Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

The DX100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.
MANDATORY

- This manual explains setup, diagnosis, maintenance, hardware, etc. of the DX100 system. Read this manual carefully and be sure to understand its contents before handling the DX100.
- General items related to safety are listed in Section 1. To ensure correct and safe operation, carefully read the section.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX100.

In this manual, the Notes for Safe Operation are classified as “WARNING”, “CAUTION”, “MANDATORY”, or “PROHIBITED”.

- **WARNING**: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.
- **CAUTION**: Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.
- **MANDATORY**: Always be sure to follow explicitly the items listed under this heading.
- **PROHIBITED**: Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations.

At any rate, be sure to follow these important items.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.

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WARNING

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning ON the DX100 power
  - Moving the manipulator with the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press the emergency stop button immediately if there are problems. The emergency stop button is located on the right of the programming pendant.

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Before operating the manipulator, check that servo power is turned OFF when the emergency stop button on the programming pendant is pressed.
  - When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop button does not function.

Figure 1: Emergency Stop Button

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator.
  - Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Figure 2: Release of Emergency Stop
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN consists of the manipulator, the controller, the programming pendant, and manipulator cables.

In this manual, the equipment is designated as follows.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
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<tr>
<td>DX100 Controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator Cable</td>
</tr>
</tbody>
</table>

CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the DX100 cabinet after use.
  The programming pendant can be damaged if it is left in the P-point maximum envelope of the manipulator’s work area, on the floor, or near fixtures.
- Read and understand the Explanation of the Warning Labels before operating the manipulator.
Descriptions of the programming pendant, buttons, and displays are shown as follows:

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<tr>
<td>Programming Pendant</td>
<td>Character Keys</td>
</tr>
<tr>
<td></td>
<td>The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]</td>
</tr>
<tr>
<td>Symbol Keys</td>
<td>The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. page key</td>
</tr>
<tr>
<td></td>
<td>The cursor key is an exception, and a picture is not shown.</td>
</tr>
<tr>
<td>Axis Keys</td>
<td>&quot;Axis Keys&quot; and &quot;Number Keys&quot; are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Number Keys</td>
<td></td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a &quot;+&quot; sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td>Displays</td>
<td>The menu displayed in the programming pendant is denoted with { }. ex. {JOB}</td>
</tr>
</tbody>
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**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, or that the item is directly selected by touching the screen.

**Registered Trademark**

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.
Explanation of Warning Labels

The following warning labels are attached to the manipulator and DX100. Fully comply with the precautions on the warning labels.

![Warning Label Image]

- The label described below is attached to the manipulator. Observe the precautions on the warning labels.
- Failure to observe this caution may result in injury or damage to equipment.

Refer to the manipulator manual for the warning label location.
- The following warning labels are attached to DX100. Observe the precautions on the warning labels.
Failure to observe this warning may result in injury or damage to equipment.
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1 Safety

1.1 For Your Safety

Robots generally have requirements which are different from other manufacturing equipment, such as larger working areas, high-speed operation, rapid arm movements, etc., which can pose safety hazards.

Read and understand the instruction manuals and related documents, and observe all precautions in order to avoid the risk of injury to personnel and damage to equipment.

It is the user’s responsibility to ensure that all local, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions are met and followed.

MANDATORY

• Teaching maintenance of the robot must conform to:
  – Industrial Safety and Health Law
  – Enforcement Order of Industrial Safety and Health Law
  – Ordinance of Industrial Safety and Health Law

Other related laws are:
  – Occupational Safety and Health Act in USA
  – Factory Act (Gewerbeordnung) in Germany
  – Health and Safety at Work, etc. Act in UK
  – Machinery Directive 2006/42/EC, 2004/108/EC on Electromagnetic Compatibility (EMCD) and 2006/95/EC on Low Voltage (LVD) in EU

• Prepare
  – SAFETY WORK REGULATIONS

based on concrete policies for safety management complying with related laws.

• Observe the
  – MANIPULATING INDUSTRIAL ROBOTS-SAFETY (ISO 10218)

for safe operation of the robot. (Japan Only) (JIS B 8433)

• Reinforce the
  – SAFETY MANAGEMENT SYSTEM

by designating authorized workers and safety managers, as well as giving continuing safety education.

• Teaching and maintaining the robot are specified as “Hazardous Operations” in the Industrial Safety and Health Law (Japan only).

Workers employed in these above operations are requested to attend special training offered by YASKAWA.
1.2 Special Training

MANDATORY

- Persons who teach or inspect the manipulator must undergo required training before using the manipulator.
- For more information on training, inquire at the nearest YASKAWA branch office.

The telephone numbers are listed on the back cover of this manual.

1.3 Motoman Manual List

MANDATORY

- It is important to have and be familiar with all manuals concerning the MOTOMAN.

You should have the four manuals listed below:
- MOTOMAN-□□□ INSTRUCTIONS
- DX100 INSTRUCTIONS
- DX100 OPERATOR’S MANUAL

Confirm that you have all these manuals on hand.
If any manuals are missing, contact your salesman from YASKAWA’s local branch office.
The relevant telephone numbers are listed on the back cover.
1.4 Personnel Safety

The entire manipulator P-point maximum envelope is potentially dangerous.

All personnel working with the MOTOMAN (safety administration, installation, operation, and maintenance personnel) must always be prepared and "Safety First" minded, to ensure the safety of all personnel.

---

**CAUTION**

- Avoid any dangerous actions in the area where the MOTOMAN is installed.

There is a danger of injury if there is contact with the manipulator or peripheral equipment.

- Please take strict safety precautions by placing signs such as "Flammable", "High Voltage", "Waiting", and "Off-limits to Unauthorized Personnel" in necessary areas in the factory.

Failure to observe these cautions may result in fire, electric shock, or injury due to contact with the manipulator and other equipment.

- Strictly observe the following items:
  - Always wear approved work clothes (no loose-fitting clothes).
  - Do not wear gloves when operating the MOTOMAN.
  - Do not allow underwear, shirts, or neckties to hang out from the work clothes.
  - Do not wear large jewelry, such as earrings, rings, or pendants.

Always wear protective safety equipment such as helmets, safety shoes (with slip-proof soles), face shields, safety glasses, and gloves as necessary.

Improper clothing may result in injury.

- Unauthorized persons should not approach the manipulator or associated peripheral equipment.

Failure to observe this caution may result in injury due to contact with DX100, controller, the workpiece, the positioner, etc.
1.4 Personnel Safety

CAUTION

• Never forcibly move the manipulator axes. Failure to observe this caution may result in injury or equipment damage.

• Never lean on DX100 or other controllers, and avoid inadvertently pushing buttons. Failure to observe this caution may result in injury or damage by unexpected movement of the manipulator.

• Never allow unauthorized personnel to touch the DX100 during operation. Failure to observe this caution may result in injury or damage resulting from unexpected movement of the manipulator.
1.5 Motoman Safety

1.5.1 Installation and Wiring Safety

Refer to the MOTOMAN-□□□□ Instructions manual and DX100 Instructions for details on installation and wiring.

In planning installation, adapt an easy to observe arrangement to ensure safety. Take safety into consideration when planning the installation. Observe the following when installing the manipulator:

**WARNING**

- Select an area such as that described below to install the manipulator:
  Confirm that the area is large enough so that the fully extended manipulator arm with tool will not reach a side wall, safeguarding, or the controller.

Failure to observe this caution may result in injury or damage resulting from unexpected movement of the manipulator.

- Perform grounding in accordance with all applicable electrical codes.

Failure to observe this caution may result in fire or electric shock.
CAUTION

- Operation of the crane, sling, or forklift should only be performed by authorized personnel. Failure to observe this precaution may result in injury or equipment damage.

MOTOMAN should be lifted with a crane using wire rope threaded through the shipping bolts and positioners and the body should be lifted in an upright posture as described in the manipulator instruction manual. Failure to observe these precautions may cause the manipulator to turn downward, potentially causing injury or damage to equipment.
CAUTION

- When lifting the DX100, please check the following:
  - As a rule, handling of DX100 must be performed using a crane with wire rope threaded through attached eyebolts.
  - Be sure to use wire that is strong enough to handle the weight of the DX100.

- Be sure the eyebolts are securely fastened.
  Failure to observe this caution may result in injury or damage to equipment.

- If storing the manipulator temporarily before installation, be sure to place it on a stable and flat surface and take precautions to prevent unauthorized personnel from touching it.
  Failure to observe this precaution may result in injury of damage to equipment.

Table 1-1: Approx. Weight of DX100

<table>
<thead>
<tr>
<th>Models Available for DX100</th>
<th>Approx. Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>small capacity: MA1400, MA1900, VA1400, MH5, MH5L, MH6, HP20D, HP20D-6, HP20RD</td>
<td>250</td>
</tr>
<tr>
<td>middle/large capacity: MH50, MH50-20, MH50-35, MS80, VS50, S1A50D, MA1800, ES165D, ES165RD, ES200D, ES200RD, HP165D, UP350D</td>
<td></td>
</tr>
</tbody>
</table>

Wire Rope

M16 Eye Bolt

Table 1-1: Approx. Weight of DX100
1 Safety

1.5 Motoman Safety

**CAUTION**

- Be sure there is sufficient room for maintenance on the manipulator, DX100, and other peripheral equipment. Failure to observe this precaution could result in injury during maintenance.

- To ensure safety, be sure to operate the controller from a location where the manipulator is easily visible. Operation by unauthorized personnel may result in injury or equipment damage.

- Install the DX100 outside the safeguarding of the manipulator’s safety enclosure. Failure to observe this precaution may result in injury or damage to equipment resulting from contact with the manipulator.

- Install the manipulator using bolts of the size and type specified for each MOTOMAN in the MOTOMAN INSTRUCTION MANUAL. Failure to observe this caution may result in injury or damage to equipment.

DX100 Maintenance Area (Unit: mm)  
DX100 External Dimensions (Unit: mm)
1.5 Motoman Safety

**CAUTION**

- Secure the position of the DX100 after setting up.

Attach the DX100 to the floor or rack, etc., using the screw holes on the bottom of the DX100.

Failure to observe this caution could lead to injury or equipment damage if the DX100 should shift or fall.

- Be familiar with the connection diagram before wiring the DX100, and perform the wiring in accordance with the connection diagram.

There is a danger of equipment damage or injury due to miswiring and unexpected movement of the equipment.

- Take precautions when wiring and piping between the DX100, manipulator, 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 the forklift.

Operators and other personnel may stumble on exposed wiring or piping. Cable damage can cause unexpected manipulator motion resulting in injury or property damage.
1.5.2 Work Area Safety

Carelessness contributes to serious accidents in the work area.

To ensure safety, enforce the following precautions:

WARNING

- Install a safeguarding around the manipulator to prevent any accidental contact with the manipulator while the power is ON. Post a warning sign stating "Off-limits During Operation" at the entrance of the enclosure. The gate of the safeguarding must be equipped with a safety interlock. Be sure the interlock operates correctly before use.

Failure to observe this caution may result in a serious accident due to contact with the manipulator.

CAUTION

- Store tools and similar equipment in proper locations outside of the enclosure.

Tools and loose equipment should not be left on the floor around the manipulator, DX100, or welding fixture, etc., as injury or damage to equipment can occur if the manipulator comes in contact with objects or equipment left in the work area.
1.5.3 Operation Safety

**WARNING**

- When attaching a tool such as the welding torch to the manipulator, be sure to turn OFF the power supply of the DX100 and the tool, lock the switch, and display a warning sign.

Turning the power ON during tool installation may cause electric shock or injury due to unexpected movement of the manipulator.

- Never exceed the rated capacity of the manipulator (capacity can be found in the specifications section of the manipulator manual.) Failure to observe this caution may result in injury or damage to equipment.

- Teach jobs from outside the manipulator’s work area whenever possible.

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Always view the manipulator from the front.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
  - Ensure that you have a place to retreat to in case of emergency.

Improper or unintentional manipulator operation can result in injury.
WARNING

• Before operating the manipulator, check that the SERVO ON lamp on the programming pendant goes out when the emergency stop buttons on the right of the programming pendant and on an external control device, etc. are pressed. And confirm that the servo lamp is turned OFF.

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

• Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator when:
  – Turning ON the DX100 power
  – Moving the manipulator with the programming pendant.
  – Running the system in the check mode
  – Performing automatic operations

Injury may result from contact with the manipulator if persons enter the P-point maximum envelope of the manipulator.

Press the emergency stop button immediately if there are problems.

The emergency stop button is located on the right of the programming pendant.
CAUTION

- Perform the following inspection procedures prior to teaching the manipulator. If problems are found, correct them immediately, and be sure that all other necessary tasks have been performed.
  - Check for problems in manipulator movement.
  - Check for damage to the insulation and sheathing of external wires.

- Always return the programming pendant to its hook on the DX100 cabinet after use.

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

MANDATORY

- Persons operating or inspecting the manipulator should be trained as required by applicable laws and company policies.
  - Refer to Section 1.2 “Special Training” on page 1-2
1.6 Notes for Moving and Transferring the MOTOMAN

When moving or transferring the Motoman, observe the following safety precautions:

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Attach the instructions to the controller cabinet so that all users have access to necessary manuals. See Section 1.3 “Motoman Manual List” on page 1-2 for a complete list of manuals. If any manuals are missing, contact your Yaskawa representative.</td>
</tr>
<tr>
<td>• If the warning labels on the manipulator and DX100 are illegible, clean the labels so that they can be seen clearly. Note that some local laws may prohibit equipment operation if safety labels are not in place. Contact your YASKAWA representative if you require new warning labels.</td>
</tr>
<tr>
<td>• When the MOTOMAN is transferred, it is recommended to check with Yaskawa Engineering Co. which is listed on back cover of this manual. Incorrect installation or wiring may result in personal injury and property damage.</td>
</tr>
</tbody>
</table>
1.7 Notes on MOTOMAN Disposal

**PROHIBITED**

- Never modify the manipulator or DX100.
  Failure to observe this precaution could result in injury or damage resulting from fire, power failure, or operation error.

---

**CAUTION**

- When disposing of the MOTOMAN, follow the applicable national/local laws and regulations.
- Anchor the manipulator well, even when temporarily storing it before disposal.
  Failure to observe this precaution may result in injury due to the manipulator falling down.
2  Product Confirmation

2.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

Standard delivery includes the following five items (Information for the content of optional goods is given separately):

- Manipulator
- DX100
- Programming Pendant
- Manipulator Cable (Between Manipulator and DX100)
- Complete Set of Manuals

Fig. 2-1: Standard Five Items
2.2 Order Number Confirmation

Confirm that the order number pasted on the manipulator and DX100 match.

The order number plates are affixed as shown in the figure below.

<Example>

THE MANIPULATOR AND THE CONTROLLER
SHOULD HAVE SAME ORDER NUMBER.

ORDER NO.  S78796-1
3 Installation

3.1 Handling Procedure

CAUTION

- Crane, sling, and forklift operations must be performed only by authorized personnel. Failure to observe this caution may result in injury or damage.
- Avoid jarring, dropping, or hitting the controller during handling. Excessive vibration or impacting the DX100 may adversely affect the performance of the DX100.

3.1.1 Using a Crane to Move the Controller

Check the following before handling the DX100:

- Confirm the weight of the controller before handling, and use a wire rope with a rating that is greater than the weight of the controller.
- Install eyebolts for handling and confirm they are securely fastened before hoisting.
3.1 Handling Procedure

**WARNING**
Do not open the door with power ON.

### Table 3-1: Approx. Weight of DX100

<table>
<thead>
<tr>
<th>Models Available for DX100</th>
<th>Approx. Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>small capacity: MA1400, MA1900, VA1400, MH5, MH5L, MH6, HP20D, HP20D-6, HP20RD</td>
<td>250</td>
</tr>
</tbody>
</table>
3.1.2 Using a Forklift to Move the Controller

Observe the following precautions when using a forklift to handle the controller:

- Confirm that there is a safe work environment and that the DX100 can be transported safely to the installation site.
- Inform people along the forklift route that equipment is being moved in their area.
- Secure the controller so it cannot shift or fall during handling.
- Transport the controller at the lowest possible height.
- Avoid jarring, dropping, or hitting the controller during handling.
- When carrying the controller, operate the forklift at a safe speed.

![Diagram of forklift with protective padding, tiedown straps, palette, and forklift]
3.2 Place of Installation

The conditions listed below must be met before installing the DX100:

• Ambient temperature must be 0 to 45°C (32 to 113°F) during operation and -10 to 60°C (14 to 140°F) during transportation and maintenance.

• Humidity must be low with no condensation (10~90%RH).

• It must be a place with little dirt, dust, or water.

• No flammable or corrosive liquids or gases, etc. in the area.

• Little jarring or potential for striking of the DX100 (under 0.5 oscillation).

• No large electric noise source (such as a TIG welding device, etc.) nearby.

• No potential for collision with moving equipment such as forklifts.
3.3 Location

1. Install the DX100 outside of the P-point maximum envelope of the manipulator (outside of the safeguarding.)

*Fig. 3-1: Location of DX100*

2. Install the controller in a location from which the manipulator is easily visible.

3. Install the controller in a location from which you can easily inspect it when the door is open.

4. Install the controller at least 500mm from the nearest wall to allow maintenance access.
3.4 Mounting the Controller

**CAUTION**

- Do not climb on top of the DX100.

Failure to observe this caution could lead to injury or mechanical failure.

Attach the controller to the floor using user-supplied brackets made according to the specifications shown below.

Refer to the Instruction Manual for information on the installation of the manipulator.
4 Connection

WARNING

• The system must be grounded. Failure to ground equipment may result in injury from fire or electric shock.

• Before wiring, make sure to turn OFF the primary power supply, and put up a warning sign. (ex. DO NOT TURN THE POWER ON) Failure to observe this caution may result in injury and electric shock.

• Do not touch any board inside the controller for five minutes after turning OFF the power supply. Capacitors inside the controller store electricity after power is turned OFF. Exercise caution whenever handling circuit boards. Failure to observe this caution may cause electrical shock.

• Power cannot be turned ON unless the door is closed. Interlocks prevent power from being turned ON. Failure to observe this caution may result in fire and electric shock.

• Any occurrence during wiring while the DX100 is in the emergency stop mode is the user’s responsibility. Do an operation check once the wiring is completed. Failure to observe this caution could lead to injury or mechanical failure.

CAUTION

• Wiring must be performed only by authorized personnel. Incorrect wiring may cause fire and electric shock.

• Perform wiring in accordance with the rated capacity as specified in the Instructions. Incorrect wiring may cause fire or mechanical breakdown.

• Be sure the power circuit screws are securely tightened. Loose power circuit wires can cause fire and electric shock.

• Do not handle the circuit board directly by hand. The IC board may malfunction due to electrostatics.
4.1 Notes on Cable Junctions

- The cables that connect the controller to peripheral device are low voltage circuits. Keep controller signal cables away from the primary power circuit. High voltage power lines should not be run in parallel to controller signal cables. If running parallel cables is unavoidable, use metal ducts or conduit to isolate electrical signal interference. If cables must be crossed, run the power cables perpendicular across the signal cables.

- Confirm the connector and cable numbers to prevent misconnection and equipment damage. One connects the manipulator and DX100. Another connects the DX100 and peripheral device. A wrong connection can cause damage to electronic equipment.

- Clear the area of all unauthorized personnel while making cable connections. Place all cables in a covered cable channel in the floor.

Fig. 4-1: DX100 Cable Junction Diagram
4.2 Power Supply

4.2.1 Three-Phase Power Supply

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 three-phase power supply consists as follows:

- With built-in transformer: 400/415/440 VAC at 50/60 Hz
- Without built-in transformer: 200 VAC at 50/60 Hz and 220 VAC at 60 Hz

Fig. 4-2: Input Power Connection

**CAUTION**

- The system must be grounded.

If the DX100 for European standards is used in Japan, an electric shock may result from increase in leakage current due to differences in power supply condition.
4.2.2 Primary Power Supply Breaker Installation

Install the primary power supply breaker as shown.

Fig. 4-3: Installation of the Primary Power Supply Breaker

![Diagram showing the installation of the primary power supply breaker](image)

Table 4-1: DX100 Power Capacity, Cable Sizes, and Breaker Capacities

<table>
<thead>
<tr>
<th>Manipulator</th>
<th>Power capacity (kVA)</th>
<th>Cable size (size of terminal) (In case of Cabtyre cable (three cores)) (AWG)</th>
<th>Capacity of breaker in DX100 (With transformer) (A)</th>
<th>Capacity of breaker in DX100 (Without transformer) (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH5, MH5L</td>
<td>1</td>
<td>12 (M5)</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>MH6, MA1400, VA1400</td>
<td>1.5</td>
<td>12 (M5)</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>HP20D, HP20D-6, HP20RD, MA1900</td>
<td>2.0</td>
<td>12 (M5)</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>MH50, MH50-20, MH50-35, MS80</td>
<td>4.0</td>
<td>10 (M5)</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>VS50, ES165D, ES165RD, ES200D, ES200RD, SIA50D, HP165D, UP350D</td>
<td>5.0</td>
<td>10 (M5)</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

The maximum load value (payload, operation speed, and frequency, etc.) is displayed.
However, the power capacity is different depending on work conditions.

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

NOTE

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.
4.3 Connection Methods

A connection diagram for the manipulator, manipulator cable, primary power cable and programming pendant is shown below.

Fig. 4-4: Cable Connection

4.3.1 Connecting the Primary Power Supply

1. Open the front door of the DX100.
   
   (1) Insert the special key in the door lock on the front of DX100, and rotate it 90 degrees clockwise.

Fig. 4-5: Rotating the Door Lock Clockwise
4 Connection
4.3 Connection Methods

(2) Rotate the main power supply switch to the "OFF" position and open the door gently.

*Fig. 4-6: Rotating the main power supply switch to the OFF position*

(3) Confirm that the primary power supply is OFF.

(4) Connect the primary power supply cable.
   - Connect the primary power supply cable to the power supply connector on the back of DX100.

---

**CAUTION**

- The system must be grounded.

If the DX100 for European standards is used in Japan, an electric shock may result from increase in leakage current due to differences in power supply condition.

- In the DX100, the N-phase of the transformer wires to the ground. Therefore, if the power supply whose S-phase wires to the ground is connected to the controller, the earth leakage breaker of the equipment trips or the transformer oscillates.

To connect the power supply whose S-phase does not wire to the ground to the DX100, put an isolation transformer between the equipment and the DX100.

---

2. Connect a ground wire to reduce noise and prevent electric shock.

(1) Perform grounding in accordance with all relevant local and national electrical codes. The size of ground wire must be 8.0 mm² or larger.

---

**NOTE**

The customer must prepare the ground wire.
4.3 Connection Methods

Fig. 4-7: Exclusive Grounding

![Diagram showing exclusive grounding with DX100 and ground resistance of 100 ohm maximum.]

Do not connect the grounding wire with the wires for the electric power source, the welder, etc.

Ground in accordance with all relevant governmental regulations when using metallic ducts, metallic conduits, and cable tray to construct the cable.

(2) Connect the primary power supply cable.

Fig. 4-8: Connection of the Primary Power Supply Cable

![Diagram showing the connection of the primary power supply cable with DX100.]

To connect the primary power supply to the DX100, the user must prepare a CEE connector (type: 432C6, manufacturer: ABB).

![Image of a connector for DX100 side and cable side.]

Connector type (DX100 side) 432BS6 (ABB)
Connector type (Cable side) 432C6 (ABB)
4.3.2 Connecting the Manipulator Cable

1. Remove the package, and take out the manipulator cable. Connect the cable to the connectors on the back side of DX100.

Fig. 4-9: Connection of the Manipulator Cable

![Back View with Manipulator Cable](image)

For more information on connecting the manipulator cable, please refer to the Instruction Manual which corresponds to the particular DX100 model.

2. Connect the manipulator to the DX100.
   - Confirm the shape and size of the cable connector, the key fitting, and the position of the pins of the manipulator. Push the cable connector into the manipulator side connector firmly, and tighten securely.

3. Close the DX100 door.
   (1) Close the door gently.
   (2) Rotate the door lock counterclockwise 90 degrees.

Fig. 4-10: Rotating the Door Lock Counterclockwise

![Door Lock Rotation](image)

**CAUTION**

Always close the door of the controller (DX100) except for maintenance. Make sure to rotate all the door locks counterclockwise. If dust or water enter inside the controller, electric shock or breakdown of DX100 may result.
4.3.3 Connecting the Programming Pendant

1. Connect the programming pendant cable to the connector on the door lower right side of the controller cabinet.

*Fig. 4-11: Connecting the Programming Pendant*

The manipulator, DX100, and the programming pendant connections are now complete.
5 Turning ON and OFF the Power Supply

5.1 Turning ON the Main Power Supply

The main power supply is turned ON when the main power supply switch on the front of the DX100 is turned to the "ON" position, and the initial diagnosis and the current position setting begin.

**Fig. 5-1: Turning ON the Main Power Supply**

The main power supply switch

---

**WARNING**

- Confirm that nobody is present in the P-point maximum envelope of the manipulator when turning ON the DX100 power supply.

Failure to observe this caution could result in injury caused by accidental contact with the manipulator.

Press the emergency stop button immediately if any problems occur.

The emergency stop button is located on the upper right side of the programming pendant.
5.1.1 Initial Diagnosis

The initial diagnosis are performed in the DX100 when main power is turned ON, and the startup window is shown on the programming pendant screen.

*Fig. 5-2: Startup Window*

5.1.2 When Initial Diagnosis are Complete

When the power supply is turned OFF, the DX100 saves all condition data, including:

- Mode of operation
- Called job (active job if the DX100 is in the play mode; edit job if the DX100 is in the teach mode) and the cursor position in the job.

*Fig. 5-3: Initial Window*

### CAUTION

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.

  After operation, the key should be removed and stored by the system manager.

  Improper or unintended manipulator 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.
5.2 Turning ON the Servo Power

5.2.1 During Play Mode
The worker’s safety is secure if the safety plug is turned ON.

- When the safeguarding is closed, press [SERVO ON READY] on the programming pendant to turn ON the servo power supply. [SERVO ON] lamp will light, when the servo power is turned ON.

![SERVO ON READY Light](image)

**NOTE** When the safeguarding is open, the servo power supply cannot be turned ON.

5.2.2 During Teach Mode
1. Press [SERVO ON READY] on the programming pendant to turn ON the servo power supply. [SERVO ON] lamp will flicker when the servo power is turned ON.

![SERVO ON Flicker](image)

2. The servo power is turned ON and [SERVO ON] lamp on the programming pendant lights when the operator grips the Enable switch.
5. Turning ON and OFF the Power Supply

5.2 Turning ON the Servo Power

Servo Power ON/OFF --- Enable Switch

When the operator grips the Enable switch, the servo power turns ON. However, if the operator squeezes the switch until a “click” is heard, the servo power will turn OFF.

Release -> OFF  Squeeze -> ON  Squeeze Tightly -> OFF

NOTE

When performing emergency stop by the programming pendant or external signal, the servo power-on operation from the Enable switch is cancelled. When turning the power back ON, follow the previously listed instructions.
5.3 Turning OFF the Power Supply

5.3.1 Turning OFF the Servo Power (Emergency Stop)

The manipulator cannot be operated when the emergency stop button is pressed and the servo power supply is turned OFF.

- Press the emergency stop button and the servo power supply is turned off. The emergency stop button is located on the right side of the programming pendant.
- The brake operates once the servo power supply is turned OFF, and the manipulator can no longer operate. The emergency stop mode can be operated at any mode (Teach mode, Play mode, Remote mode.)

![Programming Pendant](image)

5.3.2 Turning OFF the Main Power

After turning OFF the servo power, turn OFF the main power.

- When the main power switch on the front of DX100 is turned to the “OFF” position, the main power is turned OFF.
6 Test of Program Operation

**WARNING**

- Press the emergency stop button on the right of the front door of the DX100 and the programming pendant before operating the manipulator. Confirm that the SERVO ON lamp is turned OFF. Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency. The emergency stop buttons are attached on the front door of the DX100 and right of the programming pendant.

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Always view the manipulator from the front.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
  - Ensure that you have a place to retreat to in case of emergency. Improper or unintentional manipulator operation can result in injury.

- Prior to performing the following operations, be sure that there is no one within the P-point maximum envelope of the manipulator, and be sure that you are in a safe place yourself.
  - Turning ON the DX100 power
  - Moving the manipulator with the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Injury may result from collision with the manipulator to anyone entering the P-point maximum envelope of the manipulator.
6 Test of Program Operation
6.1 Movement of the Axes

6.1 Movement of the Axes

Move each axis of the manipulator by pressing the axis keys on the programming pendant.

This figure illustrates each axis of motion in the joint coordinates.

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 manipulator 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 manipulator, fixture, or on the floor, the manipulator or a tool could collide with it during manipulator movement, possibly causing injuries or equipment damage.

• Make sure that a system manager stores the key of the mode select switch on the programming pendant.

After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator 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.

NOTE

Be sure to remove all items from the area before moving the manipulator. Refer to the INSTRUCTION MANUAL for the appropriate position of the fixture.
6 Test of Program Operation

6.1 Movement of the Axes

- **E**: Rotates lower arm
- **S**: Rotates main body
- **L**: Moves lower arm forward/backward
- **U**: Moves upper arm up/down
- **R**: Rotates upper arm
- **B**: Moves wrist up/down
- **T**: Rotates wrist

Axis Keys:

- **U-Axis**
- **R-Axis**
- **B-Axis**
- **T-Axis**
- **L-Axis**
- **S-Axis**
- **E-Axis**

Moves lower arm forward/backward
Rotates main body
Moves upper arm up/down
Rotates lower arm
Rotates upper arm
Moves wrist up/down
Rotates wrist
7 Security System

7.1 Protection Through Security Mode Settings

The DX100 modes setting are protected by a security system. The system allows operation and modification of settings according to operator clearance. Be sure operators have the correct level of training for each level to which they are granted access.

7.1.1 Security Mode

There are three security modes. Editing mode and management mode require a user ID. The user ID consists of numbers and letters, and contains no less than 4 and no more than 8 characters. (Significant numbers and signs: "0 to 9", ",", ".")

<table>
<thead>
<tr>
<th>Security Mode</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Mode</td>
<td>This mode allows basic operation of the robot (stopping, starting, etc.) for people operating the robot work on the line.</td>
</tr>
<tr>
<td>Editing Mode</td>
<td>This mode allows the operator to teach and edit jobs and robot settings.</td>
</tr>
<tr>
<td>Management Mode</td>
<td>This mode allows those authorized to set up and maintain robot system: parameters, system time and modifying user IDs.</td>
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<td>SELECT JOB</td>
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<td>JOB CAPACITY</td>
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<td></td>
<td>RES. START (JOB)&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>RES. STATUS&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>POSITION (ST)</td>
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<td>SPECIFIC OUTPUT</td>
<td>Operation -</td>
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<td>NETWORK INPUT</td>
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<td>ANALOG OUTPUT</td>
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<td>SV POWER STATUS</td>
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<td>I/O ALARM</td>
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<td>I/O MESSAGE</td>
<td>Management, Management</td>
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## 7 Security System
### 7.1 Protection Through Security Mode Settings

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<td><strong>FD/CF</strong></td>
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<td><strong>PARAMETER</strong></td>
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<td>GRP COMBINATION(3)</td>
<td>Management</td>
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<tr>
<td>RESERVE JOB NAME</td>
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<td>Edit</td>
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<tr>
<td>USER ID</td>
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<td>Edit</td>
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</tr>
<tr>
<td>SET SPEED</td>
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<tr>
<td>KEY ALLOCATION(1)</td>
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<td>RES. START (CNCT)</td>
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<td>AUTO BACK SET</td>
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<table>
<thead>
<tr>
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<th>Operation</th>
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<tbody>
<tr>
<td>ARC END COND.</td>
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<td>Edit</td>
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<tr>
<td>ARC AUX COND.</td>
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<tr>
<td>POWER SOURCE COND.</td>
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<th>HANDLING DIAGNOSIS</th>
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<td></td>
<td>GUN CONDITION</td>
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<td>Management</td>
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<td></td>
<td>CLEARANCE SETTING</td>
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<tr>
<td></td>
<td>POWER SOURCE COND</td>
<td>Management</td>
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<table>
<thead>
<tr>
<th>SPOT WELDING (MOTOR GUN)</th>
<th>WELD DIAGNOSIS</th>
<th>Operation</th>
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<tbody>
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<tr>
<td>GUN CONDITION</td>
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<tr>
<td>CLEARANCE SETTING</td>
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<tr>
<td>SPOT POWER SOURCE COND</td>
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<tr>
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<table>
<thead>
<tr>
<th>GENERAL</th>
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<tbody>
<tr>
<td></td>
<td>GENERAL DIAG.</td>
<td>Operation</td>
<td>Edit</td>
</tr>
</tbody>
</table>

| COMMON TO ALL APPLICATIONS | I/O VARIABLE CUSTOMIZE | Operation | Operation |

---

1. Displayed in the teach mode only.
2. It is possible to initialize a floppy at FC1/FC2.
3. Displayed only with two or more control groups.
4. Displayed in the teach mode only.

*Data is cleared in the edit mode or higher.*
7.1.1.1 Changing the Security Mode

1. Select {SYSTEM INFO} under the main menu.
   – The sub menu appears.

   ![SubMenu.png](image)

   Note: Icons for the main menu such as arc welding system differ depending on the system being used.

2. Select {SECURITY}.
   – The selection window of security mode appears.

   ![SecurityMode.png](image)
3. Press [SELECT].
   - Select "SECURITY MODE".

![Security Mode Selection](image)

4. Input the user ID.
   - The user ID input window appears.

![User ID Input Window](image)

The following user ID numbers are set by default.
- Editing Mode: [00000000]
- Management Mode: [99999999]

5. Press [ENTER].
   - The input user ID is compared with the user ID of the selected security mode.
   - When the correct user ID is entered, the security mode is changed.
7.1.2 User ID

User ID is requested when Editing Mode or Management Mode is operated.

Create the user ID with four to eight numbers and symbols: the numbers 0 to 9; the symbols "," and ",".

7.1.2.1 Changing User ID

In order to change the user ID, the DX100 must be in Editing Mode or Management Mode. Higher security modes can make changes the user ID of to lower security modes.

1. Select {SETUP} under the main menu.
   – The sub menu appears.

2. Select {USER ID}.
   – The USER ID window appears.
3. Select the desired ID.
   - The character input line appears, and a message "Input current ID no. (4 to 8 digits)" appears.

4. Input the current ID and press [ENTER].
   - When the correct user ID is entered, a new ID is requested to be input. "Input new ID no.(4 to 8 digits)" appears.

5. Input new ID and press [ENTER].
   - User ID is changed.
8 System Setup

WARNING

- Various settings control system compatibility and manipulator performance characteristics. Exercise caution when changing settings that can result in improper manipulator operation. Personal injury and/or equipment damage may result if incorrect settings are applied by the user.

- Observe the following precautions to safeguarding system settings:
  - Maintain supervisory control of user functions.
  - Retain data backups of control settings each time settings are changed.
8.1 Home Position Calibration

**WARNING**

- Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop buttons on the right of the front door of the DX100 and the programming pendant are pressed.

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

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always prepare your reactions to a manipulator’s unexpected approach toward you.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator, and be sure that you are in a safe place when:
  - Turning ON the DX100 power.
  - Operating the manipulator with the programming pendant.

Injury may result from contact with the manipulator if persons enter the P-point maximum envelope of the manipulator.

Always press the emergency stop button immediately if there are problems.

Emergency stop buttons are located on the right of the front door of the DX100 and the programming pendant.
8.1 Home Position Calibration

8.1.1 Home Position Calibration

Teaching and playback are not possible before the completion of the home position calibration. In a system with two or more manipulators, the home position of all the manipulators must be calibrated before starting teaching or playback.

Home position calibration is an operation in which the home position and absolute encoder position coincide. Although this operation is performed prior to shipment at the factory, the following cases require this operation to be performed again.

- Change in the combination of the manipulator and DX100
- Replacement of the motor or absolute encoder
- Clearing stored memory (by replacement of NIF01 circuit board, weak battery, etc.)
- Home position deviation caused by hitting the manipulator against a workpiece, etc.

To calibrate the home position, use the axis keys to calibrate the home position mark on each axis so that the manipulator can take its posture for the home position. There are two operations for home position calibration:
8.1 Home Position Calibration

- All the axes can be moved at the same time: Recalibrate the home position by moving all the axes together if changing the combination of manipulator and circuit board.

- Axes can be moved individually: Recalibrate the home position for the individual axes that were affected by the replacement, if replacing the motor or absolute encoder.

If the absolute data of its posture for the home position is already known, set the absolute data again after completing home position registration.

### Home Position

The home position is the pulse value "0" for each axis and its posture. See Section 8.1.3 "Home Position of the Robot" on page 8-10.

### 8.1.2 Calibrating Operation

**NOTE**
Home position calibration screen is displayed only in security mode or management mode.

#### 8.1.2.1 Registering All Axes at One Time

1. Select (ROBOT) under the main menu.
   - The sub menu appears
8 System Setup
8.1 Home Position Calibration

2. Select {HOME POSITION}.
   – The HOME POSITIONING window appears.

3. Select {DISPLAY} under the menu.
   – The pull-down menu appears.
   – The same operation as the instruction 3 can also be performed by selecting (PAGE), and selection box appears.
4. Select the desired control group.
   - Select the control group for HOME POSITIONING.
   - The control group can also be selected by pressing page key .
5. Select {EDIT} under the menu.
   - The pull-down menu appears.

6. Select {SELECT ALL AXES}.
   - The confirmation dialog box appears.

7. Select {YES}.
   - Displayed position data of all axes are registered as home position. When {NO} is selected, the registration will be canceled.

8.1.2.2 Registering Individual Axes

1. Select {ROBOT} under the main menu.
   - The sub menu appears.
2. Select {HOME POSITION}.
3. Select the desired control group.
   - Perform the step 3 and 4 of the "Registering All Axes at One Time" to select the desired control group.
4. Select the axis to be registered.
   - Move the cursor to the axis to be registered, and select it.

   ![Diagram showing axis selection process]

   - A confirmation dialog box appears.

   ![Confirmation dialog box showing YES and NO options]

5. Select {YES}.
   - Displayed position data of the axis is registered as home position. When {NO} is selected, the registration will be canceled.

8.1.2.3 Changing the Absolute Data

To change the absolute data of the axis when home position calibration is completed, perform the following:

1. Select {ROBOT} under the main menu.
2. Select {HOME POSITION}.
3. Select the desired control group.
   - Perform the step 3 and 4 of the “Registering All Axes at One Time” to select the desired control group.
4. Select the absolute data to be registered.
   – The number can now be entered.

5. Enter the absolute data using the numeric keys.

6. Press [ENTER].
   – Absolute data is modified.

8.1.2.4 Clearing Absolute Data

1. Select {ROBOT} under the main menu.
   – The sub menu appears

2. Select {HOME POSITION}.
   – Perform the step 3 and 4 of the “Registering All Axes at One Time” to select the desired control group.

3. Select {DATA} under the main menu.
   – The pull-down menu appears
4. Select [CLEAR ALL DATA].
   – A confirmation dialog box appears.

5. Select {YES}.
   – All absolute data are cleared.
   – When {NO} is selected, the registration will be canceled.
8.1.3 Home Position of the Robot

In case of VA1400, the home position are as follows.

- **B-axis center line angle against U-axis center line**: (0°).
- **U-axis angle against horizontal line on the ground**: (0°).
- **L-axis angle against vertical line to the ground**: (0°).

**NOTE**

Other manipulator models have different positions. Always refer to "MANIPULATOR INSTRUCTIONS" for the correct manipulator model.
8.2 Setting the Second Home Position (Check Point)

**WARNING**

- Be aware of safety hazards when performing the position confirmation of the second home position (check point).

When "OUT OF RANGE (ABSO DATA)" alarm occurs, abnormality of the PG system may be a cause of the alarm. The manipulator may operate in an unexpected manner, and there is a risk of damage to equipment or injury to personnel.

- Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop buttons on the front door of DX100 and the programming pendant are pressed.

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

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator, and be sure that you are in a safe place when:
  - Turning ON the DX100 power
  - Moving the manipulator with the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Injury may result from contact with the manipulator if persons enter the P-point maximum envelope of the manipulator.

Press the emergency stop button immediately whenever there are problems.

- Emergency stop buttons are attached on the front door of the DX100 and the right side of the programming pendant.
8.2 Setting the Second Home Position (Check Point)

8.2.1 Purpose of Position Check Operation

If the absolute number of rotation detected at power supply ON does not match the data stored in the absolute encoder the last time the power supply was turned OFF, an alarm is issued when the controller power is turned ON.

There are two possible causes of this alarm:

- Error in the PG system
- The manipulator was moved after the power supply was turned OFF.

If there is an error with the PG system, the manipulator may stall when playback is started. If the absolute data allowable range error alarm has occurred, playback and test runs will not function and the position must be checked.
8.2 Setting the Second Home Position (Check Point)

**Position Check**

After the "OUT OF RANGE (ABSO DATA)" alarm occurs, move to the second home position using the axis keys and perform the position confirmation. Playback, test runs, and FWD operation will not function unless "CONFIRM POSITION" is performed.

**Pulse Difference Check**

The pulse number at the second home position is compared with that at the current position. If the difference is within the allowable range, playback is enabled. If not, the alarm occurs again.

- The allowable range pulse is the number of pulses per rotation of the motor (PPR data).
- The initial value of the second home position is the home position (where all axes are at pulse 0). The second home position can be changed. For details, refer to Section 8.2.2 “Procedure for the Second Home Position Setting (Check Point)” on page 8-14.

---

**Procedure After Alarm Occurs**

1. **Position confirmation operation**
2. Compare second home position (check point)* pulses with current position pulses

   - NG: Alarm occurs again
   - OK: Correct defective axis
     - Replace PG system
     - Home position calibration

3. Playback possible

---

*Position checking point*
Alarm Occurrence

If the alarm occurs again, there may be an error in the PG system. Check the system. After adjusting the erroneous axis, calibrate the home position of the axis, then check the position again.

- Home position calibration of all the axes at the same time enables playback operations without having to check the position.
- Sometimes in a system with a manipulator with no brake, it is possible to enable playback without position checking after the alarm occurs. **However, as a rule, always perform "CONFIRM POSITION".** Under the above special conditions, the manipulator moves as follows:
  - After the start, the manipulator moves at low speed (1/10 of the maximum speed) to the step indicated by the cursor. If it stops and restarts during this motion, the low speed setting is retained until the step at cursor is reached.
  - Regardless of cycle setting, the manipulator stops after reaching to the step indicated by cursor. Starting the manipulator again then moves it at the programmed speed and cycle of the job.

8.2.2 Procedure for the Second Home Position Setting (Check Point)

Apart from the "home position" of the manipulator, the second home position can be set up as a check point for absolute data. Use the following steps to set the specified point.

If two or more manipulators or stations are controlled by one controller, the second home position must be set for each manipulator or station.

1. Select {ROBOT} under the main menu.
   - The sub menu appears.
2. Select {SECOND HOME POS}.
   - The SECOND HOME POS window appears. A message “Available to move to and modify specified point” is displayed.

3. Press the page key , or select {PAGE} to display the selection window for the control group.
   - When there are two or more group axes, select the group axes to which the second home position is to be specified.

4. Press the axis keys.
   - Move the manipulator to the new second home position.

5. Press [MODIFY], then [ENTER].
   - The second home position is changed.
8.2 Setting the Second Home Position (Check Point)

8.2.3 Procedure after the Alarm

**WARNING**

- Be aware of safety hazards when performing the position confirmation of the specified point.

Abnormality of the PG system may be the cause of the alarm. The manipulator may operate in an unexpected manner, and there is a risk of damage to equipment or injury to personnel.

If the "OUT OF RANGE (ABSO DATA)" alarm occurs:

- Reset the alarm;
- Turn ON the servo power;

then confirm the second home position. After the confirmation, if the PG system is found to be the cause of the alarm, perform the necessary operation, such as replacing the PG, etc.

The robot current position data when turning main power supply OFF and ON can be confirmed in "POWER ON/OFF POS" window.

For details on the "POWER ON/OFF POS" window, refer to Section 7.7 “Position Data When Power is Turned ON/OFF” in DX100 MAINTENANCE MANUAL.

1. Select {ROBOT} under the main menu.
   - The sub menu appears.
2. Select {SECOND HOME POS}.
   - The SECOND HOME POS window appears.

3. Press the page key , or select {PAGE} to display the selection window for the control group.
8 System Setup

8.2 Setting the Second Home Position (Check Point)

- When there are two or more group axes, select the group axes to which the second home position is to be specified.

4. Press [FWD].
   - TCP moves to the second home position. The robot moving speed is set as selected manual speed.

5. Select {DATA} under the menu.

6. Select {CONFIRM POSITION}.
   - A message “Home position checked” appears.
   - Pulse data of the second home position and current pulse data are compared. If the compared error is in allowed range, playback operation can be done.
   - If the error is beyond the allowed range, the alarm occurs again.
8.3 Tool Data Setting

8.3.1 Registering Tool Files

8.3.1.1 Number of Tool Files

There are 64 tool files numbered 0 to 63. Each file is called as a tool file.

Tool File Extension Function

Normally, one robot uses one kind of tool file. The tool file extension function can change many tool files to be used by one robot. Use the following parameter to set this function.

S2C333: TOOL NO. SWITCHING (1: enabled; 0: disabled)

For more details, refer to Section 8 “Parameter ” in the DX100 OPERATOR’S MANUAL.

8.3.1.2 Registering Coordinate Data

When the number input operation is used for registering the tool file, input the TCP of the tool on the flange coordinates.
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1. Select {ROBOT} under the main menu.
   - The sub menu appears.

2. Select {TOOL}.
   (1) Move the cursor to the number of the desired tool, and press {SELECT} in the tool list window.
   (2) The tool coordinate window of the selected number appears.
   - In the tool coordinate window, the tool number can be changed by pressing the page key or selecting {PAGE}.

3. Select the desired tool number.

4. Place the cursor in the part to register the desired coordinate data and press [SELECT].
   - The number is ready to input.

5. Input the coordinate data.
6. Press [ENTER].
   - The coordinate data is registered.

   - Setting Example

   In case of Tool A, B

   | X   | 0.000 mm | Rx | 0.0000 deg. |
   | Y   | 0.000 mm | Ry | 0.0000 deg. |
   | Z   | 260.000 mm | Rz | 0.0000 deg. |

   In case of Tool C

   | X   | 145.000 mm | Rx | 0.0000 deg. |
   | Y   | 260.000 mm | Ry | 0.0000 deg. |
   | Z   | 0.0000 mm | Rz | 0.0000 deg. |

8.3.1.3 Registering Tool Angle

The tool pose data is angle data which shows the relation between the flange coordinates and the tool coordinates. The angle when the flange coordinates are rotated to meet to the tool coordinates becomes an input value. Clockwise toward the arrow is the positive direction. Register in the order of Rz → Ry → Rx.
8 System Setup
8.3 Tool Data Setting

In the following case, register Rz=180, Ry=90, Rx=0

1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
3. Select the desired tool number.
   – In the same way as shown in Explanation 2 and 3 in Section 8.3.1.2 “Registering Coordinate Data” on page 8-18, display the desired tool coordinate window.
4. Select the desired coordinate axis to modify.
   – First, select Rz.
5. Input the tool pose data.
   – Input rotation angle around Z_F of the flange coordinates.
6. Press [ENTER].
   – The rotation angle of Rz is registered.

In the same way, register the angle of Ry, Rx.

Ry must be the input rotation angle around Y'F flange coordinates.

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8.3 Tool Data Setting

8.3.1.4 Setting the Tool Load Information

The tool load information includes weight, a center of gravity position, and moment of inertia at the center of gravity of the tool installed at the flange.

For more details on the tool load information, refer to Section 8.4.3 “Tool Load Information Setting” on page 8-43.
8.3.2 Tool Calibration

8.3.2.1 Tool Calibration

To ensure that the manipulator can perform motion type operations such as linear and circular motion type correctly, accurate dimensional information on tools such as torches, tools, and guns must be registered and the position of the TCP must be defined.

Tool calibration is a function that enables this dimensional information to be registered easily and accurately. When this function is used, the TCP is automatically calculated and registered in the tool file.

What is registered in tool calibration is the coordinates of the TCP and the tool posture data in the flange coordinates.

8.3.2.2 Setting of Tool Calibration Method

There are three tool calibration methods, which are selected by setting parameter.

S2C432: Designation of tool calibration method

0: Calibrates only the coordinates.
   “Coordinates” calculated from 5 calibration teaching points is registered in the tool file.
   In this case “Tool Posture Data” is all cleared to be 0.00.

1: Calibrates only the posture.
   “Tool Posture Data” calculated from the first calibration teaching point is registered in the tool file.
   In this case, “Coordinates” will not be changed. (the prior value is maintained.)

2: Calibrates the coordinates and the posture.
   “Coordinates” calculated from 5 calibration teaching points and “Tool Posture Data” calculated from the first calibration teaching point are registered in the tool file.
8.3 Tool Data Setting

8.3.2.3 Teaching of Calibration Point

- **Teaching for defining coordinates**
  In order to calibrate coordinates, five different postures (TC1 to 5) must be taught with the TCP as the reference point. The tool dimensions are automatically calculated on the basis of these five points.

  ![Teaching Diagram](image)

  Each posture must be arbitrary. Accuracy may decrease when pose setting is rotated in a constant direction.

- **Teaching for defining posture**
  The calibration of tool posture data is performed with the first calibration teaching point (TC1).

  Teach TC1 with Z-axis of the desired tool coordinates downward vertically to the ground. (the Z-axis of the tool coordinates is parallel to the Z-axis of the base tool and points to the opposite direction.)

  Tool posture data is automatically calculated with this TC1 posture.

---

**NOTE**

- In case of S2C432=0 (only coordinates is calibrated), tool posture data is overwritten with 0. (When the coordinates calculated from tool calibration is registered in the tool file in which the tool posture data is already registered, the tool posture data will be deleted.)
- In case of S2C432=1 (only posture is calibrated), the coordinates are maintained.
- In case of S2C432=1, 5 teaching points need to be registered though only the first point is used for calculation.
8 System Setup
8.3 Tool Data Setting

The X-axis of the tool coordinates is defined in the same direction as the X-axis of the base coordinates.

In case of calibrating with S2C432=2, teach TC1 with Z-axis of the desired tool coordinates downward vertically to the ground. Then teach the other calibration teaching points (TC2~TC5) with all tool points meet at the TC1’s tool point as shown in the figure below.

If teaching in one place as the figure above is impossible due to the interference of peripheral equipment and so on, perform calibration of coordinates with S2C432=0 or 2, and then change to S2C432=1, teach only TC1 in a different position and register the tool posture data.

- There are 64 tool files numbered 0 to 63.
- In a basic system with one manipulator and one tool, the tool file for tool No.0 is used.
- If there is more than one tool, for example when using a multihand, use the tool numbers in the order of 0, 1, 2, etc.
1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
3. Select the desired tool number.
   - In the same way as shown in the instruction 2 and 3 of the Section 8.3.1.2 “Registering Coordinate Data” on page 8-18, display the desired tool coordinate window.
4. Select {UTILITY} under the menu.
   - The pull-down menu appears.
5. Select {CALIBRATION}.
   - The TOOL CALIBRATION window is shown.

6. Select the robot.
   (1) Select the robot to calibrate.
       (When the robot has already been selected or there is only one of
        robot, this operation should not be performed.)
   (2) Select "***" in the TOOL CALIBRATION window and select the
       robot in the shown selection dialog box.
   (3) The robot is set.

7. Select "POSITION."
   - The selection dialog box is shown.
(1) Select the teaching point for calibration.

8. Move the manipulator using the axis key.
9. Press [MODIFY] and [ENTER].
   - Taught position is registered.
   - Repeat 7 to 9 operation to teach TC1 to TC5.
   - “●” indicates that teaching is completed and “O” indicates that it is not completed.
   - To check the taught positions, call up the required window among TC1 to TC5 and press [FWD]. The manipulator moves to the set position.
   - If there is a difference between the current position of the manipulator and the shown position data, “TC□” next to “POSITION” in the window flashes.
10. Select “COMPLETE”.

- Calibration data is registered in the tool file. Once the calibration is completed, the tool coordinate window is displayed on the screen.

8.3.2.4 Clearing Calibration Data

Before the calibration of a new tool, clear the robot information and calibration data.

1. Select (DATA) under the pull-down menu.

- The pull-down menu appears.
2. Select {CLEAR DATA}.
   - The confirmation dialog box is shown.

3. Select {YES}.
   - All data is cleared.
8.3.2.5 Checking the TCP

After registering the tool file, check if the TCP is correctly registered by performing a TCP fixed operation like the one shown below, in any coordinate system other than the joint.

1. Press [COORD].
   - Select any coordinate system except “JOINT” by pressing [COORD].

2. Select desired tool number.
   - Show the tool coordinate window of the desired tool by pressing the page key or selecting it in the tool list window.
3. Move the R, B, or T axes using the axis key.
   – By pressing the axis keys for the R, B, and T axes, change the
     manipulator pose without changing the TCP position.
     If this operation shows a large TCP error, adjust the tool data.

For details on the TCP fixed operation, see Section 2.8.1
“Motion about TCP” in the OPERATOR’S MANUAL.

8.3.3 Automatic Measurement of the Tool Load and the Center of Gravity

8.3.3.1 What is the Automatic Measurement of the Tool Load and the Center of Gravity?

With this function, the user can register the load of tool and the position of
the tools center of gravity.

The tool load and the position of it's center of gravity are measured and
registered in a tool file.

This function can be used where the manipulator is installed
level on the ground.

For the conditions required for manipulator installation, refer
to Section 8.4 “ARM Control” on page 8-38.
8.3.3.2 Measurement of the Tool Load and the Center of Gravity

To measure the tool load and the center of gravity, move the manipulator to its home position (horizontal to the U-, B- and R-axes) and operate the U-, B- and T-axes.

To correctly measure the tool load or the center of gravity, remove the cables or wires connected to the tool.
1. Select {ROBOT} under the main menu.

2. Select {TOOL}.
   - The tool list window appears.
   - The tool list window is called up only when the file extension function is valid.

If the file extension function is invalid, the tool coordinate window appears.

3. Select the desired tool number.
   - Move the cursor to the desired number in the tool list window and press [SELECT].
   - The tool coordinate window of the selected number is shown.
   - In the tool coordinate window, the number can be changed by pressing the page key or selecting {PAGE}.
8.3 Tool Data Setting

– To switch the tool list window and the tool coordinate window, press {DISPLAY} \(\rightarrow\) (LIST) or {DISPLAY} \(\rightarrow\) (COORDINATE DATA).

4. Select {UTILITY} under the menu.

5. Select {W.GRAV.POS MEASURE}.

– The window for the automatic measurement of the tool load and the center of gravity is shown.

6. Press the page key  

– In a system with several manipulators, use the page key  to change the group to be controlled.
7. Press [FWD].

   – Press [FWD] again, and measurement starts. Keep the button pressed until measurement is completed.

The manipulator moves in the order listed below. Once measurement is completed, “O” changes to “●”.

1. Measurement of the U-axis: U-axis home position +4.5 degrees → -4.5 degrees
2. Measurement of the B-axis: B-axis home position +4.5 degrees → -4.5 degrees
3. First measurement of the T-axis: T-axis home position +4.5 degrees → -4.5 degrees
4. Second measurement of the T-axis: T-axis home position +60 degrees → +4.5 degrees → -4.5 degrees

- The speed during measurement automatically changes to “Medium”.
- During the measurement, “HOME” or “U” blinks on the screen.
- During the measurement, the [FWD] button has to be kept pressed. If the button is released during the measurement or if it is released before “O” changes into “●”, the measurement is aborted and the following message appears: “Stopped measurement”.
- The measurement starts again from the first home position.

- When all the measurements are completed or when all the “O” marks have changed into “●”, the measured data appears on the screen.
9. Select “REGISTER”.

- The measured data is registered in the tool file, and the tool coordinate window appears.
- Select “CANCEL” to call up the tool list window without registering the measured data in the tool file.
8.4 ARM Control

8.4.1 ARM Control

ARM Control, a control system originally developed by Yaskawa, achieves an enhanced robot motion performance such as improved path accuracy or reduced cycle time.

The moment of inertia and the gravity moment etc. of each axis are calculated by the ARM control function, and DX100 controls robot motion according to the result. It is necessary to set the robot setup condition and the tool load information to request these accurately.

The robot setup condition is robot installation angle relative to ground and the weight and a center of gravity position of the load installed at each part of robot, etc.

The tool load information is weight, a center of gravity position, and moment of inertia at the center of gravity, of the tool installed at the flange.

It is necessary to set these information correctly to do a better operation control by the ARM control.

8.4.2 ARM CONTROL Window

**CAUTION**

- Correctly set the robot setup condition.

Make sure to avoid any mistake in setting the unit indication or specifying positive and negative values. Failure to observe this caution may lead to improper control of the manipulator, resulting in error occurrence or short life span of speed reducer.

- Confirm the operation path of robot of each job when modifying settings.

Set the robot setup condition when setting up the manipulator.

Confirm the operation path of manipulator of each job afterwards when the setting should be modified after the installation.

Modifying the settings of the ARM control may slightly change the operation path. To avoid injury or damage to machinery caused by collision between tool and positioner, make sure to check the operation path before executing a job.

8.4.2.1 Robot Setup Condition

Fulfill the following robot setup condition to enable the ARM control.

- Robot installation angle
- S-head payload
- U-arm payload
8 System Setup
8.4 ARM Control

■ Robot installation angle
The angle of the manipulator installed relative to ground is set in ANGLE REL. TO GROUND to calculate the gravity moment which loads to each axis of the manipulator.

The robot installation angle sets how much X axis of the robot coordinates has inclined with the ground around Y axis of the robot coordinates. The direction of + in the U axis operation from the home position posture of the manipulator becomes direction of + of the robot installation angle. Therefore, the robot installation angle for a vertical downward wall mount specification becomes -90 degrees.

<Example>

If the robot installation angle is not correctly set, the manipulator cannot be properly controlled. Therefore, make sure to set the value correctly, paying special attentions to the direction “+” or “-”.

![Diagram of robot installation angle]

Only rotation angle around Y axis of the robot coordinates can be set in the robot installation angle. Contact YASKAWA representative when robots is installed to incline Y axis of the robot coordinates relative to ground.

■ S-head payload
Set the weight and the center of gravity position roughly when the equipment such as transformer is installed at the S-head.

It is not necessary to set these values when there is no installed load on the S-head.
WEIGHT (unit: kg)
The weight of the installed load is set.
It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual load. (Round up the value with each fraction between 0.5 to 1 kg.)

X (From S-Axis), Y (From S-Axis) (unit: mm)
The center of gravity position of the installed load is set by the distance in the direction of X and the direction of Y from S axis center here. It can be set with a rough value.
The direction of X and Y applies to the robot coordinates. The value is set by a negative number when the position is in “-” direction.

Fig. 8-1: Load on the S-head (Top View)

■ U-arm payload
Set the weight and the center of gravity position roughly when the equipment such as the wire supplying motors is installed on U arm.
A standard value is set when shipping from the factory.
Set the weight in “0” if there is no installing equipment on U arm.

WEIGHT (unit: kg)
The weight of the installing load is set here.
Set a little large value though it does not care by a rough value. (Rase to a unit in each 0.5 to 1kg)

X (From U-Axis), HEIGHT (From U-Axis) (unit: mm)
The center of gravity position of the installing load is set here. It does not care by a rough value.

X (From U-Axis) is horizontal distance from U axis rotation center to the center of gravity position of the load. Set negative number when there is mass side in the back from U-axis rotation center.
HEIGHT (From U-Axis) is height of the vertical direction from U-axis rotation center to the center of gravity position of the load.
8 System Setup
8.4 ARM Control

Fig. 8-2: Load on the U-arm: Center of Gravity Position (Side View)

NOTE

ARM CONTROL window is displayed only when the security mode is set in the management mode.

1. Select {ROBOT} under the main menu.
2. Select {ARM CONTROL}.
   - The ARM CONTROL window appears.

3. Press the page key, or select {PAGE}.
   - Select the desired control group when there are two or more group axes.

4. Select the desired item.

5. Input the value and press [ENTER].
8.4.3 Tool Load Information Setting

### CAUTION

- Set the tool load information correctly.
  The speed reducer longevity might decrease or the alarm might occur when the tool load information is not set correctly.
- Confirm the operation path of robot of each job which uses the tool file after the tool load information is changed.

Set the tool load information before teaching the job after the tool is installed.

Confirm the operation path of each job which uses the tool file when the tool load information should be modified after teaching.

Modifying the tool load information may slightly change the operation path. To avoid injury or damage to machinery caused by collision between tool and positioner, make sure to check the operation path before executing a job.

---

**8.4.3.1 Tool Load Information**

Tool load information includes weight, a center of gravity position, and moment of inertia at the center of gravity of the tool installed at the flange. These are registered in the tool file.

**Moment of inertia around the Center of Gravity**

$I_x$, $I_y$, $I_z$

---

**8.4.3.2 How to Calculate Tool Load Information**

- **Weight: W (Unit: kg)**
  The total weight of the installing tool is set.
  It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual load. (Round up the value with each fraction between 0.5 to 1 kg for small and medium size manipulator, and 1 to 5 kgs for large manipulator.)
Center of gravity position: \(x_g, y_g, z_g\) (Unit: mm)
The center of gravity position of the installed tool is set as the position in the flange coordinates.

Since it is usually difficult to get a strict center of gravity position, it can be set with a rough value. Presume and set a center of gravity position roughly from outline of the tool.

Set the value when the center of gravity position of the installed tool is clear from specifications, etc.

Moment of inertia at the center of gravity: \(I_x, I_y, I_z\) (Unit: kg·m\(^2\))
It is a moment of inertia of the tool at the center of gravity position.

The value is calculated around the each axis of the coordinates which is in parallel to the flange coordinates and which home position is the center of gravity position of the tool.

It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual value.

This setting is used to calculate the moment of inertia which loads to each axis of the manipulator. However, the moment of inertia at the center of gravity does not need to be set when this data is small enough for the moment of inertia calculated from weight and the center of gravity position.

However, the setting is required when the moment of inertia of the tool is large (as a rough guide, the tool is considered to be large when the tool size is about more than 2-times the distance between the flange and the center of gravity).

Rough value of the moment of inertia at the center of gravity can be calculated by the following methods.

- Method to approximate the entire tool in hexahedron or cylinder.
- Method to calculate from each weight and center of gravity position of plural mass.
Refer to the following setting examples for details.

**<Example 1>**

In the example of sealing gun of the figure below, the center of gravity is set on the flange coordinates assuming that the center of gravity is positioned slightly inclined to the head from the center.

There is no need to set the moment of inertia at the center of gravity since the size of the gun is not too large.

**<Setting>**

- $W : 7.000$ kg
- $X_g : 100.000$ mm
- $Y_g : 0.000$ mm
- $Z_g : 70.000$ mm
- $I_x : 0.000$ kg $\cdot m^2$
- $I_y : 0.000$ kg $\cdot m^2$

---

**The own moment of inertia calculation for hexahedron and cylinder**

The own moment of inertia of hexahedron and cylinder can be calculated by the next expression when the center of gravity is at the center.

Refer to the expression when the calculation of the moment of inertia at the center of gravity.

- $I_x = \frac{3 r^2 + H^2}{12} \cdot W$
- $I_y = \frac{3 r^2 + r^2}{12} \cdot W$
- $I_z = \frac{r^2}{2} \cdot W$

* Unit of Weight : [kg]
* Unit of Length : [m]
* Unit of $I_x$, $I_y$, $I_z$ : [kg.m$^2$]
<Example 2>

It is necessary to set the moment of inertia at the center of gravity when the entire size of the tool and workpiece is large compared to the distance from the flange to the center of gravity position.

Calculate the moment of inertia at the center of gravity roughly from the expression (refer to the forementioned supplement: "The own moment of inertia calculation for hexahedron and cylinder"), by approximating the entire tool in the shape of the hexahedron or the cylinder.

If the weight of held workpiece is greatly different in the handling usage etc., it is more effective to set tool load information on each workpiece and to switch the tool on each step according to the held workpiece. Set the tool load information in the state to hold the heaviest workpiece when using the tools without switching them.

Weight: \[ W = 55 + 40 = 95 \]
\[ = \text{approx. 100[kg]} \]

Center of gravity: Position at flange right under 250mm almost
\[ (X_g, Y_g, Z_g) = (0,0,250) \]

Moment of inertia at the center of gravity:

The hexahedron of 0.500 x 0.400 x 1.000[m] which encloses the entire tool + workpiece is assumed.

By the expression to calculate the own moment of inertia of hexahedron,

\[ I_x = \left( \frac{L_y^2 + L_z^2}{12} \right) \cdot W \]
\[ = \left( \frac{(0.400^2 + 1.000^2)}{12} \right) \cdot 100 = 9.667 \approx \text{10.000} \]
\[ I_y = \left( \frac{L_x^2 + L_z^2}{12} \right) \cdot W = \left( \frac{(0.500^2 + 0.400^2)}{12} \right) \cdot 100 = 3.417 \approx \text{3.500} \]
\[ I_z = \left( \frac{L_x^2 + L_y^2}{12} \right) \cdot W = \left( \frac{(0.500^2 + 1.000^2)}{12} \right) \cdot 100 = 10.417 \approx \text{10.500} \]
How to calculate "Center of gravity position" and "moment of inertia at center of gravity" for plural mass

The center of gravity position and the moment of inertia at the center of gravity of the entire tool can be calculated by the weight and the center of gravity position of each mass when the tool can be thought that the tool consists of two or more big mass like the twin gun system etc.

1. Divide the tool into some parts as the weight and the center of gravity position can be roughly presumed. It is not necessary to divide in detail. The tool is approximated in construction of rough parts.

2. Calculate the weight and the center of gravity position of the each parts on flange coordinates. It does not care by a rough value. Calculate the own moments of inertia of the big parts. (If parts are small, it is not necessary to calculate the own moments of inertia. Refer to above-mentioned supplement: "The own moment of inertia calculation for hexahedron and cylinder" for how to calculate the own moment of inertia.)

\[ \begin{align*}
\text{wi} & : \text{Weight of the i-th parts} \ [\text{kg}] \\
(xi, yi, zi) & : \text{Center of gravity position of the i-th parts} \ (\text{On flange coordinates}) \ [\text{mm}] \\
Icxi, Icyi, Iczi & : \text{Own moments of inertia of the i-th parts} \ [\text{kg} \cdot \text{m}^2]
\end{align*} \]

3. The center of gravity position of the entire tool is calculated by the next expression.

\[ xg = \frac{w1 \cdot x1 + w2 \cdot x2 + \ldots + w_i \cdot xi}{w1 + w2 + \ldots + w_i} \]
\[ yg = \frac{w1 \cdot y1 + w2 \cdot y2 + \ldots + w_i \cdot yi}{w1 + w2 + \ldots + w_i} \]
\[ zg = \frac{w1 \cdot z1 + w2 \cdot z2 + \ldots + w_i \cdot zi}{w1 + w2 + \ldots + w_i} \]

4. The moment of inertia at the center of gravity position of the entire tool is calculated by the next expression.

\[ Ix = \{ w1 \cdot ((y1 - yg)^2 + (z1 - zg)^2) \cdot 10^{-6} + Icxi1 \} + \{ w2 \cdot ((y2 - yg)^2 + (z2 - zg)^2) \cdot 10^{-6} + Icxi2 \} \]
\[ \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \]
\[ + \{ wi \cdot ((yi - yg)^2 + (zi - zg)^2) \cdot 10^{-6} + Icxi \} \]

\[ Iy = \{ w1 \cdot ((x1 - xg)^2 + (z1 - zg)^2) \cdot 10^{-6} + Icy1 \} + \{ w2 \cdot ((x2 - xg)^2 + (z2 - zg)^2) \cdot 10^{-6} + Icy2 \} \]
\[ \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \]
\[ + \{ wi \cdot ((xi - xg)^2 + (zi - zg)^2) \cdot 10^{-6} + Icyi \} \]

\[ Iz = \{ w1 \cdot ((x1 - xg)^2 + (y1 - yg)^2) \cdot 10^{-6} + Icz1 \} + \{ w2 \cdot ((x2 - xg)^2 + (y2 - yg)^2) \cdot 10^{-6} + Icz \} \]
\[ \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \]
\[ + \{ wi \cdot ((xi - xg)^2 + (yi - yg)^2) \cdot 10^{-6} + Idzi \} \]
<Example 3>

When there are two or more big mass such as the twin gun system as shown in the figure below, perform:

1. Set the center of gravity position when the center of gravity position of the entire tool is roughly understood, and set the moment of inertia at the center of gravity calculated by approximating the entire tool in the shape of hexahedron or cylinder. (It is enough in this setting usually.); or

2. When weight in each mass and the center of gravity position are understood, the center of gravity position and the moment of inertia at the center of gravity of the entire tool can be calculated. (Refer to formentioned supplement column: "How to calculate "Center of gravity position" and "moment of inertia at the center of gravity" for plural mass").

This example shows the calculation with the method 2.

![Diagram of twin gun system with weights and centers of gravity](image)

Weight: $\sum W = w_1 + w_2$

- $w_1 = 3$ kg
- $w_2 = 6$ kg

Center of gravity:

- $x_1 = 100$ mm
- $y_1 = 50$ mm
- $z_1 = 40$ mm
- $x_2 = 100$ mm
- $y_2 = -150$ mm
- $z_2 = 70$ mm

Calculate the center of gravity:

- $X_g = \frac{(w_1 \cdot x_1 + w_2 \cdot x_2)}{(w_1 + w_2)} = \frac{(3 \cdot 100 + 6 \cdot 100)}{(3+6)} = 100.0$ mm
- $Y_g = \frac{(w_1 \cdot y_1 + w_2 \cdot y_2)}{(w_1 + w_2)} = \frac{(3 \cdot 50 + 6 \cdot (-150))}{(3+6)} = -83.333$ mm
- $Z_g = \frac{(w_1 \cdot z_1 + w_2 \cdot z_2)}{(w_1 + w_2)} = \frac{(3 \cdot 40 + 6 \cdot 70)}{(3+6)} = 60.0$ mm

Calculate the moment of inertia:

- $I_x = \frac{1}{2} \sum w \cdot (x^2 + y^2 + z^2) = \sum w \cdot (x^2 + y^2 + z^2) + I_{cx}$
- $I_y = \frac{1}{2} \sum w \cdot (x^2 + z^2) = \sum w \cdot (x^2 + z^2) + I_{cy}$

- $I_x = 3 \cdot ((50 - (-83))^2 + (40 - 60)^2) \cdot 10^{-6} + 0.082$
- $I_y = 3 \cdot ((100 - 100)^2 + (40 - 60)^2) \cdot 10^{-6} + 0.002$

- $I_x = 0.082 \approx 0.100$
- $I_y = 0.002 \approx 0.010$
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\[
I_z = 3 \times ((100 - 100)^2 + (50 - (-83))^2) \times 10^{-6} \\
+ 6 \times ((100 - 100)^2 + ((-150) - (-83))^2) \times 10^{-6} \\
= 0.080 \approx 0.100
\]

* The own moment of inertia \((I_{cx}, I_{cy}, I_{cz})\) of the gun is disregarded in this example, since each gun is smaller than the entire tool.

<Setting>

- \(W\) : 10.000 kg
- \(X_g\) : 100.000 mm
- \(Y_g\) : -83.333 mm
- \(Z_g\) : 60.000 mm
- \(I_x\) : 0.100 kg\(\cdot\)m\(^2\)
- \(I_y\) : 0.010 kg\(\cdot\)m\(^2\)
- \(I_z\) : 0.100 kg\(\cdot\)m\(^2\)

### 8.4.3.3 Tool Load Information Registering

Tool load information is registered in the tool file.

1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
   - The tool coordinate window appears.
   - The tool coordinate window appears only when the file extension function is valid.
   - When the file extension function is invalid, the tool list window appears.
3. Select the desired tool number.

(1) Move the cursor to the number of the desired tool, and press [SELECT] in the tool list window.

(2) The tool coordinate window of the selected number appears.

(3) Select the desired number in the tool coordinate window by pressing the page key or clicking on the [PAGE] button.

(4) To switch the tool list window and the tool coordinate window, press {DISPLAY} → {LIST} or {DISPLAY} → {COORDINATE DATA}.

4. Select the desired item to register and input the value.

- The window can be scrolled with the cursor.

- The menu enters the state of a numeric input if the cursor is on the desired item to register and the [SELECT] is pressed.
5. Press [ENTER].
   – The input value is registered.
   – The servo power is automatically turned OFF when editing the value while the servo power is ON, followed by a message "Servo off by changing data" displayed for three seconds.

When the data setting is not done

It is considered that data is not set correctly in tool load information in the following cases.
   • When the weight (W) is "0".
   • When the center of gravity position (Xg, Yg, Zg) are all "0".

In these cases, the manipulator is controlled by using the standard parameter values (vary according to each robot model) which were set by default.

Standard Value:
   Weight: \( W = \text{Payload} \)
   Center of gravity position:
   \[ (Xg, Yg, Zg) = (0, 0, \text{Allowed value of B-axis for payload}) \]

In this case, when an actual tool load is not large enough, the manipulator cannot sufficiently exert its function, (speed and acceleration / deceleration). Especially, when operating the manipulator with the standard value, a difference of 100 kg or more in the load between the actual tool load and the standard value may cause vibrations in the manipulator motion: it is therefore essential to correctly set the tool load information for the proper operation of the manipulator.

Moreover, when the tool which an actual tool center of gravity position greatly offsets in X-direction or Y-direction is installed the generated moment by the tool cannot be compensated.

• Switch of the tool file

In case that two or more tool files are used, information on an effective tool file is referred for tool load information used by the ARM control at that time in according to switch tool file.

Set the same value of tool load information in each tool file when the tool file is switched to change only TCP (when neither the weight nor the center of gravity position of the entire tool installed in the flange is changed).

Moreover, set tool load information to the corresponding tool file respectively when total weight and the center of gravity position etc. of the tool is changed (when the system which exchange the tool by automatic tool changer.)
8.5  **Work Home Position**

8.5.1  **What is the Work Home Position?**

The Work Home Position is a reference point for manipulator operations. It prevents interference with peripheral device by ensuring that the manipulator is always within a set range as a precondition for operations such as starting the line. The manipulator can be moved to the set work home position by operation from the programming pendant, or by signal input from an external device. When the manipulator is in the vicinity of the work home position, the work home position signal turns ON.

8.5.2  **Setting Work Home Position**

8.5.2.1  **Work Home Position Window**

1. Select {ROBOT} under the main menu.

2. Select {WORK HOME POS}.

   - The WORK HOME POSITION window is appears.
3. Press the page key.
   – When two or more manipulators exist in the system, use the page key to change the control group, or click on (PAGE) to select the desired control group.

8.5.2.2 Registering/Changing the Work Home Position

1. Press the axis keys in the work home position display.
   – Move the manipulator to the new work home position.

2. Press [MODIFY], [ENTER].
When the work home position is changed, the cubic interference area is automatically set as cube 64 to 57 in the base coordinate system.

- The cube 64 is for ROBOT1
- The cube 63 is for ROBOT2
- The cube 62 is for ROBOT3
- The cube 61 is for ROBOT4
- The cube 60 is for ROBOT5
- The cube 59 is for ROBOT6
- The cube 58 is for ROBOT7
- The cube 57 is for ROBOT8

The work home position cube is a cube like the one shown in the figure below; the length of its sides is determined by a parameter setting made by the user (units: µm). By changing this parameter setting, the size of the cube can be changed.

Fig. 8-3: S3C805: The work home position cube length of its sides (µm)

Specify whether “COMMAND POSITION” or “FEEDBACK POSITION” is to be set to the work home position cube signal’s CHECK MEASURE in the interference area settings. “COMMAND POSITION” is the default setting.

### 8.5.2.3 Returning to the Work Home Position

- **In the teach mode**
  1. Press [FWD] in the work home position display.
     - The manipulator moves to the new work home position. The moving speed is the selected manual speed.

- **In the play mode**
  When the work home position return signal is input (detected at leading edge), the TCP of the manipulator is moved to the work home position. When the manipulator moves, a message “Manipulator is moving to work home position” is displayed. In this case, the move interpolation is MOVJ, and the speed applied is the one set in the parameters. (S1CxG56; units: 0.01 %.)
8.5.2.4 Output of the Work Home Position Signal

This signal is output any time the current position of the TCP of the manipulator is checked and found to be within the work home position cube.
8.6 Interference Area

8.6.1 Interference Area

The interference area is a function that prevents interference between multiple manipulators or the manipulator and peripheral device. The area can be set up to 32 area. There are two types of interference areas, as follows:

- Cubic Interference Area
- Axis Interference Area

The DX100 judges whether the TCP of the manipulator is inside or outside this area, and outputs this status as a signal.

8.6.2 Cubic Interference Area

8.6.2.1 Cubic Interference Area

This area is a rectangular parallelepiped which is parallel to the base coordinate, robot coordinate, or user coordinate. The DX100 judges whether the current position of the manipulator's TCP is inside or outside this area, and outputs this status as a signal.

8.6.2.2 Cube Setting Method

There are three ways to set cubic a interference area as described in the following sections:

1. Enter the maximum and minimum values for the cube coordinates.
2. Move the manipulator at the maximum and minimum value positions of the cube corner using the axis keys.

3. After entering the lengths of the three faces of the cube (axial length) using the Numeric keys, move the manipulator to the center point of the cube using the axis keys.
8.6.2.3 Setting Operation

1. Select {ROBOT} under the main menu.

![Main Menu Screen](image1.png)

2. Select {INTERFERENCE}.
   
   - The INTERFERENCE AREA window is shown.

![Interference Area Window](image2.png)
3. Select the desired cube number.
   – Select the desired cube number with the page key or by number input.
   – When selecting the cube number by number input, select (PAGE) to input the desired signal number.

4. Select “METHOD”.
   – “AXIS INTERFERENCE” and “CUBIC INTERFERENCE” are displayed alternately every time [SELECT] is pressed. If “CUBIC INTERFERENCE” is selected, the window is changed.
5. Select “CONTROL GROUP”.
   – A selection dialog box appears. Select the desired control group.

6. Select “REF COORDINATES”.
   (1) A selection box appears.
   (2) Select the desired coordinate.
   (3) If the user coordinates are selected, the number input line is displayed. Input the user coordinate number and press [ENTER].
7. Select “CHECK MEASURE.”

- Each time [SELECT] is pressed, “COMMAND POSITION” and “FEEDBACK POSITION” are displayed alternately.

To stop the manipulator movement using the interference signal (use the cube interference signal for mutual interference between robots), set CHECK MEASURE to “COMMAND POSITION”.

When set to the “FEEDBACK POSITION”, the manipulator decelerates to a stop after entering the interference area.

When using the interference signal to inform an external unit of the actual manipulator position, use the “FEEDBACK POSITION” setting to enable the signal output in more accurate timing.

### Number Input of the Cube Coordinates

1. Select “METHOD”.

   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.

---

![Diagram](image-url)
2. Input number for “MAX” and “MIN” data and press [ENTER].
   - The cubic interference area is set.

![Image]

### Teaching Corner

1. Select “METHOD”.
   
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.
   
   (2) Select “MAX/MIN”.

2. Press [MODIFY].
   - A message “Teach max./min. position” appears.

![Image]

3. Move the cursor to “<MAX>” or “<MIN>.”
   - Move the cursor to “<MAX>” when changing the maximum value, and move cursor to “<MIN>” when changing the minimum value.
   
   The cursor only moves to either “<MIN>” or “<MAX>” at this time.

4. Move the manipulator using the axis keys.
   - Move the manipulator to the maximum or minimum position of the cube using the axis keys.
5. Press [ENTER].
   - The cubic interference area is registered.

■ Number Input of the Side of Cube and Teaching Center
1. Select “METHOD”.
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.
   (2) Select “CENTER POS”.

   ![Diagram of interference area setup]

   ![Diagram of number input of side and teaching center setup]
2. Input data for length of the cube, then press [ENTER].
   - The length is set.

3. Press [MODIFY].
   - A message "Move to center point and teach" appears. The cursor only moves to either “<MIN>” or “<MAX>” at this time.

4. Move the manipulator using the axis keys.
   - Move the manipulator to the center point of the cube using the axis keys.
5. Press [ENTER].
   - The current position is registered as the center point of the cube.

### 8.6.3 Axis Interference Area

#### 8.6.3.1 Axis Interference Area

The axis interference area is a function that judges the current position of the each axis and outputs a signal. Once the maximum and minimum values have been set at the plus and minus sides of the axis to define the working range, a signal indicating whether the current position of the axis is inside or outside this range is output. (ON: inside, OFF: outside)

*Fig. 8-4: Axis Interference Signal for Station Axis*
8.6.3.2 Setting Operation

1. Select {ROBOT} under the main menu.
2. Select {INTERFERENCE}.
   - The INTERFERENCE AREA window appears.

3. Select the desired interference signal number.
   - Select the desired interference signal number using the page key or by number input.
   - When selecting the desired interference signal number by number input, select {PAGE} to input the desired signal number.
4. Select “METHOD”.

- "AXIS INTERFERENCE" and "CUBIC INTERFERENCE" are displayed alternately every time [SELECT] is pressed. Select “AXIS INTERFERENCE”.

5. Select “CONTROL GROUP”.

- A selection box appears. Select the desired control group.

6. Select “CHECK MEASURE”.

- Each time [SELECT] is pressed, “COMMAND POSITION” and “FEEDBACK POSITION” switch alternately.
Number Input of the Axis Data Coordinates

1. Select “METHOD”.

   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.

2. Input number for “MAX” and “MIN” data and press [ENTER].

   - The axis interference area is set.
Teaching Corner

1. Select “METHOD”.
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.
   (2) Select “MAX/MIN”.

2. Press [MODIFY].
   - A message “Teach max./min. position” appears.

3. Move the cursor to “<MAX>” or “<MIN>”.
   - Move the cursor to “<MAX>” when changing the maximum value, and move cursor to “<MIN>” when changing the minimum value.
   - The cursor only moves to either “<MIN>” or “<MAX>” at this time.

4. Move the manipulator using the axis keys.
   - Move the manipulator to the maximum or minimum position of the cube using the axis keys.
5. Press [ENTER].
   – The cubic interference area is registered.

   Number Input of Center Position (WIDTH) and Teaching Center
   1. Select “METHOD”.
      (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.
      (2) Select “CENTER POS”.

   ![Diagram of interference area registration process]

   ![Diagram of method selection process]
2. Input number for "WIDTH" data and press [ENTER].
   – “WIDTH” is set.

3. Press [MODIFY]
   – A message “Move to the center point and teach” appears.
   – The cursor only moves to either “<MIN>” or “<MAX>” at this time.

4. Move the manipulator using the axis keys.
   – Move the manipulator to the center position of the cube using the axis keys.

5. Press [ENTER].
   – The center position of the cube is registered.
8.6.4 Clearing the Interference Area Data

1. Select {ROBOT} under the main menu.

2. Select {INTERFERENCE}.
   - The INTERFERENCE AREA window is shown.

3. Select interference signal to be cleared.
   - Select the desired interference signal number to be cleared using the page key or by number input.
   - When selecting the desired interference signal number by number input, select {PAGE} to input the desired signal number.
4. Select {DATA} under the menu.
   - The pull-down menu appears.

5. Select {CLEAR DATA}.
   - The confirmation dialog box appears.

6. Select {YES}.
   - All the data of the interference signal number are cleared.
8.7 Shock Detection Function

8.7.1 Shock Detection Function

The shock detection function is a function to decrease damage due to the collision by stopping the manipulator without any external sensor when the tool or the manipulator collide with peripheral device.

When the shock is detected either in teach mode or in play mode, the manipulator is stopped immediately.

**WARNING**

This function does not completely avoid damage to the peripheral devices; moreover, it does not guarantee the user’s safety. Make sure to prepare the safety measures such as the safeguarding etc. Refer to Chapter 1 “Safety” on page 1-1 through Chapter 6 “Test of Program Operation” on page 6-1 for the safety measures in details.

Failure to observe this warning may result in Injury or damage to machinery caused by contact with the manipulator.

8.7.2 Shock Detection Function Setting

The shock detection function is set not to mis-detect the shock even if operating by the ratings load with the maximum speed when shipping from the factory. If tool load information is set correctly, the detection sensitivity can be improved. Moreover, it is possible to set the lower sensitivity of detection only for a specific section where the contact work etc. The sensitivity of detection is set by setting the detection level.

8.7.2.1 Shock Detection Level Setting

The shock detection level is set in the shock detection level set file. The shock detection level set file are nine condition files as following figure.

- Condition number 1 to 7 are used when the detection level is changed in a specific section in play mode.
- Condition number 8 is used as standard in play mode: this function is operated by the detection level set in this file when playback operation.
- Condition number 9 is for teach mode: the shock detection function applies the detection level set here when the manipulator is operated in teach mode.

The detection level is changed by a job instruction SHCKSET.

- After the instruction is executed, the shock will be detected by the specified detection level when the condition number is specified with the SHCKSET instruction.
- The detection level is returned to standard level when the SHCKRST instruction is executed.
8 System Setup
8.7 Shock Detection Function

Setting in the specific section in play mode (Condition number 1 to 7)

Standard used for play mode (Condition number 1 to 8)

Used for teach mode (Condition number 9)

Shock Detection Level File
Condition number 1
Condition number 7
Condition number 8
Condition number 9

The detection level of condition number 8 (a standard in play mode) is adopted in play mode excluding the range between SHCKSET and SHCKRST in the job.

Detection Mode
Indicates the shock detection mode.

Condition Number (1 to 9)
1 to 7: for changing detection level in play mode.
8: for standard detection level in play mode.
9: for detection level in teach mode.

Function Select
Specifies VALID/INVALID of the shock detection function. The shock detection function is specified by each manipulator with this function.
1. Move the cursor to the manipulator of which function is to be enabled or disabled; press [SELECT] to change the function to "VALID" or "INVALID".
2. "VALID" and "INVALID" can be changed alternately whenever [SELECT] is pressed. The change is available for all the condition numbers.

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### 8.7 Shock Detection Function

#### Max. Disturbance Force
Indicates the maximum disturbance force to the manipulator when the manipulator is moved in play back operation or axis operation.

Refer to this value when inputting the detection level value in. The maximum disturbance force can be cleared by selecting {DATA} → {CLEAR MAX VALUE} in the menu.

#### Detection Level (Level range: 1 to 500)
Specifies the shock detection level. Set a value larger than the maximum disturbance force. The value set by default (the level 100) enables the function without false detection even if the manipulator is operated at the maximum speed.

To change DETECT LEVEL, move the cursor to the subject manipulator, and press [SELECT] to display the numeric input status; input the value with a numeric key and press [ENTER]. To increase the detection sensitivity, set the level to small value, and to decrease the sensitivity, set the level to large value.

#### Method of Shock Detection Level File Setting
1. Select {ROBOT} under the main menu.
2. Select {SHOCK SENS LEVEL}.
   - The SHOCK DETECT LEVEL window appears.
   - Perform either of the following operations to display the page of desired condition number:
     1. Select {PAGE} and input the desired condition number, then press [ENTER].
     2. Press the page key to change the page of condition number.
3. Select the desired condition number.
4. Select the desired item and perform setting.

To avoid false detection during the manipulator operation, set the detection level greater than the maximum disturbance force by 20%.

**NOTE**
An emergency stop of the manipulator due to the false detection may become a factor to damage the speed reducers and tools.

**<Example>**
When the maximum disturbance force is 80, set the detection level at 96 or more.

**NOTE**
"Detection level" can be modified only when the security mode is set in management mode.
8.7.2.2 Tool Load Information Setting

To increase the accuracy of shock detection, set the tool load information in the tool file. Refer to Section 8.4.3 "Tool Load Information Setting" on page 8-43 for details of the tool load information setting.

8.7.2.3 Instruction of Shock Detection Function

- **SHCKSET instruction**
  The SHCKSET instruction changes the shock detection level to the value set in the shock detection level file during play back operation.

  The additional items of the SHCKSET instruction are as follows.

  \[
  \text{SHCKSET} \quad R1 \quad \text{SSL#(1)}
  \]

  ① **Robot Setting**
  Specifies the manipulator of which shock detection level is to be modified. If nothing is specified, the modification is applied to the shock detection level of the job control group in this instruction. However, in case of coordinated job, the modification is applied to the shock detection level of the slave axis group.

  ② **Shock Detection Level Condition Number (1 to 7)**
  Specifies the shock detection level condition number in which the detection level in playback mode is set.

- **SHCKRST instruction**
  The shock detection level changed by the SHCKSET instruction is reset and returned to the detection level of the standard (value set in condition number 8) by the SHCKRST instruction.

  The additional item of the SHCKRST instruction is as follows.

  \[
  \text{SHCKRST} \quad R1
  \]

  ① **Robot Setting**
  Specifies the manipulator of which shock detection level is to be reset. If nothing is specified, the modification will be applied to the shock detection level of the job control group of this instruction. However, in case of coordinated job, the modification is applied to the shock detection level of the slave axis group.
8 System Setup
8.7 Shock Detection Function

**Instruction Registration**
The instruction is registered when the cursor is in the address area in the JOB CONTENT window in teach mode.

1. Select {JOB} under the main menu.

2. Select {JOB}.

3. Move the cursor in the address area.

**SHCKSET**
1. Move the cursor to the immediately preceding line where the SHCKSET instruction is to be registered.

2. Press [INFORM LIST].
   - The inform list dialog box is shown.

3. Select SHCKSET instruction.
   (1) SHCKSET instruction is shown in the input buffer line.

4. Change the value of additional item and numerical data.
   (2) When registering the instruction as it is >
   Operate the step 5 when registering the instruction in the input buffer line as it is.
   (2) When adding or changing the additional item >

   **When changing the shock detection level**
   (1) When changing the shock detection level, move the cursor to the shock detection level condition number; hold down [SHIFT] and press the up/down cursor key to change the condition number.
8.7  Shock Detection Function

- **When the value is input with the numeric key**
  
  I) When the value is input with the numeric key, press [SELECT] to display the input buffer line.

  ![Input Buffer Line]

  II) Press [ENTER] to change the number in the input buffer line.

- **When robot specification is added**
  
  I) When robot specification is added, move the cursor to the instruction in the input buffer line and press [SELECT] to display the DETAIL window.

  ![ DETAIL Window]

  II) Move the cursor to "UNUSED" of "ROBOT/STATION", and press [SELECT].

  III) The selection box appears.

  IV) Point the cursor to the robot to be added and press [SELECT].

  ![Selection Box]

  V) When the addition of robot is completed, press [ENTER].

  VI) The DETAIL window closes and the JOB CONTENT window appears.

5. Press [INSERT] then [ENTER].

   - The instruction displayed in the input buffer line is registered.
8 System Setup
8.7 Shock Detection Function

**SHCKRST**
1. Move the cursor to the immediately preceding line where the SHCKRST instruction is to be registered.
2. Press [INFORM LIST].
   - The inform list appears.
3. Select SHCKRST instruction.
   - SHCKRST instruction appears in the input buffer line.
4. Change the value of the additional item.
   - < When registering the instruction as it is>
     Operate the step 5 when registering the instruction in the input buffer line as it is.
   - < When adding or changing the additional item>
     (1) When adding the robot specification, move the cursor to instruction in the input buffer line and press [SELECT] to display the DETAIL window.
8.7 Shock Detection Function

(2) Move the cursor to "UNUSED" of "ROBOT/STATION", and press [SELECT].

(3) The selection box appears.

(4) Point the cursor to the robot to be added and press [SELECT].

(5) When the addition of robot is completed, press [ENTER].

(6) The DETAIL window closes and the JOB CONTENT window appears.

5. Press [INSERT] then [ENTER].

– The instruction displayed in the input buffer line is registered.

8.7.2.4 Resetting the Shock Detected

When the collision of tool/manipulator and peripheral device is detected with the shock detection function, the manipulator stops instantaneously with alarm output. In this case, the shock detection alarm is displayed.

The shock detection alarm in teach mode and play mode can be reset by the following operation.

1. Press [SELECT].

– The alarm is reset when “RESET” is selected on the alarm display, and the shock detection status is released.
2. Operation after resetting the detection status.
   - In teach mode, the JOG operation of the manipulator is enabled by resetting the status.
   - In the play mode, move the manipulator once to the safety position in the teach mode to check the damage though the playback operation is possible after resetting the status.

When manipulator is stopped instantaneously while having contact with the object and the detection alarm is tried to reset on the alarm window, the situation in which the alarm cannot be reset may occur since the collision may be detected again after resetting.

In this case, set the collision detection function "INVALID", or increase the detection level in teach mode and retreat the manipulator to a safety position.
8.8 User Coordinate Setting

8.8.1 User Coordinates

- Definition of the User Coordinates
  User coordinates are defined by three points that have been taught to the manipulator through axis operations. These three defining points are ORG, XX, and XY, as shown in the diagram below. These three points of positional data are registered in a user coordinate file.

  ![User Coordinate Diagram]

  ORG is the home position, and XX is a point on the X-axis. XY is a point on the Y-axis side of the user coordinates that has been taught, and the directions of Y- and Z-axes are determined by point XY.

  **NOTE** It is important that the two points ORG and XX be taught accurately.

- User Coordinate Files
  Up to 63 kinds of user coordinates can be registered. Each coordinate has a user coordinate No. and is called a user coordinate file.
8.8.2 User Coordinate Setting

8.8.2.1 Selecting the User Coordinate File

1. Select {ROBOT} under the main menu.
2. Select {USER COORDINATE}.

   (1) The USER COORDINATE window appears.

   (2) The "●" mark indicates that the user coordinates is completed to set and the "O" mark indicates that it is not completed.

   (3) To check the position of the user coordinates select {DISPLAY} → {COORDINATE DATA}.

   (4) The following window appears.

3. Select the user coordinate number.
8.8.2.2 Teaching the User Coordinates

1. Select the robot.
   - Select "**" on the upper left of the window to select the subject robot. (This operation can be omitted if the robot selection has already been made or if there is only one robot.)

2. Select “SET POS”.
   - Select the teaching point.

3. Move the manipulator to the desired position with the axis keys.
4. Press [MODIFY] then [ENTER].
   - Taught position is registered.
   - Repeat the steps 2 to 4 to teach ORG, XX and XY.
   - “●” indicates that teaching is completed and “O” indicates that it is not completed.
   - To check the taught positions, call up the required window among ORG to XY and press [FWD]. The manipulator moves to the set position.
   - If there is a difference between the current position of the manipulator and the displayed position data, “ORG”, “XX”, or “XY” flashes.

5. Select “COMPLETE”.
   - User coordinates are registered in the file.
   - Once the user coordinate setting is completed, the following window appears.
8.8.2.3 Clearing the User Coordinates

1. Select {DATA} under the pull-down menu.

2. Select {CLEAR DATA}.
   - The confirmation dialog box appears.

3. Select {YES}.
   - All data is cleared.
8.9 Overrun / Tool Shock Sensor Releasing

![CAUTION]

To operate the manipulator with the overrun or shock sensor released, pay extra attention to the safety of the surrounding operation environment.

If the manipulator stops by overrun detection or tool shock sensor detection, release the overrun or tool shock sensor by the following procedure and reset the alarm and move the manipulator with the axis keys.

1. Select {ROBOT} under the main menu.
2. Select {OVERRUN & S-SENSOR}.
   - The OVERRUN & SHOCK SENSOR window appears.
   - Select either "EMERGENCY STOP" or "HOLD" to set the item "SHOCK SENSOR STOP COMMAND" which specifies the stop condition in the current shock sensor detection.
   - "E-STOP" and "HOLD" are displayed alternately every time [SELECT] is pressed.
3. Select “RELEASE”.

- The control group in which overrun or shock sensor is detected is indicated with "●".
- If “RELEASE” is selected, overrun or tool shock sensor is released and “CANCEL” indication will be displayed.

4. Select “ALM RST”.

- The alarm is reset and manipulator can be moved with the axis keys.

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>After releasing the overrun or tool shock sensor, if “CANCEL” is selected or the window is changed to the other one, the release of the overrun or tool shock sensor will be canceled.</td>
</tr>
</tbody>
</table>
8.10 Soft Limit Release Function

The switches that are set to detect the motion range of the manipulator are called limit switches. The operating range is monitored by the software in order to stop motion before these limit switches are reached. These software limits are called “soft limits”. The operating range of the manipulator is controlled by the following two soft limits.

- Maximum motion range for each axis
- Cubic operation area set parallel to the robot coordinate system

These soft limits are continually monitored by the system, and the manipulator automatically stops when its TCP reaches a soft limit. When the manipulator is stopped at a soft limit, temporarily release the soft limit by the following procedure, then move the manipulator away from the soft limit in a direction opposite to the earlier operation direction.

1. Select {ROBOT} under the main menu.
2. Select {LIMIT RELEASE}.

- The LIMIT RELEASE window appears.

3. Select “SOFT LIMIT RELEASE”.

- Each time [SELECT] is pressed, “VALID” and “INVALID” switch alternately.

- When “SOFT LIMIT RELEASE” is set to “VALID”, a message “Soft limits have been released” appears.

- When “SOFT LIMIT RELEASE” is set to “INVALID,” a message “Soft limits off released” is displayed for a few seconds.

**NOTE**

- The taught data cannot be registered when the soft limit is being released.
- The setting of "SOFT LIMIT RELEASE" becomes "INVALID" when the mode is changed to the play mode.
8.11 All Limit Release Function

CAUTION

To operate the manipulator with all limits released, pay extra attention to ensure the safety of the surrounding operation environment. Failure to observe this caution may result in injury or damage to equipment due to the unexpected manipulator motion exceeding its range of motion.

The following limits can be released with the All Limit Release function:

<table>
<thead>
<tr>
<th>Limit Type</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Limit</td>
<td>Limit to check manipulator’s range of motion.</td>
</tr>
<tr>
<td>L-U Interference</td>
<td>Limit to check L- and U-axis interference area.</td>
</tr>
<tr>
<td>Soft Limit on Each Axis</td>
<td>Soft limit to check manipulator’s range of motion.</td>
</tr>
<tr>
<td>Cube Interference</td>
<td>Limit to check cube interference area set by user.</td>
</tr>
</tbody>
</table>

All limit release function is not available if the security mode is not in the management mode. Refer to Chapter 7 “Security System” on page 7-1 for details on the security modes.

1. Select {ROBOT} under the main menu.
2. Select {LIMIT RELEASE}.
   - The LIMIT RELEASE window appears.
3. Select “ALL LIMITS RELEASE”.
   - “VALID” and “INVALID” are displayed alternately every time [SELECT] is pressed.
   - When ALL LIMIT RELEASE is changed to “VALID”, a message “All limits have been released” is displayed. When the setting changes to “INVALID”, a message “All limits off released” is displayed for a few seconds.
8.12 Instruction Level Setting

8.12.1 Setting Contents

8.12.1.1 Instruction Set

There are three instruction sets that can be used when registering the instructions for the robot programming language (INFORM III): the subset instruction set, the standard instruction set, and the expanded instruction set.

Subset Instruction Set

The instructions displayed in the instruction list are limited to just those that are most frequently used, reducing the number of instructions that can be registered. Since few instructions are shown, selection and input are simple.

Standard Instruction Set / Expanded Instruction Set

All the INFORM III instructions can be used. The number of additional items to be used in each instruction differ in the standard instruction set and expansion instruction set.

In the standard instruction set, the following functions cannot be used. However, operation becomes easier because the number of data items decreases when registering an instruction.

- Use of local variables and arrangement variable
- Use of variables for additional items (Example: MOVJ VJ = I000)

When instructions are executed, for example during playback, all the instructions can be executed regardless of the instruction set used.

8.12.1.2 Learning Function

When an instruction is entered from the instruction list, the additional items that were entered last time are also shown. This function can simplify instruction input.

To register the same additional items as those in the former operation, register them without changing.
8 System Setup
8.12 Instruction Level Setting

1. An instructions are registered.

2. The next time an attempt is made to register the same instruction as in 1, the same additional items as were registered last time are also shown in the input buffer line.

8.12.2 Setting the Instruction Set Level

1. Select {SETUP} under the main menu.
2. Select {TEACHING COND}.
   – The TEACHING CONDITION window appears.

3. Select “LANGUAGE LEVEL”.
   – The selection list appears.
4. Select desired language level.
   – Language level is set.

8.12.3 Setting the Learning Function

The learning function is set at "VALID" by default.

1. Select {SETUP} under the main menu.
2. Select {TEACHING COND}.
   – The TEACHING CONDITION window appears.
3. Select "INSTRUCTION INPUT LEARNING".
   - "VALID" and "INVALID" are displayed alternately every time [SELECT] is pressed.
8.13 Setting the Controller Clock

The clock inside the DX100 controller can be set as follows.

1. Select {SETUP} under the main menu.
2. Select {DATE/TIME}.
   - The DATE/CLOCK SET window appears.
3. Select "DATE" or "CLOCK".
   - The input buffer line appears.
4. Input the new date/time.
   - For instance, to set the date to August 1, 2008, input "2008.8.1". To set the time at twelve o’clock, enter "12.00".
5. Press [ENTER].
   - The date/time is changed.
8 System Setup
8.14 Setting the Play Speed

1. Select {SETUP} under the main menu.
2. Select {SET SPEED}.
   - The SPEED SET window is shown.
3. Press the page key .
   - When two or more manipulators and stations exist in the system, use the page key or click on {PAGE} to select the desired control group.
4. Select “JOINT” or “LNR/CIR”.
   - The type of speed alternately changes from “JOINT” to “LNR/CIR”.

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5. Select the speed to modify.
   – The input buffer line appears.

6. Input the speed value.

7. Press [ENTER].
   – The speed is modified.
8.15 Numeric Key Customize Function

8.15.1 What is the Numeric Key Customize Function?

With this function, the user can set the function of an application that has been allocated to the numeric keys of the programming pendant to the other function. Since any frequently used operation can be allocated to the numeric keys on the programming pendant, decreased key operations reduce the teaching time.

**NOTE** The Numeric Key Customize Function is allowed to set only when the security mode is in the management mode.

8.15.2 Allocatable Functions

There are two allocation methods as follows:

- Key Allocation (EACH)
- Key Allocation (SIM)

8.15.2.1 Key Allocation (EACH)

With key allocation (EACH), the manipulator operates according to the allocated function when the numeric key is pressed. The allocatable functions are listed below.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer allocation</td>
<td>Allocated by Yaskawa. Allocating another function invalidates the function allocated by the manufacturer.</td>
</tr>
<tr>
<td>Instruction allocation</td>
<td>Allocates any instructions assigned by the user.</td>
</tr>
<tr>
<td>Job call allocation</td>
<td>Allocates job call instructions (CALL instructions). The jobs to be called are only those registered in the reserved job names. (Specified by the registration No.)</td>
</tr>
<tr>
<td>Display allocation</td>
<td>Allocates any displays assigned by the user.</td>
</tr>
</tbody>
</table>

8.15.2.2 Key Allocation (SIM)

With key allocation (SIM), the manipulator operates according to the allocated function when the [INTERLOCK] and the numeric key are pressed at the same time. The allocatable functions are listed below.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate output allocation</td>
<td>Turns ON/OFF the specified user output signal when [INTERLOCK] and the allocated Numeric key are pressed at the same time.</td>
</tr>
<tr>
<td>Momentary output allocation</td>
<td>Turns ON the specified user output signal user when [INTERLOCK] and the allocated user key are pressed at the same time.</td>
</tr>
<tr>
<td>Pulse output allocation</td>
<td>Turns ON the specified user output signal only for the specified period when [INTERLOCK] and the allocated Numeric key are pressed at the same time.</td>
</tr>
</tbody>
</table>
8 System Setup
8.15 Numeric Key Customize Function

### Function Description

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group output allocation</td>
<td>Sends the specified output to the specified general group output signals when [INTERLOCK] and the allocated Numeric key are pressed at the same time.</td>
</tr>
<tr>
<td>(4-bit/8-bit)</td>
<td></td>
</tr>
<tr>
<td>Analog output allocation</td>
<td>Sends the specified voltage to the specified output port when [INTERLOCK] and the allocated Numeric key are pressed at the same time.</td>
</tr>
<tr>
<td>Analog incremental output allocation</td>
<td>Sends the voltage increased by the specified value to the specified output port when [INTERLOCK] and the allocated Numeric key are pressed at the same time.</td>
</tr>
</tbody>
</table>

In a system for multiple applications, a numeric key can be allocated for each application.

### 8.15.3 Allocating an Operation

#### 8.15.3.1 Allocation Window

1. Select {SETUP} under the main menu.
2. Select {KEY ALLOCATION}.
   - The KEY ALLOCATION (EACH) window appears.
3. Select {DISPLAY}.
   - Pull-down menu appears.
   - To call up the KEY ALLOCATION (SIM) window, select {ALLOCATE SIM. KEY}.

![Allocation Window](image)

![DISPLAY Window](image)
4. Select {ALLOCATE SIM. KEY}.
   - The KEY ALLOCATION (SIM) window appears.
   - In a system multiple applications, press the page key \[\text{Page}\] to change the window to the allocation window for each application, or click on \{PAGE\} to select the desired application number.

8.15.3.2 Instruction Allocation

1. Set this function in the KEY ALLOCATION (EACH) window. Move the cursor to “FUNCTION” of the key to be allocated and press [SELECT].
   - Selection list appears.

2. Select “INSTRUCTION”.
   - The instruction is shown in the “ALLOCATION CONTENT”.

![Image of KEY ALLOCATION window with instructions]
8.15 Numeric Key Customize Function

(1) To change the instruction, move the cursor to the instruction and press [SELECT]. Then the instruction group list appears.

(2) Select the group which contains the instruction to modify.

(3) When the instruction list dialog box is shown, select the instruction to be changed.

8.15.3.3 Job Call Allocation

Set this function in the KEY ALLOCATION (EACH) window.

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   - A selection list appears.
2. Select “JOB CALL”:
   - The reserved job registration No. is shown in the “ALLOCATION CONTENT” (reserved job registration No.: 1 to 10).

(1) To change the reserved job registration No. move the cursor to the No. and press [SELECT]. Then input buffer line appears.

(2) Input the number to be changed, and press [ENTER].

8.15.3.4 Display Allocation

Set this function in the KEY ALLOCATION (EACH) window.

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   - Selection list appears.

2. Select [DISPLAY].

3. Move the cursor to “ALLOCATION CONTENT” and press [SELECT].
   - Character input is available.

4. Input the name of the reserved window and press [ENTER].
   - The reserved name input to the “ALLOCATION CONTENT” is shown.
5. Open the window for allocation.
6. Press [INTERLOCK] and the allocated key at the same time.
   – A message “Reserved display registered” appears, and the window is registered.
   – In this case, the CURRENT POSITION window is registered by pressing [INTERLOCK] + [0] with the CURRENT POSITION window displayed on the screen.

8.15.3.5 Alternate Output Allocation

Set this function in the KEY ALLOCATION (SIM) window.

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – Selection list appears.
2. Select “ALTERNATE OUTPUT”.
   - The output No. is displayed in the “ALLOCATION CONTENT”.

(1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.

(2) Input the number to be changed, and press [ENTER].

8.15.3.6 Momentary Output Allocation

Set this function in the KEY ALLOCATION (SIM) window.

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   - A selection list appears.

2. Select “MOMENTARY OUTPUT”.
   - The output No. is displayed in the “ALLOCATION CONTENT”.

(1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.

(2) Input the number to be changed, and press [ENTER].
8.15.3.7 Pulse Output Allocation

Set this function in the KEY ALLOCATION (SIM) window.

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – A selection list appears.

2. Select “PULSE OUTPUT”.
   – The output No. and output time are displayed in the “ALLOCATION CONTENT”.

![Diagram of KEY ALLOCATION (SIM) window](image)

(1) To change the output No. or output time, move the cursor to the No. or time and press [SELECT]. Then numeric value can be entered.

(2) Input the number or time to be changed, and press [ENTER].

8.15.3.8 Group (4-bit/8-bit) Output Allocation

Set this function in the KEY ALLOCATION (SIM) window.

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – A selection list appears.
2. Select “4 BIT OUTPUT” or “8 BIT OUTPUT”.
   – The output No. and output value are displayed in the “ALLOCATION CONTENT”.

   ![Diagram](image)

   (1) To change the output No. or output value, move the cursor to the No. or value and press [SELECT]. Then numeric value can be entered.
   (2) Input the number or value to be changed, and press [ENTER].

8.15.3.9 Analog Output Allocation

Set this function in the KEY ALLOCATION (SIM) window.

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – A selection list appears.
2. Select “ANALOG OUTPUT”.
   – The output port number and the output voltage value are displayed in the “ALLOCATION CONTENT”.

   ![Diagram](image)

   (1) To change the output port No. or output voltage value, move the cursor to the No. or voltage value and press [SELECT]. Then numeric value can be entered.
   (2) Input the number or voltage value to be changed, and press [ENTER]
8.15.3.10 Analog Incremental Output Allocation

Set this function in the KEY ALLOCATION (SIM) window.

1. Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT].
   - A selection list appears.

2. Select “ANALOG INC OUTPUT.”
   - The output port No. and incremental value are displayed in the "ALLOCATION CONTENT".

   (1) To change the output port No. or incremental value, move the cursor to the No. or incremental value and press [SELECT]. Then numeric values can be entered.

   (2) Input the number or incremental value to be changed, and press [ENTER].

8.15.4 Allocation of I/O Control Instructions

In key allocation (SIM), output control instructions can be allocated to the numeric keys that have been allocated one of the following I/O controls with key allocation (EACH).

<table>
<thead>
<tr>
<th>Function</th>
<th>Output Control Instruction allowed to be Allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate output allocation</td>
<td>DOUT OT# (No.) ON</td>
</tr>
<tr>
<td>Momentary output allocation</td>
<td></td>
</tr>
<tr>
<td>Pulse output allocation</td>
<td>PULSE OT# (No.) T = output time</td>
</tr>
<tr>
<td>Group output allocation (4-bit)</td>
<td>DOUT OGH (No.) output value</td>
</tr>
<tr>
<td>Group output allocation (8-bit)</td>
<td>DOUT OG# (No.) output value</td>
</tr>
<tr>
<td>Analog output allocation</td>
<td>AOUT AO# (No.) output voltage value</td>
</tr>
</tbody>
</table>
1. Allocation of I/O control instruction.
   – Allocate the I/O control instruction with key allocation (SIM) following the forementioned procedure.

2. Move the cursor to the “FUNCTION” of the key that has been allocated with I/O control with key allocation (SIM) and press [SELECT].
   – Selection list appears.

3. Select “OUTPUT CONTROL INST”.
   – The instruction corresponding to the I/O control allocated by key allocation (SIM) is displayed in the “ALLOCATION CONTENT”.

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8.15 Numeric Key Customize Function
8.15 Numeric Key Customize Function

– The allocated instruction changes automatically when “ALLOCATION CONTENT” is changed by key allocation (SIM). Even if the I/O control allocation is changed to the default setting allocated by the manufacturer with key allocation (SIM), the settings for key allocation (EACH) remain the same.

8.15.5 Execution of Allocation

8.15.5.1 Executing the Instruction/Output Control Allocation

1. Press the key allocated for instruction allocation or output control allocation.
   – The allocated instruction is displayed in the input buffer line.
     
     ![Instruction Display](image)

2. Press [INSERT] and [ENTER].
   – The instruction displayed in the input buffer line is registered.
     
     ![Instruction Registration](image)

8.15.5.2 Executing the Job Call Allocation

1. Press the key allocated for the job call allocation.
   – The CALL instruction is displayed in the input buffer line.

2. Press [INSERT] then [ENTER].
   – The CALL instruction shown in the input buffer line is registered.

8.15.5.3 Executing the Display Allocation

1. Press the key allocated for the display allocation.
   – The allocated display appears.

8.15.5.4 Executing the I/O Control Allocation

Alternate output allocation, momentary output allocation, pulse output allocation, group output allocation (4-bit/8-bit), analog output allocation, analog incremental output allocation are executed by the following operation.

1. Press [INTERLOCK] and the key allocated for I/O control allocation at the same time.
   – Allocated functions are executed.
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8.16 Changing the Output Status

The status of external output signals can be changed from the programming pendant by using either of the following two methods.

- On the user output status window
- On the RELAY ON window

The method that uses the RELAY ON window, which is described here, simplifies the operation for changing the status of signals that are used frequently.

A maximum of 64 output signals can be shown on the RELAY ON window and they must be set in advance to parameters S4C327 to S4C390. If they are not set, the sub menu in the RELAY ON window will not be displayed.

1. Select {IN/OUT} under the main menu.
2. Select {RELAY ON}.

- The RELAY ON window appears.

3. Select the desired signal to change the output status.
   - Select the status (● or ○) of the desired signal.

4. Press [INTERLOCK] +[SELECT].
   - The output status is changed. (●: status ON; ○: status OFF.)
It is also possible to turn the relevant external output signal on only for the duration that [INTERLOCK]+[SELECT] are pressed. This selection is made in advance by setting the parameters (S4C391 to 454) to “1”.
8.17 Changing the Parameter Setting

The parameter settings can be changed only by the operator who has the correct user ID number for the management mode.

1. Select (PARAMETER) under the main menu.
2. Select the parameter type.
   - The PARAMETER window appears. Select the desired parameter.

3. Move the cursor to the desired parameter number.
   - When the desired parameter number is not in the current window, move the cursor in the following way:
8.17 Changing the Parameter Setting

(1) Move the cursor to a parameter number and press [SELECT].

(2) Enter the desired parameter number with the numeric keys.

(3) Press [ENTER].

(4) The cursor moves to the selected parameter number.

Set the parameters in the following manner.

1. Select the parameter data to be set.
   
   (1) Move the cursor to the parameter number data (decimal or binary) in the PARAMETER window, and press [SELECT].
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8.17 Changing the Parameter Setting

(2) To enter a decimal setting, select the decimal figure.

(3) To enter a binary setting, select the binary figure.

2. Enter the value.
   – If a decimal figure is selected, enter a decimal value with the numeric keys.

   320095  10000000

   – If a binary figure is selected, move the cursor to the binary figure data in the input buffer line, and press [SELECT].
   – Each time [SELECT] is pressed, “0” and “1” alternate in the window.
   – “0” or “1” can also be entered with the numeric keys.

3. Press [ENTER].
   – The new setting appears in the position where the cursor is located.
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8.18 File Initialization

8.18 File Initialization

8.18.1 Initializing Job File

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
   – The INITIALIZE window appears.

   ![INITIALIZE Window]

5. Select {JOB}.
   – A confirmation dialog box appears.

   ![Confirmation Dialog Box]

6. Select {YES}.
   – The job data is initialized.
8.18.2 Initializing Data File

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {FILE/GENERAL DATA}.
   - The INITIALIZE window appears.
6. Select the data file to be initialized.
   - The selected data file/general data are marked with “*”.
   - The parameters marked with “■” cannot be selected.
7. Press [ENTER].
   – A confirmation dialog box appears.

8. Select {YES}.
   – The selected data file/general data are initialized.

8.18.3 Initializing Parameter File
1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {PARAMETER}.
   – The parameter selection window appears.
8.18 File Initialization

6. Select the parameter to be initialized.
   - The selected parameter is marked with "★".
   - The parameters marked with "◼" cannot be selected.

7. Press [ENTER].
   - A confirmation dialog box appears.

8. Select {YES}.
   - The selected parameter is initialized.

### 8.18.4 Initializing I/O Data

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {I/O DATA}.
   – The I/O data selection window appears.

6. Select data to be initialized.
   – The selected data is marked with "★".
   – The I/O data marked with "■" cannot be selected.

7. Press [ENTER].
   – A confirmation dialog box appears.
8. Select {YES}.
   – The selected data is initialized.

### 8.18.5 Initializing System Data

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {SYSTEM DATA}.
   – The system data selection window appears.

   ![Initialize System Data Window]

6. Select the parameter to be initialized.
   – The selected data is marked with "★".
   – The system data marked with "■" cannot be selected.
8 System Setup
8.18 File Initialization

7. Press [ENTER].
   – A confirmation dialog box appears.

8. Select {YES}.
   – The selected data is initialized.
8.19 Display Setting Function

8.19.1 Font Size Setting

DX100 enables changing the font size displayed on the screen.

The fonts displayed on the screen can be selected from eight patterns of fonts in the font size setting dialog box.

8.19.1.1 Applicable Range for the Font Size Change

Changing the font size is allowed in the general display area indicated in the following figure:

8.19.1.2 Settable Font Size

The following eight patterns of fonts are available in setting the size of fonts displayed on the screen.

<table>
<thead>
<tr>
<th>Font Size</th>
<th>Font Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Small</td>
</tr>
<tr>
<td>2</td>
<td>Regular</td>
</tr>
<tr>
<td>3</td>
<td>Bold</td>
</tr>
<tr>
<td>4</td>
<td>Large</td>
</tr>
<tr>
<td>5</td>
<td>Extra large</td>
</tr>
<tr>
<td>6</td>
<td>Bold</td>
</tr>
<tr>
<td>7</td>
<td>Regular</td>
</tr>
<tr>
<td>8</td>
<td>Bold</td>
</tr>
</tbody>
</table>
8.19.1.3 Setting the Font Size

To set the font size, first off display the font size setting dialog box as follows.

1. Select {DISPLAY SETUP} then {CHANGE FONT} under the main menu.

2. The font size setting dialog box appears on the center of the current window.

   - To set the font size in the font size setting dialog box, follow the procedure below.

     1. Specify the font style.
        - The (Bold Type) check box can be checked or unchecked alternately each time the check box is selected.
8 System Setup
8.19 Display Setting Function

• Check the {Bold Type} check box as follows to set the font to the bold style.

[Image of bold type setting]

• Clear the {Bold Type} check box as follows to set the font to the regular style.

[Image of regular type setting]

2. Specify the font size.
   – Select a button from the four buttons in the dialog box.
3. The font size setting dialog box is closed, and the screen displays the font specified in the dialog box.

- To cancel the setting of the font size, follow the procedure below.
  1. Select {Cancel} in the font size setting dialog box.

  2. The dialog box closes without changing the font size.
8.19.2 Operation Button Size Setting

DX100 enables changing the size of operation buttons.

The button size in the main menu area, menu area, and instruction list can be respectively selected from three sizes.

8.19.2.1 Applicable Range for the Button Size Change

Changing the button size is allowed in the main menu, menu (pull-down menu), and instruction list indicated in the following figure:

8.19.2.2 Settable Button Size

The following three sizes of buttons are available in setting the size of each operation button; the font style of the character string on buttons can also be specified.

<table>
<thead>
<tr>
<th>Button Size</th>
<th>Font Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Regular</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
To set the button size, first off display the button size setting dialog box as follows.

1. Select {DISPLAY SETUP} then {CHANGE BUTTON} under the main menu.

- The font size setting dialog box appears on the center of the current window.

To set the button size in the button size setting dialog box, follow the procedure below.

1. Specify the area to set the button size.
   (1) Select the desired area from the area setting buttons.
   (2) The buttons in the selected area is subject to size setting.
   (3) Note that only the last-selected button determines the area subject to size setting, even if settings are performed several times before then.
2. Specify the font style.
   - The {Bold Type} check box can be checked or unchecked alternately each time the check box is selected.
     • Check the {Bold Type} check box as follows to set the font to the bold style.
     • Clear the {Bold Type} check box as follows to set the font to the regular style.

3. Specify the button size.
   - Select a button from the three buttons in the dialog box.
4. The font size setting dialog box is closed, and the screen displays the buttons specified in the dialog box.

- The modification is applied only to the buttons in the area selected with the area setting button. (In this example, the change is applied only to the pull-down menu buttons in the menu area.)

To cancel the setting of the button size, follow the procedure below.

1. Select (Cancel) in the button size setting dialog box.

- The dialog box closes without changing the button size.
8.19.3 Initialization of Screen Layout

The font/button size changed with the font/button size setting function can be collectively changed back to the regular size.

8.19.3.1 Initializing the Screen Layout

To initialize the screen layout, follow the procedure below.

1. Select {DISPLAY SETUP} then {INITIALIZE LAYOUT} under the main menu.

   - A confirmation dialog box appears on the center of the current window.

   ![Confirmation Dialog Box]

   Do not turn OFF the DX100 power supply when the button size is being changed (when the button size setting dialog box is on the screen, or when an hourglass is indicated in the middle of the screen).
To initialize the screen layout, follow the procedure below.
1. Select {OK}.

- The dialog box is closed, and the font/button sizes are collectively changed to the regular size.

To cancel the initialized screen layout, follow the procedure below.
1. Select {CANCEL}.
8.19.4 Layout Storage

The settings of the font or button sizes are saved in the programming pendant. The screen displays the font/button size specified last time with the current programming pendant.

---

**NOTE**

Do not turn OFF the DX100 power supply when the screen layout is being initialized (when the confirmation dialog box is on the screen, or when an hourglass is indicated in the middle of the screen).
9  System Backup

For the DX100, the system data can be collectively backed up in advance so that the data can be immediately loaded and restored in case of an unexpected trouble such as data loss.

9.1  System Backup with DX100

For the DX100, four types of collective backup are available: CMOS.BIN, CMOSBK.BIN, ALCMSxx.HEX, and CMOSxx.HEX.

9.1.1  Function Types of Data

9.1.1.1  CMOS.BIN

For the normal backup, use this data.

Save: Perform in the maintenance mode (the editing mode or higher.)
Load: Perform in the maintenance mode (the management mode.)

As for the load/save procedures, refer to Section 9.2 “Backup by CMOS.BIN” on page 9-3.

Target Area: All areas of the internally stored data. (Note that the monitoring time is not loaded.)

9.1.1.2  CMOSBK.BIN

This data is used in the automatic backup function.

Save: Saves with the preset conditions in the normal mode.
Load: Perform for the system restoration in the maintenance mode (the management mode.)

For details, refer to Section 9.5 “Error List” on page 9-19.

Target Area: All areas of the internally stored data. (Note that the monitoring time is not loaded.)

9.1.1.3  CMOSxx.HEX

This data is loaded/saved in the FD/CF menu in the normal mode.

Save: Perform in the normal mode (the editing mode or higher.)
Load: Perform in the normal mode (the management mode.)

For details, refer to “DX100 OPERATOR’S MANUAL”.

Target Area: The collected data including “Job File”, “Data File”, “Parameter File”, “System Data”, and “I/O Data” which can be individually loaded/saved in the FD/CF menu. Because the setting information of robot etc. are not included in this collected data, the system cannot be completely restored.

9.1.1.4  ALCMSxx.HEX

This data is for the manufacturer only. Users can save but cannot load this data.
9.1.2 Device

For the backup of the DX100 system, the CompactFlash can be used. The following tables show the recommended CompactFlash.

<Recommended CompactFlash>

<table>
<thead>
<tr>
<th>No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hagiwara Sys-Com</td>
<td>MCF10P-256MS-YE2</td>
<td>(256MB)</td>
</tr>
<tr>
<td>2</td>
<td>Hagiwara Sys-Com</td>
<td>MCF10P-512MS</td>
<td>(512MB)</td>
</tr>
<tr>
<td>3</td>
<td>Hagiwara Sys-Com</td>
<td>MCF10P-A01GS</td>
<td>(1GB)</td>
</tr>
<tr>
<td>4</td>
<td>Hagiwara Sys-Com</td>
<td>MCF10P-A02GS</td>
<td>(2GB)</td>
</tr>
<tr>
<td>5</td>
<td>SiliconSystems, Inc.</td>
<td>SSD-C25M3512</td>
<td>(2GB)</td>
</tr>
</tbody>
</table>

< Recommended USB Memory>

<table>
<thead>
<tr>
<th>No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hagiwara Sys-Com</td>
<td>UDG3-GA series</td>
<td>(1GB, 2GB)</td>
</tr>
</tbody>
</table>

In order to save the batch data, the following free space per file is needed in the media.

JZNC-NIF01-1: 18 MByte
JZNC-NIF01-2: 21 MByte
JZNC-NIF01-3: 21 MByte

Note that the free space for one working file is needed in addition to the free space for the stored files when using the automatic backup function. Also, it is recommended to store the backup data in two or more media cards to minimize problems if the media is damaged.

The water-proof function of the Pendant is not effective while the USB memory is connected.

If USB memory is connected constantly, there is a risk it drops off.

Use CompactFlash if there is no measures to maintain water-proof function or to prevent USB memory from dropping off.
9.2 Backup by CMOS.BIN

Perform the backup by CMOS.BIN in the maintenance mode.

The chart below shows the availability of CMOS save/CMOS load in each security mode in the maintenance mode.

<table>
<thead>
<tr>
<th>Security</th>
<th>CMOS Save</th>
<th>CMOS Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Mode</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Editing Mode</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td>Management Mode</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Yaskawa Mode</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

9.2.1 CMOS.BIN Save

Follow the procedures below to save CMOS.BIN.

1. Turn ON the DX100 power supply while pressing [MAIN MENU].
2. Insert a CompactFlash into the CompactFlash slot on the programming pendant.
   - when USB memory is used instead of CompactFlash, mount the USB memory and select (DEVICE) → "USB: PENDANT"
3. Select {FD/PC CARD} under the main menu.
   - The sub menu appears.
4. Select {SAVE}.
   - The save display appears.

   ![Save Display](image)

   - The items marked with "■" cannot be selected.

5. Select {CMOS SAVE}.
   The confirmation dialog box appears.

   ![Confirmation Dialog](image)
9.2 Backup by CMOS.BIN

6. Select {YES}.
   – Select {YES} to save the CMOS data into the CompactFlash.
   – When saving the file, if the CMOS.BIN file already exists in the CompactFlash, the following confirmation dialog box appears.

![Confirmation dialog box]

7. Select {YES}.
   – The CMOS.BIN file is overwritten in the CompactFlash.

9.2.2 CMOS.BIN Load

Follow the procedures below to load CMOS.BIN.

1. Turn ON the DX100 power supply while pressing [MAIN MENU].
2. Change the security mode to the maintenance mode, or Yaskawa mode.
3. Insert a CompactFlash into the CompactFlash on the programming pendant.
   – When USB memory is used instead of CompactFlash, mount USB memory and select (DEVICE) → “USB: PENDANT”.
4. Select {FD/PC CARD} under the main menu.
   – The sub menu appears.
5. Select {LOAD}.

The load display appears.

- The items marked with "■" cannot be selected.

6. Select {CMOS LOAD}.

- The confirmation dialog box appears.

7. Select {YES}.

- The loaded CMOS.BIN file contents are reflected in the data inside the robot.

---

**CAUTION**

When the {CMOS LOAD} is performed, the current CMOS data is replaced with the CMOS data (the contents of "CMOS.BIN") in the CompactFlash. Therefore, before performing the load, make sure to perform the {CMOS SAVE} of the CMOS data to be loaded.
9.3 Automatic Backup Function

9.3.1 Automatic Backup Function

9.3.1.1 Objective

With the automatic backup function, the data saved in the DX100 such as system setting or operational condition are collectively backed up in the CompactFlash which is inserted in the programming pendant.

In case of an unexpected trouble such as data loss, the backup data saved in the CompactFlash by the automatic backup function can be loaded to the DX100 memory to restore the file data.

NOTE

The automatic backup function is enabled only while the DX100 power supply is ON whereas it isn’t while in the maintenance mode or the power supply is OFF.

9.3.1.2 Outline

The automatic backup function saves the internally stored data in a single file in advance for the smooth restoration from unexpected troubles of the DX100.

The teaching operation is one of the factors that changes the internally stored data. Thus, a mode which backs up the latest data after the teaching operation is prepared. To confirm the termination of the teaching operation, check the mode key whether it is changed from teach mode to play mode.

Other than the teaching operation, the present position of the robot or the value of a variable can be pointed out as the factors to change the internally stored data. These data, however, are changed after each operation and have very little need to be retained permanently. Accordingly, backing up these data at regular interval should be well enough to operate and the mode to back up the data at regular interval is also prepared.

Furthermore, the mode to back up the data when starting up the DX100 and when inputting signals are also available for some specific versions.

With the automatic backup function, all the part where the internal data is stored in the physical memory area is collectively saved. If there is any data which is in the middle of changing while executing the automatic backup function, the data might not be usable for restoration because of its inconsistency. Therefore, the function is terminated with an error during the play back operation or while the manipulator is in motion so that the automatic backup cannot be operated. Set the automatic backup function to be executed while the manipulator is not in the playback status and while the manipulator is stopped.
The automatic backup function has the following functions and features.

<table>
<thead>
<tr>
<th>No</th>
<th>Function/Feature</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cyclic backup</td>
<td>In the teach mode, the data in memory is backed up in a specified cycle from a specified starting time. This function backs up as much of the latest data as possible during editing. The backup data saved in the CompactFlash can be loaded to the DX100 in case of data loss so that the damage can be minimized.</td>
</tr>
<tr>
<td>2</td>
<td>Backup when switching modes</td>
<td>When switching the mode from the teach mode to the play mode, the data in memory is backed up. The editing data is backed up when editing is completed. The latest data is automatically backed up with this mode.</td>
</tr>
<tr>
<td>3</td>
<td>Backup when start-up</td>
<td>When the DX100 is start-up, the data in memory is backed up. When the DX 100 starts up, the data in memory is backed up. Since the editing/playback operation is usually completed when the DX100 power is turned OFF, the latest data is automatically backed up with this mode.</td>
</tr>
<tr>
<td>4</td>
<td>Backup when inputting specified signals</td>
<td>The data in memory is backed up when a specified signal (#40560) is input. The data in memory is backed up by the signal from the host at the intended timing. Although the above mentioned items 1 to 3 are designed to back up the data automatically, this function backs up the data in accordance with the instruction from the host.</td>
</tr>
<tr>
<td>5</td>
<td>Backup while robot program is stopped</td>
<td>The backup during playback is disabled. However, in the play mode, the backup is enabled if the robot is stopped. (&quot;Cyclic backup&quot; and &quot;Backup when inputting specified signals&quot;) Backs up the variables for essential data.</td>
</tr>
<tr>
<td>6</td>
<td>Backup and retry at low priority</td>
<td>The data in memory is backed up at low priority so that this operation does not affect the other operations. When other operations affect the backup operation, the backup is suspended and retried later. The backup operation hardly affects the other operations so that the programming pendant can be used even during the backup operation.</td>
</tr>
<tr>
<td>7</td>
<td>Backup in binary</td>
<td>The data is saved as binary data. The range is same as that of the &quot;ALL CMOS AREA&quot; in (FD/CF), but the data type is different. Backup in binary allows the system to be easily and speedily restored.</td>
</tr>
<tr>
<td>8</td>
<td>Setting of items</td>
<td>Parameters can limit the settings of the backup condition. Unnecessary settings can be avoided with this setting.</td>
</tr>
</tbody>
</table>
9.3.2 Settings for Automatic Backup

To set the automatic backup function, insert a CompactFlash in the CompactFlash slot on the programming pendant, then set each item on the AUTO BACKUP SET display.

Four ways to perform the automatic backup are available: "Cyclic backup", "Backup when switching modes", "Backup when start-up", and "Backup when inputting specified signals". The automatic backup can be performed only when the robot is not during playback and the robot is stopped.

9.3.2.1 CompactFlash

To use the automatic backup function, insert CompactFlash in the CompactFlash slot on the programming pendant. Only while the DX100 power supply is OFF, the CompactFlash can be inserted or removed.

When the data could not be saved in CompactFlash during an automatic backup due to the absence or insufficient capacity of the CompactFlash, an error message “Cannot backup CompactFlash” appears. At the same time, the signal “occurrence of error” is output, but the robot program will not be stopped. Check if CompactFlash is inserted and if it has enough capacity, and take the necessary actions. If no actions are taken while the error occurs, the data cannot be saved.

Yaskawa recommends that the data be saved in two or more CompactFlash to minimize problems if the CompactFlash should be damaged.

The products in the table below are recommended as Compact Flash for auto backup.

<Currently recommended products>

<table>
<thead>
<tr>
<th>No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hagiwara Sys-Com</td>
<td>MCF10P-256MS (IOOAII-YE2)</td>
<td>256MB</td>
</tr>
<tr>
<td>2</td>
<td>SiliconSystems, Inc.</td>
<td>SSD-C25M-3512</td>
<td>256MB</td>
</tr>
</tbody>
</table>

Storage capacities needed for CompactFlash are as follows:

When using JANCD-YIF01-1E, JANCD-YIF01-1EV:

(The number of stored files + 1) x 17.8MByte

When using JANCD-YIF01-2E, JANCD-YIF01-2EV, JANCD-YIF01-3E, JANCD-IF01-3EV:

(The number of stored files + 1) x 20.8MByte

The number of storable files is automatically calculated and the MAX value is shown when AUTO BACKUP SET display appears.
9.3.2.2 AUTO BACKUP SET Display

**Settings**
Select the following items on the AUTO BACKUP SET display and set values for the automatic backup.

- RESERVE TIME BACKUP (VALID/INVALID of the cyclic backup)
- BASE TIME
- BACKUP CYCLE
- RETRY CYCLE
- MODE CHANGE BACKUP (VALID/INVALID of the backup when switching the mode from teach mode to play mode)
- STARTUP AUTO BACKUP (VALID/INVALID of the backup when the DX 100 is started up)
- SPECIFIC INPUT BACKUP (VALID/INVALID of the backup when inputting specified signals)
- UNIV.OUT NO. ON ERROR
- DISPLAY AT EMERGENCY
- DURING ALARM OCCURRENCE
- STORED FILE SETTING

With the version in which "STORED FILE SETTING" is settable, the capacity of a CompactFlash card inserted in the programming pendant is checked when the setting window appears. Therefore, a few seconds may be needed to open the setting window and an error may occur if no CompactFlash is inserted.

When changing the settings of "STORED FILE SETTING" or executing "ARRANGE", the files "CMOSBK.BIN" and "CMOSBK???.BIN" (?? denotes figures) in the CompactFlash card are changed in name or deleted. If a certain file of this type is needed to be saved before changed in name or deleted, evacuate it into a PC, etc. beforehand.

1. Turn ON the DX100.
   - If the auto backup function is already set valid, insert a CompactFlash.
2. Insert a CompactFlash in the CompactFlash slot on the programming pendant.
3. Change the security mode to the management mode.
4. Select {SETUP} under the main menu.
5. Select {AUTO BACKUP SET}.

   - The AUTO BACKUP SET display appears.

A. RESERVE TIME BACKUP
Set the backup function to valid or invalid in a specified cycle from a specified starting time.
Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.
The reserve time can be set by inputting values in B, C and D in the display.
Every time values are set to these three items, reset the RESERVE TIME BACKUP to VALID.
If these settings are incorrect, the RESERVE TIME BACKUP cannot be reset to VALID.
If so, check and then change the values to the correct settings.

B. BASE TIME
Specify the reference time to start reserve time backup.
The time elapsed from the reference time for a BACKUP CYCLE period is recognized as the BACKUP TIME.
The first automatic backup is performed at the first BACKUP TIME after the power of the DX 100 is turned ON.
The automatic backup after the first time, is performed at the interval of BACKUP CYCLES.
The reference time ranges from 0:00 to 23:59.

C. BACKUP CYCLE
Specify the length of time for a cycle to back up. After the first backup, the next backup is performed automatically in the time specified in the BACKUP CYCLE.
Set the backup cycle in units of minutes. The cycle setting ranges from 10 to 9999 minutes, and is longer than the RETRY CYCLE.
9 System Backup
9.3 Automatic Backup Function

D. RETRY CYCLE
Specify the length of time for a cycle to retry backing up when the backup operation is suspended.
After being suspended, the backup is retried in the time specified in the RETRY CYCLE.
Set the retry cycle in units of minutes. The cycle setting ranges from 0 to 255, and is shorter than the BACKUP CYCLE.
When it is set to 0, retry will not be performed.

E. MODE CHANGE BACKUP
Set the automatic backup function to be valid or invalid when the mode is switched from teach mode to play mode.
Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

F. STARTUP AUTO BACKUP
Set the backup function to be valid or invalid when the power of the DX100 is turned ON.
Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

G. SPECIFIC INPUT BACKUP
Set the backup function to be valid or invalid when specific input signal (# 40560) is input (rising edge from 0 to 1).
Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

H. UNIV.OUT NO. ON ERROR
Set "1" to the specified user output signal which was specified in this chapter when the automatic backup error occurs.
The term "automatic backup error" here means that the backup is not performed successfully before the next backup (including retry operation) starts.

I. DISPLAY AT EMERGENCY
Set the method of notification of the automatic backup error to "ERROR" or "MESSAGE."
Each time [SELECT] is pressed, "ERROR" and "MESSAGE" are displayed alternately.

J. DURING ALARM OCCURRENCE
Set the backup function to be valid or invalid when an alarm is occurred.
Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

K. STORED FILE SETTING
Set the number of files to be stored by the automatic backup function.
The number mentioned on the right side of this item with "(Max)" indication is the maximum number of files that can be stored in the Compact-Flash inserted when this window is displayed.
The settings range from 1 to (Max). When this setting value is changed, the backup file arrangement starts.
9 System Backup
9.3 Automatic Backup Function

L. BACKUP FILES
Indicates the existence of the files or the number of backup files stored in the CompactFlash inserted when this window is displayed.

M. LATEST BACKUP FILE
Indicates the date of the latest file in the CompactFlash inserted when this window is displayed.

N. ARRANGE
When the setting of maximum number of stored files is changed, the file arrangement of the backup files in the CompactFlash is executed. With this operation, the file arrangement can be performed without changing the maximum number of stored files.

6. Set the desired item, and press [ENTER].

Window Settings
RS parameter can restrict the settings of some items in the automatic backup window.

When setting the bit of RS096 parameter shown below to "1", the corresponding items are restricted. The restricted items are indicated with "INVALID" in the display and inputting/modification to the item becomes impossible. Also, the automatic backup does not function with the restricted items.

---

<table>
<thead>
<tr>
<th>Backup Timing</th>
<th>DX100 Status</th>
<th>Automatic Backup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teach mode</td>
<td>Editing (Accessing to the memory)</td>
<td>Retry</td>
</tr>
<tr>
<td></td>
<td>When editing is interrupted</td>
<td>Backup</td>
</tr>
<tr>
<td>Play mode</td>
<td>Executing jobs</td>
<td>Disabled</td>
</tr>
<tr>
<td>Remote mode</td>
<td>When stopped</td>
<td>Backup</td>
</tr>
</tbody>
</table>
### 9.3 Automatic Backup Function

<table>
<thead>
<tr>
<th>When a specified signal (#40560) is input</th>
<th>Teach mode</th>
<th>Editing (Accessing to the memory)</th>
<th>Error</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>When editing is interrupted</td>
<td>Backup</td>
<td>Error</td>
</tr>
<tr>
<td>Play mode</td>
<td></td>
<td>Executing jobs</td>
<td>Disabled</td>
<td>Disabled</td>
</tr>
<tr>
<td>Remote mode</td>
<td></td>
<td>When stopped</td>
<td>Backup</td>
<td>Error</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>When switching the mode from the teach mode to the play mode</th>
<th>Teach mode</th>
<th>Remote mode</th>
<th>Error</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Backup</td>
<td>Error</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>When the DX100 starts up</th>
<th>Teach mode</th>
<th>Remote mode</th>
<th>Error</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Backup</td>
<td>Error</td>
</tr>
</tbody>
</table>

* Retry is not performed when an error occurs.

* An error can be indicated by a message depending on setting.

#### Reserve Time Backup

While the data in the DX100 memory is being edited or overwritten, the automatic backup is not performed at the specified backup starting time and is suspended and retried later. To start the backup at the reserved time, set to the time when the robot program is stopped and no job or file is edited.

#### Backup when Switching from Teach Mode to Play Mode

When the mode is repeatedly switched from the teach mode to the play mode or vice versa within 1 to 2 seconds, backup starts after the last time the mode is switched.

#### Backup when the DX 100 starts up

Since the automatic backup process is added to the DX100 start-up process, a few extra seconds are needed to start up the DX100.

#### Backup when Specific Signal is Input

While the DX100 memory is edited such as overwriting, the backup operation becomes an error even if there is an input to a specific signal (#40560). To start the specific input backup, perform it while the robot program is stopped and a job or file is not being modified.

Also, since the signal input is executed at rising detection, turn the signal to "0" if it is already "1", then return to "1" again.

#### Overwriting Limit in CompactFlash

The number of times that the CompactFlash can be overwritten is limited to approx. 100,000 times. Because frequent backup operations may shorten the life of CompactFlash, the number of backup times should be minimized as much as possible.
9.3.2.4 Setting Examples

**Setting Example 1**
The following diagram shows a setting example with the following conditions:

- **BASE TIME:** 12:30
- **BACKUP CYCLE:** 60 (minutes)
- **RETRY CYCLE:** 10 (minutes)

While a job is being executed, the automatic backup or retry is not performed. Also, after an error occurs in writing into the CompactFlash, the retry is not performed until the next backup starting time.

**Setting Example 2**
The following diagram shows a setting example with the following conditions:

- **BASE TIME:** 20:00
- **BACKUP CYCLE:** 1440 (minutes) (24 hours)
- **RETRY CYCLE:** 60 (minutes)
9.4 Loading the Backup Data from the CompactFlash

Restore the backup data saved in the CompactFlash to the DX100 in maintenance mode.

9.4.1 Loading Procedure

1. Insert the CompactFlash with the backup data in the CompactFlash slot on the programming pendant.
   – The backup data is stored under the file name "CMOSBK.BIN" or "CMOSBK???.BIN" (?? denotes figures.)
2. Turn ON the DX100 power supply while pressing [MAIN MENU].
3. Change the security mode to the management mode.
4. Select {EX. MEMORY} under the main menu.
   – The sub menu appears.
5. Select {CompactFlash}.
   – The CompactFlash display appears.
6. Select {SYSTEM RESTORE} in the CompactFlash display.
   - The Backup File list display appears.

7. Select the file to be loaded.
   - The dialog box appears for the YIF/YCP01 board replacement confirmation.

   Select (YES) if the YIF/YCP01 board has been replaced, or select (NO) if it has not been replaced.
   - Selecting (YES) initializes the system monitoring time.
   - Selecting (NO) continues the counting of the current system’s monitoring time.
9.4 Loading the Backup Data from the CompactFlash

8. Select {YES} or {NO} for the message "Exchanged YIF/YCP01 board?"
   - The dialog box appears for the loading confirmation.
   - Select {YES} in the loading confirmation dialog box to start loading the contents of "CMOSBK.BIN" or "CMOSBK???.BIN" (?? denotes figures) from the CompactFlash to the DX100 CMOS.

9. Select {YES}.

---

**CAUTION**

Note that executing "SYSTEM RESTORE" replaces the current CMOS data with the data of the file "CMOSBK.BIN" or "CMOSBK???.BIN" (?? denotes figures) in the CompactFlash.

After "CMOSBK.BIN" has been loaded, check if the new data is the same as the previously saved data in the CMOS, and call the master job to confirm that the current manipulator position is correct and safe. Then, start moving the manipulator.
## 9.5 Error List

### 9.5.1 Error Contents

<table>
<thead>
<tr>
<th>Error No.</th>
<th>Data</th>
<th>Message</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>0770</td>
<td>*</td>
<td>The robot or the station is in motion.</td>
<td>The automatic backup would not work when the robot or a manipulator is in motion.</td>
</tr>
<tr>
<td>3390</td>
<td></td>
<td>File not found</td>
<td>The file to be loaded no longer exists.</td>
</tr>
<tr>
<td>3460</td>
<td>*</td>
<td>Cannot backup CompactFlash</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>Insufficient capacity of the CompactFlash</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>Cannot access the CompactFlash</td>
</tr>
<tr>
<td>3501</td>
<td>*</td>
<td>Confirm the status of CompactFlash.</td>
<td>Cannot access the CompactFlash</td>
</tr>
<tr>
<td>3550</td>
<td>*</td>
<td>The automatic backup is executed. Try it later.</td>
<td>The automatic backup window cannot be called to display while the automatic backup is being processed.</td>
</tr>
<tr>
<td>3551</td>
<td>*</td>
<td>The automatic backup is executed. Arrange the file after it is finished.</td>
<td>The file arrangement cannot be operated during the automatic backup operation.</td>
</tr>
<tr>
<td>3560</td>
<td>*</td>
<td>Failed to re-arrange the backup file.</td>
<td>Failed to re-arrange the backup file for another reason than the access to CompactFlash.</td>
</tr>
<tr>
<td>3580</td>
<td>*</td>
<td>Accessing to backup file. Try it later.</td>
<td>To display another window and then display the automatic backup window again after &quot;ARRANGE&quot; operation, &quot;ARRANGE&quot; process should be completely finished.</td>
</tr>
<tr>
<td>3581</td>
<td>*</td>
<td>Accessing to backup file. Try &quot;ARRANGE&quot; operation later.</td>
<td>The previous &quot;ARRANGE&quot; process should be completely finished to perform the next &quot;ARRANGE&quot; operation.</td>
</tr>
</tbody>
</table>
10 Upgrade Function

10.1 Functional Overview

DX100 applies two software for the CPU configuration: a software for YCP01 (for the main CPU board) and a software for YPP01 (for programming pendant). The system works only with the combination of certain versions due to a compatibility problem of each software. Therefore, with the system version NS3.00 and the subsequent versions, DX100 can upgrade the software for YPP01 if the combination of the software for YCP01 and YPP01 is invalid.

10.2 Upgrade Procedure

10.2.1 Confirmation of Software Version

The compatibility of the versions of YCP01 and YPP01 are automatically checked in 20 seconds after the DX100 power supply is turned on.

- In case the versions of YCP01 and YPP01 matches.
1. Automatic upgrade process completes and the communication process between YCP01 and YPP01 is restarted.
10.2 Upgrade Procedure

2. Initial window appears approx. 40 seconds later.

10.2.2 Automatic Upgrade of YPP01

In case that the pendant application version of YPP01 is older than the one of YCP01 or the pendant application version of YPP01 is not compatible to the one of YCP01, the YPP01 is automatically upgraded.

Not only the application software but the OS of the Programming Pendant is also upgraded automatically.
(OS: Operating System)

1. Automatic upgrade process completes and the communication process between YCP01 and YPP01 is restarted.
   - Some upgraded software require restart.
     In this case restart is done automatically and the communication process between YPP01 and YCP01 starts again.

2. Initial window appears approx. 40 seconds later.

**NOTE**
Every time the OS is upgraded automatically, restart is done. There is no need of calibrating, for the calibration data is taken over.
DO NOT turn off the main power supply during automatic upgrade process.
In case the main power supply is turned off, exercise the following process.

- Turn on the main power supply of DX100.
  - Automatic upgrade might be exercised again.
- In case error occurs during automatic upgrade process.
  1. Prepare CF for upgrading or USB memory.
  2. Press [2], [8] and [HIGH SPEED] at the same time.
     Upgrade of the OS of Programming Pendant
  3. Press [INTERLOCK], [8] and [SELECT] at the same time.
  4. Exercise manual upgrading.
     Refer to "DX100 Upgrade Procedure" (HW0485193).
- If no recovery is made with all the procedure above, replace the pendant.
10.3 Error Message

If error occurs while automatic upgrading, exercise the following procedure.

- Turn on the main power supply of DX100.
  - Automatic upgrade might be exercised again.

- In case error occurs during automatic upgrade process.
  1. Prepare CF for upgrading or USB memory.
  2. Press [2], [8] and [HIGH SPEED] at the same time.
     - Upgrade of the OS of Programming Pendant
  3. Press [INTERLOCK], [8] and [SELECT] at the same time.
  4. Exercise manual upgrading.
     - Refer to “DX100 Upgrade Procedure” (161409-1CD) for detail.
11 Modification of System Configuration

11.1 Addition of I/O Modules

To add I/O modules, turn OFF the power supply.

Addition operation must be performed in the management mode.
In the operation mode or editing mode, only reference of status setting is possible.

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the "SECURITY MODE" to the "MANAGEMENT MODE".
3. Select {SYSTEM} under the main menu.
   - The system window appears.

4. Select {SETUP}.
   - The SETUP window appears.
   - The items marked with "■" cannot be selected.
5. Select [IO MODULE].
   - The current status of the mounted I/O module is shown.

6. Confirm the status of mounted I/O module.
   - Confirm that each station (ST#) window is the same as the I/O module's actual mounting status.
   - The following information is shown for each station.

<table>
<thead>
<tr>
<th>ST#</th>
<th>Station address of I/O module</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI</td>
<td>Number of contact input points 1)</td>
</tr>
<tr>
<td>DO</td>
<td>Number of contact output points 1)</td>
</tr>
<tr>
<td>AI</td>
<td>Number of analog input points 1)</td>
</tr>
<tr>
<td>AO</td>
<td>Number of analog output points 1)</td>
</tr>
<tr>
<td>BOARD</td>
<td>Circuit board type 2)</td>
</tr>
</tbody>
</table>

1) A hyphen, -, indicates that the corresponding I/O section is not mounted.
2) If the system cannot recognize the circuit board type, a row of stars (*****) are shown. No problem will occur as long as the values displayed in DI, DO, AI, and AO are correct.

7. Press [ENTER];
   - Confirm the statuses of the mounted I/O modules for the other stations.
11. Modification of System Configuration

11.2 Addition of Base and Station Axes

8. Press [ENTER].
   - The confirmation dialog box is shown.

9. Select {YES}.
   - The system parameters are then set automatically according to the current mounted hardware status. The procedure for the addition of the I/O module is complete.

   If there is a difference between the displayed contents and the actual mounted status, confirm the status again. If the status is correct, the I/O module may be defective: in such a case, contact your Yaskawa representative.

11.2 Addition of Base and Station Axes

To add the base and station axes, mount all hardware correctly and then execute maintenance mode.

Addition operation must be performed in the management mode.
In the operation mode or editing mode, only reference of status setting is possible.

When adding a base and a station axis, set the following items:

- **TYPE**
  Select one in the type list.
  - In case of base axis (B1,B2,B3,...B8)
    Select one of RECT-X, -Y, -Z, -XY, -XZ, -YZ or -XYZ.
  - In case of station axis (S1,S2,S3,S4,...S24)
    Select UNIV-* (** represents the number of axes) when using a mechanism other than the registered type as a station axis.

- **CONNECTION**
  In the CONNECTION window, specify the SERVOPACK which is connected with each axis group and the contactor which is used for the SERVOPACK.

- **AXIS TYPE**
11.2 Addition of Base and Station Axes

Select from the axis type list.

- In case of TURN-* type
  No need to select (The axis type is set as TURN type.)
- In case of RECT-* type
  Select BALL-SCREW type or RACK & PINION type.
- In case of UNIV-* type
  Select BALL-SCREW type, RACK & PINION type or TURN type.

**MECHANICAL SPECIFICATION**

- If axis type is ball-screw type, set the following items:
  - MOTION RANGE (+) [mm]
  - MOTION RANGE (-) [mm]
  - REDUCTION RATIO (numerator)
  - REDUCTION RATIO (denominator)
  - BALL-SCREW PITCH [mm/r]

- If axis type is rack & pinion type, set the following items.
  - MOTION RANGE (+) [mm]
  - MOTION RANGE (-) [mm]
  - REDUCTION RATIO (numerator)
  - REDUCTION RATIO (denominator)
  - PINION DIAMETER [mm]

- If axis type is turn type, set the following items.
  - MOTION RANGE (+) [deg]
  - MOTION RANGE (-) [deg]
  - REDUCTION RATIO (numerator)
  - REDUCTION RATIO (denominator)
  - OFFSET (1st and 2nd axis) [mm]
11.2  Addition of Base and Station Axes

- **MOTOR SPECIFICATION**
  Set the following items.
  - MOTOR
  - SERVO AMP
  - CONVERTER
  - ROTATION DIRECTION  [normal/reverse]
  - MAX. RPM  [rpm]
  - ACCELERATION SPEED  [sec]
  - INERTIA RATIO
  - * Select MOTOR, AMPLIFIER and CONVERTER from each type list on the display.

### 11.2.1  Base Axis Setting

#### 11.2.1.1  Selection of Base Axis Type

Select the type of base axis to be added/modified.

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the "SECURITY MODE" to the "MANAGEMENT MODE".
3. Select (SYSTEM) under the main menu.
   - The system window appears.
4. Select {SETUP}.
   - The SETUP window appears.
   - Note that the items marked with "■" cannot be set.

5. Select {CONTROL GROUP}.
   - The current control group type is displayed.
6. Point the cursor to the type of control group to be modified, and press [SELECT].
   - The MACHINE LIST window is displayed.

7. Select one in the type list.
   - After the type selection, the window returns to the CONTROL GROUP window.

   - The window moves to the CONNECTION window.
11.2 Addition of Base and Station Axes

- **RECT-X**: Base axis direction of travel coincides with robot coordinate X-Axis.

- **RECT-Y**: Base axis direction of travel coincides with robot coordinate Y-Axis.

- **RECT-Z**: Base axis direction of travel coincides with robot coordinate Z-Axis.

- **RECT-XY**: Base 1st and 2nd axes directions of travel coincide with robot coordinate X-Axis and Y-Axis, respectively.

- **RECT-YZ**: Base 1st and 2nd axes directions of travel coincide with robot coordinate Y-Axis and Z-Axis, respectively.

- **RECT-XZ**: Base 1st, 2nd, and 3rd axes directions of travel coincide with robot coordinate X-Axis, Y-Axis, and Z-Axis, respectively.

- **RECT-XYZ**: Base 1st, 2nd, and 3rd axes directions of travel coincide with robot coordinate X-Axis, Y-Axis, and Z-Axis, respectively.
11.2.1.2 Connection Setting

In the CONNECT window, each axis in respective control groups is specified to be connected to which connector of the SERVO board, or to which brake of the contactor unit, or to which converter.

1. Confirm type of each control group in the CONNECTION window.
   - The connection status of each control group is displayed.

2. Select the connection item of desired control group.
   - The settable items are displayed.
   - When the item is selected, the window returns to the CONNECTION window.

- It is possible to change the connection freely between each axis of each control group and each connector (CN) of a SERVO board. The number in [ ] represents the axis number, and it indicates which axis is to be connected with which connector.
- It is possible to change the connection freely between each axis of each control group and each brake (BRK) of a contactor unit. The number in [ ] represents the axis number, and it indicates which axis is to be connected with which brake.
- It is possible to change the connection freely between each axis of each control group and each converter (CV). The number in [ ] represents the converter number, and it indicates which axis is to be connected with which converter.
11.2 Addition of Base and Station Axes

– In this example, B1 (Base) is to be connected as shown in the following manner:

1st axis  →  SERVO Board (SV #2), Connector (7CN),
            Contactor Unit (TU #1), Brake Connector (BRK7),
            Converter (CV #1)

2nd axis  →  SERVO Board (SV #2), Connector (8CN)
            Contactor Unit (TU #1), Brake Connector (BRK8)
            Converter (CV #2)

3rd axis  →  SERVO Board (SV #2), Connector (9CN)
            Contactor Unit (TU #1), Brake Connector (BRK9)
            Converter (CV #3)

3. Select the desired item.
   – The setting in the CONNECTION window is completed and the window moves to the AXES CONFIG window.

11.2.1.3 Axis Configuration Setting

The axis type is specified in the AXES CONFIG window.

1. Confirm axis type of each axis in the AXES CONFIG window.
   – The axis type of each axis is displayed.
2. Select the axis type to be modified.

(1) The settable axis type is displayed.

(2) Select "BALL-SCREW" when the servo track is ball-screw type, and "RACK&PINION" when the servo track is rack & pinion type. After the selection, the window returns to the AXES CONFIG window.

(3) Select the axis type.


4. The setting in the AXES CONFIG window is completed and the window moves to the MECHANICAL SPEC window.

11.2.1.4 Mechanical Specification Setting

The mechanical data is specified in the MECHANICAL SPEC window.

1. Confirm specification of each axis in the MECHANICAL SPEC window.
   - The mechanical specification of axis is shown.

The MECHANICAL SPEC window (in case of the BALL-SCREW type)

- MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)
11  Modification of System Configuration
11.2  Addition of Base and Station Axes

- **REDUCTION RATIO**: Input the numerator and the denominator.  
  <e.g.> If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.

- **BALL-SCREW PITCH**: Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

**The MECHANICAL SPEC window (in case of the RACK&PINION type)**

- **MOTION RANGE**: Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

- **REDUCTION RATIO**: Input the numerator and the denominator.  
  <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

- **PINION DIAMETER**: Input the diameter of a pinion. (Unit: mm)

2. Select the item to be modified.

   - Point the cursor to the item subject for setting value modification, and press [SELECT].

3. Modify the settings.

   - The selected item is in the input status.  
   Input the setting value, and press [ENTER].


   - After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner.

   - When [ENTER] is pressed in the MECHANICAL SPEC window for the last axis, the setting in the MECHANICAL SPEC window is completed and the window moves to the MOTOR SPEC window.
### 11.2.1.5 Motor Specification Setting

The motor data is specified in the MOTOR SPEC window.

1. Confirm specification of each axis in the MOTOR SPEC window.
   - The motor specification of each axis is displayed.

![MOTOR SPEC Window](image)

2. Select the desired item.
   - When a numerical value is selected, the number input buffer line appears.
   - When MOTOR (or SERVO AMP or CONVERTER) is selected, the list window of MOTOR (SERVO AMP, or CONVERTER) appears.
   - ROTATION DIRECTION: Set the rotation direction to which the current position is increased. (The counterclockwise view from the loaded side is the normal rotation.)

![Fig. 11-1: AC Servo Motor](image)

- MAX. RPM: Input maximum rotation speed of a motor. (Unit: rpm)
- ACCELERATION TIME: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
- INERTIA RATIO: The initial value is set at 300 in case of servo track; 0 in case of rotation axis. However, if the following phenomenon occurs in motion, deal with the followed procedure.
- <Phenomenon1>
  During motion, the axis moves unsteady on advance direction.
  → Confirm the motion with increasing this ratio in each 100.
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11.2 Addition of Base and Station Axes

– <Phenomenon2>
  During pause, the motor makes a lot of noise.
  ⇒ Confirm the motion with decreasing this ratio in each 100.

3. Modify the settings.

   – After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner.
   – When [ENTER] is pressed in the MOTOR SPEC window for the last axis, the setting in the MOTOR SPEC window is completed and the confirmation dialog box appears.

– If {YES} is selected, the system parameter is set automatically.

11.2.2 Station Axis Setting

11.2.2.1 Selection of Station Axis Type

Select the type of station axis to be added/modified.

1. Confirm the type of control group in CONTROL GROUP window.
   – The CONTROL GROUP window appears.
2. Select the type of control group to be modified.
   - The MACHINE LIST window appears.

3. Select desired type in the type list.
   - After the type selection, the window returns to CONTROL GROUP window.
   - Select "UNIV" (universal) when using a mechanism other than the registered type (such as a servo track) as a station axis. When "UNIV" is selected, interpolation motion (linear, circular, etc.) is not supported.

11.2.2.2 Connection Setting

In the CONNECTION window, each axis in respective control group is specified to be connected to which connector of the SERVO board, or to which brake of the contactor unit, or to which converter.
11.2 Addition of Base and Station Axes

1. Confirm type of each control group in the CONNECTION window.
   – Connection status of each control group is displayed.

2. Select the connection item of desired control group.
   – The settable items are displayed.
   – When the item is selected, the window returns to the CONNECTION window.
   – It is possible to change the connection freely between each axis of each control group and each connector (CN) of a SERVO board. The number in [ ] represents the axis number, and it indicates which axis is to be connected with which connector.
   – It is possible to change the connection freely between each axis of each control group and each brake (BRK) of a contactor unit. The number in [ ] represents the axis number, and it indicates which axis is to be connected with which brake.
   – It is possible to change the connection freely between each axis of each control group and each converter (CV). The number in [ ] represents the converter number, and it indicates which axis is to be connected with which converter.
   – In this example, S1 (station) is to be connected as shown in the following manner:

   
   1st axis \( \rightarrow \) SERVO Board (SV #1), Connector (7CN),
   Contactor Unit (TU #1), Brake Connector (BRK7),
   Converter (CV #2)

   2nd axis \( \rightarrow \) SERVO Board (SV #1), Connector (8CN),
   Contactor Unit (TU #1), Brake Connector (BRK8),
   Converter (CV #3)

3. Select the desired item.

   – The setting in the CONNECTION window is completed and the window moves to the AXES CONFIG window.
11.2.3 Axis Configuration Setting

The axis type and motor type are specified in the AXES CONFIG window.

1. Confirm axis type of each axis in the AXES CONFIG window.
   - The axis type of each axis is displayed.

The AXES CONFIG window (in case of the TURN type)

2. Select the axis type to be modified.
   - The settable axis type is displayed.
11.2  Addition of Base and Station Axes

3. Select the desired axis type.

4. Press [ENTER] in the AXES CONFIG window
   – The setting in the AXES CONFIG window is completed and the window moves to the MECHANICAL SPEC window.

11.2.2.4 Mechanical Specification Setting

The mechanical data is specified in the MECHANICAL SPEC window.

1. Confirm specification of each axis in the MECHANICAL SPEC window.
   – The mechanical specification of axis is shown.

   **OFFSET**
   - Offset should be specified at “TURN-2” type only.
   - Input length between the center of bending axis (1st axis) and the turning table (2nd axis).
   - (Unit: mm)

   **MOTION RANGE**
   - Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0.
   - (Unit: deg)

   **REDUCTION RATIO**
   - Input the numerator and the denominator.
   - e.g. If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.
11.2 Addition of Base and Station Axes

The MECHANICAL SPEC window (in case of the BALL-SCREW type)

- **MOTION RANGE**: Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

- **REDUCTION RATIO**: Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.

- **BALL-SCREW PITCH**: Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

The MECHANICAL SPEC window (in case of the RACK&PINION type)

- **MOTION RANGE**: Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

- **REDUCTION RATIO**: Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

- **PINION DIAMETER**: Input the diameter of a pinion. (Unit: mm)
Modification of System Configuration

11.2 Addition of Base and Station Axes

The MECHANICAL SPEC window (In case of the ROTATION type)

- MOTION RANGE: Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: deg)

- REDUCTION RATIO: Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

2. Modify the settings.


- After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner. When [ENTER] is pressed in the MECHANICAL SPEC window for the last axis, the setting in the MECHANICAL SPEC window is completed and the window moves to the MOTOR SPEC window.

11.2.2.5 Motor Specification Setting

The motor data is specified in the MOTOR SPEC window.

1. Confirm specification of each axis in the MOTOR SPEC window.

- The motor specification of each axis is displayed.
2. Select desired item.
   – When a numerical value is selected, the number input buffer line appears.
     When MOTOR (or SERVO AMP or CONVERTER) is selected, the list window of MOTOR (SERVO AMP or CONVERTER) appears.
   – When the type is selected, the window returns to the AXES CONFIG window.
   – ROTATION DIRECTION: Set the rotation direction to which the current position is increased. (The counterclockwise view from the loaded side is the normal rotation.)

![Fig. 11-2: AC Servo Motor](image)

   – MAX. RPM: Input maximum rotation speed of a motor. (Unit: rpm)
   – ACCELERATION TIME: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
   – INERTIA RATIO: The initial value is set at 300 in case of servo track; 0 in case of rotation axis. However, if the following phenomenon occurs in motion, deal with the followed procedure.
     – <Phenomenon1> During motion, the axis moves unsteady on advance direction.
       → Confirm the motion with increasing this ratio in each 100.
     – <Phenomenon2> During pause, the motor makes a lot of noise.
       → Confirm the motion with decreasing this ratio in each 100.

3. Modify the settings.

---

CAUTION

If the control axis configuration is changed by addition of a base axis or station axis, the internal data of the job file are also changed so that the job file data should be initialized.

Initialize the job file data with procedure “File Initialize” in this manual after changing the construction.

When the data, motion range for example, should be changed after the addition of a base axis or station axis, the change can be done in the same procedure as shown above.

In that case, the control axis configuration is not changed so the job file data should not be initialized.
12 DX100 Specification

WARNING

• When turning ON the power to DX100, be sure that there is no one within the P-point maximum envelope of the manipulator, and that you are in a safe place.

Injury may result from collision with the manipulator to anyone entering the P-point maximum envelope of the manipulator. Always press the emergency stop button immediately if there are problems.

• Always set the teach lock before starting teaching.

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

Improper or unintentional manipulator operation can result in injury.

• Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop button on the programming pendant is pressed.

Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency. The emergency stop button is located on the right of 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 manipulator 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 manipulator, fixture, or on the floor, the manipulator or a tool could collide with it during manipulator movement, possibly causing injuries or equipment damage.

• Make sure that a system manager stores the key of the mode select switch on the programming pendant.

After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator 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.
# 12.1 Specification List

<table>
<thead>
<tr>
<th>Controller</th>
<th>Construction</th>
<th>Free-standing, enclosed type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>Dimensions</td>
<td>Refer to the following</td>
</tr>
<tr>
<td>Cooling System</td>
<td>Cooling System</td>
<td>Indirect cooling</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>Ambient Temperature</td>
<td>0°C to + 45°C (during operation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-10°C to + 60°C (during transit and storage)</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Relative Humidity</td>
<td>10% to 90%RH (non-condensing)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>Power Supply</td>
<td>3-phase, 400/415/440 VAC (+10% to -15%) at 50/60 Hz (±2%) (Built-in transformer tap switchable)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Built-in transformer 400 V-415 V-440 V/200 V (autotransformer -)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Connect a power supply (400/415/440 VAC) to the X4 connector on the panel rear side. Switch the built-in transformer tap according to the supplied voltage on your side. (400 VAC is set before shipment.)</td>
</tr>
<tr>
<td>Grounding</td>
<td>Grounding</td>
<td>Grounding resistance: 100 Ω or less Exclusive grounding</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>Digital I/O</td>
<td>Specific signal (hardware)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23 inputs and 5 outputs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General signals (standard, maximum)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 inputs and 40 outputs (transistor: 32 outputs, relay: 8 outputs)</td>
</tr>
<tr>
<td>Positioning System</td>
<td>Positioning System</td>
<td>By serial communication (absolute encoder)</td>
</tr>
<tr>
<td>Drive Unit</td>
<td>Drive Unit</td>
<td>SERVOPACK for AC servomotors</td>
</tr>
<tr>
<td>Acceleration/ Deceleration</td>
<td>Acceleration/ Deceleration</td>
<td>Software servo control</td>
</tr>
<tr>
<td>Memory Capacity</td>
<td>Memory Capacity</td>
<td>200000 steps, 10000 instructions</td>
</tr>
</tbody>
</table>

| Common to small, medium, and large capacities | MH5, MH5L, MH6, MA1400, MA1900, VA1400, HP20D, HP20D-6, HP20RD, MH50, MH50-20, MH50-35, MA1800, MS80, VS50, SIA50D, ES165D, ES165RD, ES165D, ES200D, ES200RD, HP165D, UP350D |
|                                               | 800(W) × 1000(H) × 650(D) mm |
### 12.2 Function List

<table>
<thead>
<tr>
<th>Programming Pendant Operation</th>
<th>Coordinate System</th>
<th>Coordinate Modification of Teaching Points</th>
<th>Inching Operation</th>
<th>Path Confirmation</th>
<th>Speed Adjustment</th>
<th>Timer Setting</th>
<th>Short-cut Function</th>
<th>Interface</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Joint, Rectangular/Cylindrical, Tool, User Coordinates</td>
<td>Adding, Deleting, Correcting (Robot axes and external axes respectively can be corrected.)</td>
<td>Possible</td>
<td>Possible</td>
<td>Fine adjustment possible during operating or pausing</td>
<td>Possible every 0.01 s</td>
<td>Direct-open function, Multi-window</td>
<td>CF (Compact Flash) card slot, USB port (USB1.1) (At Programming Pendant) RS232C (At Control Circuit Board) LAN (100 BASE-TX/10BASE-T) (At Control Circuit Board) (Option)</td>
<td>Arc welding, Spot welding, Handling, General, Others</td>
</tr>
<tr>
<td>Safety Feature</td>
<td>Essential Measures</td>
<td>Running Speed Limit</td>
<td>Enable Switch</td>
<td>Collision Proof Frames</td>
<td>Self-Diagnosis</td>
<td>User Alarm Display</td>
<td>Machine Lock</td>
<td>Door Interlock</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JIS (Japanese Industrial Standard)</td>
<td>User definable</td>
<td>3 position type. Servo power can be turned on at the middle position only. (Located on programming pendant)</td>
<td>S-axis frame (doughnut-sector), Cubic frame (user coordinate)</td>
<td>Classifies error and two types of alarms (major and minor) and displays the data</td>
<td>Possible to display alarm messages for peripheral device</td>
<td>Test-run of peripheral devices without robot motion</td>
<td>A door can be opened only when a circuit breaker is OFF.</td>
<td></td>
</tr>
<tr>
<td>Maintenance Function</td>
<td>Operation Time Display</td>
<td>Alarm Display</td>
<td>I/O Diagnosis</td>
<td>T.C.P. Calibration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control power-on time, Servo power-on time, Playback time, Operation time, Work time</td>
<td>Alarm message, troubleshooting, previous alarm records</td>
<td>Simulated enabled/disabled output possible</td>
<td>Automatically calibrates parameters for end effectors using a master positioner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 12.3 Programming Pendant

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

### Material
- Reinforced thermoplastic enclosure with a detachable suspending strap

### Dimensions
- 169(W) × 314.5(H) × 50(D) mm (excluding protrusions)

### Displayed Units
- TFT Color liquid crystal display, VGA (640 × 480) Touch panel

### Operated Units
- Three-position Enable switch, Start switch, Hold switch, Mode select switch (with key, three mode)

### Others
- Provided with CF (Compact Flash) card slot USB port (USB1.1) X 1
12.4 Equipment Configuration

The DX100 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 DX100 equipment.

12.4.1 Arrangement of Units and Circuit Boards

The arrangements of units and circuit boards in small-capacity, medium-capacity, and large-capacity DX100s are shown.

Small Capacity

SERVOPACK  Power Supply Contact Unit

*Fig. 12-1: Configuration for Small Capacity*

<table>
<thead>
<tr>
<th>Table 12-1: Configuration for Small Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td>MH5</td>
</tr>
<tr>
<td>MH5L</td>
</tr>
<tr>
<td>MH6</td>
</tr>
<tr>
<td>MA1400</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>VA1400</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>MA1900</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>HP20D</td>
</tr>
<tr>
<td>HP20D-6</td>
</tr>
<tr>
<td>HP20RD</td>
</tr>
</tbody>
</table>
12.4 Equipment Configuration

**Medium and Large Capacity**

*Fig. 12-2: Configuration for Medium and Large Capacity*

---

**Table 12-2(a): Configuration for Medium Capacity**

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>DX100</th>
<th>SERVOPACK</th>
<th>Converter</th>
<th>Power Supply Contact Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH50</td>
<td>ERDR-MH00050-E02</td>
<td>JZRCR-YSV04-11</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
<tr>
<td>MH50-20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MH50-35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS80</td>
<td>ERDR-MS00080-E02</td>
<td>JZRCR-YSV05-11</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
<tr>
<td>VS50</td>
<td>ERDR-VS00050-E02</td>
<td>JZRCR-YSV05-41</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
<tr>
<td>SIA50D</td>
<td>ERDR-SIA050D-E02</td>
<td>JZRCR-YSV05-41</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
<tr>
<td>MA1800</td>
<td>ERDR-MA01800-E02</td>
<td>JZRCR-YSV08-11</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ERDR-MA01800-E04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Table 12-2(b): Configuration for Large Capacity**

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>DX100</th>
<th>SERVOPACK</th>
<th>Converter</th>
<th>Power Supply Contact Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES165D</td>
<td>ERDR-ES0165D-E02</td>
<td>JZRCR-YSV06-11</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
<tr>
<td>ES165RD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES200D</td>
<td>ERDR-ES0200D-E02</td>
<td>JZRCR-YSV06-11</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
<tr>
<td>ES200RD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP165D</td>
<td>ERDR-HP0165D-E02</td>
<td>JZRCR-YSV06-11</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
<tr>
<td>UP350D</td>
<td>ERDR-UP0350D-E02</td>
<td>JZRCR-YSV07-11</td>
<td>SRDA-COA30A01A-E</td>
<td>JZRCR-YPU01-1</td>
<td></td>
</tr>
</tbody>
</table>

---
12.4.2 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 DX100. Make sure the door of the DX100 is closed when it's used to keep this cooling system effective.

*Fig. 12-3: Cooling System*
13 Description of Units and Circuit Boards

WARNING

• When turning ON the power to DX100, be sure that there is no one within the P-point maximum envelope of the manipulator, and that you are in a safe place.

Injury may result from collision with the manipulator to anyone entering the P-point maximum envelope of the manipulator. Always press the emergency stop button immediately if there are problems.

• Always set the teach lock before starting teaching.

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

Improper or unintentional manipulator operation can result in injury.

• Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop button on the programming pendant is pressed.

Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency. The emergency stop button is located on the right of the programming pendant.
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 manipulator movement.
- Check for damage to 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 manipulator or fixture, or on the floor, the manipulator or a tool could collide with it during manipulator movement, possibly causing injuries or equipment damage.

• Make sure that a system manager stores the key of the mode select switch on the programming pendant.

After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator 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.
### Cautions for Connection of Dual Input Signals

#### CAUTION

- Connect the switch (contact) that turns the dual signals ON and OFF simultaneously.
- If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs. Refer to the figure below.

![Diagram of dual input signals connection](image)

- Do not connect two signals to the same contact point. (Prepare two individual contact points)
- Since the power supply for each signal is reversed, it will short-circuit and may cause breakdown of DX100 Unit if the signals are connected to the same contact point.

![Diagram showing short-circuit](image)
13.1 Power Supply Contactor Unit

The power supply contactor unit consists of the power supply contactor sequence circuit board (JARCR-YPC01-1) and the contactor (1KM, 2KM) for servo power and the line filter (1Z). It turns the contactor servo power ON and OFF using the signal for servo power control from the power supply contactor sequence circuit board and supplies power (3-phase AC200/220V) to the unit.

The power supply (single phase AC200/220V) is supplied to the control power supply via the line filter.

Table 13-1: Power Supply Contactor Unit Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Robot Type</th>
</tr>
</thead>
</table>

Fig. 13-1: Power Supply Unit Configuration (JZRCR-YPU01-□)

(CN601) Main Power Supply Input

(CN607) Contactor Control Input

(CN608) Brake Interlock Output

(CN605, CN604, CN603) AC Control Power Supply

(CN606) AC Cooling Fan

(2FU),(1FU) Fuse for AC Control Power Supply 021801P(10A 250V)

(4FU),(3FU) Fuse for AC Cooling Fan GP25(2.5A 200V)
13.2 Major Axes Control Circuit Board (SRDA-EAXA01□)

13.2.1 Major Axes Control Circuit Board (SRDA-EAXA01□)

The major axes control circuit board (SRDA-EAXA01□) controls the servomotors of the manipulator’s six axes. It also controls the converter, the PWM amplifiers, and the power supply contactor circuit board of the power supply contactor unit. Mounting an external axes control circuit board of an option (SRDA-EAXB01□) makes it possible to control the servomotor of nine axes, including the robot axes.

The major axes control circuit board (SRDA-EAXA01□) also has the following functions.

- Brake Power Supply Control Circuit
- Shock sensor (shock) input circuit
- Direct-in circuit

*Fig. 13-2: Major Axes Control Circuit Board (SRDA-EAXA01 □)*
13.2.2 Connection for Tool Shock Sensor (SHOCK)

13.2.2.1 To connect the tool shock sensor directly to the tool shock sensor signal line

1. Disconnect the minus SHOCK (-) and plus SHOCK (+) pin terminal from the DINAMIC connector, the EAXA-CN512 major axes control circuit board.

2. Connect the minus SHOCK (-) and plus SHOCK (+) pin terminals to the signal line of the tool shock sensor. Use the following pin terminals for preparing the end of the signal line.

<table>
<thead>
<tr>
<th>Pin Terminal Name</th>
<th>Pin Terminal Model</th>
<th>Signal Line Terminal Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHOCK-</td>
<td>TMEDN-630809-MA</td>
<td>TMEDN-630809-FA (manufactured by NICHIFU Co., Ltd.)</td>
</tr>
<tr>
<td>SHOCK+</td>
<td>TMEDN-630809-FA</td>
<td>TMEDN-630809-MA (manufactured by NICHIFU Co., Ltd.)</td>
</tr>
</tbody>
</table>

Fig. 13-3: Direct Connection to Tool Shock Sensor Signal Line
13.2.2.2 To connect the tool shock sensor with the cable that is built into the manipulator

1. Disconnect the minus SHOCK (-) and plus SHOCK (+) pin terminal from the DINAMIC connector, the EAXA-CN512 major axes control circuit board.

2. Connect the minus SHOCK (-) pin terminal to the minus SHOCK (-) pin terminal of the manipulator.

**NOTE**

Cable that is built into the manipulator is not connected to shocks sensor because the tool shock sensor is a option. For connecting the tool shock sensor, refer to the wiring diagrams in the INSTRUCTIONS for the manipulator.

*Fig. 13-4: Connection with Manipulator Cable*

When the tool shock sensor input signal is used, the stopping method of the robot can be specified. The stopping methods are hold stop and servo power supply OFF. Selection of the stopping method is set in the display of the programming pendant. Refer to explanations in Chapter 8 “System Setup” on page 8-1 for details.
13.2.3 Connection for Direct-in

- **Direct-in (Servo) 1 to 6**

  This signal is used to input a responsive signal in search functions.

  *Fig. 13-5: Connection for Direct-in (Servo) 1 to 6*

  The part of wiring is for the slave for the coordinated control side major axes control circuit board, SRDA-EAXA01D.
13.3 CPU Unit

13.3.1 CPU Unit Configuration

CPU unit consists of circuit board racks, control circuit boards, robot I/F board.

The JZNC-YRK01-1E CPU unit contains only circuit board racks and control circuit boards. It does not contain robot I/F board.

*Fig. 13-6: CPU Unit Configuration (JZNC-YRK01-1E)*
13.3.2 Unit and Circuit Board in the CPU Unit

13.3.2.1 Control Circuit Board (JANCD-YCP01-E)

This board performs to control the entire system, display to the programming pendant, control the operating keys, control operation and calculate interpolation. This board has the serial interface for RS-232C and LAN (100BASE-TX/10BASE-T).

13.3.2.2 Robot I/F Board (JANCD-YIF01-□E)

The robot I/F board controls the entire robotic system. It is connected to the control circuit board (JANCD-YCP01-E) with a PCI bus interface on the backboard, and to the major axes control circuit board (SRDA-EAXA01A-□) with high-speed serial transmissions.
13.4 CPS Unit (JZNC-YPS01-E)

This unit (JZNC-YPS01-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.

Fig. 13-7: CPU Unit JZNC-YPS01-E
### 13.4 CPS Unit (JZNC-YPS01-E)

#### Input
- **Rating Input Voltage:** 200/220VAC
- **Voltage Fluctuation Range:** +10% to -15% (170 to 242VAC)
- **Frequency:** 50/60Hz ± 2Hz (48 to 62Hz)

#### Output Voltage
- DC +5V

#### Indicator

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>Color</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE</td>
<td>Green</td>
<td>Lights with power supply input. Lights out when internal live part completes discharge. (Power supply status: being input)</td>
</tr>
<tr>
<td>POWER ON</td>
<td>Green</td>
<td>Lights when PWR_OK output signal is ON. (Power supply status: being output)</td>
</tr>
<tr>
<td>+5V</td>
<td>Red</td>
<td>Lights with +5V over-current (ON when abnormal)</td>
</tr>
<tr>
<td>+24V</td>
<td>Red</td>
<td>Lights with +24V over-current (ON when abnormal)</td>
</tr>
<tr>
<td>FAN</td>
<td>Red</td>
<td>Lights when FAN error occurs.</td>
</tr>
<tr>
<td>OHT</td>
<td>Red</td>
<td>Lights when unit interior overheats</td>
</tr>
</tbody>
</table>

#### Control Power ON/OFF

To turn ON the DX100 controller power, turn ON the non-fuse breaker of the controller so that the control power supply is turned ON. If the controller is not located at the workplace, the CPS unit can be turned ON/OFF by an external device, etc. after the non-fuse breaker of the controller is turned ON. It is operated by the external switch connected with CN152 of control power supply as shown in the following figure. (CN152-1 and CN152-2 is shortaged when shipment)

*Fig. 13-8: Connection to Control Power Supply Unit*

![Connection to Control Power Supply Unit](image)

See Section 13.8 “WAGO Connector” on page 13-22 for wiring of CN152 connector.
13.5 Brake Control Board (JANCD-YBK01-1E)

13.5.1 Brake Control Board (JANCD-YBK01-1E)

Brake Control Board controls ON/OFF of the brakes of total nine axes (Robot + external axes) according to the command signal from Major Axes Control Circuit Board (SRDA-EAXA01□).

- (CN405) Brake Command Input
- (CN404) Contactor Interlock Input
- (CN403) Brake Power Supply Input
- (CN402) Brake Command Input
- (CN401) Brake Release Switch Connection
- (CN400) Brake Output
- F1: Fuse 3.15 A/250 V
- Brake Power Supply Input
- For Switching External Power Supply
- Brake Command Input
- Brake Release Switch Connection
- Brake Output
13.6 Robot I/O Unit (JZNC-YIU02-E)

13.6.1 Robot I/O Unit (JZNC-YIU02-E)

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

The I/Os are divided into two types: universal 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 manipulator and related equipment as a system. Universal I/O are mainly used as timing signals for the manipulator and peripheral devices in jobs that require robot motion.

Refer to Section 13.12 “Universal I/O Signal Assignment” on page 13-41 for more details on signal allocation.

For the connection of the robot’s universal I/O signal connectors, and the I/O signal related to start and stop, refer to “Connection Wire with Universal I/O Connector (CN306, 307, 308, 309)” on page 13-15 and “Specific I/O Signal Related to Start and Stop” on page 13-16.

Fig. 13-9: I/O Unit (JZNC-YIU02-E)
13 Description of Units and Circuit Boards
13.6 Robot I/O Unit (JZNC-YIU02-E)

- Connection Wire with Universal I/O Connector (CN306, 307, 308, 309)
Please refer to the figure below when you manufacture the cable connecting with robot universal I/O connector (CN306, 307, 308, 309) of robot I/O unit (JZNC-YIU02-E). Unshielded twisted pair cable must be used. (The cable side connector and the I/O terminal block are the options.)

- Connector A detail (cable side)
  Connector Model: FCN-361J040-AU (FUJITSU)
  (Soldered Pin type)
  Hood Model: FCN-360C040-B (FUJITSU)

- Connector C detail (cable side)
  Connector Model: 1903404-1
  (Tyco Electronics Amp)
  (MT Type)

- Connector B details
  Connector Model: 1747053-1
  (Tyco Electronics Amp)

I/O Unit (JZNC-YIU01-E)

I/O Cable (YIU ~ external)

I/O Cable (YIU ~ Terminal Block)

I/O Terminal Block
  Stripped length: 10mm
  Applicable max cable outside diameter: 3mm dia.

Model: TIFS553YS (KASUGA ELECTRIC)
13 Description of Units and Circuit Boards

13.6 Robot I/O Unit (JZNC-YIU02-E)

**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: JZNC-YIU02-E)
- External Servo ON (common to all application: System input terminal block -X18)
- External Start (depending on application: JZNC-YIU02-E)
- Operating (depending on application: JZNC-YIU02-E)
- External Hold (common to all application: System input terminal block -X18)
- External Emergency Stop (common to all application: System input terminal block -X18)

<Timing Chart>

Manipulator

While Servo ON

Servo ON

External Start

Operating

External Hold

Ext. E-Stop

Note: Set T=100msec or more
Example of Servo ON Sequence Circuit from External Device

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

![Servo ON Sequence Circuit Diagram]

---

Example of Start Sequence Circuit from External Device

Only the rising edge of the external start signal is valid. This signal starts the manipulator. Reset this signal with the interlock configuration that determines if operation can start and with the playback (RUNNING) signal confirming that the manipulator has actually started moving.

![Start Sequence Circuit Diagram]
Connection of External Power Supply for I/O

At factory setting, the internal power supply for I/O is used. If the external power supply for I/O is used, connect it with following procedure.

1. Remove the wire connected between CN303-1 to -3 and CN303-2 to -4 of the robot I/O unit.

2. Connect +24V of the external power supply to CN303-1 and 0V to CN303-2 of the robot I/O unit.

For the connection of the CN303 connector, refer to Section 13.8 “WAGO Connector” on page 13-22.

Fig. 13-10: Connection of External Power Supply for I/O

- The internal power supply of 24 V of about 1.5 A of DX100 can be used for I/O. Use external 24 V power supply for higher currents and to isolate the circuit inside and outside the DX100.

- Power supply circuit for I/O (+24 VU, 024 VU) has 3.15A fuses (F1, F2).

- Install the external power supply outside the DX100 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 line of the external power supply to the +24 VU and 0 VU terminals. The unit may malfunction if the external power supply is also connected.
13.7 Machine Safety Unit (JZNC-YSU01-1E)

13.7.1 Machine Safety Unit (JZNC-YSU01-1E)

This unit contains dual processing circuits for safety signal. It processes external safety signals with the dual processing circuits and control ON/OFF of the contactor for SERVO power supply of the contactor unit (JZRCR-YPU) according to conditions.

Followings are the main functions of Machine Safety Unit.

- Robot specific I/O circuit (safety signal dual circuits)
- Servo-ON Enable (ONEN) Input Circuit (dual circuits)
- Overrun (OT, EXOT) Input Circuit (dual circuits)
- Programming Pendant Signal PPESP, PPDSW, etc. Input Circuit (safety signal dual circuits)
- Contactor Control Signal Output Circuit (dual circuits)
- Emergency Stop Signal Input Circuit (dual circuits)
13.7.2 Connection for Servo-ON Enable Input (ONEN1 and ONEN2)

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

Refer to “8 Servo Power Supply Individual Control Function” of “Independent/Coordinated Function Instructions Manual” for the usage of the Servo-ON Enable signals.

For the connection of CN211 Connector, refer to Section 13.8 “WAGO Connector” on page 13-22

Fig. 13-11: Connection for Servo-ON Enable Input
13.7.3 Connection for External Axis Overrun (EXOT)

With a unit of standard specifications without an external axis, the external axis overrun input signal is not used. In this case, a jumper cable is connected as shown in the following figure.

If an overrun input signal for an axis other than manipulator axes, for example the external axis, is required, connect the signal input circuit in the following manner.

For safe reason, a dual circuits are used for the external axis overrun signal input. Connect the external axis overrun signal so that both input signals are turned ON or OFF at the same time. If only one signal is turned ON, an alarm occurs.

1. Remove the jumper cable between the connectors CN211-9 and -10 and between the connectors CN211-11 and -12 of the JZNC-YSU01-1E machine safety unit.

2. Connect the external axis overrun wiring between the connectors CN211-9 and -10 and between the connectors CN211-11 and -12 of the JZNC-YSU01-1E machine safety unit.

For the connection of CN211 Connector, refer to Section 13.8 “WAGO Connector” on page 13-22.

**CAUTION**

- Remove jumper cable installed on specific input signal before connecting the input signal lines.

Failure to observe this caution could lead to injury or mechanical failure.

*Fig. 13-12: Connection for External Axis Overrun*
13.8 WAGO Connector

CN211 on the machine safety unit (JZNC-YSU01-1E), CN152 on the CPS unit (JZNC-YP01-E), and CN303 on the robot I/O unit (JZNC-YIU02-E) are equipped with a connector made by WAGO.

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

The tools (total 3, 2 types) are supplied with the DX100.

Use them with the appropriate sizes of connectors.

The wiring procedure is described as follows:

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

<table>
<thead>
<tr>
<th>Connector to be applied</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPS unit: (JZNC-YP01-E) CN152</td>
<td>Max cable outside diameter: 4.1mm dia. Stripped length: 8-9mm</td>
</tr>
<tr>
<td>Machine safety unit: (JZNC-YSU01-1E) CN211</td>
<td>Max cable outside diameter: 3.4mm dia. Stripped length: 7mm</td>
</tr>
<tr>
<td>Robot I/O unit: (JZNC-YIU02-E) CN303</td>
<td></td>
</tr>
</tbody>
</table>
2. Insert or pull out the wire while pushing the wiring tool downward (Direction of the arrow.)

3. Remove the wiring tool from the connector. (Complete)
   Keep this wiring tool for the future use.
13.9 Robot System Input Terminal Block (-X18) (JARCR-YCU03)

The robot system input terminal block (-X18) is equipped at lower part of the right side of DX100 as shown below. The input terminal block (-X18) is used for the input of robot system signals.

For connections, refer to connection diagrams for each corresponding items.

*Fig. 13-13: Robot System Input Terminal Block (-X18)*
13 Description of Units and Circuit Boards
13.9 Robot System Input Terminal Block (-X18) (JARCR-YCU03)

- Wiring Procedure of the X18 (JARCR-YCU03) Connector
  For your safety, appropriate work must be done by following the instructions below.

1. Tool: Screwdriver
   - For the connection, be sure to use a screwdriver of an applicable size and configuration.

   * WAGO standard screwdriver
     WAGO 210-119
     WAGO 210-119SB (Short, delivered with the product)

2. Applicable Wires
   (1) The length of the exposed conductor (L) should be as follows:
      - * The length of the exposed conductor set for the terminal block (L)
        WAGO series 250 (with 5.0 mm pitch): 9-10 mm
      - * Applicable max cable outside diameter: 3.1 mm dia.

   (2) In case that the conductor is bent or feazed, make it straight as illustrated in the figure above.
3. Wire Connection

(1) Insert the driver in this hole.

(2) Push the driver in this direction.

(3) Remove the wire jacket, and insert the wire.

(4) Pull out the screwdriver to clamp the conductor with a spring.

(5) Check if the wire is connected firmly by pulling the wire softly.

Terminal block: screwless clamp
Terminal: Phoenix ZFKDS series
13.9 Robot System Input Terminal Block (-X18) (JARCR-YCU03)

**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.

---

**CAUTION**

- Always connect the signals after removing jumper header.
If the headers are not removed, injury or damage to machinery may result and the external emergency stop will not work even if the signal is input.

---

**Fig. 13-14: Connection for External Emergency Stop**

Remove the jumper headers, then keep them at the EXTRA area of the terminal block -X18.
13.9 Robot System Input Terminal Block (-X18) (JARCR-YCU03)

**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.

**CAUTION**

- Always connect the signals after removing jumper header. If the headers are not removed, injury or damage to machinery may result and the external emergency stop will not work even if the signal is input.

*Fig. 13-15: Connection for Safety Plug*
Installation of Safety Plug

The manipulator 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.

*Fig. 13-16: Safety Plug Installation Example*

If the servo power is ON when the interlock signal is input, the servo power turns OFF. The servo power cannot be turned ON while the interlock signal is input. 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.
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. 13-17: Connection for Full-speed Test
13. Description of Units and Circuit Boards

13.9 Robot System Input Terminal Block (-X18) (JARCR-YCU03)

- **Slow Speed Mode Selection**
  This signal is 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%)

  *Fig. 13-18: Connection for Slow Speed Mode Selection*

- **External Servo ON**
  This signal is used to connect the servo ON switch of an external operation device. If the signal is input, the servo power supply is turned ON.

  *Fig. 13-19: Connection for External Servo ON*
13. Description of Units and Circuit Boards

13.9 Robot System Input Terminal Block (-X18) (JARCR-YCU03)

- **External Hold**

  This signal is used to connect the temporary stop switch of an external device. If the signal is input, the job is stopped. While the signal is input, starting and axis operations are disabled.

  ![CAUTION]

  - Always connect the signals after removing jumper header.
  
  If the headers are not removed, injury or damage to machinery may result and the external emergency stop will not work even if the signal is input.

  **Fig. 13-20: Connection for External Hold**

  [Diagram of external hold connection]

  Remove the jumper headers, then keep them at the EXTRA area of the terminal block -X18.
13  Description of Units and Circuit Boards
13.9  Robot System Input Terminal Block (-X18) (JARCR-YCU03)

- **External Enable Switch**
  This signal is used to connect Enable switch other than the one on the programming pendant when two people are teaching.

**CAUTION**

- Always connect the signals after removing jumper header.

If the headers are not removed, injury or damage to machinery may result and the external emergency stop will not work even if the signal is input.

*Fig. 13-21: Connection for External Enable Switch*
### Description of Units and Circuit Boards

#### 13.9 Robot System Input Terminal Block (-X18) (JARCR-YCU03)

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Connection No. (-X18)</th>
<th>Dual input</th>
<th>Function</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXESP1+</td>
<td>-X6</td>
<td>-13</td>
<td>Applicable</td>
<td>External Emergency Stop</td>
</tr>
<tr>
<td>EXESP1-</td>
<td>-X6</td>
<td>-14</td>
<td></td>
<td>Short-circuit with a jumper header (J3, J4)</td>
</tr>
<tr>
<td>EXESP2+</td>
<td>-X6</td>
<td>-15</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>EXESP2-</td>
<td>-X6</td>
<td>-16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAFF1+</td>
<td>-X6</td>
<td>-3</td>
<td>Applicable</td>
<td>Safety Plug</td>
</tr>
<tr>
<td>SAFF1-</td>
<td>-X6</td>
<td>-4</td>
<td></td>
<td>Short-circuit with a jumper header (J1, J2)</td>
</tr>
<tr>
<td>SAFF2+</td>
<td>-X6</td>
<td>-5</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>SAFF2-</td>
<td>-X6</td>
<td>-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FST1+</td>
<td>-X6</td>
<td>-17</td>
<td>Applicable</td>
<td>Full-speed Test</td>
</tr>
<tr>
<td>FST1-</td>
<td>-X6</td>
<td>-18</td>
<td></td>
<td>Open</td>
</tr>
<tr>
<td>FST2+</td>
<td>-X6</td>
<td>-19</td>
<td></td>
<td>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 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%).</td>
</tr>
<tr>
<td>FST2-</td>
<td>-X6</td>
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<tr>
<td>SSP+</td>
<td>-X6</td>
<td>-21</td>
<td>-</td>
<td>Slow Speed Mode Selection</td>
</tr>
<tr>
<td>SSP-</td>
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<td>-22</td>
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<td>Short-circuit with a jumper header (J5)</td>
</tr>
<tr>
<td>EXSVON+</td>
<td>-X6</td>
<td>-23</td>
<td>-</td>
<td>External Servo ON</td>
</tr>
<tr>
<td>EXSVON-</td>
<td>-X6</td>
<td>-24</td>
<td></td>
<td>Open</td>
</tr>
<tr>
<td>EXHSVON+</td>
<td>-X6</td>
<td>-23</td>
<td>-</td>
<td>Used to connect the servo ON switch of an external operation device. If the signal is input, the servo power supply is turned ON.</td>
</tr>
<tr>
<td>EXHSVON-</td>
<td>-X6</td>
<td>-24</td>
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<td></td>
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<tr>
<td>EXHOLD+</td>
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<td>-1</td>
<td>-</td>
<td>External Hold</td>
</tr>
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<td>EXHOLD-</td>
<td>-X5</td>
<td>-2</td>
<td></td>
<td>Short-circuit with a jumper header (J6)</td>
</tr>
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<td>EXHOLD+</td>
<td>-X5</td>
<td>-3</td>
<td>Applicable</td>
<td>Used to connect the temporary stop switch of an external device. If the signal is input, the job is stopped. While the signal is input, starting and axis operations are disabled.</td>
</tr>
<tr>
<td>EXHOLD-</td>
<td>-X5</td>
<td>-4</td>
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<tr>
<td>EXDSW1+</td>
<td>-X5</td>
<td>-5</td>
<td>Applicable</td>
<td>External Enable Switch</td>
</tr>
<tr>
<td>EXDSW1-</td>
<td>-X5</td>
<td>-6</td>
<td></td>
<td>Short-circuit with a jumper header (J7, J8)</td>
</tr>
<tr>
<td>EXDSW2+</td>
<td>-X6</td>
<td>-7</td>
<td></td>
<td>Used to connect a Enable switch other than the one on the programming pendant when two people are teaching.</td>
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<tr>
<td>EXDSW2-</td>
<td>-X6</td>
<td>-8</td>
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</tbody>
</table>
13.10 Contact Output of Emergency Stop Button

The contact output terminal for the emergency stop button on the programming pendant is provided on the terminal block -X18 at lower part of the right side of DX100.

This contact output is always valid no matter whether the DX100 main power supply status is ON or OFF. (Status output signal: normally closed contact)

CAUTION

- Do not use the emergency stop button with 24 VDC, 0.5 A or more. Failure to observe this instruction may result in damage to equipment.

Fig. 13-22: Contact Output Terminal Block of Emergency Button (-X18)
13.11 SERVOPACK

A SERVOPACK consists of a converter and a PWM amplifier of which there are two types. One type is the SERVOPACK with a combined converter and a PWM amplifier and the other type is one where both units are separate. (Refer to attached table “SERVOPACK Configuration.”)

13.11.1 Description of Each Unit

13.11.1.1 Converter

This exchanges the power supply (3-phase: 200/220 VAC) supplied by the contactor unit for DC power supply and supplies the power to PWM amplifiers for each axis.

13.11.1.2 PWM Amplifier

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

13.11.2 SERVOPACK Configuration

Table 13-2:

<table>
<thead>
<tr>
<th>Configuration Device</th>
<th>MHS/MHSL</th>
<th>MH6</th>
<th>MA1400</th>
<th>VA1400</th>
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<tr>
<td></td>
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<td>Model</td>
<td>Model</td>
<td>Model</td>
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<tr>
<td>SERVOPACK</td>
<td>JZRCR-YSV01-11</td>
<td>JZRCR-YSV02-11</td>
<td>JZRCR-YSV02-11</td>
<td>JZRCR-YSV02-31</td>
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<td>SRDA-SDA06A01A-E</td>
<td>SRDA-SDA14A01A-E</td>
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<td>SRDA-SDA03A01A-E</td>
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### Table 13-3:

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<thead>
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<th>HP20D</th>
<th>HP20D-6</th>
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<tbody>
<tr>
<td>SERVOPACK</td>
<td>JZRCR-YSV03-11</td>
<td>JZRCR-YSV03-11</td>
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</tr>
<tr>
<td>Converter</td>
<td>SRDA-COA12A01A-E</td>
<td>SRDA-COA12A01A-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PWM Amplifier S</td>
<td>SRDA-SDA14A01A-E</td>
<td>SRDA-SDA14A01A-E</td>
<td></td>
<td></td>
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<td>SRDA-SDA06A01A-E</td>
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<tr>
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### Table 13-4:

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<th>MH50</th>
<th>MH50-20</th>
<th>MH50-35</th>
<th>MS80</th>
<th>VS50</th>
<th>SIA50D</th>
<th>MA1800</th>
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<td>Model</td>
<td></td>
<td></td>
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<tr>
<td>SERVOPACK</td>
<td>JZRCR-YSV04-11</td>
<td>JZRCR-YSV05-11</td>
<td>JZRCR-YSV05-41</td>
<td>JZRCR-YSV08-11</td>
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<td>PWM Amplifier S</td>
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<tr>
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<th>HP165D</th>
<th>ES200D</th>
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<td>SERVOPACK</td>
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<td>JZRCR-YSV06-11</td>
<td>JZRCR-YSV06-11</td>
<td>JZRCR-YSV07-11</td>
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<tr>
<td>PWM Amplifier S</td>
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<td>SRDA-SDA71A01A-E</td>
<td>SRDA-SDA71A01A-E</td>
<td>SRDA-SDA71A01A-E</td>
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<tr>
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<tr>
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<td>SRDA-SDA71A01A-E</td>
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Fig. 13-23: SERVOPACK Configuration for MH5, MH5L, MH6, MA1400, MA1900, HP20D, HP20D-6, HP20RD

Fig. 13-24: SERVOPACK Configuration for VA1400
13 Description of Units and Circuit Boards

13.11 SERVOPACK

Fig. 13-25: SERVOPACK Configuration for MH50, MH50-20, MH50-35, MS80, MA1800

Fig. 13-26: SERVOPACK Configuration for VS50, SIA50D
13 Description of Units and Circuit Boards
13.11 SERVOPACK

Fig. 13-27: SERVOPACK Configuration for ES165D, ES165RD, ES200D, ES200RD, HP165D, UP350D

(EAXA Base is closed)  (EAXA Base is open)
13.12 Universal I/O Signal Assignment

13.12.1 Arc Welding

Fig. 13-28: JZNC-YIU02-E(CN308 Connector) I/O Allocation and Connection Diagram (For Arc Welding)

```
<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Name</th>
<th>Signal</th>
<th>Terminal Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>B1 External Start</td>
<td>N</td>
<td>B1</td>
</tr>
<tr>
<td>20011</td>
<td>A1 -</td>
<td>N</td>
<td>A1</td>
</tr>
<tr>
<td>20012</td>
<td>B2 Call Master Job</td>
<td>N</td>
<td>B2</td>
</tr>
<tr>
<td>20013</td>
<td>A2 Alarm/Error</td>
<td>N</td>
<td>A2</td>
</tr>
<tr>
<td>20014</td>
<td>B3 -</td>
<td>N</td>
<td>B3</td>
</tr>
<tr>
<td>20015</td>
<td>A3 Select Play Mode</td>
<td>N</td>
<td>A3</td>
</tr>
<tr>
<td>20016</td>
<td>B4 Select Teach Mode</td>
<td>N</td>
<td>B4</td>
</tr>
<tr>
<td>20017</td>
<td>A4 -</td>
<td>N</td>
<td>A4</td>
</tr>
<tr>
<td>20020</td>
<td>B5 Remote Mode Selected</td>
<td>N</td>
<td>B5</td>
</tr>
<tr>
<td>20021</td>
<td>A5 Teach Mode Selected</td>
<td>N</td>
<td>A5</td>
</tr>
<tr>
<td>20022</td>
<td>B6 Work Prohibited</td>
<td>N</td>
<td>B6</td>
</tr>
<tr>
<td>20023</td>
<td>A6 Work Response</td>
<td>N</td>
<td>A6</td>
</tr>
<tr>
<td></td>
<td>B7 24VDC</td>
<td></td>
<td>A7 24VDC</td>
</tr>
<tr>
<td></td>
<td>A8 24VDC</td>
<td></td>
<td>A8 24VDC</td>
</tr>
<tr>
<td></td>
<td>B9 Top of Master Job</td>
<td>OUT</td>
<td>B9</td>
</tr>
<tr>
<td></td>
<td>A9 Alarm/Error Occurred</td>
<td>OUT</td>
<td>A9</td>
</tr>
<tr>
<td></td>
<td>B10 Battery Alarm</td>
<td>OUT</td>
<td>B10</td>
</tr>
<tr>
<td></td>
<td>A10 Remote Mode Selected</td>
<td>OUT</td>
<td>A10</td>
</tr>
<tr>
<td></td>
<td>B11 Play Mode Selected</td>
<td>OUT</td>
<td>B11</td>
</tr>
<tr>
<td></td>
<td>A11 Teach Mode Selected</td>
<td>OUT</td>
<td>A11</td>
</tr>
<tr>
<td></td>
<td>B12 In Cube 1</td>
<td>OUT</td>
<td>B12</td>
</tr>
<tr>
<td></td>
<td>A12 In Cube 2</td>
<td>OUT</td>
<td>A12</td>
</tr>
<tr>
<td></td>
<td>B13 Work Home Position</td>
<td>OUT</td>
<td>B13</td>
</tr>
<tr>
<td></td>
<td>A13 Idle S/Off (Sequence Continuing)</td>
<td>OUT</td>
<td>A13</td>
</tr>
<tr>
<td></td>
<td>B14 A14</td>
<td></td>
<td>B14</td>
</tr>
<tr>
<td></td>
<td>A15 A15</td>
<td></td>
<td>A15</td>
</tr>
<tr>
<td></td>
<td>B16 24VDC</td>
<td></td>
<td>B16</td>
</tr>
<tr>
<td></td>
<td>A16 24VDC</td>
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<tr>
<td></td>
<td>B17 24VDC</td>
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<td>B17</td>
</tr>
<tr>
<td></td>
<td>A17 24VDC</td>
<td></td>
<td>A17</td>
</tr>
<tr>
<td></td>
<td>B18 +24VDC</td>
<td></td>
<td>B18</td>
</tr>
<tr>
<td></td>
<td>A18 +24VDC</td>
<td></td>
<td>A18</td>
</tr>
<tr>
<td></td>
<td>B19 +24VDC</td>
<td></td>
<td>B19</td>
</tr>
<tr>
<td></td>
<td>A19 +24VDC</td>
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<td>A19</td>
</tr>
<tr>
<td></td>
<td>B20 FG</td>
<td></td>
<td>B20</td>
</tr>
<tr>
<td></td>
<td>A20 Q24W</td>
<td></td>
<td>A20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
```
### Description of Units and Circuit Boards

#### 13.12 Universal I/O Signal Assignment

**Fig. 13-29: JZNC-YIU02-E (CN309 Connector) I/O Allocation and Connection Diagram (For Arc Welding)**

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Connector Terminal Converter (Optional) Model: TIFS553YS</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>B1</td>
</tr>
<tr>
<td>A1</td>
<td>A1</td>
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<tr>
<td>B2</td>
<td>B2</td>
</tr>
<tr>
<td>B3</td>
<td>B3</td>
</tr>
<tr>
<td>A2</td>
<td>A2</td>
</tr>
<tr>
<td>A3</td>
<td>A3</td>
</tr>
<tr>
<td>B4</td>
<td>B4</td>
</tr>
<tr>
<td>A4</td>
<td>A4</td>
</tr>
<tr>
<td>A5</td>
<td>A5</td>
</tr>
<tr>
<td>B5</td>
<td>B5</td>
</tr>
<tr>
<td>A6</td>
<td>A6</td>
</tr>
<tr>
<td>B6</td>
<td>B6</td>
</tr>
<tr>
<td>A7</td>
<td>A7</td>
</tr>
<tr>
<td>B7</td>
<td>B7</td>
</tr>
<tr>
<td>B8</td>
<td>B8</td>
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<tr>
<td>B9</td>
<td>B9</td>
</tr>
<tr>
<td>A8</td>
<td>A8</td>
</tr>
<tr>
<td>A9</td>
<td>A9</td>
</tr>
</tbody>
</table>

**DX100 I/O Unit (JZNC-YIU02-E)**

- Each Point 24VDC 8mA max.
- Each Point 24VDC 50mA max.
- Internal Power Supply: +24V, 1.5A
- External Power Supply: +24V E

**CN309 Connector**

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Connector Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
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<tbody>
<tr>
<td>20024</td>
<td>B1</td>
<td>IN</td>
<td>024V</td>
</tr>
<tr>
<td>20025</td>
<td>A1</td>
<td>IN</td>
<td>024V</td>
</tr>
<tr>
<td>20026</td>
<td>B2</td>
<td>IN</td>
<td>024V</td>
</tr>
<tr>
<td>20027</td>
<td>A2</td>
<td>IN</td>
<td>024V</td>
</tr>
<tr>
<td>20030</td>
<td>B3</td>
<td>IN01 User Input</td>
<td>024V</td>
</tr>
<tr>
<td>20031</td>
<td>A3</td>
<td>IN02 User Input</td>
<td>024V</td>
</tr>
<tr>
<td>20032</td>
<td>B4</td>
<td>IN03 User Input</td>
<td>024V</td>
</tr>
<tr>
<td>20033</td>
<td>A4</td>
<td>IN04 User Input</td>
<td>024V</td>
</tr>
<tr>
<td>20034</td>
<td>B5</td>
<td>IN05 User Input</td>
<td>024V</td>
</tr>
<tr>
<td>20035</td>
<td>A5</td>
<td>IN06 User Input</td>
<td>024V</td>
</tr>
<tr>
<td>20036</td>
<td>B6</td>
<td>IN07 User Input</td>
<td>024V</td>
</tr>
<tr>
<td>20037</td>
<td>A6</td>
<td>IN08 User Input</td>
<td>024V</td>
</tr>
</tbody>
</table>

- IN01 User Input: Gas Shortage (Monitor) OUT
- IN02 User Input: Wire Shortage (Monitor) OUT
- IN03 User Input: Wire Sticking (Monitor) OUT
- IN04 User Input: Arc Shortage (Monitor) OUT
- IN05 User Input: OUT01 User Output OUT
- IN06 User Input: OUT02 User Output OUT
- IN07 User Input: OUT03 User Output OUT
- IN08 User Input: OUT04 User Output OUT

**CN303 I/O Unit**

- Internal Power Supply: +24V, 1.5A

- Terminal Numbers:
  - A1, A2, A3, A4, A5, A6, A7, A8
  - B1, B2, B3, B4, B5, B6, B7, B8

- Jumper-Pins Note:
  - Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.

---

* Diagram showing I/O allocation and connection details for DX100 I/O Unit (JZNC-YIU02-E) with CN309 Connector and CN303 I/O Unit.*
### Universal I/O Signal Assignment

**Fig. 13-30: JZNC-YIU02-E (CN306 Connector) I/O Allocation and Connection Diagram (For Arc Welding)**

<table>
<thead>
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<tbody>
<tr>
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<td>20341</td>
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<td>20342</td>
<td>IN11</td>
<td>User Input</td>
</tr>
<tr>
<td>20343</td>
<td>IN12</td>
<td>User Input</td>
</tr>
<tr>
<td>20344</td>
<td>IN13</td>
<td>User Input</td>
</tr>
<tr>
<td>20345</td>
<td>IN14</td>
<td>User Input</td>
</tr>
<tr>
<td>20346</td>
<td>IN15</td>
<td>User Input</td>
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<tr>
<td>20347</td>
<td>IN16</td>
<td>User Input</td>
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<td>OUT09</td>
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<td>20349</td>
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<td>20350</td>
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<td>20354</td>
<td>OUT15</td>
<td>User Output</td>
</tr>
<tr>
<td>20355</td>
<td>OUT16</td>
<td>User Output</td>
</tr>
</tbody>
</table>

**Connector Terminal Converter (Optional)**

Model: TIFS553YS

* Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
13.12 Universal I/O Signal Assignment

**DX100**

**I/O Unit (JZNC-YIU02-E)**

**CN307 Connector**

<table>
<thead>
<tr>
<th>Signal Number</th>
<th>Connector Terminal Converter (Optional)</th>
</tr>
</thead>
<tbody>
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<td>Signal Number</td>
<td>Model: TIFS553YS</td>
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<tr>
<td>20050 B1</td>
<td>B1</td>
</tr>
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<td>20051 A1</td>
<td>A1</td>
</tr>
<tr>
<td>20052 A2</td>
<td>A2</td>
</tr>
<tr>
<td>20053 A3</td>
<td>A3</td>
</tr>
<tr>
<td>20054 A4</td>
<td>A4</td>
</tr>
<tr>
<td>20055 A5</td>
<td>A5</td>
</tr>
<tr>
<td>20056 A6</td>
<td>A6</td>
</tr>
<tr>
<td>20057 A7</td>
<td>A7</td>
</tr>
</tbody>
</table>

**Each Point 24VDC 8mA max.**

- Each Point 24VDC 8mA max.

**Internal Power Supply**

- +24V (024 V (24V.1.5A))

**External Power Supply**

- +24V

**CN303**

- 1: 24V (24V.1.5A)
- 2: 024 V

**Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.**

---

*Fig. 13-31: JZNC-YIU02-E (CN307 Connector) I/O Allocation and Connection Diagram (For Arc Welding)*

---

**DX100**

**Connector Terminal Converter (Optional)**

Model: TIFS553YS

<table>
<thead>
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<th>Signal Number</th>
<th>Connector Terminal Converter (Optional)</th>
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</thead>
<tbody>
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<td>Model: TIFS553YS</td>
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<tr>
<td>20051 A1</td>
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</tr>
<tr>
<td>20052 A2</td>
<td>A2</td>
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<td>A3</td>
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</tr>
<tr>
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<td>A6</td>
</tr>
<tr>
<td>20057 A7</td>
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</table>

**Each Point 24VDC 500mA max.**

- Each Point 24VDC 500mA max.

---

*Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.*
## Table 13-6: Specific Input (Arc Welding)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
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<tr>
<td></td>
<td>Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job(^1). This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).</td>
</tr>
<tr>
<td>20013</td>
<td>ALARM/ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE</td>
</tr>
<tr>
<td></td>
<td>The play mode is selected when the mode key on the programming pendant is set at &quot;REMOTE&quot;. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE</td>
</tr>
<tr>
<td></td>
<td>The teach mode is selected when the mode key of the programming pendant is set at &quot;REMOTE&quot;. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube (^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube (^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20022</td>
<td>WORK PROHIBITED (Arc Generation Prohibited)</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>20023</td>
<td>WORK RESPONSE (Pseudo Arc ON Response)</td>
</tr>
<tr>
<td></td>
<td>This signal is used as a pseudo signal in cases that &quot;Arc Generation Confirmation&quot; signal is not equipped on a welding power supply. Wire this signal ON normally (short to OV).</td>
</tr>
<tr>
<td>20026</td>
<td>WEAVING PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>Weaving is prohibited while this signal is ON. Use this signal to check taught steps and movements without performing the weaving operation.</td>
</tr>
<tr>
<td>20027</td>
<td>SENSING PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>Arc sensing is prohibited while this signal is ON. Use this signal to check taught steps and movements if an arc sensor is mounted.</td>
</tr>
</tbody>
</table>

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

\(^2\) See Section 8.6 “Interference Area” on page 8-56.
### Table 13-7: Specific Output (Arc Welding)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>RUNNING</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td>SERVO IS ON</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX100 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td>TOP OF MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called. 1)</td>
</tr>
<tr>
<td>30013</td>
<td>ALARM/ERROR OCCURRED</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td>BATTERY ALARM</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td>REMOTE/PLAY/TEACH MODE SELECTED</td>
</tr>
<tr>
<td></td>
<td>These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td>IN CUBE 1</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td>IN CUBE 2</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td>WORK HOME POSITION (IN CUBE 32) 2)</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.</td>
</tr>
<tr>
<td>30023</td>
<td>INTERMEDIATE START OK</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30024</td>
<td>GAS SHORTAGE (MONITOR)</td>
</tr>
<tr>
<td></td>
<td>This signal stays ON while the gas shortage signal from the welding power supply is ON.</td>
</tr>
<tr>
<td>30025</td>
<td>WIRE SHORTAGE (MONITOR)</td>
</tr>
<tr>
<td></td>
<td>This signal status ON while the wire shortage signal from the welding power supply is ON.</td>
</tr>
<tr>
<td>30026</td>
<td>WIRE STICKING (MONITOR)</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>30027</td>
<td>ARC SHORTAGE (MONITOR)</td>
</tr>
<tr>
<td></td>
<td>This signal stays ON while the arc shortage signal from the welding power supply is ON.</td>
</tr>
</tbody>
</table>

1) This signal is not output during operation.
2) The work home position cube and Cube 32 are same.
### 13.12 Universal I/O Signal Assignment

#### 13.12.2 Handling

*Fig. 13-32: JZNC-YIU02-E (CN308 Connector) I/O Allocation and Connection Diagram (For Handling)*

**DX100**

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Signal</th>
<th>Name</th>
<th>Number</th>
<th>Connector Terminal Converter (Optional) Model: TIFS553YS</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>B1</td>
<td>External Start</td>
<td>IN</td>
<td>B1</td>
</tr>
<tr>
<td>20011</td>
<td>A1</td>
<td>-</td>
<td>IN</td>
<td>A1</td>
</tr>
<tr>
<td>20012</td>
<td>B2</td>
<td>Call Master Job</td>
<td>IN</td>
<td>B2</td>
</tr>
<tr>
<td>20013</td>
<td>A2</td>
<td>Alarm/Error Reset</td>
<td>IN</td>
<td>A2</td>
</tr>
<tr>
<td>20014</td>
<td>B3</td>
<td>-</td>
<td>IN</td>
<td>B3</td>
</tr>
<tr>
<td>20015</td>
<td>A3</td>
<td>Select Play Mode</td>
<td>IN</td>
<td>A3</td>
</tr>
<tr>
<td>20016</td>
<td>B4</td>
<td>Select Teach Mode</td>
<td>IN</td>
<td>B4</td>
</tr>
<tr>
<td>20017</td>
<td>A4</td>
<td>-</td>
<td>IN</td>
<td>A4</td>
</tr>
<tr>
<td>20020</td>
<td>B5</td>
<td>Interference Entrance</td>
<td>IN</td>
<td>B5</td>
</tr>
<tr>
<td>20021</td>
<td>A5</td>
<td>Interference Entrance</td>
<td>IN</td>
<td>A5</td>
</tr>
<tr>
<td>20022</td>
<td>B6</td>
<td>-</td>
<td>IN</td>
<td>B6</td>
</tr>
<tr>
<td>20023</td>
<td>A6</td>
<td>-</td>
<td>IN</td>
<td>A6</td>
</tr>
<tr>
<td>20024</td>
<td>B7</td>
<td>024Vr</td>
<td></td>
<td>A7</td>
</tr>
<tr>
<td>20025</td>
<td>A7</td>
<td>024Vr</td>
<td></td>
<td>A7</td>
</tr>
<tr>
<td>30010</td>
<td>B6</td>
<td>Running</td>
<td>0xT</td>
<td>B6</td>
</tr>
<tr>
<td>30011</td>
<td>A8</td>
<td>Sensor CN</td>
<td>0xT</td>
<td>A8</td>
</tr>
<tr>
<td>30012</td>
<td>B9</td>
<td>Top of Master Job</td>
<td>0xT</td>
<td>B9</td>
</tr>
<tr>
<td>30013</td>
<td>A9</td>
<td>Alarm/Error Occurred</td>
<td>0xT</td>
<td>A9</td>
</tr>
<tr>
<td>30014</td>
<td>B10</td>
<td>Battery Alarm</td>
<td>0xT</td>
<td>B10</td>
</tr>
<tr>
<td>30015</td>
<td>A10</td>
<td>Remote Mode Selected</td>
<td>0xT</td>
<td>A10</td>
</tr>
<tr>
<td>30016</td>
<td>B11</td>
<td>Play Mode Selected</td>
<td>0xT</td>
<td>B11</td>
</tr>
<tr>
<td>30017</td>
<td>A11</td>
<td>Teach Mode Selected</td>
<td>0xT</td>
<td>A11</td>
</tr>
<tr>
<td>30020</td>
<td>B12</td>
<td>In Cube 1</td>
<td>0xT</td>
<td>B12</td>
</tr>
<tr>
<td>30021</td>
<td>A12</td>
<td>In Cube 2</td>
<td>0xT</td>
<td>A12</td>
</tr>
<tr>
<td>30022</td>
<td>B13</td>
<td>Work Home Position</td>
<td>0xT</td>
<td>B13</td>
</tr>
<tr>
<td>30030</td>
<td>A13</td>
<td>Sequence Continuing</td>
<td>0xT</td>
<td>A13</td>
</tr>
<tr>
<td>30033</td>
<td>B14</td>
<td>-</td>
<td>0xT</td>
<td>B14</td>
</tr>
<tr>
<td></td>
<td>A14</td>
<td>-</td>
<td>0xT</td>
<td>A14</td>
</tr>
<tr>
<td></td>
<td>B15</td>
<td>-</td>
<td></td>
<td>B15</td>
</tr>
<tr>
<td></td>
<td>A15</td>
<td>-</td>
<td></td>
<td>A15</td>
</tr>
<tr>
<td></td>
<td>B16</td>
<td>024Vr</td>
<td></td>
<td>B16</td>
</tr>
<tr>
<td></td>
<td>A16</td>
<td>024Vr</td>
<td></td>
<td>A16</td>
</tr>
<tr>
<td></td>
<td>B17</td>
<td>024Vr</td>
<td></td>
<td>B17</td>
</tr>
<tr>
<td></td>
<td>A17</td>
<td>024Vr</td>
<td></td>
<td>A17</td>
</tr>
<tr>
<td></td>
<td>B18</td>
<td>024Vr</td>
<td></td>
<td>B18</td>
</tr>
<tr>
<td></td>
<td>A18</td>
<td>024Vr</td>
<td></td>
<td>A18</td>
</tr>
<tr>
<td></td>
<td>B19</td>
<td>024Vr</td>
<td></td>
<td>B19</td>
</tr>
<tr>
<td></td>
<td>A19</td>
<td>024Vr</td>
<td></td>
<td>A19</td>
</tr>
<tr>
<td></td>
<td>B20</td>
<td>F6</td>
<td></td>
<td>B20</td>
</tr>
<tr>
<td></td>
<td>A20</td>
<td>F6</td>
<td></td>
<td>A20</td>
</tr>
</tbody>
</table>

*Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.*
Fig. 13-33: JZNC-YIU02-E (CN309 Connector) I/O Allocation and Connection Diagram (For Handling)

DX100

I/O Unit (JZNC-YIU02-E)

CN309 Connector

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Terminal Letter</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>20024</td>
<td>B1</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>20025</td>
<td>A1</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>20026</td>
<td>B2</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>20027</td>
<td>A2</td>
<td>Low Pressure</td>
<td>N</td>
</tr>
<tr>
<td>20030</td>
<td>B3</td>
<td>N03</td>
<td>User Input</td>
</tr>
<tr>
<td>20031</td>
<td>A3</td>
<td>N02</td>
<td>User Input</td>
</tr>
<tr>
<td>20032</td>
<td>B4</td>
<td>N01</td>
<td>User Input</td>
</tr>
<tr>
<td>20033</td>
<td>A4</td>
<td>N04</td>
<td>User Input</td>
</tr>
<tr>
<td>20034</td>
<td>B5</td>
<td>N05</td>
<td>User Input</td>
</tr>
<tr>
<td>20035</td>
<td>A5</td>
<td>N06</td>
<td>User Input</td>
</tr>
<tr>
<td>20036</td>
<td>B6</td>
<td>N07</td>
<td>User Input</td>
</tr>
<tr>
<td>20037</td>
<td>A6</td>
<td>N08</td>
<td>User Input</td>
</tr>
<tr>
<td>30004</td>
<td>B8</td>
<td>-</td>
<td>O1/3</td>
</tr>
<tr>
<td>30025</td>
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<td>-</td>
<td>O1/3</td>
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<tr>
<td>30026</td>
<td>B9</td>
<td>-</td>
<td>O1/3</td>
</tr>
<tr>
<td>30027</td>
<td>A9</td>
<td>-</td>
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<td>B10</td>
<td>OUT1</td>
<td>User Output</td>
</tr>
<tr>
<td>30031</td>
<td>A10</td>
<td>OUT2</td>
<td>User Output</td>
</tr>
<tr>
<td>30032</td>
<td>B11</td>
<td>OUT3</td>
<td>User Output</td>
</tr>
<tr>
<td>30033</td>
<td>A11</td>
<td>OUT4</td>
<td>User Output</td>
</tr>
<tr>
<td>30034</td>
<td>B12</td>
<td>OUT5</td>
<td>User Output</td>
</tr>
<tr>
<td>30035</td>
<td>A12</td>
<td>OUT6</td>
<td>User Output</td>
</tr>
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<td>30036</td>
<td>B13</td>
<td>OUT7</td>
<td>User Output</td>
</tr>
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<td>30037</td>
<td>A13</td>
<td>OUT8</td>
<td>User Output</td>
</tr>
<tr>
<td>30038</td>
<td>B14</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>30039</td>
<td>A14</td>
<td>-</td>
<td></td>
</tr>
<tr>
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<td>B15</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>30041</td>
<td>A15</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>30042</td>
<td>B16</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30043</td>
<td>A16</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30044</td>
<td>B17</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30045</td>
<td>A17</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30046</td>
<td>B18</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30047</td>
<td>A18</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30048</td>
<td>B19</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30049</td>
<td>A19</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30050</td>
<td>B20</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>30051</td>
<td>A20</td>
<td>+24V</td>
<td></td>
</tr>
</tbody>
</table>

* Remove the jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.

Connector Terminal Converter (Optional)

Model: TIFS553YS

<table>
<thead>
<tr>
<th>Internal Power Supply</th>
<th>+24V</th>
<th>-24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-24V</td>
<td></td>
</tr>
</tbody>
</table>

Each Point 24VDC 8mA max.

Each Point 24VDC 50mA max.
### Description of Units and Circuit Boards

#### 13.12 Universal I/O Signal Assignment

**DX100**

**Fig. 13-34: JZNC-YIU02-E (CN306 Connector) I/O Allocation and Connection Diagram (For Handling)**

* Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
### Description of Units and Circuit Boards

#### 13.12 Universal I/O Signal Assignment

#### Fig. 13-35: JZNC-YIU02-E (CN307 Connector) I/O Allocation and Connection Diagram (For Handling)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Logical Number</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>20050</td>
<td>A1</td>
<td>Sensor Input 1</td>
</tr>
<tr>
<td>20051</td>
<td>A2</td>
<td>Sensor Input 2</td>
</tr>
<tr>
<td>20052</td>
<td>A3</td>
<td>Sensor Input 3</td>
</tr>
<tr>
<td>20053</td>
<td>A4</td>
<td>Sensor Input 4</td>
</tr>
<tr>
<td>20054</td>
<td>A5</td>
<td>Sensor Input 5</td>
</tr>
<tr>
<td>20055</td>
<td>A6</td>
<td>Sensor Input 6</td>
</tr>
<tr>
<td>20056</td>
<td>A7</td>
<td>Sensor Input 7</td>
</tr>
<tr>
<td>20057</td>
<td>A8</td>
<td>Sensor Input 8</td>
</tr>
</tbody>
</table>

Each Point 24VDC 8mA max.

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Logical Number</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>24VDC</td>
<td>024W</td>
<td>Sensor Input 8</td>
</tr>
<tr>
<td>024W</td>
<td>A7</td>
<td>Sensor Input 7</td>
</tr>
<tr>
<td>024W</td>
<td>A6</td>
<td>Sensor Input 6</td>
</tr>
<tr>
<td>024W</td>
<td>A5</td>
<td>Sensor Input 5</td>
</tr>
</tbody>
</table>

Each Point 24VDC 500mA max.

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Logical Number</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>24VDC</td>
<td>024W</td>
<td>Sensor Input 4</td>
</tr>
<tr>
<td>024W</td>
<td>A4</td>
<td>Sensor Input 3</td>
</tr>
<tr>
<td>024W</td>
<td>A3</td>
<td>Sensor Input 2</td>
</tr>
<tr>
<td>024W</td>
<td>A2</td>
<td>Sensor Input 1</td>
</tr>
</tbody>
</table>

**Hand Valve**

- 1-1-1: Hand Valve 1-1-
- 1-1+: Hand Valve 1-1+
- 1-2-: Hand Valve 1-2-
- 1-2+: Hand Valve 1-2+

**Sensor Input**

- 1: Sensor Input 1
- 2: Sensor Input 2
- 3: Sensor Input 3
- 4: Sensor Input 4
- 5: Sensor Input 5
- 6: Sensor Input 6
- 7: Sensor Input 7
- 8: Sensor Input 8

**Internal Power Supply**

+24V, 1.5A

**External Power Supply**

+24V

---

*Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.*
### Table 13-8: Specific Input (Handling)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START</td>
</tr>
<tr>
<td></td>
<td>Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).</td>
</tr>
<tr>
<td>20013</td>
<td>ALARM/ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE</td>
</tr>
<tr>
<td></td>
<td>The play mode is selected when the mode key on the programming pendant is set at &quot;REMOTE&quot;. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE</td>
</tr>
<tr>
<td></td>
<td>The teach mode is selected when the mode key of the programming pendant is set at &quot;REMOTE&quot;. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20026</td>
<td>TOOL SHOCK SENSOR</td>
</tr>
<tr>
<td></td>
<td>This is normally ON (NC) signal input. When it turns OFF, the DX100 displays a message &quot;HAND TOOL SHOCK SENSOR OPERATING&quot; 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.</td>
</tr>
<tr>
<td>20027</td>
<td>LOW AIR PRESSURE</td>
</tr>
<tr>
<td></td>
<td>This signal is normally OFF (NO). When it turns ON, the DX100 displays user alarm in the PLAY mode or displays user message in the teach mode.</td>
</tr>
<tr>
<td>20050 to 20057</td>
<td>SENSOR INPUT 1 - 8</td>
</tr>
<tr>
<td></td>
<td>Inputs 1 to 8 are monitored with the HSEN handling specific instructions. Sensor inputs 1 to 8 correspond to HSEN 1 to 8.</td>
</tr>
</tbody>
</table>

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

2 See Section 8.6 “Interference Area” on page 8-56.
Table 13-9: Specific Output (Handling)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>RUNNING</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td>SERVO IS ON</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX100 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td>TOP OF MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.</td>
</tr>
<tr>
<td>30013</td>
<td>ALARM/ERROR OCCURRED</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td>BATTERY ALARM</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td>REMOTE/PLAY/TEACH MODE SELECTED</td>
</tr>
<tr>
<td></td>
<td>These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td>IN CUBE 1</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td>IN CUBE 2</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td>WORK HOME POSITION (IN CUBE 32)</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.</td>
</tr>
<tr>
<td>30023</td>
<td>INTERMEDIATE START OK</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30050 to 30057</td>
<td>HAND VALVE 1-4</td>
</tr>
<tr>
<td></td>
<td>These outputs are controlled by the HAND handling specific instructions. Hand valves 1 to 4 correspond to HAND 1 to 4.</td>
</tr>
</tbody>
</table>

1 This signal is not output during operation.
2 The work home position cube and Cube 32 are same.
13.12.3 General Application

Fig. 13-36: JZNC-YIU02-E (CN308 Connector) I/O Allocation and Connection Diagram (For General Application)

* Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
Fig. 13-37: JZNC-YIU02-E (CN309 Connector) I/O Allocation and Connection Diagram (For General Application)

* Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
13 Description of Units and Circuit Boards
13.12 Universal I/O Signal Assignment

Fig. 13-38: JZNC-YIU02-E (CN306 Connector) I/O Allocation and Connection Diagram (General Application)

* Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
Fig. 13-39: JZNC-YIU02-E (CN307 Connector) I/O Allocation and Connection Diagram (For General Application)

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Logical Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>20005</td>
<td>B1</td>
<td>N17</td>
<td>IN</td>
</tr>
<tr>
<td>20005</td>
<td>B1</td>
<td>N18</td>
<td>IN</td>
</tr>
<tr>
<td>20005</td>
<td>B2</td>
<td>N19</td>
<td>IN</td>
</tr>
<tr>
<td>20005</td>
<td>B3</td>
<td>N20</td>
<td>IN</td>
</tr>
<tr>
<td>20005</td>
<td>B4</td>
<td>N21</td>
<td>IN</td>
</tr>
<tr>
<td>20005</td>
<td>A4</td>
<td>N22</td>
<td>IN</td>
</tr>
<tr>
<td>20005</td>
<td>B5</td>
<td>N23</td>
<td>IN</td>
</tr>
<tr>
<td>20005</td>
<td>A5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20005</td>
<td>B6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20005</td>
<td>A6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20005</td>
<td>B7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20005</td>
<td>A7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20005</td>
<td>B8</td>
<td>01T17</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>A8</td>
<td>01T17</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>B9</td>
<td>01T18</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>A9</td>
<td>01T18</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>B10</td>
<td>01T19</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>A10</td>
<td>01T19</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>B11</td>
<td>01T20</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>A11</td>
<td>01T20</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>B12</td>
<td>01T21</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>A12</td>
<td>01T21</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>B13</td>
<td>01T22</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>A13</td>
<td>01T22</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>B14</td>
<td>01T23</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>A14</td>
<td>01T23</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>B15</td>
<td>01T24</td>
<td>OUT</td>
</tr>
<tr>
<td>20005</td>
<td>A15</td>
<td>01T24</td>
<td>OUT</td>
</tr>
</tbody>
</table>

* Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
Table 13-10: Specific Input (General application)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START</td>
</tr>
<tr>
<td></td>
<td>Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job(^1). This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).</td>
</tr>
<tr>
<td>20013</td>
<td>ALARM/ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE</td>
</tr>
<tr>
<td></td>
<td>The play mode is selected when the mode key on the programming pendant is set at &quot;REMOTE&quot;. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE</td>
</tr>
<tr>
<td></td>
<td>The teach mode is selected when the mode key of the programming pendant is set at &quot;REMOTE&quot;. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube 1(^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube 2(^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20022</td>
<td>WORK PROHIBITED (Tool ON Prohibited)</td>
</tr>
<tr>
<td></td>
<td>Even if TOOLON instruction is executed, the DX100 doesn't output to external while this signal is ON.</td>
</tr>
<tr>
<td>20024</td>
<td>INTERFERENCE 3 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube 3(^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20025</td>
<td>INTERFERENCE 4 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube 4(^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
</tbody>
</table>

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

2 See Section 8.6 “Interference Area” on page 8-56.
## Description of Units and Circuit Boards
### 13.12 Universal I/O Signal Assignment

#### Table 13-11: Specific Output (General application)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>RUNNING</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td>SERVO IS ON</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for the DX100 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td>TOP OF MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called. ¹</td>
</tr>
<tr>
<td>30013</td>
<td>ALARM/ERROR OCCURRED</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td>BATTERY ALARM</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td>REMOTE/PLAY/TEACH MODE SELECTED</td>
</tr>
<tr>
<td></td>
<td>This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td>IN CUBE 1</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td>IN CUBE 2</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td>WORK HOME POSITION (IN CUBE 32)²</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the robot is in the start position.</td>
</tr>
<tr>
<td>30023</td>
<td>INTERMEDIATE START OK</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30024</td>
<td>IN CUBE 3</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30025</td>
<td>IN CUBE 4</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30026</td>
<td>WORK COMMAND</td>
</tr>
<tr>
<td></td>
<td>This signal provides the command for the general tool to operate. TOOL ON instruction execution or the [TOOL ON] key in the programming pendant turns this signal ON and TOOL OFF instruction execution or the [TOOL OFF] key in the programming pendant turns it OFF. However, it remains OFF while the WORK PROHIBITED signal (2022) is input or while the robot is stopped.</td>
</tr>
</tbody>
</table>

---

¹ This signal is not output during operation.
² The work home position cube and Cube 32 are same.
13.12.4 Spot Welding

*Fig. 13-40: JZNC-YIU02-E (CN308 Connector) I/O Allocation and Connection Diagram (For Spot Welding)*

Each Point 24VDC 8mA max.

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Name Signal</th>
<th>IN/OUT</th>
<th>Pin Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>B1</td>
<td>IN</td>
<td>1</td>
</tr>
<tr>
<td>20011</td>
<td>A1</td>
<td>IN</td>
<td>2</td>
</tr>
<tr>
<td>20012</td>
<td>B2</td>
<td>IN</td>
<td>3</td>
</tr>
<tr>
<td>20013</td>
<td>A2</td>
<td>IN</td>
<td>4</td>
</tr>
<tr>
<td>20014</td>
<td>B3</td>
<td>IN</td>
<td>5</td>
</tr>
<tr>
<td>20015</td>
<td>A3</td>
<td>IN</td>
<td>6</td>
</tr>
<tr>
<td>20016</td>
<td>B4</td>
<td>IN</td>
<td>7</td>
</tr>
<tr>
<td>20017</td>
<td>A4</td>
<td>IN</td>
<td>8</td>
</tr>
<tr>
<td>20018</td>
<td>B5</td>
<td>IN</td>
<td>9</td>
</tr>
<tr>
<td>20019</td>
<td>A5</td>
<td>IN</td>
<td>10</td>
</tr>
<tr>
<td>20020</td>
<td>B6</td>
<td>IN</td>
<td>11</td>
</tr>
<tr>
<td>20021</td>
<td>A6</td>
<td>IN</td>
<td>12</td>
</tr>
<tr>
<td>20022</td>
<td>B7</td>
<td>IN</td>
<td>13</td>
</tr>
<tr>
<td>20023</td>
<td>A8</td>
<td>IN</td>
<td>14</td>
</tr>
</tbody>
</table>

*Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.*
13 Description of Units and Circuit Boards
13.12 Universal I/O Signal Assignment

Fig. 13-41: JZNC-YIU02-E (CN309 Connector) I/O Allocation and Connection Diagram (For Spot Welding)

DX100

I/O Unit (JZNC-YIU02-E) CN309 Connector

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Connector Terminal Converter</th>
</tr>
</thead>
<tbody>
<tr>
<td>20024 B1</td>
<td>Internal Power Supply</td>
</tr>
<tr>
<td>20025 A1</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20026 B2</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20027 A2</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20030 A3</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20031 A4</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20032 A5</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20033 A6</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20034 A7</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20035 A8</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20036 A9</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20037 A10</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20038 A11</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20039 A12</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20040 A13</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20041 A14</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20042 A15</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20043 A16</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20044 A17</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20045 A18</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20046 A19</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
<tr>
<td>20047 A20</td>
<td>+24 V 024 V (24V,1.5A)</td>
</tr>
</tbody>
</table>

Each Point 24VDC 8mA max.

- Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
13 Description of Units and Circuit Boards
13.12 Universal I/O Signal Assignment

Fig. 13-42: JZNC-YIU02-E (CN306 Connector) I/O Allocation and Connection Diagram (For Spot Welding)

DX100

I/O Unit (JZNC-YIU02-E) - CN306 Connector

<table>
<thead>
<tr>
<th>Local Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>20040</td>
<td>B1</td>
<td>IN</td>
</tr>
<tr>
<td>20041</td>
<td>A1</td>
<td>IN</td>
</tr>
<tr>
<td>20042</td>
<td>B2</td>
<td>IN</td>
</tr>
<tr>
<td>20043</td>
<td>A2</td>
<td>IN</td>
</tr>
<tr>
<td>20044</td>
<td>B3</td>
<td>IN</td>
</tr>
<tr>
<td>20045</td>
<td>A3</td>
<td>IN</td>
</tr>
<tr>
<td>20046</td>
<td>B4</td>
<td>IN</td>
</tr>
<tr>
<td>20047</td>
<td>A4</td>
<td>IN</td>
</tr>
</tbody>
</table>

I/O Unit (JZNC-YIU02-E) - CN306 Connector

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B1</td>
<td>OUT</td>
</tr>
<tr>
<td>2</td>
<td>B2</td>
<td>OUT</td>
</tr>
<tr>
<td>3</td>
<td>B3</td>
<td>OUT</td>
</tr>
<tr>
<td>4</td>
<td>B4</td>
<td>OUT</td>
</tr>
<tr>
<td>5</td>
<td>B5</td>
<td>OUT</td>
</tr>
</tbody>
</table>

Internal Power Supply +24V (24V/1.5A)

External Power Supply +24V (24V/1.5A)

CN303

* Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
13 Description of Units and Circuit Boards
13.12 Universal I/O Signal Assignment

Fig. 13-43: JZNC-YIU02-E (CN307 Connector) I/O Allocation and Connection Diagram (For Spot Welding)

DX100

I/O Unit (JZNC-YIU02-E)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>20050</td>
<td>B1</td>
<td>IN</td>
</tr>
<tr>
<td>20051</td>
<td>A1</td>
<td>IN</td>
</tr>
<tr>
<td>20052</td>
<td>B2</td>
<td>IN</td>
</tr>
<tr>
<td>20053</td>
<td>A2</td>
<td>IN</td>
</tr>
<tr>
<td>20054</td>
<td>B3</td>
<td>IN</td>
</tr>
<tr>
<td>20055</td>
<td>A3</td>
<td>IN</td>
</tr>
<tr>
<td>20056</td>
<td>B4</td>
<td>IN</td>
</tr>
<tr>
<td>20057</td>
<td>A4</td>
<td>IN</td>
</tr>
<tr>
<td>20058</td>
<td>B5</td>
<td>IN</td>
</tr>
<tr>
<td>20059</td>
<td>A5</td>
<td>IN</td>
</tr>
<tr>
<td>20060</td>
<td>B6</td>
<td>IN</td>
</tr>
<tr>
<td>20061</td>
<td>A6</td>
<td>IN</td>
</tr>
<tr>
<td>20062</td>
<td>B7</td>
<td>IN</td>
</tr>
<tr>
<td>20063</td>
<td>A7</td>
<td>IN</td>
</tr>
<tr>
<td>20064</td>
<td>B8</td>
<td>OUT</td>
</tr>
<tr>
<td>20065</td>
<td>A8</td>
<td>OUT</td>
</tr>
<tr>
<td>20066</td>
<td>B9</td>
<td>OUT</td>
</tr>
<tr>
<td>20067</td>
<td>A9</td>
<td>OUT</td>
</tr>
<tr>
<td>20068</td>
<td>B10</td>
<td>OUT</td>
</tr>
<tr>
<td>20069</td>
<td>A10</td>
<td>OUT</td>
</tr>
<tr>
<td>20070</td>
<td>B11</td>
<td>OUT</td>
</tr>
<tr>
<td>20071</td>
<td>A11</td>
<td>OUT</td>
</tr>
<tr>
<td>20072</td>
<td>B12</td>
<td>OUT</td>
</tr>
<tr>
<td>20073</td>
<td>A12</td>
<td>OUT</td>
</tr>
<tr>
<td>20074</td>
<td>B13</td>
<td>OUT</td>
</tr>
<tr>
<td>20075</td>
<td>A13</td>
<td>OUT</td>
</tr>
<tr>
<td>20076</td>
<td>B14</td>
<td>OUT</td>
</tr>
<tr>
<td>20077</td>
<td>A14</td>
<td>OUT</td>
</tr>
<tr>
<td>20078</td>
<td>B15</td>
<td>OUT</td>
</tr>
<tr>
<td>20079</td>
<td>A15</td>
<td>OUT</td>
</tr>
<tr>
<td>20080</td>
<td>B16</td>
<td>OUT</td>
</tr>
<tr>
<td>20081</td>
<td>A16</td>
<td>OUT</td>
</tr>
<tr>
<td>20082</td>
<td>B17</td>
<td>OUT</td>
</tr>
<tr>
<td>20083</td>
<td>A17</td>
<td>OUT</td>
</tr>
<tr>
<td>20084</td>
<td>B18</td>
<td>OUT</td>
</tr>
<tr>
<td>20085</td>
<td>A18</td>
<td>OUT</td>
</tr>
<tr>
<td>20086</td>
<td>B19</td>
<td>OUT</td>
</tr>
<tr>
<td>20087</td>
<td>A19</td>
<td>OUT</td>
</tr>
<tr>
<td>20088</td>
<td>B20</td>
<td>OUT</td>
</tr>
<tr>
<td>20089</td>
<td>A20</td>
<td>OUT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connector Terminal Converter (Optional) Model: TIFS550YS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal Number</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

- Each Point 24VDC 8mA max.
- Each Point 24VDC 500mA max.
- Remove the Jumper-pins between CN303-1 to -3, CN303-2 to -4 when the external power supply is used.
- **This assignment can be changed at the I/O assignment display. Refer to Specific Input list and Specific Output list for detail.
- ***This assignment can be changed at the PSEDU input display. Refer to Specific Input list and Specific Output list for detail.
- * means internal relay
- + means 24VDC 500mA max.
- +24VU means 24VDC 1.5A max.
### Table 13-12: Specific Input (Spot Welding) (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START</td>
</tr>
<tr>
<td></td>
<td>Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job. This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).</td>
</tr>
<tr>
<td>20013</td>
<td>ALARM/ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE</td>
</tr>
<tr>
<td></td>
<td>The play mode is selected when the mode key on the programming pendant is set at &quot;REMOTE&quot;. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE</td>
</tr>
<tr>
<td></td>
<td>The teach mode is selected when the mode key of the programming pendant is set at &quot;REMOTE&quot;. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20022</td>
<td>WELDING ON/OFF (From sequencer)</td>
</tr>
<tr>
<td></td>
<td>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 manipulator status.</td>
</tr>
<tr>
<td>20023</td>
<td>WELDING PAUSE (From sequencer)</td>
</tr>
<tr>
<td></td>
<td>This signal is used to move the manipulator 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.</td>
</tr>
<tr>
<td>20024</td>
<td>INTERFERENCE 3 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20025</td>
<td>INTERFERENCE 4 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20050</td>
<td>TIMER COOLING WATER ERROR</td>
</tr>
<tr>
<td></td>
<td>This signal monitors the status of timer cooling water. The manipulator displays alarm and stops when this signal is input. The servo power remains ON.</td>
</tr>
<tr>
<td>20051</td>
<td>GUN COOLING WATER ERROR</td>
</tr>
<tr>
<td></td>
<td>This signal monitors the status of gun cooling water. The manipulator displays alarm and stops when this signal is input. The servo power supply remains ON.</td>
</tr>
</tbody>
</table>
13 Description of Units and Circuit Boards
13.12 Universal I/O Signal Assignment

Table 13-12: Specific Input (Spot Welding) (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
</table>
| 20052 3) | TRANSTHERMO ERROR  
Error signal is sent from the transformer in the gun to the robot. This signal is ON normally (NC) and an alarm occurs when the signal is OFF. The servo power supply remains ON. |
| 20053 3) | LOW AIR PRESSURE  
When air pressure is reduced and this input is turned ON, an alarm occurs. The servo power supply remains ON. |
| 4) | 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. |
| 4) | 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. |
| 4) | 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. |
| 4) | GUN FULL OPEN DETECTION  
This signal indicates that the stroke of the double stroke gun is full open. |
| 4) | GUN SHORT OPEN DETECTION  
This signal is connected with a single gun open verification limit switch or a double stroke gun short open verification limit switch to verify the gun open. |
| 4) | GUN PRESSURE DETECTION  
This signal indicates that a gun is in pressing status. |
| 4) | 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. |

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

2 See Section 8.6 “Interference Area” on page 8-56

3 This signal can be set as “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.

4 This signal can be allocated to any universal I/O signal at the I/O allocation display in operation condition.
<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>RUNNING&lt;br&gt;This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td>SERVO IS ON&lt;br&gt;This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX100 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td>TOP OF MASTER JOB&lt;br&gt;This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.¹)²)</td>
</tr>
<tr>
<td>30013</td>
<td>ALARM/ERROR OCCURRED&lt;br&gt;This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td>BATTERY ALARM&lt;br&gt;This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td>REMOTE/PLAY/TEACH MODE SELECTED&lt;br&gt;This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td>IN CUBE 1&lt;br&gt;This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td>IN CUBE 2&lt;br&gt;This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td>WORK HOME POSITION (IN CUBE 32)²)&lt;br&gt;This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the robot is in the start position.</td>
</tr>
<tr>
<td>30057 ³)</td>
<td>TIP REPLACE REQUEST&lt;br&gt;This signal is output when the stored number of welding reaches the number of welding set for the tip replacement.</td>
</tr>
<tr>
<td>30023</td>
<td>INTERMEDIATE START OK&lt;br&gt;This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30024</td>
<td>IN CUBE 3&lt;br&gt;This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30025</td>
<td>IN CUBE 4&lt;br&gt;This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30050 ³)</td>
<td>WELD ON/OFF&lt;br&gt;Outputs a signal input from the interlock panel, etc. considering the robot status.</td>
</tr>
</tbody>
</table>

¹) ³) Refer to the DX100 manual.
13 Description of Units and Circuit Boards
13.12 Universal I/O Signal Assignment

Table 13-13: Specific Output (Spot Welding) (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30051 4)</td>
<td>WELD ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>This signal commands the reset error status of the Power Source. This is operated with the programming pendant operation.</td>
</tr>
<tr>
<td>30052 to 30056</td>
<td>WELD CONDITION (Level signals)</td>
</tr>
<tr>
<td></td>
<td>1(1), 2(2), 4(3), 8(4), 16(5), 32(6), 64(7), 128(8)</td>
</tr>
<tr>
<td></td>
<td>Sets the welding conditions for the Power Source. The output format can be selected as binary or discrete (bit number). It can handle up to 255 conditions. Most-significant bit is the parity bit (when specified).</td>
</tr>
<tr>
<td>4)</td>
<td>WELDING COMMAND</td>
</tr>
<tr>
<td></td>
<td>This signal outputs execution command signal to the Power Source. This signal is not necessary for a Power Source which is executed using the WELDING CONDITION signal.</td>
</tr>
<tr>
<td>4)</td>
<td>STROKE CHANGE1</td>
</tr>
<tr>
<td></td>
<td>SINGLE SOLENOID</td>
</tr>
<tr>
<td></td>
<td>DOUBLE SOLENOID</td>
</tr>
<tr>
<td></td>
<td>This is a signal, when a double stroke gun is used, to change the open stroke of the welding gun.</td>
</tr>
<tr>
<td>4)</td>
<td>GUN PRESS COMMAND</td>
</tr>
<tr>
<td></td>
<td>This outputs gun press command.</td>
</tr>
</tbody>
</table>

1 This signal is not output during operation.
2 The work home position cube and Cube 32 are same.
3 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.
4 This signal can be allocated to any universal I/O signal at the I/O allocation display in operation condition.

<table>
<thead>
<tr>
<th>Pseudo Input Signal 8202x</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
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<td>Timer Cooling Water Error Validating (or IN09)</td>
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<td>Gun Cooling Water Error Validating (or IN10)</td>
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<td>Transthermo Error Validating (or IN11)</td>
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<td>Low Air Pressure Validating (or IN12)</td>
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<td>Weld ON/OFF Validating (or OUT09)</td>
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13.12.5 JANCD-YEW01-E Circuit Board (Standard)

13.12.5.1 Arc Welding

JANCD-YEW01-E Circuit Board: Analog outputs ×2 ports, Analog inputs ×2 ports + Status signal I/O of a Welder.
Specifications are subject to change without notice for ongoing product modifications and improvements.