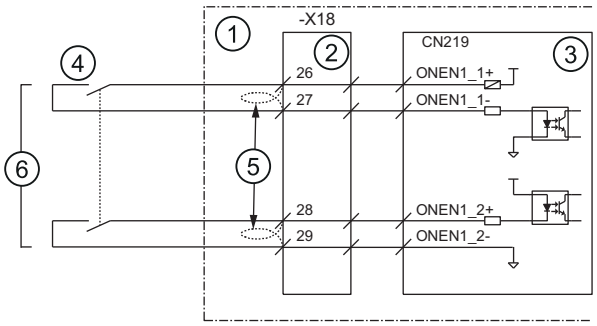


Fig. 8-16: Connection for SERVO-ON enable input

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ SERVO-ON enable input
⑤ Remove jumper
⑥ Switch on/off at the same time

8.18 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.

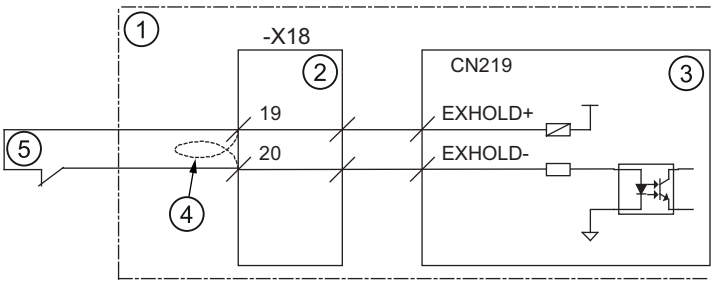


Fig. 8-17: Connection for external stop

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ Remove jumper
⑤ External stop

8.19 Emergency stop output

Outputs the contact output terminals for both emergency stop buttons on the programming pendant.

These contact outputs are always valid regardless of the DX200 main power supply status ON or OFF (Status output signal: normally closed contact).

⚠ CAUTION!

Damage to property caused by short-circuit

- ▶ Do not use the emergency stop button with a voltage of 24 V AC, 0.1 A or more.
- ▶ When connect the inductive load, such as the 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.

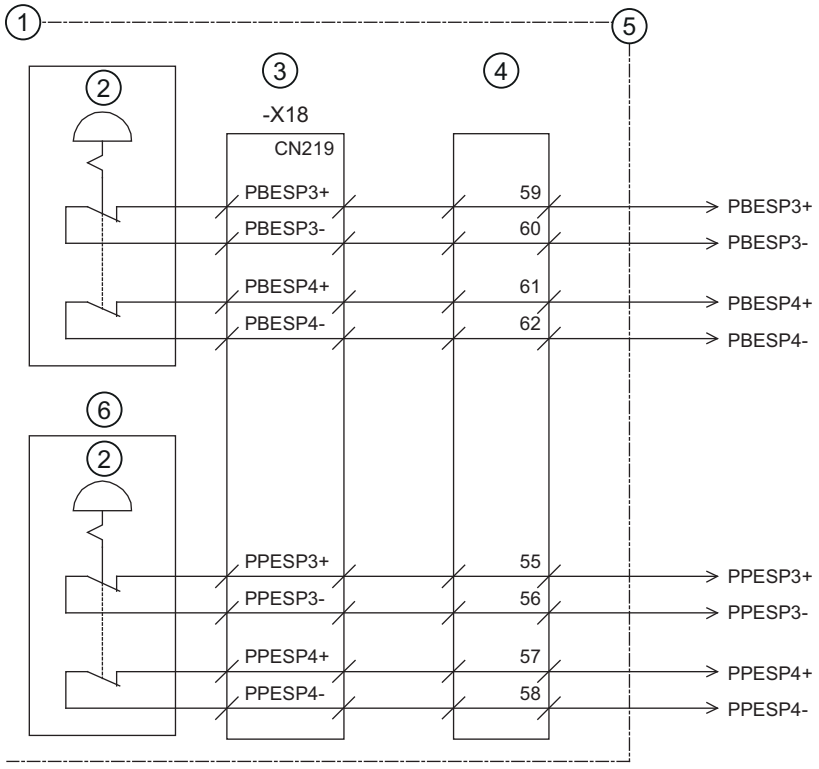


Fig. 8-18: Emergency stop button output

①	Control cabinet door of the robot controller	④	I/O terminal board (machine safety)
②	EMERGENCY STOP button	⑤	Robot controller
③	I/O board (machine safety)	⑥	Programming pendant

8.20 Connection Direct-in

This signal is used to input a response signal with search functions.

This part of the wiring is for the SLAVE, for control voltage supply and for the control card for the main axles of the slave robot, SRDA-EAXA01.

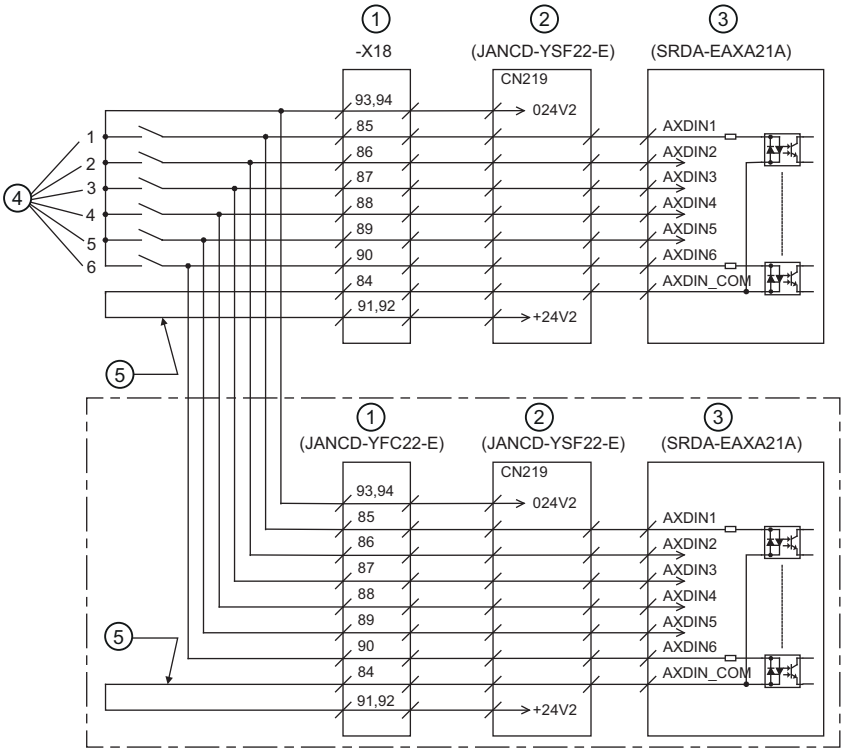


Fig. 8-19: Connection for Direct-in (SERVO) 1 to 6

① I/O terminal (machine safety)
② I/O board (machine safety)
③ Connect the jumper
④ Direct-in (SERVO)
⑤ Connect the jumper

8.21 General purpose input (SERVO)

Connect when use the general purpose signal.

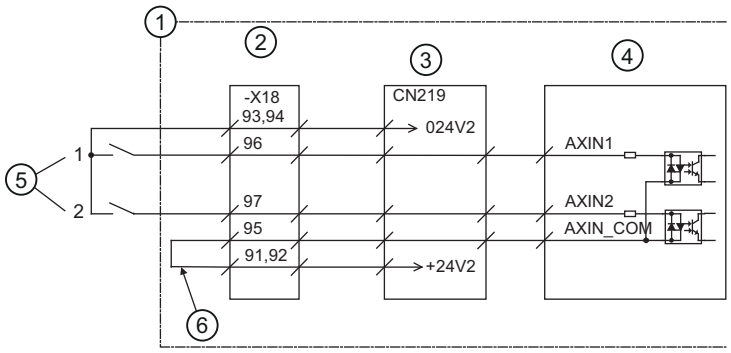


Fig. 8-20: General purpose input (SERVO)

① Robot controller
② Safety terminal block board
③ Safety circuit board
④ Main axis control board
⑤ General purpose input (SERVO)
⑥ Connect the jumper

8.22 General purpose output (SERVO)

Connection when using universal signals

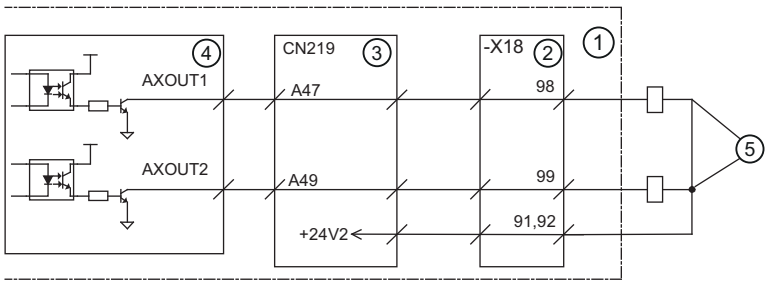


Fig. 8-21: Universal output (SERVO)

① Robot controller
② I/O terminal (machine safety)
③ I/O board (machine safety)
④ Control board (basic axis)
⑤ Universal output (SERVO)

8.23 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”.

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 “Gernaral 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”.

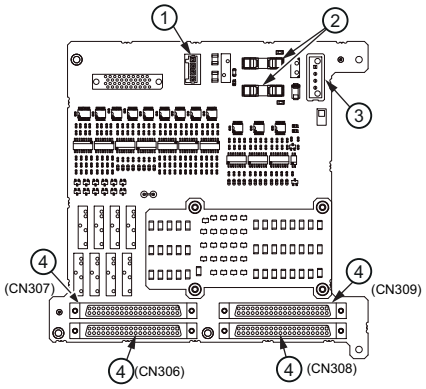
I/O board

① For switching external power supply (CN303)

② Power Supply Protective Fuse (F1, F2) 3,15A / 250 V

③ Power Supply Output (CN304)

④ Digital I/O (CN307, CN306, 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).

- **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).

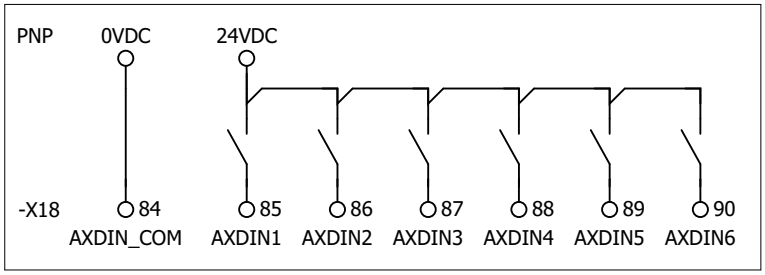


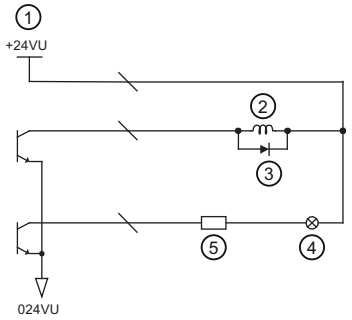
Fig. 8-22: PNP logic

NOTICE

When connecting an inductive load to the output circuit, connect a flyback (snubber) diode in parallel to the inductive load to suppress the surge voltage. Not using the flyback (snubber) diode may damage the output circuit.

When connecting the load with a large inrush current such as the lamp, connect the current limiting resistor in series to the load, so that the output current does not exceed its maximum value. Exceeding the maximum output current value may damage the output circuit.

① General purpose I/O board
② Inductive load
③ Flyback diode
④ Lamp
⑤ Current limiting resistor



Refer to chapter 8.28 "Assignment of universal I/O signals" from 95 about the maximum current of the transistor and the relay output circuits.

- **Specific I/O signal related to start and stop.**

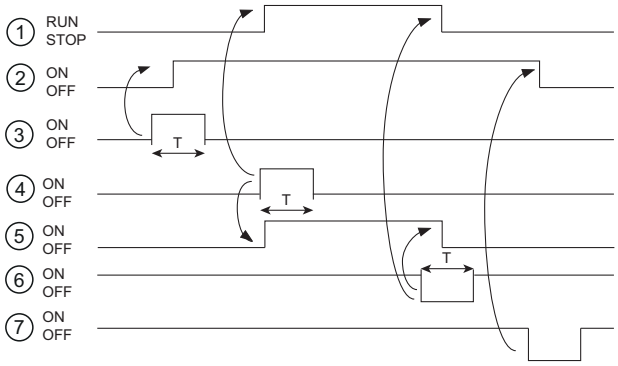
The following signals are specific I/O signals related to start and stop.

- SERVO ON (depending on application:
- External SERVO ON (common to all application)
- External start (depending on application)
- Operating (depending on application)

- External hold (common to all application)
- External emergency stop (common to all application)

Timing chart

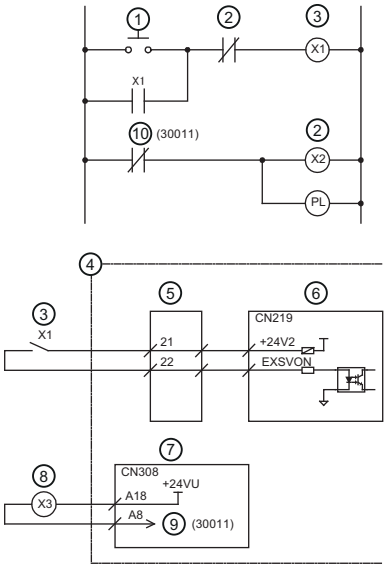
① Robot
② While SERVO-ON
③ SERVO-ON
④ External start
⑤ Operating
⑥ External hold
⑦ External emergency stop



Note: Set T = 100 ms minimum

Example of SERVO ON sequence circuit from external device

① SERVO ON PB
② SERVO ON confirmation
③ SERVO_ON command
④ Robot controller
⑤ Machine safety terminal block board
⑥ Machine safety I/O logic board
⑦ Universal I/O board
⑧ SERVO-ON power ON
⑨ SERVO-ON is output
⑩ SERVO-ON power ON X3

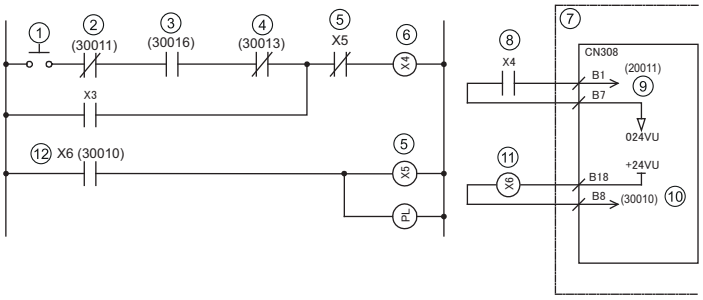


Number in ( ) means output signal number assigned to YIU21.

PL: Pilot lamp

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 external device

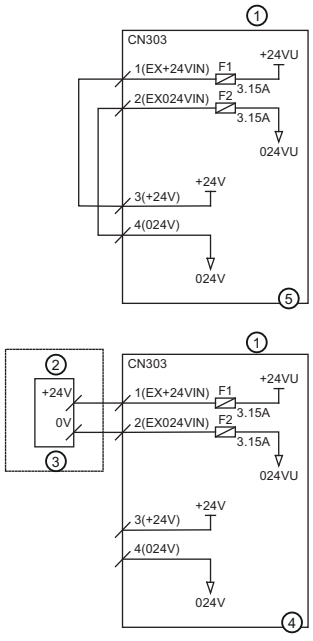


① Run PB
② While SERVO-ON
③ Selects PLAY mode
④ Alarm/Error occurring
⑤ Running confirmation
⑥ Start (Command)
PL: Pilot lamp
⑦ Robot controller
⑧ External Start Command
⑨ External start input
⑩ Ongoing output
⑪ Running, etc.
⑫ Execute X6

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 Universal I/O board
② External power supply
③ Provided by the customer
④ In case of using external power supply.
⑤ In case of using internal power supply (factory settings).



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 universal 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.

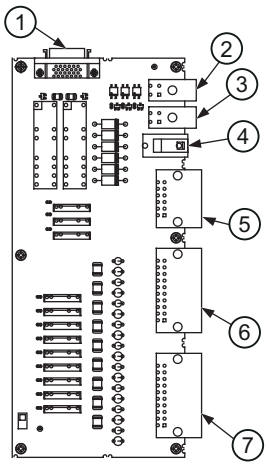
NOTICE

- 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, F2).
- 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.

8.24 Brake control circuit board (JANCD-YBK21-3E)

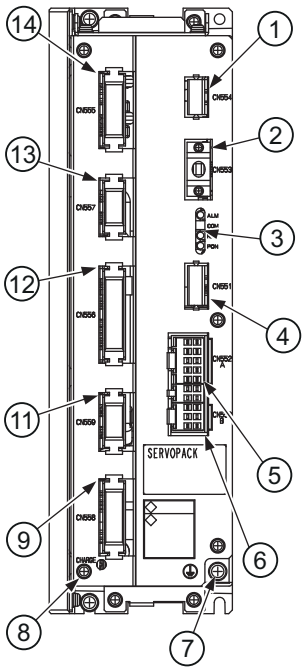
The brake control circuit board controls ON/OFF of the brakes of total nine axes (Robot + external axes) according to the command signal from the major axes control circuit board (SRDA-EAXA21A).

① Axes control cicuit board I/F (CN405)
② For external brake power supply (CN404)
③ Brake power supply input (CN403)
④ Brake power supply fuse (F1: For external axes) 3,15A/ 250V
⑤ Brake interlock (CN402)
⑥ Handbrake release unit I/F (CN401)
⑦ Brake I/F (CN400)



8.25 Converter (SRDA-COA30A21B-E)

The converter (SRDA-COA30A21B-E) exchanges the power supply (3-phase: AC200/220V) supplied by the power ON unit for DC power supply and supplies the power to the amplifier module (PWM amplifiers).



① Grounding detection input (CN554)
② Converter control signal (CN553)
③ Monitor/Alarm indication LED
④ DC control power supply (CN551)
⑤ Control power supply output for six axes amplifier (CN552A)
⑥ Control power supply output for external axes amplifier (CN552B)
⑦ Grounding terminal
⑧ Charge lamp
⑨ External axes main circuit connection (CN558)
⑩ Power supply regenerative unit connection (CN559)
⑪ Main circuit power supply output (CN556)
⑫ Regenerative resistor (CN557)
⑬ Main circuit power supply input (CN555)

8.26 Capacitor module (SRDA-CUA ❑ AA)

The capacitor module smooth the DC voltage (PN voltage) created in the converter and also save the electric energy.

There are two type of the capacitors shown below:

- Small capacity: SRDA-CUA662AA
- Medium / Large capacity: SRDA-CUA133AA

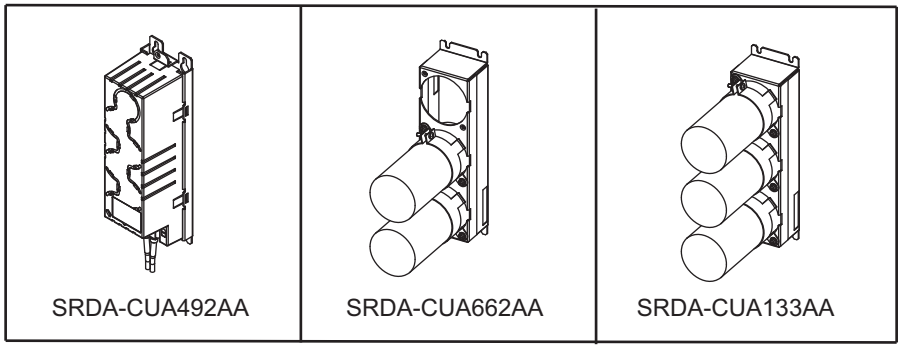
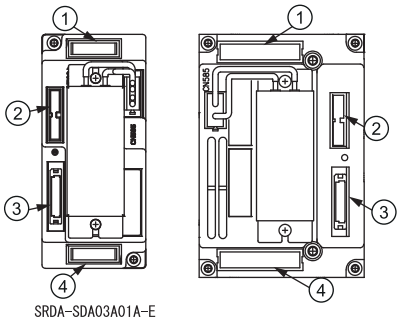


Fig. 8-23: Capacitor module (SDRA-CUA ❑ AA)

8.27 Amplifier module (SDRA-SDA ❑ A01A-E)

The amplifier module exchanges the DC power supply supplied by a converter for a 3-phase motor power source and outputs to each servo motor.

① Main circuit power supply input (CN583)
② Control power supply input (CN582)
③ PWM signal (CN581)
④ Motor power output (CN584)



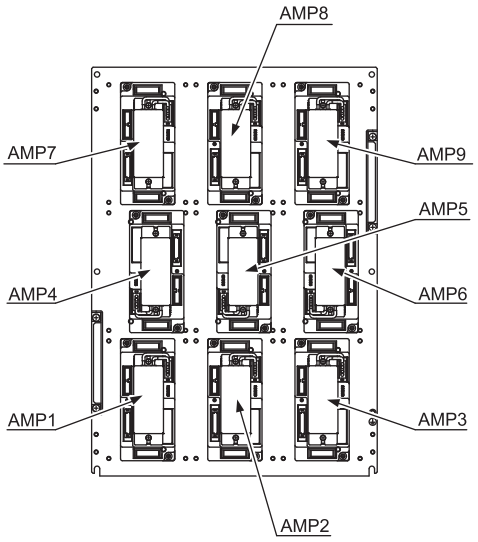


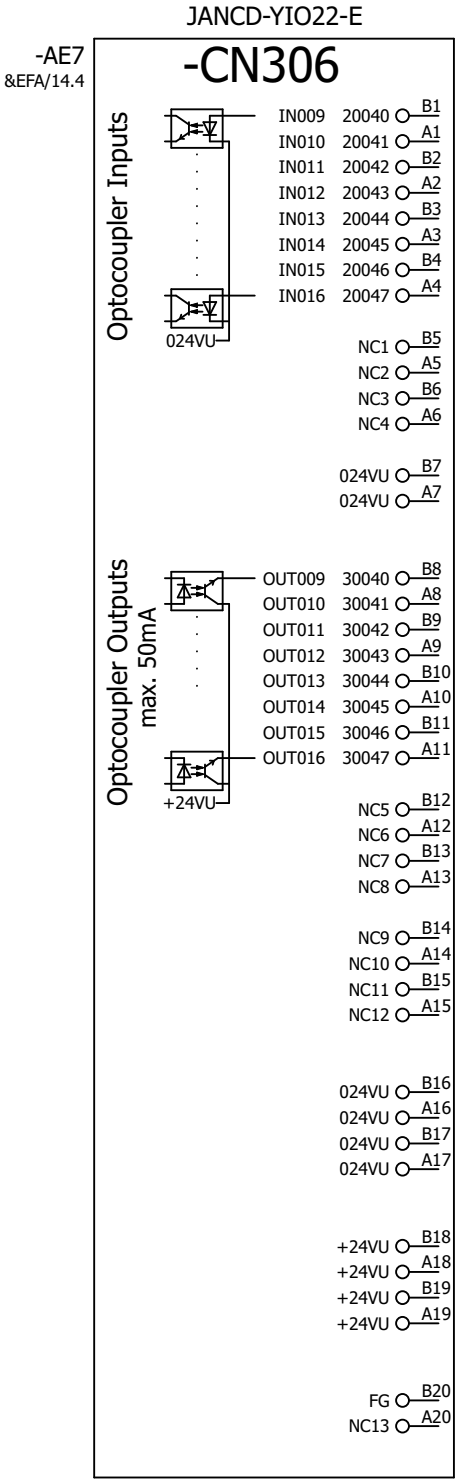
Fig. 8-24: Amplifier Position

8.28 Assignment of universal I/O signals

NOTICE

Damage to property caused by short-circuit

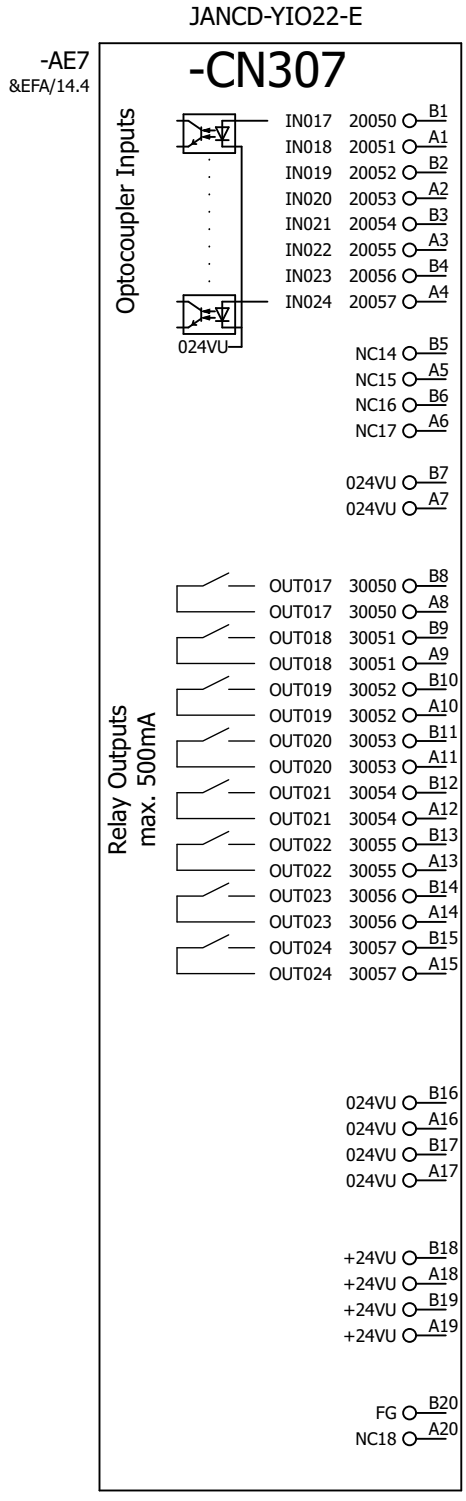
Detailed information about the wiring can be found in the wiring diagram.



assignment interface board

-AE7-CN306	-XD306
B1	B1
A1	A1
B2	B2
A2	A2
B3	B3
A3	A3
B4	B4
A4	A4
B5	B5
A5	A5
B6	B6
A6	A6
B7	B7
A7	A7
B8	B8
A8	A8
B9	B9
A9	A9
B10	B10
A10	A10
B11	B11
A11	A11
B12	B12
A12	A12
B13	B13
A13	A13
B14	B14
A14	A14
B15	B15
A15	A15
B16	B16
A16	A16
B17	B17
A17	A17
B18	B18
A18	A18
B19	B19
A19	A19
B20	B20
A20	A20

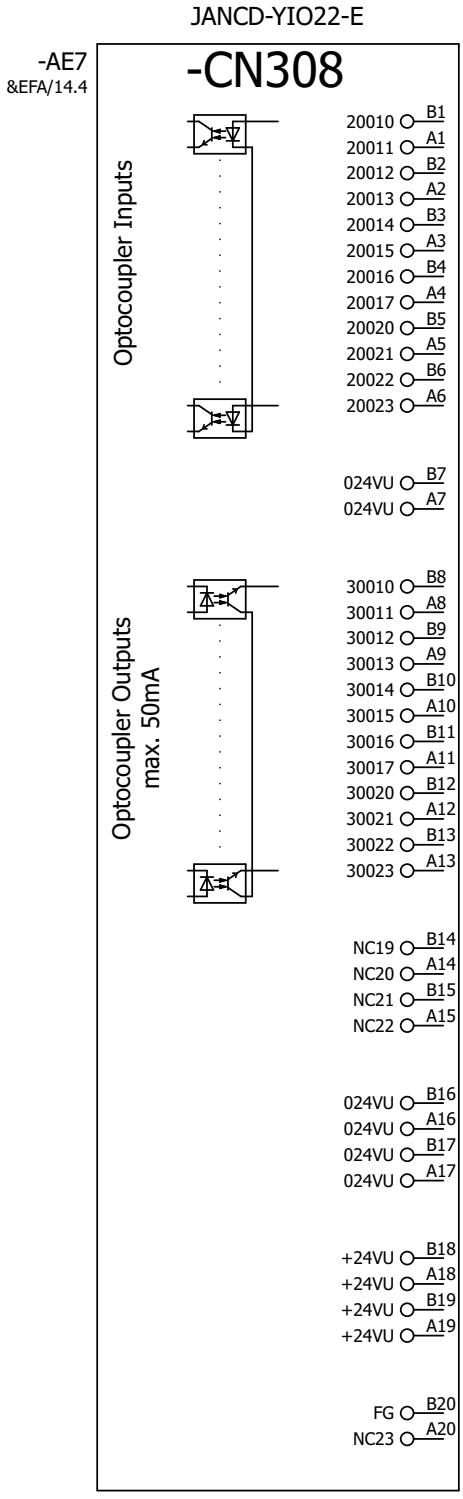
Fig. 8-25: JANCD-YIO22-E (CN306 connector) I/O assignment



assignment interface board

-AE7-CN307	-XD307
B1	B1
A1	A1
B2	B2
A2	A2
B3	B3
A3	A3
B4	B4
A4	A4
B5	B5
A5	A5
B6	B6
A6	A6
B7	B7
A7	A7
B8	B8
A8	A8
B9	B9
A9	A9
B10	B10
A10	A10
B11	B11
A11	A11
B12	B12
A12	A12
B13	B13
A13	A13
B14	B14
A14	A14
B15	B15
A15	A15
B16	B16
A16	A16
B17	B17
A17	A17
B18	B18
A18	A18
B19	B19
A19	A19
B20	B20
A20	A20

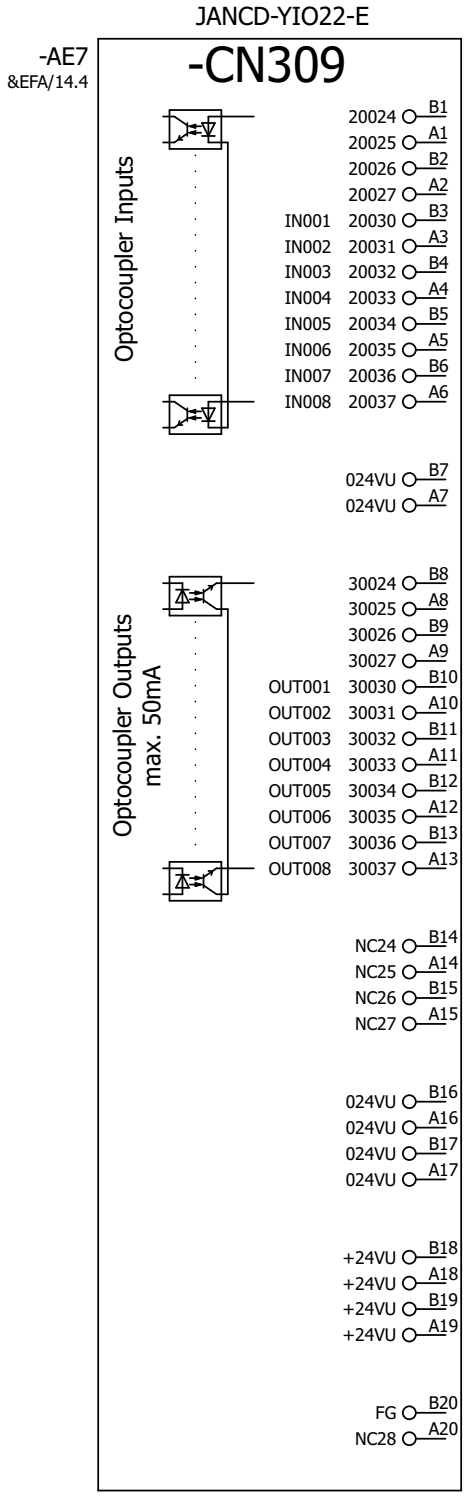
Fig. 8-26: JANCD-YIO22-E (CN307 connector) I/O assignment



assignment interface board

-AE7-CN308	-XD308
B1	B1
A1	A1
B2	B2
A2	A2
B3	B3
A3	A3
B4	B4
A4	A4
B5	B5
A5	A5
B6	B6
A6	A6
B7	B7
A7	A7
B8	B8
A8	A8
B9	B9
A9	A9
B10	B10
A10	A10
B11	B11
A11	A11
B12	B12
A12	A12
B13	B13
A13	A13
B14	B14
A14	A14
B15	B15
A15	A15
B16	B16
A16	A16
B17	B17
A17	A17
B18	B18
A18	A18
B19	B19
A19	A19
B20	B20
A20	A20

Fig. 8-27: JANCD-YIO22-E (CN308 connector) I/O assignment



assignment interface board

-AE7-CN309	-XD309
B1	B1
A1	A1
B2	B2
A2	A2
B3	B3
A3	A3
B4	B4
A4	A4
B5	B5
A5	A5
B6	B6
A6	A6
B7	B7
A7	A7
B8	B8
A8	A8
B9	B9
A9	A9
B10	B10
A10	A10
B11	B11
A11	A11
B12	B12
A12	A12
B13	B13
A13	A13
B14	B14
A14	A14
B15	B15
A15	A15
B16	B16
A16	A16
B17	B17
A17	A17
B18	B18
A18	A18
B19	B19
A19	A19
B20	B20
A20	A20

Fig. 8-28: JANCD-YIO22-E (CN309 connector) I/O assignment

Logical number	Input label/function
20010	**EXTERNAL START** The function are identical to those of the [START] button on the programming pendant. Only the rising edge of this signal is valid. It starts robot movement (playback). This signal is invalid if an external start is impermissible according to the playback status display.

Logical number	Input label/function
20012	**CALL MASTER JOB** Only the rising edge of this signal is valid. The upper part of the robot programme is called, i.e. the upper part of the master job.[1]. This signal is invalid during playback, during teach-lock and when a play master or call is impermissible (set in the playback status window).
20013	**ALARM/ERROR RESET** Resets the alarm/error.
20015	**SELECT PLAY MODE** Playback mode is selected if the selector switch is set to REMOTE on the programming pendant. Only the rising edge of this signal is valid. If this selection signal is assigned together with another mode selection signal, priority is given to the selection of teach mode. This signal remains invalid as long as the operating mode selector should not be actuated.
20016	**SELECT TEACH MODE** Teach mode is selected when the selector switch on the programming pendant is set to "REMOTE". No other modes can be selected as long as this signal is present. The signal has priority even if the other selection signal is present and enables the selection of teach mode.
20020	**INTERFERENCE 1 ENTRANCE PROHIBITED** If the robot attempts to enter CUBE 1[2] while this signal is ON, the robot is put into wait status (with servo power ON). During wait status, robot movement is started as soon as this signal turns OFF.
20021	**INTERFERENCE 2 ENTRANCE PROHIBITED** If the robot attempts to enter CUBE 2[2] while this signal is ON, the robot is put into wait status (with servo power ON). During wait status, robot movement is started as soon as this signal turns OFF.

1. A master JJO is a JOB (programme) which can be called by CALL MASTER JOB. Other functions are the same as for normal JOBs. Normally, the main job, which manages the sub-jobs called immediately after the power is turned ON, is set as the master job.

2. See system setup manual, chapter "Interference area”

Logical number	Output label/function
30010	**RUNNING** This signal indicates that the job is running. (This means that the job is running, the system status is "Waiting for reserved start” or a test run is being carried out). This signal status is identical to [START] on the programming pendant.
30011	**SERVO IS ON** This signal indicates that the servo voltage is switched on, internal processing such as position definition is completed, and the system is waiting for a start command. This signal is switched off when the servo voltage is switched off. The signal can be used for robot controller status diagnosis for an external start.

Logical number	Output label/function
30012	**TOP OF MASTER JOB** This signal indicates that the execution position is at 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 indicates that an alarm or error has occurred. If a major alarm occurs, this signal remains on until the power supply is switched off.
30014	B**ATTERY ALARM** This signal indicates that the battery voltage for the backup memory of the encoder is low and the battery must be replaced. Loss of data due to exhausted batteries may have serious consequences. It is therefore recommended that you treat this signal as a warning.
30015 to 30017	**REMOTE/PLAY/TEACH MODE SELECTED** This signal indicates which mode is currently set. These signals are synchronised with the operating mode selector switch on the programming pendant. The signal corresponding to the selected mode is switched ON.
30020	**IN CUBE 1** This signal is turned ON when the current TCP lies within a pre-defined area (cube 1). Use this signal to prevent faults due to other robots or positioners.
30021	**IN CUBE 2** This signal is turned ON when the current TCP lies within a pre-defined area (cube 2). Use this signal to prevent faults due to other robots or positioners.
30022	**WORK HOME POSITION (IN CUBE 64)**[2] This signal is present when the current TCP lies within the range of the home position. Use this signal to check whether the robot is in the starting position.
30023	**INTERMEDIATE START OK** This signal is switched on when the robot moves. It is switched off when the line currently being executed is moved with the cursor or when it is edited after a HOLD operation during the movement. The signal can therefore be used as a restart interlock after a HOLD operation. However, it is also triggered in teach mode and is to be referenced together with the "teach mode selected" signal.

1. This signal is not output during operation.

2. The CUBE of the home position and CUBE 64 are identical.

8.28.1 ARC welding

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.
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.

Logical number	I/O designation/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.
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	I/O designation/function
30024	**GAS SHORTAGE (MONITOR)** This signal stays ON while the gas shortage signal from the welding power supply is ON.
30025	**WIRE SHORTAGE (MONITOR)** This signal status ON while the wire shortage signal from the welding power supply is ON.
30026	**WIRE STICKING (MONITOR)** 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	**ARC SHORTAGE (MONITOR)** This signal stays ON while the arc shortage signal from the welding power supply is ON.

8.28.2 Handling

Logical number	Input name/Function
20026	TOOL SHOCK SENSOR This is normally ON (NC) signal input. When it turns OFF, an DX200 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.
20027	LOW AIR PRESSURE This signal is normally OFF (NO). When it turns ON, DX200 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.

Logical number	I/O designation/function
20026	**TOOL SHOCK SENSOR** This signal is normally ON (NC). When it turns OFF, the robot controller displays a message "HAND TOOL SHOCK SENSOR OPERATING" and a HOLD is applied. Enabling in teach mode is carried out on the diagnostic display of the handling application. Set the TOOL SHOCK SENSOR function "NOT USE" on the diagnostic display of the handling application if the signal is not used.

Logical number	I/O designation/function
20027	**LOW AIR PRESSURE** This signal is normally OFF (NO). When it turns ON, the robot controller displays a user alarm in the PLAY mode or displays a message in the teach mode.
20050 to 20057	**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.
30050 to 30057	**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.

8.28.3 GP application

Logical number	I/O designation/function
20024	**INTERFERENCE 3 ENTRANCE PROHIBITED** If the robot attempts to enter CUBE 2[1] while this signal is ON, the robot is put into wait status (with servo power ON). During wait status, robot movement is started as soon as this signal turns OFF.
20025	**INTERFERENCE 4 ENTRANCE PROHIBITED** If the robot attempts to enter CUBE 2[1] while this signal is ON, the robot is put into wait status (with servo power ON). During wait status, robot movement is started as soon as this signal turns OFF.
30024	**IN CUBE 3** This signal is turned ON when the current TCP lies within a predefined area (CUBE 3). Use this signal to prevent faults due to other robots or positioners.
30025	**IN CUBE 4** This signal is turned ON when the current TCP lies within a predefined area (CUBE 4). Use this signal to prevent faults due to other robots or positioners.

1. See system setup manual, chapter "Interference area”

8.28.4 Spot welding

Logical number	I/O designation/function
20022	**WELDING ON/OFF (from sequencer)** This signal inputs the welding ON/OFF selector switch status from the sequencer in the interlock unit. The WELD ON/OFF signal is output to the Power Source according to this signal and the robot status.
20023	**WELDING PAUSE (from sequencer)** This signal is used to move the robot to the home position when an error occurs in the Power Source or the gun. The robot ignores the spot welding instruction and operates playback motion.
20024	**INTERFERENCE 3 ENTRANCE PROHIBITED** If the robot attempts to enter cube 3 while this signal is ON, the robot is put into wait status (with SERVO power ON). During wait status the robot movement is started as soon as the signal is switched to OFF.
20025	**INTERFERENCE 4 ENTRANCE PROHIBITED** If the robot attempts to enter cube 4 while this signal is ON, the robot is put into wait status (with SERVO power ON). During wait status the robot movement is started as soon as the signal is switched to OFF.
20050[1]	**TIMER COOLING WATER ERROR** This signal monitors the status of timer cooling water. The robot displays alarm and stops when this signal is input. The SERVO power supply remains ON.
20051[1]	**GUN COOLING WATER ERROR** This signal monitors the status of gun cooling water. The robot displays alarm and stops when this signal is input. The SERVO power supply remains ON.
20052[1]	**TRANSTHERMO ERROR** Error signal is sent from the transformer in the welding gun to the robot. The signal is normally an ON (NC) signal. An alarm occurs when the signal is OFF. The SERVO power supply remains ON.
20053[1]	**LOW AIR PRESSURE** When air pressure is reduced and this input is turned ON, an alarm occurs. The SERVO power supply remains ON.
	WELD COMPLETION This signal indicates that the Power Source completed welding without error. This signal is used as a confirmation signal for welding instruction execution and manual spot welding. After this signal is input, the welding sequence is completed and the next step is executed when confirmation limit switch is not provided.
	WELDING ERROR This signal indicates an abnormal welding result or Power Source's error. Alarm occurs and the manipulator stops if this signal is input during welding.

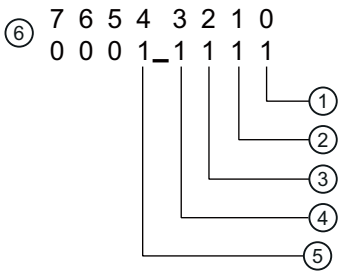
Logical number	I/O designation/function
	STICK DETECTION This signal indicates an abnormal welding result or Power Source's error. Alarm occurs and the manipulator stops if this signal is input during welding.
	GUN FULL OPEN DETECTION This signal indicates that the stroke of the double stroke gun is full open.
	GUN SHORT OPEN DETECTION This signal is connected with a single gun open verification limit switch or a double stroke gun open verification limit switch to verify the gun "open".
	GUN PRESSURE DETECTION This signal indicates that a gun is in pressing status.
	TIP REPLACE COMPLETION When this signal is input after tip replacement, the TIP REPLACE REQUEST signal turns OFF, and the stored number of welding is cleared.
30057	**TIP REPLACE REQUEST** This signal is output when the stored number of welding reaches the number of welding set for the tip replacement.
30024	**IN CUBE 3** This signal is turned ON when the current TCP lies within a pre-defined area (CUBE 3). Use this signal to prevent faults due to other robots or positioners.
30025	**IN CUBE 4** This signal is turned ON when the current TCP lies within a pre-defined area (CUBE 4). Use this signal to prevent faults due to other robots or positioners.
30050[1]	**WELD ON/OFF** Outputs a signal input from the interlock panel, etc.considering the robot status.
30051[2]	**WELD ERROR RESET** This signal commands the reset error status of the power source. This is operated with the programming pendant.
(30052 to 300564)[2]	**WELD CONDITION (level signals)** 1(1), 2(2), 4(3), 8(4), 16(5), 32(6), 64(7), 128(8) Sets the welding conditions for the power source. The output format can be set as binary or discrete (bit number.) It can handle up to 255 conditions. Most-significant bit is the parity bit (when specified).
	WELDING COMMAND This signal outputs execution command signal to the Power Source. This signal is not necessary for power sources which are executed using the WELDING CONDITION signal.

Logical number	I/O designation/function
	STROKE CHANGE1 **SINGLE SOLENOID** **DOUBLE SOLENOID** This is a signal, when a double stroke gun is used, to change the open stroke of the welding gun.
	GUN PRESS COMMAND This outputs the command of gun press.

1. This signal can be select “USE” or “NOT USE” by pseudo input signal 8202x. If "NOT USE" is selected, this signal can be used as the universal I/O signal described in parentheses.

2. This signal can be allocated to any universal I/O signal at the I/O allocation display in operation condition.

① Timer cooling water error validating (or IN09)
② GUN Cooling Water Error Validating (or IN10)
③ Trans thermo error validating (or IN11)
④ Low air pressure validating (or IN12)
⑤ Weld ON/OFF Validating (or OUT09)
⑥ Pseudo Input Signal 8202x



8.28.5 JANCD-YEW01-E board (standard)

JANCD-YEW01-E - circuit board: Analogue outputs ´2 connections, analogue inputs´ 2 connections + I/O status signal of the welding device.

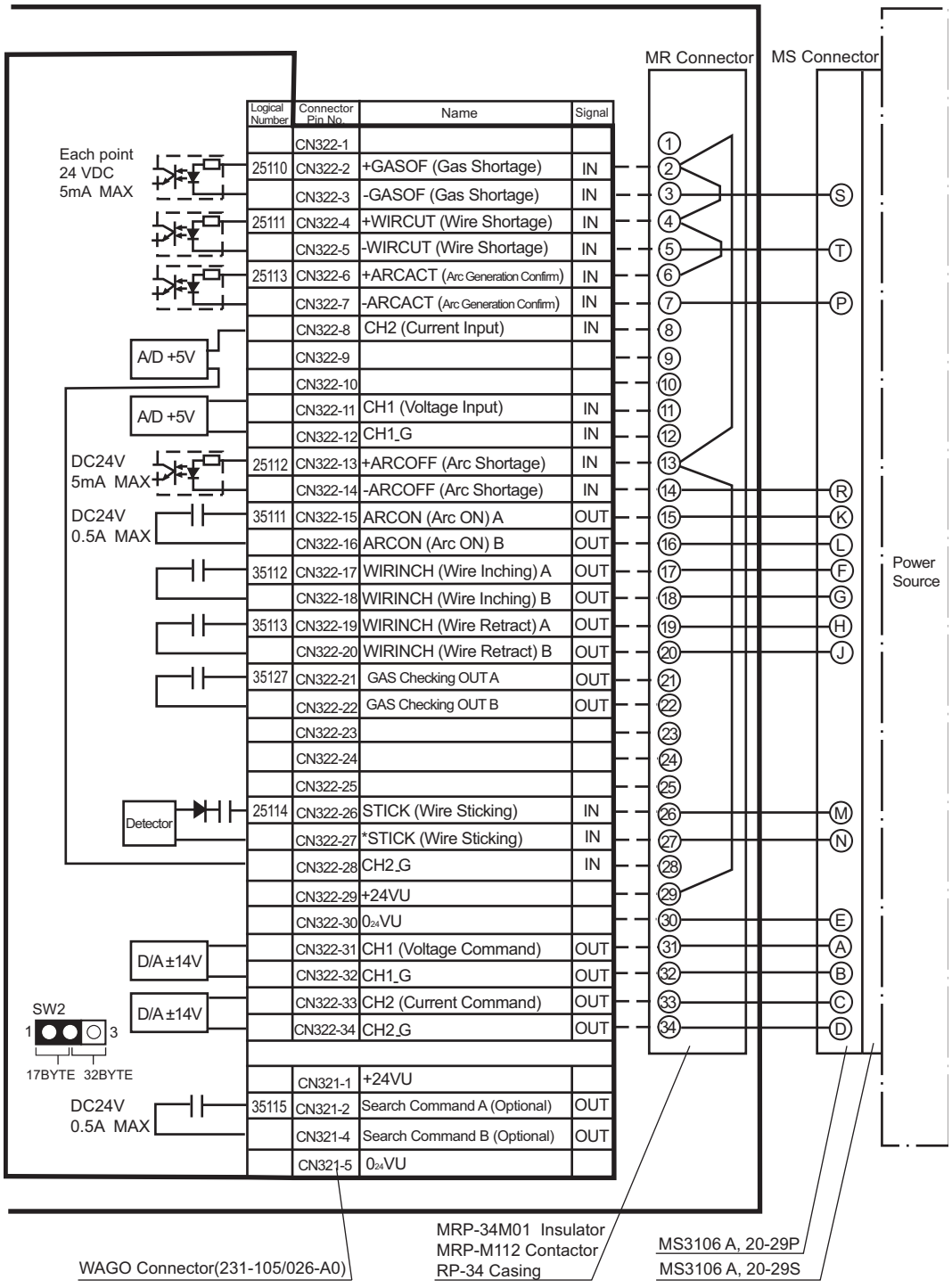


Fig. 8-29: JANCD-YEW01-E board (standard)

8.28.6 List of device configuration depending on model

Model		MA1440/MH12
Type		ERER-MA1440/MH12-A00
Dimensions H x L x W (mm)		1000 x 800 x 650
Breaker		Cutter C60 3P C16A 24350
Control power supply unit		JZNC-YPS21-E
CPU unit	-	JZNC-YRK21-1E
	CPU Circuit Board	JANCD-YCP21-E
	Back circuit board	JANCD-YBB21-E
	PCI raiser board	JANCD-YBB22-E
Robot I/F circuit board		JANCD-YIF01-2E
Machine safety CPU board		JANCD-YSF21-E
Machine safety I/O logic circuit board		JANCD-YSF22-E
Machine safety terminal block		348742 (-X18)
Universal I/O circuit board		JANCD-YIO22-E
XSU board		JZRCR-YPU51-1
Main axis control board		SRDA-EAXA21A
Control board brake		JANCD-YBK21-3E
Converter		SRDA-COA30A21B-E
Capacitor module		SRDA-CUA662AA
Amplifier module	**AMP1 (S-axis)**	SRDA-SDA14A01A-E
	AMP2 (L-axis)	SRDA-SDA21A01A-E
	AMP3 (U-axis)	SRDA-SDA14A01A-E
	AMP4 (R-axis)	SRDA-SDA06A01A-E
	AMP5 (B-axis)	SRDA-SDA06A01A-E
	AMP6 (T-axis)	SRDA-SDA06A01A-E
Regeneration resistor	**Type**	SMVK500W6R0J/R0 A6103
	Nominal value	500W
	Resistance value	6 Ω
Heat exchanger		2x SUNON DP 201A 2123HBT.GN; YNR P/N 8650004
Cooling fan		3x SUNON DP 201A 2123HBT.GN; YNR P/N 8650004

Tab. 8-2: Model MA1440 and MH12

Model		MS210/MH225
Type		ERER-MS210/MH225-A00
Dimensions H x L x W (mm)		1000 x 800 x 650
Breaker		NF32-SVF 3P 30A
Control power supply unit		JZNC-YPS21-E
CPU unit	-	JZNC-YRK21-1E
	CPU Circuit Board	JANCD-YCP21-E
	Back circuit board	JANCD-YBB21-E
	PCI raiser board	JANCD-YBB22-E
Robot I/F circuit board		JANCD-YIF01-2E
Machine safety CPU board		JANCD-YSF21-E
Machine safety I/O logic circuit board		JANCD-YSF22-E
Machine safety terminal block		JANCD-YFC22-E
Universal I/O circuit board		JANCD-YIO21-E
Power ON Unit		JZRCR-YPU51-1
Main axis control board		SRDA-EAXA21A
Control board brake		JANCD-YBK21-3E
Converter		SRDA-COA30A21B-E
Capacitor module		SRDA-CUA133AA
Amplifier module	**AMP1 (S-axis)**	SRDA-SDA71A01A-E
	AMP2 (L-axis)	SRDA-SDA71A01A-E
	AMP3 (U-axis)	SRDA-SDA71A01A-E
	AMP4 (R-axis)	SRDA-SDA35A01A-E
	AMP5 (B-axis)	SRDA-SDA35A01A-E
	AMP6 (T-axis)	SRDA-SDA35A01A-E
Regeneration resistor	**Type**	SMVK500W2R0J A5978 x3
	Nominal value	1500W
	Resistance value	6 Ω
Heat exchanger		TCSIP-16A4Y-0C
Fan		4715MS-22T-B50-B00 x3 or 11938MB-B2N-EA-01 x3

Tab. 8-3: Model MS210/MH225

Model		MS165/MH180
Type		ERER-MS165/MH180-A00
Dimensions H x L x W (mm)		1000 x 800 x 650
Breaker		NF32-SVF 3P 30A
Control power supply unit		JZNC-YPS21-E
CPU unit	-	JZNC-YRK21-1E
	CPU Circuit Board	JANCD-YCP21-E
	Back circuit board	JANCD-YBB21-E
	PCI raiser board	JANCD-YBB22-E
Robot I/F circuit board		JANCD-YIF01-2E
Machine safety CPU board		JANCD-YSF21-E
Machine safety I/O logic circuit board		JANCD-YSF22-E
Machine safety terminal block		JANCD-YFC22-E
Universal I/O circuit board		JANCD-YIO22-E
Power ON Unit		JZRCR-YPU51-1
Main axis control board		SRDA-EAXA21A
Control board brake		JANCD-YBK21-3E
Converter		SRDA-COA30A21B-E
Capacitor module		SRDA-CUA133AA
Amplifier module	**AMP1 (S-axis)**	SRDA-SDA71A01A-E
	AMP2 (L-axis)	SRDA-SDA71A01A-E
	AMP3 (U-axis)	SRDA-SDA71A01A-E
	AMP4 (R-axis)	SRDA-SDA35A01A-E
	AMP5 (B-axis)	SRDA-SDA35A01A-E
	AMP6 (T-axis)	SRDA-SDA35A01A-E
Regeneration resistor	**Type**	SMVK500W2R0J A5978 x3
	Nominal value	1500W
	Resistance value	6 Ω
Heat exchanger		TCSIP-16A4Y-0C
Fan		4715MS-22T-B50-B00 x3 or 11938MB-B2N-EA-01 x3

Tab. 8-4: Model MS165/MH180

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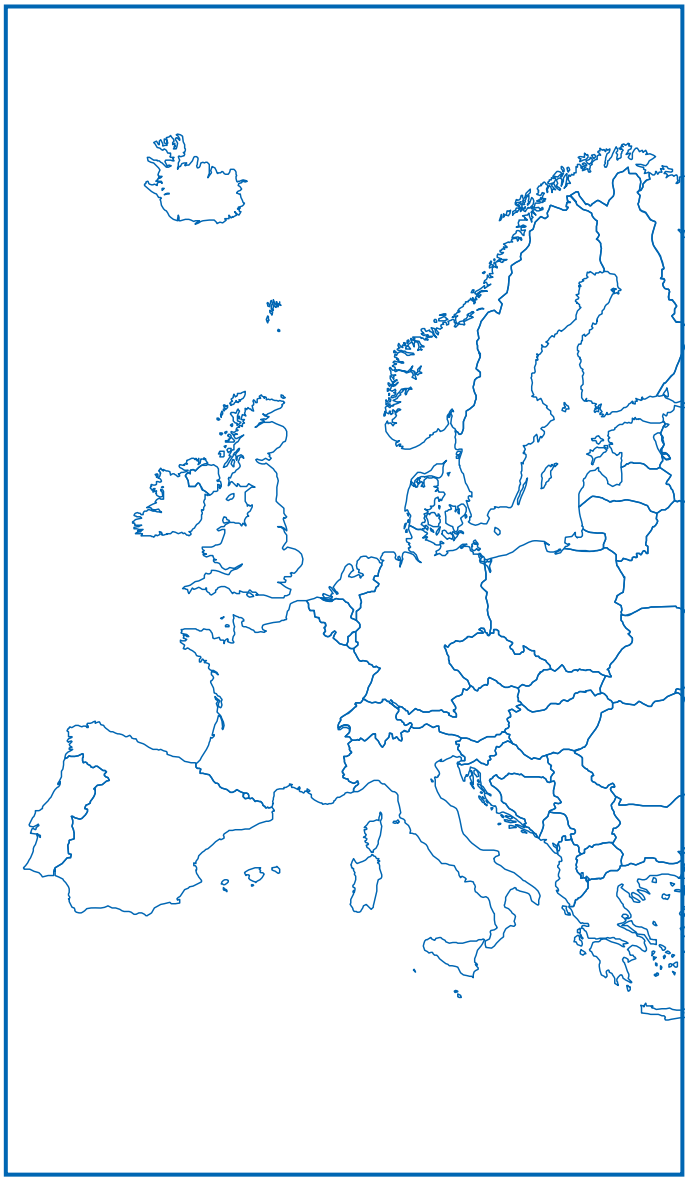

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