DX100
INSTRUCTIONS

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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR'S MANUAL
DX100 MAINTENANCE MANUAL

The DX100 operator's manuals above correspond to specific usage.
Be sure to use the appropriate manual.



YASKAWA

MANUAL NO. RE-CTO-A215 ①

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”.

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 an emergency stop button immediately if there are problems.The emergency stop buttons are located on the right of the front door of the DX100 and 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 buttons on the front door of the DX100 and programming pendant are 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 buttons do not function.

Fig. : 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.

Fig. : Release of Emergency Stop



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.

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.

Equipment	Manual Designation
DX100 Controller	DX100
DX100 Programming Pendant	Programming Pendant
Cable between the manipulator and the controller	Manipulator Cable

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

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. page key  The cursor key is an exception, and a picture is not shown.
	Axis Keys Number Keys	“Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means that the cursor is moved to the object item and the SELECT key is pressed, 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

- 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.

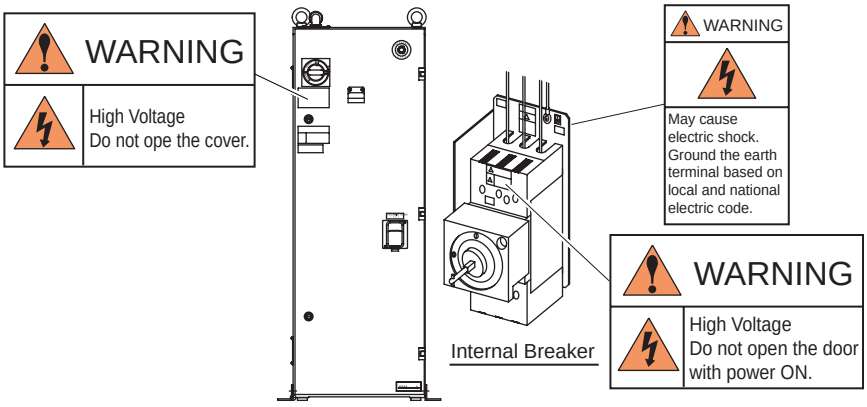


Refer to the manipulator manual for the warning label location.

- 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
  - EC Machinery Directive 98/37/EC
- Prepare
  - SAFETY WORK REGULATIONS

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

- Observe
  - JIS B 8433-1:2007 (ISO 10218-1:2006)
  - INDUSTRIAL ROBOT- SAFETY REQUIREMENTS

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.

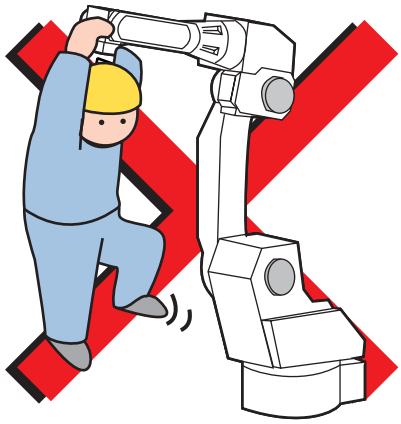
- Unauthorized persons should not approach the manipulator or associated peripheral equipment.

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

CAUTION

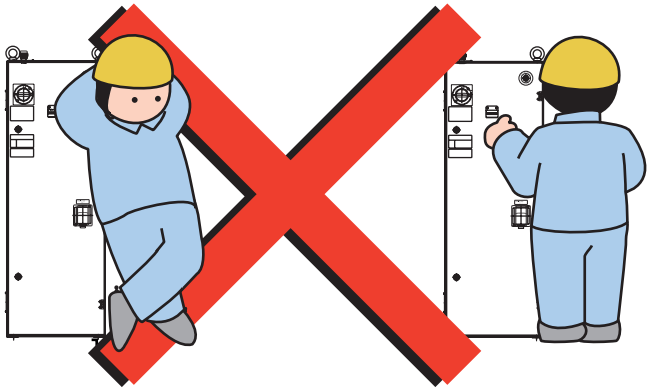
- Never forcibly move the manipulator axes.

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

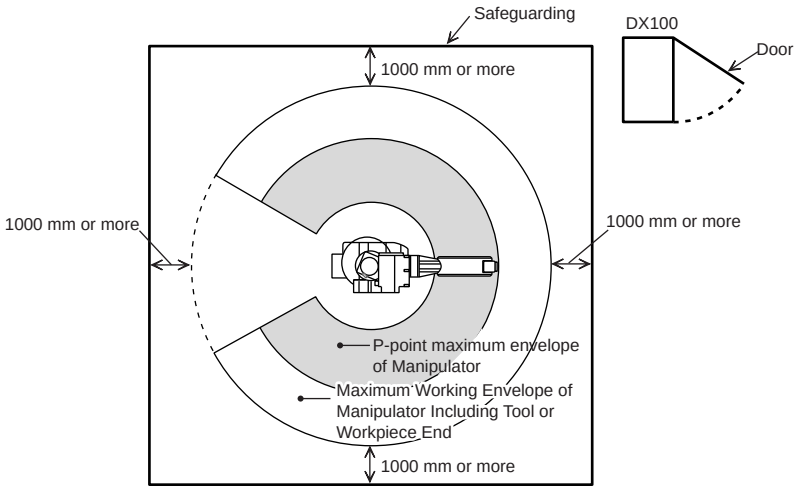
Refer to the MOTOMAN-□□□ Instructions manual and DX100 Instructions for details on installation and wiring.

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.

CAUTION

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.

- 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.

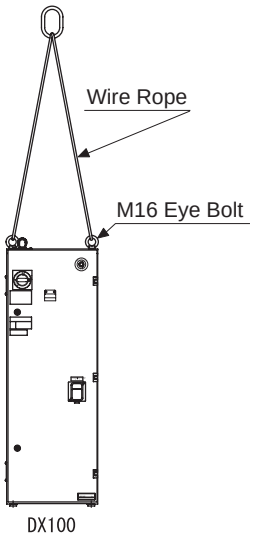


Table 1-1: Approx. Weight of DX100

Models Available for DX100	**Approx. Weight (kg)**
small capacity: MA1400, MA1900, VA1400, MH5, MH5L, MH6, HP20D, HP20D-6	A-Type (standard) 100
middle/large capacity: MH50, MS80, ES165D, ES200D, VS50, SIA50D	A-Type (standard) 100

- Be sure the eyebolts are securely fastened.

Failure to observe this caution may result in injury or damage to equipment.

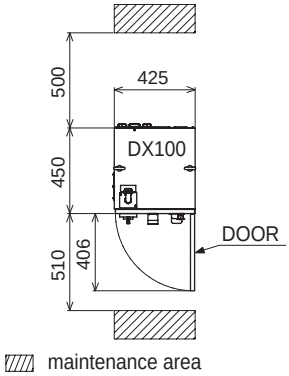
- If storing the manipulator temporarily before installation, be sure to place it on a stable and flat surface and take precautions to prevent unauthorized personnel from touching it.

Failure to observe this precaution may result in injury of damage to equipment.

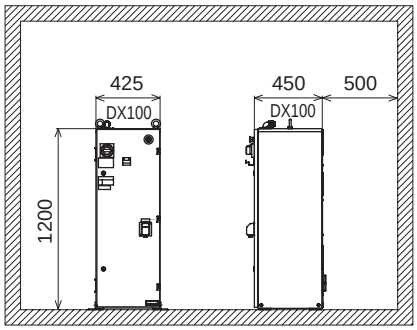
CAUTION

- 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.



DX100 Maintenance Area (Unit: mm)



DX100 External Dimensions (Unit: mm)
A-Type (Standard)

- 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.

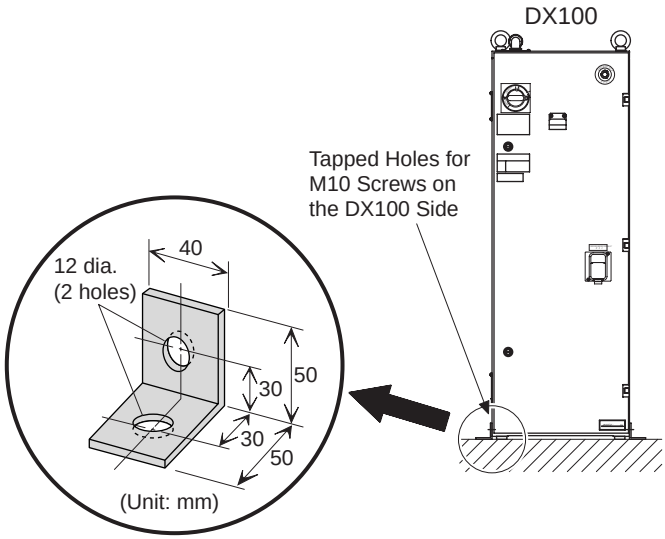
Failure to observe this caution may result in injury or damage to equipment.

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.

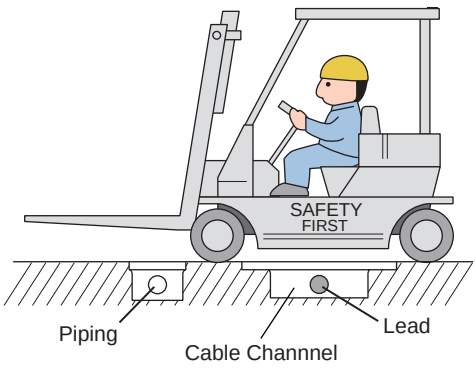
Failure to observe this caution could lead to injury or equipment damage if the DX100 should shift or fall.



- 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

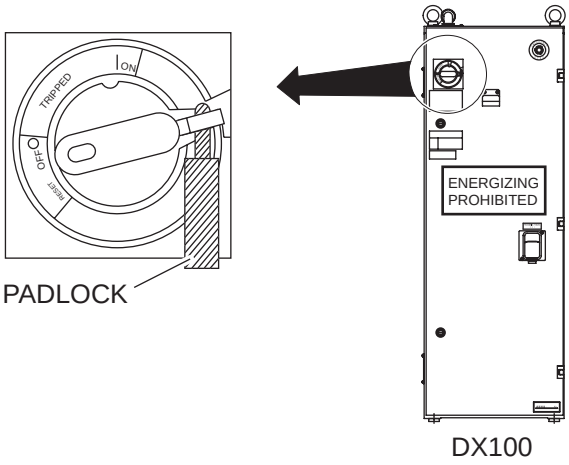
- Store tools and similar equipment in proper locations outside of the enclosure.

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 case 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 front door of the DX100, on the programming pendant, and on the external control device, etc. are pressed. And confirm that the servo lamp is turned OFF.

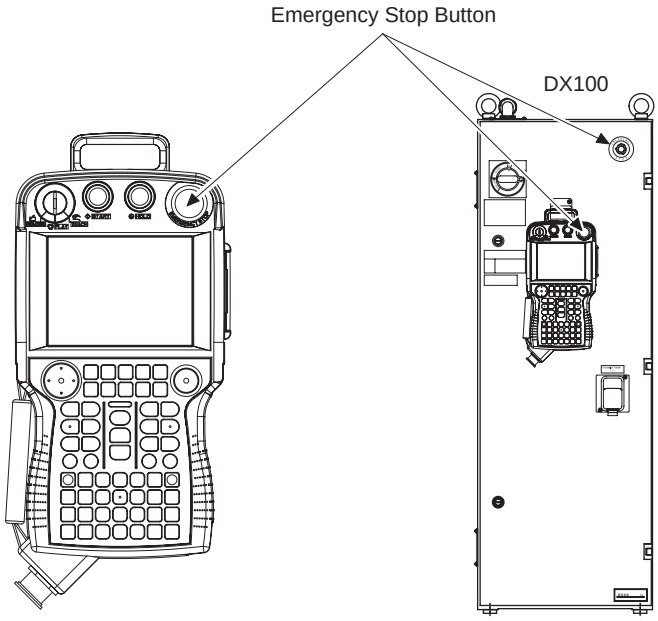
Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

- 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 buttons are located on the right of the front door of the DX100 and 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 *chapter 1.2 “Special Training” at page 1-2*

1.6 Notes for Moving and Transferring the MOTOMAN

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

CAUTION

- Attach the instructions to the controller cabinet so that all users have access to necessary manuals. See Section *chapter 1.3 "Motoman Manual List" at page 1-2* for a complete list of manuals.

If any manuals are missing, contact your Yaskawa representative.

- If the warning labels on the manipulator and DX100 are illegible, clean the labels so that they can be read 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.

- 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.

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

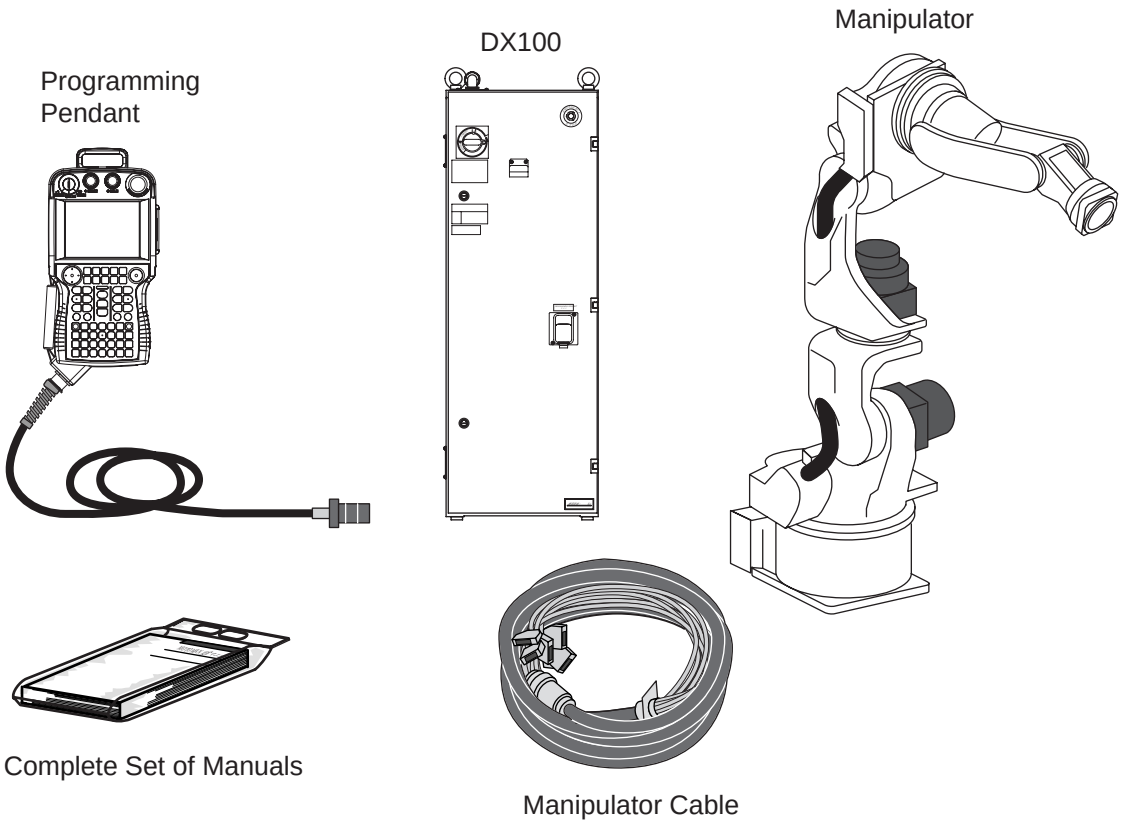
2.1 Contents Confirmation

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

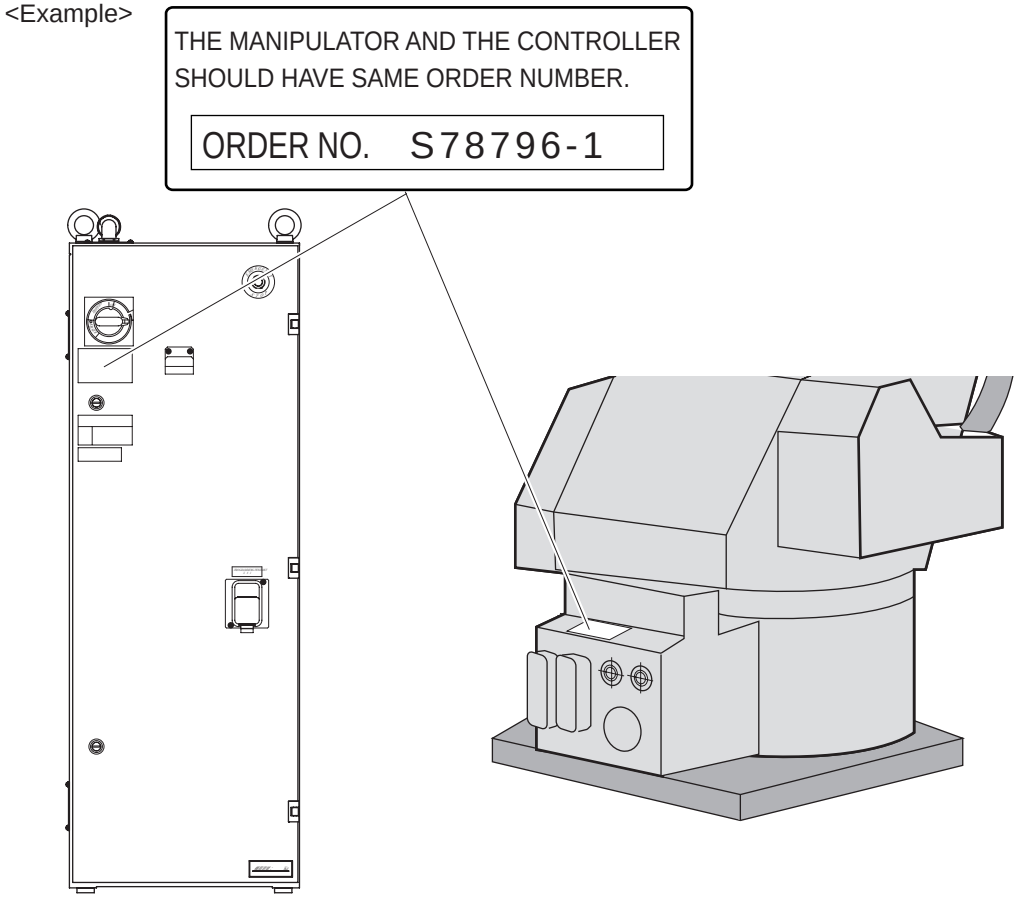


2.2 Order Number Confirmation

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

The order number plates are affixed to the figure below.

<Example>



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.

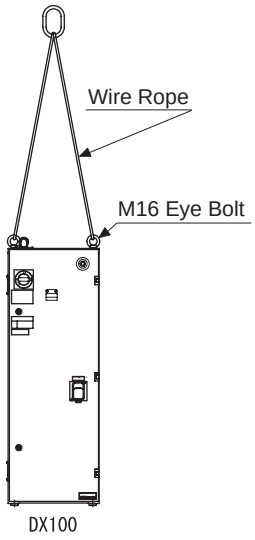


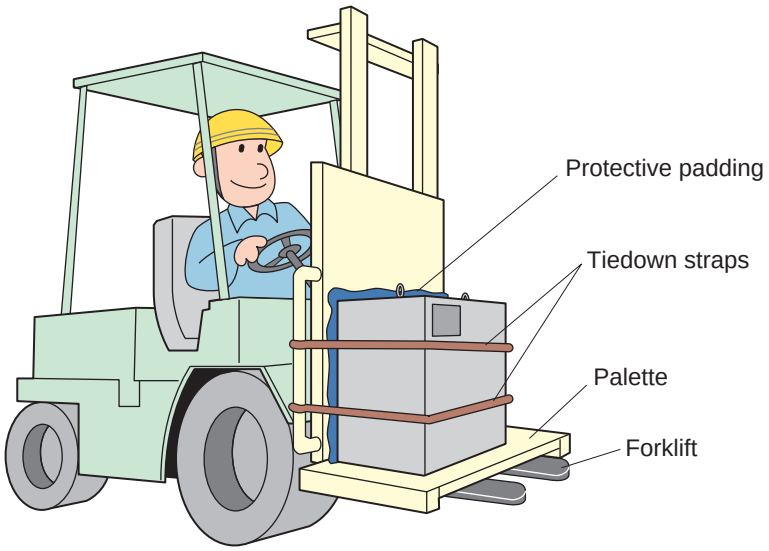
Table 3-1: Approx. Weight of DX100

Models Available for DX100	Approx. Weight (kg)
small capacity: MA1400, MA1900, VA1400, MH5, MH5L, MH6, HP20D, HP20D-6	A-Type (standard) 100
middle, large capacity: MH50, MS80, ES165D, ES200D, VS50, SIA50D	A-Type (standard) 100

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.



3.2 Place of Installation

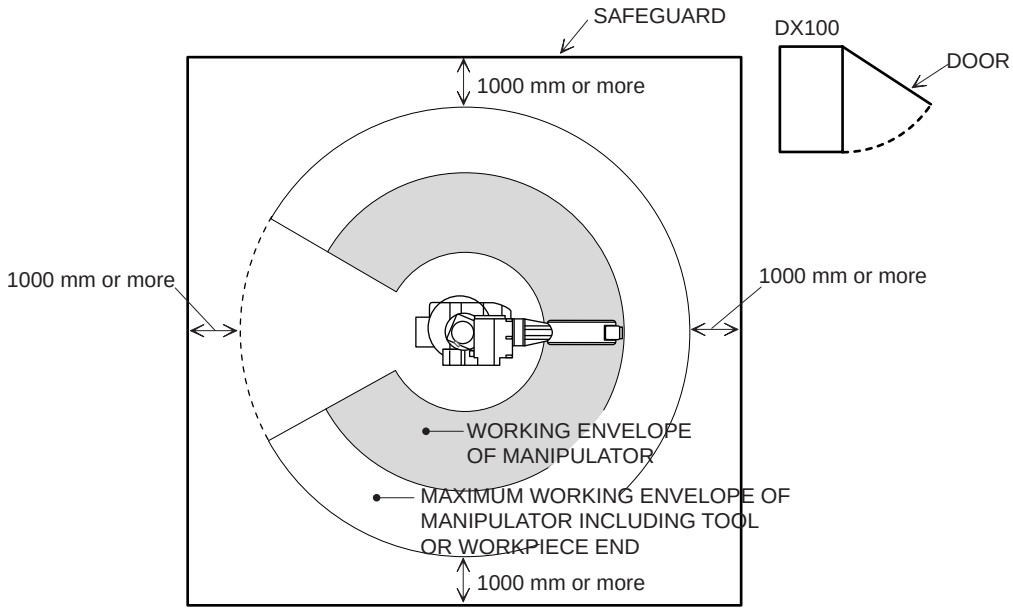
The conditions listed below must be met before installing the DX100:

- 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.

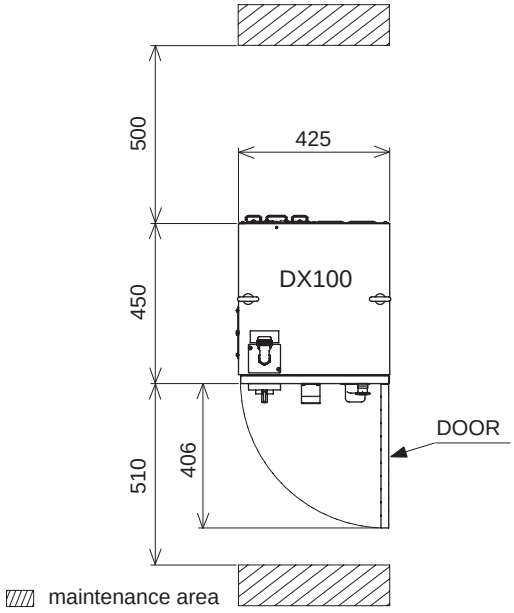
3.3 Location

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

Fig. 3-1: Location of DX100

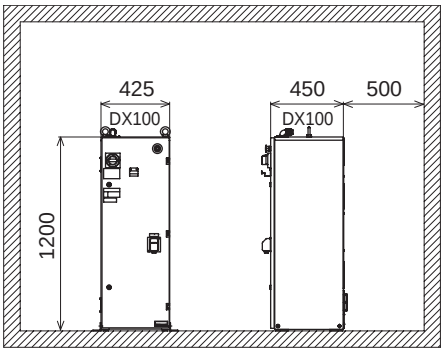


2. Install the controller in a location from which the manipulator is easily visible.
3. Install the controller in a location from which you can easily inspect it when the door is open.



A-Type（Standard）

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



A-Type (Standard)

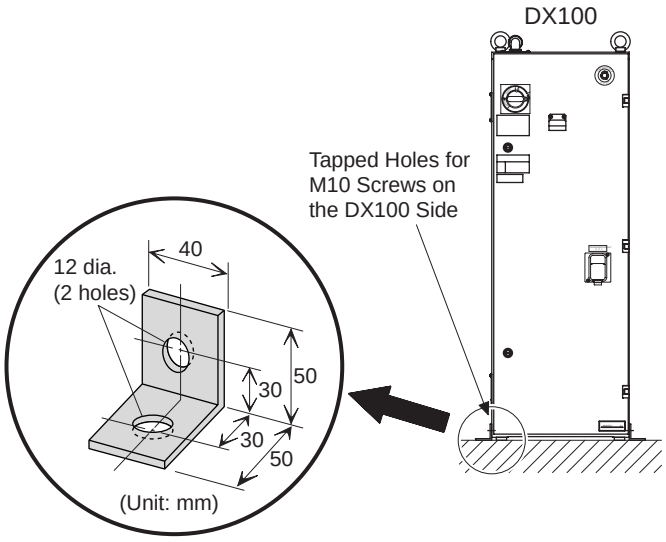
3.4 Mounting the Controller

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.



NOTE Refer to the Instruction Manual for information on 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.

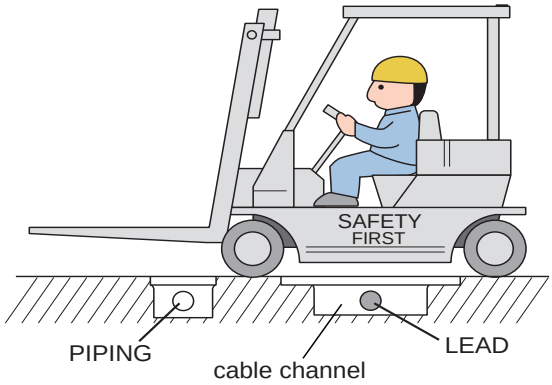
- Do not handle the circuit board directly by hand.

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

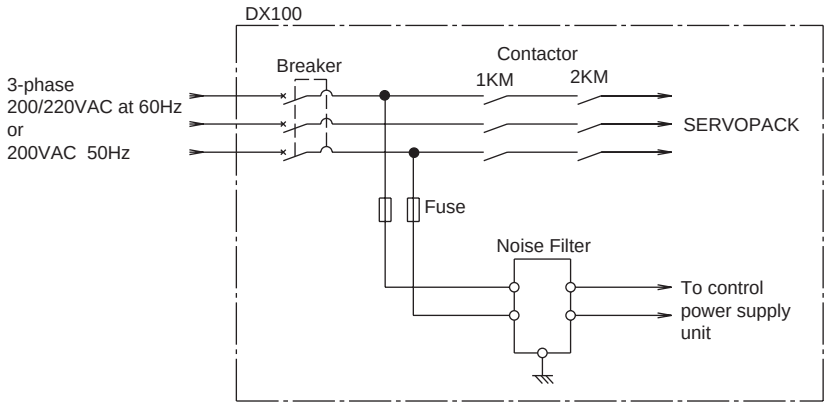
NOTE

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 of 200/220VAC at 60Hz and 200VAC at 50Hz.

Fig. 4-2: Input Power Connection

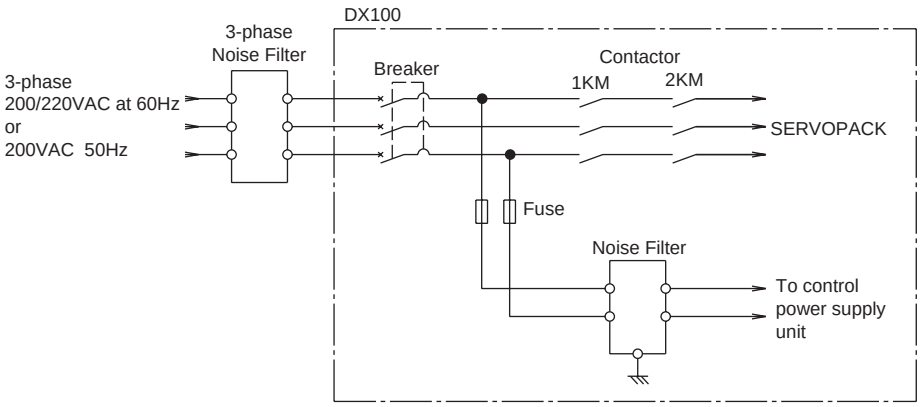


4.2.2 Noise Filter Installation

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

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

Fig. 4-3: Connection of Three-Phase Noise Filter



4.2.3 Leakage Breaker Installation

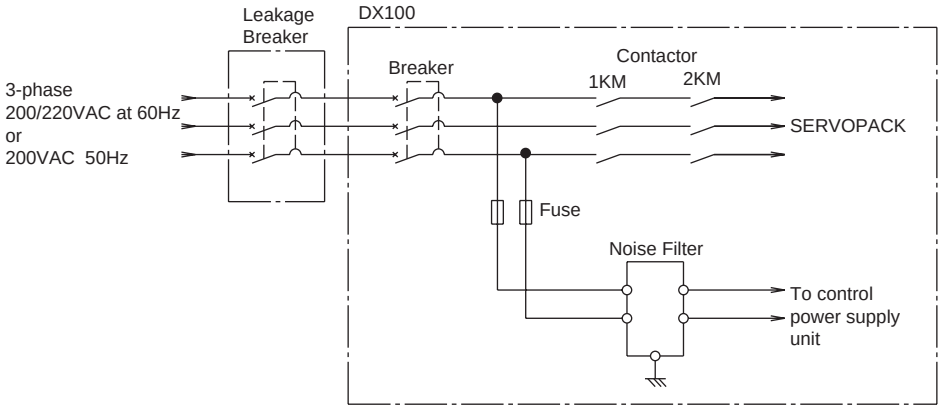
When connecting the leakage breaker to the controller power supply wiring, use a leakage breaker which can handle high frequencies from the DX100 inverter. Leakage breakers which cannot handle high frequencies may malfunction.

Table 4-1: Example of High Frequency Leakage Breaker

Maker	Model
Mitsubishi Electric Co., Ltd.	NV series (manufactured since 1988)
Fuji Electric Co., Ltd.	EG or SG Series (manufactured since 1984)

Even with a leakage breaker installed, there is still a possibility of some high frequency current leakage from the DX100 inverter. However, this current leakage presents no safety risks.

Fig. 4-4: Connection of the Leakage Breaker



4.2.4 Primary Power Supply Breaker Installation

Install the primary power supply breaker as shown.

Fig. 4-5: Installation of the Primary Power Supply Breaker

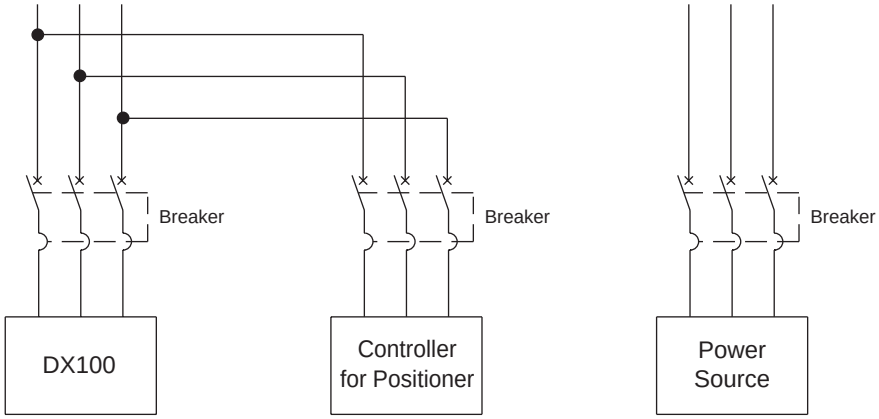


Table 4-2: DX100 Power Capacity, Cable Sizes, and Breaker Capacities

Manipulator	**Power capacity (kVA)**	**Cable size (size of terminal) (In case of Cabtyre cable (three cores)) (mm^2)**	**Capacity of breaker in DX100 (A)**
MH5, MH5L	1	3.5 (M5)	15
MH6, MA1400N VA1400	1.5	3.5 (M5)	15
HP20D, HP20D-6 MA1900	2.0	3.5 (M5)	15
MH50, MS80	4.0	5.5 (M5)	30
VS50, SIA50D, ES165D, ES200D	5.0	5.5 (M5)	30

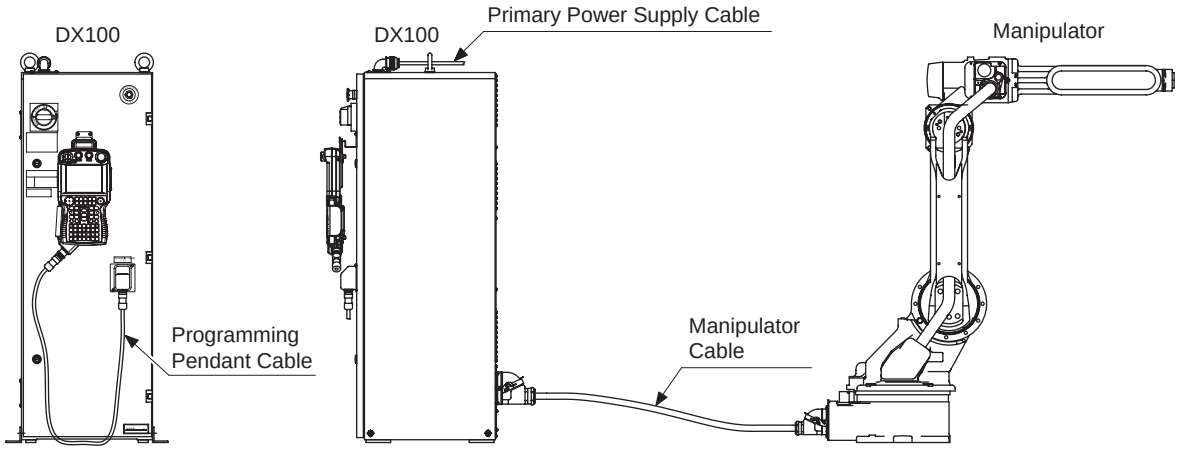
The maximum load value (payload, operation speed, and frequency, etc.) is displayed.
However, the power capacity is different depending on work conditions.

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

4.3 Connection Methods

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

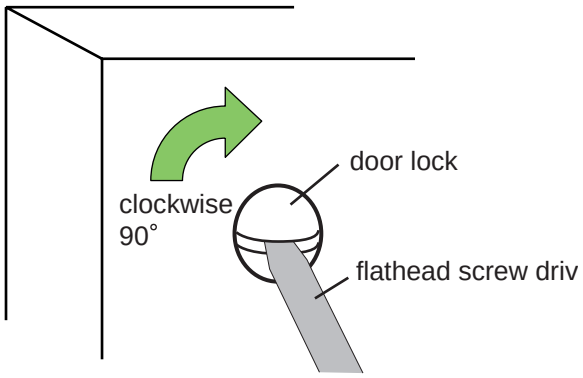
Fig. 4-6: Cable Connection



4.3.1 Connecting the Primary Power Supply

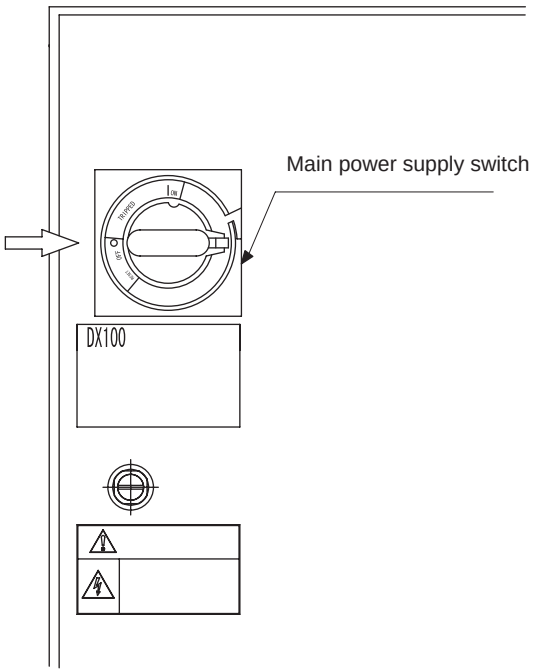
1. Open the front door of the DX100.
   (1) Using a flathead screwdriver, rotate the door locks on the front of the DX100 (two places) 90 degrees clockwise.

Fig. 4-7: Rotating the Door Lock Clockwise



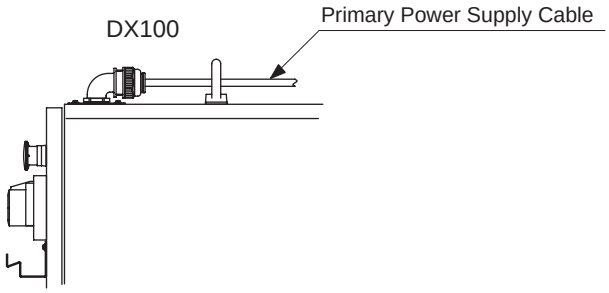
(2) Rotate the main power supply switch to the "OFF" position and open the door gently.

Fig. 4-8: Rotating the Main Power Supply Switch to the OFF Position



2. Confirm that the primary power supply is OFF.
3. Connect the primary power supply cable.
   – Draw the primary power supply cable in from the cable entrance on top side of DX100 and fix it firmly with the cable clamp so that it won't shift or slip out of place.

Fig. 4-9: Cable Clamp



CAUTION

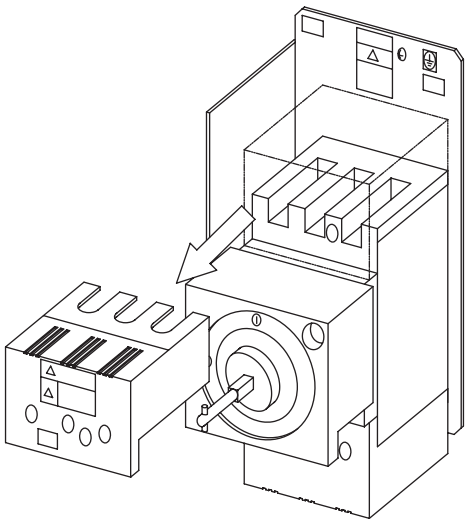
Cable clamp must be used when connnecting primary power supply.

Make sure that the cable clamp is fastened tightly to prevent dust or water from entering.

Failure to observe this caution may result in electric shock or breakdown of DX100.

(1) Pull off the primary cover of the switch which is on the upper right side of the DX100.

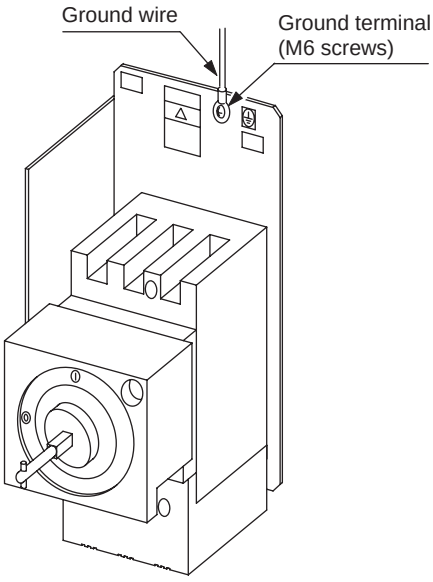
Fig. 4-10: Pulling Off the Cover



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

I) Connect the ground wire to the ground terminal (screw) of the switch which is on the upper left side of DX100.

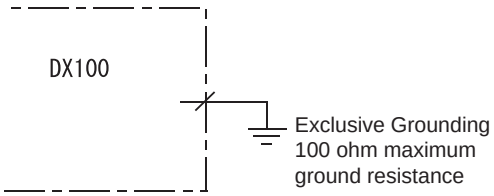
Fig. 4-11: Connection of the Ground Wire



II) Perform grounding in accordance with all relevant local and national electrical codes. The size of ground wire must the same as listed on *table 4-2 "DX100 Power Capacity, Cable Sizes, and Breaker Capacities" at page 4-5*.

NOTE The customer must prepare the ground wire.

Fig. 4-12: Exclusive Grounding

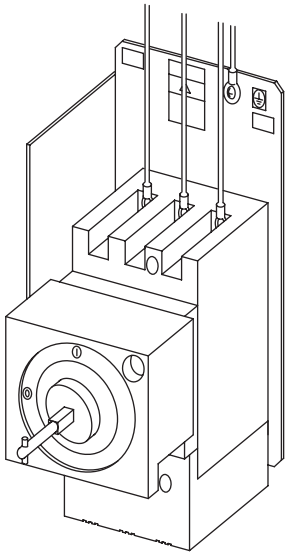


NOTE Don't connect the grounding wire with the wires for the electric power source, the welder, etc.

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

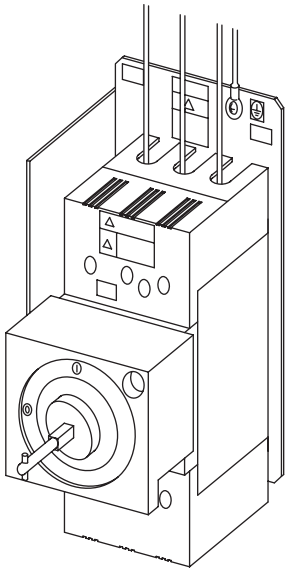
(3) Connect the primary power supply cable.

Fig. 4-13: Connection of the Primary Power Supply Cable



(4) Install the cover.

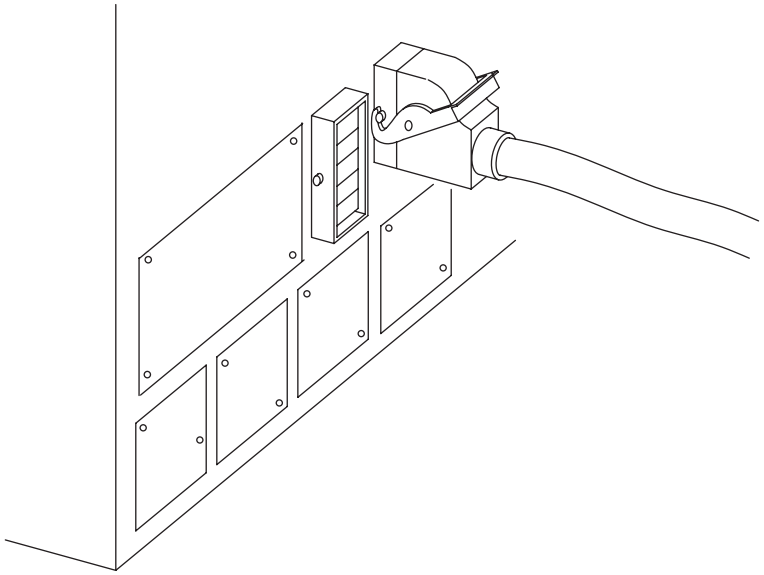
Fig. 4-14: Install the Cover



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.

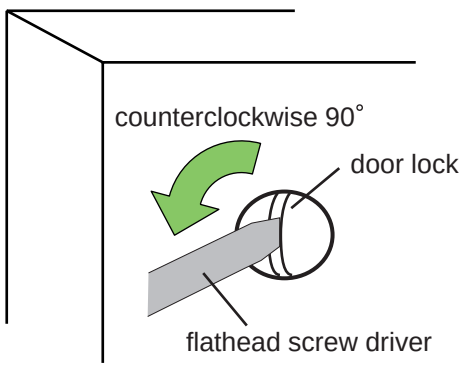
Fig. 4-15: Connection of the Manipulator Cable



NOTE 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. 4-16: Rotating the Door Lock Counterclockwise



CAUTION

Always close the door of the controller (DX100) except for maintenance.

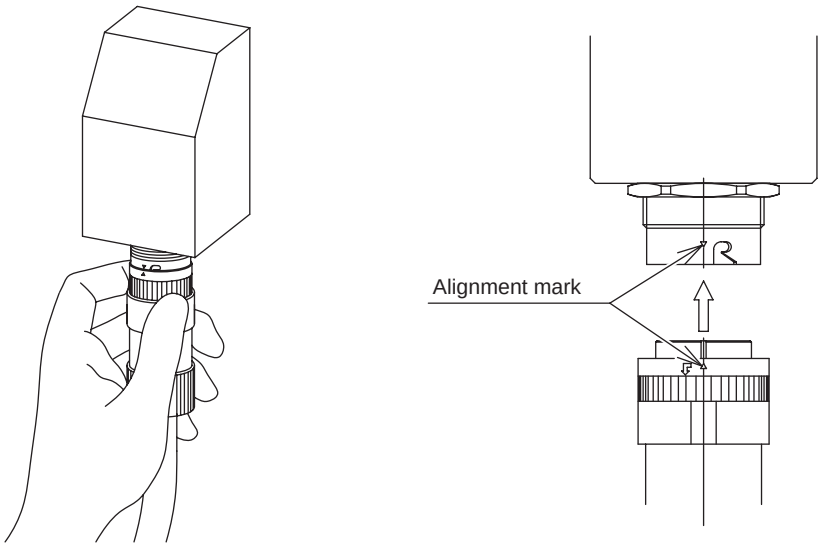
Make sure to rotate all the door locks counterclockwise.

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. 4-17: 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

WARNING

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

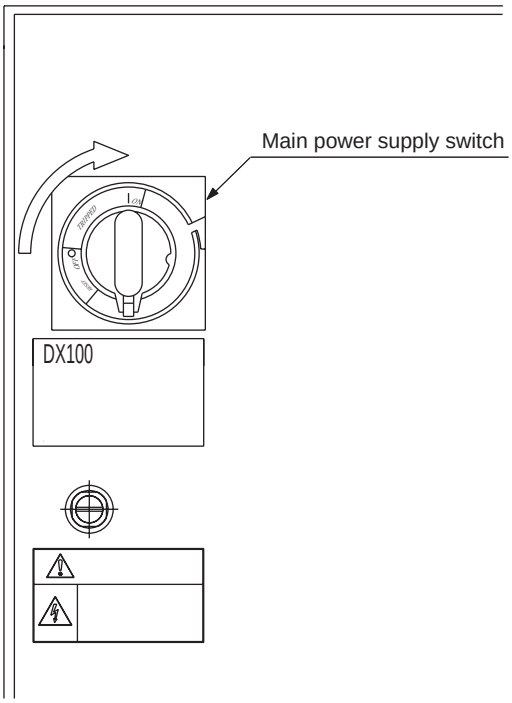
Failure to observe this caution could result in injury caused by accidental contact with the manipulator.

Press the emergency stop button immediately if any problems occur.

The emergency stop buttons are located on the right side of the front door of the DX100 and on the right side of the programming pendant.

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.

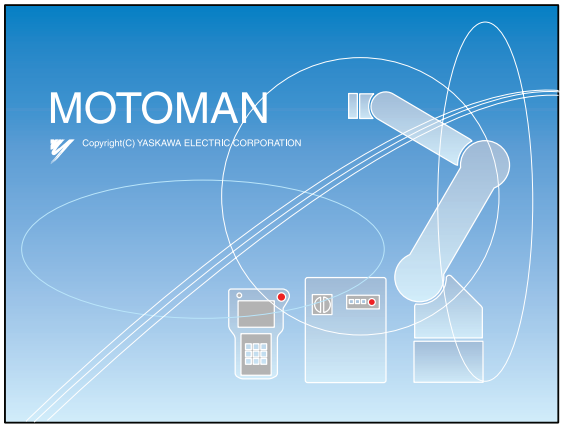
Fig. 5-1: Turning ON the Main Power Supply



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

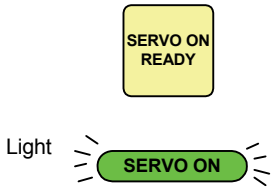


5.2 Turning ON the Servo Power

5.2.1 During Play Mode

The worker's safety is secure if the safety plug is turned ON.

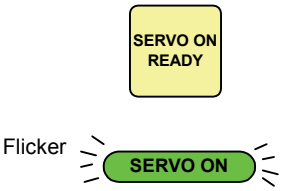
- When the safeguarding is closed, press [SERVO ON READY] on the programming pendant to turn ON the servo power supply. [SERVO ON] lamp will light, when the servo power is turned ON.



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.



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



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.

SUPPLE -MENT



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

NOTE

When performing emergency stop on the front door of the DX100, 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 buttons are located on the front door of the DX100 and 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

EMERGENCY STOP

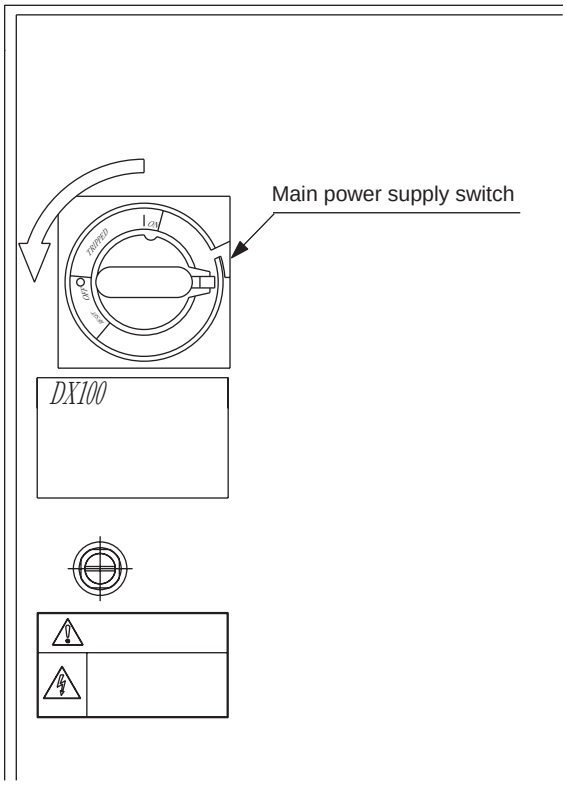


Door upper side

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.

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.

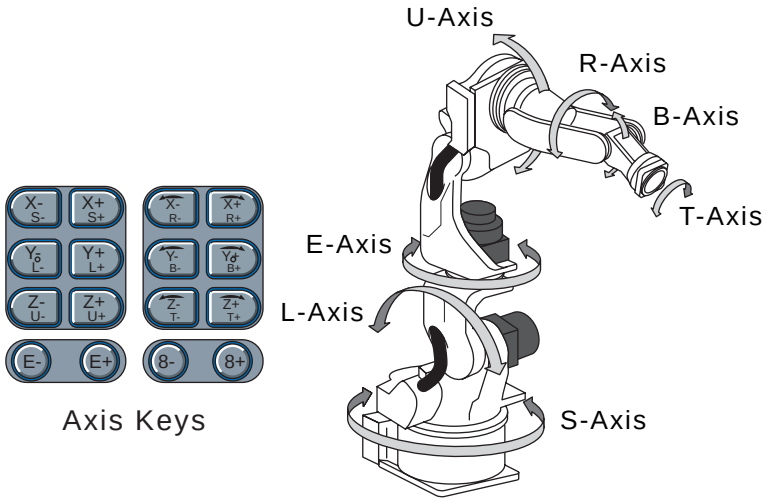
If the programming pendant is inadvertently left on the manipulator, fixture, or on the floor, the manipulator or a tool could collide with it during manipulator movement, possibly causing injuries or equipment damage.

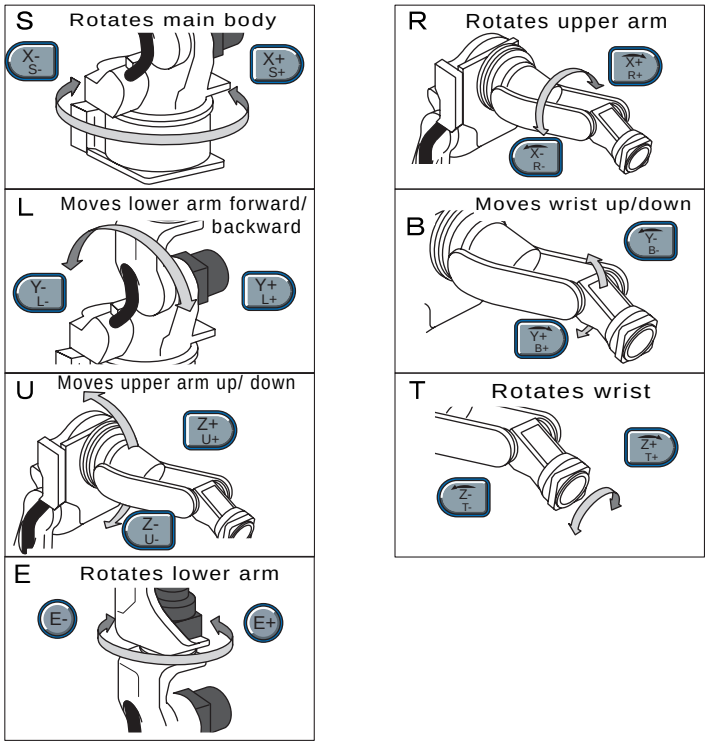
6.1 Movement of the Axes

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.

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.




S
Rotates main body
X-
S-
X+
S+
L
Moves lower arm forward/
backward
Y-
L-
Y+
L+
U
Moves upper arm up/ down
Z+
U+
Z-
U-
E
Rotates lower arm
E-
E+
R
Rotates upper arm
X+
R+
X-
R-
B
Moves wrist up/down
Y-
B-
Y+
B+
T
Rotates wrist
Z+
T+
Z-
T-

System Up

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 7-1: Security Mode Descriptions

Security Mode	Explanation
Operation Mode	This mode allows basic operation of the robot (stopping, starting, etc.) for people operating the robot work on the line.
Editing Mode	This mode allows the operator to teach and edit jobs and robot settings.
Management Mode	This mode allows those authorized to set up and maintain robot system: parameters, system time and modifying user IDs.

Table 7-2: Menu & Security Mode (Sheet 1 of 3)

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
JOB	JOB	Operation	Edit
	SELECT JOB	Operation	Operation
	CREATE NEW JOB[1)]	Edit	Edit
	MASTER JOB	Operation	Edit
	JOB CAPACITY	Operation	-
	RES. START (JOB)[1)]	Edit	Edit
	RES. STATUS[2)]	Operation	-
	CYCLE	Operation	Operation
VARIABLE	BYTE	Operation	Edit
	INTEGER	Operation	Edit
	DOUBLE	Operation	Edit
	REAL	Operation	Edit
	STRING	Operation	Edit
	POSITION (ROBOT)	Operation	Edit
	POSITION (BASE)	Operation	Edit
	POSITION (ST)	Operation	Edit
	LOCAL VARIABLE	Operation	-
IN/OUT	EXTERNAL INPUT	Operation	-
	EXTERNAL OUTPUT	Operation	-
	UNIVERSAL INPUT	Operation	Edit
	UNIVERSAL OUTPUT	Operation	Edit
	SPECIFIC INPUT	Operation	-
	SPECIFIC OUTPUT	Operation	-
	RIN	Operation	-
	CPRIN	Operation	-
	REGISTER	Operation	-
	AUXILIARY RELAY	Operation	-
	CONTROL INPUT	Operation	-
	PSEUDO INPUT SIG	Operation	Management
	NETWORK INPUT	Operation	-
	NETWORK OUTPUT	Operation	-
	ANALOG OUTPUT	Operation	-
	SV POWER STATUS	Operation	-
	LADDER PROGRAM	Management	Management
	I/O ALARM	Management	Management
	I/O MESSAGE	Management	Management

Table 7-2: Menu & Security Mode (Sheet 2 of 3)

ROBOT	CURRENT POSITION	Operation	-
	COMMAND POSITION	Operation	-
	SERVO MONITOR	Management	-
	WORK HOME POS	Operation	Edit
	SECOND HOME POS	Operation	Edit
	DROP AMOUNT	Management	Management
	POWER ON/OFF POS	Operation	-
	TOOL	Edit	Edit
	INTERFERENCE	Management	Management
	SHOCK SENS LEVEL	Operation	Management
	USER COORDINATE	Edit	Edit
	HOME POSITION	Management	Management
	MANIPULATOR TYPE	Management	-
	ANALOG MONITOR	Management	Management
	OVERRUN&S-SENSOR[1)]	Edit	Edit
	LIMIT RELEASE[1)]	Edit	Edit
	ARM CONTROL[1)]	Management	Management
	SHIFT VALUE	Operation	-
SYSTEM INFO	VERSION	Operation	-
	MONITORING TIME	Operation	Management
	ALARM HISTORY	Operation	Management
	I/O MSG HISTORY	Operation	Management
	SECURITY	Operation	Operation
FD/CF	LOAD	Edit	-
	SAVE	Operation	-
	VERIFY	Operation	-
	DELETE	Operation	-
	DEVICE	Operation	Operation
	FOLDER	Edit	Management
	INITIALIZE[2)]	Operation	-
PARAMETER	S1CxG	Management	Management
	S2C	Management	Management
	S3C	Management	Management
	S4C	Management	Management
	A1P	Management	Management
	A2P	Management	Management
	A3P	Management	Management
	A4P	Management	Management
	RS	Management	Management
	S1E	Management	Management
	S2E	Management	Management
	S3E	Management	Management
	S4E	Management	Management

Table 7-2: Menu & Security Mode (Sheet 3 of 3)

SETUP	TEACHING COND	Edit	Edit
	OPERATE COND	Management	Management
	DATE/TIME	Management	Management
	GRP COMBINATION[3)]	Management	Management
	RESERVE JOB NAME	Edit	Edit
	USER ID	Edit	Edit
	SET SPEED	Management	Management
	KEY ALLOCATION[1)]	Management	Management
	RES. START (CNCT)	Management	Management
	AUTO BACK SET	Management	Management
	WRONG DATA LOG	Operation	Management
ARC WELDING	ARC START COND.	Operation	Edit
	ARC END COND.	Operation	Edit
	ARC AUX COND.	Operation	Edit
	POWER SOURCE COND.	Operation	Edit
	ARC WELD DIAG.	Operation	Edit
	WEAVING	Operation	Edit
	ARC MONITOR[4)]	Operation	-
	ARC MONITOR (SAMPL)	Operation	-
HANDLING	HANDLING DIAGNOSIS	Operation	Edit
SPOT WELDING	WELD DIAGNOSIS	Operation	Edit
	I/O ALLOCATION	Management	Management
	GUN CONDITION	Management	Management
	CLEARANCE SETTING	Operation	Edit
	POWER SOURCE COND	Management	Management
SPOT WELDING (MOTOR GUN)	WELD DIAGNOSIS	Operation	Edit
	GUN PRESSURE	Edit	Edit
	PRESSURE	Edit	Edit
	I/O ALLOCATION	Management	Management
	GUN CONDITION	Management	Management
	CLEARANCE SETTING	Operation	Edit
	SPOT POWER SOURCE COND	Management	Management
	TIP INSTALLATION	Operation	Management
GENERAL	WEAVING	Operation	Edit
	GENERAL DIAG.	Operation	Edit
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.

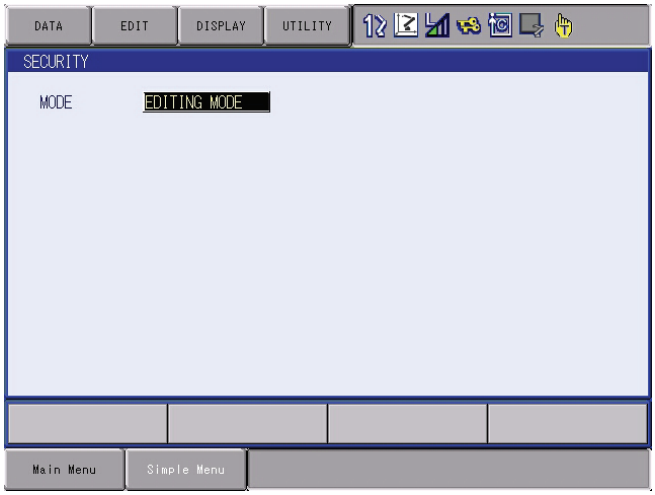
7.1.1.1 Changing the Security Mode

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

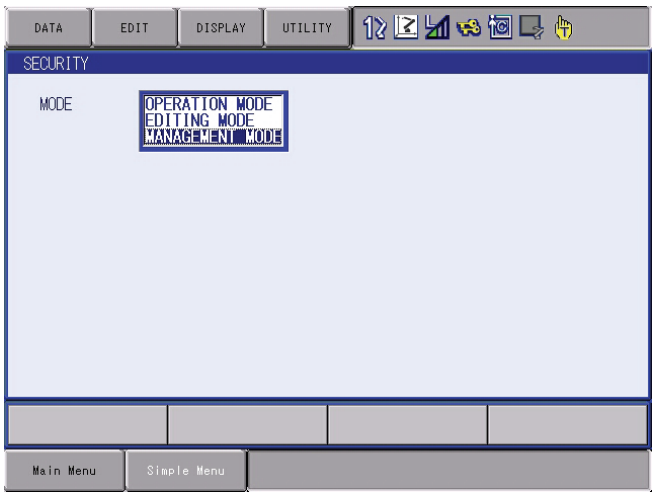


Note: Icons for the main menu such as arc welding system differ depending on the system being used.

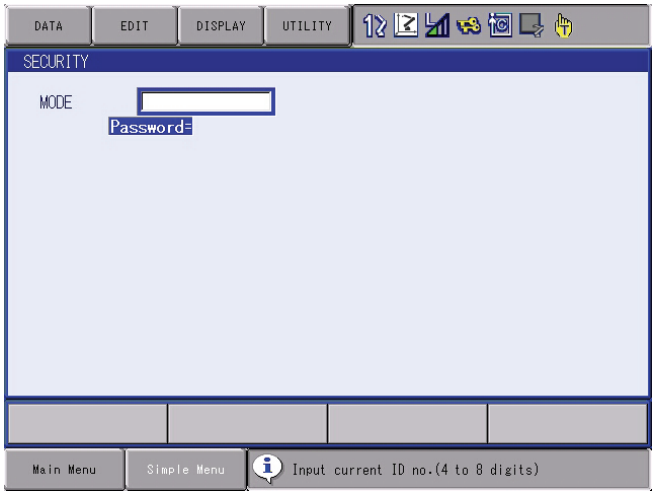
2. Select {SECURITY}.
   – The selection window of security mode appears.



3. Press [SELECT] .
   – Select "SECURITY MODE".



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



SUPPLE -MENT

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

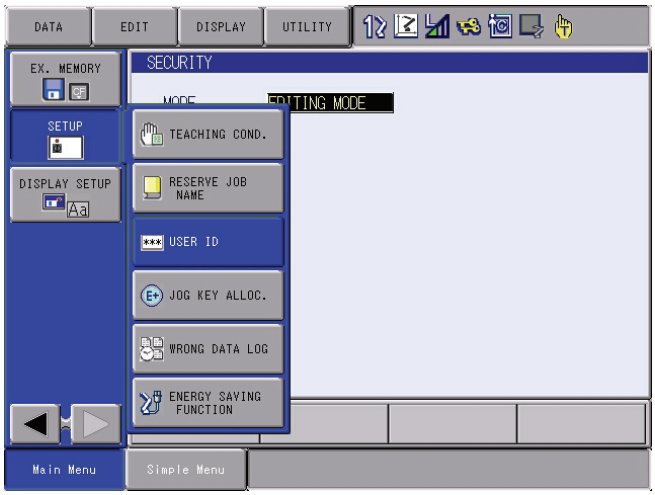
User ID is requested when Editing Mode or Management Mode is operated.

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

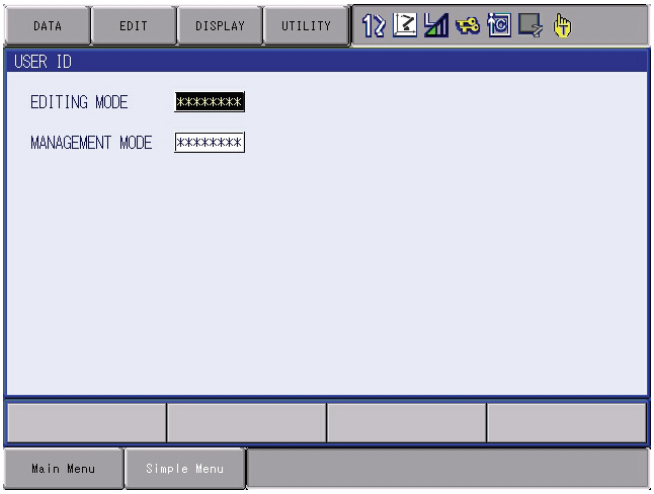
7.1.2.1 Changing User ID

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.

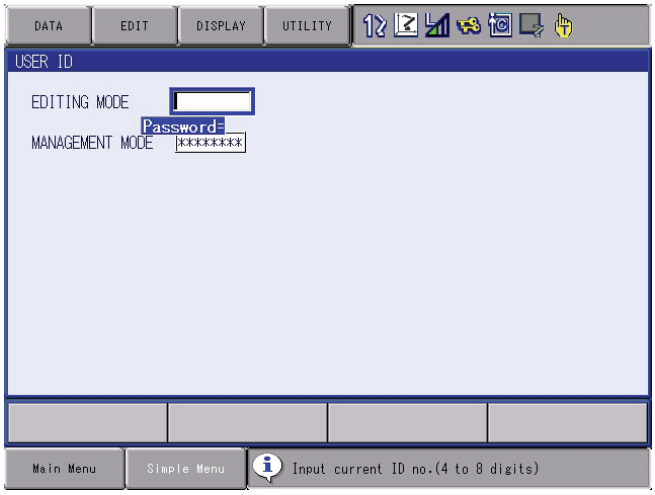
1. Select {SETUP} under the main menu.
   – The sub menu appears.



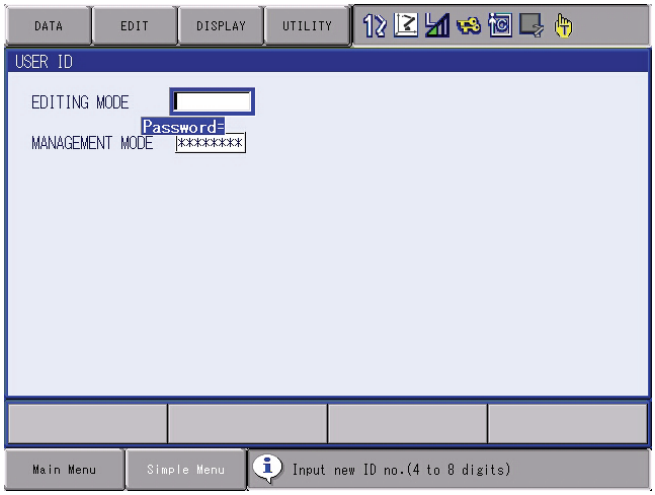
2. Select {USER ID}.
   – The USER ID window appears.



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.

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.

8.1.1 Home Position Calibration

NOTE

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:

- 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

SUPPLE -MENT

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

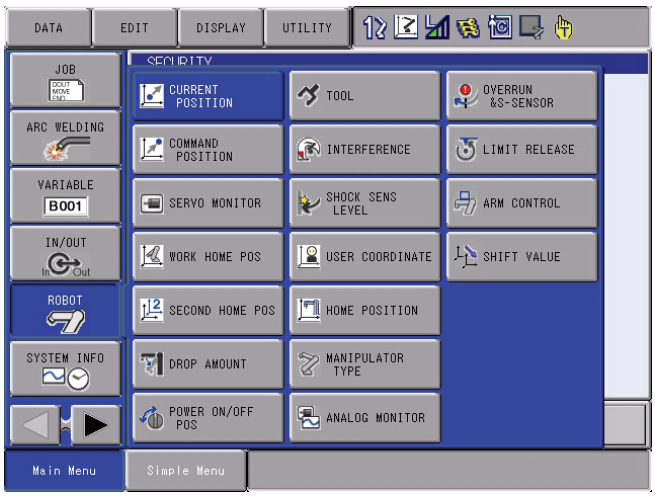
8.1.2 Calibrating Operation

NOTE

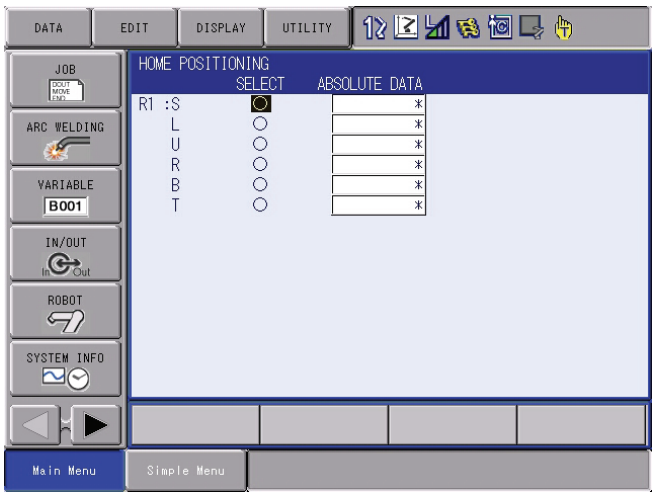
Home position calibration screen is displayed only in security mode or management mode.

8.1.2.1 Registering All Axes at One Time

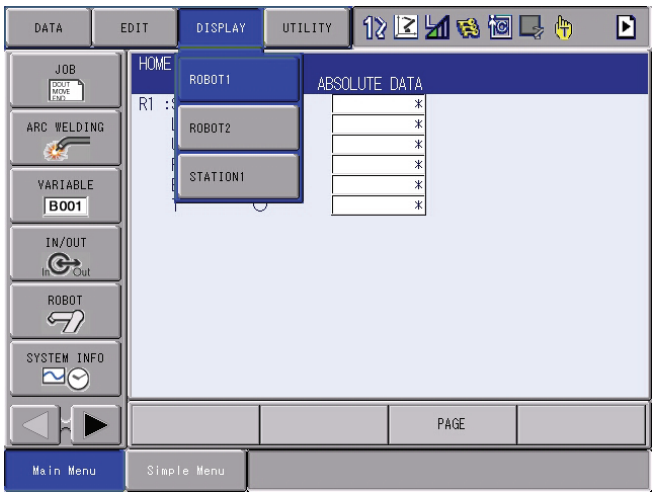
1. Select {ROBOT} under the main menu.
   – The sub menu appears



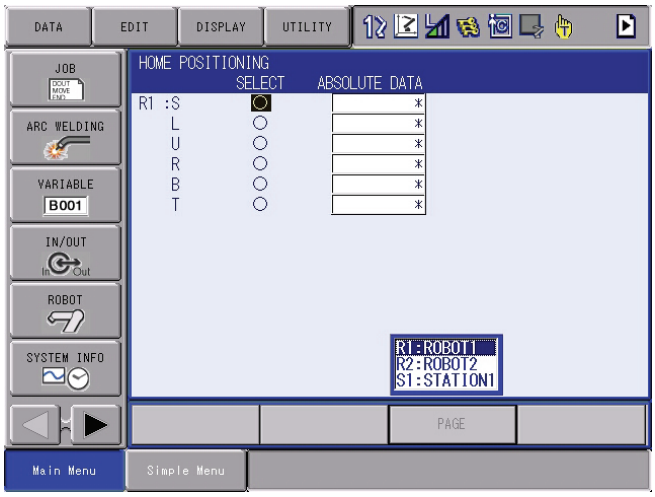
2. Select {HOME POSITION}.
   – The HOME POSITIONING window appears.



3. Select {DISPLAY} under the menu.
   – The pull-down menu appears.

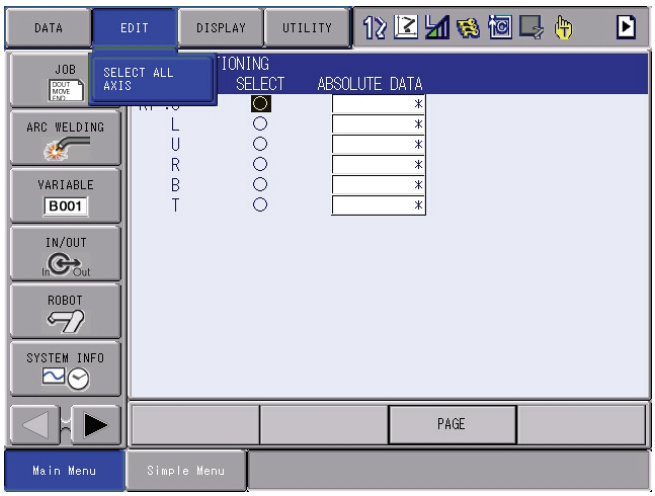


   – The same operation as the instruction 3 can also be performed by selecting {PAGE}, and selection box appears.

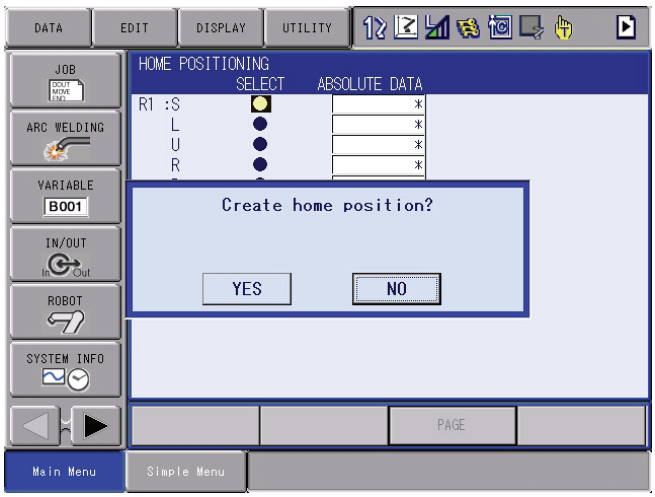


4. Select the desired control group.
   – Select the control group for HOME POSITIONING.
   – The control group can also be selected by pressing page key .

5. Select {EDIT} under the menu.
   – The pull-down menu appears.



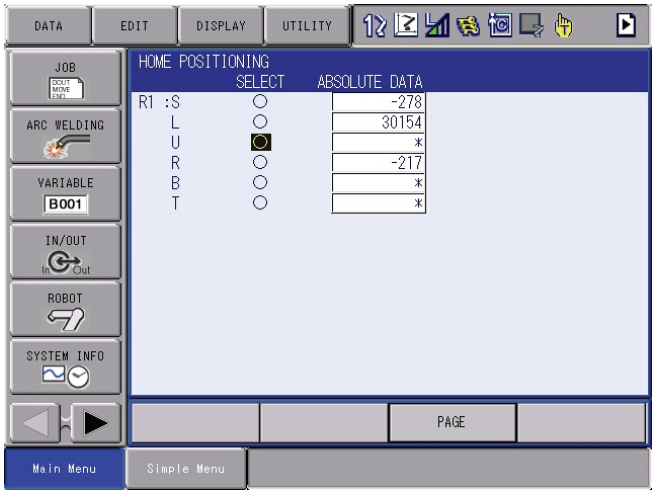
6. Select {SELECT ALL AXES}.
   – The confirmation dialog box appears.



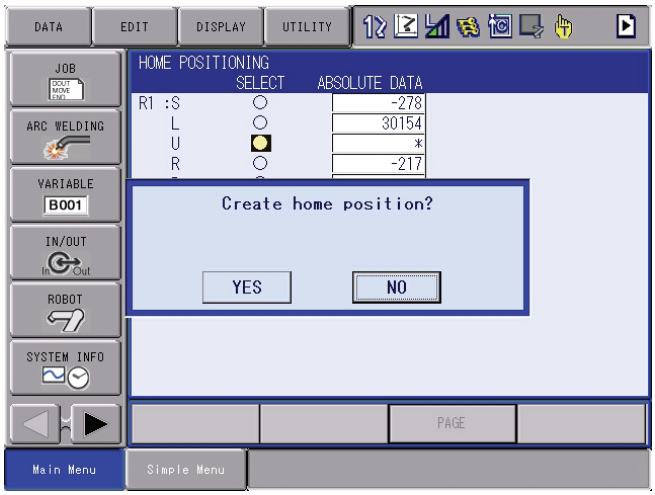
7. Select {YES}.
   – Displayed position data of all axes are registered as home position. When {NO} is selected, the registration will be canceled.

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.



   – A confirmation dialog box appears.

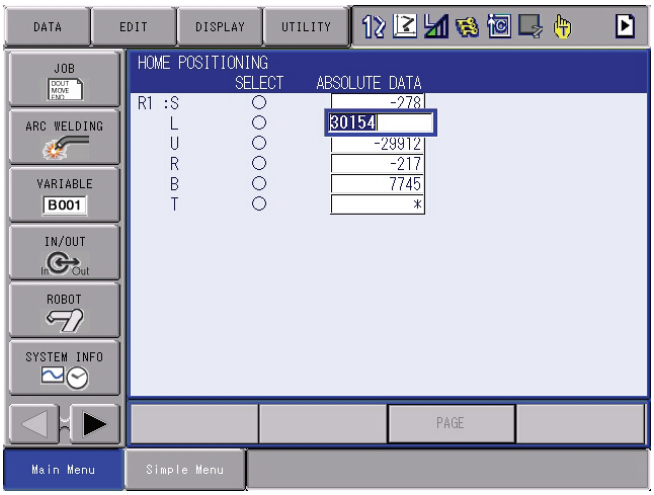


5. Select {YES}.
   – Displayed position data of the axis is registered as home position. When {NO} is selected, the registration will be canceled.

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.

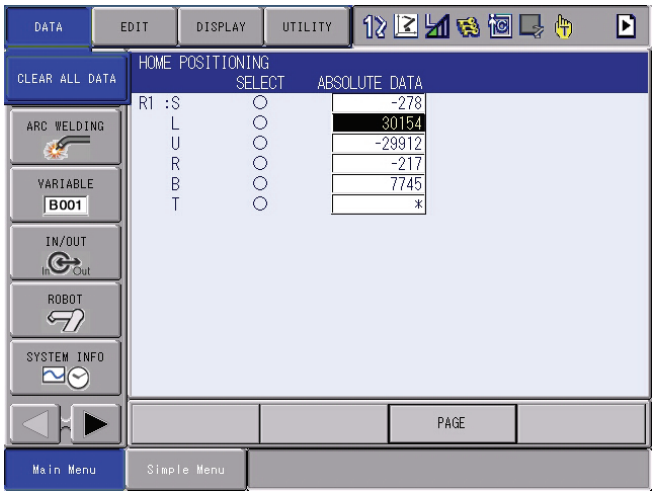


5. Enter the absolute data using the numeric keys.
6. Press [ENTER].
   – Absolute data is modified.

8.1.2.4 Clearing Absolute Data

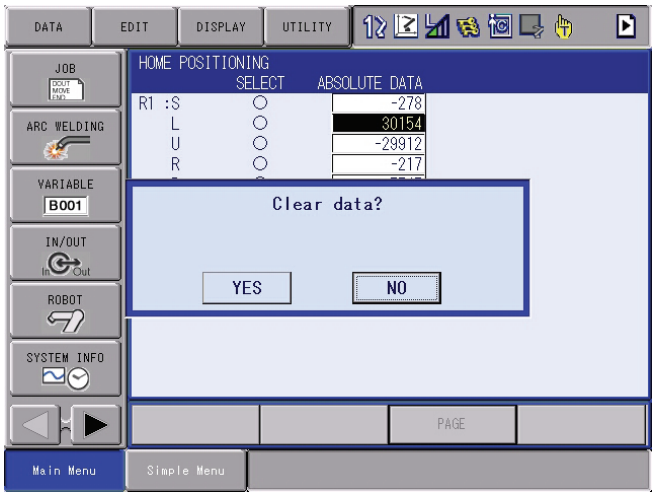
1. Select {ROBOT} under the main menu.
   – The sub menu appears
2. Select {HOME POSITION}.
   – Perform the step 3 and 4 of the “Registering All Axes at One Time” to select the desired control group.
3. Select {DATA} under the main menu.

– The pull-down menu appears



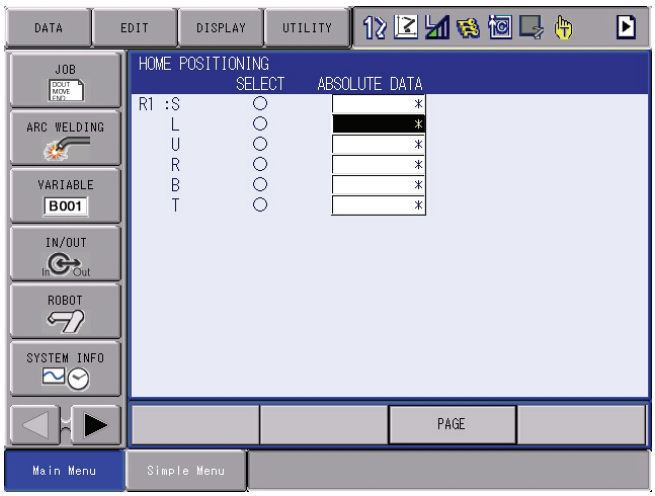
4. Select [CLEAR ALL DATA].

– A confirmation dialog box appears.



5. Select {YES}.

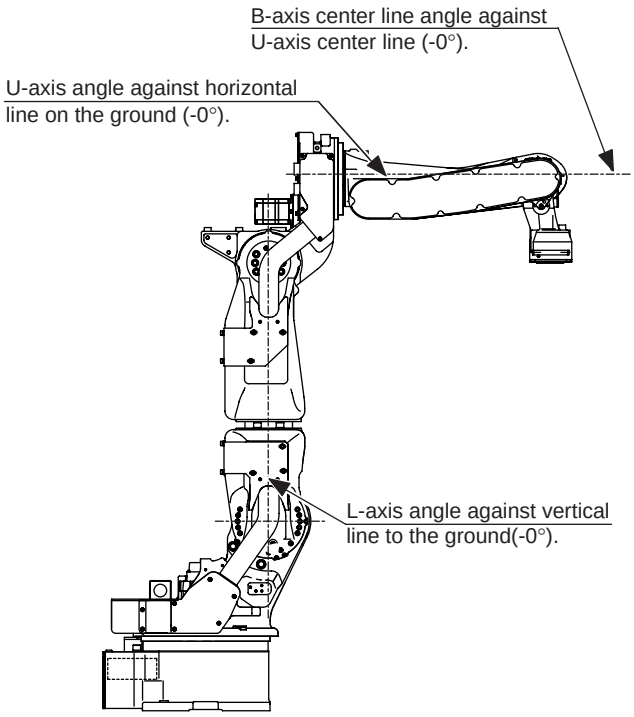
– All absolute data are cleared.



– 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.



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.

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.

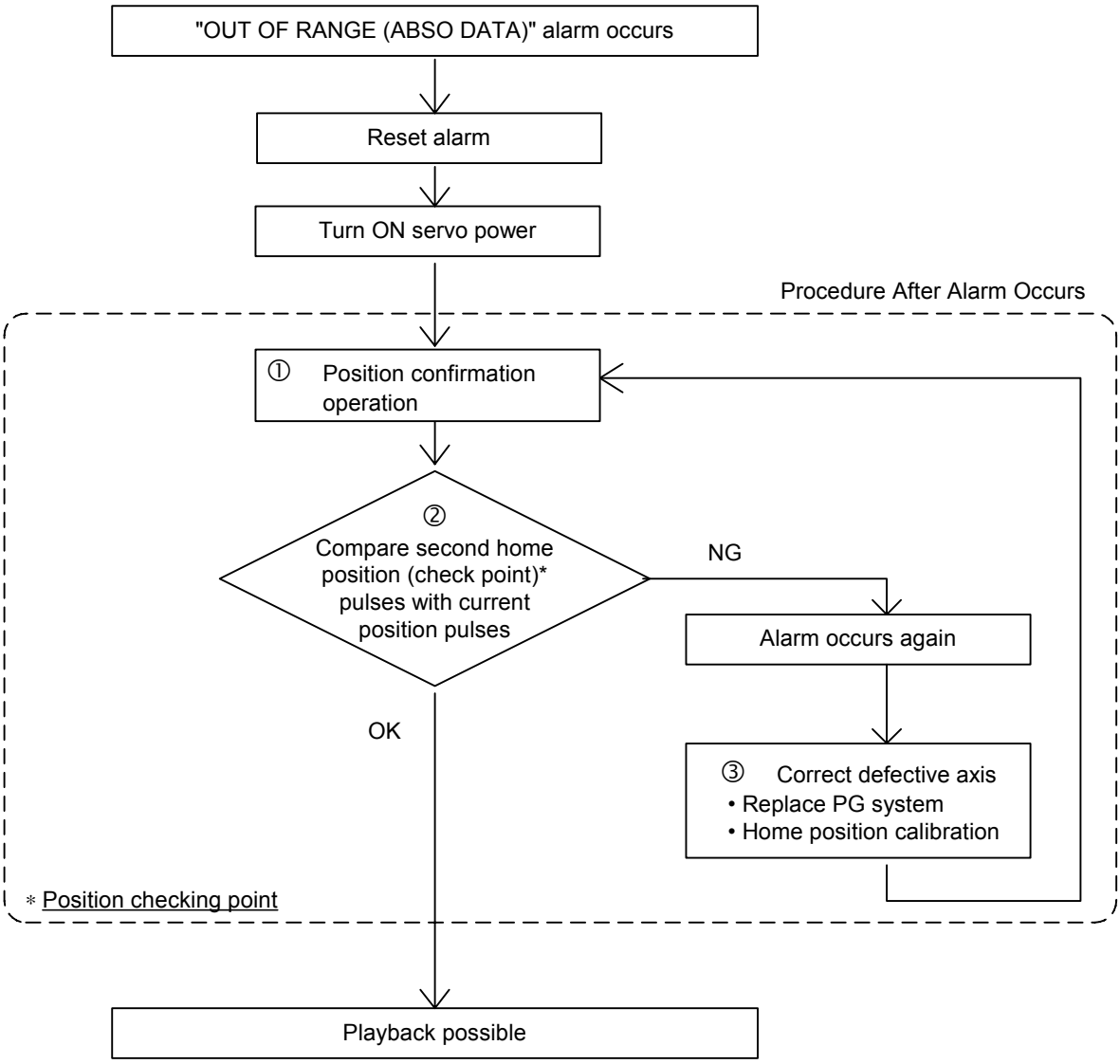
8.2.1 Purpose of Position Check Operation

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.



① 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.

② 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 *chapter 8.2.2 "Procedure for the Second Home Position Setting (Check Point)" at page 8-14*.

③ 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.

NOTE

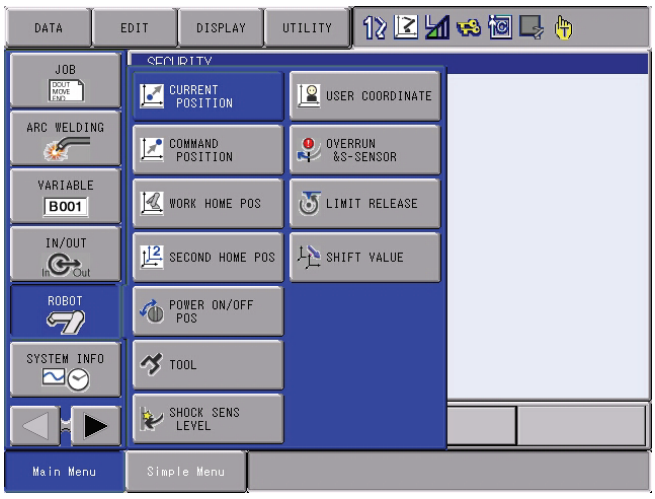
- Home position calibration of all the axes at the same time enables playback operations without having to check the position.
- Sometimes in a system with a manipulator with no brake, it is possible to enable playback without position checking after the alarm occurs. **However, as a rule, always perform "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)

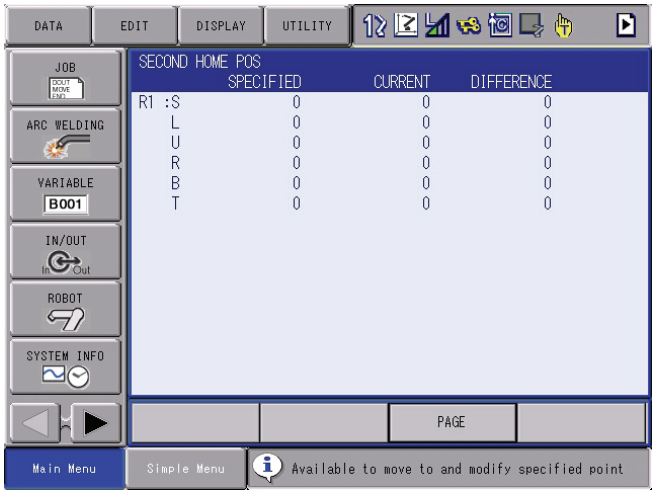
Apart from the "home position" of the manipulator, the second home position can be set up as a check point for absolute data. Use the following steps to set the specified point.

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

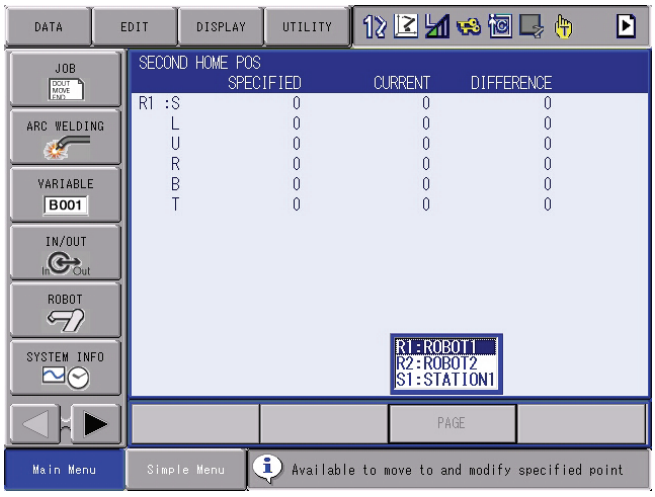
1. Select {ROBOT} under the main menu.
   – The sub menu appears.



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.

8.2.3 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;

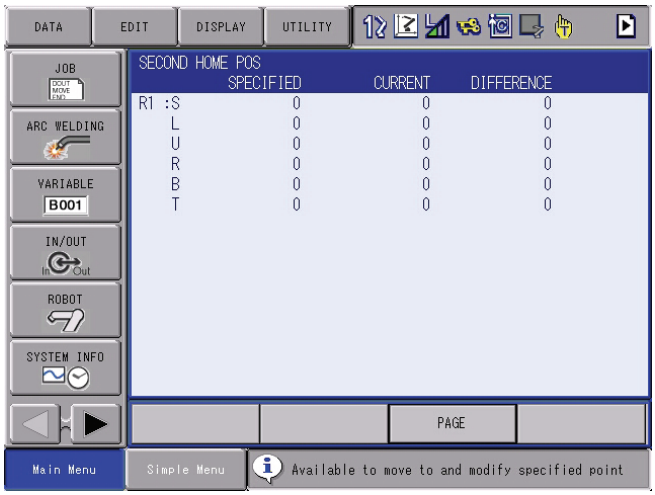
then confirm the second home position. After the confirmation, if the PG system is found to be the cause of the alarm, perform the necessary operation, such as replacing the PG, etc.

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

SUPPLE -MENT

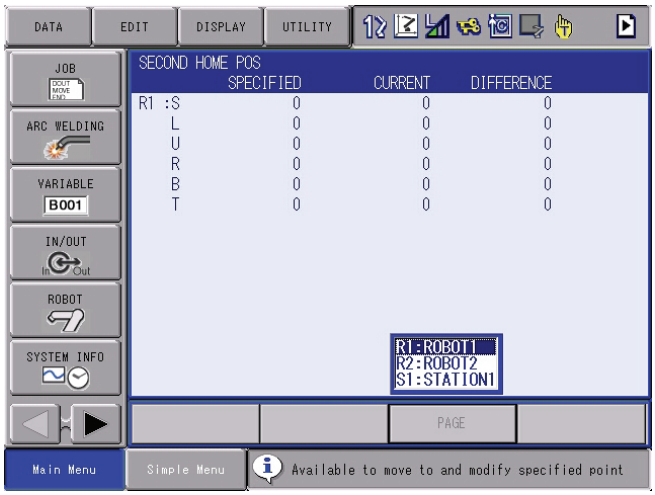
For details on the “POWER ON/OFF POS" window, refer to " 7.7 Position Data When Power is Turned ON/OFF " in DX100 MAINTENANCE MANUAL.

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.

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



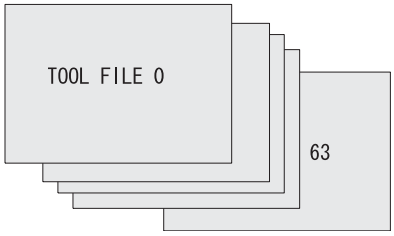
4. Press [FWD].
   – TCP moves to the second home position. The robot moving speed is set as selected manual speed.
5. Select {DATA} under the menu.
6. Select {CONFIRM POSITION}.
   – A message “Home position checked” appears.
   – Pulse data of the second home position and current pulse data are compared. 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.

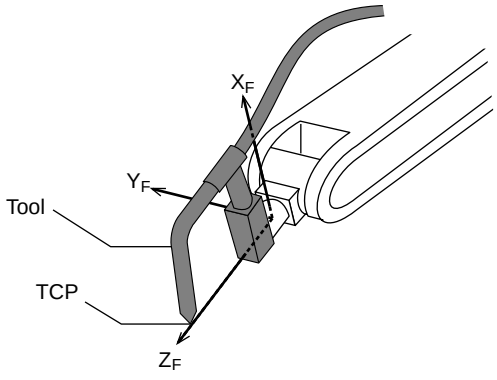


SUPPLE -MENT

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 " 8 Parameter " in DX100 OPERATOR'S MANUAL.

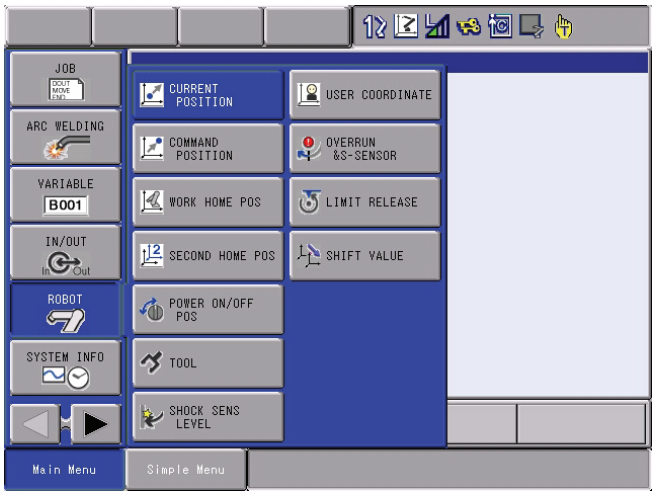
8.3.1.2 Registering Coordinate Data

When the number input operation is used for registering the tool file, input the TCP of the tool on the flange coordinates.



1. Select {ROBOT} under the main menu.

– The sub menu appears.

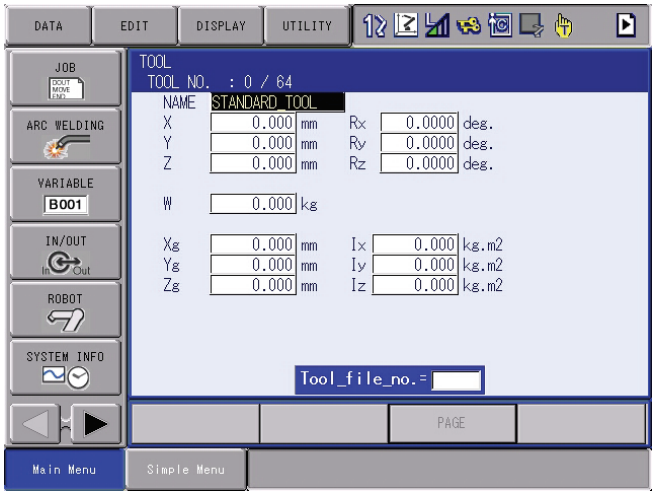


2. Select {TOOL}.

(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} .



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

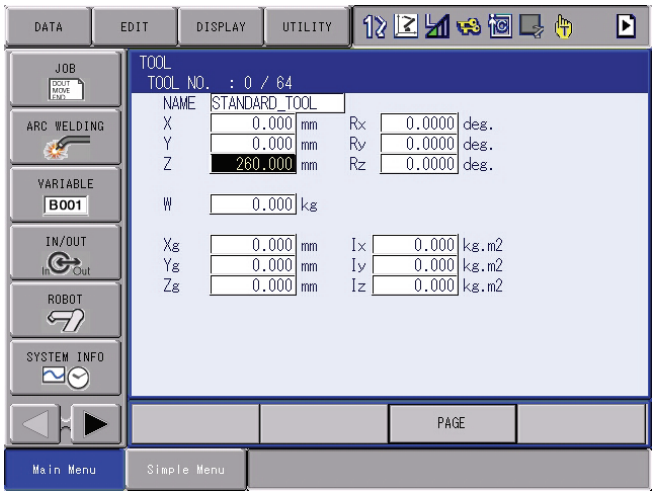


3. Select the desired tool number.
4. Place the cursor in the part to register the desired coordinate data and press [SELECT].

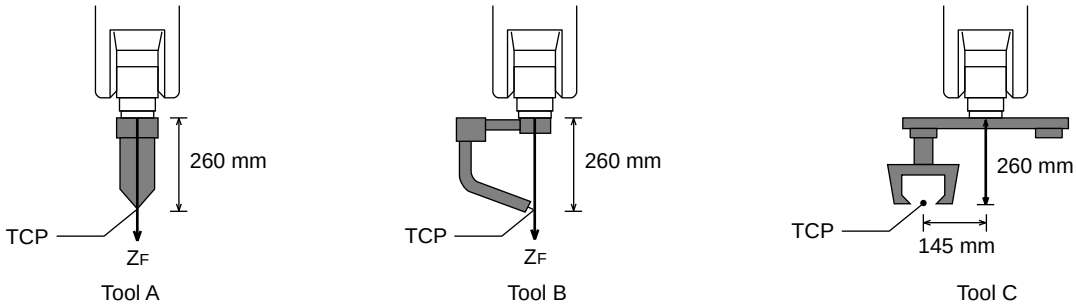
– The number is ready to input.

5. Input the coordinate data.
6. Press [ENTER].

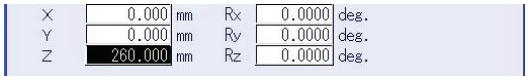
– The coordinate data is registered.



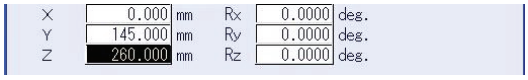
<Setting Example>



In case of Tool A, B



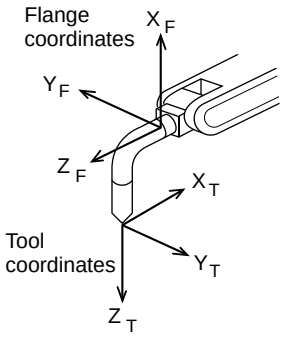
In case of Tool C



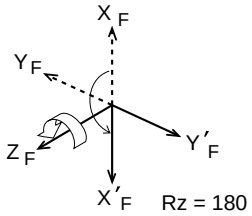
8.3.1.3 Registering Tool Angle

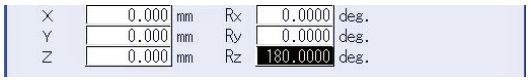
The tool pose data is angle data which shows the relation between the flange coordinates and the tool coordinates. The angle when the flange coordinates are rotated to meet to the tool coordinates becomes an input value. Clockwise toward the arrow is the positive direction. Register in the order of Rz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

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, 3 in *chapter 8.3.1.2 "Registering Coordinate Data" at 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.

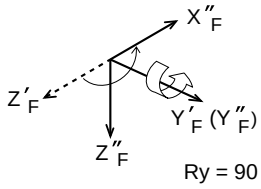


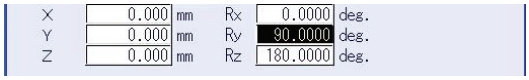


6. Press [ENTER].
   – The rotation angle of Rz is registered.

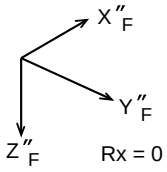
In the same way, register the angle of Ry, Rx.

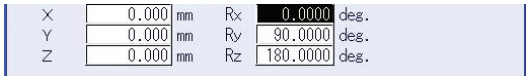
Ry must be the input rotation angle around Y'_F flange coordinates.





– Rx must be the input rotation angle around X'_F of flange coordinates.





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.

SUPPLE -MENT

For more details on the tool load information, refer to
chapter 8.4.3 "Tool Load Information Setting" at page 8-43

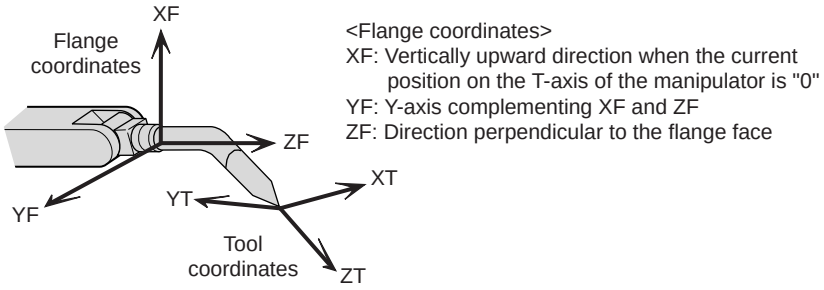
8.3.2 Tool Calibration

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, "Coodinates" 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.

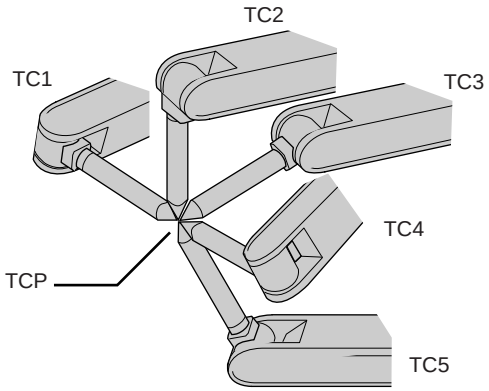
NOTE

- In case of S2C432=0 (only coordiantes 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.

8.3.2.3 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.



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

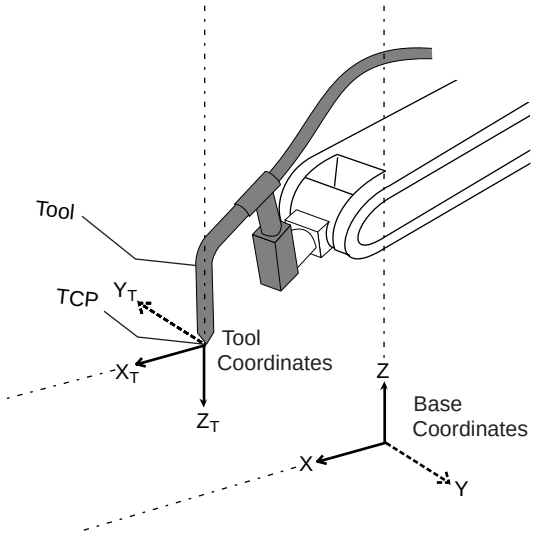
■ **Teaching for defining posture**

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.)

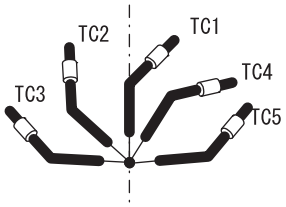
Tool posture data is automatically calcurated with this TC1 posture.

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

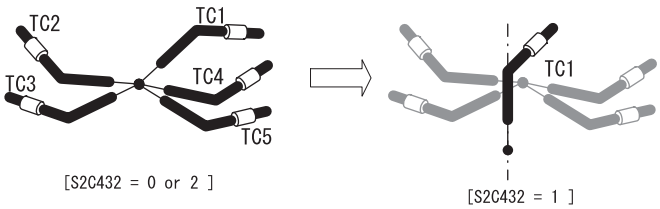


SUPPLE -MENT

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 the all tool points meet at the TC1's tool point as shown in the figure below.



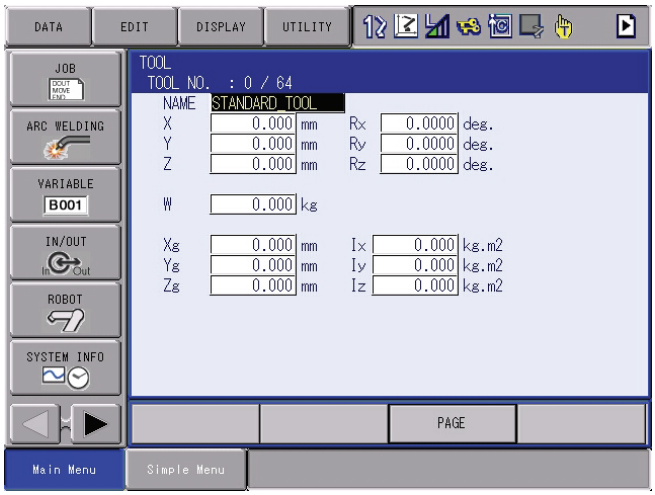
If teaching in one place as the figure above is impossible due to the interferance of peripheral equipments and so on, perform calibration of coordinates with S2C432=0 or 2, and then change to S2C432=1, teach only TC1 in a different position and register the tool posture data.



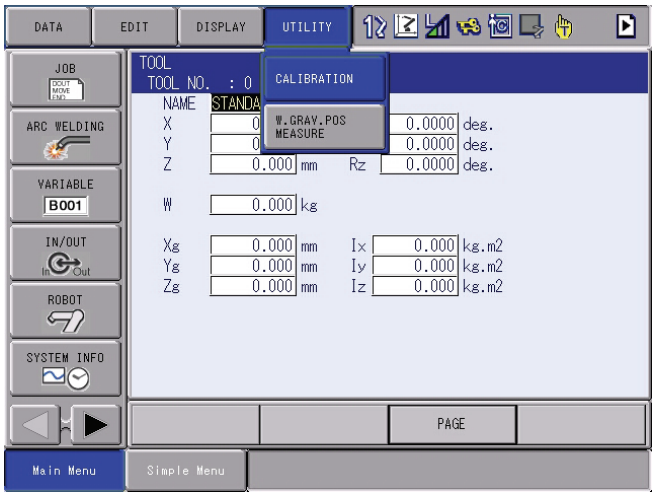
SUPPLE -MENT

- 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.

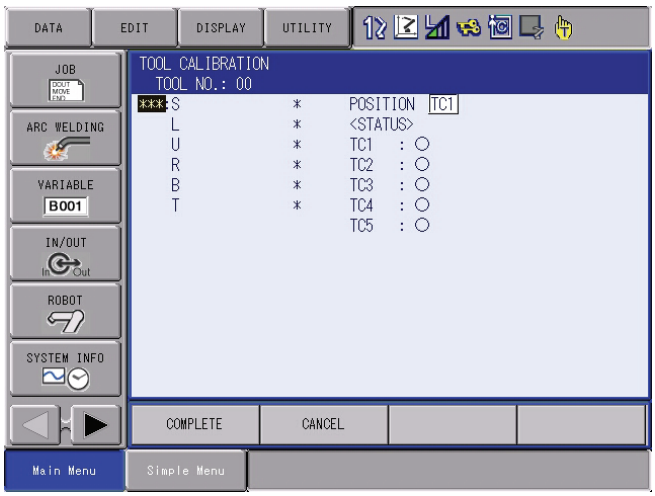
1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
3. Select the desired tool number.
   – In the same way as shown in the instruction 2 and 3 of the *chapter 8.3.1.2 “Registering Coordinate Data” at page 8-18*, display the desired tool coordinate window.



4. Select {UTILITY} under the menu.
   – The pull-down menu appears.



5. Select {CALIBRATION}.
   – The TOOL CALIBRATION window is shown.

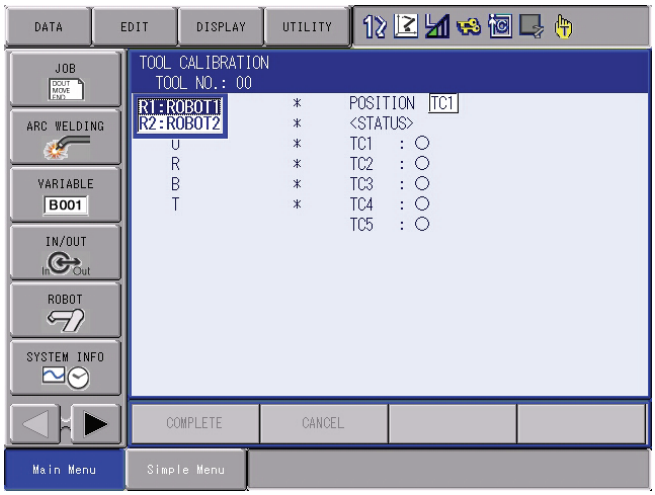


6. Select the robot.

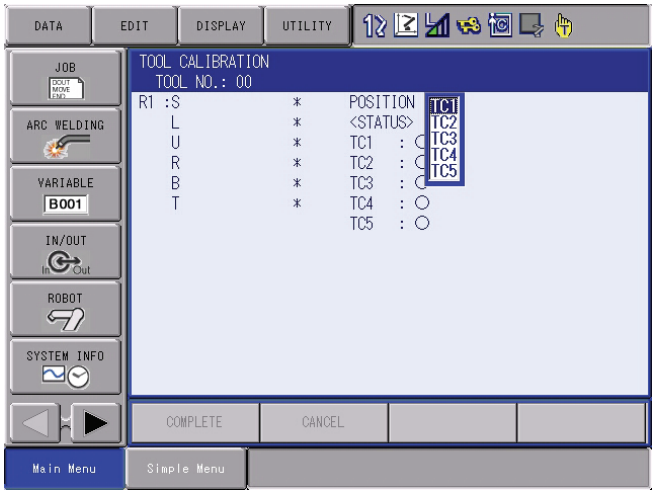
   (1) Select the robot to calibrate.
   (When the robot has already been selected or there is only one of robot, this operation should not be performed.)

   (2) Select “**” in the TOOL CALIBRATION window and select the robot in the shown selection dialog box.

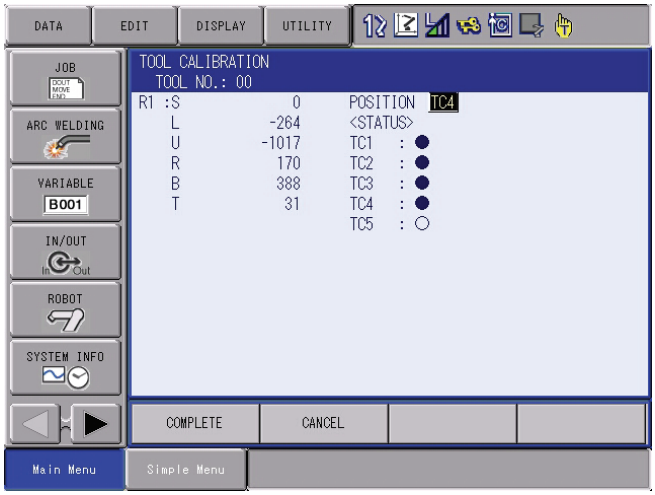
   (3) The robot is set.



7. Select “POSITION”.
   – The selection dialog box is shown.
   (1) Select the teaching point for calibration.

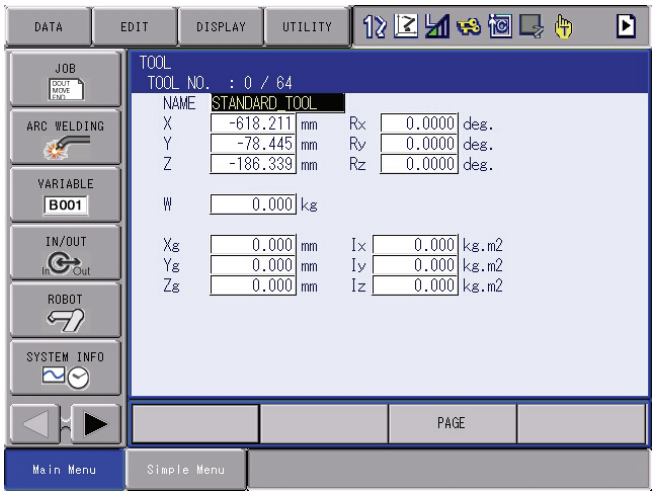


8. Move the manipulator using the axis key.
9. Press [MODIFY] and [ENTER].
   – Taught position is registered.
   Repeat 7 to 9 operation to teach TC1 to TC5.
   "●" indicates that teaching is completed and "○" indicates that it is not completed.



   – 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”.

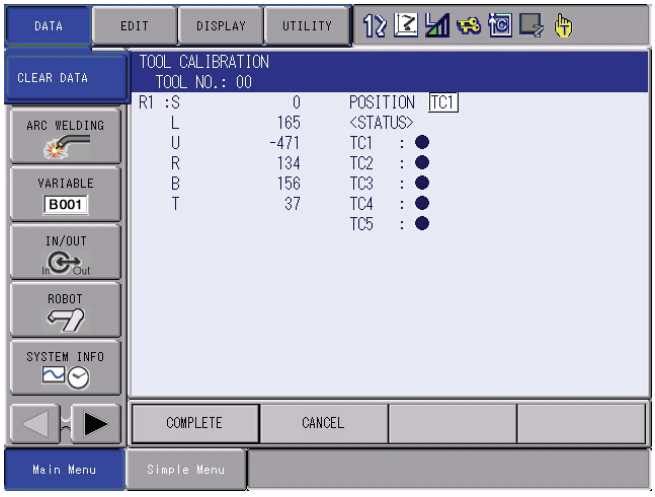
– Calibration data is registered in the tool file. Once the calibration is completed, the tool coordinate window is displayed on the screen.



8.3.2.4 Clearing Calibration Data

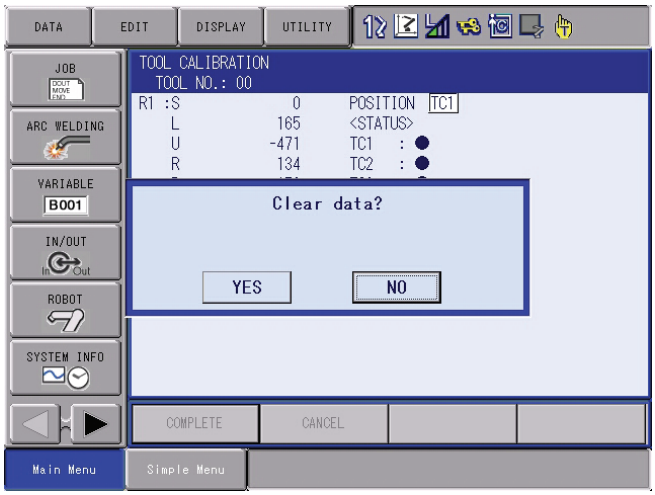
Before the calibration of a new tool, clear the robot information and calibration data.

1. Select {DATA} under the pull-down menu.
   – The pull-down menue appears.



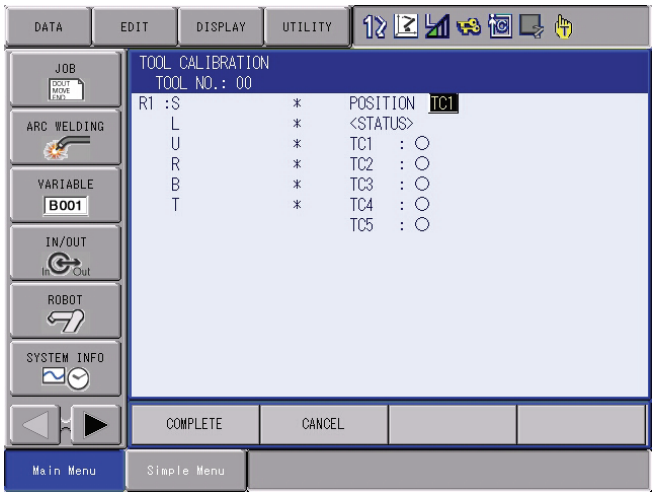
2. Select {CLEAR DATA}.

– The confirmation dialog box is shown.



3. Select {YES}.

– All data is cleared.

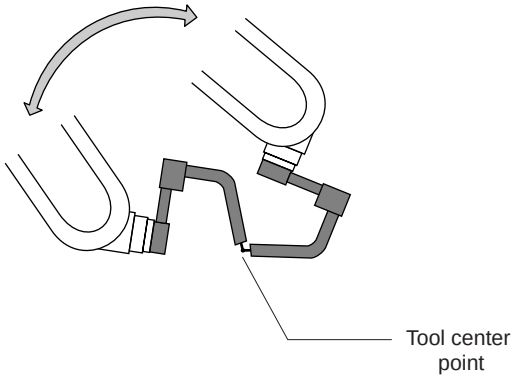


SUPPLE-MENT

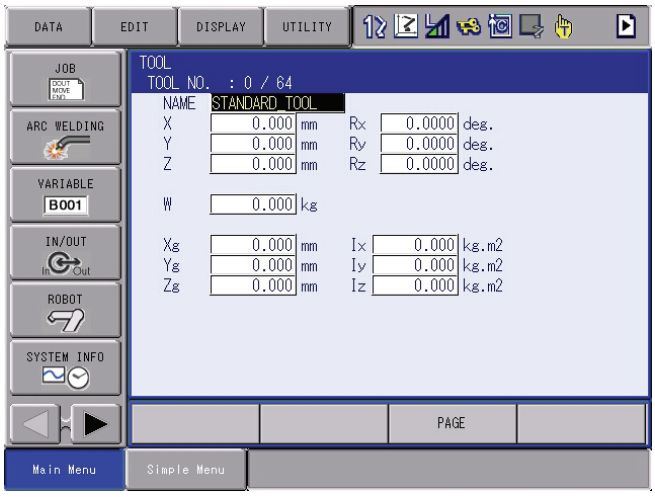
If tool angle data is required, input the data number in the tool coordinate window.
Refer to *chapter 8.3.1.3 “Registering Tool Angle” at page 8-21* for the operating instructions.

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.

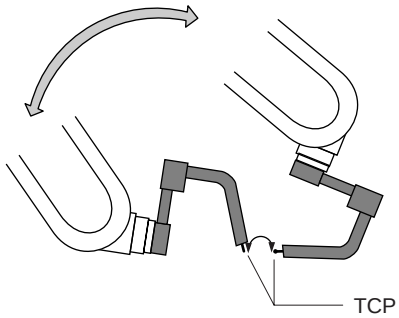


1. Press [COORD].
   – Select any coordinate system except “ JOINT” by pressing [COORD].



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.



SUPPLE -MENT For details on the TCP fixed operation, see "2.8.1 Motion about TCP" in 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?

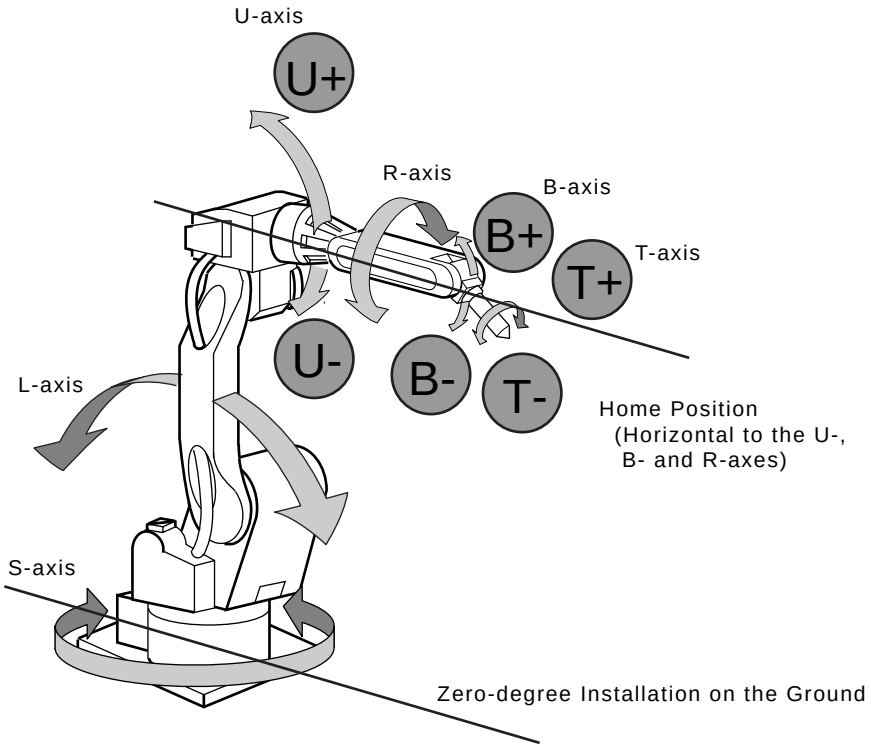
With this function, the user can register the load of tool and the position of the tools center of gravity.

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

NOTE This function can be used where the manipulator is installed level on the ground.
For the conditions required for manipulator installation, refer to *chapter 8.4 "ARM Control" at page 8-38*.

8.3.3.2 Measurement of the Tool Load and the Center of Gravity

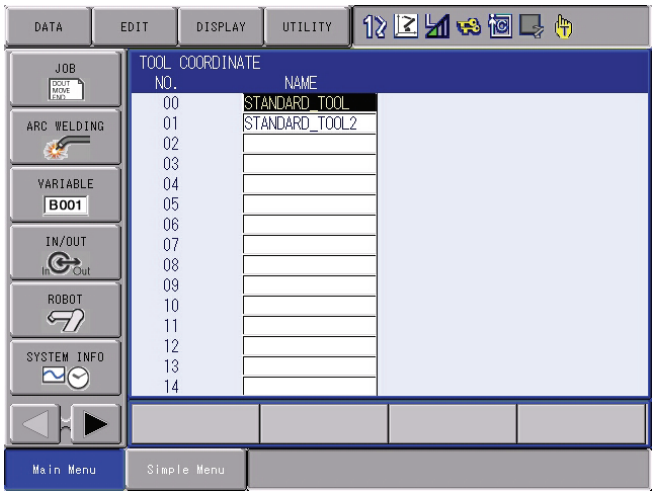
To measure the tool load and the center of gravity, move the manipulator to its home position (horizontal to the U-, B- and R-axes) and operate the U-, B- and T-axes.

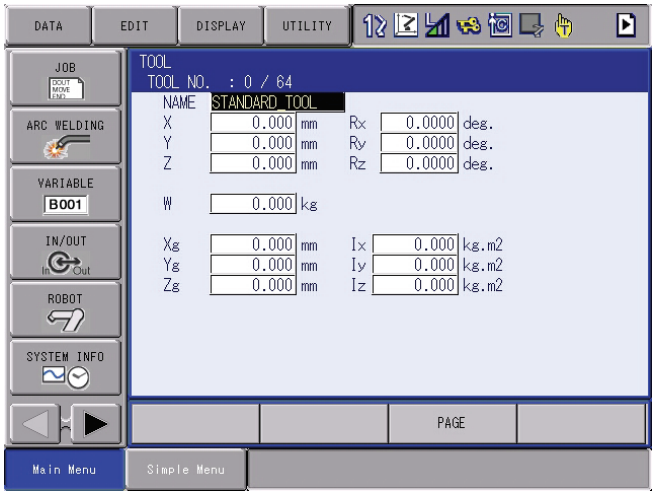


NOTE To correctly measure the tool load or the center of gravity, remove the cables or wires connected to the tool.

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.

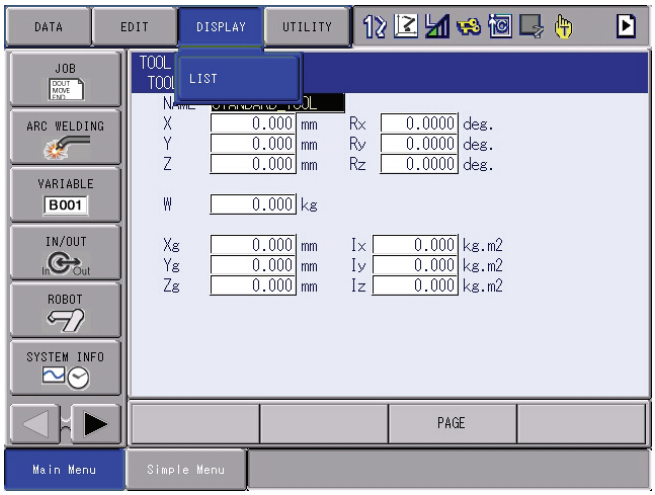
If the file extension function is invalid, the tool coordinate window appears.



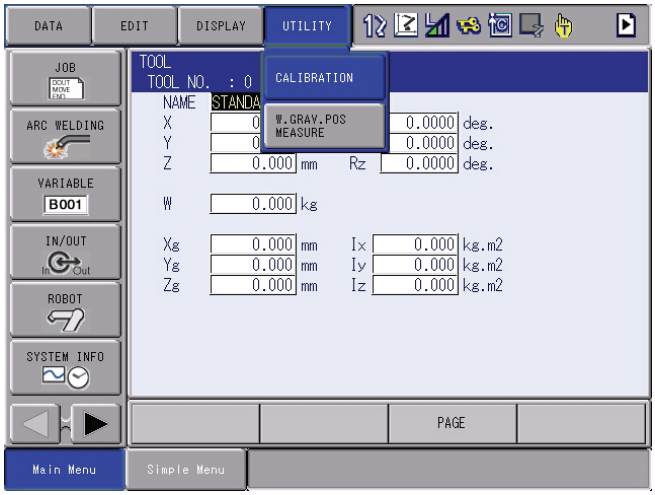


3. Select the desired tool number.
   – Move the cursor to the desired number in the tool list window and press [SELECT].
   – The tool coordinate window of the selected number is shown.
   – In the tool coordinate window, the number can be changed by pressing the page key  or selecting {PAGE}.

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

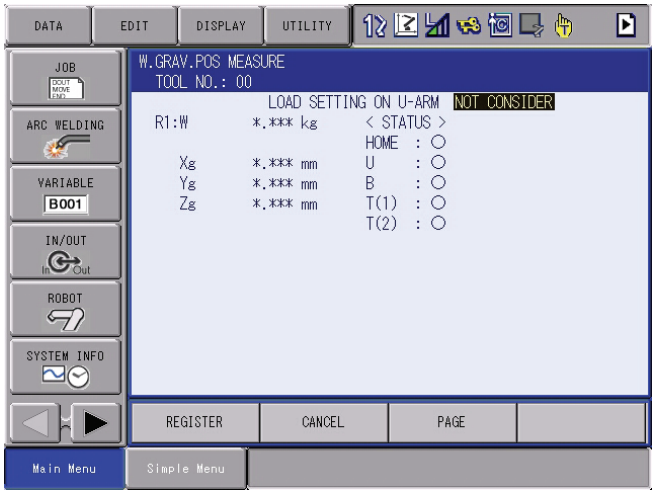


4. Select {UTILITY} under the menu.



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] once, and the manipulator moves to the home position (horizontal to the U-, B- and R-axes).
8. Press [FWD] again.
   – 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, “○“changes to “●“.

③ 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

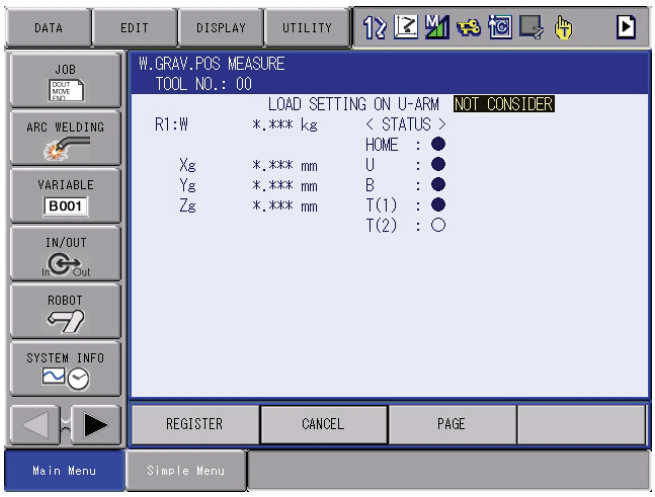
③ First measurement of the T-axis: T-axis home position +4.5 degrees → -4.5 degrees

④ Second measurement of the T-axis: T-axis home position +60 degrees → +4.5 degrees → -4.5 degrees

SUPPLE -MENT

- 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 “○“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 “○“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 educed 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

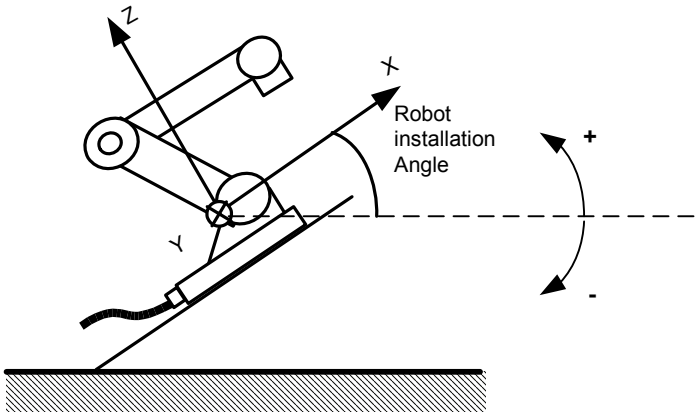
Fulfill the following robot setup condition to enable the ARM control.

- Robot installation angle
- S-head payload
- U-arm payload

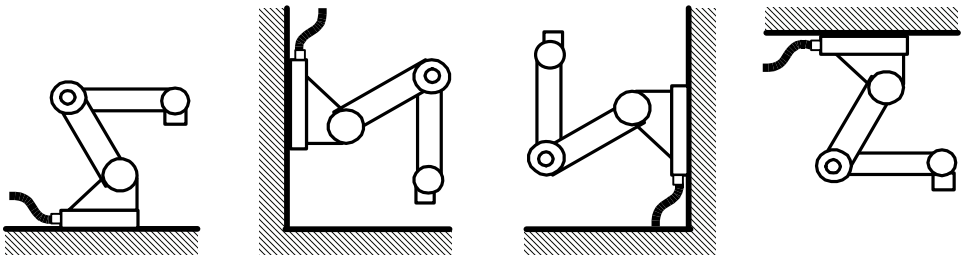
■ **Robot installation angle**

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>



0 degrees -90 degrees +90 degrees 180 degrees

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 “-”.

NOTE

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.

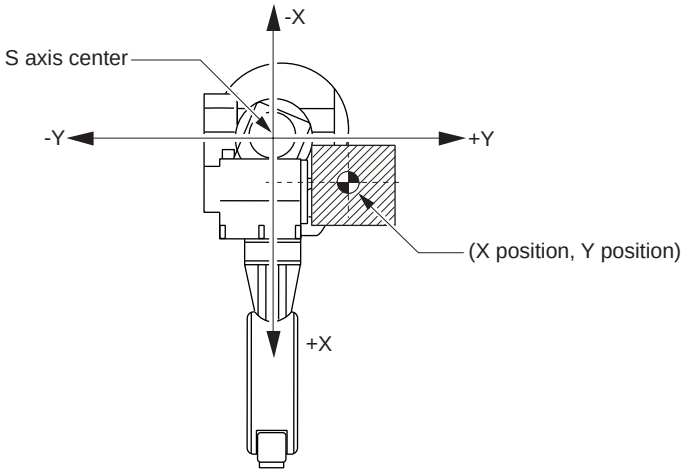
It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual load. (Round up the value with each fraction between 0.5 to 1 kg.)

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.

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)

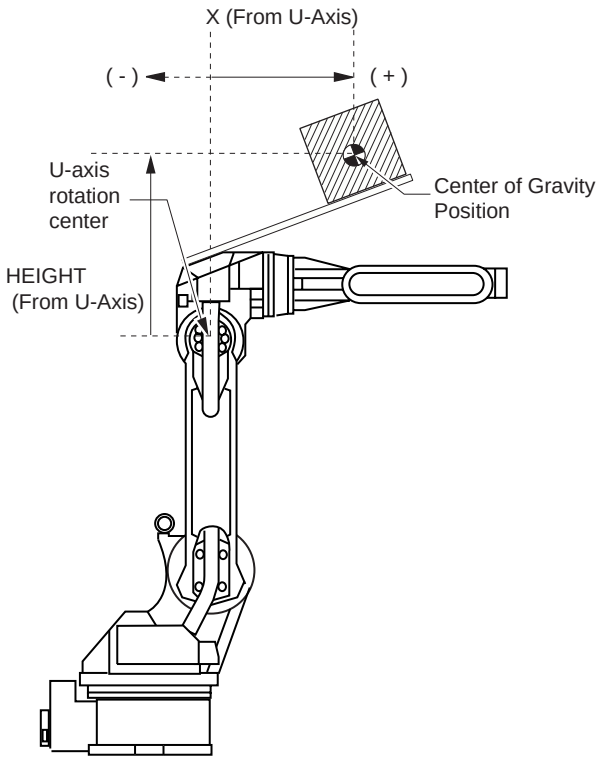
X (From U-Axis), HEIGHT (From U-Axis) (unit: mm)

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.

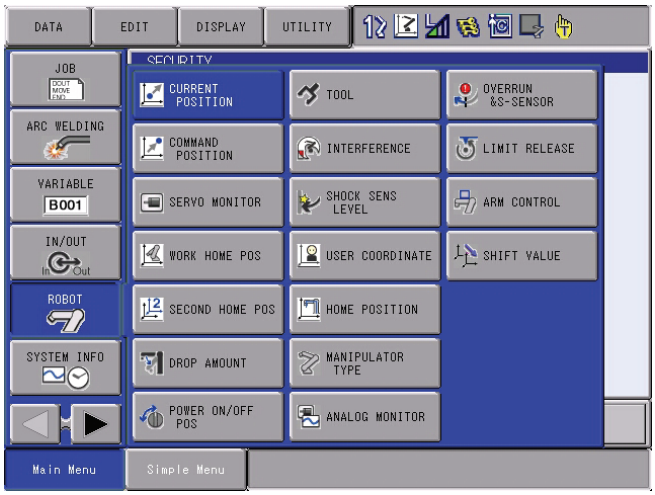
HEIGHT (From U-Axis) is height of the vertical direction from U-axis rotation center to the center of gravity position of the load.

Fig. 8-1: Load on the U-arm: Center of Gravity Position (Side View)

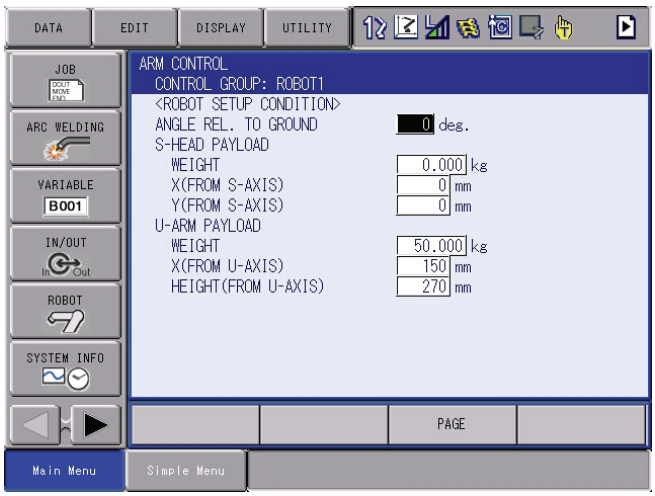


NOTE ARM CONTROL window is displayed only when the security mode is set in the management mode.

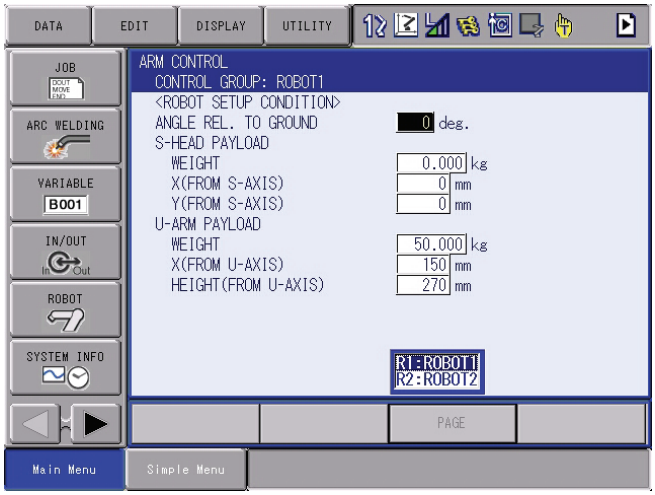
1. Select {ROBOT} under the main menu.



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.

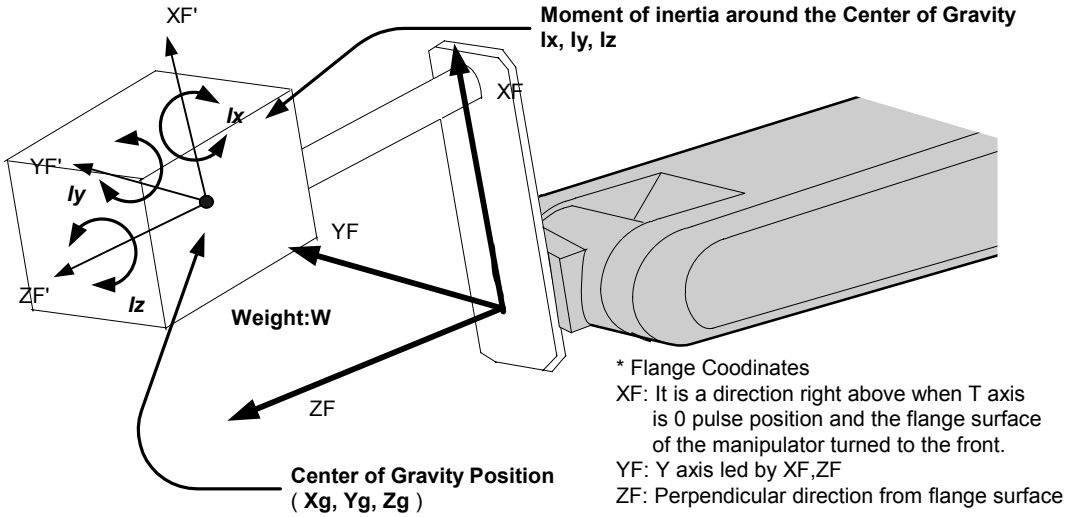
Set the tool load information before teaching the job after the tool is installed.

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.



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: xg, yg, zg (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.

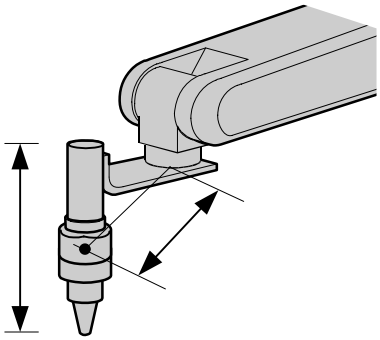
■ **Moment of inertia at the center of gravity: Ix, Iy, Iz (Unit: kg·m^2)**
It is an moment of inertia of the tool at the center of gravity position.

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.

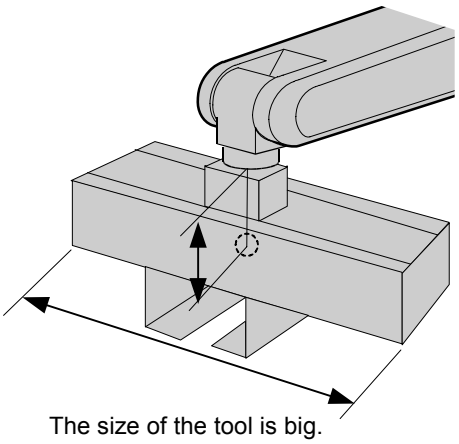
It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual value.

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).



The size of the tool is not too big.
Setting the moment of inertia at center of gravity is not necessary.



The size of the tool is big.
Setting the moment of inertia at center of gravity is necessary.

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

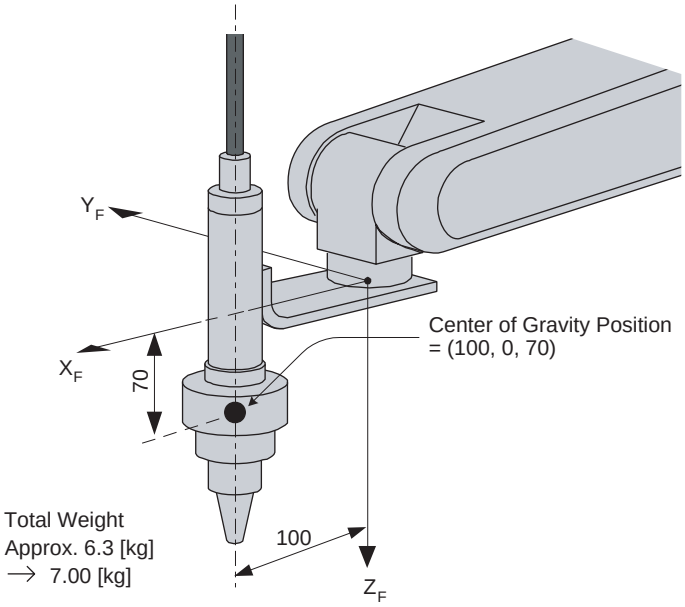
- Method to approximate the entire tool in hexahedron or cylinder.
- Method to calculate from each weight and center of gravity position of plural mass.

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>

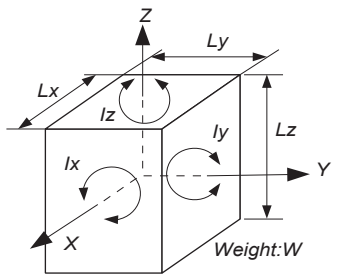
- W : 7.000 kg
- Xg : 100.000 mm
- Yg : 0.000 mm
- Zg : 70.000 mm
- Ix : 0.000 kg •m²
- Iy : 0.000 kg •m²
- Iz : 0.000 kg •m²

SUPPLE-MENT

- 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.

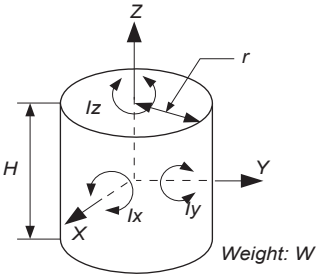
Refer to the expression when the calculation of the moment of inertia at the center of gravity.



$$Ix = \frac{Ly^2 + Lz^2}{12} * W$$

$$Iy = \frac{Lx^2 + Lz^2}{12} * W$$

$$Iz = \frac{Lx^2 + Ly^2}{12} * W$$



$$Ix = Iy = \frac{3r^2 + H^2}{12} * W$$

$$Iz = \frac{r^2}{2} * W$$

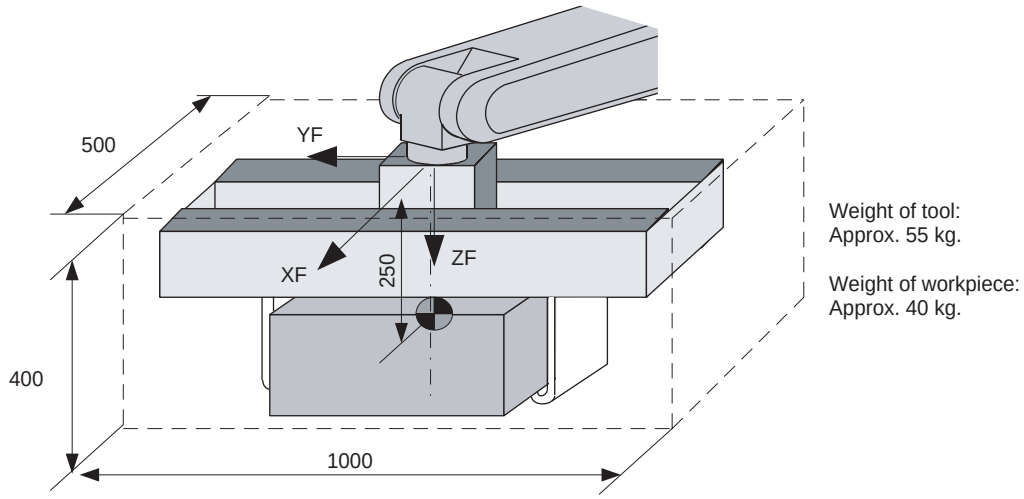
* Unit of Weight : [kg]
* Unit of Length : [m]
* Unit of Ix, Iy, Iz : [kg·m²]

<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

= approx. 100[kg]

Center of gravity: Position at flange right under 250mm almost

(Xg, Yg, Zg) = (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,

$Ix = (Ly^2 + Lz^2 / 12) * W$

$= ((0.400^2 + 1.000^2) / 12) * 100 = 9.667 =$ approx. 10.000

$Iy = (Lx^2 + Lz^2 / 12) * W = ((0.500^2 + 0.400^2) / 12) * 100 = 3.417 =$ approx. 3.500

$Iz = (Lx^2 + Ly^2 / 12) * W = ((0.500^2 + 1.000^2) / 12) * 100 = 10.417 =$ approx. 10.500

<Setting>

- W : 100.000 kg
- Xg : 0.000 mm
- Yg : 0.000 mm
- Zg : 250.000 mm
- Ix : 10.000 kg.m^2
- Iy : 3.500 kg.m^2
- Iz : 10.500 kg.m^2

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.)

   wi : Weight of the i-th parts [kg]

   (xi, yi, zi) : Center of gravity position of the i- th parts (On flange coordinates)[mm]

   Icxi, Icyi, Iczi : Own moments of inertia of the i-th parts [kg*m^2]

SUPPLE -MENT

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

$$xg = \{w1 * x1 + w2 * x2 + ... + wi * xi\} / (w1 + w2 + ... + wi)$$

$$yg = \{w1 * y1 + w2 * y2 + ... + wi * yi\} / (w1 + w2 + ... + wi)$$

$$zg = \{w1 * z1 + w2 * z2 + ... + wi * zi\} / (w1 + w2 + ... + wi)$$

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

$$Ix = \{ w1 * ((y1 - yg)^2 + (z1 - zg)^2) * 10^{-6} + Icx1\} + \{ w2 * ((y2 - yg)^2 + (z2 - zg)^2) * 10^{-6} + Icx2\}$$
$$.....$$
$$+ \{ wi * ((yi - yg)^2 + (zi - zg)^2) * 10^{-6} + Icxi\}$$

$$Iy = \{ w1 * ((x1 - xg)^2 + (z1 - zg)^2) * 10^{-6} + Icy1\} + \{ w2 * ((x2 - xg)^2 + (z2 - zg)^2) * 10^{-6} + Icy2\}$$
$$.....$$
$$+ \{ wi * ((xi - xg)^2 + (zi - zg)^2) * 10^{-6} + Icyi\}$$

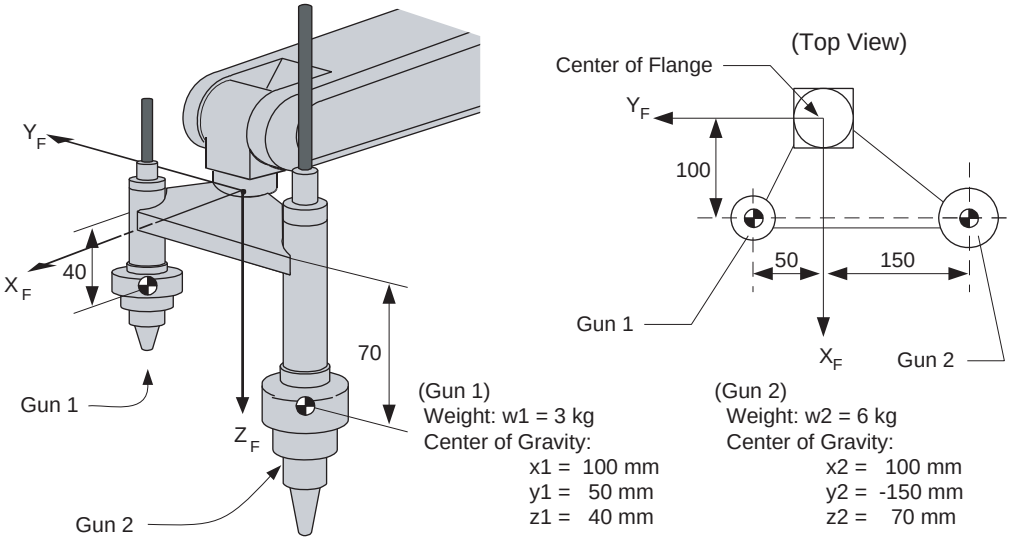
$$Iz = \{ w1 * ((x1 - xg)^2 + (y1 - yg)^2) * 10^{-6} + Icz1\} + \{ w2 * ((x2 - xg)^2 + (y2 - yg)^2) * 10^{-6} + Icz$$
$$.....$$
$$+ \{ wi * ((xi - xg)^2 + (yi - yg)^2) * 10^{-6} + Iczi\}$$

<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 forementioned 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 mothod 2.



(Gun 1)
Weight: w1 = 3 kg
Center of Gravity:
x1 = 100 mm
y1 = 50 mm
z1 = 40 mm

(Gun 2)
Weight: w2 = 6 kg
Center of Gravity:
x2 = 100 mm
y2 = -150 mm
z2 = 70 mm

Weight : $W = w1 + w2$

$= 3 + 6 = 9 = \text{approx. } 10[kg]$

Center of gravity $Xg = (w1 * x1 + w2 * x2) / (w1 + w2)$

$= (3 * 100 + 6 * 100) / (3+6) = 100.0\ [mm]$

$Yg = (3 * 50 + 6 * (-150)) / (3+6) = -83.333\ [mm]$

$Zg = (3 * 40 + 6 * 70) / (3+6) = 60.0\ [mm]$

The moment of inertia at the center of gravity position:

$Ix = \{ w1 * ((y1 - Yg)^2 + (z1 - Zg)^2) * 10^{-6} + Icx1\}$

$+ \{ w2 * ((y2 - Yg)^2 + (z2 - Zg)^2) * 10^{-6} + Icx2\}$

$= 3 * ((50 - (-83))^2 + (40 - 60)^2) * 10^{-6}$

$+ 6 * (((-150) - (-83))^2 + (70 - 60)^2) * 10^{-6}$

$= 0.082 = \text{approx. } 0.100$

$Iy = 3 * ((100 - 100)^2 + (40 - 60)^2) * 10^{-6}$

$+ 6 * ((100 - 100)^2 + (70 - 60)^2) * 10^{-6}$

$= 0.002 = \text{approx. } 0.010$

$$Iz = 3 * ((100 - 100)^2 + (50 - (-83))^2) * 10^{-6}$$
$$+ 6 * ((100 - 100)^2 + ((-150) - (-83))^2) * 10^{-6}$$
$$= 0.080 = \text{approx. } 0.100$$

* The own moment of inertia (Icxi, Icyi, Iczi) of the gun is disregarded in this example, since each gun is smaller than the entire tool.

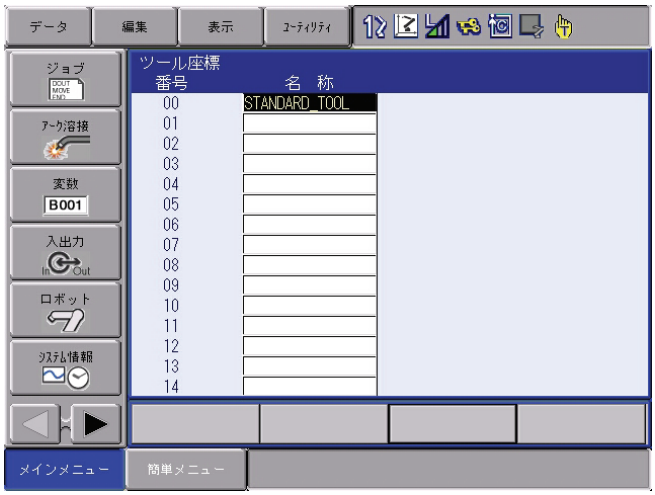
<Setting>

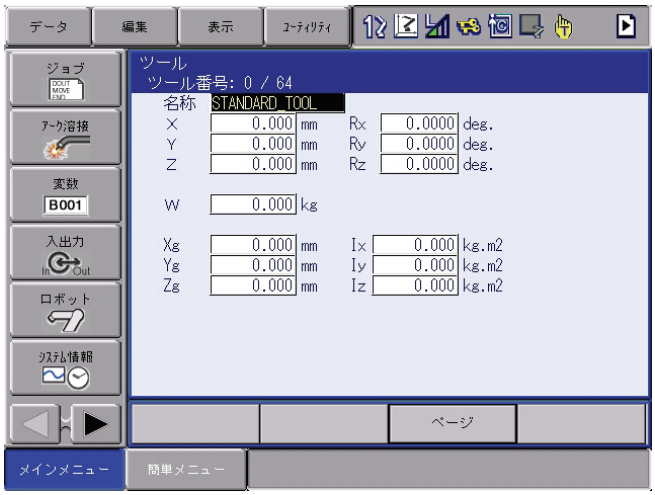
- W : 10.000 kg
- Xg : 100.000 mm
- Yg : -83.333 mm
- Zg : 60.000 mm
- Ix : 0.100 $kg.m^2$
- Iy : 0.010 $kg.m^2$
- Iz : 0.100 $kg.m^2$

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.

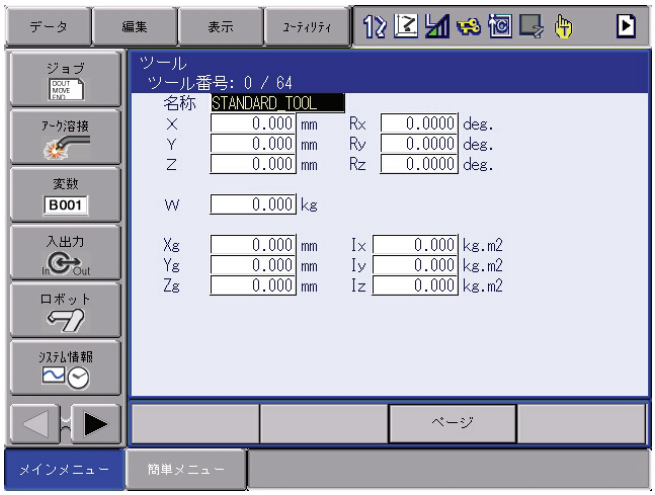
   (3) Select the desired number in the tool coordinate window by pressing the page key  or clicking on the {PAGE} button.

   (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 = Payload

Center of gravity position:

(Xg, Yg, Zg) = (0, 0, Allowed value of B-axis for payload)

NOTE

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

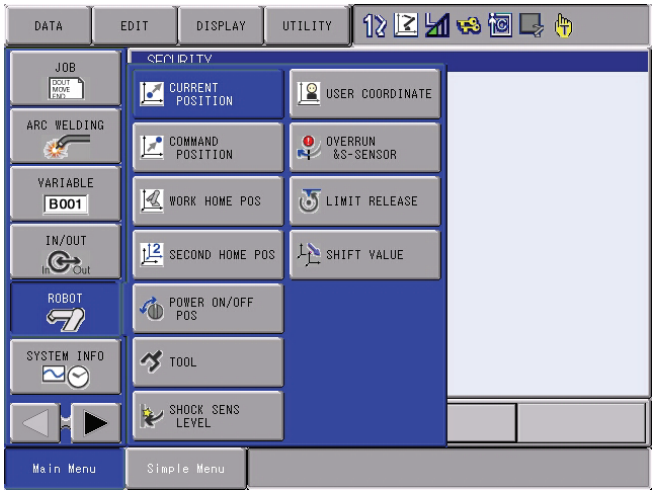
8.5.1 What is the Work Home Position?

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.

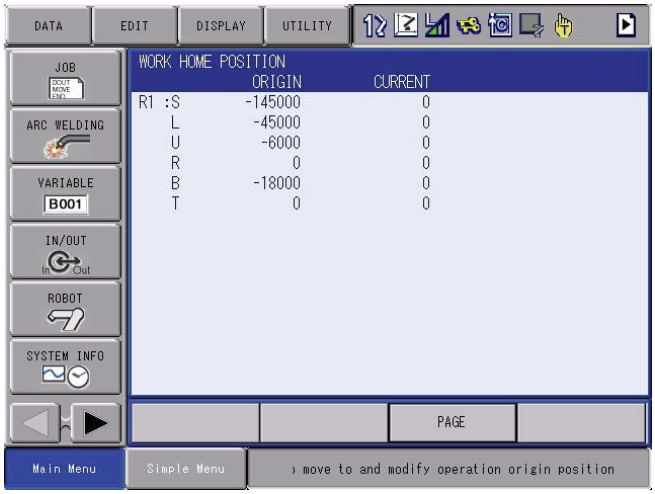
8.5.2 Setting Work Home Position

8.5.2.1 Work Home Position Window

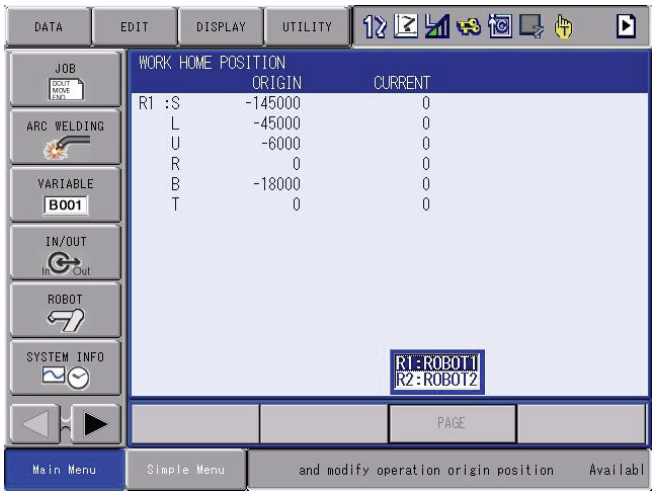
1. Select {ROBOT} under the main menu.



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].
   – New work home position is set.

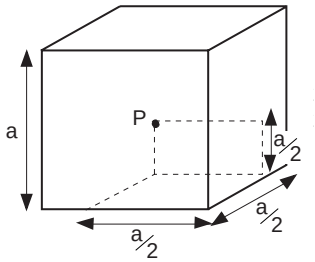
When the work home position is changed, the cubic interference area is automatically set as cube 64 to 57 in the base coordinate system.

- 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

NOTE

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. 8-2: 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:

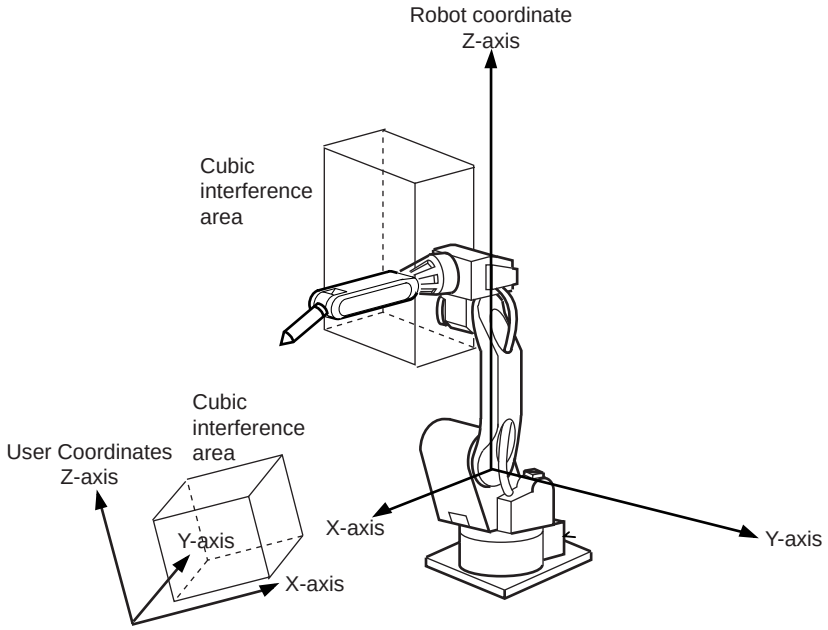
- Cubic Interference Area
- Axis Interference Area

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

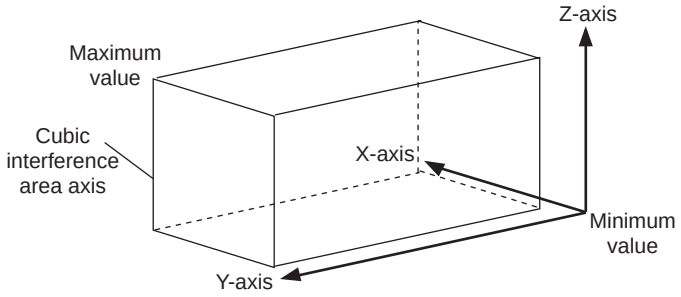
This area is a rectangular parallelepiped which is parallel to the base coordinate, robot coordinate, or user coordinate. The DX100 judges whether the current position of the manipulator's TCP is inside or outside this area, and outputs this status as a signal.



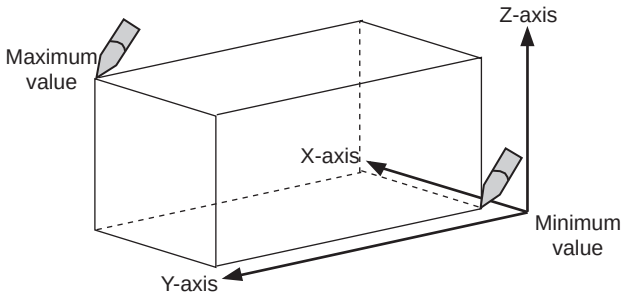
8.6.2.2 Cube Setting Method

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

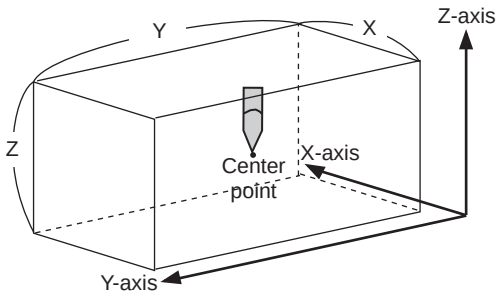
1. Enter the maximum and minimum values for the cube coordinates.



2. Move the manipulator at the maximum and minimum value positions of the cube corner using the axis keys.

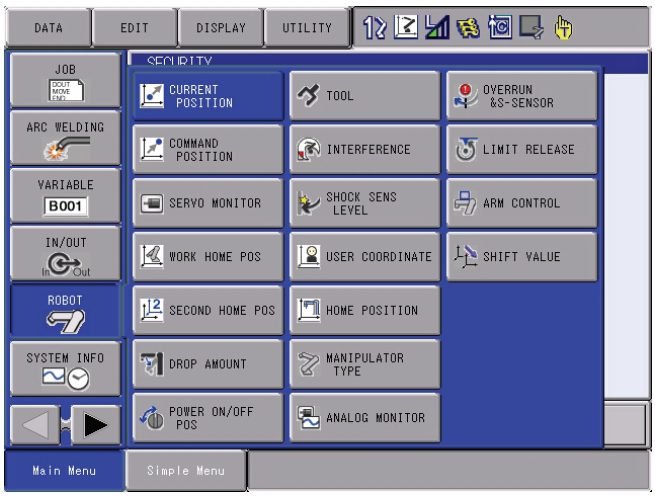


3. After entering the lengths of the three faces of the cube (axial length) using the Numeric keys, move the manipulator to the center point of the cube using the axis keys.

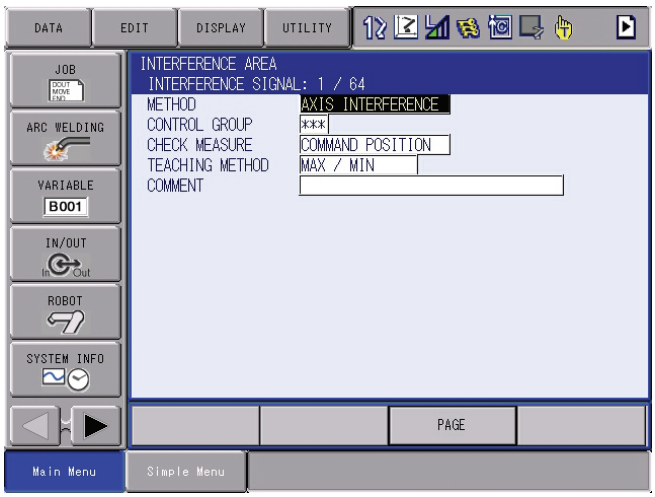


8.6.2.3 Setting Operation

1. Select {ROBOT} under the main menu.

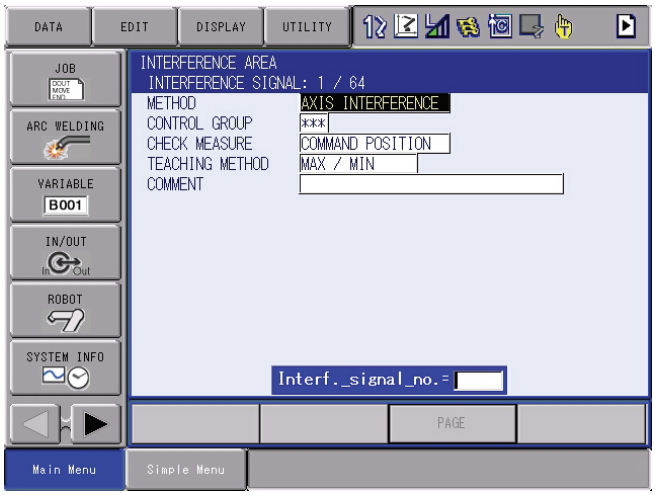


2. Select {INTERFERENCE}.
   – The INTERFERENCE AREA window is shown.



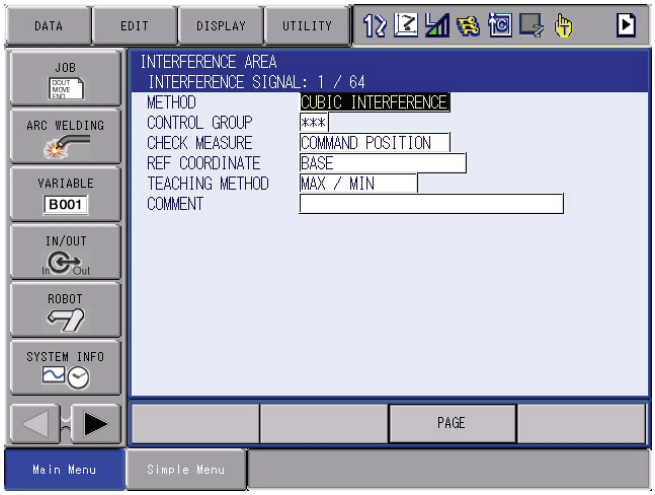
3. Select the desired cube number.
   – Select the desired cube number with the page key  or by number input.

– When selecting the cube number by number input, select {PAGE} to input the desired signal number.



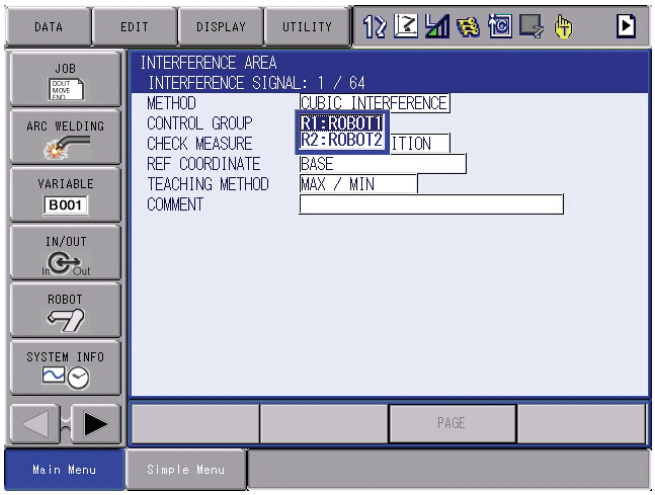
4. Select “METHOD”.

– ”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.

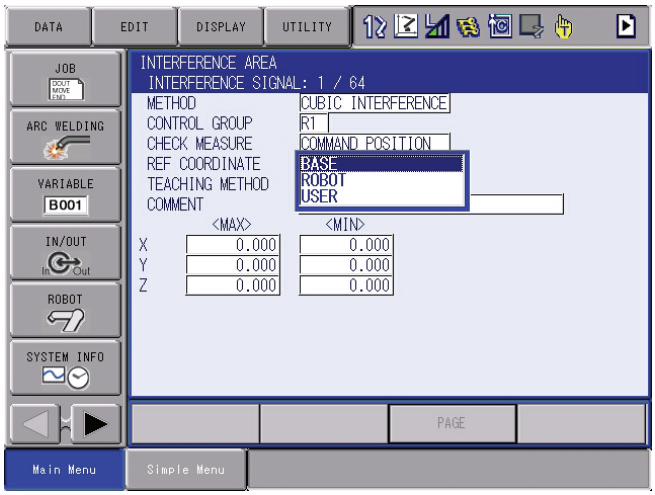


6. Select “REF COORDINATES”.

(1) A selection box appears.

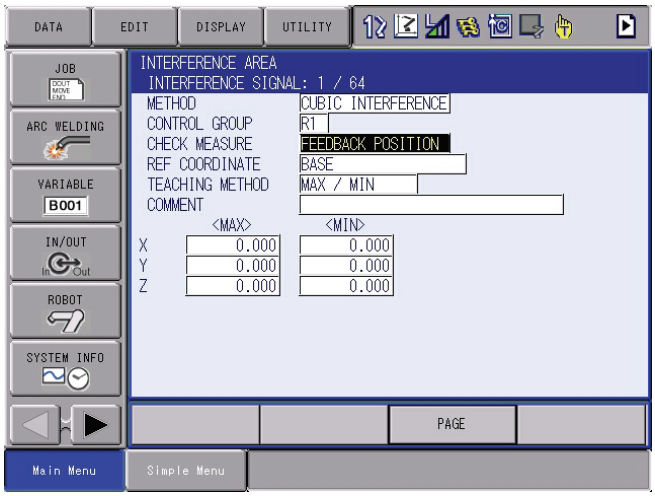
(2) Select the desired coordinate.

(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.



NOTE

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.

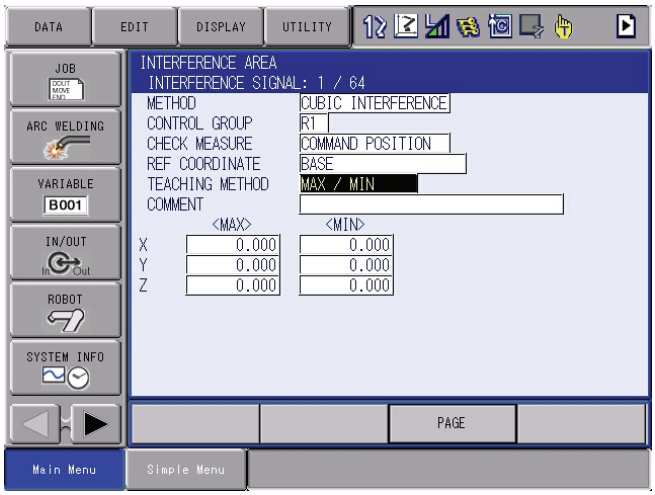
When using the interference signal to inform an external unit of the actual manipulator position, use the "FEEDBACK POSITION" setting to enable the signal output in more accurate timing.

■ **Number Input of the Cube Coordinates**

1. Select “METHOD”.

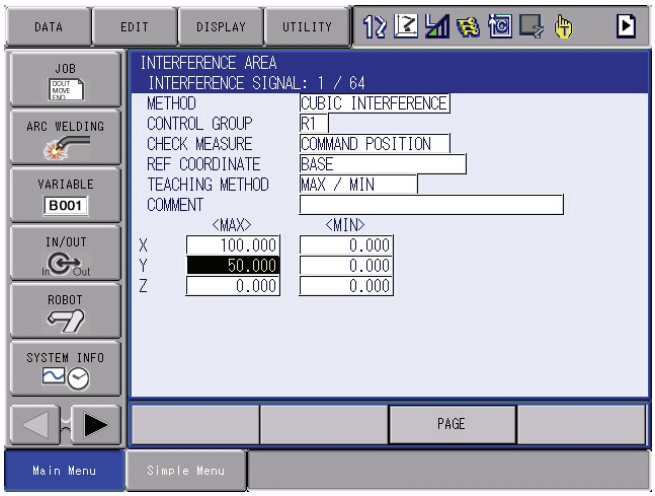
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.



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

   – The cubic interference area is set.



■ **Teaching Corner**

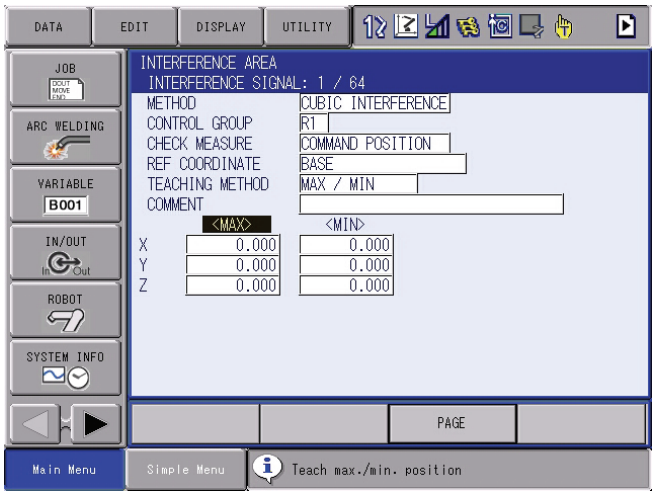
1. Select “METHOD”.

   (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>.”

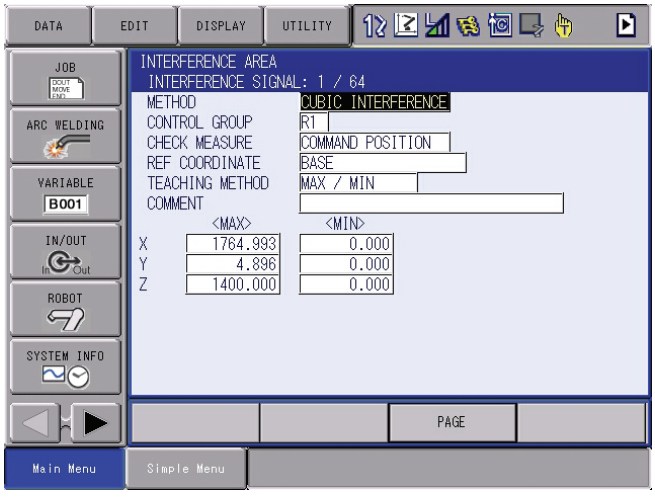
   – Move the cursor to “<MAX>” when changing the maximum value, and move cursor to “<MIN>” when changing the minimum value. The cursor only moves to either “<MIN>” or “<MAX>” at this time.

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.

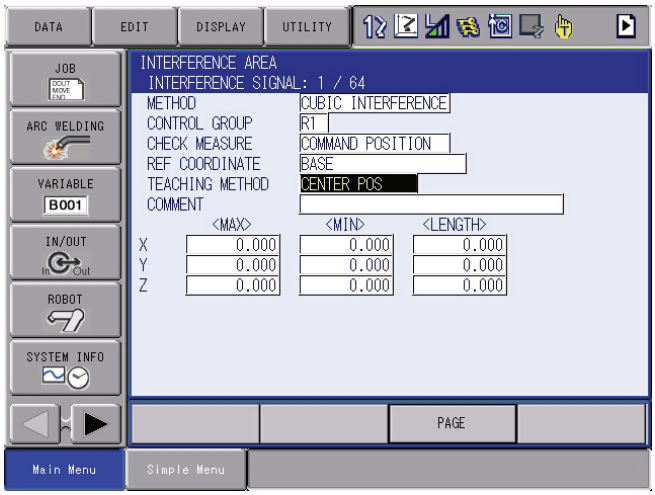


■ **Number Input of the Side of Cube and Teaching Center**

1. Select “METHOD”.

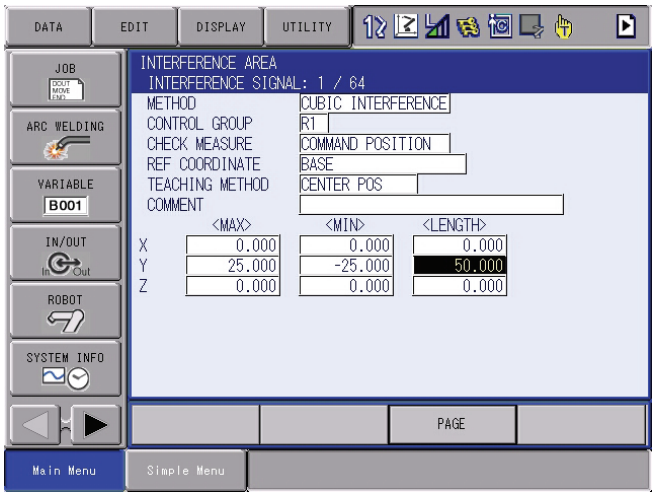
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

(2) Select “CENTER POS”.



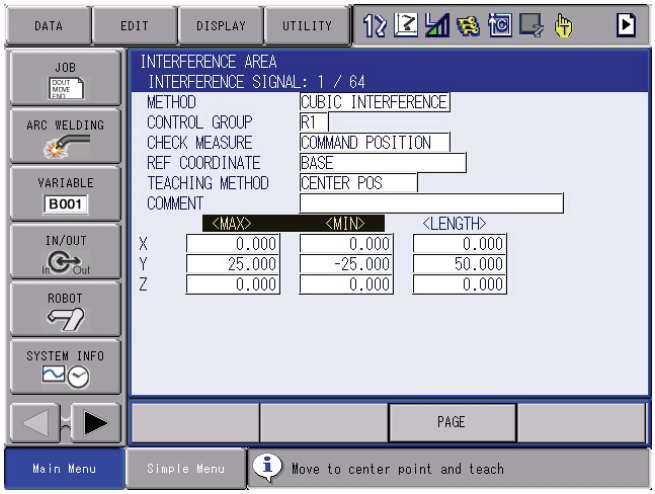
2. Input data for length of the cube, then press [ENTER].

– The length is set.

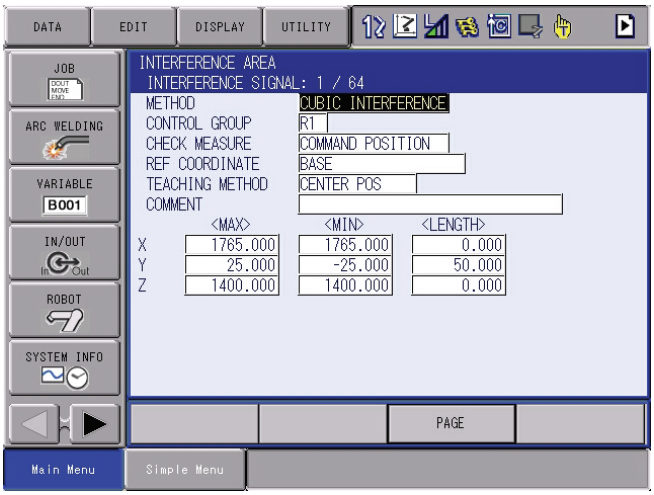


3. Press [MODIFY].

– 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.

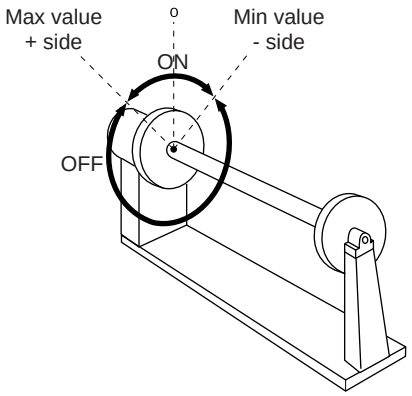


8.6.3 Axis Interference Area

8.6.3.1 Axis Interference Area

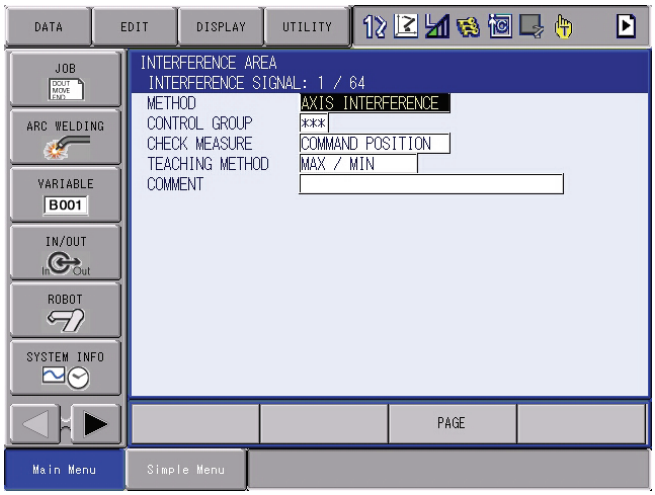
The axis interference area is a function that judges the current position of the each axis and outputs a signal. Once the maximum and minimum values have been set at the plus and minus sides of the axis to define the working range, a signal indicating whether the current position of the axis is inside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

Fig. 8-3: Axis Interference Signal for Station Axis

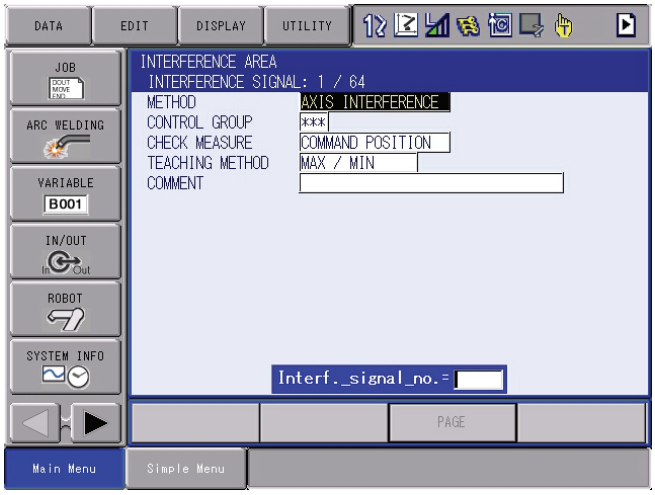


8.6.3.2 Setting Operation

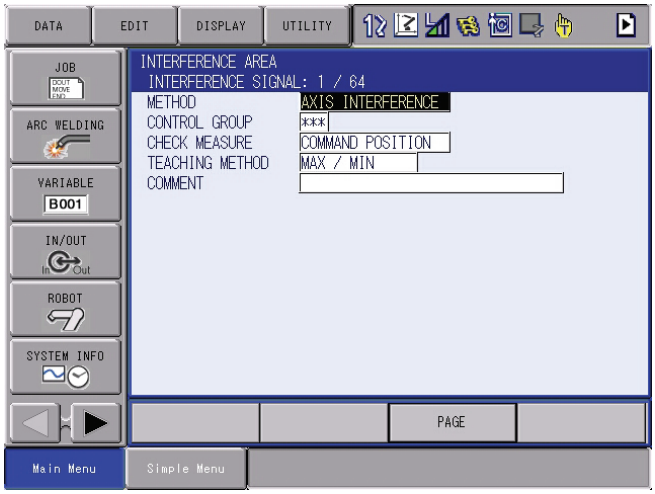
1. Select {ROBOT} under the main menu.
2. Select {INTERFERENCE}.
   – The INTERFERENCE AREA window appears.



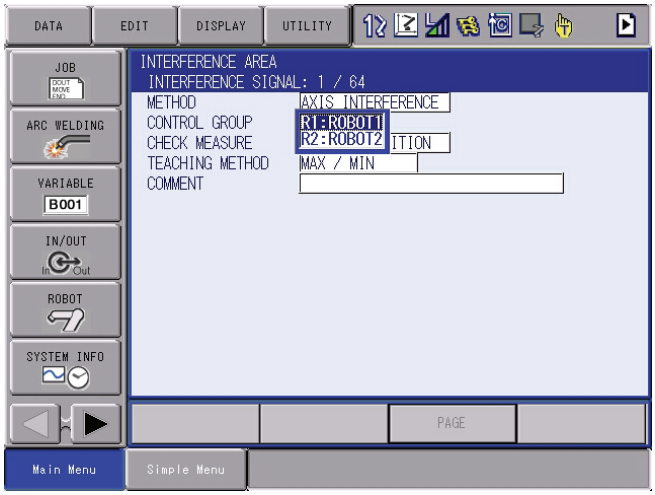
3. Select the desired interference signal number.
   – Select the desired interference signal number using the page key  or by number input.
   – When selecting the desired interference signal number by number input, select {PAGE} to input the desired signal number.



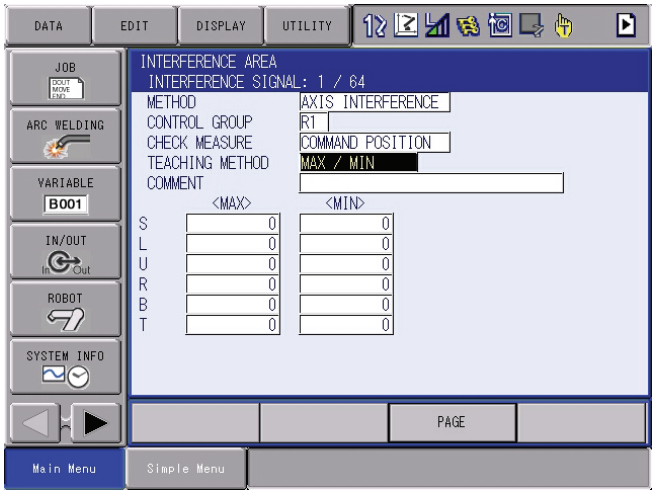
4. Select “METHOD”.
   – ”AXIS INTERFERENCE” and “CUBIC INTERFERENCE” are displayed alternately every time [SELECT] is pressed. Select “AXIS INTERFERENCE”.



5. Select “CONTROL GROUP”.
   – A selection box appears. Select the desired control group.



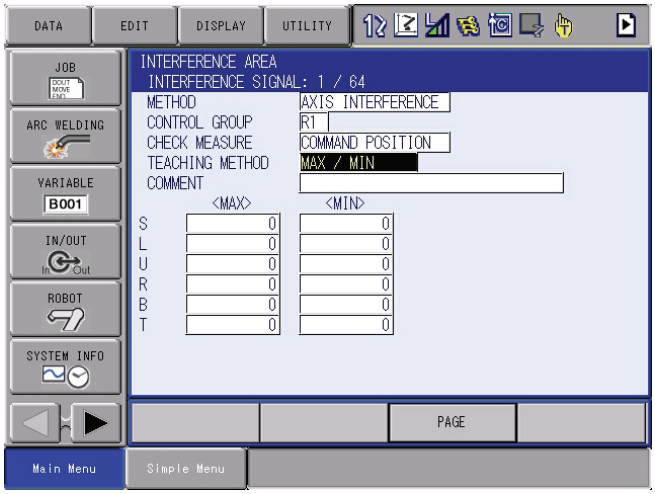
6. Select “CHECK MEASURE”.
   – Each time [SELECT] is pressed, “COMMAND POSITION” and “FEEDBACK POSITION” switch alternately.



■ **Number Input of the Axis Data Coordinates**

1. Select “METHOD”.

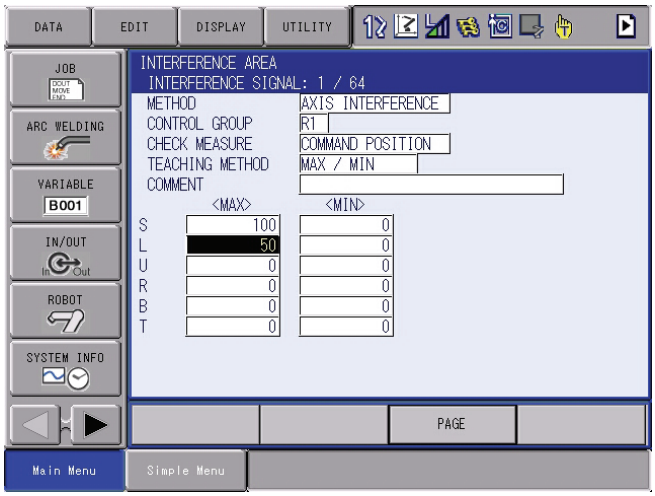
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.



   (2) Select “MAX/MIN”.

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

   – The axis interference area is set.

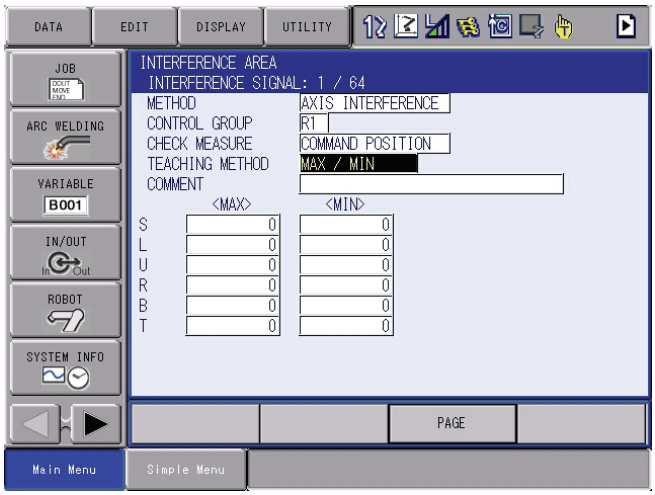


■ **Teaching Corner**

1. Select “METHOD”.

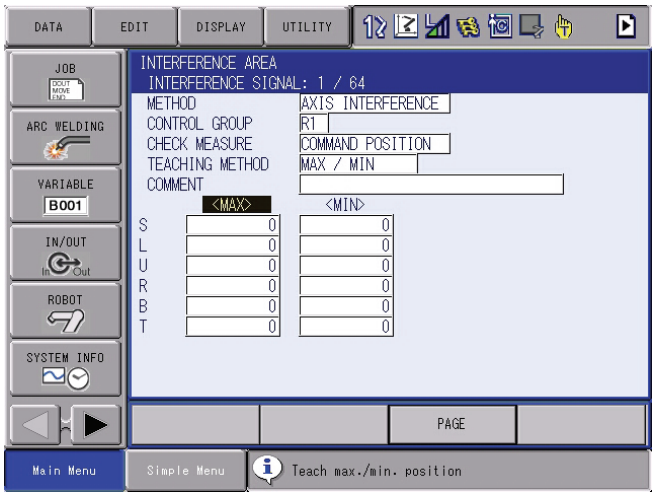
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.



2. Press [MODIFY].

   – A message “Teach max./min. position” appears.



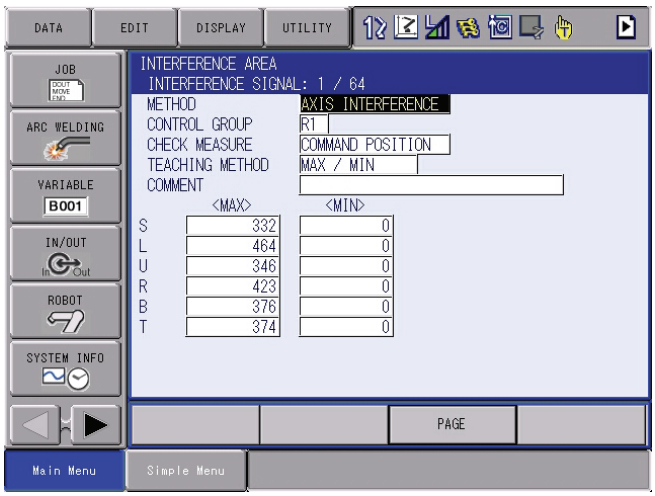
3. Move the cursor to “<MAX>” or “<MIN>.”

   – 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.

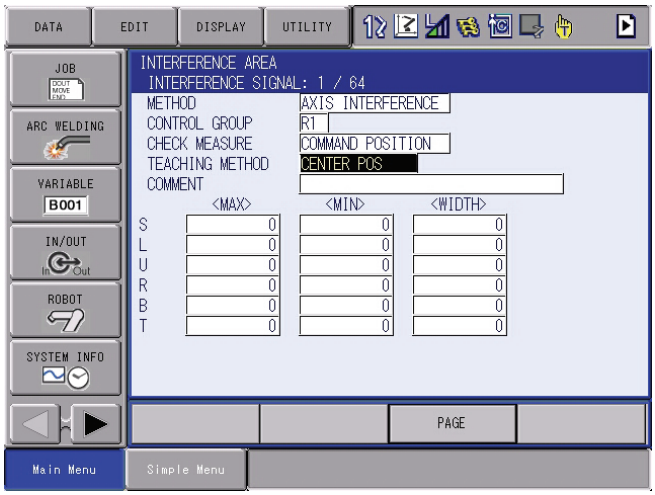


■ **Number Imput of Center Position (WIDTH) and Teaching Center**

1. Select “METHOD”.

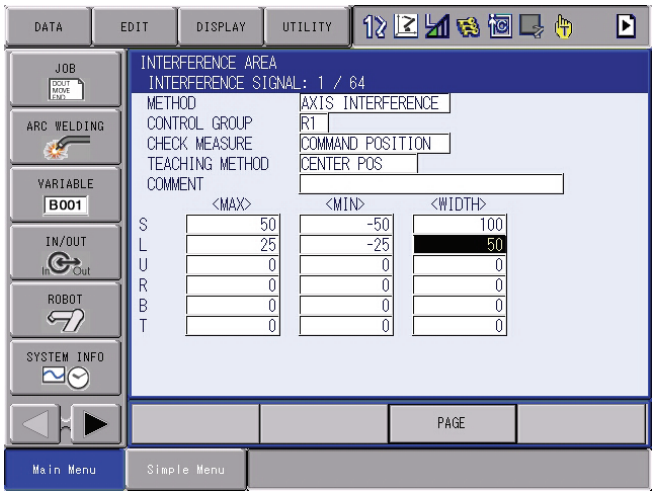
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “CENTER POS”.



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

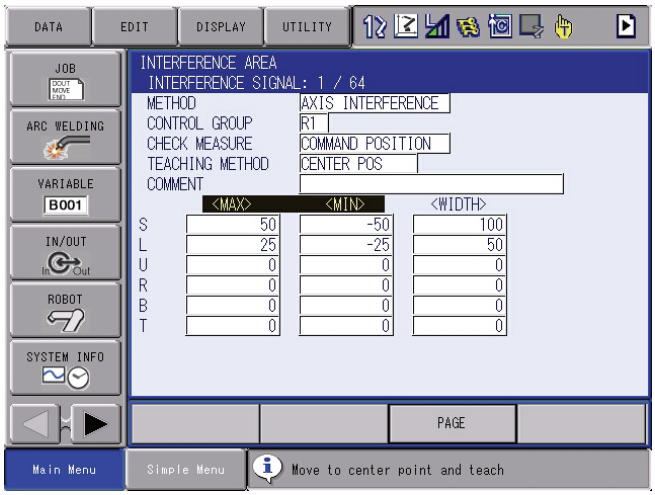
   – “WIDTH” is set.



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.

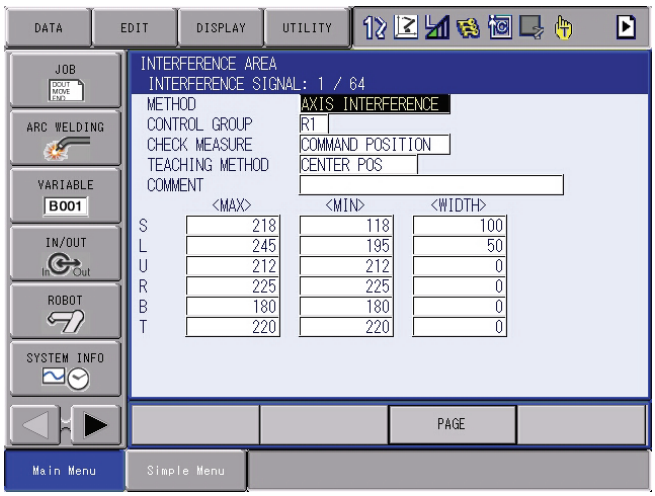
   – Move the manipulator to the center position of the cube using the axis keys.

5. Press [ENTER].

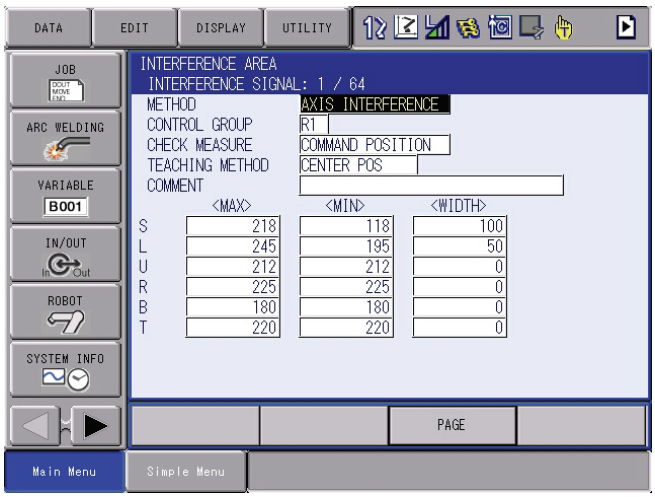
   – The center position of the cube is registered.

8.6.4 Clearing the Interference Area Data

1. Select {ROBOT} under the main menu.

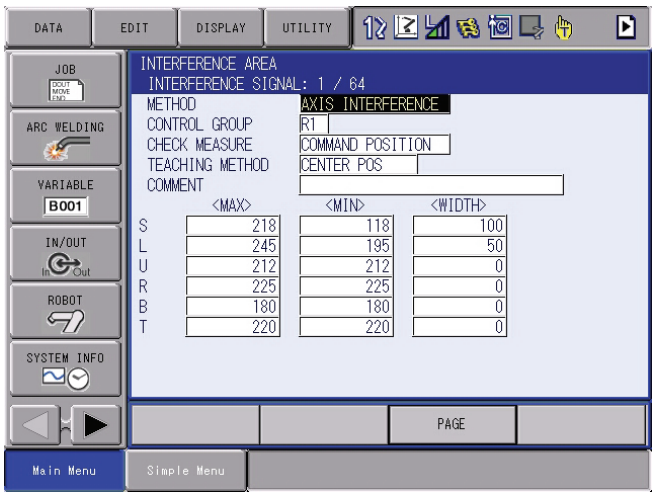


2. Select {INTERFERENCE}.
   – The INTERFERENCE AREA window is shown.

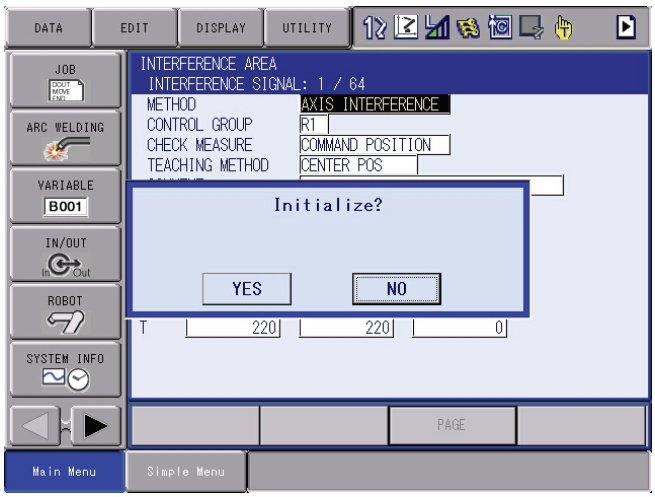


3. Select interference signal to be cleared.
   – Select the desired interference signal number to be cleared using the page key  or by number input.
   – When selecting the desired interference signal number by number input, select {PAGE} to input the desired signal number.

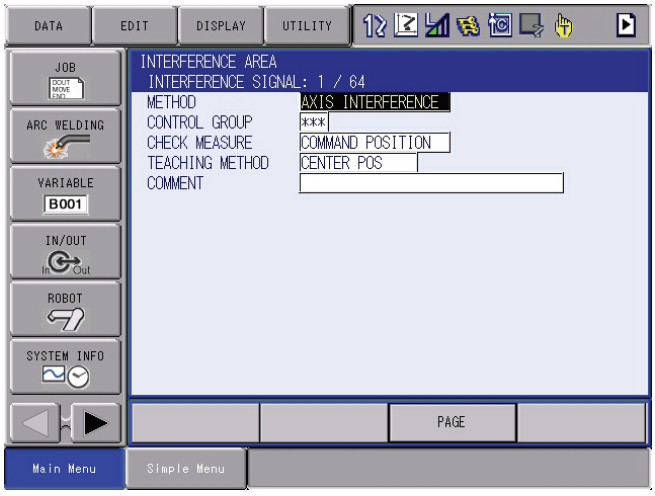
4. Select {DATA} under the menu.
   – The pull-down menu appears.



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" at page 1-1* to *chapter 6 "Test of Program Operation" at 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

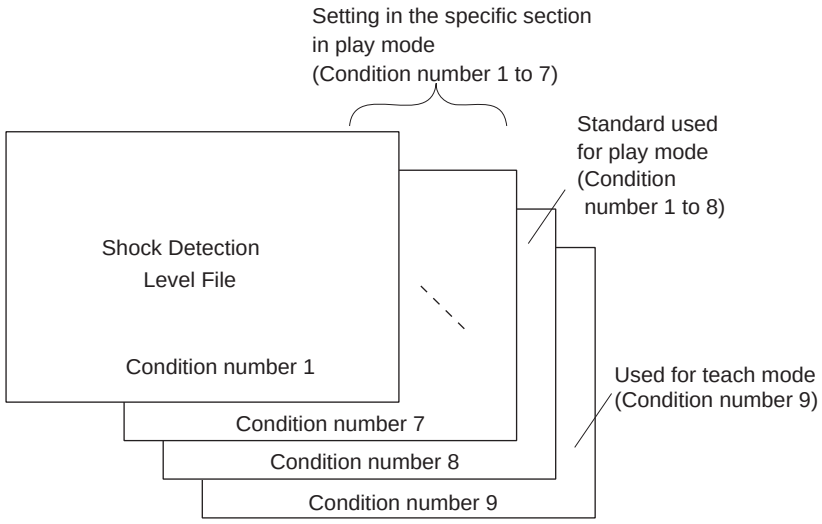
The shock detection level is set in the shock detection level set file.

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.

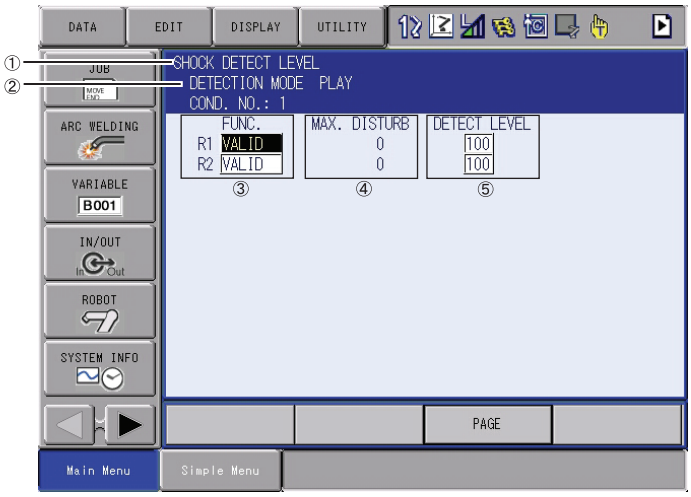
The detection level is changed by a job instruction SHCKSET.

- 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.



SUPPLE-MENT

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.



①Detection Mode

Indicates the shock detection mode.

②Condition 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.

③Function 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.

④Max. 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 in⑤.
The maximum disturbance force can be cleared by selecting {DATA} à {CLEAR MAX VALUE} in the menu.

⑤Detection 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.

NOTE

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

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 *chapter 8.4.3 "Tool Load Information Setting" at 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.

SHCKSET R1 SSL#(1)
① ②

①Robot 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.

②Shock 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.

SHCKRST R1
①

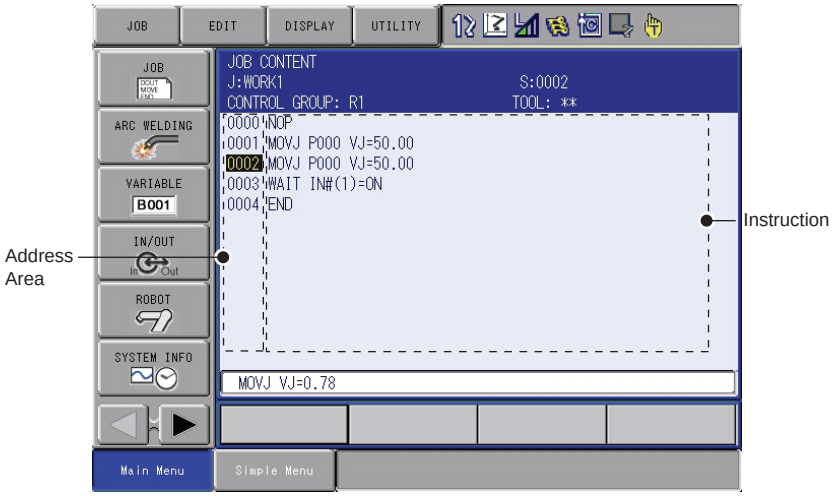
①Robot Setting

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.

■ **Instruction Registration**

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

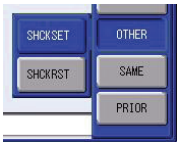
1. Select {JOB} under the main menu.



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.



   (2) Change the value of additional item and numerical data.
   (3) Press [INSERT] then [ENTER].
4. Change the value of additional item and numerical data.
   – < 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 >

• 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.



• When the value is input with the numeric key

I) When the value is input with the numeric key, press [SELECT]

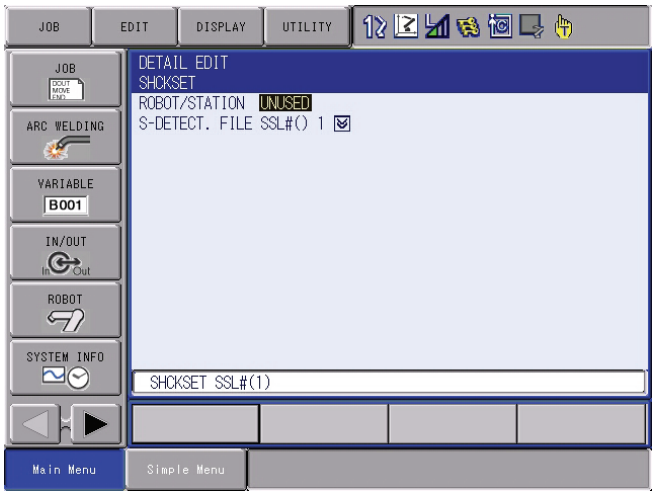
to display the input buffer line.



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

• When robot specification is added

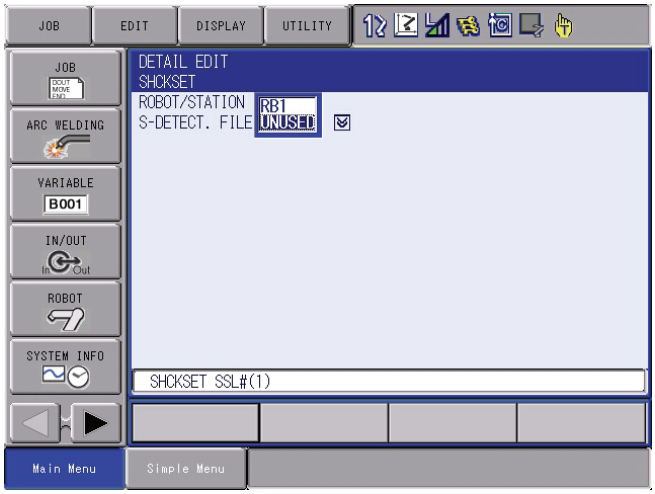
I) When robot specification is added, move the cursor to the instruction in the input buffer line and press [SELECT] to display the DETAIL window.



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].



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].

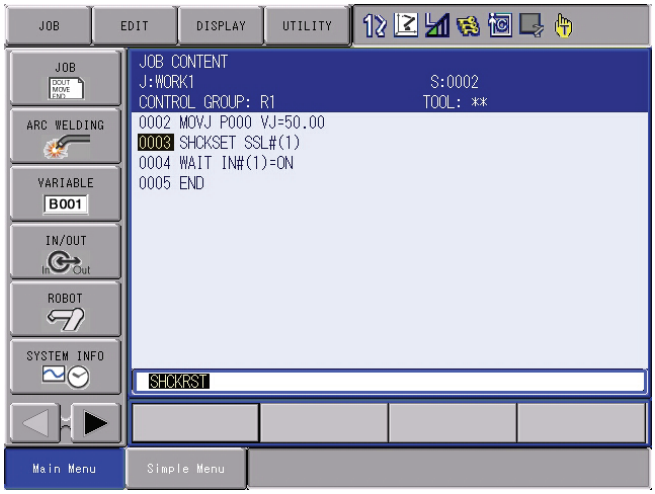
– The instruction displayed in the input buffer line is registered.

■ **SHCKRST**

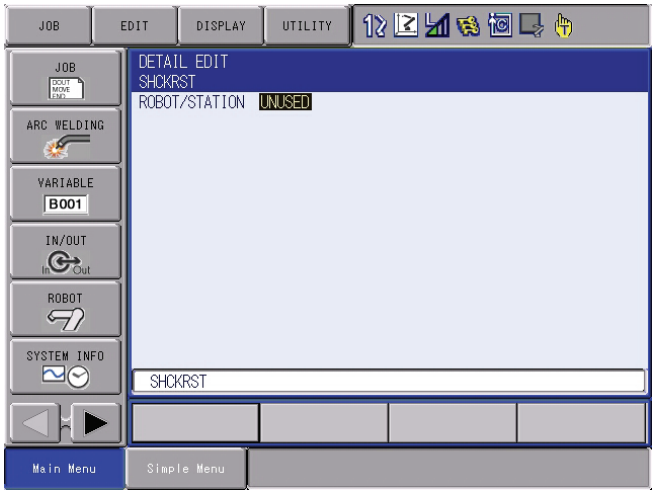
1. Move the cursor to the immediately preceding line where the SHCKRST instruction is to be registered.
2. Press [INFORM LIST].
   – The inform list appears.



3. Select SHCKRST instruction.
   – SHCKRST instruction appears in the input buffer line.



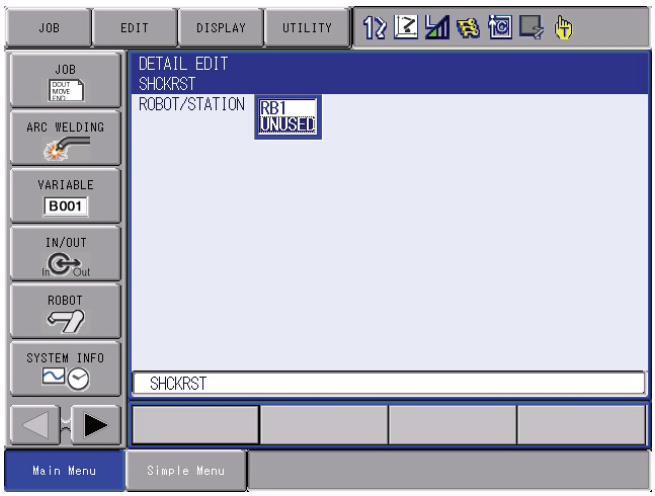
4. Change the value of the additional item.
   – < When registering the instruction as it is >
   Operate the step 5 when registering the instruction in the input buffer line as it is.
   – < When adding or changing the additional item >
   (1) When adding the robot specification, move the cursor to instruction in the input buffer line and press [SELECT] to display the DETAIL window.



   (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].

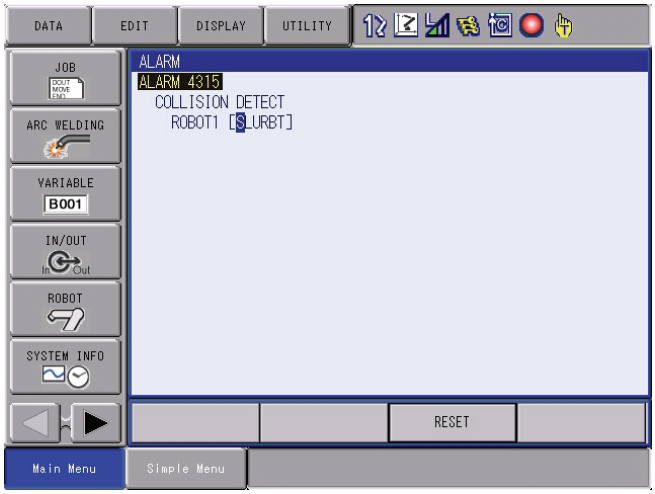
(6) The DETAIL window closes and the JOB CONTENT window appears.

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.

NOTE

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.

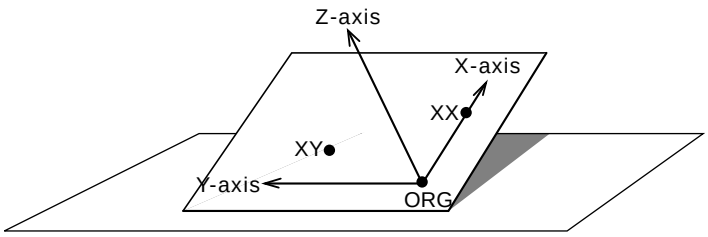
In this case, set the collision detection function "INVALID", or increase the detection level in teach mode and retreat the manipulator to a safety position.

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.



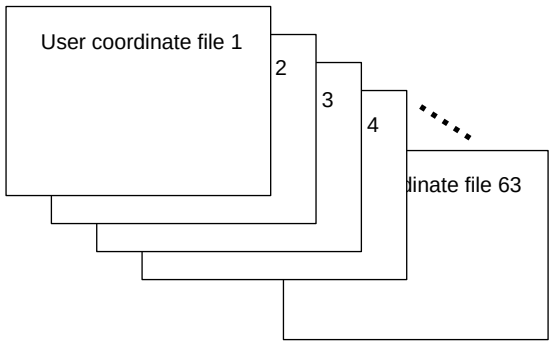
User coordinate definition point
ORG: Home position
XX: Point on the X-axis
XY: Point on the Y-axis

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**

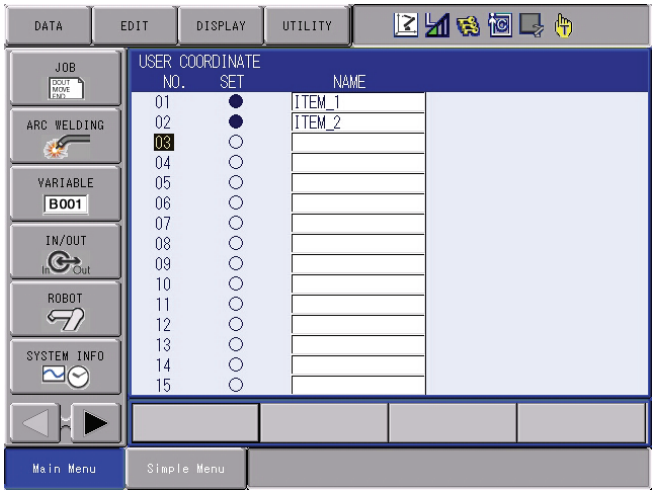
Up to 63 kinds of user coordinates can be registered. Each coordinate has a user coordinate No. and is called a user coordinate file.



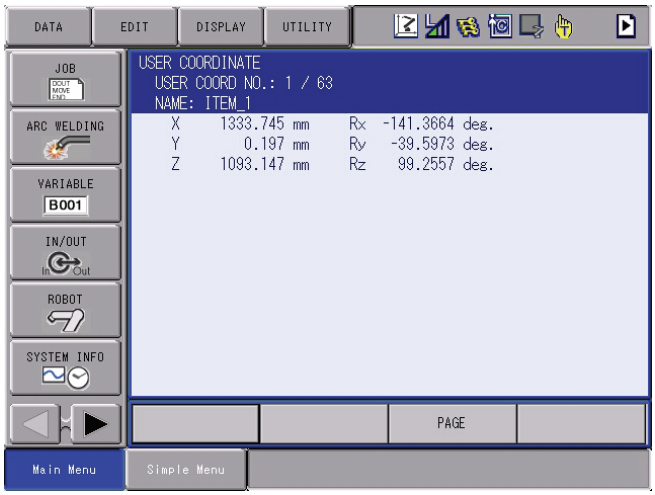
8.8.2 User Coordinate Setting

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.



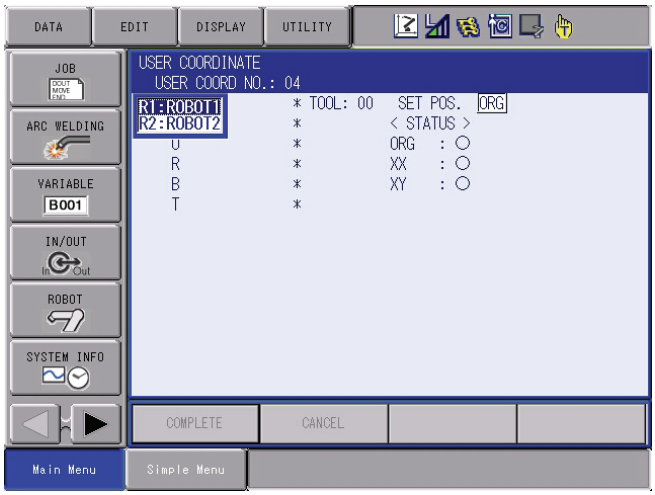
   (2) The "●" mark indicates that the user coordinates is completed to set and the "O" mark indicates that it is not completed.
   (3) To check the position of the user coordinates select {DISPLAY} → {COORDINATE DATA}.
   (4) The following window appears.



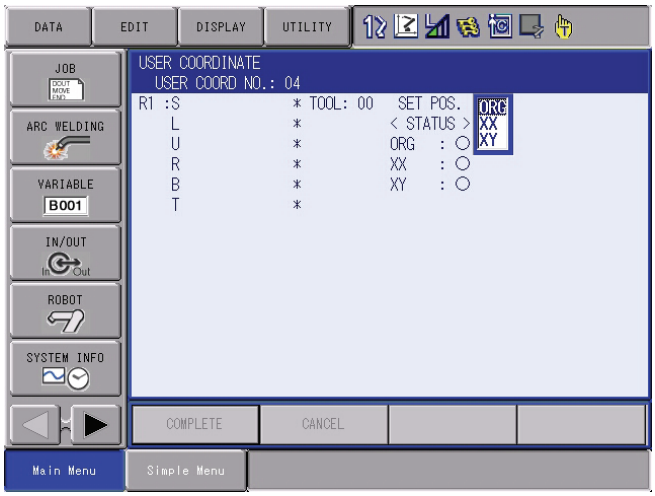
3. Select the user coordinate number.

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.)

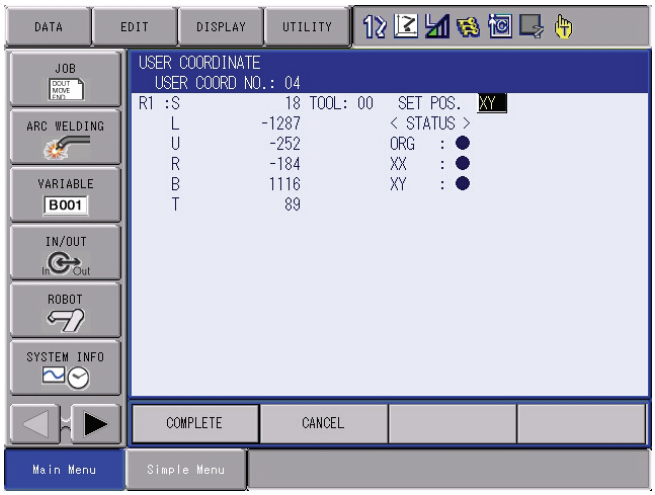


2. Select “SET POS”.
   – Select the teaching point.



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 "○" indicates that it is not completed.



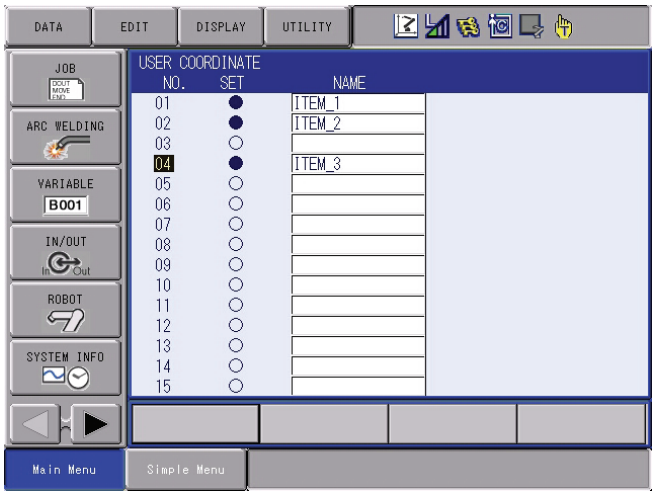
– To check the taught positions, call up the required window among ORG to XY and press [FWD]. The manipulator moves to the set position.

– 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”.

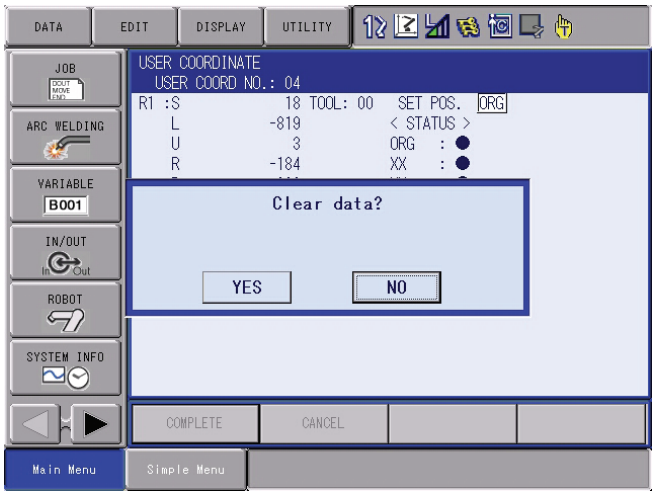
– User coordinates are registered in the file.

– Once the user coordinate setting is completed, the following window appears.

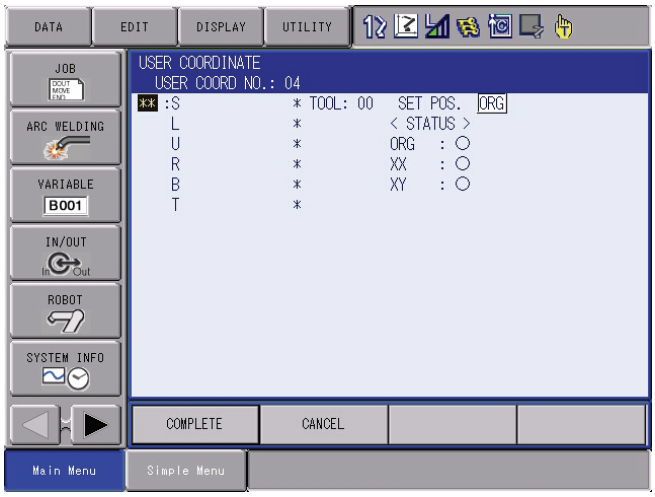


8.8.2.3 Clearing the User Coordinates

1. Select {DATA} under the pull-down menu.
2. Select {CLEAR DATA}.
   – The confirmation dialog box appears.



3. Select {YES}.
   – All data is cleared.



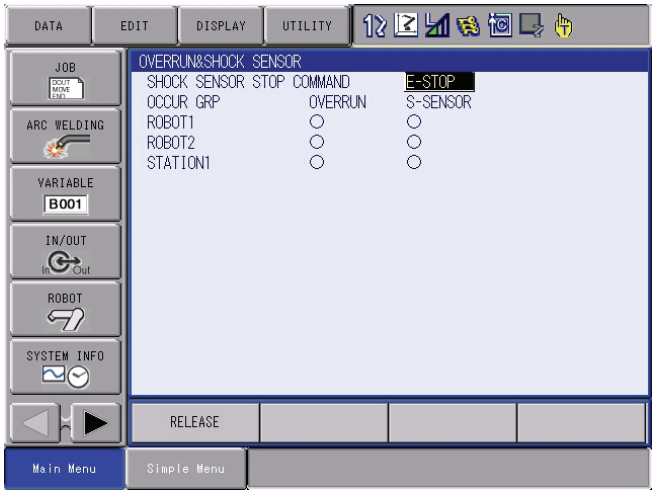
8.9 Overrun / Tool Shock Sensor Releasing

CAUTION

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

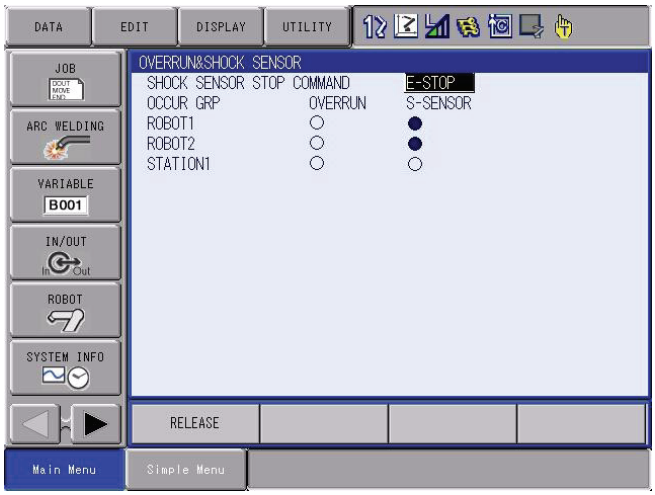
If the manipulator stops by overrun detection or tool shock sensor detection, release the overrun or tool shock sensor by the following procedure and reset the alarm and move the manipulator with the axis keys.

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.

NOTE 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.

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 the 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 "Softlimits 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:

Limit Type	Contents
Mechanical Limit	Limit to check manipulator's range of motion.
L-U Interference	Limit to check L- and U-axis interference area.
Soft Limit on Each Axis	Soft limit to check manipulator's range of motion.
Cube Interference	Limit to check cube interference area set by user.

NOTE All limit release function is not available if the security mode is not in the management mode. Refer to *chapter 7 "Security System" at 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.

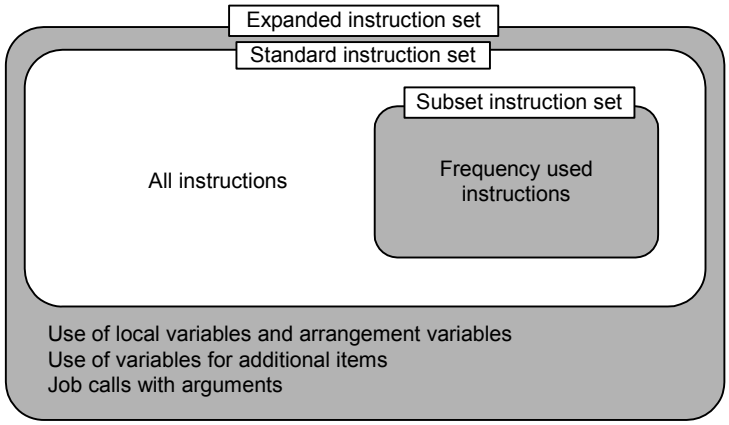
Standard Instruction Set / Expanded Instruction Set

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.



Instruction set

8.12.1.2 Learning Function

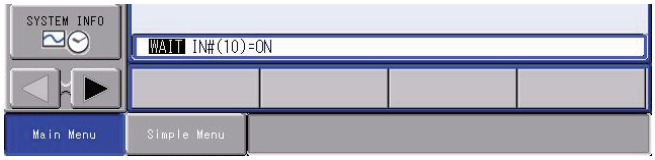
When an instruction is entered from the instruction list, the additional items that were entered last time are also shown. This function can simplify instruction input.

To register the same additional items as those in the former operation, register them without changing.

1. An instructions are registered.

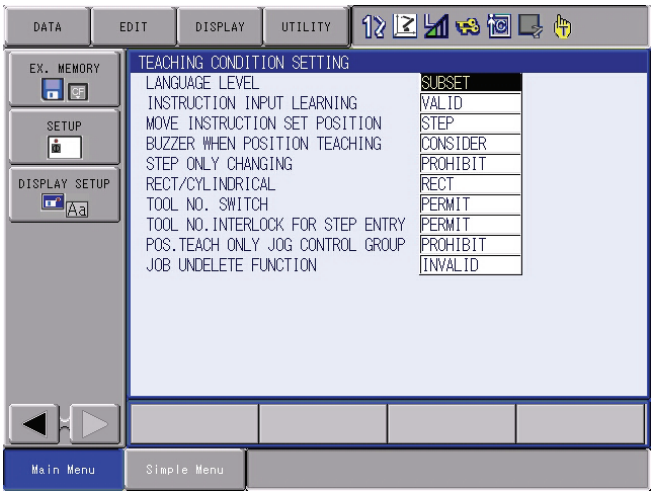


2. The next time an attempt is made to register the same instruction as in 1, the same additional items as were registered last time are also shown in the input buffer line.

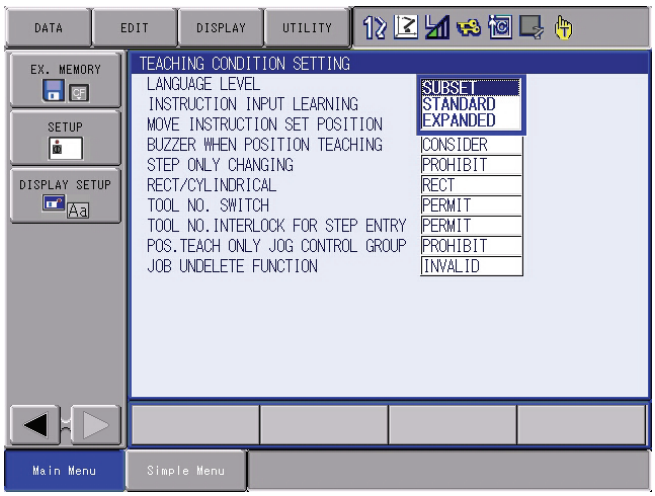


8.12.2 Setting the Instruction Set Level

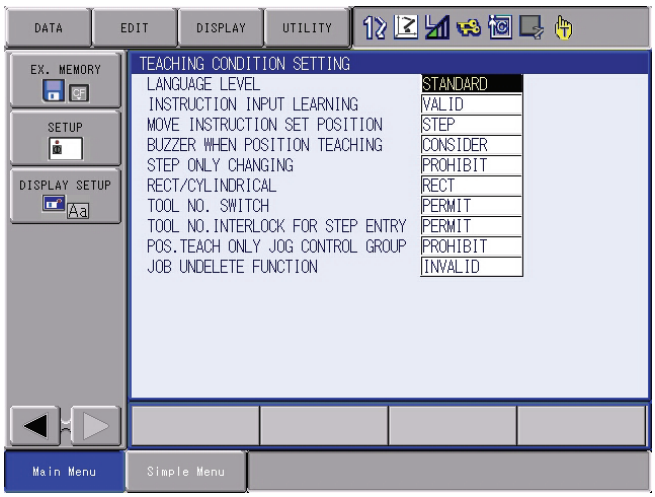
1. Select {SETUP} under the main menu.
2. Select {TEACHIG COND}.
   – The TEACHING CONDITION window appears.



3. Select “LANGUAGE LEVEL”.
   – The selection list appears.



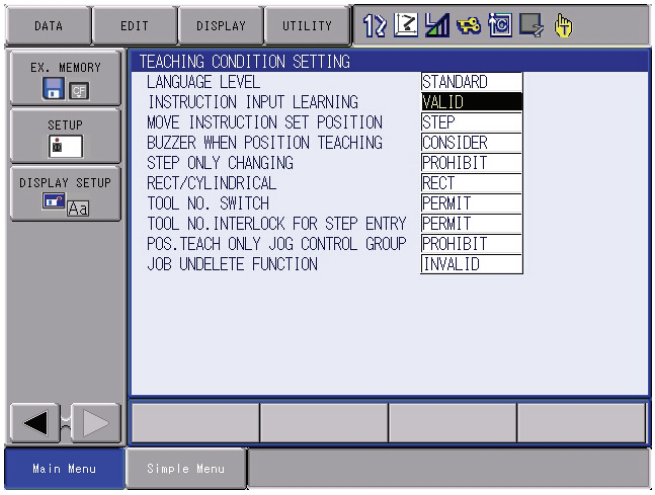
4. Select desired language level.
   – Language level is set.



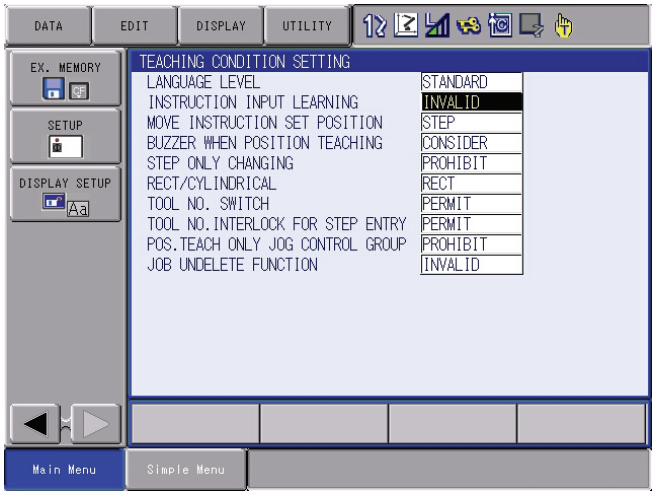
8.12.3 Setting the Learning Function

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

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



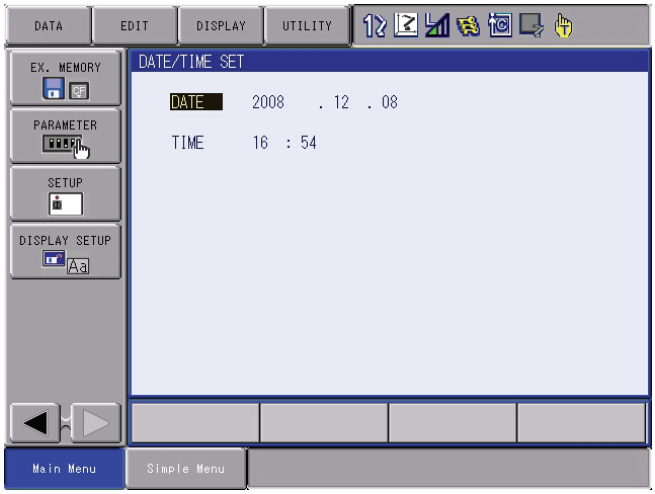
3. Select "INSTRUCTION INPUT LEARNING".
   – VALID” and “INVALID” are displayed alternately every time [SELECT] is pressed.



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.

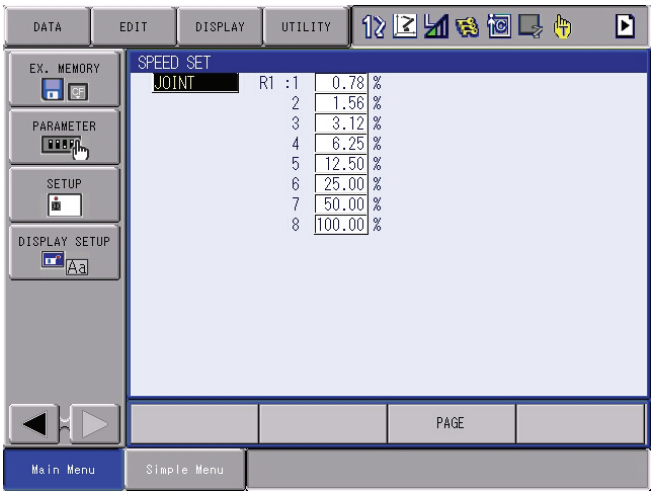


3. Select “DATE” or “CLOCK.
   – ”The input buffer line appears.
4. Input the new date/time.
   – For instance, to set the date to August 1, 2008, input "2008.8.1". To set the time at twelve o’clock, enter "12.00".
5. Press [ENTER].
   – The date/time is changed.

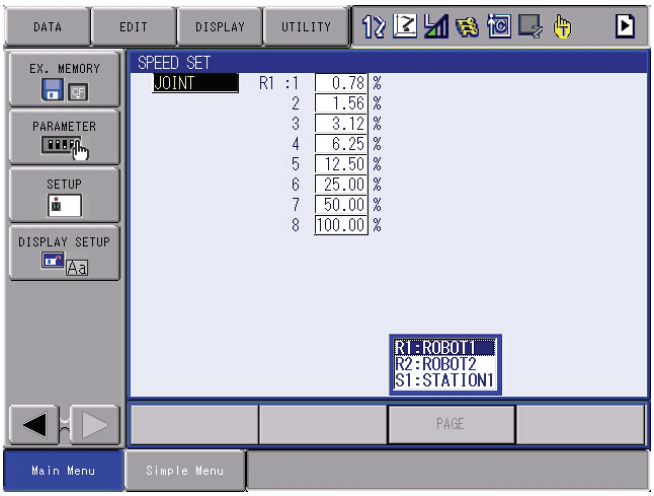


8.14 Setting the Play Speed

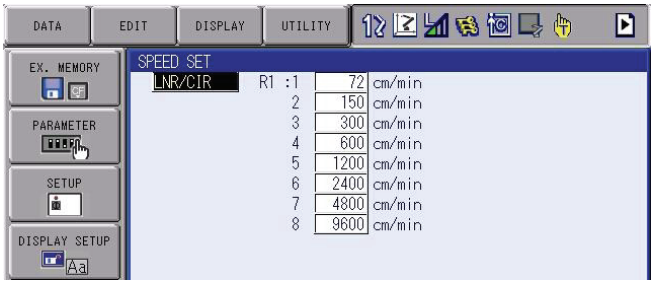
1. Select {SETUP} under the main menu.
2. Select {SET SPEED}.
   – The SPEED SET window is shown.



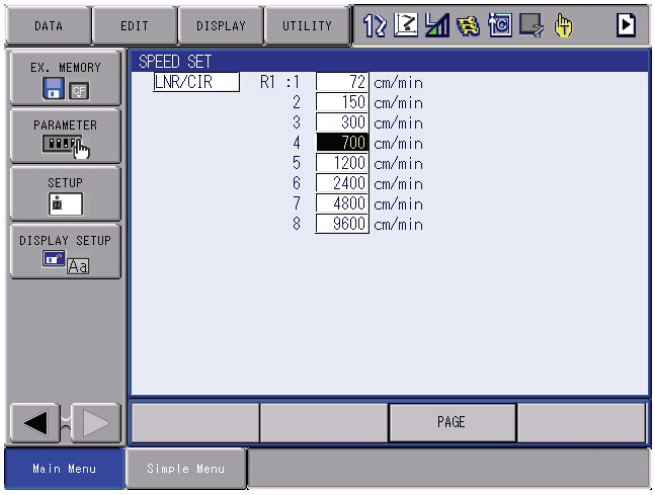
3. Press the page key .
   – When two or more manipulators and stations exist in the system, use the page key  to change the control group, or click on {PAGE} to select the desired control group.



4. Select “JOINT” or “LNR/CIR”.
   – The type of speed alternately changes from “JOINT” to “LNR/CIR”.



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.

Function	Description
Manufacturer allocation	Allocated by Yaskawa. Allocating another function invalidates the function allocated by the manufacturer.
Instruction allocation	Allocates any instructions assigned by the user.
Job call allocation	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.)
Display allocation	Allocates any displays assigned by the user.

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.

Function	Description
Alternate output allocation	Turns ON/OFF the specified user output signal when [INTERLOCK] and the allocated Numeric key are pressed at the same time.
Momentary output allocation	Turns ON the specified user output signal user when [INTERLOCK] and the allocated user key are pressed at the same time.
Pulse output allocation	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.
Group output allocation (4-bit/8-bit)	Sends the specified output to the specified general group output signals when [INTERLOCK] and the allocated Numeric key are pressed at the same time.
Analog output allocation	Sends the specified voltage to the specified output port when [INTERLOCK] and the allocated Numeric key are pressed at the same time.
Analog incremental output allocation	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.

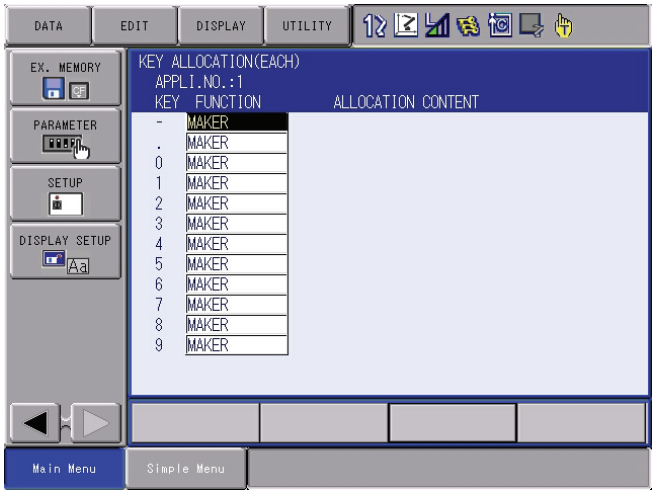


In a system for multiple applications, a numeric key can be allocated for each application.

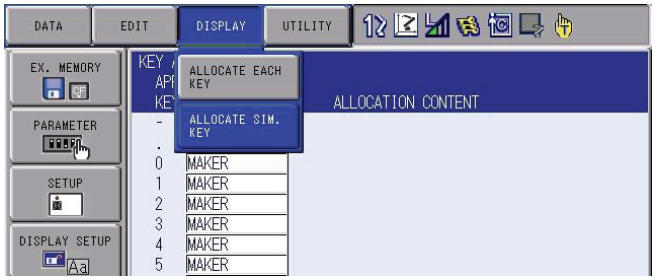
8.15.3 Allocating an Operation

8.15.3.1 Allocation Window

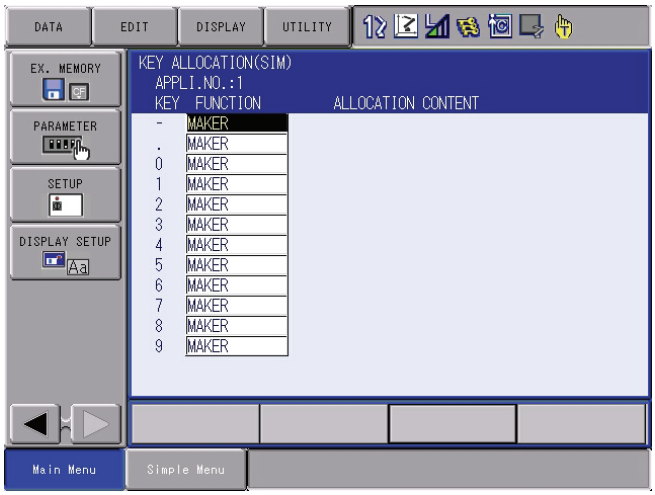
1. Select {SETUP} under the main menu.
2. Select {KEY ALLOCATION}.
   – The KEY ALLOCATION (EACH) window appears.



3. Select {DISPLAY}.
   – Pull-down menu appears.
   – To call up the KEY ALLOCATION (SIM) window, select {ALLOCATE SIM. KEY}.

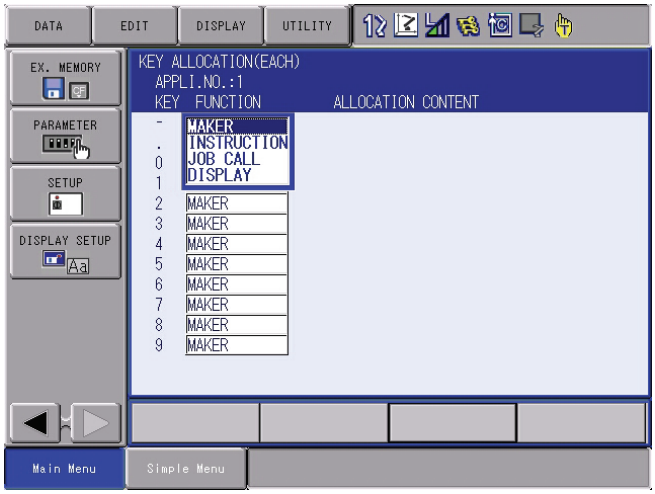


4. Select {ALLOCATE SIM. KEY}.
   – The KEY ALLOCATION (SIM) window appears.
   – In a system multiple applications, press the page key  to change the window to the allocation window for each application, or click on {PAGE} to select the desired application number.

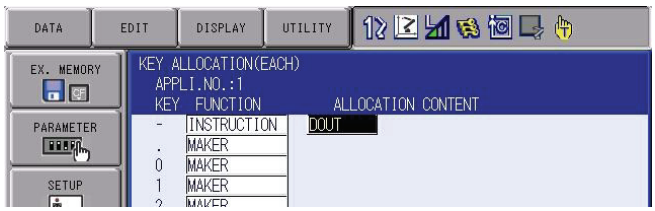


8.15.3.2 Instruction Allocation

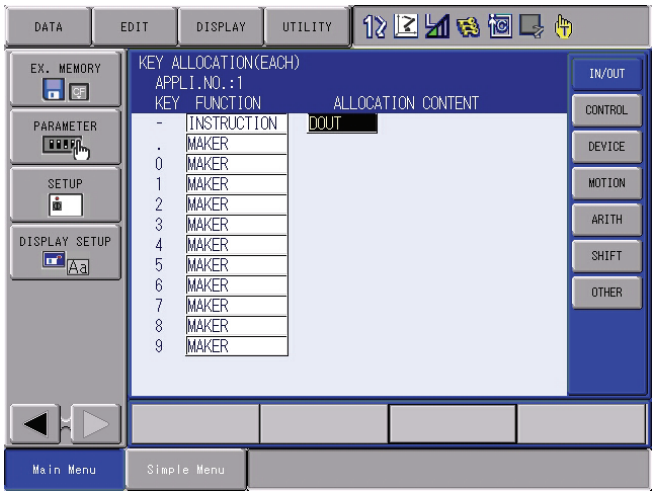
1. Set this function in the KEY ALLOCATION (EACH) window. Move the cursor to “FUNCTION” of the key to be allocated and press [SELECT].
   – Selection list appears.



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

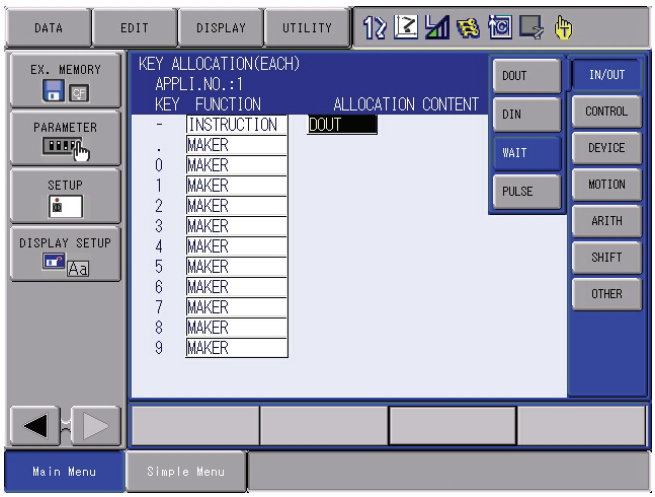


(1) To change the instruction, move the cursor to the instruction and press [SELECT]. Then the instruction group list appears.



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

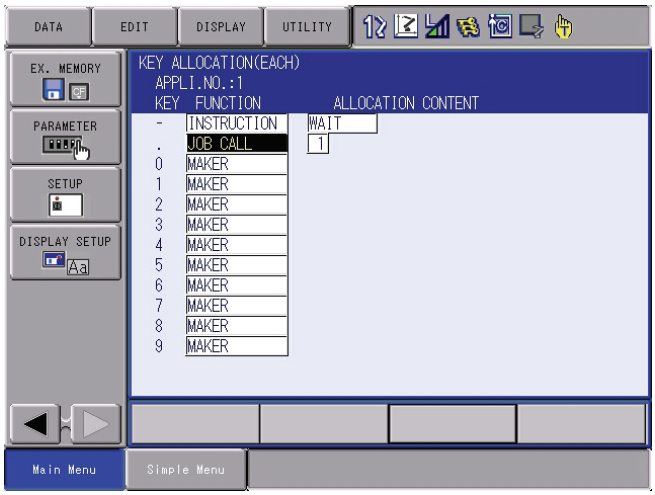
(3) When the instruction list dialog box is shown, select the instruction to be changed.



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.

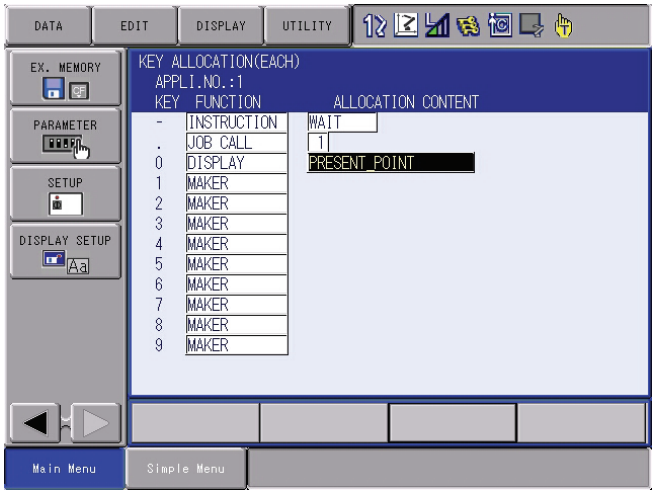
(2) Input the number to be changed, and press [ENTER].

8.15.3.4 Display Allocation

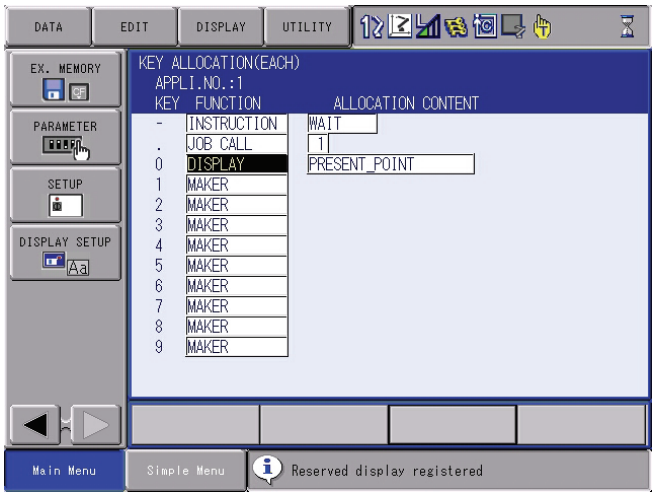
Set this function in the KEY ALLOCATION (EACH) window.

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.



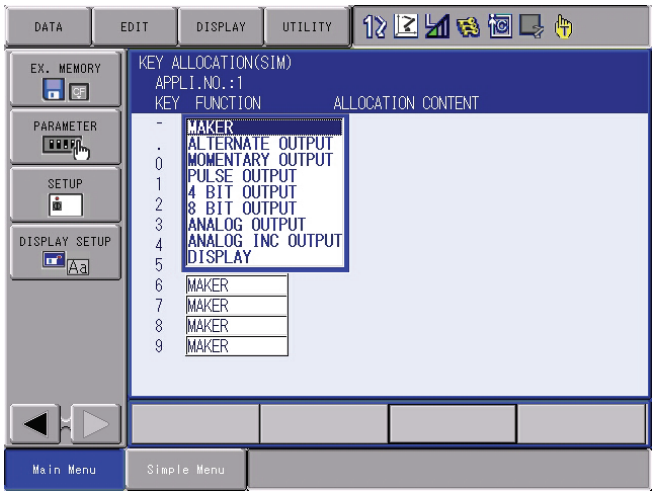
5. Open the window for allocation.
6. Press [INTERLOCK] and the allocated key at the same time.
   – A message “Reserved display registered” appears, and the window is registered.
   – In this case, the CURRENT POSITION window is registered by pressing [INTERLOCK] + [0] with the CURRENT POSITION window displayed on the screen.



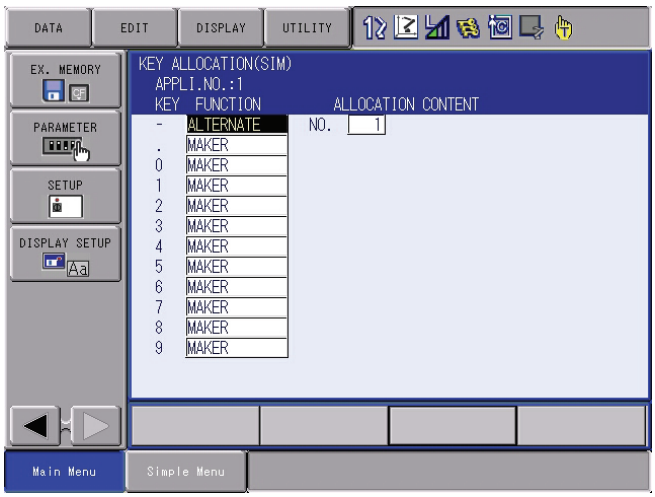
8.15.3.5 Alternate Output Allocation

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”.



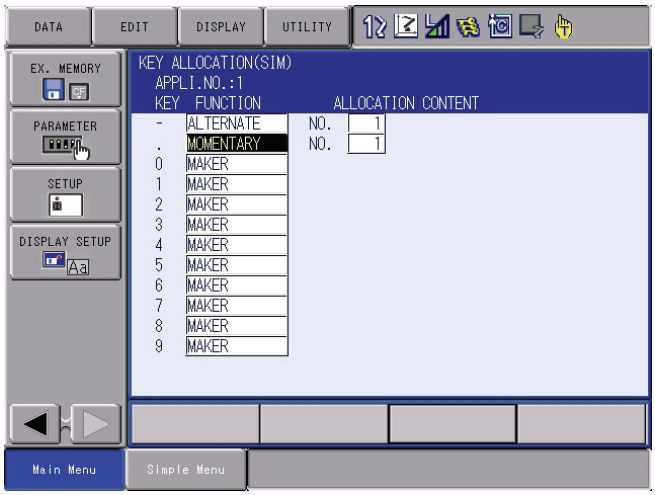
   (1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.

   (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”.



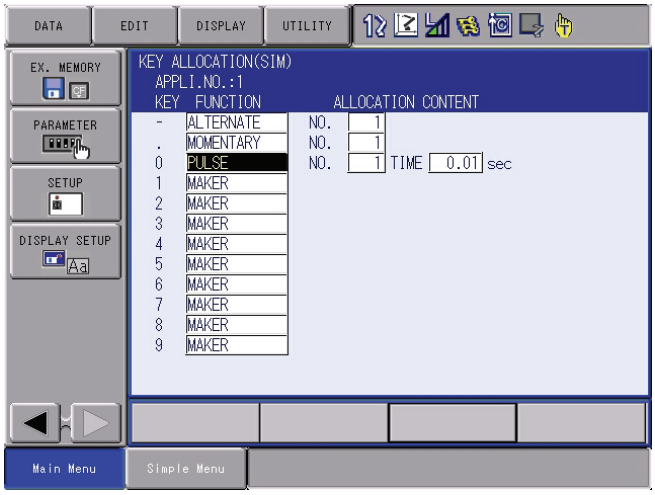
(1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.

(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”.



(1) To change the output No. or output time, move the cursor to the

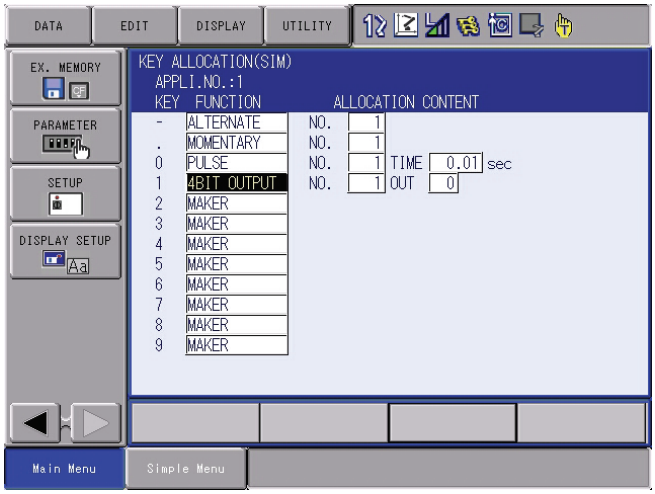
No. or time and press [SELECT]. Then numeric value can be entered.

(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”.



(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.

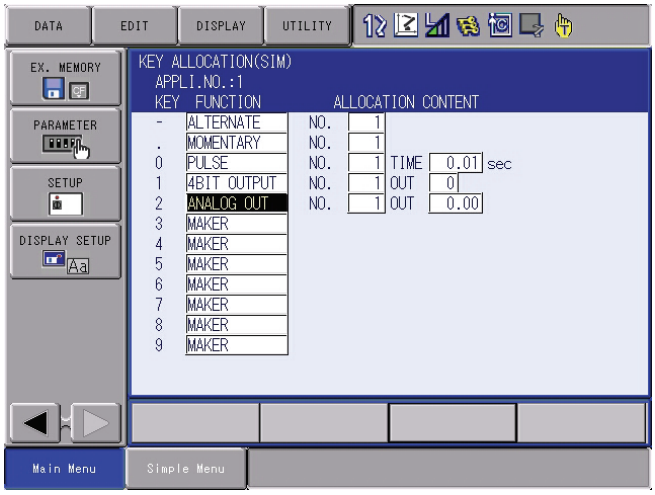
(2) Input the number or value to be changed, and press [ENTER].

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”.



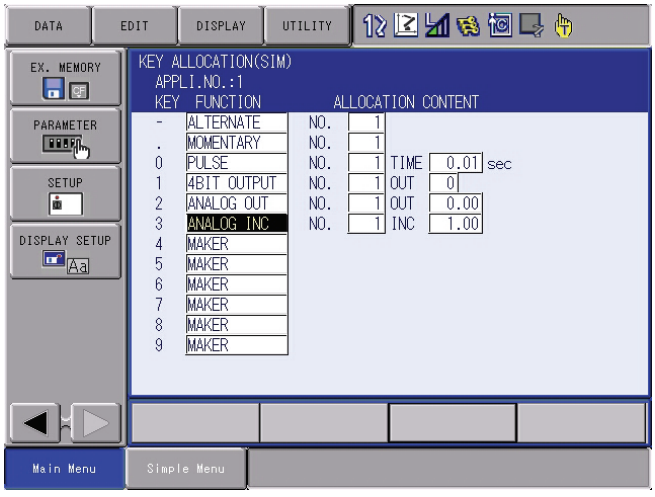
(1) To change the output port No. or output voltage value, move the cursor to the No. or voltage value and press [SELECT]. Then numeric value can be entered.

(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.

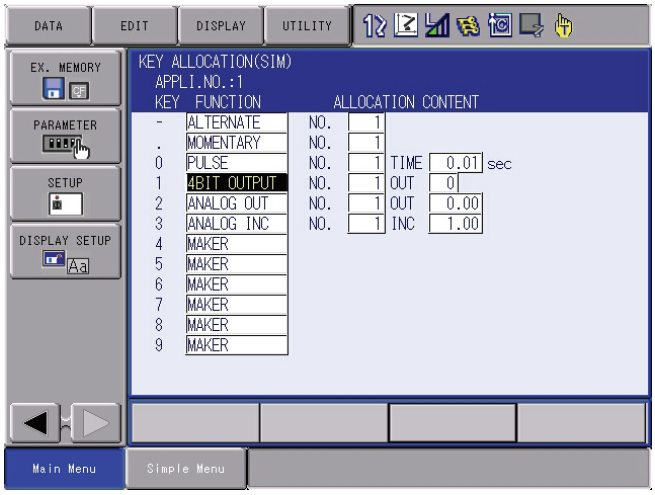
(2) Input the number or incremental value to be changed, and press [ENTER].

8.15.4 Allocation of I/O Control Instructions

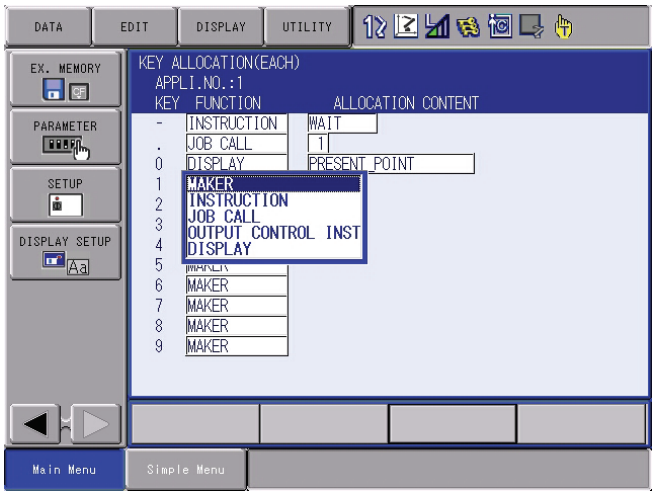
In key allocation (SIM), output control instructions can be allocated to the numeric keys that have been allocated one of the following I/O controls with key allocation (EACH).

Function	Output Control Instruction allowed to be Allocated
Alternate output allocation	DOUT OT# (No.) ON
Momentary output allocation	
Pulse output allocation	PULSE OT# (No.) T = output time
Group output allocation (4-bit)	DOUT OGH (No.) output value
Group output allocation (8-bit)	DOUT OG# (No.) output value
Analog output allocation	AOUT AO# (No.) output voltage value

1. Allocation of I/O control instruction.
   – Allocate the I/O control instruction with key allocation (SIM) following the forementioned procedure.



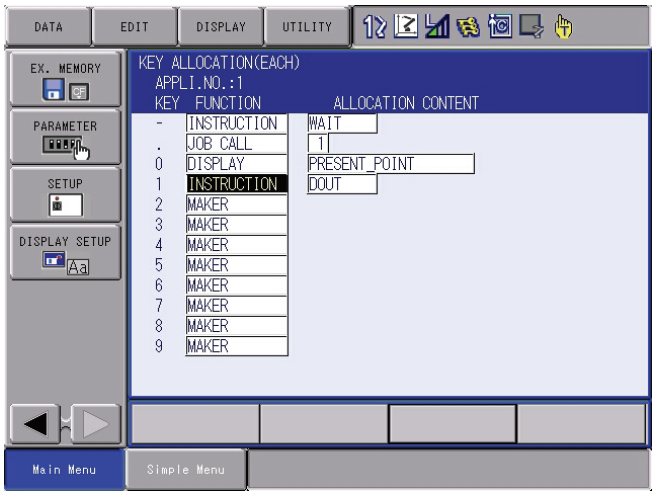
2. Move the cursor to the “FUNCTION” of the key that has been allocated with I/O control with key allocation (SIM) and press [SELECT].



   – 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”.



– 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.



2. Press [INSERT] and [ENTER].
   – The instruction displayed in the input buffer line is registered.



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.

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.

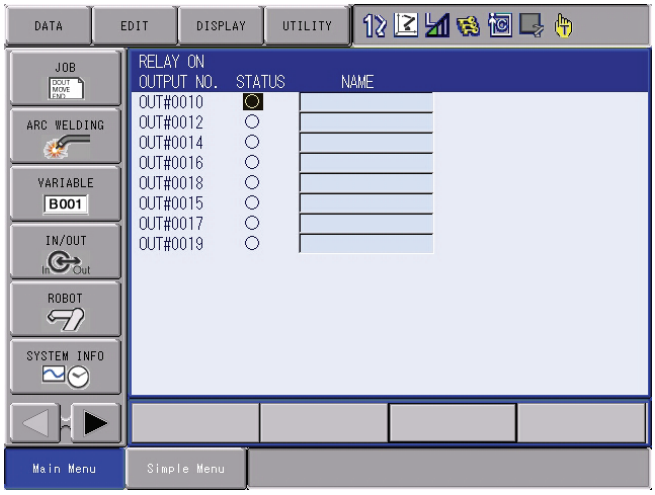
- On the user output status window
- On the RELAY ON window

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.

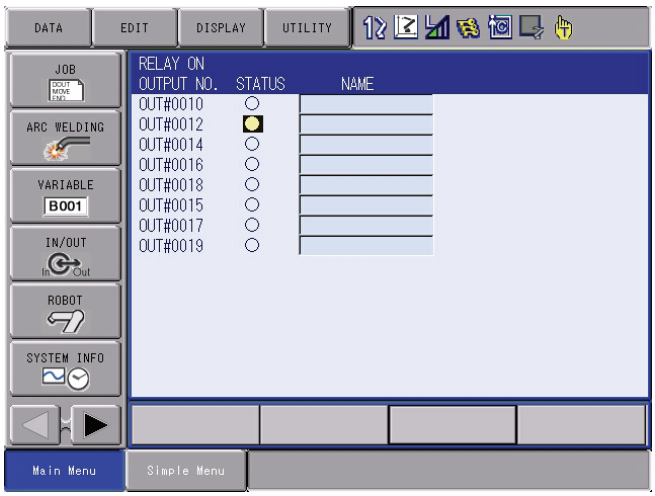
NOTE

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.)



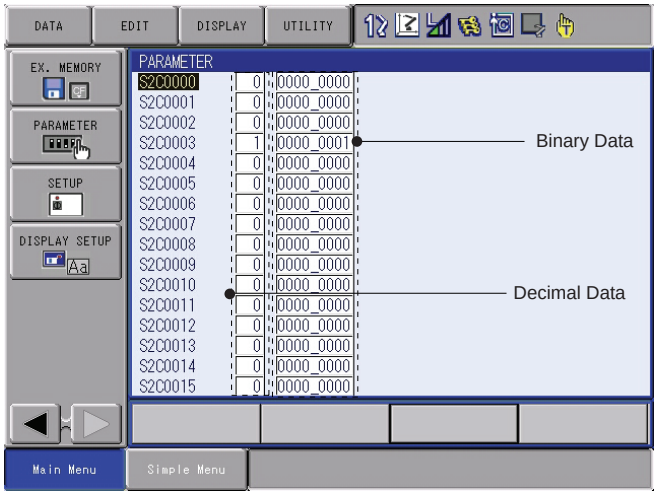


It is also possible to turn the relevant external output signal on only for the duration that [INTERLOCK]+[SELECT] are pressed. This selection is made in advance by setting the parameters (S4C391 to 454) to “1”.

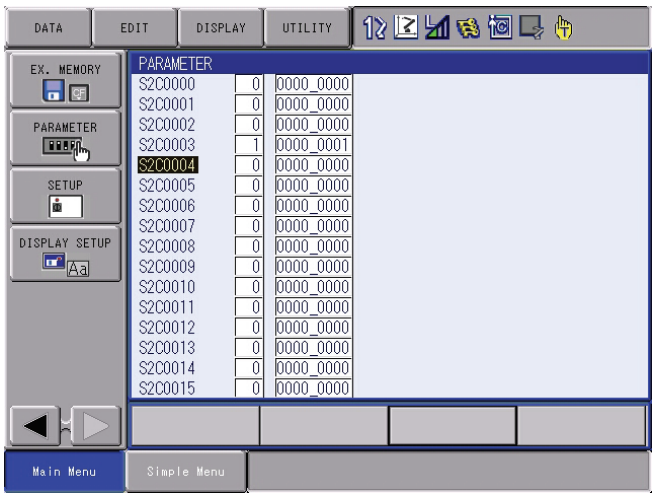
8.17 Changing the Parameter Setting

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.

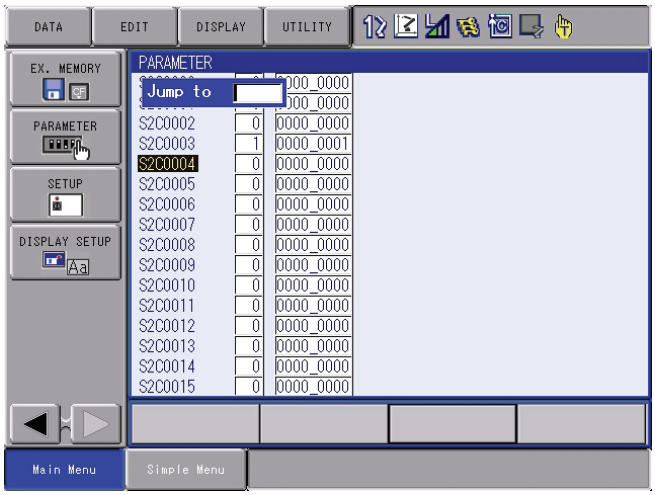


3. Move the cursor to the desired parameter number.

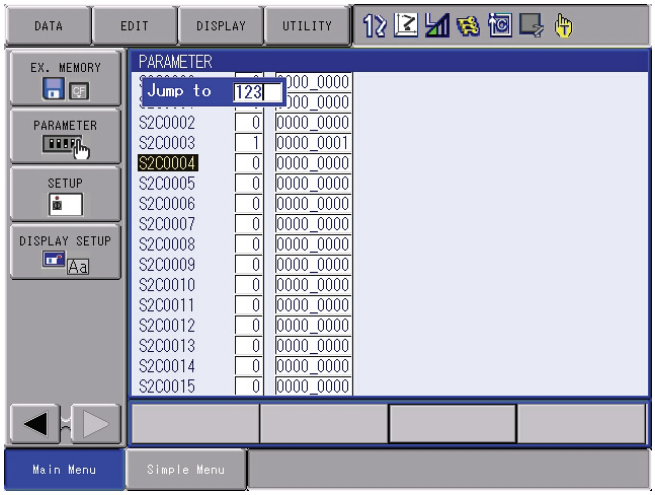


   – When the desired parameter number is not in the current window, move the cursor in the following way:

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

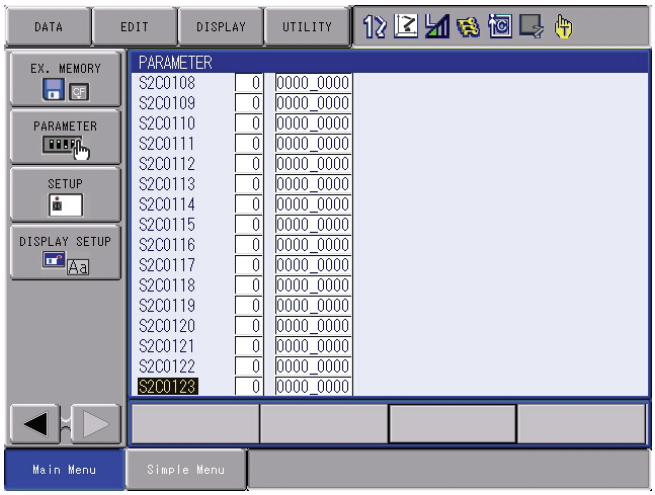


(2) Enter the desired parameter number with the numeric keys.



(3) Press [ENTER].

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



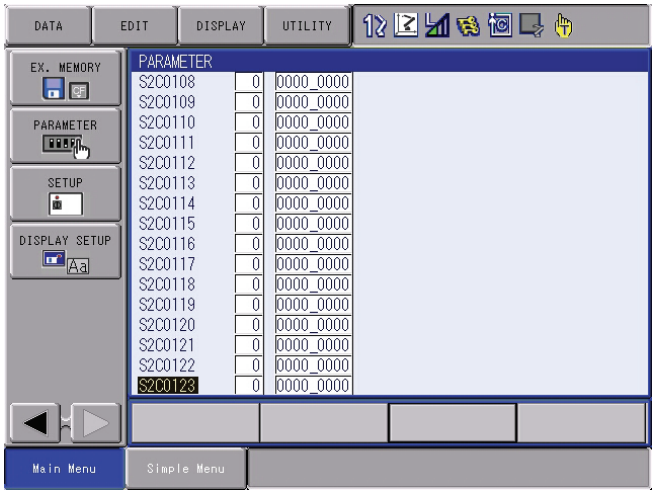
Set the parameters in the following manner.

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].

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

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



2. Enter the value.

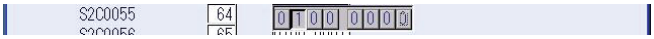
   – If a decimal figure is selected, enter a decimal value with the numeric keys.



   – If a binary figure is selected, move the cursor to the binary figure data in the input buffer line, and press [SELECT].

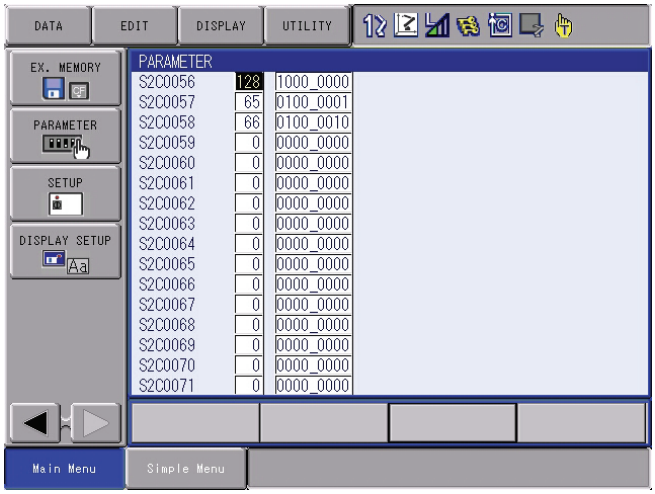
   – Each time [SELECT] is pressed, “0” and “1” alternate in the window.

   – “0” or “1” can also be entered with the numeric keys.



3. Press [ENTER].

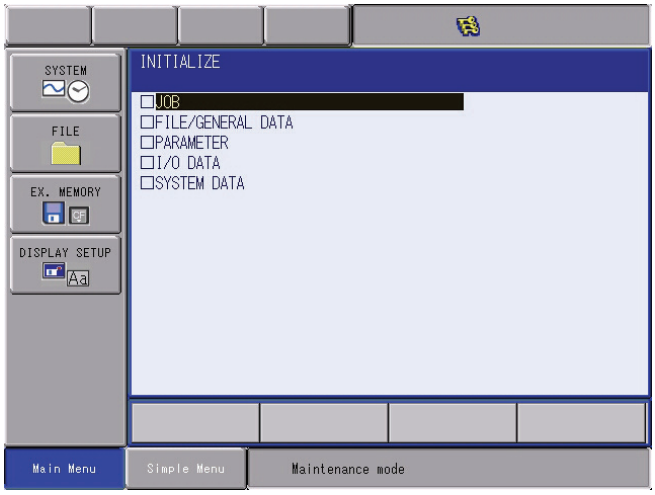
   – The new setting appears in the position where the cursor is located.



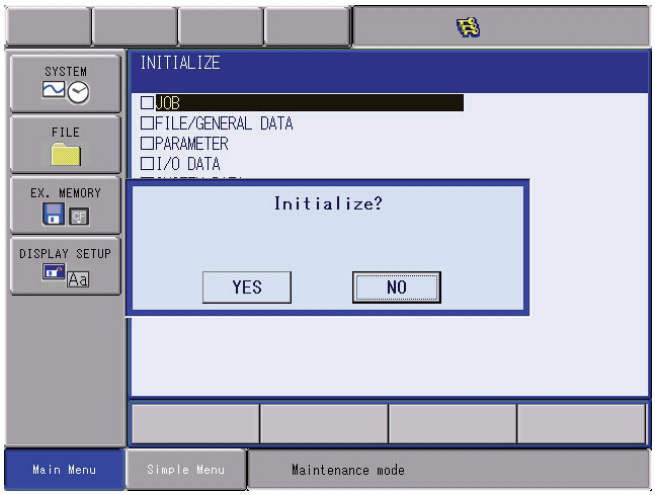
8.18 File Initialization

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.



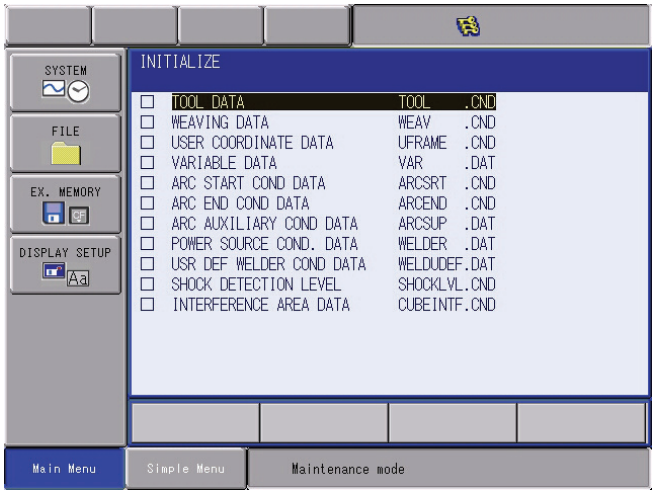
5. Select {JOB}.
   – A confirmation dialog box appears.



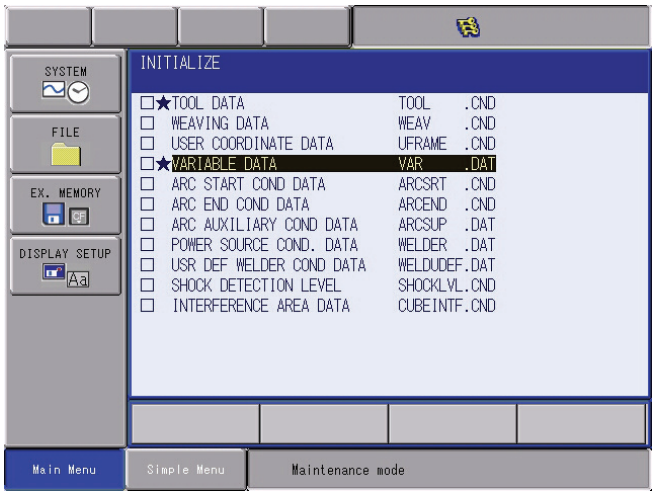
6. Select {YES}.
   – The job data is initialized.

8.18.2 Initializing Data File

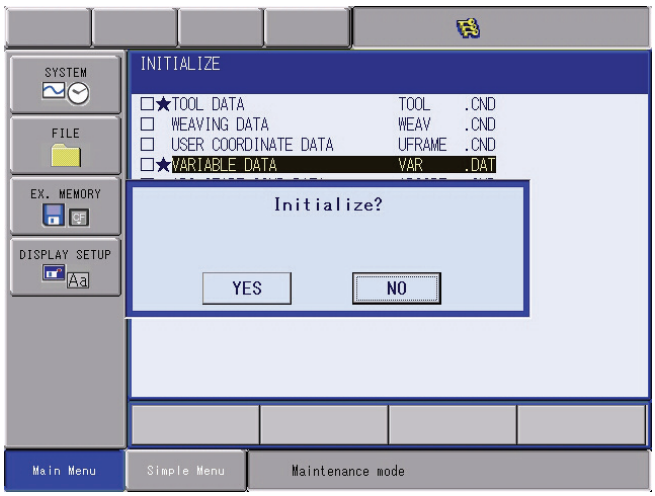
1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {FILE/GENERAL DATA}.
   – The INITIALIZE window appears.



6. Select the data file to be initialized.
   – The selected data file/general data are marked with “★“.
   – The parameters marked with "■" cannot be selected.



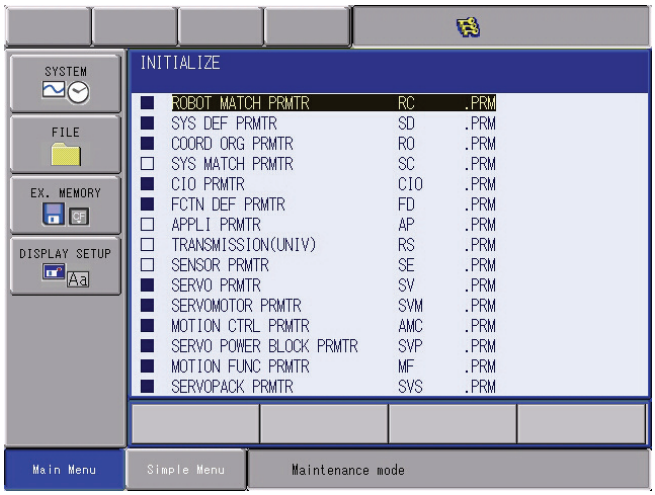
7. Press [ENTER].
   – A confirmation dialog box appears.



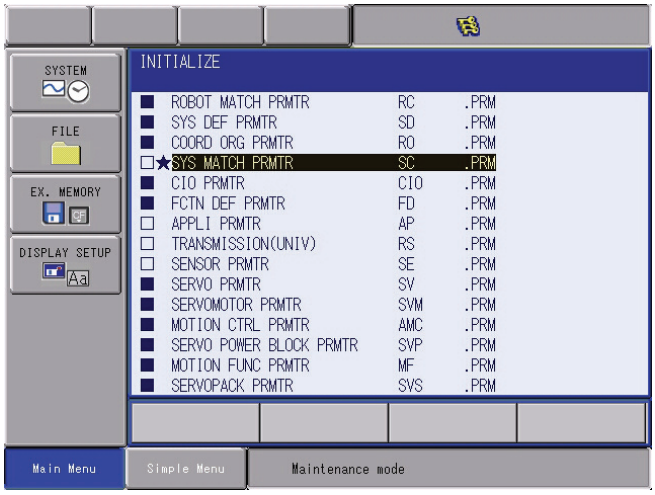
8. Select {YES}.
   – The selected data file/general data are initialized.

8.18.3 Initializing Parameter File

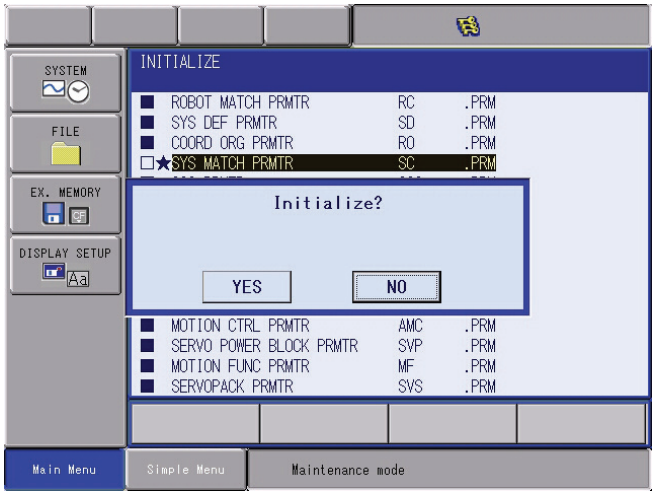
1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {PARAMETER}.
   – The parameter selection window appears.



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.

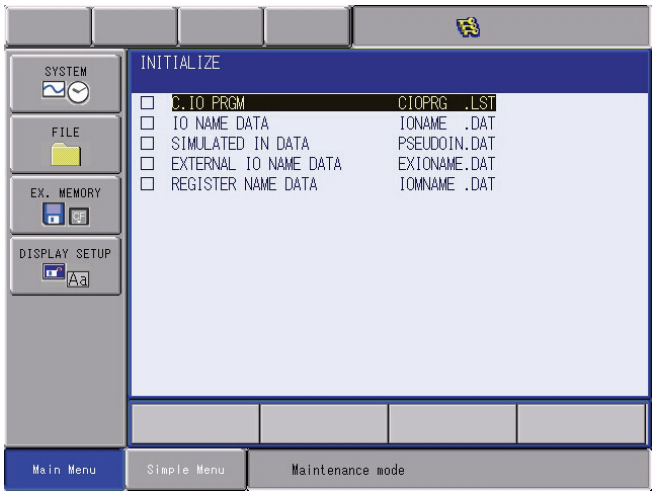


8. Select {YES}.
   – The selected parameter is initialized.

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}.

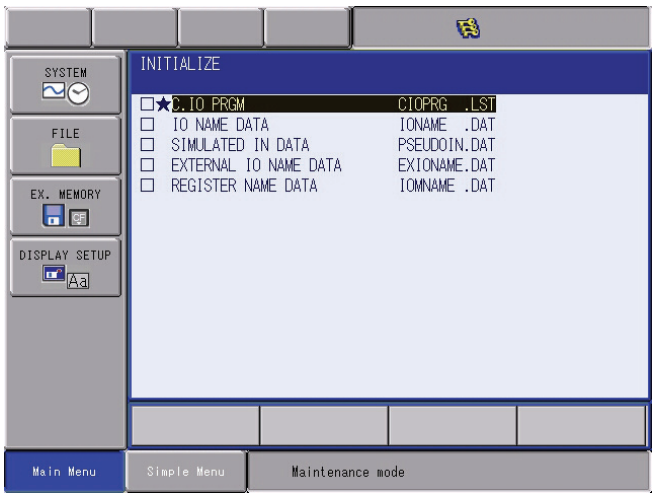
– The I/O data selection window appears.



6. Select data to be initialized.

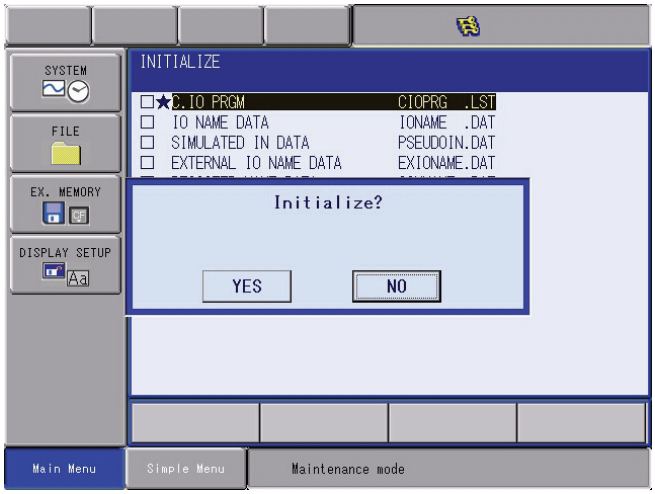
– The selected data is marked with “★“.

– The I/O data marked with "■" cannot be selected.



7. Press [ENTER].

– A confirmation dialog box appears.

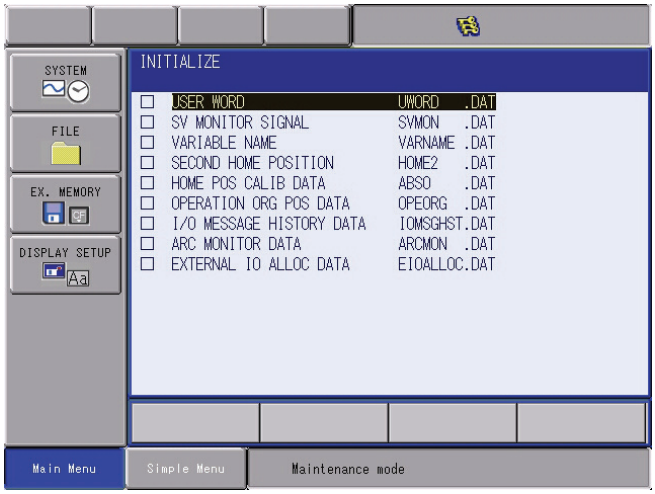


8. Select {YES}.

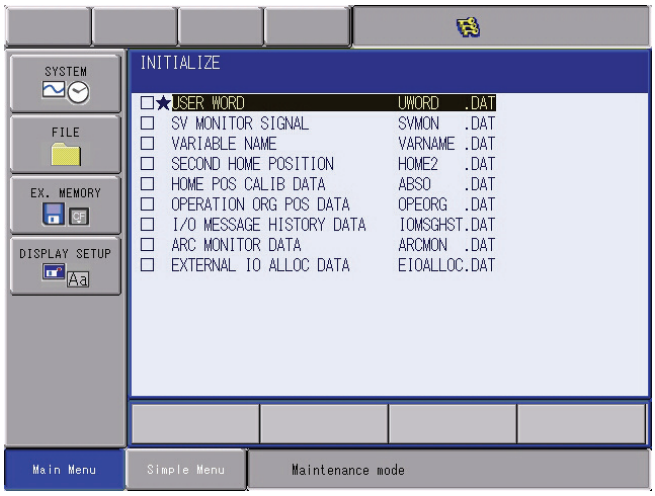
– The selected data is initialized.

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.



6. Select the parameter to be initialized.
   – The selected data is marked with “★“.
   – The system data marked with "■" cannot be selected



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



8. Select {YES}.
   – The selected data is initialized.

8.19 Display Setting Function

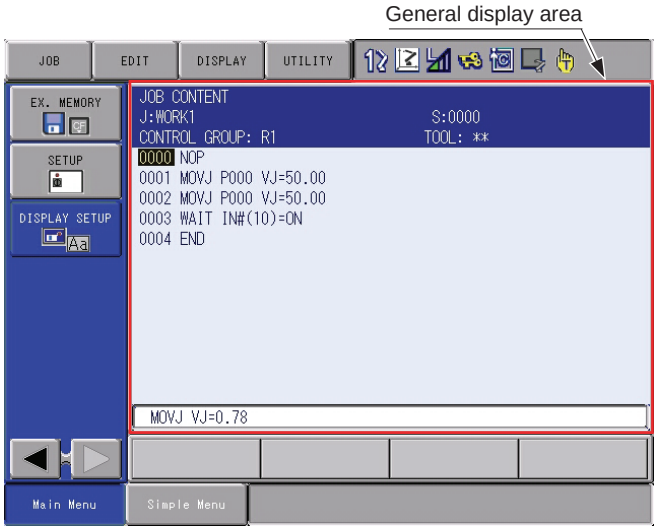
8.19.1 Font Size Setting

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

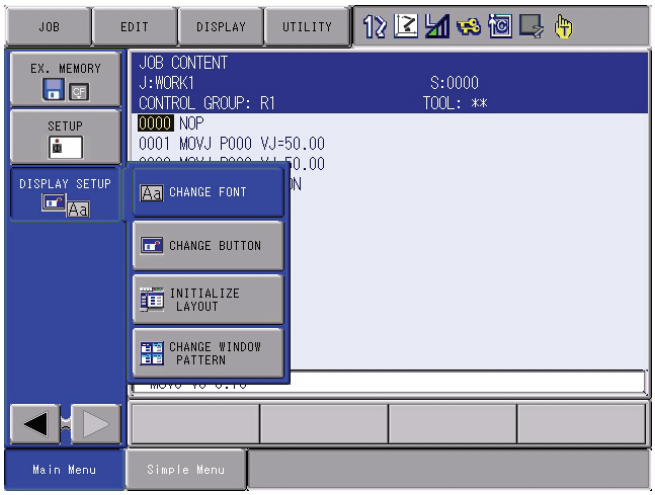
The following eight patterns of fonts are available in setting the size of fonts displayed on the screen.

	Font Size	Font Style
1	Small	Regular
2	Small	Bold
3	Regular	Regular
4	Regular	Bold
5	Large	Regular
6	Large	Bold
7	Extra large	Regular
8	Extra large	Bold

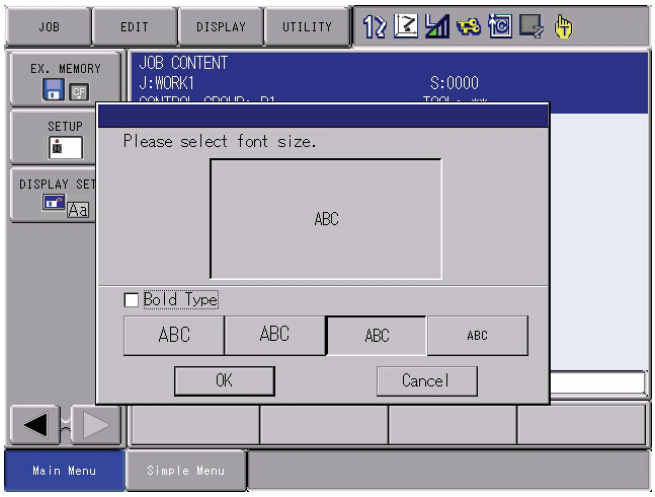
8.19.1.3 Setting the Font Size

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.

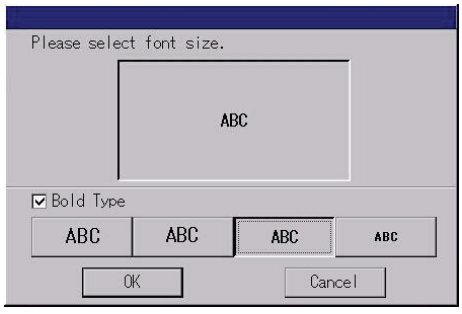


■ **To set the font size in the font size setting dialog box, follow the procedure below.**

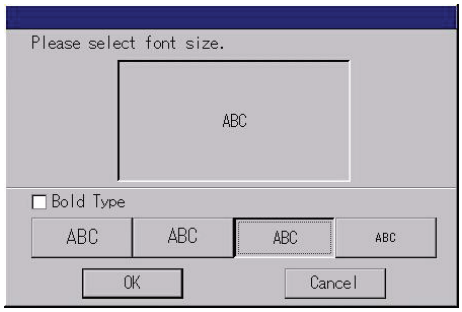
1. Specify the font style.

   – The {Bold Type} check box can be checked or unchecked alternately each time the check box is selected.

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

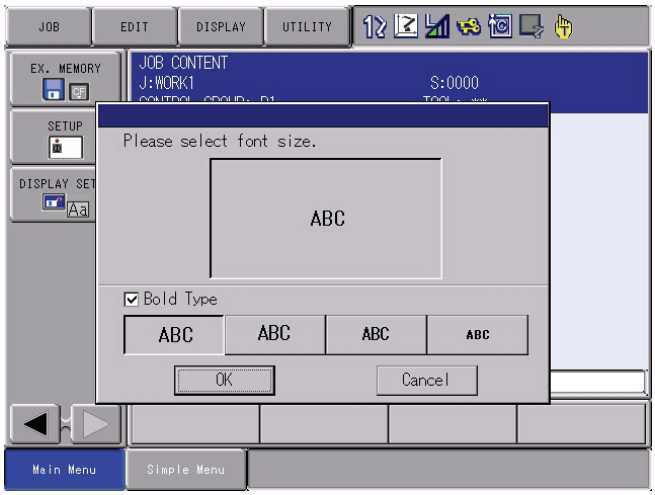


• Clear the {Bold Type} check box as follows to set the font to the regular style.

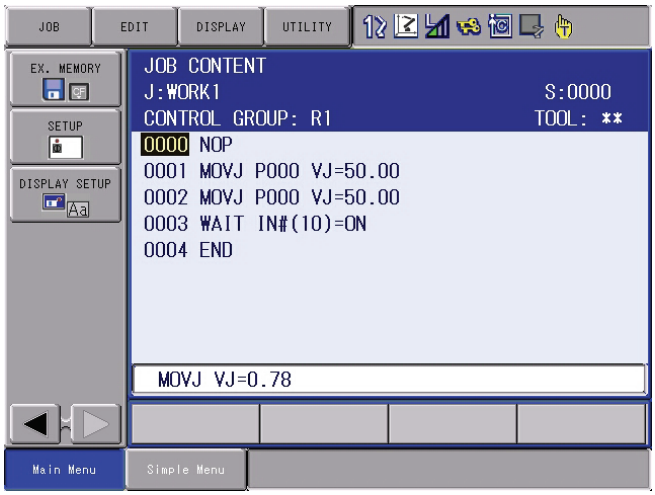


2. Specify the font size.

– Select a button from the four buttons in the dialog box.

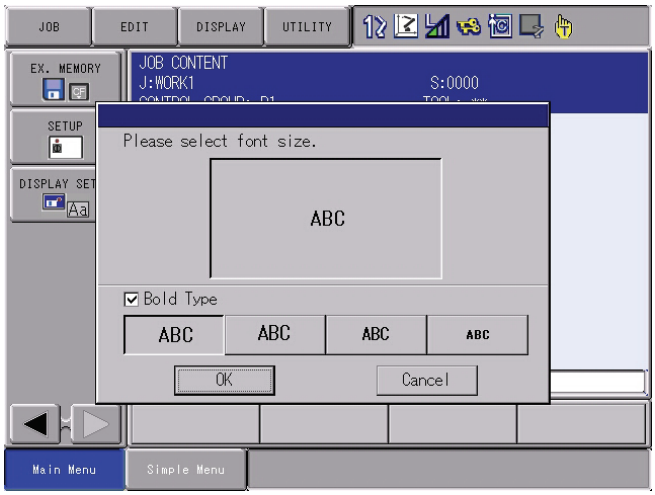


3. The font size setting dialog box is closed, and the screen displays the font specified in the dialog box.

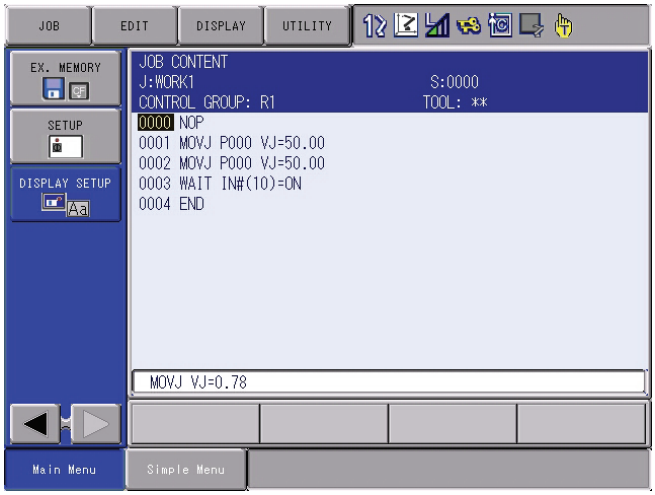


■ **To cancel the setting of the font size, follow the procedure below.**

1. Select {Cancel} in the font size setting dialog box.



2. The dialog box closes without changing the font size.



NOTE Do not turn OFF the DX100 power supply when the font size is being changed (when the font size setting dialog box is on the screen).

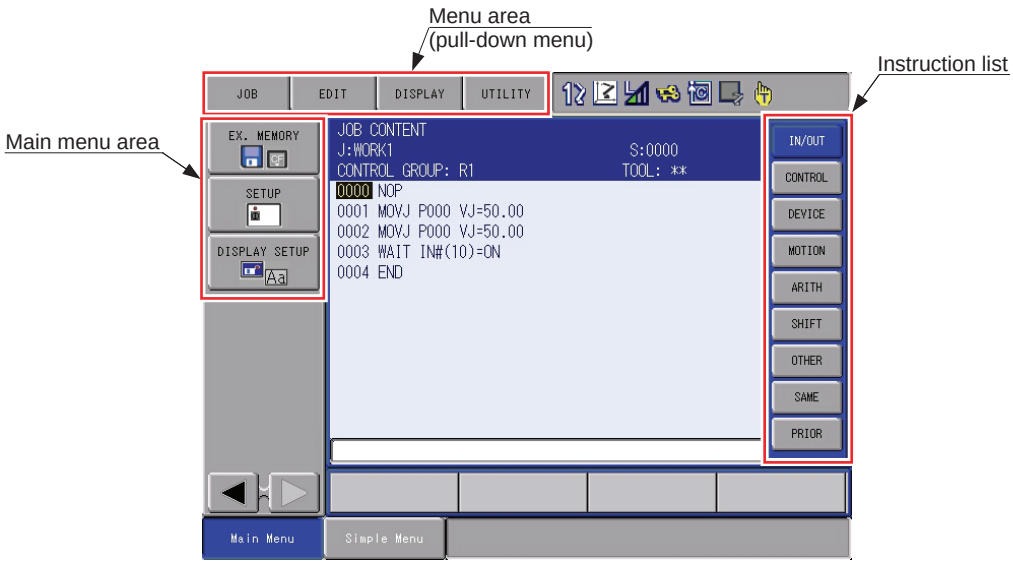
8.19.2 Operation Button Size Setting

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

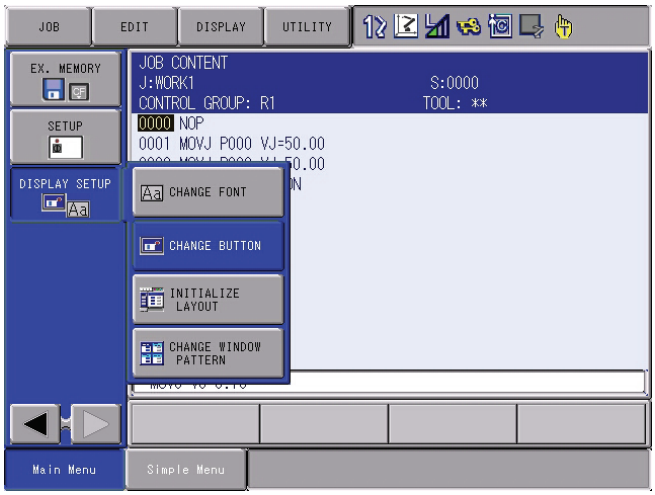
The following three sizes of buttons are available in setting the size of each operation button; the font style of the character string on buttons can also be specified.

	Button Size	**Font Style**
1	Small	Regular
		Bold
2	Regular	Regular
		Bold
3	Large	Regular
		Bold

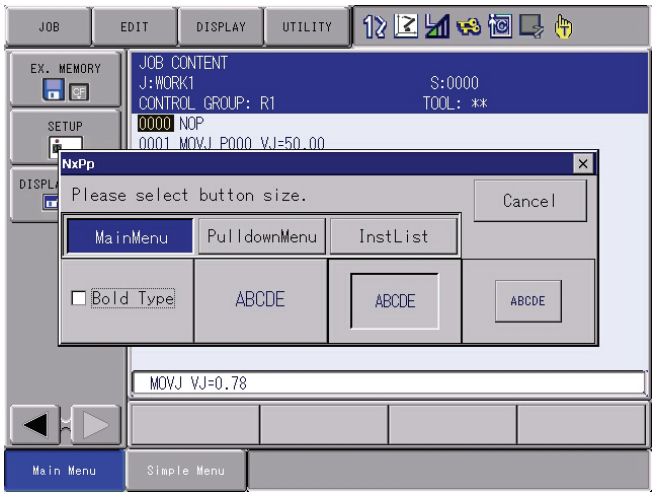
8.19.2.3 Setting the Button Size

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.



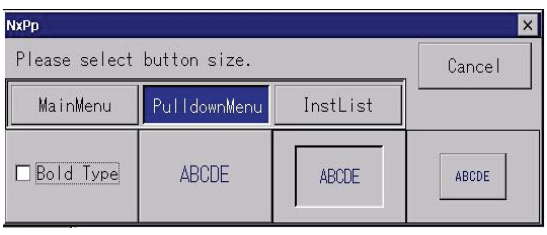
■ **To set the button size in the button size setting dialog box, follow the procedure below.**

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.

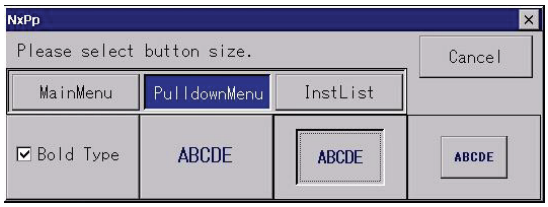
   (3) Note that only the last-selected button determines the area subject to size setting, even if settings are performed several times before then.



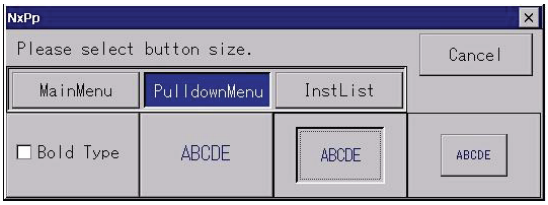
2. Specify the font style.

   – 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.

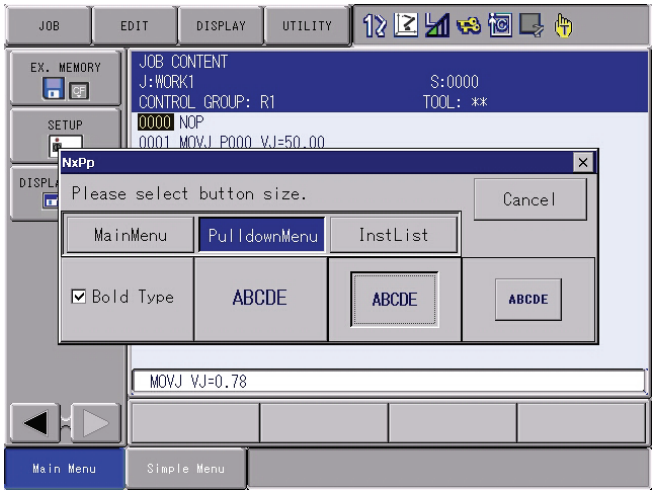


• Clear the {Bold Type} check box as follows to set the font to the regular style.



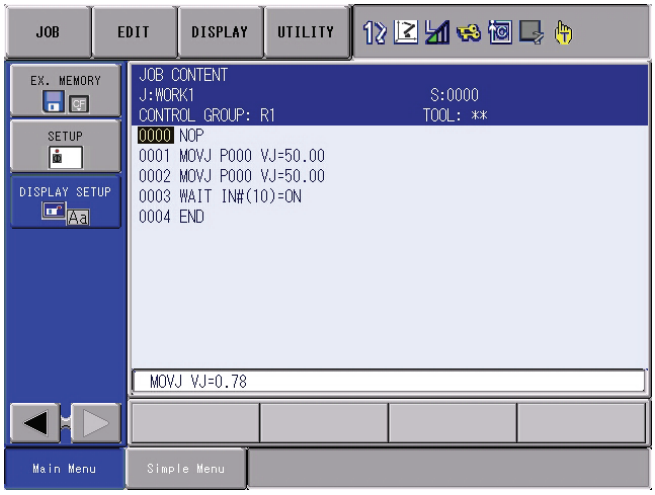
3. Specify the button size.

– Select a button from the three buttons in the dialog box.



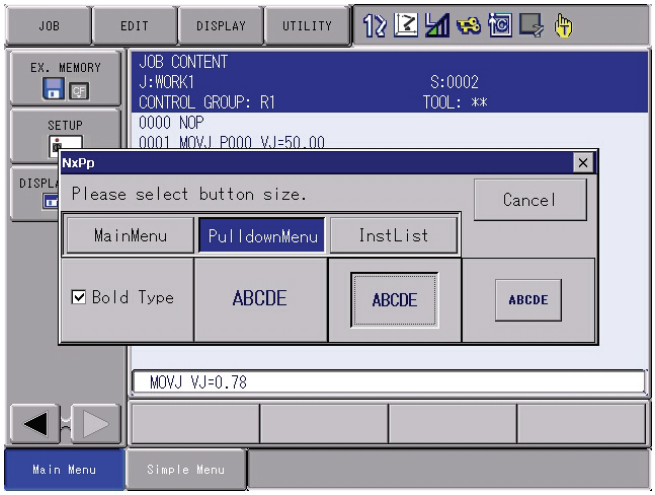
4. The font size setting dialog box is closed, and the screen displays the buttons specified in the dialog box.

– 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.)

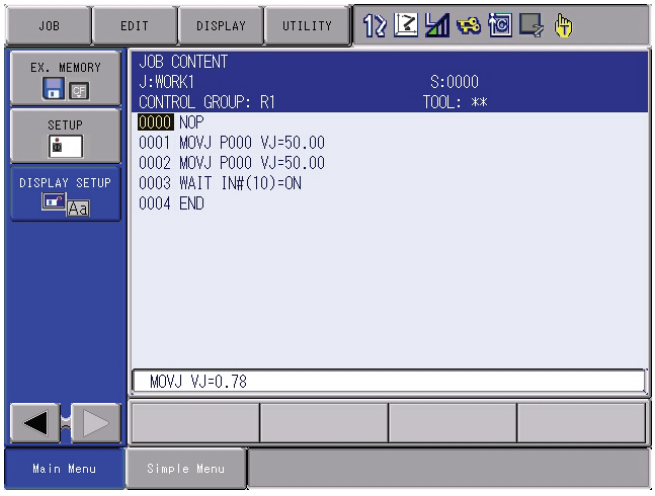


■ **To cancel the setting of the button size, follow the procedure below.**

1. Select {Cancel} in the button size setting dialog box.



– The dialog box closes without changing the button size.



NOTE

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).

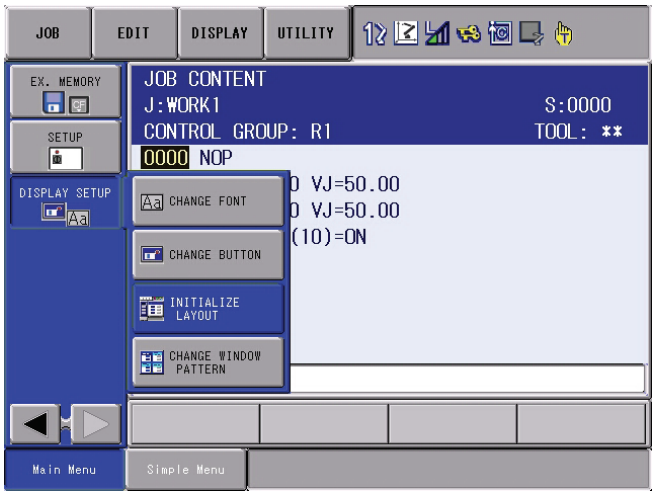
8.19.3 Initialization of Screen Layout

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

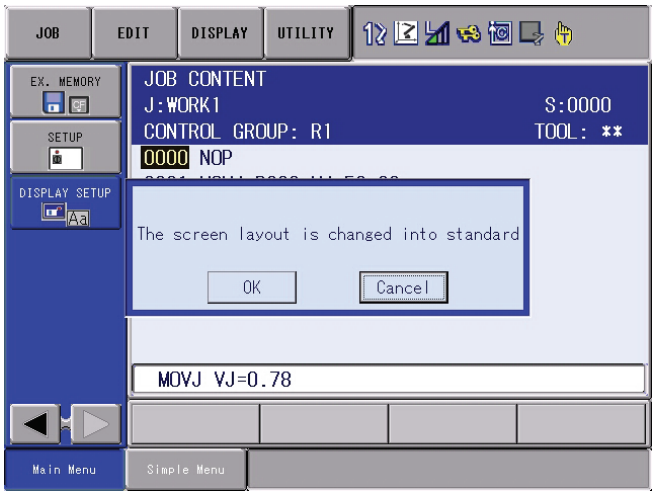
8.19.3.1 Initializing the Screen Layout

To initialize the screen layout, follow the procedure below.

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

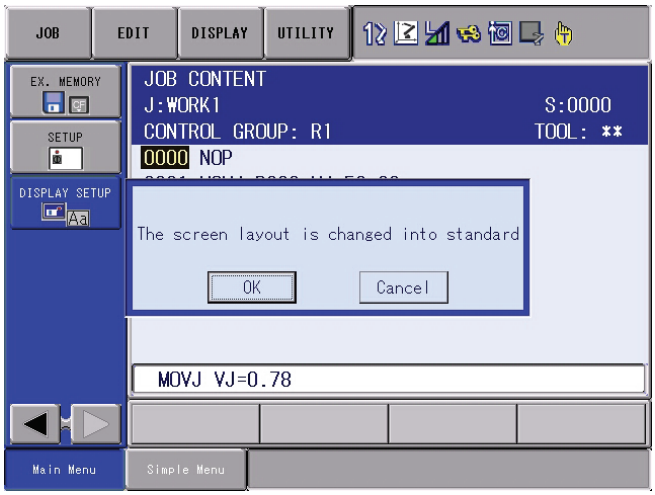


– A confirmation dialog box appears on the center of the current window.

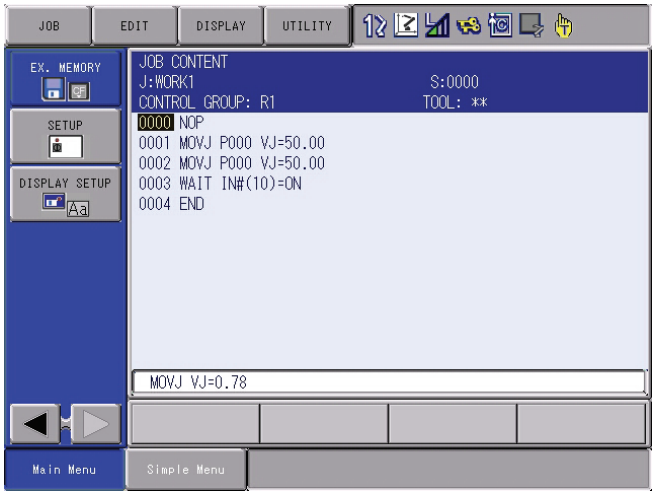


■ **To Initialize the screen layout, follow the procedure below.**

1. select {OK}.

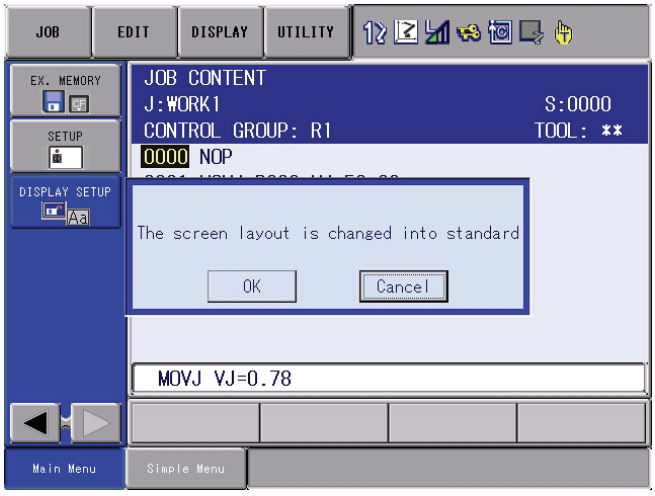


– The dialog box is closed, and the font/button sizes are collectively changed to the regular size.

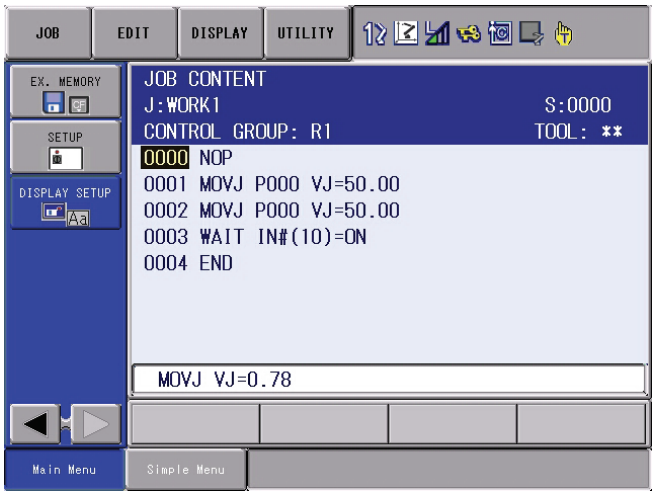


■ **To cancel the Initialized screen layout, follow the procedure below.**

1. Select {CANCEL}.



– The dialog box closes without changing the current screen layout.



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).

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.

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 *chapter 9.2 "Backup by CMOS.BIN" at 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 *chapter 9.5 "Error List" at page 9-20*.

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>

No.	Manufacturer	Model	Remarks
1	Hagiwara Sys-Com	MCF10P-256MS-YE2	(256MB)
2	Hagiwara Sys-Com	MCF10P-512MS	(512MB)
3	Hagiwara Sys-Com	MCF10P-A01GS	(1GB)
4	Hagiwara Sys-Com	MCF10P-A02GS	(2GB)
5	SiliconSystems, Inc.	SSD-C25M3512	(2GB)

< Recommended USB Memory>

No.	Manufacturer	Model	Remarks
1	Hagiwara Sys-Com	UDG3-GA series	(1GB, 2GB)

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

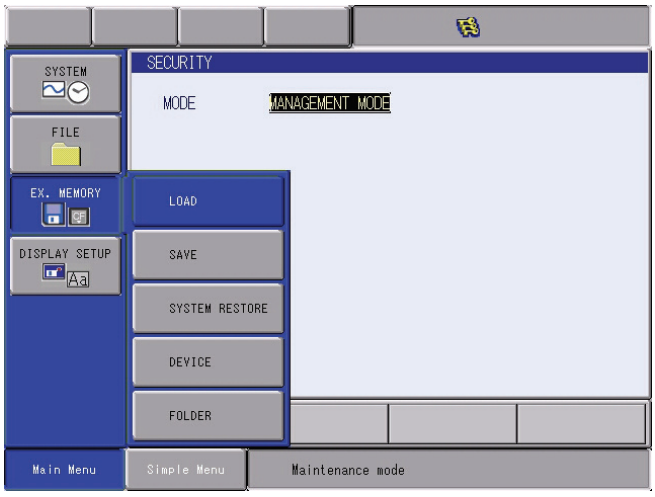
Perform the backup by CMOS.BIN in the maintenance mode.
The chart below shows the availability of CMOS save/CMOS load in each security mode in the maintenance mode.

Security	CMOS Save	CMOS Load
Operation Mode	X	X
Editing Mode	O	X
Management Mode	O	O
Yaskawa Mode	O	O

9.2.1 CMOS.BIN Save

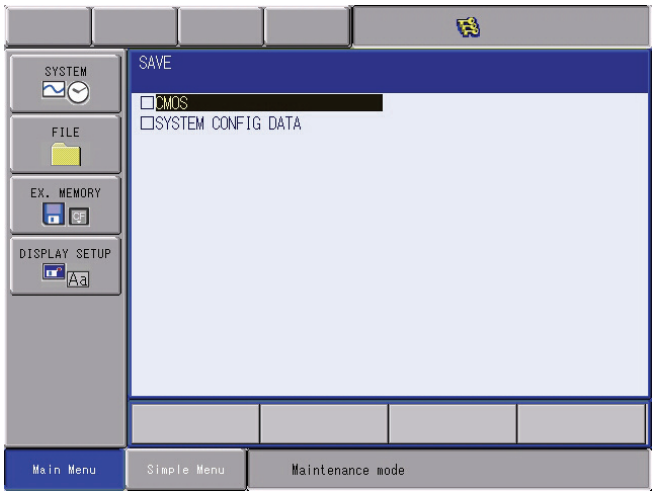
Follow the procedures below to save CMOS.BIN.

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}.

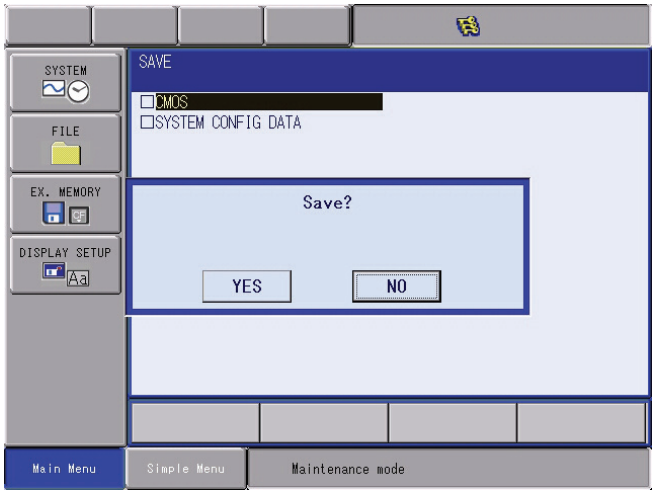
The save display appears.



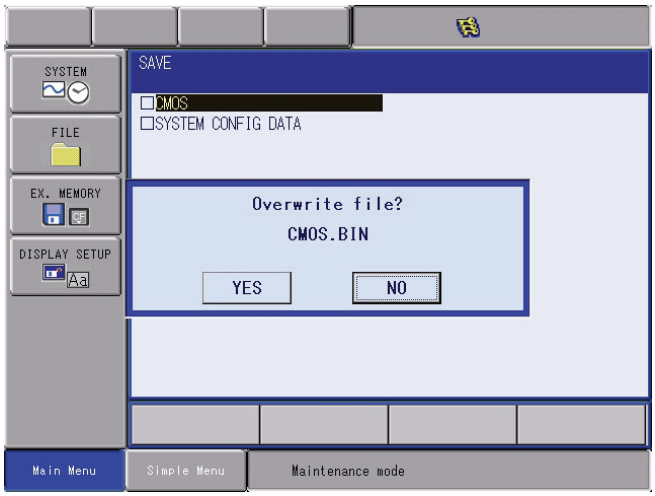
The items marked with "■" cannot be selected.

5. Select {CMOS SAVE}.

The confirmation dialog box appears.



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.

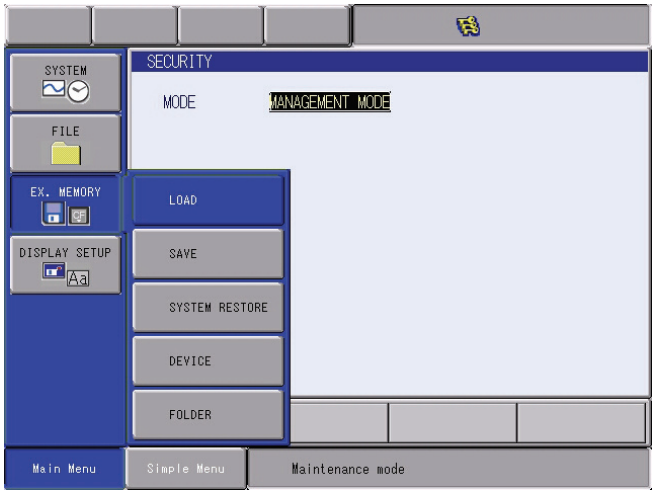


7. Select {YES}.
   – The CMOS.BIN file is overwritten in the CompactFlash.

9.2.2 CMOS.BIN Load

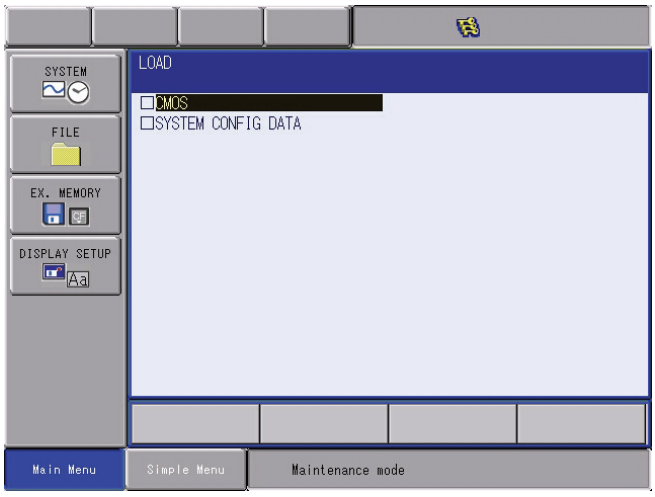
Follow the procedures below to load CMOS.BIN.

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.



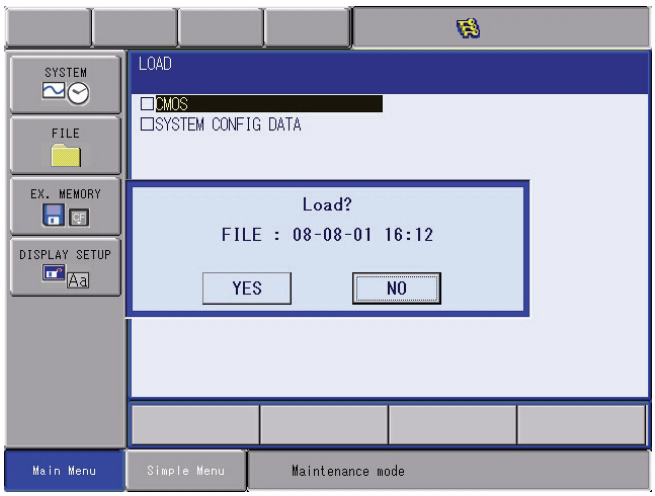
5. Select {LOAD}.

The load display appears.



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

6. Select {CMOS LOAD}.
   – The comfirmation 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.

No	Function/Feature	Explanation
1	Cyclic backup 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.
2	Backup when switching modes 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.
3	Backup when start-up 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.
4	Backup when inputting specified signals 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.
5	Backup while robot program is stopped The backup during playback is disabled. However, in the play mode, the backup is enabled if the robot is stopped. ("Cyclic backup" and "Backup when inputting specified signals")	Backs up the variables for essential data.
6	Backup and retry at low priority 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.
7	Backup in binary The data is saved as binary data. The range is same as that of the "ALL CMOS AREA" in {FD/CF}, but the data type is different.	Backup in binary allows the system to be easily and speedily restored.
8	Setting of items Parameters can limit the settings of the backup condition.	Unnecessary settings can be avoided with this setting.

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.

NOTE

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>

No.	Manufacturer	Model	Remarks
1	Hagiwara Sys-Com	MCF10P-256MS (IOOAII-YE2)	256MB
2	SiliconSystems, Inc.	SSD-C25M-3512	256MB

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 vlue 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 OCCURENCE
- STORED FILE SETTING

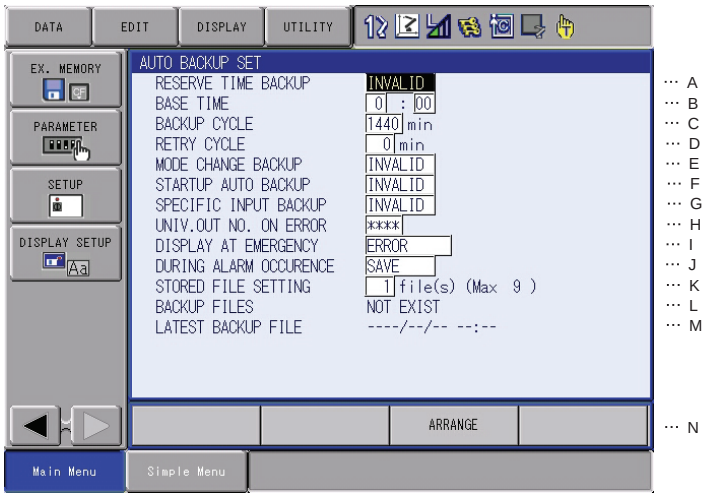
NOTE

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 recognaized 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.

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 DX 100 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 OCCURENCE

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 CompactFlash inserted when this window is displayed.
The settings range from 1 to (Max). When this setting value is changed, the backup file arrangement starts.

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

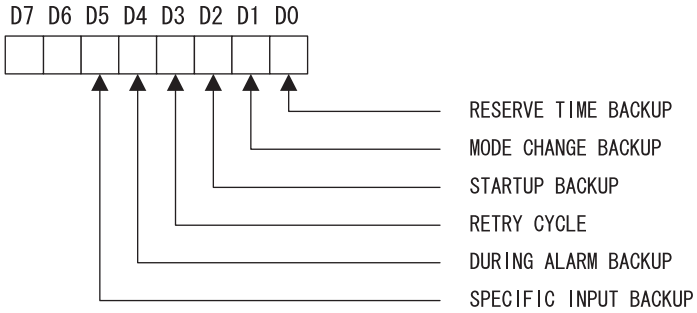
When the setting of maximum number of stored files is changed, the file arrangement of the backup files in the CompactFlash is executed.
With this operation, the file arrangement can be performed without changing the maximum number of stored files.

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.



9.3.2.3 DX100 Status and Automatic Backup

Backup Timing	DX100 Status		Automatic Backup	
			Compact Flash ready to save the data	Absence or insufficient capacity of the CompactFlash
From a specified starting time	Teach mode	Editing (Accessing to the memory)	Retry	Retry
		When editing is interrupted	Backup	Error
	Play mode Remote mode	Executing jobs	Disabled	Disabled
		When stopped	Backup	Error
When a specified signal(#40560) is input	Teach mode	Editing (Accessing to the memory)	Error	Error
		When editing is interrupted	Backup	Error
	Play mode Remote mode	Executing jobs	Disabled	Disabled
		When stopped	Backup	Error
When switching the mode from the teach mode to the play mode	-		Backup	Error
When the DX100 starts up	-		Backup	Error

* 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.

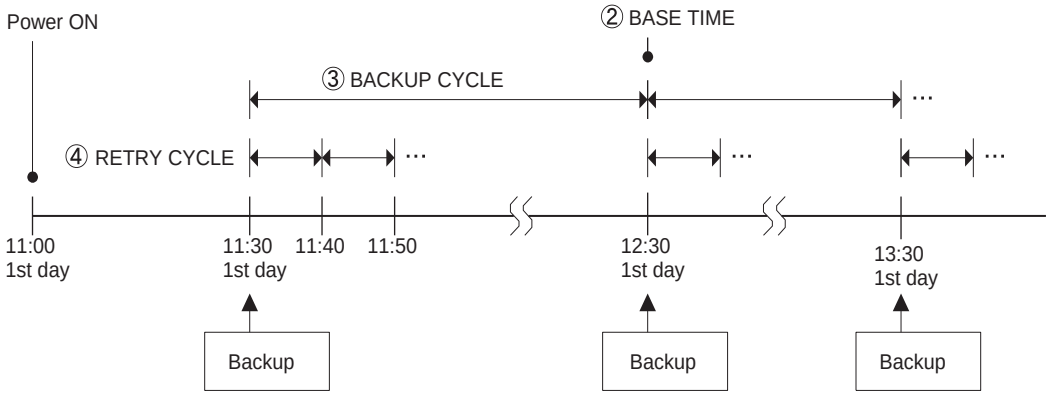
9.3.2.4 Setting Examples

■ **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)

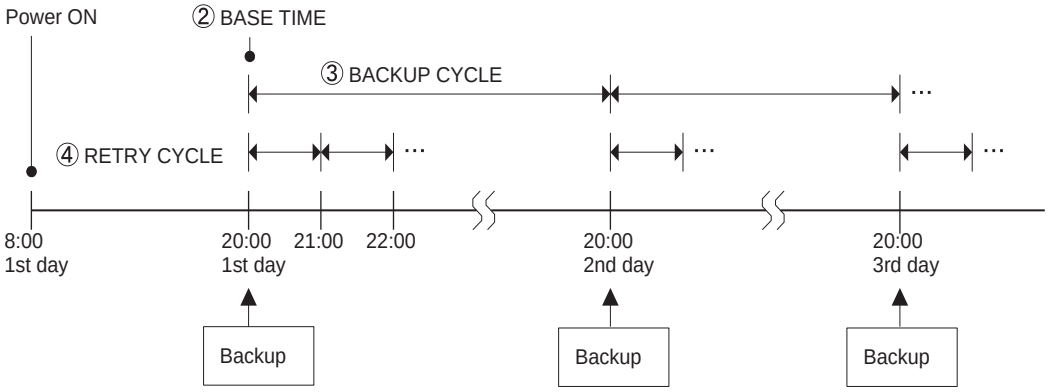


■ **Setting Example 2**
The following diagram shows a setting example with the following conditions:

BASE TIME: 20:00

BACKUP CYCLE: 1440 (minutes) (24 hours)

RETRY CYCLE: 60 (minutes)



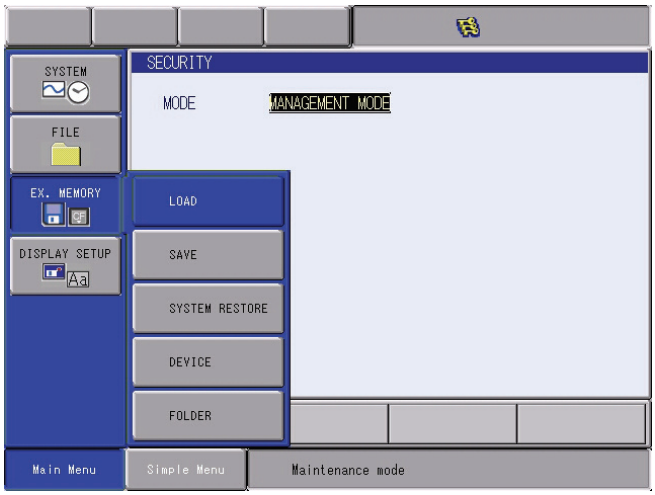
NOTE While a job is being executed, the automatic backup or retry is not performed. Also, after an error occurs in writing into the CompactFlash, the retry is not performed until the next backup starting time.

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.



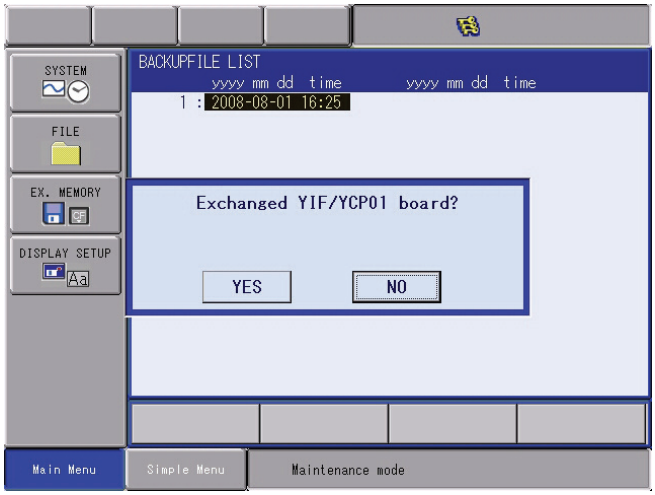
5. Select {CompactFlash}.
   – The CompactFlash display appears.



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.

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

Error No.	Data	Message	Cause
0770	*	The robot or the station is in motion.	The automatic backup would not work when the robot or a manipulator is in motion.
3390		File not found	The file to be loaded no longer exists.
3460	*	Cannot backup CompactFlash	
	1		Insufficient capacity of the CompactFlash
	2		Cannot access the CompactFlash
3501	*	Confirm the status of CompactFlash.	Cannot access the CompactFlash
3550	*	The automatic backup is executed. Try it later.	The automatic backup window cannot be called to display while the automatic backup is being processed.
3551	*	The automatic backup is executed. Arrange the file after it is finished.	The file arrangement cannot be operated during the automatic backup operation.
3560	*	Failed to re-arrange the backup file.	Failed to re-arrange the backup file for another reason than the access to CompactFlash.
3580	*	Accessing to backup file. Try it later.	To display another window and then display the automatic backup window again after "ARRANGE" operation, “ARRANGE” process should be completely finished.
3581	*	Accessing to backup file. Try "ARRANGE"operation later.	The previous "ARRANGE" process should be completely finished to perform the next "ARRANGE" operation.

10 Upgrade Function

10.1 Functional Overview

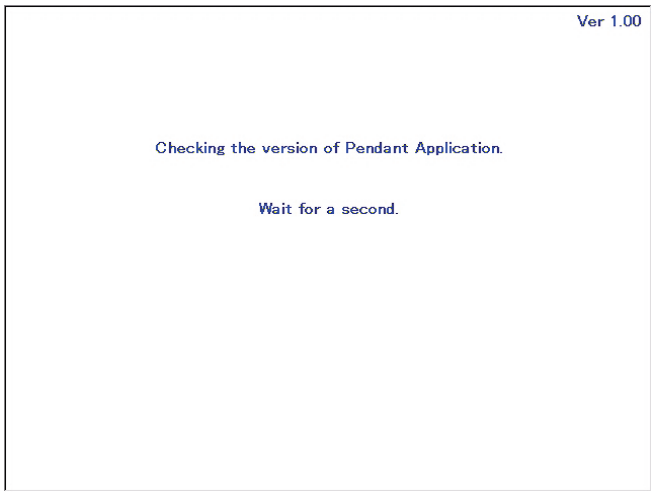
DX100 applies two softwares for the CPU configuration: a software for YCP01 (for the main CPU board) and a software for YPP01 (for programming pendant). The system works only with the combination of certain versions due to a compatibility problem of each software.

Therefore, with the system version NS3.00 and the subsequent versions, DX100 can upgrade the software for YPP01 if the combination of the softwares for YCP01 and YPP01 is invalid.

10.2 Upgrade Procedure

10.2.1 Confirmation of Software Version

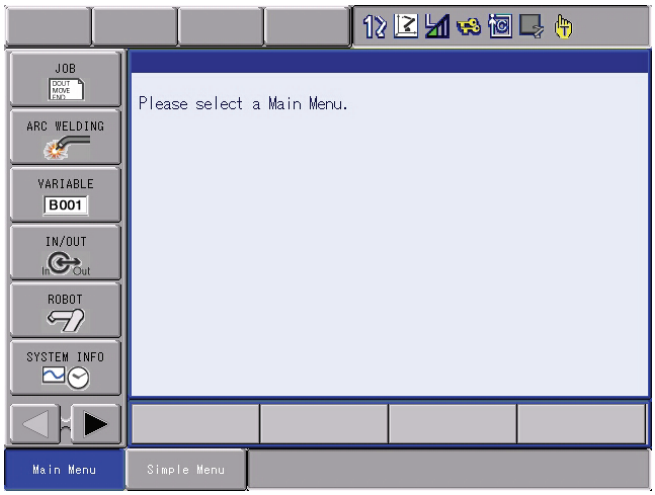
The compatibility of the versions of YCP01 and YPP01 are automatically checked in 20 seconds after the DX100 power supply is turned on.



• In case the versions of YCP01 and YPP01 matches.

1. Automatic upgrade process completes and the communication process between YCP01 and YPP01is restarted.

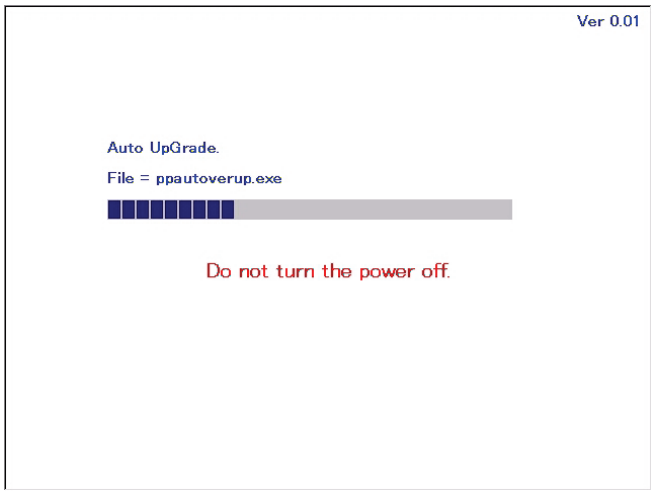
2. Initial window appears approx. 40 seconds later.



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 appplication 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 comletes and the communication process between YCP01 and YPP01is restarted.
   – Some upgraded softwares 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.

NOTE

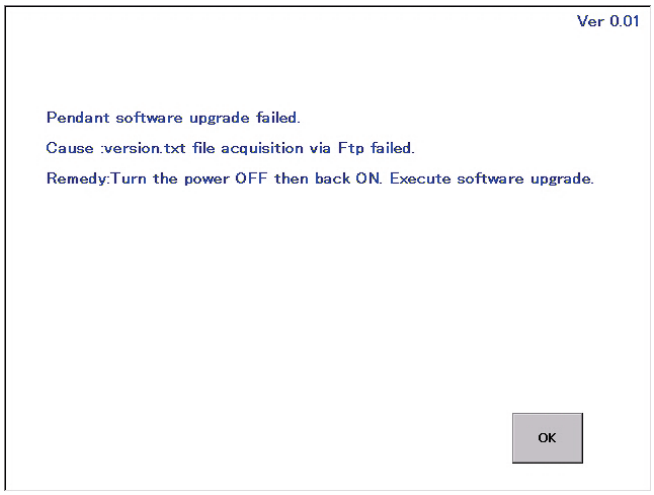
DO NOT turn off the main power supply during automatic upgrade process.

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” (HW0485193) for detail.

11 Modification of System Configuration

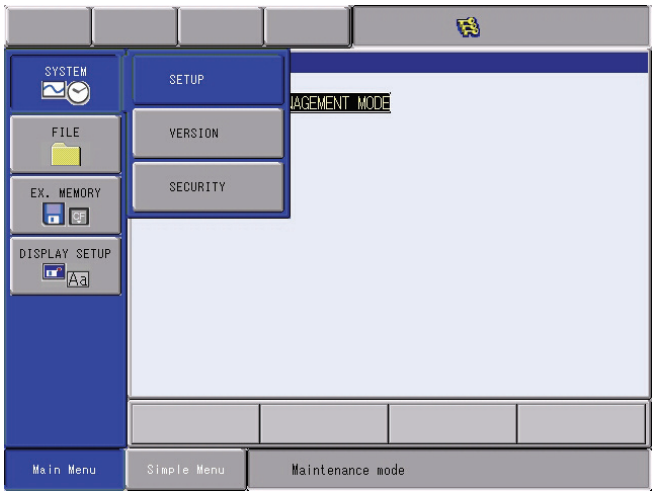
11.1 Addition of I/O Modules

To add I/O modules, turn OFF the power supply.

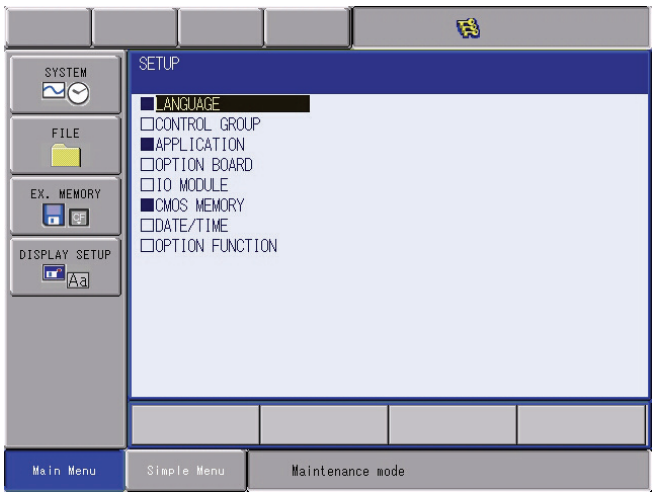
SUPPLE -MENT

Addition operation must be performed in the management mode.
In the operation mode or editing mode, only reference of status setting is possible.

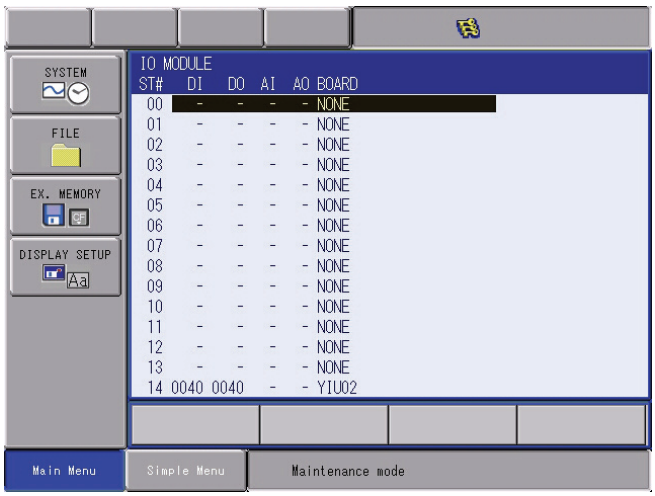
1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the "SECURITY MODE" to the "MANAGEMENT MODE".
3. Select {SYSTEM} under the main menu.
   – The system window appears.



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.

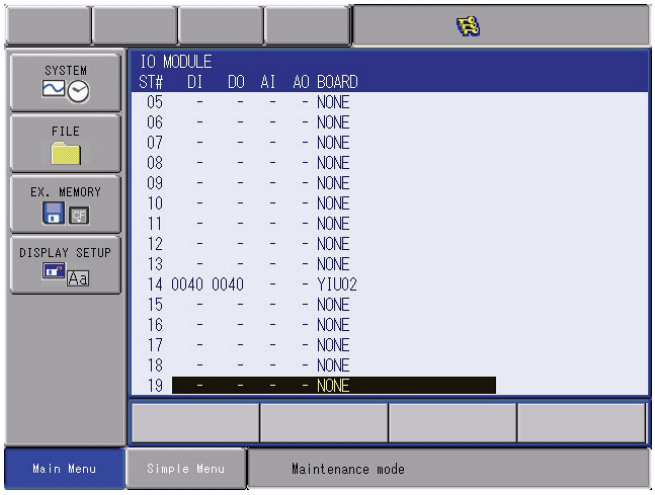


6. Confirm the status of mounted I/O module.
   – Confirm that each station (ST#) window is the same as the I/O module's actual mounting status.
   – The following information is shown for each station.

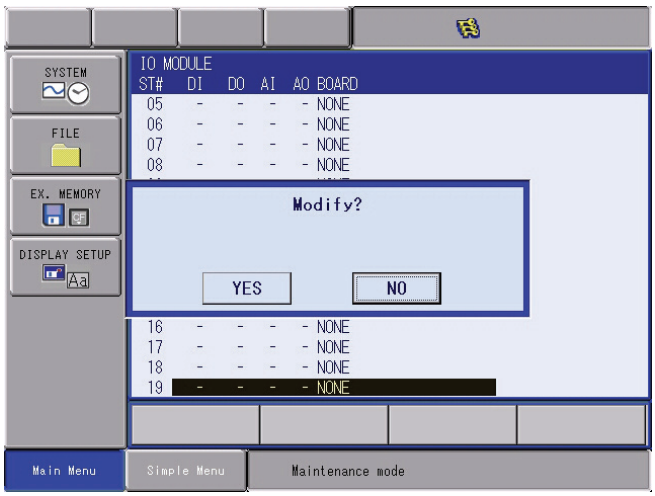
ST#	Station address of I/O module
DI	Number of contact input points[1)]
DO	Number of contact output points[1)]
AI	Number of analog input points[1)]
AO	Number of analog output points[1)]
BOARD	Circuit board type[2)]

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.



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.

NOTE 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.

SUPPLE -MENT 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,S5... 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

  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]

- MOTOR SPECIFICATION

  Set the following items.

  - MOTOR
  - SERVO AMP
  - CONVERTER
  - ROTATION DIRECTION [normal/reverse]
  - MAX. RPM [rpm]
  - ACCELERATION SPEED [sec]
  - INERTIA RATIO

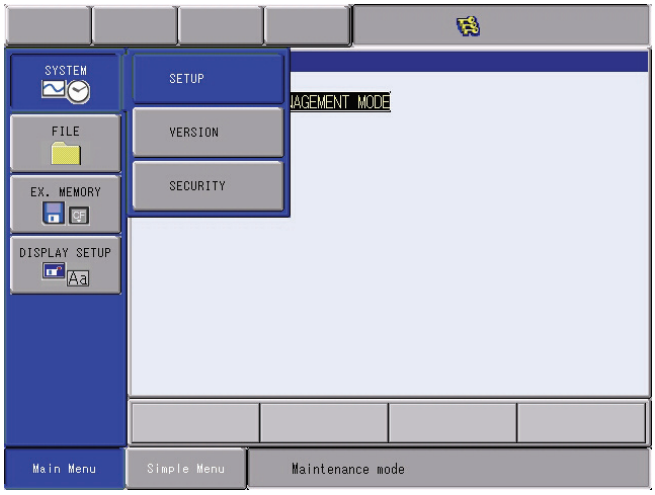
* Select MOTOR, AMPLIFIER and CONVERTER from each type list on the display.

11.2.1 Base Axis Setting

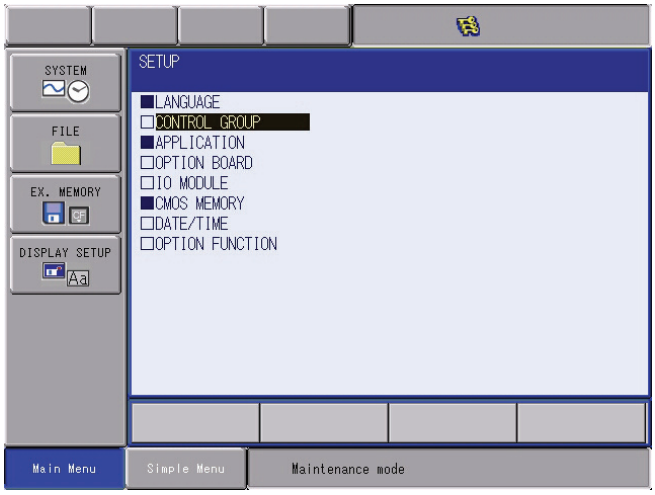
11.2.1.1 Selection of Base Axis Type

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.

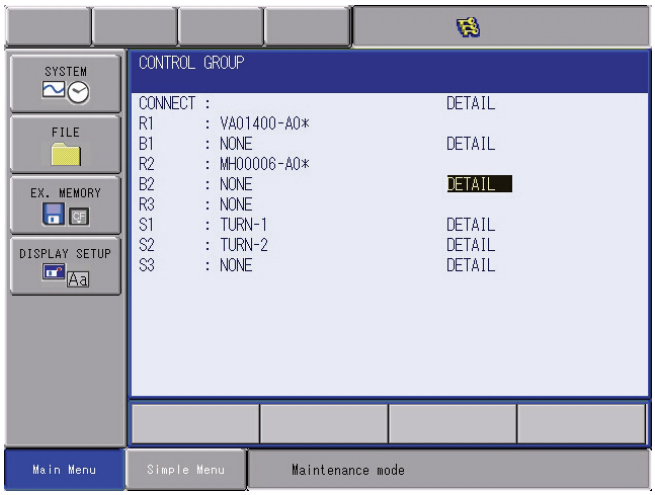


4. Select {SETUP}.
   – The SETUP window appears.
   – Note that the items marked with "■" cannot be set.



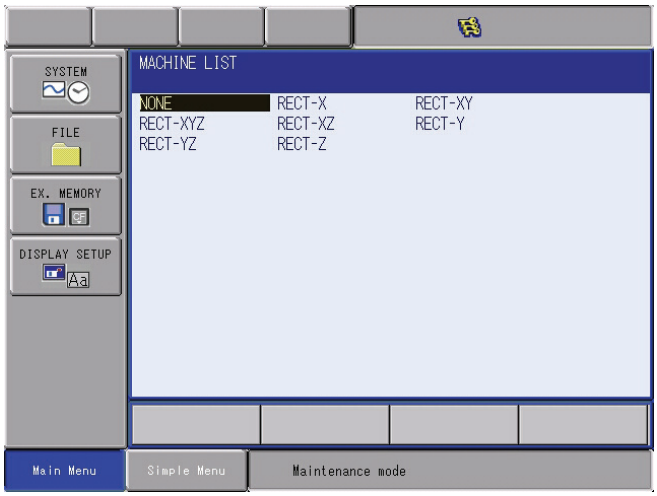
5. Select {CONTROL GROUP}.

– The current control group type is displayed.



6. Point the cursor to the type of control group to be modified, and press [SELECT].

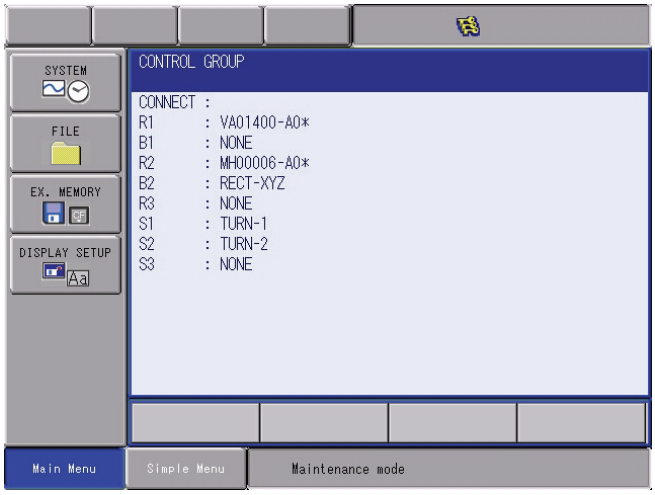
– The MACHINE LIST window is displayed.



RECT-X: traverse X-axis base
RECT-Y: traverse Y-axis base
RECT-Z: traverse Z-axis base
RECT-XZ: traverse XZ-axis base
RECT-XY: traverse XY-axis base
RECT-XYZ: traverse XYZ-axis base
(See the figures on the next page)

7. Select one in the type list.

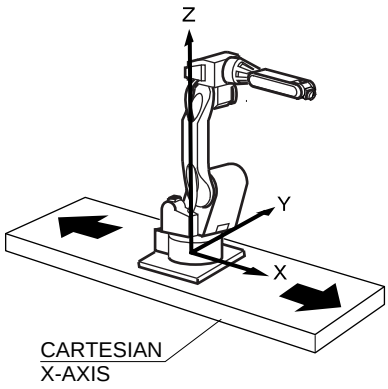
– After the type selection, the window returns to the CONTROL GROUP window.



8. Press [ENTER] in CONTROL GROUP window.

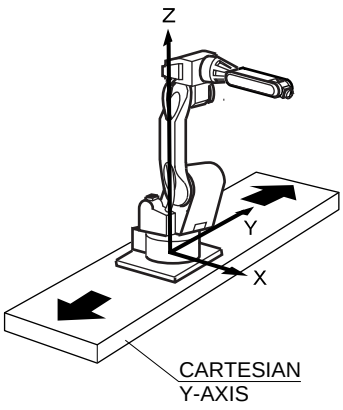
– The window moves to the CONNECTION window.

RECT-X



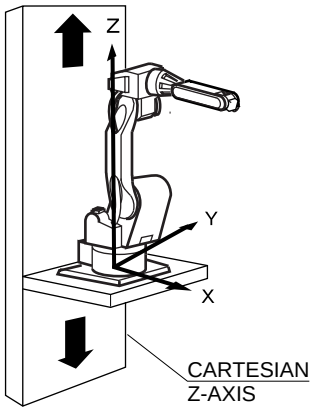
Base axis direction of travel coincides with robot coordinate X-Axis.

RECT-Y



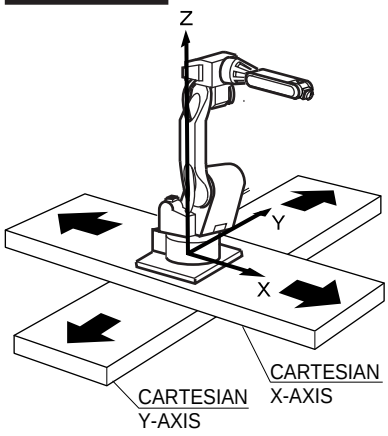
Base axis direction of travel coincides with robot coordinate Y-Axis.

RECT-Z



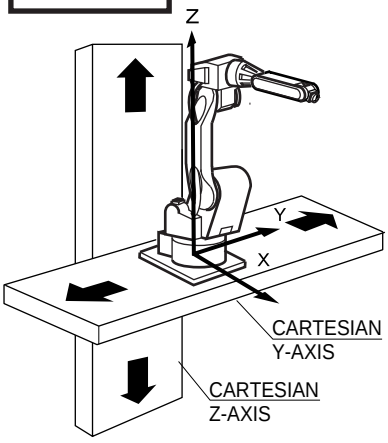
Base axis direction of travel coincides with robot coordinate Z-Axis.

RECT-XY



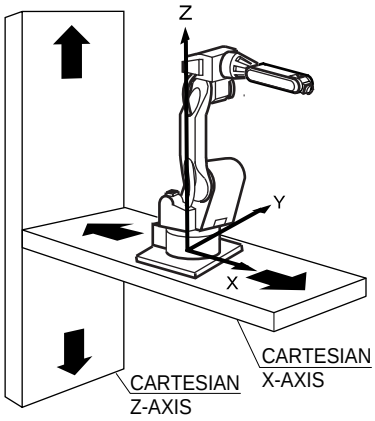
Base 1st and 2nd axes directions of travel coincide with robot coordinate X-Axis and Y-Axis, respecitively.

RECT-YZ



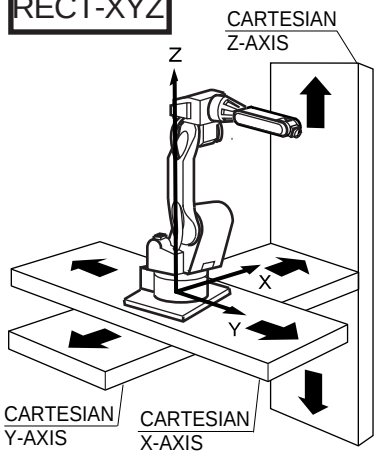
Base 1st and 2nd axes directions of travel coincide with robot coordinate Y-Axis and Z-Axis, respectively.

RECT-XZ



Base 1st and 2nd axes directions of travel coincide with robot coordinate X-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.

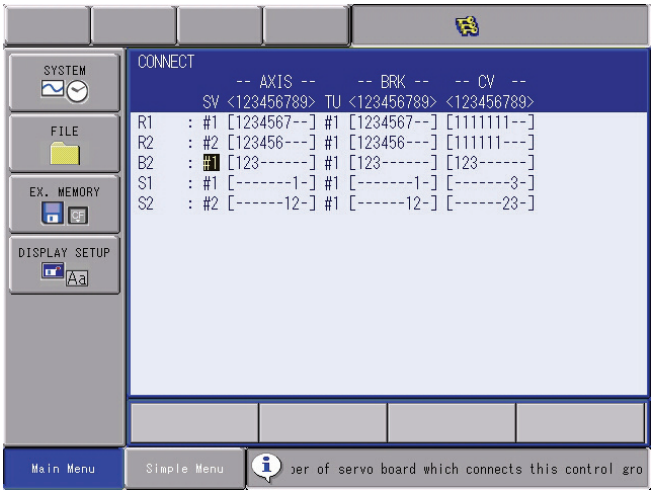
11.2.1.2 Connection Setting

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.

– In this example, B1 (Base) is to be connected as shown in the following manner:

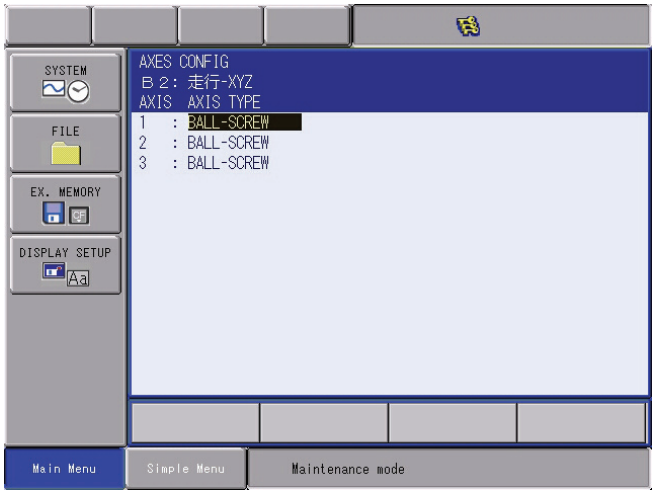
1st axis	→	SERVO Board (SV #2),	Connector (7CN),
		Contactor Unit (TU #1),	Brake Connector (BRK7),
		Converter (CV #1)	
2nd axis	→	SERVO Board (SV #2),	Connector (8CN)
		Contactor Unit (TU #1),	Brake Connector (BRK8)
		Converter (CV #2)	
3rd axis	→	SERVO Board (SV #2),	Connector (9CN)
		Contactor Unit (TU #1),	Brake Connector (BRK9)
		Converter (CV #3)	

3. Select the desired item.
4. Press [ENTER] in the CONNECTION window.
   – The setting in the CONNECTION window is completed and the window moves to the AXES CONFIG window.

11.2.1.3 Axis Configuration Setting

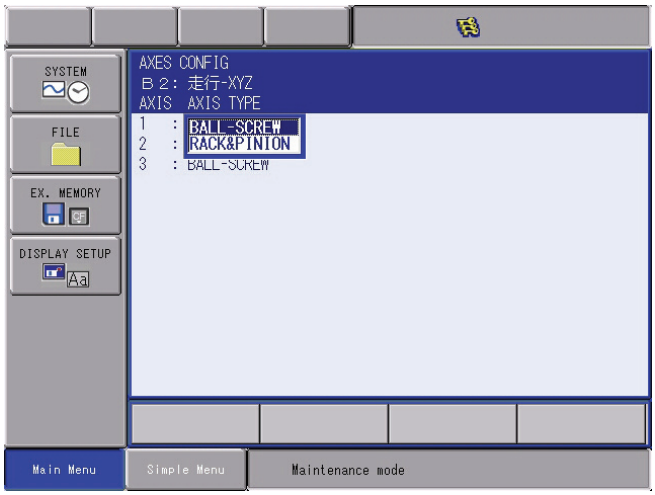
The axis type is specified in the AXES CONFIG window.

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.

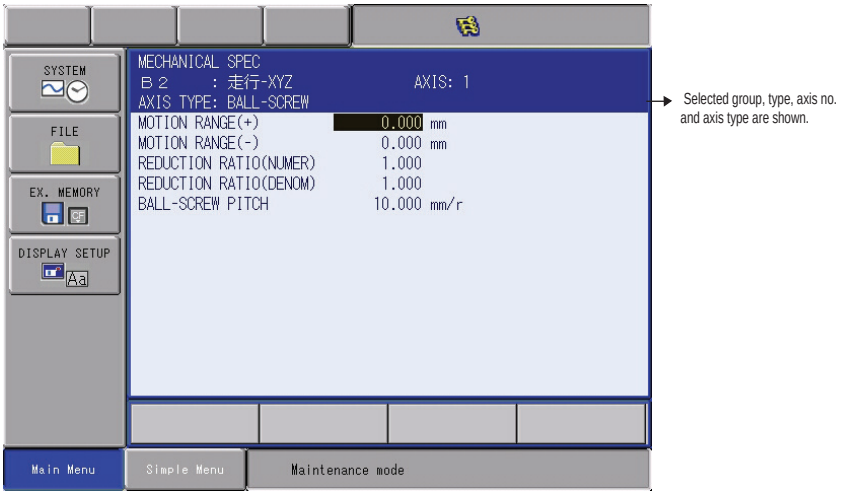
3. Press [ENTER] in the AXES CONFIG window.
4. The setting in the AXES CONFIG window is completed and the window moves to the MECHANICAL SPEC window.

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)

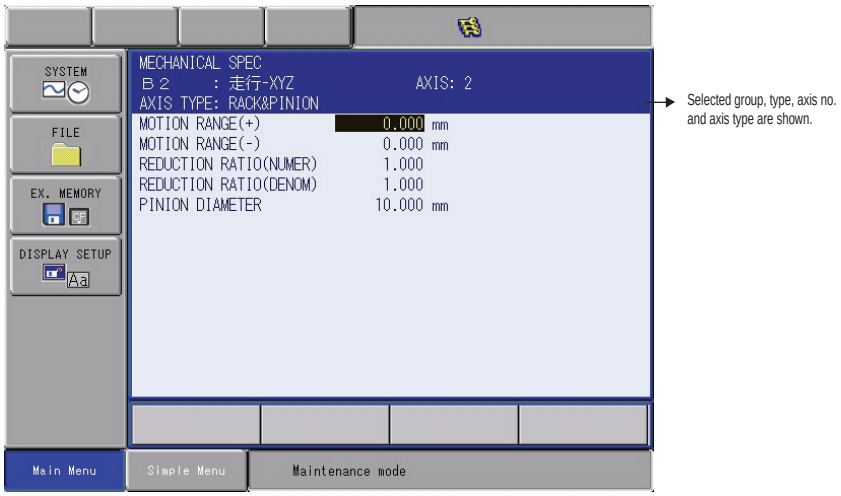


– MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

– 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].

4. Press [ENTER] in the MECHANICAL SPEC window.

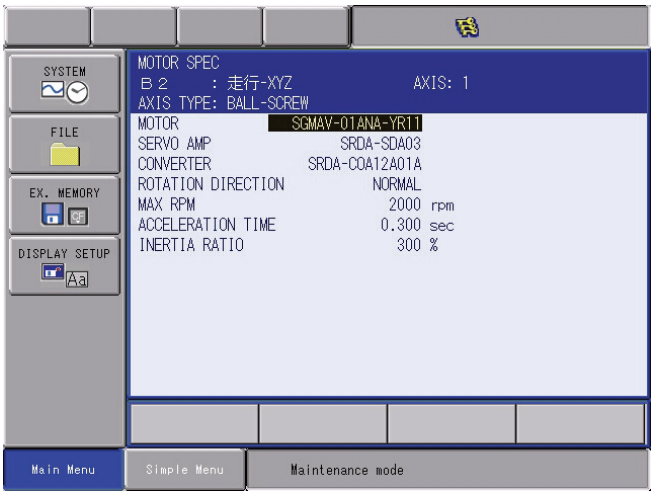
   – After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner.

   – 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

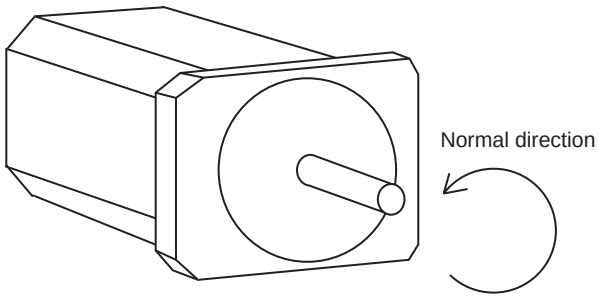
The motor data is specified in the MOTOR SPEC window.

1. Confirm specification of each axis in the MOTOR SPEC window.
   – The motor specification of each axis is displayed.



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.)

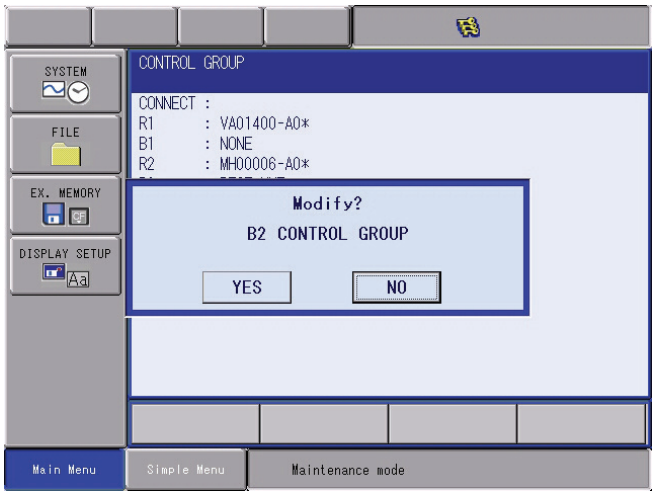
Fig. 11-1: AC Servo Motor



   – MAX. RPM: Input maximum rotation speed of a motor. (Unit: rpm)
   – ACCELARATION 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.
4. Press [ENTER] in the MOTOR SPEC window.
   – 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.



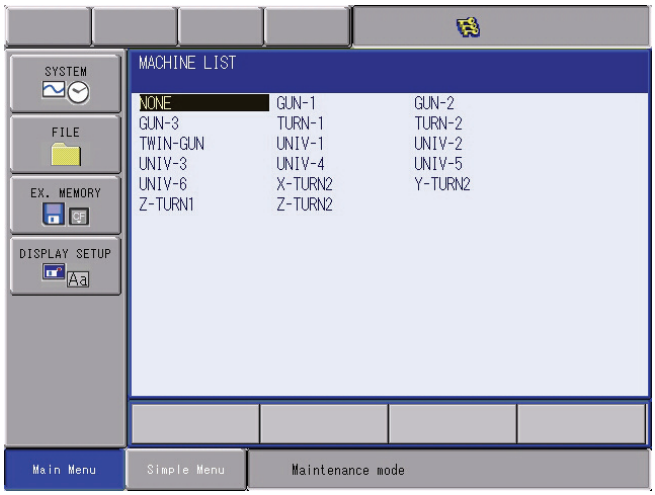
   – If {YES} is selected, the system parameter is set automatically.

11.2.2 Station Axis Setting

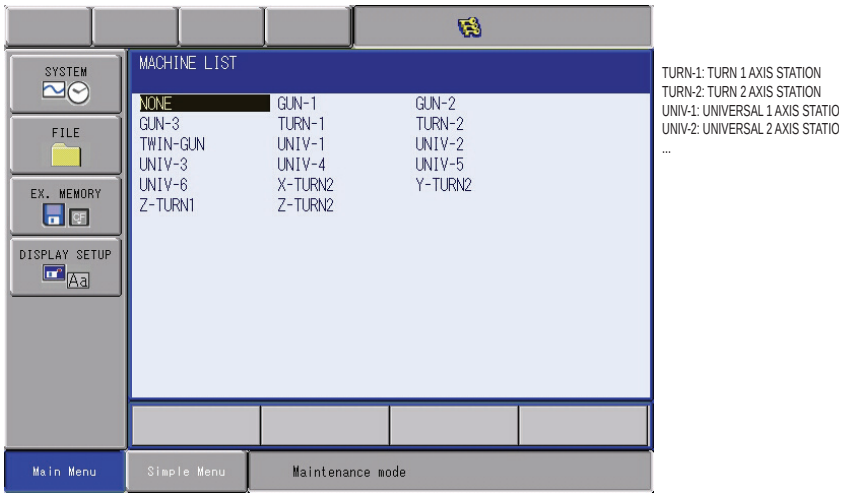
11.2.2.1 Selection of Station Axis Type

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.

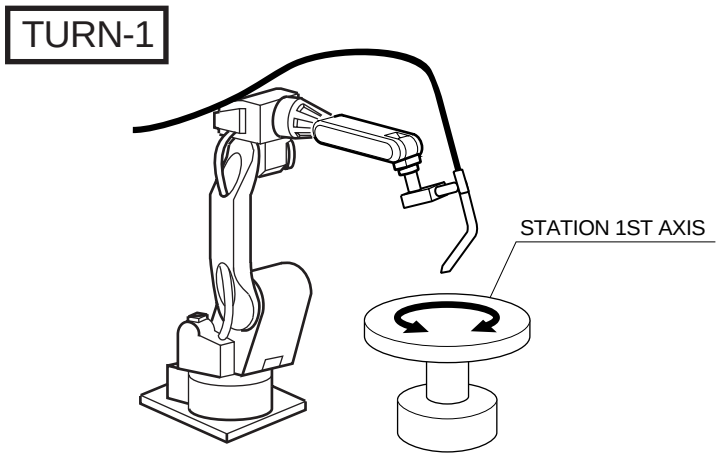


2. Select the type of control group to be modified.
   – The MACHINE LIST window appears.



3. Select desired type in the type list.
   – After the type selection, the window returns to CONTROL GROUP window.

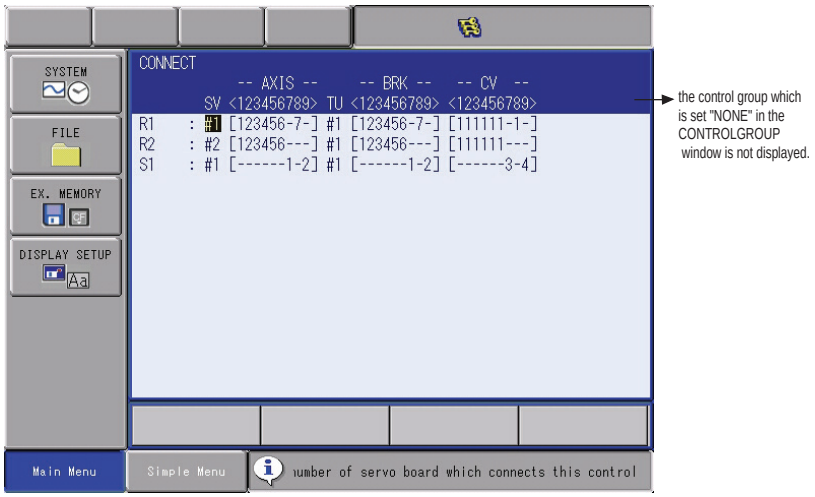
   – Select "UNIV" (universal) when using a mechanism other than the registered type (such as a servo track) as a station axis. When “UNIV” is selected, interpolation motion (linear, circular, etc.) is not supported.



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.

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	→	SERVO Board (SV #1),	Connector (7CN),
		Contactor Unit (TU #1),	Brake Connector (BRK7),
		Converter (CV #2)	
2nd axis	→	SERVO Board (SV #1),	Connector (8CN),
		Contactor Unit (TU #1),	Brake Connector (BRK8),
		Converter (CV #3)	

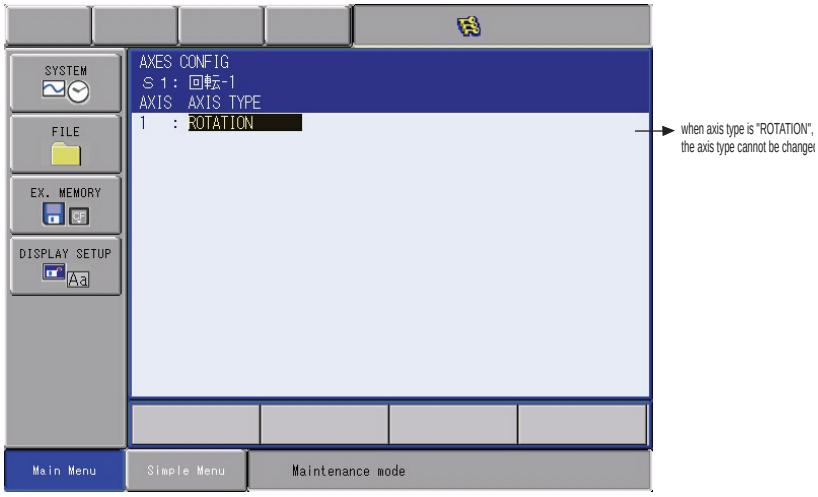
3. Select the desired item.
4. Press [ENTER] in the CONNECTION window.
   – The setting in the CONNECTION window is completed and the window moves to the AXES CONFIG window.

11.2.2.3 Axis Configuration Setting

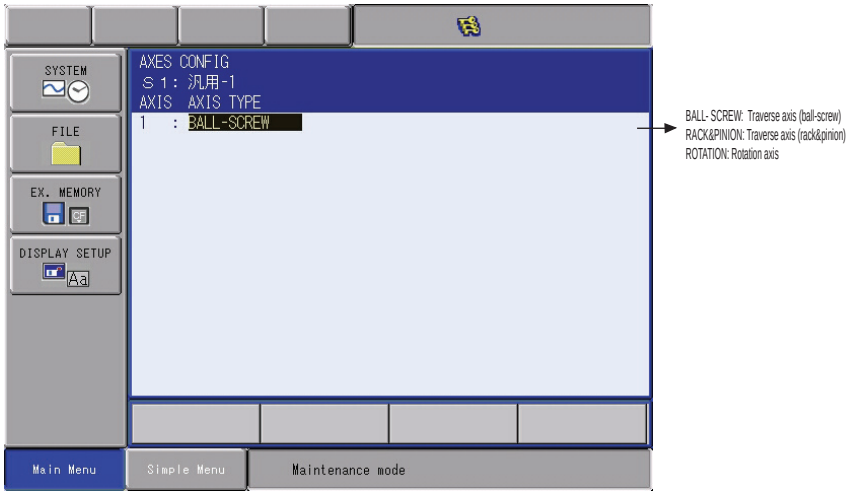
The axis type and motor type are specified in the AXES CONFIG window.

1. Confirm axis type of each axis in the AXES CONFIG window.
   – The axis type of each axis is displayed.

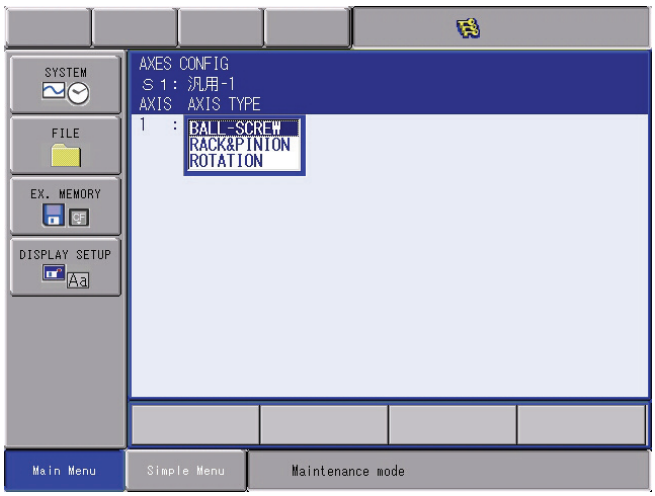
The AXES CONFIG window (in case of the TURN type)



The AXES CONFIG window (in case of the UNIVERSAL type)



2. Select the axis type to be modified.
   – The settable axis type is displayed.

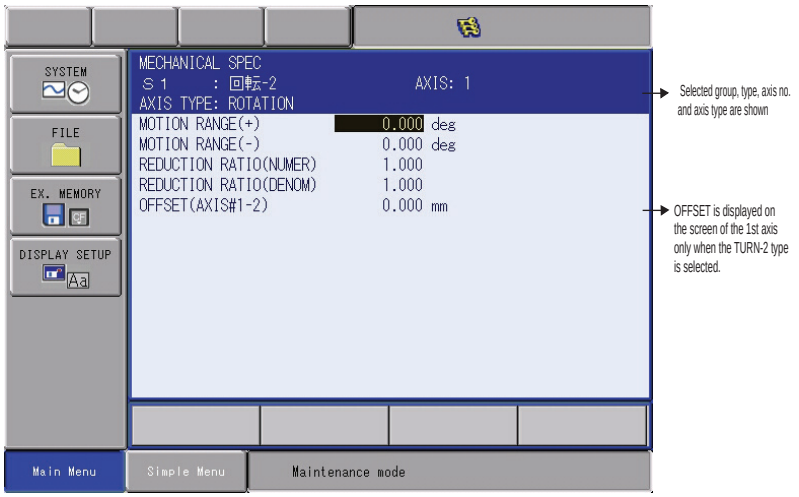


3. Select the desired axis type.
4. Press [ENTER] in the AXES CONFIG window
   – The setting in the AXES CONFIG window is completed and the window moves to the MECHANICAL SPEC window.

11.2.2.4 Mechanical Specification Setting

The mechanical data is specified in the MECHANICAL SPEC window.

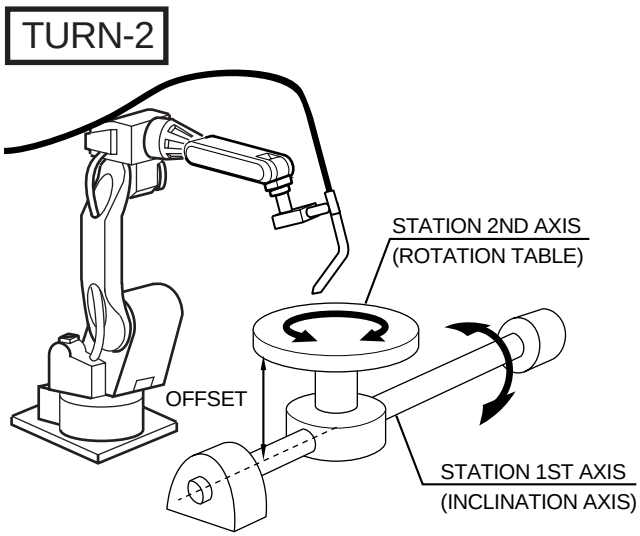
1. Confirm specification of each axis in the MECHANICAL SPEC window.
   – The mechanical specification of axis is shown.



– 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.

– 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)



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)

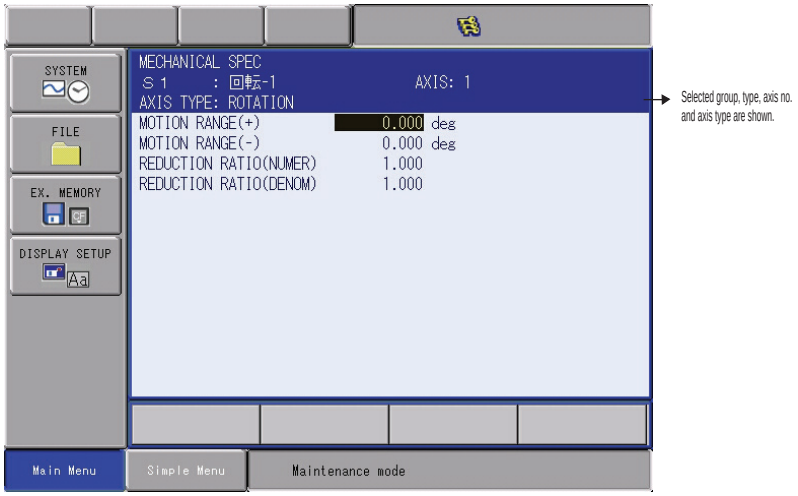


– MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

– 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)

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.
3. Press [ENTER] in the MECHANICAL SPEC window.

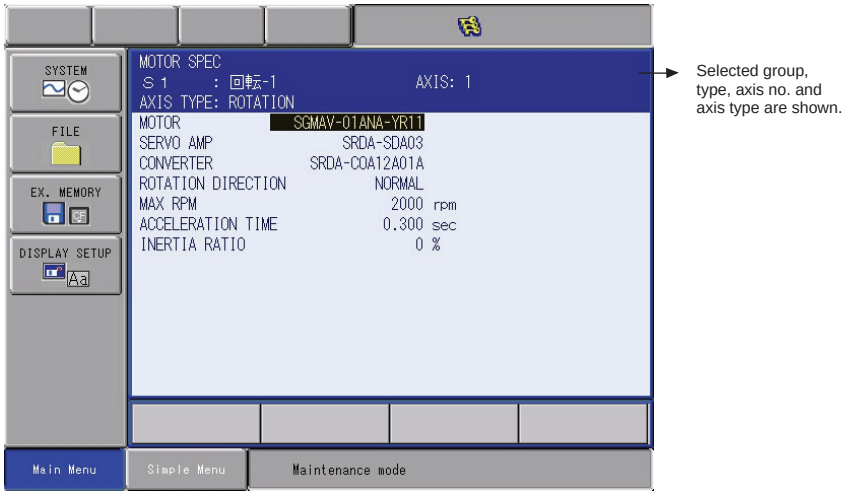
– After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner.When [ENTER] is pressed in the MECHANICAL SPEC window for the last axis, the setting in the MECHANICAL SPEC window is completed and the window moves to the MOTOR SPEC window.

11.2.2.5 Motor Specification Setting

The motor data is specified in the MOTOR SPEC window.

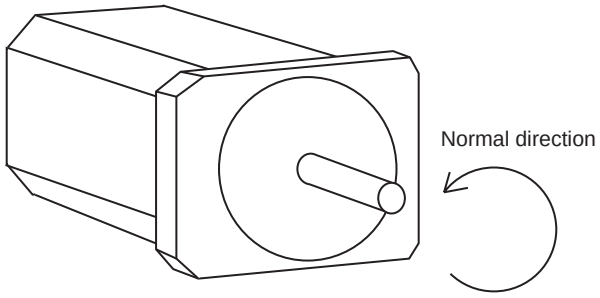
1. Confirm specification of each axis in the MOTOR SPEC window.

– 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



   - MAX. RPM: Input maximum rotation speed of a motor. (Unit: rpm)
   - ACCELARATION SPEED: 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

Make sure that there is no one within the P-point maximum envelope of the manipulator and that you are in a safe place before turning ON the DX100 power.

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

- 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 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.

The emergency stop buttons are located on the right of the front door of the DX100 and the programming pendant.

CAUTION

- Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in 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.

12.1 Specification List

Controller	**Construction**	Free-standing, enclosed type
	Dimensions	Refer to following
	Cooling System	Indirect cooling
	Ambient Temperature	0°C to + 45°C (During operation) -10°C to + 60°C (During transit and storage)
	Relative Humidity	10% to 90%RH (non-condensing)
	Power Supply	3-phase, 200/220 VAC (+10% to -15%) at 60Hz(±2%) 200 VAC(+10% to -15%) at 50Hz(±2%)
	Grounding	Grounding resistance: 100Ω or less Exclusive grounding
	Digital I/O	Specific signal (hardware) 23 inputs and 5 outputs General signals (standard, max.) 40 inputs and 40 outputs (Transistor: 32 outputs, Relay: 8 outputs)
	Positioning System	By serial communication (absolute encoder)
	Drive Unit	SERVOPACK for AC servomotors
	Acceleration/ Deceleration	Software servo control
	Memory Capacity	200000 steps, 10000 instructions

Small capacity A-Type (standard)	MA1400, MA1900, VA1400, MH5L, MH6, HP20D, HP20D-6, 425(W) × 1200(H) × 450(D) mm
Medium and Large capacity A-Type (standard)	MH50, MS80, ES165D, ES200D, VS50 425(W) × 1200(H) × 450(D) mm

12.2 Function List

Programming Pendant Operation	**Coordinate System**	Joint, Rectangular/Cylindrical, Tool, User Coordinates
	Modification of Teaching Points	Adding, Deleting, Correcting (Robot axes and external axes respectively can be corrected.)
	Inching Operation	Possible
	Path Confirmation	Forward/Reverse step, Continuous feeding
	Speed Adjustment	Fine adjustment possible during operating or pausing
	Timer Setting	Possible every 0.01 s
	Short-cut Function	Direct-open function, Multi-window
	Interface	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)
	Application	Arc welding, Spot welding, Handling, General, Others
Safety Feature	**Essential Measures**	JIS (Japanese Industrial Standard)
	Running Speed Limit	User definable
	Enable Switch	3 position type. Servo power can be turned on at the middle position only. (Located on programming pendant)
	Collision proof Frames	S-axis frame (doughnut-sector), Cubic frame (user coordinate)
	Self-Diagnosis	Classifies error and two types of alarms (major and minor) and displays the data
	User Alarm Display	Possible to display alarm messages for peripheral device
	Machine Lock	Test-run of peripheral devices without robot motion
	Door Interlock	A door can be opened only when a circuit breaker is OFF.
Maintenance Function	**Operation Time Display**	Control power-on time, Servo power-on time, Playback time, Operation time, Work time
	Alarm Display	Alarm message, troubleshooting, previous alarm records
	I/O Diagnosis	Simulated enabled/disabled output possible
	T.C.P. Calibration	Automatically calibrates parameters for end effectors using a master positioner

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

12.3 Programming Pendant

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 Breaker Power Supply Contact Unit

Fig. 12-1: Configuration for Small-Capacity A-Type (Standard)

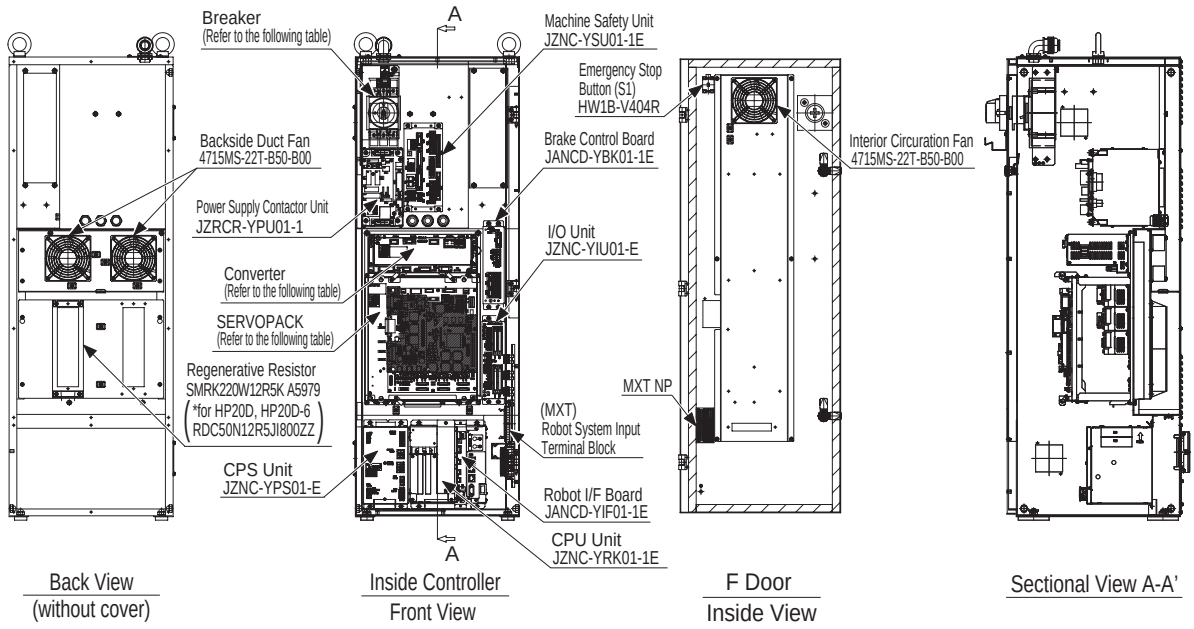


Table 12-1: Configuration for Small Capacity

Model Type	DX100	SERVOPACK (Converter integrated)	Breaker	Power Supply Contact Unit
MH5	ERDR-MH00005-A00	JZRCR-YSV01-11	NF32-SW 3P 15A	JZRCR-YPU01-1
MH5L				
MH6	ERDR-MH00006-A00	JZRCR-YSV02-11	NF32-SW 3P 15A	JZRCR-YPU01-1
MA1400	ERDR-MA01400-A00	JZRCR-YSV02-11	NF32-SW 3P 15A	JZRCR-YPU01-1
VA1400	ERDR-VA01400-A00	JZRCR-YSV02-31	NF32-SW 3P 15A	JZRCR-YPU01-1
MA1900	ERDR-MA01900-A00	JZRCR-YSV03-11	NF32-SW 3P 15A	JZRCR-YPU01-1
HP20D	ERDR-HP0020D-A00	JZRCR-YSV03-11	NF32-SW 3P 15A	JZRCR-YPU01-1
HP20D-6				

■ Medium and Large Capacity

Fig. 12-2: Configuration for Medium and Large Capacity A-Type (Standard)

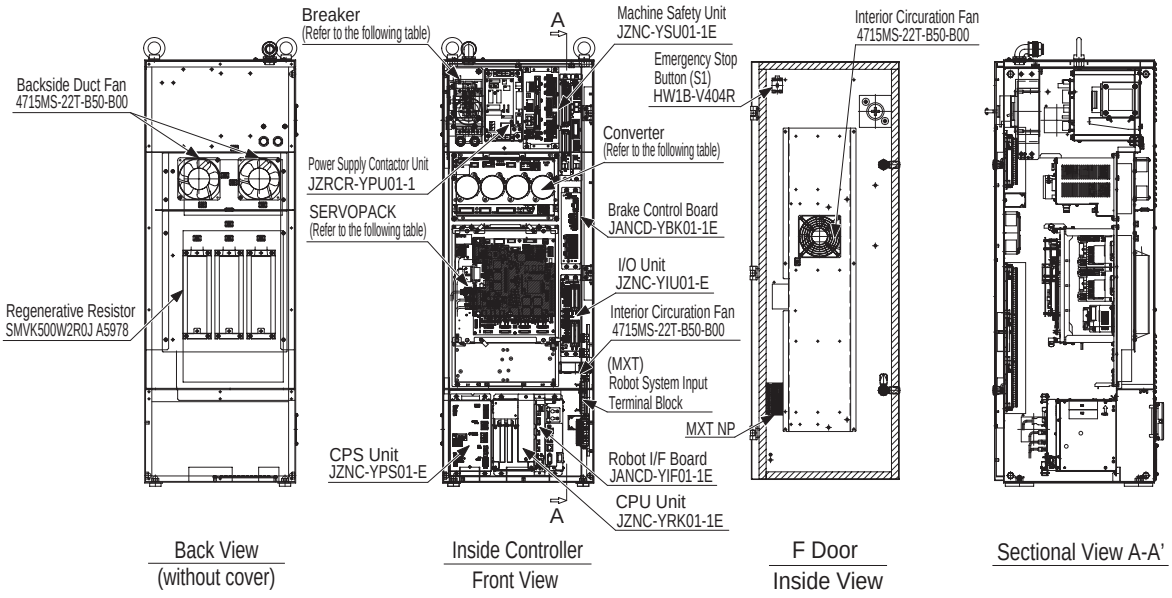


Table 12-2(a): Configuration for Medium Capacity

Model / Type	DX100	SERVOPACK	Converter	Breaker	Power Supply Contact Unit
MH50	ERDR-MH00050-A00	JZRCR-YSV04-11	SRDA-COA30A01A-E	NF32-SW 3P 30A	JZRCR-YPU01-1
MS80	ERDR-MS00080-A00	JZRCR-YSV05-11	SRDA-COA30A01A-E	NF32-SW 3P 30A	JZRCR-YPU01-1
VS50	ERDR-VS00050-A00	JZRCR-YSV05-41	SRDA-COA30A01A-E	NF32-SW 3P 30A	JZRCR-YPU01-1
SIA50D	ERDR-SIA050D-A00	JZRCR-YSV05-41	SRDA-COA30A01A-E	NF32-SW 3P 30A	JZRCR-YPU01-1

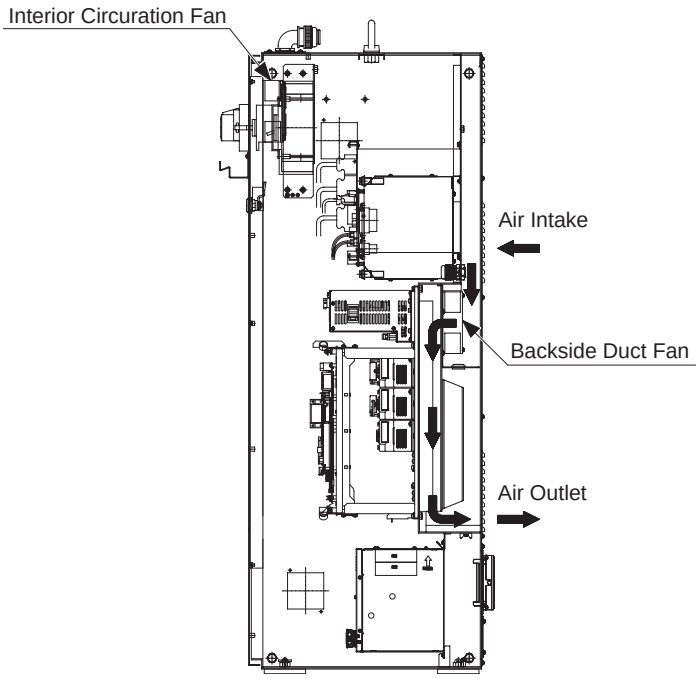
Table 12-3(a): Configuration for Large Capacity

Model / Type	DX100	SERVOPACK	Converter	Breaker	Power Supply Contact Unit
ES165D	ERDR-ES0165D-A00	JZRCR-YSV06-11	SRDA-COA30A01A-E	NF32-SW 3P 30A	JZRCR-YPU01-1
ES200D	ERDR-ES0200D-A00	JZRCR-YSV06-11	SRDA-COA30A01A-E	NF32-SW 3P 30A	JZRCR-YPU01-1

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

- 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 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. The emergency stop buttons are located on the right of the front door of DX100 and the programming pendant.

- 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.

- 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.

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 insulation and sheathing of external wires.

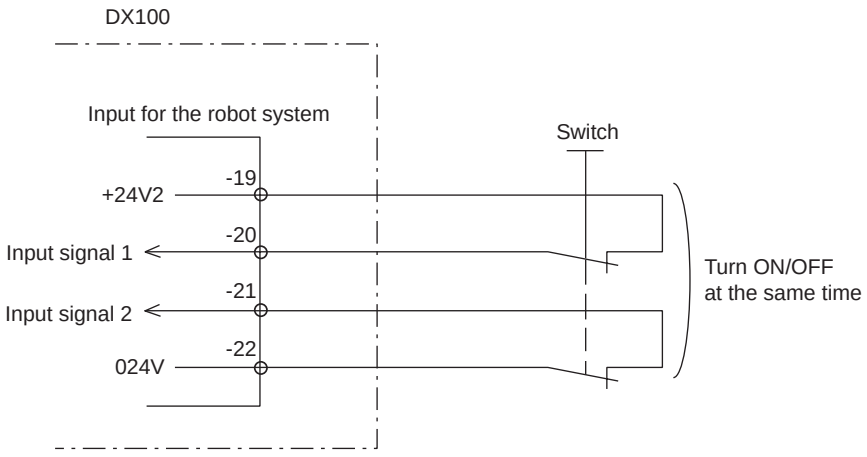
- Always return the programming pendant to its specified position after use.

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.

■ Cautions for Connection of Dual Input Signals

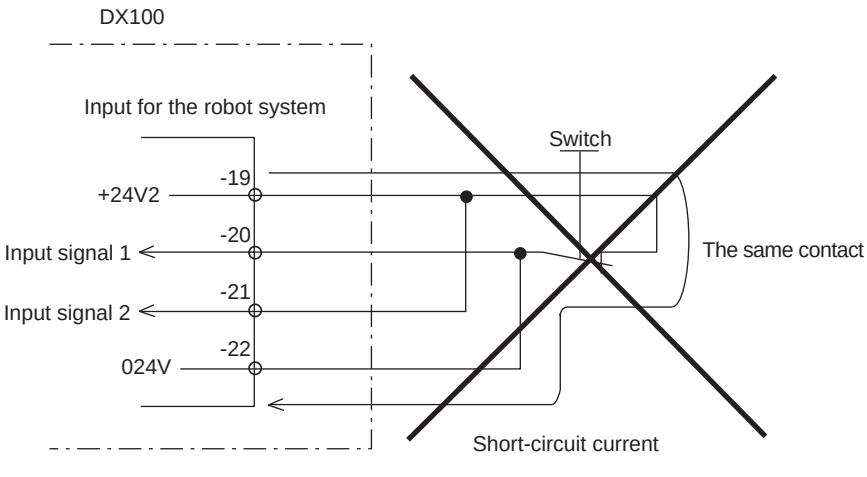
CAUTION

- 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.



CAUTION

- Do not connect two signals to the same contact point.
  (Prepare two indivisual 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.



13.1 Power Supply Contactor Unit

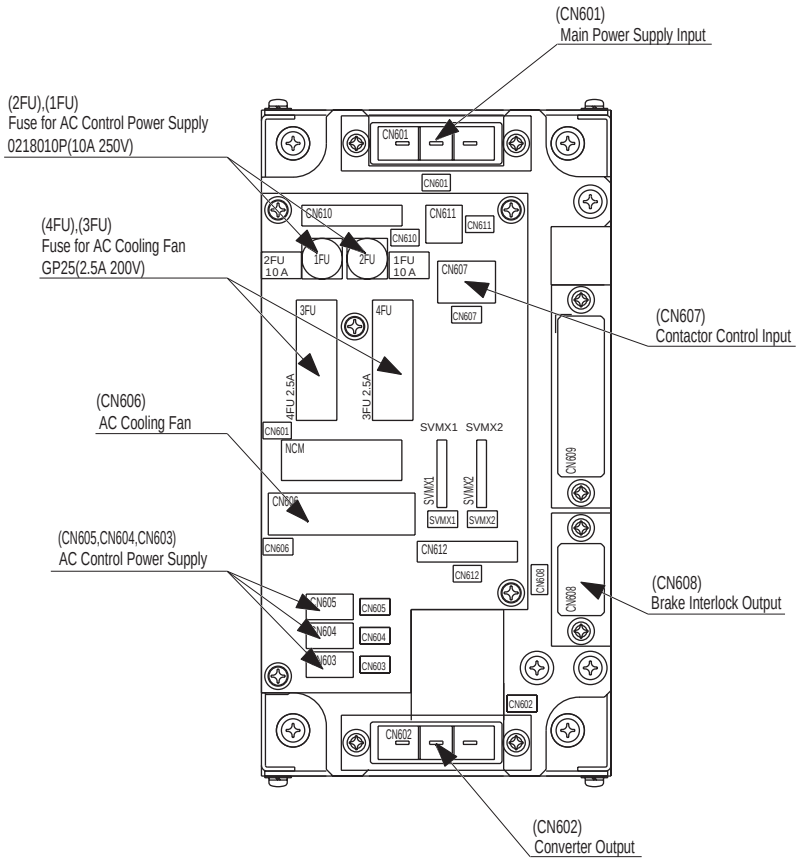
The power supply contactor unit consists of the power supply contactor sequence circuit board (JARCR-YPC01-1) and the contactor (1KM, 2KM) for servo power and the line filter (1Z). It turns the contactor servo power ON and OFF using the signal for servo power control from the power supply contactor sequence 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

Model	Robot Type
JZRCR-YPU01-□	MH5, MH5L, MH6, MA1400, VA1400, MA1900, HP20D, HP20D-6, MH50, MS80, VS50, ES165D, ES200D, SIA50D

Fig. 13-1: Power Supply Unit Configuration (JZRCR-YPU01-□)



13.2 Major Axes Control Circuit Board (SRDA-EAXA01□)

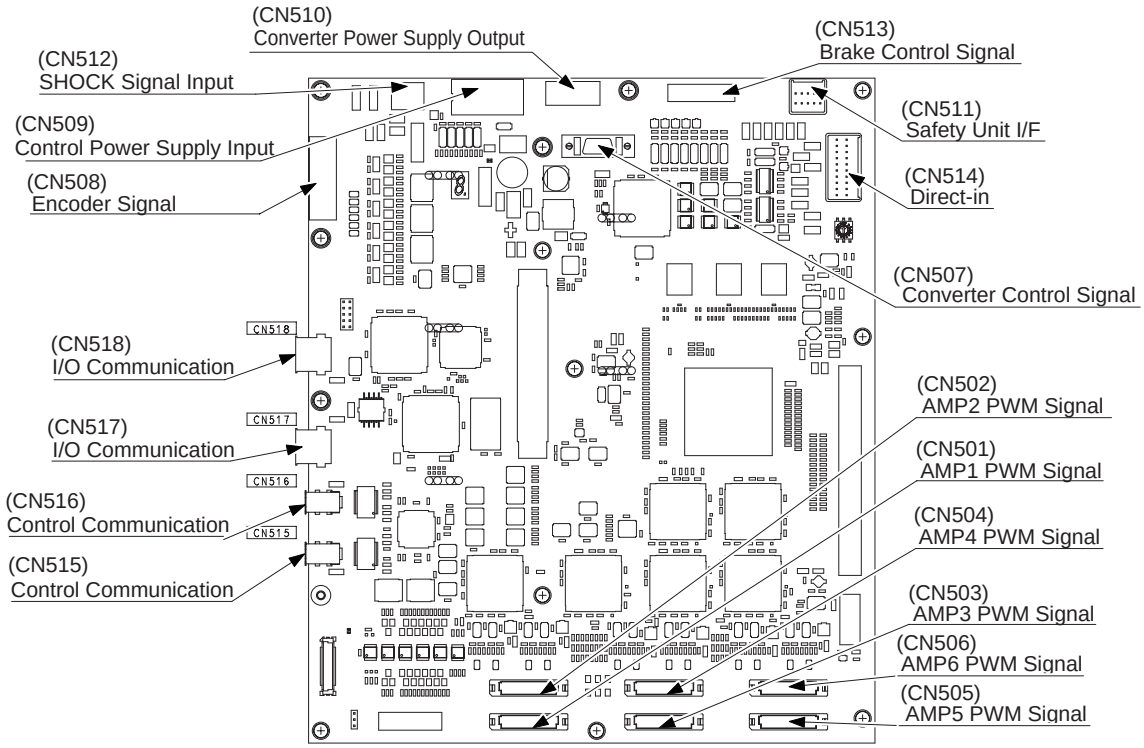
13.2.1 Major Axes Control Circuit Board (SRDA-EAXA01□)

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□)



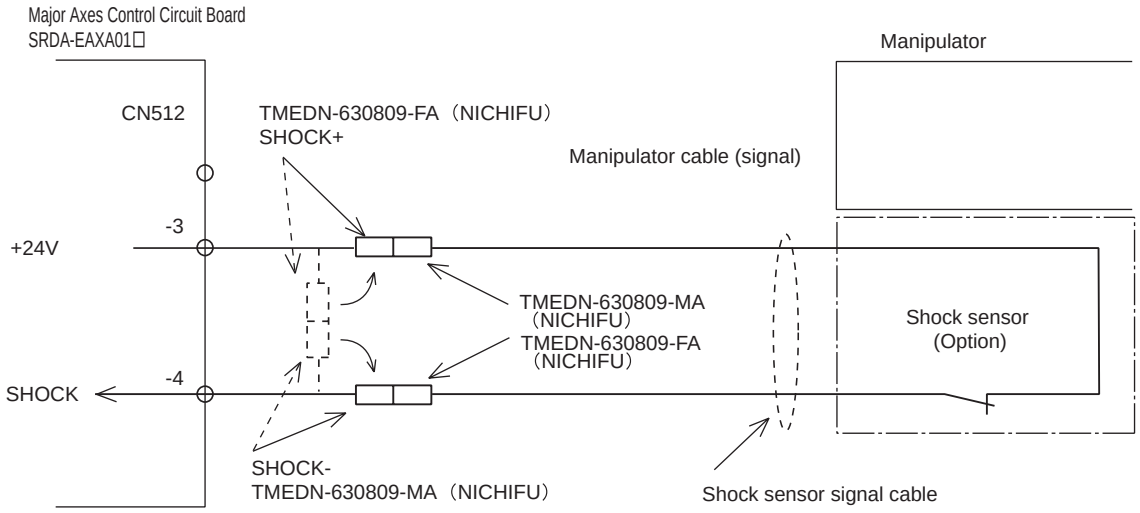
13.2.2 Connection for Tool Shock Sensor (SHOCK)

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.

Pin Terminal Name	Pin Terminal Model	Signal Line Terminal Model
SHOCK-	TMEDN-630809-MA	TMEDN-630809-FA (manufactured by NICHIFU Co., Ltd.)
SHOCK+	TMEDN-630809-FA	TMEDN-630809-MA (manufactured by NICHIFU Co., Ltd.)

Fig. 13-3: Direct Connection to Tool Shock Sensor Signal Line



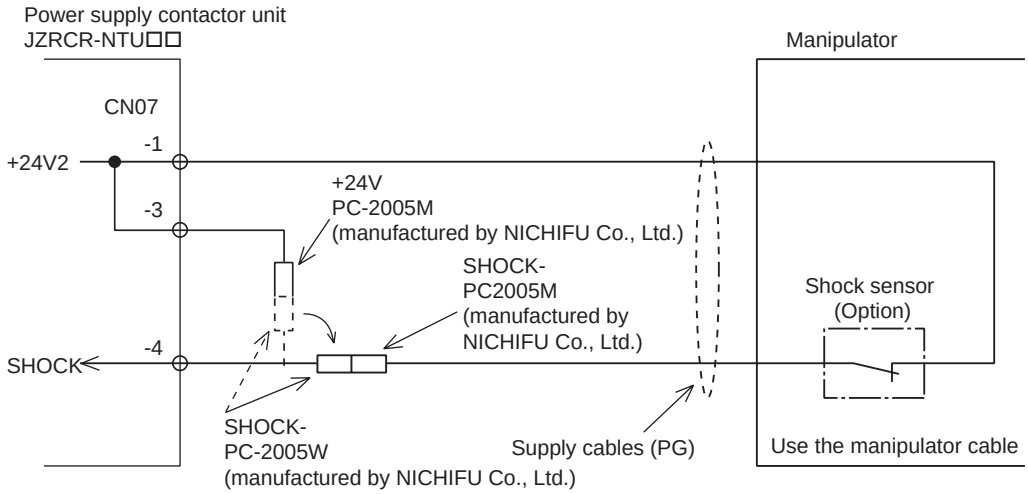
13.2.2.2 To connect the tool shock sensor with the cable that is built into the manipulator

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



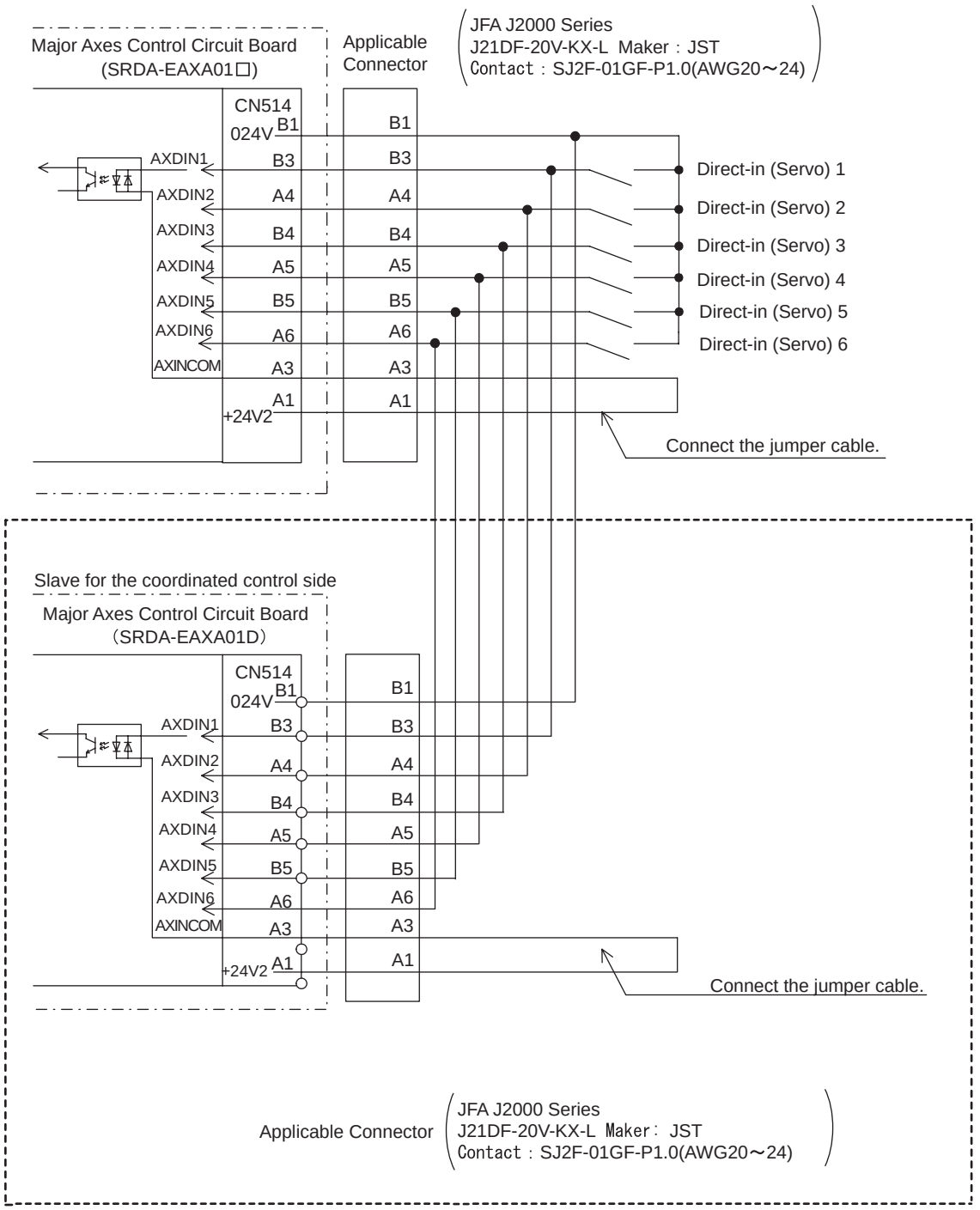
SUPPLE-MENT

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 programing pendant. Refer to explanations in *chapter 8 "System Setup" at 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



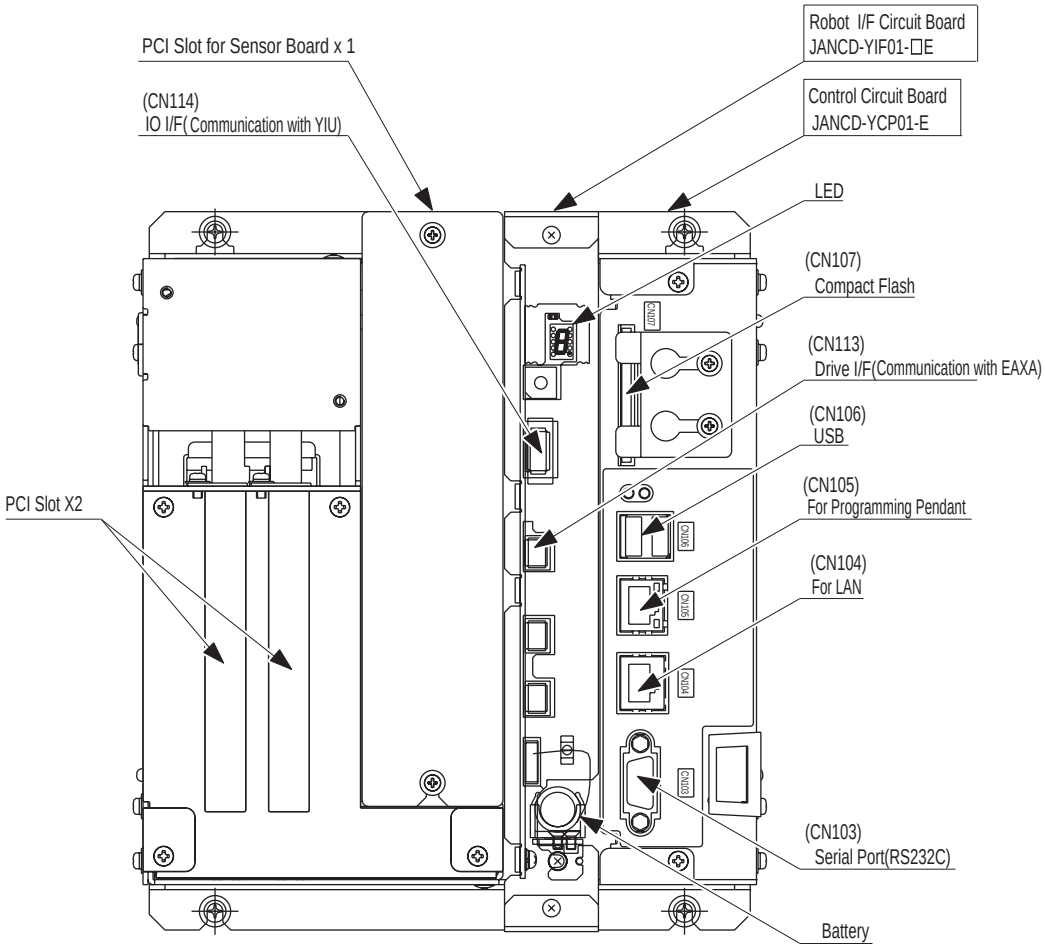
The part of wiring is for the slave for the coordinated control side major axes control circuit board, SRDA-EAXA01□

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-E 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).

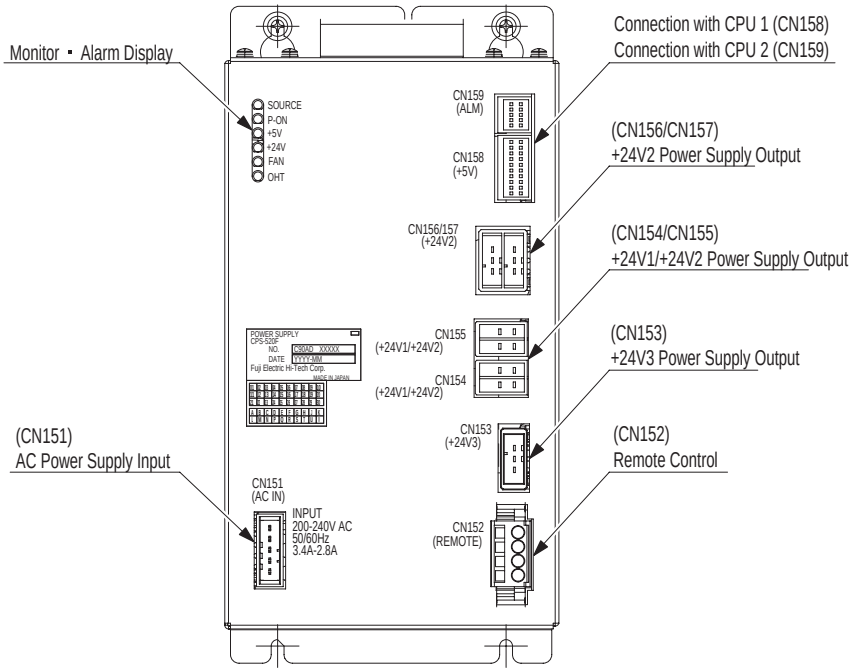
13.3.2.2 Robot I/F Board (JANCD-YIF01-1E)

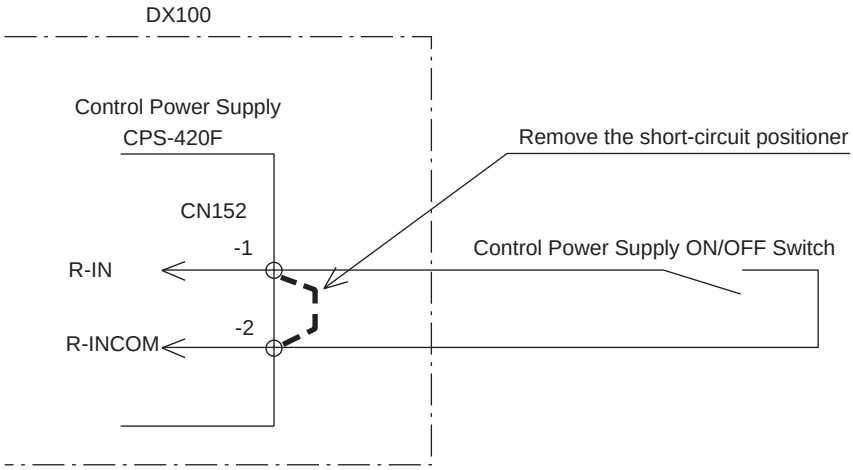
The robot I/F board controls the entire robotic system. It is connected to the control circuit board (JANCD-YCP01-E) with a PCI bus interface on the backboard, and to the major axes control circuit board (SRDA-EAXA01A-□) with high-speed serial transmissions.

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



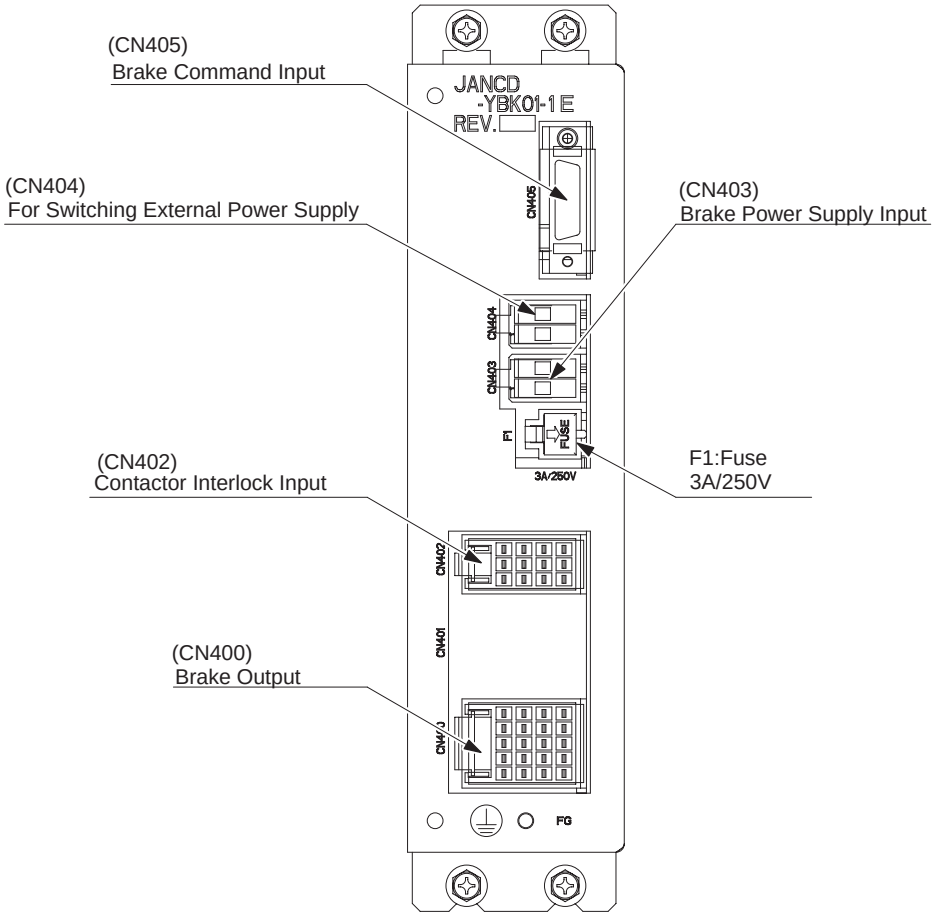
<table>
<tr><th>Items</th><th>Specifications</th></tr>
<tr><td>Input</td><td>Rating Input Voltage: 200/220VAC
Voltage Fluctuation Range: +10% to -15% (170 to 242VAC)
Frequency: 50/60Hz ± 2Hz (48 to 62Hz)</td></tr>
<tr><td>Output Voltage</td><td>DC + 5V
DC +24V (24V1: System, 24V2: I/O, 24V3: Brake)</td></tr>
<tr><td>Indicator</td><td>
<table>
<tr><th>DISPLAY</th><th>Color</th><th>Status</th></tr>
<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>
</table>
</td></tr>
<tr><td>Control Power ON/OFF</td><td>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 control power supply can be turned ON/OFF by an external device, etc. after the non-fuse breaker of the controller is turned ON. It is operated by the external switch connected with CN152 of the CPS unit as shown in the following figure. (CN152-1 and CN152-2 is shortaged when shipment)
Fig. 13-8: Connection to Control Power Supply Unit


See chapter 13.8 “WAGO Connector” at page 13-21 for wiring of CN152 connector.</td></tr>
</table>

13.5 Brake Control Board (JANCD-YBK01-□E)

13.5.1 Brake Control Board (JANCD-YBK01-□E)

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□).



13.6 Robot I/O Unit (JZNC-YIU01-E)

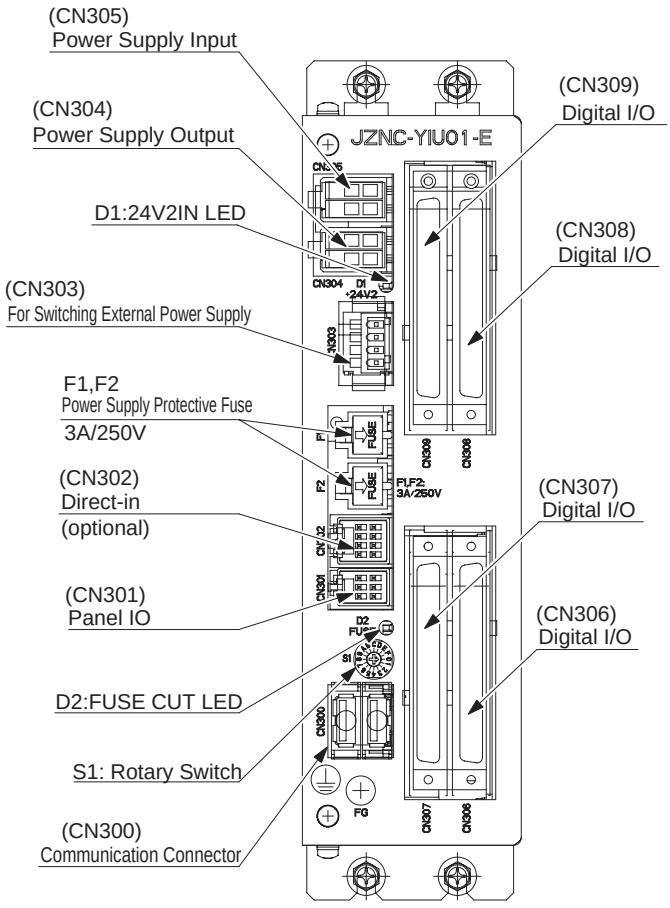
13.6.1 Robot I/O Unit (JZNC-YIU01-E)

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.

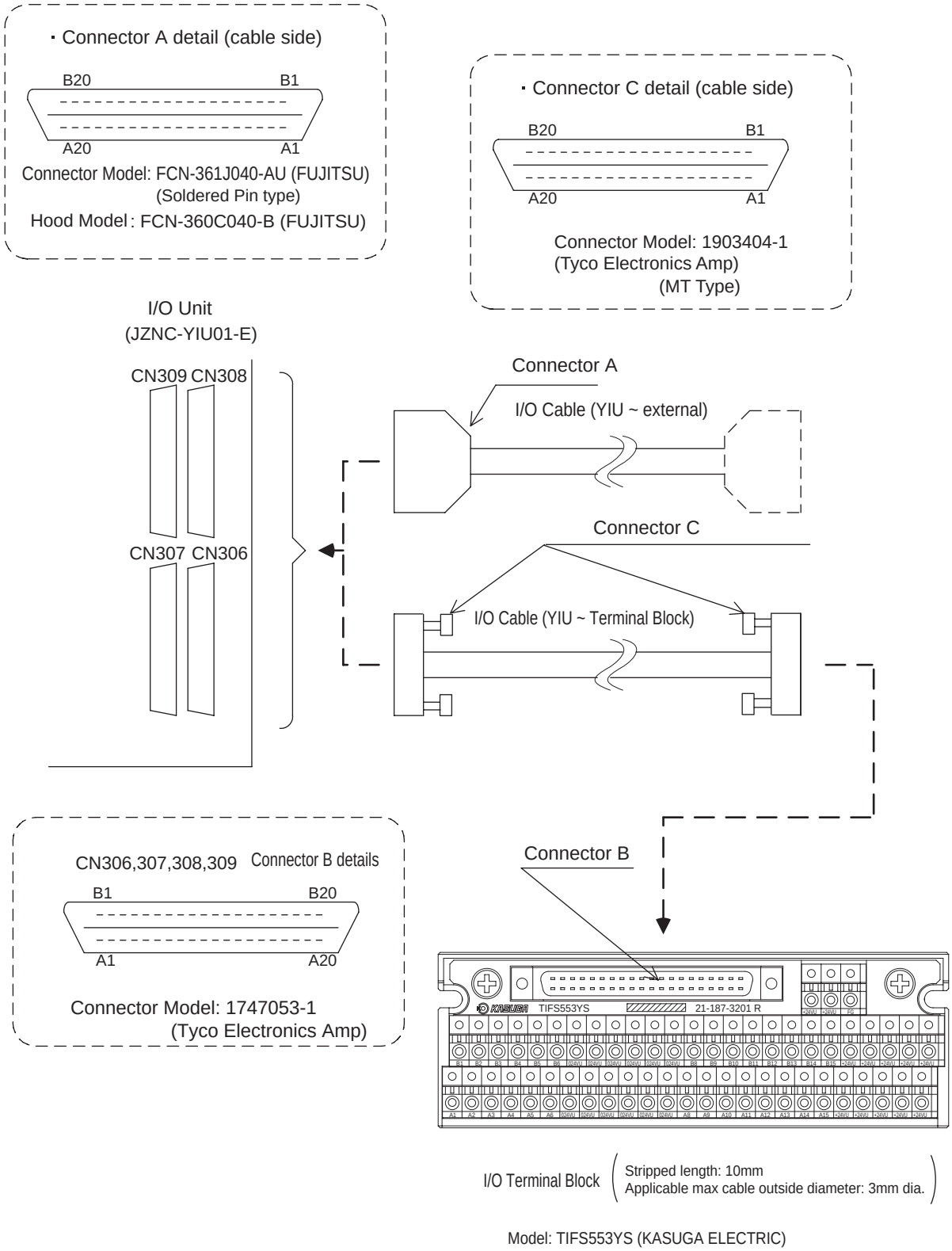
Refer to *chapter 13.12 "Universal I/O Signal Assignment" at page 13-40* for more details on signal allocation.

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)" at page 13-14* and *"Specific I/O Signal Related to Start and Stop" at page 13-15*

Fig. 13-9: I/O Unit (JZNC-YIU01-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-YIU01-E). Unshielded twisted pair cable must be used.(The cable side connector and the I/O terminal block are the options)

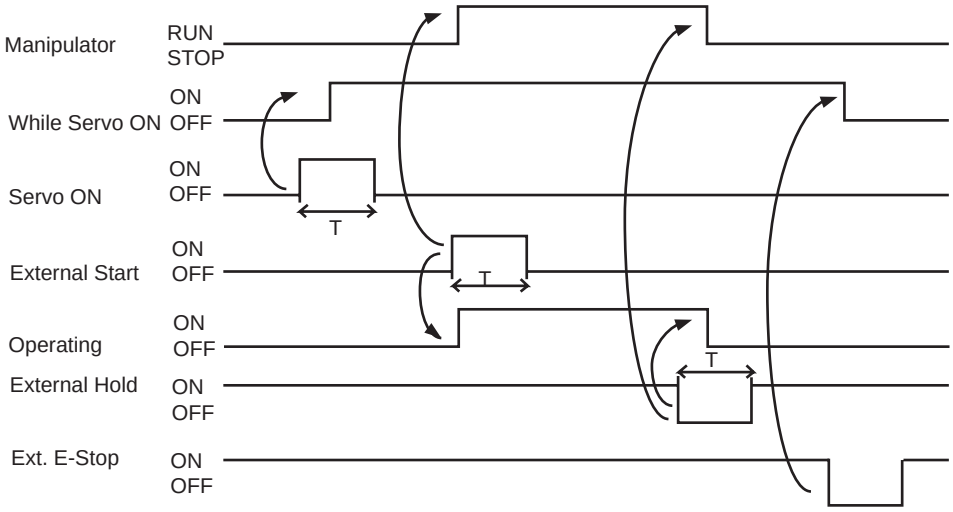


■ **Specific I/O Signal Related to Start and Stop**

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

- Servo ON (depending on application: JZNC-YIU01-E)
- External Servo ON (common to all application: Specific input terminal block MXT)
- External Start (depending on application: JZNC-YIU01-E)
- Operating (depending on application: JZNC-YIU01-E)
- External Hold (common to all application: Specific input terminal block MXT)
- External Emergency Stop (common to all application: Specific input terminal block MXT)

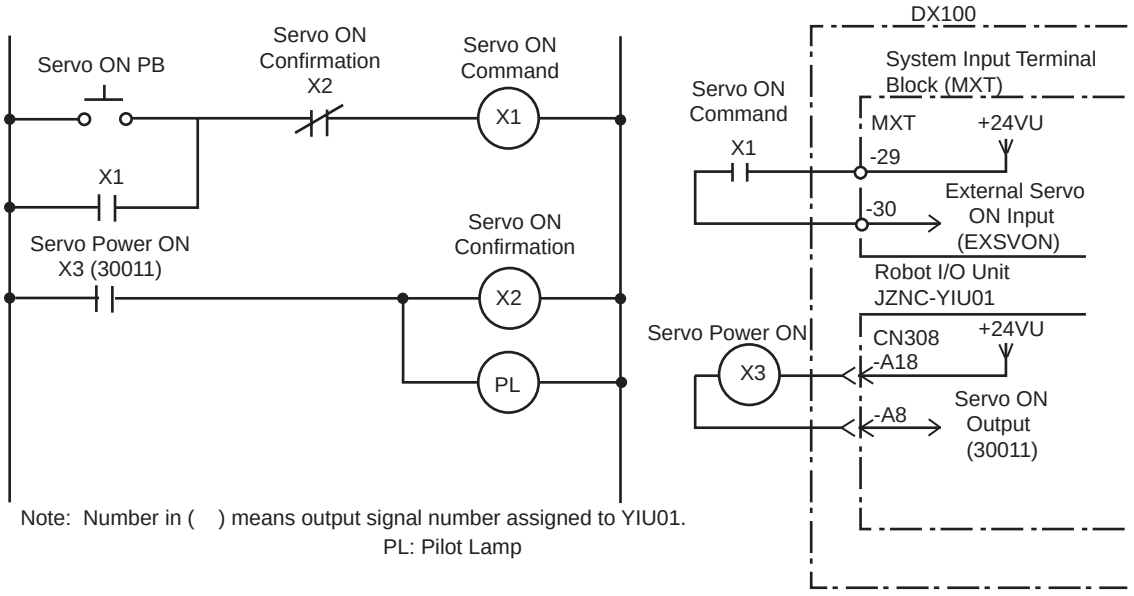
<Timing Chart>



Note: Set T=100msec or more

■ **Example of Servo ON Sequence Circuit from External Device**

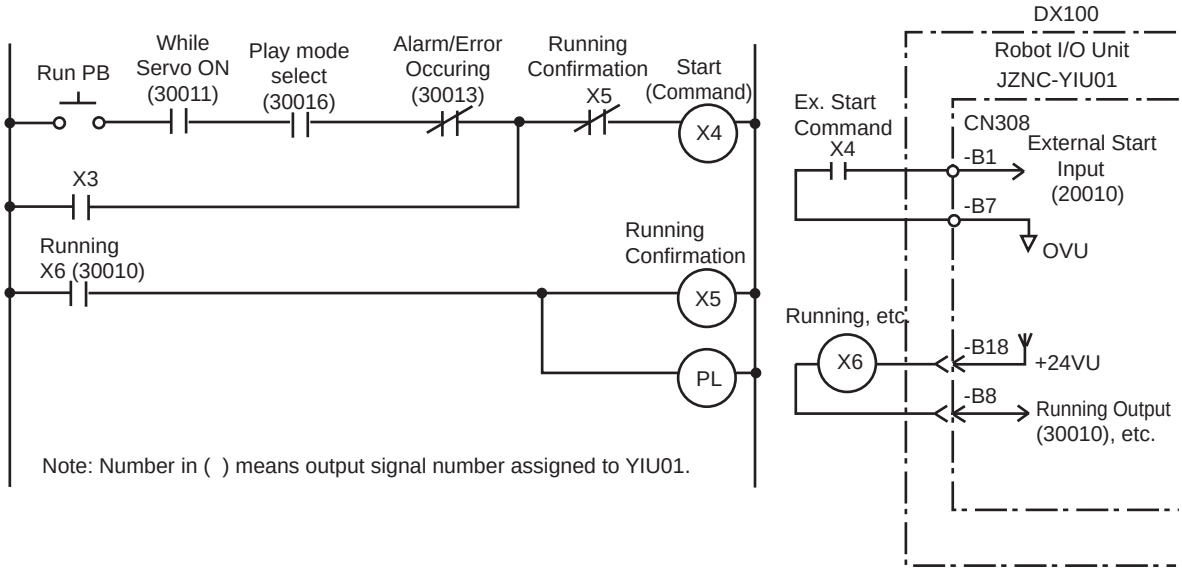
Only the rising edge of the servo ON signal is valid. This signal turns ON the manipulator servo power supply. The set and reset timings are shown in the following.



Note: Number in ( ) means output signal number assigned to YIU01.
PL: Pilot Lamp

■ **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.



Note: Number in ( ) means output signal number assigned to YIU01.

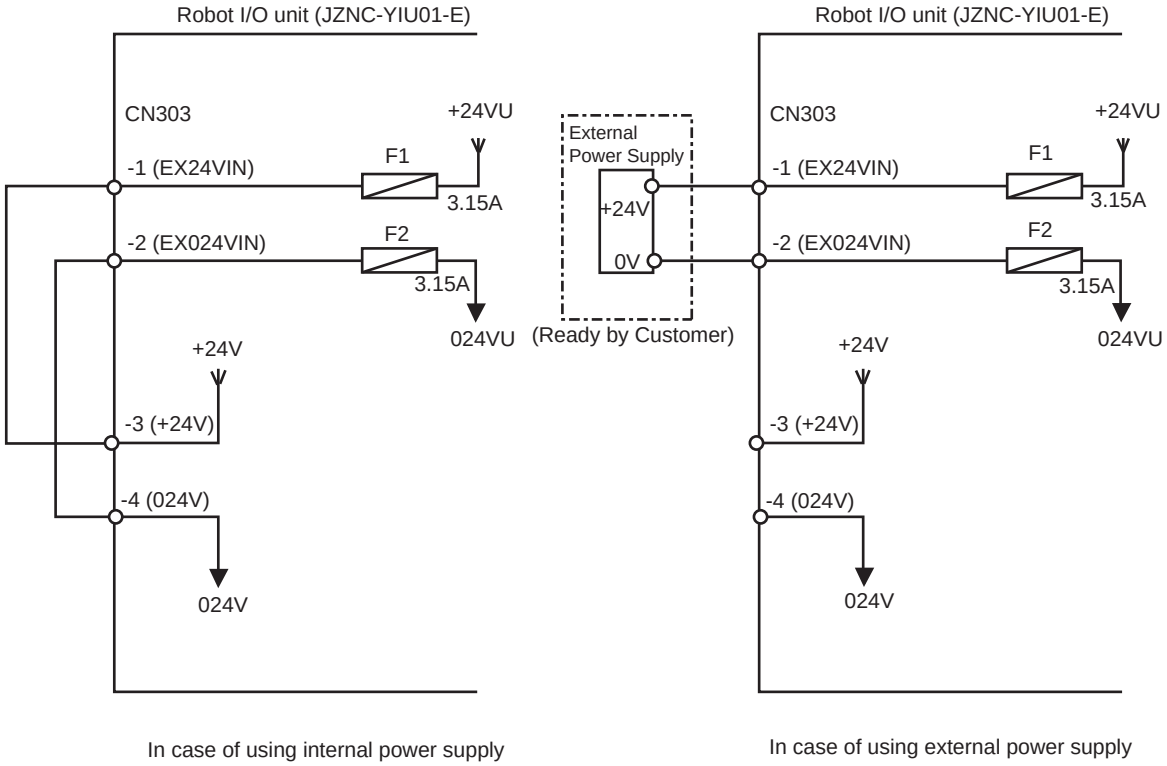
■ Connection of External Power Supply for I/O

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 *chapter 13.8 "WAGO Connector" at page 13-21*.

Fig. 13-10: Connection of External Power Supply for I/O



In case of using internal power supply

In case of using external power supply

NOTE

- The internal power supply of 24V of about 1.5A of DX100 can be used for I/O.
  Use external 24V 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 +24VU and 0VU terminals. The unit may malfunction if the external power supply is also connected.

13.7 Machine Safety Unit (JZNC-YSU01-1E)

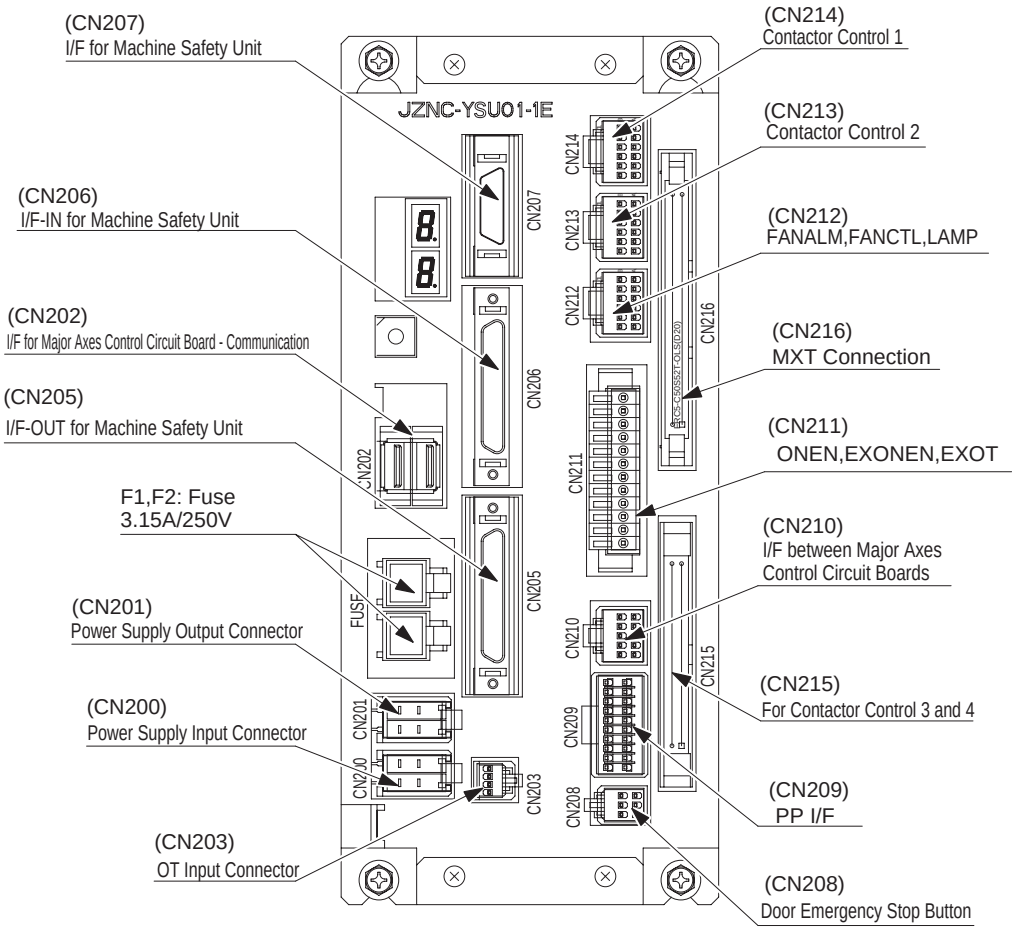
13.7.1 Machine Safety Unit (JZNC-YSU01-1E)

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)

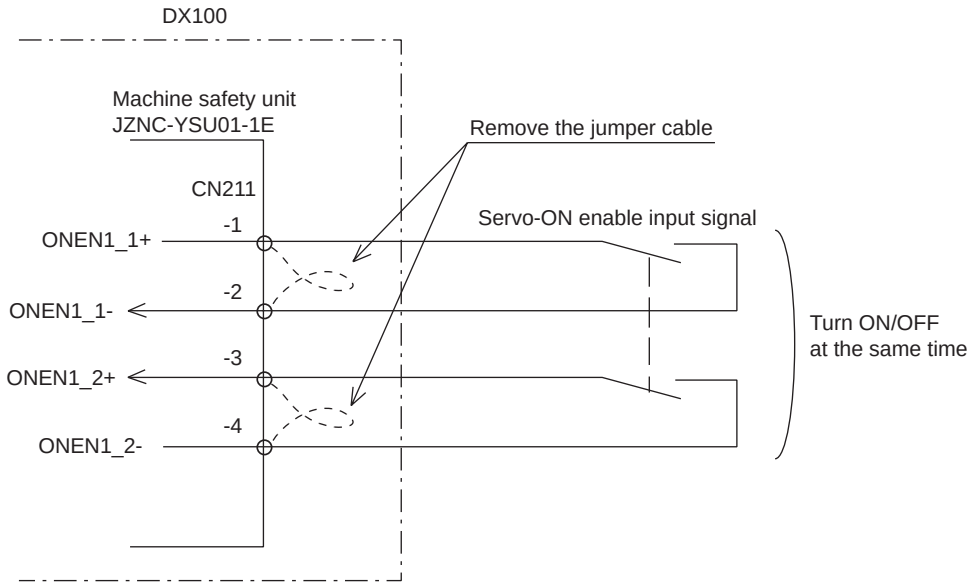
Connect the ONEN signal lines to enable the function to turn ON or OFF the servo power supply of an individual servo when a robotic system is divided into areas. Because these signals are not used for units of standard specifications, a jumper cable is connected as shown in the following figure.

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 *chapter 13.8 “WAGO Connector” at page 13-21*

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.

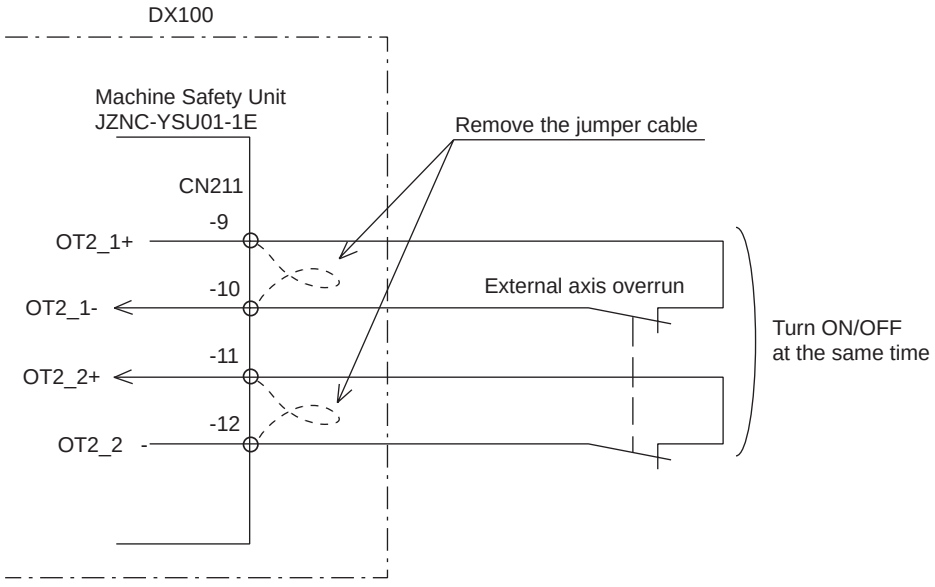
For the connection of CN211 Connector, refer to *chapter 13.8 "WAGO Connector" at page 13-21*

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-YPS01-E), and CN303 on the robot I/O unit (JZNC-YIU01-E) are equipped with a connector made by WAGO.

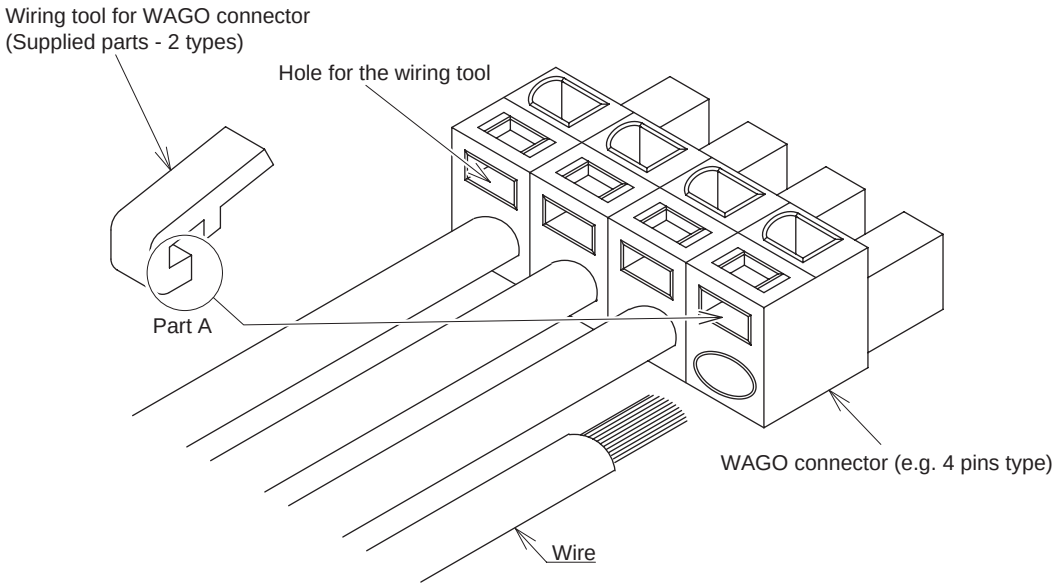
The “wiring tool for the WAGO connector” is necessary to wire the WAGO connector.

The tools (total 3, 2 types) are supplied with the DX100.

Use them with the appropriate sizes of connectors.

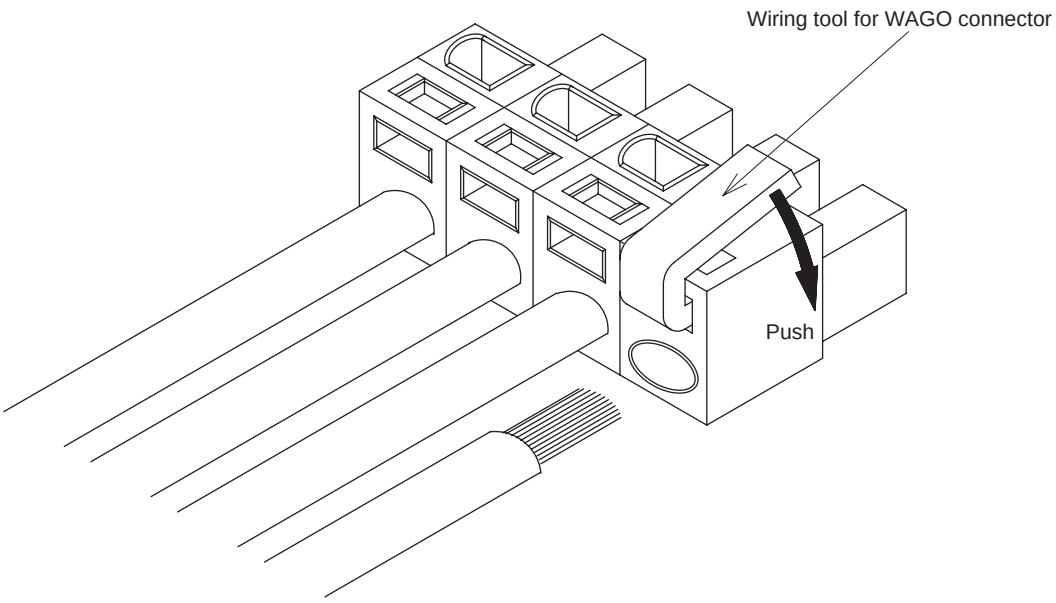
The wiring procedure is described as follows:

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



Connector to be applied		Specification	
CPS unit:	(JZNC-YPS01-E) CN152	Max cable outside diameter: Stripped lentgh:	4.1mm dia. 8-9mm
Machine safety unit: Robot I/O unit:	(JZNC-YSU01-1E) CN211 (JZNC-YIU02-E) CN303	Max cable outside diameter: Stripped lentgh:	3.4mm dia. 7mm

2. Insert or pull out the wire while pushing the wiring tool downward (Direction of the arrow).



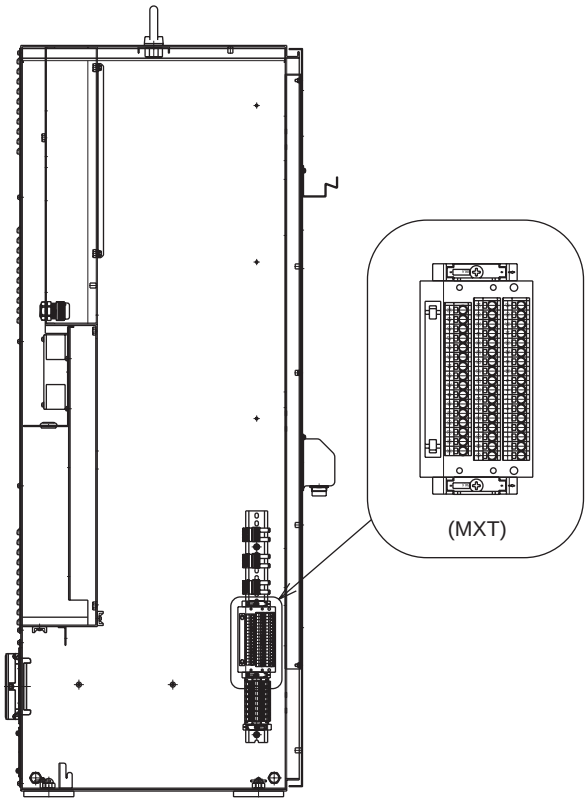
3. Remove the wiring tool from the connector. (Complete)
   Keep this wiring tool for the future use.

13.9 Robot Specific Input Terminal Block (MXT)

The robot specific input termial block (MXT) is equipped at lower part of the right side of DX100 as shown below. The input termilnal block (MXT) is used for the input of robot system signals.

For connections, refer to connection diagrams for each corresponding items.

Fig. 13-13: Robot Specific Input Terminal Block (MXT)



DX100 Inside Right Side

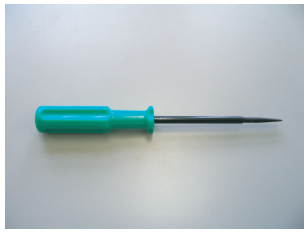
■ **Wiring Procedure of the MXT Connector**

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

1. Tool: Screwdriver

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

   * WAGO standard screwdriver
   WAGO 210-119
   WAGO 210-119SB (Short, delivered with the product)

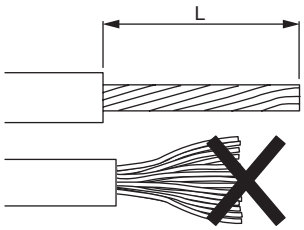


2. Applicable Wires

   (1) The length of the exposed conductor (L) should be as follows:

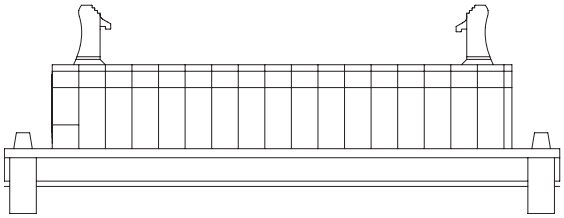
   – * The length of the exposed conductor set for the terminal block (L)
   WAGO series 250 (with 5.0 mm pitch): 9-10 mm

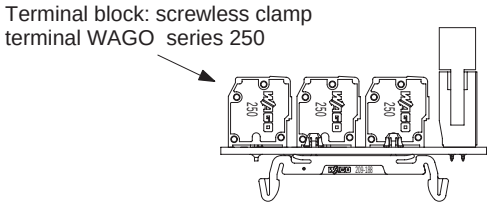
   – * Applicable max cable outside diameter: 3.1 mm dia.



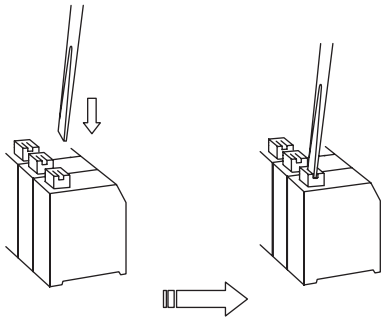
   (2) In case that the conductor is bent or feazed, make it straight as illustrated in the figure above.

3. Wire Connection

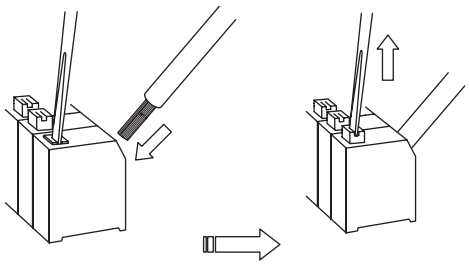




(1) Place the screwdriver on the lever upright as shown in the figure below and push straight down.



(2) Insert the wire into the connection hole slowly until its leading end touches the end of the hole.
For thin wires, never insert the wire with force, or the wire jacket may get caught in.



(3) Pull out the screwdriver to clamp the conductor with a spring.

(4) Check if the wire is connected firmly by pulling the wire softly.

■ **External Emergency Stop**

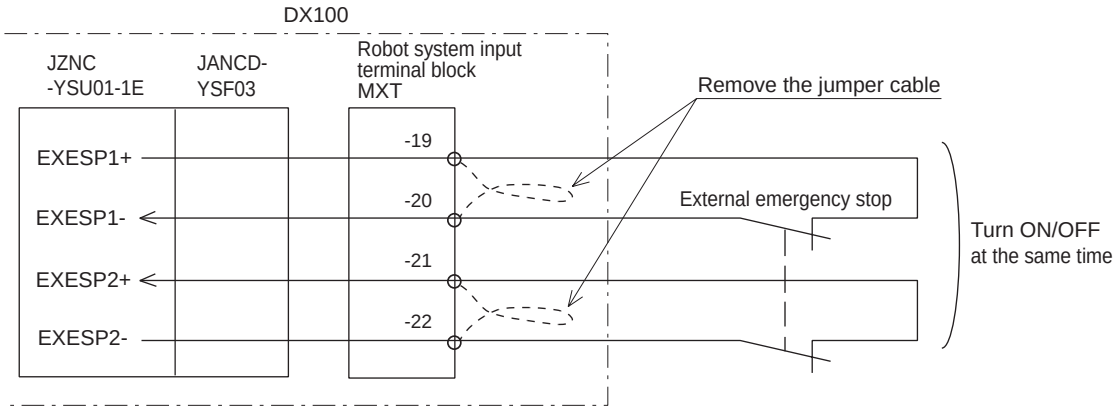
This signal is used to connect the emergency stop switch of an external device. If the signal is input, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON.

CAUTION

- Always connect the signals after removing jumper cable.

If the cables 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



■ **Safety Plug**

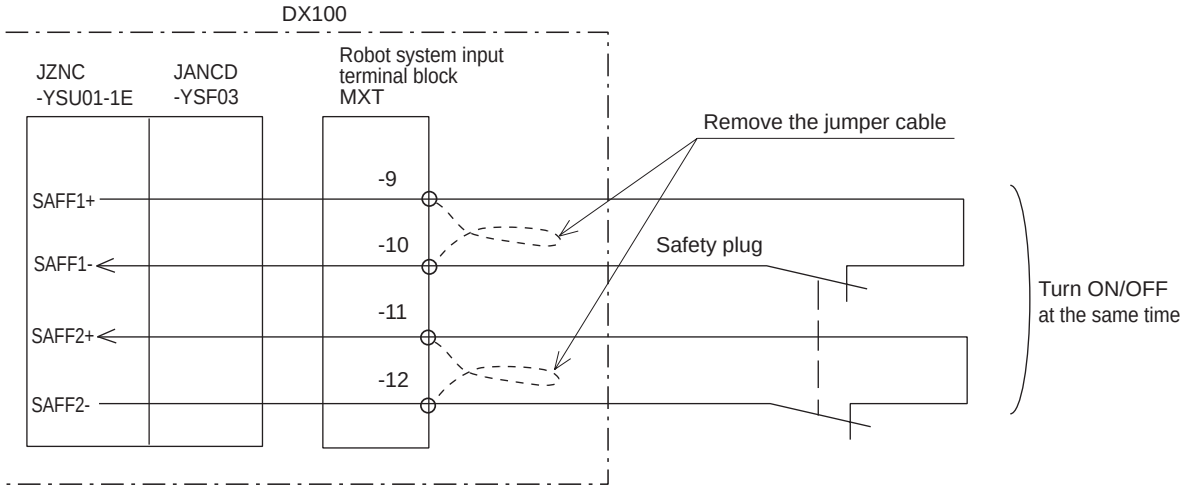
This signal is used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is input, the servo power turns OFF. While the signal is turned ON. The servo power cannot be turned ON. Note that these signals are disabled in teach mode.

CAUTION

- Always connect the signals after removing jumper cable.

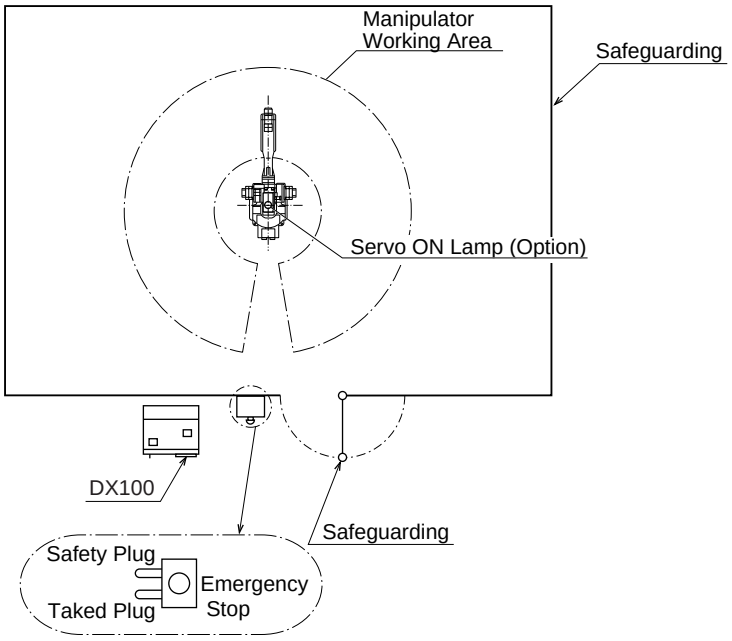
If the cables are not removed, injury or damage to machinery may result and the external emergency stop will not work even if the signal is input.

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.



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.

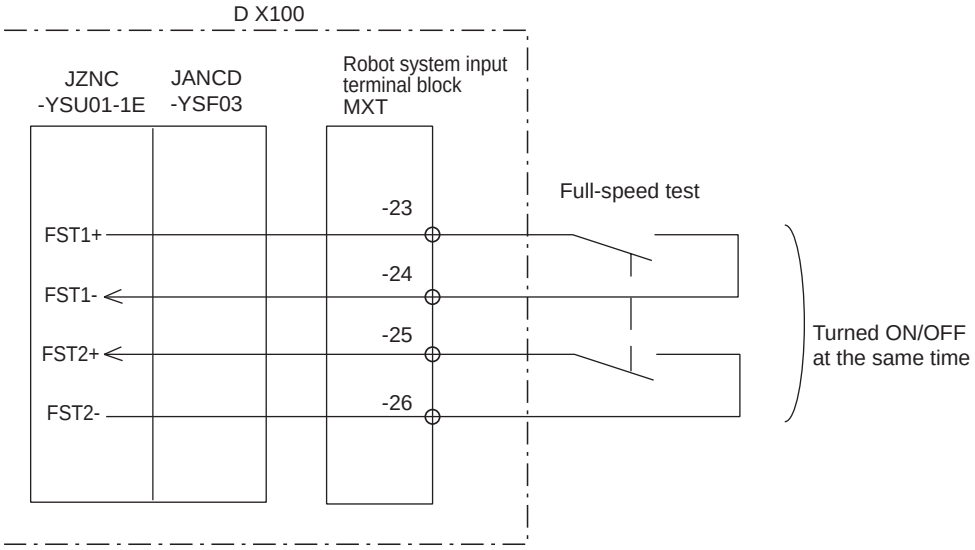
■ **Full-speed Test**

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. 13-16: Connection for Full-speed Test



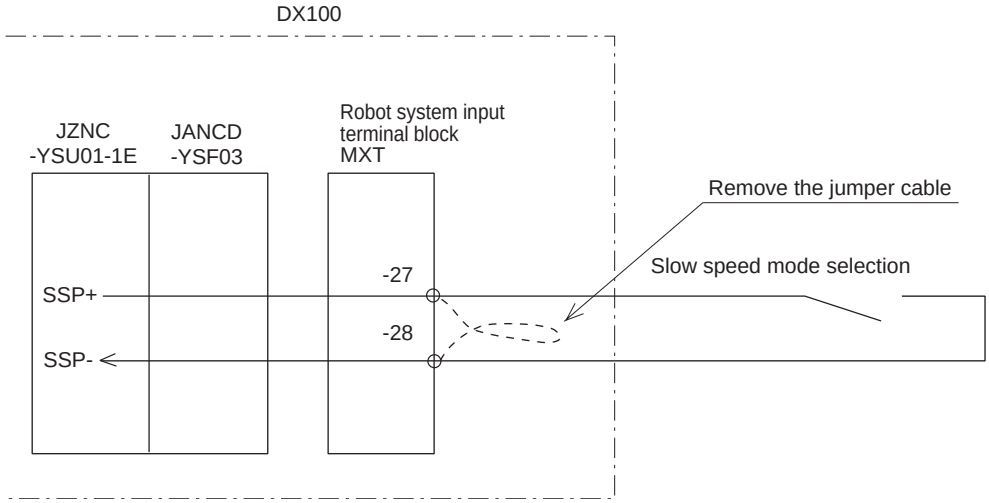
■ **Slow Speed Mode Selection**

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%)

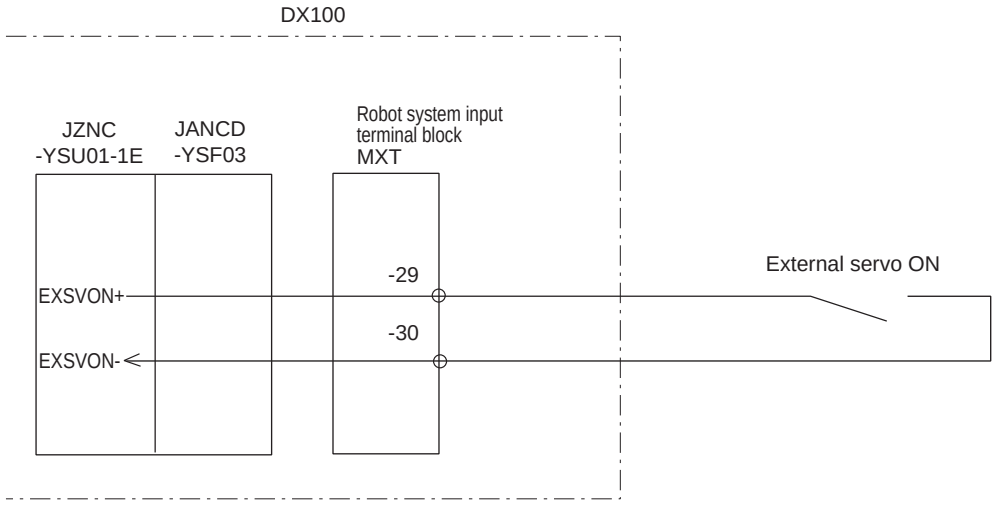
Fig. 13-17: Connection for Slow Speed Mode Selection



■ **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. 13-18: Connection for External Servo ON



■ **External Hold**

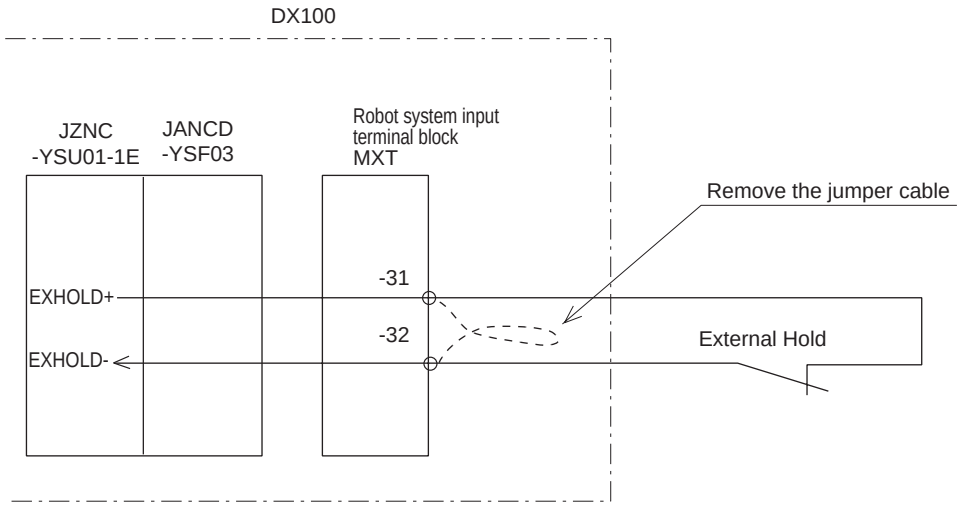
This signal is used to connect the temporary stop switch of an external device. If the signal is input, the job is stopped. While the signal is input, starting and axis operations are disabled.

CAUTION

- Always connect the signals after removing jumper cable.

If the cables 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. 13-19: Connection for External Hold



■ **External Enable Switch**

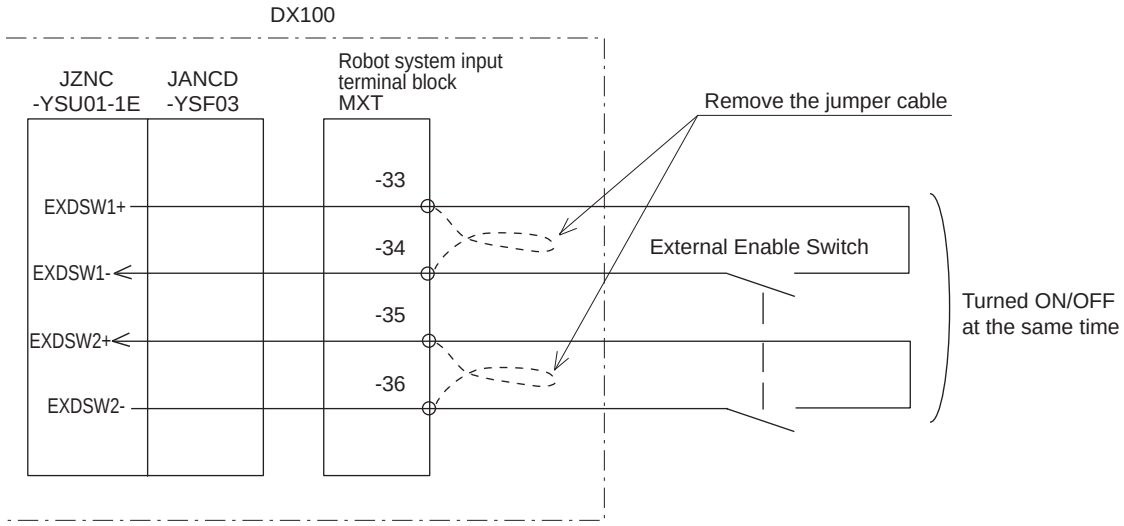
This signal is used to connect Enable switch other than the one on the programming pendant when two people are teaching.

CAUTION

- Always connect the signals after removing jumper cable.

Injury or damage to machinery may result because the external emergency stop do not work even if the signal is input.

Fig. 13-20: Connection for External Enable Switch



Signal Name	Connection No. (MXT)	Dual input	Function	Factory Setting
EXESP1+ EXESP1- EXESP2+ EXESP2-	-19 -20 -21 -22	Applicable	External Emergency Stop 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.	Short-circuit with a jumper cable
SAFF1+ SAFF1- SAFF2+ SAFF2-	-9 -10 -11 -12	Applicable	Safety Plug Used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is 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.	Short-circuit with a jumper cable
FST1+ FST1- FST2+ FST2-	-23 -24 -25 -26	Applicable	Full-speed Test 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%).	Open
SSP+ SSP-	-27 -28	-	Slow Speed Mode Selection Used to determine the speed of the test run when the FST (full-speed test) signal input circuit is open. Open: Second slow speed (2%) Short-circuit: First slow speed (16%)	Short-circuit with a jumper cable
EXSVON+ EXSVON-	-29 -30	-	External Servo ON Use to connect the servo ON switch of an external operation device. If the signal is input, the servo power supply is turned ON.	Open
EXHOLD+ EXHOLD-	-31 -32	-	External Hold 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.	Short-circuit with a jumper cable
EXDSW1+ EXDSW1- EXDSW2+ EXDSW2-	-33 -34 -35 -36	Applicable	External Enable Switch Used to connect a Enable switch other than the one on the programming pendant when two people are teaching.	Short-circuit with a jumper cable

13.10 Contact Output of Emergency Stop Button

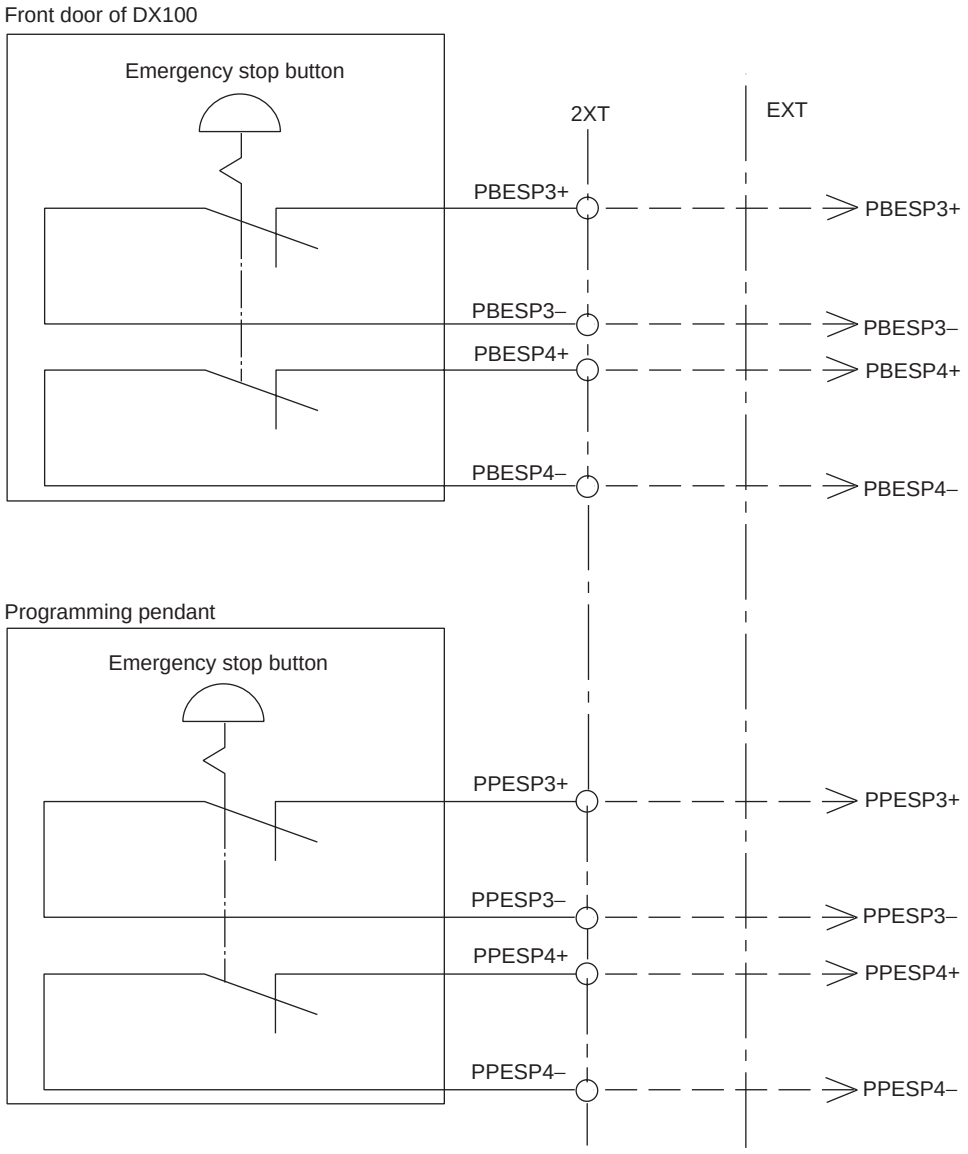
The contact output terminals for the emergency stop button on the programming pendant and the door front are provided on the terminal block 2XT (screw size M3.5) at lower part of the right side of DX100.
These contact outputs are always valid no matter of the DX100 main power supply status ON or OFF. (Status output signal: normally closed contact)

CAUTION

- Do not use the emergency stop button with 24 VAC, 0.5 A or more.

Failure to observe this instruction may result in damage to equipment.

Fig. 13-21: Contact Output Terminal Block of Emergency Button (2XT)



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 : AC200/220V) 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:

Configuration Device			**MH5/MH5L**	**MH6**	**MA1400**	**VA1400**
			Model	Model	Model	Model
SERVOPACK			JZRCR-YSV01-11	JZRCR-YSV02-11	JZRCR-YSV02-11	JZRCR-YSV02-31
	Converter		SRDA-COA12A01A-E	SRDA-COA12A01A-E	SRDA-COA12A01A-E	SRDA-COA12A01A-E
	PWM Amplifier	S	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E
		L	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E
		U	SRDA-SDA06A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E
		R	SRDA-SDA03A01A-E	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E
		B	SRDA-SDA03A01A-E	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E
		T	SRDA-SDA03A01A-E	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E
		E				SRDA-SDA14A01A-E

Table 13-3:

Configuration Device			MA1900	HP20D HP20D-6
			Model	Model
SERVOPACK			JZRCR-YSV03-11	JZRCR-YSV03-11
	Converter		SRDA-COA12A01A-E	SRDA-COA12A01A-E
	PWM Amplifier	S	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E
		L	SRDA-SDA21A01A-E	SRDA-SDA21A01A-E
		U	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E
		R	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E
		B	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E
		T	SRDA-SDA06A01A-E	SRDA-SDA06A01A-E
		E		

Table 13-4:

Configuration Device			MH50	MS80	VS50/SIA50D
			Model	Model	Model
Converter			SRDA-COA30A01A-E	SRDA-COA30A01A-E	SRDA-COA30A01A-E
SERVOPACK			JZRCR-YSV04-11	JZRCR-YSV05-11	JZRCR-YSV05-41
	PWM Amplifier	S	SRDA-SDA71A01A-E	SRDA-SDA71A01A-E	SRDA-SDA71A01A-E
		L	SRDA-SDA71A01A-E	SRDA-SDA71A01A-E	SRDA-SDA71A01A-E
		U	SRDA-SDA35A01A-E	SRDA-SDA71A01A-E	SRDA-SDA71A01A-E
		R	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E
		B	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E
		T	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E	SRDA-SDA14A01A-E
		E			SRDA-SDA71A01A-E

Table 13-5:

Configuration Device			ES165D	ES200D
			Model	Model
Converter			SRDA-COA30A01A-E	SRDA-COA30A01A-E
SERVOPACK			JZRCR-YSV06-11	JZRCR-YSV06-11
	PWM Amplifier	S	SRDA-SDA71A01A-E	SRDA-SDA71A01A-E
		L	SRDA-SDA71A01A-E	SRDA-SDA71A01A-E
		U	SRDA-SDA71A01A-E	SRDA-SDA71A01A-E
		R	SRDA-SDA35A01A-E	SRDA-SDA35A01A-E
		B	SRDA-SDA21A01A-E	SRDA-SDA21A01A-E
		T	SRDA-SDA21A01A-E	SRDA-SDA21A01A-E
		E		

Fig. 13-22: SERVOPACK Configuration for MH5, MH5L, MH6, MA1400, MA1900, HP20D, HP20D-6

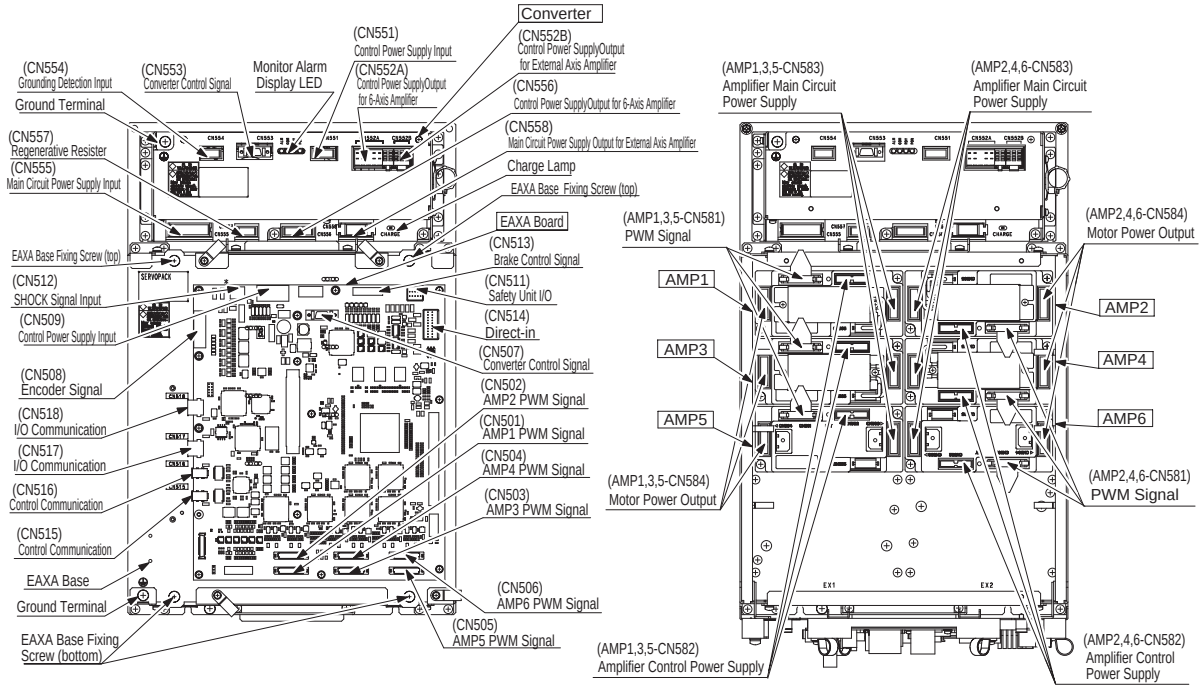


Fig. 13-23: SERVOPACK Configuration for VA1400

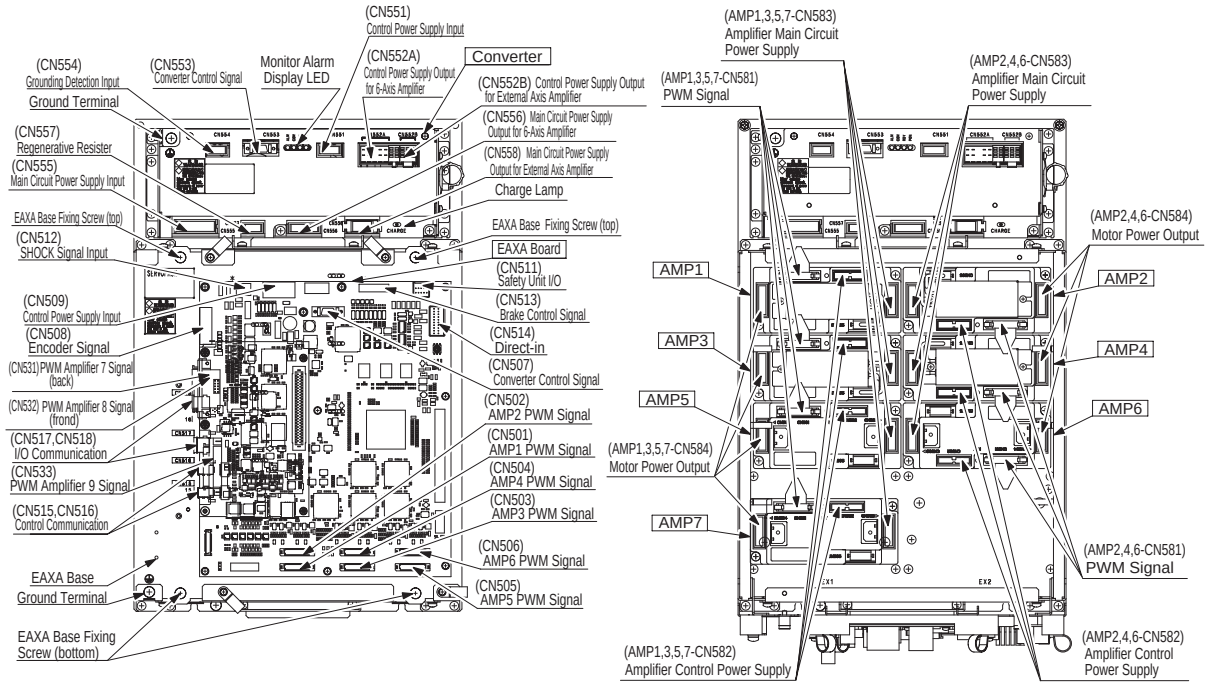


Fig. 13-24: SERVOPACK Configuration for MH50, MS80

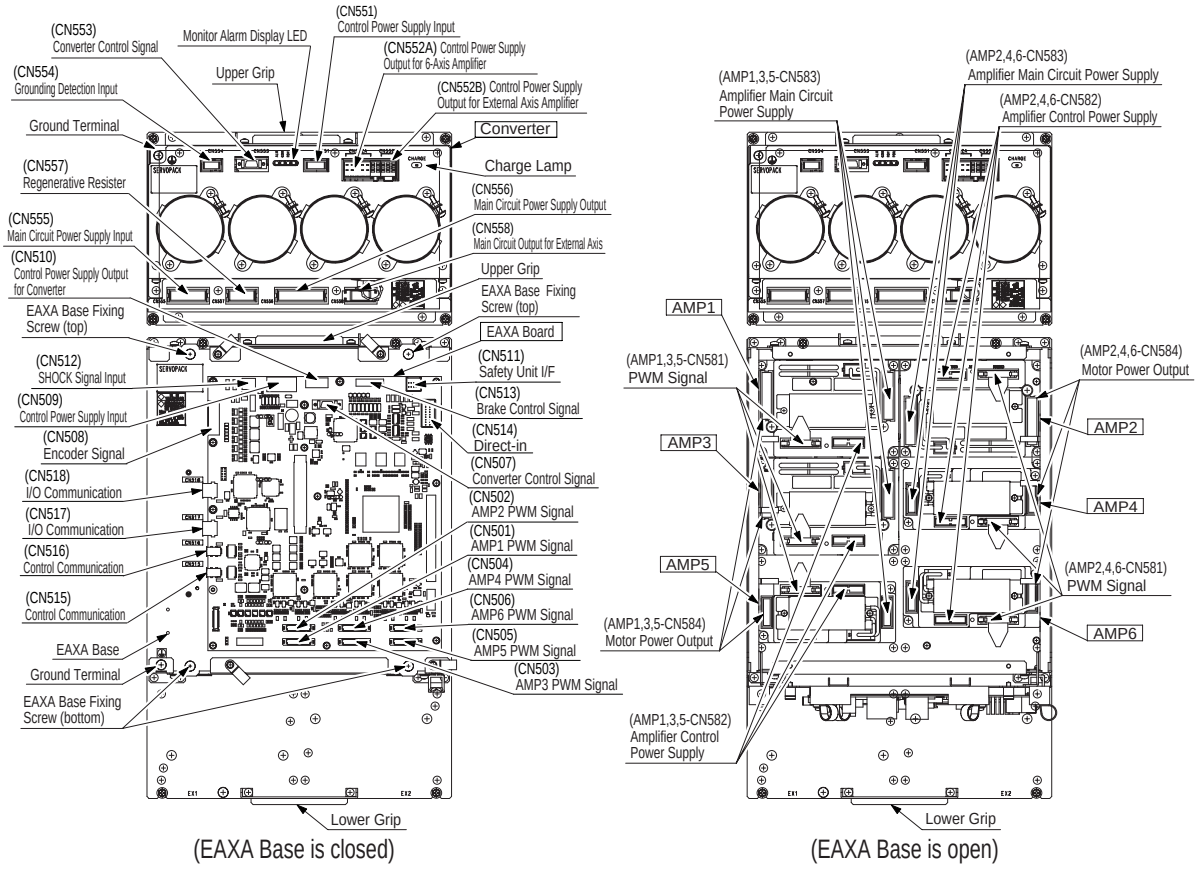


Fig. 13-25: SERVOPACK Configuration for VS50, SIA50D

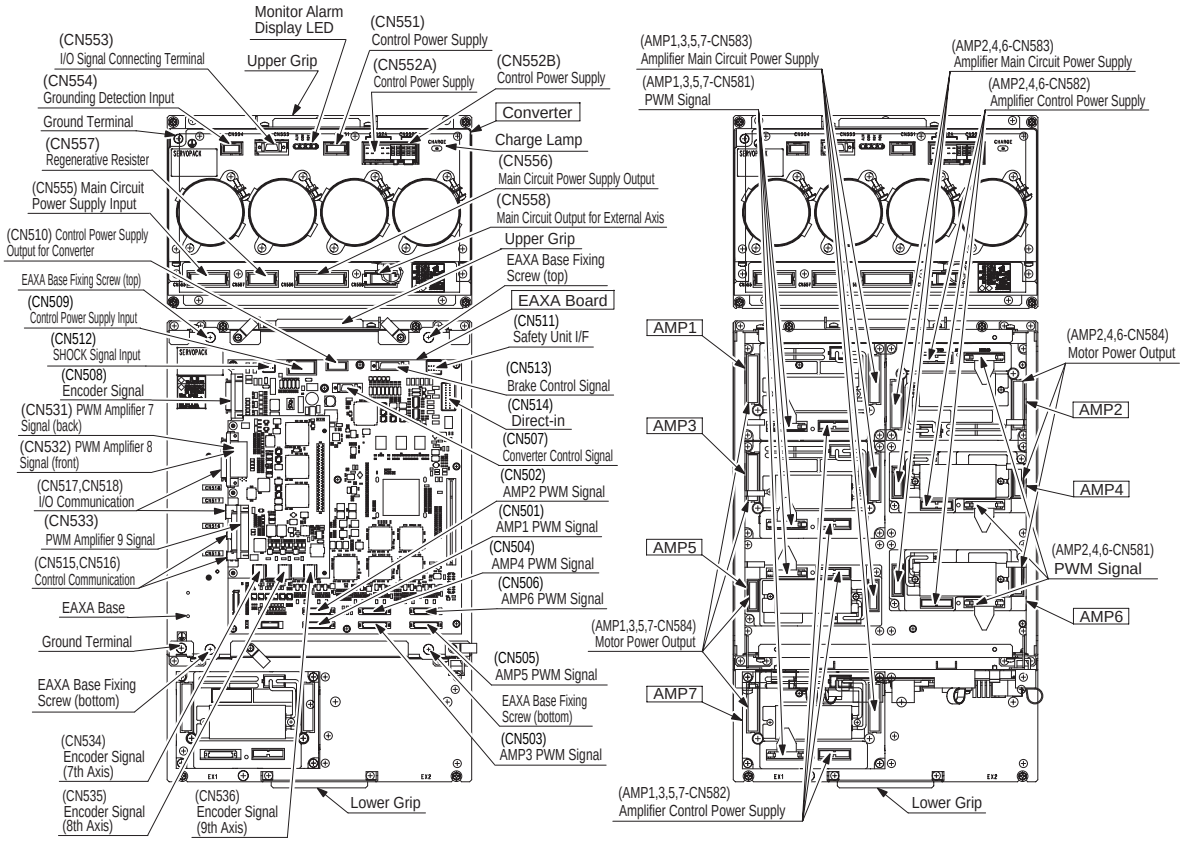
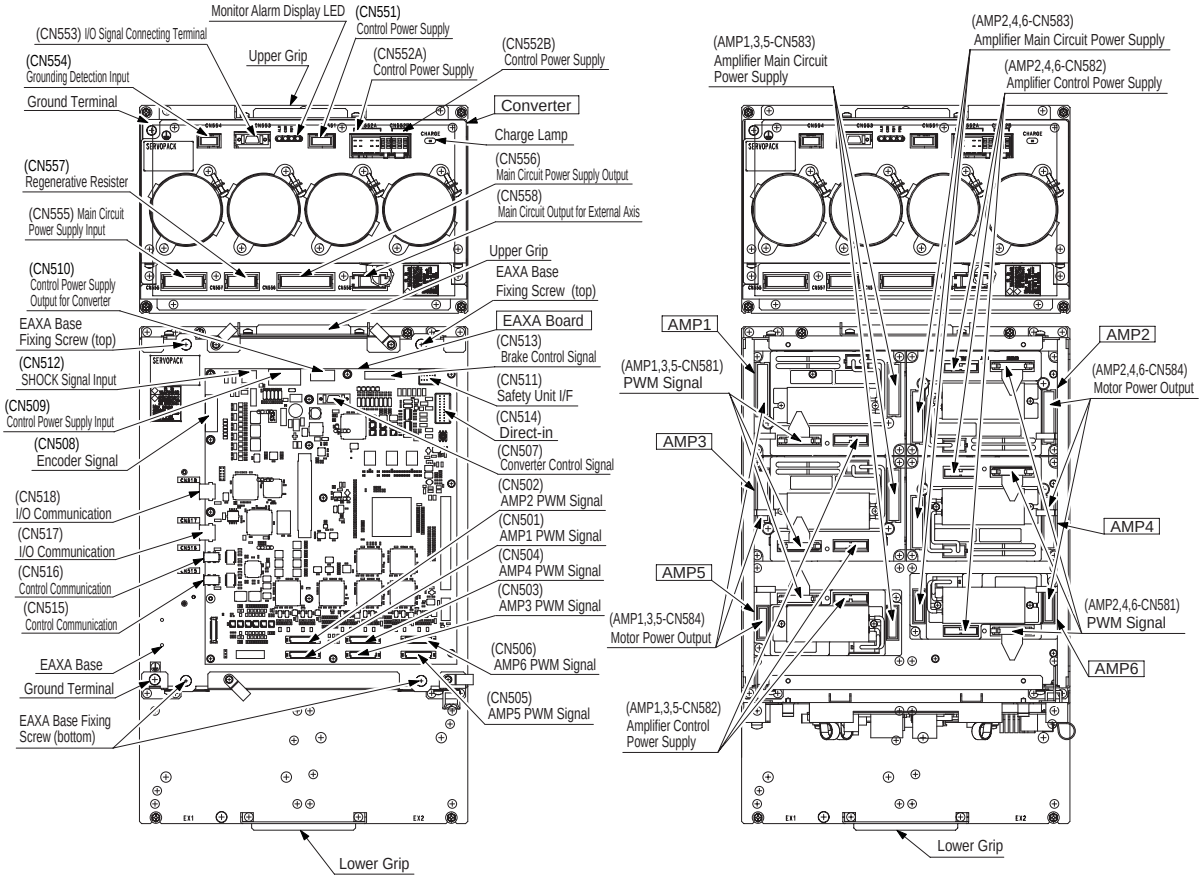


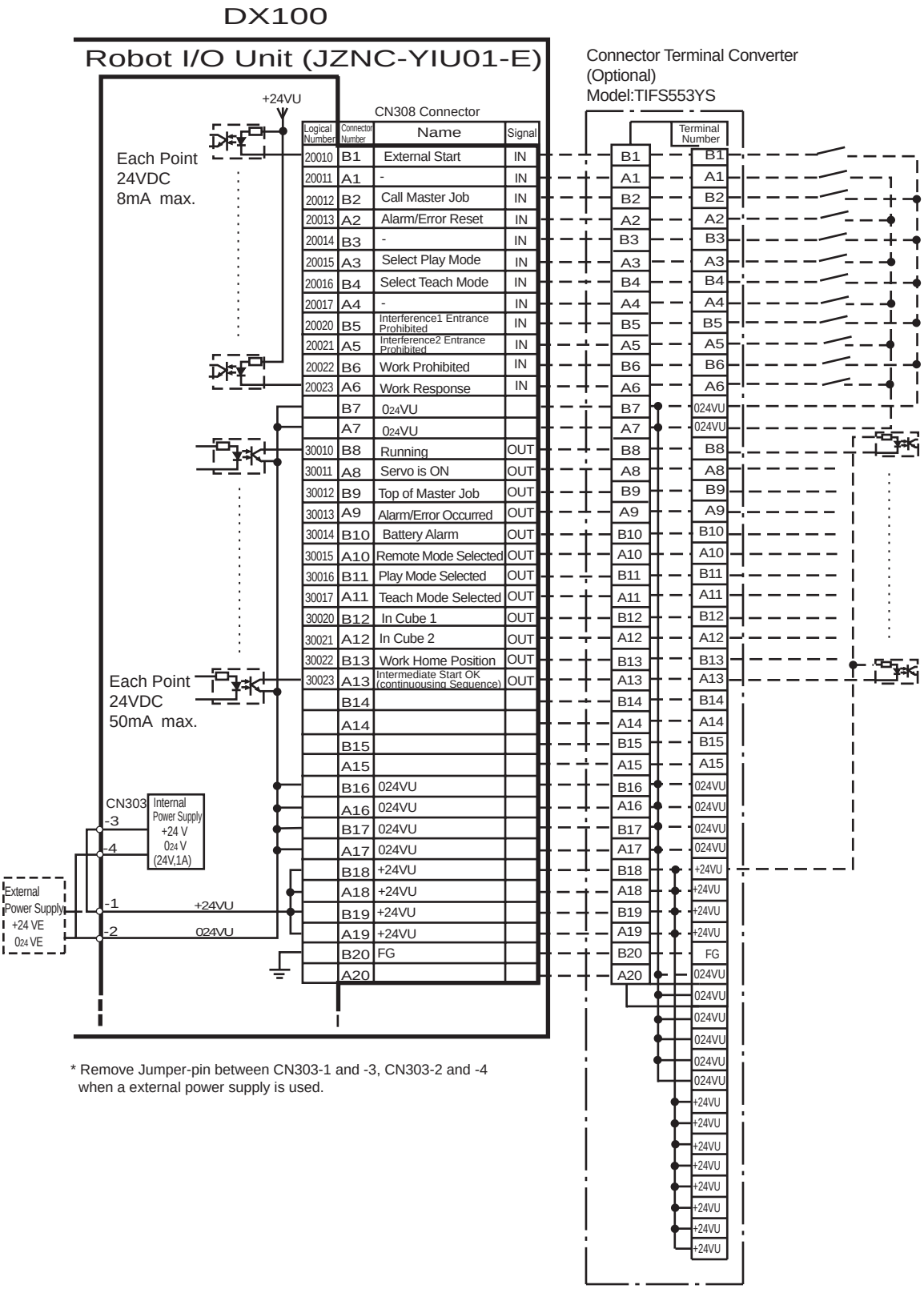
Fig. 13-26: SERVOPACK Configuration for ES165D, ES200D



13.12 Universal I/O Signal Assignment

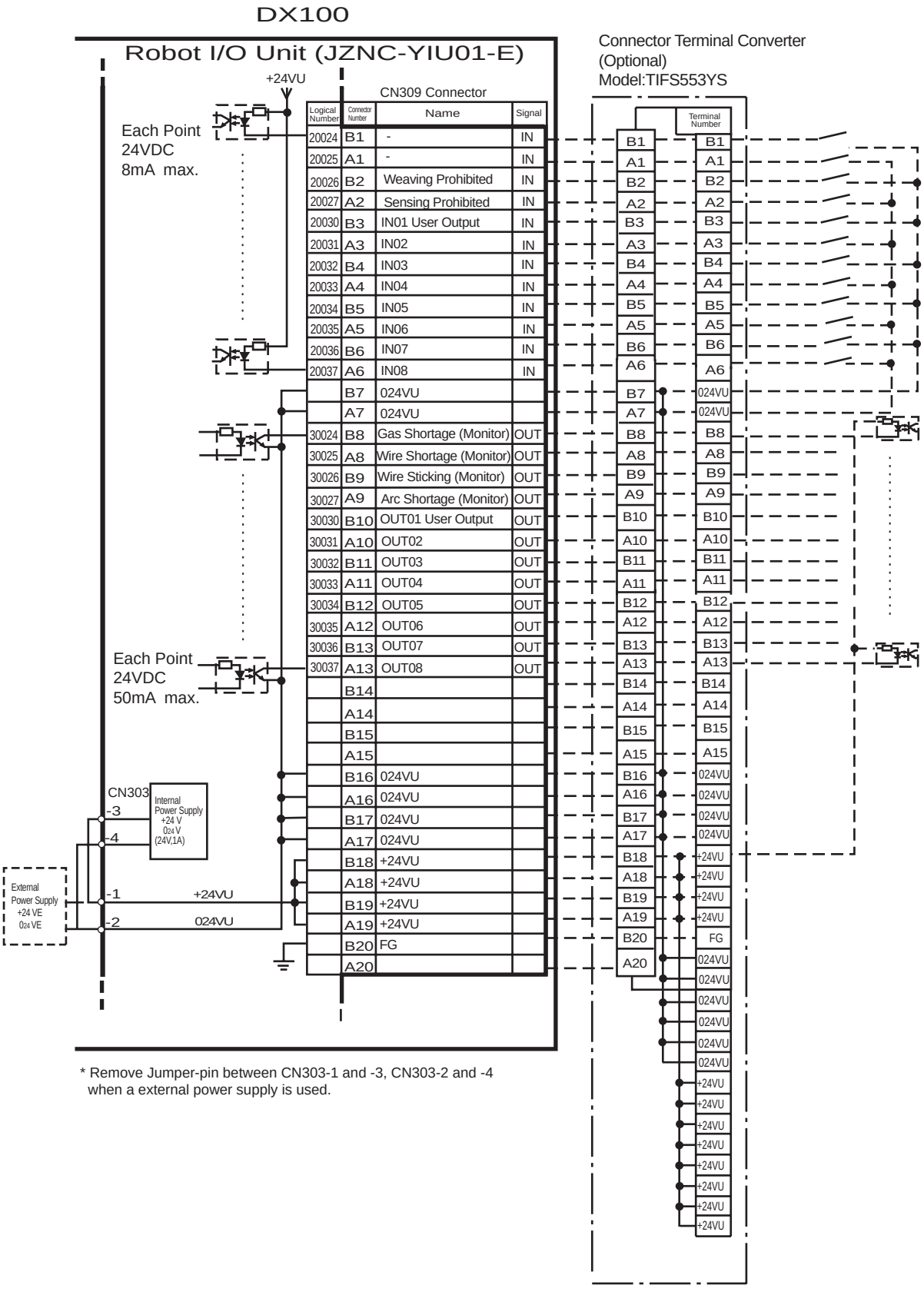
13.12.1 Arc Welding

Fig. 13-27: JZNC-YIU01-E (CN308 Connector) I/O Allocation and Connection Diagram (For Arc Welding)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 13-28: JZNC-YIU01-E (CN309 Connector) I/O Allocation and Connection Diagram (For Arc Welding)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 13-29: JZNC-YIU01-E (CN306 Connector) I/O Allocation and Connection Diagram (For Arc Welding)

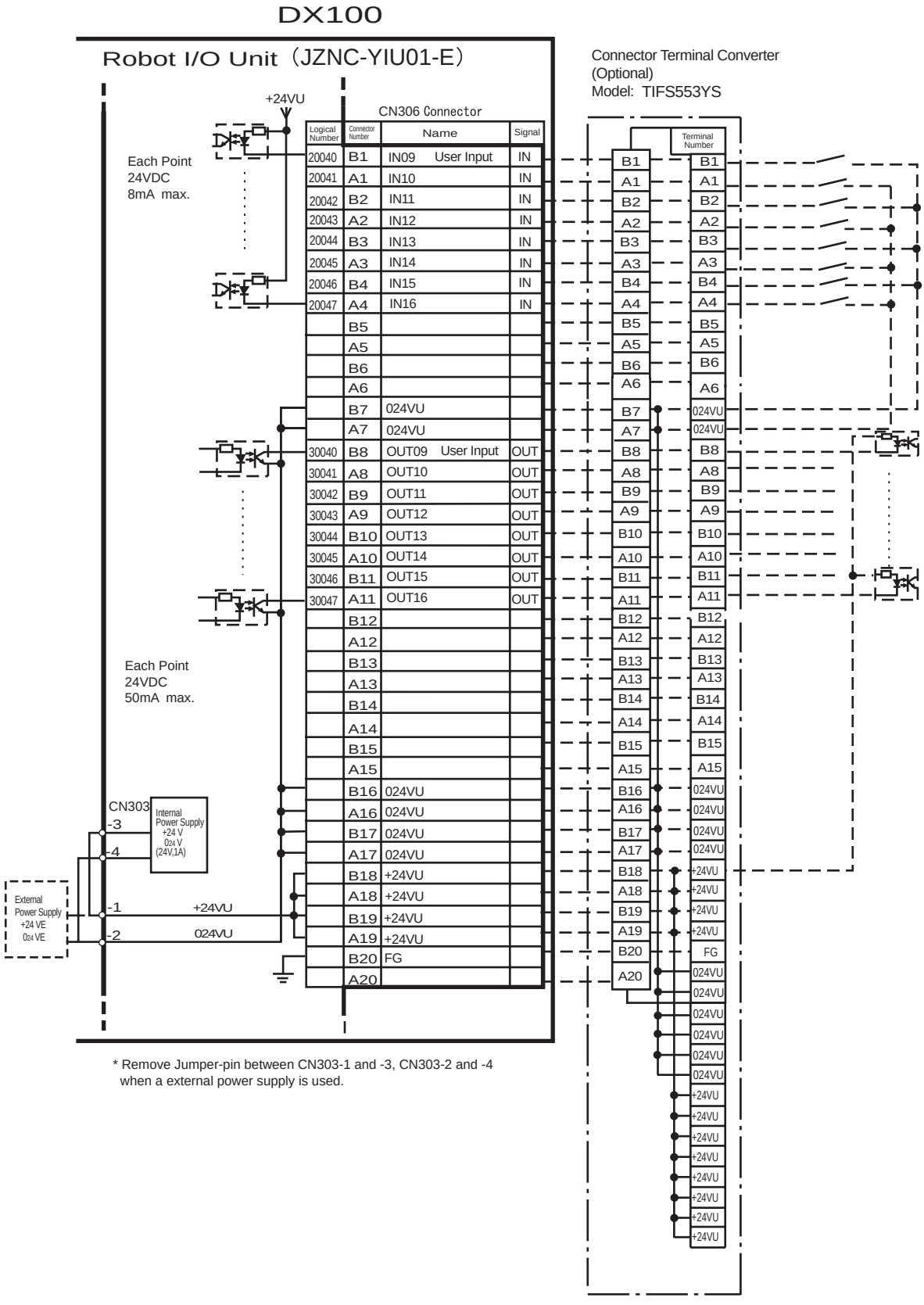
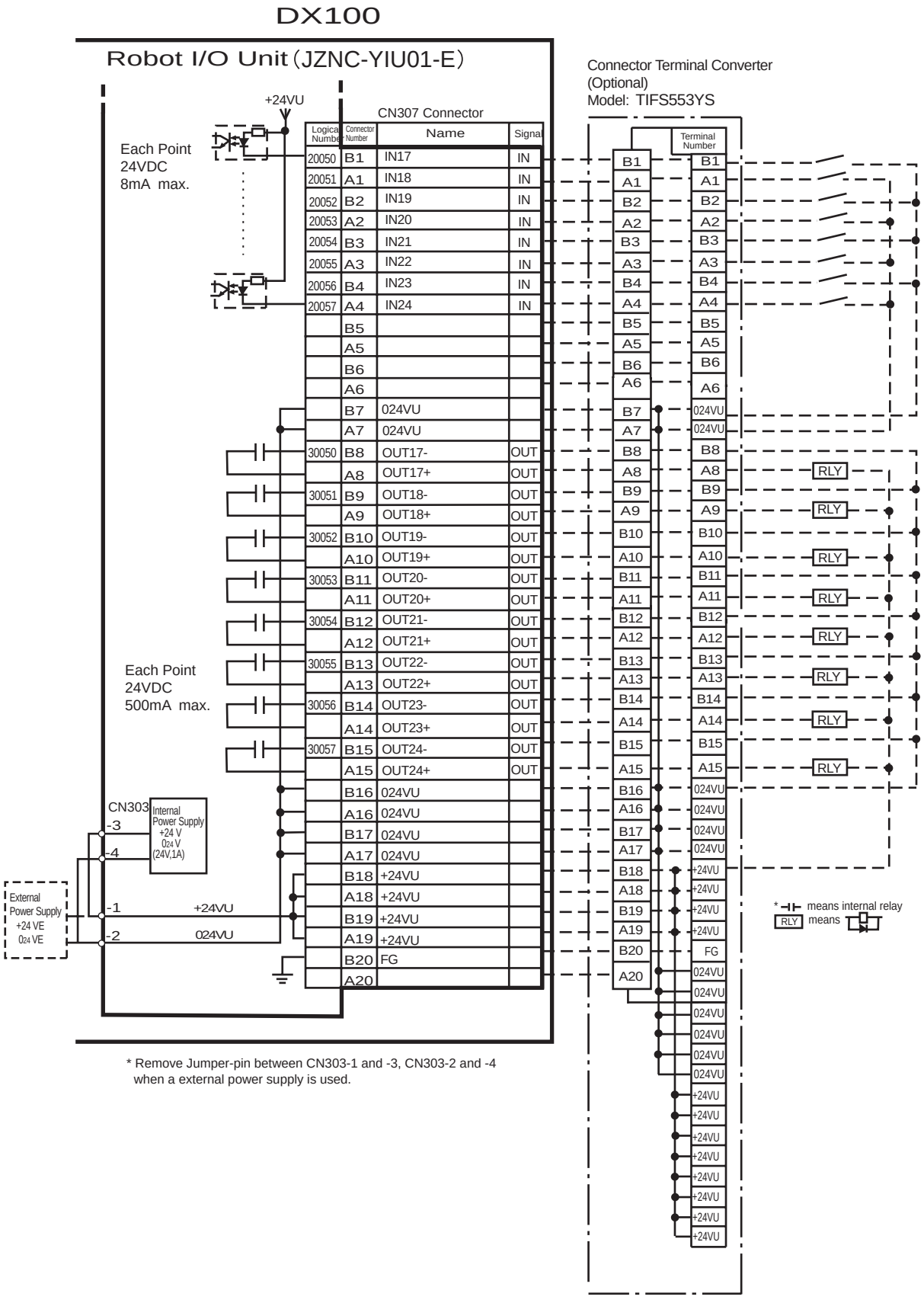


Fig. 13-30: JZNC-YIU01-E (CN307 Connector) I/O Allocation and Connection Diagram (For Arc Welding)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Table 13-6: Specific Input (Arc Welding)

Logical Number	Input Name / Function
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1)]. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at "REMOTE". Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at "REMOTE". The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
20020	INTERFERENCE 1 ENTRANCE PROHIBITED If the 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.
20021	INTERFERENCE 2 ENTRANCE PROHIBITED 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.
20022	WORK PROHIBITED (Arc Generation Prohibited) Arc generation is prohibited while this signal is ON. Arc generation starts when this signal turns OFF inside the arc-generation area. Use this signal to confirm teaching.
20023	WORK RESPONSE (Pseudo Arc ON Response) This signal is used as a pseudo signal in cases that “Arc Generation Confirmation” signal is not equipped on a welding power supply. Wire this signal ON normally (short to OV).
20026	WEAVING PROHIBITED Weaving is prohibited while this signal is ON. Use this signal to check taught steps and movements without performing the weaving operation.
20027	SENSING PROHIBITED Arc sensing is prohibited while this signal is ON. Use this signal to check taught steps and movements if an arc sensor is mounted.

1 A master job is a job (program) which can be called by CALL MASTER JOB.Other functions are the same as for normal jobs. Normally, the parent job, which manages the child jobs called up immediately after the power is turned ON, is set as the master job.
2 See *chapter 8.6 “Interference Area” at page 8-56*.

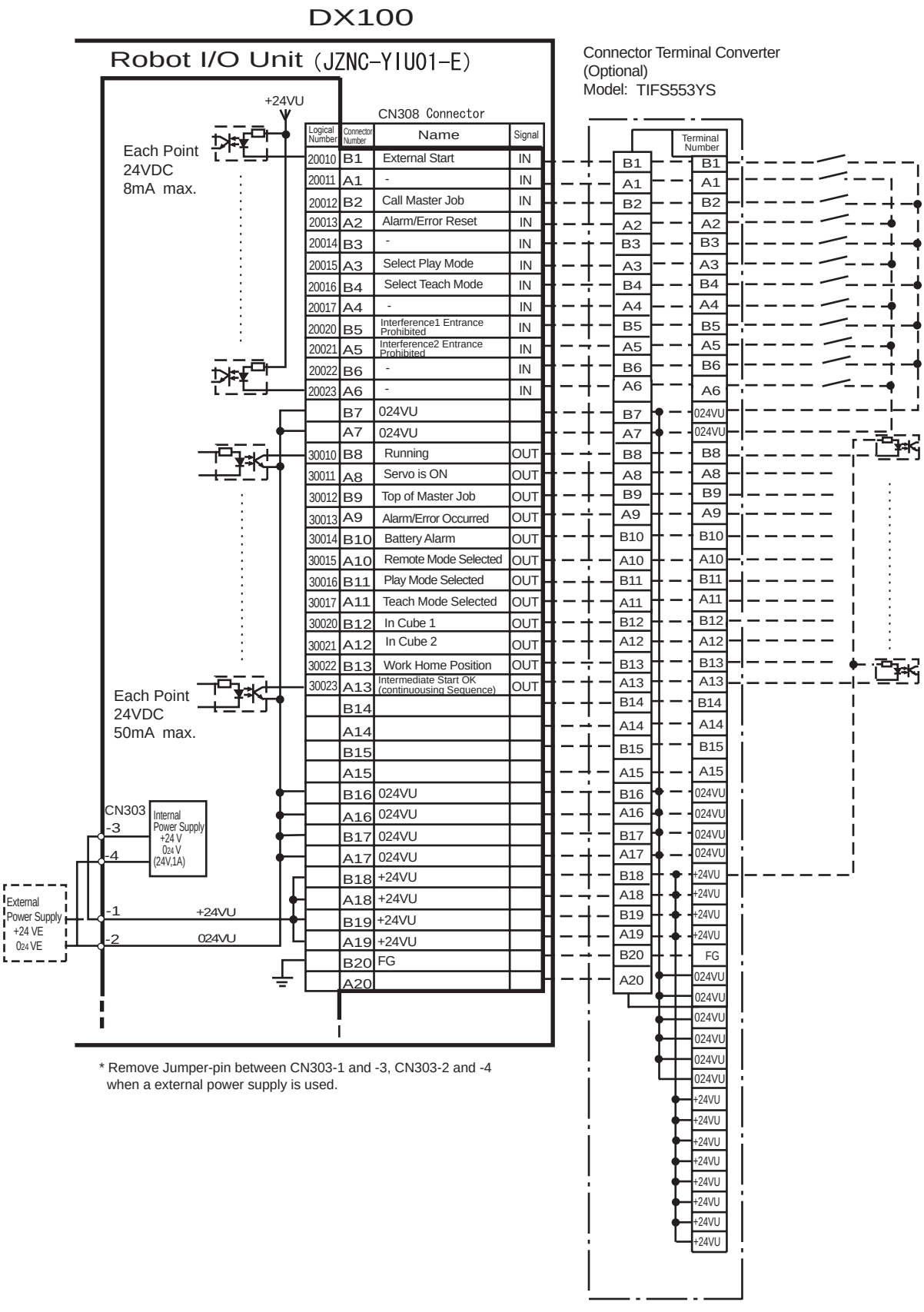
Table 13-7: Specific Output (Arc Welding)

Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX100 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 32)[2)] This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.
30023	INTERMEDIATE START OK This signal turns ON when the 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.
30024	GAS SHORTAGE (MONITOR) This signal stays ON while the gas shortage signal from the welding power supply is ON.
30025	WIRE SHORTAGE (MONITOR) This signal status ON while the wire shortage signal from the welding power supply is ON.
30026	WIRE STICKING (MONITOR) The wire sticking check is conducted automatically when the arc turns OFF. If wire sticking is detected, this signal remains ON until the wire sticking is released.
30027	ARC SHORTAGE (MONITOR) This signal stays ON while the arc shortage signal from the welding power supply is ON.

1 This signal is not output during operation.
2 The work home position cube and Cube 32 are same.

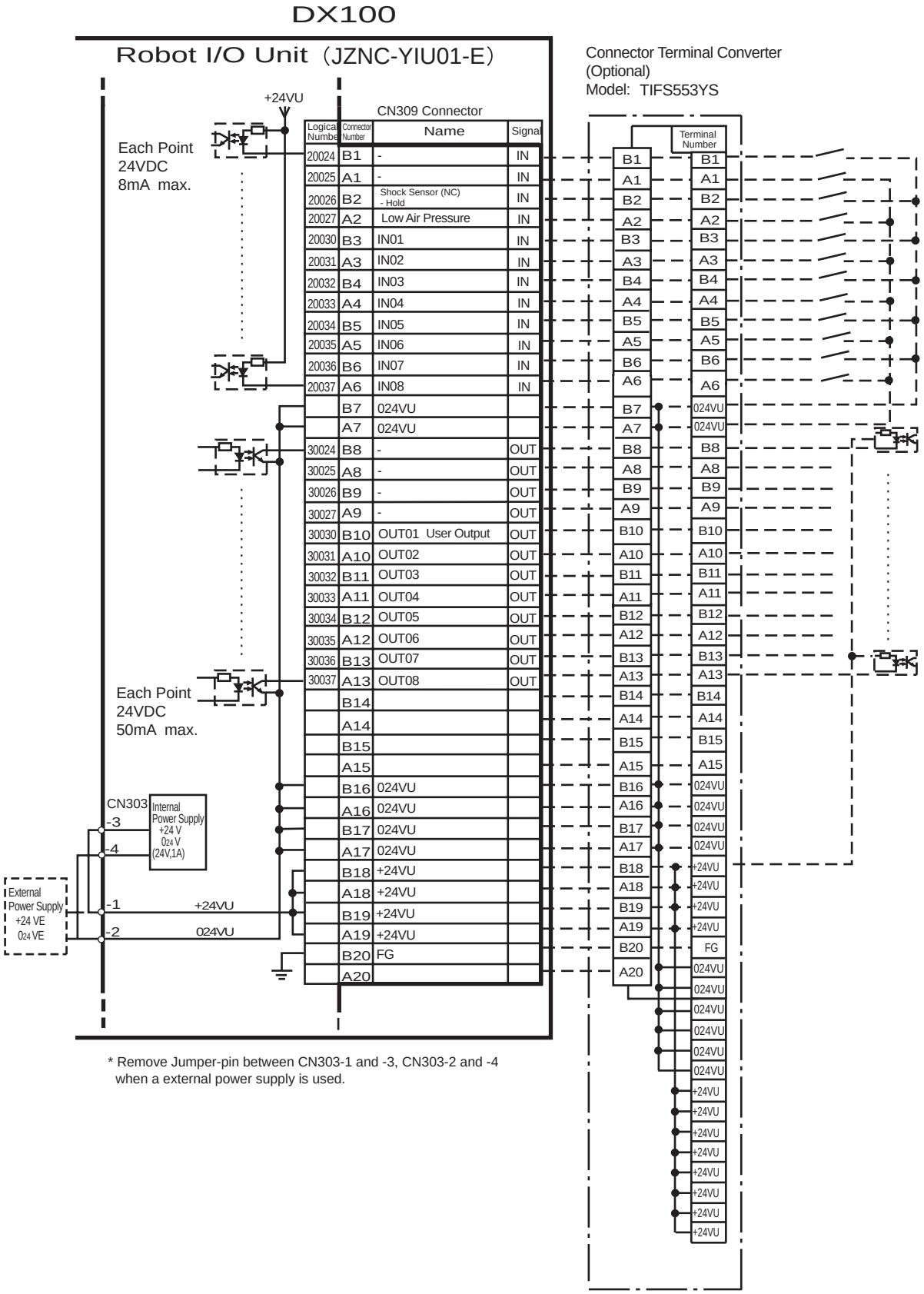
13.12.2 Handling

Fig. 13-31: JZNC-YIU01-E (CN308 Connector) I/O Allocation and Connection Diagram (For Handling)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 13-32: JZNC-YIU01-E (CN309 Connector) I/O Allocation and Connection Diagram (For Handling)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 13-33: JZNC-YIU01-E (CN306 Connector) I/O Allocation and Connection Diagram (For Handling)

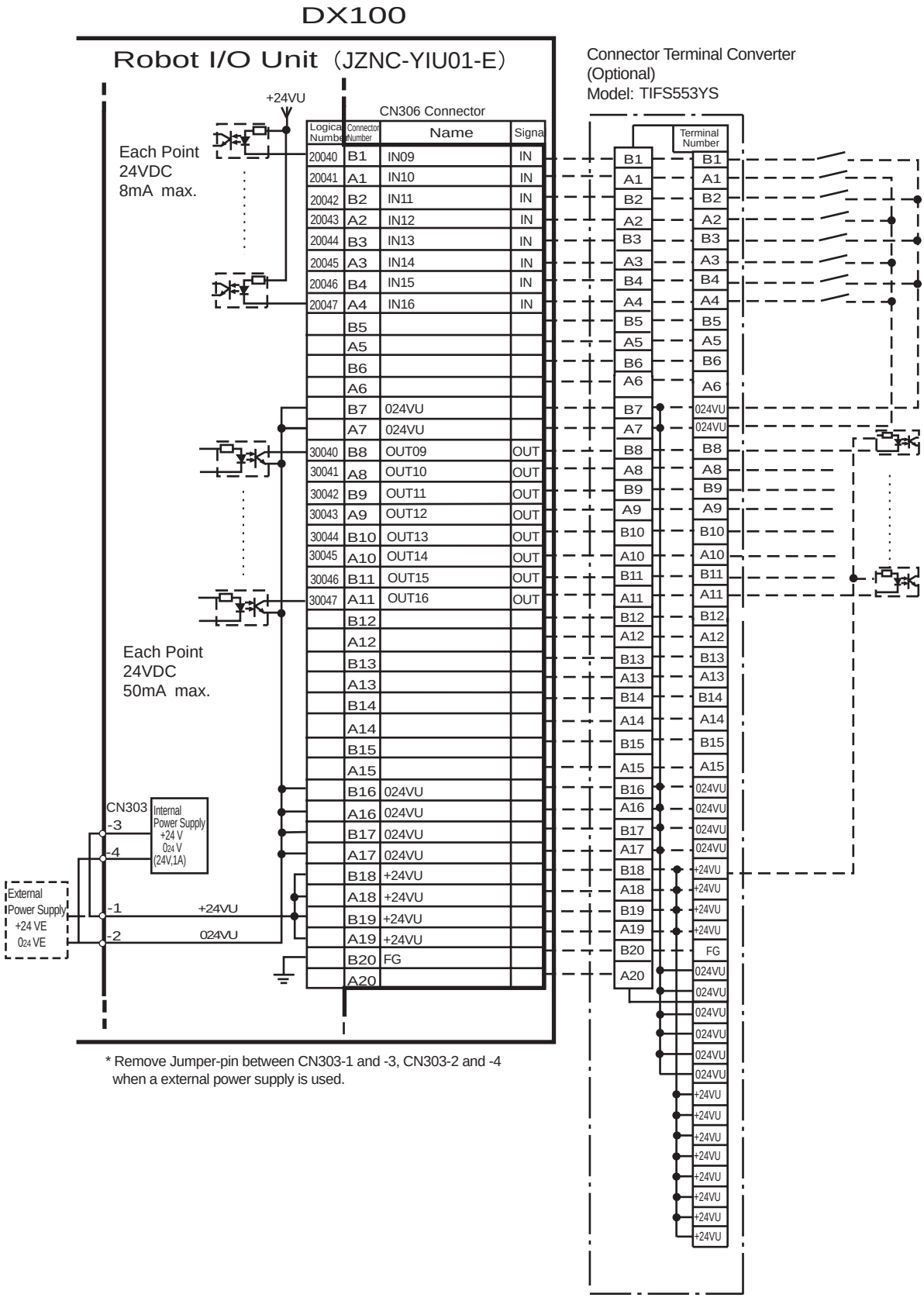


Fig. 13-34: JZNC-YIU01-E (CN307 Connector) I/O Allocation and Connection Diagram (For Handling)

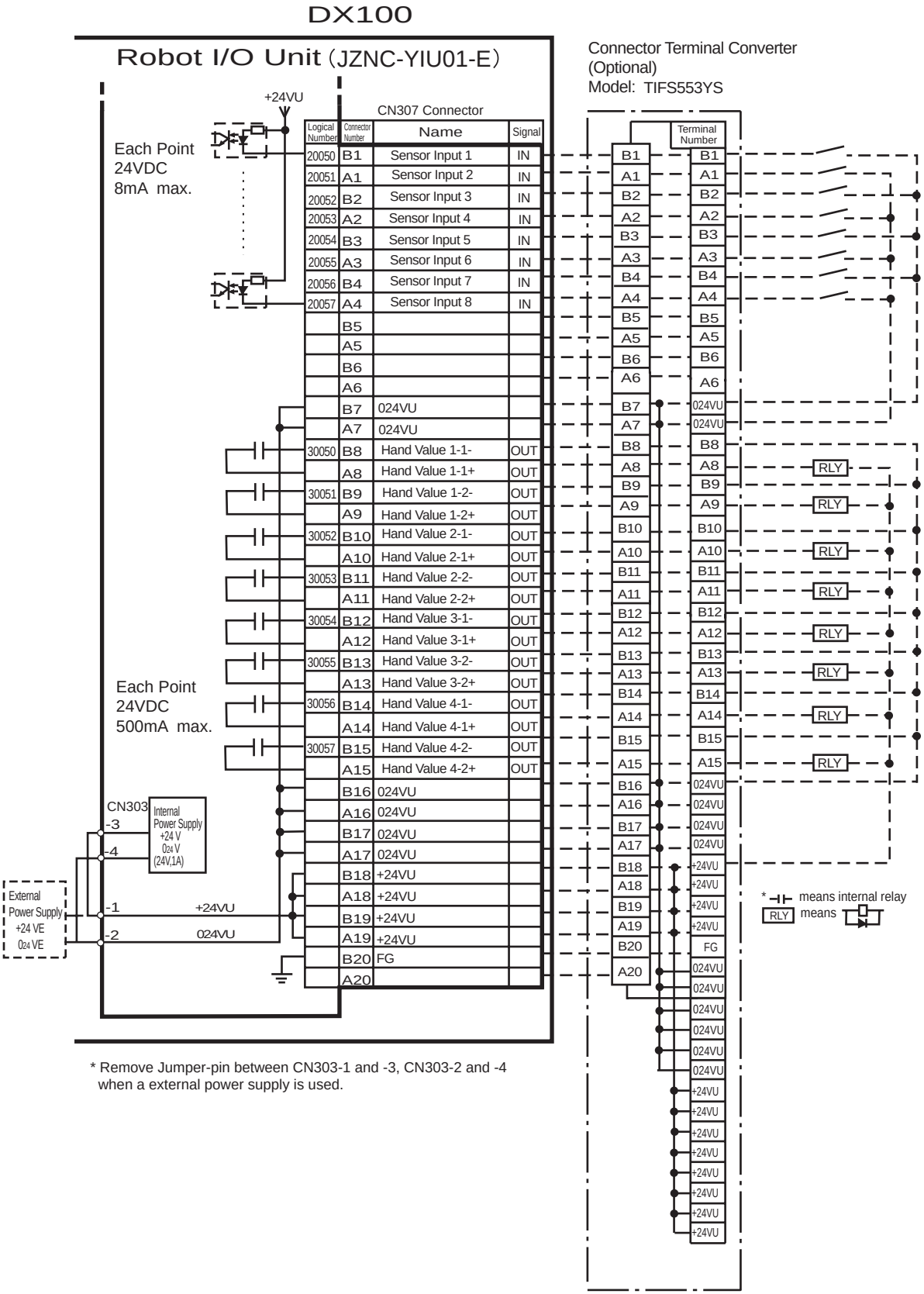


Table 13-8: Specific Input (Handling)

Logical Number	Input Name / Function
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1)]. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at "REMOTE". Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at "REMOTE". The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
20020	INTERFERENCE 1 ENTRANCE PROHIBITED If the 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.
20021	INTERFERENCE 2 ENTRANCE PROHIBITED 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.
20026	TOOL SHOCK SENSOR This is normally ON (NC) signal input. When it turns OFF, an DX100 displays a message "HAND TOOL SHOCK SENSOR OPERATING" and a HOLD is applied. The releasing in teach mode is done on the handling application diagnostic display. Set tool shock sensor function “NOT USE” on the handling applications diagnostic display if this signal is not be used.
20027	LOW AIR PRESSURE This signal is normally OFF (NO). When it turns ON, DX100 displays user alarm in the PLAY mode or displays user message in the teach mode.
20050 to 20057	SENSOR INPUT 1 - 8 Inputs 1 to 8 are monitored with the HSEN handling specific instructions. Sensor inputs 1 to 8 correspond to HSEN 1 to 8.

1 A master job is a job (program) which can be called by CALL MASTER JOB. Other functions are the same as for normal jobs. Normally, the parent job, which manages the child jobs called up immediately after the power is turned ON, is set as the master job.
2 See *chapter 8.6 “Interference Area” at page 8-56*.

Table 13-9: Specific Output (Handling)

Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX100 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 32)[2)] This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.
30023	INTERMEDIATE START OK This signal turns ON when the 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.
30050 to 30057	HAND VALVE 1-4 These outputs are controlled by the HAND handling specific instructions. Hand valves 1 to 4 correspond to HAND 1 to 4.

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. 13-35: JZNC-YIU01-E (CN308 Connector) I/O Allocation and Connection Diagram (For General Application)

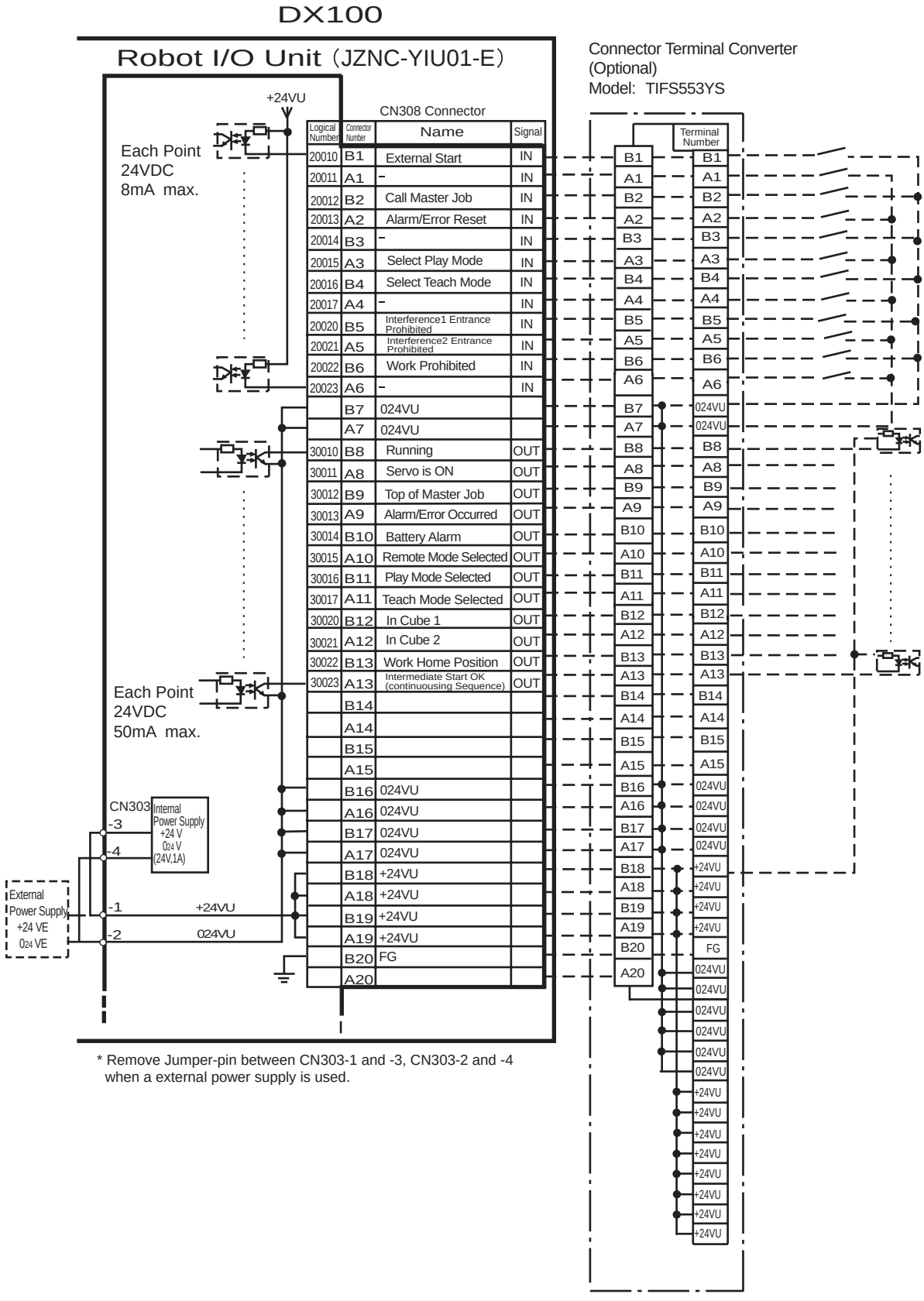
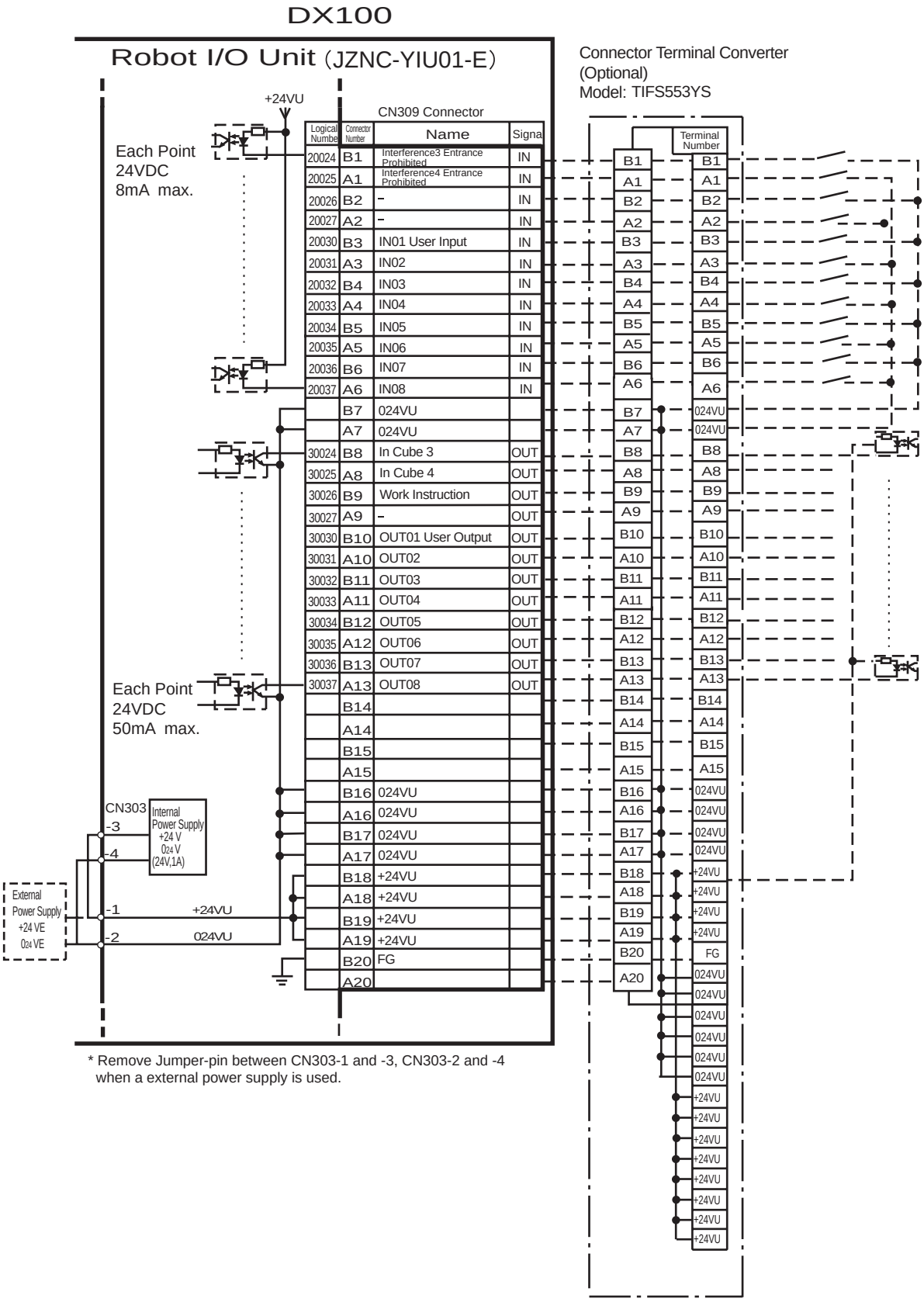


Fig. 13-36: JZNC-YIU01-E (CN309 Connector) I/O Allocation and Connection Diagram (For General Application)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 13-37: JZNC-YIU01-E (CN306 Connector) I/O Allocation and Connection Diagram (General Application)

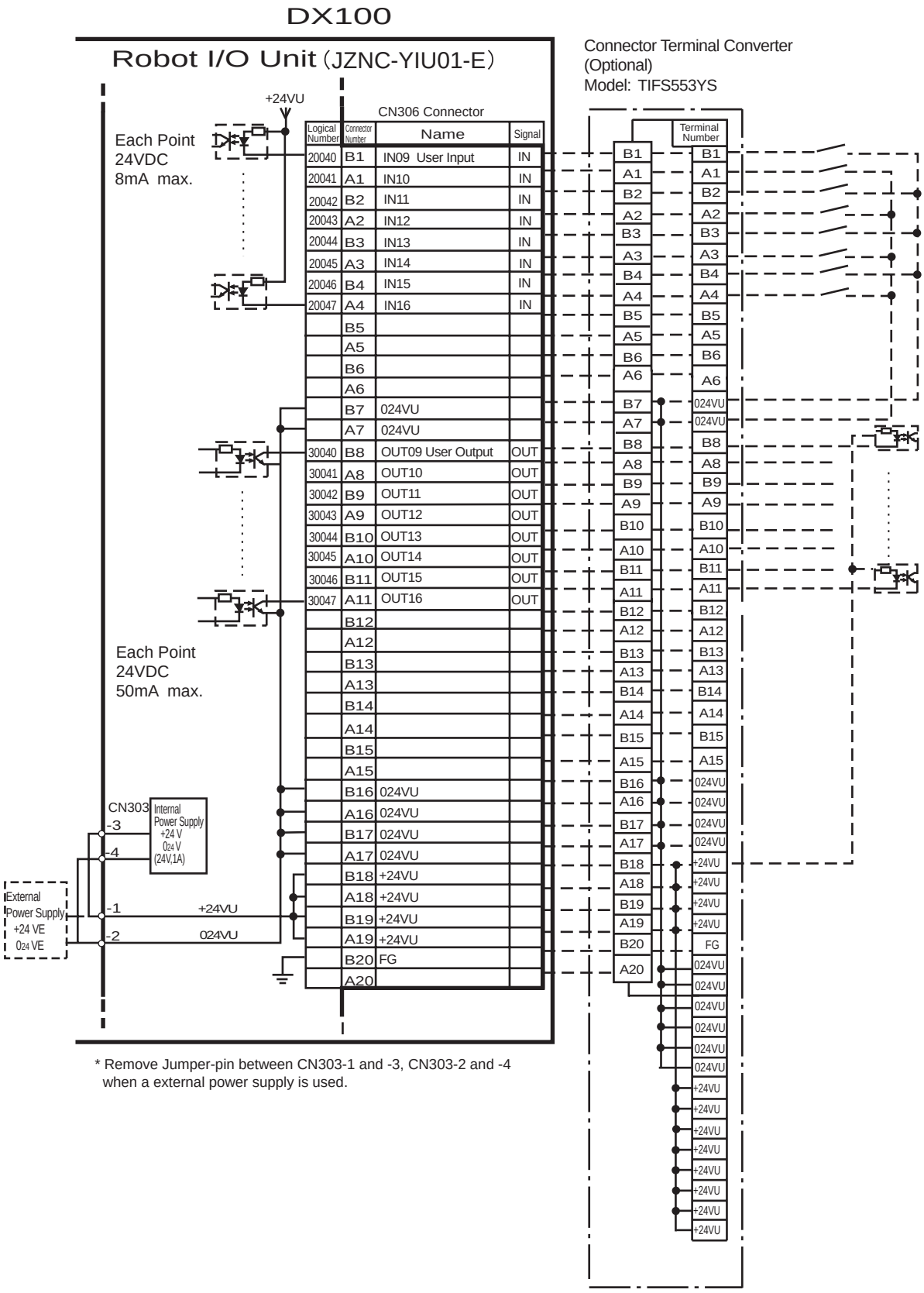
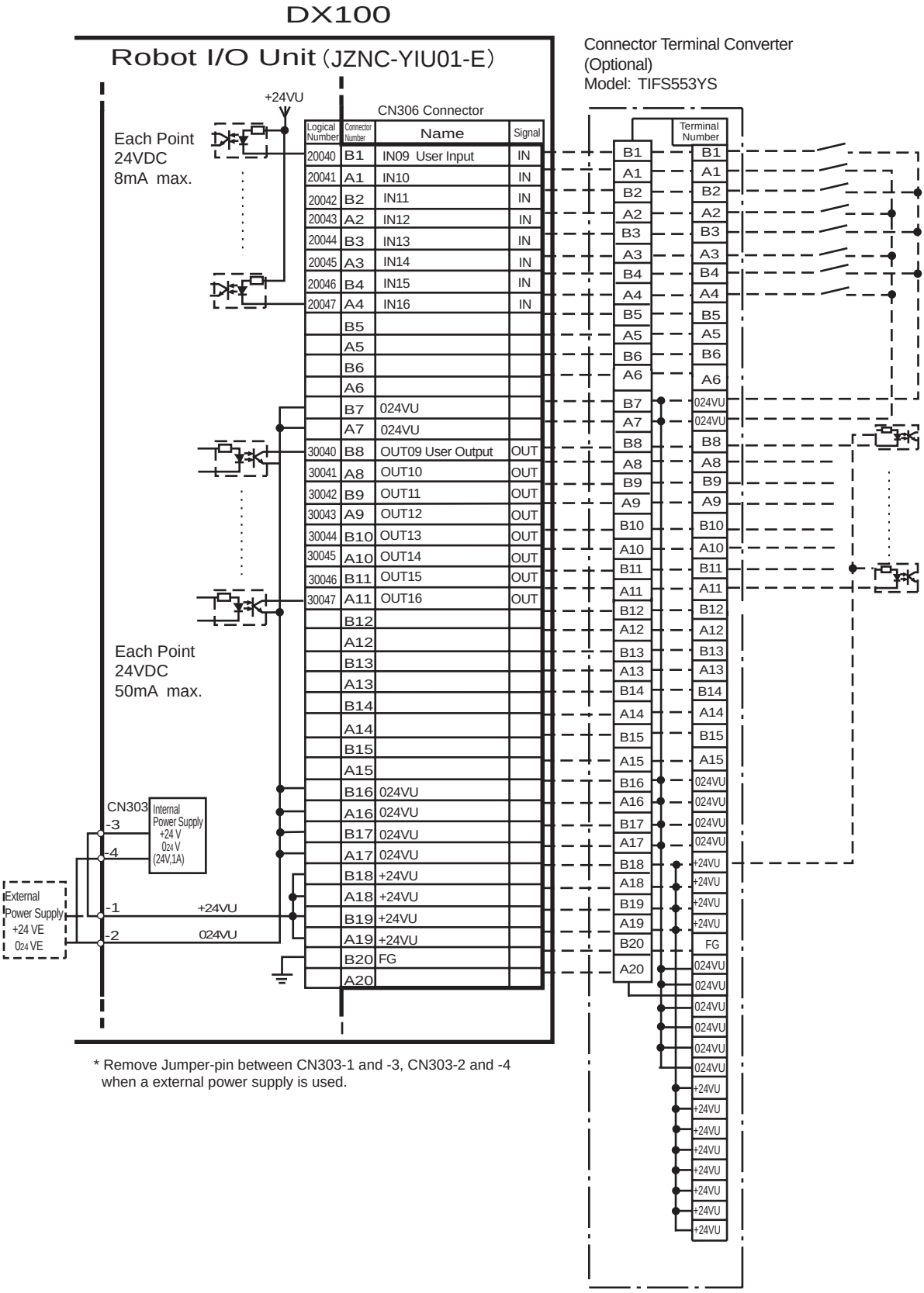


Fig. 13-38: JZNC-YIU01-E (CN307 Connector) I/O Allocation and Connection Diagram (For General Application)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Table 13-10: Specific Input (General Application)

Logical Number	Input Name / Function
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1)]. This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at "REMOTE". Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at "REMOTE". The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
20020	INTERFERENCE 1 ENTRANCE PROHIBITED If the 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.
20021	INTERFERENCE 2 ENTRANCE PROHIBITED 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.
20022	WORK PROHIBITED (Tool ON Prohibited) Even if TOOLON instruction is executed, DX100 doesn't output to external while this signal is ON.
20024	INTERFERENCE 3 ENTRANCE PROHIBITED 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.
20025	INTERFERENCE 4 ENTRANCE PROHIBITED 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.

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

2 See *chapter 8.6 "Interference Area" at page 8-56*.

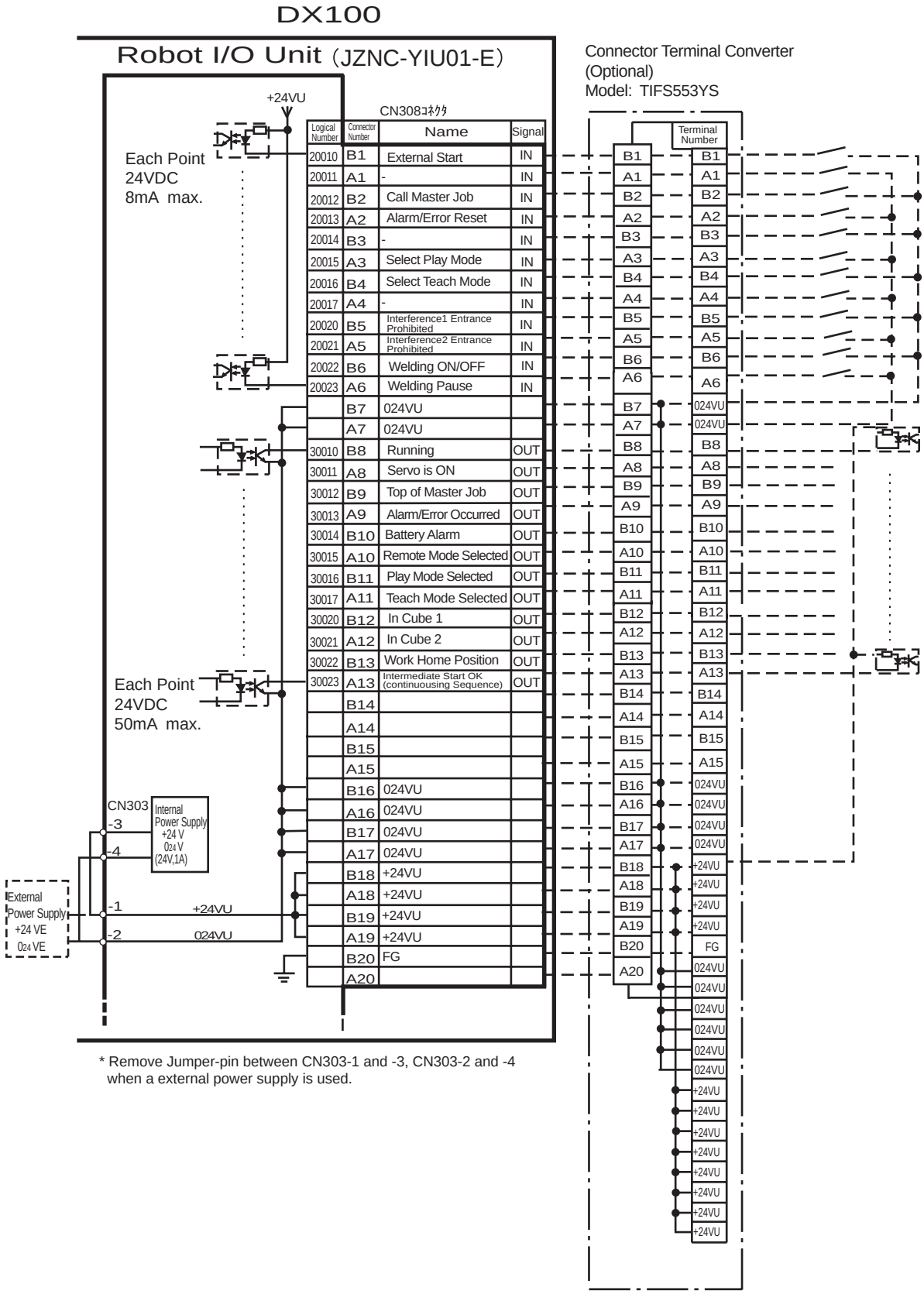
Table 13-11: Specific Output (General Application)

Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX100 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]***1***
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 32)[2)] 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.
30023	INTERMEDIATE START OK 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.
30024	IN CUBE 3 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other manipulators and positioners.
30025	IN CUBE 4 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other manipulators and positioners.
30026	WORK COMMAND This signal provides the command for the general tool to operate. TOOL ON instruction execution or the [TOOL ON] key in the programming pendant turns this signal ON and TOOL OFF instruction execution or the [TOOL OFF] key in the programming pendant turns it OFF. However, it remains OFF while the WORK PROHIBITED signal (2022) is input or while the robot is stopped.

1 This signal is not output during operation.
2 The work home position cube and Cube 32 are same.

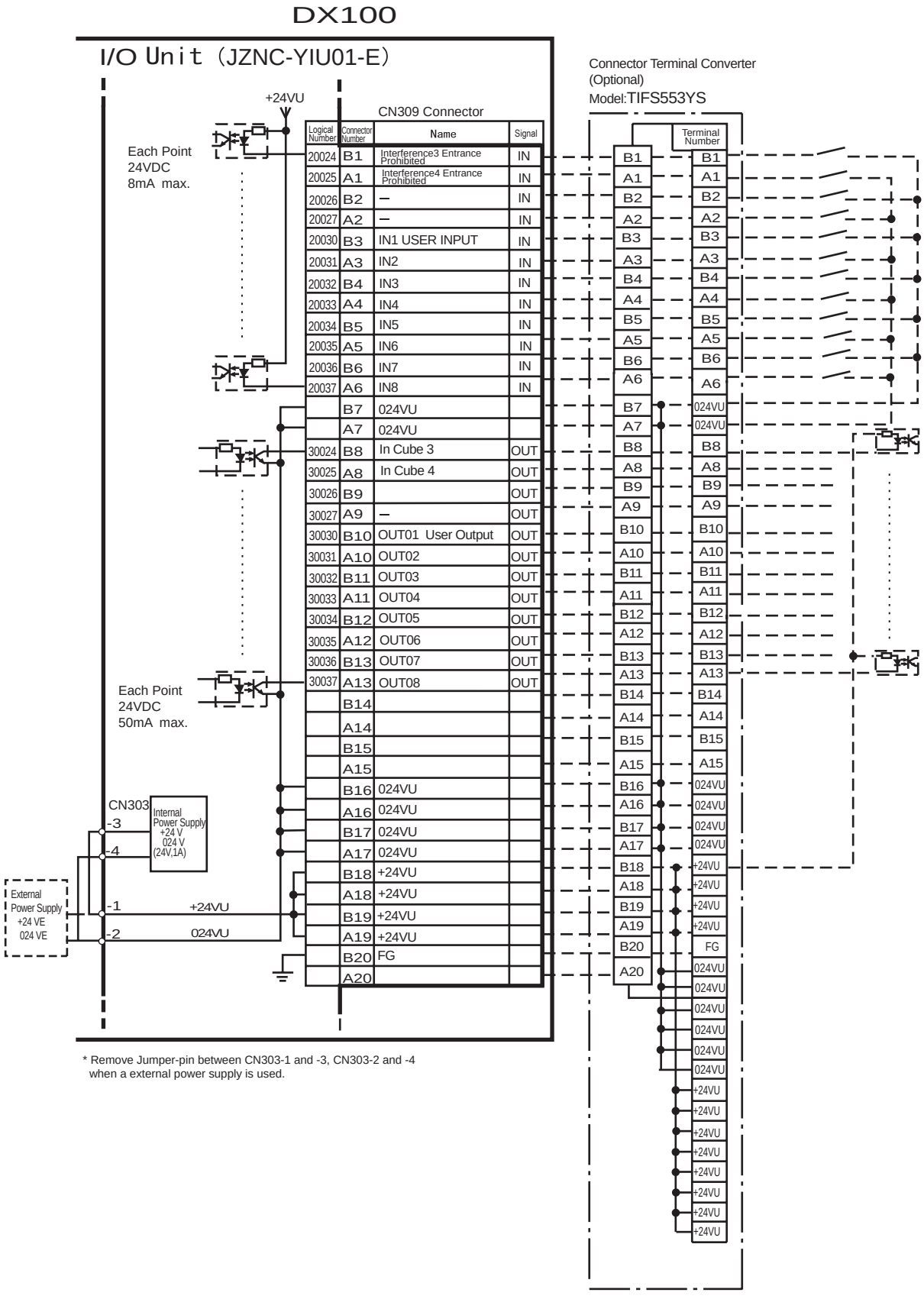
13.12.4 Spot Welding

Fig. 13-39: JZNC-YIU01-E (CN308 Connector) I/O Allocation and Connection Diagram (For Spot Welding)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 13-40: JZNC-YIU01-E (CN309 Connector) I/O Allocation and Connection Diagram (For Spot Welding)



Logical Number	Connector Number	Name	Signal
20024	B1	Interference3 Entrance Prohibited	IN
20025	A1	Interference4 Entrance Prohibited	IN
20026	B2	—	IN
20027	A2	—	IN
20030	B3	IN1 USER INPUT	IN
20031	A3	IN2	IN
20032	B4	IN3	IN
20033	A4	IN4	IN
20034	B5	IN5	IN
20035	A5	IN6	IN
20036	B6	IN7	IN
20037	A6	IN8	IN
	B7	024VU	
	A7	024VU	
30024	B8	In Cube 3	OUT
30025	A8	In Cube 4	OUT
30026	B9		OUT
30027	A9	—	OUT
30030	B10	OUT01 User Output	OUT
30031	A10	OUT02	OUT
30032	B11	OUT03	OUT
30033	A11	OUT04	OUT
30034	B12	OUT05	OUT
30035	A12	OUT06	OUT
30036	B13	OUT07	OUT
30037	A13	OUT08	OUT
	B14		
	A14		
	B15		
	A15		
	B16	024VU	
	A16	024VU	
	B17	024VU	
	A17	024VU	
	B18	+24VU	
	A18	+24VU	
	B19	+24VU	
	A19	+24VU	
	B20	FG	
	A20		

Fig. 13-41: JZNC-YIU01-E (CN306 Connector) I/O Allocation and Connection Diagram (For Spot Welding)

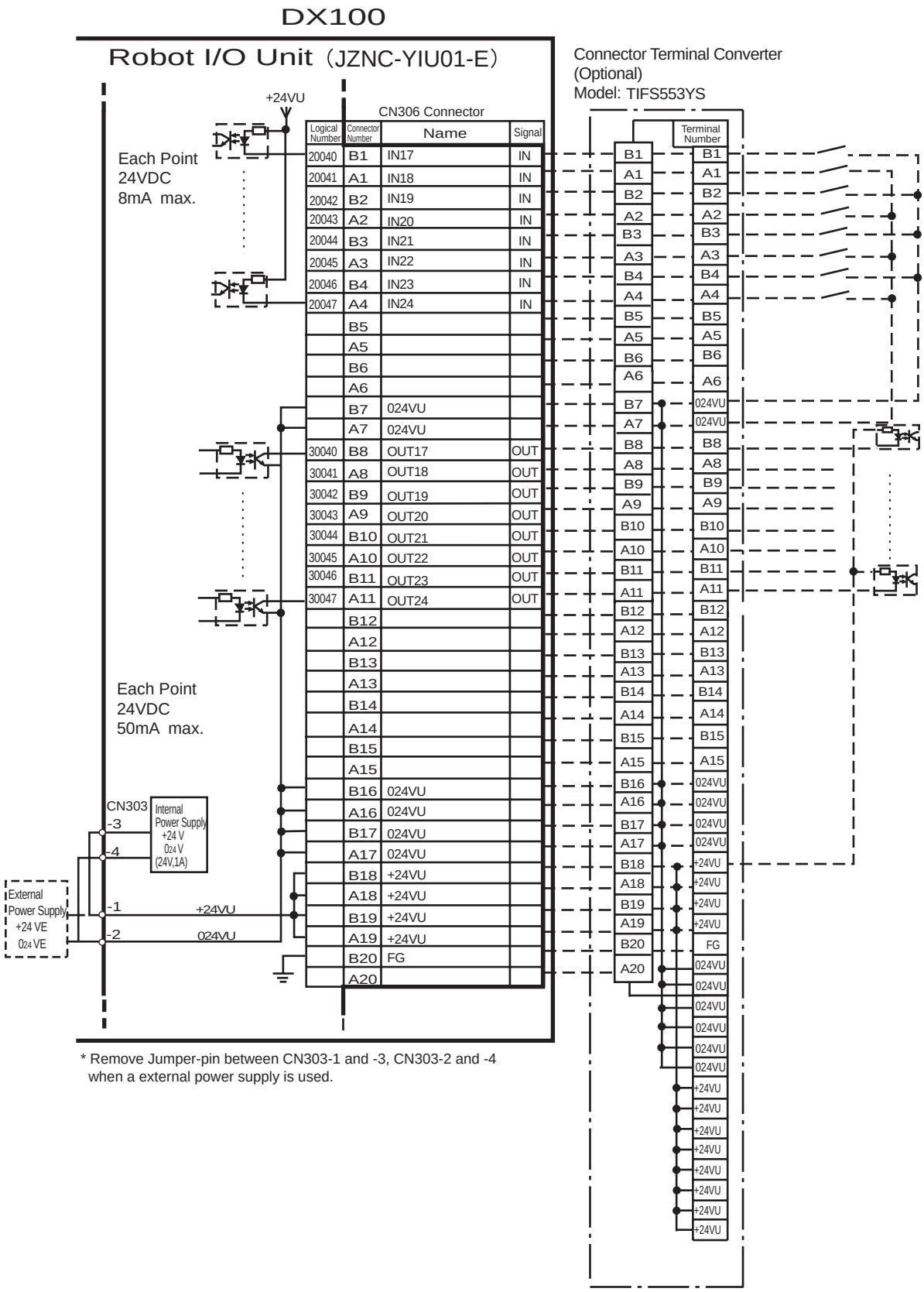
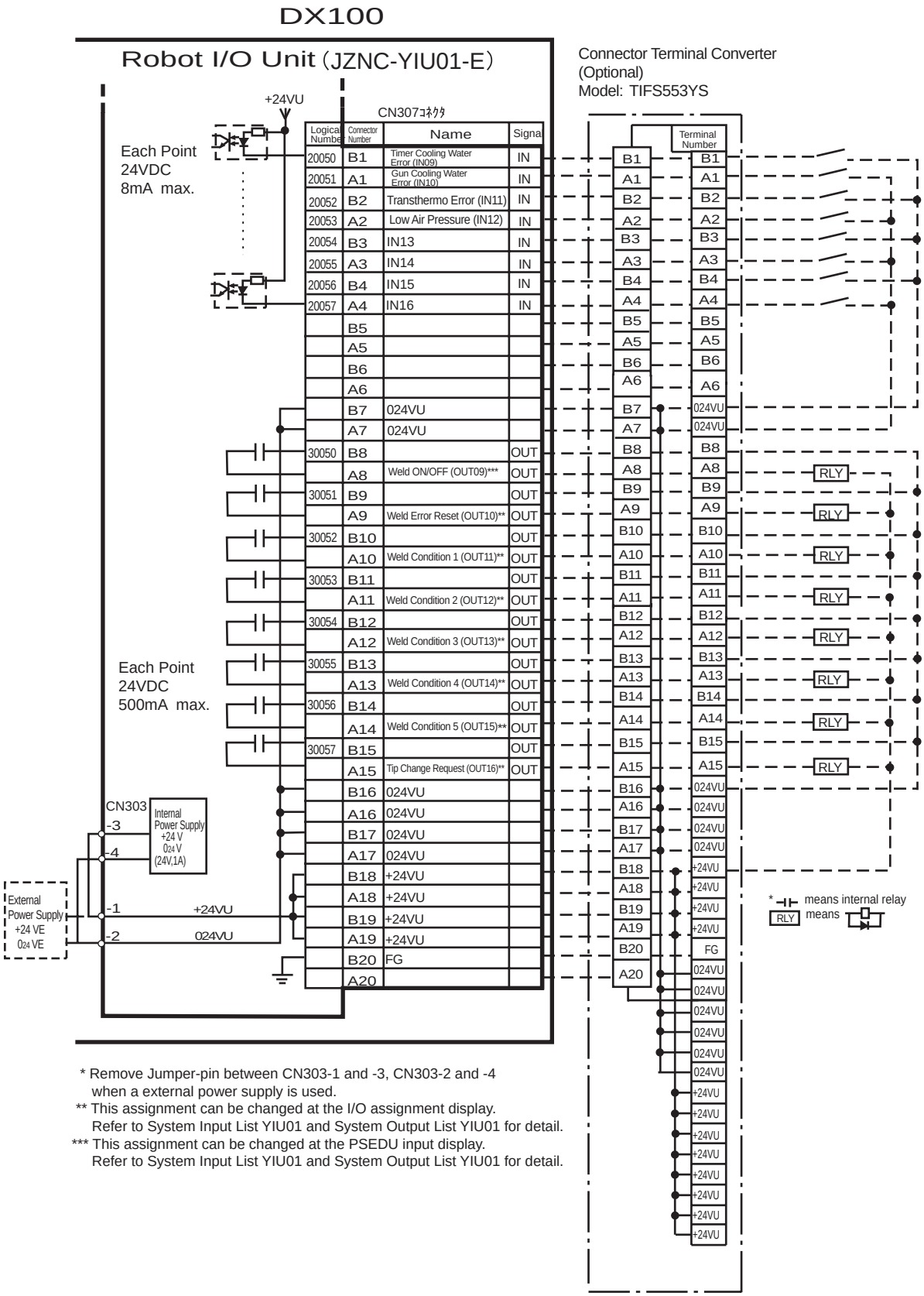


Fig. 13-42: JZNC-YIU01-E (CN307 Connector) I/O Allocation and Connection Diagram (For Spot Welding)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
** This assignment can be changed at the I/O assignment display. Refer to System Input List YIU01 and System Output List YIU01 for detail.
*** This assignment can be changed at the PSEDU input display. Refer to System Input List YIU01 and System Output List YIU01 for detail.

Table 13-12: Specific Input (Spot Welding) (Sheet 1 of 2)

Logical Number	Input Name / Function
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1)]. This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at "REMOTE". Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at "REMOTE". The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
20020	INTERFERENCE 1 ENTRANCE PROHIBITED If the 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.
20021	INTERFERENCE 2 ENTRANCE PROHIBITED 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.
20022	WELDING ON/OFF (From sequencer) This signal inputs the welding ON/OFF selector switch status from the sequencer in the interlock unit. The WELD ON/OFF signal is output to the Power Source according to this signal and the manipulator status.
20023	WELDING PAUSE (From sequencer) 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.
20024	INTERFERENCE 3 ENTRANCE PROHIBITED 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.
20025	INTERFERENCE 4 ENTRANCE PROHIBITED 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.
20050 [3)]	TIMER COOLING WATER ERROR 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.
20051 [3)]	GUN COOLING WATER ERROR 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.

Table 13-12: Specific Input (Spot Welding) (Sheet 2 of 2)

Logical Number	Input Name / Function
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 *chapter 8.6 "Interference Area" at 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.

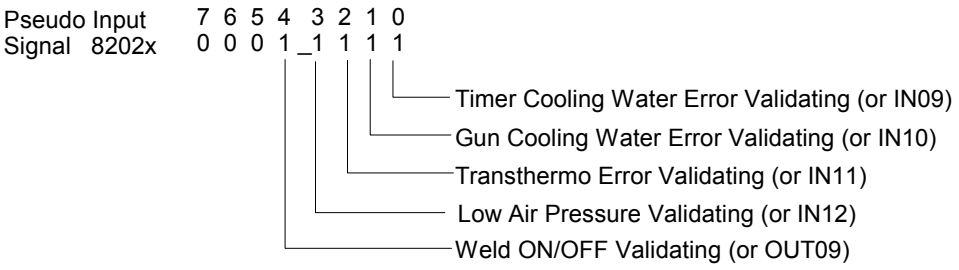


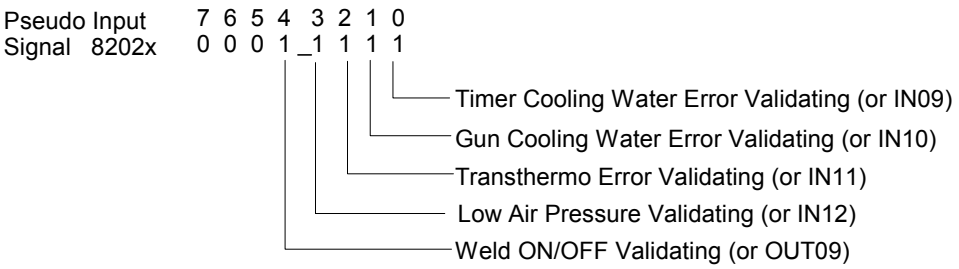
Table 13-13: Specific Output (Spot Welding) (Sheet 1 of 2)

Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX100 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 32)[2)] This signal turns ON when the current TCP lies inside a the work home position area. Use this signal to evaluate whether the robot is in the start position.
30057 [3)]	TIP REPLACE REQUEST This signal is output when the stored number of welding reaches the number of welding set for the tip replacement.
30023	INTERMEDIATE START OK 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.
30024	IN CUBE 3 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other manipulators and positioners.
30025	IN CUBE 4 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other manipulators and positioners.
30050 [3)]	WELD ON/OFF Outputs a signal input from the interlock panel, etc.considering the robot status.

Table 13-13: Specific Output (Spot Welding) (Sheet 2 of 2)

Logical Number	Output Name / Function
30051 [4]	WELD ERROR RESET This signal commands the reset error status of the Power Source. This is operated with the programing pendant operation.
30052 to 30056 [4]	WELD CONDITION (Level signals) 1(1), 2(2), 4(3), 8(4), 16(5), 32(6), 64(7), 128(8) Sets the welding conditions for the Power Source. The output format can be selected as binary or discrete (bit number). It can handle up to 255 conditions. Most-significant bit is the parity bit (when specified).
[4]	WELDING COMMAND 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.
[4]	STROKE CHANGE1 SINGLE SOLENOID DOUBLE SOLENOID This is a signal, when a double stroke gun is used, to change the open stroke of the welding gun.
[4]	GUN PRESS COMMAND This outputs gun press command.

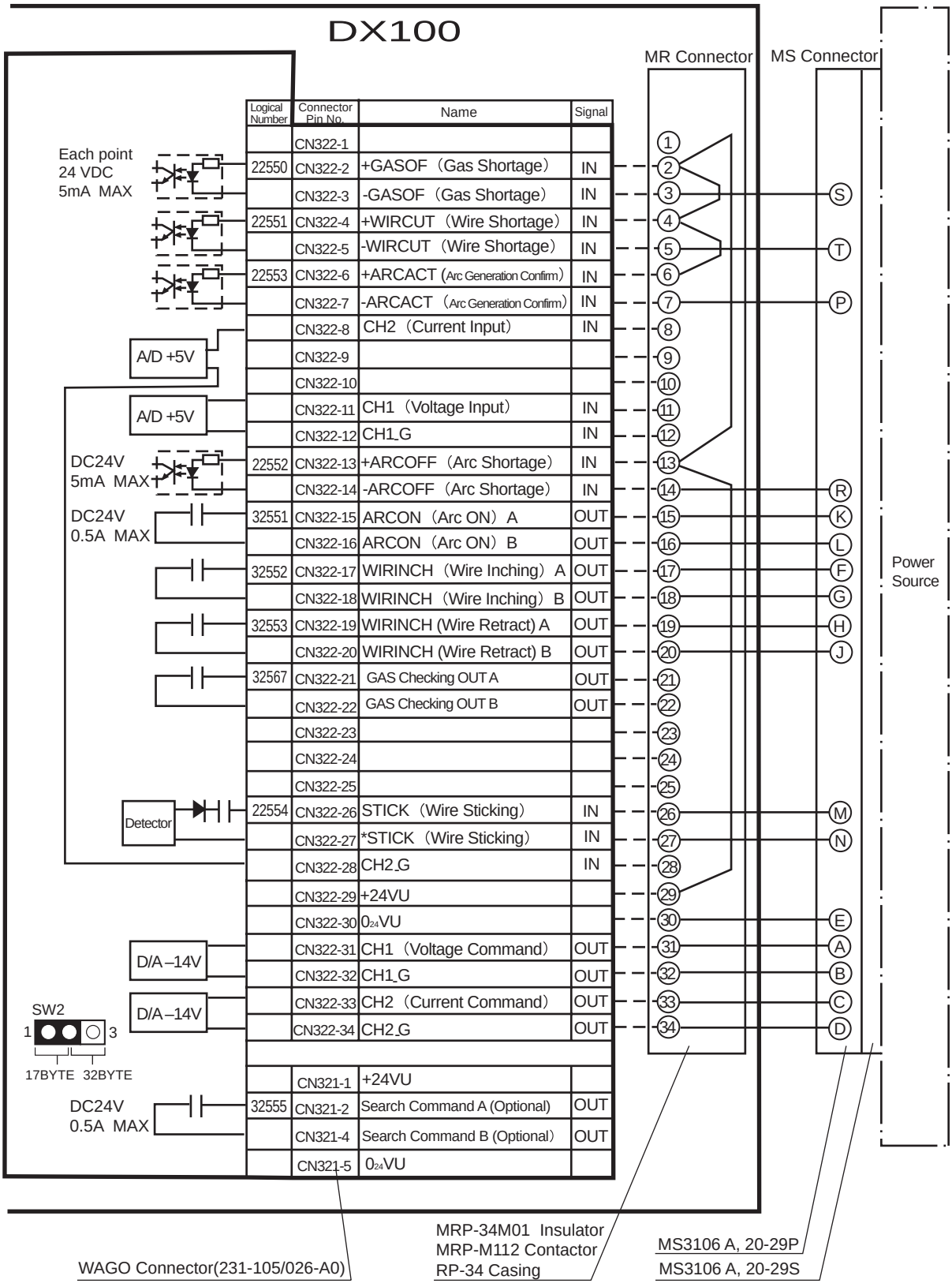
1 This signal is not output during operation.
2 The work home position cube and Cube 32 are same.
3 This signal can be select “USE” or “NOT USE” by pseudo input signal ”8202x”. If “NOT USE” is selected, this signal can be used as the universal I/O signal described in parentheses.
4 This signal can be allocated to any universal I/O signal at the I/O allocation display in operation condition.



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.



Logical Number	Connector Pin No.	Name	Signal	MR	MS
	CN322-1			1	
22550	CN322-2	+GASOF (Gas Shortage)	IN	2	
	CN322-3	-GASOF (Gas Shortage)	IN	3	S
22551	CN322-4	+WIRCUT (Wire Shortage)	IN	4	
	CN322-5	-WIRCUT (Wire Shortage)	IN	5	T
22553	CN322-6	+ARCACT (Arc Generation Confirm)	IN	6	
	CN322-7	-ARCACT (Arc Generation Confirm)	IN	7	P
	CN322-8	CH2 (Current Input)	IN	8	
	CN322-9			9	
	CN322-10			10	
	CN322-11	CH1 (Voltage Input)	IN	11	
	CN322-12	CH1_G	IN	12	
22552	CN322-13	+ARCOFF (Arc Shortage)	IN	13	
	CN322-14	-ARCOFF (Arc Shortage)	IN	14	R
32551	CN322-15	ARCON (Arc ON) A	OUT	15	K
	CN322-16	ARCON (Arc ON) B	OUT	16	L
32552	CN322-17	WIRINCH (Wire Inching) A	OUT	17	F
	CN322-18	WIRINCH (Wire Inching) B	OUT	18	G
32553	CN322-19	WIRINCH (Wire Retract) A	OUT	19	H
	CN322-20	WIRINCH (Wire Retract) B	OUT	20	J
32567	CN322-21	GAS Checking OUT A	OUT	21	
	CN322-22	GAS Checking OUT B	OUT	22	
	CN322-23			23	
	CN322-24			24	
	CN322-25			25	
22554	CN322-26	STICK (Wire Sticking)	IN	26	M
	CN322-27	*STICK (Wire Sticking)	IN	27	N
	CN322-28	CH2_G	IN	28	
	CN322-29	+24VU		29	
	CN322-30	0_{24}VU		30	E
	CN322-31	CH1 (Voltage Command)	OUT	31	A
	CN322-32	CH1_G	OUT	32	B
	CN322-33	CH2 (Current Command)	OUT	33	C
	CN322-34	CH2_G	OUT	34	D
	CN321-1	+24VU			
32555	CN321-2	Search Command A (Optional)	OUT		
	CN321-4	Search Command B (Optional)	OUT		
	CN321-5	0_{24}VU			

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MANUAL NO. RE-CTO-A215 ①

© Printed in Japan April 2009 08-12