

# Motoman NX100 Controller

# **NX100**

# **Controller Manual**

|                   |                  |
|-------------------|------------------|
| Part Number:      | 149201-1         |
| Release Date:     | February 5, 2004 |
| Document Version: | 3                |
| Document Status:  | Final            |



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# NOTES

## Chapter 1

# Introduction

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The Motoman NX100 controller represents state-of-the-art technology in robotics today. The NX100 controller coordinates the operation of the robot with external equipment such as power supply and positioning tables. The NX100 processes input and output signals, maintains variable data, and performs numeric processing to convert to and from different coordinate systems. Furthermore, it provides main logic functions, servo control, program and constant data memory, and power distribution. Please read this manual thoroughly to familiarize yourself with the many aspects of the NX100 controller.

## 1.1 About This Document

This manual provides system information for the NX100 controller and contains the following sections:

### **SECTION 1 - INTRODUCTION**

Provides general information about the structure of this manual, a list of reference documents, and customer service information.

### **SECTION 2 - SAFETY**

This section provides information regarding the safe use and operation of the NX100 controller.

### **SECTION 3 - NX100 CONTROLLER INSTRUCTIONS**

Provides detailed information about the NX100, including installation, wiring, specifications, and maintenance.

## 1.2 Reference to Other Documentation

For additional information refer to the following:

- Manipulator Manual
- Operator's Manual for your application
- Concurrent I/O Manual (P/N )
- Vendor manuals for system components not manufactured by Motoman

## 1.3 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (ES165N, HP6, EA1400N, etc.)
- Application Type (arc welding, spot welding, etc.)
- Robot Serial Number (located on back side of robot arm)
- Robot Sales Order Number (located on back of NX100 controller)

## Chapter 2

# Safety

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### 2.1 Introduction

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**It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.**

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We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06. The address is as follows:

**Robotic Industries Association**

900 Victors Way

P.O. Box 3724

Ann Arbor, Michigan 48106

TEL: (734) 994-6088

FAX: (734) 994-3338

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. **The robot must not be operated by personnel who have not been trained!**

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)

## 2.2 Standard Conventions

This manual includes information essential to the safety of personnel and equipment. As you read through this manual, be alert to the four signal words:

DANGER!

WARNING!

CAUTION!

*NOTE:*

Pay particular attention to the information provided under these headings which are defined below (in descending order of severity).



**DANGER!**

Information appearing under the **DANGER** caption concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.



**WARNING!**

Information appearing under the **WARNING** caption concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.



**CAUTION!**

Information appearing under the **CAUTION** caption concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.



*Note: Information appearing in a Note caption provides additional information which is helpful in understanding the item being explained.*



## 2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06, section 6.13.4 and 6.13.5, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

## 2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety measures are available:

- Safety fences and barriers
- Light curtains
- Door interlocks
- Safety mats
- Floor markings
- Warning lights

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

## 2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

## 2.6 Programming Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Programming tips are as follows:

Any modifications to PART 1 of the NX100 controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!

Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.

Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.

The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place.
- Check the E-STOP button on the teach pendant for proper operation before programming.
- Carry the teach pendant with you when you enter the workcell.
- Be sure that only the person holding the teach pendant enters the workcell.
- Test any new or modified program at low speed for at least one full cycle.

## 2.7 Operation Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Operation tips are as follows:

- Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Ensure that all safeguards are in place.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

## 2.8 Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Maintenance tips are as follows:

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Back up all your programs and jobs onto a floppy disk whenever program changes are made. A backup must always be made before any servicing or changes are made to options, accessories, or equipment to avoid loss of information, programs, or jobs.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Be sure all safeguards are in place.
- Use proper replacement parts.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

# NX100 INSTRUCTIONS

**SUPPLEMENTARY FOR NORTH AMERICAN STANDARD (ANSI/RIA)**

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

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## MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS

NX100 INSTRUCTIONS

NX100 OPERATOR'S MANUAL

NX100 MAINTENANCE MANUAL

The NX100 operator's manuals above correspond to specific usage.  
Be sure to use the appropriate manual.





## CAUTION

- **This manual explains the North American specifications which differ from the standard NX100 specifications.**
- **The items which are not explained in the manual are the same as the standard specifications. Use the standard “NX100 INSTRUCTIONS” with this manual.**



## MANDATORY

- **This manual explains setup, diagnosis, maintenance, hardware and so on of the NX100 system. Read this manual carefully and be sure to understand its contents before handling the NX100.**
- **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.**

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## Notes for Safe Operation

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.



### NOTE

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



## WARNING

- **Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the NX100 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.



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.



Release of Emergency Stop

- **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.

- **Confirm that no persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:**
  - **Turning ON the NX100 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 NX100 and the programming pendant.





## 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 NX100 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 manipulator is the YASKAWA industrial robot product.

The manipulator usually consists of the controller, the programming pendant, and manipulator cable.

In this manual, the equipment is designated as follows.

| Equipment  | Manual Designation  |
|--|---------------------|
| NX100 Controller                                 | NX100               |
| NX100 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 [ ].<br>ex. [ENTER]   |
|                     | Symbol Keys                 | The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture.<br>ex. page key <br><br>The cursor key is an exception, and a picture is not shown. |
|                     | Axis Keys<br>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,<br>ex. [SHIFT]+[COORD]   |
|                     | Displays                    | The menu displayed in the programming pendant is denoted with { }.<br>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.

## Explanation of Warning Labels

The following warning labels are attached to the manipulator and NX100.  
Fully comply with the precautions on the warning labels.

|  |  |  |   |
|--|--|--|---|
|  <span style="font-size: 24px; font-weight: bold;">WARNING</span>   |  |  |   |
| <ul style="list-style-type: none"> <li>• <b>The label described below is attached to the manipulator.</b></li> </ul> <p>Observe the precautions on the warning labels.<br/>Failure to observe this caution may result in injury or damage to equipment.</p>  |  |  |   |
|   | <div style="background-color: #ff9900; color: black; padding: 5px; font-weight: bold;">  <b>WARNING</b> </div> <div style="background-color: black; color: white; padding: 10px; font-weight: bold;">             Moving parts<br/>may cause<br/>injury           </div>  |    | <div style="background-color: #ff9900; color: black; padding: 5px; font-weight: bold;">  <b>WARNING</b> </div> <div style="background-color: black; color: white; padding: 10px; font-weight: bold;">             Do not enter<br/>robot<br/>work area.           </div> |
| <ul style="list-style-type: none"> <li>• <b>The following warning labels are attached to NX100.</b></li> </ul> <p>Observe the precautions on the warning labels.<br/>Failure to observe this warning may result in injury or damage to equipment.</p>  |  |  |   |
| <div style="border: 1px solid black; padding: 5px; width: 100%;"> <div style="display: flex; justify-content: space-between; align-items: center;">  <span style="font-size: 24px; font-weight: bold;">WARNING</span> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: center;">  <div style="font-size: 12px;">             High Voltage<br/>Do not open the door<br/>with power ON.           </div> </div> </div> | <div style="border: 1px solid black; padding: 5px; width: 100%;"> <div style="display: flex; justify-content: space-between; align-items: center;">  <span style="font-size: 24px; font-weight: bold;">WARNING</span> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: center;">  <div style="font-size: 12px;">             High Voltage<br/>Do not ope the cover.           </div> </div> </div> | <div style="border: 1px solid black; padding: 5px; width: 100%;"> <div style="display: flex; justify-content: space-between; align-items: center;">  <span style="font-size: 12px; font-weight: bold;">WARNING</span> </div> <hr/> <div style="text-align: center; padding: 5px;">  </div> <hr/> <div style="font-size: 10px;">             May cause<br/>electric shock.<br/>Ground the earth<br/>terminal based on<br/>local and national<br/>electric code.           </div> </div> |   |
| <p>Refer to the NX100 INSTRUCTIONS for the warning label location.</p>   |  |  |   |

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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 Directive 89/392 Machinery and 91/368 EEC**

- **Prepare**

- SAFETY WORK REGULATIONS**

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

- **Observe the**

- MANIPULATING INDUSTRIAL ROBOTS-SAFETY (ISO 10218)**

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

- **Reinforce the**

- SAFETY MANAGEMENT SYSTEM**

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

- **Teaching and maintaining the robot are specified as "Hazardous Operations" in the Industrial Safety and Health Law**

(Japan only).

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



## 1.2 Special Training

### MANDATORY

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

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

## 1.3 Motoman Manual List

### MANDATORY

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

You should have the four manuals listed below:

- MOTOMAN-□□□ INSTRUCTIONS**
- NX100 INSTRUCTIONS**
- NX100 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", "Warning", 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.**

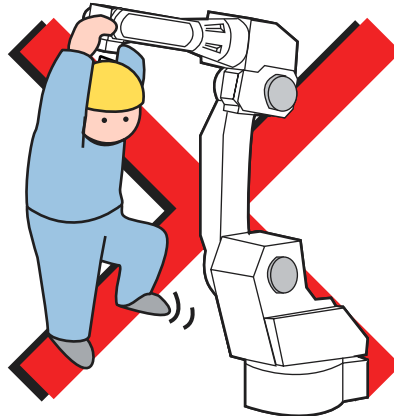
Failure to observe this caution may result in injury due to contact with NX100, controller, the workpiece, the positioner, etc.



## CAUTION

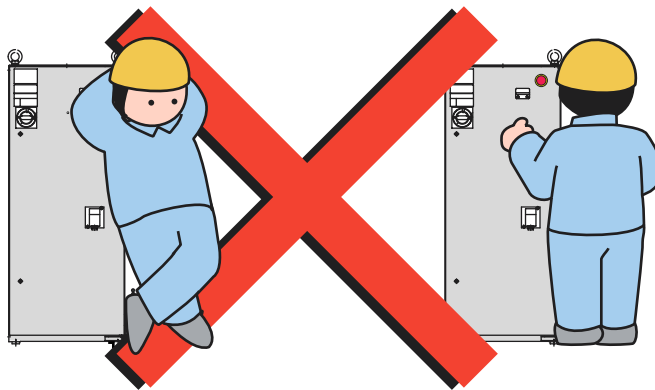
- **Never forcibly move the manipulator axes.**

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



- **Never lean on NX100 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 NX100 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 NX100 Instructions for details on installation and wiring.

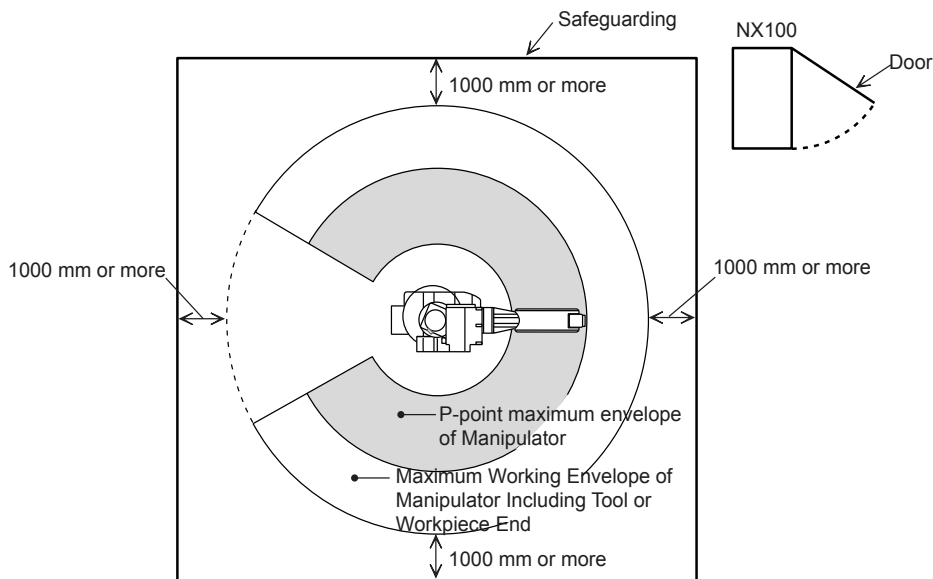
In planning installation, adapt an easy to observe arrangement to ensure safety. Take safety into consideration when planning the installation. Observe the following when installing the manipulator:



#### WARNING

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

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



- **Perform grounding in accordance with all applicable electrical codes.**

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



## CAUTION

- **Operation of the crane, sling, or forklift should only be performed by authorized personnel.**

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

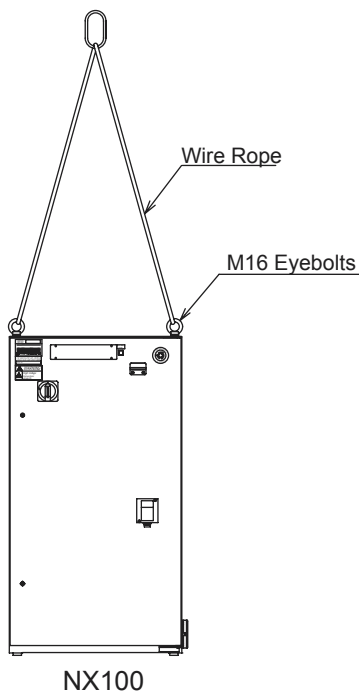
MOTOMAN should be lifted with a crane using wire rope threaded through the shipping bolts and positioners and the body should be lifted in an upright posture as described in the manipulator instruction manual.

Failure to observe these precautions may cause the manipulator to turn downward, potentially causing injury or damage to equipment.

- **When lifting the NX100, please check the following:**

**-As a rule, handling of NX100 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 NX100.**



THE WEIGHT OF NX100(approx.)

| NX100 equivalent model   | Approx. weight (kg) |
|--|---------------------|
| HP3, EA1400N, HP6, HP20, EA1900N, UP20MN, UP50N, ES165N, HP165, ES200N, ES165RN, ES200RN | 250                 |

- **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.**

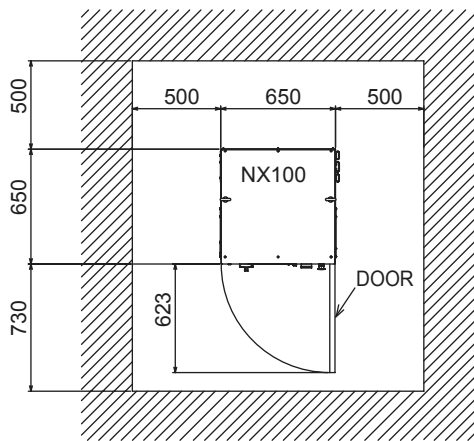
Failure to observe this precaution may result in injury of damage to equipment.



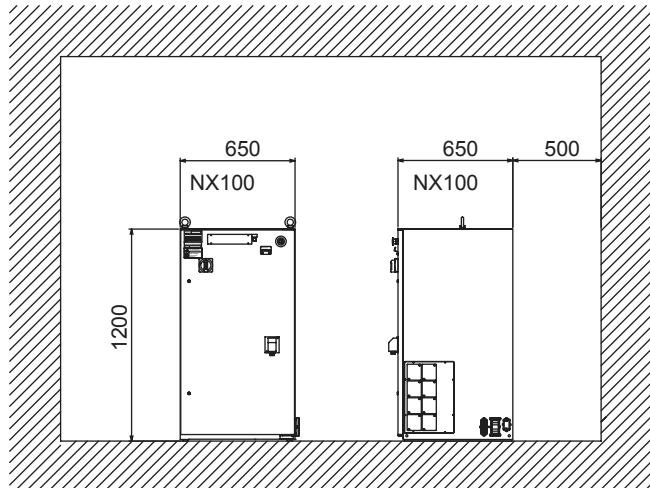
## CAUTION

- **Be sure there is sufficient room for maintenance on the manipulator, NX100, and other peripheral equipment.**

Failure to observe this precaution could result in injury during maintenance.



Securing (mm)



External Dimensions (mm)

- **The manipulator is controlled by the NX100 or the controller for positioner.**

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 NX100 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.**

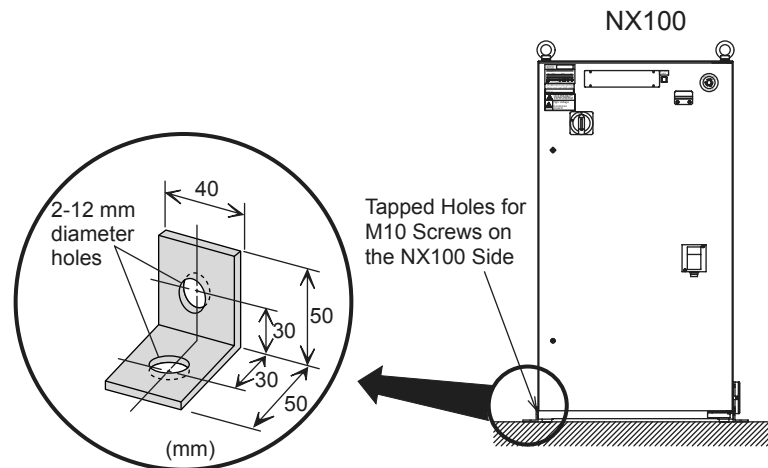
Failure to observe this caution may result in injury or damage to equipment.



## CAUTION

- **Secure the position of the NX100 after setting up.**

Attach the NX100 to the floor or rack, etc., using the screw holes on the bottom of the NX100.



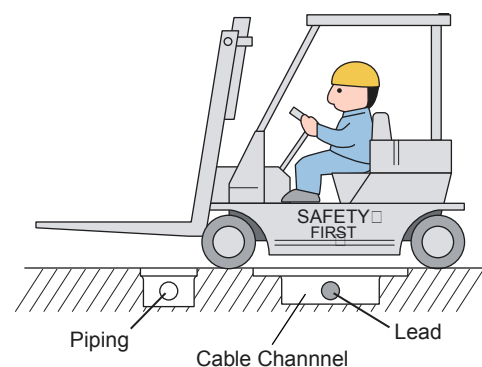
Failure to observe this caution could lead to injury or equipment damage if the NX100 should shift or fall.

- **Be familiar with the connection diagram before wiring the NX100, 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 NX100, 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.



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## 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, NX100, 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.

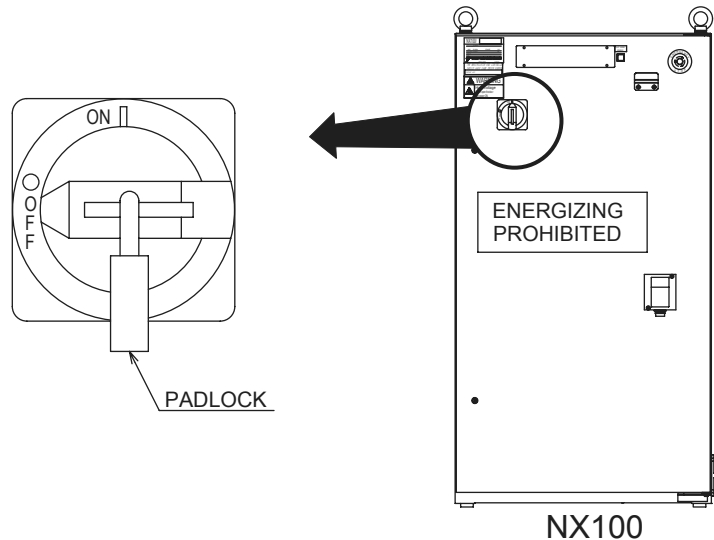


### 1.5.3 Operation Safety



## WARNING

- **When attaching a tool such as the welding torch to the manipulator, be sure the power supply of the NX100 and the tool is off, lock the switch, and display a warning sign.**



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

- **Never exceed the rated capacity of the manipulator (capacity can be found in the specifications section of the manipulator manual).**

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

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

- **Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:**

- **Always view the manipulator from the front.**
- **Always follow the predetermined operating procedure.**
- **Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.**
- **Ensure that you have a place to retreat to in case of emergency.**

Improper or unintentional manipulator operation can result in injury.

 **WARNING**

- **Before operating the manipulator, check that the **SERVO ON** lamp goes out when the emergency stop button on the right of the front door of the **NX100** and the programming pendant 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.

- **Always press Teach Lock before starting to teach.**

Failure to observe this precaution may result in injury due to unauthorized personnel operating the manipulator from the playback panel.

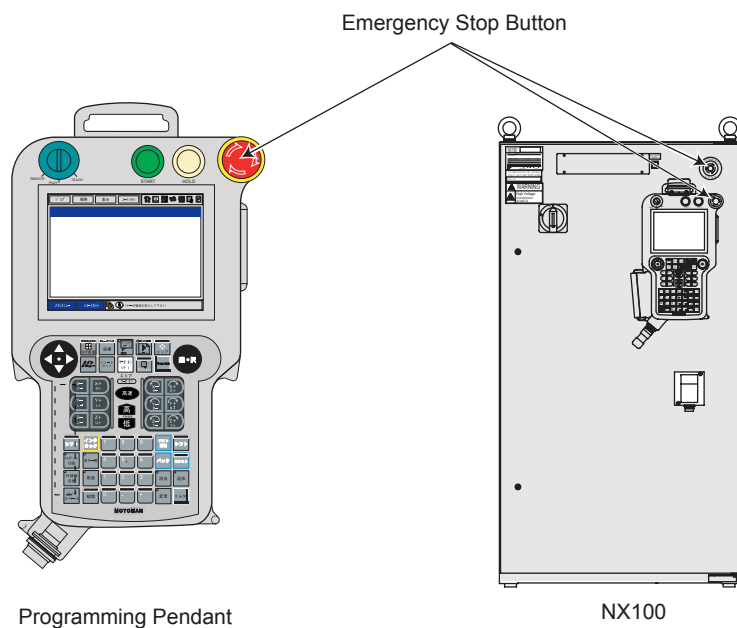
- **Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator when:**

- **Turning ON the NX100 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 NX100 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 NX100 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 the 1.2 Special Training)

## 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 1.3 for a complete list of manuals.**

If any manuals are missing, contact your Yaskawa representative.

- **If the warning labels on the manipulator and NX100 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.



### PROHIBITED

- **Never modify the manipulator or NX100.**

Failure to observe this precaution could result in injury or damage resulting from fire, power failure, or operation error.

## 1.7 Notes on MOTOMAN Disposal



### 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.

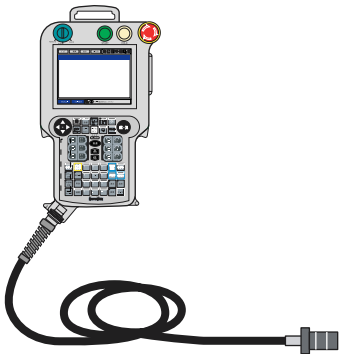
## 2 Product Confirmation

### 2.1 Contents Confirmation

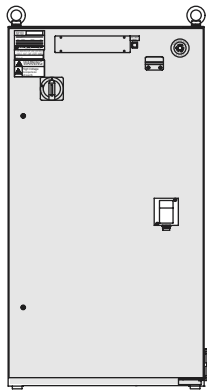
Confirm the contents of the delivery when the product arrives.  
Standard delivery includes the following five items (Information for the content of optional goods is given separately):

- Manipulator
- NX100
- Programming Pendant
- Manipulator Cable (Between Manipulator and NX100)
- Complete Set of Manuals

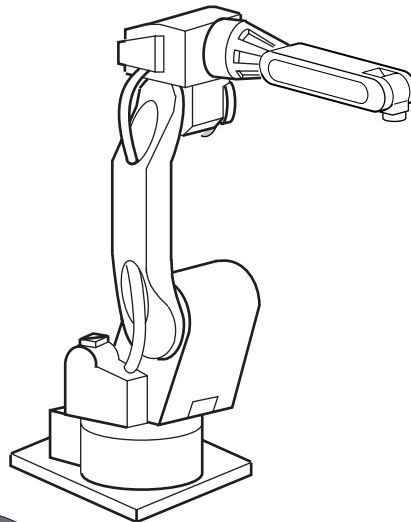
Programming  
Pendant



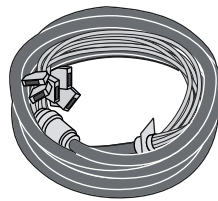
NX100



Manipulator



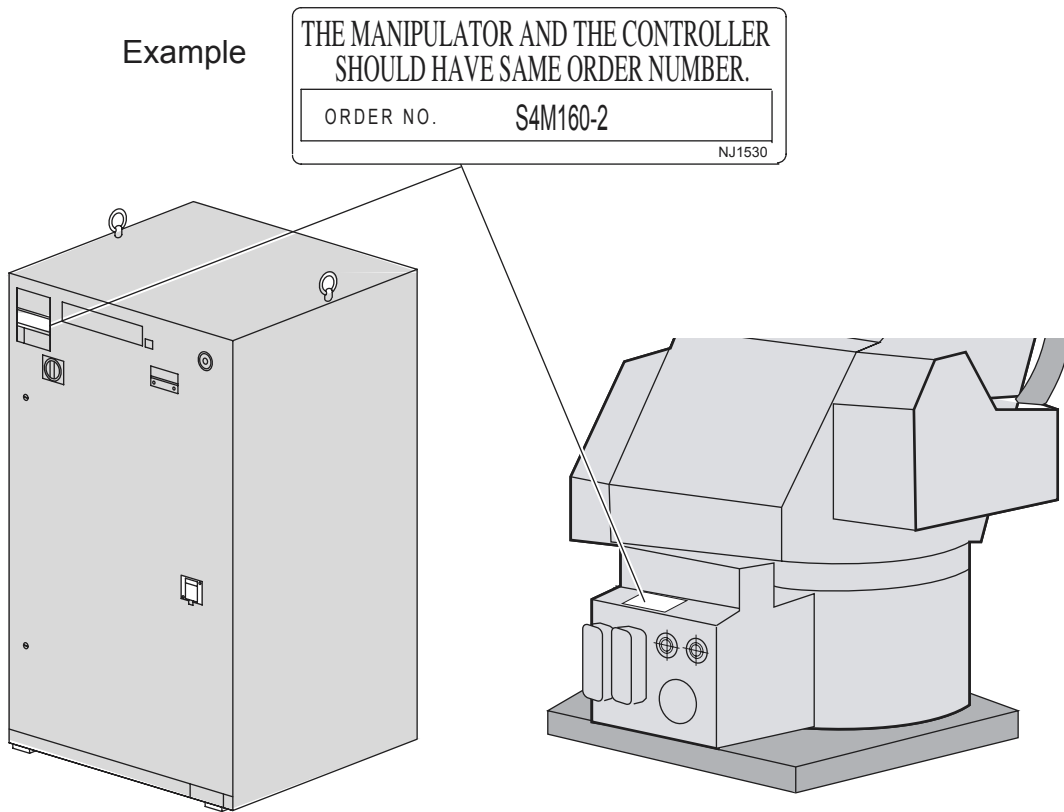
Complete Set of Manuals



Manipulator Cable

## 2.2 Order Number Confirmation

Confirm that the order number pasted on the manipulator and NX100 match.  
The order number plates are affixed to the figure below.



# 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.

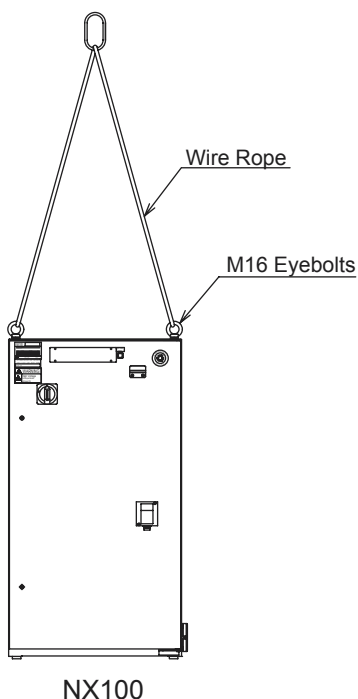
- **Avoid jarring, dropping, or hitting the controller during handling.**

Excessive vibration or impacting the NX100 may adversely affect the performance of the NX100.

### 3.1.1 Using a Crane to Move the Controller

Check the following before handling the NX100:

- 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.



THE WEIGHT OF NX100 (approx)

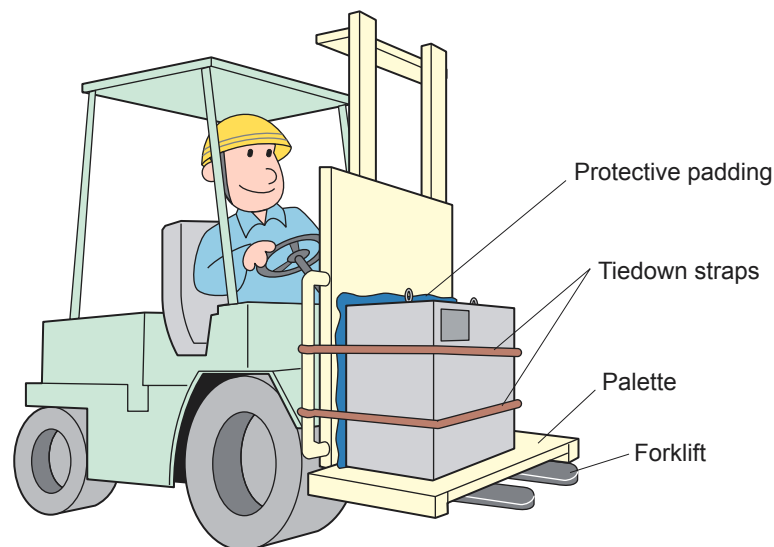
| NX100 equivalent model   | Approx. weight (kg) |
|--|---------------------|
| HP3, EA1400N, HP6, HP20, EA1900N, UP20MN, UP50N, ES165N, HP165, ES200N, ES165RN, ES200RN | 250                 |



### 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 NX100 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.



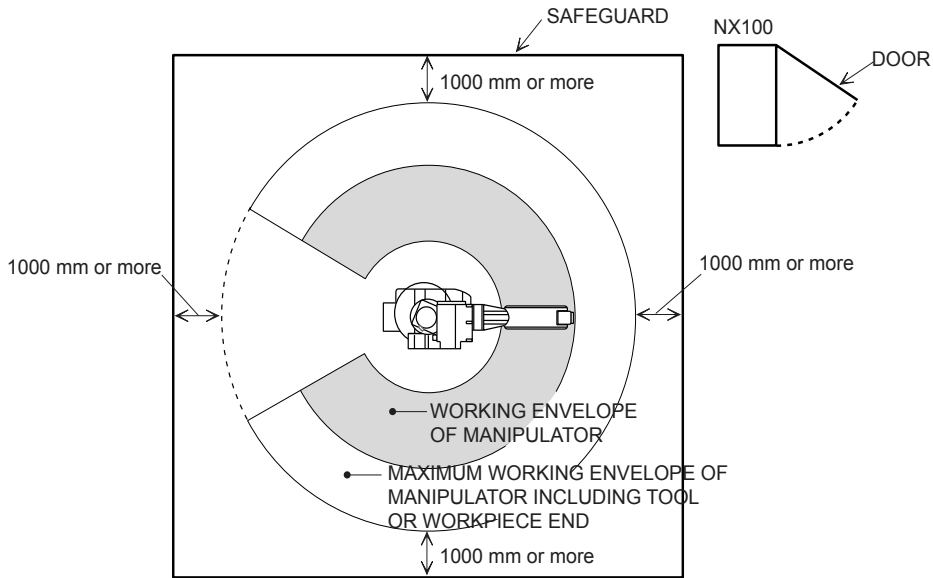
## 3.2 Place of Installation

The conditions listed below must be met before installing the NX100:

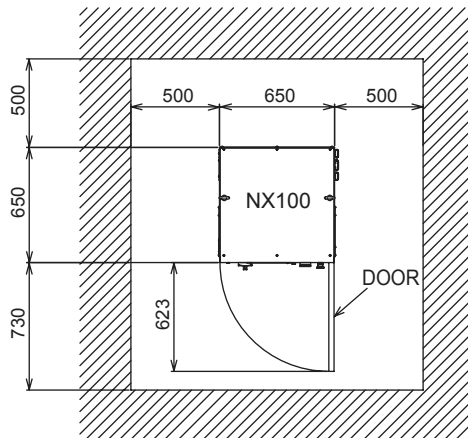
- Ambient temperature must be 0 to 45° C (32 to 113°F) during operation and -10 to 60°C (14 to 140°F) during transportation and maintenance.
- Humidity must be low with no condensation (under 10%RH).
- It must be a place with little dirt, dust, or water.
- No flammable or corrosive liquids or gases, etc. in the area.
- Little jarring or potential for striking of the NX100 (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

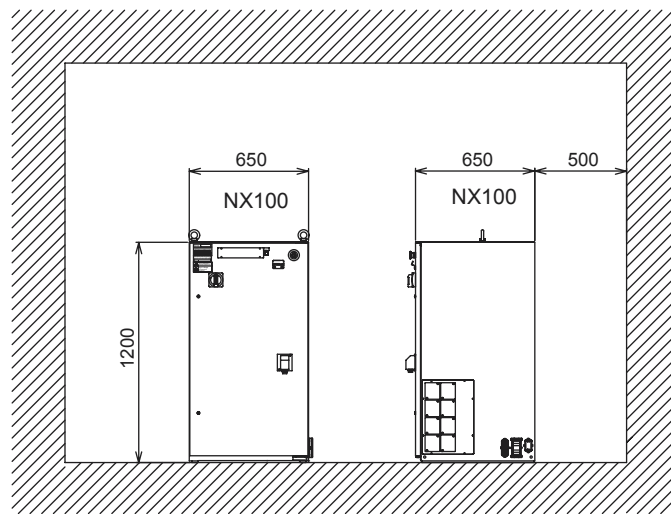
- Install the NX100 outside of the P-point maximum envelope of the manipulator (outside of the safeguarding).



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



- Install the controller at least 500mm from the nearest wall to allow maintenance access. Shows the external dimensions.



## 3.4 Mounting the Controller

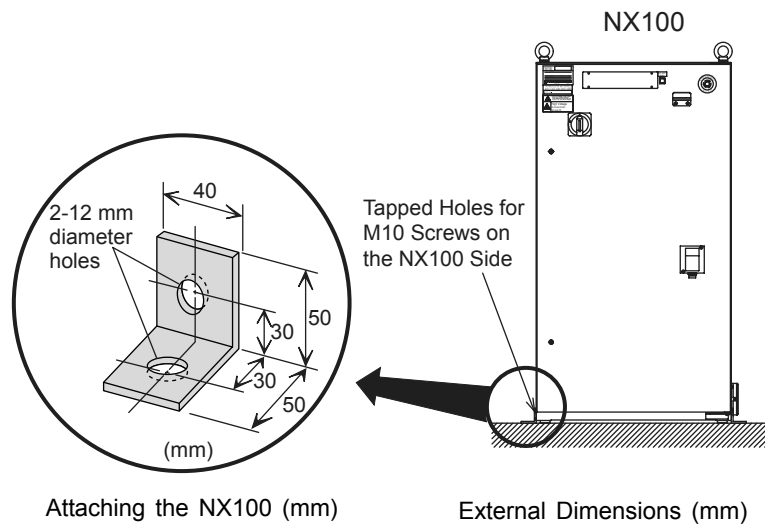


### CAUTION

- **Do not climb on top of the NX100.**

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

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



Refer to the Instruction Manual for information on 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 grounding the system, turn off the power supply and lock the main power switch.**

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 NX100 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.

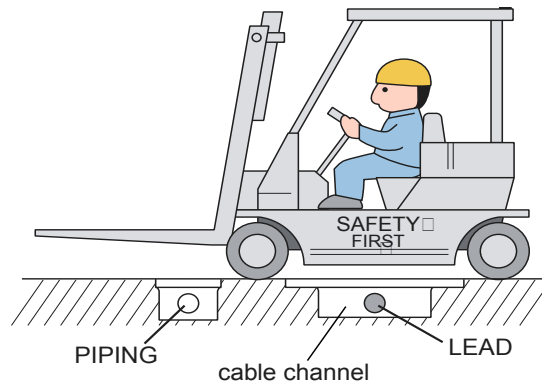
- **Do not handle the circuit board directly by hand.**

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 NX100. Another connects the NX100 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.



NX100 Cable Junction Diagram

## 4.2 Power Supply

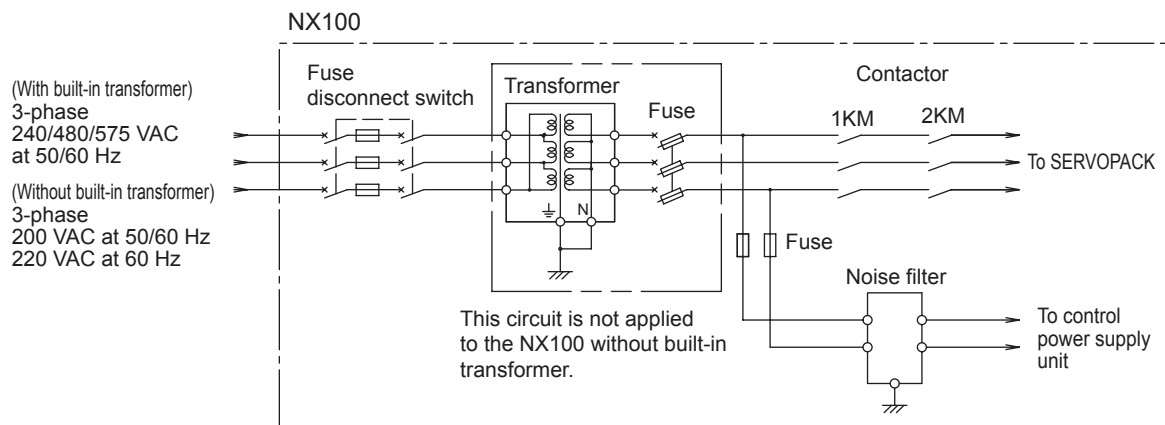
### 4.2.1 Three-Phase Power Supply

The three-phase power supply consists as follows:

- With built-in transformer: 240/480/575 VAC at 50/60 Hz
- Without built-in transformer: 200 VAC at 50/60 Hz and 220 VAC at 60 Hz

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

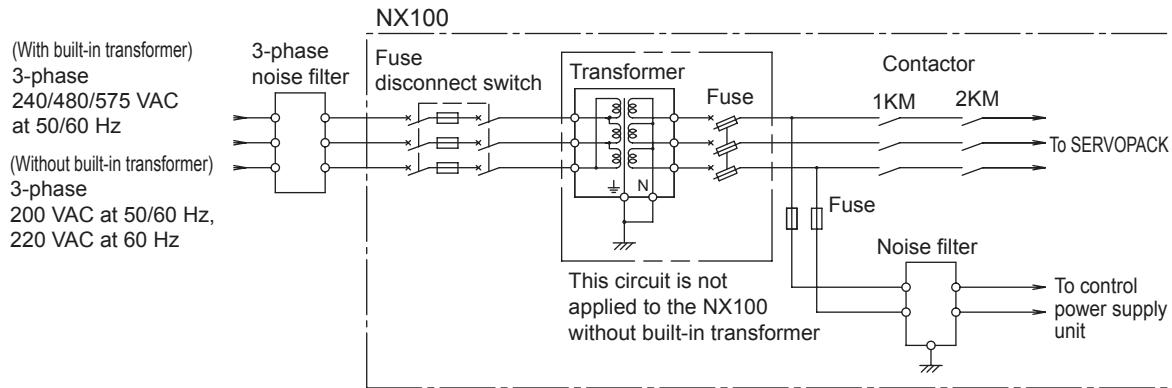
Connect the power supply to a stable power source that is not prone to power fluctuations.



Connection of Input Power Supply

### 4.2.2 Noise Filter Installation

Insert the three-phase noise filter into the primary station of the fuse disconnect switch if you hear noise coming from the power source.  
Seal up each cable opening so that dust does not enter.



Connection of 3-phase Noise Filter

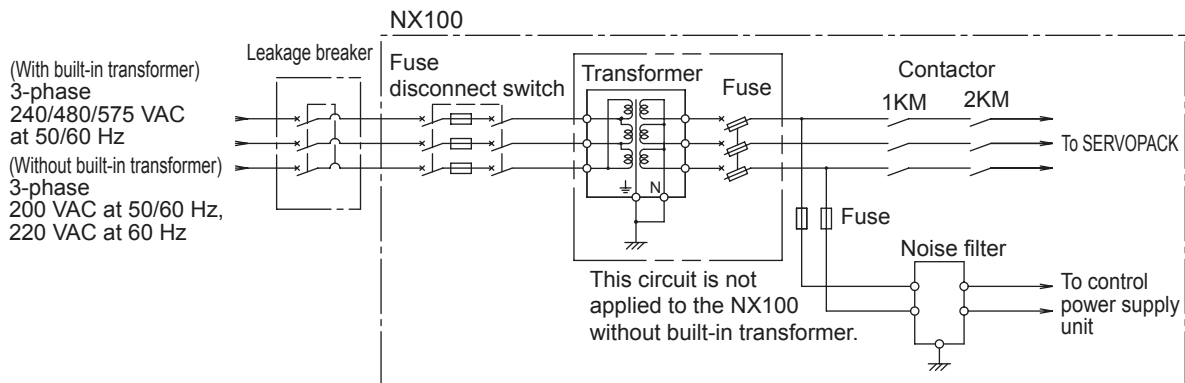
### 4.2.3 Leakage Breaker Installation

When connecting the leakage breaker to the controller power supply wiring, use a leakage breaker which can handle high frequencies from the NX100 inverter. Leakage breakers which cannot handle high frequencies may malfunction.  
For the leakage breakers, select UL-approved products.

Example of High Frequency Leakage Breakers

| Maker                         | Model                        |
|-------------------------------|------------------------------|
| Mitsubishi Electric Co., Ltd. | NV-L series (UL/CE approved) |

Even with a leakage breaker installed, there is still a possibility of some high frequency current leakage from the NX100 inverter. But, this current leakage presents no safety risks.

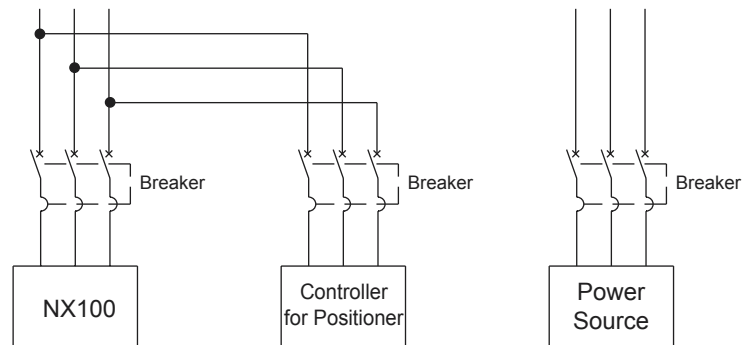


Connection of Leakage Breaker



## 4.2.4 Primary Power Supply Switch Installation

Install the primary power supply switch as shown.



Installation of the Primary Power Supply Switch

NX100 Power Capacities and Cable Sizes

| Manipulator              | Power capacity (kVA) | Cable size (size of terminal)<br>(In case of Cabtyre cable (three wicks)) AWG |
|--------------------------|----------------------|---|
| HP3                      | 1                    | 12 (M5)   |
| HP6, EA1400N             | 1.5                  | 12 (M5)   |
| HP20, EA1900N            | 2.8                  | 12 (M5)   |
| UP50N, UP20MN            | 5                    | 10 (M5)   |
| HP165, ES165N,<br>ES200N | 7.5                  | 10 (M5)   |
| ES165RN,<br>ES200RN      | 8.5                  | 10 (M5)   |

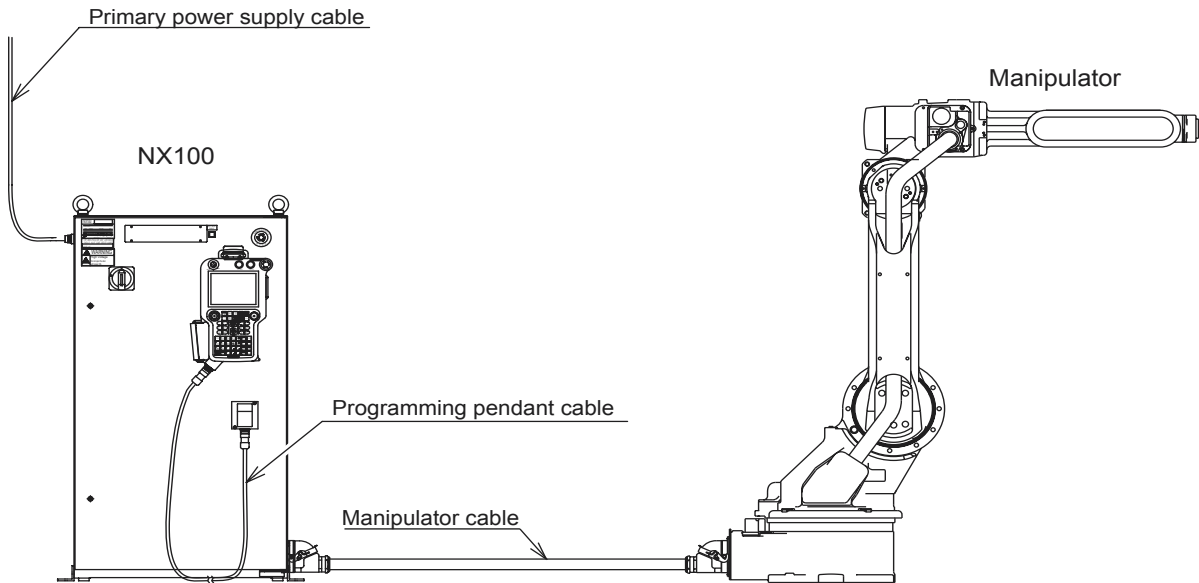
Select and utilize the breaker with appropriate breaking capacity in consideration of the NX100 power capacity for the manipulator to be used.

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.

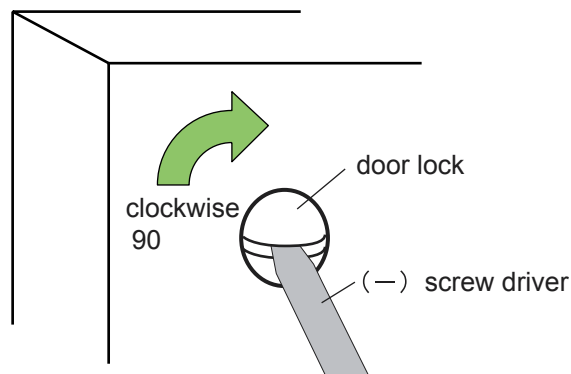
## 4.3 Connection Methods

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



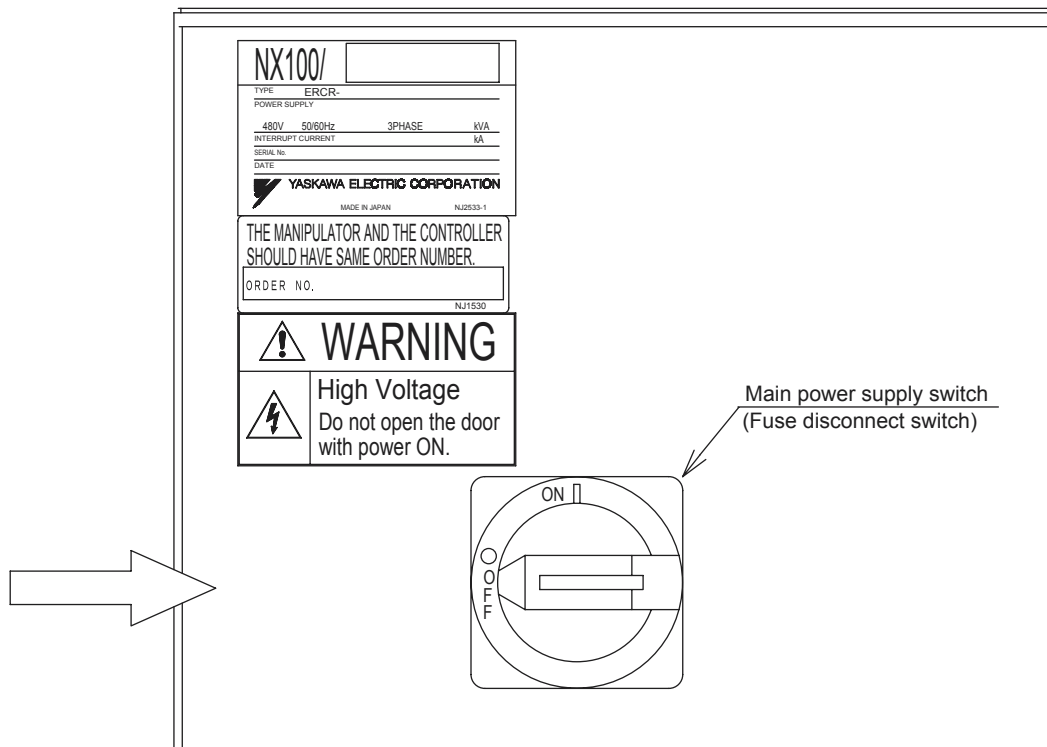
### 4.3.1 Connecting the Primary Power Supply

1. Open the front door of the NX100.
  - (1) Insert the door lock in the door lock on the front of NX100 (two places), and rotate it 90 degrees clockwise.



Rotating the Door Lock Clockwise.

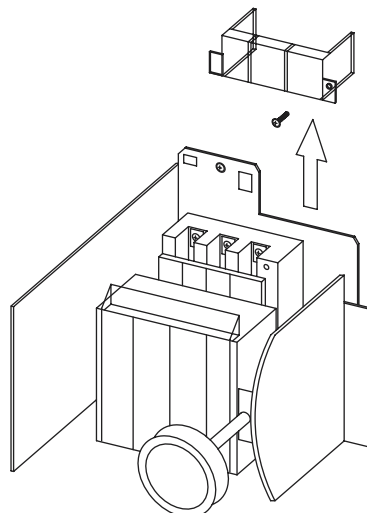
- (2) Rotate the main power supply switch to the "OFF" position and open the door gently.



Rotating the main power supply switch to the OFF position.

2. Confirm that the primary power supply is OFF.
3. Make a hole in the plate and run the primary power supply cable through it. It is located on the top or on the left side of the NX100.  
Attach the plate and cable firmly so that it won't shift or slide out of place.

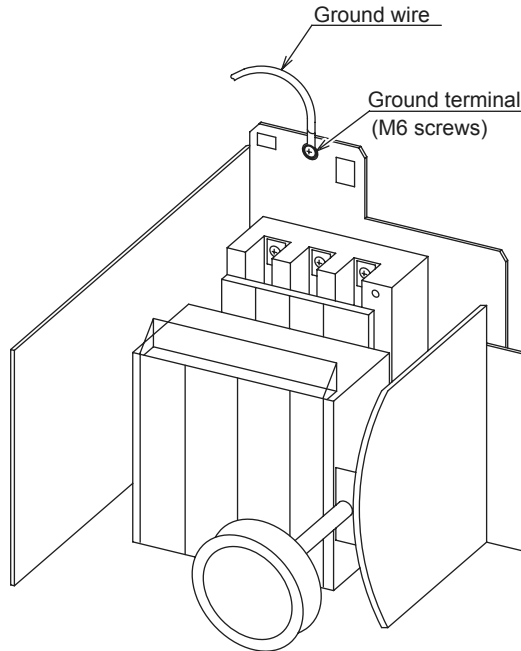
- (1) Remove the primary cover screw of the fuse disconnect switch which is on the upper left side of the NX100, and pull out the cover upward.



Pulling Out the Cover

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

- 1) Connect the ground wire to the ground terminal (screw) of the fuse disconnect switch which is on the upper left side of NX100 .

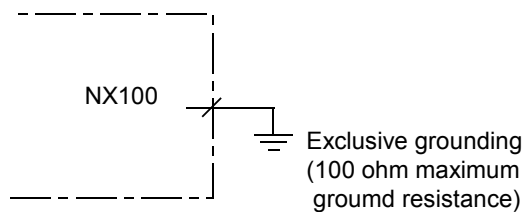


Connection of the Ground Wire

- 2) Perform grounding in accordance with all relevant local and national electrical codes. Grounding wire must be AWG 8.0 or larger.

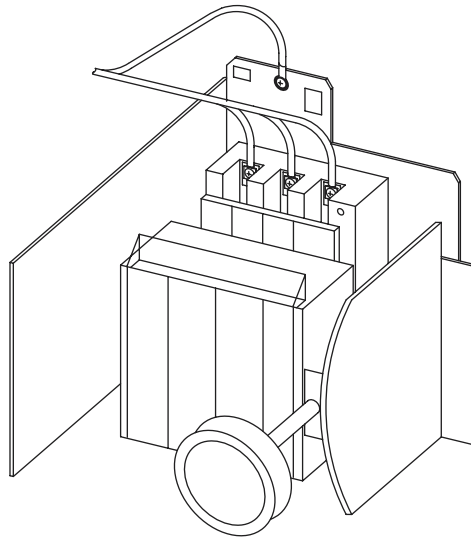


The customer must prepare the ground wire.



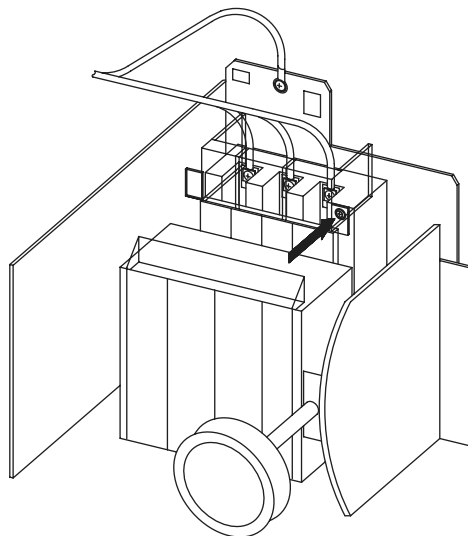
- Don't connect the grounding wire with the wires for the electric power source, the welder, etc.
- Ground in accordance with all relevant governmental regulations when using metallic ducts, metallic conduits, and cable tray to construct the cable.

(3) Connect the primary power supply cable.



Connection of the Primary Power Supply Cable

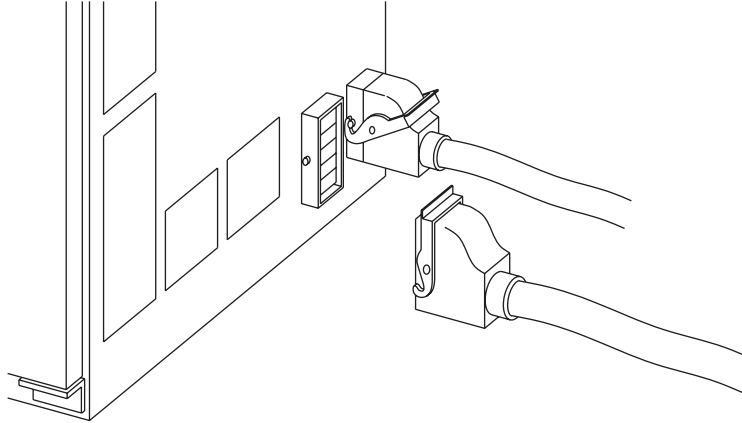
(4) Install the cover and tighten the cover screws.



Install the Cover

## 4.3.2 Connecting the Manipulator Cable

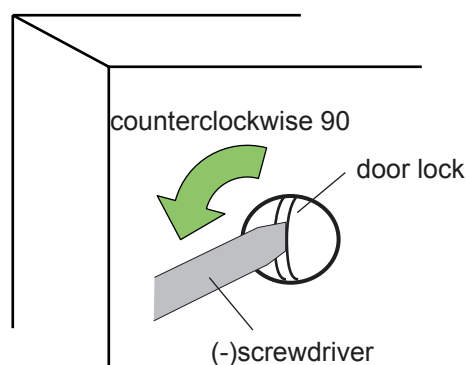
1. Remove the package, and take out the manipulator cable. Connect the cable to the connectors on each side of NX100.



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 NX100 model.

2. Connect the manipulator to the NX100.  
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 NX100 door.
  - (1) Close the door gently.
  - (2) Rotate the door lock counterclockwise 90 degrees.

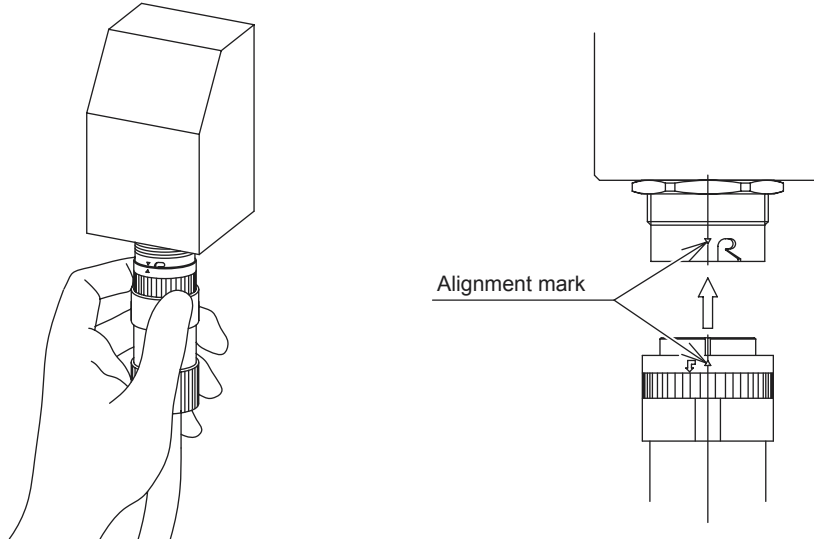


Rotating the Door Lock Counterclockwise

**NOTE** Close the door of the controller (NX100) securely to prevent dust from entering.

### 4.3.3 Connecting the Programming Pendant

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



Connecting the Programming Pendant

The manipulator, NX100, and the programming pendant connections are now complete.

# 5 Turning ON and OFF the Power Supply



## WARNING

- **Confirm that nobody is present in the P-point maximum envelope of the manipulator when turning on NX100 power supply.**

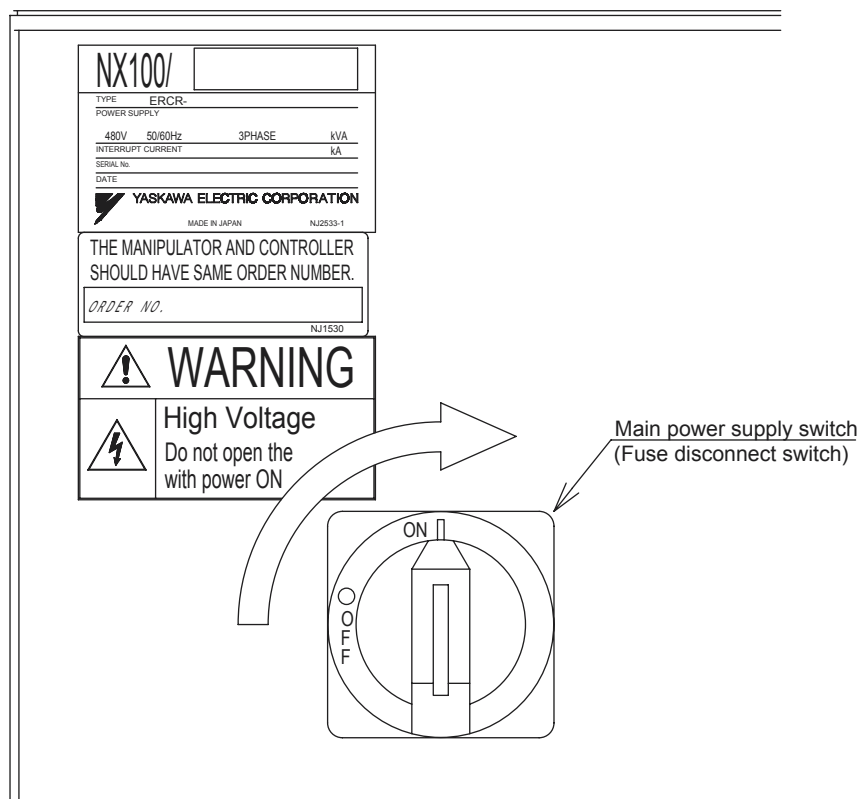
Failure to observe this caution could result in injury caused by accidental contact with the manipulator.

Push the emergency stop button immediately if any problems occur.

The emergency stop button is located in the upper left of the door on the NX100 and on the right side of the programming pendant.

## 5.1 Turning ON the Main Power Supply

The main power supply is turned ON when the main power supply switch on the front of the NX100 is turned to the "ON" position, and the initial diagnosis and the current position begin.

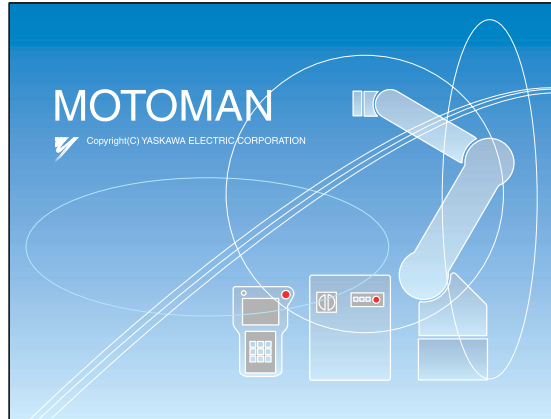


Turning ON the Main Power Supply



## 5.1.1 Initial Diagnosis

The initial diagnosis are performed in the NX100 when main power is turned on, and the startup window is shown on the programming pendant screen.

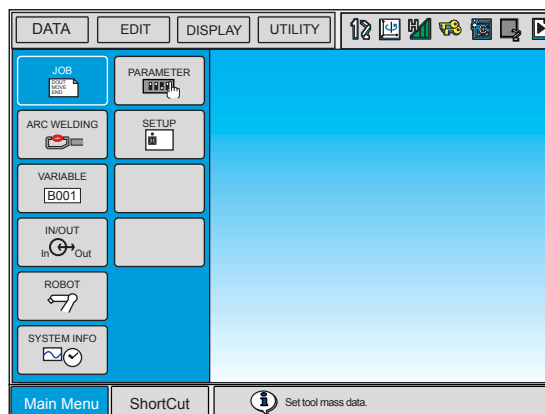


Startup Window

## 5.1.2 When Initial Diagnosis are Complete

When the power supply is turned off, the NX100 saves all condition data, including:

- Mode of operation
- Called job (active job if the NX100 is in the play mode; edit job if the NX100 is in the teach mode) and the cursor position in the job.



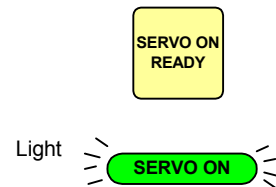
Initial Window

## 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.

1. 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.

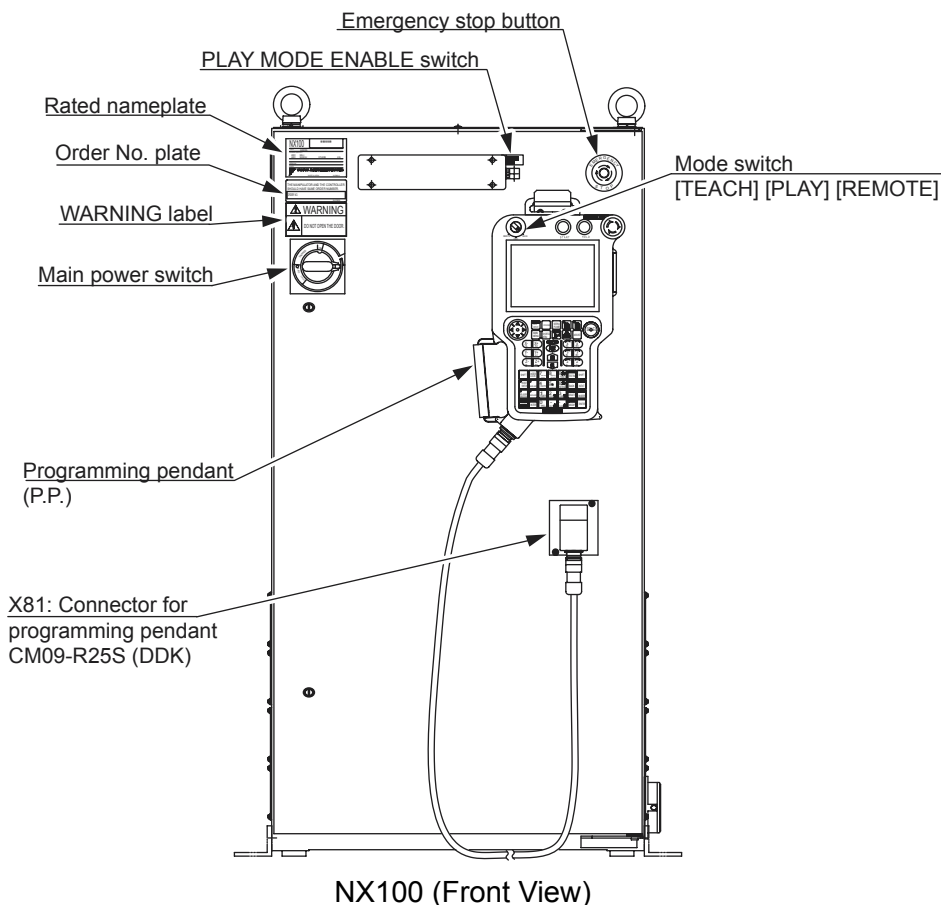


### 5.2.2 Play Mode Enable

#### ■ Play Mode Enable




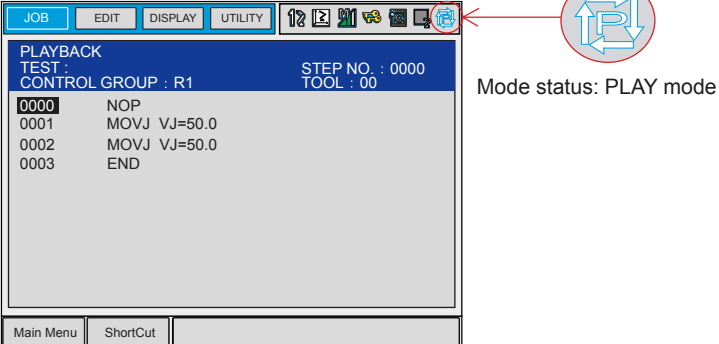
The Play Mode Enable is the interlock function which allows the change of operation mode to Play mode.

The operation mode can be changed to PLAY mode by setting the mode switch on the programming pendant to [PLAY], and pressing [PLAY MODE ENABLE] switch on the NX100. For the location of [PLAY MODE ENABLE] switch, refer to the following figure "NX100 (Front View)".



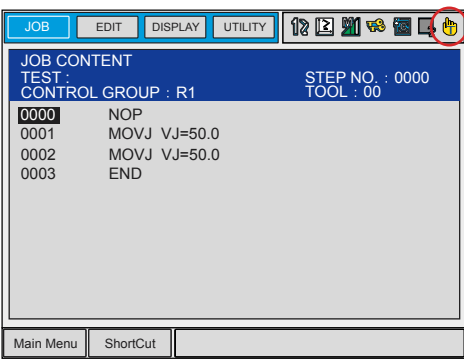


■ Procedures for Operation Mode Change

**Change of Operation Mode to PLAY Mode**

|   | Operation   | Explanation  |
|---|---|--|
| 1 | Set the mode switch on P.P. to [PLAY].<br><br> | The message "Push PLAY MODE ENABLE." is shown on the message window located bottom right of P.P. screen.   |
| 2 | Press [PLAY MODE ENABLE] switch.<br><br>       | The [PLAY MODE ENABLE] switch  lights up and the operation mode is changed to PLAY mode. The mode status icon located up right of the programming pendant screen changes to PLAY mode icon as shown below.<br><br> |

**Change of Operation Mode to TEACH Mode**

|   | Operation  | Explanation  |
|---|--|--|
| 1 | <p>Set the mode switch on P.P. to [TEACH].</p>  | <p>The [PLAY MODE ENABLE] switch  is turned off and the operation mode is changed to TEACH mode. The mode status icon located up right of the programming pendant screen changes to TEACH mode icon as shown below.</p>  <p>Mode status: TEACH mode</p> |

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

### 5.2.3 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.

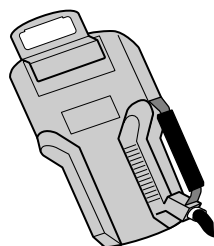


2. The servo power is turned on and [SERVO ON] lamp on the programming pendant lights when the operator grips the Enable switch.

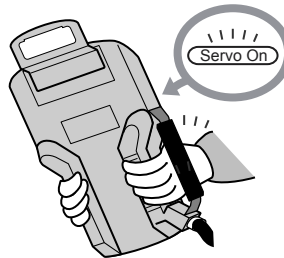


#### Servo Power ON/OFF --- Enable Switch

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.



Release -> OFF



Squeeze -> ON



Squeeze Tightly -> OFF



When performing emergency stop on the front door of the NX100, 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.

Turning the Servo Power Off

- Pressing the emergency stop button on either the programming pendant or the door side of the NX100 will turn off servo power. The emergency stop buttons are located on the right of the front door of the NX100 and 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 time. (Teach mode, Play mode, Remote mode)



Programming Pendant

EMARGENCY STOP

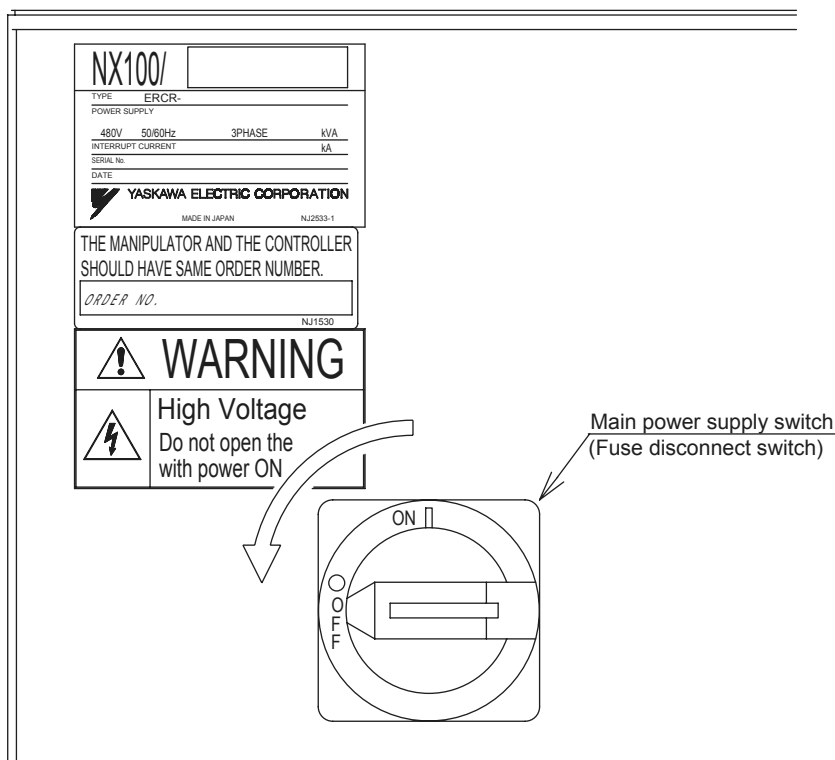


Door upper side

### 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 NX100 is turned to the “OFF” position, the main power is turned off.



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## 6 NX100 Specification

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### 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 NX100 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 NX100 and the programming pendant.

- **Before starting teaching, check that [PLAY MODE ENABLE] switch turns OFF, and always set the teach lock.**
- **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 NX100 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 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)<br>-10°C to + 60°C (During transit and storage)   |
| Relative Humidity             | 10% to 90%RH (non-condensing)  |
| Power Supply                  | 3-phase, 240/480/575 VAC (+10% to -15%) at 50/60 Hz (±2%) (Built-in transformer tap switchable)<br><br>Built-in transformer 240 V -480 V -575 V/208 V (Δ-λ)<br>Switch built-in transformer tap according to the supplied voltage on customer side. (480 VAC is set before shipment.)<br><br>For NX100 without step-down transformer:<br>3-phase, 200 VAC(+10% to -15%) at 50/60 Hz<br>220 VAC(+10% to -15%) at 60 Hz |
| Grounding                     | Grounding resistance : 100Ω or less<br>Exclusive grounding   |
| Digital I/O                   | Specific signal (hardware) 17 inputs and 3 outputs<br>General signals (standard, max.) 40 inputs and 40 outputs  |
| Positioning System            | By serial communication (absolute encoder)   |
| Drive Unit                    | SERVOPACK for AC servomotors   |
| Acceleration/<br>Deceleration | Software servo control   |
| Memory Capacity               | 60000 steps, 10000 manipulator instructions (including steps)  |

### External Dimensions

|                                  |  |
|----------------------------------|--|
| Small, Medium and Large capacity | HP3, HP6, EA1400N, HP20, EA1900N, UP20MN, UP50N, ES165N, HP165, ES200N, ES165RN, ES200RN<br><br>650(W) × 1200(H) × 650(D) mm |
|----------------------------------|--|

## 6.2 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, Screen reservation function  |
|                               | Interface                       | CF (Compact Flash) card slot (At Programming Pendant)<br>RS232C (At Control Circuit Board)<br>LAN (100 BASE-TX/10BASE-T) (At Control Circuit Board) (Option) |
|                               | Application                     | Arc welding, Spot welding, Handling, General, Others   |
| Safety Feature                | Essential Measures              | Designed in accordance with UL, ANSI/RIA 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 Disconnect switch 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 and 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   |

## 6.3 Programming Pendant

|                 |  |
|-----------------|--|
| Material        | Reinforced thermoplastic enclosure with a detachable suspending strap            |
| Dimensions      | 199(W) × 338(H) × 60(D) mm   |
| Displayed Units | TFT Color liquid crystal display, 6.5 inch, VGA (640 × 480)                      |
|                 | Touch panel  |
| Operated Units  | 3 position enable switch, Start switch, Hold switch, Mode select switch (3 mode) |
| Others          | Provided with CF (Compact Flash) card slot                                       |

## 6.4 Equipment Configuration

The NX100 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 NX100 equipment.

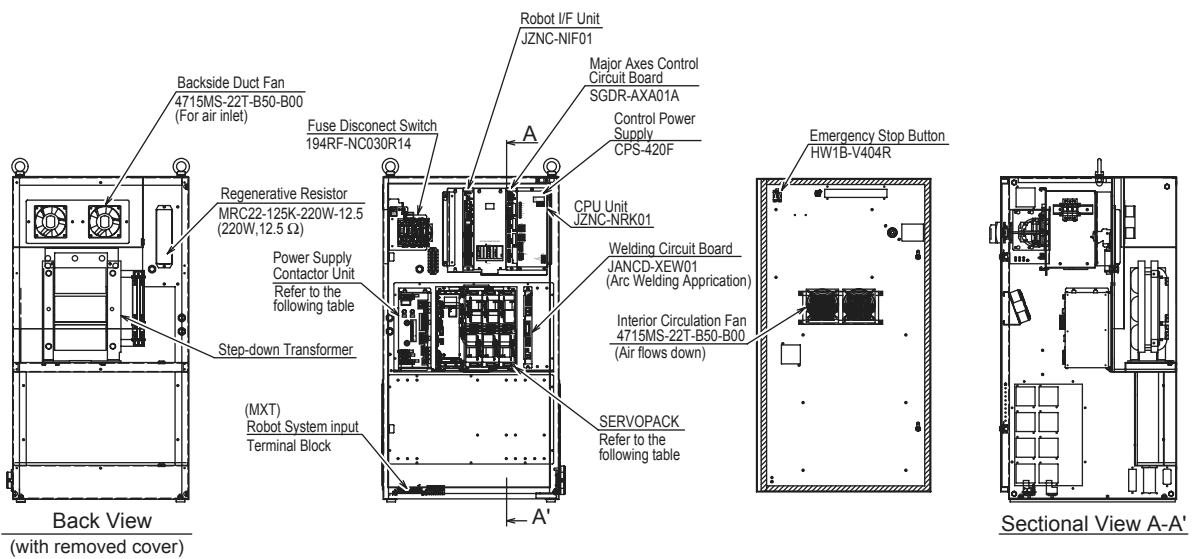
### 6.4.1 Arrangement of Units and Circuit Boards

#### ■ Configuration

The arrangements of units and circuit boards in small-capacity, medium-capacity, and large-capacity NX100s are shown.

#### Small Capacity

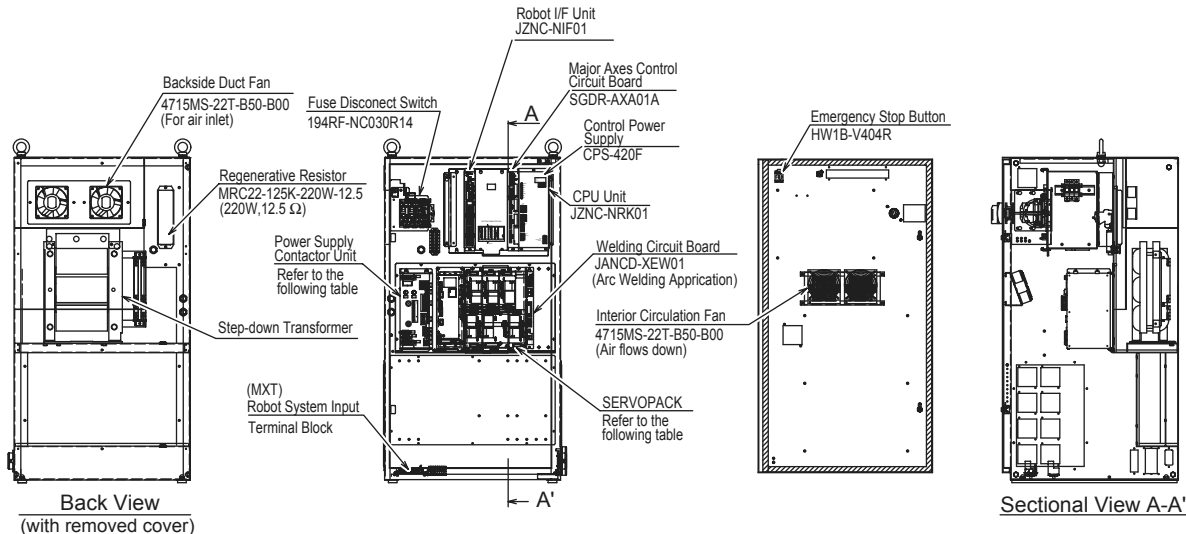
#### SERVOPACK Fuse Disconnect Switch Power Supply Contact Unit



| Model Type  | NX100             | SERVOPACK (Converter Intergrated) | Fuse (Disconnect Switch) | Power Supply Contactor Unit |
|-------------|-------------------|-----------------------------------|--------------------------|-----------------------------|
| HP3         | ERCR-HP3-AB00     | SGDR-EA1400NY26                   | ATDR5 3A *               | JZRRCR-NTU01-2              |
| EA1400N HP6 | ERCR-EA1400N-AB00 | SGDR-EA1400N                      | ATDR5 5A *               | JZRRCR-NTU01-2              |

\* 3-phase 480 AVC, with built-in transformer

Configuration 1 for Small-Capacity NX100

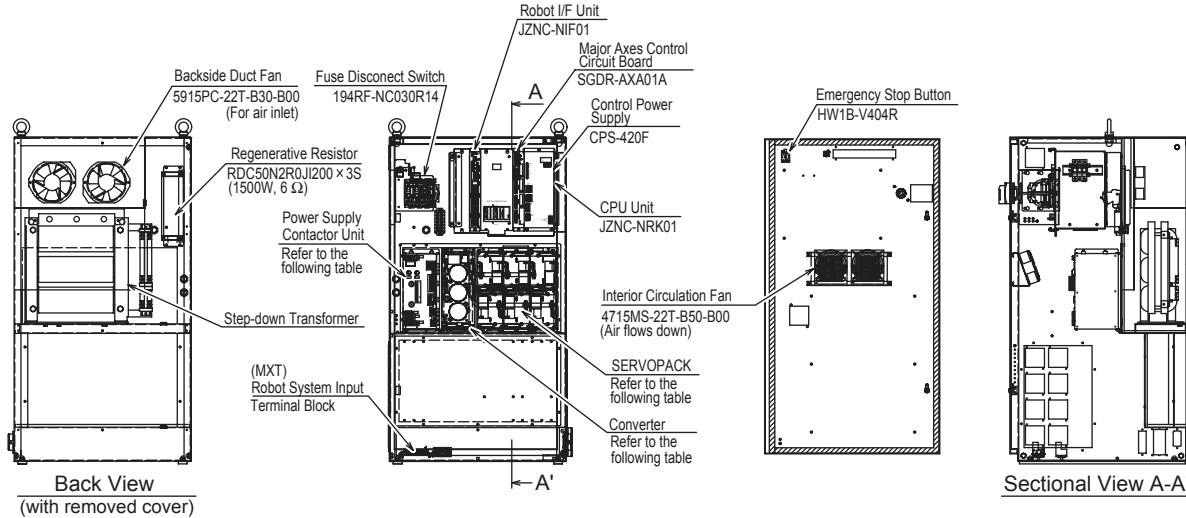


| Model Type   | NX100          | SERVOPACK    | Converter       | Fuse (Disconnect Switch) | Power Supply Contactor Unit |
|--------------|----------------|--------------|-----------------|--------------------------|-----------------------------|
| HP20 EA1900N | ERCR-HP20-AB00 | SGDR-HP20Y30 | SGDR-COA080A01B | ATDR10 10A *             | JZRCR-NTU01-2               |

\* 3-phase 480 AVC, with built-in transformer

Configuration 2 for Small-Capacity NX100

Medium and Large Capacity

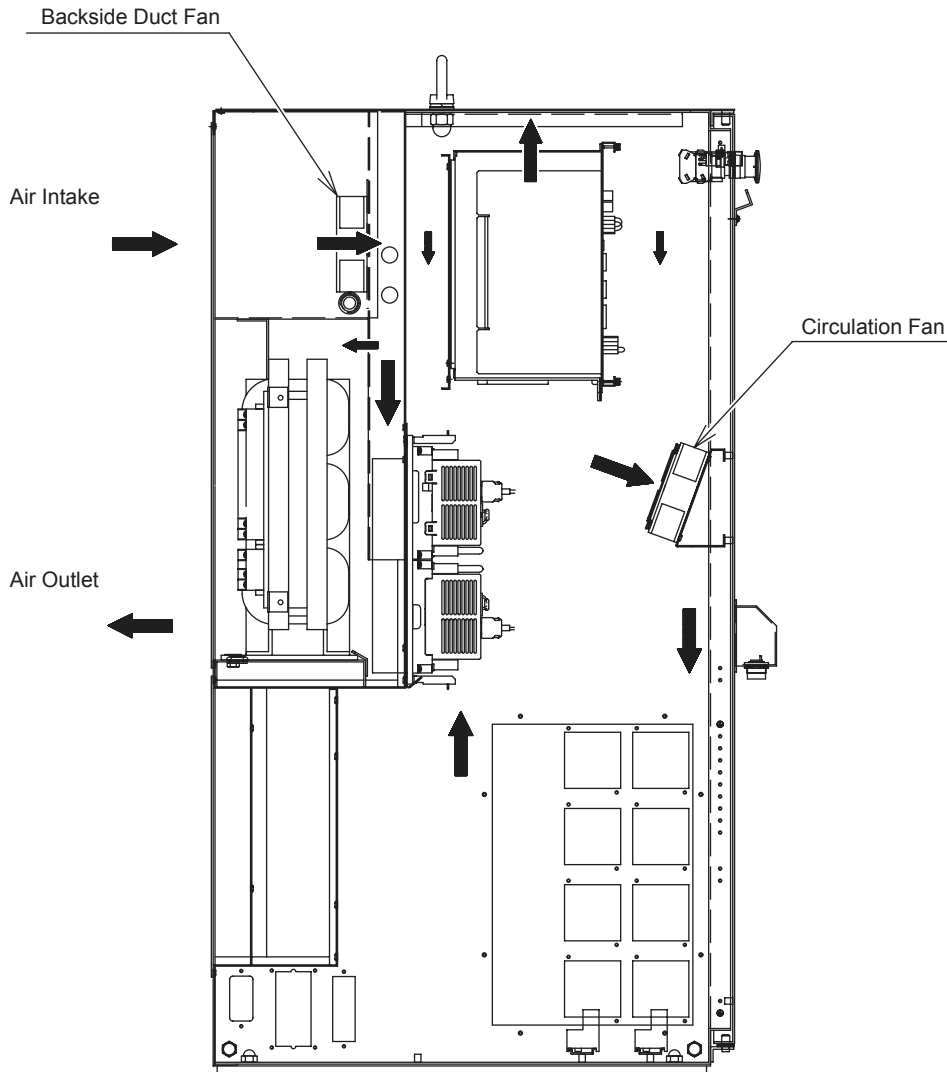


| Model Type   | NX100             | SERVOPACK      | Converter       | Fuse (Disconnect Switch) | Power Supply Contactor Unit |
|--------------|-------------------|----------------|-----------------|--------------------------|-----------------------------|
| UP20MN       | ERCR-UP20MN-AB00  | SGDR-EH50Y27   | SGDR-COA250A01B | ATDR15 15A *             | JZRCR-NTU02-2               |
| UP50N        | ERCR-UP50N-AB00   | SGDR-EH50Y24   | SGDR-COA250A01B | ATDR15 15A *             | JZRCR-NTU02-2               |
| HP165 ES165N | ERCR-ES165N-AB00  | SGDR-ES165N    | SGDR-COA250A01B | ATDR20 20A *             | JZRCR-NTU02-2               |
| ES200N       | ERCR-ES200N-AB00  | SGDR-ES165N    | SGDR-COA250A01B | ATDR20 20A *             | JZRCR-NTU02-2               |
| ES165RN      | ERCR-ES165RN-AB00 | SGDR-ES165NY28 | SGDR-COA250A01B | ATDR20 20A *             | JZRCR-NTU02-2               |
| ES200RN      | ERCR-ES200RN-AB00 | SGDR-ES165NY28 | SGDR-COA250A01B | ATDR20 20A *             | JZRCR-NTU02-2               |

\* 3-phase 480 VAC, with built-in transformer

### 6.4.2 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 NX100.



Cooling Configuration

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## 7 Description of Units and Circuit Boards

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### 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 NX100 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 NX100 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:**
  - **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.

- **When turning the power on to the NX100, 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.**

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.

## 7.1 Power Supply Contactor Unit

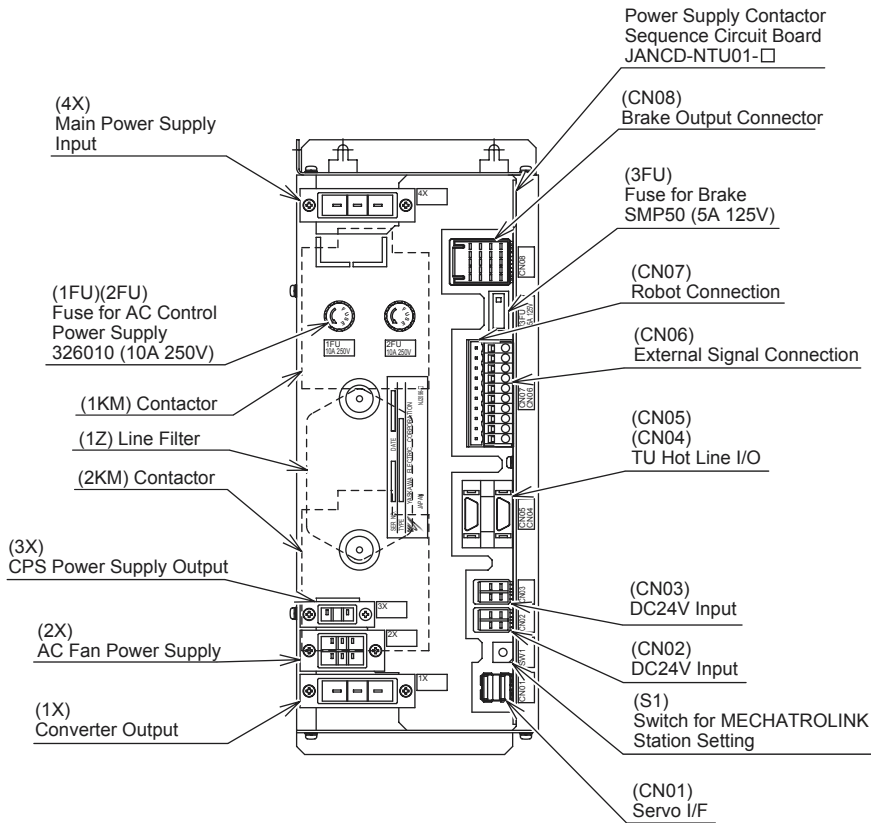
The power supply contactor unit consists of the power supply contactor sequence circuit board (JANCD-NTU□□) and the contactor (1KM, 2KM) for servo power and the line filter (1LF). It turns the contactor servo power on and off using the signal for servo power control from the power supply contactor sequence 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.

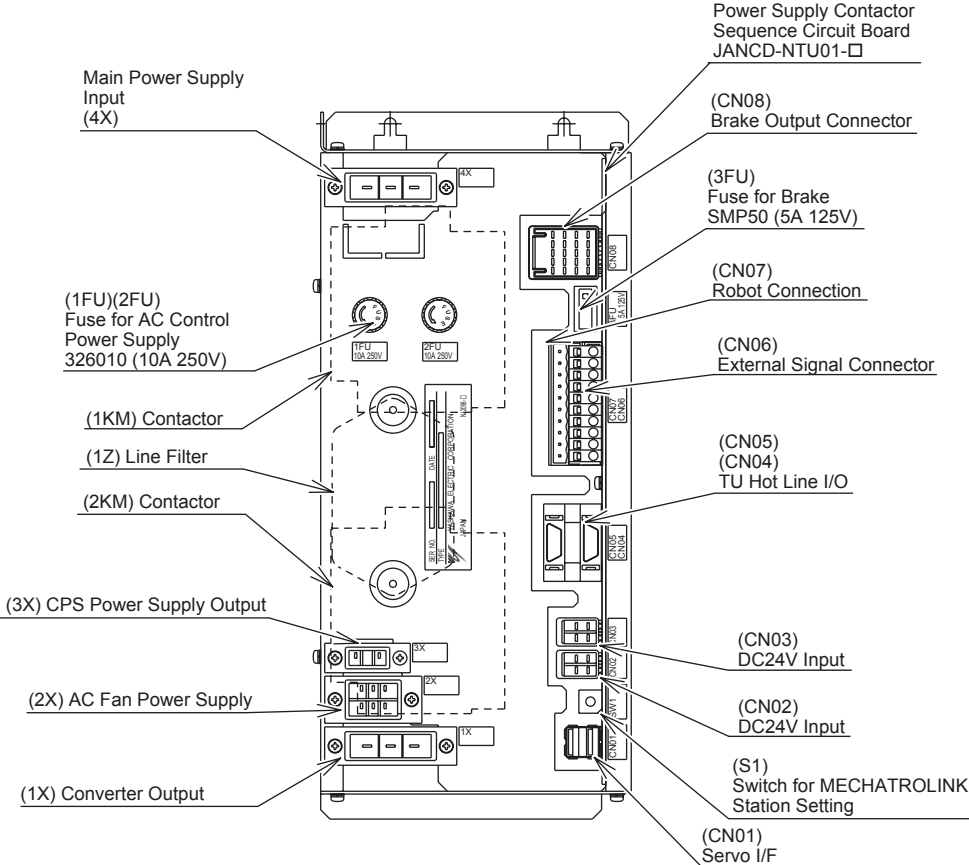
Power Supply Contactor Unit Models

| Model         | Robot Type   |
|---------------|--|
| JZRCD-NTU01-□ | HP3, HP6, EA1400N, HP20, EA1900N                       |
| JZRCD-NTU02-□ | UP20MN, UP50N, ES165N, HP165, ES200N, ES165RN, ES200RN |





Power Supply Contactor Unit Configuration (JZRCR-NTU01-□)



Power Supply Contactor Unit Configuration (JZRCR-NTU02-□)

## 7.2 Power Supply Contactor Sequence Circuit Board (JANCD-NTU01-□)

The power supply contactor sequence circuit board is controlled by the major axes circuit board (SGDR-AXA01A). The main functions of the contactor circuit board are as follows:

- Servo power supply contactor I/O circuit (dual circuit)
- Brake power supply output circuit
- Overrun signal input, tool shock sensor (SHOCK) signal input, and lamp power supply output circuit to the manipulator
- External overrun signal input circuit (dual circuit)
- Servo-on enable signal input circuit (dual circuit)
- Fan alarm (optional) input circuit
- Fan control signal output circuit
- Contactor control signal output circuit (dual circuit)
- Brake release function (Operation by programming pendant - Refer to "NX100 OPERATOR'S MANUAL".)

### ■ Connection for Tool Shock Sensor (SHOCK)

#### To connect the tool shock sensor directly to the tool shock sensor signal line

1. Disconnect the minus SHOCK (-) and 24VU pin terminal from the WAGO connector, the NTU01-CN07 power supply contactor unit.
2. Connect the minus SHOCK (-) and 24VU 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 Name Terminal | Pin Terminal Model | Signal Line Terminal Model                   |
|-------------------|--------------------|--|
| SHOCK-            | PC-2005W           | PC-2005M (manufactured by NICHIFU Co., Ltd.) |
| 24VU              | PC-2005M           | PC-2005W (manufactured by NICHIFU Co., Ltd.) |

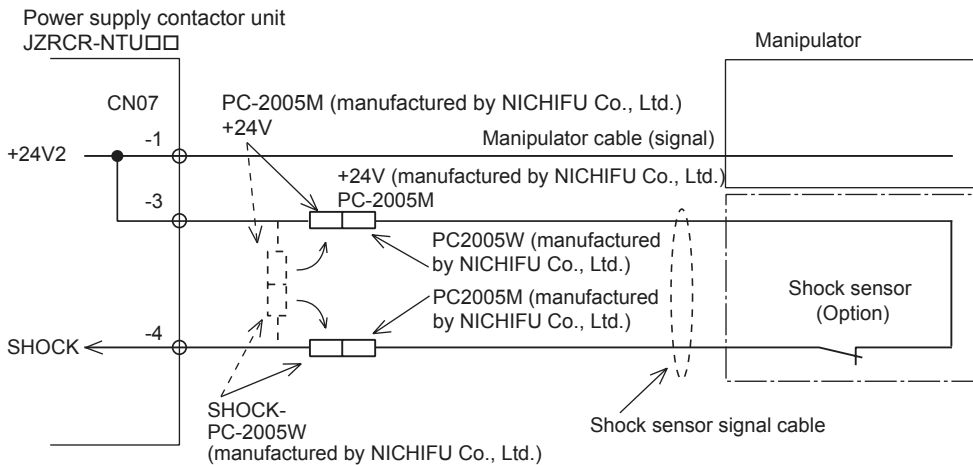


Fig. 1 Direct Connection to Tool Shock Sensor Signal Line

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

1. Disconnect the minus SHOCK (-) and 24VU pin terminal from the WAGO connector, the NTU01-CN07 power supply contactor unit.
2. Connect the minus SHOCK (-) pin terminal to the minus SHOCK (-) pin terminal of the manipulator.



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.

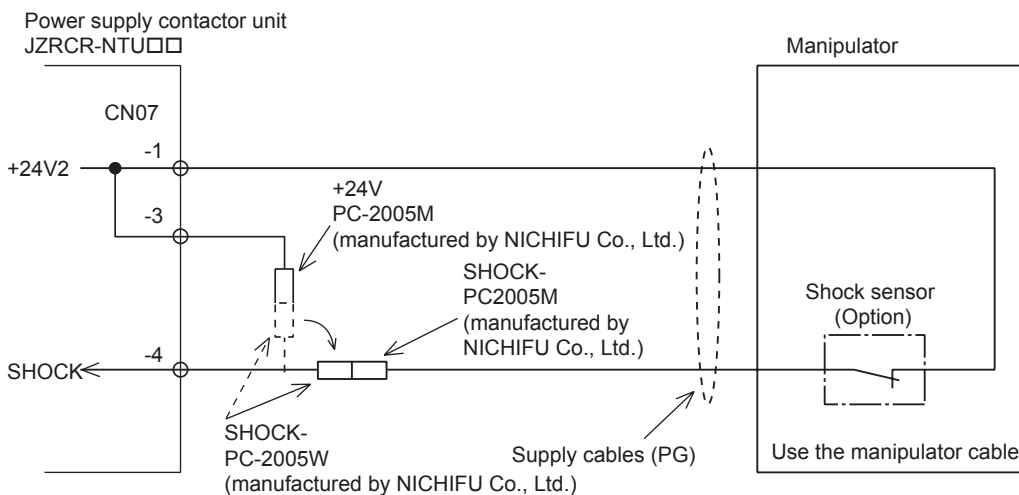


Fig. 2 Connection with Manipulator Cable



When the tool shock sensor input signal is used, the stopping method of the robot can be specified. The stopping methods are hold stop and servo power supply off. Selection of the stopping method is set in the display of the programming pendant. For details, refer to Explanation \*1 in " 9 System Setup " of NX100 INSTRUCTIONS.

## ■ 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 CN06-5 and -6 and between the connectors CN06-7 and -8 of the JZRCR-NTU□□-□ power supply contactor unit.
2. Connect the external axis overrun wiring between the connectors CN06-5 and -6 and between the connectors CN06-7 and -8 of the JZRCR-NTU□□-□ contactor unit.



### CAUTION

- **Remove jumper cable installed on system input signal before connecting the input signal lines.**

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

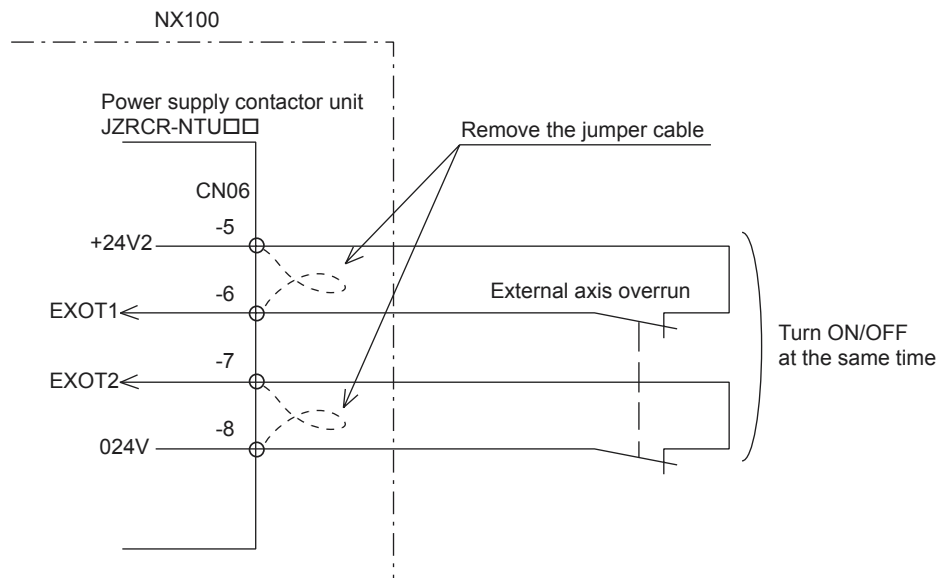


Fig. 3 Connection for External Axis Overrun

## ■ Connection for Servo-ON Enable Input (ON\_EN1 and ON\_EN2)

Connect the ON\_EN 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.

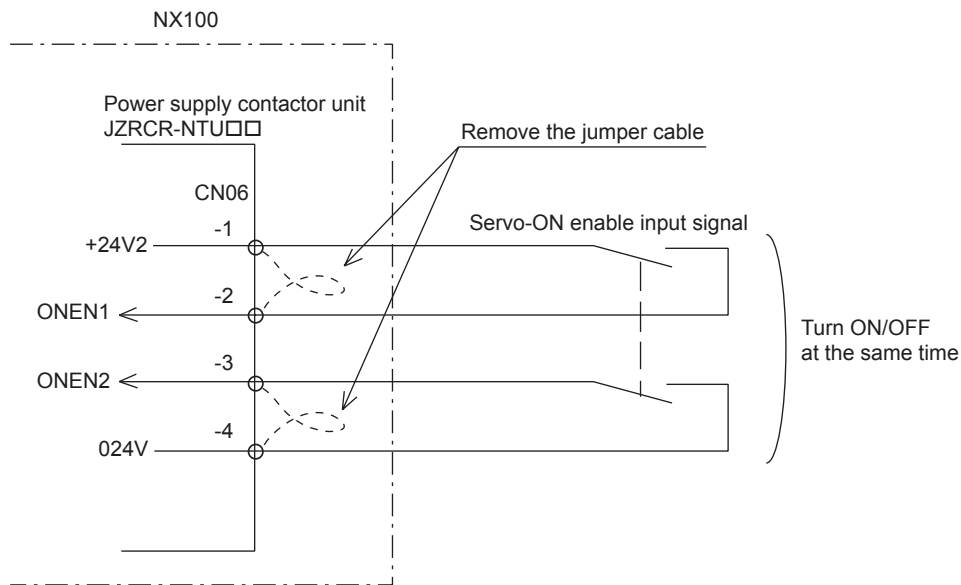
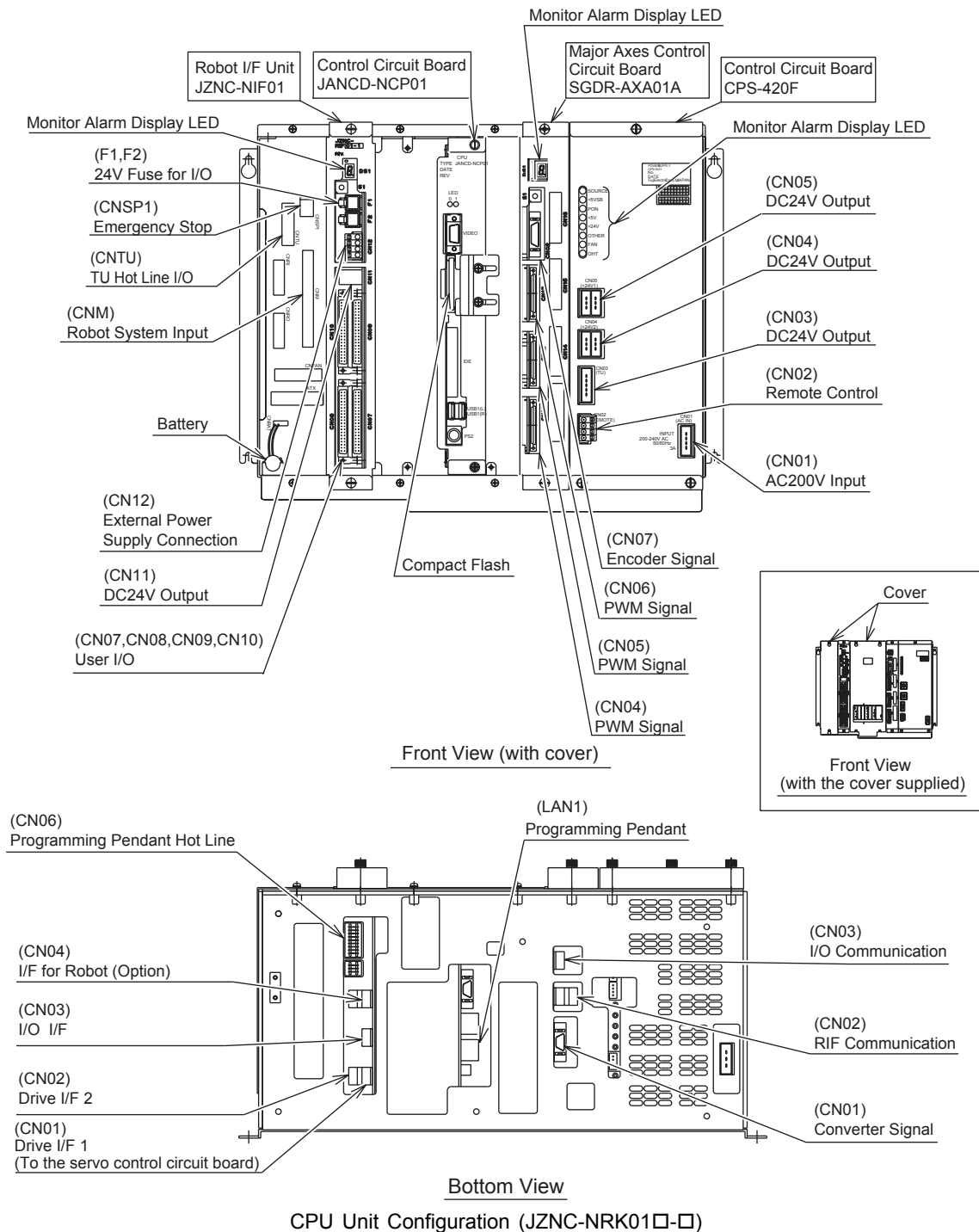


Fig. 4 Connection for Servo-ON Enable Input

## 7.3 CPU Unit

### 7.3.1 CPU Unit Configuration

CPU unit consists of the control power supply, circuit board racks, control circuit boards, robot I/F unit, and major axes control circuit boards. The JZNC-NRK01 CPU unit contains only circuit board racks and control circuit boards. It does not contain the control power supply, the robot I/F unit, and the major axes control circuit board.



## 7.3.2 Units and Circuit Boards in the CPU Unit

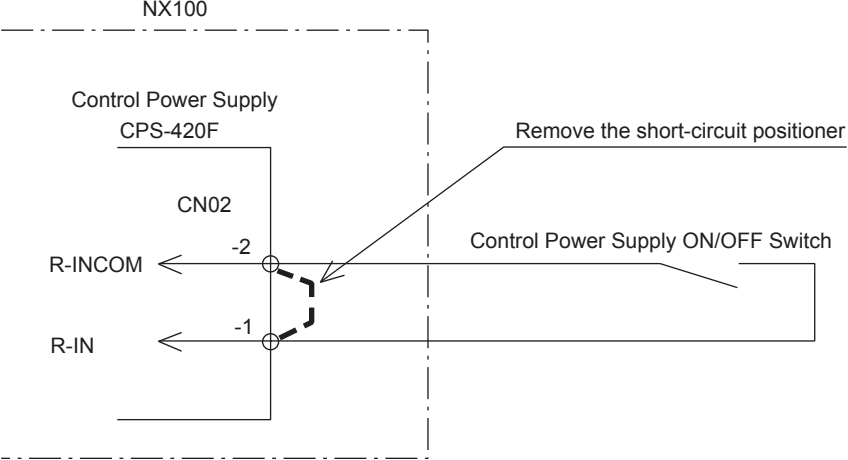
### ■ Control Circuit Board (JANCD-NCP01)

This board performs to control the entire system, display to the programming pendant, control the operating keys, control operation, calculate motion type. This board has the Serial interface for RS-232C, video output, PS2 connector, and LAN (100BASE-TX/10BASE-T). But this board, however, cannot be used for video output and PS connector. (The video output and the PS connector must be adjusted by the manufacturer only.)

### ■ Control Power Supply (CPS-420F)

This unit supplies the DC power (DC5V, DC24V, DC3.3V, DC±12V) for control (system, I/O, brake). It is also equipped with the input function for turning the control power supply on and off.

| Items          | Specifications   |       |  |
|----------------|--|-------|--|
| Input          | Rating Input Voltage: 200/220VAC<br>Voltage Fluctuation Range: +10% to -15% (170 to 242VAC)<br>Frequency: 50/60Hz ± 2Hz (48 to 62Hz) |       |  |
| Output Voltage | DC + 5V : 20A<br>DC +24V : 12A (24V1: 4A, 24V2: 3.5A, 24V3: 4.5A)<br>DC +3.3V : 12A<br>DC +12V : 1.5A<br>DC -12V : 0.5A              |       |  |
| Indicator      | DISPLAY  | Color | Status   |
|                | SOURCE   | Green | Lights when AC power supply input (Normally ON)  |
|                | POWER ON   | Green | Lights when DC power supply output (Normally ON)   |
|                | +5V  | Red   | Lights when +5V output error (ON when abnormal)  |
|                | +24V   | Red   | Lights when +24V output error (ON when abnormal)   |
|                | OTHER  | Red   | Lights when +3.3V, ±12V output error (Lights if error occurs)                                |
|                | FAN  | Red   | Lights if a fan-related errors in the control power supply unit. (Lights if error occurs)    |
|                | OHT  | Red   | Lights when units interior overheats (ON when abnormal)<br>Detection temperature: About 65°C |

| Items                       | Specifications   |
|-----------------------------|--|
| <p>Control Power ON/OFF</p> | <p>To turn on the NX100 controller power, turn the non-fuse breaker of controller to the ON position then turning on the control power supply. If the controller is not located at the workplace, the non-fuse breaker of controller can be turned ON and OFF by input from external device. It is operated by the external switch connected with CN 02 of control power supply as shown in the following figures. (CN02-1 and CN02-2 is short-circuited when shipment)</p>  <p>Connection to Control Power Supply Unit</p> <p>See "WAGO Connector" for wiring of CN02 connector.</p> |



## ■ WAGO Connector

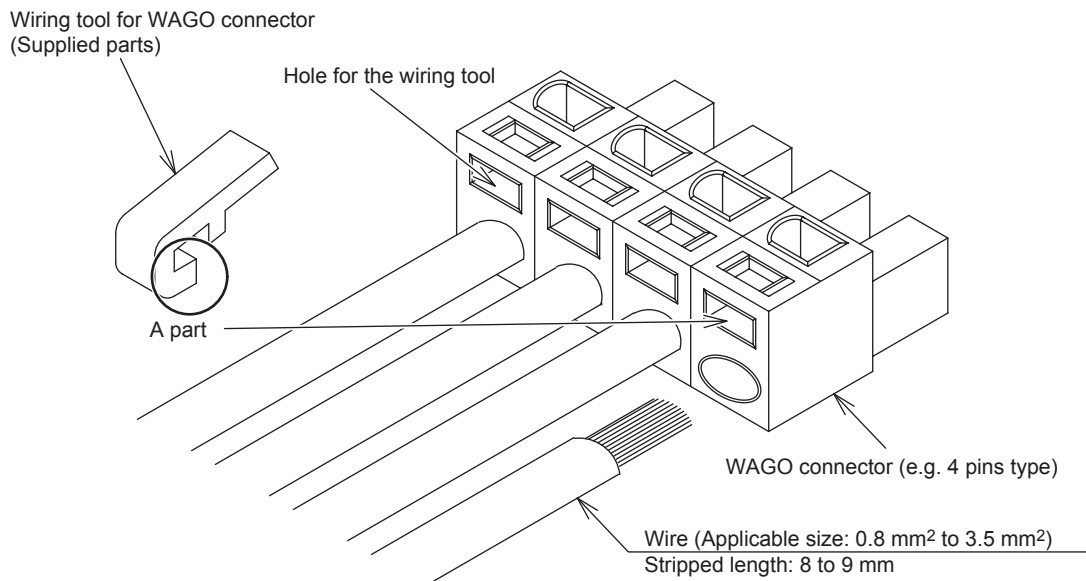
CN06, 07 on the power supply contactor unit (JZRCR-NTU□□-□), CN02 on the control power supply (CPS-420F), and CN12 on the robot I/F unit (JZNC-NIF01) are equipped with a connector made by WAGO.

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

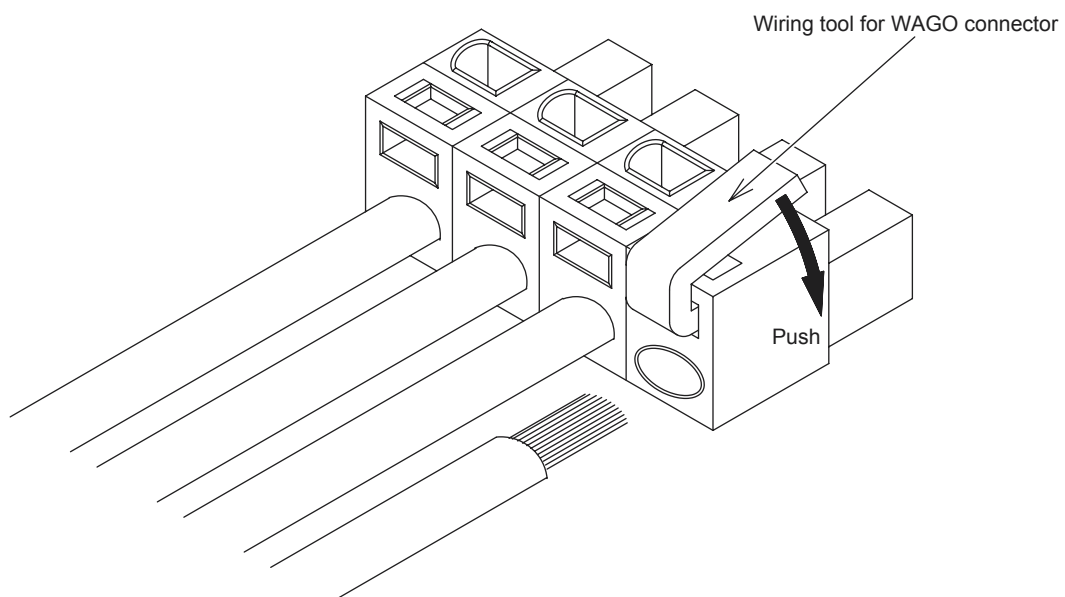
Two of these tools are supplied with the NX100.

The wiring procedure is described as follows:

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



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.

### ■ Major Axes Control Circuit Board (SGDR-AXA01A)

The major axes control circuit board (SGDR-AXB01A) controls the servomotors of the manipulator's six axes. It also controls the converter, the PWM amplifiers, and the power supply contactor sequence circuit board of the power supply contactor unit. Mounting an external axes control circuit board of an option (SGDR-AXF01A) control the servomotor of nine axes, including the robot axes.

### ■ Robot I/F Unit (JZNC-NIF01)

The robot I/F unit (JZNC-NIF01) consists of the robot I/F circuit board (JANCD-NIF01) and I/O circuit board (JANCD-NIO01).

#### • Robot I/F Circuit Board (JANCD-NIF01)

The robot I/F circuit board controls the entire robotic system. It is connected to the control circuit board (JANCD-NCP01) with a PCI bus interface on the backboard, and to the major axes control circuit board (SGDR-AXA01A) with a NIO01 board interface for high-speed serial transmissions.

And, dual circuits are built in for use with the signals for safety-related functions.

#### • I/O Circuit Board (JANCD-NIO01)

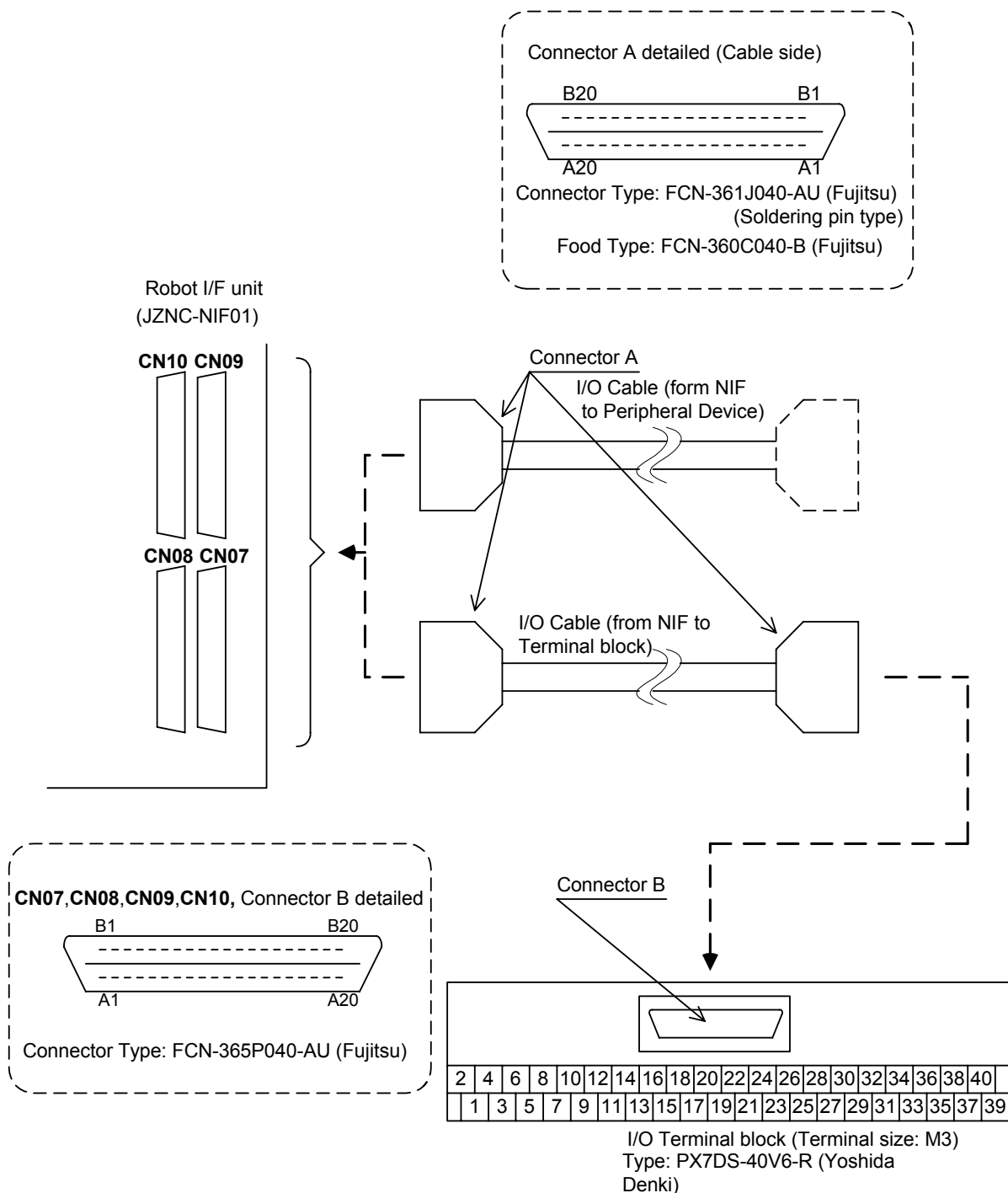
Four digital I/O connectors for the robot user I/O are provided: 40 inputs and 40 outputs. The I/Os are divided into two types: user I/O and system I/O. The I/O assignment differs depending on the application. System I/O is a signal in which the part is decided in advance. System I/O is used when the external operation equipment such as positioner controller and centralized controller control the manipulator and related equipment as a system. User I/O are mainly used as timing signals for the manipulator and peripheral devices in jobs that require robot motion.

Refer to "7.6 User I/O Signal Assignment" for more details on signal allocation.

For the connection of the robot's user I/O signal connectors, and the I/O signal related to start and stop, refer to "Connection wire with User I/O (CN07, 08, 09, 10)" and "System I/O Signal Related to Start and Stop."

■ Connection wire with Robot User I/O Connector (CN07, 08, 09, 10)

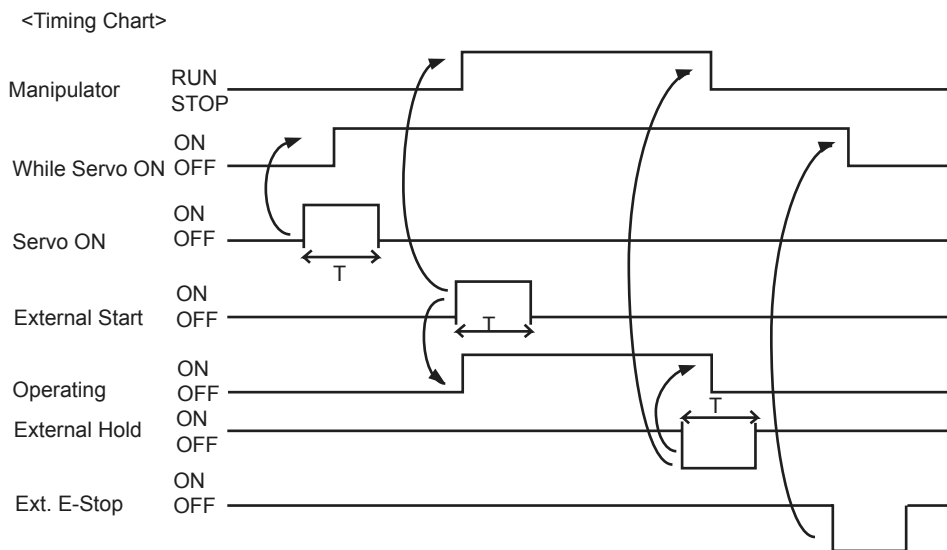
Please refer to the figure below when you manufacture the cable connecting with robot user I/O connector (CN07, 08, 09, 10) of robot I/F unit (JZNC-NIF01). (The cable side connector and the I/O terminal block are the options)



## System I/O Signal Related to Start and Stop

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

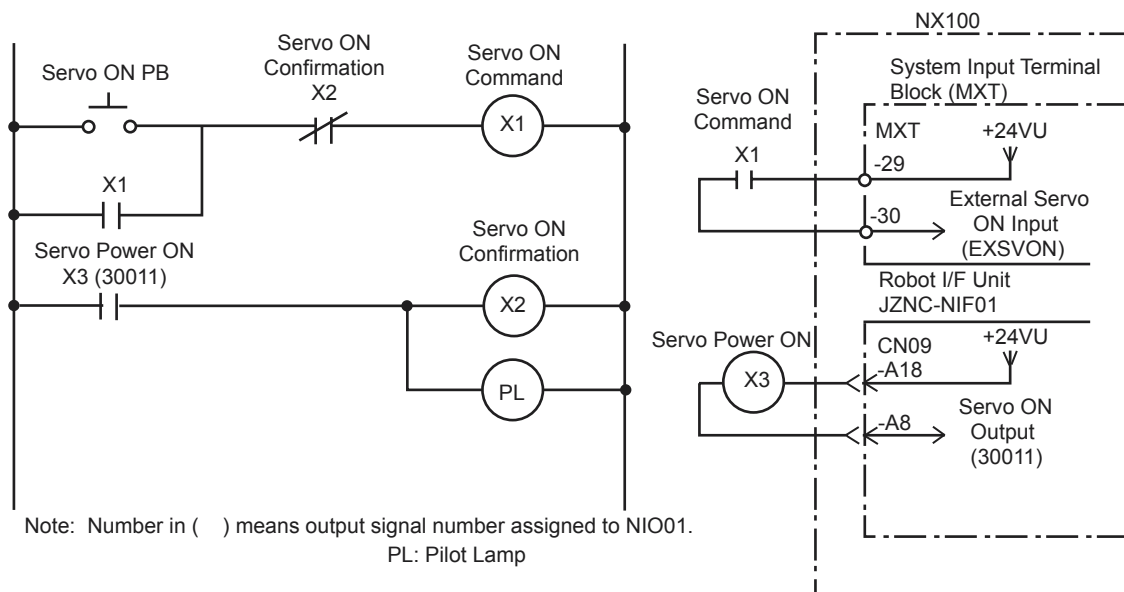
- Servo ON (depending on application: JANCD-NIO01)
- External Servo ON (common to all application: System input terminal block MXT)
- External Start (depending on application: JANCD-NIO01)
- Operating (depending on application: JANCD-NIO01)
- External Hold (common to all application: System input terminal block MXT)
- External Emergency Stop (common to all application: System input terminal block MXT)



Note: Set T=100msec or more

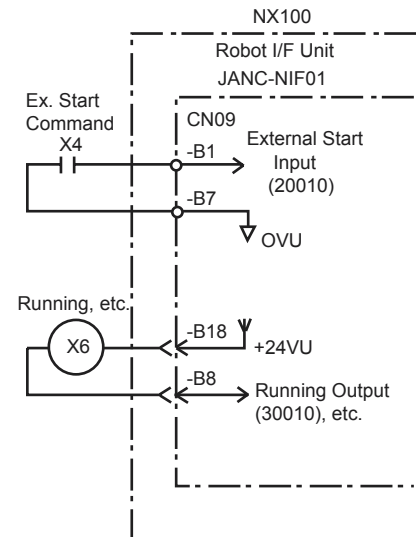
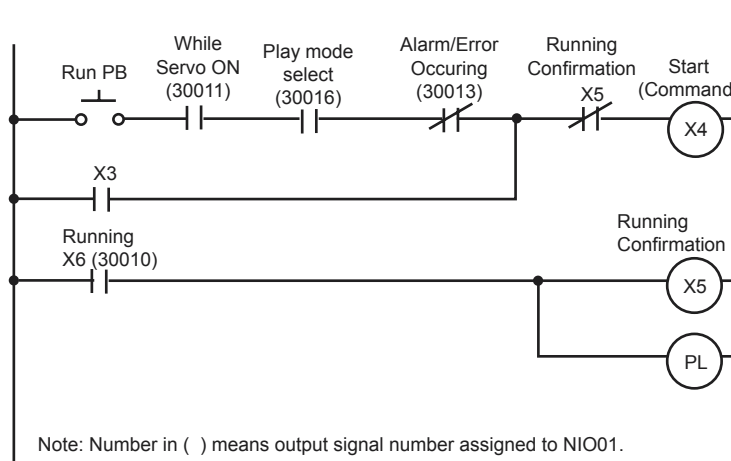
### Example of Servo ON Sequence Circuit from External Device

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.



### 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.

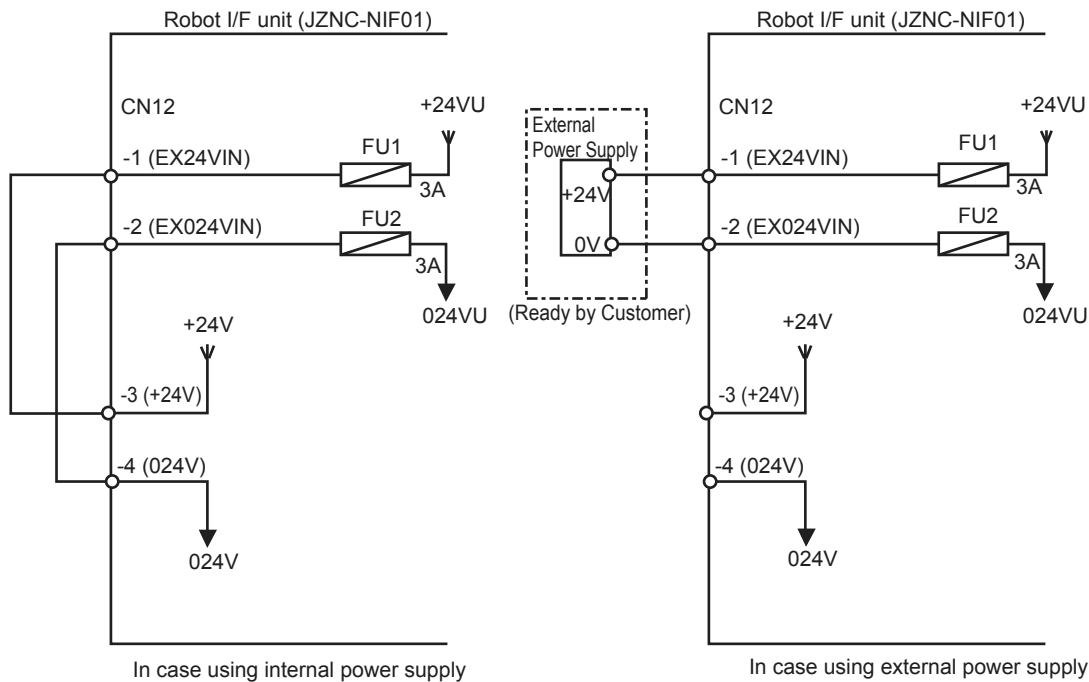


## ■ Connection of External Power Supply for I/O

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 CN12-1 to -3 and CN12-2 to -4 of the robot I/F unit.

Connect +24V of the external power supply to CN12-1 and 0V to CN12-2 of the robot I/F unit.



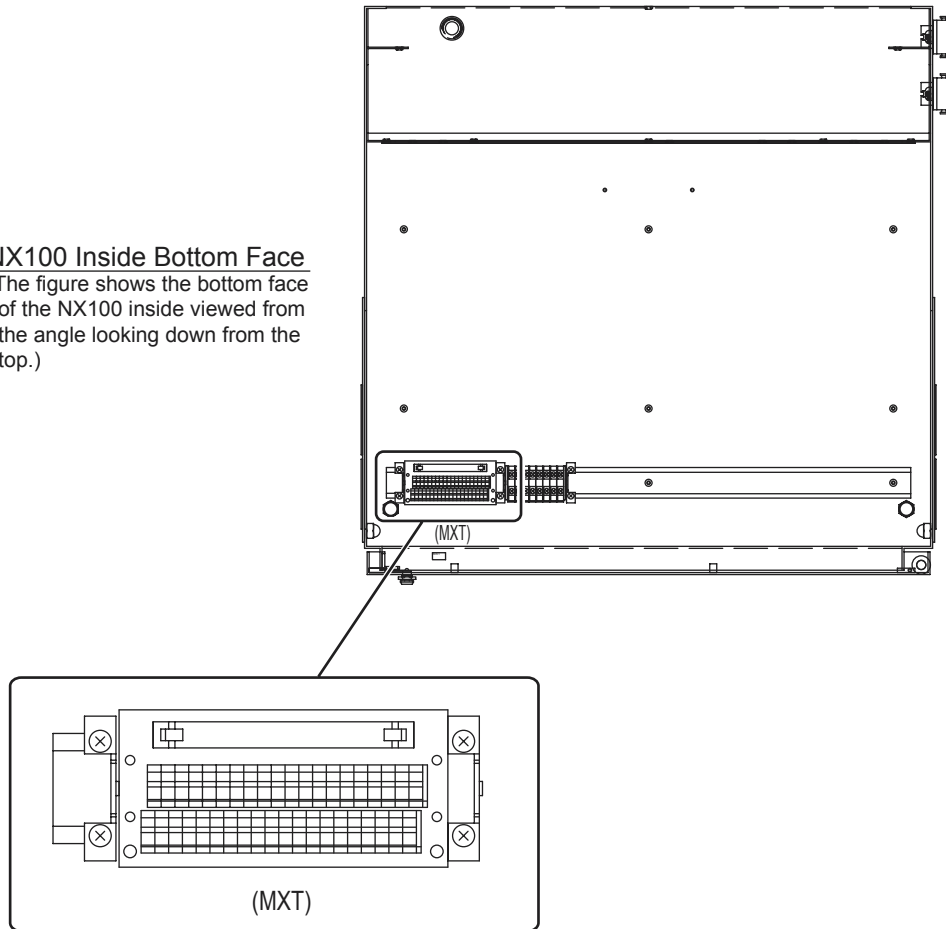
### NOTE

- The internal power supply of 24V of about 1A of NX100 can be used for I/O. Use external 24V power supply for higher currents and to isolate the circuit inside and outside the NX100.
- Power supply circuit for I/O (+24 VU, 024 VU) has 3A fuses (FU1, FU2).
- Install the external power supply outside the NX100 to avoid electric noise problems.
- If the internal power supply is selected and the external power supply is connected to CN12-1 to -3 and CN12-2 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.

## ■ Robot System Input Terminal Block (MXT)

The following signals are provided for the robot system input terminal block (MXT). Refer to the robot system input terminal block connection diagram for the connection.

NX100 Inside Bottom Face  
(The figure shows the bottom face of the NX100 inside viewed from the angle looking down from the top.)



## Wiring Procedure of the MXT Connector

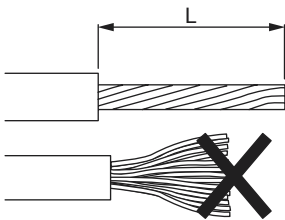
For your safety, appropriate work must be done by following the instructions below.

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

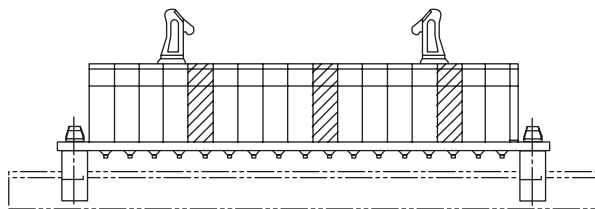
Screwdriver \* WAGO standard screwdriver  
WAGO 210-119  
WAGO 210-119SB (Short, delivered with the product)



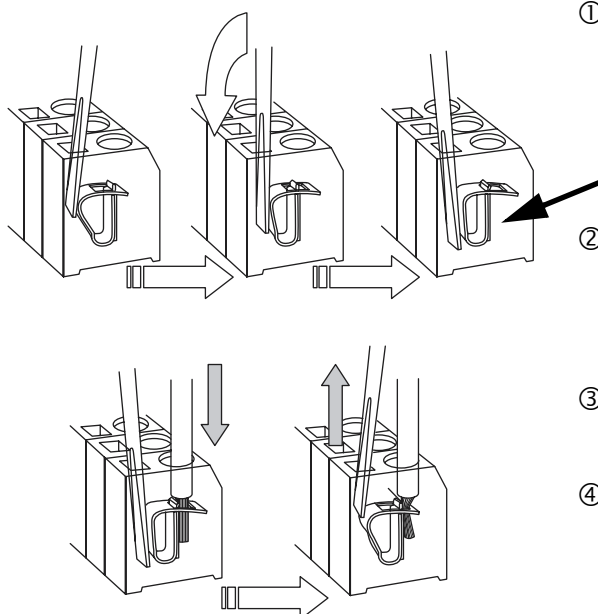
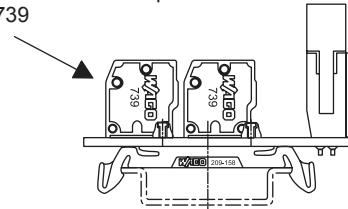
2. Applicable Wires
- ① The length of the exposed conductor (L) should be as follows:  
\* The length of the exposed conductor set for the terminal block (L)  
WAGO series 739 (with 3.5 mm pitch): 5 - 6 mm
  - ② In case that the conductor is bent or feazed, make it straght as illustrated in the figure on the left.



3. Wire Connection



Terminal block: Screwless clamp terminal  
WAGO series 739



- ① Insert the screwdriver into the hole to open up the clamp spring.  
Place the screwdriver at an angle as shown in the figure on the left, then insert it at a stroke in order to open up the clamp spring smoothly.  
**The screwdriver will be hold with a click.**
- 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 Be sure that the wire is connected firmly by pulling at the wire softly.



**NOTE** For dual input signals, wire the circuits so that both input signals are turned ON or OFF at the same time. If only one signal is turned ON, an alarm occurs.

## ■ External Emergency Stop

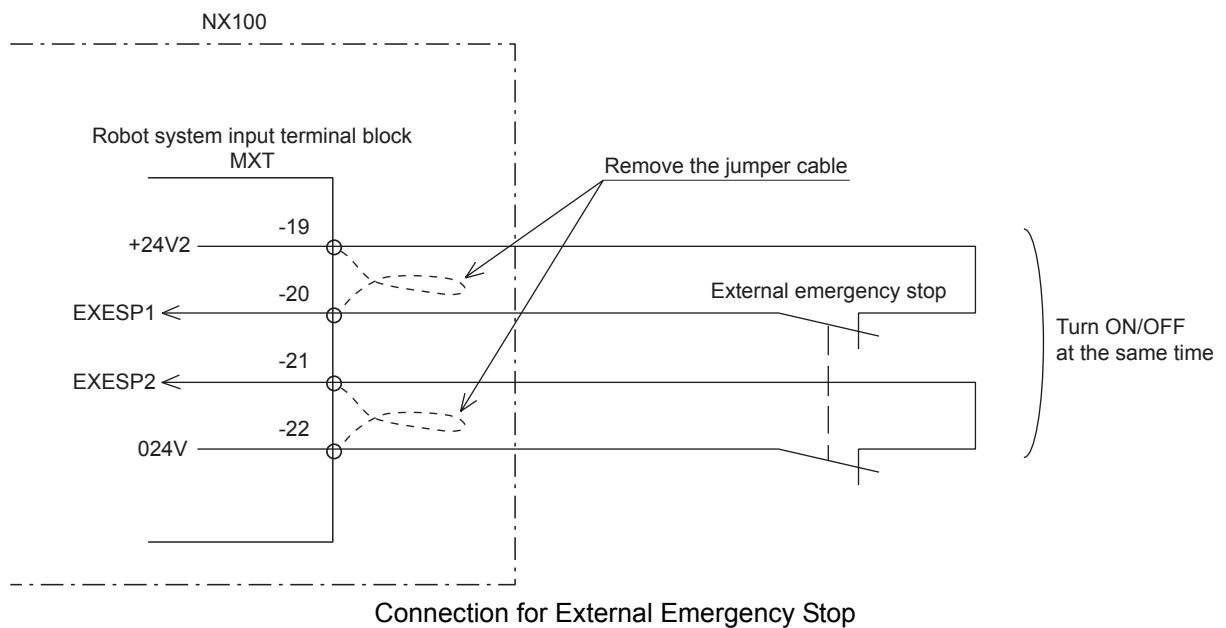
This signal is used to connect the emergency stop switch of an external device. If the signal is input, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON.



## 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.



## ■ Safety Plug

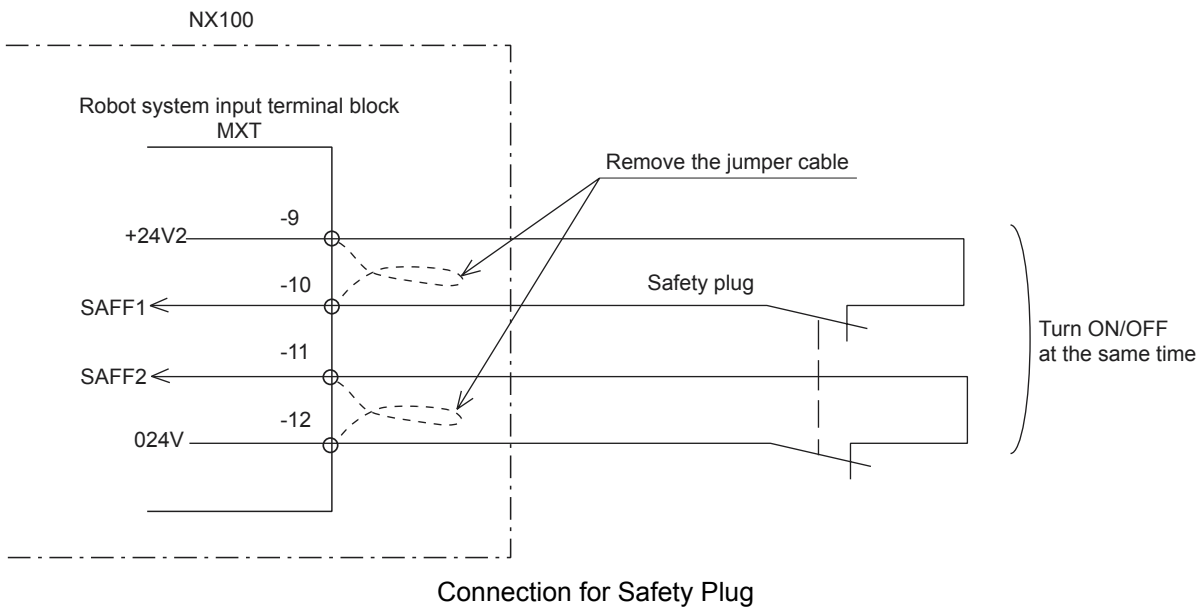
This signal is used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is input, the servo power turns OFF. While the signal is turned ON. The servo power cannot be turned ON. Note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



### CAUTION

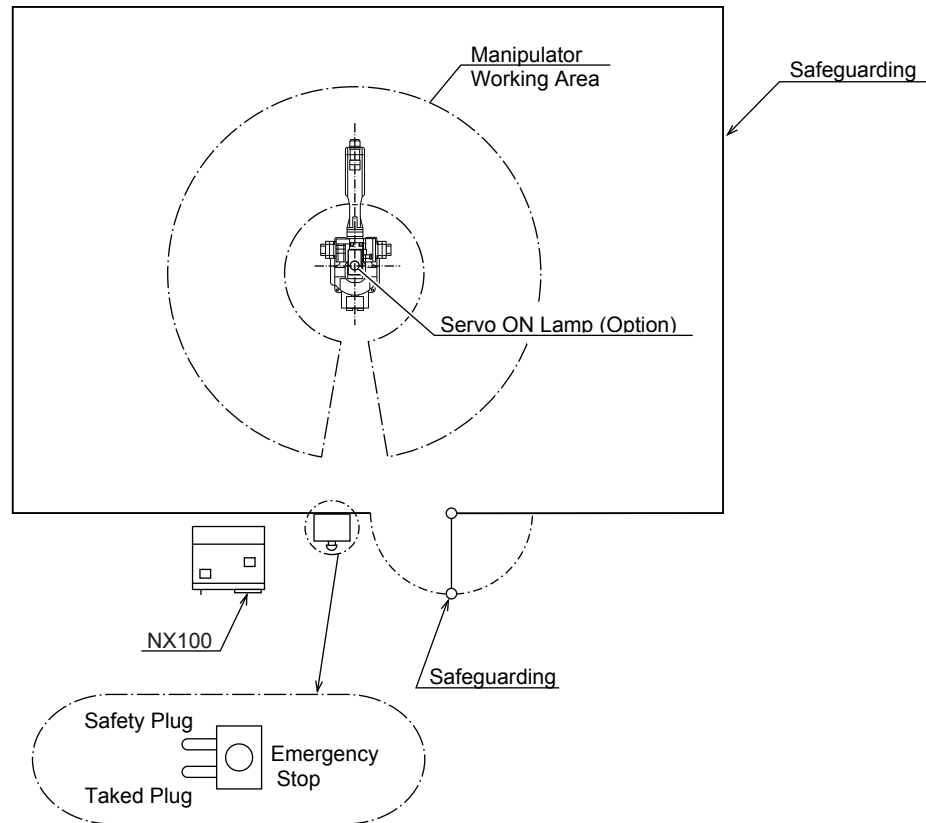
- **Always connect the signals after removing jumper cable.**

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.



## 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.

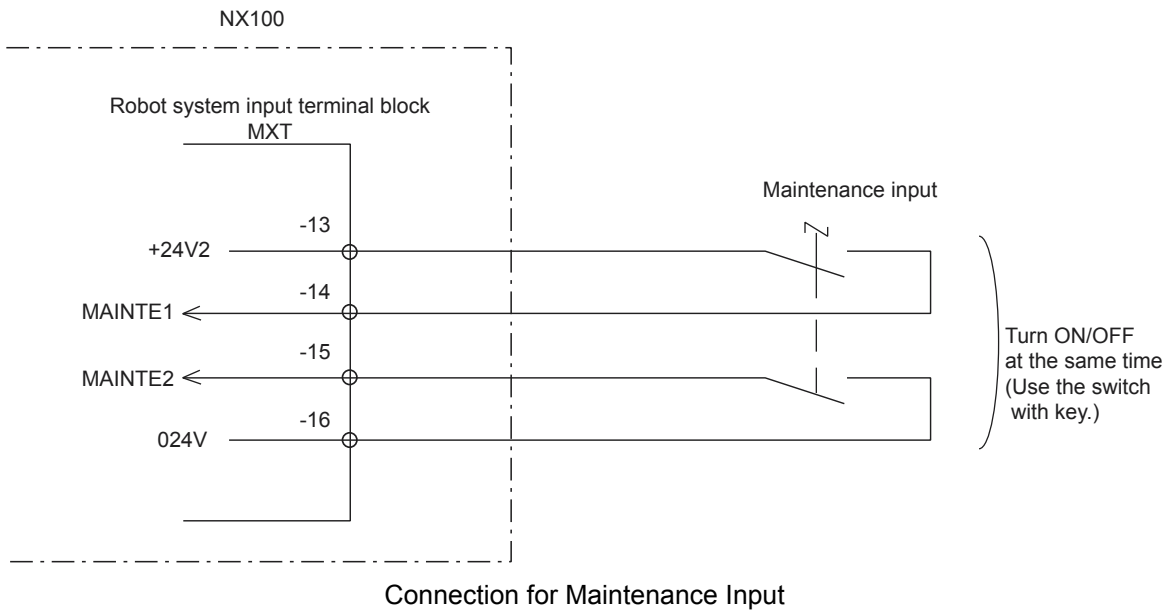
### ■ Maintenance Input

If the signal input circuit is short-circuited, the Enable switch (DSW) are disabled.  
Usually, use the system with this signal circuit open (nothing connected).  
If the circuit for this signal must be used for an unavoidable reason, be sure to use a switch with a key that is **kept under the care of the system manager**.

WARNING

- **This signal is used only for maintenance by YASKAWA's service personnel.**  
**For your safety, never use this signal for any purpose.**

Failure to observe this instruction may cause major disaster.

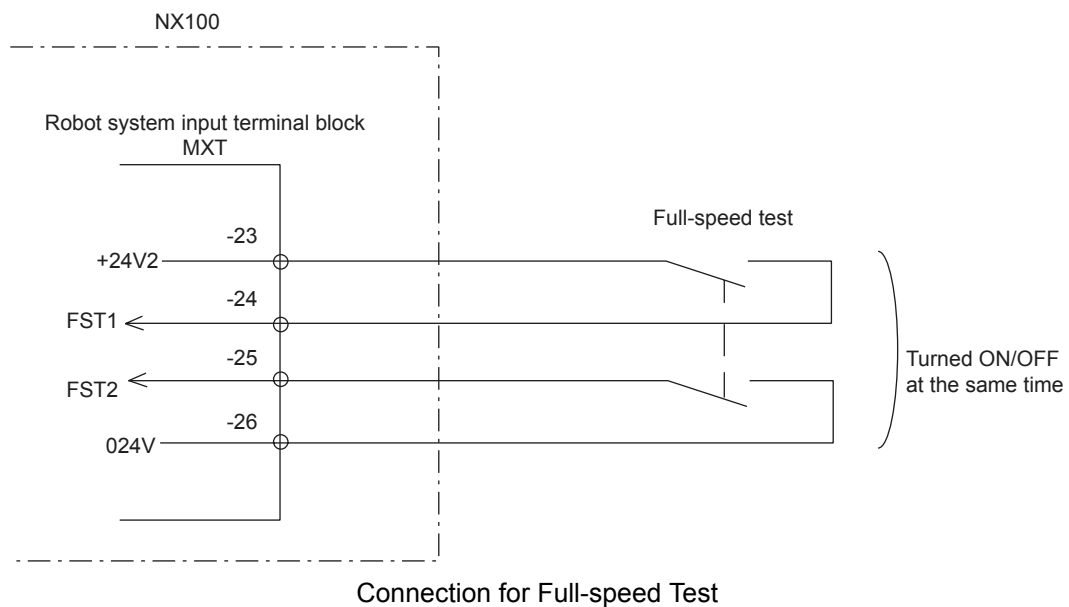


## ■ Full-speed Test

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 teach 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%).

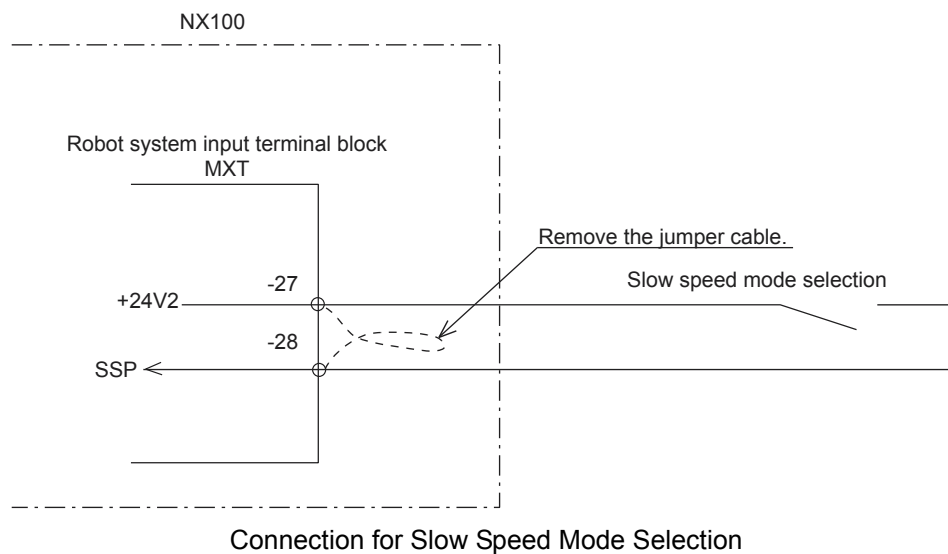


## ■ Slow Speed Mode Selection

This signal is used to determine the speed of the test run when the FST (full-speed test) signal input circuit is open.

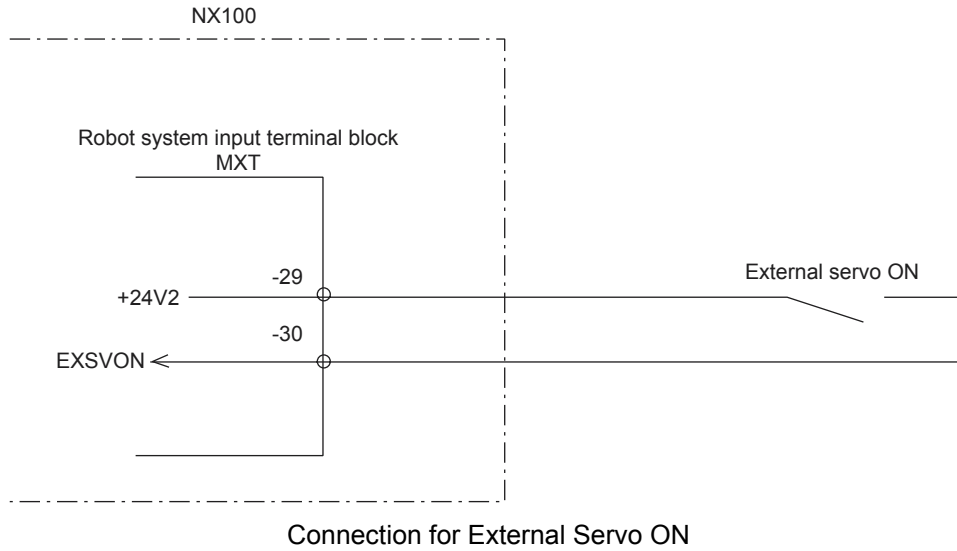
Open: Second slow speed (2%)

Short-circuit: First slow speed (16%)




### 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.



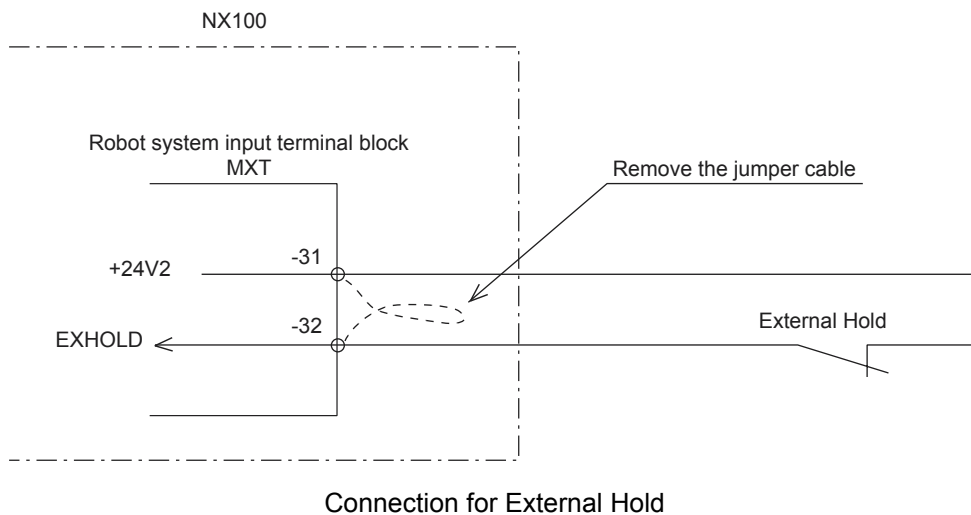
### External Hold

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.



## External Enable Switch

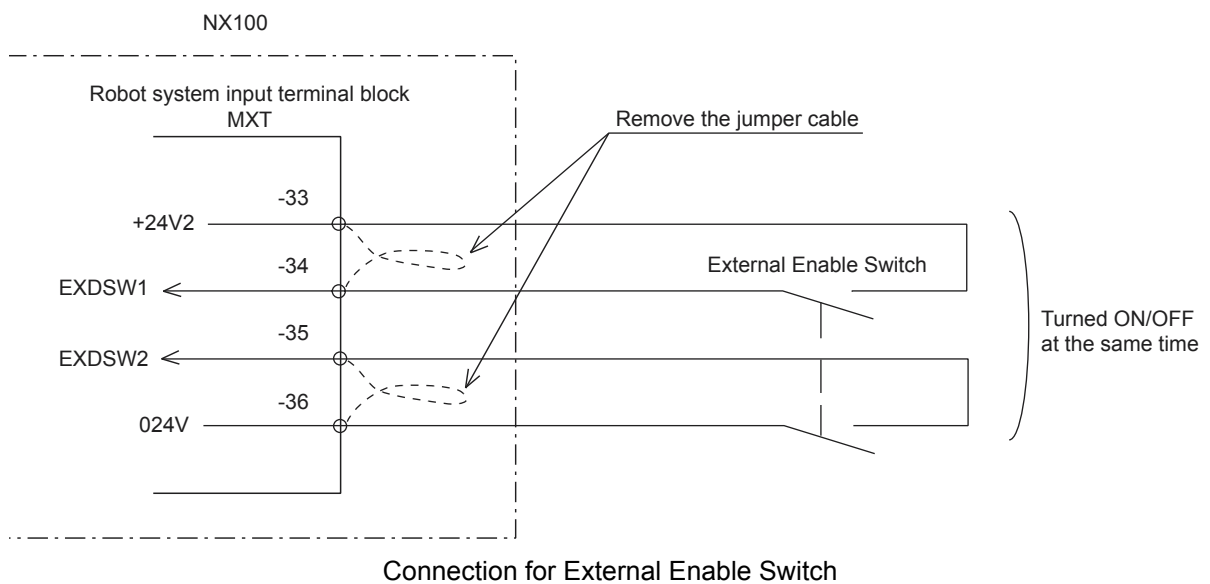
This signal is used to connect a Enable switch other than the one on the programming pendant when two people are teaching.



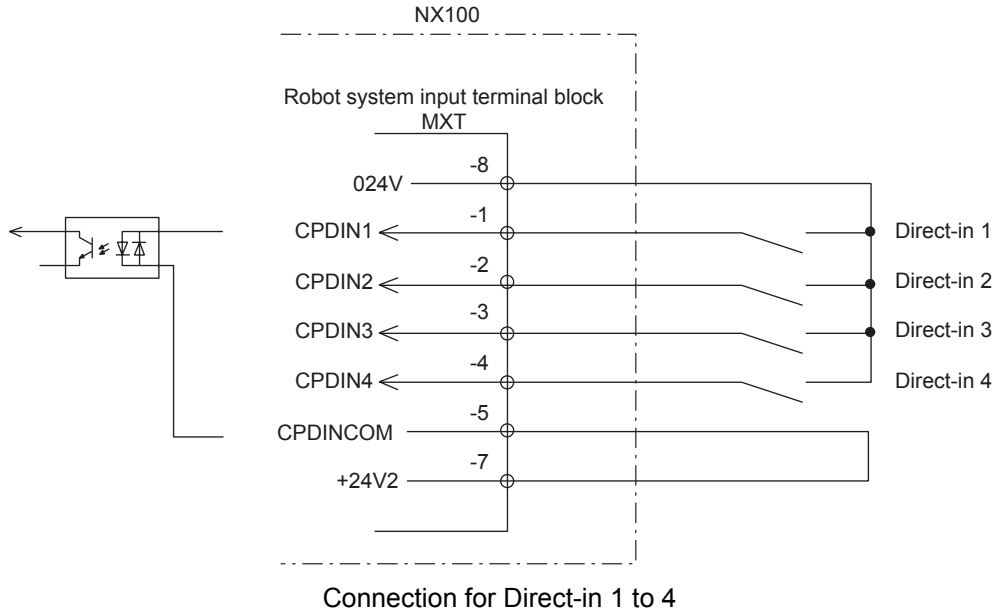
### CAUTION

- **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.

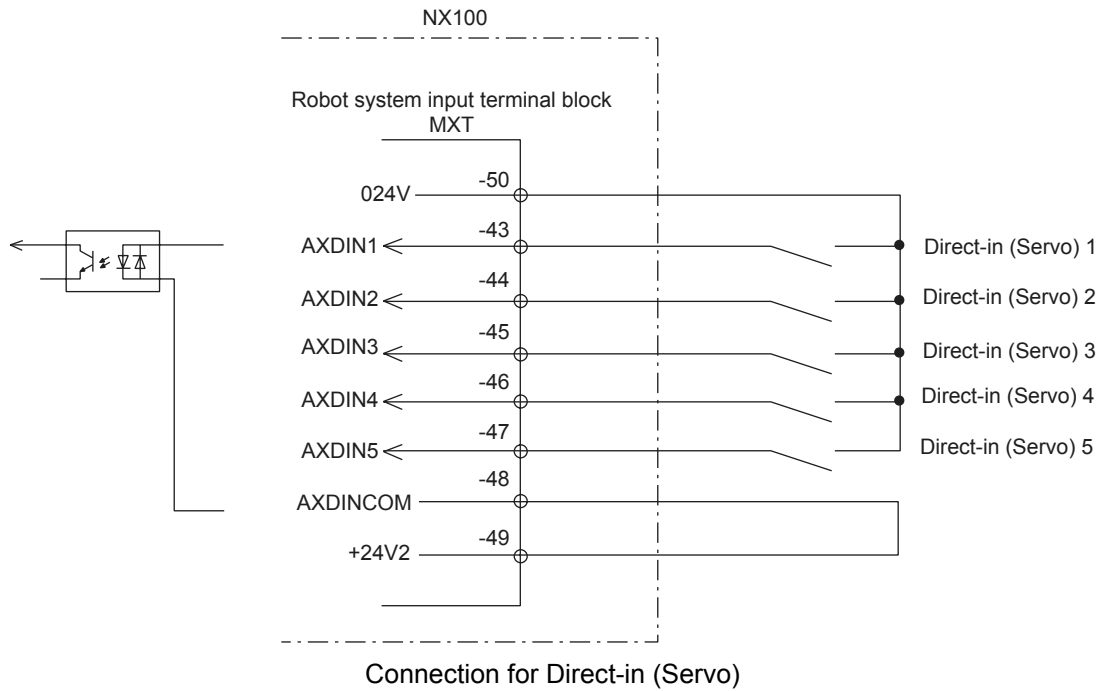


■ Direct-in 1 to 4 (Option)



■ Direct-in (Servo) 1 to 5

This signal is used to input a responsive signal in search functions.





| Signal Name | Connection No. (MXT) | Dual input | Function  | Factory Setting                   |
|-------------|----------------------|------------|---|-----------------------------------|
| EXESP1      | -19<br>-20           | Applicable | External Emergency Stop   | Short-circuit with a jumper cable |
| EXESP2      | -21<br>-22           |            | 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.  |                                   |
| SAF1        | -9<br>-10            | Applicable | Safety Plug   | Short-circuit with a jumper cable |
| SAF2        | -11<br>-12           |            | 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. |                                   |
| MAINTE1     | -13<br>-14           | Applicable | Maintenance Input   | Open                              |
| MAINTE2     | -15<br>-16           |            | If the signal input circuit is short-circuited, the Enable switch (DSW) are disabled. Usually, use the system with this signal circuit open (nothing connected). If the circuit for this signal must be used for an unavoidable reason, be sure to use a switch with a key that is <b>kept under the care of the system manager</b> .           |                                   |
| FST1        | -23<br>-24           | Applicable | Full-speed Test   | Open                              |
| FST2        | -25<br>-26           |            | 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 slow speed: The first slow speed (16%) or second slow speed (2%).                |                                   |
| SSP         | -27<br>-28           | –          | Slow Speed Mode Selection   | Short-circuit with a jumper cable |
|             |                      |            | Used to determine the speed of the test run when the FST (full-speed test) signal input circuit is open.<br>Open: Second slow speed (2%)<br>Short-circuit: First slow speed (16%)   |                                   |

### 7.3 CPU Unit

| Signal Name      | Connection No. (MXT)            | Dual input | Function   | Factory Setting                   |
|------------------|---------------------------------|------------|--|-----------------------------------|
| EXSVON           | -29<br>-30                      | –          | External Servo ON  | Open                              |
|                  |                                 |            | Use to connect the servo ON switch of an external operation device. If the signal is input, the servo power supply is turned ON.   |                                   |
| EXHOLD           | -31<br>-32                      | –          | External Hold  | Short-circuit with a jumper cable |
|                  |                                 |            | 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. |                                   |
| EXDSW            | -33<br>-34                      | Appliable  | External Enable Switch   | Short-circuit with a jumper cable |
| EXDSW2           | -35<br>-36                      |            | Used to connect a Enable switch other than the one on the programming pendant when two people are teaching.  |                                   |
| CPDIN1 to CPDIN4 | -1<br>-2<br>-3<br>-4<br>-5      | –          | Direct-in 1 to 4   | Open                              |
|                  |                                 |            | Option   |                                   |
| AXDIN1 to AXDIN5 | -43<br>-44<br>-45<br>-46<br>-48 | –          | Direct-in (Servo) 1 to 5   | Open                              |
|                  |                                 |            | Used in search functions.  |                                   |

## 7.4 Contact Output of Emergency Stop Button

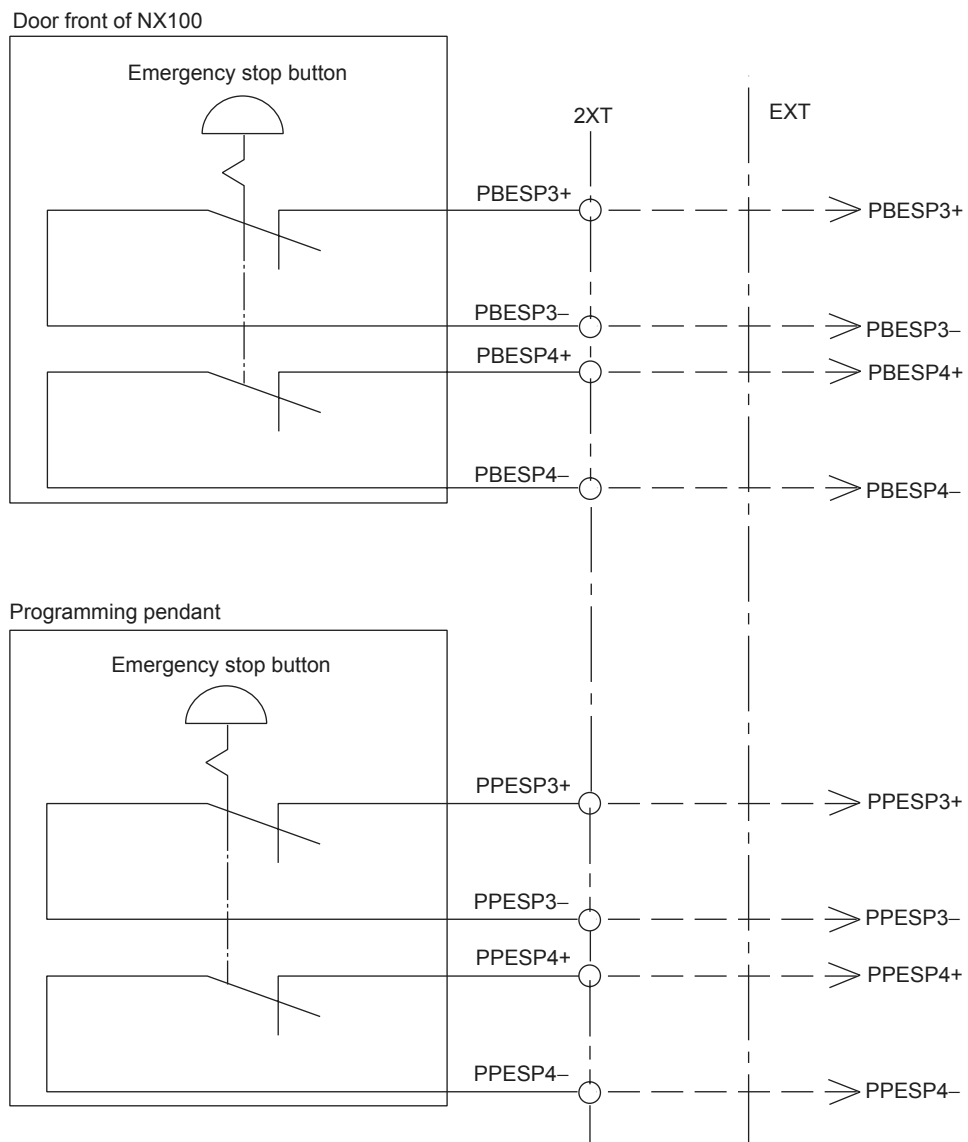
The contact output terminals for the emergency stop button on the programming pendant and the door front are provided on the terminal board 2XT (screw size M3.5) on NX100. These contact outputs are always valid no matter of the NX100 main power supply status ON or OFF. (Status output signal: normally 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.



## 7.5 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”).

### 7.5.1 Description of Each Unit

#### ■ 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.

#### ■ 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.

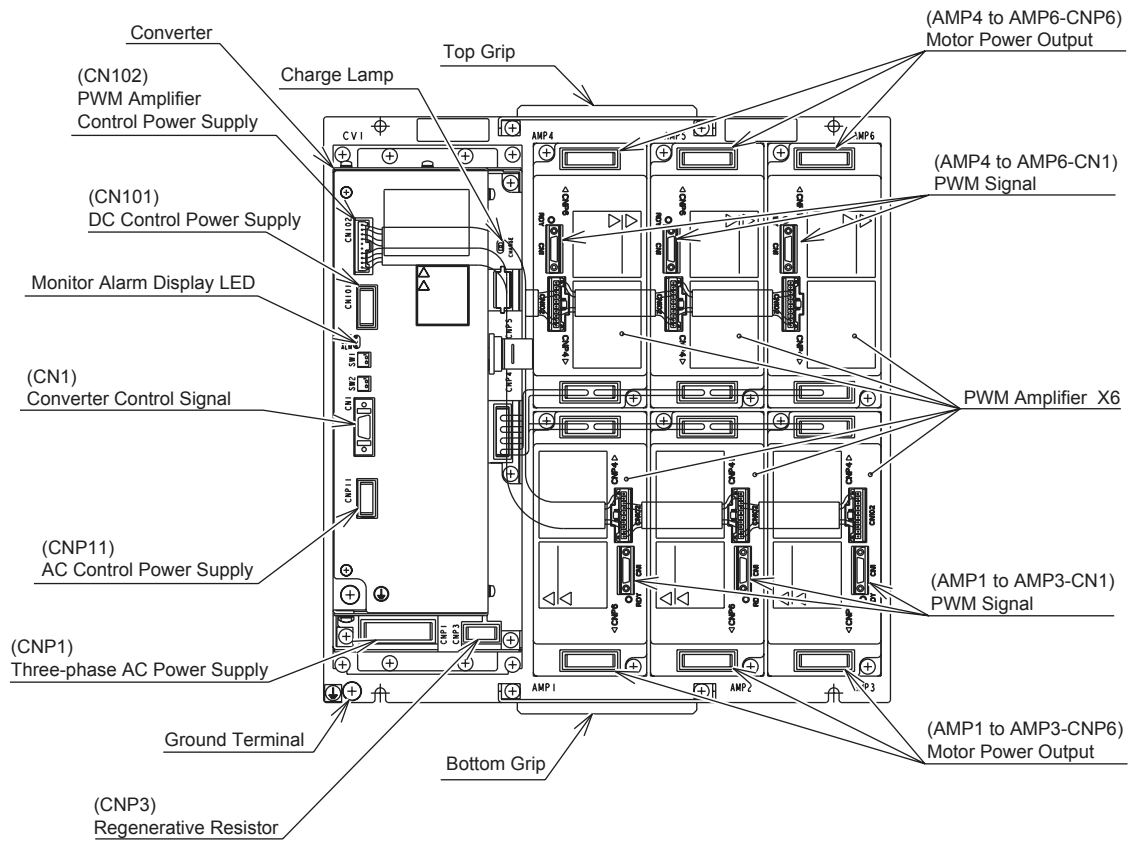
### 7.5.2 SERVOPACK Configuration

| Configuration device |   | HP3             | HP6, EA1400N       |
|----------------------|---|-----------------|--------------------|
|                      |   | Model           | Model              |
| SERVOPACK            |   | SGDR-EA1400NY26 | SGDR-EA1400N       |
| Converter            |   | SGDR-COA040A01B | SGDR-COA040A01B    |
| PWM Amplifier        | S | SGDR-SDA060A01B | SGDR-SDA140A01BY22 |
|                      | L | SGDR-SDA060A01B | SGDR-SDA140A01BY22 |
|                      | U | SGDR-SDA060A01B | SGDR-SDA140A01BY22 |
|                      | R | SGDR-SDA060A01B | SGDR-SDA060A01B    |
|                      | B | SGDR-SDA060A01B | SGDR-SDA060A01B    |
|                      | T | SGDR-SDA060A01B | SGDR-SDA060A01B    |

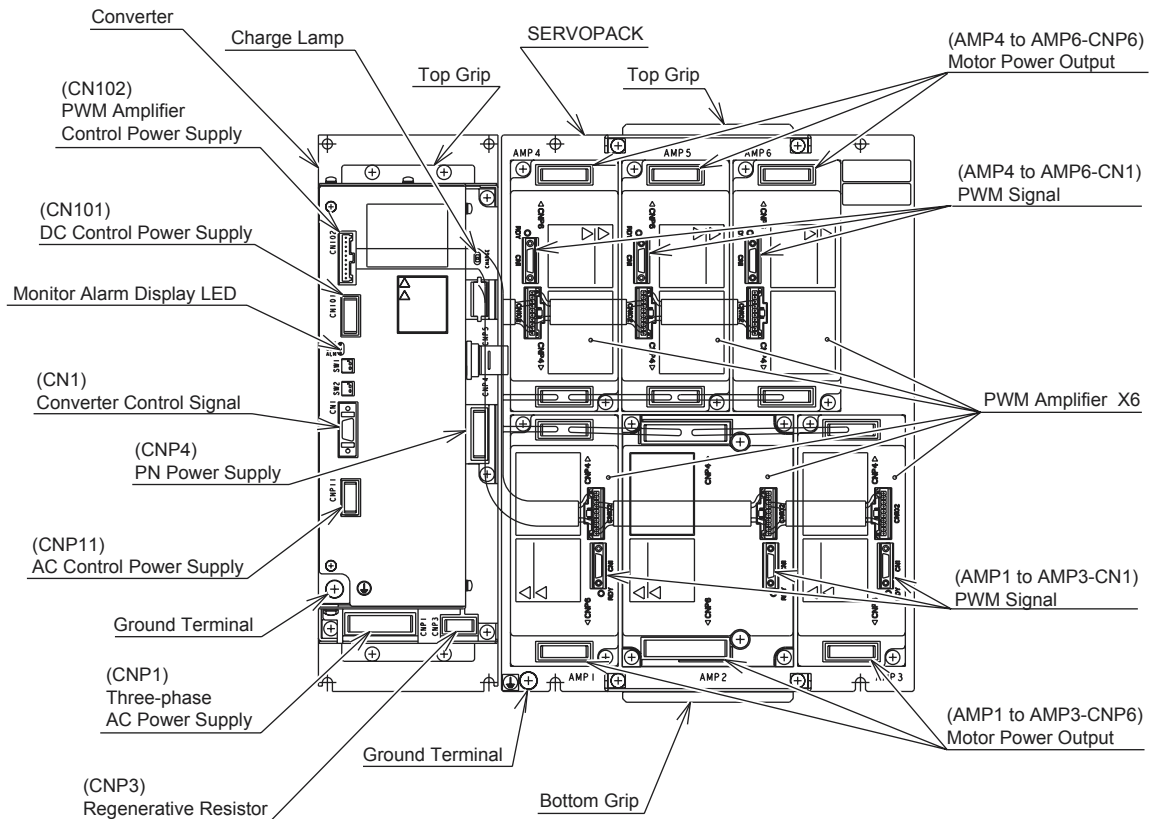
| Configuration device |   | HP20, EA1900N      | UP50N              | UP20MN          |
|----------------------|---|--------------------|--------------------|-----------------|
|                      |   | Model              | Model              |                 |
| SERVOPACK            |   | SGDR-HP20Y30       | SGDR-EH50Y24       | SGDR-EH50Y27    |
| PWM Amplifier        | S | SGDR-SDA140A01B    | SGDR-SDA710A01BY32 | SGDR-SDA710A01B |
|                      | L | SGDR-SDA350A01BY23 | SGDR-SDA710A01B    | SGDR-SDA710A01B |
|                      | U | SGDR-SDA140A01BY22 | SGDR-SDA350A01BY28 | SGDR-SDA350A01B |
|                      | R | SGDR-SDA060A01B    | SGDR-SDA140A01B    | SGDR-SDA060A01B |
|                      | B | SGDR-SDA060A01BY31 | SGDR-SDA140A01B    | SGDR-SDA060A01B |
|                      | T | SGDR-SDA060A01B    | SGDR-SDA140A01B    | SGDR-SDA060A01B |
| Converter            |   | SGDR-COA080A01B    | SGDR-COA250A01B    | SGDR-COA250A01B |

| Configuration device |   | ES165N, HP165, ES200N | ES165RN, ES200RN   |
|----------------------|---|-----------------------|--------------------|
|                      |   | Model                 | Model              |
| SERVOPACK            |   | SGDR-ES165N           | SGDR-ES165NY28     |
| PWM Amplifier        | S | SGDR-SDA710A01B       | SGDR-SDA710A01B    |
|                      | L | SGDR-SDA710A01BY29    | SGDR-SDA710A01BY29 |
|                      | U | SGDR-SDA710A01B       | SGDR-SDA710A01BY25 |
|                      | R | SGDR-SDA350A01B       | SGDR-SDA350A01B    |
|                      | B | SGDR-SDA350A01B       | SGDR-SDA350A01B    |
|                      | T | SGDR-SDA350A01B       | SGDR-SDA350A01B    |
| Converter            |   | SGDR-COA250A01B       | SGDR-COA250A01B    |

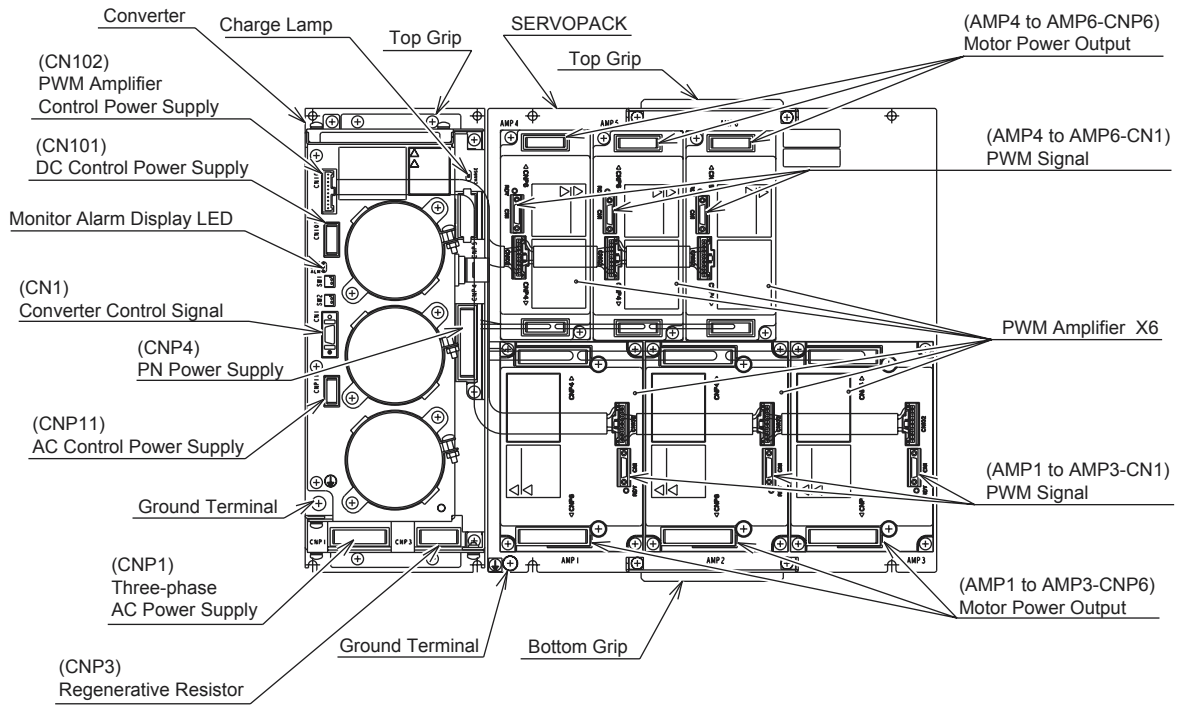
7.5 SERVOPACK



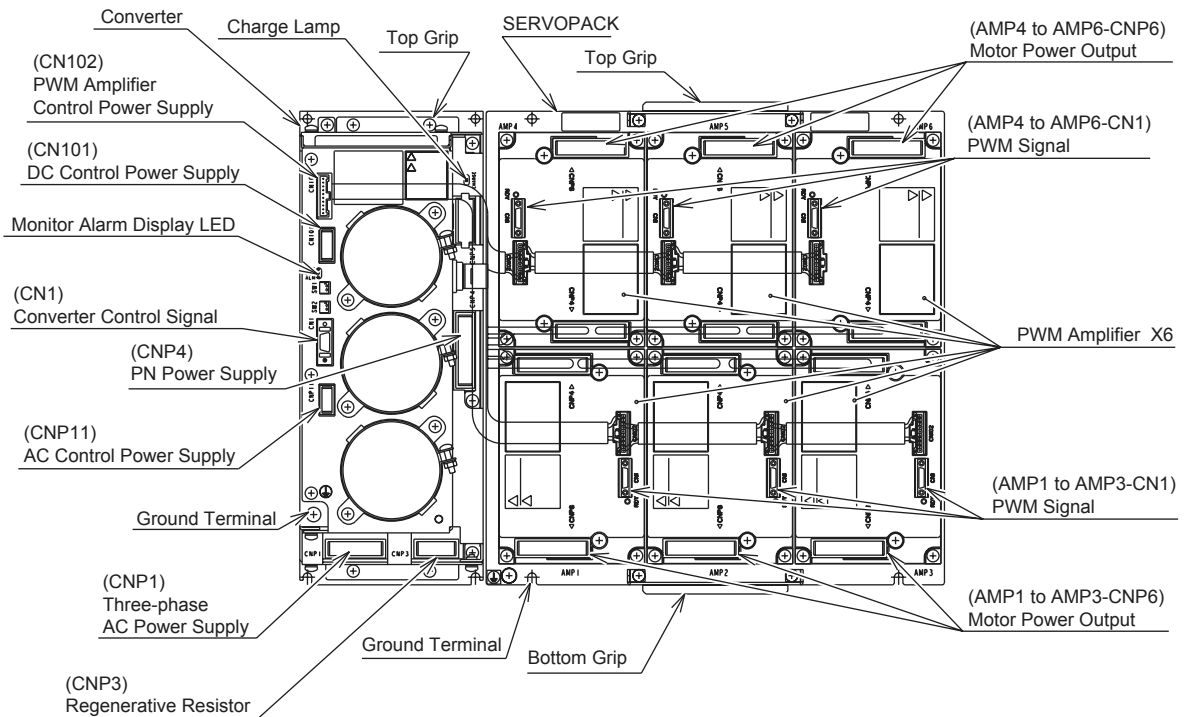
SERVOPACK Configuration for HP6 and EA1400N



SERVOPACK Configuration for HP20



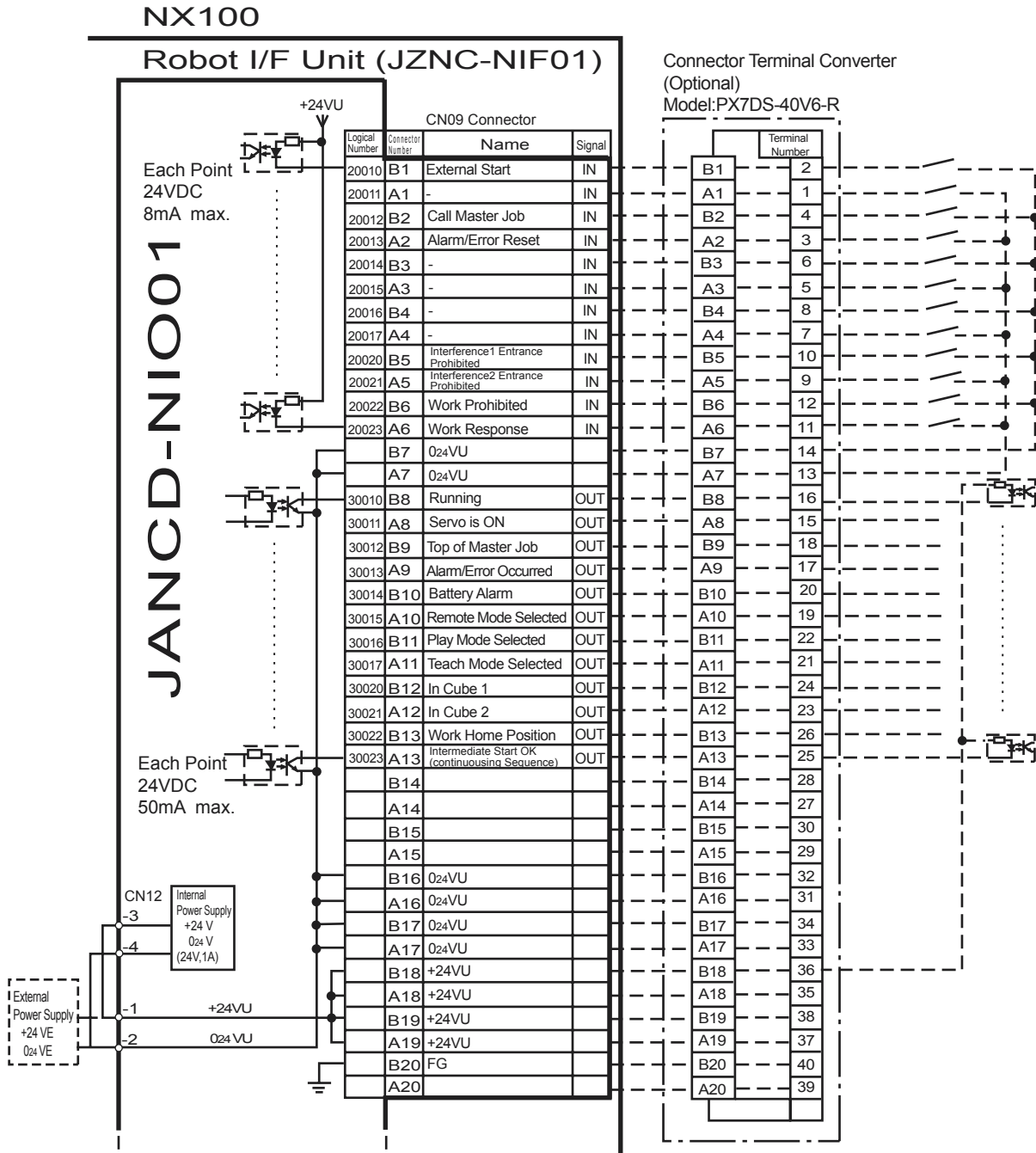
SERVOPACK Configuration for UP50N



SERVOPACK Configuration for ES165N and HP165

## 7.6 User I/O Signal Assignment

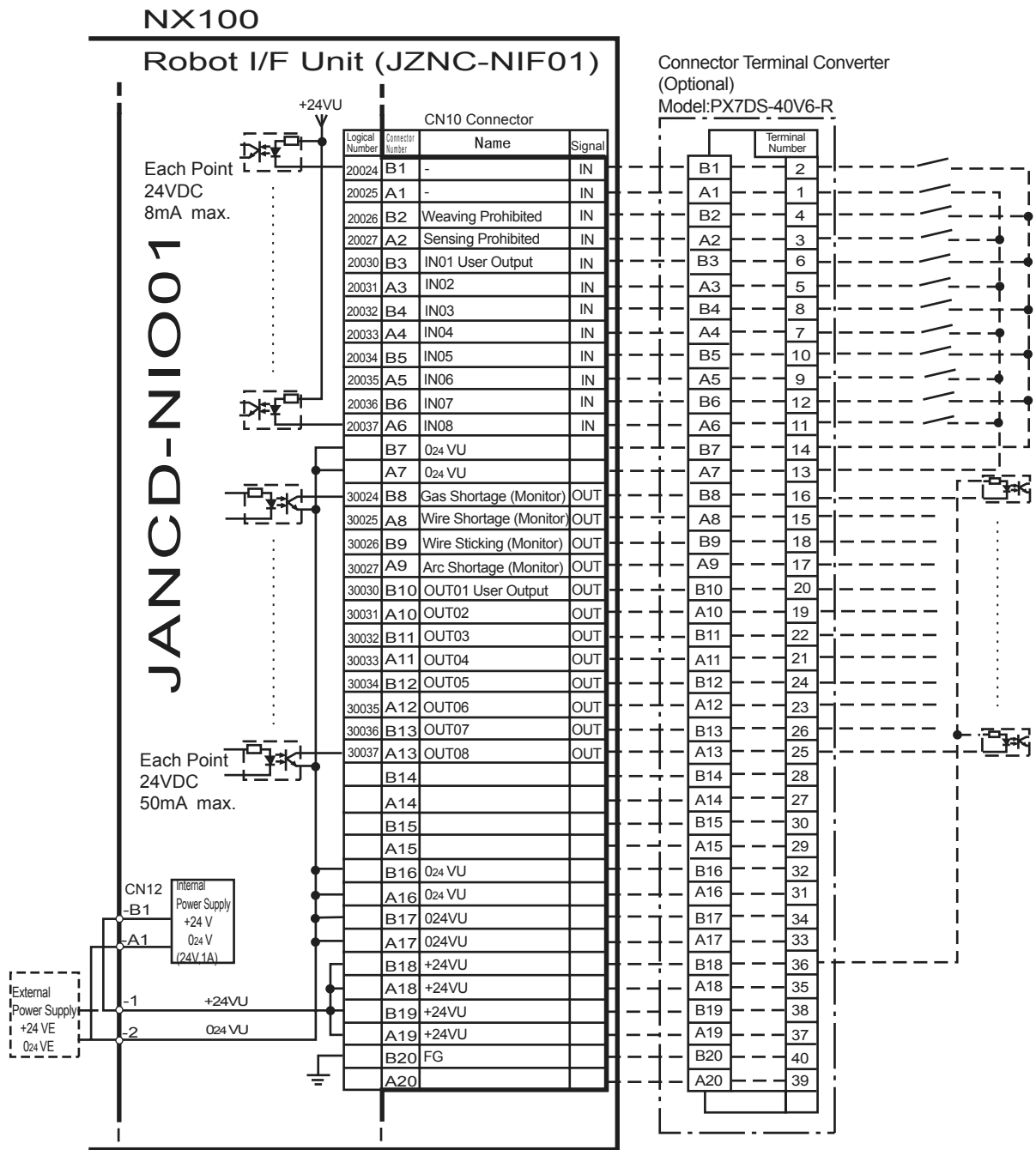
### 7.6.1 Arc Welding



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

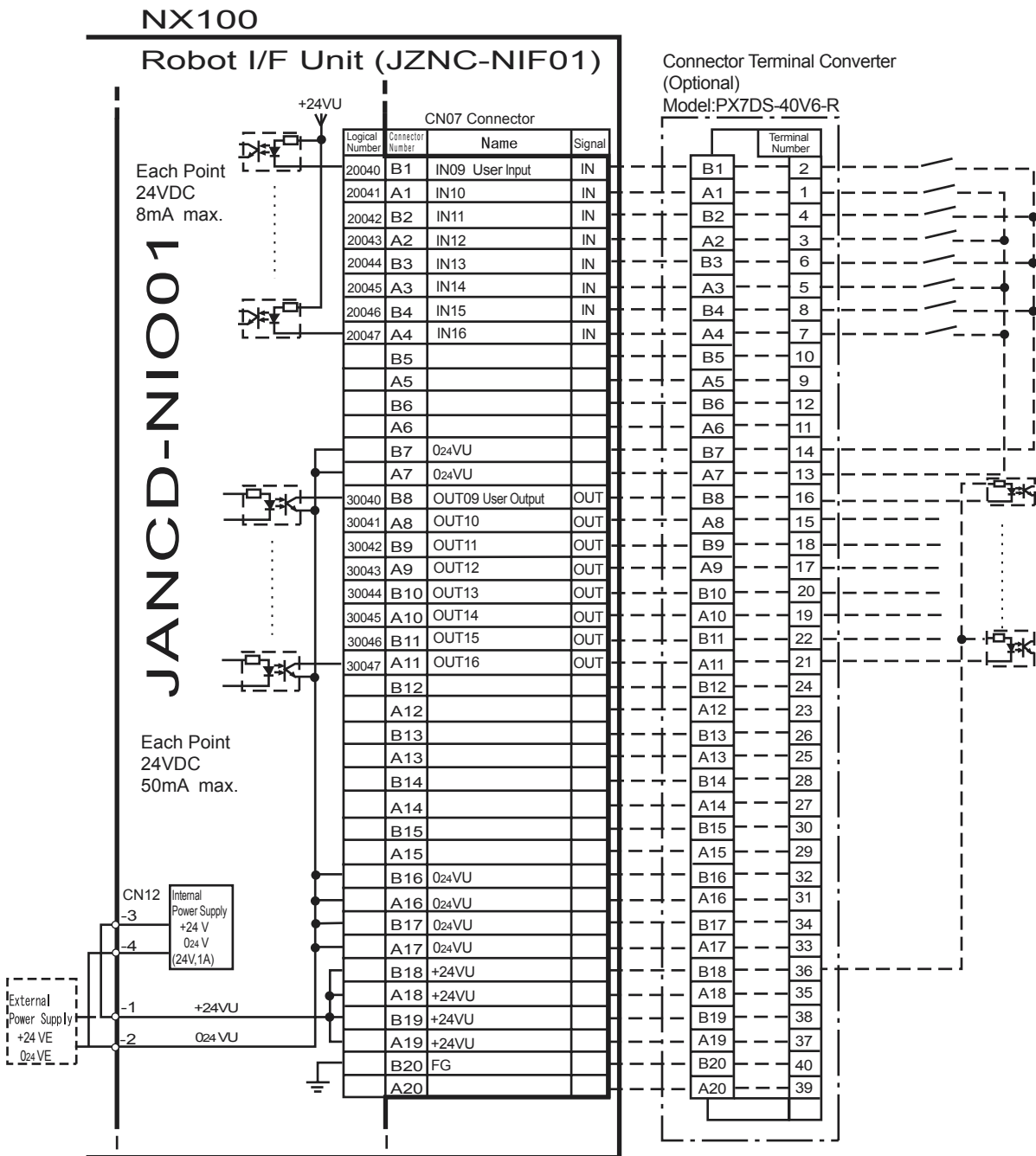
JANCD-NIO01 (CN09 Connector) I/O Allocation and Connection Diagram (For Arc Welding)





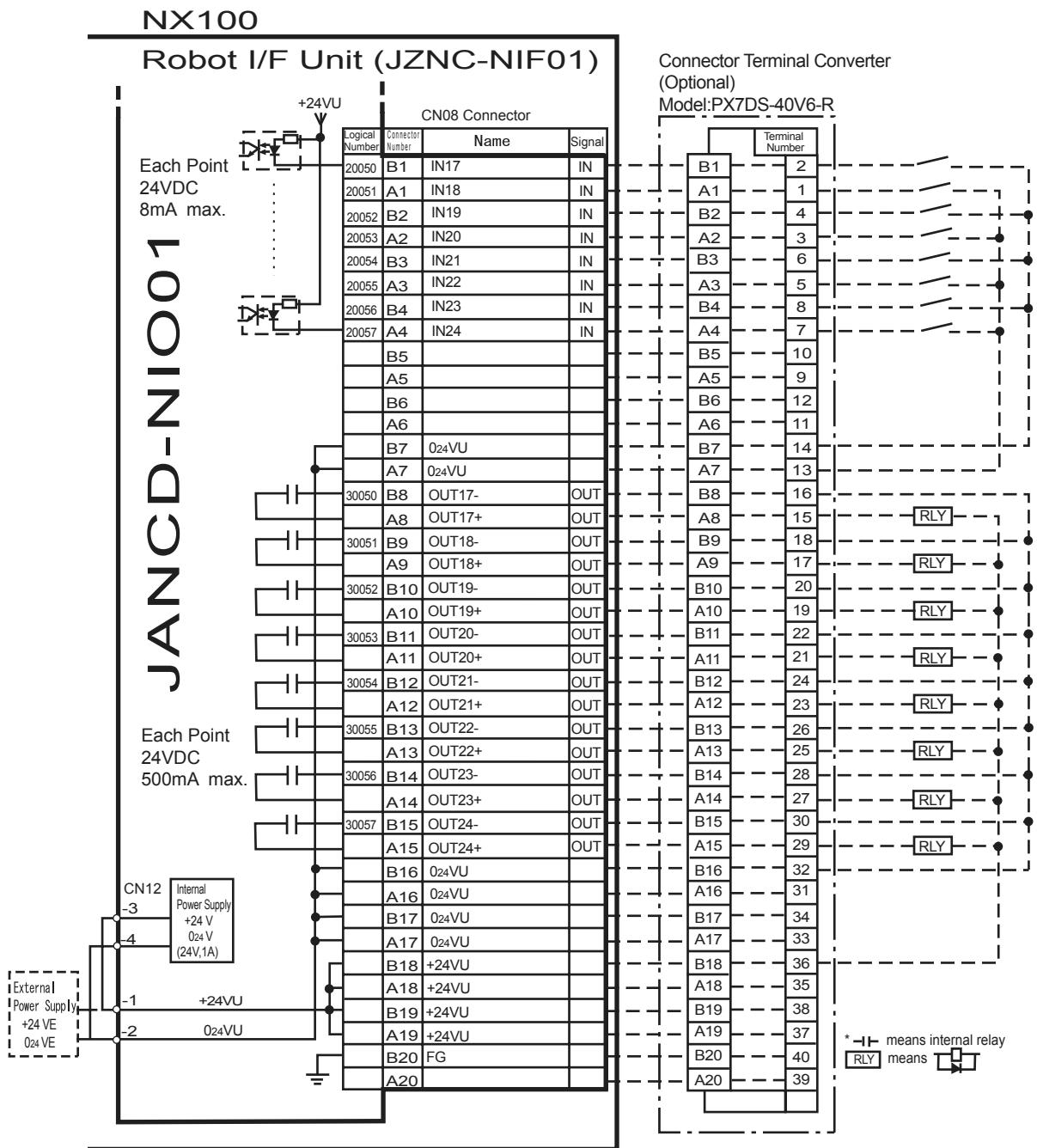
\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN10 Connector) I/O Allocation and Connection Diagram (For Arc Welding)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN07 Connector) I/O Allocation and Connection Diagram (For Arc Welding)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN08 Connector) I/O Allocation and Connection Diagram (For Arc Welding)

## 7.6 User I/O Signal Assignment

System Input List NIO01 (Arc Welding)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function  |
|----------------|---|----------------|--|
| 20010          | EXTERNAL START<br>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.                                     | 20022          | WORK PROHIBITED (Arc Generation Prohibited)<br>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. |
| 20012          | CALL MASTER JOB<br>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). | 20023          | WORK RESPONSE (Pseudo Arc ON Response)<br>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). |
| 20013          | ALARM/ERROR RESET<br>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.  | 20026          | WEAVING PROHIBITED<br>Weaving is prohibited while this signal is ON. Use this signal to check taught steps and movements without performing the weaving operation.   |
| 20020          | INTERFERENCE 1 ENTRANCE PROHIBITED<br>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.   | 20027          | SENSING PROHIBITED<br>Arc sensing is prohibited while this signal is ON. Use this signal to check taught steps and movements if an arc sensor is mounted.  |
| 20021          | INTERFERENCE 2 ENTRANCE PROHIBITED<br>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.   |                |  |

- \*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 "9.7 Interference Area" of NX100 INSTRUCTIONS (Manual No: RE-CTO-A211).

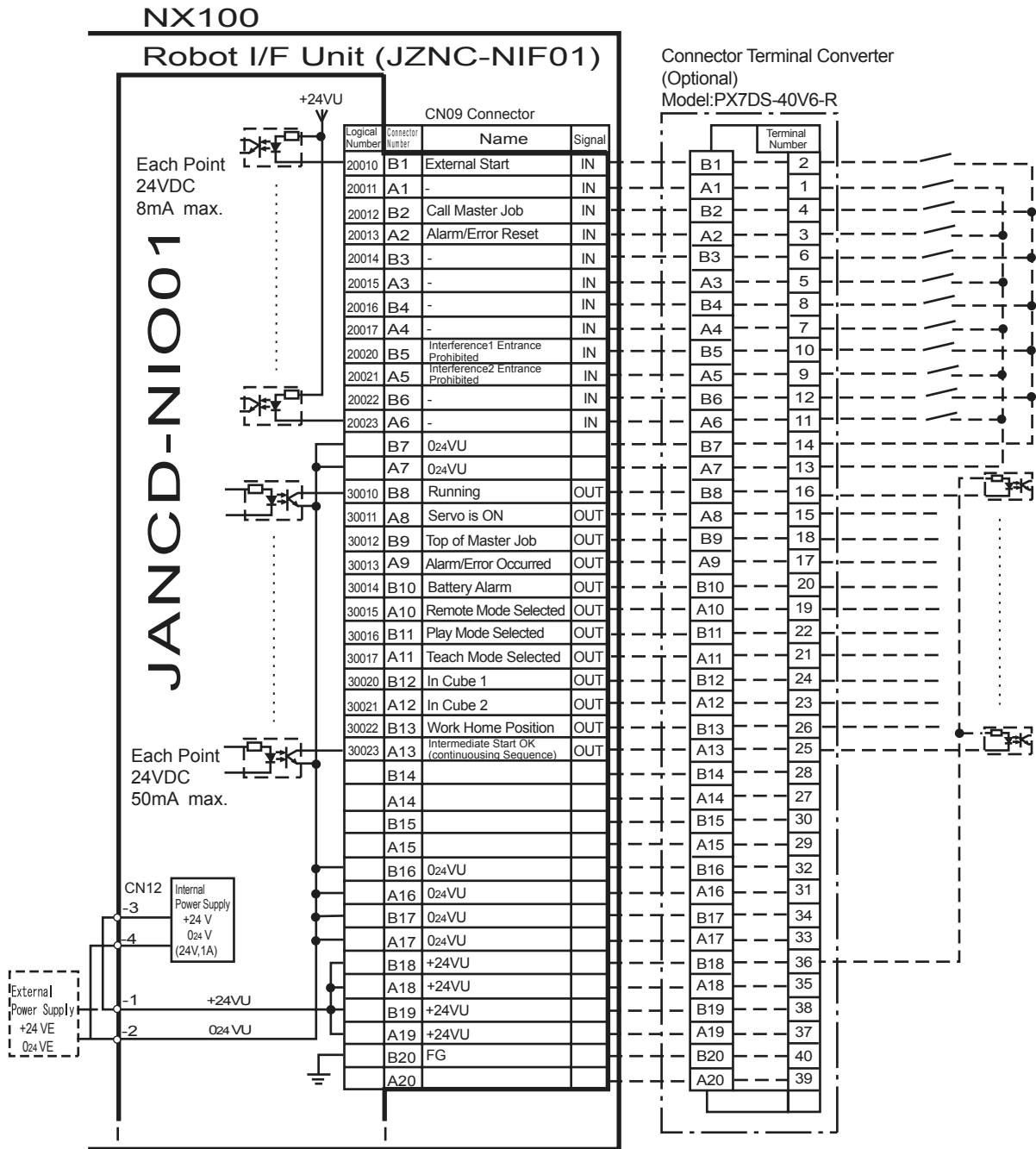
System Output List NIO01 (Arc Welding)

| Logical Number | Output Name / Function   | Logical Number | Output Name / Function   |
|----------------|--|----------------|--|
| 30010          | <b>RUNNING</b><br>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.  | 30021          | <b>IN CUBE 2</b><br>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.   |
| 30011          | <b>SERVO IS ON</b><br>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 NX100 status diagnosis for an external start.     | 30022          | <b>WORK HOME POSITION (IN CUBE 48)<sup>*1</sup></b><br>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.  |
| 30012          | <b>TOP OF MASTER JOB</b><br>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. <sup>*2</sup>  | 30023          | <b>INTERMEDIATE START OK</b><br>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. |
| 30013          | <b>ALARM/ERROR OCCURRED</b><br>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.   | 30024          | <b>GAS SHORTAGE (MONITOR)</b><br>This signal stays ON while the gas shortage signal from the welding power supply is ON.   |
| 30014          | <b>BATTERY ALARM</b><br>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. | 30025          | <b>WIRE SHORTAGE (MONITOR)</b><br>This signal status ON while the wire shortage signal from the welding power supply is ON.  |
| 30015 to 30017 | <b>REMOTE/PLAY/TEACH MODE SELECTED</b><br>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.  | 30026          | <b>WIRE STICKING (MONITOR)</b><br>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.   |
| 30020          | <b>IN CUBE 1</b><br>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.   | 30027          | <b>ARC SHORTAGE (MONITOR)</b><br>This signal stays ON while the arc shortage signal from the welding power supply is ON.   |

**\*1** The work home position cube and Cube 48 are same.

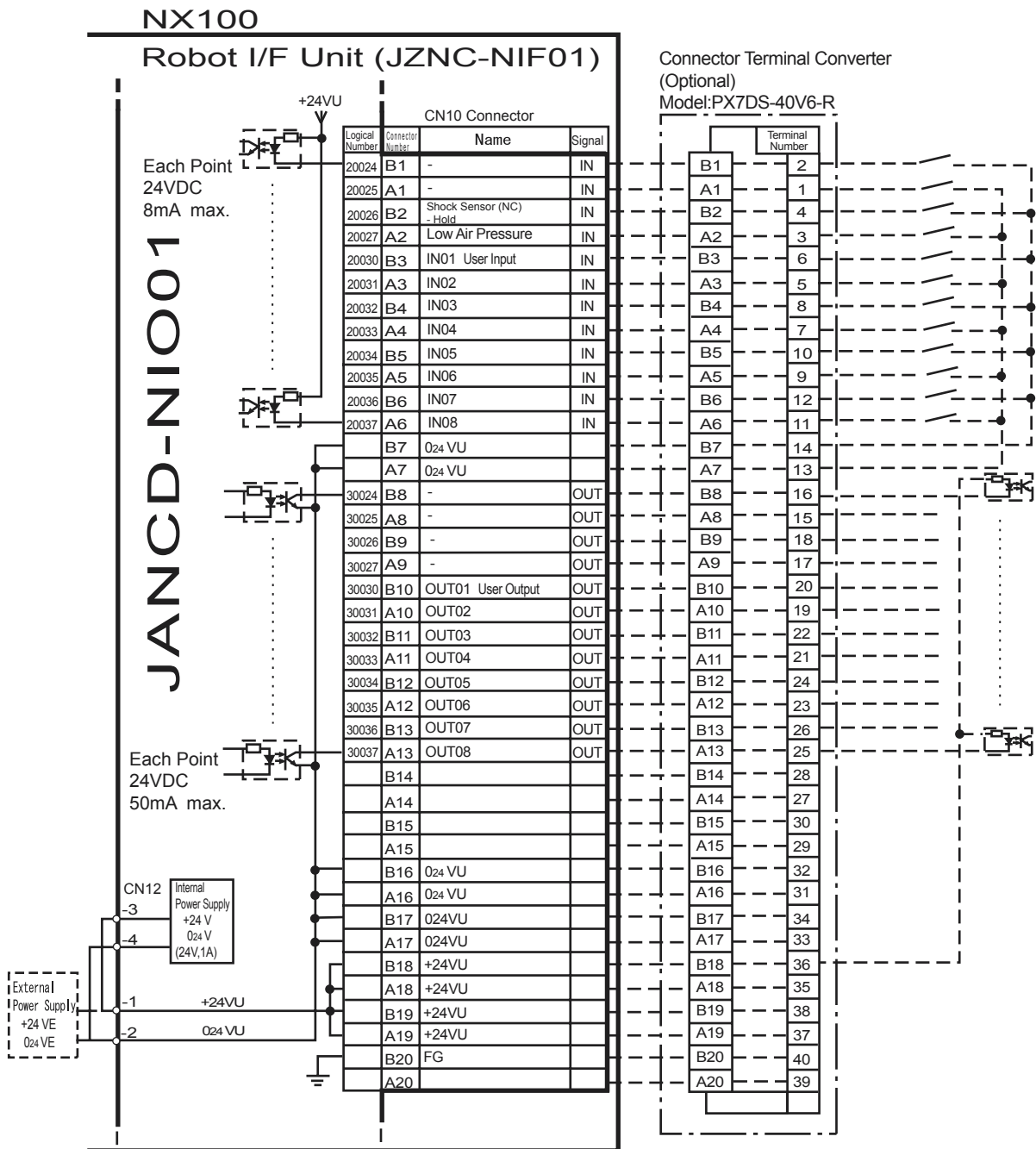
**\*2** This signal is not output during operation.

## 7.6.2 Handling



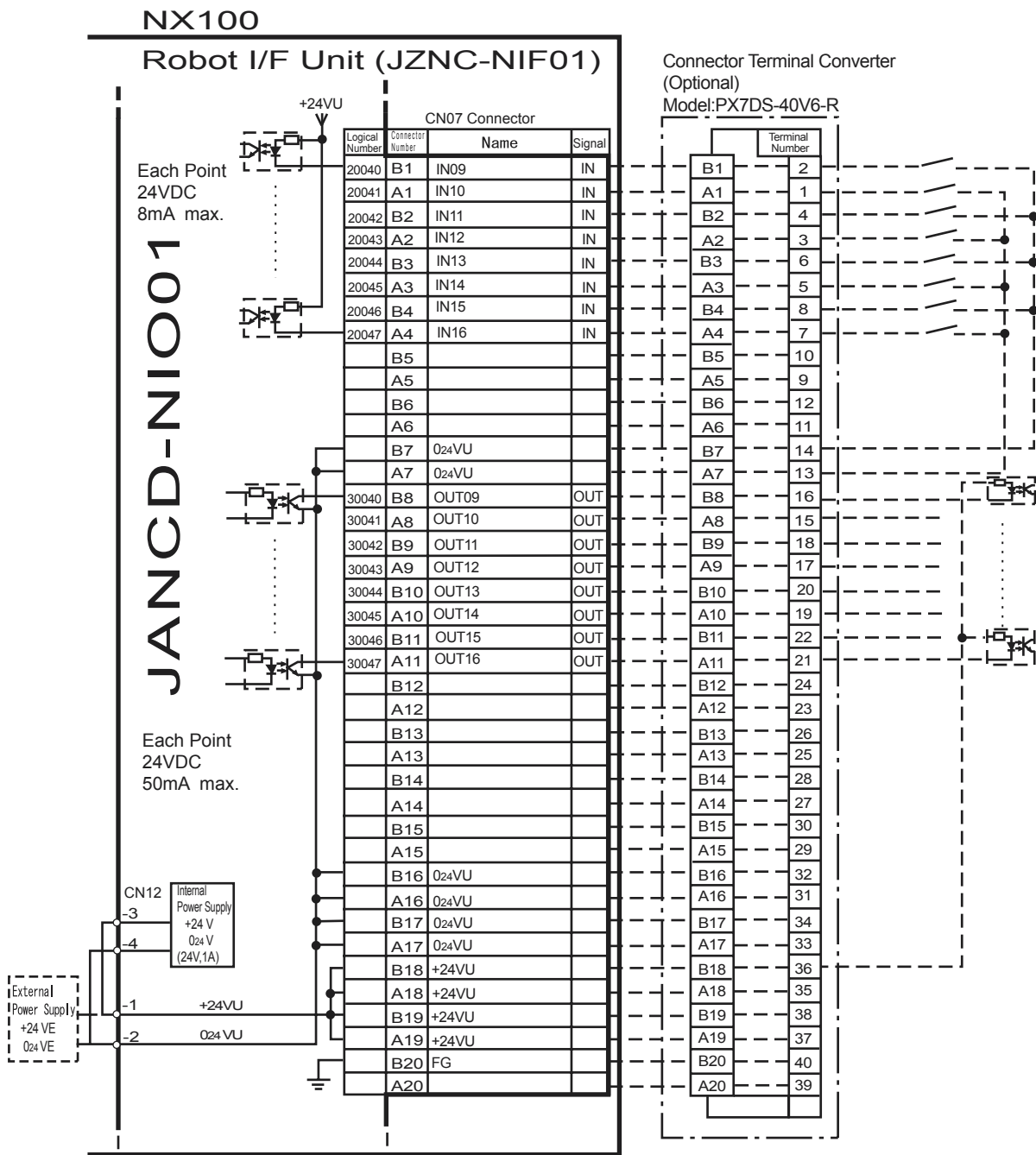
\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN09 Connector) I/O Allocation and Connection Diagram (For Handling)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

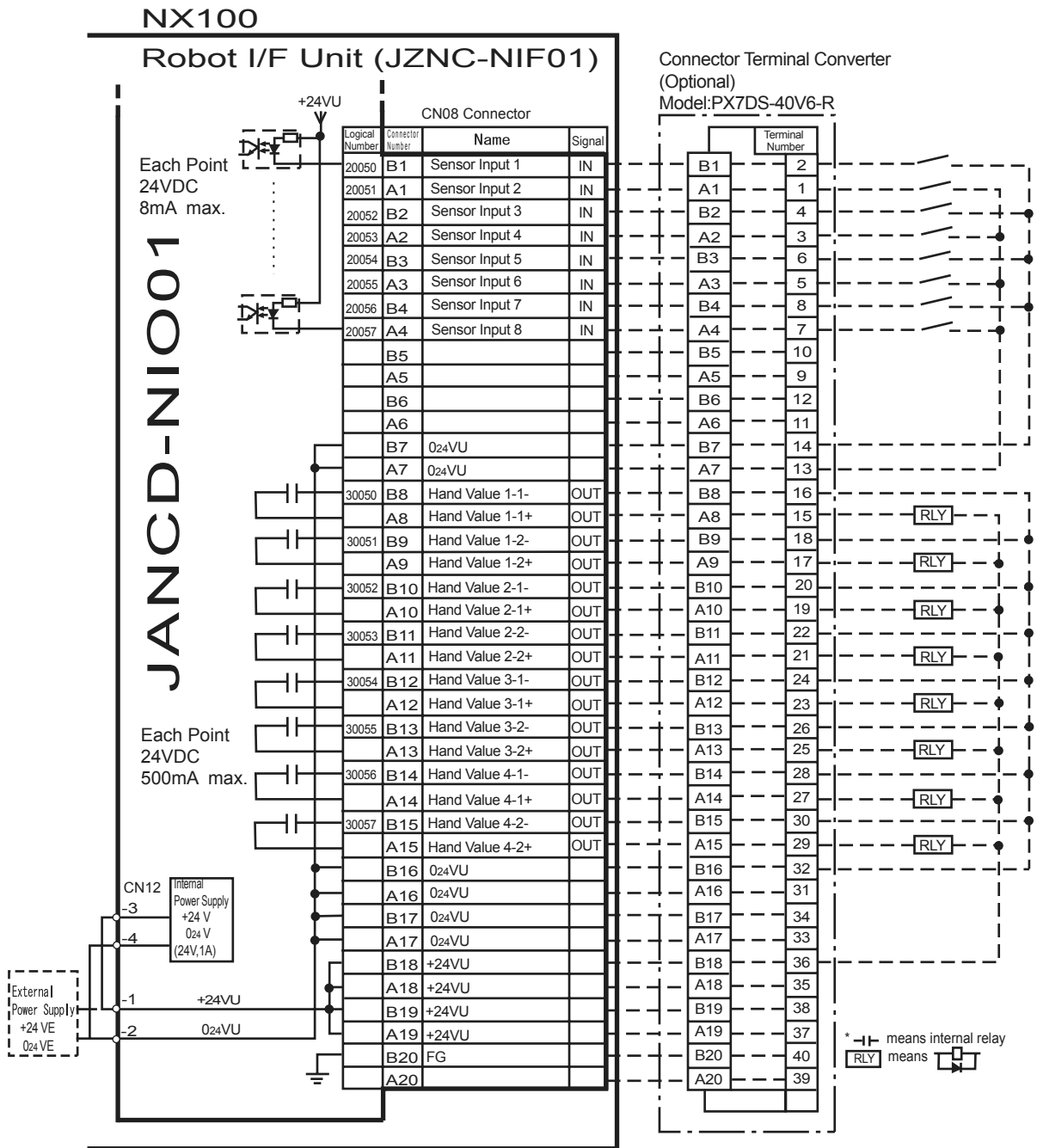
JANCD-NIO01 (CN10 Connector) I/O Allocation and Connection Diagram (For Handling)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO07 (CN07 Connector) I/O Allocation and Connection Diagram (For Handling)





\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN08 Connector) I/O Allocation and Connection Diagram (For Handling)

System Input List NIO01 (Handling)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function  |
|----------------|---|----------------|--|
| 20010          | EXTERNAL START<br>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.                                     | 20021          | INTERFERENCE 2 ENTRANCE PROHIBITED<br>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.  |
| 20012          | CALL MASTER JOB<br>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). | 20026          | TOOL SHOCK SENSOR<br>This is normally ON (NC) signal input. When it turns OFF, an NX100 displays 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. |
| 20013          | ALARM/ERROR RESET<br>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.  | 20027          | LOW AIR PRESSURE<br>This signal is normally OFF (NO). When it turns ON, XRC displays user alarm in the PLAY mode or displays user message in the teach mode.   |
| 20020          | INTERFERENCE 1 ENTRANCE PROHIBITED<br>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.   | 20050 to 20057 | SENSOR INPUT 1 - 8<br>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 "9.7 Interference Area" of NX100 INSTRUCTIONS (Manual No: RE-CTO-A211).

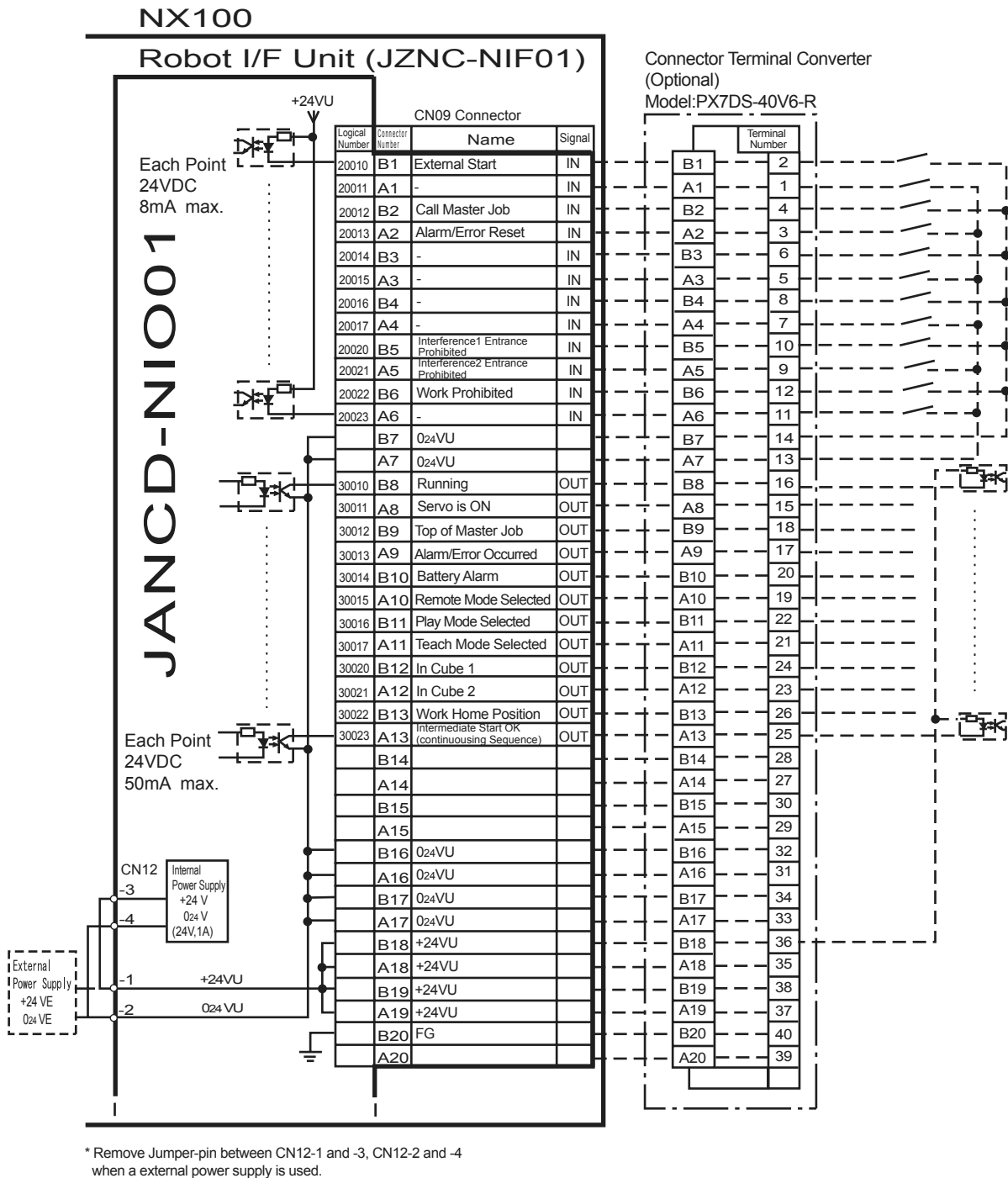
System Output List NIO01 (Handling)

| Logical Number | Output Name / Function   | Logical Number | Output Name / Function   |
|----------------|--|----------------|--|
| 30010          | <b>RUNNING</b><br>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.  | 30021          | <b>IN CUBE 2</b><br>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.   |
| 30011          | <b>SERVO IS ON</b><br>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 NX100 status diagnosis for an external start.     | 30022          | <b>WORK HOME POSITION (IN CUBE 48)*1</b><br>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.   |
| 30012          | <b>TOP OF MASTER JOB</b><br>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.*2  | 30023          | <b>INTERMEDIATE START OK</b><br>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. |
| 30013          | <b>ALARM/ERROR OCCURRED</b><br>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.   | 30050 to 30057 | <b>HAND VALVE 1-4</b><br>These outputs are controlled by the HAND handling specific instructions. Hand valves 1 to 4 correspond to HAND 1 to 4.  |
| 30014          | <b>BATTERY ALARM</b><br>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 | <b>REMOTE/PLAY/TEACH MODE SELECTED</b><br>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          | <b>IN CUBE 1</b><br>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.   |                |  |

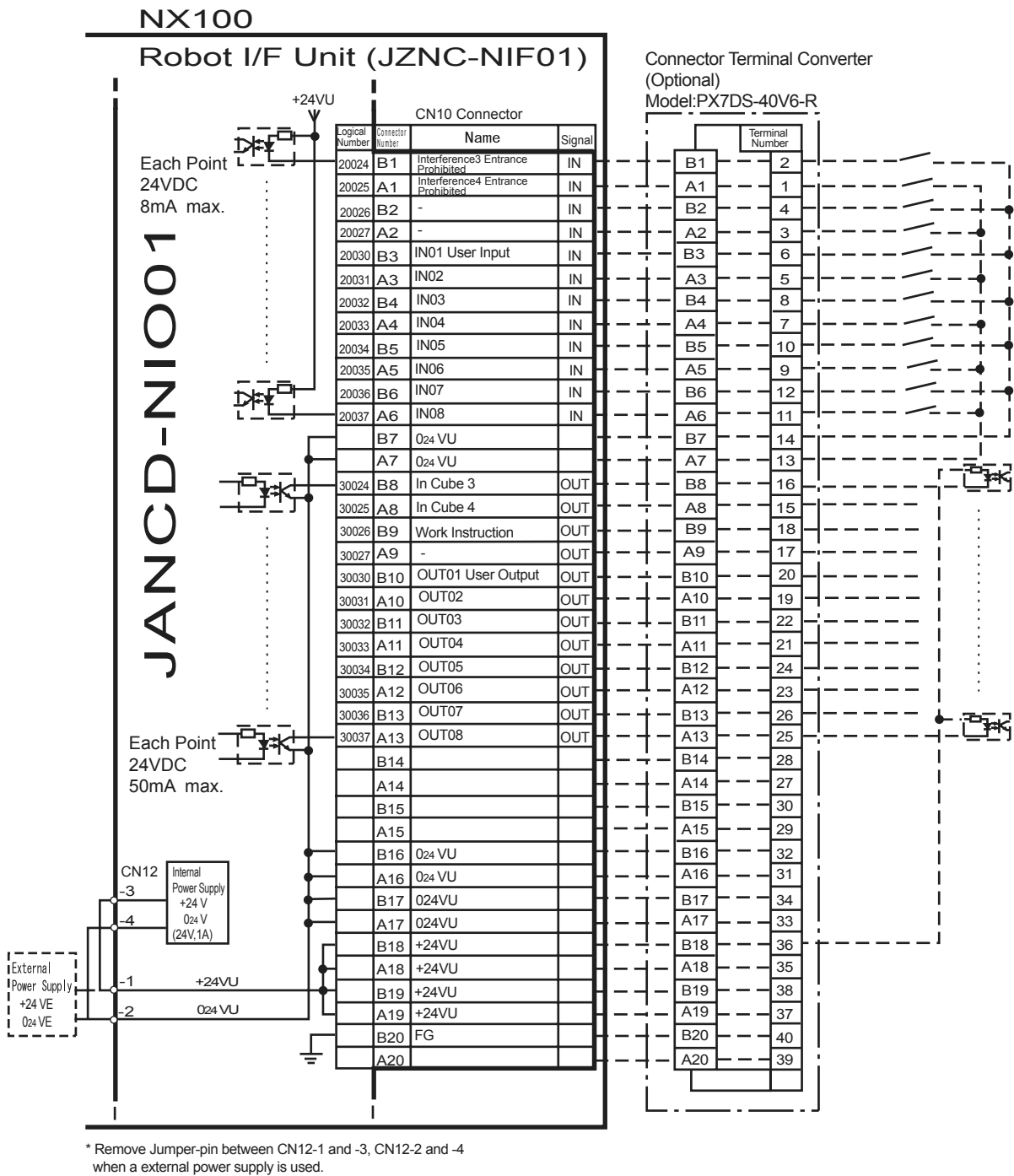
\*1 The work home position cube and Cube 48 are same.

\*2 This signal is not output during operation.

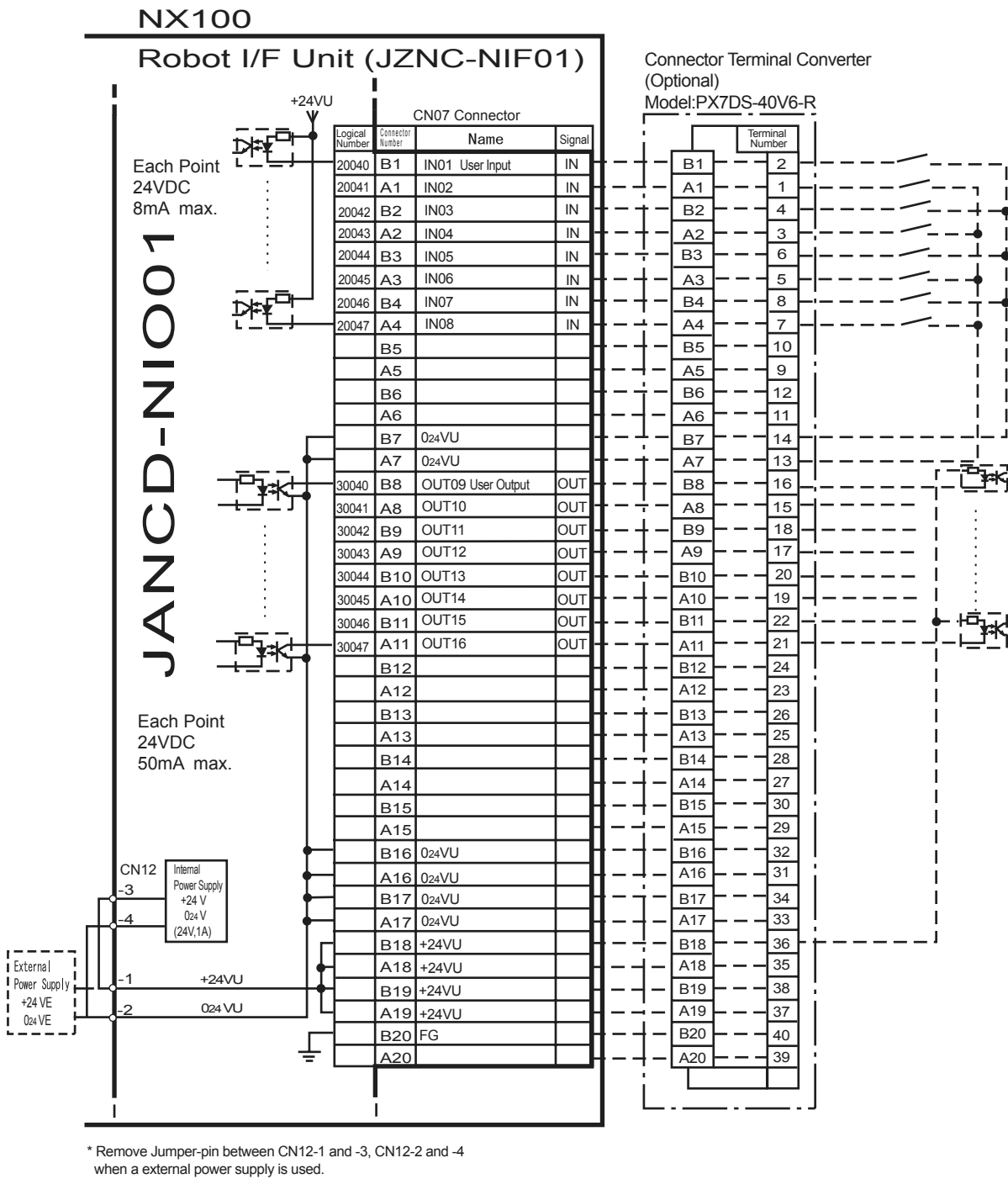
### 7.6.3 General Application



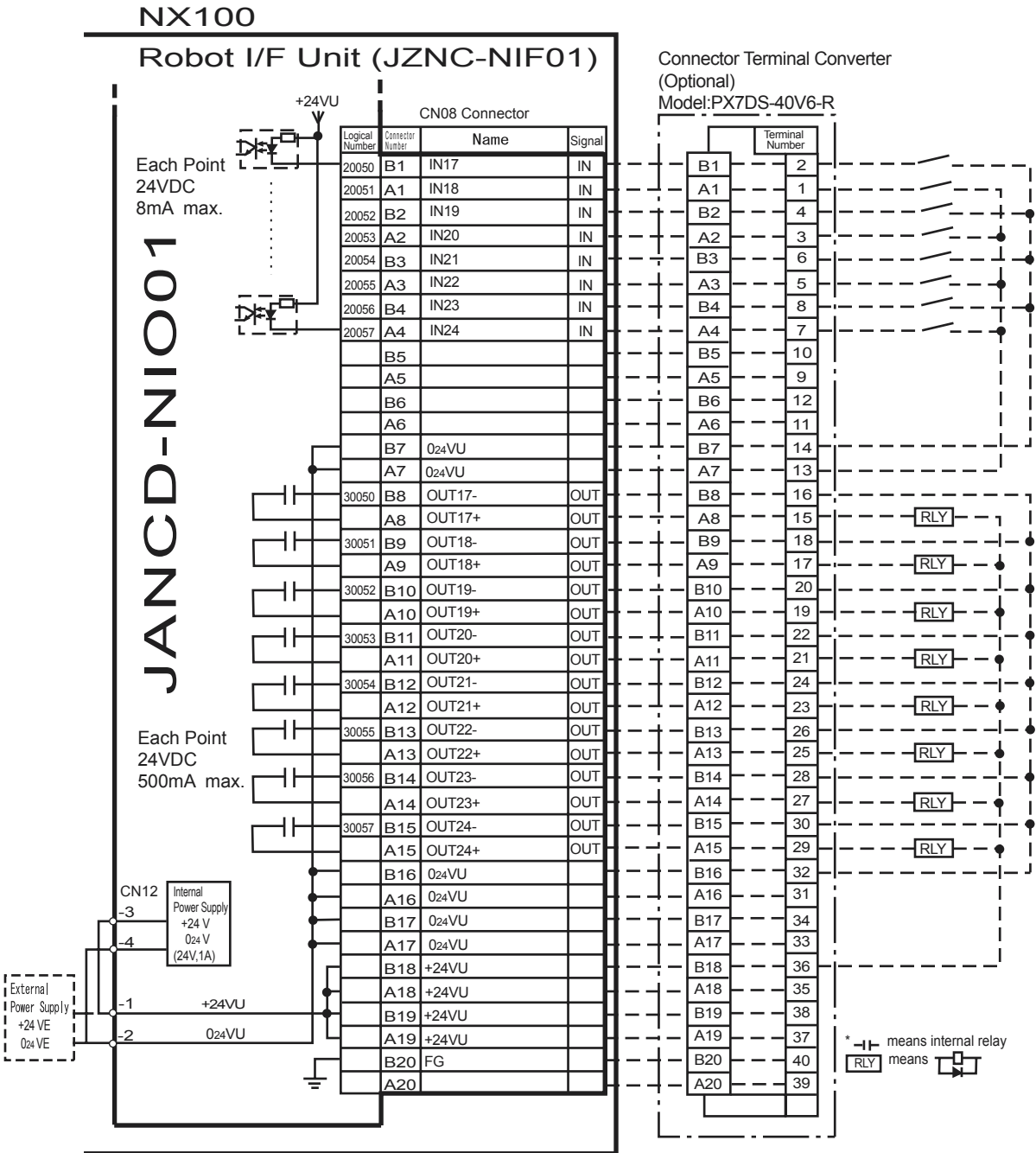
JANCD-NIO01 (CN09 Connector) I/O Allocation and Connection Diagram (For General Application)



JANCD-NIO01 (CN10 Connector) I/O Allocation and Connection Diagram (For General Application)



JANCD-NIO01 (CN07 Connector) I/O Allocation and Connection Diagram (For General Application)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN08 Connector) I/O Allocation and Connection Diagram (For General Application)

## 7.6 User I/O Signal Assignment

System Input List NIO01 (General application)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function  |
|----------------|---|----------------|--|
| 20010          | EXTERNAL START<br>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.                                     | 20021          | INTERFERENCE 2 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 2 <sup>2</sup> 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. |
| 20012          | CALL MASTER JOB<br>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). | 20022          | WORK PROHIBITED (Tool ON Prohibited)<br>Even if TOOLON instruction is executed, XRC doesn't output to external while this signal is ON.  |
| 20013          | ALARM/ERROR RESET<br>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.  | 20024          | INTERFERENCE 3 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 3 <sup>2</sup> 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. |
| 20020          | INTERFERENCE 1 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 1 <sup>2</sup> 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<br>If the manipulator attempts to enter the cube 4 <sup>2</sup> 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 "9.7 Interference Area" of NX100 INSTRUCTIONS (Manual No: RE-CTO-A211).



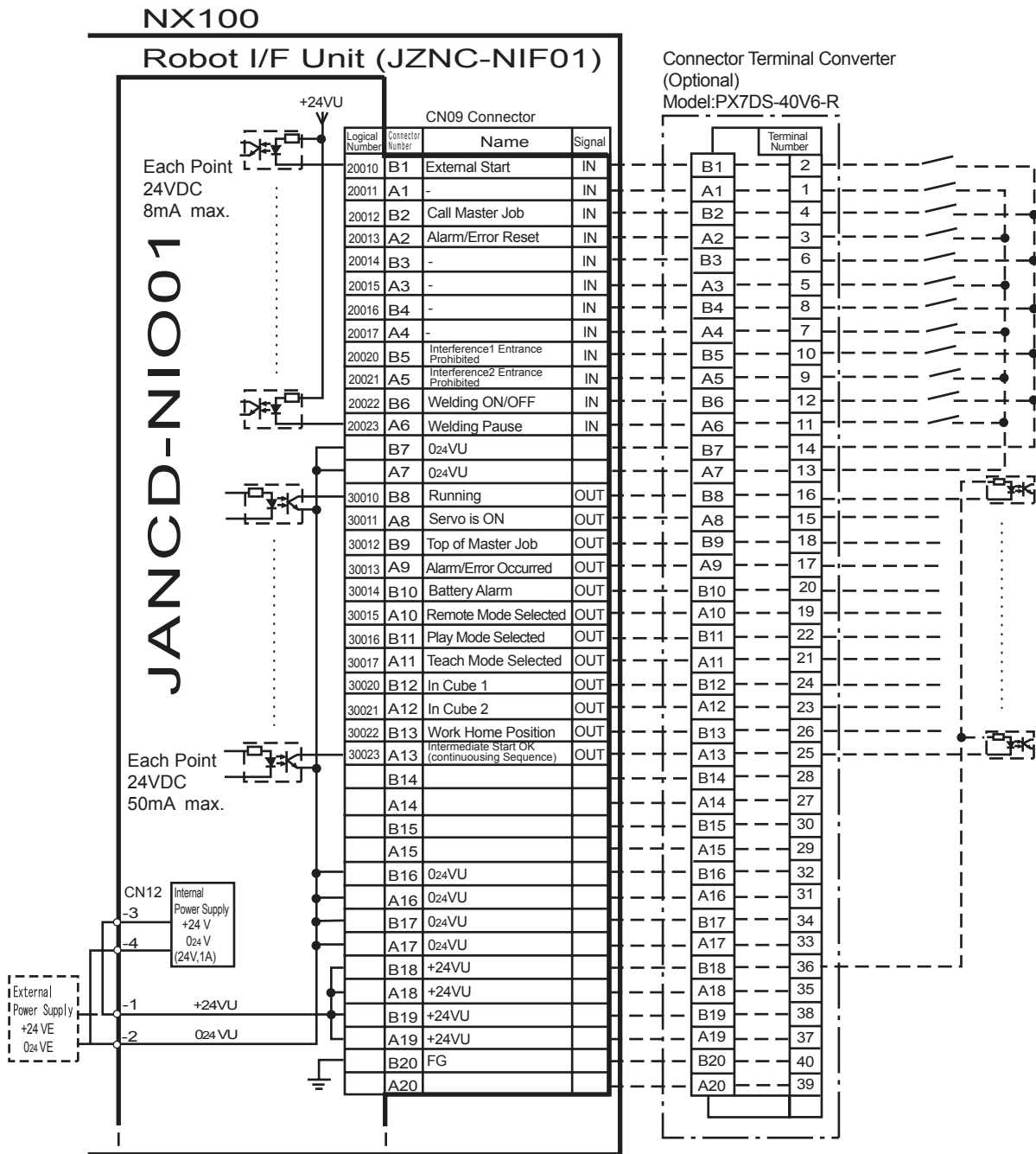
System Output List NIO01 (General application)

| Logical Number | Output Name / Function   | Logical Number | Output Name / Function   |
|----------------|--|----------------|--|
| 30010          | <b>RUNNING</b><br>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.  | 30021          | <b>IN CUBE 2</b><br>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.   |
| 30011          | <b>SERVO IS ON</b><br>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 XRC status diagnosis for an external start.       | 30022          | <b>WORK HOME POSITION (IN CUBE 48)*1</b><br>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.   |
| 30012          | <b>TOP OF MASTER JOB</b><br>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.*2  | 30023          | <b>INTERMEDIATE START OK</b><br>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. |
| 30013          | <b>ALARM/ERROR OCCURRED</b><br>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.   | 30024          | <b>IN CUBE 3</b><br>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.   |
| 30014          | <b>BATTERY ALARM</b><br>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. | 30025          | <b>IN CUBE 4</b><br>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.   |
| 30015 to 30017 | <b>REMOTE/PLAY/TEACH MODE SELECTED</b><br>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.  | 30026          | <b>WORK COMMAND</b><br>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.                                |
| 30020          | <b>IN CUBE 1</b><br>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.   |                |  |

\*1 The work home position cube and Cube 48 are same.

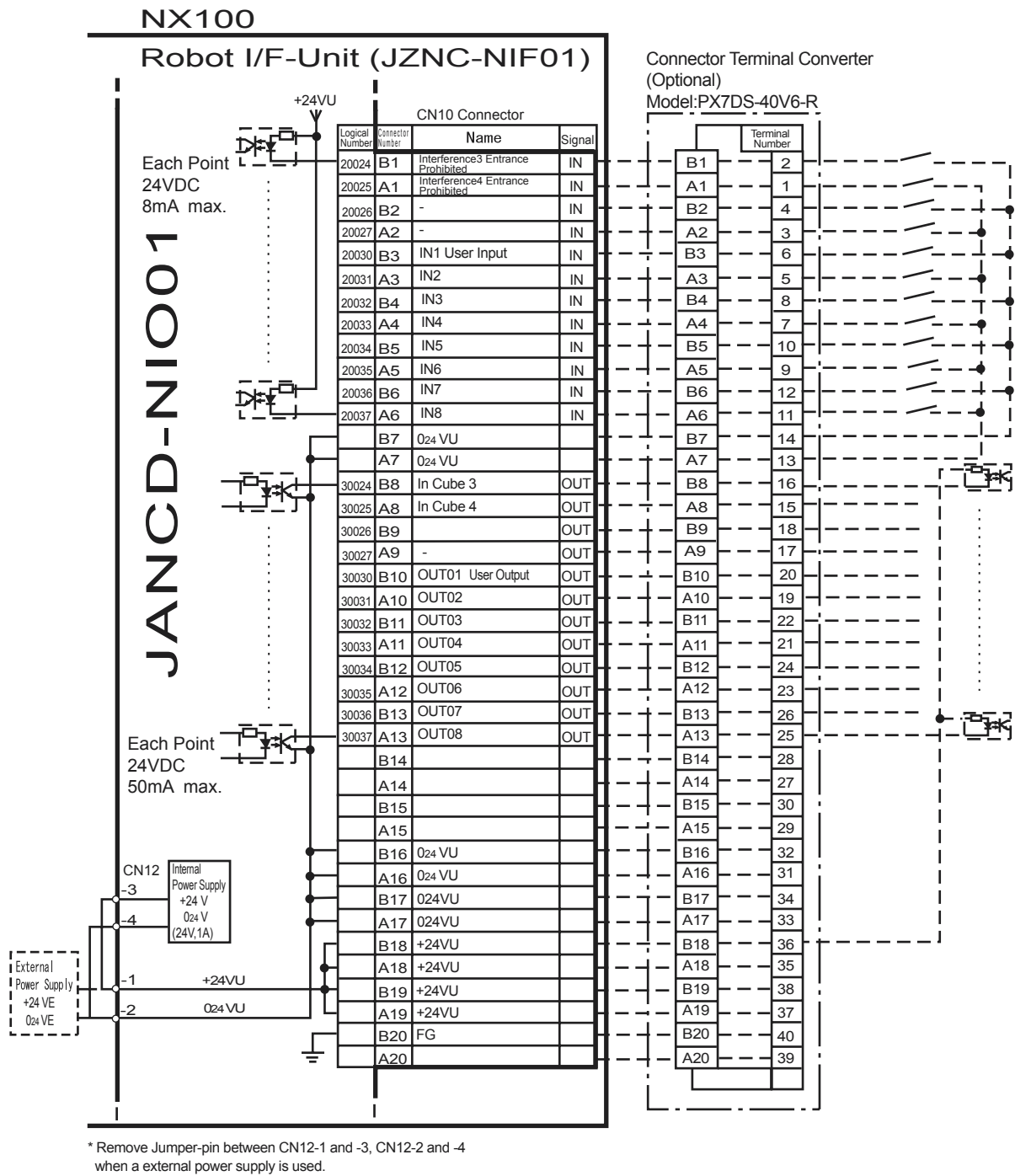
\*2 This signal is not output during operation.

### 7.6.4 Spot Welding

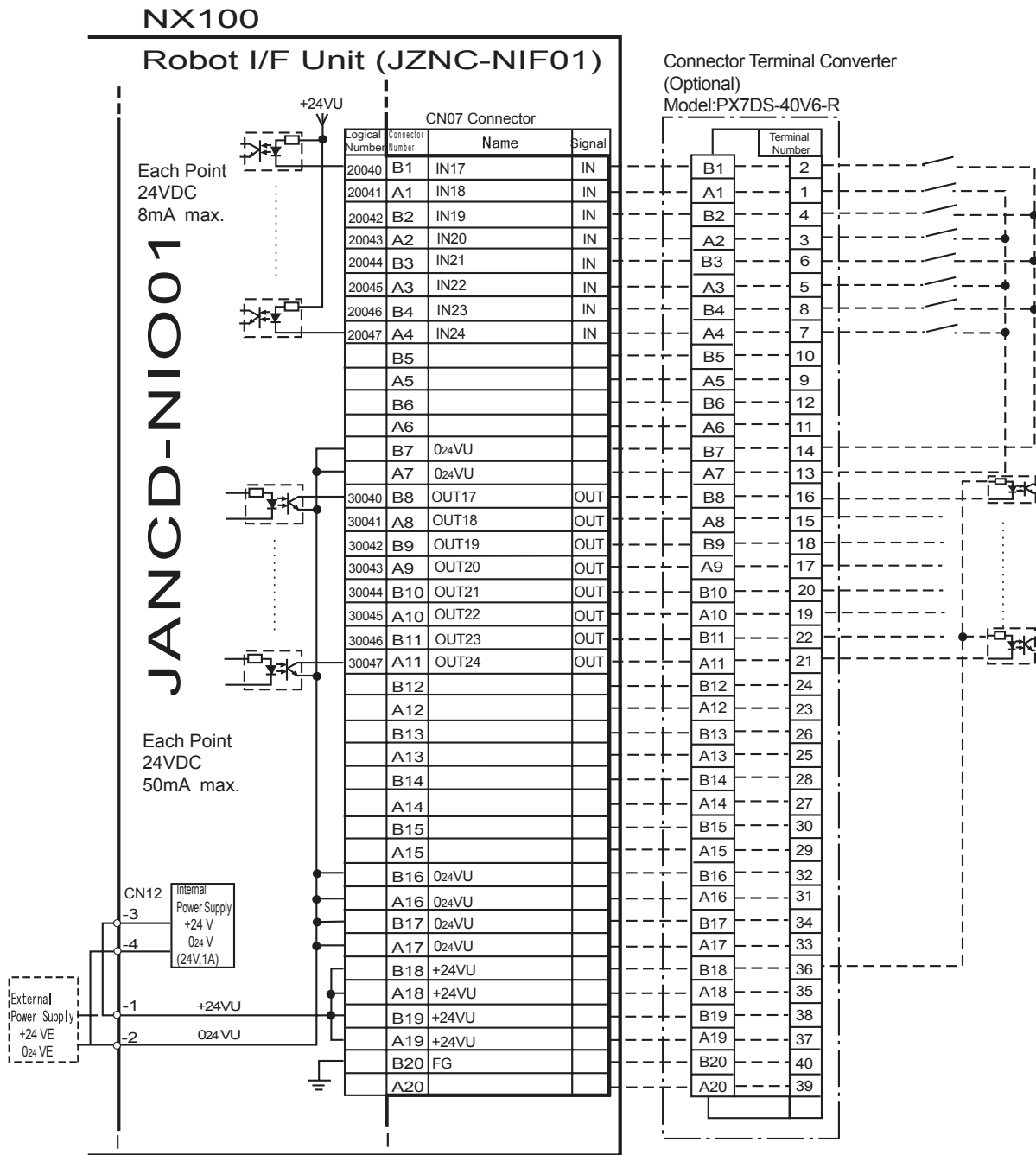


\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN09 Connector) I/O Allocation and Connection Diagram (For Spot Welding)

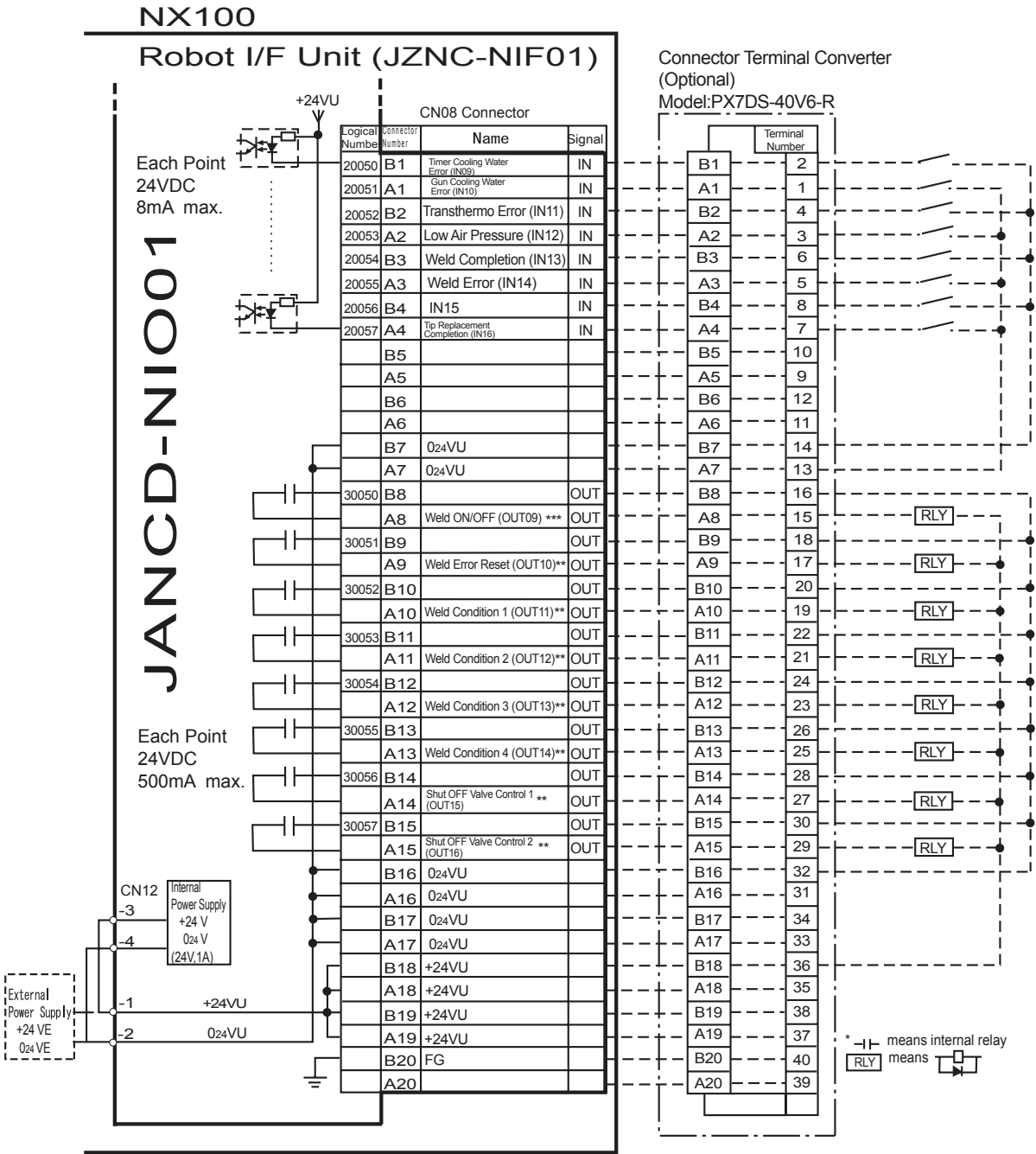


JANCD-NIO01 (CN10 Connector) I/O Allocation and Connection Diagram (For Spot Welding)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN07 Connector) I/O Allocation and Connection Diagram (For Spot Welding)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.  
\*\* This assignment can be changed at the I/O assignment display. Refer to System Input List NIO01 and System Output List NIO01 for detail.  
\*\*\* This assignment can be changed at the PSEDU input display. Refer to System Input List NIO01 and System Output List NIO01 for detail.

JANCN-NIO01 (CN08 Connector) I/O Allocation and Connection Diagram (For Spot Welding)

## 7.6 User I/O Signal Assignment

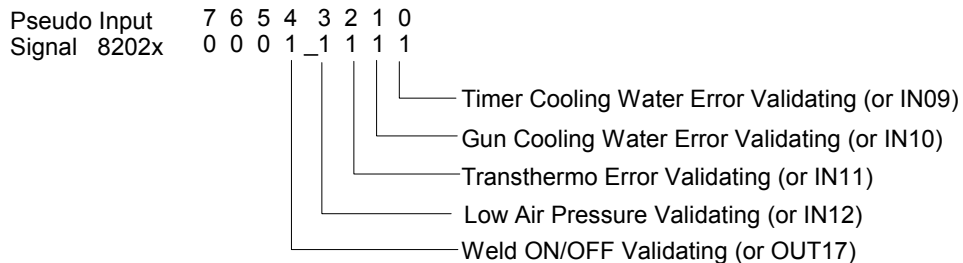
System Input List NIO01 (Spot Welding)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function   |
|----------------|---|----------------|---|
| 20010          | EXTERNAL START<br>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.                                     | 20024          | INTERFERENCE 3 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 3 <sup>2</sup> 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.  |
| 20012          | CALL MASTER JOB<br>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). | 20025          | INTERFERENCE 4 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 4 <sup>2</sup> 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.  |
| 20013          | ALARM/ERROR RESET<br>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.  | 20040<br>*4    | TIMER COOLING WATER ERROR<br>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.  |
| 20020          | INTERFERENCE 1 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 1 <sup>2</sup> 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.                              | 20041<br>*4    | GUN COOLING WATER ERROR<br>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.   |
| 20021          | INTERFERENCE 2 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 2 <sup>2</sup> 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.                              | 20042<br>*4    | TRANSTHERMO ERROR<br>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.  |
| 20022          | WELDING ON/OFF (From sequencer)<br>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.   | 20043<br>*4    | LOW AIR PRESSURE<br>When air pressure is reduced and this input is turned ON, an alarm occurs. The servo power supply remains ON.   |
| 20023          | WELDING PAUSE (From sequencer)<br>This signal is used to move the manipulator to the home position when an error occurs in the Power Source or the gun.<br>The robot ignores the spot welding instruction and operates playback motion.   | 20044<br>*3    | WELD COMPLETION<br>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. |

System Input List NIO01 (Spot Welding)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function   |
|----------------|---|----------------|---|
| 20045<br>*3    | WELDING ERROR<br>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.   | *3             | GUN SHORT OPEN DETECTION<br>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. |
| *3             | STICK DETECTION<br>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. | *3             | GUN PRESSURE DETECTION<br>This signal indicates that a gun is in pressing status.   |
| *3             | GUN FULL OPEN DETECTION<br>This signal indicates that the stroke of the double stroke gun is full open.   | 20047<br>*3    | TIP REPLACE COMPLETION<br>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 "9.7 Interference Area" of NX100 INSTRUCTIONS (Manual No: RE-CTO-A211).
- \*3** This signal can be allocated to any user I/O signal at the I/O allocation display in operation condition.
- \*4** 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 user I/O signal described in parentheses.



System Output List NIO01 (Spot Welding)

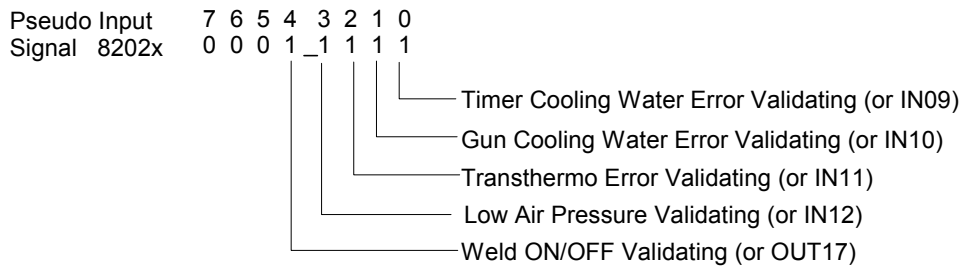
| Logical Number | Output Name / Function   | Logical Number       | Output Name / Function   |
|----------------|--|----------------------|--|
| 30010          | <b>RUNNING</b><br>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.  | 30023                | <b>INTERMEDIATE START OK</b><br>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. |
| 30011          | <b>SERVO IS ON</b><br>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 NX100 status diagnosis for an external start.     | 30024                | <b>IN CUBE 3</b><br>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.   |
| 30012          | <b>TOP OF MASTER JOB</b><br>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. *2   | 30025                | <b>IN CUBE 4</b><br>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.   |
| 30013          | <b>ALARM/ERROR OCCURRED</b><br>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.   | 30050<br>*4          | <b>WELD ON/OFF</b><br>Outputs a signal input from the interlock panel, etc. considering the robot status.  |
| 30014          | <b>BATTERY ALARM</b><br>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. | 30051<br>*3          | <b>WELD ERROR RESET</b><br>This signal commands the reset error status of the Power Source. This is operated with the programming pendant operation.   |
| 30015 to 30017 | <b>REMOTE/PLAY/TEACH MODE SELECTED</b><br>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.  | 30052 to 30055<br>*3 | <b>WELD CONDITION (Level signals)</b><br>1(1), 2(2), 4(3), 8(4), 16(5), 32(6), 64(7), 128(8)<br>Sets the welding conditions for the Power Source.<br>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).  |
| 30020          | <b>IN CUBE 1</b><br>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.   | *3                   | <b>WELDING COMMAND</b><br>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.  |
| 30021          | <b>IN CUBE 2</b><br>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.   | *3                   | <b>STROKE CHANGE1</b><br><b>SINGLE SOLENOID</b><br><b>DOUBLE SOLENOID</b><br>This is a signal, when a double stroke gun is used, to change the open stroke of the welding gun.   |
| 30022          | <b>WORK HOME POSITION (IN CUBE 48) *1</b><br>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.  | *3                   | <b>GUN PRESSURE INSTRUCTION</b><br>This outputs a gun pressure instruction.  |



System Output List NIO01 (Spot Welding)

| Logical Number | Output Name / Function   | Logical Number          | Output Name / Function   |
|----------------|--|-------------------------|--|
| 30040<br>*3    | TIP REPLACE REQUEST<br>This signal is output when the stored number of welding reaches the number of welding set for the tip replacement.  | 30506 to<br>30507<br>*3 | SHUT OFF VALVE CONTROL<br>This signal is ON and water flows into the gun tool.<br>This signal is OFF and water does not flow into the gun tool.<br>This signal is used to prevent water leakage in the case of a sticking tip. |
| 30041          | PRESSURE COMPLETION<br>When the first step pressure in welding has been completed, this signal is sent.<br>The signal is sent to the Power Source timer when completing the applying pressure. |                         |  |

- \*1 The work home position cube and Cube 24 are same.
- \*2 This signal is not output during operation.
- \*3 This signal can be allocated to any user I/O signal at the I/O allocation display in operation condition.
- \*4 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 user I/O signal described in parentheses.



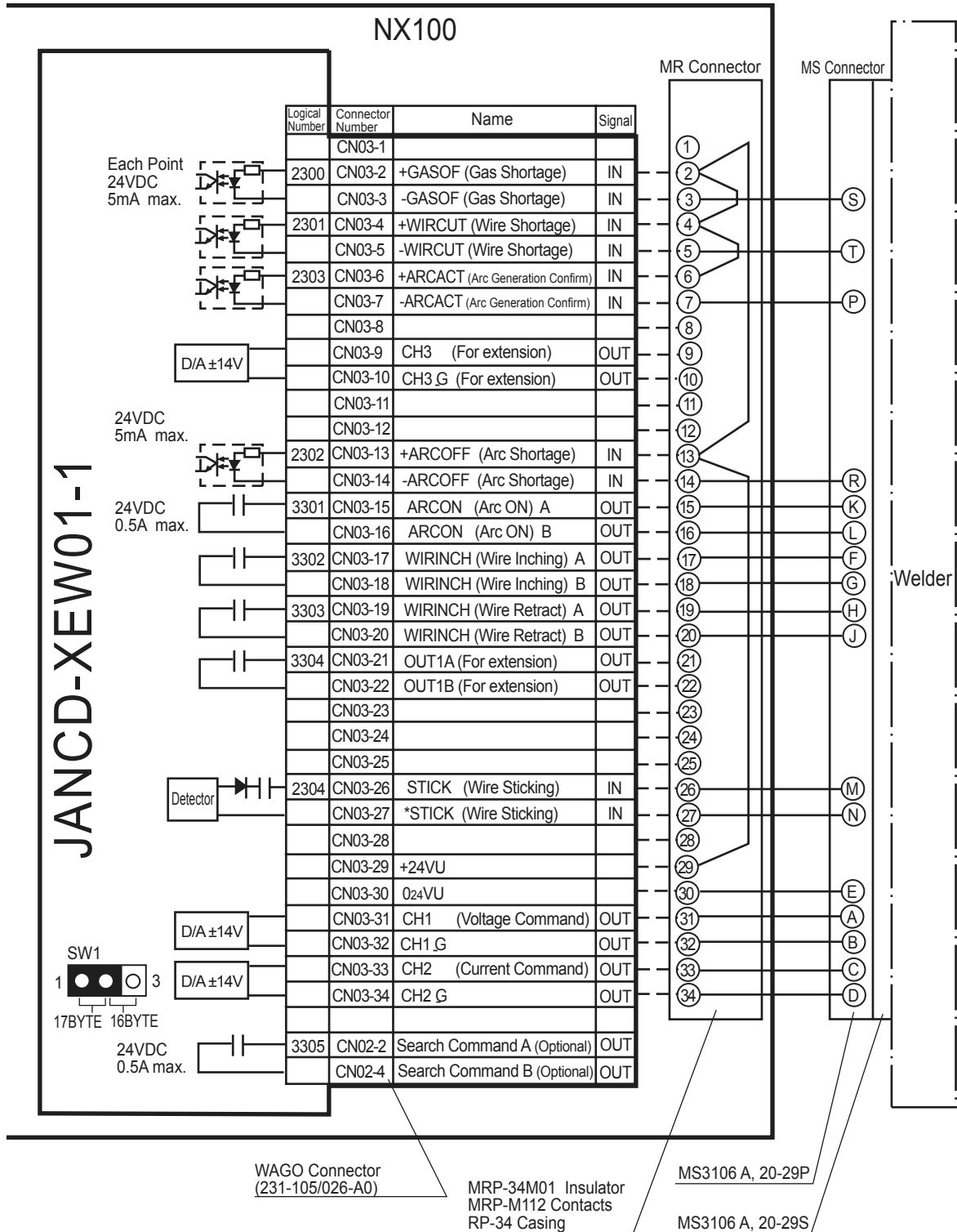
## 7.6.5 JANCD-XEW01 Circuit Board

### ■ Arc Welding

There are two types of XEW01 circuit board as follows;

XEW01-1 (standard): Analog Outputs × 3 ports + Status Signal Input of a Welder

XEW01-2: Analog Outputs × 3 ports only





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**A**

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# NX100 INSTRUCTIONS

## SUPPLEMENTARY FOR NORTH AMERICAN STANDARD (ANSI/RIA)

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YASKAWA ELECTRIC CORPORATION

YASKAWA

# NX100 INSTRUCTIONS

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

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## MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS  
NX100 INSTRUCTIONS  
NX100 OPERATOR'S MANUAL  
NX100 MAINTENANCE MANUAL

The NX100 operator's manuals above correspond to specific usage.  
Be sure to use the appropriate manual.





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 **MANDATORY**

- **This manual explains setup, diagnosis, maintenance, hardware and so on of the NX100 system. Read this manual carefully and be sure to understand its contents before handling the NX100.**
- **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.**

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## Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the NX100.

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

- **Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the NX100 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.



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.



Release of Emergency Stop

- **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.

- **Confirm that no persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:**
  - **Turning ON the NX100 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 NX100 and the programming pendant.



## 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 NX100 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 manipulator is the YASKAWA industrial robot product.

The manipulator usually consists of the controller, the programming pendant, and manipulator cable.

In this manual, the equipment is designated as follows.

| Equipment  | Manual Designation  |
|--|---------------------|
| NX100 Controller                                 | NX100               |
| NX100 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 [ ].<br>ex. [ENTER]   |
|                     | Symbol Keys                 | The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture.<br>ex. page key <br><br>The cursor key is an exception, and a picture is not shown. |
|                     | Axis Keys<br>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,<br>ex. [SHIFT]+[COORD]   |
|                     | Displays                    | The menu displayed in the programming pendant is denoted with { }.<br>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.

## Explanation of Warning Labels

The following warning labels are attached to the manipulator and NX100.  
Fully comply with the precautions on the warning labels.

|  |  |   |
|--|--|---|
|  <b>WARNING</b>   |  |   |
| <p>• <b>The label described below is attached to the manipulator.</b></p> <p>Observe the precautions on the warning labels.<br/>Failure to observe this caution may result in injury or damage to equipment.</p> |  |   |
|   |  <b>WARNING</b><br><b>Moving parts may cause injury</b> |                         |
|  <b>WARNING</b><br><b>Do not enter robot work area.</b>   |  |   |
| <p>Refer to the manipulator manual for the warning label location.</p>   |  |   |
| <p>• <b>The following warning labels are attached to NX100.</b></p> <p>Observe the precautions on the warning labels.<br/>Failure to observe this warning may result in injury or damage to equipment.</p>       |  |   |
|  <b>WARNING</b>   |  <b>WARNING</b>                                       |  <b>WARNING</b>      |
|   |   |                      |
| <p>High Voltage<br/>Do not open the door with power ON.</p>  | <p>High Voltage<br/>Do not ope the cover.</p>  | <p>May cause electric shock.<br/>Ground the earth terminal based on local and national electric code.</p> |
| <p>Refer to the NX100 INSTRUCTIONS for the warning label location.</p>   |  |   |

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# System Up

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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 Directive 89/392 Machinery and 91/368 EEC**

- **Prepare**

- SAFETY WORK REGULATIONS**

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

- **Observe the**

- MANIPULATING INDUSTRIAL ROBOTS-SAFETY (ISO 10218)**

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

- **Reinforce the**

- SAFETY MANAGEMENT SYSTEM**

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

- **Teaching and maintaining the robot are specified as "Hazardous Operations" in the Industrial Safety and Health Law**

(Japan only).

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

## 1.2 Special Training

 **MANDATORY**

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

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

## 1.3 Motoman Manual List

 **MANDATORY**

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

You should have the four manuals listed below:

- MOTOMAN-□□□ INSTRUCTIONS**
- NX100 INSTRUCTIONS**
- NX100 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", "Warning", 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.**

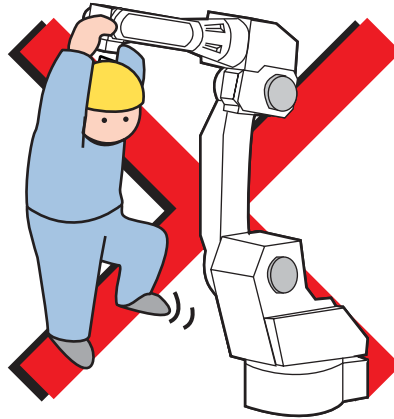
Failure to observe this caution may result in injury due to contact with NX100, controller, the workpiece, the positioner, etc.



## CAUTION

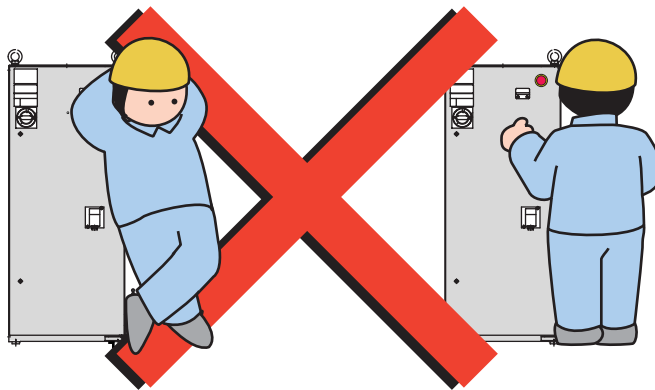
- **Never forcibly move the manipulator axes.**

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



- **Never lean on NX100 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 NX100 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 NX100 Instructions for details on installation and wiring.

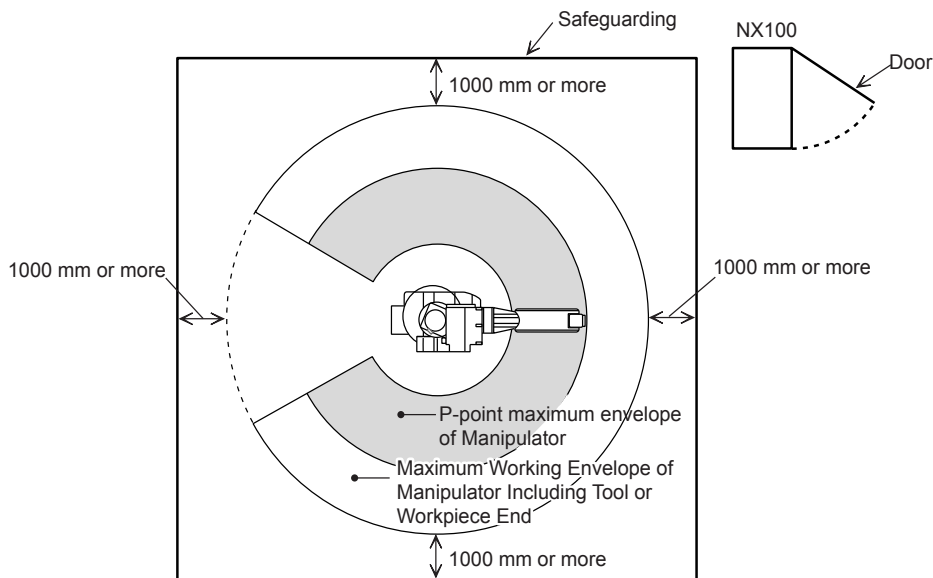
In planning installation, adapt an easy to observe arrangement to ensure safety. Take safety into consideration when planning the installation. Observe the following when installing the manipulator:



#### WARNING

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

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



- **Perform grounding in accordance with all applicable electrical codes.**

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



## CAUTION

- **Operation of the crane, sling, or forklift should only be performed by authorized personnel.**

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

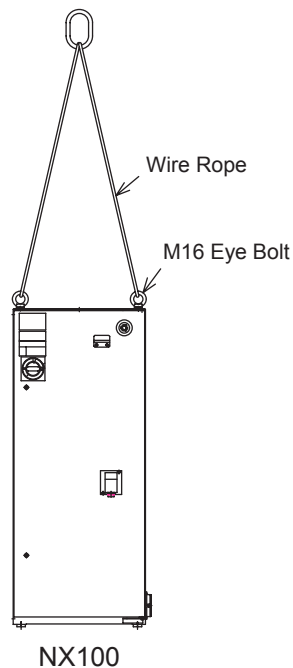
MOTOMAN should be lifted with a crane using wire rope threaded through the shipping bolts and positioners and the body should be lifted in an upright posture as described in the manipulator instruction manual.

Failure to observe these precautions may cause the manipulator to turn downward, potentially causing injury or damage to equipment.

- **When lifting the NX100, please check the following:**

**-As a rule, handling of NX100 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 NX100.**



THE WEIGHT OF NX100(approx.)

| NX100 equivalent model                                 | Approx. weight (kg) |
|--|---------------------|
| HP3, HP6, EA1400N, HP20, EA1900N                       | 100                 |
| UP20MN, UP50N, ES165N, HP165, ES200N, ES165RN, ES200RN | 150                 |

- **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.**

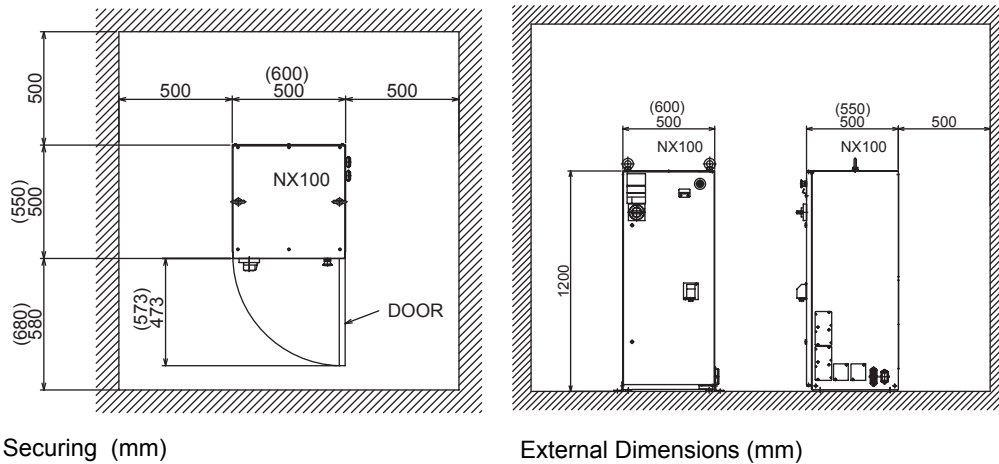
Failure to observe this precaution may result in injury of damage to equipment.



## CAUTION

- **Be sure there is sufficient room for maintenance on the manipulator, NX100, and other peripheral equipment.**

Failure to observe this precaution could result in injury during maintenance.



- **The manipulator is controlled by the NX100 or the controller for positioner.**

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 NX100 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.**

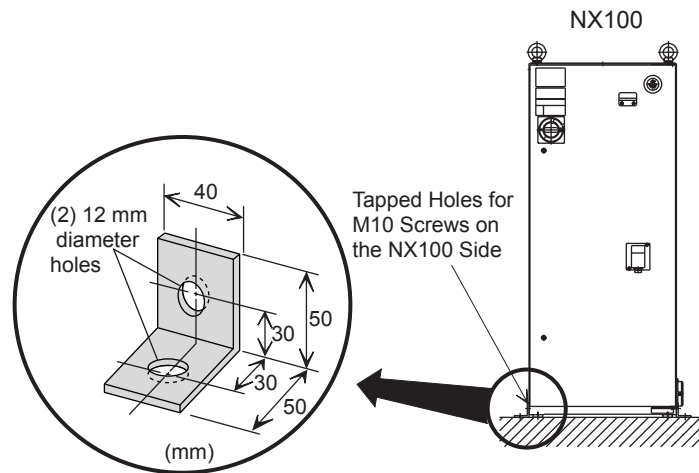
Failure to observe this caution may result in injury or damage to equipment.



## CAUTION

- **Secure the position of the NX100 after setting up.**

Attach the NX100 to the floor or rack, etc., using the screw holes on the bottom of the NX100.



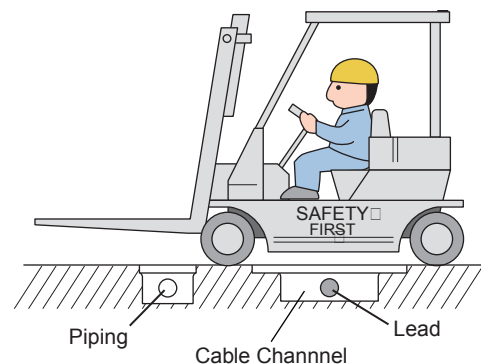
Failure to observe this caution could lead to injury or equipment damage if the NX100 should shift or fall.

- **Be familiar with the connection diagram before wiring the NX100, 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 NX100, 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.**

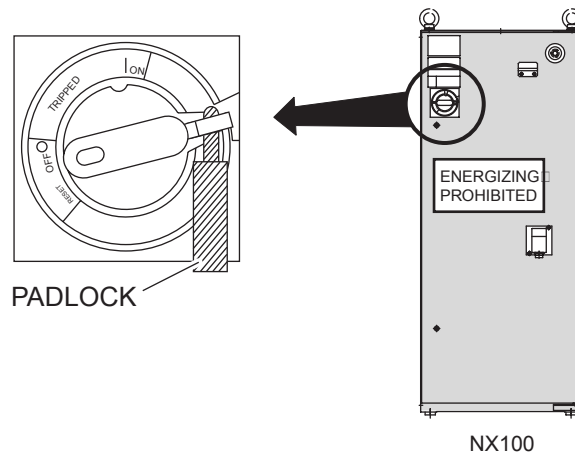
Tools and loose equipment should not be left on the floor around the manipulator, NX100, or welding fixture, etc., as injury or damage to equipment can occur if the manipulator comes in contact with objects or equipment left in the work area.

### 1.5.3 Operation Safety



## WARNING

- **When attaching a tool such as the welding torch to the manipulator, be sure the power supply of the NX100 and the tool is off, lock the switch, and display a warning sign.**



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

- **Never exceed the rated capacity of the manipulator (capacity can be found in the specifications section of the manipulator manual.).**

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

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

- **Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:**
  - **Always view the manipulator from the front.**

- **Always follow the predetermined operating procedure.**
- **Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.**
- **Ensure that you have a place to retreat to in case of emergency.**

Improper or unintentional manipulator operation can result in injury.



 **WARNING**

- **Before operating the manipulator, check that the **SERVO ON** lamp on the programming pendant goes out when the emergency stop button on the right of the front door of the NX100 and the programming pendant 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.

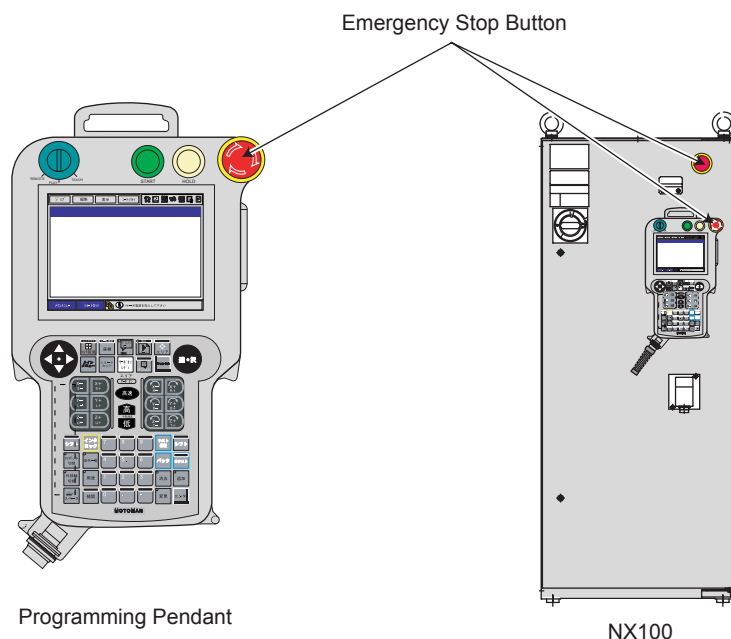
- **Always press Teach Lock before starting to teach.**

Failure to observe this precaution may result in injury due to unauthorized personnel operating the manipulator from the playback panel.

- **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 NX100 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 NX100 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 NX100 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 the 1.2 Special Training)

## 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 1.3 for a complete list of manuals.**

If any manuals are missing, contact your Yaskawa representative.

- **If the warning labels on the manipulator and NX100 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.



### PROHIBITED

- **Never modify the manipulator or NX100.**

Failure to observe this precaution could result in injury or damage resulting from fire, power failure, or operation error.

## 1.7 Notes on MOTOMAN Disposal



### 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.**

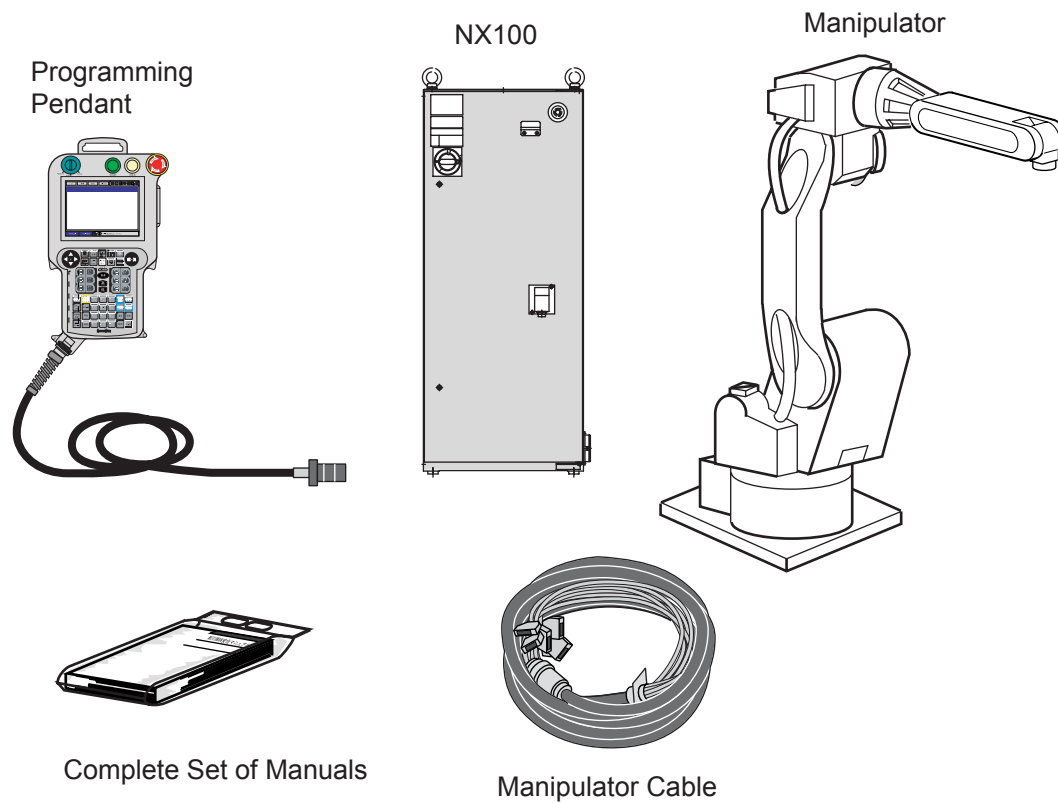
Failure to observe this precaution may result in injury due to the manipulator falling down.

## 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
- NX100
- Programming Pendant
- Manipulator Cable (Between Manipulator and NX100)
- Complete Set of Manuals



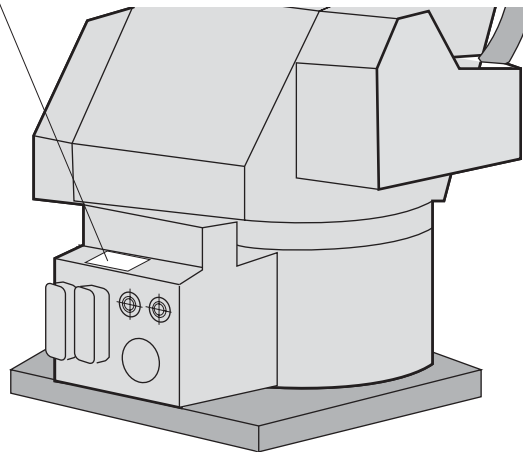
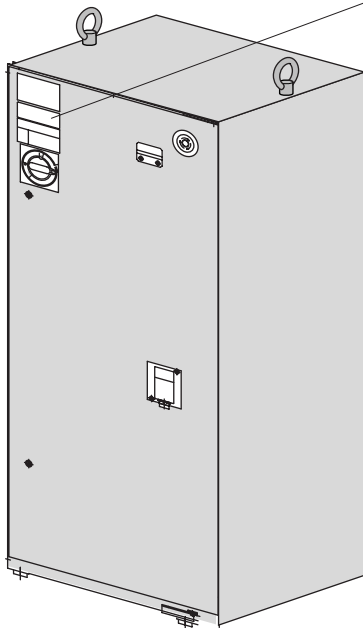
## 2.2 Order Number Confirmation

Confirm that the order number pasted on the manipulator and NX100 match.  
The order number plates are affixed to the figure below.

Example

Only connect the MOTOMAN to the  
NX100 which has same order  
number.

ORDER NO. S78796-1



# 3 Installation

## 3.1 Handling Procedure



### CAUTION

- **Crane, sling, and forklift operations must be performed only by authorized personnel.**

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

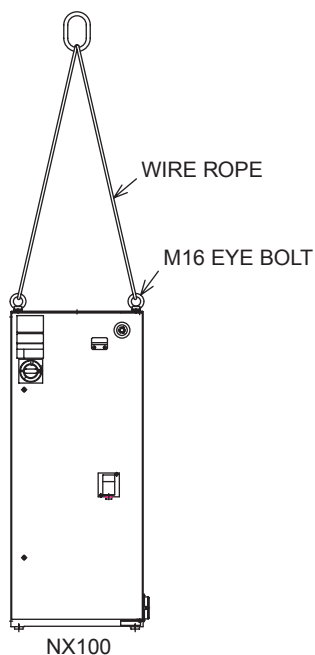
- **Avoid jarring, dropping, or hitting the controller during handling.**

Excessive vibration or impacting the NX100 may adversely affect the performance of the NX100.

### 3.1.1 Using a Crane to Move the Controller

Check the following before handling the NX100:

- 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.



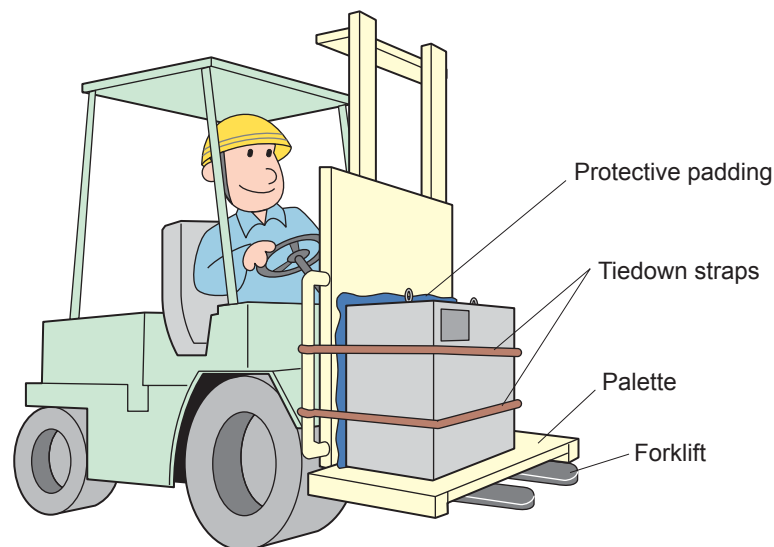
THE WEIGHT OF NX100 (approx)

| NX100 equivalent model                                 | Approx. weight (kg) |
|--|---------------------|
| HP3, HP6, EA1400N, HP20, EA1900N                       | 100                 |
| UP20MN, UP50N, ES165N, HP165, ES200N, ES165RN, ES200RN | 150                 |

### 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 NX100 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.



## 3.2 Place of Installation

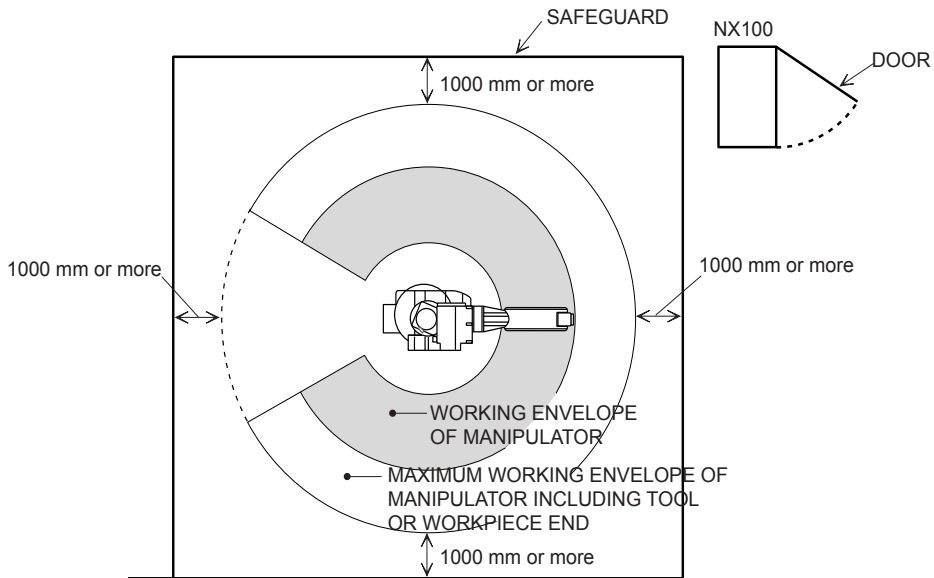
The conditions listed below must be met before installing the NX100:

- 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 (under 10%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 NX100 (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.

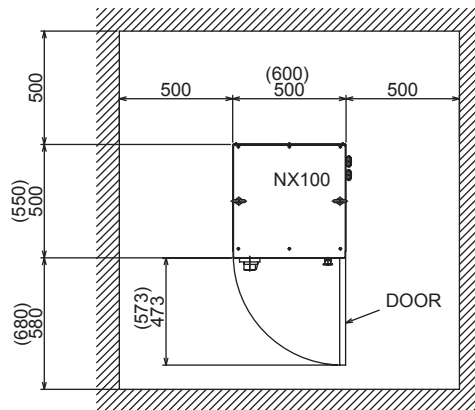


### 3.3 Location

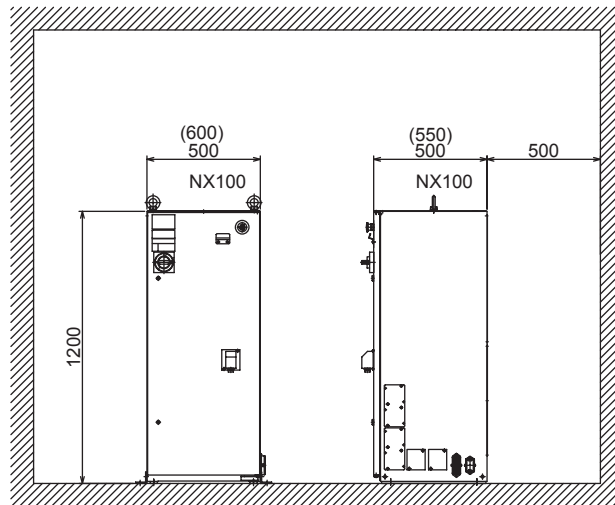
- Install the NX100 outside of the P-point maximum envelope of the manipulator (outside of the safeguarding)



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



- Install the controller at least 500mm from the nearest wall to allow maintenance access. Shows the external dimensions.



## 3.4 Mounting the Controller

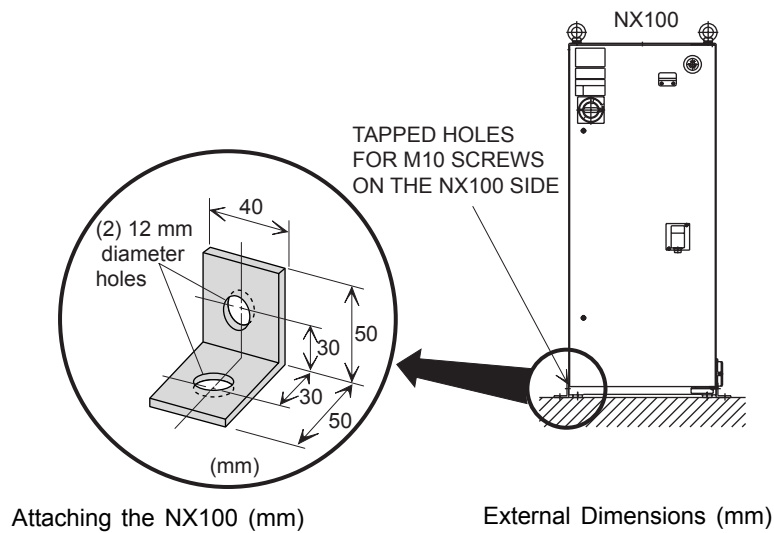


### CAUTION

- **Do not climb on top of the NX100.**

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

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



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

---

## 4 Connection

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### WARNING

- **The system must be grounded.**

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

- **Before grounding the system, turn off the power supply and lock the main power switch.**

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 NX100 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.

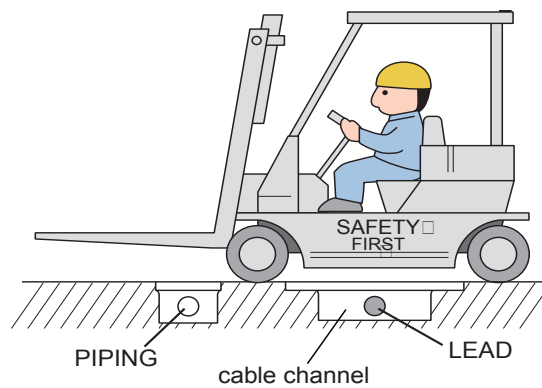
- **Do not handle the circuit board directly by hand.**

The IC board may malfunction due to electrostatics.

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## 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 NX100. Another connects the NX100 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.

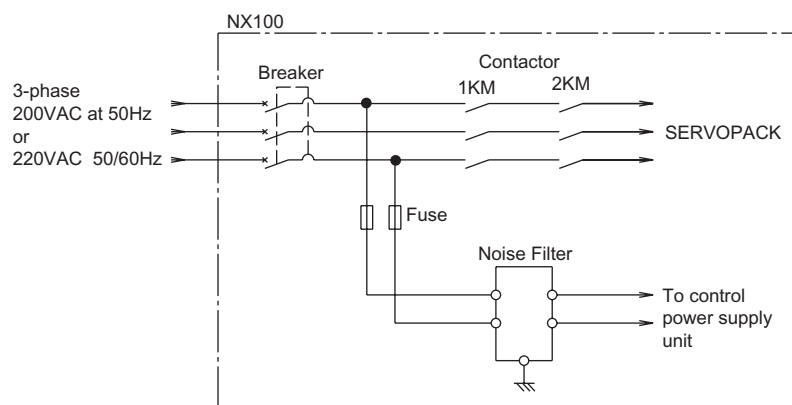


NX100 Cable Junction Diagram

## 4.2 Power Supply

### 4.2.1 Three-Phase Power Supply

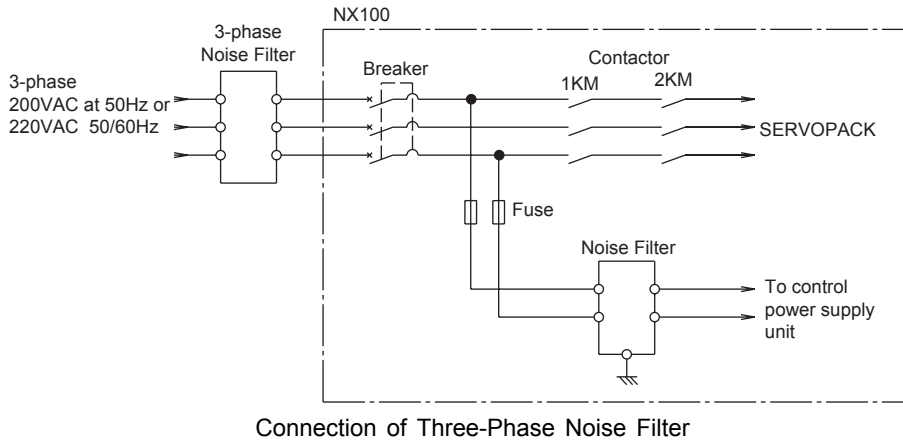
The three-phase power supply consists of 200VAC at 50Hz and 220VAC at 50/60Hz. The power failure processing circuit operates when there is a black out or drop in voltage, and the servo power turns off. Connect the power supply to a stable power source that is not prone to power fluctuations.



Input Power Supply 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.



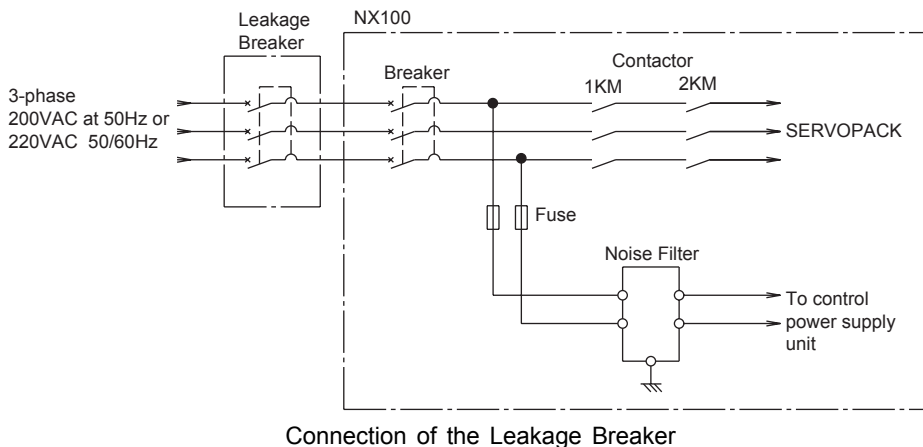
### 4.2.3 Leakage Breaker Installation

When connecting the leakage breaker to the controller power supply wiring, use a leakage breaker which can handle high frequencies from the NX100 inverter. Leakage breakers which cannot handle high frequencies may malfunction.

Example of High Frequency Leakage Breakers

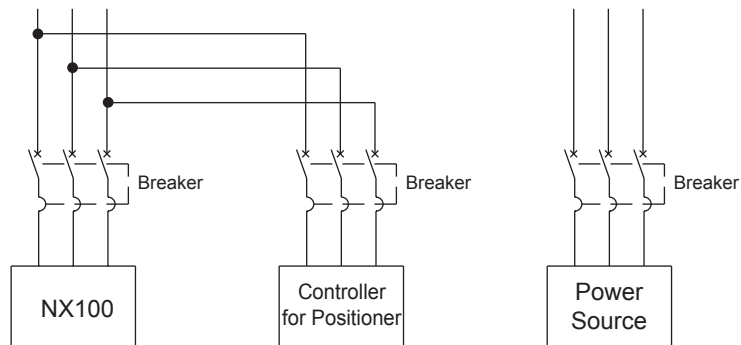
| Maker                         | Model                                     |
|-------------------------------|---|
| Mitsubishi Electric Co., Ltd. | NV series (manufactured since 1988)       |
| Fuji Electric Co., Ltd.       | EG or SG Series (manufactured since 1984) |

Even with a leakage breaker installed, there is still a possibility of some high frequency current leakage from the NX100 inverter. But, this current leakage presents no safety risks.



## 4.2.4 Primary Power Supply Switch Installation

Install the primary power supply switch as shown.



Installation of the Primary Power Supply Switch

NX100 Power Capacity, Cable Sizes, and Switch Capacities

| Manipulator           | Power capacity (kVA) | Cable size (size of terminal)<br>(In case of Cabtyre cable (four wicks))mm <sup>2</sup> | Switch capacity for NX100 (A) |
|-----------------------|----------------------|---|-------------------------------|
| HP3                   | 1                    | 3.5 (M5)  | 5                             |
| HP6, EA1400N          | 1.5                  | 3.5 (M5)  | 10                            |
| HP20, EA1900N         | 2.8                  | 3.5 (M5)  | 15                            |
| UP20MN, UP50N         | 5                    | 5.5 (M5)  | 20                            |
| ES200N, HP165, ES165N | 7.5                  | 5.5(M5)   | 30                            |
| ES165RN, ES200RN      | 8.5                  | 5.5 (M5)  | 30                            |

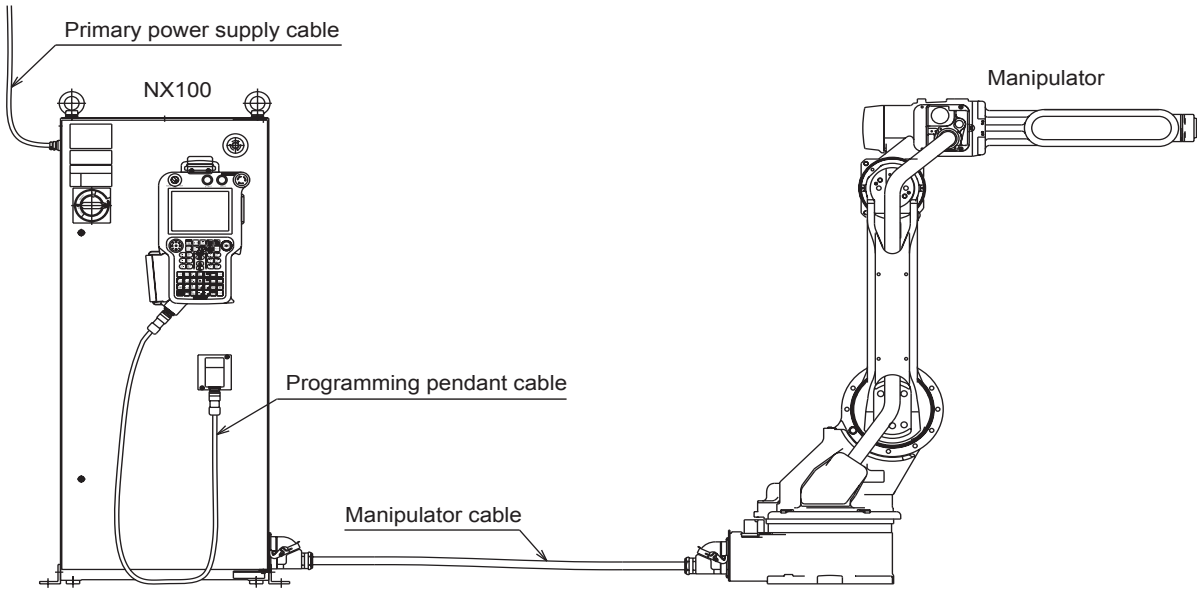
The maximum load value (payload, operation speed, and frequency, etc.) is displayed. However, the power capacity is different depending on work conditions.

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



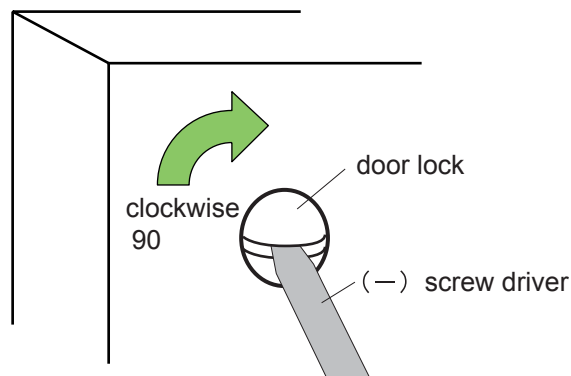
## 4.3 Connection Methods

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



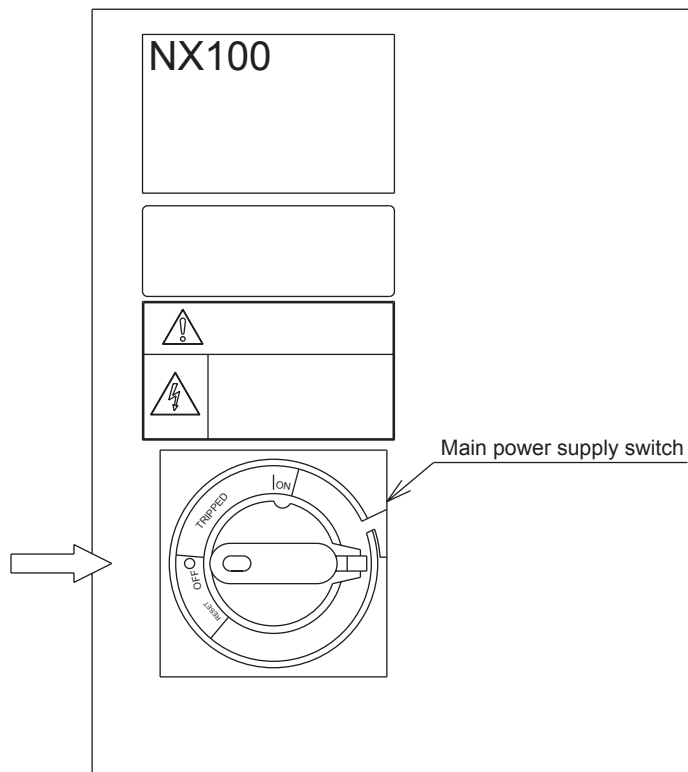
### 4.3.1 Connecting the Primary Power Supply

1. Open the front door of the NX100.
  - (1) Insert the door lock in the door lock on the front of NX100 (two places), and rotate it 90 degrees clockwise.



Rotating the Door Lock Clockwise.

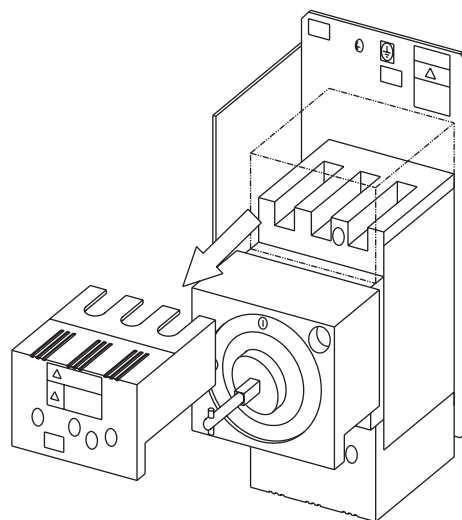
- (2) Rotate the main power supply switch to the "OFF" position and open the door gently.



Rotating the main power supply switch to the OFF position.

2. Confirm that the primary power supply is OFF.
3. Make a hole in the plate and run the primary power supply cable through it. It is located on the top or on the left side of the NX100.  
Attach the plate and cable firmly so that it won't shift or slide out of place.

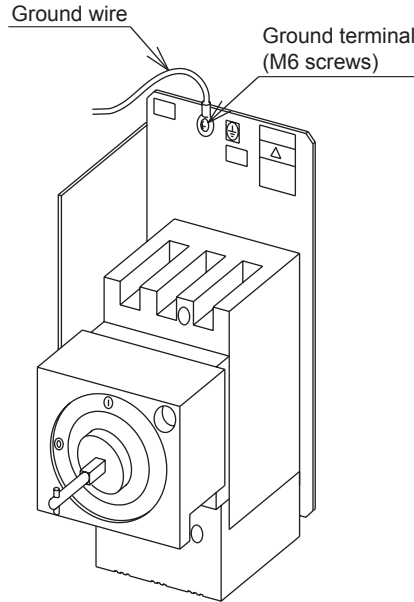
- (1) Pull off the primary cover of the switch which is on the upper left side of the NX100.



Pulling Off the Cover

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

- 1) Connect the ground wire to the ground terminal (screw) of the switch which is on the upper left side of NX100.

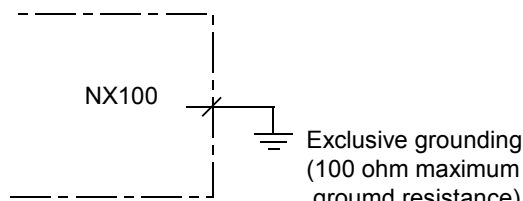


Connection of the Ground Wire

- 2) Perform grounding in accordance with all relevant local and national electrical codes. Grounding wire must be 8.0 mm<sup>2</sup> or larger.



The customer must prepare the ground wire.

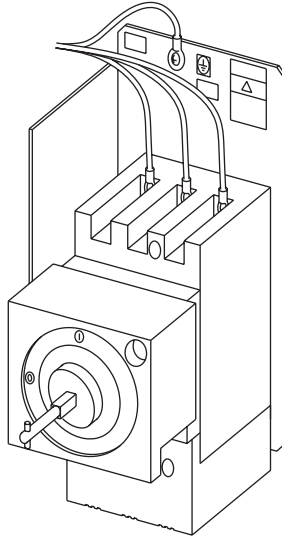


Exclusive Grounding



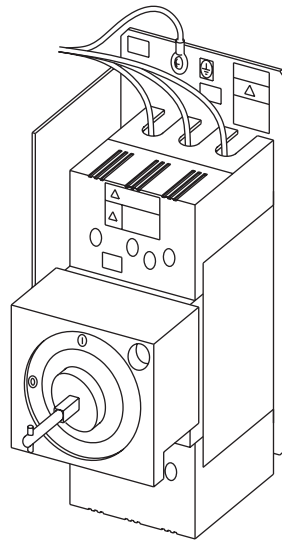
- Don't connect the grounding wire with the wires for the electric power source, the welder, etc.
- Ground in accordance with all relevant governmental regulations when using metallic ducts, metallic conduits, and cable tray to construct the cable.

(3) Connect the primary power supply cable.



Connection of the Primary Power Supply Cable

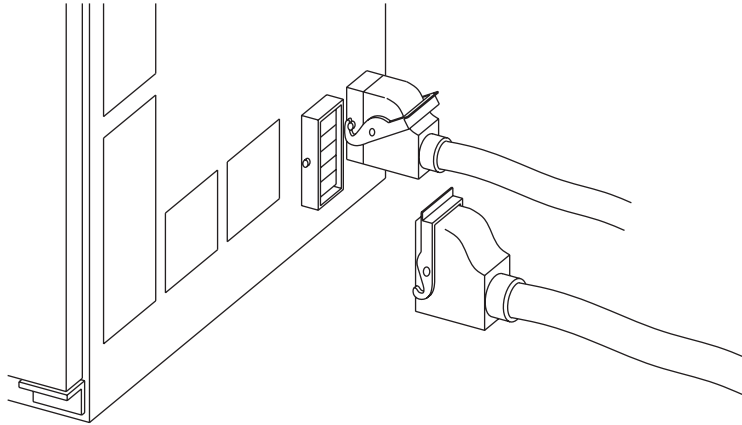
(4) Install the cover.



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 each side of NX100.

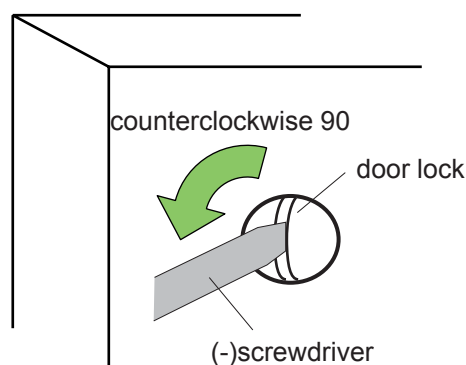


Connection of the Manipulator Cable



For more information on connecting the manipulator cable, please refer to the Instruction Manual which corresponds to the particular NX100 model.

2. Connect the manipulator to the NX100.  
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 NX100 door.
  - (1) Close the door gently.
  - (2) Rotate the door lock counterclockwise 90 degrees.



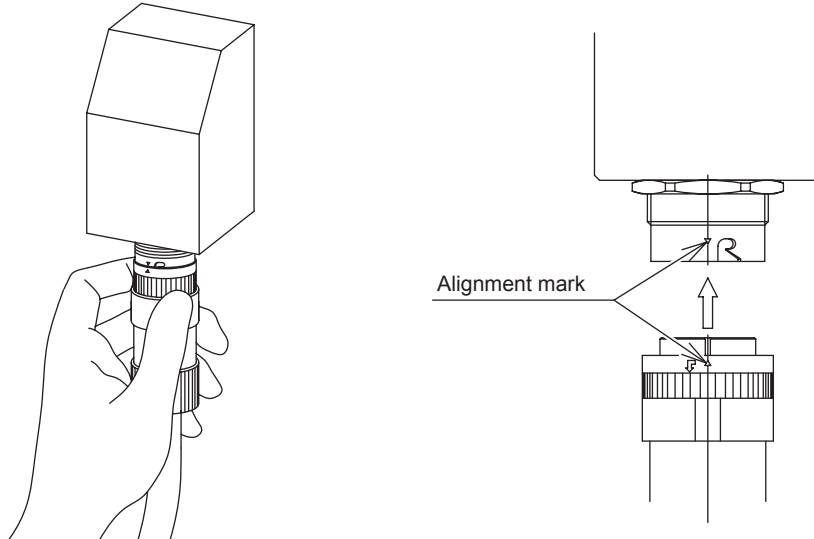
Rotating the Door Lock Counterclockwise



Close the door of the controller (NX100) securely to prevent dust from entering.

### 4.3.3 Connecting the Programming Pendant

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



Connecting the Programming Pendant

The manipulator, NX100, and the programming pendant connections are now complete.

# 5 Turning ON and OFF the Power Supply



## WARNING

- **Confirm that nobody is present in the P-point maximum envelope of the manipulator when turning on NX100 power supply.**

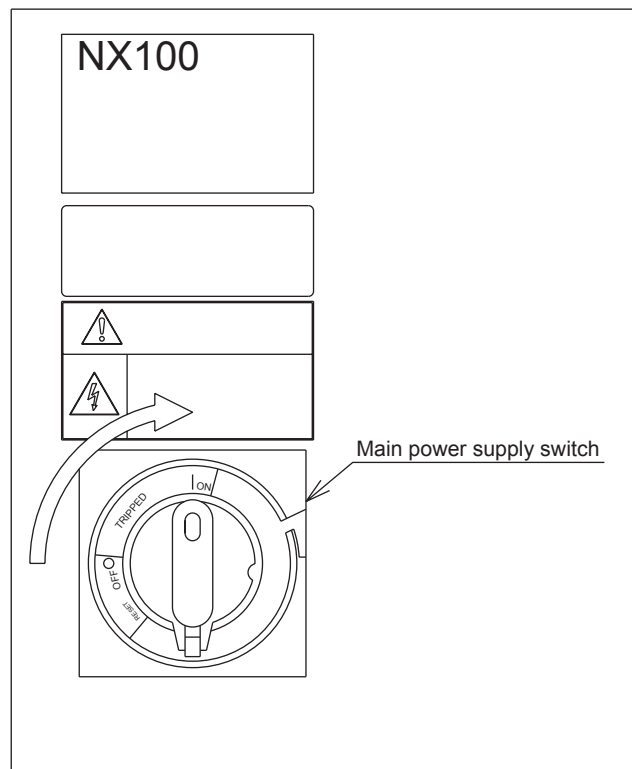
Failure to observe this caution could result in injury caused by accidental contact with the manipulator.

Push the emergency stop button immediately if any problems occur.

The emergency stop button is located in the upper left of the door on the NX100 and on the right side of the programming pendant.

## 5.1 Turning ON the Main Power Supply

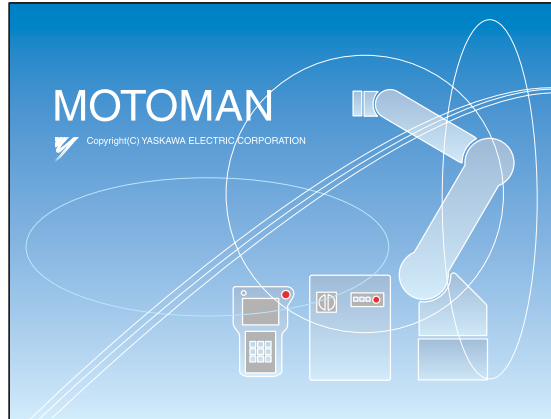
The main power supply is turned ON when the main power supply switch on the front of the NX100 is turned to the "ON" position, and the initial diagnosis and the current position begin.



Turning ON the Main Power Supply

## 5.1.1 Initial Diagnosis

The initial diagnosis are performed in the NX100 when main power is turned on, and the startup window is shown on the programming pendant screen.

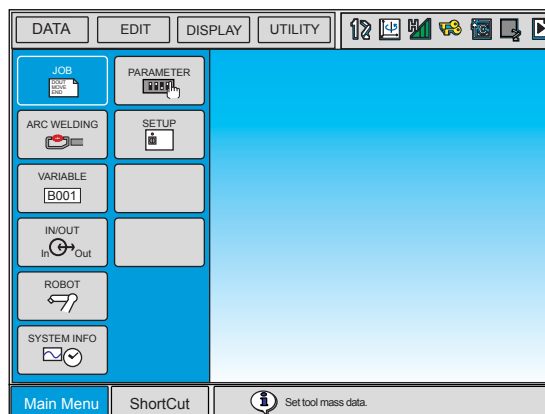


Startup Window

## 5.1.2 When Initial Diagnosis are Complete

When the power supply is turned off, the NX100 saves all condition data, including:

- Mode of operation
- Called job (active job if the NX100 is in the play mode; edit job if the NX100 is in the teach mode) and the cursor position in the job.



Initial Window

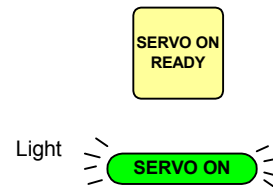


## 5.2 Turning ON the Servo Power

### 5.2.1 During Play Mode

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

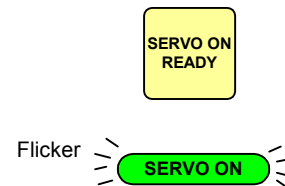
1. When the safeguarding is closed, press [SERVO ON READY] on the programming pendant to turn on the servo power supply. [SERVO ON] lamp will light, when the servo power is turned on.



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.



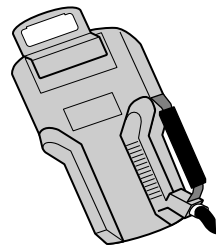
2. The servo power is turned on and [SERVO ON] lamp on the programming pendant lights when the operator grips the Enable switch.



SUPPLEMENT

**Servo Power ON/OFF --- Enable Switch**

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



Release -&gt; OFF



Squeeze -&gt; ON



Squeeze Tightly -&gt; OFF

**NOTE**

When performing emergency stop on the front door of the NX100, 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.

#### Turning the Servo Power Off

- Pressing the emergency stop button on either the programming pendant or the door side of the NX100 will turn off servo power. The emergency stop buttons are located on the right of the front door of the NX100 and 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 time. (Teach mode, Play mode, Remote mode)



Programming Pendant

EMERGENCY STOP

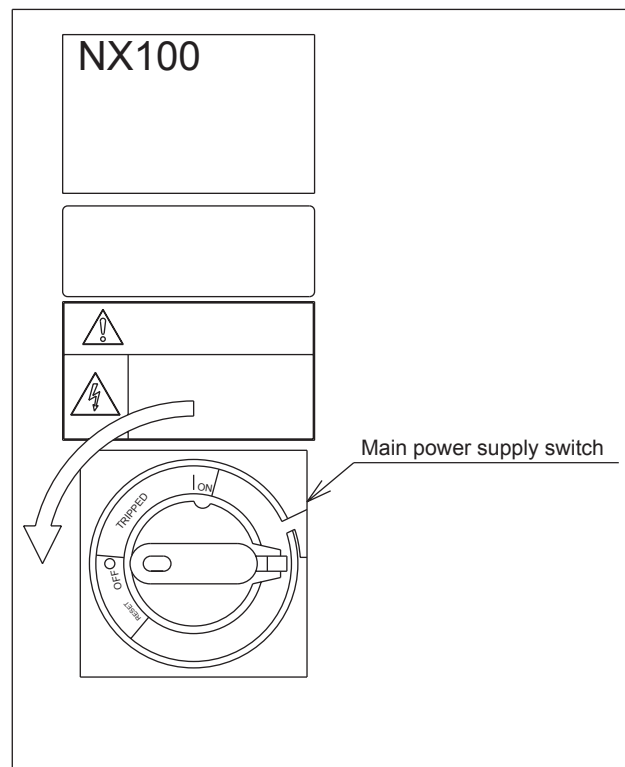


Door upper side

### 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 NX100 is turned to the “OFF” position, the main power is turned off.



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## 6 Test of Program Operation

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### WARNING

- **Press the emergency stop button on the right of the front door of the NX100 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 NX100 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 NX100 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

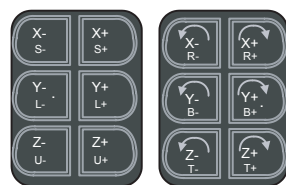
- **Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.**
  - **Check for problems in manipulator movement.**
  - **Check for damage to the insulation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

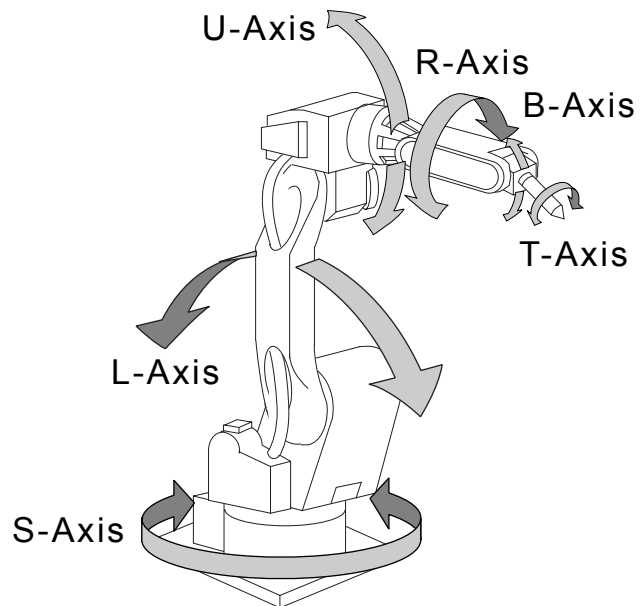
## 6.1 Movement of the Axes

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.



Axis Keys



|          |                                  |
|----------|----------------------------------|
| <b>S</b> | Rotates main body                |
|          |                                  |
| <b>L</b> | Moves lower arm forward/backward |
|          |                                  |
| <b>U</b> | Moves upper arm up/down          |
|          |                                  |

|          |                     |
|----------|---------------------|
| <b>R</b> | Rotates upper arm   |
|          |                     |
| <b>B</b> | Moves wrist up/down |
|          |                     |
| <b>T</b> | Rotates wrist       |
|          |                     |

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**System Up**

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# 7 Outline of System Up



## 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 floppy disk backups of control settings each time settings are changed.**

The NX100 controller for the Motoman industrial robot provides a full range of advanced and practical functions. It can meet the industry demands for more flexible and more sophisticated robotics systems. The following must be performed to create a more powerful system.

### Outline of System Up

Security Mode - Protection Through Security Mode

- Settings after Manipulator Installed
- Home Position Calibration
  - Specified Point (Check Point)
  - Setting the Controller Clock
  - Setting Play Speed
  - All Limits Releasing
  - Overrun/Shock Sensor Releasing
  - Interference Area
  - Work Home Position Setting
  - Tool Data Setting
  - User Coordinates Setting
  - ARM Control Setting
  - Shock Detection Function Setting
  - Instruction Level Setting
  - Numeric Key Customize Function
  - I/O Status Confirmation
  - Temporary Release of Soft Limits
  - Changing the Parameter
  - File Initialize
  - Addition of I/O Modules
  - Addition of Base and Station Axis



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Making these settings optimizes the system to perform to its maximum potential in the chosen application.



These functions can be operated in the teach mode.

## 8 Security System

### 8.1 Protection Through Security Mode Settings

The NX100 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.

#### 8.1.1 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", "-", ".".

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.    |

## 8.1 Protection Through Security Mode Settings

Menu & Security Mode

| Main Menu   | Sub Menu             | Allowed Security Mode |            |
|-------------|----------------------|-----------------------|------------|
|             |                      | DISPLAY               | EDIT       |
| JOB         | JOB                  | Operation             | Edit       |
|             | SELECT JOB           | Operation             | Operation  |
|             | CREATE NEW JOB       | Edit                  | Edit       |
|             | MASTER JOB           | Operation             | Edit       |
|             | JOB CAPACITY         | Operation             | -          |
|             | RESERVED START (JOB) | Edit                  | Edit       |
|             | RESERVATION STATUS   | Operation             | -          |
| VARIABLE    | BYTE                 | Operation             | Edit       |
|             | INTEGER              | Operation             | Edit       |
|             | DOUBLE PRECISION     | Operation             | Edit       |
|             | REAL                 | Operation             | Edit       |
|             | STRING               | Operation             | Edit       |
|             | POSITION (ROBOT)     | Operation             | Edit       |
|             | POSITION (BASE)      | Operation             | Edit       |
|             | POSITION (ST)        | Operation             | Edit       |
| IN/OUT      | EXTERNAL INPUT       | Operation             | -          |
|             | EXTERNAL OUTPUT      | Operation             | -          |
|             | USER INPUT           | Operation             | -          |
|             | USER OUTPUT          | Operation             | -          |
|             | SYSTEM INPUT         | Edit                  | -          |
|             | SYSTEM OUTPUT        | Edit                  | -          |
|             | RIN                  | Edit                  | -          |
|             | REGISTER             | Edit                  | -          |
|             | AUXILIARY RELAY      | Edit                  | -          |
|             | CONTROL INPUT        | Edit                  | -          |
|             | PSEUDO INPUT SIGNAL  | Edit                  | Management |
|             | NETWORK INPUT        | Edit                  | -          |
|             | ANALOG OUTPUT        | Edit                  | -          |
|             | SV POWER STATUS      | Edit                  | -          |
|             | LADDER PROGRAM       | Management            | Management |
|             | I/O ALARM            | Management            | Management |
| I/O MESSAGE | Management           | Management            |            |

## Menu &amp; Security Mode

| Main Menu       | Sub Menu           | Allowed Security Mode |            |
|-----------------|--------------------|-----------------------|------------|
|                 |                    | DISPLAY               | EDIT       |
| ROBOT           | CURRENT POSITION   | Operation             | -          |
|                 | COMMAND POSITION   | Operation             | -          |
|                 | SERVO MONITOR      | Management            | -          |
|                 | SECOND HOME POS    | Operation             | Edit       |
|                 | WORK HOME POSITION | 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            | -          |
|                 | ROBOT CALIBRATION  | Edit                  | Edit       |
|                 | ANALOG MONITOR     | Management            | Management |
|                 | OVERRUN&S-SENSOR   | Edit                  | Edit       |
|                 | LIMIT RELEASE      | Edit                  | Management |
|                 | ARM CONTROL        | Management            | Management |
|                 | SHIFT VALUE        | Operation             | -          |
|                 | SYSTEM INFO        | MONITORING TIME       | Operation  |
| ALARM HISTORY   |                    | Operation             | Management |
| I/O MSG HISTORY |                    | Operation             | Management |
| VERSION         |                    | Operation             | -          |
| FD/PC CARD      | LOAD               | Edit                  | -          |
|                 | SAVE               | Operation             | -          |
|                 | VERIFY             | Operation             | -          |
|                 | DELETE             | Operation             | -          |
|                 | DEVICE             | Operation             | Operation  |

## 8.1 Protection Through Security Mode Settings

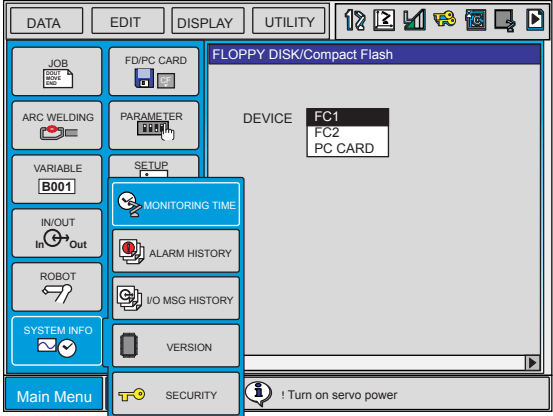
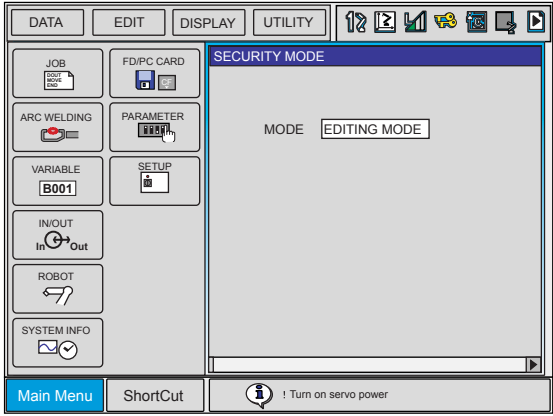
Menu & Security Mode

| Main Menu                   | Sub Menu                 | Allowed Security Mode |            |
|-----------------------------|--------------------------|-----------------------|------------|
|                             |                          | DISPLAY               | EDIT       |
| PARAMETER                   | S1CxG                    | Management            | Management |
|                             | S2C                      | Management            | Management |
|                             | S3C                      | Management            | Management |
|                             | S4C                      | Management            | Management |
|                             | A1P                      | Management            | Management |
|                             | A2P                      | Management            | Management |
|                             | A3P                      | Management            | Management |
|                             | RS                       | Management            | Management |
|                             | S1E                      | Management            | Management |
|                             | S2E                      | Management            | Management |
|                             | S3E                      | Management            | Management |
|                             | S4E                      | Management            | Management |
| SETUP                       | TEACHING COND            | Edit                  | Edit       |
|                             | OPERATE COND             | Management            | Management |
|                             | DATE/TIME                | Management            | Management |
|                             | GRP COMBINATION          | Management            | Management |
|                             | SET WORD                 | Edit                  | Edit       |
|                             | RESERVE JOB NAME         | Edit                  | Edit       |
|                             | USER ID                  | Edit                  | Edit       |
|                             | SET SPEED                | Management            | Management |
|                             | KEY ALLOCATION           | Management            | Management |
|                             | RESERVED START (CONNECT) | Management            | Management |
| ARC WELDING                 | ARC START CONDITION      | Operation             | Edit       |
|                             | ARC END CONDITION        | Operation             | Edit       |
|                             | ARC AUXILIARY CONDITION  | Operation             | Edit       |
|                             | WELDER CONDITION         | Operation             | Edit       |
|                             | ARC WELD DIAGNOSIS       | Operation             | Edit       |
|                             | WEAVING                  | Operation             | Edit       |
| HANDLING                    | HANDLING DIAGNOSIS       | Operation             | Edit       |
| SPOT WELDING                | WELD DIAGNOSIS           | Operation             | Edit       |
|                             | I/O ALLOCATION           | Management            | Management |
|                             | GUN CONDITION            | Management            | Management |
|                             | WELDER CONDITION         | Management            | Management |
| SPOT WELDING<br>(MOTOR GUN) | WELD DIAGNOSIS           | Operation             | Edit       |
|                             | GUN PRESSURE             | Edit                  | Edit       |
|                             | PRESSURE                 | Edit                  | Edit       |
|                             | I/O ALLOCATION           | Management            | Management |
|                             | GUN CONDITION            | Management            | Management |

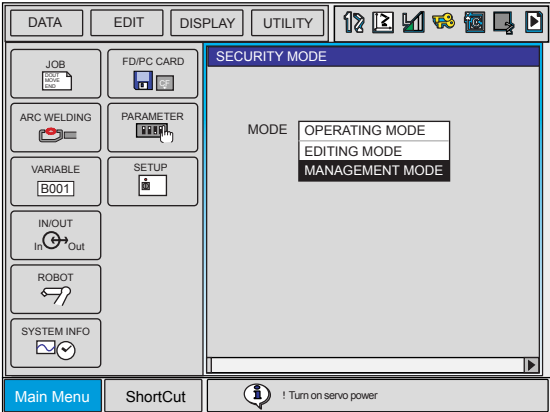
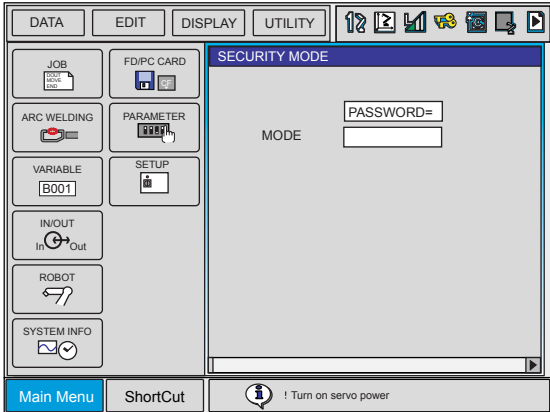

Menu & Security Mode

| Main Menu | Sub Menu          | Allowed Security Mode |            |
|-----------|-------------------|-----------------------|------------|
|           |                   | DISPLAY               | EDIT       |
|           | GUN CONDITION AUX | Management            | Management |
|           | WELDER CONDITION  | Management            | Management |
| GENERAL   | GENERAL DIAGNOSIS | Operation             | Edit       |
| PAINT     | PAINT SYSTEM      | Management            | Management |
|           | PAINT DEVICE      | Management            | Management |
|           | CCV-PAINT TABLE   | Management            | Management |
|           | PAINT CONDITION   | Operation             | Edit       |

■ Changing the Security Mode

|   | Operation                                 | Explanation   |
|---|---|---|
| 1 | Select {SYSTEM INFO} under the main menu. | <p>The main menu is shown.</p>  <p>Note: Icons for the main menu such as arc welding system differ depending on the system being used.</p> |
| 2 | Select {SECURITY}.                        | <p>The selection window of security mode is shown.</p>    |

## 8.1 Protection Through Security Mode Settings

|   | Operation                                  | Explanation  |
|---|--|--|
| 3 | Press [SELECT] and select "SECURITY MODE." |    |
| 4 | Select "SECURITY MODE."                    | <p>The user ID input window is shown.</p>  <div style="border: 1px solid blue; padding: 5px;"> <p> At the factory, the following below user ID number is preset.</p> <ul style="list-style-type: none"> <li>• Editing Mode:[00000000]</li> <li>• Management Mode:[99999999]</li> </ul> </div> |
| 5 | Input the user ID.                         |  |
| 6 | 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.   |

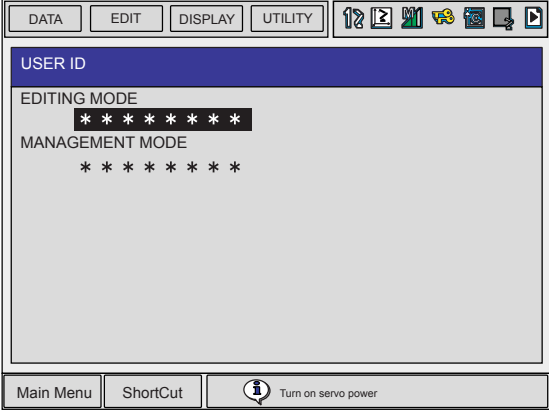
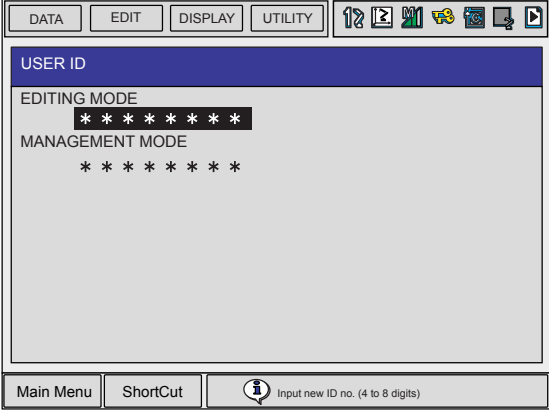
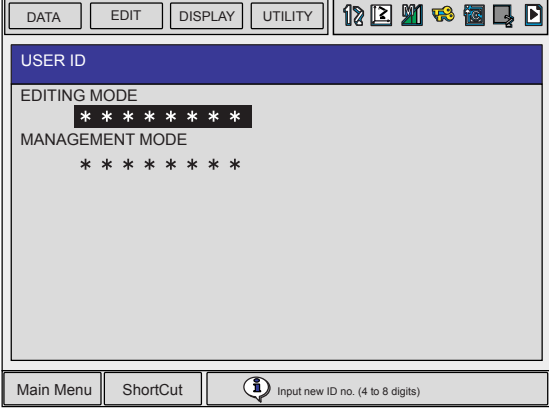
### 8.1.2 User ID

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

User ID must be between 4 characters and 8, and they must be numbers and symbols ("0 to 9", "-", and ".").

#### ■ Changing a User ID

In order to change the user ID, the NX100 must be in Editing Mode or Management Mode. Higher security modes can make changes the user ID of to lower security modes.

|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {SETUP} under the main menu. |   |
| 2 | Select {USER ID}.                   | <p>User ID window is shown.</p>   |
| 3 | Select the desired ID.              | <p>The character input line is shown, and the message "Input current ID no. (4 to 8 digits)" is shown.</p>                             |
| 4 | Input current ID and press [ENTER]. | <p>When the correct user ID is entered, a new user ID is requested to be input. "Input new user ID no.(4 to 8 digits)" is shown.</p>  |
| 5 | Input new ID and press [ENTER].     | User ID is changed.   |



## 9 System Setup

### 9.1 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 NX100 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 NX100 power.**
- **Moving 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 NX100 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 NX100 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.

### 9.1.1 Home Position Calibration



Teaching and playback are not possible before home position calibration is complete. 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 NX100
- Replacement of the motor or absolute encoder
- Clearing stored memory (by replacement of NCP01 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.

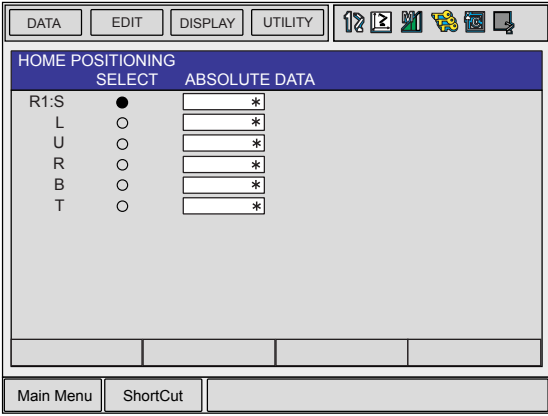
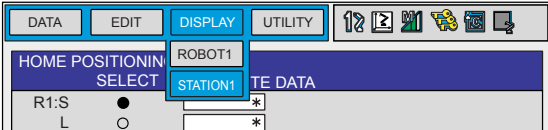
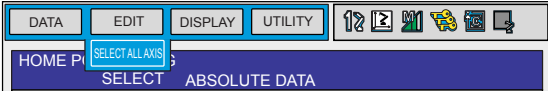
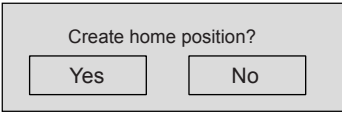


**Home Position**

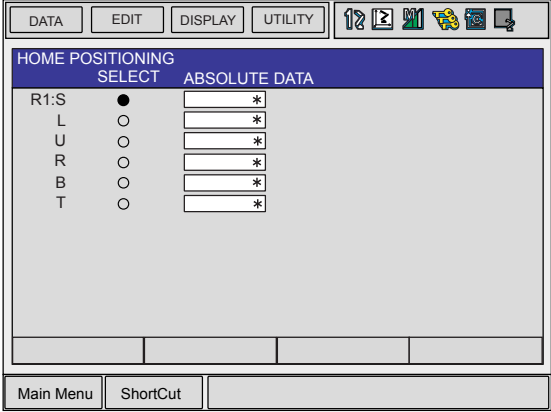
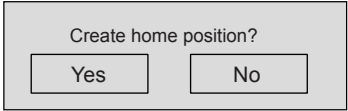
The home position is the pulse value "0" for each axis and its posture. See "9.1.3 Home Position of the Robot."

**9.1.2 Calibrating Operation**

■ **Registering All Axes at One Time**

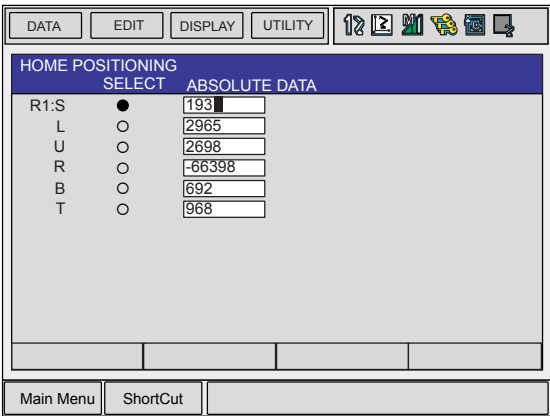
|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {ROBOT} under the main menu. |   |
| 2 | Select {HOME POSITION}.             | <p>The HOME POSITIONING window is shown.</p>   |
| 3 | Select {DISPLAY} under the menu.    | <p>The pull down menu appears.</p>            |
| 4 | Select the desired control group.   |   |
| 5 | Select {EDIT} under the menu.       | <p>The pull down menu appears.</p>            |
| 6 | Select {SELECT ALL AXES}.           | <p>The confirmation dialog box is shown.</p>  |
| 7 | Select "YES."                       | <p>Shown position data of all axes are registered as home position. When "NO" is selected, the registration will be canceled.</p> |

## ■ Registering Individual Axes

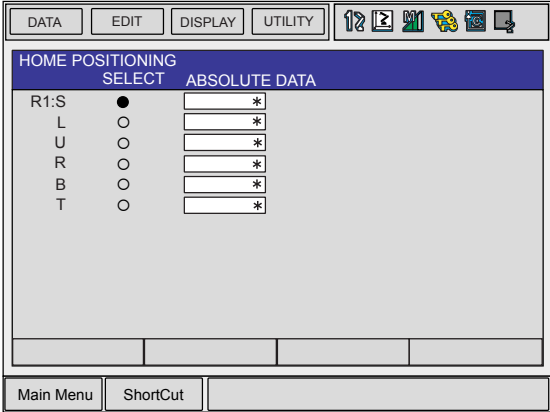
|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {ROBOT} under the main menu. |   |
| 2 | Select {HOME POSITION}.             | The HOME POSITIONING window is shown.   |
| 3 | Select {DISPLAY} under the menu.    | The pull down menu appears.   |
| 4 | Select the desired control group.   |    |
| 5 | Select the axis to be registered.   | <p>The confirmation dialog box is shown.</p>  |
| 6 | Select "YES."                       | Shown position data of axis are registered as home position. When "NO" is selected, the registration will be canceled.            |

### ■ Changing the Absolute Data

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

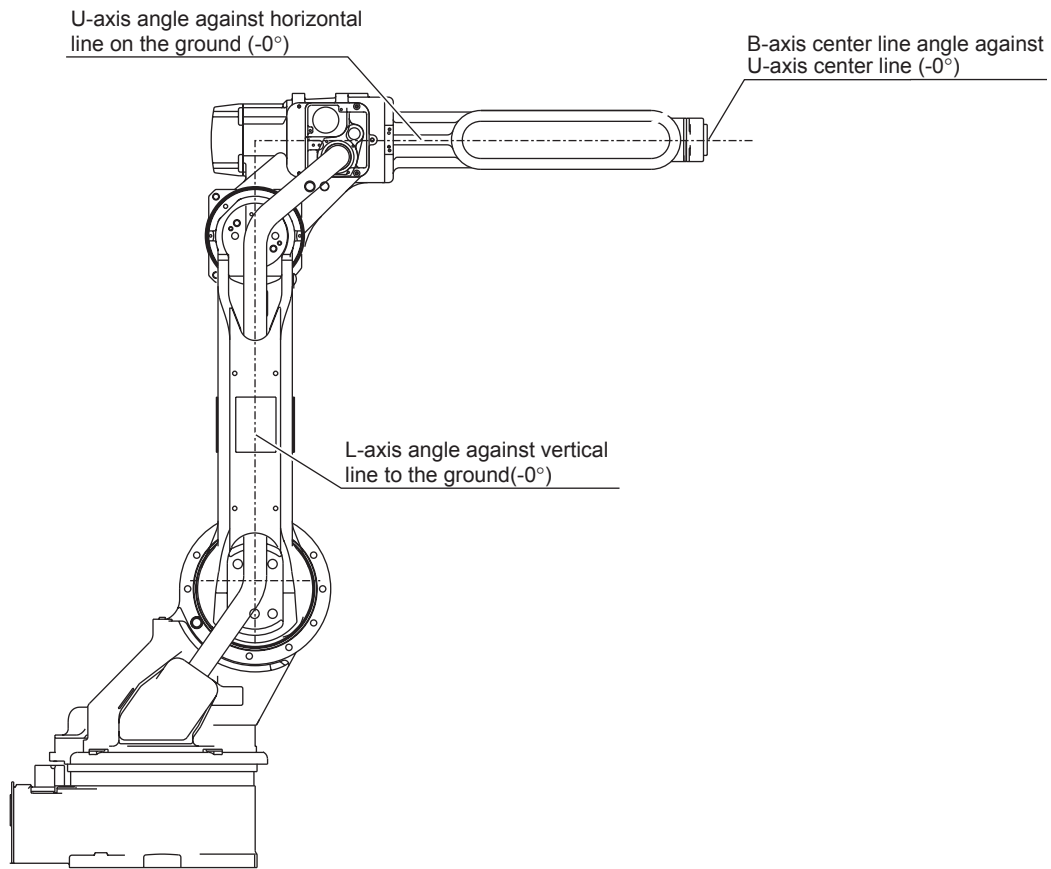
|   | Operation                                       | Explanation  |
|---|---|--|
| 1 | Select {ROBOT} under the main menu.             |  |
| 2 | Select {HOME POSITION}.                         | The HOME POSITIONING window is shown.  |
| 3 | Select {DISPLAY}.                               | The pull down menu appears.  |
| 4 | Select the desired control group.               |  |
| 5 | Select the absolute data to be registered.      |  <p>The screenshot shows a software window titled "HOME POSITIONING" with a menu bar containing "DATA", "EDIT", "DISPLAY", and "UTILITY". Below the menu bar, there are several icons. The main area of the window is divided into two columns: "SELECT" and "ABSOLUTE DATA". Under "SELECT", there are radio buttons for "R1:S", "L", "U", "R", "B", and "T". The "R1:S" radio button is selected. Under "ABSOLUTE DATA", there are input fields for each axis: "R1:S" (193), "L" (2965), "U" (2698), "R" (-66398), "B" (692), and "T" (968). At the bottom of the window, there are buttons for "Main Menu" and "ShortCut".</p> |
| 6 | Enter the absolute data using the Numeric keys. |  |
|   | Press [ENTER].                                  | Absolute data are changed.   |

■ Clearing Absolute Data

|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {ROBOT} under the main menu. |   |
| 2 | Select {HOME POSITION}.             | The HOME POSITIONING window is shown.   |
| 3 | Select {DISPLAY}.                   | The pull down menu appears.   |
| 4 | Select the desired control group.   |   |
| 5 | Select {DATA} under the menu.       |   |
| 6 | Select {CLEAR ALL DATA}.            | <p>The all absolute data are cleared.</p>  |

### 9.1.3 Home Position of the Robot

In case of HP6, the home position are as follows.



Other manipulator models have different positions. Always refer to "MANIPULATOR INSTRUCTIONS" for the correct manipulator model.

## 9.2 Second Home Position (Check Point)



### WARNING

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

Abnormality of the PG system may be a cause for 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 NX100 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 NX100 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.

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

Emergency stop buttons are attached on the right of the front door of the NX100 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 NX100 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.

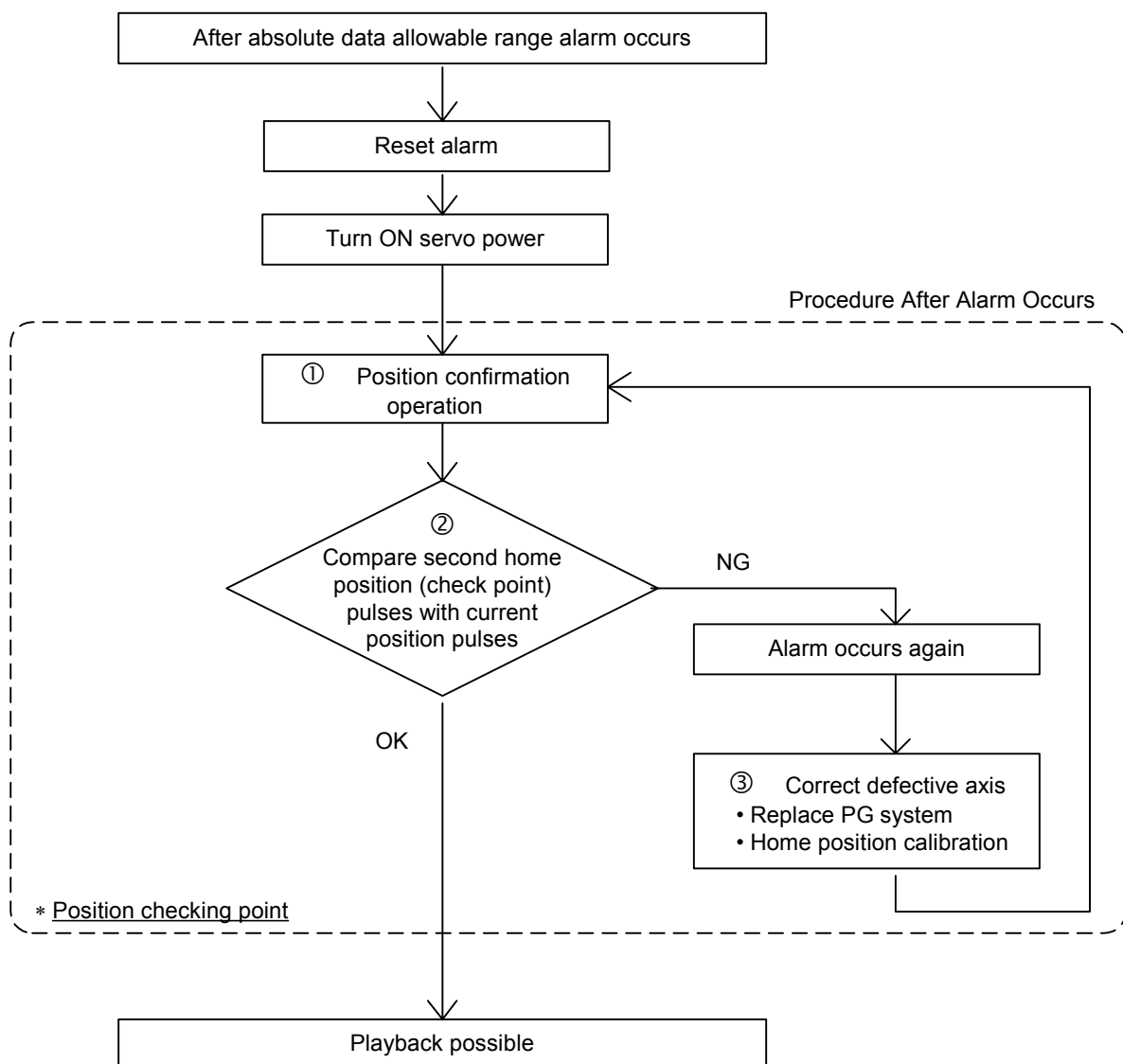
## 9.2.1 Purpose of Position Check Operation

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 absolute data allowable range alarm occurs, move to the second home position using the axis keys and check the position. To prevent the position from changing, playback, test runs, and FWD operation will not function.

### ②Pulse 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 error 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 "9.2.2 Setting the Second Home Position (Check Point)."

### ③Alarm Occurrence

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



- Home position calibration of all the axes at the same time enables playback operations without having to check the position.

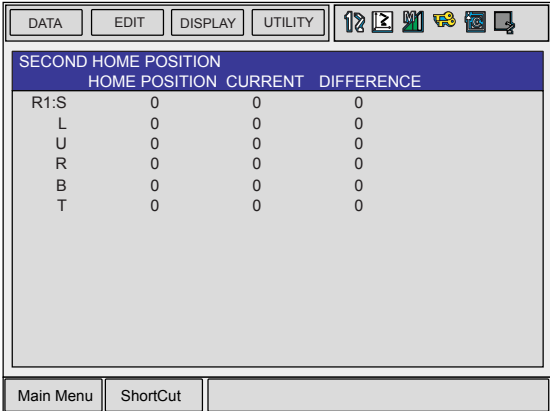

- Sometimes in a system with a manipulator that has no brake, it is possible to enable playback without position checking after the absolute data allowable range error alarm occurs. **However, as a rule, always check the position.**

Under the above special conditions, the manipulator moves as follows:


After starting, the manipulator moves at low speed (1/10 of the maximum speed) to the step indicated by the cursor. If it is stopped and restarted during this motion, the low speed setting is retained until the step at cursor is reached. Regardless of cycle setting, the manipulator stops after the cursor step is reached. Starting the manipulator again then moves it at the programmed speed and cycle of the job.

## 9.2.2 Setting the Second Home Position (Check Point)

Apart from the normal 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.

|                      | Operation  | Explanation  |                      |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------------------|--|--|----------------------|--|--|--|--|---------------|---------|------------|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1                    | Select {ROBOT} under the main menu.  |  |                      |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 2                    | Select {SECOND HOME POS}.  | <p>The SECOND HOME POSITION window is shown.<br/>The message "Available to move to any modify second home position" is shown.</p>  <table border="1"> <thead> <tr> <th colspan="4">SECOND HOME POSITION</th> </tr> <tr> <th></th> <th>HOME POSITION</th> <th>CURRENT</th> <th>DIFFERENCE</th> </tr> </thead> <tbody> <tr> <td>R1:S</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>L</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>U</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>R</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>B</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>T</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table> | SECOND HOME POSITION |  |  |  |  | HOME POSITION | CURRENT | DIFFERENCE | R1:S | 0 | 0 | 0 | L | 0 | 0 | 0 | U | 0 | 0 | 0 | R | 0 | 0 | 0 | B | 0 | 0 | 0 | T | 0 | 0 | 0 |
| SECOND HOME POSITION |  |  |                      |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|                      | HOME POSITION  | CURRENT  | DIFFERENCE           |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| R1:S                 | 0  | 0  | 0                    |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L                    | 0  | 0  | 0                    |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| U                    | 0  | 0  | 0                    |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| R                    | 0  | 0  | 0                    |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| B                    | 0  | 0  | 0                    |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| T                    | 0  | 0  | 0                    |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 3                    | Press the page key  . | The group axes by which the second home position is set is selected when there are two or more group axes.   |                      |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 4                    | Press the axis keys.   | Move the manipulator to the new second home position.  |                      |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5                    | Press [MODIFY] and [ENTER].  | The second home position is changed.   |                      |  |  |  |  |               |         |            |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### 9.2.3 Procedure After an Alarm


WARNING


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

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


If the absolute data allowable range alarm occurs, perform the followings

- Reset the alarm
- Turn Servo power ON

and 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 Position Window".

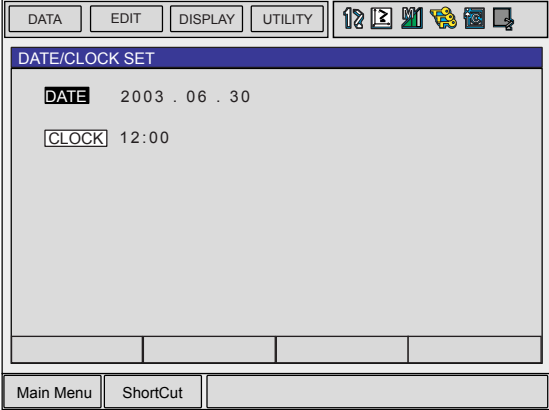
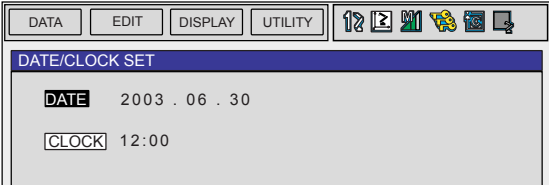


Refer to NX100 MAINTENANCE MANUAL " 7.7 Position Data When Power is Turned ON/OFF " for details on the "Power ON/OFF Position Window."

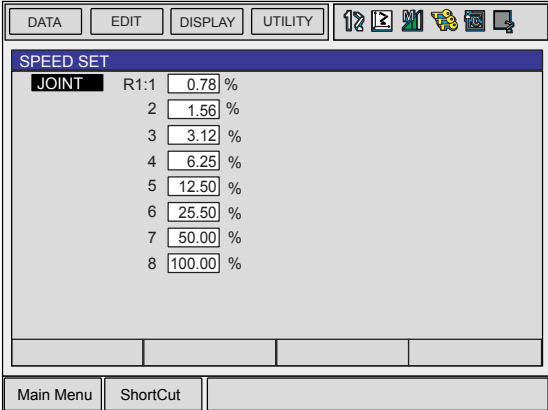


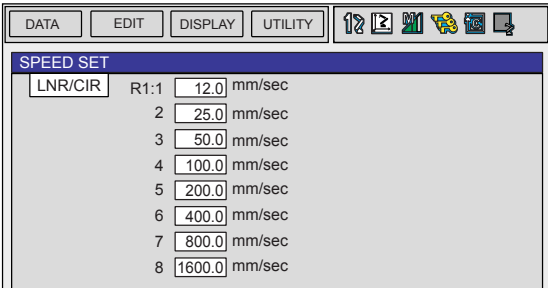
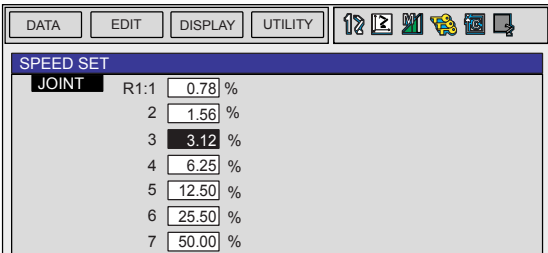
|   | Operation  | Explanation  |
|---|--|--|
| 1 | Select {ROBOT} under the main menu.  |  |
| 2 | Select {SECOND HOME POS}.  | The SECOND HOME POSITION window is shown.  |
| 3 | Press the page key  . | The group axes by which the second home position is set is selected when there are two or more group axes.   |
| 4 | Press [FWD].   | TCP moves to the second home position. The robot moving speed is set as selected manual operation speed.   |
| 5 | Select {DATA} under the menu.  |  |
| 6 | Select {CONFIRM POSITION}.   | The message "Home position checked" is shown. 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. |

## 9.3 Setting the Controller Clock

The clock inside of the NX100 controller can be set.

|   | Operation                           | Explanation  |
|---|-------------------------------------|--|
| 1 | Select {SETUP} under the main menu. |  |
| 2 | Select {DATE/TIME}.                 | <p>The DATE/CLOCK SET window is shown.</p>  |
| 3 | Select "DATE" or "CLOCK."           | The input buffer line is shown.  |
| 4 | Input the new date or time.         | For instance, to make the date June 30, 2003, input [2003.6.30]. To set the time at exactly twelve o'clock, enter [12.00].     |
| 5 | Press [ENTER].                      | <p>Date and time are changed.</p>          |

## 9.4 Setting Play Speed

|   | Operation  | Explanation  |
|---|--|--|
| 1 | Select {SETUP} under the main menu.  |  |
| 2 | Select {SET SPEED}.  | <p>The SPEED SET window is shown.</p>    |
| 3 | Press the page key  . | <p>When two or more manipulators and stations exist in the system, the control group is changed by the page key .</p> |
| 4 | Select "JOINT" or "LNR/CIR."   | <p>The type of speed alternately changes from "JOINT" to "LNR/CIR".</p>    |
| 5 | Select desired speed value.  | The input buffer line is shown.  |
| 6 | Input the speed value.   |  |
| 7 | Press [ENTER].   | <p>The speed value is changed.</p>   |

## 9.5 All Limits Releasing



### CAUTION

- **To operate the manipulator with all limits released, pay extra attention to the operating environment around you.**

When all limits are released, the manipulator or equipment may be damaged.

The following limits can be released by the operation explained in the following.

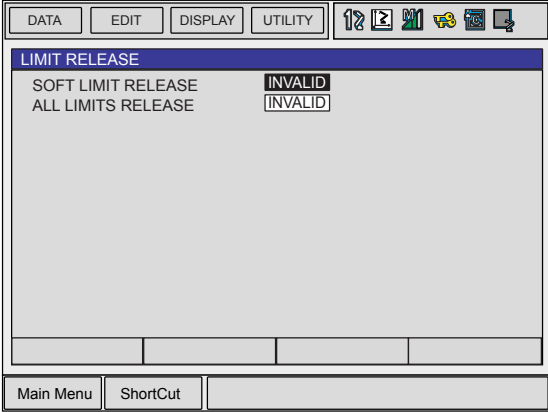
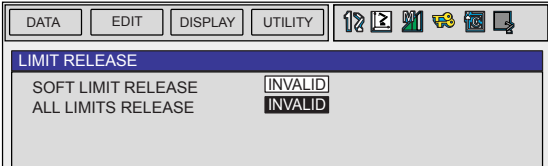
| Limit Type        | Contents   |
|-------------------|--|
| Mechanical Limit  | Limit for checking manipulator's range of motion                 |
| L-U Interference  | Limit for checking L- and U-axes interference area               |
| Software Limit    | Every axis soft limit for checking manipulator's range of motion |
| Cube Interference | Limit for checking cube interference area set by user            |



If the security mode is not at management mode, all limits releasing is not allowed. Refer to "8 Security System" for details about security modes.



## 9.5 All Limits Releasing

|   | Operation                           | Explanation  |
|---|-------------------------------------|--|
| 1 | Select {ROBOT} under the main menu. |  |
| 2 | Select {LIMIT RELEASE}.             | <p>The LIMIT RELEASE window is shown.</p>  <p>The screenshot shows a window titled "LIMIT RELEASE" with a menu bar containing "DATA", "EDIT", "DISPLAY", and "UTILITY". Below the menu bar, there are two rows of text: "SOFT LIMIT RELEASE" followed by "INVALID" and "ALL LIMITS RELEASE" followed by "INVALID". At the bottom of the window, there are two buttons labeled "Main Menu" and "ShortCut".</p>  |
| 3 | Select "ALL LIMITS RELEASE."        | <p>"VALID" and "INVALID" are shown alternately every time [SELECT] is pressed.<br/>           When ALL LIMITS RELEASE is changed to "VALID", the message "All limits have been released" is shown. When the setting changes to "INVALID", the message "All limits release has been canceled" is shown for three seconds.</p>  <p>This screenshot is identical to the one in step 2, showing the "LIMIT RELEASE" window with "SOFT LIMIT RELEASE" and "ALL LIMITS RELEASE" both set to "INVALID".</p> |

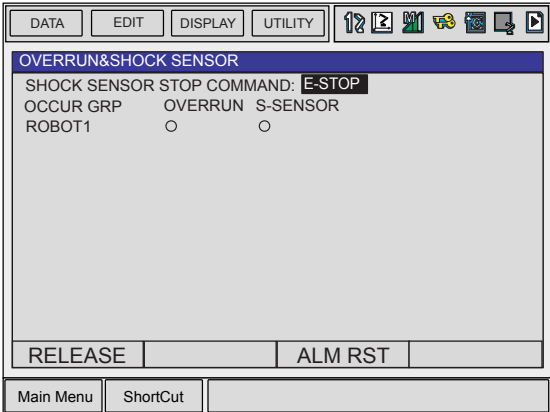
## 9.6 Overrun / Tool Shock Sensor Releasing

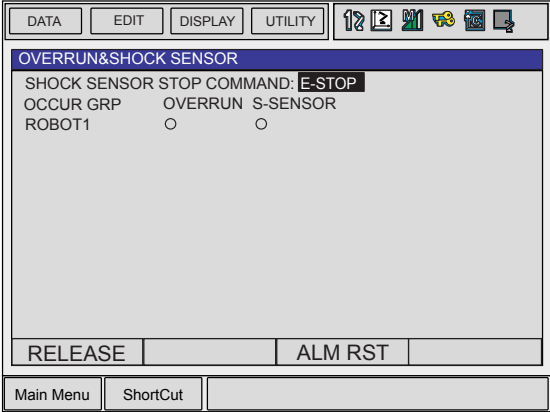


### CAUTION

- **To operate the manipulator with overrun released or with tool shock sensor released, pay extra attention to the operating environment around you.**

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 using the axis keys.

|   | Operation                           | Explanation  |
|---|-------------------------------------|--|
| 1 | Select {ROBOT} under the main menu. |  |
| 2 | Select {OVERRUN & S-SENSOR}.        | <p>The OVERRUN &amp; TOOL SHOCK SENSOR window is shown. The stopping condition when the tool shock sensor is detected can be selected "EMERGENCY STOP" or "HOLD" at the "TOOL SHOCK SENSOR STOP COMMAND". "E-STOP" and "HOLD" are displayed alternately every time [SELECT] is pressed.</p>  |

|   | Operation         | Explanation   |
|---|-------------------|---|
| 3 | Select "RELEASE." | <p>“●” is shown at the control group which detects overrun or tool shock sensor. If “RELEASE” is selected, overrun or tool shock sensor is released and “CANCEL” is shown.</p>  |
| 4 | Select "ALM RST." | Alarm is reset and manipulator can be moved using the axis keys.  |

**NOTE**

- After overrun or tool shock sensor releasing, the manipulator can be moved using the axis keys with low speed or inching motion only.
- After overrun or tool shock sensor releasing, if “CANCEL” is selected or the window is changed to the other one, overrun or tool shock sensor releasing is canceled.
- The axis operation can be performed only in the joint.

## 9.7 Interference Area

### 9.7.1 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

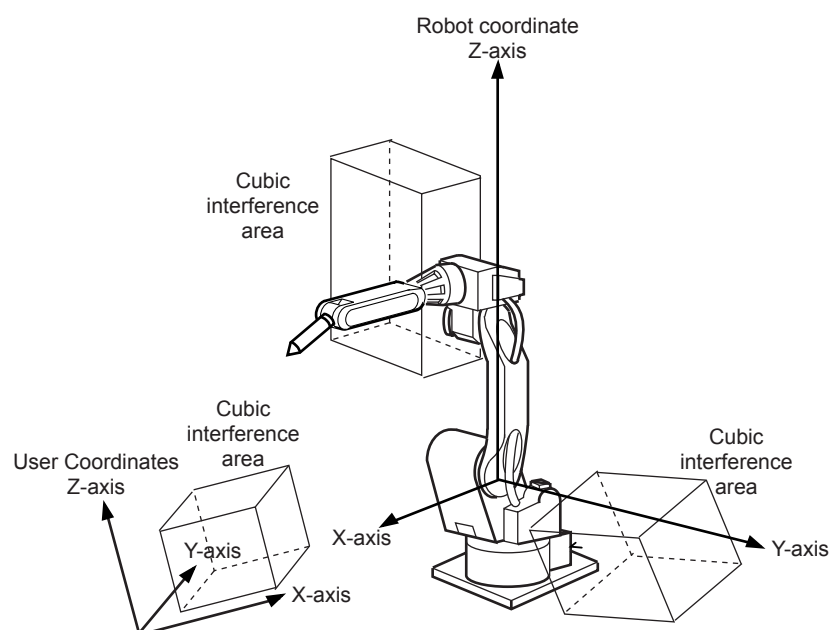
The NX100 judges whether the TCP of the manipulator is inside or outside this area, and outputs this status as a signal.

If the TCP of the manipulator is inside the area, the interference 1 inside signal or interference 2 inside signal are turned on and the manipulator automatically decelerates to a stop. The manipulator stands by until these signals are turned off, whereupon it automatically restarts.

### 9.7.2 Cubic Interference Area

#### ■ Cubic Interference Area

This area is a rectangular parallelepiped which is parallel to the base coordinate, robot coordinate, or user coordinate. The NX100 judges whether the current position of the manipulator's TCP is inside or outside this area, and outputs this status as a signal. The cubic interference areas can be set, parallel to the base coordinate or user coordinate.

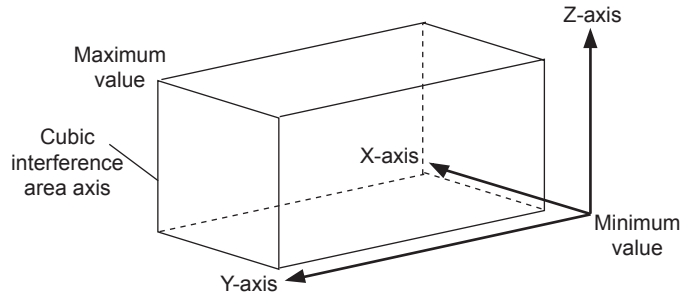


## ■ Cube Setting Method

There are three ways to set cubic interference areas, as described in the following:

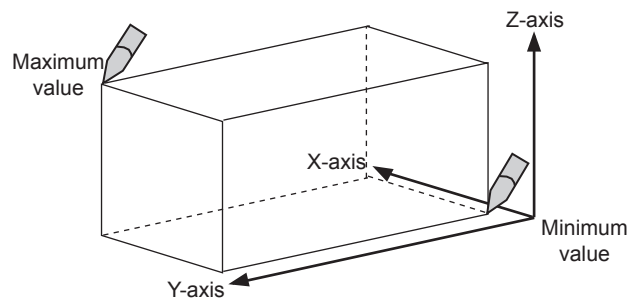
### Number Input of Cube Coordinates

Enter the maximum and minimum values for the cube coordinates.



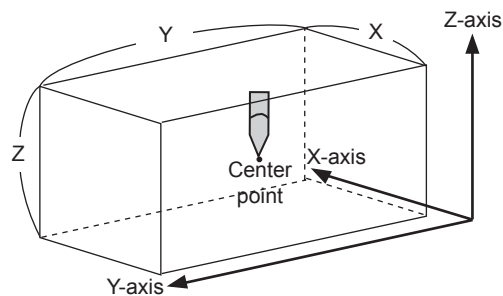
### Teaching Corner

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

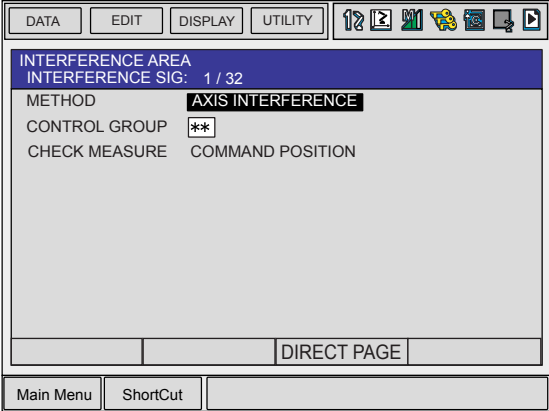

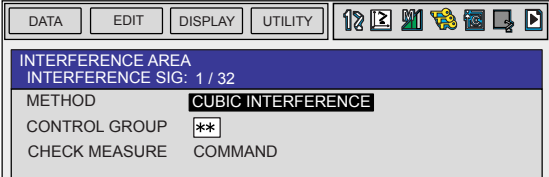
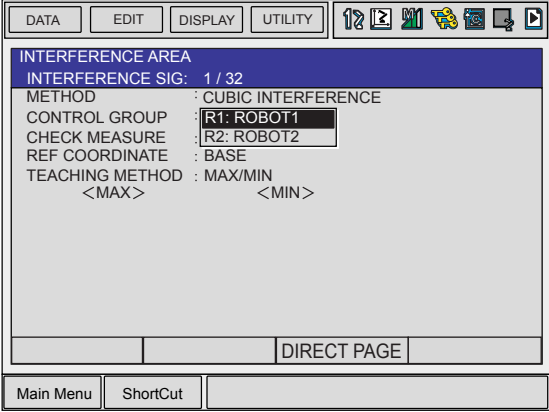


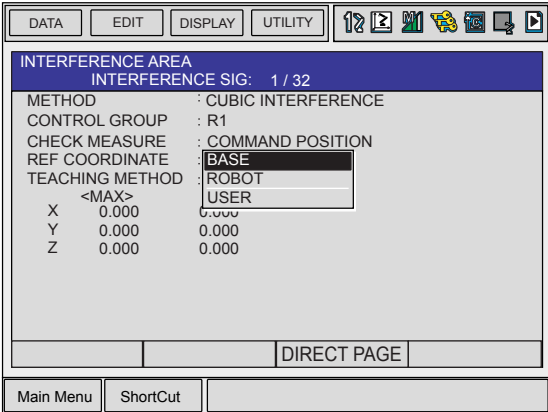
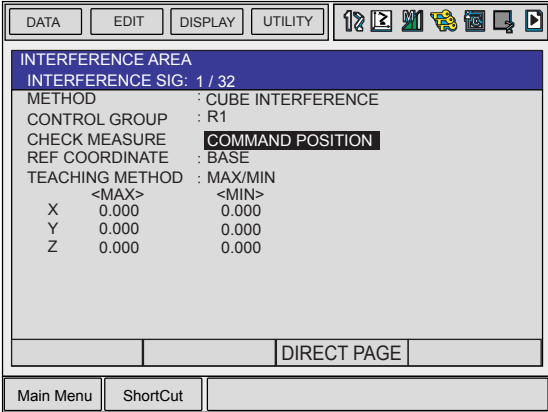
### Number Input of the Side of Cube and Teaching Center

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.



## ■ Setting Operation

|   | Operation                           | Explanation  |
|---|-------------------------------------|--|
| 1 | Select {ROBOT} under the main menu. |  |
| 2 | Select {INTERFERENCE}.              | <p>The INTERFERENCE AREA window is shown.</p>    |
| 3 | Select the desired cube number.     | <p>Select the desired cube number using the page key  or by number input.</p> <p>The method for number input is as follows: Move cursor to "INTERFERENCE SIG" and press [ENTER] to display the number input line. Input desired signal number and press [ENTER].</p> |
| 4 | Select "METHOD."                    | <p>"AXIS INTERFERENCE" and "CUBIC INTERFERENCE" are displayed alternately every time [SELECT] is pressed. If "CUBIC INTERFERENCE" is selected, the window is changed.</p>    |
| 5 | Select "CONTROL GROUP."             | <p>The selection dialog box is shown. Select desired control group.</p>    |

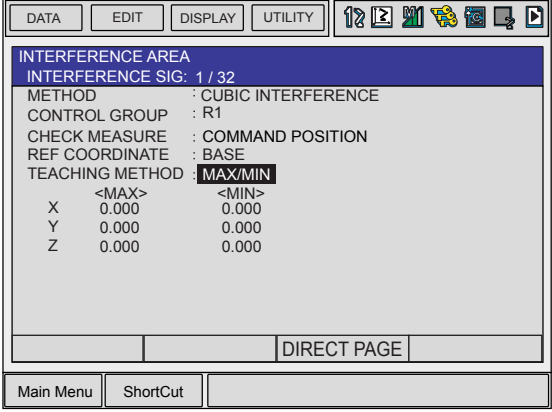
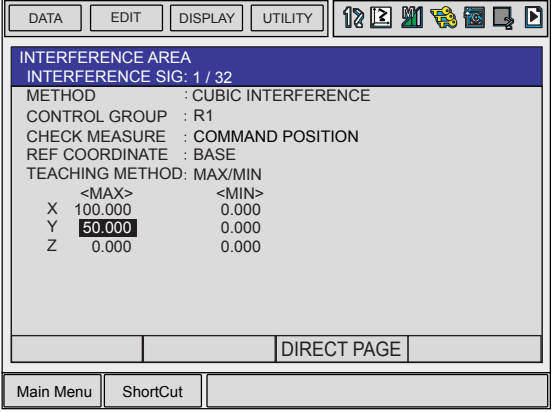
|   | Operation                 | Explanation   |
|---|---------------------------|---|
| 6 | Select "REF COORDINATES." | <p>The selection dialog box is shown. Select desired coordinate. If the user coordinates are selected, the number input line is shown. Input the user coordinate number and press [ENTER].</p>  |
| 7 | Select "CHECK MEASURE."   | <p>Each time [SELECT] is pressed, "COMMAND POSITION" and "FEEDBACK POSITION" are shown alternately.</p>    |

**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.

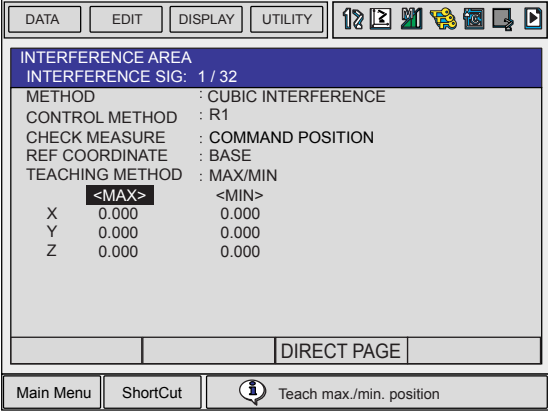
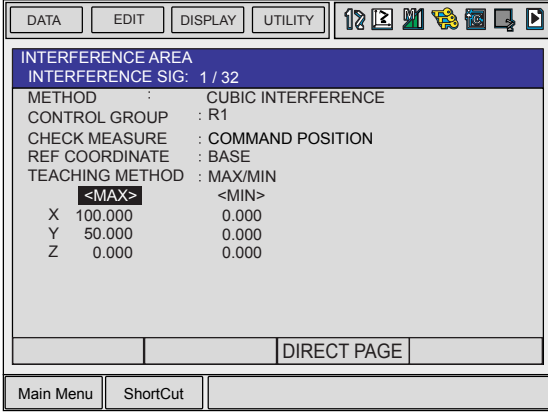
When informing an external unit of the actual manipulator position, use the "FEEDBACK POSITION" setting so the timing of the output signal is more accurate.

**Number Input of Cube Coordinates**

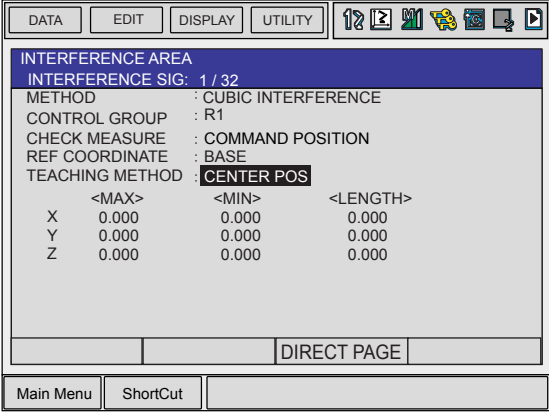
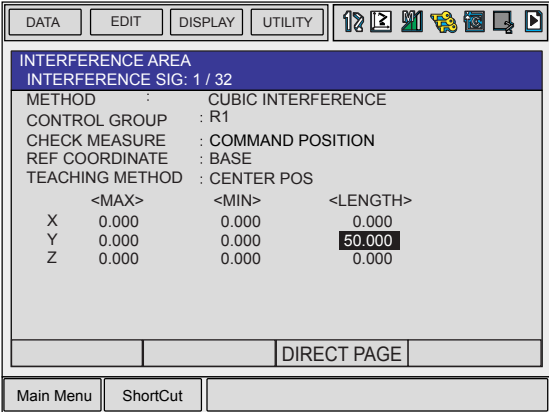
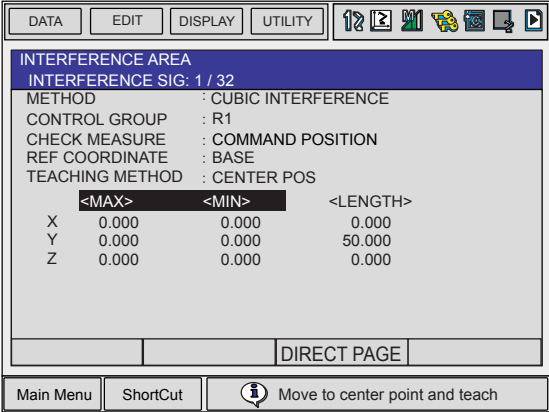
|   | Operation  | Explanation  |
|---|--|--|
| 1 | Select "METHOD."   | <p>Each time [SELECT] is pressed, "MAX/MIN" and "CENTER POS" alternate.<br/>Select "MAX/MIN".</p>  <p>The screenshot shows a menu titled "INTERFERENCE AREA" with the following settings: INTERFERENCE SIG: 1 / 32, METHOD: CUBIC INTERFERENCE, CONTROL GROUP: R1, CHECK MEASURE: COMMAND POSITION, REF COORDINATE: BASE, and TEACHING METHOD: MAX/MIN. The X, Y, and Z coordinates are all set to 0.000. The menu has buttons for DATA, EDIT, DISPLAY, UTILITY, and a "DIRECT PAGE" button at the bottom.</p> |
| 2 | Input number for "MAX" and "MIN" data and press [ENTER]. | <p>The cubic interference area is set.</p>  <p>The screenshot shows the same "INTERFERENCE AREA" menu. The settings are: INTERFERENCE SIG: 1 / 32, METHOD: CUBIC INTERFERENCE, CONTROL GROUP: R1, CHECK MEASURE: COMMAND POSITION, REF COORDINATE: BASE, and TEACHING METHOD: MAX/MIN. The X coordinate is 100.000, the Y coordinate is 50.000, and the Z coordinate is 0.000. The menu has buttons for DATA, EDIT, DISPLAY, UTILITY, and a "DIRECT PAGE" button at the bottom.</p>                           |



**Teaching Corner**

|   | Operation                                 | Explanation   |
|---|---|---|
| 1 | Select "METHOD."                          | Each time [SELECT] is pressed, "MAX/MIN" and "CENTER POS" alternate.<br>Select "MAX/MIN".   |
| 2 | Press [MODIFY].                           | The message "Teach max./min. position" is shown.<br> The screenshot shows a software interface titled "INTERFERENCE AREA" with a sub-header "INTERFERENCE SIG: 1 / 32". It lists several parameters: METHOD (CUBIC INTERFERENCE), CONTROL METHOD (R1), CHECK MEASURE (COMMAND POSITION), REF COORDINATE (BASE), and TEACHING METHOD (MAX/MIN). Below these, there are two columns: "<MAX>" and "<MIN>". The values for X, Y, and Z are all 0.000. At the bottom, there is a "DIRECT PAGE" button and a status bar with "Main Menu", "ShortCut", and "Teach max./min. position". |
| 3 | Move the cursor to "<MAX>" or "<MIN>."    | Move cursor to "<MAX>" for changing maximum value and move cursor to "<MIN>" for changing minimum value. The cursor moves to only either "<MIN>" or "<MAX>" at this time. The cursor moves freely when this operation is canceled by pressing [CANCEL].   |
| 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.<br> The screenshot shows the same "INTERFERENCE AREA" interface as in step 2. The values for X, Y, and Z are now 100.000, 50.000, and 0.000 respectively. The "<MAX>" column is highlighted with a black background. The status bar at the bottom still shows "Main Menu", "ShortCut", and "Teach max./min. position".   |

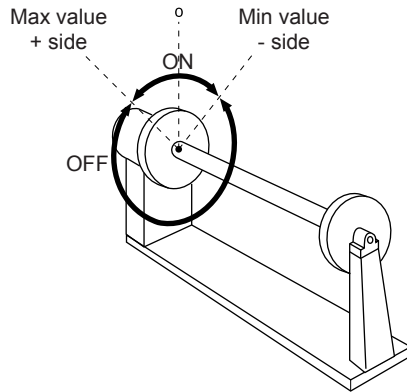
## Number Input of the Side of Cube and Teaching Center

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Select "METHOD."                                     | <p>Each time [SELECT] is pressed, "MAX/MIN" and "CENTER POS" alternate.<br/>Select "CENTER POS"</p>  <p>The screenshot shows the 'INTERFERENCE AREA' screen with the following settings: METHOD: CUBIC INTERFERENCE, CONTROL GROUP: R1, CHECK MEASURE: COMMAND POSITION, REF COORDINATE: BASE, and TEACHING METHOD: CENTER POS. The X, Y, and Z coordinates are all 0.000. The &lt;MAX&gt;, &lt;MIN&gt;, and &lt;LENGTH&gt; columns are also empty.</p> |
| 2 | Input data for length of the cube and press [ENTER]. | <p>The length is set.</p>  <p>The screenshot shows the 'INTERFERENCE AREA' screen with the same settings as above, but the &lt;LENGTH&gt; column for X, Y, and Z is now set to 0.000, and the &lt;LENGTH&gt; column for Z is highlighted with 50.000.</p>  |
| 3 | Press [MODIFY].                                      | <p>The message "Move to center point and teach" is shown.<br/>The cursor moves to only either "&lt;MIN&gt;" or "&lt;MAX&gt;" at this time.<br/>The cursor moves freely when this operation is canceled by pressing [CANCEL].</p>  <p>The screenshot shows the 'INTERFERENCE AREA' screen with the same settings as above, but the cursor is now positioned over the &lt;MAX&gt; column for X, Y, and Z.</p>   |
| 4 | Move the manipulator using the axis keys.            | <p>Move the manipulator to the center point of the cube using the axis keys.</p>  |
| 5 | Press [ENTER].                                       | <p>The current position is registered as the center point of the cube.</p>  |

### 9.7.3 Axis Interference Area

#### ■ Axis Interference Area

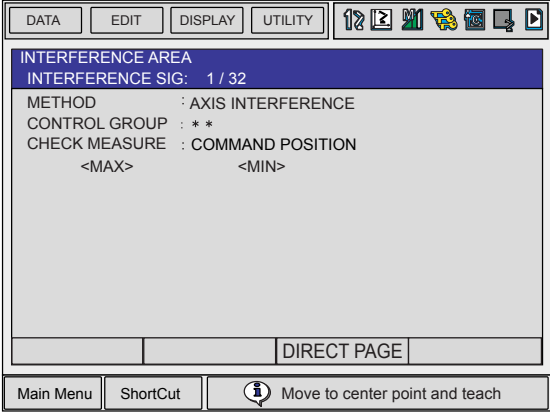

The axis interference area is a function that judges the current position of the each axis and outputs a signal. Once the maximum and minimum values have been set at the plus and minus sides of the axis to define the working range, a signal indicating whether the current position of the axis is inside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

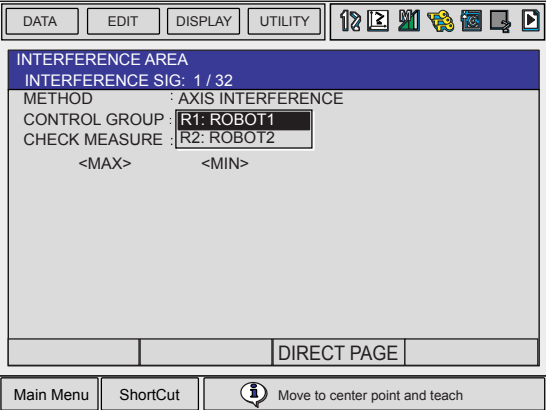
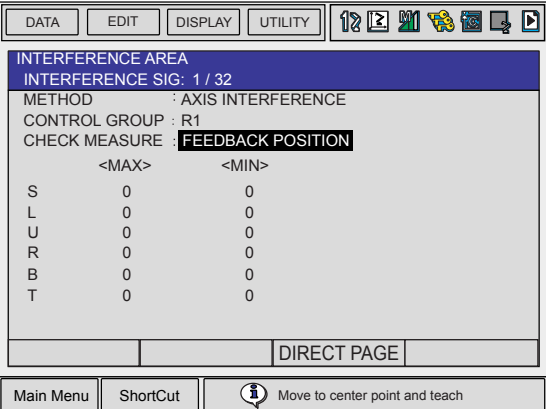
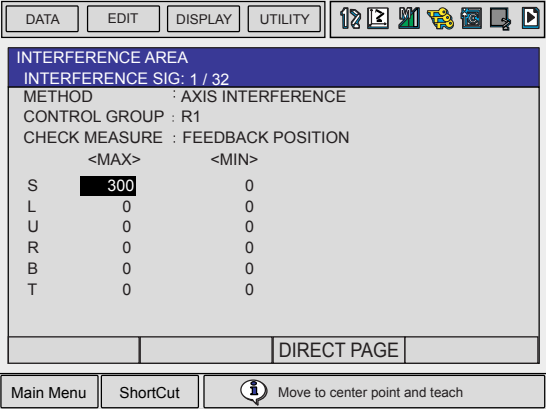


Axis Interference Signal for Station Axis

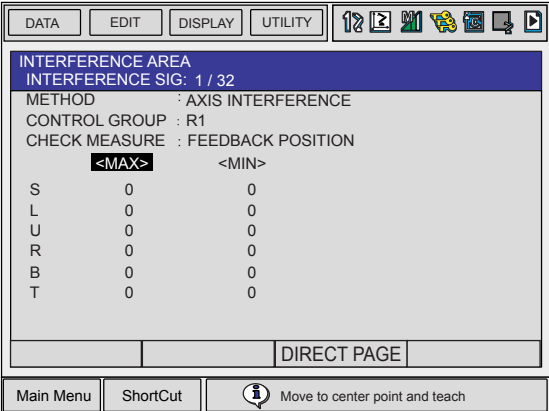
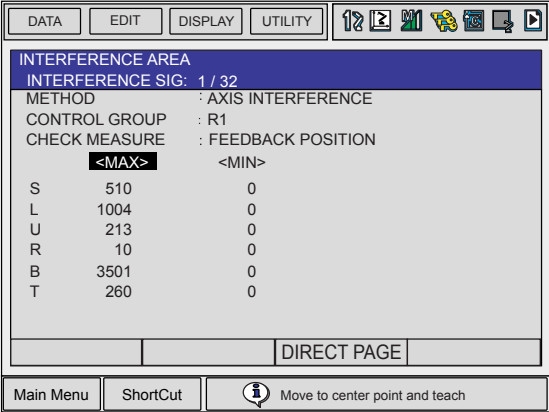
#### ■ Setting Operation

##### Number Input of Axis Data


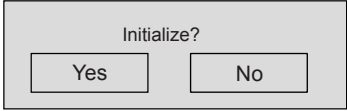
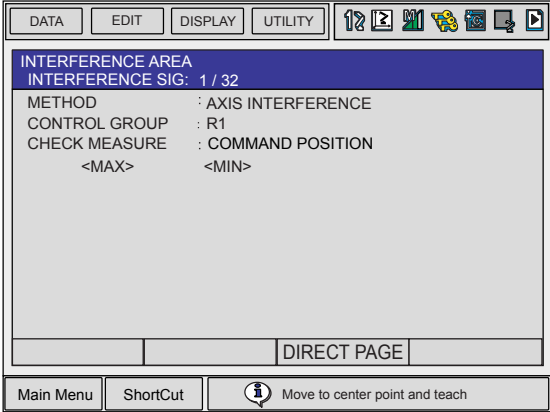
|   | Operation                                      | Explanation  |
|---|--|--|
| 1 | Select {ROBOT} under the main menu.            |  |
| 2 | Select {INTERFERENCE}.                         | The INTERFERENCE AREA window is shown.<br>   |
| 3 | Select the desired interference signal number. | Select the desired interference signal number using the page key  or by number input.<br>The method for number input is as follows: Move cursor to "INTERFERENCE SIG" and press [SELECT] to display the number input line. Input desired signal number and press [ENTER]. |
| 4 | Select "METHOD."                               | "AXIS INTERFERENCE" and "CUBIC INTERFERENCE" are shown alternately every time [SELECT] is pressed. Select "AXIS INTERFERENCE".   |

|   | Operation                                      | Explanation  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|--|--|--|-------|-------|---|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | Select "CONTROL GROUP."                        | <p>The selection dialog box is shown. Select desired control group.</p>  <p>The screenshot shows a software window titled "INTERFERENCE AREA" with a sub-header "INTERFERENCE SIG: 1 / 32". The "METHOD" is "AXIS INTERFERENCE". The "CONTROL GROUP" is set to "R1: ROBOT1" and "CHECK MEASURE" is "R2: ROBOT2". There are fields for "&lt;MAX&gt;" and "&lt;MIN&gt;". At the bottom, there are buttons for "Main Menu", "ShortCut", and "Move to center point and teach".</p>   |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 6 | Select "CHECK MEASURE."                        | <p>Each time [SELECT] is pressed, "COMMAND POSITION" and "FEEDBACK POSITION" alternate.</p>  <p>The screenshot shows the same "INTERFERENCE AREA" window. The "CONTROL GROUP" is now "R1" and "CHECK MEASURE" is "FEEDBACK POSITION". Below these fields is a table with columns "&lt;MAX&gt;" and "&lt;MIN&gt;".</p> <table border="1"> <thead> <tr> <th></th> <th>&lt;MAX&gt;</th> <th>&lt;MIN&gt;</th> </tr> </thead> <tbody> <tr><td>S</td><td>0</td><td>0</td></tr> <tr><td>L</td><td>0</td><td>0</td></tr> <tr><td>U</td><td>0</td><td>0</td></tr> <tr><td>R</td><td>0</td><td>0</td></tr> <tr><td>B</td><td>0</td><td>0</td></tr> <tr><td>T</td><td>0</td><td>0</td></tr> </tbody> </table> <p>At the bottom, there are buttons for "Main Menu", "ShortCut", and "Move to center point and teach".</p> |  | <MAX> | <MIN> | S | 0   | 0 | L | 0 | 0 | U | 0 | 0 | R | 0 | 0 | B | 0 | 0 | T | 0 | 0 |
|   | <MAX>  | <MIN>  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| S | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| U | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| R | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| B | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| T | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 7 | Input data for desired axis and press [ENTER]. | <p>The axis interference area is set.</p>  <p>The screenshot shows the same "INTERFERENCE AREA" window. The "CHECK MEASURE" is still "FEEDBACK POSITION". In the table below, the "S" row under the "&lt;MAX&gt;" column now has the value "300" entered.</p> <table border="1"> <thead> <tr> <th></th> <th>&lt;MAX&gt;</th> <th>&lt;MIN&gt;</th> </tr> </thead> <tbody> <tr><td>S</td><td>300</td><td>0</td></tr> <tr><td>L</td><td>0</td><td>0</td></tr> <tr><td>U</td><td>0</td><td>0</td></tr> <tr><td>R</td><td>0</td><td>0</td></tr> <tr><td>B</td><td>0</td><td>0</td></tr> <tr><td>T</td><td>0</td><td>0</td></tr> </tbody> </table> <p>At the bottom, there are buttons for "Main Menu", "ShortCut", and "Move to center point and teach".</p>   |  | <MAX> | <MIN> | S | 300 | 0 | L | 0 | 0 | U | 0 | 0 | R | 0 | 0 | B | 0 | 0 | T | 0 | 0 |
|   | <MAX>  | <MIN>  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| S | 300  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| U | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| R | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| B | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| T | 0  | 0  |  |       |       |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

**Setting Axis Data by Moving Manipulator Using the Axis Key**

|   | Operation                                      | Explanation  |
|---|--|--|
| 1 | Select {ROBOT} under the main menu.            |  |
| 2 | Select {INTERFERENCE}.                         |  |
| 3 | Select the desired interference signal number. |  |
| 4 | Select "METHOD."                               |  |
| 5 | Select "CONTROL GROUP."                        | Operate in the same way as shown in Explanation 2 to 5 in "Number Input of Axis Data".   |
| 6 | Press [MODIFY].                                | <p>Move cursor to "&lt;MAX&gt;" for changing maximum value and move cursor to "&lt;MIN&gt;" for changing minimum value. The cursor moves to only either "&lt;MIN&gt;" or "&lt;MAX&gt;" at this time. The cursor moves freely when this operation is canceled by pressing [CANCEL].</p>  |
| 7 | Move the manipulator using the axis keys.      | Move the manipulator to the desired position using the axis keys.  |
| 8 | Press [ENTER].                                 | <p>The axis interference area is registered.</p>   |

## 9.7.4 Clearing Interference Area Data

|   | Operation                                | Explanation  |
|---|--|--|
| 1 | Select interference signal for clearing. | Select the desired interference signal number for clearing using the page key  or by number input.<br>The method for number input is as follows: Move cursor to the signal number and press [SELECT] to display the number input line. Input desired signal number and press [ENTER]. |
| 2 | Select {DATA} under the menu.            |  |
| 3 | Select {CLEAR DATA}.                     | The confirmation dialog box is shown.<br>  |
| 4 | Select "YES."                            | All the data of the interference signal number are cleared.<br>   |

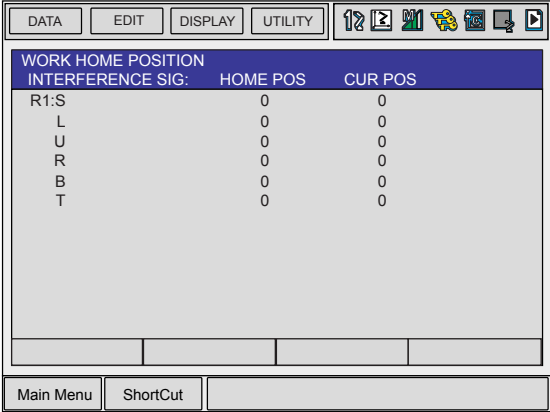


## 9.8 Work Home Position

### 9.8.1 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.

### 9.8.2 Setting Work Home Position

#### ■ Work Home Position Window

|   | Operation  | Explanation  |
|---|--|--|
| 1 | Select {ROBOT} under the main menu.  |  |
| 2 | Select {WORK HOME POSITION}.   | The WORK HOME POSITION window is shown.<br>  |
| 3 | Press the page key  . | When two or more manipulators exist in the system, the control group is changed using the page key  . |

#### ■ Registering/Changing the Work Home Position

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Press the axis keys in the work home position display. | Move the manipulator to the new work home position. |
| 2 | Press [MODIFY] and [ENTER].                            | New work home position is set.                      |

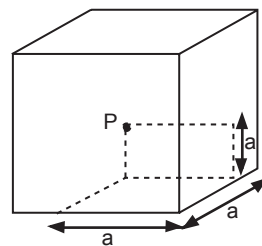
**NOTE**

When the work home position is changed, the cubic interference area is automatically set as cube 32 to 29 in the base coordinate system.

- The cube 32 is for ROBOT1
- The cube 31 is for ROBOT2
- The cube 30 is for ROBOT3
- The cube 29 is for ROBOT4

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:  $\mu\text{m}$ ). By changing this parameter setting, the size of the cube can be changed.

S3C805 : The work home position cube length of its sides(  $\mu\text{m}$ )



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.

## ■ Returning to the Work Home Position

### In the teach mode

|   | Operation                                      | Explanation  |
|---|--|--|
| 1 | Press [FWD] in the work home position display. | The manipulator moves to the new work home position. During movement, the message “Manipulator is moving to work home position” is shown. 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 using the same operation as the teach mode. However, the speed for this is set in the parameters.

## ■ 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.

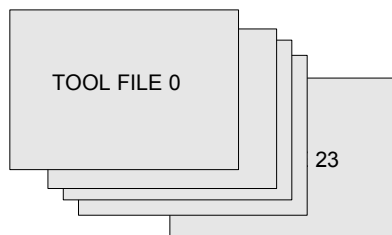


## 9.9 Tool Data Setting

### 9.9.1 Registering Tool Files

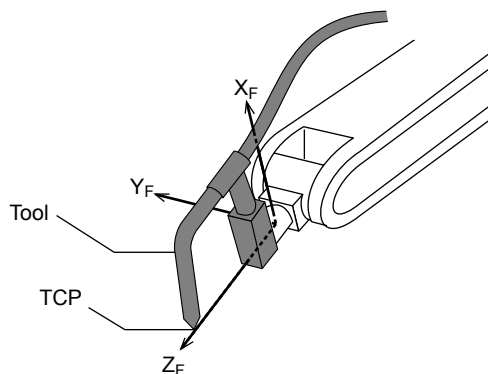
#### ■ Number of Tool Files


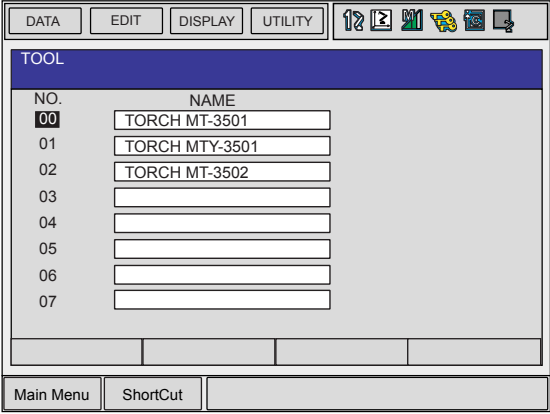
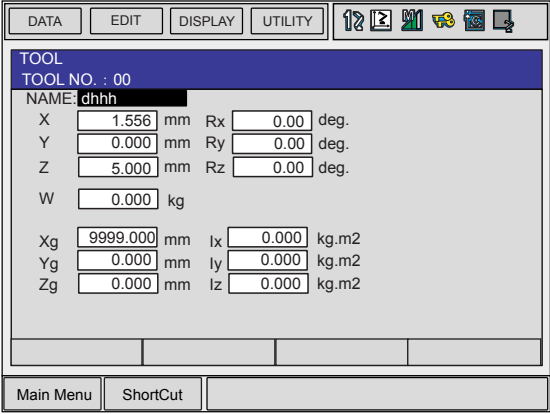
There are 24 tool files numbered 0 to 23. Each file is called as a tool file.




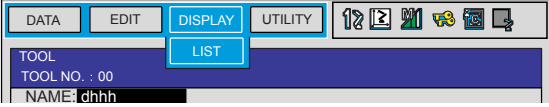
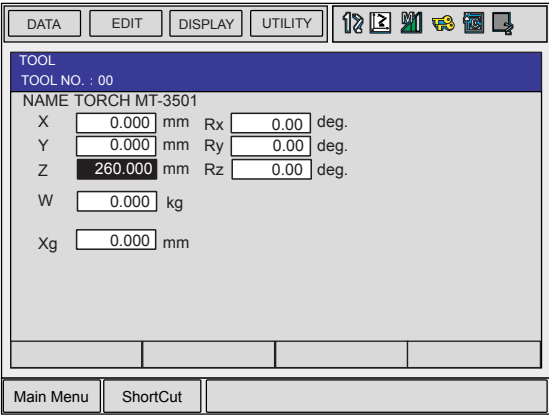
#### ■ Registering Coordinate Data

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

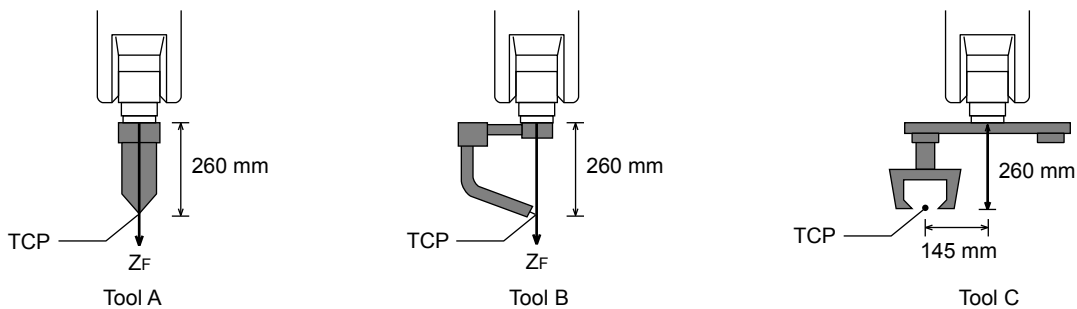


|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {ROBOT} under the main menu. |   |
| 2 | Select {TOOL}.                      | <p>The TOOL window is shown. When the tool extension function is valid, the list is shown. When the tool extension function is invalid, the TOOL COORDINATE window is shown.</p> <div style="border: 1px solid blue; padding: 5px;">  <p><b>Tool File Extension Function</b><br/>           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.<br/>           S2C333: TOOL NO. SWITCHING (1: enabled, 0: disabled)<br/>           For more details, refer to NX100 OPERATOR'S MANUAL "9 Parameter."</p> </div> <div style="border: 1px solid gray; padding: 5px;">  <p>The screenshot shows the 'TOOL' window with a menu bar (DATA, EDIT, DISPLAY, UTILITY) and a toolbar. The main area contains a table with columns 'NO.' and 'NAME'. The first row is selected, showing '00' and 'TORCH MT-3501'. Other rows are empty or partially filled.</p> </div> <div style="border: 1px solid gray; padding: 5px;">  <p>The screenshot shows the 'TOOL COORDINATE' window with a menu bar and toolbar. It displays various parameters for tool 00, including X, Y, Z, W, Xg, Yg, Zg, Rx, Ry, Rz, lx, ly, and lz, each with a numerical value and unit.</p> </div> |

## 9.9 Tool Data Setting

|   | Operation                                     | Explanation   |
|---|---|---|
| 3 | Select the desired tool number.               | <p>When the TOOL window is shown, move the cursor and press [SELECT]. The coordinate window of the selected tool is shown.</p> <p>If the coordinate window is shown, press the page key  to select the desired tool.</p> <p>To switch the TOOL window and the coordinate window, press {DISPLAY} → {LIST} or {DISPLAY} → {COORDINATE DATA}.</p>  |
| 4 | Select the desired coordinate axis to modify. | The number input line is shown.   |
| 5 | Input the tool data.                          |   |
| 6 | Press [ENTER].                                | <p>The tool data is registered.</p>    |

### <Setting Example>

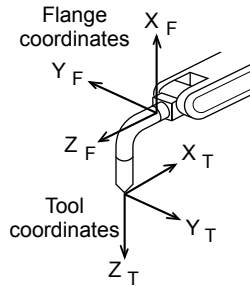


| Case of Tool A, B  | Case of Tool C                       |                                    |    |                                   |                                   |      |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |  |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |   |                                      |    |    |                                   |      |
|--|--------------------------------------|------------------------------------|----|-----------------------------------|-----------------------------------|------|---|------------------------------------|----|----|-----------------------------------|------|---|--------------------------------------|----|----|-----------------------------------|------|--|---|------------------------------------|----|----|-----------------------------------|------|---|--------------------------------------|----|----|-----------------------------------|------|---|--------------------------------------|----|----|-----------------------------------|------|
| <table border="1"> <tr> <td>X</td> <td><input type="text" value="0.000"/></td> <td>mm</td> <td>Rx</td> <td><input type="text" value="0.00"/></td> <td>deg.</td> </tr> <tr> <td>Y</td> <td><input type="text" value="0.000"/></td> <td>mm</td> <td>Ry</td> <td><input type="text" value="0.00"/></td> <td>deg.</td> </tr> <tr> <td>Z</td> <td><input type="text" value="260.000"/></td> <td>mm</td> <td>Rz</td> <td><input type="text" value="0.00"/></td> <td>deg.</td> </tr> </table> | X                                    | <input type="text" value="0.000"/> | mm | Rx                                | <input type="text" value="0.00"/> | deg. | Y | <input type="text" value="0.000"/> | mm | Ry | <input type="text" value="0.00"/> | deg. | Z | <input type="text" value="260.000"/> | mm | Rz | <input type="text" value="0.00"/> | deg. | <table border="1"> <tr> <td>X</td> <td><input type="text" value="0.000"/></td> <td>mm</td> <td>Rx</td> <td><input type="text" value="0.00"/></td> <td>deg.</td> </tr> <tr> <td>Y</td> <td><input type="text" value="145.000"/></td> <td>mm</td> <td>Ry</td> <td><input type="text" value="0.00"/></td> <td>deg.</td> </tr> <tr> <td>Z</td> <td><input type="text" value="260.000"/></td> <td>mm</td> <td>Rz</td> <td><input type="text" value="0.00"/></td> <td>deg.</td> </tr> </table> | X | <input type="text" value="0.000"/> | mm | Rx | <input type="text" value="0.00"/> | deg. | Y | <input type="text" value="145.000"/> | mm | Ry | <input type="text" value="0.00"/> | deg. | Z | <input type="text" value="260.000"/> | mm | Rz | <input type="text" value="0.00"/> | deg. |
| X  | <input type="text" value="0.000"/>   | mm                                 | Rx | <input type="text" value="0.00"/> | deg.                              |      |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |  |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |   |                                      |    |    |                                   |      |
| Y  | <input type="text" value="0.000"/>   | mm                                 | Ry | <input type="text" value="0.00"/> | deg.                              |      |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |  |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |   |                                      |    |    |                                   |      |
| Z  | <input type="text" value="260.000"/> | mm                                 | Rz | <input type="text" value="0.00"/> | deg.                              |      |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |  |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |   |                                      |    |    |                                   |      |
| X  | <input type="text" value="0.000"/>   | mm                                 | Rx | <input type="text" value="0.00"/> | deg.                              |      |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |  |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |   |                                      |    |    |                                   |      |
| Y  | <input type="text" value="145.000"/> | mm                                 | Ry | <input type="text" value="0.00"/> | deg.                              |      |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |  |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |   |                                      |    |    |                                   |      |
| Z  | <input type="text" value="260.000"/> | mm                                 | Rz | <input type="text" value="0.00"/> | deg.                              |      |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |  |   |                                    |    |    |                                   |      |   |                                      |    |    |                                   |      |   |                                      |    |    |                                   |      |

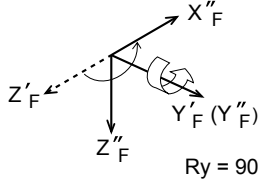
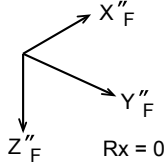
## ■ Registering Tool Angle

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  $R_z \rightarrow R_y \rightarrow R_x$ .

The following, register  $R_z=180$ ,  $R_y=90$ ,  $R_x=0$



|   | Operation                                     | Explanation   |    |                                     |      |    |                                   |      |   |                                    |    |    |                                   |      |   |                                    |    |    |                                     |      |
|---|---|---|----|-------------------------------------|------|----|-----------------------------------|------|---|------------------------------------|----|----|-----------------------------------|------|---|------------------------------------|----|----|-------------------------------------|------|
| 1 | Select {ROBOT} under the main menu.           |   |    |                                     |      |    |                                   |      |   |                                    |    |    |                                   |      |   |                                    |    |    |                                     |      |
| 2 | Select {TOOL}.                                |   |    |                                     |      |    |                                   |      |   |                                    |    |    |                                   |      |   |                                    |    |    |                                     |      |
| 3 | Select the desired tool number.               | In the same way shown in Explanation 2, 3 in "■ Registering Coordinate Data," the desired TOOL COORDINATE window is shown.  |    |                                     |      |    |                                   |      |   |                                    |    |    |                                   |      |   |                                    |    |    |                                     |      |
| 4 | Select the desired coordinate axis to modify. | First, select $R_z$ .   |    |                                     |      |    |                                   |      |   |                                    |    |    |                                   |      |   |                                    |    |    |                                     |      |
| 5 | Input the tool pose data.                     | Input rotation angle around $Z_F$ of the flange coordinates. <div style="text-align: center;"> </div> <div style="text-align: center; border: 1px solid black; padding: 5px; margin-top: 10px;"> <table border="1"> <tbody> <tr> <td>X</td> <td><input type="text" value="0.000"/></td> <td>mm</td> <td>Rx</td> <td><input type="text" value="0.00"/></td> <td>deg.</td> </tr> <tr> <td>Y</td> <td><input type="text" value="0.000"/></td> <td>mm</td> <td>Ry</td> <td><input type="text" value="0.00"/></td> <td>deg.</td> </tr> <tr> <td>Z</td> <td><input type="text" value="0.000"/></td> <td>mm</td> <td>Rz</td> <td><input type="text" value="180.00"/></td> <td>deg.</td> </tr> </tbody> </table> </div> | X  | <input type="text" value="0.000"/>  | mm   | Rx | <input type="text" value="0.00"/> | deg. | Y | <input type="text" value="0.000"/> | mm | Ry | <input type="text" value="0.00"/> | deg. | Z | <input type="text" value="0.000"/> | mm | Rz | <input type="text" value="180.00"/> | deg. |
| X | <input type="text" value="0.000"/>            | mm  | Rx | <input type="text" value="0.00"/>   | deg. |    |                                   |      |   |                                    |    |    |                                   |      |   |                                    |    |    |                                     |      |
| Y | <input type="text" value="0.000"/>            | mm  | Ry | <input type="text" value="0.00"/>   | deg. |    |                                   |      |   |                                    |    |    |                                   |      |   |                                    |    |    |                                     |      |
| Z | <input type="text" value="0.000"/>            | mm  | Rz | <input type="text" value="180.00"/> | deg. |    |                                   |      |   |                                    |    |    |                                   |      |   |                                    |    |    |                                     |      |

|   | Operation      | Explanation  |    |        |      |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |   |       |    |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |
|---|----------------|--|----|--------|------|----|------|------|---|-------|----|----|-------|------|---|-------|----|----|--------|------|---|-------|----|----|------|------|---|-------|----|----|-------|------|---|-------|----|----|--------|------|
| 6 | Press [ENTER]. | <p>The rotation angle of Rz is registered.<br/>                     In the same way, register the angle of Ry, Rx.<br/>                     Ry must be the input rotation angle around Y'F flange coordinates.</p>  <table border="1"> <tr> <td>X</td> <td>0.000</td> <td>mm</td> <td>Rx</td> <td>0.00</td> <td>deg.</td> </tr> <tr> <td>Y</td> <td>0.000</td> <td>mm</td> <td>Ry</td> <td>90.00</td> <td>deg.</td> </tr> <tr> <td>Z</td> <td>0.000</td> <td>mm</td> <td>Rz</td> <td>180.00</td> <td>deg.</td> </tr> </table> <p>Rx must be the input rotation angle around X'F of flange coordinates.</p>  <table border="1"> <tr> <td>X</td> <td>0.000</td> <td>mm</td> <td>Rx</td> <td>0.00</td> <td>deg.</td> </tr> <tr> <td>Y</td> <td>0.000</td> <td>mm</td> <td>Ry</td> <td>90.00</td> <td>deg.</td> </tr> <tr> <td>Z</td> <td>0.000</td> <td>mm</td> <td>Rz</td> <td>180.00</td> <td>deg.</td> </tr> </table> | X  | 0.000  | mm   | Rx | 0.00 | deg. | Y | 0.000 | mm | Ry | 90.00 | deg. | Z | 0.000 | mm | Rz | 180.00 | deg. | X | 0.000 | mm | Rx | 0.00 | deg. | Y | 0.000 | mm | Ry | 90.00 | deg. | Z | 0.000 | mm | Rz | 180.00 | deg. |
| X | 0.000          | mm   | Rx | 0.00   | deg. |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |   |       |    |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |
| Y | 0.000          | mm   | Ry | 90.00  | deg. |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |   |       |    |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |
| Z | 0.000          | mm   | Rz | 180.00 | deg. |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |   |       |    |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |
| X | 0.000          | mm   | Rx | 0.00   | deg. |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |   |       |    |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |
| Y | 0.000          | mm   | Ry | 90.00  | deg. |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |   |       |    |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |
| Z | 0.000          | mm   | Rz | 180.00 | deg. |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |   |       |    |    |      |      |   |       |    |    |       |      |   |       |    |    |        |      |



If tool data is registered in the tool file by tool calibration, the old data will be deleted.

### ■ Setting the Tool Load Information

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

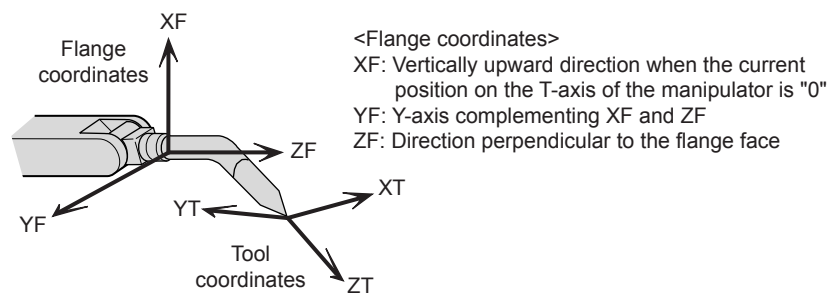


For more details on the tool load information, refer to " 9.11.3 Tool Load Information Setting."

## 9.9.2 Tool Calibration

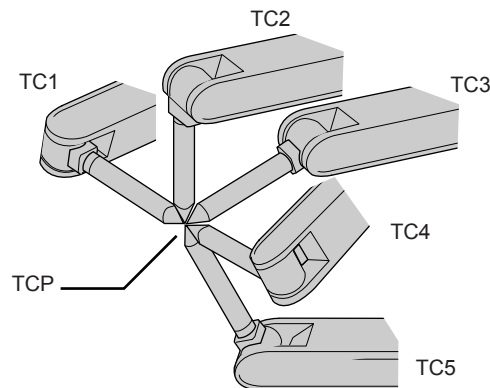
### ■ Tool Calibration

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 in the flange coordinates.



### ■ Teaching

In order to perform tool calibration, five different angle (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 angle must be arbitrary. Accuracy may decrease when pose setting is rotated in a constant direction.

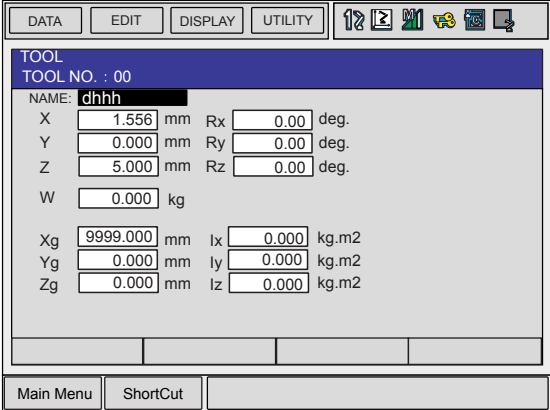
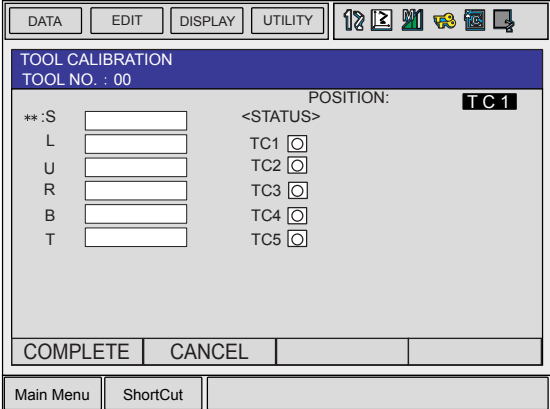


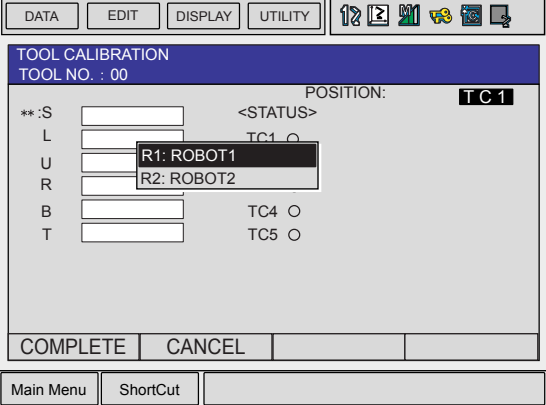
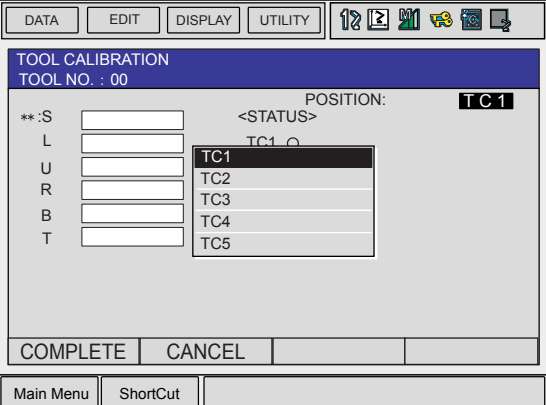
There are 24 tool files numbered 0 to 23. In a basic system with one manipulator and one tool, the tool file for tool No.0 is used. If there is more than one tool, for example when using a multihand, use the tool numbers in the order 0, 1, 2, .... etc.



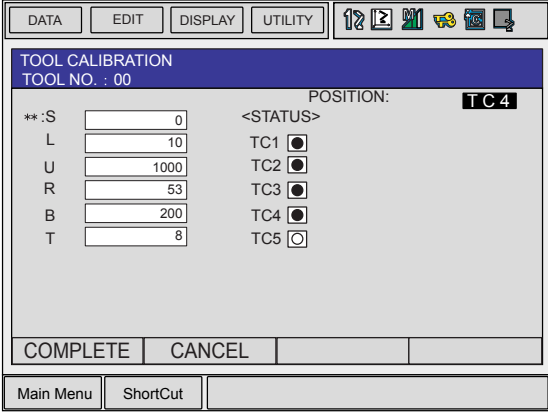
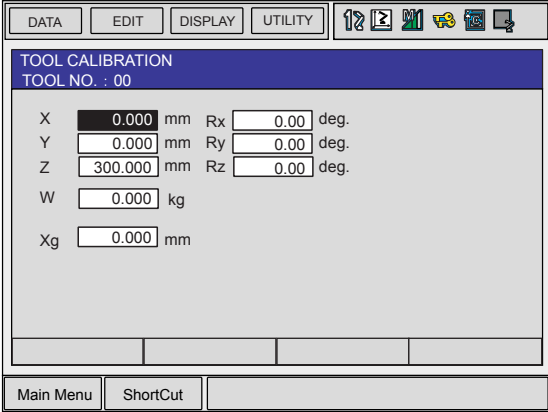
Tool pose data is not registered in tool calibration. For details on how to register pose data, refer to "■ Registering Tool Angle" of "9.9.1 Registering Tool Files."

9.9 Tool Data Setting

|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {ROBOT} under the main menu. |   |
| 2 | Select {TOOL}.                      |   |
| 3 | Select the desired tool number.     | <p>In the same way shown in Explanation 2, 3 in "■ Registering Coordinate Data" of "9.9.1 Registering Tool Files," the desired coordinate window is shown.</p>  |
| 4 | Select {UTILITY} under the menu.    |   |
| 5 | Select {CALIBRATION}.               | <p>The TOOL CALIBRATION window is shown.</p>    |

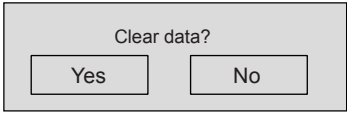
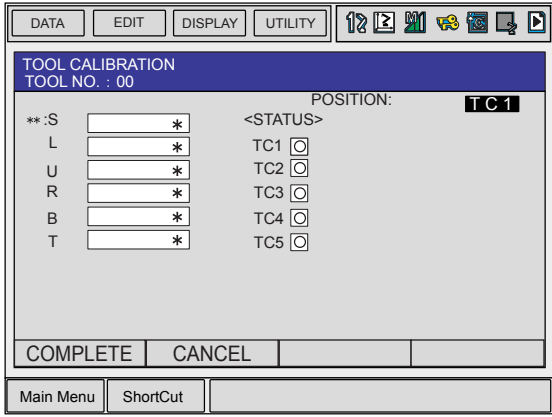
|   | Operation                                | Explanation  |
|---|--|--|
| 6 | Select the robot.                        | <p>Select the robot to calibrate. (When the robot has already been selected or there is only one of robot, this operation should not be performed.) Select "***" in the TOOL CALIBRATION window and select the robot in the shown selection dialog box.</p>  <p>The screenshot shows the 'TOOL CALIBRATION' window with 'TOOL NO. : 00' and 'POSITION: TC1'. A selection dialog is open, showing 'R1: ROBOT1' and 'R2: ROBOT2' as options. The window includes buttons for DATA, EDIT, DISPLAY, UTILITY, and navigation icons. At the bottom, there are 'COMPLETE' and 'CANCEL' buttons, and a 'Main Menu' / 'ShortCut' bar.</p> |
| 7 | Select "POSITION."                       | <p>The selection dialog box is shown. Select the teaching point for calibration.</p>  <p>The screenshot shows the 'TOOL CALIBRATION' window with 'TOOL NO. : 00' and 'POSITION: TC1'. A selection dialog is open, showing 'TC1', 'TC2', 'TC3', 'TC4', and 'TC5' as options. The window includes buttons for DATA, EDIT, DISPLAY, UTILITY, and navigation icons. At the bottom, there are 'COMPLETE' and 'CANCEL' buttons, and a 'Main Menu' / 'ShortCut' bar.</p>   |
| 8 | Move the manipulator using the axis key. |  |



|    | Operation                   | Explanation   |
|----|-----------------------------|---|
| 9  | Press [MODIFY] and [ENTER]. | <p>Taught position is registered.<br/>Repeat 7 to 9 operation to teach TC1 to TC5.<br/>● indicates that teaching is completed and ○ indicates that it is not completed.</p>  <p>To check the taught positions, call up the required window among TC1 to TC5 and press [FWD]. The manipulator moves to the set position.<br/>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.</p> |
| 10 | Select "COMPLETE."          | <p>Calibration data is registered in the tool file. Once calibration is completed, the coordinate window is shown.</p>    |

## ■ Clearing Calibration Data

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

|   | Operation                          | Explanation   |
|---|------------------------------------|---|
| 1 | Select {DATA} under the main menu. |   |
| 2 | Select {CLEAR DATA}.               | The confirmation dialog box is shown.<br><br> |
| 3 | Select "YES."                      | All data is cleared.<br><br>                 |

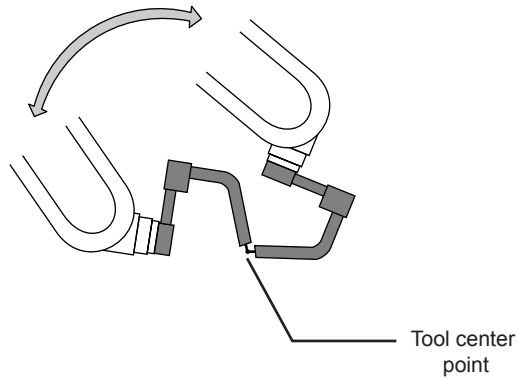



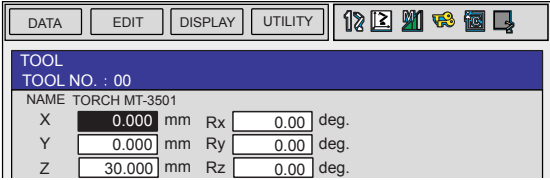

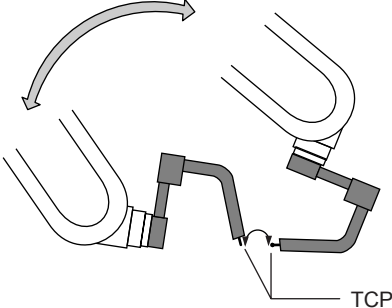
Only tool coordinate data are calculated using tool calibration. If tool angle data is required, input the data number in the coordinate window.

Refer to "■ Registering Tool Angle" of "9.9.1 Registering Tool Files" for the operation.

■ 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.



|   | Operation                                    | Explanation  |
|---|--|--|
| 1 | Press [COORD].                               | Select any coordinate system except “  JOINT” by pressing [COORD].<br>                                   |
| 2 | Select desired tool number.                  | Show the coordinate window of the desired tool by pressing the page key  or selecting it in the TOOL 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.<br>If this operation shows a large TCP error, adjust the tool data.<br> |



For details on TCP fixed operation, see the Operator's Manual "2.8.1 Motion about TCP."

### 9.9.3 Automatic Measurement of the Tool Load and the Center of Gravity

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

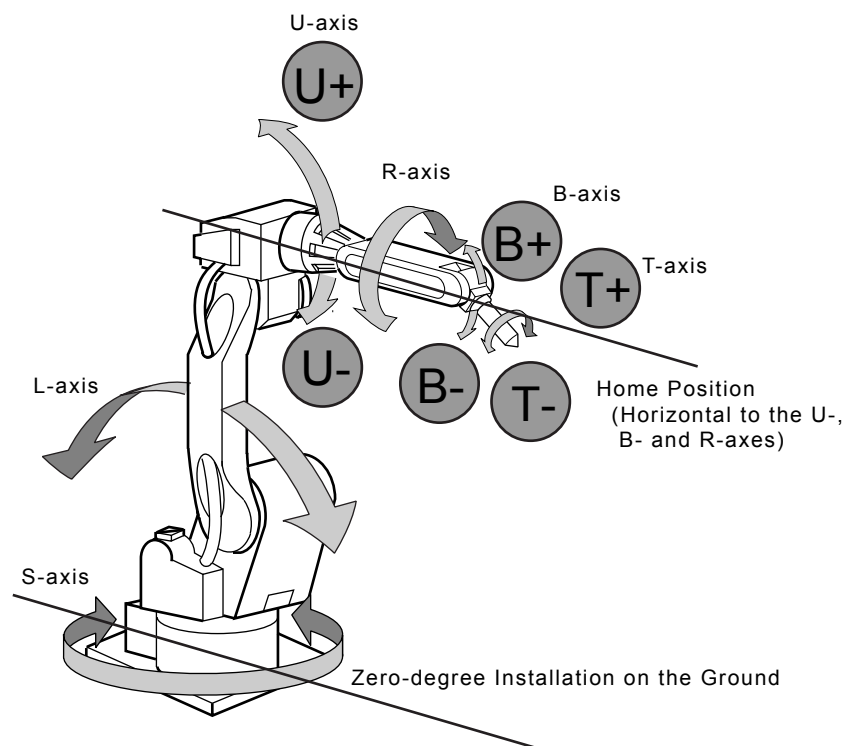
With this function, the user can register the load of tool and the position of the tools center of gravity.

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 " 9.11 ARM Control ".

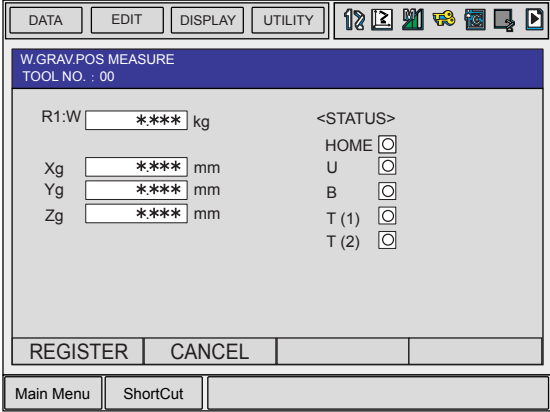


- Measurement of the Tool Load and the Center of Gravity

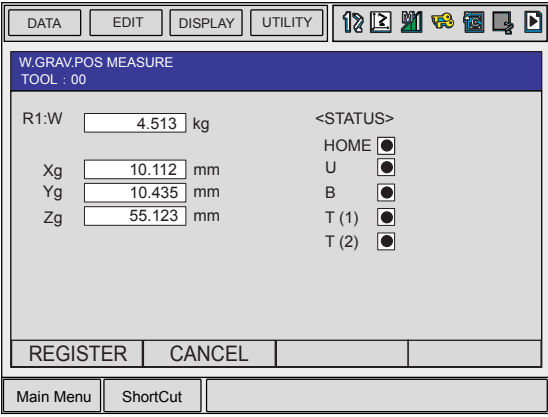
To measure the tool load and the center of gravity, move the manipulator to its home position (horizontal to the U-, B- and R-axes) and operate the U-, B- and T-axes.



**NOTE** To measure the tool load or the center of gravity, remove the cables or wires connected to the tool. Otherwise, the measurements may not be correct.

|     | Operation                           | Explanation   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
|-----|-------------------------------------|---|-----|-------|-------|---------------|------|----------------|----|---------------|----|--|----|--|----|--|----|--|----|--|---|-------|----|----|------|------|---|-------|----|----|------|------|---|-------|----|----|------|------|---|-------|----|--|--|--|----|----------|----|----|-------|-------|----|-------|----|----|-------|-------|----|-------|----|----|-------|-------|
| 1   | Select {ROBOT} under the main menu. |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 2   | Select {TOOL}.                      | <p>The TOOL window is shown. The TOOL window is called up only when the file extension function is valid. If the file extension function is invalid, the coordinate window is shown.</p> <div style="border: 1px solid black; padding: 5px;">  <p><b>Tool File Extension Function</b><br/>           Use the following parameter to set the Tool File Extension Function.<br/> <b>S2C261: TOOL NO. SWITCHING</b><br/>           “0”: Tool switching prohibited.<br/>           “1”: Can change 24 kinds of tools numbering from 0 to 23.</p> </div> <div style="border: 1px solid gray; padding: 5px;"> <p>DATA EDIT DISPLAY UTILITY </p> <p><b>TOOL</b></p> <table border="1"> <thead> <tr> <th>NO.</th> <th>NAME</th> </tr> </thead> <tbody> <tr><td>00</td><td>TORCH MT-3501</td></tr> <tr><td>01</td><td>TORCH MTY-3501</td></tr> <tr><td>02</td><td>TORCH MT-3502</td></tr> <tr><td>03</td><td></td></tr> <tr><td>04</td><td></td></tr> <tr><td>05</td><td></td></tr> <tr><td>06</td><td></td></tr> <tr><td>07</td><td></td></tr> </tbody> </table> <p>Main Menu ShortCut</p> </div> <div style="border: 1px solid gray; padding: 5px;"> <p>DATA EDIT DISPLAY UTILITY </p> <p><b>TOOL</b></p> <p>TOOL NO. : 00</p> <p>NAME: dhhh</p> <table border="1"> <tr> <td>X</td><td>1.556</td><td>mm</td> <td>Rx</td><td>0.00</td><td>deg.</td> </tr> <tr> <td>Y</td><td>0.000</td><td>mm</td> <td>Ry</td><td>0.00</td><td>deg.</td> </tr> <tr> <td>Z</td><td>5.000</td><td>mm</td> <td>Rz</td><td>0.00</td><td>deg.</td> </tr> <tr> <td>W</td><td>0.000</td><td>kg</td><td></td><td></td><td></td> </tr> <tr> <td>Xg</td><td>9999.000</td><td>mm</td> <td>ix</td><td>0.000</td><td>kg.m2</td> </tr> <tr> <td>Yg</td><td>0.000</td><td>mm</td> <td>iy</td><td>0.000</td><td>kg.m2</td> </tr> <tr> <td>Zg</td><td>0.000</td><td>mm</td> <td>iz</td><td>0.000</td><td>kg.m2</td> </tr> </table> <p>Main Menu ShortCut</p> </div> | NO. | NAME  | 00    | TORCH MT-3501 | 01   | TORCH MTY-3501 | 02 | TORCH MT-3502 | 03 |  | 04 |  | 05 |  | 06 |  | 07 |  | X | 1.556 | mm | Rx | 0.00 | deg. | Y | 0.000 | mm | Ry | 0.00 | deg. | Z | 5.000 | mm | Rz | 0.00 | deg. | W | 0.000 | kg |  |  |  | Xg | 9999.000 | mm | ix | 0.000 | kg.m2 | Yg | 0.000 | mm | iy | 0.000 | kg.m2 | Zg | 0.000 | mm | iz | 0.000 | kg.m2 |
| NO. | NAME                                |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 00  | TORCH MT-3501                       |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 01  | TORCH MTY-3501                      |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 02  | TORCH MT-3502                       |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 03  |                                     |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 04  |                                     |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 05  |                                     |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 06  |                                     |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 07  |                                     |   |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| X   | 1.556                               | mm  | Rx  | 0.00  | deg.  |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| Y   | 0.000                               | mm  | Ry  | 0.00  | deg.  |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| Z   | 5.000                               | mm  | Rz  | 0.00  | deg.  |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| W   | 0.000                               | kg  |     |       |       |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| Xg  | 9999.000                            | mm  | ix  | 0.000 | kg.m2 |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| Yg  | 0.000                               | mm  | iy  | 0.000 | kg.m2 |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| Zg  | 0.000                               | mm  | iz  | 0.000 | kg.m2 |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| 3   | Select the desired tool number.     | <p>Move the cursor to the desired number in the TOOL window and press [SELECT]. The coordinate window of the selected number is shown. In the coordinate window, change the desired number by pressing the page key . To alternate between the TOOL and the coordinate window, select {DISPLAY} and {LIST}, or {DISPLAY} and {COORDINATE VALUE} under the menu.</p> <div style="border: 1px solid gray; padding: 5px;"> <p>DATA EDIT DISPLAY UTILITY </p> <p><b>TOOL</b></p> <p>TOOL NO. : 00</p> <p>NAME: dhhh</p> <table border="1"> <tr> <td>X</td><td>1.556</td><td>mm</td> <td>Rx</td><td>0.00</td><td>deg.</td> </tr> </table> </div>  | X   | 1.556 | mm    | Rx            | 0.00 | deg.           |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |
| X   | 1.556                               | mm  | Rx  | 0.00  | deg.  |               |      |                |    |               |    |  |    |  |    |  |    |  |    |  |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |    |      |      |   |       |    |  |  |  |    |          |    |    |       |       |    |       |    |    |       |       |    |       |    |    |       |       |

|   | Operation  | Explanation  |
|---|--|--|
| 4 | Select {UTILITY} under the menu.   |  |
| 5 | Select {W.GRAV.POS MEASURE}.   | <p>The window for the automatic measurement of the tool load and the center of gravity is shown.</p>   |
| 6 | Press the page key  . | <p>In a system with several manipulators, use the page key  to change the group to be controlled.</p> |
| 7 | Press [FWD].   | <p>Press [FWD] once, and the manipulator moves to the home position (horizontal to the U-, B- and R-axes).</p>   |

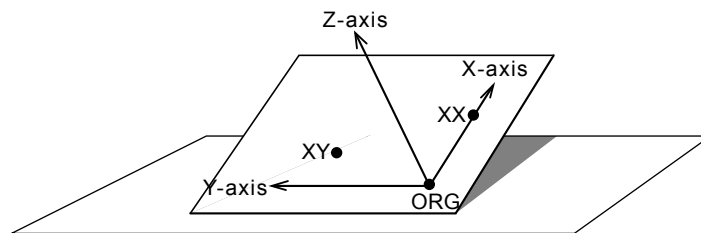
|   | Operation          | Explanation  |
|---|--------------------|--|
| 8 | Press [FWD] again. | <p>Press [FWD] again, and measurement starts. Keep the button pressed until measurement is completed. The manipulator moves in the order listed below. Once measurement is completed, “○“changes to “●“.</p> <ol style="list-style-type: none"> <li>① Measurement of the U-axis: U-axis home position + 4.5 degrees → -4.5 degrees</li> <li>② Measurement of the B-axis: B-axis home position + 4.5 degrees → -4.5 degrees</li> <li>③ First measurement of the T-axis: T-axis home position + 4.5 degrees → -4.5 degrees</li> <li>④ Second measurement of the T-axis: T-axis home position +60 degrees → + 4.5 degrees → -4.5 degrees</li> </ol> <div style="border: 1px solid blue; padding: 10px; margin-top: 10px;"> <p><b>NOTE</b></p> <ul style="list-style-type: none"> <li>• The speed during measurement automatically changes to “Medium”.</li> <li>• During measurement, “HOME” or “U” blinks on the screen.</li> <li>• During measurement, the [FWD] button has to be kept pressed. If the button is released during measurement or if it is released before “○“changes into “●“, measurement is aborted and the following message appears.<br/>“Stopped measurement”<br/>Measurement starts again from the first home position.</li> </ul> </div> <p>When all measurements are completed or when all the “○“marks have changed into “●“, the measurements appears on the screen.</p>  <p>The screenshot shows a control panel with buttons for DATA, EDIT, DISPLAY, UTILITY, and several function icons. The main display area is titled 'W.GRAV.POS MEASURE' and 'TOOL : 00'. It contains the following information:</p> <ul style="list-style-type: none"> <li>R1:W: 4.513 kg</li> <li>Xg: 10.112 mm</li> <li>Yg: 10.435 mm</li> <li>Zg: 55.123 mm</li> <li>&lt;STATUS&gt; section with radio buttons for HOME, U, B, T (1), and T (2), all of which are currently selected.</li> </ul> <p>At the bottom of the screen, there are buttons for REGISTER, CANCEL, Main Menu, and ShortCut.</p> |
| 9 | Select “REGISTER.” | <p>The measurements are registered in the tool file, and the coordinate window are shown. Select “CANCEL” to call up the TOOL window without registering the measurements in the tool file.</p>  |

## 9.10 User Coordinates Setting

### 9.10.1 User Coordinates

#### ■ Definition of 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

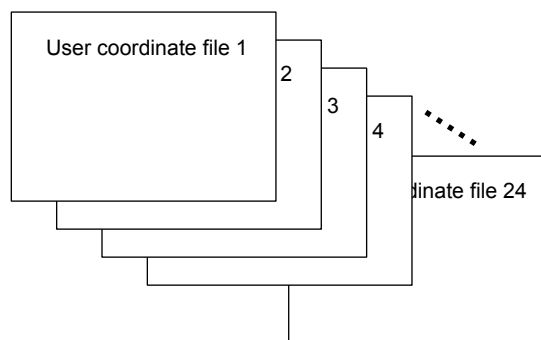
ORG is the home position, and XX is a point on the X-axis. XY is a point on the Y-axis side of the user coordinates that has been taught, and the directions of Y- and Z-axes are determined by point XY.

#### NOTE

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

#### ■ User Coordinates File

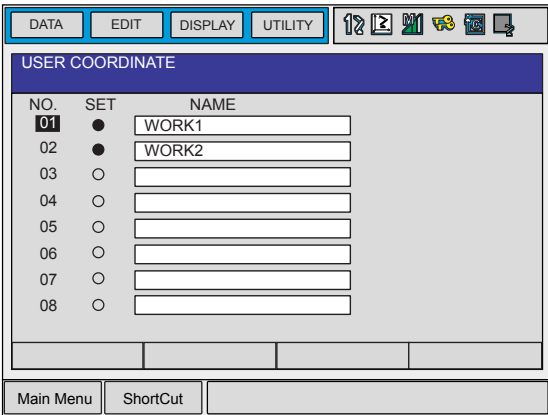
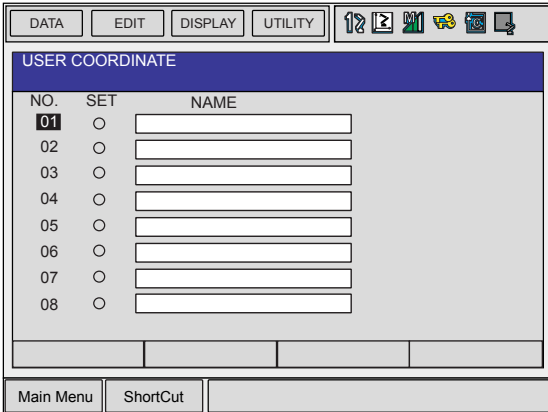
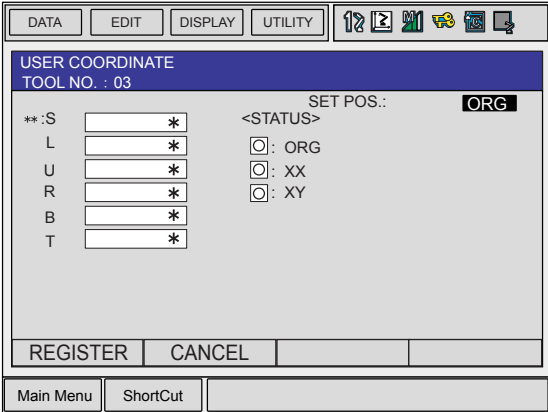
Up to 24 kinds of user coordinates can be registered. Each coordinate has a user coordinate No. and is called a user coordinate file.



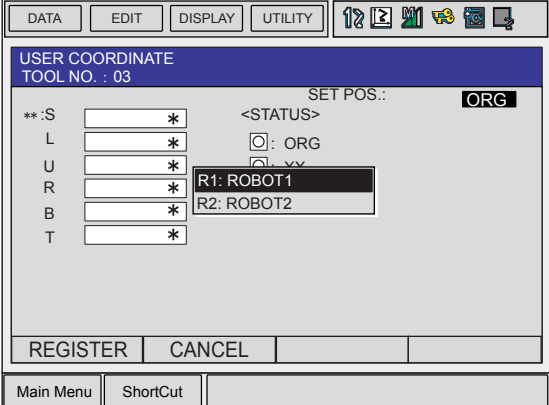
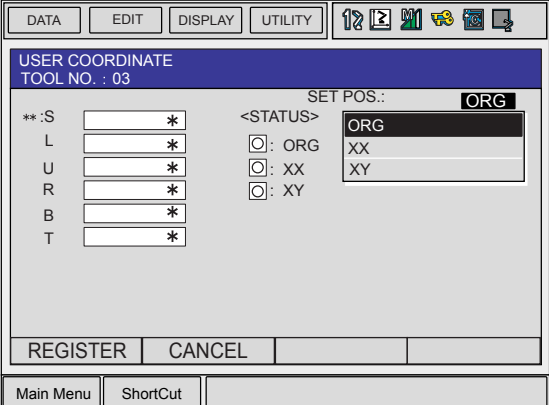


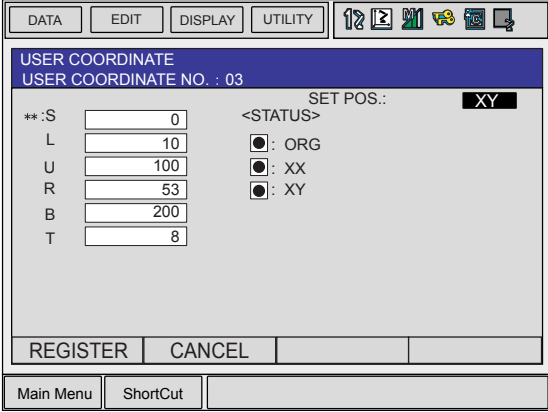
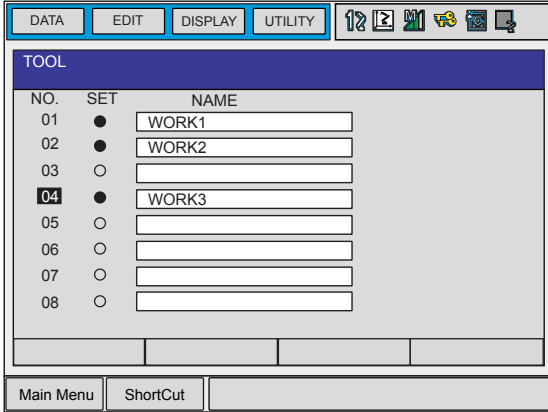
## 9.10.2 User Coordinates Setting

### ■ Selecting User Coordinates File

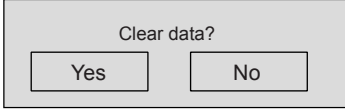
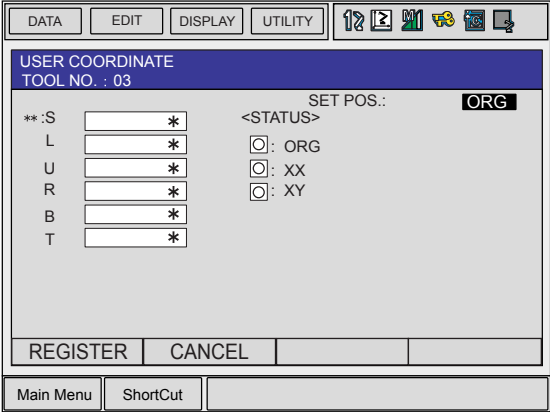
|   | Operation                              | Explanation   |
|---|--|---|
| 1 | Select {ROBOT} under the main menu.    |   |
| 2 | Select {USER COORDINATE}.              | <p>The USER COORDINATE window is shown.</p>  <p>● indicates that the user coordinates is completed to set and ○ indicates that it is not completed.<br/>To check the position of the user coordinates select {DISPLAY} → {COORDINATE DATA}. The following window is shown.</p>  |
| 3 | Select desired user coordinate number. | <p>Select the desired user coordinate number for setting in the USER COORDINATE window. The following window is shown.</p>    |

## ■ Teaching User Coordinates

|   | Operation                                | Explanation  |
|---|--|--|
| 1 | Select the robot.                        | <p>Select the robot for teaching user coordinates. (When the robot has already been selected or there is only one robot, this operation should not be performed.) Select "***" in the following window and select the robot in the shown selection dialog box. The robot is registered.</p>  |
| 2 | Select "SET POS."                        | <p>The selection dialog box is shown. Select the teaching point.</p>    |
| 3 | Move the manipulator using the axis key. |  |

|   | Operation                   | Explanation   |
|---|-----------------------------|---|
| 4 | Press [MODIFY] and [ENTER]. | <p>Taught position is registered.<br/>                     Repeat 2 to 4 operation to teach ORG, XX and XY.<br/>                     ● indicates that teaching is completed and ○ indicates that it is not completed.</p>  <p>To check the taught positions, call up the required window among ORG to XY and press [FWD]. The manipulator moves to the set position.<br/>                     If there is a difference between the current position of the manipulator and the shown position data, "ORG", "XX", or "XY" flashes.</p> |
| 5 | Select "COMPLETE."          | <p>User coordinates are registered in the file. Once the user coordinate setting is completed, the following window is shown.</p>   |

■ Clearing User Coordinates

|   | Operation                          | Explanation   |
|---|------------------------------------|---|
| 1 | Select {DATA} under the main menu. |   |
| 2 | Select {CLEAR DATA}.               | <p>The confirmation dialog box is shown.</p>  |
| 3 | Select "YES."                      | <p>All data is cleared.</p>                  |

## 9.11 ARM Control

### 9.11.1 ARM Control

In NX100, the operation performance of the robot which satisfies various demands on the production site such as the improvement of the path accuracy and the cycle time shortening is achieved by adopting the ARM (Advanced Robot Motion) control which Yaskawa originally developed.

The moment of inertia and the gravity moment etc. of each axis are calculated in the ARM control, and NX100 controls robot motion according to it. 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.

### 9.11.2 ARM CONTROL Window

In ARM CONTROL window, the robot setup condition etc. are set.



#### CAUTION

- **Set the robot setup condition exactly.**

Set the robot setup condition very noting of mistake the unit, the value or the positive and negative of number.

An appropriate operation control cannot be done, decrease the speed reducer longevity, or occur the alarm when these are not correctly set.

- **Confirm the operation path of robot of each job when you change setting.**

Set the robot setup condition when you basically set up the robot.

Confirm the operation path of robot of each job afterwards when you change the setting unavoidably.

Injury or damage to machinery may result by collision between tool and positioner because the operation path might be changed slightly when the setting about the ARM control is changed.

## ■ Robot Setup Condition

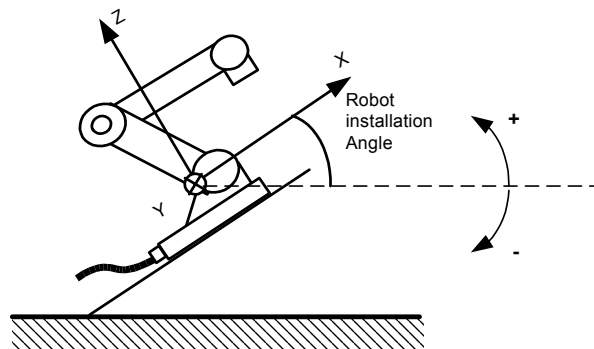
It is necessary to set the following robot setup condition to execute the ARM control appropriately.

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

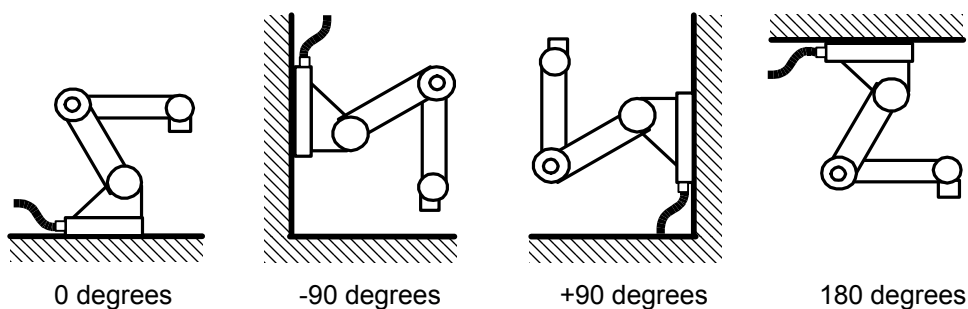
### Robot installation angle

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 earth 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>



Because the gravity moment which loads to each axis can't be calculated correctly when this value is not correctly set, it can not be possible to control the manipulator appropriately. Set the value correctly. Especially, note the direction "+" or "-".



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 value when there is no installed load at the S-head.

#### WEIGHT (Unit:kg)

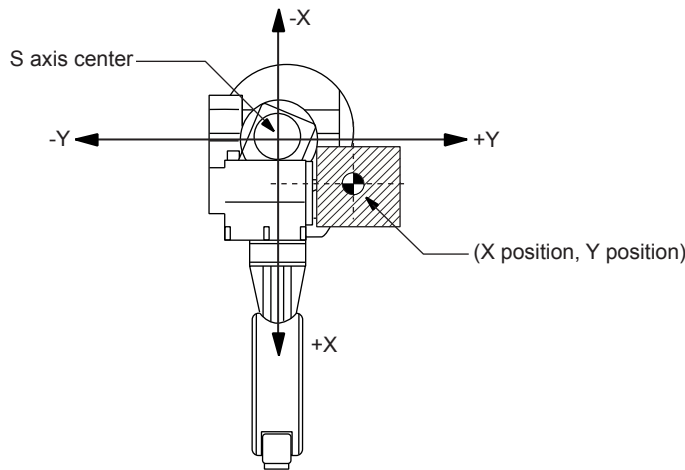
The weight of the installed load is set.

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 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 does not care by 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 at 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.

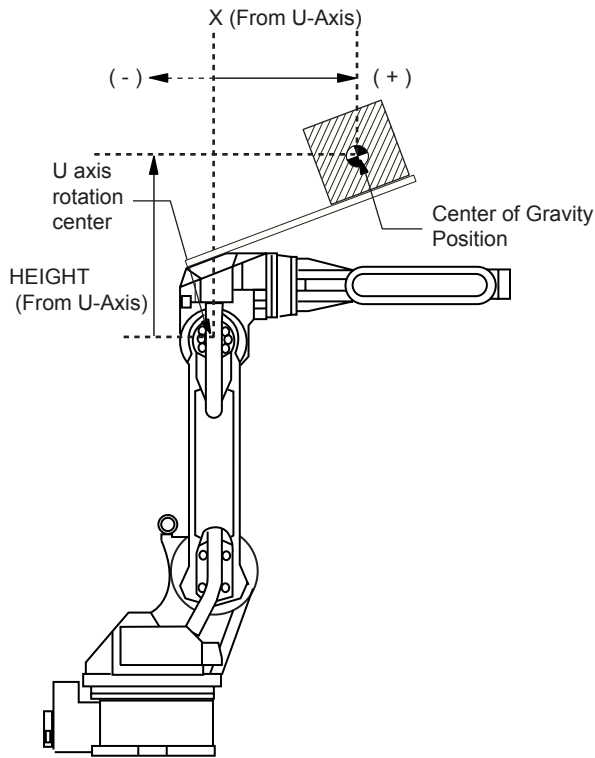
Set a little large value though it does not care by a rough value. (Rase to a unit in each 0.5 to 1kg)

#### 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.

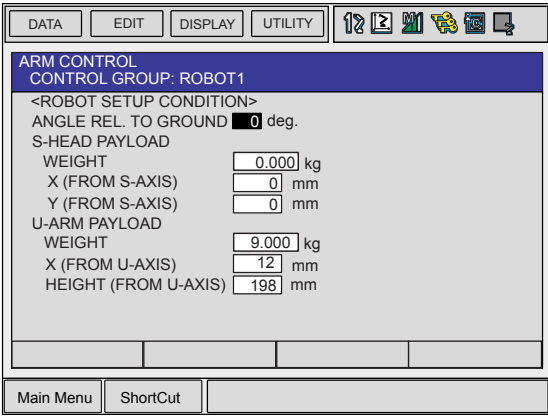



Load on U arm : Center of gravity position (Side View )



■ Setting

**NOTE** ARM CONTROL window is shown only when the security mode is set as management mode.

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Select {ROBOT} under the main menu.  |   |
| 2 | Select {ARM CONTROL}.  | <p>The ARM CONTROL window is shown.</p>  |
| 3 | Press the page key  . | 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].   |   |

### 9.11.3 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.

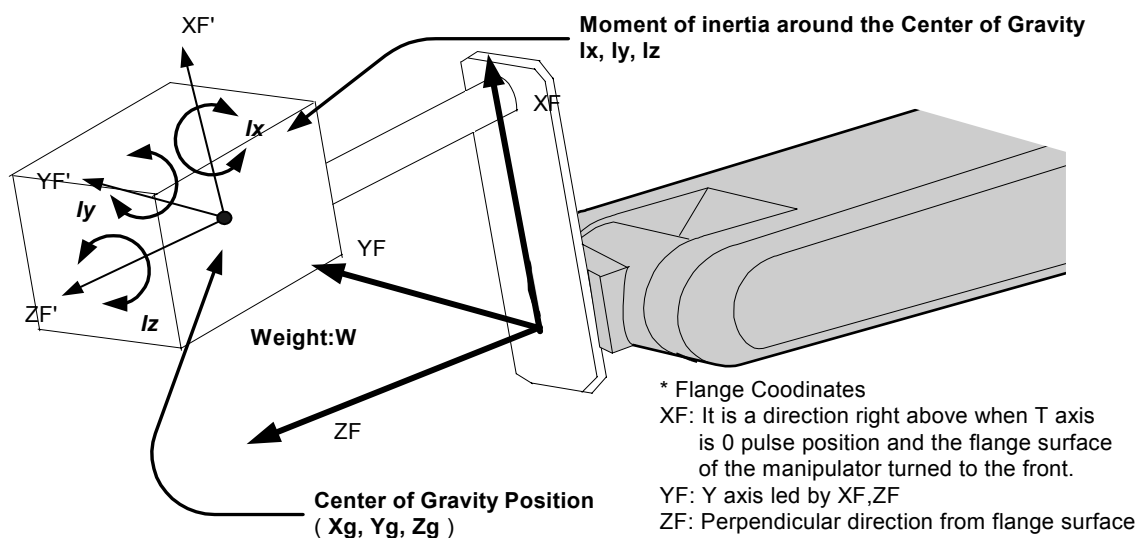
- **Confirm the operation path of robot of each job which uses the tool file after the tool load information is changed.**

Set the tool load information basically 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 is changed after teaching, unavoidably.

Injury or damage to machinery may result by collision between tool and positioner because the operation path might be changed slightly when the tool load information is changed.

#### ■ 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.



#### ■ How to Calculate Tool Load Information

##### Weight : W (Unit:kg)

The total weight of the installing tool is set.

Set a little large value though it does not care by a rough value. Rase to a unit in each 0.5 to 1kg for small or middle robot and rase to a unit in each 1 to 5kg for large robot.

**Center of gravity position :  $x_g, y_g, z_g$  (Unit : mm)**

The center of gravity position of the installed tool is set as the position in the flange coordinates.

It does not care by setting a rough value because it is usually difficult to get a strict center of gravity position. Presume and set a center of gravity position roughly from outline of the tool. Set the value when the center of gravity position of the installed tool is clear from specifications etc.

**moment of inertia at the center of gravity:  $I_x, I_y, I_z$  (Unit :  $kg \cdot m^2$ )**

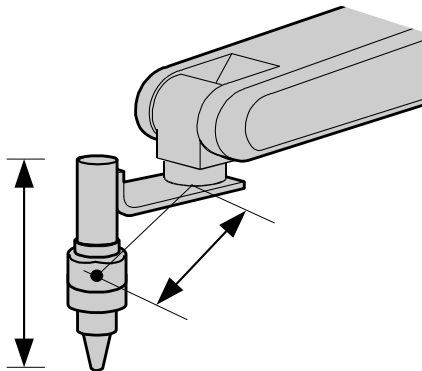
It is an moment of inertia of the tool at the center of gravity position.

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.

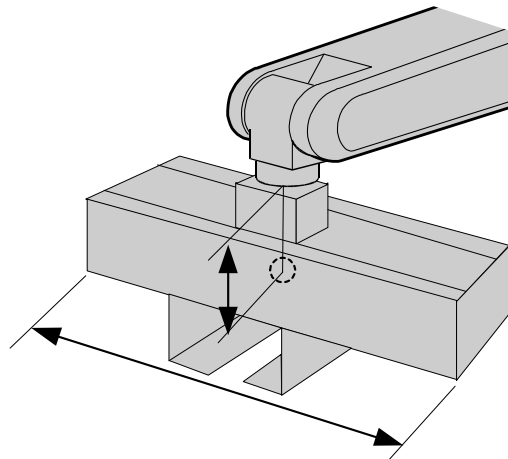
Set a little large value though it does not care by a rough value.

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 need not usually set because this data is small enough to the moment of inertia calculated from weight and the center of gravity position.

Only when the moment of inertia of the tool is large (The size of the tool is, as a standard, in case of about twice or more the distance from the flange to the center of gravity position), this setting is needed.



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 enough. 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 followings methods.

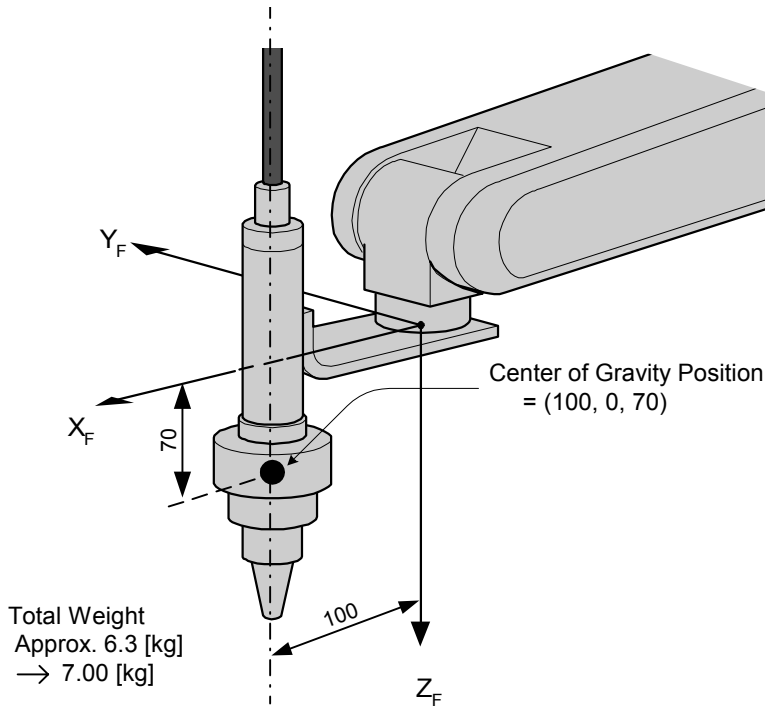
- Method to approximate the entire tool in hexahedron or cylinder.
- Method to calculate from each weight and center of gravity position of plural mass.

Refer to the following setting examples for details.

**<Example1>**

In the example of sealing gun of the figure below, it is assumed that there is center of gravity in the position where inclined to head from the center a little, and sets the center of gravity position on the flange coordinates.

There is no problem even if the moment of inertia at the center of gravity is not set because the size of the gun is not too large.



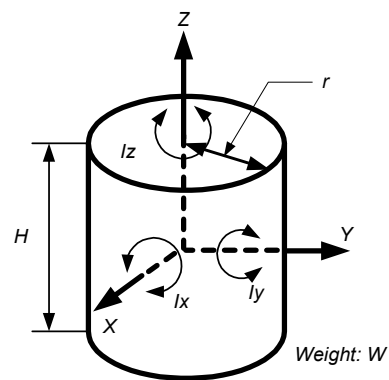
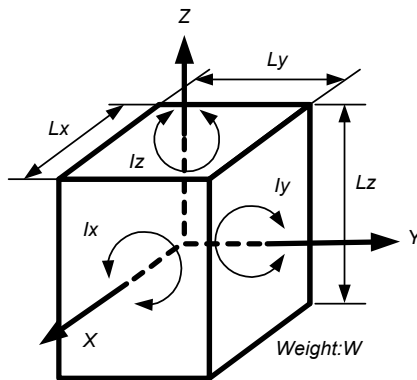
**<Setting>**

- W : 7.000 kg
- Xg : 100.000 mm
- Yg : 0.000 mm
- Zg : 70.000 mm
- Ix : 0.000 kg·m<sup>2</sup>
- Iy : 0.000 kg·m<sup>2</sup>
- Iz : 0.000 kg·m<sup>2</sup>



- The own moment of inertia calculation for hexahedron and cylinder

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



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

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

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

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

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

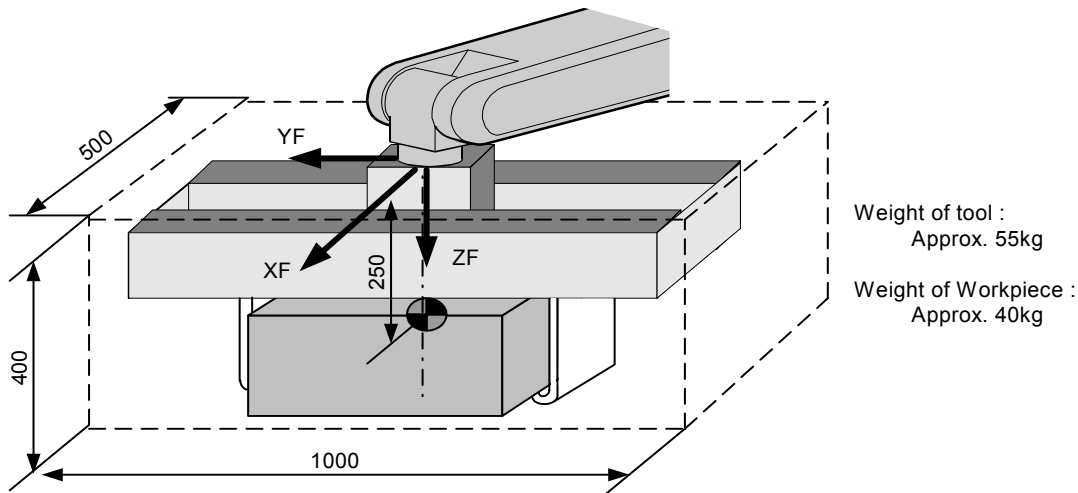
- \* Unit of Weight : [kg]
- \* Unit of Length : [m]
- \* Unit of Ix, Iy, Iz : [kg·m<sup>2</sup>]

**<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 enough comparing with 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 above-mentioned 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 like 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 the tool is not switched.



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

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

Moment of inertia at the center of gravity :

The hexahedron of  $0.500 \times 0.400 \times 1.000[\text{m}]$  which encloses the entire tool + workpiece is assumed.

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

$$I_x = (L_y^2 + L_z^2 / 12) * W$$

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

$$I_y = (L_x^2 + L_z^2 / 12) * W = ((0.500^2 + 0.400^2) / 12) * 100 = 3.417 = \text{approx. } 3.500$$

$$I_z = (L_x^2 + L_y^2 / 12) * W = ((0.500^2 + 1.000^2) / 12) * 100 = 10.417 = \text{approx. } 10.500$$

<Setting>

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



- 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.)

$w_i$  : Weight of the i-th parts [kg]

$(x_i, y_i, z_i)$  : Center of gravity position of the i-th parts (On flange coordinates)[mm]

$I_{cxi}, I_{c yi}, I_{c zi}$  : Own moments of inertia of the i-th parts [kg\*m<sup>2</sup>]

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

$$x_g = \{w_1 * x_1 + w_2 * x_2 + \dots + w_i * x_i\} / (w_1 + w_2 + \dots + w_i)$$

$$y_g = \{w_1 * y_1 + w_2 * y_2 + \dots + w_i * y_i\} / (w_1 + w_2 + \dots + w_i)$$

$$z_g = \{w_1 * z_1 + w_2 * z_2 + \dots + w_i * z_i\} / (w_1 + w_2 + \dots + w_i)$$

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

$$I_x = \begin{aligned} & \{ w_1 * ((y_1 - y_g)^2 + (z_1 - z_g)^2) * 10^{-6} + I_{cx1} \} \\ & + \{ w_2 * ((y_2 - y_g)^2 + (z_2 - z_g)^2) * 10^{-6} + I_{cx2} \} \\ & \dots \dots \dots \\ & + \{ w_i * ((y_i - y_g)^2 + (z_i - z_g)^2) * 10^{-6} + I_{cxi} \} \end{aligned}$$

$$I_y = \begin{aligned} & \{ w_1 * ((x_1 - x_g)^2 + (z_1 - z_g)^2) * 10^{-6} + I_{cy1} \} \\ & + \{ w_2 * ((x_2 - x_g)^2 + (z_2 - z_g)^2) * 10^{-6} + I_{cy2} \} \\ & \dots \dots \dots \\ & + \{ w_i * ((x_i - x_g)^2 + (z_i - z_g)^2) * 10^{-6} + I_{c yi} \} \end{aligned}$$

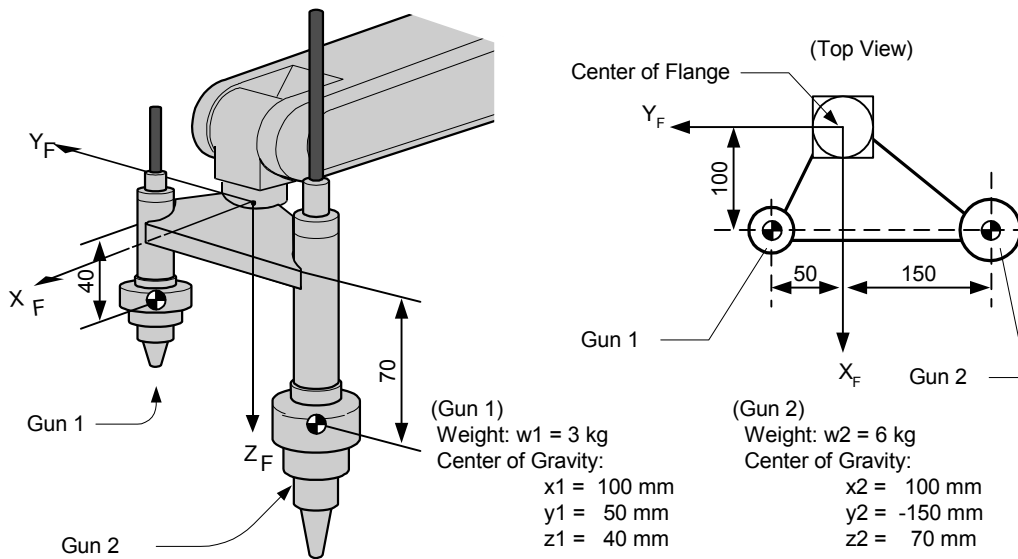
$$I_z = \begin{aligned} & \{ w_1 * ((x_1 - x_g)^2 + (y_1 - y_g)^2) * 10^{-6} + I_{cz1} \} \\ & + \{ w_2 * ((x_2 - x_g)^2 + (y_2 - y_g)^2) * 10^{-6} + I_{cz2} \} \\ & \dots \dots \dots \\ & + \{ w_i * ((x_i - x_g)^2 + (y_i - y_g)^2) * 10^{-6} + I_{c zi} \} \end{aligned}$$

**<Example 3>**

When there is two or more big mass like the twin gun system like the figure below,

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)
2. Or, 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 above-mentioned supplement: "How to calculate "Center of gravity position" and "moment of inertia at the center of gravity" for plural mass")

How by the method of 2 to calculate the value is shown here.



Weight :  $W = w_1 + w_2$   
 $= 3 + 6 = 9 = \text{approx. } 10[\text{kg}]$

Center of gravity  $X_g = (w_1 * x_1 + w_2 * x_2) / (w_1 + w_2)$   
 $= (3 * 100 + 6 * 100) / (3+6) = 100.0 [\text{mm}]$   
 $Y_g = (3 * 50 + 6 * (-150)) / (3+6) = -83.333 [\text{mm}]$   
 $Z_g = (3 * 40 + 6 * 70) / (3+6) = 60.0 [\text{mm}]$

The moment of inertia at the center of gravity position :

$$I_x = \{ w_1 * ((y_1 - Y_g)^2 + (z_1 - Z_g)^2) * 10^{-6} + I_{cx1} \}$$

$$+ \{ w_2 * ((y_2 - Y_g)^2 + (z_2 - Z_g)^2) * 10^{-6} + I_{cx2} \}$$

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

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

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

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

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

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

$$I_z = 3 * ((100 - 100)^2 + (50 - (-83))^2) * 10^{-6}$$

$$+ 6 * ((100 - 100)^2 + ((-150) - (-83))^2) * 10^{-6}$$

$$= 0.080 = \text{approx. } 0.100$$

\* Here, the own moment of inertia ( $I_{cxi}$ ,  $I_{c yi}$ ,  $I_{c zi}$ ) of the gun is disregarded, because each gun are smaller enough than the entire tool.

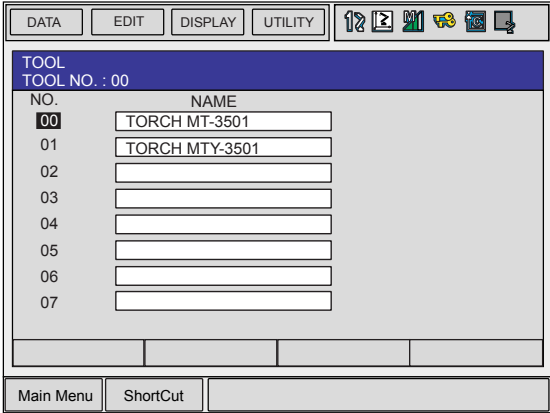
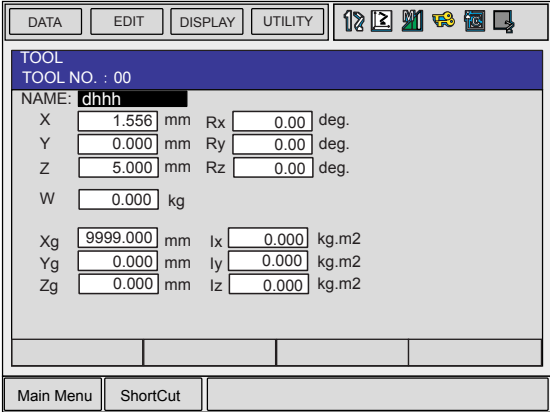

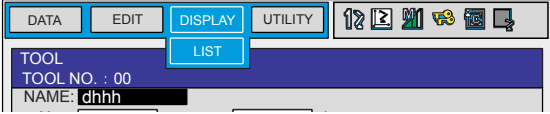
<Setting>

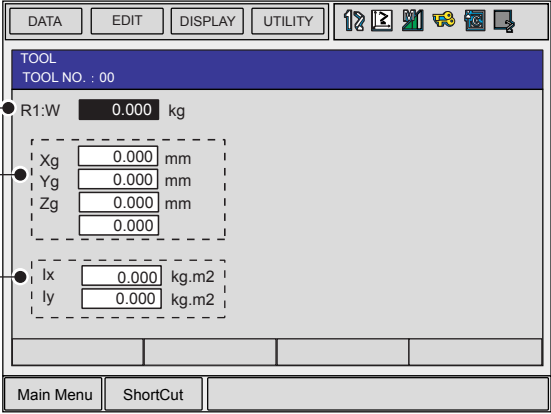
- W : 10.000 kg
- Xg : 100.000 mm
- Yg : -83.333 mm
- Zg : 60.000 mm
- Ix : 0.100 kg.m<sup>2</sup>
- Iy : 0.010 kg.m<sup>2</sup>
- Iz : 0.100 kg.m<sup>2</sup>



## ■ Tool load Information registering

Tool load Information is registered in the tool file.

|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {ROBOT} under the main menu. |   |
| 2 | Select {TOOL}.                      | <p>The TOOL window is shown. Only when the file expansion function is valid, the TOOL window is shown. When the file expansion function is invalid, the coordinate window is shown.</p>    |
| 3 | Select the desired tool number.     | <p>Move the cursor to the number of the desired tool, and press [SELECT] in the TOOL window. The coordinate window of the selected number is shown. Select the desired number with page key  in the coordinate window.</p> <p>Select { DISPLAY } → { LIST } or { DISPLAY } → { COORDINATE DATA } under the menu in order to switch between the TOOL window and the coordinate window.</p>  |

|   | Operation  | Explanation  |
|---|--|--|
| 4 | Select the desired item to register and input the value. | <p>The window can be scrolled by 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.</p>  |
| 5 | Press [ENTER].   | <p>The input value is registered. The servo power is automatically turned off when editing the value during the servo power turned on, and the message "Servo off by changing data " is shown for three seconds.</p>   |



- 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 value (Differ in each robot model) which were set when shipping.

Standard Value.....Weight : W = Payload

Center of gravity position :

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

In this case, when an actual tool load is not too heavy, the manipulator can't be performed enough.

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).

## 9.12 Shock Detection Function

### 9.12.1 Shock Detection Function

The shock detection function is a function to decrease damage because of the collision by instantaneously detecting the shock and 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 and in play mode, the manipulator is stopped instantaneously.



#### WARNING

- **This function cannot do away with the damage to peripheral device completely. Moreover, this function does not guarantee safety to the person. Prepare the safety measures such as the safeguarding etc. Refer to "1 Safety" for the safety measures in detail.**

Injury or damage to machinery may result by contact with the manipulator.

### 9.12.2 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.

#### ■ Shock Detection Level Setting

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

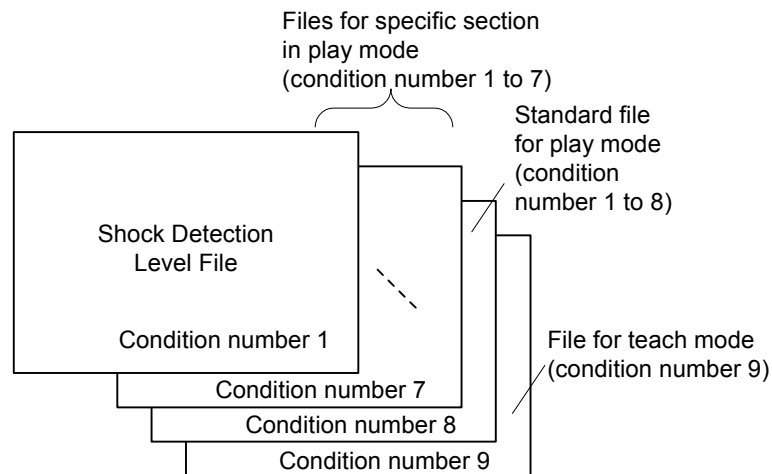
The shock detection level set file are nine condition files as following figure.


Condition number 1 to 7 are used when the detection level is changed in a specific section in play mode.

Condition number 8 is a file used as standard in play mode. This function is operated by the detection level set in this file when playback operation.

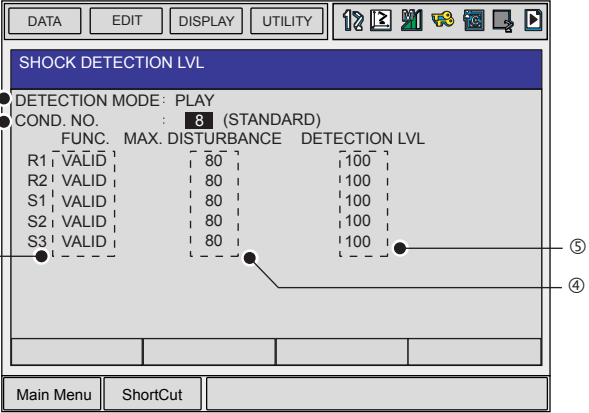

Condition number 9 is a file for teach mode. The shock is detected by the detection level set in this file when the manipulator is operated in teach mode.

The detection level is changed by the SHCKSET instruction. After this instruction is executed, the shock will be detected by the detection level of the specified file when the condition number is specified at SHCKSET instruction. The detection level is returned to standard level when the SHCKRST instruction is executed.



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

### Method of Shock Detection Level File Setting

|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {ROBOT} under the main menu. |   |
| 2 | Select {SHOCK SENS LEVEL}.          | <p>The SHOCK DETECTION LVL window is shown.</p>  <p><b>① Detection Mode</b><br/>The shock detection mode is indicated.</p> <p><b>② Condition Number (1 to 9)</b><br/>                     1 to 7 : For changing detection level in play mode<br/>                     8 : For standard detection level in play mode<br/>                     9 : For detection level in teach mode</p> <p>Do either of the following operations to display the desired condition number. When the desired condition number is input with a Numeric key and the [ENTER] is pressed after the cursor is moved on the condition number and [SELECT] is pressed, the file of the selected condition number is shown.</p> <p>When page key  is pressed, the condition number file is changed.</p> |

|   | Operation                            | Explanation   |
|---|--------------------------------------|---|
| 2 | (cont'd)                             | <p><b>③Function Select</b><br/>           VALID/INVALID of the shock detection function is specified here. The shock detection function is specified by each manipulator or each station axes which has this function. The cursor is moved to the robot or the station axis which is desired to change the function "VALID" or "INVALID" and [SELECT] is pressed. "VALID" and "INVALID" is changed alternately whenever [SELECT] is pressed. The changing of "VALID" or "INVALID" is effective for all the condition number files.</p> <p><b>④Max. Disturbance Force</b><br/>           The maximum disturbance force to the manipulator when the manipulator is moved in play back operation or axis operation is shown here. Refer to this value when the detection level in ⑤ is input. The maximum disturbance force can be cleared by setting in menu {DATA} → {CLEAR MAX VALUE }.</p> <p><b>⑤Detection Level (Level range : 1 to 500)</b><br/>           The shock detection level is specified here. Bigger value than the maximum disturbance force should be set. The value (The detection level:100) not mis-detected the shock even if robot is operated at the maximum speed is set when shipping from the factory. To change "Detection level", move the cursor to the robot or the station axis which is desired to change to appear the numeric input status and press [SELECT] moreover input the value by a Numeric key and press [ENTER]. Set the level to small value to raise the detection sensitivity or set the level to large value to lower sensitivity.</p> |
| 3 | Select the desired condition number. |   |
| 4 | Select the desired item and set it.  |   |



Set the level 20% or more greatly than the maximum disturbance force for the mis-detection prevention when the manipulator works. An instantaneous stopping the manipulator by the mis-detection may become a factor to damage the speed reducer or the tool.

**<Example>**

When the maximum disturbance force is 80, set the detection level 96 or more.



"Detection level" can be changed only when the security mode is set as management mode.

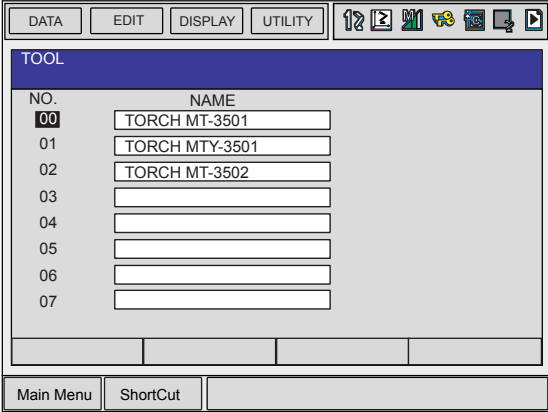
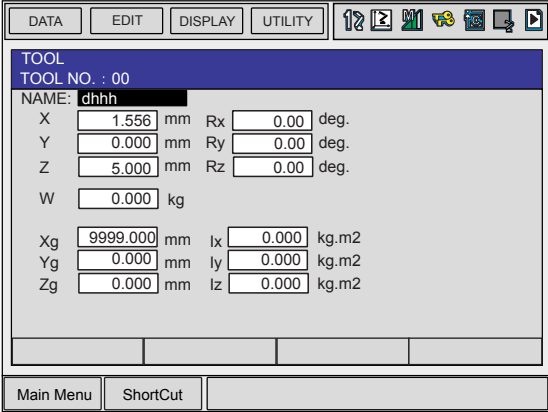
## ■ Tool load Information Setting


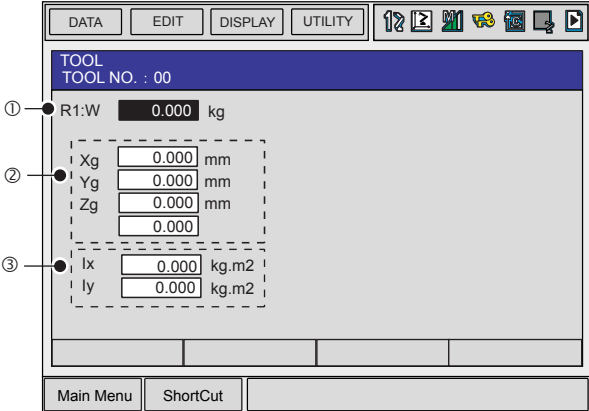
To be the more accurate shock detection, the tool load information is set in the tool file.

SUPPLEMENT

Refer to " 9.11.3 Tool Load Information Setting " for details concerning the tool load information setting.

### Method of the Tool load Information Setting

|   | Operation                           | Explanation  |
|---|-------------------------------------|--|
| 1 | Select {ROBOT} under the main menu. |  |
| 2 | Select {TOOL}.                      | <p>The TOOL window is shown. Only when the file expansion function is valid, the TOOL window is shown. When the file expansion function is invalid, the coordinate window is shown.</p> <div style="text-align: center; margin: 10px 0;">  </div> <div style="text-align: center; margin: 10px 0;">  </div> |

|   | Operation                           | Explanation  |
|---|-------------------------------------|--|
| 3 | Select the desired tool number.     | <p>Move the cursor to the number of the desired tool and press [ENTER] in the TOOL window. The coordinate window of the selected number is shown. Select the desired number with page key  in the coordinate window.</p> <p>Select { DISPLAY } → { LIST } or { DISPLAY } → { COORDINATE DATA } under the menu in order to switch between the TOOL and the coordinate window. The coordinate window is scrolled by the cursor.</p>  <p><b>①Weight</b><br/>This is total weight of the installed tool.<br/>Input weight by a Numeric key and press [ENTER] after the numeric input status is appeared by moving the cursor and pressing [SELECT].</p> <p><b>②Center of Gravity Position</b><br/>This is center of gravity position of the installed tool. The value are specified by the coordinates value on each axis of the flange coordinates. Input the center of gravity position by a Numeric key and press [ENTER] after the numeric input status is appeared by moving the cursor and pressing [SELECT].</p> <p><b>③Moment of inertia at the Center of Gravity</b><br/>This is Moment of inertia of the tool at the Center of Gravity in ②. The value are specified around each axis of the coordinates which is in parallel to the flange coordinates and which home position is the center of gravity position.<br/>Input the moment of inertia by a Numeric key and press [ENTER] after the numeric input status is appeared by moving the cursor and pressing [SELECT].</p> |
| 4 | Select the desired item and set it. |  |

## ■ 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 / Station Setting

The robot or the station axis which is desired to change the shock detection level is specified. If nothing is specified, the shock detection level of the control group of the job to which this instruction is registered is changed.

However, if the job is coordinated job, the shock detection level of the slave axis group is changed.

#### ②Shock Detection Level File (1 to 7)

The shock detection level file number is specified here. The shock detection level value when playback operation is set in the file. The shock detection level is changed by the condition of the file set here.

### 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 / Station Setting

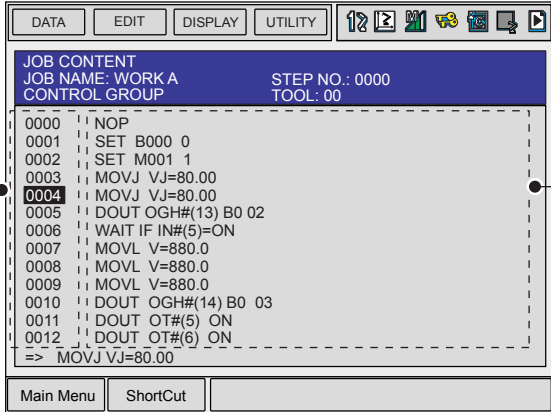
The robot or the station axis which is desired to reset the shock detection level is specified here. If nothing is specified, the shock detection level of the control group of the job to which this instruction is registered is changed.

However, if the job is coordinated job, the shock detection level of the slave axis group is changed.

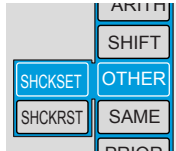



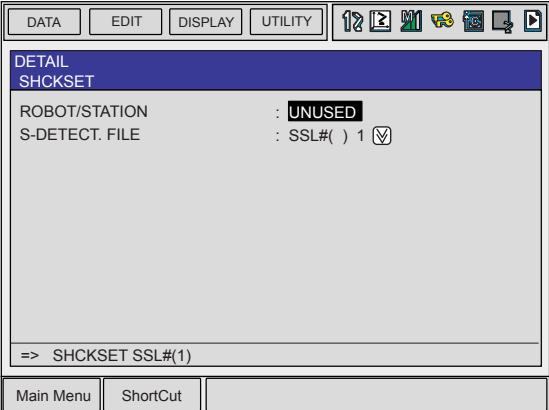
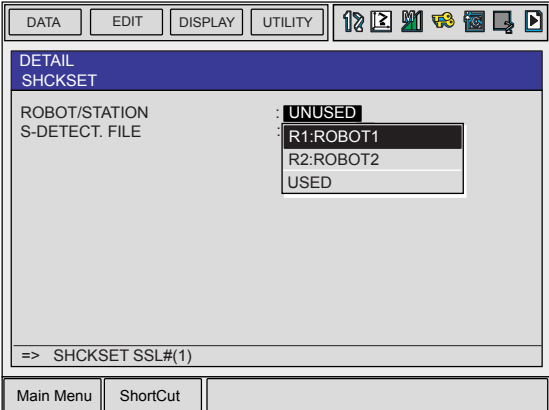
### Instruction Registration

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



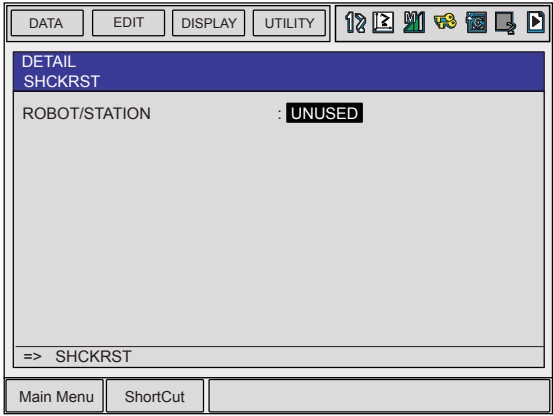
|   | Operation                            | Explanation  |
|---|--------------------------------------|--|
| 1 | Select {JOB} under the main menu.    |  |
| 2 | Select {JOB}.                        |  |
| 3 | Move the cursor in the address area. |  |

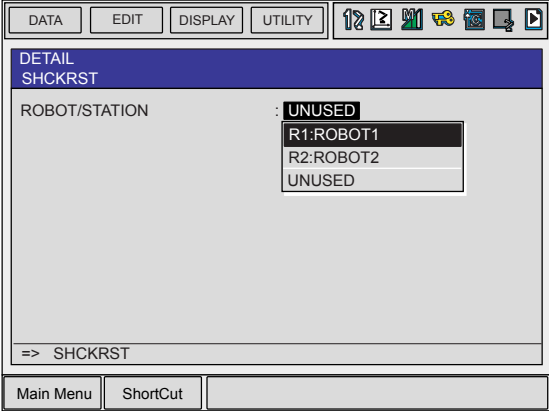
### SHCKSET

|   | Operation  | Explanation  |
|---|--|--|
| 1 | Move the cursor to the line just before the location where SHCKSET instruction is desired to register. |  |
| 2 | Press [INFORM LIST].   | <p>The inform list dialog box is shown.</p>                    |
| 3 | Select SHCKSET instruction.  | <p>SHCKSET instruction is shown in the input buffer line.</p>  |

|   | Operation  | Explanation  |
|---|--|--|
| 4 | <p>Change the value of additional item and numerical data.</p> | <p>&lt; When registering as it is &gt;<br/>Operate 5 procedure when the instruction the input buffer line as it is should be registered.</p> <p>&lt; When adding or changing the additional item &gt;<br/>• When the shock detection level file is changed, move the cursor to the shock detection level file number, and increase or decrease the file number by pressing about [SHIFT] and the cursor key simultaneously.</p> <pre>=&gt; SHCKSET SSL#(1)</pre> <p>When the value is input with the Numeric key, press [SELECT] to display the input buffer line.</p> <pre>Shock_sens_file no. = =&gt; SHCKSET SSL#( )</pre> <p>And press [ENTER] to change the number in the input buffer line.</p> <ul style="list-style-type: none"> <li>• When robot/station specification is added, move the cursor to the instruction in the input buffer line and press [SELECT] to show the DETAIL window.</li> </ul>  <p>Move the cursor to "UNUSED" of "ROBOT/STATION", and press [SELECT]. The selection dialog box is shown. Move the cursor to added robot or station and press [SELECT].</p>  <p>When the addition of robot/station ends, press [ENTER]. The DETAIL window shuts and the JOB CONTENT window is shown.</p> |
| 5 | <p>Press [INSERT] and [ENTER].</p>                             | <p>The instruction shown in the input buffer line is registered.</p>   |

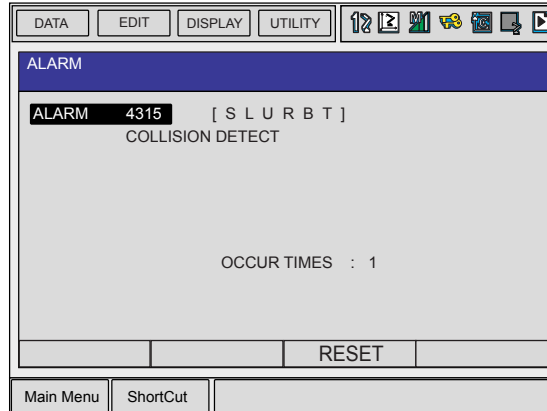
**SHCKRST**

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Move the cursor to the line just before the location where SHCKRST instruction is desired to register. |   |
| 2 | Press [INFORM LIST].   | <p>The inform list dialog box is shown.</p>   |
| 3 | Select SHCKRST instruction.  | <p>SHCKRST instruction is shown in the input buffer line.</p>   |
| 4 | Change the value of additional item.   | <p>&lt; When registering as it is &gt;<br/>Operate 5 procedure when the instruction the input buffer line as it is should be registered.</p> <p>&lt; When adding or changing the additional item &gt;<br/>When robot/station specification is added, move the cursor to the instruction in the input buffer line and press [SELECT] to show the DETAIL window.</p>  <p>Move the cursor to "UNUSED" of "ROBOT/STATION", and press [SELECT]. The selection dialog box is shown. Move the cursor to added robot or station and press [SELECT].</p> |

|   | Operation                   | Explanation  |
|---|-----------------------------|--|
| 4 | (cont'd)                    |  <p>When the addition of the robot/the station ends, press [ENTER]. The DETAIL window shuts and the JOB CONTENT window is shown.</p> |
| 5 | Press [INSERT] and [ENTER]. | The instruction shown in the input buffer line is registered.  |

### ■ Reset Shock detected

When the tool and the manipulator are collided with peripheral device and it is detected by the shock detection function, the manipulator is stopped in the instantaneously with alarm output. At this time, the shock detection alarm is shown.



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

|   | Operation                                       | Explanation  |
|---|---|--|
| 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 becomes possible again after resetting. In play mode, confirm the damage after moving the manipulator to the safety position once with teach mode though the playback operation is possible after resetting. |



When manipulator was 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 might be occurred because the collision might be detected again after resetting.

In this case, set the collision detection function "INVALID" with the shock detection level file or enlarge the detection level in teach mode and move the manipulator to safety position.

## 9.13 Instruction Level Setting

### 9.13.1 Setting Contents

#### ■ 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

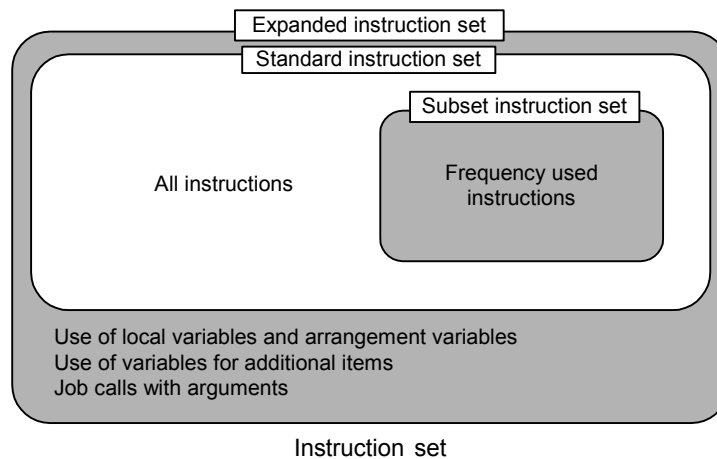
The instructions displayed in the instruction list are limited to just those that are most frequently used, reducing the number of instructions that can be registered. Since few instructions are shown, selection and input are simple.

#### 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)

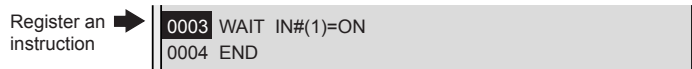
When instructions are executed, for example during playback, all the instructions can be executed regardless of the instruction set used.



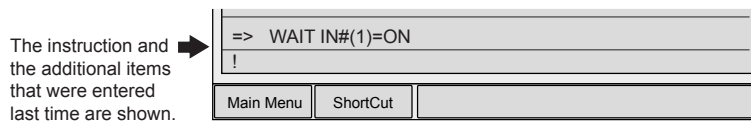
## ■ Learning Function

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.

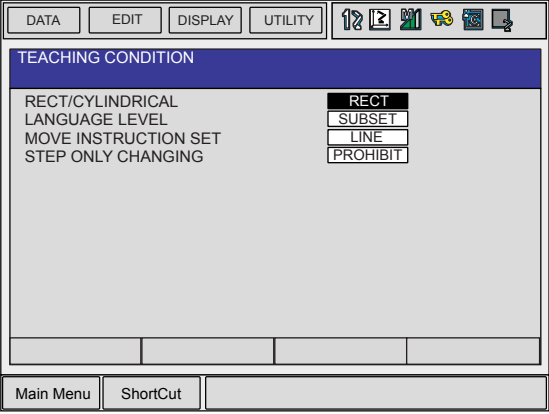
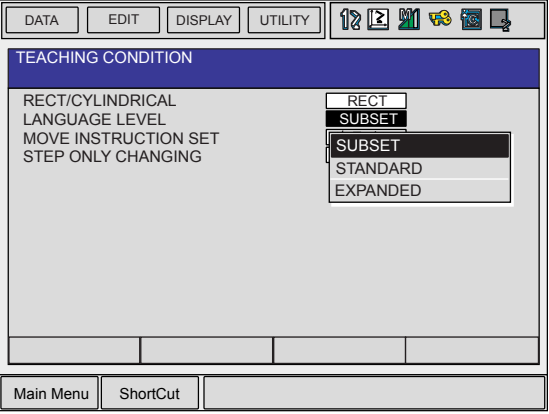
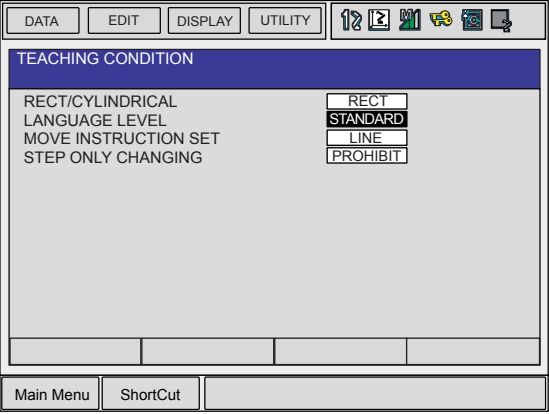


① An instructions are registered



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.

## 9.13.2 Setting Instruction Set Level Operation

|   | Operation                           | Explanation   |
|---|-------------------------------------|---|
| 1 | Select {SETUP} under the main menu. |   |
| 2 | Select {TEACHIG COND}.              | <p>The TEACHING CONDITION window is shown.</p>  |
| 3 | Select "LANGUAGE LEVEL."            | <p>The selection dialog box is shown.</p>      |
| 4 | Select desired language level.      | <p>Language level is set.</p>                 |



## 9.14 Numeric Key Customize Function

### 9.14.1 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 key of the programming pendant to the other function. Since any frequently used operation can be allocated to a Numeric keys on the programming pendant, decreasing the number of key operations reduces the teaching time.



The Numeric Key Customize Function is only valid when the security mode is set to the management mode.

### 9.14.2 Allocatable Functions

There are two allocation methods as follows:

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

#### ■ Key Allocation (EACH)

With key allocation (EACH), the manipulator operates according to the allocated function when the Numeric key is pressed. The following shows the functions that can be allocated.

| 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. (Specify it by the registration No.) |
| Display allocation      | Allocates any displays assigned by the user.   |

## ■ 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 following shows the functions that can be allocated.

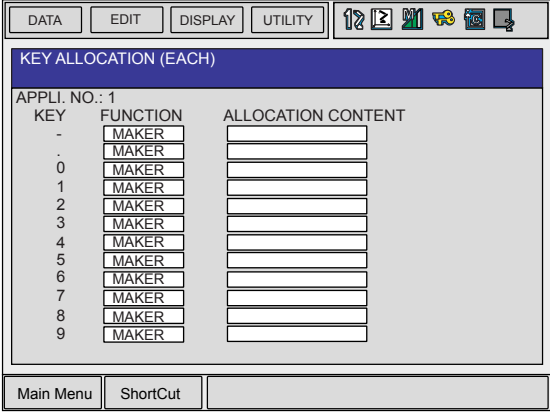
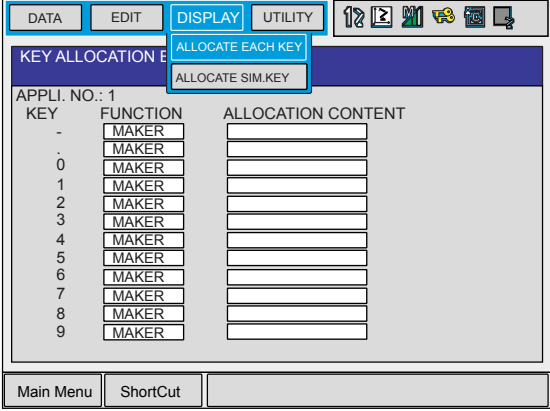

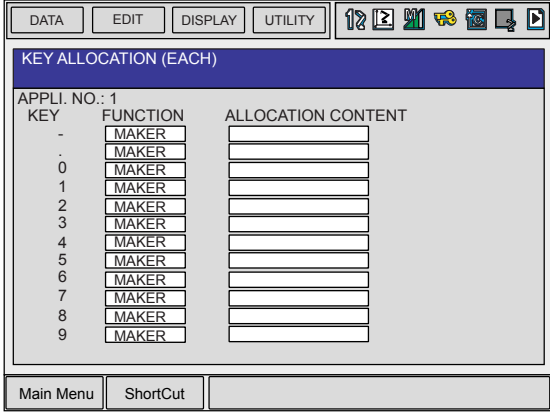
| Function                              | Description  |
|---------------------------------------|--|
| Alternate output allocation           | Turns ON/OFF the specified user output signal when [INTERLOCK] and the allocated Numeric key are pressed at the same time.                                   |
| 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.

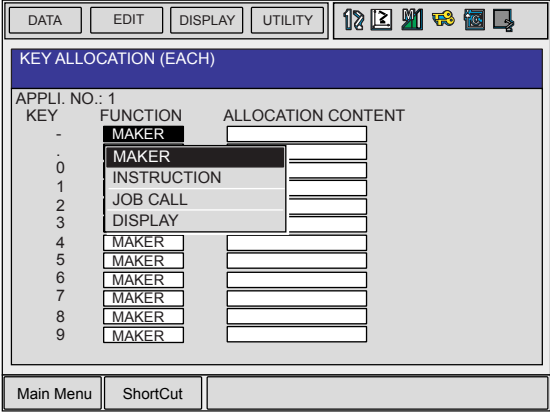
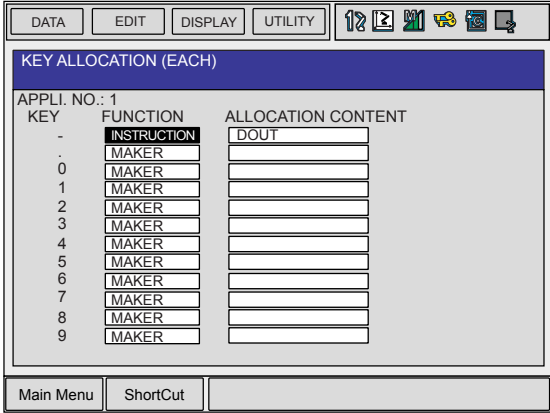
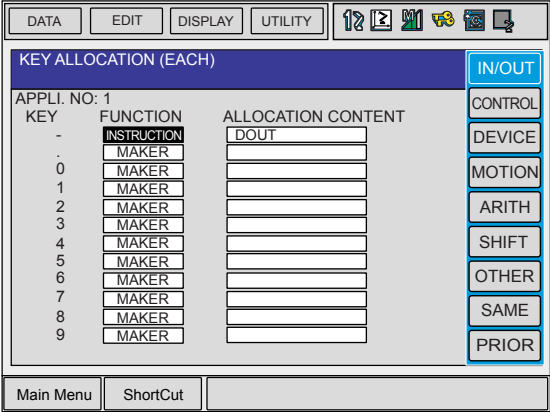
### 9.14.3 Allocating an Operation

#### Allocation Window

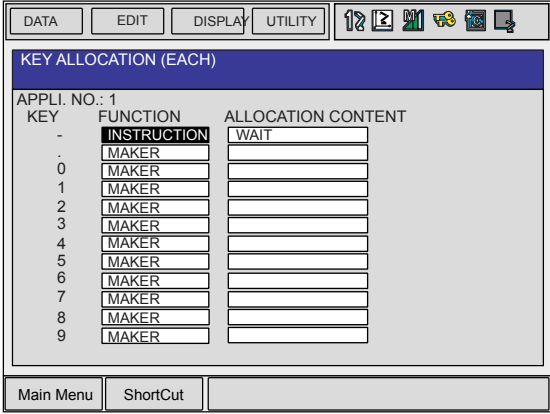
|   | Operation                           | Explanation  |
|---|-------------------------------------|--|
| 1 | Select {SETUP} under the main menu. |  |
| 2 | Select {KEY ALLOCATION}.            | <p>The KEY ALLOCATION (EACH) window is shown.</p>    |
| 3 | Select {DISPLAY}.                   | <p>The pull-down menu is shown. To call up the KEY ALLOCATION (SIM) window, select {ALLOCATE SIM. KEY}.</p>    |
| 4 | Select {ALLOCATE SIM. KEY}.         | <p>The KEY ALLOCATION (SIM) window is shown.</p> <p>In a system multiple applications, press the page key  to change the window to the allocation window for each application.</p>  |

■ Instruction Allocation

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

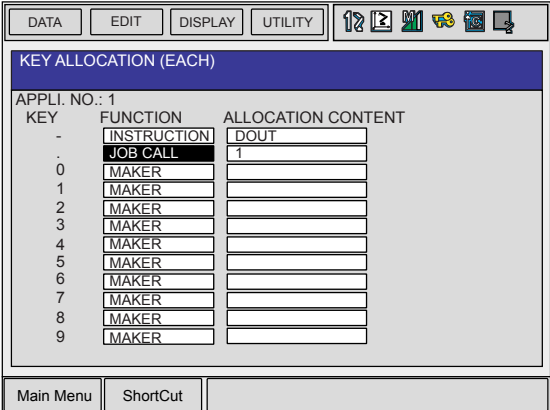
|   | Operation  | Explanation  |
|---|--|--|
| 1 | Move the cursor to "FUNCTION" of the key to be allocated and press [SELECT]. | <p>The selection dialog box is shown.</p>    |
| 2 | Select "INSTRUCTION."  | <p>The instruction is shown in the "ALLOCATION CONTENT".</p>  <p>To change the instruction, move the cursor to the instruction and press [SELECT]. Then the instruction group list dialog box is shown. Select the group containing the instruction to be changed.</p>  <p>When the instruction list dialog box is shown, select the instruction to be changed.</p> |

9.14 Numeric Key Customize Function

|     | Operation   | Explanation  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
|-----|-------------|--|-----|----------|--------------------|---|-------------|------|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|
| 2   | (cont'd)    |  <p>The screenshot shows a software interface titled "KEY ALLOCATION (EACH)". At the top, there are menu buttons: DATA, EDIT, DISPLAY, and UTILITY, along with several utility icons. Below the title bar, it says "APPLI. NO.: 1". The main area contains a table with three columns: KEY, FUNCTION, and ALLOCATION CONTENT. The first row has KEY "-", FUNCTION "INSTRUCTION", and ALLOCATION CONTENT "WAIT". The following rows (KEY ".", "0", "1", "2", "3", "4", "5", "6", "7", "8", "9") all have "MAKER" in the FUNCTION column and empty boxes in the ALLOCATION CONTENT column. At the bottom of the window, there are buttons for "Main Menu" and "ShortCut".</p> <table border="1"> <thead> <tr> <th>KEY</th> <th>FUNCTION</th> <th>ALLOCATION CONTENT</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>INSTRUCTION</td> <td>WAIT</td> </tr> <tr> <td>.</td> <td>MAKER</td> <td></td> </tr> <tr> <td>0</td> <td>MAKER</td> <td></td> </tr> <tr> <td>1</td> <td>MAKER</td> <td></td> </tr> <tr> <td>2</td> <td>MAKER</td> <td></td> </tr> <tr> <td>3</td> <td>MAKER</td> <td></td> </tr> <tr> <td>4</td> <td>MAKER</td> <td></td> </tr> <tr> <td>5</td> <td>MAKER</td> <td></td> </tr> <tr> <td>6</td> <td>MAKER</td> <td></td> </tr> <tr> <td>7</td> <td>MAKER</td> <td></td> </tr> <tr> <td>8</td> <td>MAKER</td> <td></td> </tr> <tr> <td>9</td> <td>MAKER</td> <td></td> </tr> </tbody> </table> | KEY | FUNCTION | ALLOCATION CONTENT | - | INSTRUCTION | WAIT | . | MAKER |  | 0 | MAKER |  | 1 | MAKER |  | 2 | MAKER |  | 3 | MAKER |  | 4 | MAKER |  | 5 | MAKER |  | 6 | MAKER |  | 7 | MAKER |  | 8 | MAKER |  | 9 | MAKER |  |
| KEY | FUNCTION    | ALLOCATION CONTENT   |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| -   | INSTRUCTION | WAIT   |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| .   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 0   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 1   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 2   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 3   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 4   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 5   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 6   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 7   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 8   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 9   | MAKER       |  |     |          |                    |   |             |      |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |

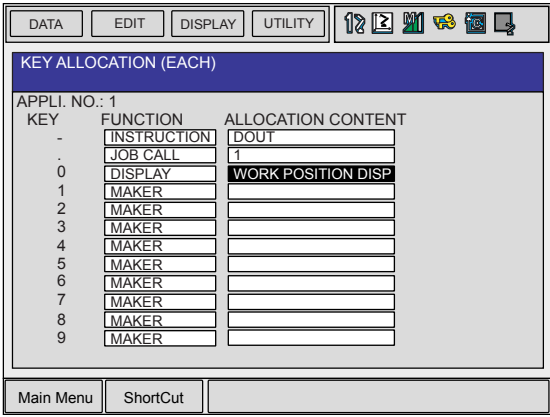
■ Job Call Allocation

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

|     | Operation  | Explanation  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
|-----|--|--|-----|----------|--------------------|---|-------------|------|---|----------|---|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|
| 1   | Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT]. | The selection dialog box is shown.   |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 2   | Select "JOB CALL."   | <p>The reserved job registration No. is shown in the "ALLOCATION CONTENT" (reserved job registration No.: 1 to 10).</p>  <p>The screenshot shows a window titled "KEY ALLOCATION (EACH)" with a menu bar (DATA, EDIT, DISPLAY, UTILITY) and a toolbar. Below the title bar, it says "APPLI. NO.: 1". The main area contains a table:</p> <table border="1"> <thead> <tr> <th>KEY</th> <th>FUNCTION</th> <th>ALLOCATION CONTENT</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>INSTRUCTION</td> <td>DOUT</td> </tr> <tr> <td>-</td> <td>JOB CALL</td> <td>1</td> </tr> <tr> <td>0</td> <td>MAKER</td> <td></td> </tr> <tr> <td>1</td> <td>MAKER</td> <td></td> </tr> <tr> <td>2</td> <td>MAKER</td> <td></td> </tr> <tr> <td>3</td> <td>MAKER</td> <td></td> </tr> <tr> <td>4</td> <td>MAKER</td> <td></td> </tr> <tr> <td>5</td> <td>MAKER</td> <td></td> </tr> <tr> <td>6</td> <td>MAKER</td> <td></td> </tr> <tr> <td>7</td> <td>MAKER</td> <td></td> </tr> <tr> <td>8</td> <td>MAKER</td> <td></td> </tr> <tr> <td>9</td> <td>MAKER</td> <td></td> </tr> </tbody> </table> <p>At the bottom of the window, there are buttons for "Main Menu" and "ShortCut".</p> <p>To change the reserved job registration No., move the cursor to the No. and press [SELECT]. Numeric values can now be entered. Input the number to be changed, and press [ENTER].</p> | KEY | FUNCTION | ALLOCATION CONTENT | - | INSTRUCTION | DOUT | - | JOB CALL | 1 | 0 | MAKER |  | 1 | MAKER |  | 2 | MAKER |  | 3 | MAKER |  | 4 | MAKER |  | 5 | MAKER |  | 6 | MAKER |  | 7 | MAKER |  | 8 | MAKER |  | 9 | MAKER |  |
| KEY | FUNCTION   | ALLOCATION CONTENT   |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| -   | INSTRUCTION  | DOUT   |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| -   | JOB CALL   | 1  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 0   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 1   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 2   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 3   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 4   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 5   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 6   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 7   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 8   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 9   | MAKER  |  |     |          |                    |   |             |      |   |          |   |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |

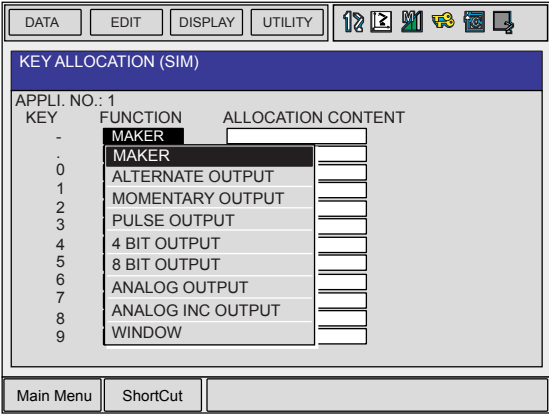
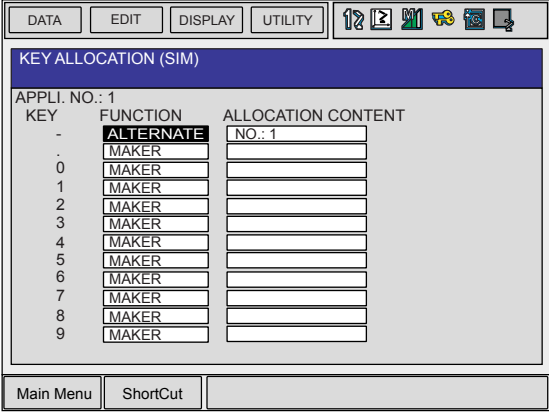
## ■ Window Allocation

Use this function is used in the KEY ALLOCATION (EACH) window.

|   | Operation  | Explanation  |
|---|--|--|
| 1 | Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT]. | The selection dialog box is shown.   |
| 2 | Select "DISPLAY."  |  |
| 3 | Move the cursor to "ALLOCATION CONTENT" and press [SELECT].                      | The character input status is entered.   |
| 4 | Input the name of the reserved window and press [ENTER].                         | The reserved name input to the "ALLOCATION CONTENT" is shown.<br> |
| 5 | Open the window for allocation.  |  |
| 6 | Press [INTERLOCK] and the allocated key at the same time.                        | A message "Reserved window registered" is shown, and the window is registered.   |

■ Alternate Output Allocation

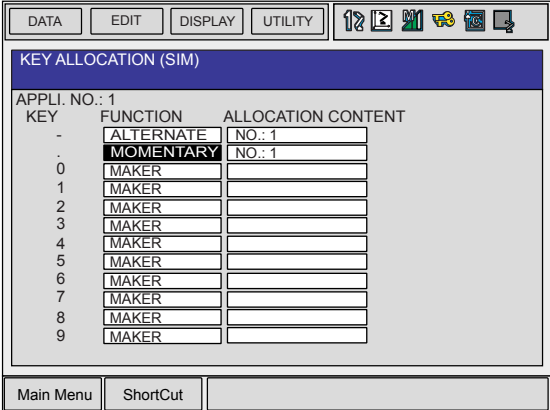
Use this function is used in the KEY ALLOCATION (SIM) window.

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT]. | <p>The selection dialog box is shown.</p>   |
| 2 | Select "ALTERNATE OUTPUT."   | <p>The output No. is shown in the "ALLOCATION CONTENT".</p>  <p>To change the output No., move the cursor to the No. and press [SELECT]. Numeric values can now be entered. Input the number to be changed, and press [ENTER].</p> |



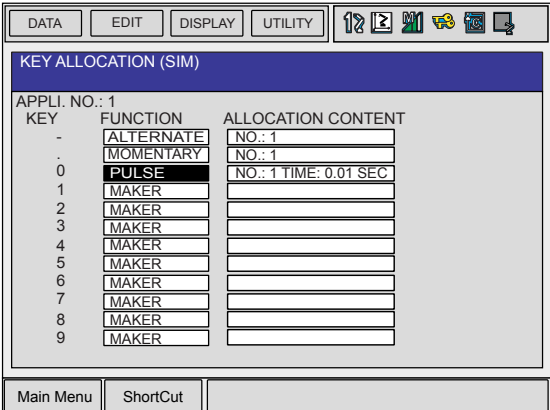
### ■ Momentary Output Allocation

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

|   | Operation  | Explanation  |
|---|--|--|
| 1 | Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT]. | The selection dialog box is shown.   |
| 2 | Select "MOMENTARY OUTPUT."   | <p>The output No. is shown in the "ALLOCATION CONTENT".</p>  <p>To change the output No., move the cursor to the No. and press [SELECT]. Numeric values can now be entered. Input the number to be changed, and press [ENTER].</p> |

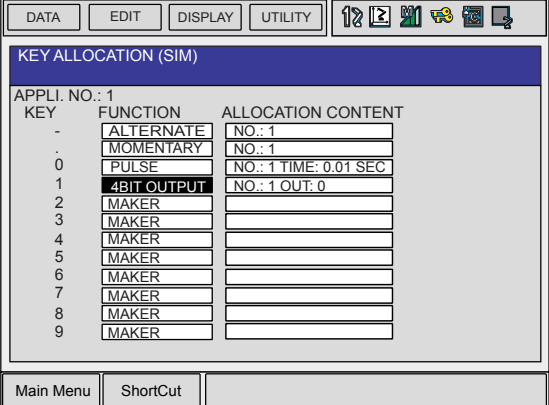
### ■ Pulse Output Allocation

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

|   | Operation  | Explanation  |
|---|--|--|
| 1 | Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT]. | The selection dialog box is shown.   |
| 2 | Select "PULSE OUTPUT."   | <p>The output No. and output time are shown in the "ALLOCATION CONTENT".</p>  <p>To change the output No. or output time, move the cursor to the No. or time and press [SELECT]. Numeric values can now be entered. Input the number or time to be changed, and press [ENTER].</p> |

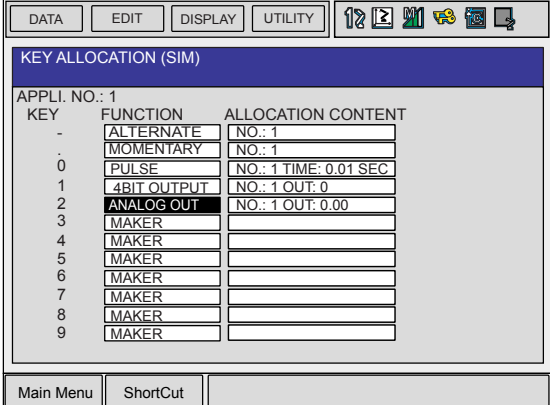
■ Group (4-bit/8-bit) Output Allocation

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

|     | Operation  | Explanation  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
|-----|--|--|-----|----------|--------------------|---|-----------|--------|---|-----------|--------|---|-------|-----------------------|---|--------------------|---------------|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|
| 1   | Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT]. | The selection dialog box is shown.   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 2   | Select "4 BIT OUTPUT" or "8 BIT OUTPUT."   | <p>The output No. and output value are shown in the "ALLOCATION CONTENT".</p>  <p>The screenshot shows a window titled "KEY ALLOCATION (SIM)" with a menu bar (DATA, EDIT, DISPLAY, UTILITY) and a toolbar. Below the title bar, it says "APPLI. NO.: 1". A table is displayed with three columns: KEY, FUNCTION, and ALLOCATION CONTENT. The rows are as follows:</p> <table border="1"> <thead> <tr> <th>KEY</th> <th>FUNCTION</th> <th>ALLOCATION CONTENT</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>ALTERNATE</td> <td>NO.: 1</td> </tr> <tr> <td>.</td> <td>MOMENTARY</td> <td>NO.: 1</td> </tr> <tr> <td>0</td> <td>PULSE</td> <td>NO.: 1 TIME: 0.01 SEC</td> </tr> <tr> <td>1</td> <td><b>4BIT OUTPUT</b></td> <td>NO.: 1 OUT: 0</td> </tr> <tr> <td>2</td> <td>MAKER</td> <td></td> </tr> <tr> <td>3</td> <td>MAKER</td> <td></td> </tr> <tr> <td>4</td> <td>MAKER</td> <td></td> </tr> <tr> <td>5</td> <td>MAKER</td> <td></td> </tr> <tr> <td>6</td> <td>MAKER</td> <td></td> </tr> <tr> <td>7</td> <td>MAKER</td> <td></td> </tr> <tr> <td>8</td> <td>MAKER</td> <td></td> </tr> <tr> <td>9</td> <td>MAKER</td> <td></td> </tr> </tbody> </table> <p>At the bottom of the window, there are buttons for "Main Menu" and "ShortCut".</p> <p>To change the output No. or output value, move the cursor to the No. or value and press [SELECT]. Numeric values can now be entered. Input the number or value to be changed, and press [ENTER].</p> | KEY | FUNCTION | ALLOCATION CONTENT | - | ALTERNATE | NO.: 1 | . | MOMENTARY | NO.: 1 | 0 | PULSE | NO.: 1 TIME: 0.01 SEC | 1 | <b>4BIT OUTPUT</b> | NO.: 1 OUT: 0 | 2 | MAKER |  | 3 | MAKER |  | 4 | MAKER |  | 5 | MAKER |  | 6 | MAKER |  | 7 | MAKER |  | 8 | MAKER |  | 9 | MAKER |  |
| KEY | FUNCTION   | ALLOCATION CONTENT   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| -   | ALTERNATE  | NO.: 1   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| .   | MOMENTARY  | NO.: 1   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 0   | PULSE  | NO.: 1 TIME: 0.01 SEC  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 1   | <b>4BIT OUTPUT</b>   | NO.: 1 OUT: 0  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 2   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 3   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 4   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 5   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 6   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 7   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 8   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 9   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |                    |               |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |

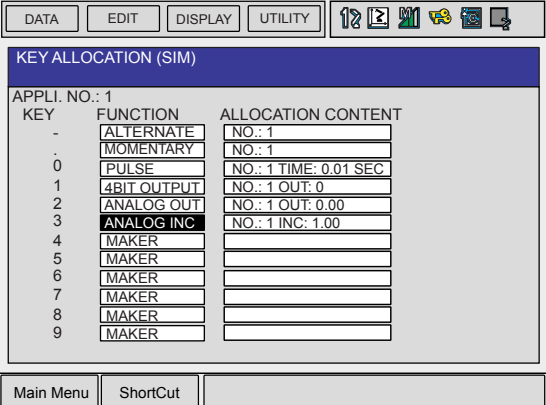
## ■ Analog Output Allocation

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

|     | Operation  | Explanation  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
|-----|--|--|-----|----------|--------------------|---|-----------|--------|---|-----------|--------|---|-------|-----------------------|---|-------------|---------------|---|-------------------|------------------|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|---|-------|--|
| 1   | Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT]. | The selection dialog box is shown.   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 2   | Select "ANALOG OUTPUT."  | <p>The output port number and the output voltage value are shown in the "ALLOCATION CONTENT".</p>  <p>The screenshot shows a window titled 'KEY ALLOCATION (SIM)' with a menu bar (DATA, EDIT, DISPLAY, UTILITY) and a toolbar. Below the title bar, it says 'APPLI. NO.: 1'. The main area contains a table with three columns: 'KEY', 'FUNCTION', and 'ALLOCATION CONTENT'. The 'ANALOG OUT' function for key '2' is highlighted. The 'ALLOCATION CONTENT' for 'ANALOG OUT' is 'NO.: 1 OUT: 0.00'. At the bottom, there are buttons for 'Main Menu' and 'ShortCut'.</p> <table border="1"> <thead> <tr> <th>KEY</th> <th>FUNCTION</th> <th>ALLOCATION CONTENT</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>ALTERNATE</td> <td>NO.: 1</td> </tr> <tr> <td>.</td> <td>MOMENTARY</td> <td>NO.: 1</td> </tr> <tr> <td>0</td> <td>PULSE</td> <td>NO.: 1 TIME: 0.01 SEC</td> </tr> <tr> <td>1</td> <td>4BIT OUTPUT</td> <td>NO.: 1 OUT: 0</td> </tr> <tr> <td>2</td> <td><b>ANALOG OUT</b></td> <td>NO.: 1 OUT: 0.00</td> </tr> <tr> <td>3</td> <td>MAKER</td> <td></td> </tr> <tr> <td>4</td> <td>MAKER</td> <td></td> </tr> <tr> <td>5</td> <td>MAKER</td> <td></td> </tr> <tr> <td>6</td> <td>MAKER</td> <td></td> </tr> <tr> <td>7</td> <td>MAKER</td> <td></td> </tr> <tr> <td>8</td> <td>MAKER</td> <td></td> </tr> <tr> <td>9</td> <td>MAKER</td> <td></td> </tr> </tbody> </table> <p>To change the output port No. or output voltage value, move the cursor to the No. or voltage value and press [SELECT]. Numeric values can now be entered. Input the number or voltage value to be changed, and press [ENTER].</p> | KEY | FUNCTION | ALLOCATION CONTENT | - | ALTERNATE | NO.: 1 | . | MOMENTARY | NO.: 1 | 0 | PULSE | NO.: 1 TIME: 0.01 SEC | 1 | 4BIT OUTPUT | NO.: 1 OUT: 0 | 2 | <b>ANALOG OUT</b> | NO.: 1 OUT: 0.00 | 3 | MAKER |  | 4 | MAKER |  | 5 | MAKER |  | 6 | MAKER |  | 7 | MAKER |  | 8 | MAKER |  | 9 | MAKER |  |
| KEY | FUNCTION   | ALLOCATION CONTENT   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| -   | ALTERNATE  | NO.: 1   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| .   | MOMENTARY  | NO.: 1   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 0   | PULSE  | NO.: 1 TIME: 0.01 SEC  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 1   | 4BIT OUTPUT  | NO.: 1 OUT: 0  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 2   | <b>ANALOG OUT</b>  | NO.: 1 OUT: 0.00   |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 3   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 4   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 5   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 6   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 7   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 8   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |
| 9   | MAKER  |  |     |          |                    |   |           |        |   |           |        |   |       |                       |   |             |               |   |                   |                  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |   |       |  |

## ■ Analog Incremental Output Allocation

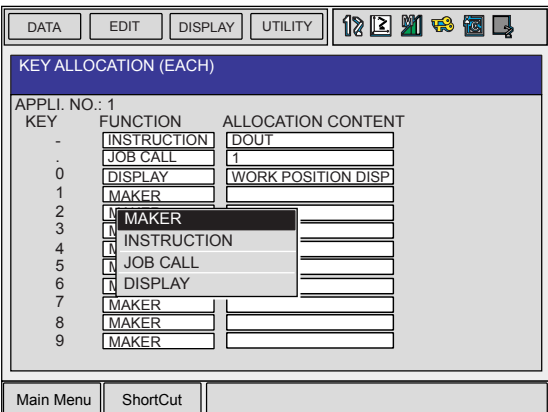
Use this function in the KEY ALLOCATION (SIM) window.

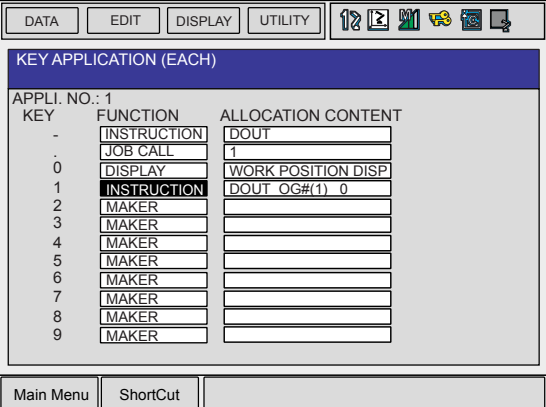
|   | Operation  | Explanation   |
|---|--|---|
| 1 | Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT]. | The selection dialog box is shown.  |
| 2 | Select "ANALOG INC OUTPUT."  | <p>The output port No. and incremental value are shown in the "ALLOCATION CONTENT".</p>  <p>To change the output port No. or incremental value, move the cursor to the No. or incremental value and press [SELECT]. Numeric values can now be entered. Input the number or incremental value to be changed, and press [ENTER].</p> |

### 9.14.4 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 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        |

| Operation   | Explanation  |
|---|--|
| 1 Move the cursor to the "FUNCTION" of the key that has been allocated with I/O control with key allocation (SIM) and press [SELECT]. | <p>The selection dialog box is shown.</p>  |

|   | Operation                     | Explanation   |
|---|-------------------------------|---|
| 2 | Select "OUTPUT CONTROL INST." | <p>The instruction corresponding to the I/O control allocated by key allocation (SIM) is shown in the "ALLOCATION CONTENT".</p>  <p>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.</p> |

## 9.14.5 Execution of Allocation

### ■ Executing the Instruction/Output Control Allocation

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Press the key allocated for instruction allocation or output control allocation. | The allocated instruction is shown in the input buffer line.<br><pre style="text-align: center;">   =&gt; WAIT IN#(1)=ON   </pre> |
| 2 | Press [INSERT] and [ENTER].  | The instruction displayed in the input buffer line is registered.   |

### ■ Executing the Job Call Allocation

|   | Operation  | Explanation  |
|---|--|--|
| 1 | Press the key allocated for the job call allocation. | The CALL instruction is shown in the input buffer line.<br><pre style="text-align: center;">   =&gt; CALL JOB:ARCON   </pre> |
| 2 | Press [INSERT] and [ENTER].                          | The CALL instruction shown in the input buffer line is registered.   |

### ■ Executing the Window Allocation

|   | Operation  | Explanation                    |
|---|--|--------------------------------|
| 1 | Press the key allocated for the window allocation. | The allocated window is shown. |

### ■ 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.

|   | Operation  | Explanation                       |
|---|--|-----------------------------------|
| 1 | Press [INTERLOCK] and the key allocated for I/O control allocation at the same time. | Allocated functions are executed. |

## 9.15 Changing the Output Status

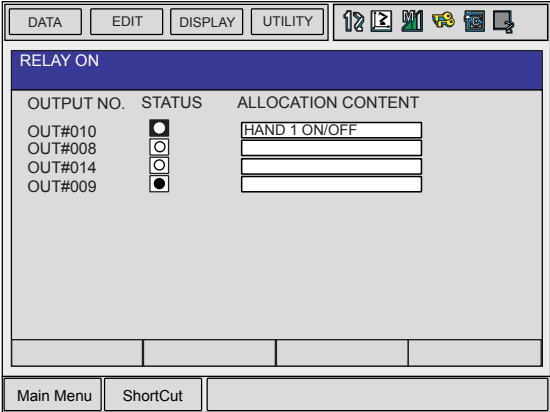
The status of external output signals can be changed from the programming pendant by using either of the following two methods.

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

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

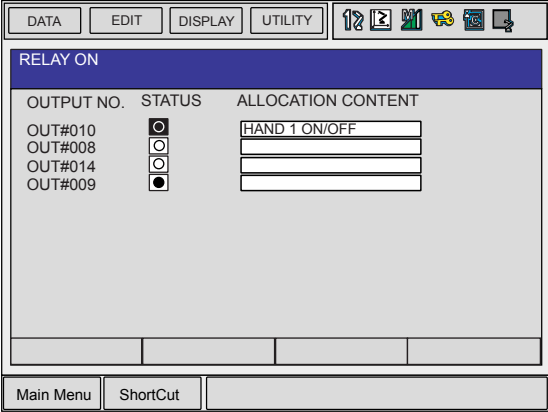


A maximum of 16 output signals can be shown on the RELAY ON window and they must be set in advance with parameter settings S2C285 to S2C300. If not having set, the sub menu in the RELAY ON window is not displayed.

|   | Operation                               | Explanation   |
|---|---|---|
| 1 | Select {IN/OUT} under the main menu.    |   |
| 2 | Select {RELAY ON}.                      | The RELAY ON window is shown.<br> |
| 3 | Select the desired signal for changing. | Select the status (○ or ●) of the desired signal to change.   |



9.15 Changing the Output Status

|   | Operation                    | Explanation   |
|---|------------------------------|---|
| 4 | Press [INTERLOCK] +[SELECT]. | <p>The status is changed. (●: status ON, ○ : status OFF)</p>  |



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 parameter to "1".

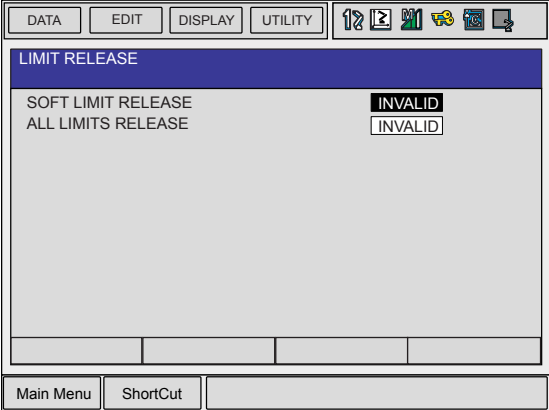
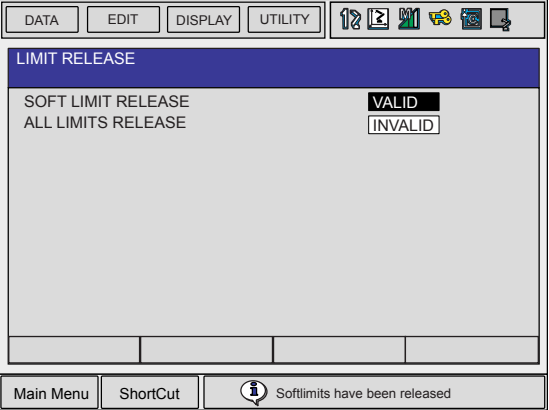
## 9.16 Temporary Release of Soft Limits

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. When it is detected that the manipulator (TCP) has reached a soft limit, the manipulator automatically stops.

When the manipulator is stopped at a soft limit, temporarily release the soft limit by following the procedure below, then move the manipulator away from that which exceeded the soft limit.

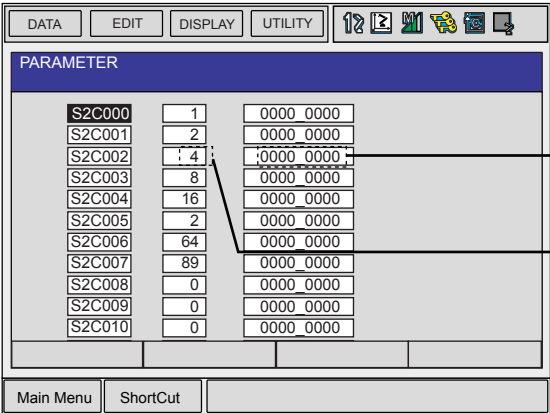
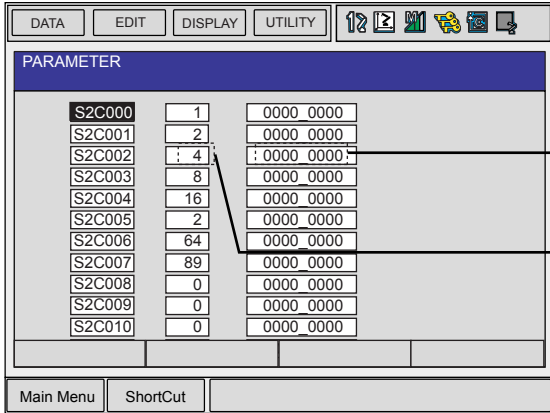
|   | Operation                           | Explanation  |
|---|-------------------------------------|--|
| 1 | Select {ROBOT} under the main menu. |  |
| 2 | Select {LIMIT RELEASE}.             | <p>The LIMIT RELEASE window is shown.</p>  <p>The screenshot shows a window titled 'LIMIT RELEASE' with a menu bar containing 'DATA', 'EDIT', 'DISPLAY', and 'UTILITY'. Below the menu bar are several icons. The main area of the window contains two rows of text: 'SOFT LIMIT RELEASE' and 'ALL LIMITS RELEASE'. To the right of each row is a box containing the word 'INVALID'. At the bottom of the window, there are two buttons labeled 'Main Menu' and 'ShortCut'.</p>  |
| 3 | Select "SOFT LIMIT RELEASE."        | <p>Each time [SELECT] is pressed, "VALID" and "INVALID" alternate. When "SOFT LIMIT RELEASE" is set to "VALID," the message "Soft limits have been released" is shown.</p>  <p>The screenshot shows the same 'LIMIT RELEASE' window as in the previous step. In this state, the 'SOFT LIMIT RELEASE' box now contains the word 'VALID', while the 'ALL LIMITS RELEASE' box still contains 'INVALID'. At the bottom of the window, a message box is visible with an information icon and the text 'Softlimits have been released'.</p> <p>When "SOFT LIMIT RELEASE" is set to "INVALID," the message "Soft limits have not been released" is shown for three seconds.</p> |



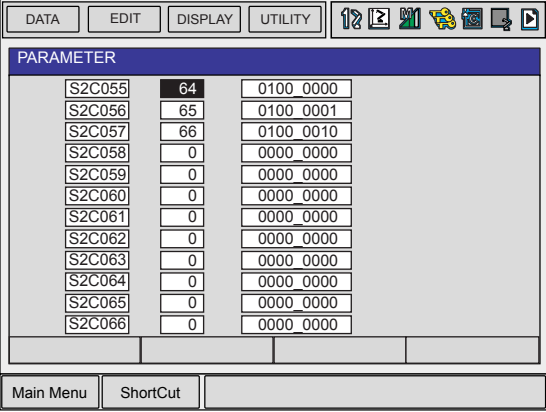
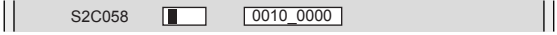

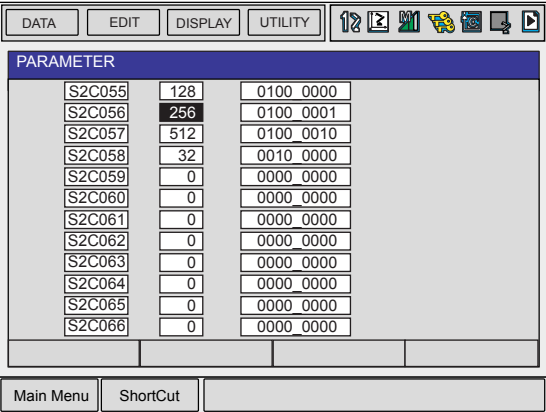
The teaching data cannot be entered while releasing software limit.

## 9.17 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.

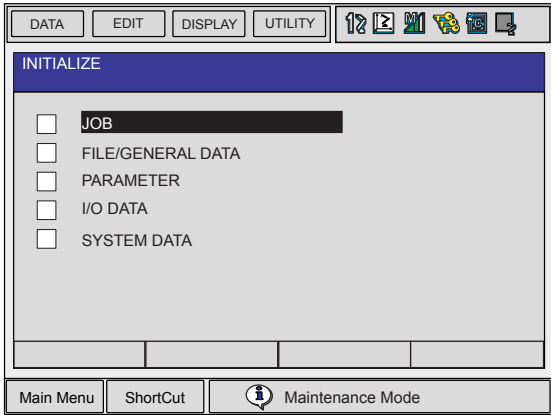
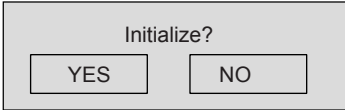
|           | Operation   | Explanation  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
|-----------|---|--|-----------|-------|-----------|--------|---|-----------|--------|---|-----------|--------|---|------------|--------|---|-----------|--------|----|-----------|--------|---|-----------|--------|----|-----------|--------|----|-----------|--------|---|-----------|--------|---|-----------|--------|---|-----------|
| 1         | Select {PARAMETER} under the main menu.                                 |  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| 2         | Select the parameter type.  | <p>The PARAMETER window is shown. Select the desired parameter.</p>  <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Data Type</th> </tr> </thead> <tbody> <tr><td>S2C000</td><td>1</td><td>0000 0000</td></tr> <tr><td>S2C001</td><td>2</td><td>0000 0000</td></tr> <tr><td>S2C002</td><td>4</td><td>:0000 0000</td></tr> <tr><td>S2C003</td><td>8</td><td>0000 0000</td></tr> <tr><td>S2C004</td><td>16</td><td>0000 0000</td></tr> <tr><td>S2C005</td><td>2</td><td>0000 0000</td></tr> <tr><td>S2C006</td><td>64</td><td>0000 0000</td></tr> <tr><td>S2C007</td><td>89</td><td>0000 0000</td></tr> <tr><td>S2C008</td><td>0</td><td>0000 0000</td></tr> <tr><td>S2C009</td><td>0</td><td>0000 0000</td></tr> <tr><td>S2C010</td><td>0</td><td>0000 0000</td></tr> </tbody> </table>   | Parameter | Value | Data Type | S2C000 | 1 | 0000 0000 | S2C001 | 2 | 0000 0000 | S2C002 | 4 | :0000 0000 | S2C003 | 8 | 0000 0000 | S2C004 | 16 | 0000 0000 | S2C005 | 2 | 0000 0000 | S2C006 | 64 | 0000 0000 | S2C007 | 89 | 0000 0000 | S2C008 | 0 | 0000 0000 | S2C009 | 0 | 0000 0000 | S2C010 | 0 | 0000 0000 |
| Parameter | Value   | Data Type  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C000    | 1   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C001    | 2   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C002    | 4   | :0000 0000   |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C003    | 8   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C004    | 16  | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C005    | 2   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C006    | 64  | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C007    | 89  | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C008    | 0   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C009    | 0   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C010    | 0   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| 3         | Move the cursor to the parameter number whose setting is to be changed. | <p>When the desired parameter number is not in the present window, move the cursor to a parameter number and press [SELECT]. Enter the desired parameter number with the Numeric keys and press [ENTER]. The cursor moves to the selected parameter number.</p>  <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Data Type</th> </tr> </thead> <tbody> <tr><td>S2C000</td><td>1</td><td>0000 0000</td></tr> <tr><td>S2C001</td><td>2</td><td>0000 0000</td></tr> <tr><td>S2C002</td><td>4</td><td>:0000 0000</td></tr> <tr><td>S2C003</td><td>8</td><td>0000 0000</td></tr> <tr><td>S2C004</td><td>16</td><td>0000 0000</td></tr> <tr><td>S2C005</td><td>2</td><td>0000 0000</td></tr> <tr><td>S2C006</td><td>64</td><td>0000 0000</td></tr> <tr><td>S2C007</td><td>89</td><td>0000 0000</td></tr> <tr><td>S2C008</td><td>0</td><td>0000 0000</td></tr> <tr><td>S2C009</td><td>0</td><td>0000 0000</td></tr> <tr><td>S2C010</td><td>0</td><td>0000 0000</td></tr> </tbody> </table> | Parameter | Value | Data Type | S2C000 | 1 | 0000 0000 | S2C001 | 2 | 0000 0000 | S2C002 | 4 | :0000 0000 | S2C003 | 8 | 0000 0000 | S2C004 | 16 | 0000 0000 | S2C005 | 2 | 0000 0000 | S2C006 | 64 | 0000 0000 | S2C007 | 89 | 0000 0000 | S2C008 | 0 | 0000 0000 | S2C009 | 0 | 0000 0000 | S2C010 | 0 | 0000 0000 |
| Parameter | Value   | Data Type  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C000    | 1   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C001    | 2   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C002    | 4   | :0000 0000   |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C003    | 8   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C004    | 16  | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C005    | 2   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C006    | 64  | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C007    | 89  | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C008    | 0   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C009    | 0   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |
| S2C010    | 0   | 0000 0000  |           |       |           |        |   |           |        |   |           |        |   |            |        |   |           |        |    |           |        |   |           |        |    |           |        |    |           |        |   |           |        |   |           |        |   |           |

Set the parameters in the following manner.

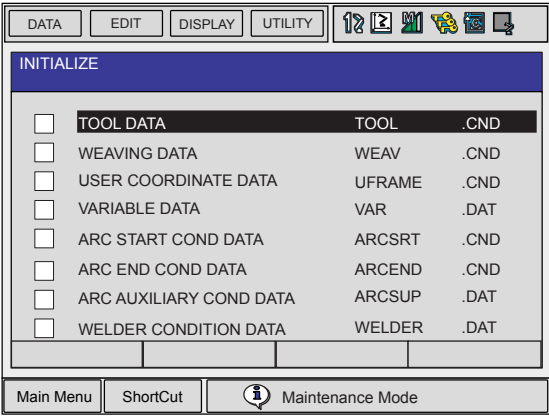
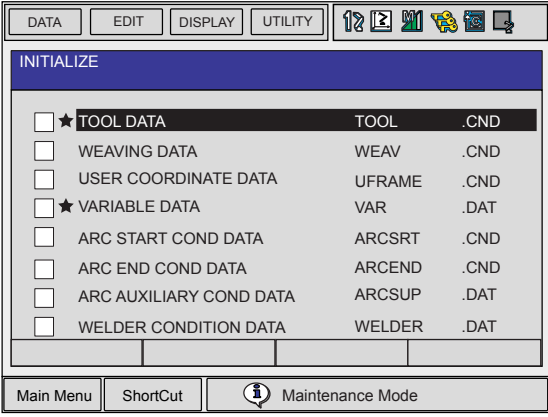
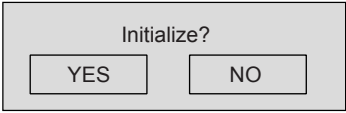
|   | Operation                   | Explanation   |
|---|-----------------------------|---|
| 1 | Select a parameter setting. | <p>Move the cursor to the parameter number data (decimal or binary) in the PARAMETER window, and press [SELECT].</p> <ul style="list-style-type: none"> <li>- To enter a decimal setting, select the decimal figure.</li> <li>- To enter a binary setting, select the binary figure.</li> </ul>   |
| 2 | Enter the value.            | <p>If a decimal figure is selected, enter a decimal value with the Numeric keys.</p>  <p>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.</p>  |
| 3 | Press [ENTER].              | <p>The new setting appears in the position where the cursor is located.</p>   |

## 9.18 File Initialize

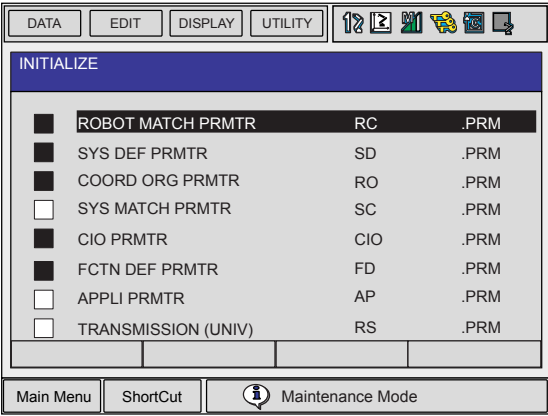
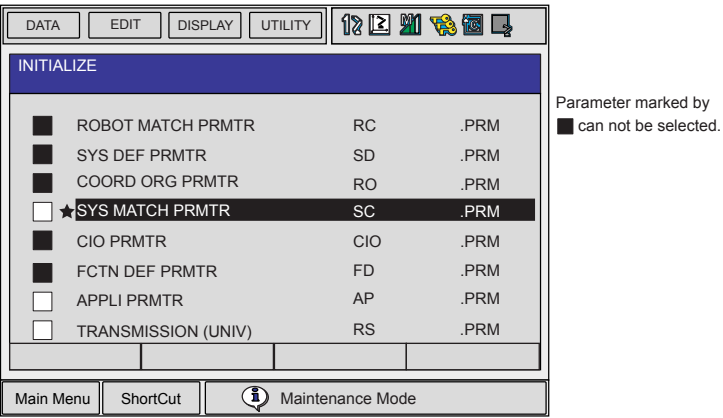
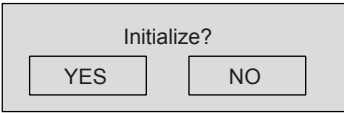
### 9.18.1 Initialize Job File

|   | Operation   | Explanation   |
|---|---|---|
| 1 | Turn the power supply ON again while pressing [MAIN MENU] simultaneously. |   |
| 2 | Change the security mode to management mode.                              |   |
| 3 | Select {FILE} under the main menu.  |   |
| 4 | Select {INITIALIZE}.  | <p>The INITIALIZE window is shown.</p>  <p>Item marked by ■ can not be selected.</p> |
| 5 | Select {JOB}.   | <p>The confirmation dialog box is shown.</p>                                        |
| 6 | Select "YES."   | Job data is initialized.  |

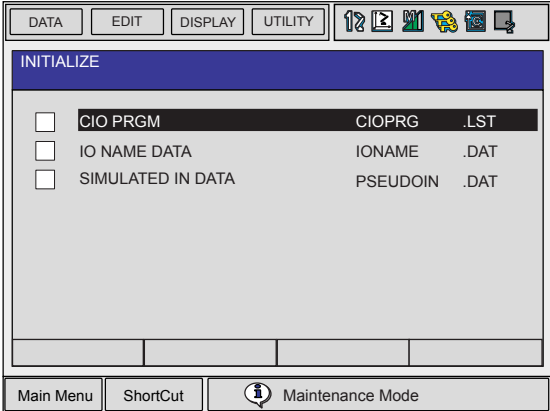
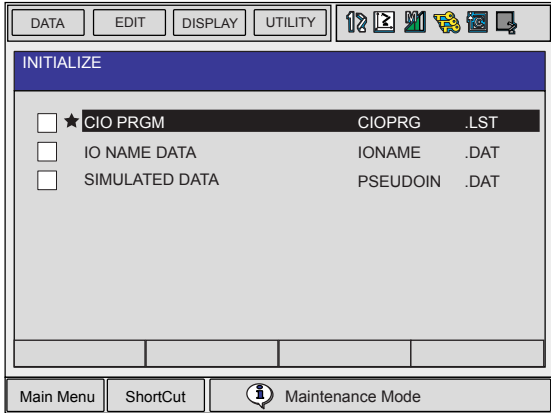
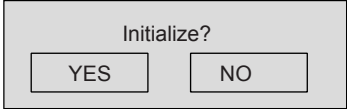
## 9.18.2 Initialize Data File

|                          | Operation   | Explanation   |                          |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
|--------------------------|---|---|--------------------------|-----------|------|------|--------------------------|--------------|------|------|--------------------------|----------------------|--------|------|--------------------------|---------------|-----|------|--------------------------|---------------------|--------|------|--------------------------|-------------------|--------|------|--------------------------|-------------------------|--------|------|--------------------------|-----------------------|--------|------|
| 1                        | Turn the power supply ON again while pressing [MAIN MENU] simultaneously. |   |                          |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| 2                        | Change the security mode to management mode.                              |   |                          |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| 3                        | Select {FILE} under the main menu.  |   |                          |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| 4                        | Select {INITIALIZE}.  |   |                          |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| 5                        | Select {FILE/GENERAL DATA}.   | <p>The INITIALIZE window is shown.</p>  <p>The screenshot shows a software window titled 'INITIALIZE' with a menu bar (DATA, EDIT, DISPLAY, UTILITY) and a toolbar. Below the title bar is a list of data files with checkboxes and file names. The 'TOOL DATA' row is highlighted in black. At the bottom of the window are buttons for 'Main Menu', 'ShortCut', and 'Maintenance Mode'.</p> <table border="1"> <thead> <tr> <th><input type="checkbox"/></th> <th>TOOL DATA</th> <th>TOOL</th> <th>.CND</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td>WEAVING DATA</td> <td>WEAV</td> <td>.CND</td> </tr> <tr> <td><input type="checkbox"/></td> <td>USER COORDINATE DATA</td> <td>UFRAME</td> <td>.CND</td> </tr> <tr> <td><input type="checkbox"/></td> <td>VARIABLE DATA</td> <td>VAR</td> <td>.DAT</td> </tr> <tr> <td><input type="checkbox"/></td> <td>ARC START COND DATA</td> <td>ARCSRT</td> <td>.CND</td> </tr> <tr> <td><input type="checkbox"/></td> <td>ARC END COND DATA</td> <td>ARCEND</td> <td>.CND</td> </tr> <tr> <td><input type="checkbox"/></td> <td>ARC AUXILIARY COND DATA</td> <td>ARCSUP</td> <td>.DAT</td> </tr> <tr> <td><input type="checkbox"/></td> <td>WELDER CONDITION DATA</td> <td>WELDER</td> <td>.DAT</td> </tr> </tbody> </table> | <input type="checkbox"/> | TOOL DATA | TOOL | .CND | <input type="checkbox"/> | WEAVING DATA | WEAV | .CND | <input type="checkbox"/> | USER COORDINATE DATA | UFRAME | .CND | <input type="checkbox"/> | VARIABLE DATA | VAR | .DAT | <input type="checkbox"/> | ARC START COND DATA | ARCSRT | .CND | <input type="checkbox"/> | ARC END COND DATA | ARCEND | .CND | <input type="checkbox"/> | ARC AUXILIARY COND DATA | ARCSUP | .DAT | <input type="checkbox"/> | WELDER CONDITION DATA | WELDER | .DAT |
| <input type="checkbox"/> | TOOL DATA   | TOOL  | .CND                     |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| <input type="checkbox"/> | WEAVING DATA  | WEAV  | .CND                     |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| <input type="checkbox"/> | USER COORDINATE DATA  | UFRAME  | .CND                     |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| <input type="checkbox"/> | VARIABLE DATA   | VAR   | .DAT                     |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| <input type="checkbox"/> | ARC START COND DATA   | ARCSRT  | .CND                     |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| <input type="checkbox"/> | ARC END COND DATA   | ARCEND  | .CND                     |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| <input type="checkbox"/> | ARC AUXILIARY COND DATA   | ARCSUP  | .DAT                     |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| <input type="checkbox"/> | WELDER CONDITION DATA   | WELDER  | .DAT                     |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| 6                        | Select data file for initializing.  | <p>The selected data file /General data is marked with "★".</p>  <p>The screenshot shows the same 'INITIALIZE' window as in step 5, but now the 'TOOL DATA' and 'VARIABLE DATA' rows are marked with a star (★) next to their checkboxes. A legend on the right indicates that files marked with a star cannot be selected.</p> <p>File/Data marked by ★ cannot be selected.</p>  |                          |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| 7                        | Press [ENTER].  | <p>The confirmation dialog box is shown.</p>  <p>The screenshot shows a simple dialog box with the title 'Initialize?' and two buttons: 'YES' and 'NO'.</p>   |                          |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |
| 8                        | Select "YES."   | Selected data file /General data is initialized.  |                          |           |      |      |                          |              |      |      |                          |                      |        |      |                          |               |     |      |                          |                     |        |      |                          |                   |        |      |                          |                         |        |      |                          |                       |        |      |

### 9.18.3 Initialize Parameter File

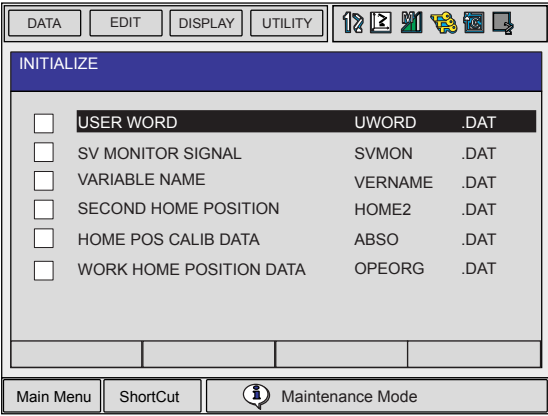
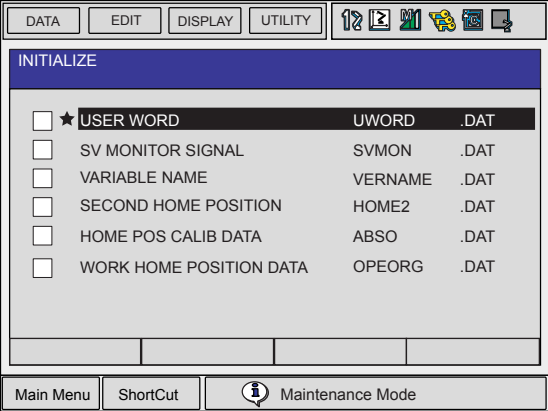
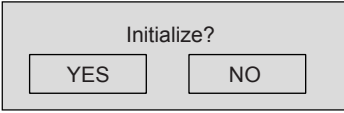
|   | Operation   | Explanation  |
|---|---|--|
| 1 | Turn the power supply ON again while pressing [MAIN MENU] simultaneously. |  |
| 2 | Change the security mode to management mode.                              |  |
| 3 | Select {FILE} under the main menu.  |  |
| 4 | Select {INITIALIZE}.  |  |
| 5 | Select {PARAMETER}.   | <p>The parameter selection window is shown.</p>     |
| 6 | Select parameter for initializing.  | <p>The selected parameter is marked with “★”.</p>  |
| 7 | Press [ENTER].  | <p>The confirmation dialog box is shown.</p>       |
| 8 | Select “YES.”   | Selected parameter is initialized.   |

## 9.18.4 Initializing I/O Data

|   | Operation   | Explanation  |
|---|---|--|
| 1 | Turn the power supply ON again while pressing [MAIN MENU] simultaneously. |  |
| 2 | Change the security mode to management mode.                              |  |
| 3 | Select {FILE} under the main menu.  |  |
| 4 | Select {INITIALIZE}.  |  |
| 5 | Select {I/O DATA}.  | <p>The I/O data selection window is shown.</p>    |
| 6 | Select data for initializing.   | <p>The selected data is marked with “★”.</p>  <p>Parameters marked by ★ can not be selected.</p> |
| 7 | Press [ENTER].  | <p>The confirmation dialog box is shown.</p>   |
| 8 | Select “YES.”   | The selected data is initialized.  |




## 9.18.5 Initializing System Data

|   | Operation   | Explanation   |
|---|---|---|
| 1 | Turn the power supply ON again while pressing [MAIN MENU] simultaneously. |   |
| 2 | Change the security mode to management mode.                              |   |
| 3 | Select {FILE} under the main menu.  |   |
| 4 | Select {INITIALIZE}.  |   |
| 5 | Select {SYSTEM DATA}.   | <p>The system data selection window is shown.</p>    |
| 6 | Select the parameter to be initialized.                                   | <p>The selected data is marked with "★".</p>  <p>Parameter marked by ★ can not be selected.</p> |
| 7 | Press [ENTER].  | <p>The confirmation dialog box is shown.</p>    |
| 8 | Select "YES."   | The selected data is initialized.   |

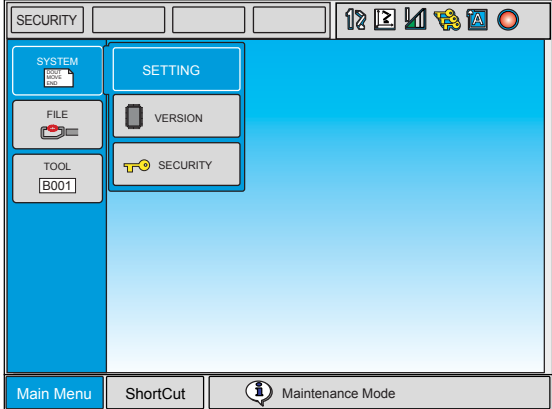
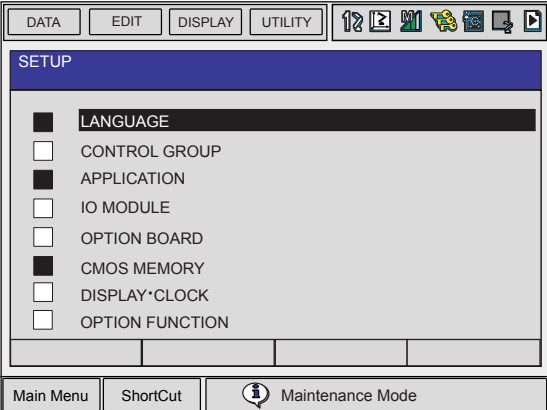
# 10 Modification of System Configuration

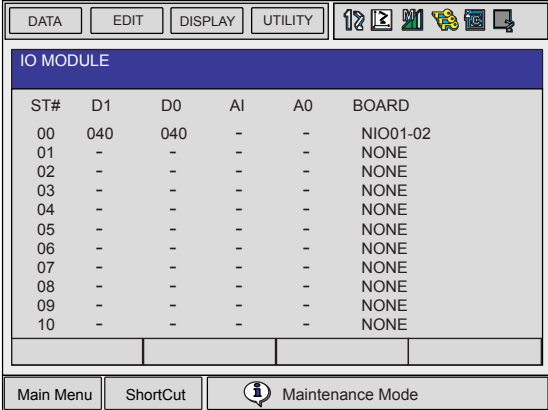
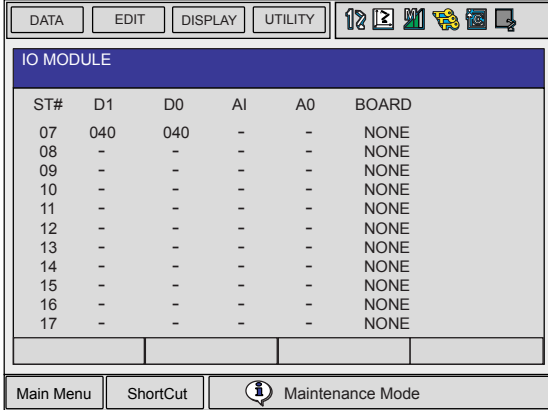
## 10.1 Addition of I/O Modules

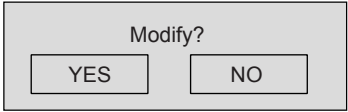
For addition of I/O modules, turn the power supply off.



The additional operation must be done in the management mode.  
In operation mode or editing mode, only reference of status setting is possible.

|   | Operation   | Explanation  |
|---|---|--|
| 1 | Turn the power supply ON again while pressing [MAIN MENU] simultaneously. |  |
| 2 | Change the "SECURITY MODE" to the "MANAGEMENT MODE."                      |  |
| 3 | Select {SYSTEM} under the main menu.                                      | <p>The system window is shown.</p>   |
| 4 | Select {SETUP}.   | <p>The SETUP window is shown.</p>  <p style="font-size: small;">Item marked by <input checked="" type="checkbox"/> can not be set.</p> |

|       | Operation                                 | Explanation  |     |                               |          |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
|-------|---|--|-----|-------------------------------|----------|-------------------------------------|----|--------------------------------------|----|------------------------------------|-----|-------------------------------------|-------|-------------------------|----|---|---|---|---|------|----|---|---|---|---|------|----|---|---|---|---|------|----|---|---|---|---|------|----|---|---|---|---|------|----|---|---|---|---|------|----|---|---|---|---|------|----|---|---|---|---|------|----|---|---|---|---|------|----|---|---|---|---|------|
| 5     | Select {IO MODULE}.                       | <p>The current status of the mounted I/O module is shown.</p>  <table border="1"> <thead> <tr> <th>ST#</th> <th>D1</th> <th>D0</th> <th>AI</th> <th>A0</th> <th>BOARD</th> </tr> </thead> <tbody> <tr> <td>00</td> <td>040</td> <td>040</td> <td>-</td> <td>-</td> <td>NIO01-02</td> </tr> <tr> <td>01</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>02</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>03</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>04</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>05</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>06</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>07</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>08</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>09</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>10</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> </tbody> </table>  | ST# | D1                            | D0       | AI                                  | A0 | BOARD                                | 00 | 040                                | 040 | -                                   | -     | NIO01-02                | 01 | - | - | - | - | NONE | 02 | - | - | - | - | NONE | 03 | - | - | - | - | NONE | 04 | - | - | - | - | NONE | 05 | - | - | - | - | NONE | 06 | - | - | - | - | NONE | 07 | - | - | - | - | NONE | 08 | - | - | - | - | NONE | 09 | - | - | - | - | NONE | 10 | - | - | - | - | NONE |
| ST#   | D1  | D0   | AI  | A0                            | BOARD    |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 00    | 040                                       | 040  | -   | -                             | NIO01-02 |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 01    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 02    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 03    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 04    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 05    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 06    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 07    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 08    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 09    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 10    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 6     | Confirm the status of mounted I/O module. | <p>Confirm that each station (ST#) window is the same as the I/O module's actual mounting status.<br/>The following information is shown for each station.</p> <table border="1"> <thead> <tr> <th>ST#</th> <th>Station address of I/O module</th> </tr> </thead> <tbody> <tr> <td>DI</td> <td>Number of contact input points (*1)</td> </tr> <tr> <td>DO</td> <td>Number of contact output points (*1)</td> </tr> <tr> <td>AI</td> <td>Number of analog input points (*1)</td> </tr> <tr> <td>AO</td> <td>Number of analog output points (*1)</td> </tr> <tr> <td>BOARD</td> <td>Circuit board type (*2)</td> </tr> </tbody> </table> <p><b>*1</b> A hyphen, -, indicates that the corresponding I/O section is not mounted.<br/><b>*2</b> If the system cannot recognize the circuit board type, a row of stars (*****) are shown.<br/>No problem will occur as long as the values displayed in DI, DO, AI, and AO are correct.</p>  | 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) |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 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)                   |  |     |                               |          |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 7     | Press [ENTER].                            | <p>Confirm the statuses of the mounted I/O modules for the other stations.</p> <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE</b> If the slot window is different, confirm the status again. If the status is correct, the I/O module may be defective. Contact your Yaskawa representative.</p> </div>  <table border="1"> <thead> <tr> <th>ST#</th> <th>D1</th> <th>D0</th> <th>AI</th> <th>A0</th> <th>BOARD</th> </tr> </thead> <tbody> <tr> <td>07</td> <td>040</td> <td>040</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>08</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>09</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>10</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>11</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>12</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>13</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>14</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>15</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>16</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> <tr> <td>17</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>NONE</td> </tr> </tbody> </table> | ST# | D1                            | D0       | AI                                  | A0 | BOARD                                | 07 | 040                                | 040 | -                                   | -     | NONE                    | 08 | - | - | - | - | NONE | 09 | - | - | - | - | NONE | 10 | - | - | - | - | NONE | 11 | - | - | - | - | NONE | 12 | - | - | - | - | NONE | 13 | - | - | - | - | NONE | 14 | - | - | - | - | NONE | 15 | - | - | - | - | NONE | 16 | - | - | - | - | NONE | 17 | - | - | - | - | NONE |
| ST#   | D1  | D0   | AI  | A0                            | BOARD    |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 07    | 040                                       | 040  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 08    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 09    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 10    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 11    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 12    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 13    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 14    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 15    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 16    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |
| 17    | -   | -  | -   | -                             | NONE     |                                     |    |                                      |    |                                    |     |                                     |       |                         |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |    |   |   |   |   |      |

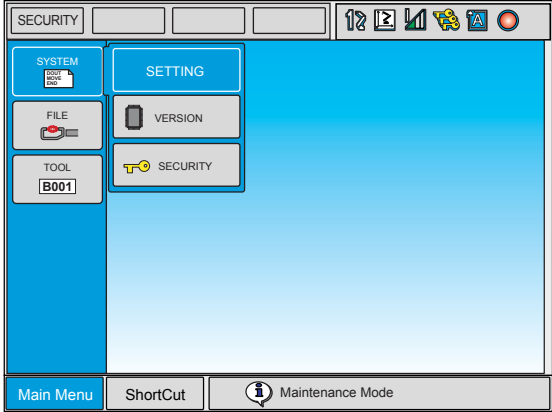
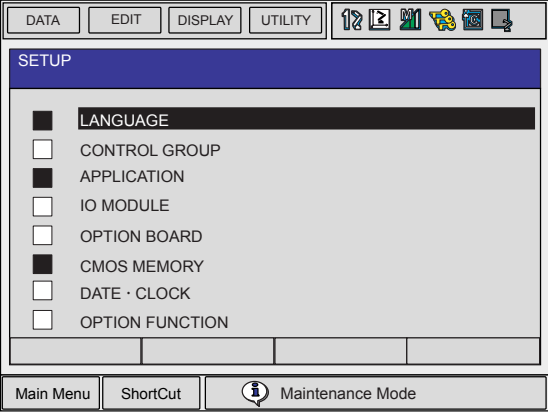

|   | Operation      | Explanation  |
|---|----------------|--|
| 8 | Press [ENTER]. | The confirmation dialog box is shown.<br>                                      |
| 9 | Select "YES."  | The system parameters are then set automatically according to the current mounted hardware status. The procedure for the addition of the I/O module is complete. |

## 10.2 Addition of Base and Station Axis

For addition of base and station axis, mount all hardware correctly and then execute maintenance mode.



The additional operation must be done in the management mode.  
In operation mode or editing mode, only reference of status setting is possible.

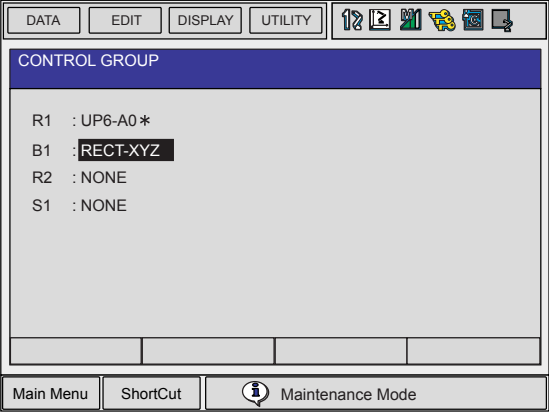
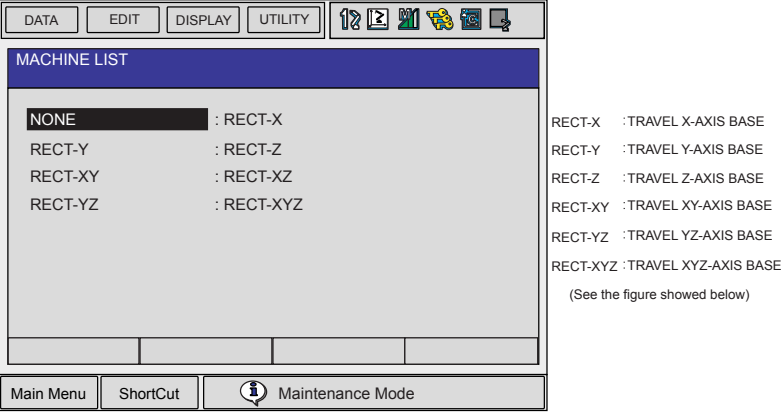
|   | Operation   | Explanation  |
|---|---|--|
| 1 | Turn the power supply ON again while pressing [MAIN MENU] simultaneously. |  |
| 2 | Change the "SECURITY MODE" to the "MANAGEMENT MODE."                      |  |
| 3 | Select {SYSTEM} under the main menu.                                      | <p>The system window is shown.</p>    |
| 4 | Select {SETUP}.   | <p>The SETUP window is shown.</p>  <p>Item marked by  can not be set.</p> |

|   | Operation  | Explanation  |
|---|--|--|
| 5 | Select {CONTROL GROUP}.<br>(Display moves to the control group display.) | <p>The window moves to the CONTROL GROUP window shown in the followings pages.</p> <p>The following items must be set for base and station axes.</p> <p>-TYPE<br/>Select one in the type list.</p> <p><b>In case of base axis (B1,B2,B3)</b><br/>Select one of RECT-X, -Y, -Z, -XY, -XZ, -YZ or -XYZ.</p> <p><b>In case of station axis (S1,S2,S3,S4,S5,S6)</b><br/>Select one of TURN-1, -2.</p> <p><b>In case of other type, select one of UNIV-1, -2, -3, -4, -5, -6</b></p> <p>-CONNECTION<br/>In the CONNECTION window, specify the SERVOPACK which is connected with each axis group and the contactor which is used for the SERVOPACK.</p> <p>-AXIS TYPE<br/>Select one in the axis type list.</p> <p><b>In case of TURN-* type</b><br/>No need to select (The axis type is set as TURN type.)</p> <p><b>In case of RECT-* type</b><br/>Select BALL-SCREW type or RACK &amp; PINION type.</p> |

|   | Operation | Explanation   |
|---|-----------|---|
| 5 |           | <p><b>In case of UNIV-* type</b><br/>           Select BALL-SCREW type, RACK &amp; PINION type or TURN type.</p> <p>-MECHANICAL SPECIFICATION<br/>           If axis type is ball-screw type, set the following items.</p> <p>MOTION RANGE (+) [mm]<br/>           MOTION RANGE (-) [mm]<br/>           REDUCTION RATIO (numerator)<br/>           REDUCTION RATIO (denominator)<br/>           BALL-SCREW PITCH [mm/r]</p> <p>If axis type is rack &amp; pinion type, set the following items.</p> <p>MOTION RANGE (+) [mm]<br/>           MOTION RANGE (-) [mm]<br/>           REDUCTION RATIO (numerator)<br/>           REDUCTION RATIO (denominator)<br/>           PINION DIAMETER [mm]</p> <p>If axis type is turn type, set the following items.</p> <p>MOTION RANGE (+) [deg]<br/>           MOTION RANGE (-) [deg]<br/>           REDUCTION RATIO (numerator)<br/>           REDUCTION RATIO (denominator)<br/>           OFFSET (1st and 2nd axis) [mm]</p> <p>-MOTOR SPECIFICATION<br/>           Set the following items.</p> <p>MOTOR<br/>           SERVO AMP<br/>           CONVERTER<br/>           ROTATION DIRECTION [NORMAL/REVERSE]<br/>           MAX. RPM [rpm]<br/>           ACCELERATION SPEED [sec]<br/>           INERTIA RATIO</p> <p>* Select MOTOR, AMPLIFIER and CONVERTER from each type's list.</p> |

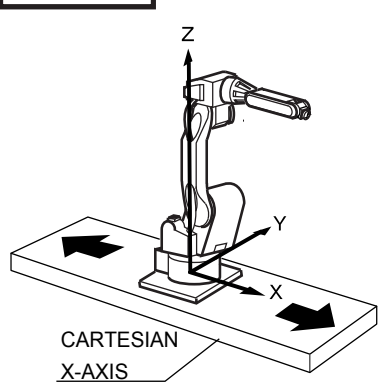
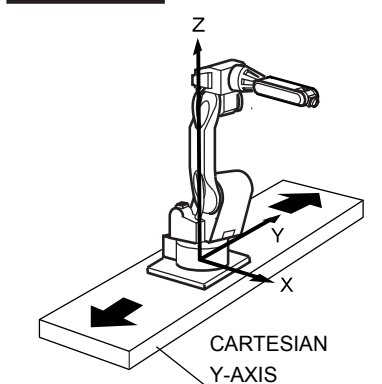
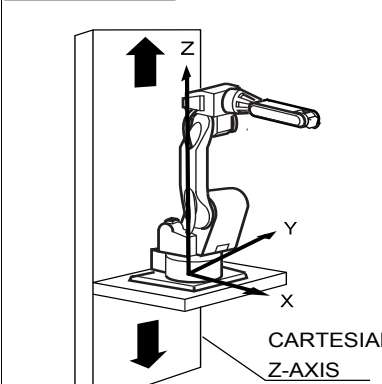
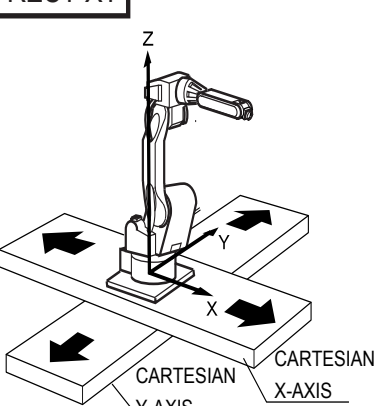
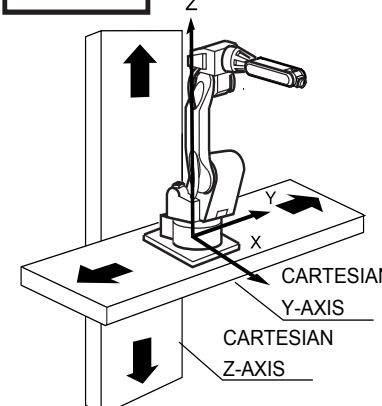
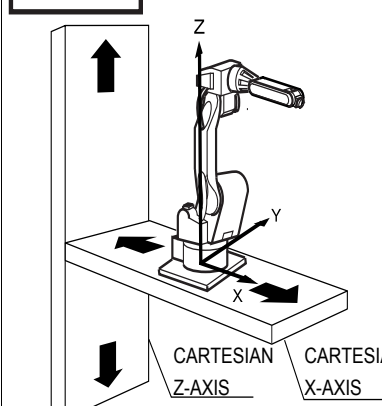
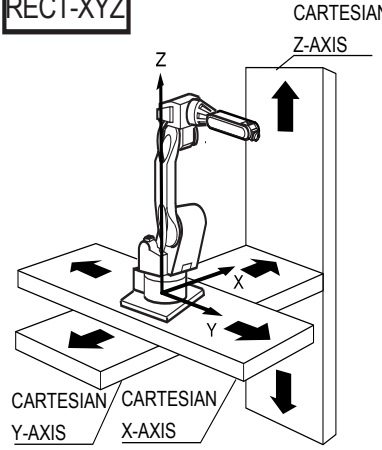
### 10.2.1 Base Axis Setting

First, select control group type

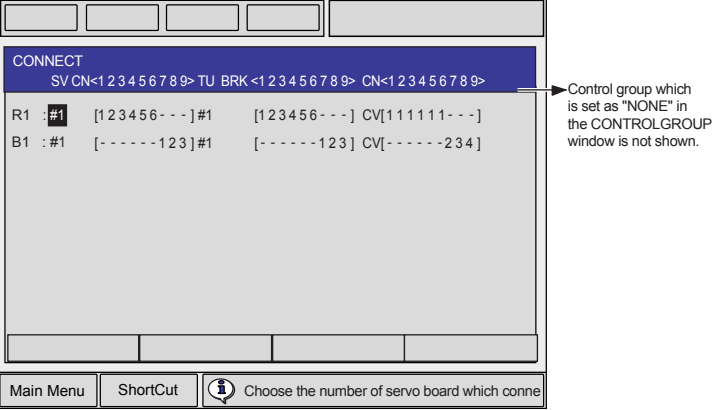
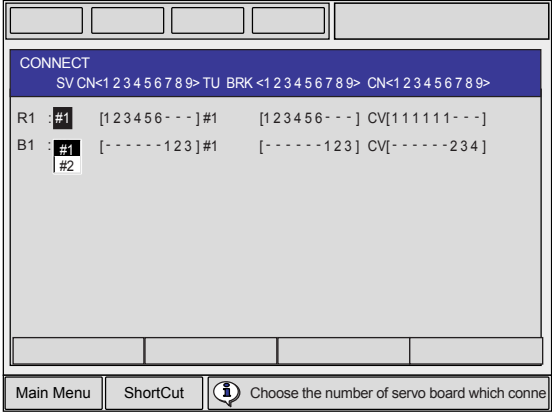
|   | Operation  | Explanation  |
|---|--|--|
| 1 | Confirm the type of control group in CONTROL GROUP window. | The type of the control group is shown.  |
| 2 | Select type of control group for changing.                 | The MACHINE LIST window is shown.       |
| 3 | Select one in the type list.                               | After the type selection, the window returns to CONTROL GROUP window.  |
| 4 | Press [ENTER] in CONTROL GROUP window.                     | The window moves to the CONNECTION window.   |



Direction of Base Axis

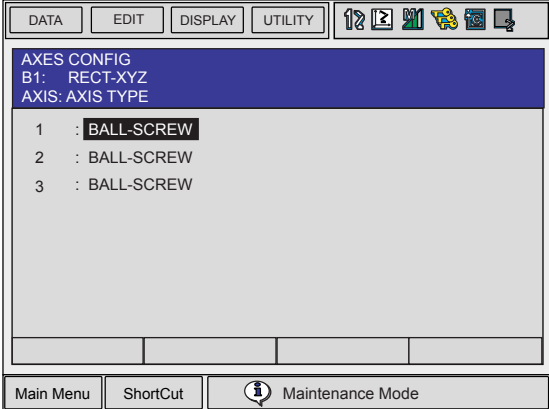
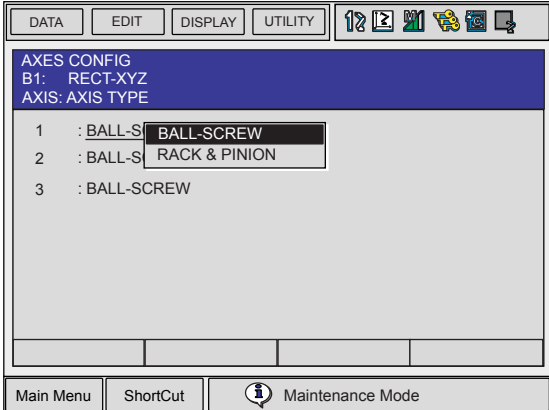
|   |   |  |
|---|---|--|
| <p><b>RECT-X</b></p>  <p>CARTESIAN X-AXIS</p> <p>Base axis direction of travel coincides with robot coordinate X-Axis.</p>   | <p><b>RECT-Y</b></p>  <p>CARTESIAN Y-AXIS</p> <p>Base axis direction of travel coincides with robot coordinate Y-Axis.</p>   | <p><b>RECT-Z</b></p>  <p>CARTESIAN Z-AXIS</p> <p>Base axis direction of travel coincides with robot coordinate Z-Axis.</p>   |
| <p><b>RECT-XY</b></p>  <p>CARTESIAN X-AXIS<br/>CARTESIAN Y-AXIS</p> <p>Base 1st and 2nd axes directions of travel coincide with robot coordinate X-Axis and Y-Axis, respectively.</p>                                       | <p><b>RECT-YZ</b></p>  <p>CARTESIAN Y-AXIS<br/>CARTESIAN Z-AXIS</p> <p>Base 1st and 2nd axes directions of travel coincide with robot coordinate Y-Axis and Z-Axis, respectively.</p> | <p><b>RECT-XZ</b></p>  <p>CARTESIAN X-AXIS<br/>CARTESIAN Z-AXIS</p> <p>Base 1st and 2nd axes directions of travel coincide with robot coordinate X-Axis and Z-Axis, respectively.</p> |
| <p><b>RECT-XYZ</b></p>  <p>CARTESIAN X-AXIS<br/>CARTESIAN Y-AXIS<br/>CARTESIAN Z-AXIS</p> <p>Base 1st, 2nd, and 3rd axes directions of travel coincide with robot coordinate X-Axis, Y-Axis, and Z-Axis, respectively.</p> |   |  |

In the CONNECTION windows, each axes in respective control groups are specified to be connected to which connector of the SERVO board, or to which brake of the contactor unit, or to which converter.

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Confirm type of each control group in the CONNECTION window. | <p>The connection status of each control group is shown.</p>    |
| 2 | Select connection item of desired control group.             | <p>The items which can be set are shown. When the item is selected, the window returns to the CONNECTION window.</p>  <p>-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 [ ] means axis number, and it indicates which axis is to be connected with which connector.</p> <p>-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 [ ] means axis number, and it indicates which axis is to be connected with which brake.</p> <p>-It is possible to change the connection freely between each axis of each control group and each converter (CV). The number in [ ] means converter number, and it indicates which axis is to be connected with which converter.</p> |

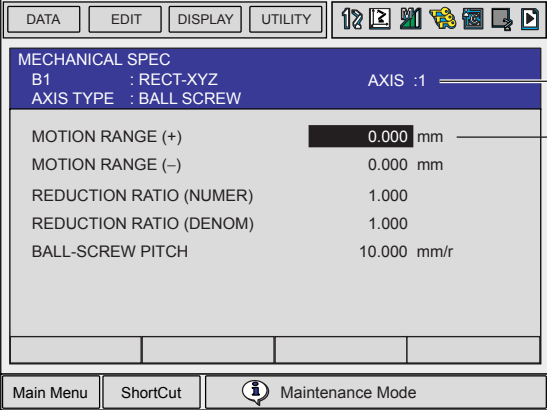
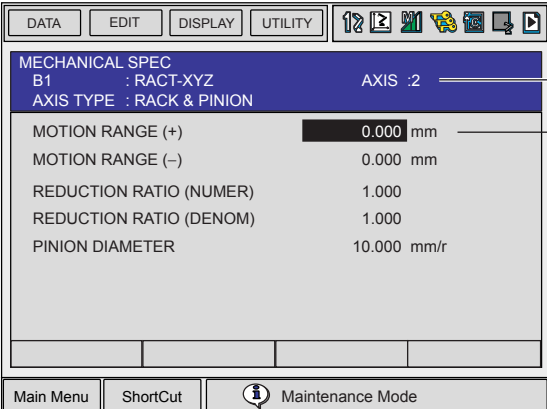
|   | Operation   | Explanation  |
|---|---|--|
| 2 | (Cont'd) Select connection item of desired control group. | <p>The axes are connected as shown in the following manner:</p> <p>R1(Robot)</p> <p>1st axis → SERVO Board (SV #1), Connector (1CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK1)<br/>           Converter (CV #1)</p> <p>2nd axis→ SERVO Board (SV #1), Connector (2CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK2)<br/>           Converter (CV #1)</p> <p>3rd axis → SERVO Board (SV #1), Connector (3CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK3)<br/>           Converter (CV #1)</p> <p>4th axis → SERVO Board (SV #1), Connector (4CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK4)<br/>           Converter (CV #1)</p> <p>5th axis → SERVO Board (SV #1), Connector (5CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK5)<br/>           Converter (CV #1)</p> <p>6th axis → SERVO Board (SV #1), Connector (6CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK6)<br/>           Converter (CV #1)</p> <p>B1(Base)</p> <p>1st axis → SERVO Board (SV #1), Connector (7CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK7)<br/>           Converter (CV #2)</p> <p>2nd axis→ SERVO Board (SV #1), Connector (8CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK8)<br/>           Converter (CV #3)</p> <p>3rd axis → SERVO Board (SV #1), Connector (9CN)<br/>           Contactor Unit (TU #1), Brake Connector (BRK9)<br/>           Converter (CV #4)</p> |
| 3 | Select 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.  |

In the AXES CONFIG window, the axis type are specified.

|   | Operation   | Explanation   |
|---|---|---|
| 1 | Confirm axis type of each axis in the AXES CONFIG window. | <p>The axis type of each axis is shown.</p>  <p>The screenshot shows the 'AXES CONFIG' window with a blue header. Below the header, it displays 'B1: RECT-XYZ' and 'AXIS: AXIS TYPE'. A list shows three axes, each with 'BALL-SCREW' selected in a black box. The window has a menu bar with 'DATA', 'EDIT', 'DISPLAY', and 'UTILITY', and a bottom bar with 'Main Menu', 'ShortCut', and 'Maintenance Mode'.</p>  |
| 2 | Select desired axis type.                                 | <p>The axis type which can be set is shown.</p>  <p>The screenshot shows the 'AXES CONFIG' window with a selection menu open for axis 1. The menu lists 'BALL-SCREW' and 'RACK &amp; PINION'. The other two axes are still set to 'BALL-SCREW'. The window layout is the same as in the previous screenshot.</p> <p>The travel axis of ball-screw type should be selected as “ BALL-SCREW ”, the one of rack &amp; pinion type should be selected as “ RACK &amp; PINION ”. Then the window returns to the AXES CONFIG window.</p> |
| 3 | Select 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.  |

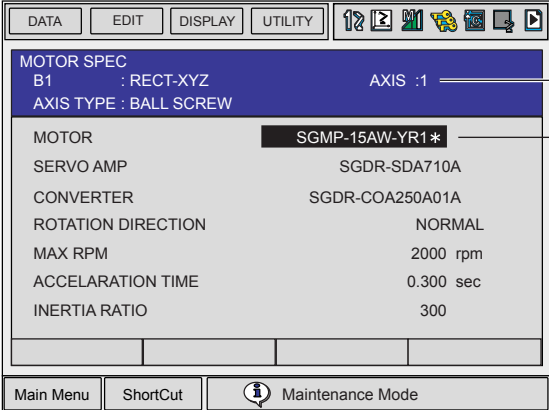
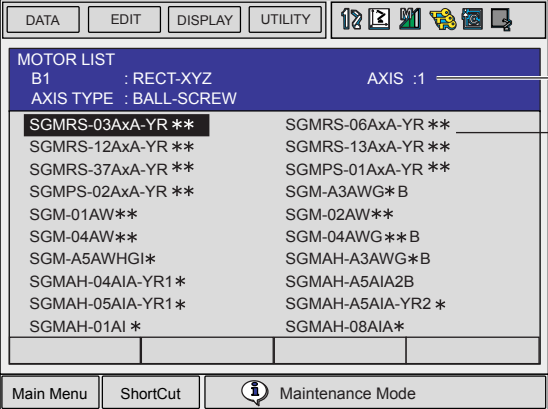
10.2 Addition of Base and Station Axis

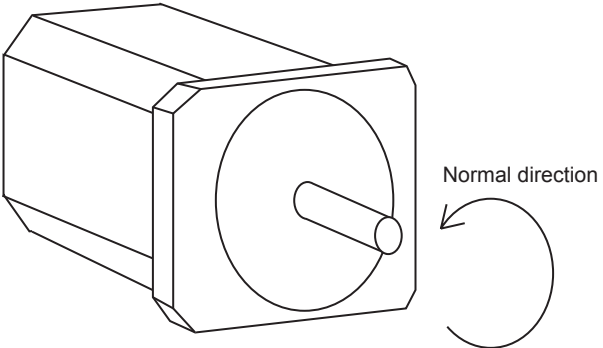
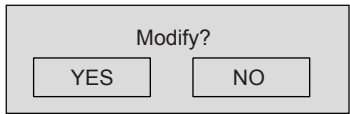
In the MECHANICAL SPEC window, mechanical data are specified.

|   | Operation   | Explanation   |
|---|---|---|
| 1 | Confirm specification of each axis in the MECHANICAL SPEC window. | <p>The mechanical specification of axis is shown.</p> <p>The MECHANICAL SPEC window (In case of BALL-SCREW type)</p>  <p>Group, Type, Axis Number and Axis Type selected currently are shown.</p> <p>The cursor is reserved.</p> <p>MOTION RANGE: Input maximum moving position (+ direction and - direction) from home position. (Unit: mm)</p> <p>REDUCTION RATIO: Input the numerator and the denominator.<br/>         &lt;e.g.&gt; If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.</p> <p>BALL-SCREW PITCH: Input the traveling length when the ball-screw rotates once. (Unit: mm/r)</p> <p>The MECHANICAL SPEC window (In case of RACK &amp; PINION type)</p>  <p>Group, Type, Axis Number and Axis Type selected currently are shown.</p> <p>The cursor is reserved.</p> <p>MOTION RANGE: Input maximum moving position (+ direction and - direction) from home position. (Unit: mm)</p> <p>REDUCTION RATIO: Input the numerator and the denominator.<br/>         &lt;e.g.&gt;If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.</p> <p>PINION DIAMETER :Input the diameter of a pinion. (Unit: mm)</p> |
| 2 | Select desired item.  |   |
| 3 | Change the setting contents.                                      |   |

|   | Operation                                    | Explanation  |
|---|--|--|
| 4 | Press [ENTER] in the MECHANICAL SPEC window. | After this setting, the window moves to the next axis. Set them for all axes.<br>When [ENTER] is pressed in the MECHANICAL SPEC window for last axis the setting in the MECHANICAL SPEC window is completed and the window moves to the MOTOR SPEC window. |

In the MOTOR SPEC display, motor data are specified.

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Confirm specification of each axis in the MOTOR SPEC window. | <p>The motor specification of each axis is shown.</p>  <p>Group, Type, Axis Number and Axis Type selected currently are shown.</p> <p>The cursor is reserved.</p>  |
| 2 | Select desired item.   | <p>When an item which is input by number is selected the number input buffer line is shown.</p> <p>When MOTOR (or SERVO AMP or CONVERTER) is selected, the list window of MOTOR (SERVO AMP, or CONVERTER) is shown.</p>  <p>Group, Type, Axis Number and Axis Type selected currently are shown.</p> <p>The type list registered in ROM is shown.</p> |

|   | Operation                                    | Explanation  |
|---|--|--|
| 2 |  | <p>ROTATION DIRECTION : Set the rotation direction to which the current position is increased. (The counterclockwise view from the loaded side is positioned normal.)</p>  <p>AC Servo Motor</p> <p>MAX. RPM: Input maximum rotation speed of a motor. (Unit: rpm)<br/>           ACCELARATION SPEED: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)<br/>           INERTIA RATIO: " 300 " when in case of travel axis or " 0 " when in case of rotation axis is set as initial value. But if the following phenomenon occurs in motion, deal with the followed procedure.<br/>           &lt;Phenomenon1&gt; During motion, the axis moves unsteady on advance direction.<br/>           → Confirm the motion with increasing this ratio in each 100.<br/>           &lt;Phenomenon2&gt; during pause, the motor makes a lot of noise.<br/>           → Confirm the motion with decreasing this ratio in each 100.</p> |
| 3 | Change the setting contents.                 |  |
| 4 | Press [ENTER] in the MECHANICAL SPEC window. | <p>After this motor specification setting, the display moves to the next axis. Set them for all axes.<br/>           When [ENTER] is pressed at the MOTOR SPEC window for last axis, the setting in this display is completed and the confirmation dialog box is shown.</p>  <p>If " YES " is selected, the system parameter is set automatically.<br/>           The addition of the base axis setting is complete.</p>   |



## CAUTION

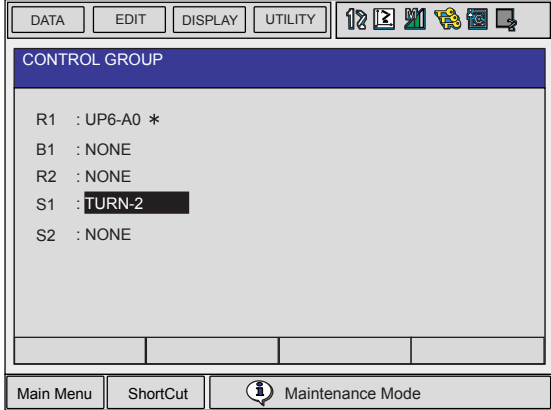
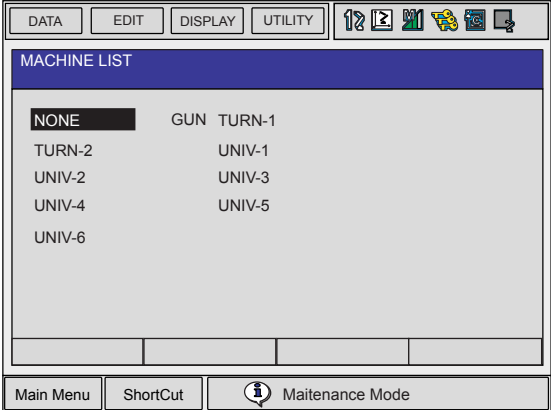
If the control axis configuration is changed by addition a base axis or station axis, the internal data of the job file are also changed so that the job file data should be initialized. Initialize the job file data with the procedure “File Initialize” in this manual after changing the construction.

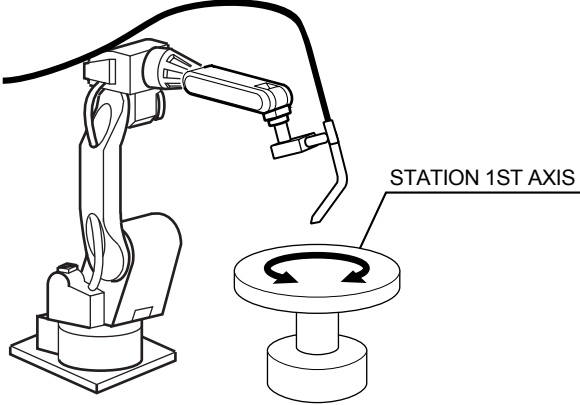
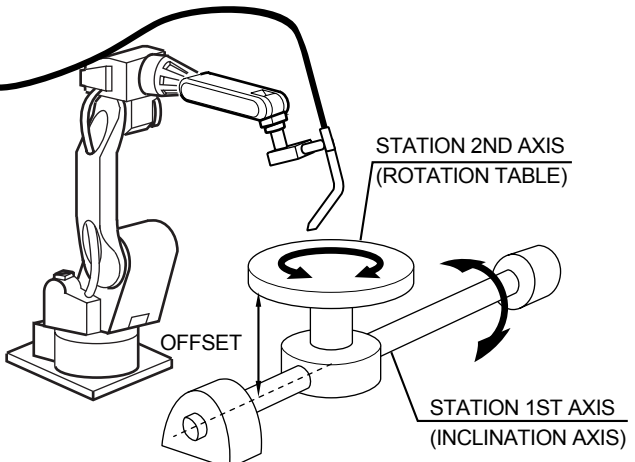
When the data, for example motion range, must be changed after the addition of a base axis or station axis, the change can be done with the same procedure shown above.

In that case, the control axis configuration is not changed so the job file data should not be initialized.

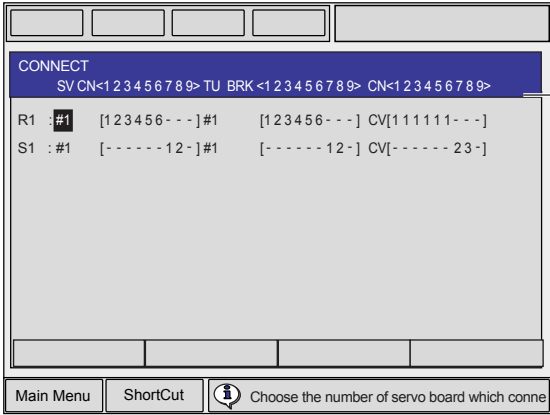
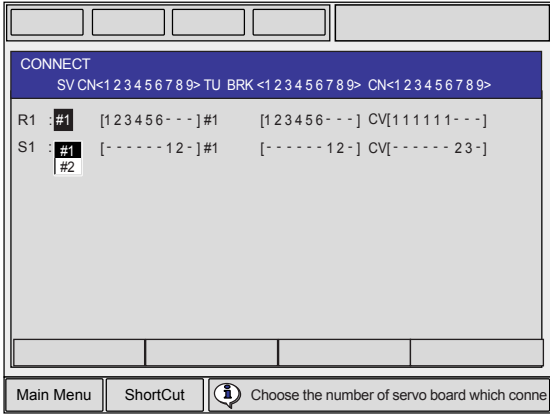


## 10.2.2 Station Axis Setting

|   | Operation  | Explanation   |
|---|--|---|
| 1 | Confirm the type of control group in CONTROL GROUP window. | <p>The CONTROL GROUP window is shown.</p>   |
| 2 | Select type of control group for changing.                 | <p>The MACHINE LIST window is shown.</p>  <p>TURN-1:TURN 1 AXIS STATION<br/>         TURN-2:TURN 2 AXES STATION<br/>         UNIV-1: UNIVERSAL 1 AXIS STATION<br/>         UNIV-2: UNIVERSAL 2 AXES STATION<br/>         ...</p> |

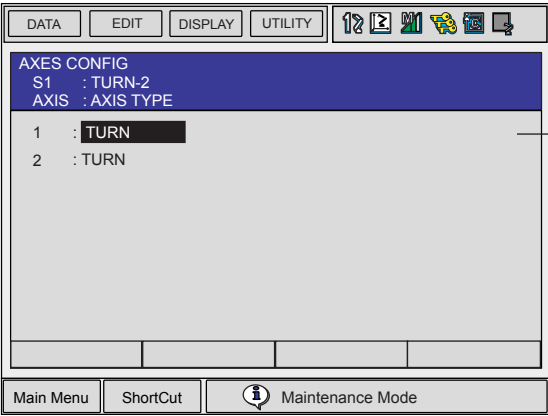
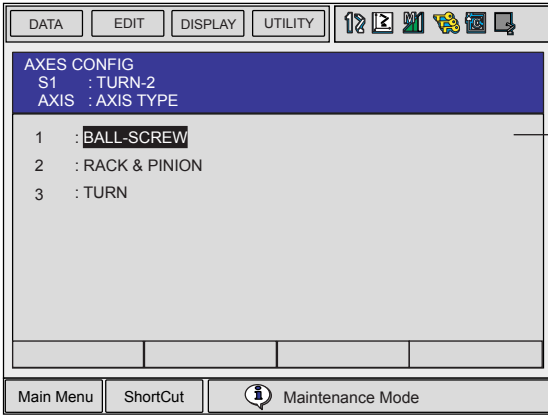
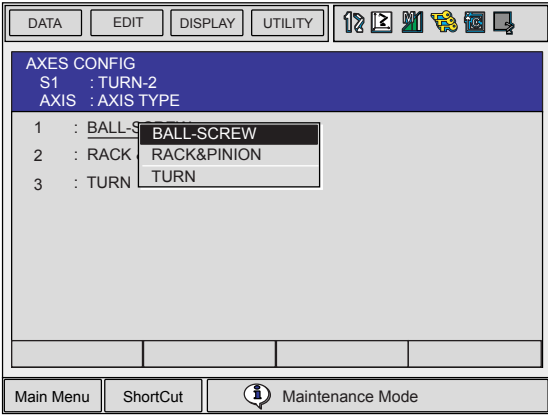
|   | Operation                              | Explanation  |
|---|--|--|
| 3 | Select desired type in the type list.  | <p>After the type selection, the window returns to CONTROL GROUP window.</p> <p>When the station axis is not "TURN-1" and "TURN-2" (like a travel axis) "UNIVERSAL" should be selected. When "UNIVERSAL" is selected, interpolation motion (linear, circular, etc.) is not supported.</p> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 10px;">TURN-1</div>  <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 10px;">TURN-2</div>  <p>If the number of axes is set beyond 27, error occurs.</p> |
| 4 | Press [ENTER] in CONTROL GROUP window. | The setting in the CONTROL GROUP window is completed and the window moves to the CONNECTION window.  |

In the CONNECTION windows, each axes in respective control groups are specified to be connected to which connector of the SERVO board, or to which brake of the contactor unit, or to which converter.

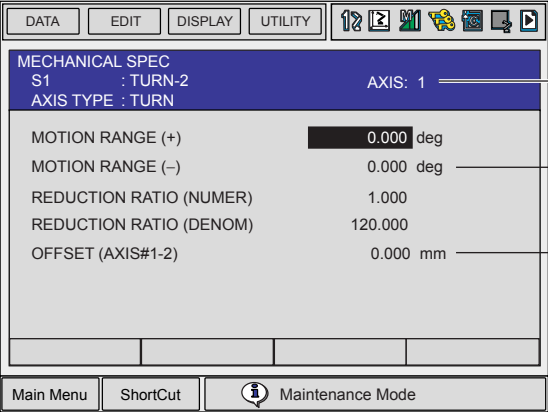
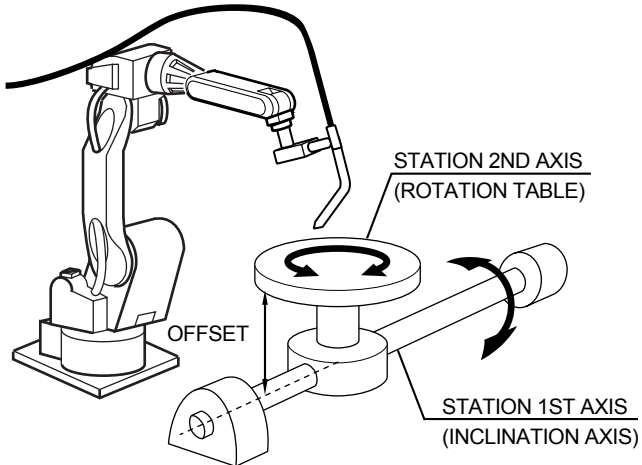
|   | Operation  | Explanation  |
|---|--|--|
| 1 | Confirm type of each control group in the CONNECTION window. | <p>Connection status of each control group is shown.</p>   |
| 2 | Select connection item of desired control group.             | <p>The items which can be set are shown. When the item is selected, the window returns to the CONNECTION window.</p>  <p>-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 [ ] means axis number, and it indicates which axis is to be connected with which connector.</p> <p>-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 [ ] means axis number, and it indicates which axis is to be connected with which brake.</p> <p>-It is possible to change the connection freely between each axis of each control group and each converter (CV). The number in [ ] means converter number, and it indicates which axis is to be connected with which converter.</p> |

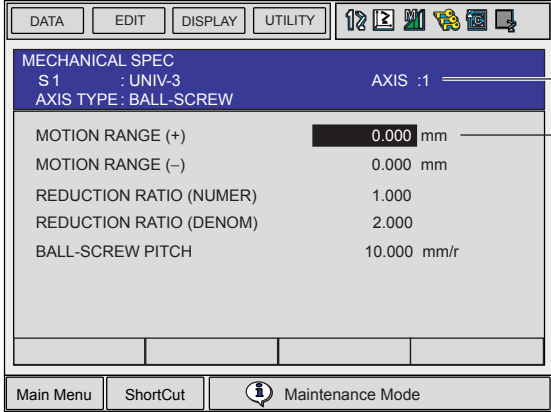
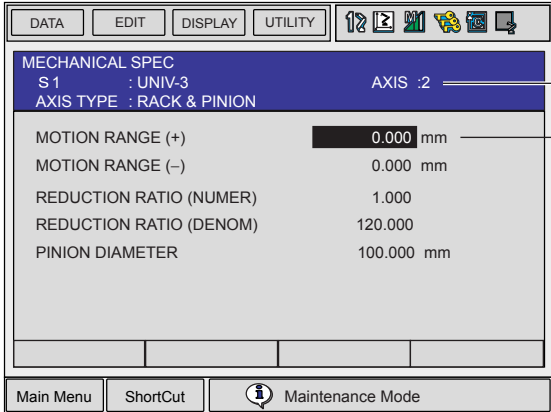
|   | Operation   | Explanation   |
|---|---|---|
| 2 | (Cont'd) Select connection item of desired control group. | <p>The axes are connected as shown in the following manner:</p> <p>R1(Robot)</p> <p>1st axis → SERVO Board (SV #1), Connector (1CN)<br/> Contactor Unit (TU #1), Brake Connector (BRK1)<br/> Converter (CV #1)</p> <p>2nd axis→ SERVO Board (SV #1), Connector (2CN)<br/> Contactor Unit (TU #1), Brake Connector (BRK2)<br/> Converter (CV #1)</p> <p>3rd axis → SERVO Board (SV #1), Connector (3CN)<br/> Contactor Unit (TU #1), Brake Connector (BRK3)<br/> Converter (CV #1)</p> <p>4th axis → SERVO Board (SV #1), Connector (4CN)<br/> Contactor Unit (TU #1), Brake Connector (BRK4)<br/> Converter (CV #1)</p> <p>5th axis → SERVO Board (SV #1), Connector (5CN)<br/> Contactor Unit (TU #1), Brake Connector (BRK5)<br/> Converter (CV #1)</p> <p>6th axis → SERVO Board (SV #1), Connector (6CN)<br/> Contactor Unit (TU #1), Brake Connector (BRK6)<br/> Converter (CV #1)</p> <p>S1(Station)</p> <p>1st axis → SERVO Board (SV #1), Connector (7CN)<br/> Contactor Unit (TU #1), Brake Connector (BRK7)<br/> Converter (CV #2)</p> <p>2nd axis→ SERVO Board (SV #1), Connector (8CN)<br/> Contactor Unit (TU #1), Brake Connector (BRK8)<br/> Converter (CV #3)</p> |
| 3 | Select 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.   |

In the AXES CONFIG window, the axis type and motor type are specified.

|   | Operation   | Explanation  |
|---|---|--|
| 1 | Confirm axis type of each axis in the AXES CONFIG window. | <p>The axis type of each axis is shown.</p> <p>The AXES CONFIG window (In case of TURN type)</p>  <p>The AXES CONFIG window (In case of UNIVERSAL type)</p>                               |
| 2 | Select desired axis.                                      | <p>The axis types which can be set are shown.</p>  <p>The travel axis for the ball-screw type should be selected as “ BALL-SCREW ”, the one for rack &amp; pinion type should be selected as “ RACK &amp; PINION ”. Then the window returns to the AXES CONFIG window.</p> |
| 3 | Select 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.   |

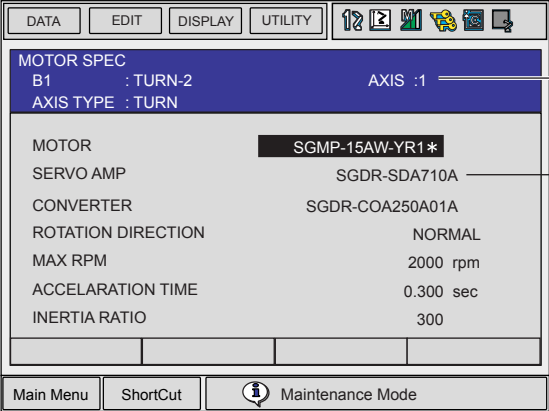
In the MECHANICAL SPEC window, mechanical data are specified.

|   | Operation  | Explanation  |
|---|--|--|
| 1 | <p>Confirm specification of each axis in the MECHANICAL SPEC window.</p> | <p>The mechanical specification of axis is shown.</p> <p>The MECHANICAL SPEC window (In case of ROTATION type)</p>  <p>MOTION RANGE (+): Input maximum moving position (+ direction and - direction) when setting home position to 0. (Unit: deg)</p> <p>MOTION RANGE (-): Input maximum moving position (- direction) when setting home position to 0. (Unit: deg)</p> <p>REDUCTION RATIO: Input the numerator and the denominator. &lt;e.g.&gt; If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.</p> <p>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)</p> <p><b>TURN-2</b></p>  |

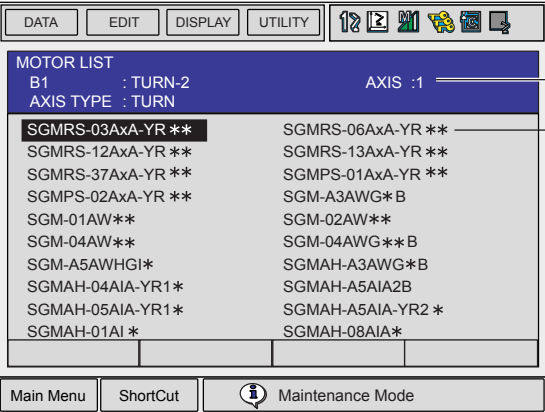
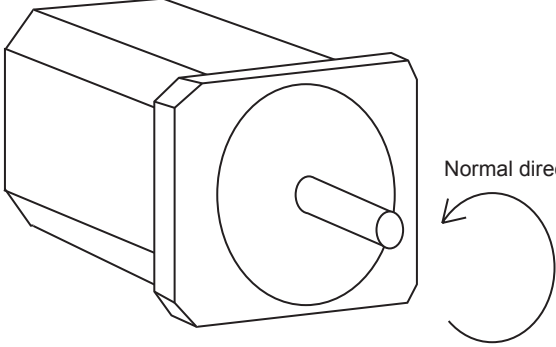
| Operation | Explanation   |
|-----------|---|
| 1         | <p>The MECHANICAL SPEC window (In case of BALL-SCREW type)</p>  <p>Group, Type, Axis Number and Axis Type selected currently are shown.</p> <p>The cursor is reversed.</p> <p>MOTION RANGE: Input maximum moving position (+ direction and - direction) when setting home position to 0. (Unit: mm)</p> <p>REDUCTION RATIO: Input the numerator and the denominator.<br/>         &lt;e.g.&gt; If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.</p> <p>BALL-SCREW PITCH :Input the traveling length when the ball-screw rotates once. (Unit: mm/r)</p> <p>The MECHANICAL SPEC window (In case of RACK&amp;PINION type)</p>  <p>Group, Type, Axis Number and Axis Type selected currently are shown.</p> <p>The cursor is reversed.</p> <p>MOTION RANGE: Input maximum moving position (+ direction and - direction) when setting home position to 0. (Unit: mm)</p> <p>REDUCTION RATIO: Input the numerator and the denominator.<br/>         &lt;e.g.&gt;If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.</p> <p>PINION DIAMETER: Input the diameter of a pinion. (Unit: mm)</p> |
| 2         | Change the setting contents.  |

|   | Operation                                      | Explanation   |
|---|--|---|
| 3 | Press [ENTER] in the mechanical specification. | After this setting, the window moves to the next axis. Set them for all axes.<br>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. |

In the MOTOR SPEC window, motor data are specified.

|   | Operation  | Explanation  |
|---|--|--|
| 1 | Confirm specification of each axis in the MOTOR SPEC window. | <p>The motor specification of each axis is shown.</p>  <p>Group, Type, Axis Number and Axis Type selected currently are shown.</p> <p>The cursor is reversed.</p> |



| Operation                     | Explanation   |
|-------------------------------|---|
| <p>2 Select desired item.</p> | <p>When an item which is input by number is selected, the number input buffer line is shown.<br/>           And when MOTOR (or SERVO AMP or CONVERTER) is selected, the list window of MOTOR (SERVO AMP or CONVERTER) is shown.</p>  <p>Group, Type, Axis Number and Axis Type selected currently are shown.<br/>           The motor type list registered in ROM is shown.</p> <p>When the type is selected, the window moves to the AXES CONFIG window.<br/> <b>ROTATION DIRECTION</b> : Set the rotation direction to which the current position is increased. (The counterclockwise from view from the loaded side is positioned normal.)</p>  <p>AC Servo Motor<br/> <b>MAX. RPM</b>: Input maximum rotation speed of a motor. (Unit: rpm)<br/> <b>ACCELARATION SPEED</b>: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)<br/> <b>INERTIA RATIO</b>: “ 300 ” when in case of travel axis or “ 0 ” when in case of rotation axis is set as initial value. But if the following phenomenon occurs in motion, deal with the followed procedure.<br/>           &lt;Phenomenon1&gt; During motion, the axis moves unsteady on advance direction.<br/>           → Confirm the motion with increasing this ratio in each 100.<br/>           &lt;Phenomenon2&gt; During pause, the motor makes a lot of noise.<br/>           → Confirm the motion with decreasing this ratio in each 100.</p> |
| <p>3 Change the setting.</p>  |   |

|   | Operation                               | Explanation   |
|---|---|---|
| 4 | Press [ENTER] in the MOTOR SPEC window. | <p>After this motor specification setting, the window moves to the next axis. Set them for all axes.<br/>When [ENTER] is pressed at the MOTOR SPEC window for the last axis, the setting in this window is completed and the confirmation dialog box is shown.</p> <div style="text-align: center;"><p>Modify?</p><input type="button" value="YES"/> <input type="button" value="NO"/></div> <p>If " YES " is selected, the system parameters are modified automatically.</p> <p>Then addition of the station axis setting is complete.</p> |



### 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.

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# 11 NX100 Specification



## 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 NX100 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 NX100 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:**
  - **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 NX100 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.

## 11.1 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)<br>-10°C to + 60°C (During transit and storage)                                |
| Relative Humidity             | 10% to 90%RH (non-condensing)   |
| Power Supply                  | 3-phase, 200 VAC(+10% to -15%) at 50/60Hz(±2%)<br>220 VAC(+10% to -15%) at 60Hz(±2%)                            |
| Grounding                     | Grounding resistance : 100Ω or less<br>Exclusive grounding  |
| Digital I/O                   | Specific signal (hardware) 17 inputs and 3 outputs<br>General signals (standard, max.) 40 inputs and 40 outputs |
| Positioning System            | By serial communication (absolute encoder)  |
| Drive Unit                    | SERVOPACK for AC servomotors  |
| Acceleration/<br>Deceleration | Software servo control  |
| Memory Capacity               | 60000 steps, 10000 instructions (including steps)   |

## External Dimensions

|                           |  |
|---------------------------|--|
| Small capacity            | HP3, HP6, EA1400N, HP20, EA1900N<br>500(W) × 1200(H) × 500(D) mm                       |
| Medium and Large capacity | UP20MN, UP50N, ES165N, HP165, ES200N, ES165RN, ES200RN<br>600(W) × 1200(H) × 550(D) mm |

## 11.2 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, Screen reservation function  |
|                               | Interface                       | CF (Compact Flash) card slot (At Programming Pendant)<br>RS232C (At Control Circuit Board)<br>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 and 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   |

## 11.3 Programming Pendant

|                 |  |
|-----------------|--|
| Material        | Reinforced thermoplastic enclosure with a detachable suspending strap            |
| Dimensions      | 199(W) × 338(H) × 60(D) mm (excluding protrusion)                                |
| Displayed Units | TFT Color liquid crystal display, 6.5 inch, VGA (640 × 480)                      |
|                 | Touch panel  |
| Operated Units  | 3 position Enable switch, Start switch, Hold switch, Mode select switch (3 mode) |
| Others          | Provided with CF (Compact Flash) card slot                                       |

## 11.4 Equipment Configuration

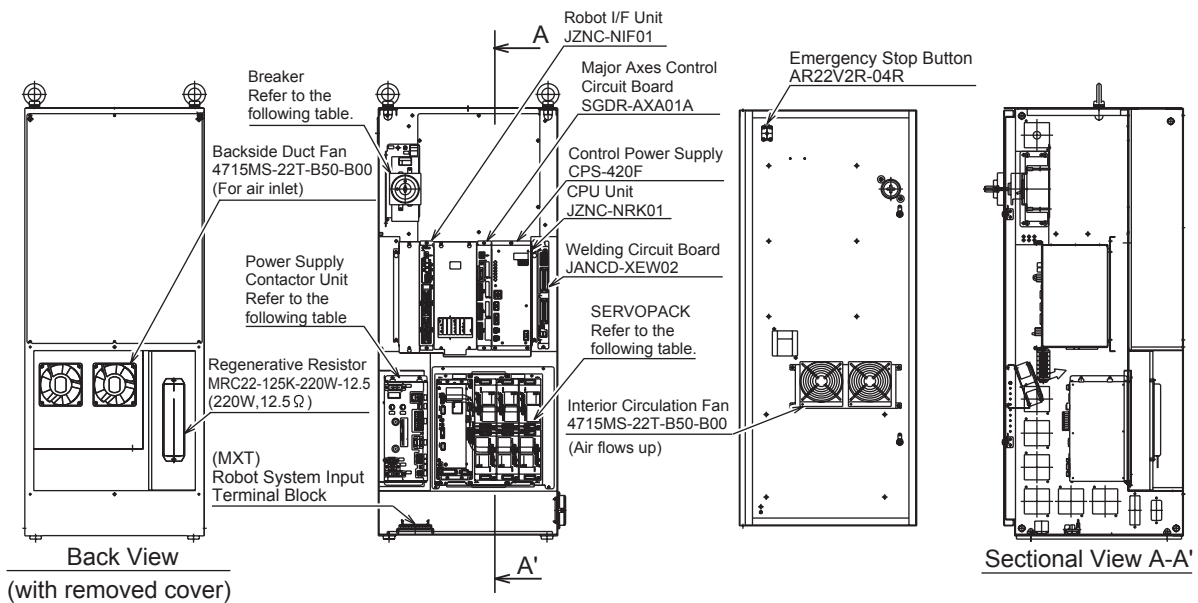
The NX100 is comprised of individual units and modules (circuit boards). Malfunctioning components can generally be easily repaired after a failure by replacing a unit or a module. This section explains the configuration of the NX100 equipment.

### 11.4.1 Arrangement of Units and Circuit Boards

#### ■ Configuration

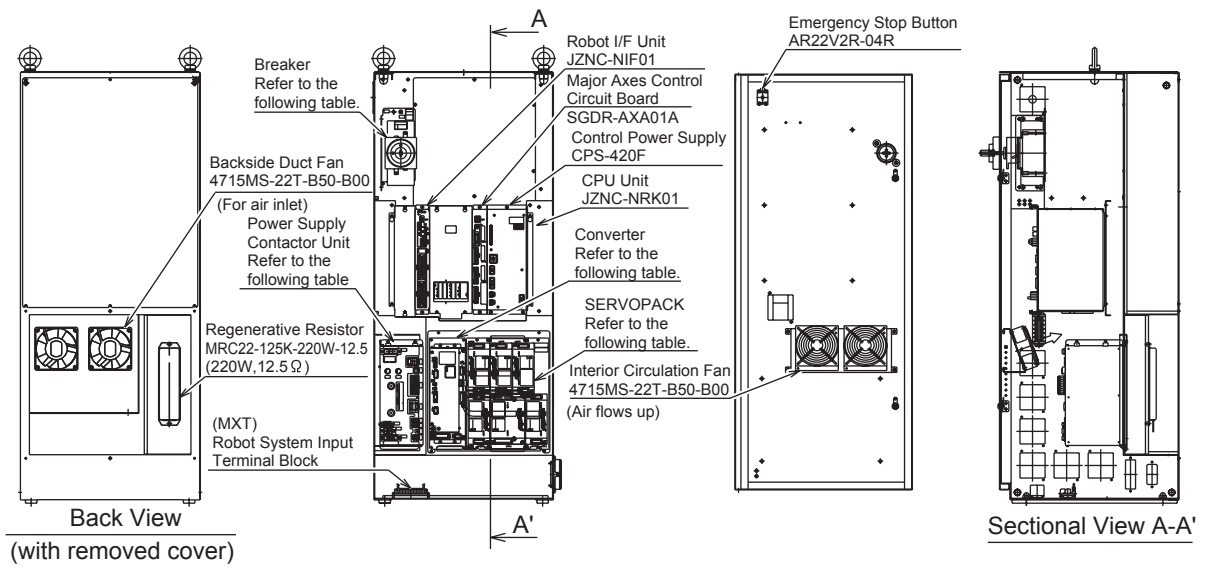
The arrangements of units and circuit boards in small-capacity, medium-capacity, and large-capacity NX100s are shown.

#### Small Capacity SERVOPACK Breaker Power Supply Contact Unit



| Model Type | NX100             | SERVOPACK (Converter Integrated) | Breaker       | Power Supply Contactor Unit |
|------------|-------------------|----------------------------------|---------------|-----------------------------|
| HP3        | ERCR-HP3-AA00     | SGDR-EA1400NY26                  | NF30SW 3P 5A  | JZRRCR-NTU01-1              |
| EA1400N    | ERCR-EA1400N-AA00 | SGDR-EA1400N                     | NF30SW 3P 10A |                             |
| HP6        |                   |                                  |               |                             |

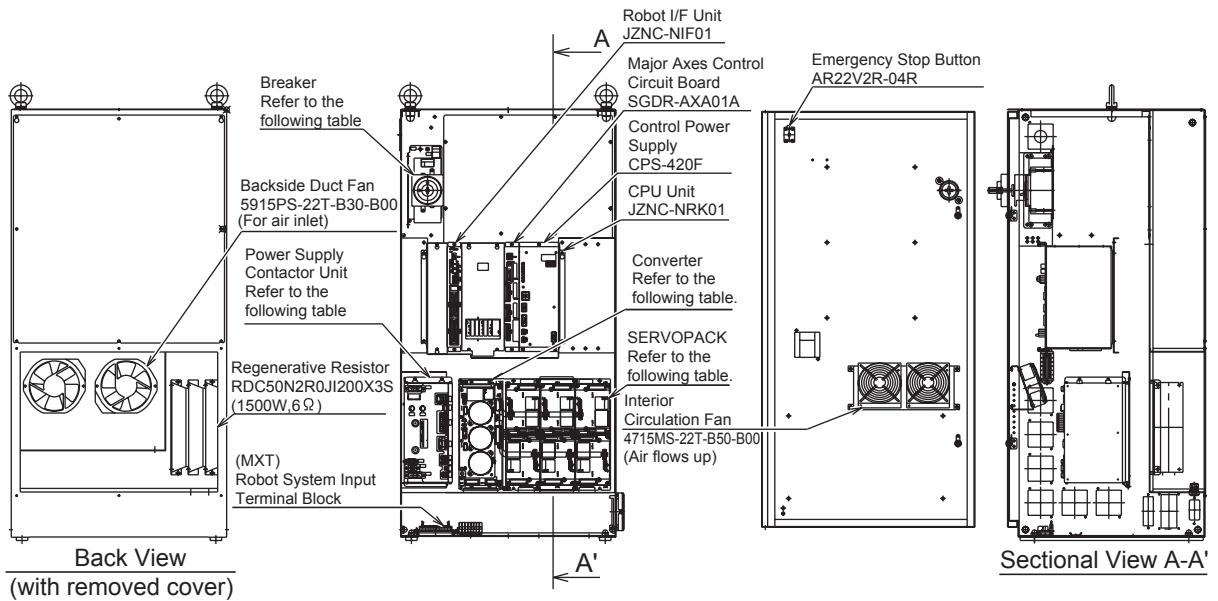
Configuration 1 for Small-Capacity NX100



| Model Type | NX100          | SERVOPACK    | Converter       | Breaker       | Power Supply Contactor Unit |
|------------|----------------|--------------|-----------------|---------------|-----------------------------|
| HP20       | ERCR-HP20-AA00 | SGDR-HP20Y30 | SGDR-COA080A01B | NF30SW 3P 15A | JZRCR-NTU01-1               |
| EA1900N    |                |              |                 |               |                             |

Configuration 2 for Small-Capacity NX100

Medium and Large Capacity

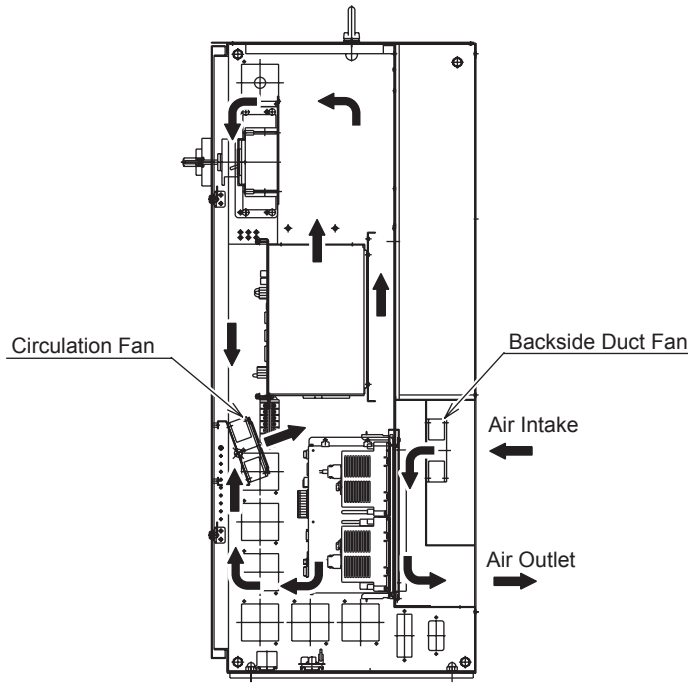


| Model Type | NX100             | SERVOPACK      | Converter       | Breaker       | Power Supply Contactor Unit |
|------------|-------------------|----------------|-----------------|---------------|-----------------------------|
| UP20MN     | ERCR-UP20MN-AA00  | SGDR-EH50Y27   | SGDR-COA250A01B | NF30SW 3P 20A | JZRCR-NTU02-1               |
| UP50N      | ERCR-UP50N-AA00   | SGDR-EH50Y24   |                 |               |                             |
| ES165N     | ERCR-ES165N-AA00  | SGDR-ES165N    |                 | NF30SW 3P 30A |                             |
| HP165      |                   |                |                 |               |                             |
| ES200N     | ERCR-ES200N-AA00  | SGDR-ES165NY28 |                 |               |                             |
| ES165RN    | ERCR-ES165RN-AA00 |                |                 |               |                             |
| ES200RN    | ERCR-ES200RN-AA00 |                |                 |               |                             |

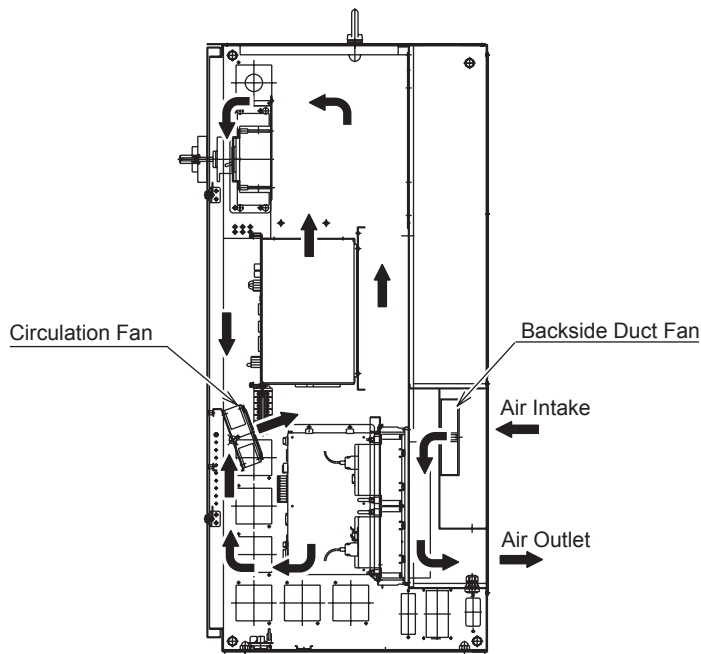


## 11.4.2 Cooling System of the Controller Interior

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 NX100.



Cooling Configuration (Small capacity)



Cooling Configuration (Medium and Large capacity)

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## 12 Description of Units and Circuit Boards

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### 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 NX100 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 NX100 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:**
  - **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.

- **When turning the power on to the NX100, 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.**

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.

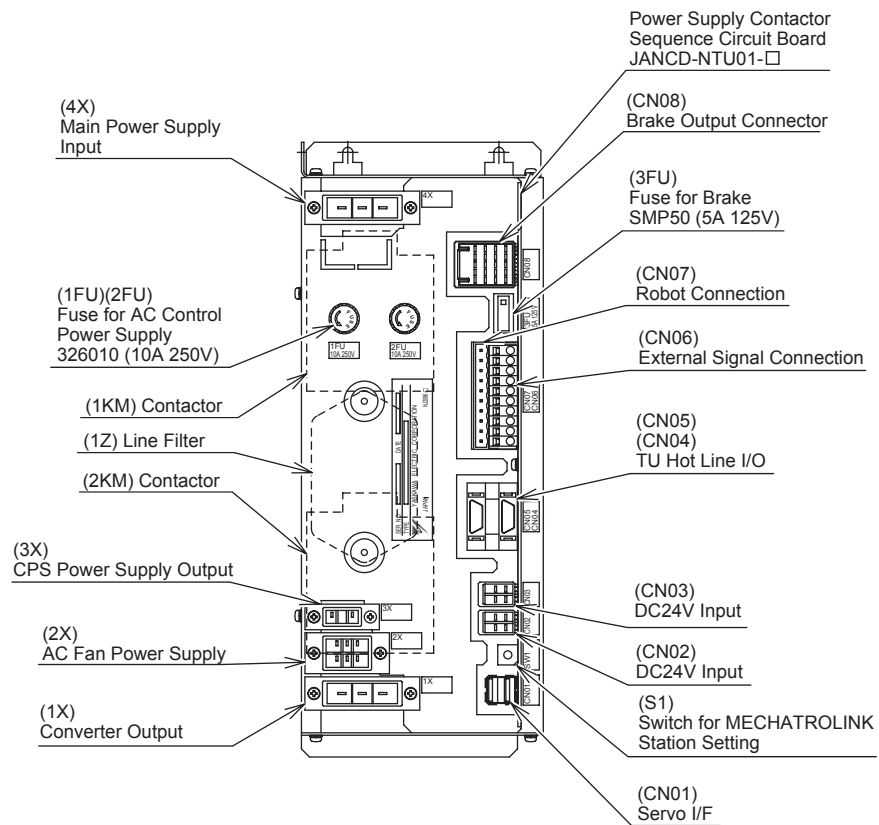
## 12.1 Power Supply Contactor Unit

The power supply contactor unit consists of the power supply contactor sequence circuit board (JANCD-NTU□□) and the contactor (1KM, 2KM) for servo power and the line filter (1LF). 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.

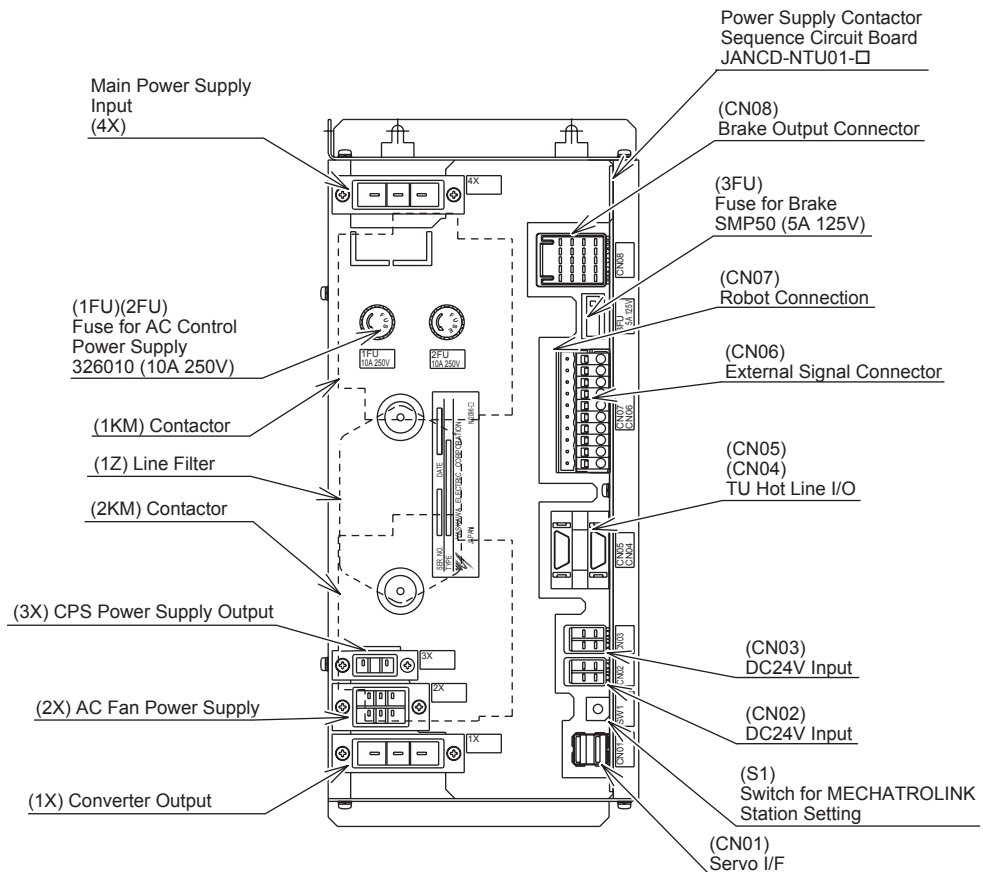
The power supply (single phase AC200/220V) is supplied to the control power supply via the line filter.

Power Supply Contactor Unit Models

| Model          | Robot Type   |
|----------------|--|
| JZRRCR-NTU01-□ | HP3, HP6, EA1400N, HP20, EA1900N                       |
| JZRRCR-NTU02-□ | UP20MN, UP50N, ES165N, HP165, ES200N, ES165RN, ES200RN |



Power Supply Unit Configuration (JZRCR-NTU01-□)



Power Supply Unit Configuration (JZRCR-NTU02-□)

## 12.2 Power Supply Contactor Sequence Circuit Board (JANCD-NTU01-□)

The power supply contactor sequence circuit board is controlled by the major axes circuit board (SGDR-AXA01A). The main functions of the contactor circuit board are as follows:

- Servo power supply contactor I/O circuit (dual circuit)
- Brake power supply output circuit
- Overrun signal input, tool shock sensor (SHOCK) signal input, and lamp power supply output circuit to the manipulator
- External overrun signal input circuit (dual circuit)
- Servo-on enable signal input circuit (dual circuit)
- Fan alarm (optional) input circuit
- Fan control signal output circuit
- Contactor control signal output circuit (dual circuit)

### ■ Connection for Tool Shock Sensor (SHOCK)

**To connect the tool shock sensor directly to the tool shock sensor signal line**

1. Disconnect the minus SHOCK (-) and 24VU pin terminal from the WAGO connector, the NTU01-CN07 power supply contactor unit.
2. Connect the minus SHOCK (-) and 24VU 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 Name Terminal | Pin Terminal Model | Signal Line Terminal Model                   |
|-------------------|--------------------|--|
| SHOCK-            | PC-2005W           | PC-2005M (manufactured by NICHIFU Co., Ltd.) |
| 24VU              | PC-2005M           | PC-2005W (manufactured by NICHIFU Co., Ltd.) |

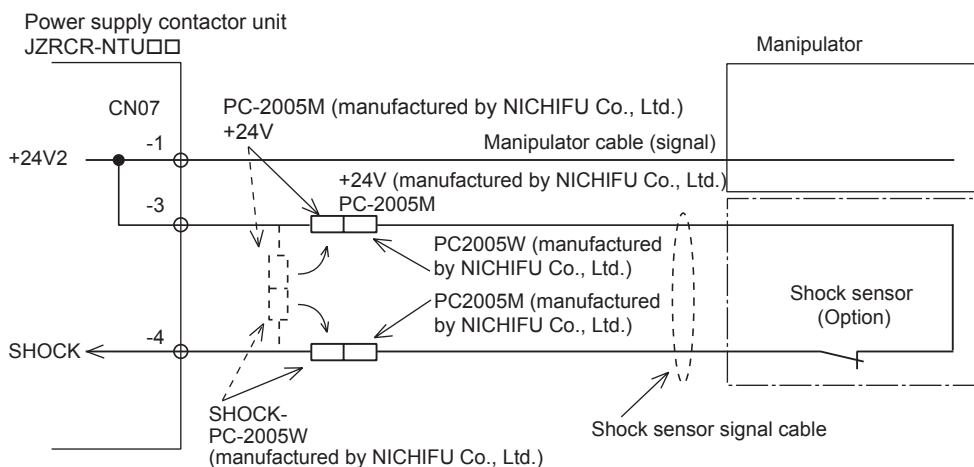


Fig. 1 Direct Connection to Tool Shock Sensor Signal Line

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

1. Disconnect the minus SHOCK (-) and 24VU pin terminal from the WAGO connector, the NTU01-CN07 power supply contactor unit.
2. Connect the minus SHOCK (-) pin terminal to the minus SHOCK (-) pin terminal of the manipulator.



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.

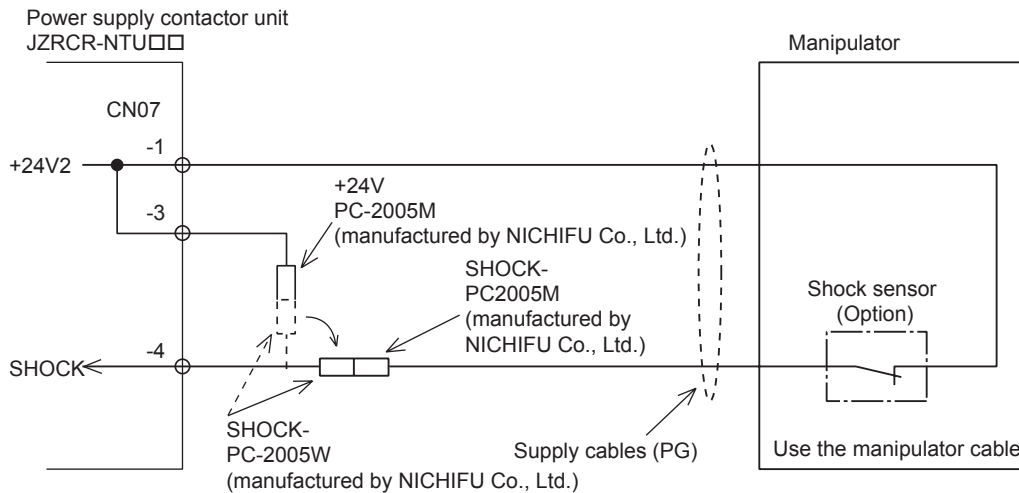


Fig. 2 Connection with Manipulator Cable



When the tool shock sensor input signal is used, the stopping method of the robot can be specified. The stopping methods are hold stop and servo power supply off. Selection of the stopping method is set in the display of the programming pendant. Refer to Explanation \*1 in " 9 System Setup " for details.

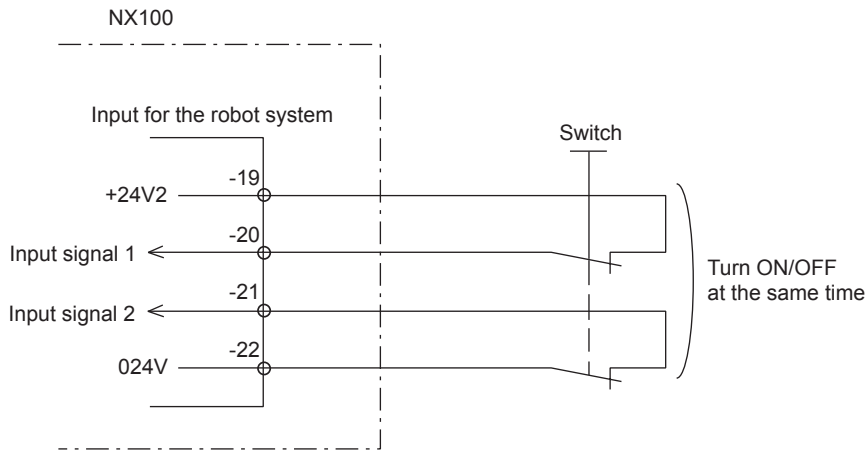
■ Cautions for Connection of Dual Input Signals



**CAUTION**

- **Connect the switch (contact) that turns the dual signals ON and OFF simultaneously.**

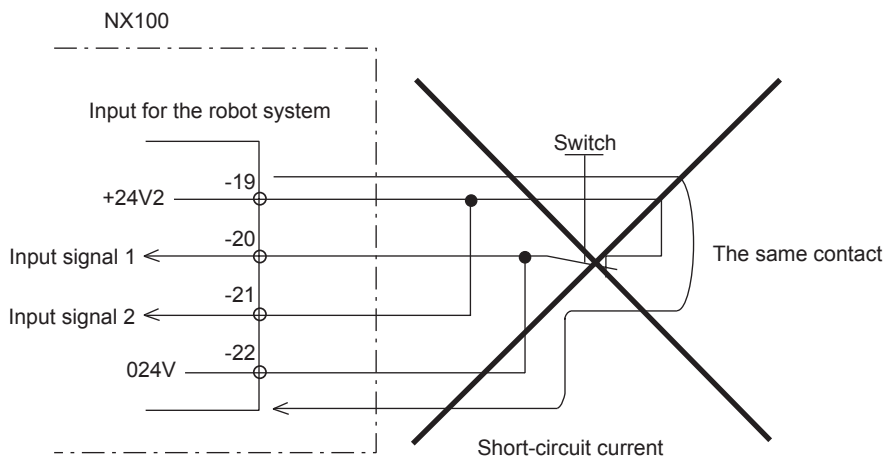
If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs. Refer to the figure below.



**CAUTION**

- **Do not connect two signals to the same contact point.**

Since the power supply for each signal is reversed, it will short-circuit if the signals are connected to the same contact point.



## ■ 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 CN06-5 and -6 and between the connectors CN06-7 and -8 of the JZRCR-NTU□□-□ power supply contactor unit.
2. Connect the external axis overrun wiring between the connectors CN06-5 and -6 and between the connectors CN06-7 and -8 of the JZRCR-NTU□□-□ contactor unit.



### CAUTION

- **Remove jumper cable installed on system input signal before connecting the input signal lines.**

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

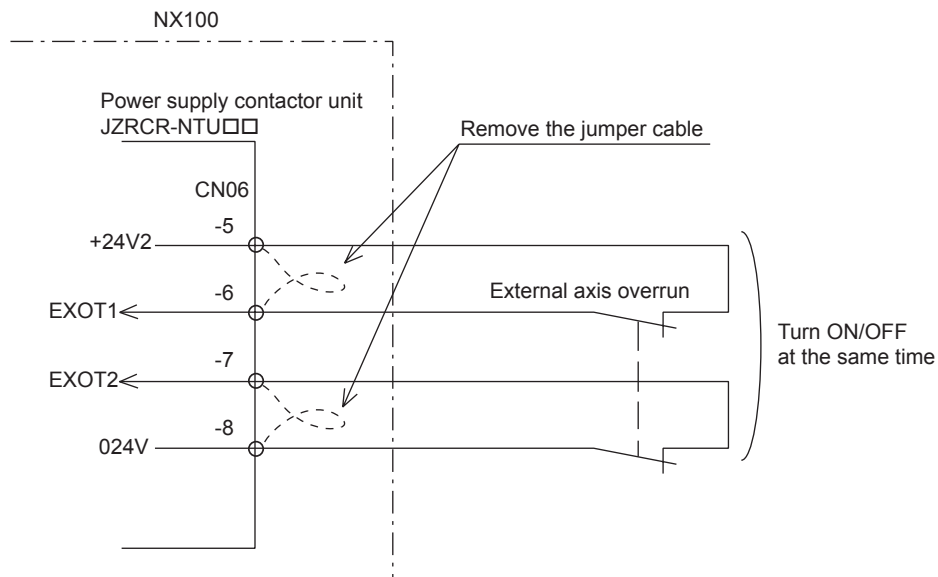


Fig. 3 Connection for External Axis Overrun



### ■ Connection for Servo-ON Enable Input (ON\_EN1 and ON\_EN2)

Connect the ON\_EN 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.

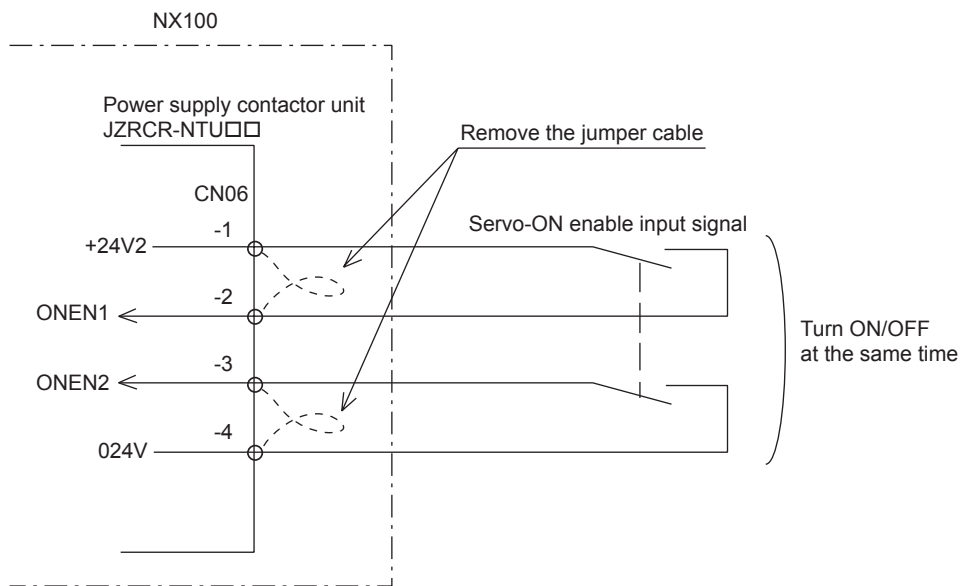
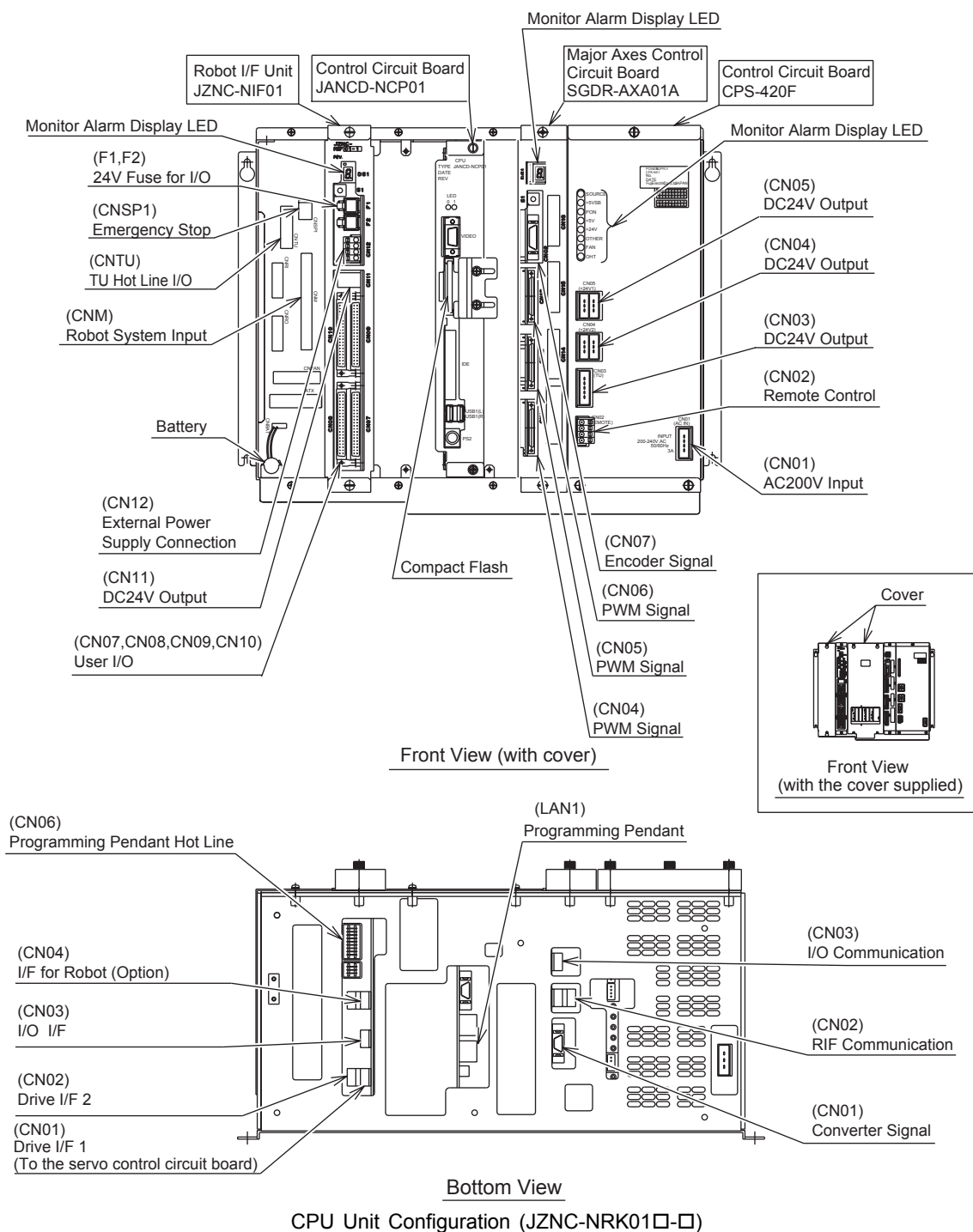


Fig. 4 Connection for Servo-ON Enable Input

## 12.3 CPU Unit

### 12.3.1 CPU Unit Configuration

CPU unit consists of the control power supply, circuit board racks, control circuit boards, robot I/F unit, and major axes control circuit boards. The JZNC-NRK01 CPU unit contains only circuit board racks and control circuit boards. It does not contain the control power supply, the robot I/F unit, and the major axes control circuit board.



## 12.3.2 Units and Circuit Boards in the CPU Unit

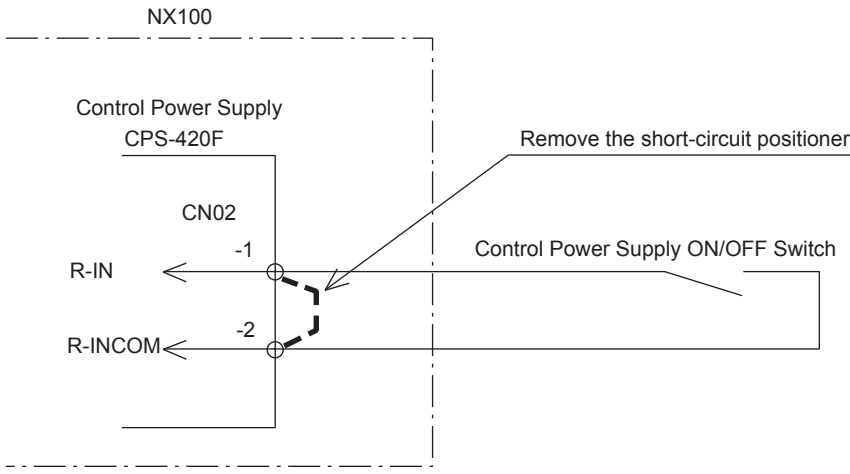
### ■ Control Circuit Board (JANCD-NCP01)

This board performs to control the entire system, display to the programming pendant, control the operating keys, control operation, calculate motion type. This board has the Serial interface for RS-232C, video output, PS2 connector, and LAN (100BASE-TX/10BASE-T). But this board, however, cannot be used for video output and PS connector. (The video output and the PS connector must be adjusted by the manufacturer only.)

### ■ Control Power Supply (CPS-420F)

This unit supplies the DC power (DC5V, DC24V, DC3.3V, DC±12V) for control (system, I/O, brake). It is also equipped with the input function for turning the control power supply on and off.

| Items          | Specifications   |       |  |
|----------------|--|-------|--|
| Input          | Rating Input Voltage: 200/220VAC<br>Voltage Fluctuation Range: +10% to -15% (170 to 242VAC)<br>Frequency: 50/60Hz ± 2Hz (48 to 62Hz) |       |  |
| Output Voltage | DC + 5V : 20A<br>DC +24V : 12A (24V1: 4A, 24V2: 3.5A, 24V3: 4.5A)<br>DC +3.3V : 12A<br>DC +12V : 1.5A<br>DC -12V : 0.5A              |       |  |
| Indicator      | DISPLAY  | Color | Status   |
|                | SOURCE   | Green | Lights when AC power supply input (Normally ON)  |
|                | +5VSB  | Green | Lights when +5V (internally used) is normal. (Normally ON)                                   |
|                | POWER ON   | Green | Lights when DC power supply output (Normally ON)   |
|                | +5V  | Red   | Lights when +5V output error (ON when abnormal)  |
|                | +24V   | Red   | Lights when +24V output error (ON when abnormal)   |
|                | OTHER  | Red   | Lights when +3.3V, ±12V output error (Lights if error occurs)                                |
|                | FAN  | Red   | Lights if a fan-related errors in the control power supply unit. (Lights if error occurs)    |
|                | OHT  | Red   | Lights when units interior overheats (ON when abnormal)<br>Detection temperature: About 65°C |

| Items                | Specifications   |
|----------------------|--|
| Control Power ON/OFF | <p>To turn on the NX100 controller power, turn the non-fuse breaker of controller to the ON position then turning on the control power supply. If the controller is not located at the workplace, the non-fuse breaker of controller can be turned ON and OFF by input from external device. It is operated by the external switch connected with CN 02 of control power supply as shown in the following figures. (CN02-1 and CN02-2 is short-circuited when shipment)</p>  <p>Connection to Control Power Supply Unit</p> <p>See "WAGO Connector" for wiring of CN02 connector.</p> |

## ■ WAGO Connector

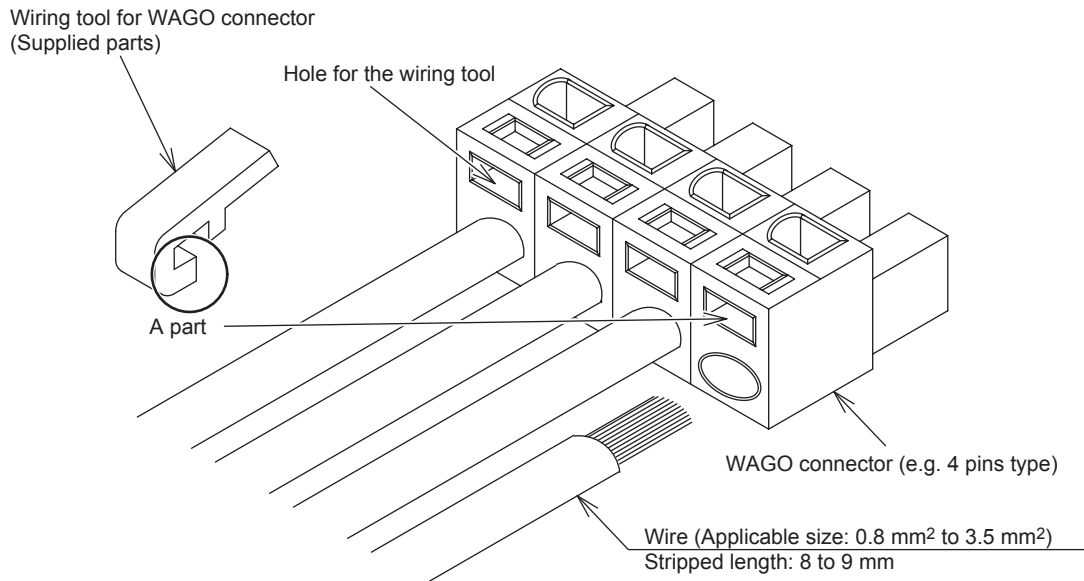
CN06, 07 on the power supply contactor unit (JZRCR-NTU□□-□), CN02 on the control power supply (CPS-420F), and CN12 on the robot I/F unit (JZNC-NIF01) are equipped with a connector made by WAGO.

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

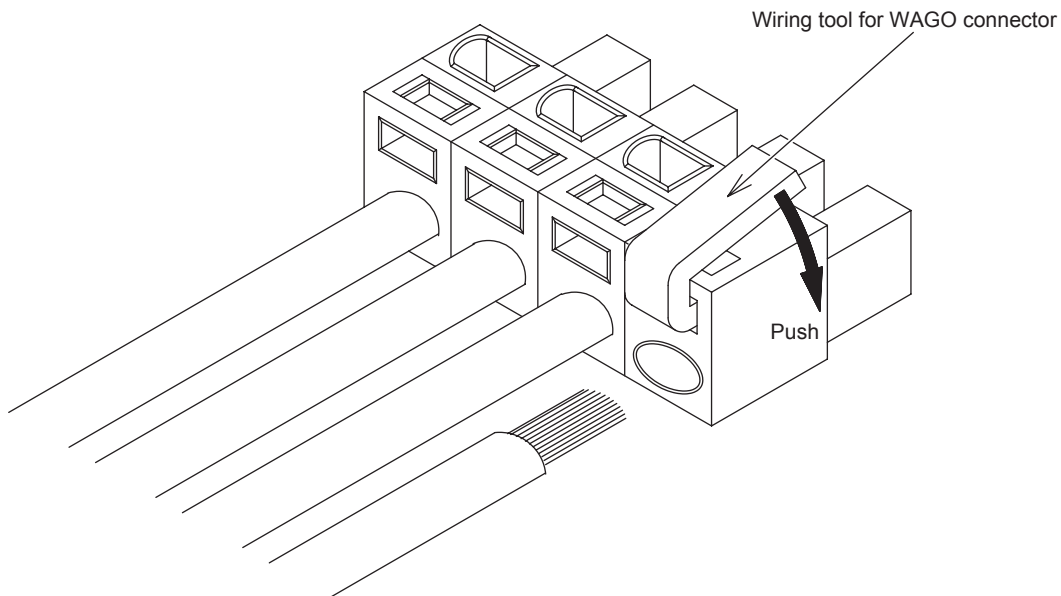
Two of these tools are supplied with the NX100.

The wiring procedure is described as follows:

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



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.

---

## ■ Major Axes Control Circuit Board (SGDR-AXA01A)

The major axes control circuit board (SGDR-AXB01A) controls the servomotors of the manipulator's six axes. It also controls the converter, the PWM amplifiers, and the power supply contactor sequence circuit board of the power supply contactor unit. Mounting an external axes control circuit board of an option (SGDR-AXF01A) control the servomotor of nine axes, including the robot axes.

## ■ Robot I/F Unit (JZNC-NIF01)

The robot I/F unit (JZNC-NIF01) consists of the robot I/F circuit board (JANCD-NIF01) and I/O circuit board (JANCD-NIO01).

### • Robot I/F Circuit Board (JANCD-NIF01)

The robot I/F circuit board controls the entire robotic system. It is connected to the control circuit board (JANCD-NCP01) with a PCI bus interface on the backboard, and to the major axes control circuit board (SGDR-AXA01A) with a NIO01 board interface for high-speed serial transmissions.

And, dual circuits are built in for use with the signals for safety-related functions.

### • I/O Circuit Board (JANCD-NIO01)

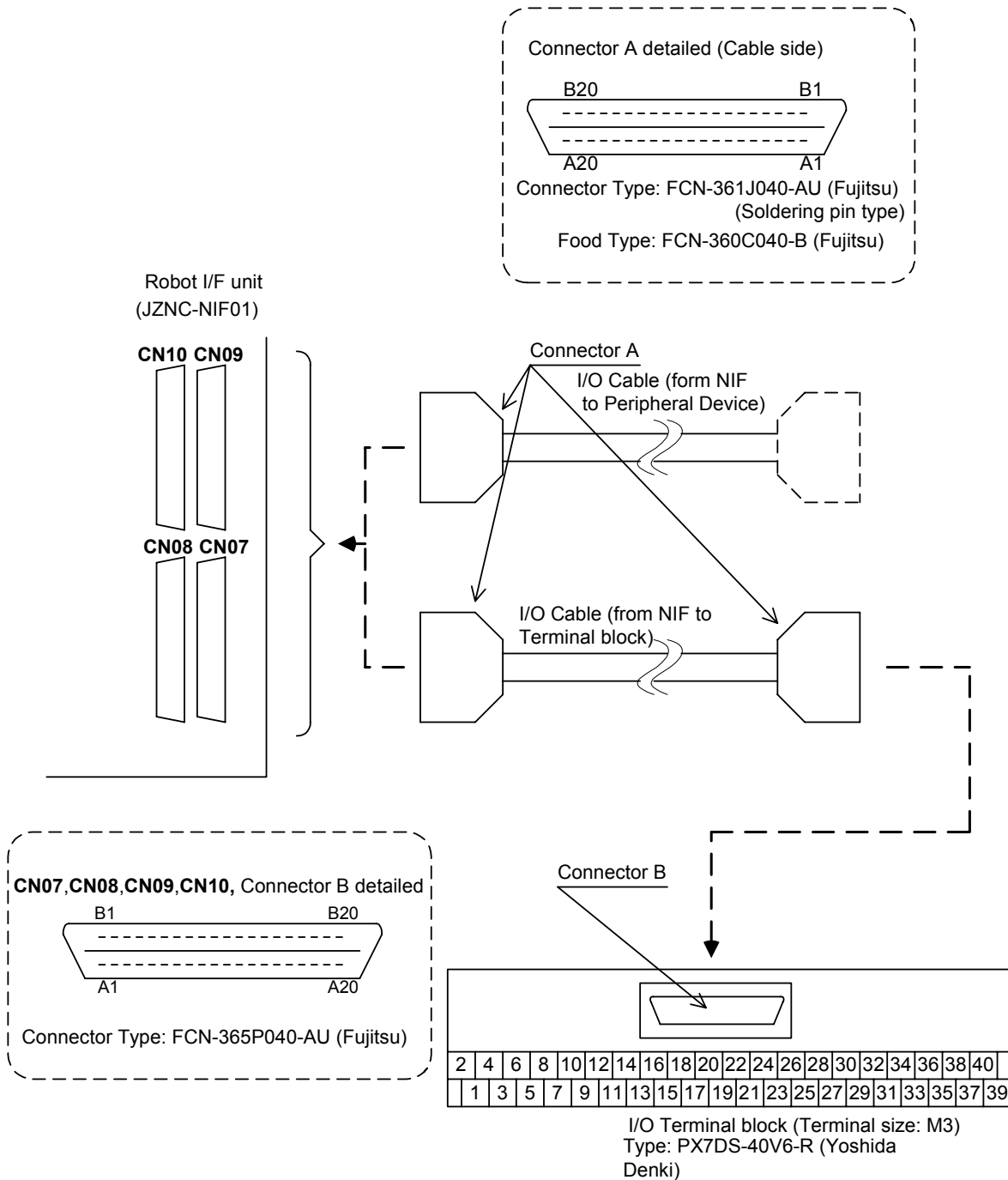
Four digital I/O connectors for the robot user I/O are provided: 40 inputs and 40 outputs. The I/Os are divided into two types: user I/O and system I/O. The I/O assignment differs depending on the application. System I/O is a signal in which the part is decided in advance. System I/O is used when the external operation equipment such as positioner controller and centralized controller control the manipulator and related equipment as a system. User I/O are mainly used as timing signals for the manipulator and peripheral devices in jobs that require robot motion.

Refer to "12.6 User I/O Signal Assignment" for more details on signal allocation.

For the connection of the robot's user I/O signal connectors, and the I/O signal related to start and stop, refer to "Connection wire with User I/O (CN07, 08, 09, 10)" and "System I/O Signal Related to Start and Stop."

■ Connection wire with Robot User I/O Connector (CN07, 08, 09, 10)

Please refer to the figure below when you manufacture the cable connecting with robot user I/O connector (CN07, 08, 09, 10) of robot I/F unit (JZNC-NIF01). (The cable side connector and the I/O terminal block are the options)

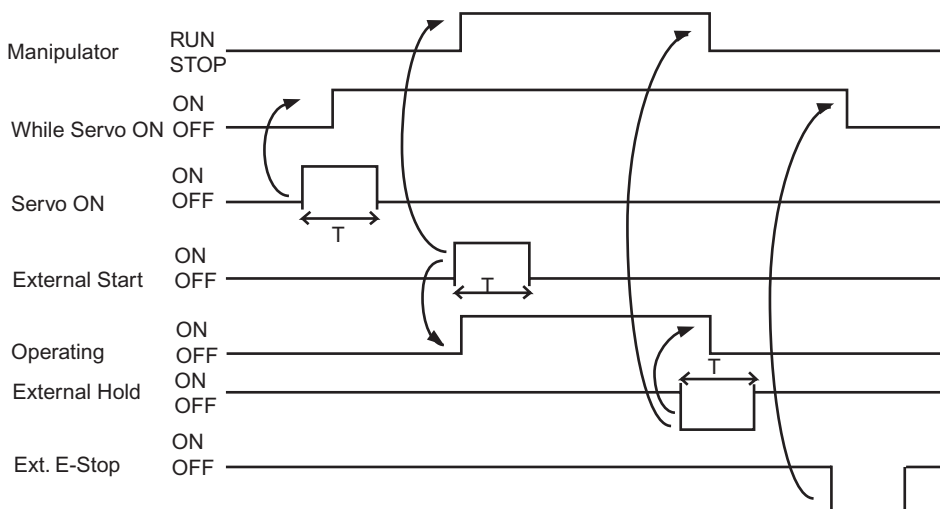


## ■ System I/O Signal Related to Start and Stop

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

- Servo ON (depending on application: JANCD-NIO01)
- External Servo ON (common to all application: System input terminal block MXT)
- External Start (depending on application: JANCD-NIO01)
- Operating (depending on application: JANCD-NIO01)
- External Hold (common to all application: System input terminal block MXT)
- External Emergency Stop (common to all application: System input terminal block MXT)

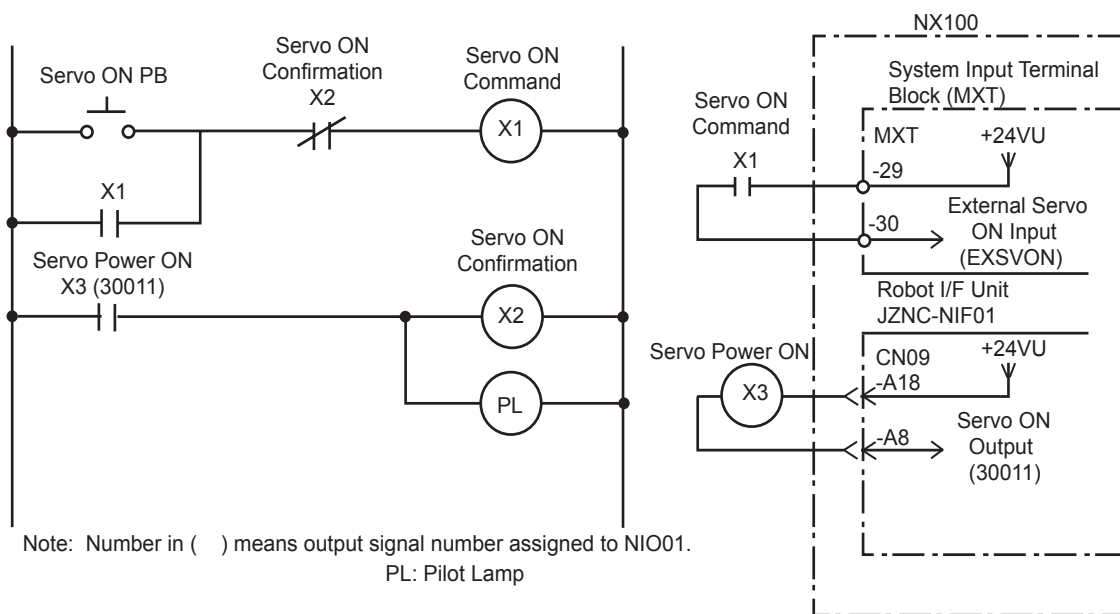
<Timing Chart>



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.

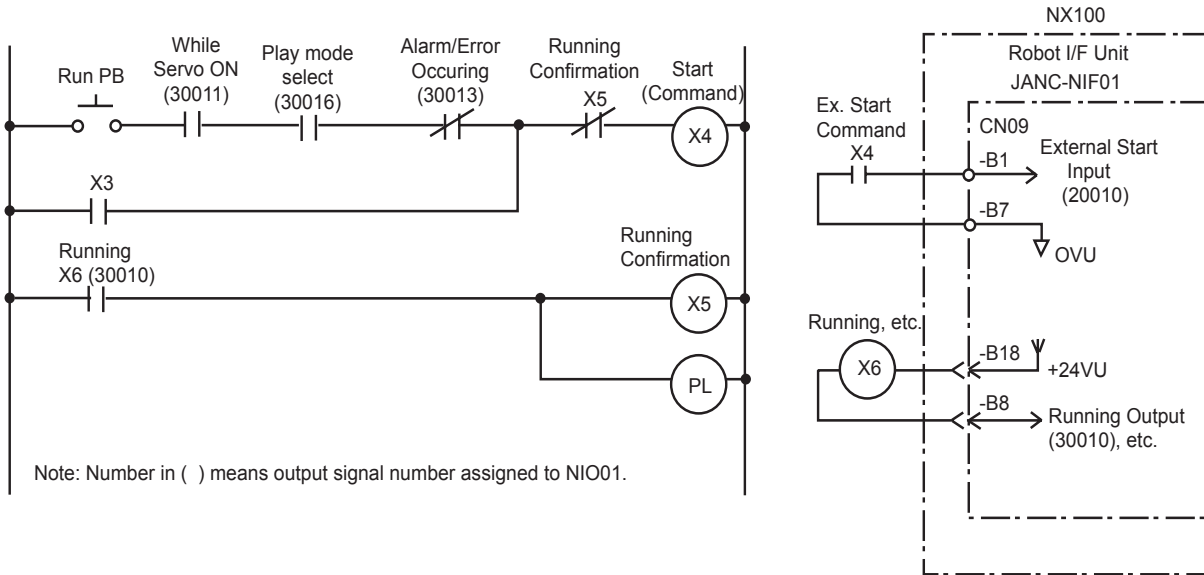


Note: Number in ( ) means output signal number assigned to NIO01.  
PL: Pilot Lamp



### Example of Start Sequence Circuit from External Device

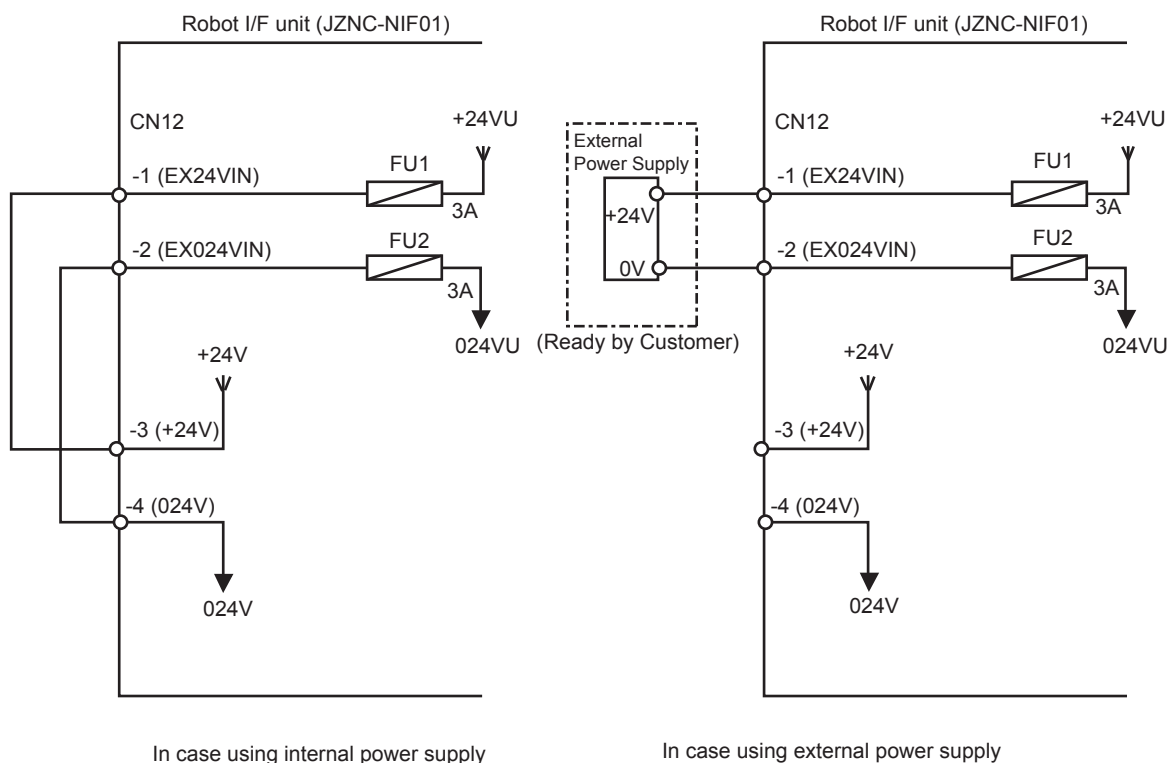
Only the rising edge of the external start signal is valid. This signal starts the manipulator. Reset this signal with the interlock configuration that determines if operation can start and with the playback (RUNNING) signal confirming that the manipulator has actually started moving.



## ■ 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 CN12-1 to -3 and CN12-2 to -4 of the robot I/F unit.
2. Connect +24V of the external power supply to CN12-1 and 0V to CN12-2 of the robot I/F unit.



### NOTE

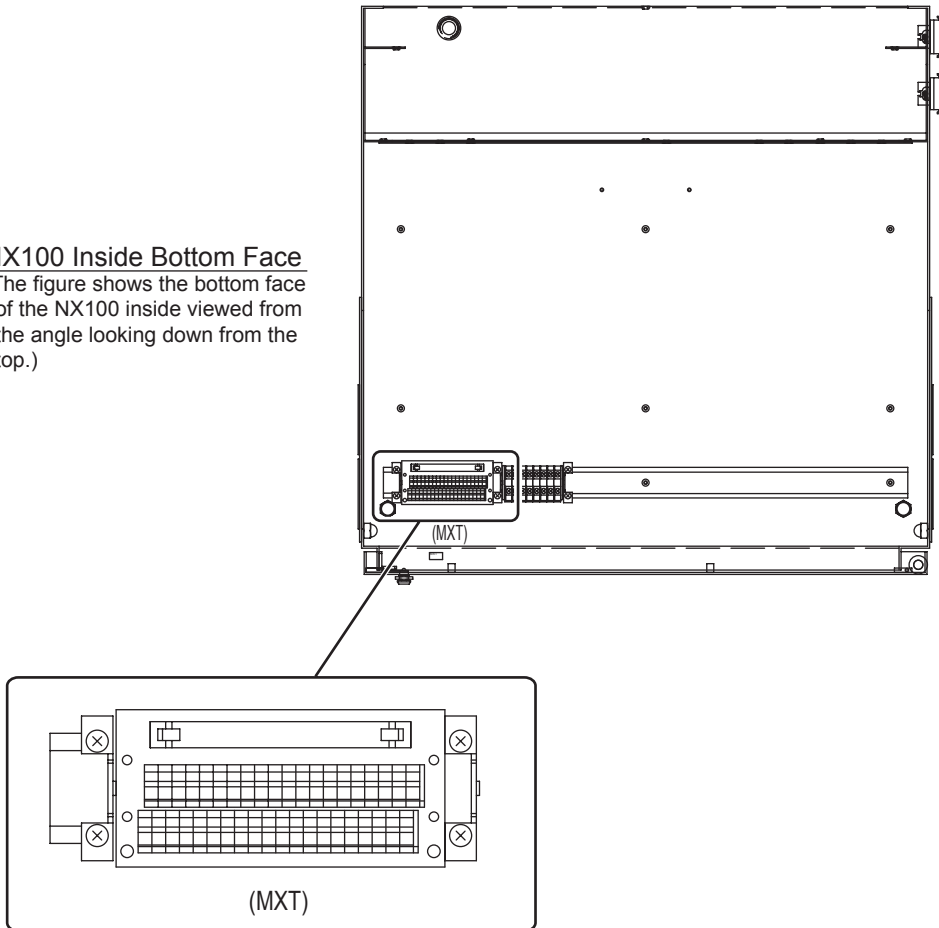
- The internal power supply of 24V of about 1A of NX100 can be used for I/O. Use external 24V power supply for higher currents and to isolate the circuit inside and outside the NX100.
- Power supply circuit for I/O (+24 VU, 024 VU) has 3A fuses (FU1, FU2).
- Install the external power supply outside the NX100 to avoid electric noise problems.
- If the internal power supply is selected and the external power supply is connected to CN12-1 to -3 and CN12-2 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.

### ■ Robot System Input Terminal Block (MXT)

The robot system input terminal block (MXT) is equipped on the bottom face of the inside NX100 as shown below. The input terminal block (MXT) is used for the input of robot system signals.

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

NX100 Inside Bottom Face  
(The figure shows the bottom face of the NX100 inside viewed from the angle looking down from the top.)



## Wiring Procedure of the MXT Connector

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

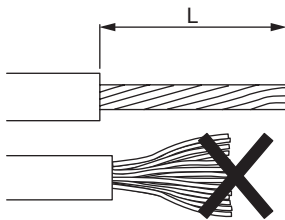
- Tools For the connection, be sure to use a screwdriver of an applicable size and configuration.

### Screwdriver

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

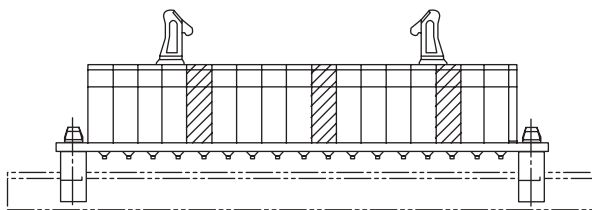


### 2. Applicable Wires

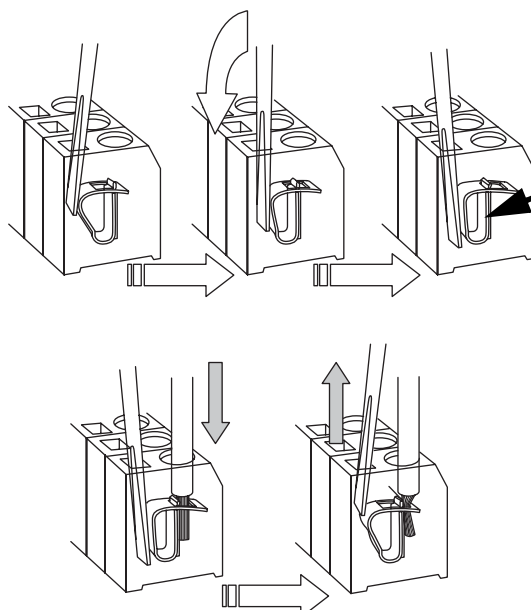
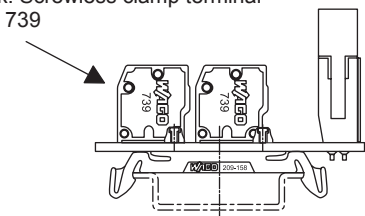


- The length of the exposed conductor (L) should be as follows:  
\* The length of the exposed conductor set for the terminal block (L)  
WAGO series 739 (with 3.5 mm pitch): 5 - 6 mm
- In case that the conductor is bent or feazed, make it straght as illustrated in the figure on the left.

### 3. Wire Connection



Terminal block: Screwless clamp terminal  
WAGO series 739



- Insert the screwdriver into the hole to open up the clamp spring.  
Place the screwdriver at an angle as shown in the figure on the left, then insert it at a stroke in order to open up the clamp spring smoothly.  
**The screwdriver will be hold with a click.**
- 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.**
- Pull out the screwdriver to clamp the conductor with a spring.
- Be sure that the wire is connected firmly by pulling at the wire softly.

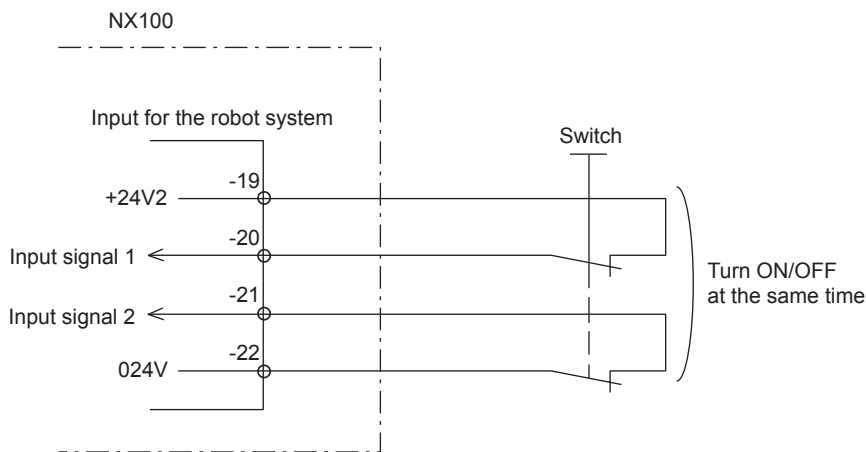
■ Cautions for Connection of Dual Input Signals



CAUTION

- **Connect the switch (contact) that turns the dual signals ON and OFF simultaneously.**

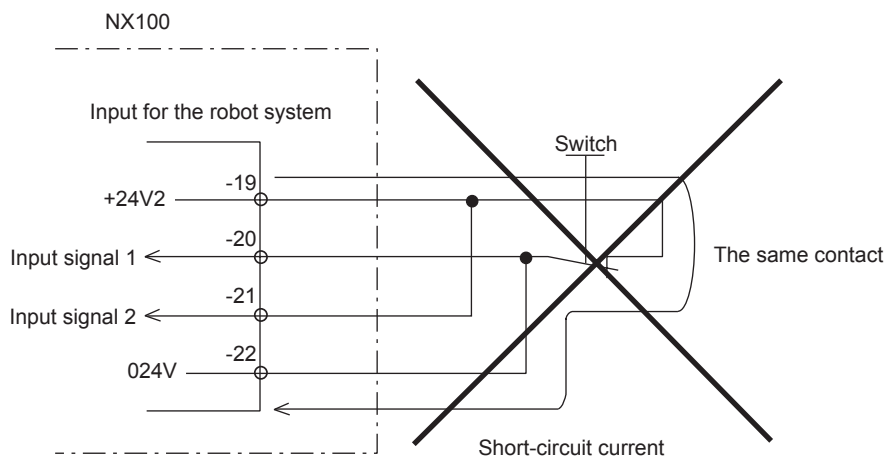
If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs. Refer to the figure below.



CAUTION

- **Do not connect two signals to the same contact point.**

Since the power supply for each signal is reversed, it will short-circuit if the signals are connected to the same contact point.



## External Emergency Stop

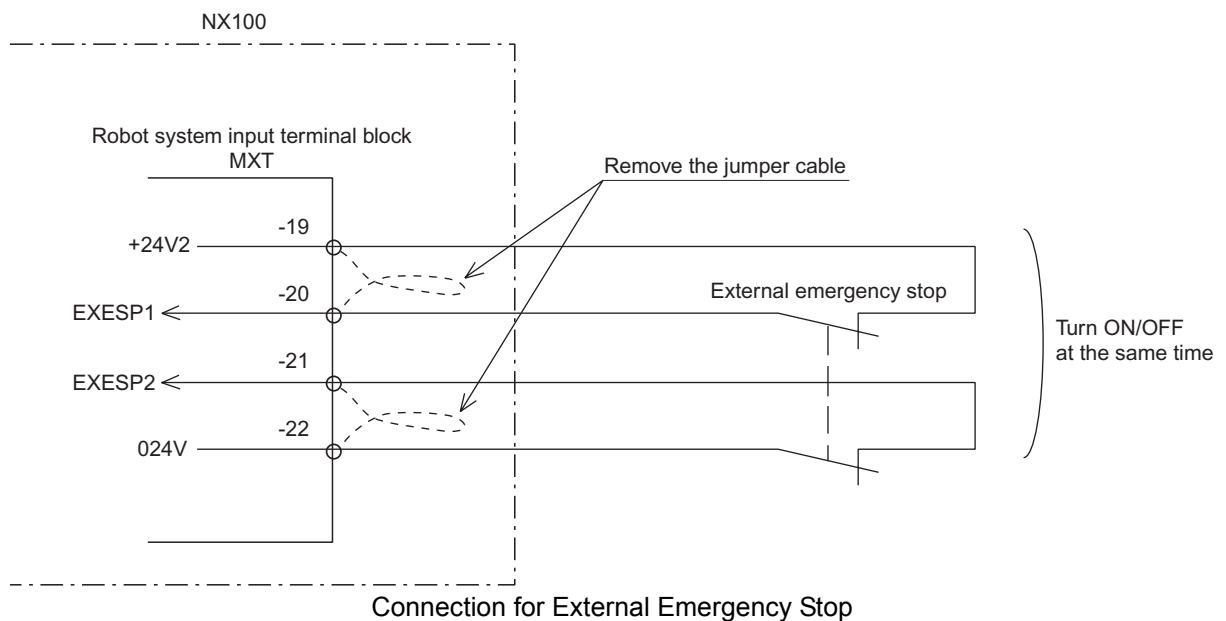
This signal is used to connect the emergency stop switch of an external device. If the signal is input, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON.



### 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.



## ■ Safety Plug

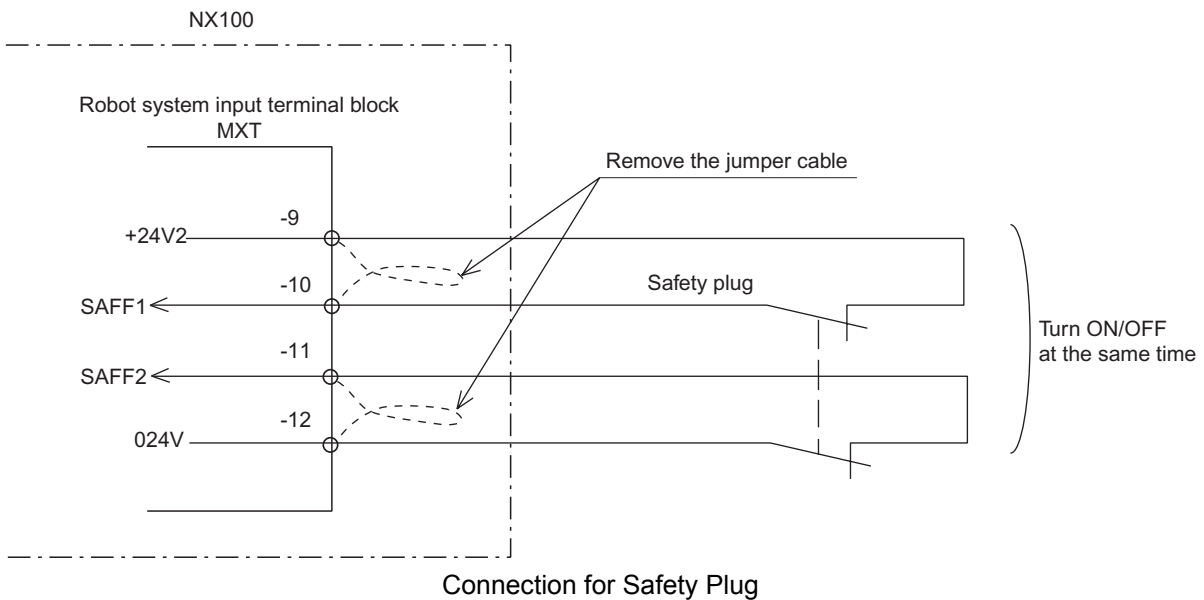
This signal is used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is input, the servo power turns OFF. While the signal is turned ON. The servo power cannot be turned ON. Note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



### CAUTION

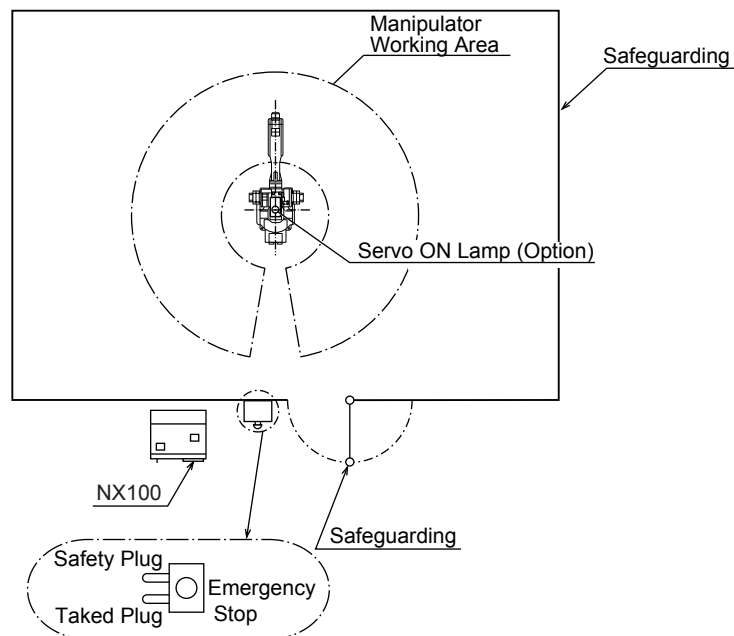
- **Always connect the signals after removing jumper cable.**

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.



## 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.



### ■ Maintenance Input

If the signal input circuit is short-circuited, the Enable switch (DSW) are disabled.

Usually, use the system with this signal circuit open (nothing connected).

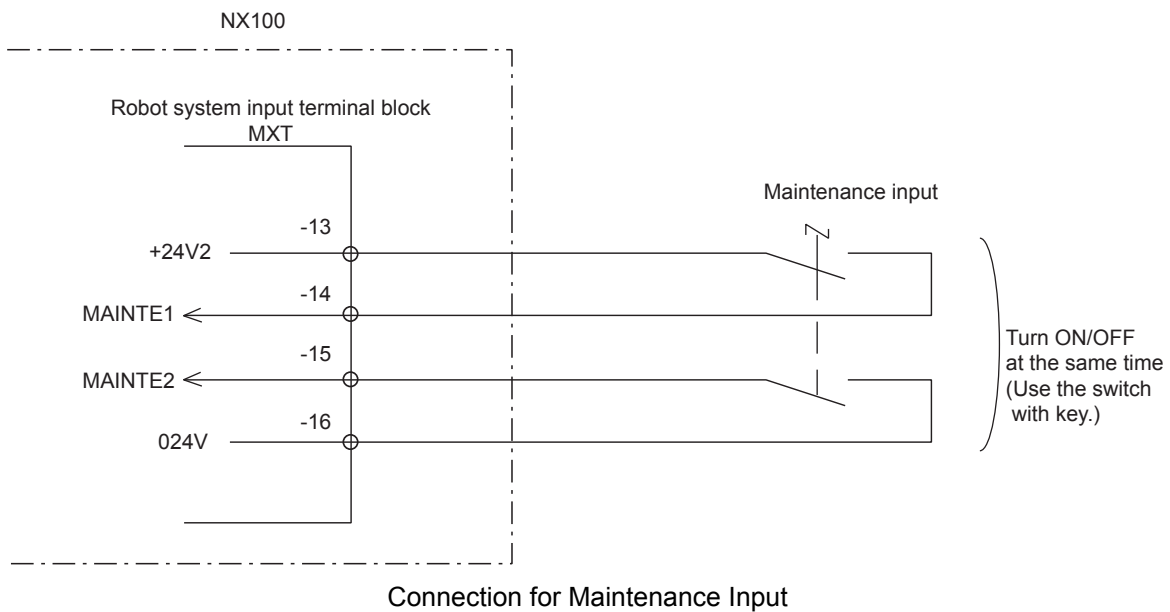
If the circuit for this signal must be used for an unavoidable reason, be sure to use a switch with a key that is **kept under the care of the system manager**.



## WARNING

- **This signal is used only for maintenance by YASKAWA's service personnel.**  
**For your safety, never use this input for any purpose.**

Failure to observe this instruction may cause major disaster.

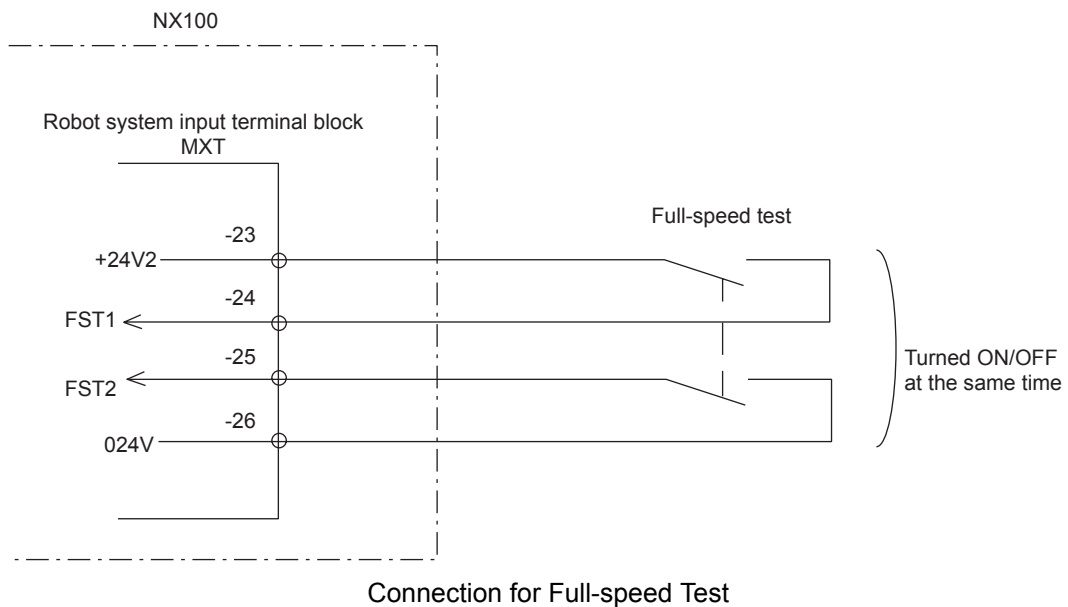


## ■ Full-speed Test

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 teach 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%).

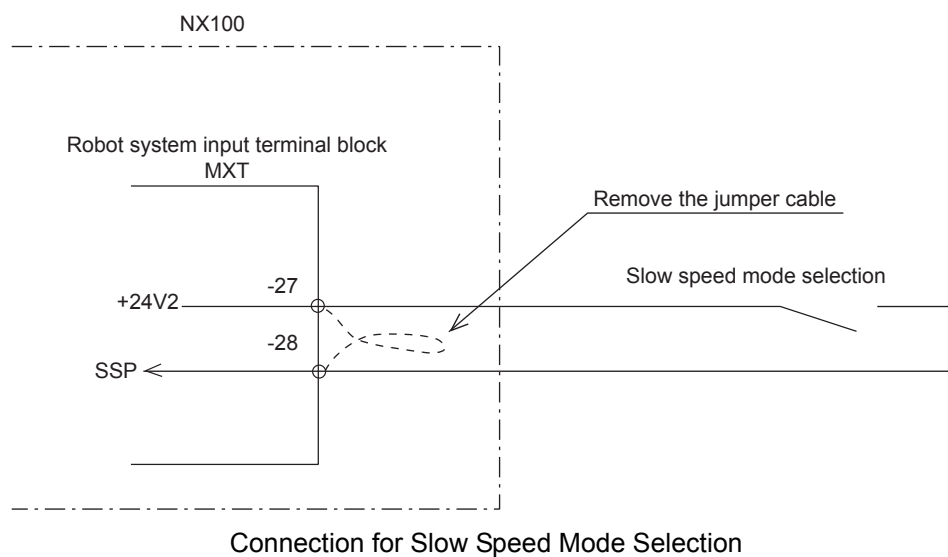


## ■ Slow Speed Mode Selection

This signal is used to determine the speed of the test run when the FST (full-speed test) signal input circuit is open.

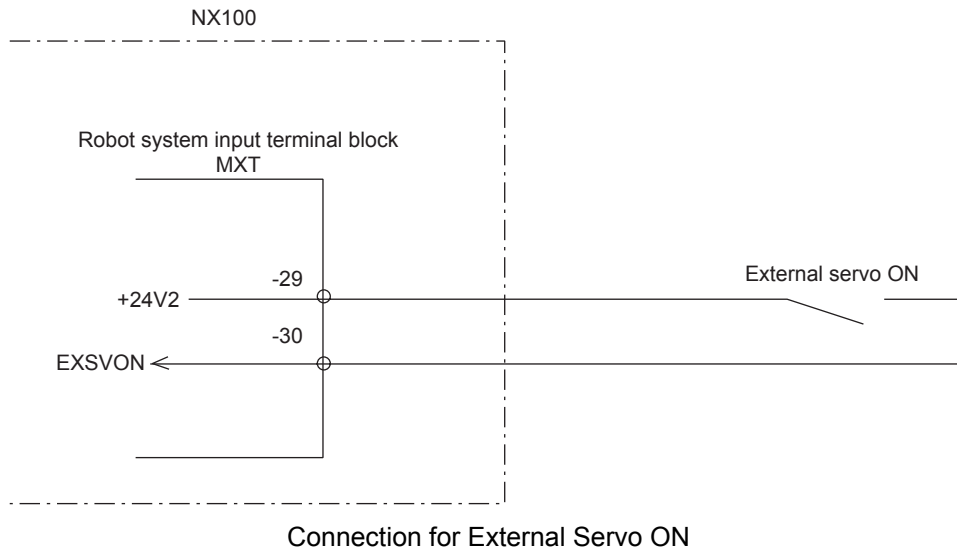
Open: Second slow speed (2%)

Short-circuit: First slow speed (16%)



### 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.



## 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.

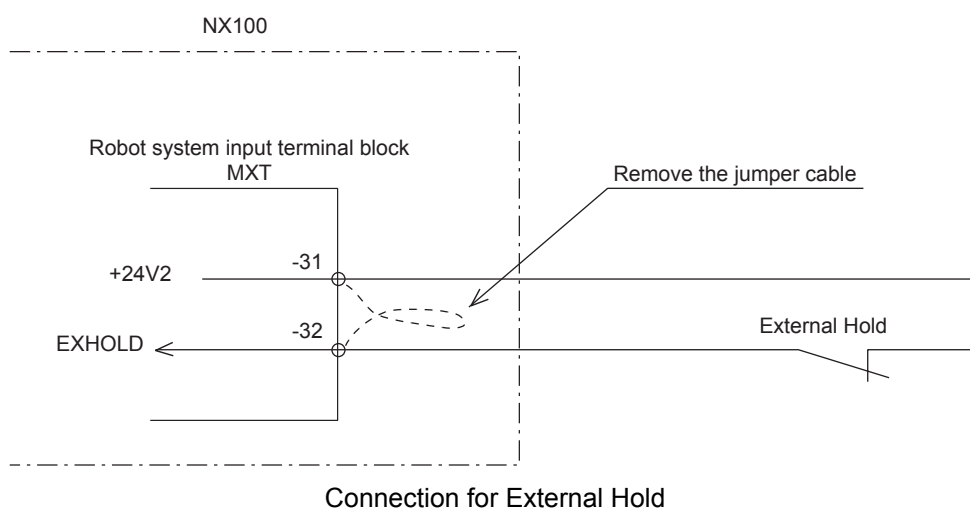
While the signal is input, starting and axis operations are disabled.



### 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.



### External Enable Switch

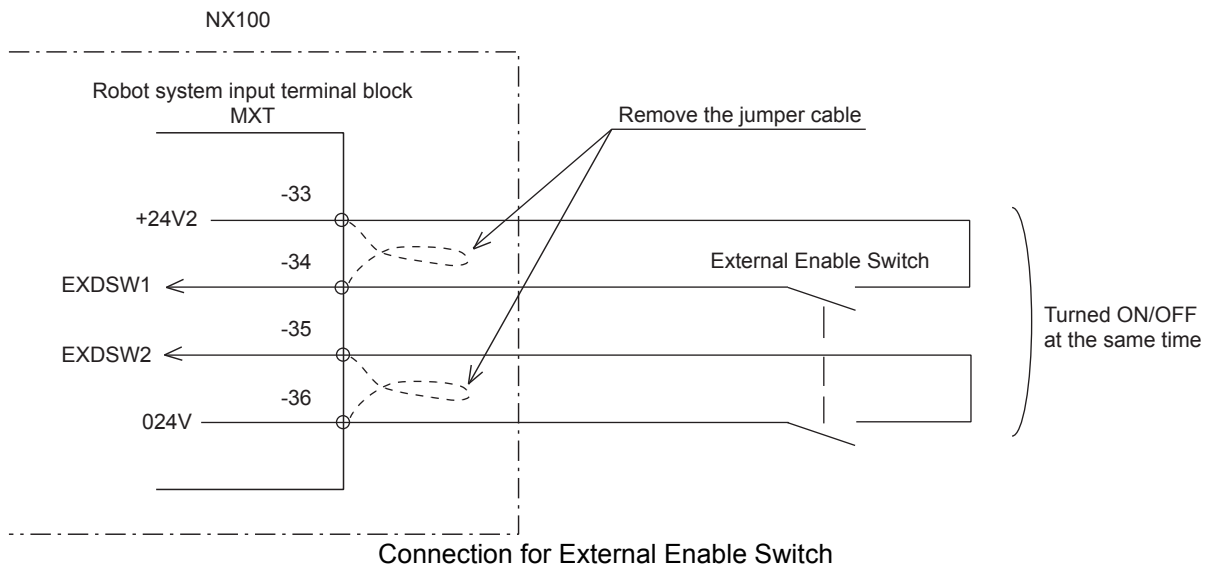
This signal is used to connect a Enable switch other than the one on the programming pendant when two people are teaching.



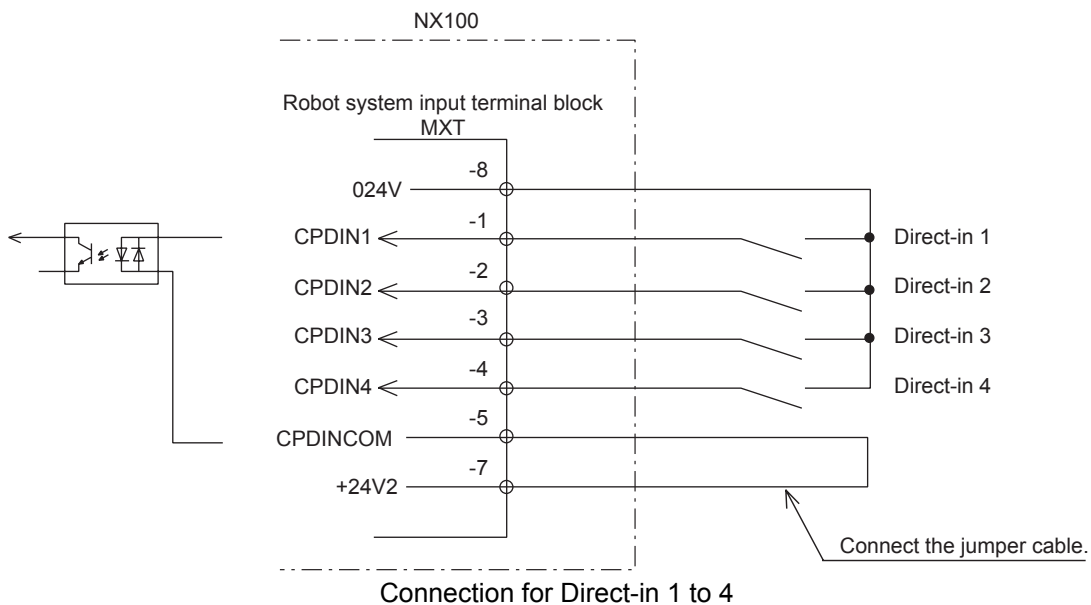
## CAUTION

- **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.

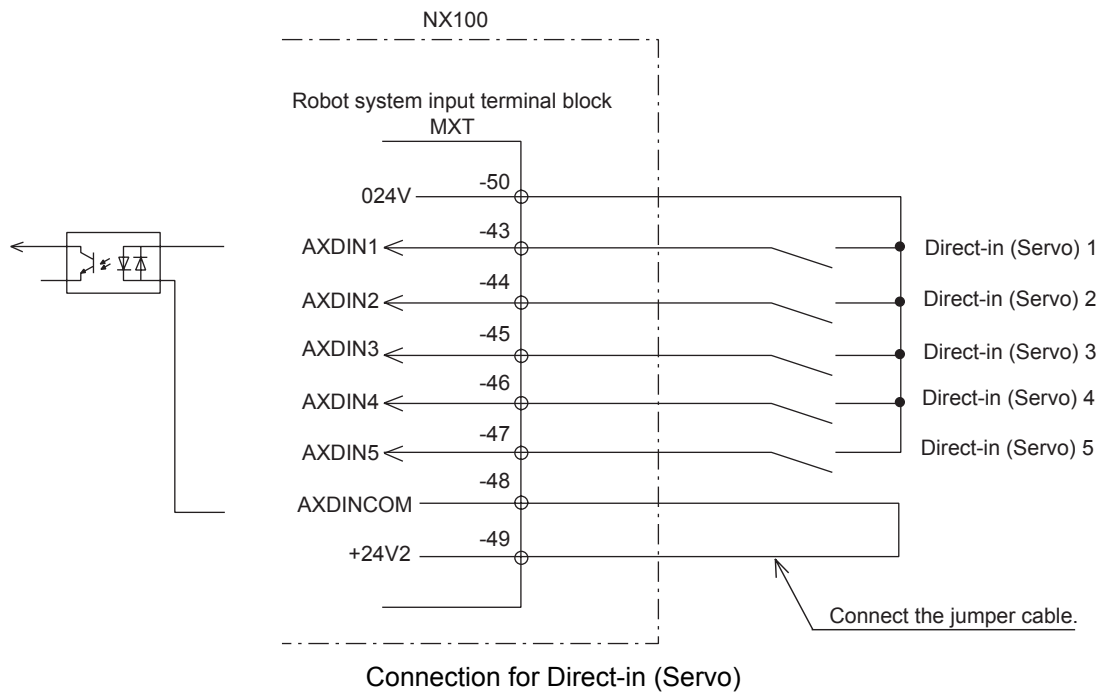


### Direct-in 1 to 4 (Option)



## ■ Direct-in (Servo) 1 to 5

This signal is used to input a responsive signal in search functions.



| Signal Name | Connection No. (MXT) | Dual input | Function  | Factory Setting                   |
|-------------|----------------------|------------|---|-----------------------------------|
| EXESP1      | -19<br>-20           | Applicable | External Emergency Stop   | Short-circuit with a jumper cable |
| EXESP2      | -21<br>-22           |            | 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.  |                                   |
| SAF1        | -9<br>-10            | Applicable | Safety Plug   | Short-circuit with a jumper cable |
| SAF2        | -11<br>-12           |            | 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. |                                   |
| MAINTE1     | -13<br>-14           | Applicable | Maintenance Input   | Open                              |
| MAINTE2     | -15<br>-16           |            | If the signal input circuit is short-circuited, the Enable switch (DSW) are disabled. Usually, use the system with this signal circuit open (nothing connected). If the circuit for this signal must be used for an unavoidable reason, be sure to use a switch with a key that is <b>kept under the care of the system manager</b> .           |                                   |
| FST1        | -23<br>-24           | Applicable | Full-speed Test   | Open                              |
| FST2        | -25<br>-26           |            | 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%).              |                                   |
| SSP         | -27<br>-28           | –          | Slow Speed Mode Selection   | Short-circuit with a jumper cable |
|             |                      |            | Used to determine the speed of the test run when the FST (full-speed test) signal input circuit is open.<br>Open: Second slow speed (2%)<br>Short-circuit: First slow speed (16%)   |                                   |

| Signal Name      | Connection No. (MXT)            | Dual input | Function  | Factory Setting                   |
|------------------|---------------------------------|------------|---|-----------------------------------|
| EXSVON           | -29<br>-30                      | –          | External Servo ON   | Open                              |
|                  |                                 |            | Use to connect the servo ON switch of an external operation device.<br>If the signal is input, the servo power supply is turned ON.   |                                   |
| EXHOLD           | -31<br>-32                      | –          | External Hold   | Short-circuit with a jumper cable |
|                  |                                 |            | Used to connect the temporary stop switch of an external device.<br>If the signal is input, the job is stopped. While the signal is input, starting and axis operations are disabled. |                                   |
| EXDSW            | -33<br>-34                      | Applicable | External Enable Switch  | Short-circuit with a jumper cable |
| EXDSW2           | -35<br>-36                      |            | Used to connect a Enable switch other than the one on the programming pendant when two people are teaching.   |                                   |
| CPDIN1 to CPDIN4 | -1<br>-2<br>-3<br>-4<br>-5      | –          | Direct-in 1 to 4  | Open                              |
|                  |                                 |            | Option  |                                   |
| AXDIN1 to AXDIN5 | -43<br>-44<br>-45<br>-46<br>-48 | –          | Direct-in (Servo) 1 to 5  | Open                              |
|                  |                                 |            | Used in search functions.   |                                   |



## 12.4 Contact Output of Emergency Stop Button

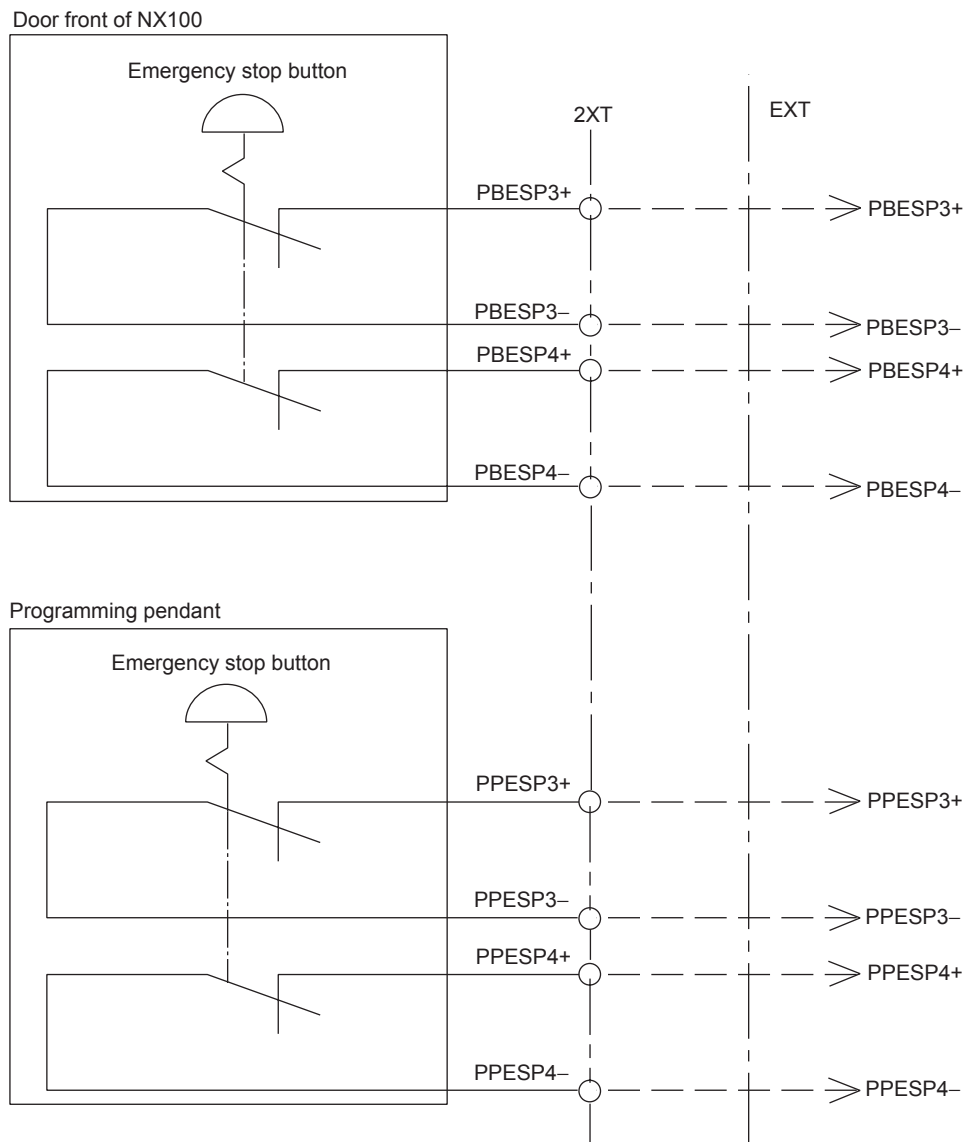
The contact output terminals for the emergency stop button on the programming pendant and the door front are provided on the terminal board 2XT (screw size M3.5) on NX100. These contact outputs are always valid no matter of the NX100 main power supply status ON or OFF. (Status output signal: normally 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.



## 12.5 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”).

### 12.5.1 Description of Each Unit

#### ■ 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.

#### ■ 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.

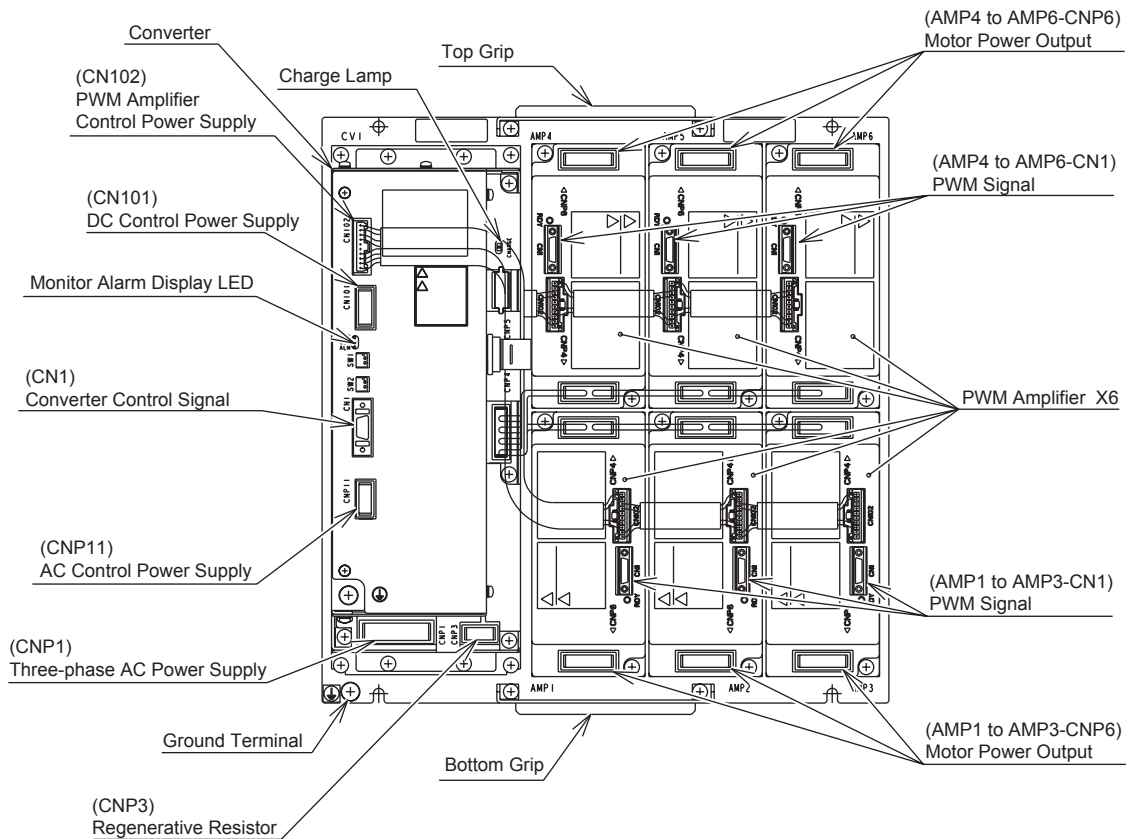
### 12.5.2 SERVOPACK Configuration

| Configuration device |   | HP3             | HP6, EA1400N       |
|----------------------|---|-----------------|--------------------|
|                      |   | Model           | Model              |
| SERVOPACK            |   | SGDR-EA1400NY26 | SGDR-EA1400N       |
| Converter            |   | SGDR-COA040A01B | SGDR-COA040A01B    |
| PWM Amplifier        | S | SGDR-SDA060A01B | SGDR-SDA140A01BY22 |
|                      | L | SGDR-SDA060A01B | SGDR-SDA140A01BY22 |
|                      | U | SGDR-SDA060A01B | SGDR-SDA140A01BY22 |
|                      | R | SGDR-SDA060A01B | SGDR-SDA060A01B    |
|                      | B | SGDR-SDA060A01B | SGDR-SDA060A01B    |
|                      | T | SGDR-SDA060A01B | SGDR-SDA060A01B    |

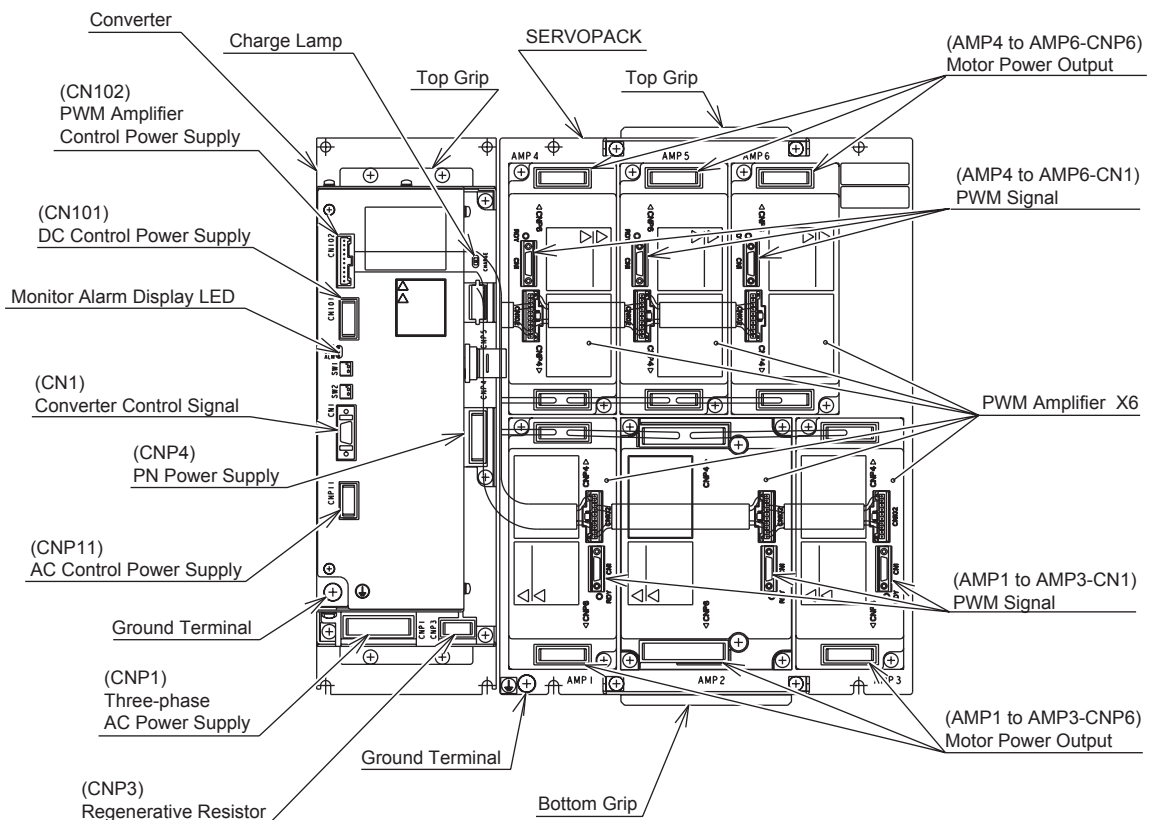
## 12.5 SERVOPACK

| Configuration device |   | HP20, EA1900N      | UP50N              | UP20MN          |
|----------------------|---|--------------------|--------------------|-----------------|
|                      |   | Model              | Model              | Model           |
| SERVOPACK            |   | SGDR-HP20Y30       | SGDR-EH50Y24       | SGDR-EH50Y27    |
| PWM Amplifier        | S | SGDR-SDA140A01B    | SGDR-SDA710A01BY32 | SGDR-SDA710A01B |
|                      | L | SGDR-SDA350A01BY23 | SGDR-SDA710A01B    | SGDR-SDA710A01B |
|                      | U | SGDR-SDA140A01BY22 | SGDR-SDA350A01BY28 | SGDR-SDA350A01B |
|                      | R | SGDR-SDA060A01B    | SGDR-SDA140A01B    | SGDR-SDA060A01B |
|                      | B | SGDR-SDA060A01BY31 | SGDR-SDA140A01B    | SGDR-SDA060A01B |
|                      | T | SGDR-SDA060A01B    | SGDR-SDA140A01B    | SGDR-SDA060A01B |
| Converter            |   | SGDR-COA080A01B    | SGDR-COA250A01B    | SGDR-COA250A01B |

| Configuration device |   | ES165N, HP165, ES200N | ES165RN, ES200RN   |
|----------------------|---|-----------------------|--------------------|
|                      |   | Model                 | Model              |
| SERVOPACK            |   | SGDR-ES165N           | SGDR-ES165NY28     |
| PWM Amplifier        | S | SGDR-SDA710A01B       | SGDR-SDA710A01B    |
|                      | L | SGDR-SDA710A01BY29    | SGDR-SDA710A01BY29 |
|                      | U | SGDR-SDA710A01B       | SGDR-SDA710A01BY25 |
|                      | R | SGDR-SDA350A01B       | SGDR-SDA350A01B    |
|                      | B | SGDR-SDA350A01B       | SGDR-SDA350A01B    |
|                      | T | SGDR-SDA350A01B       | SGDR-SDA350A01B    |
| Converter            |   | SGDR-COA250A01B       | SGDR-COA250A01B    |

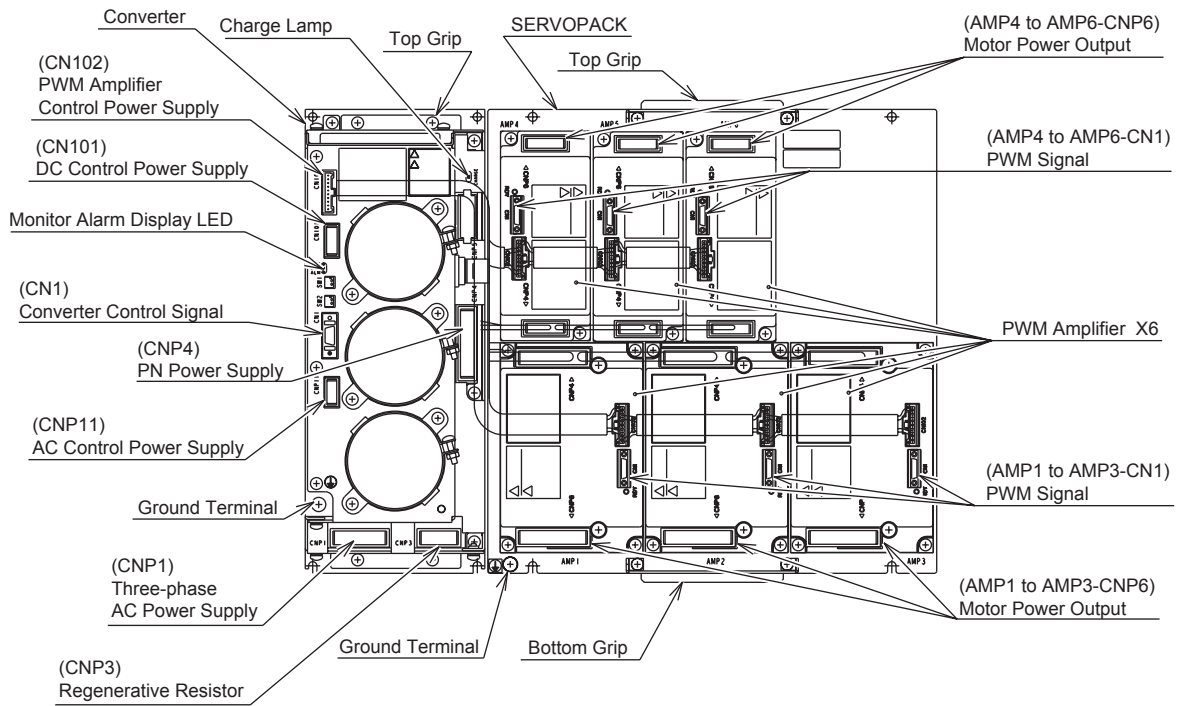


SERVOPACK Configuration for HP3, HP6 and EA1400N

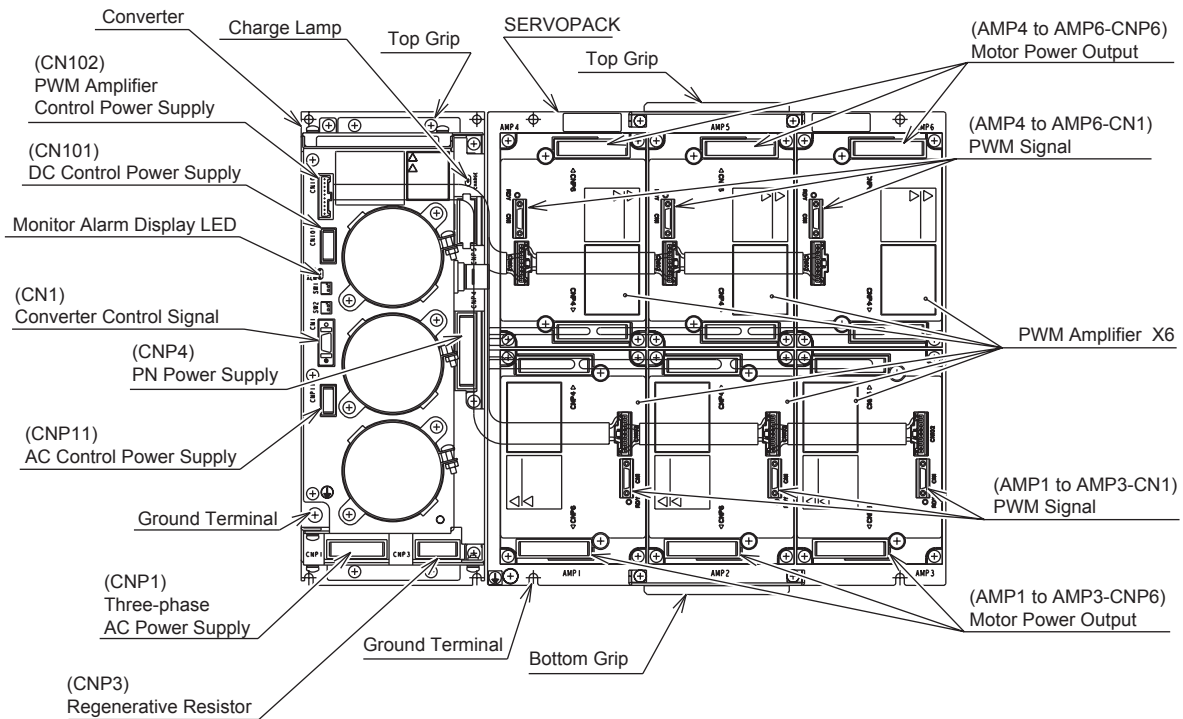


SERVOPACK Configuration for HP20 and EA1900N

## 12.5 SERVOPACK



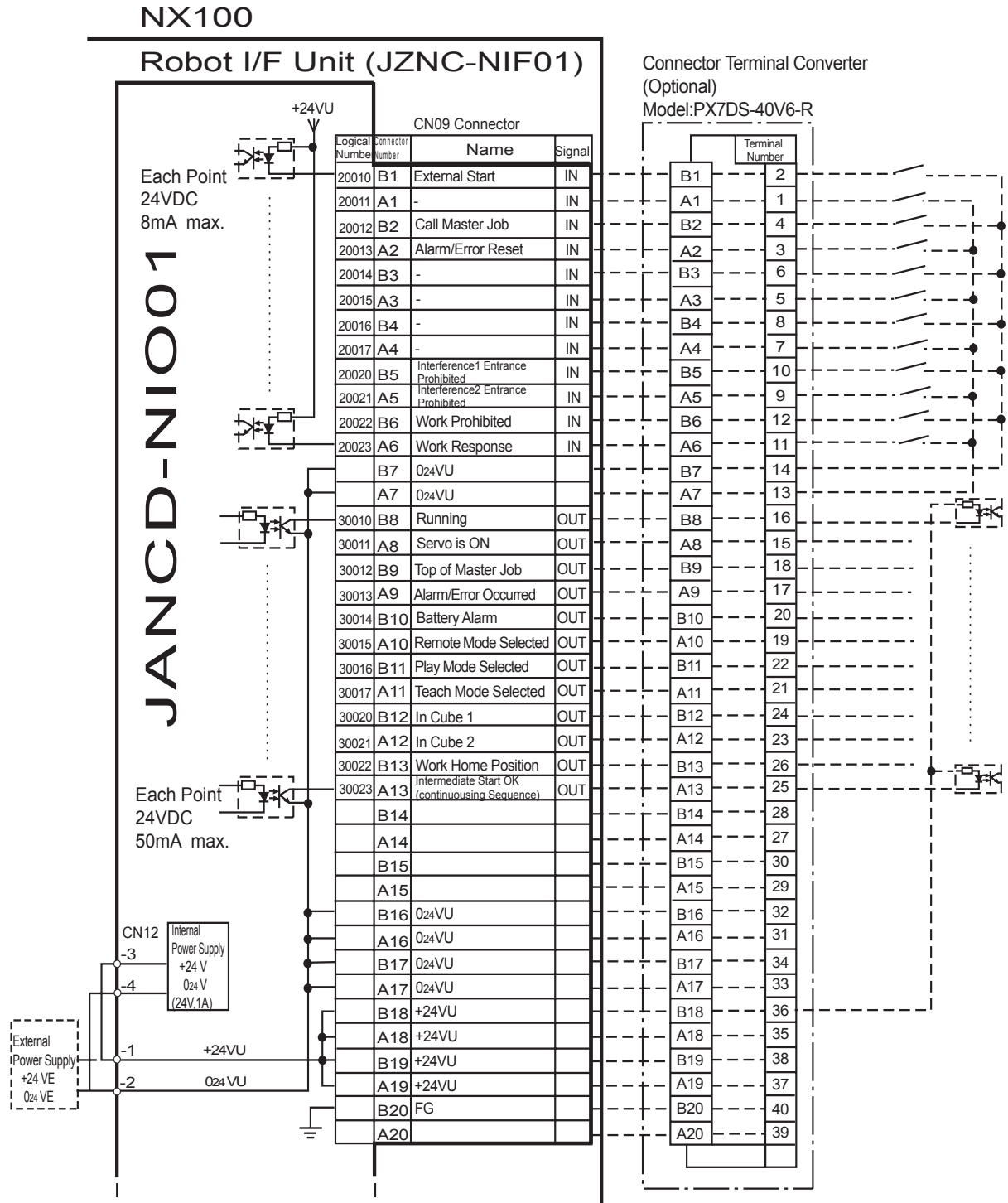
SERVOPACK Configuration for UP20MN and UP50N



SERVOPACK Configuration for ES165N, HP165, ES200N, ES165RN, and ES200RN

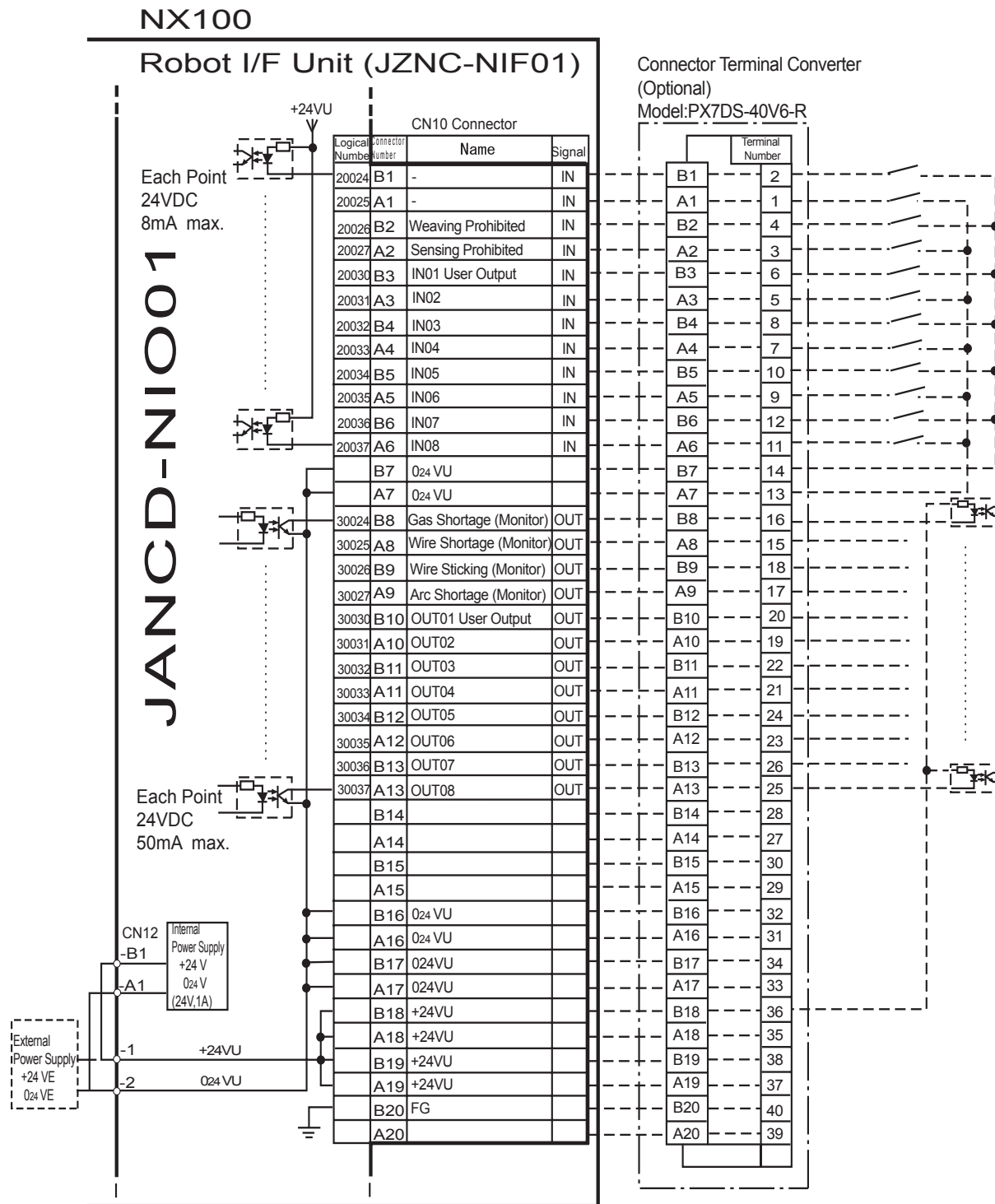
# 12.6 User I/O Signal Assignment

## 12.6.1 Arc Welding



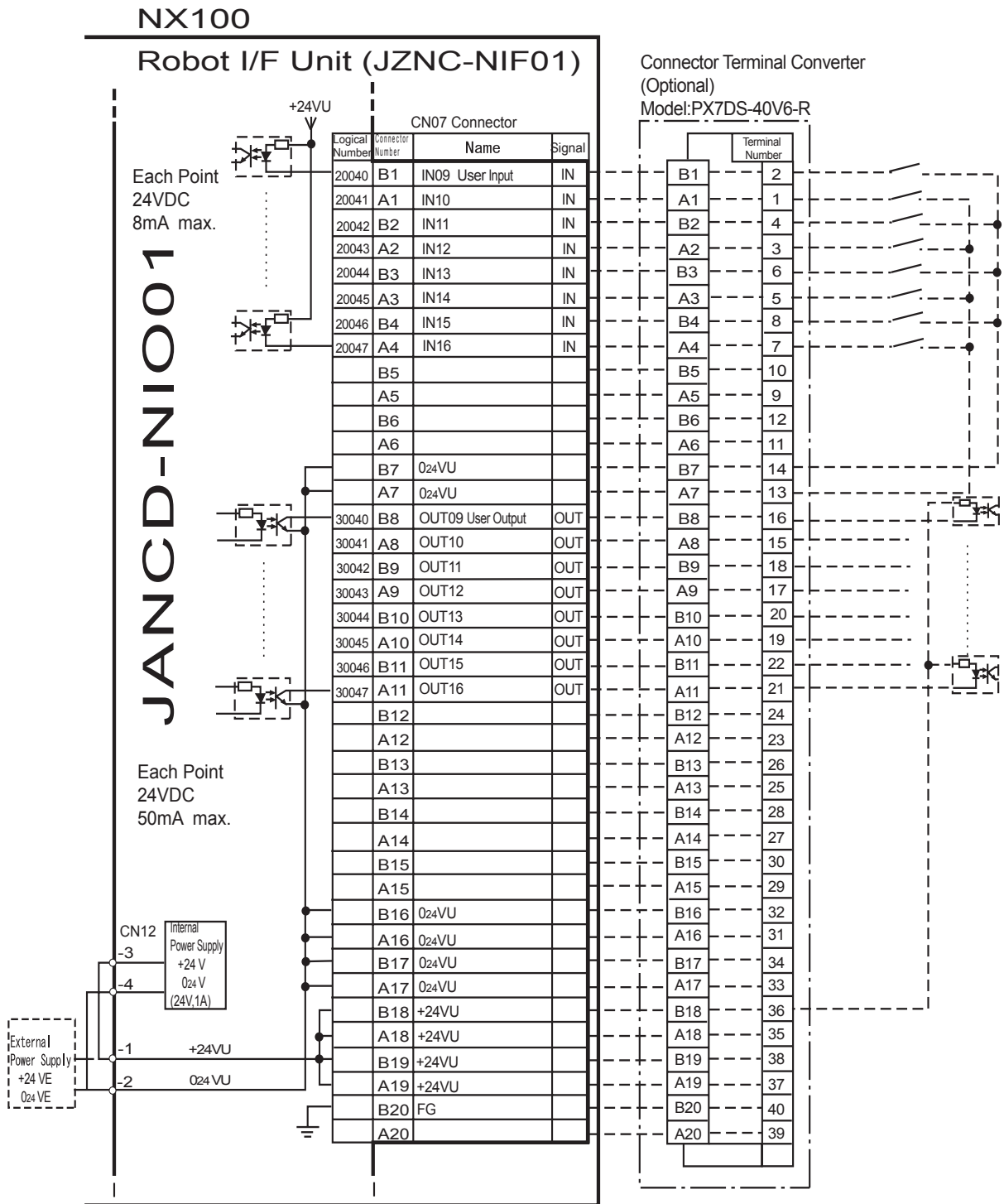
\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when a external power supply is used.

JANCD-NIO01 (CN09 Connector) I/O Allocation and Connection Diagram (For Arc Welding)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

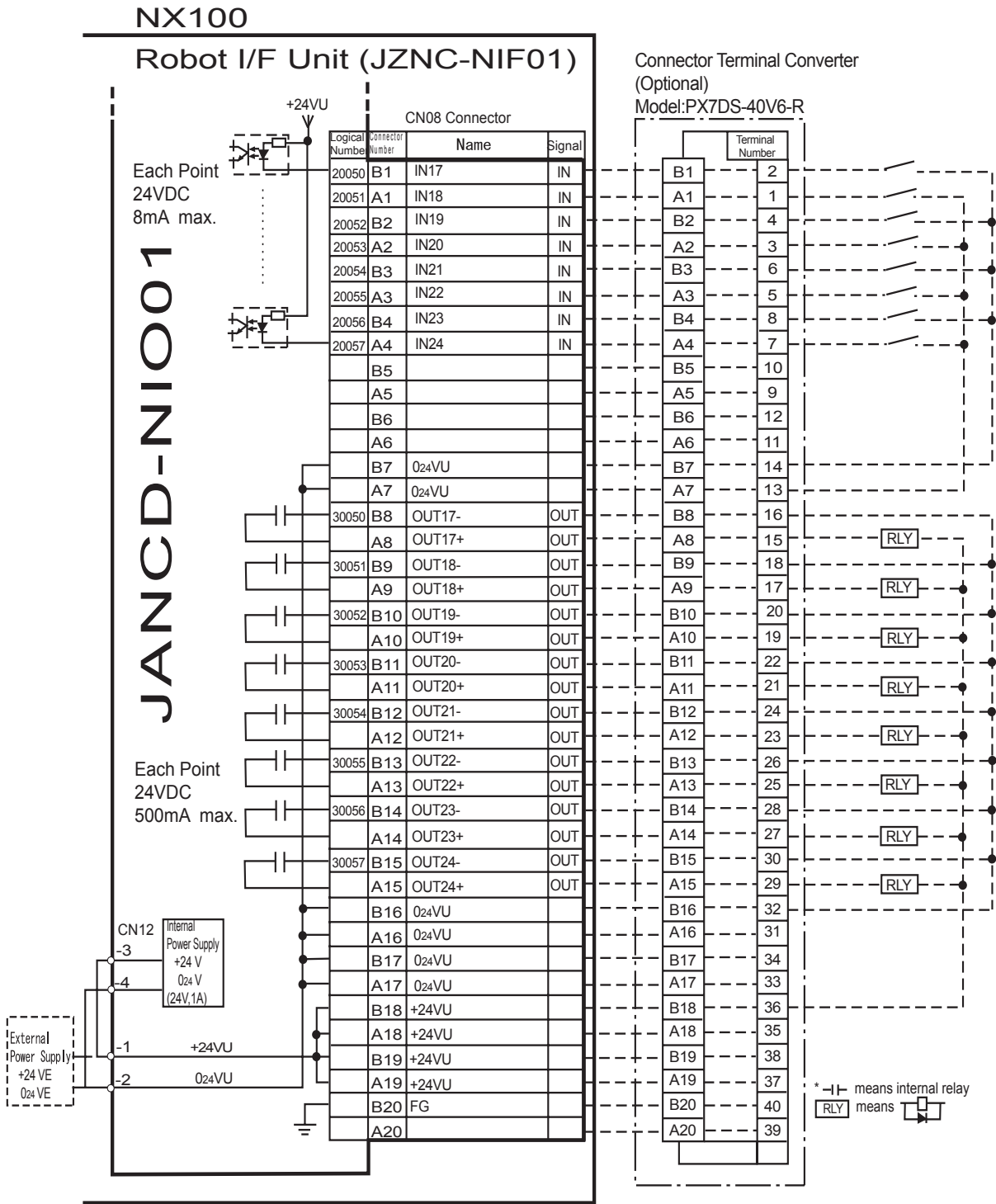
JANCD-NIO01 (CN10 Connector) I/O Allocation and Connection Diagram (For Arc Welding)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN07 Connector) I/O Allocation and Connection Diagram (For Arc Welding)





\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN08 Connector) I/O Allocation and Connection Diagram (For Arc Welding)

System Input List NIO01 (Arc Welding)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function  |
|----------------|---|----------------|--|
| 20010          | EXTERNAL START<br>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.                                     | 20022          | WORK PROHIBITED (Arc Generation Prohibited)<br>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. |
| 20012          | CALL MASTER JOB<br>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). | 20023          | WORK RESPONSE (Pseudo Arc ON Response)<br>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). |
| 20013          | ALARM/ERROR RESET<br>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.  | 20026          | WEAVING PROHIBITED<br>Weaving is prohibited while this signal is ON. Use this signal to check taught steps and movements without performing the weaving operation.   |
| 20020          | INTERFERENCE 1 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 1 <sup>2</sup> 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.                              | 20027          | SENSING PROHIBITED<br>Arc sensing is prohibited while this signal is ON. Use this signal to check taught steps and movements if an arc sensor is mounted.  |
| 20021          | INTERFERENCE 2 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 2 <sup>2</sup> 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 "9.7 Interference Area."

## 12.6 User I/O Signal Assignment

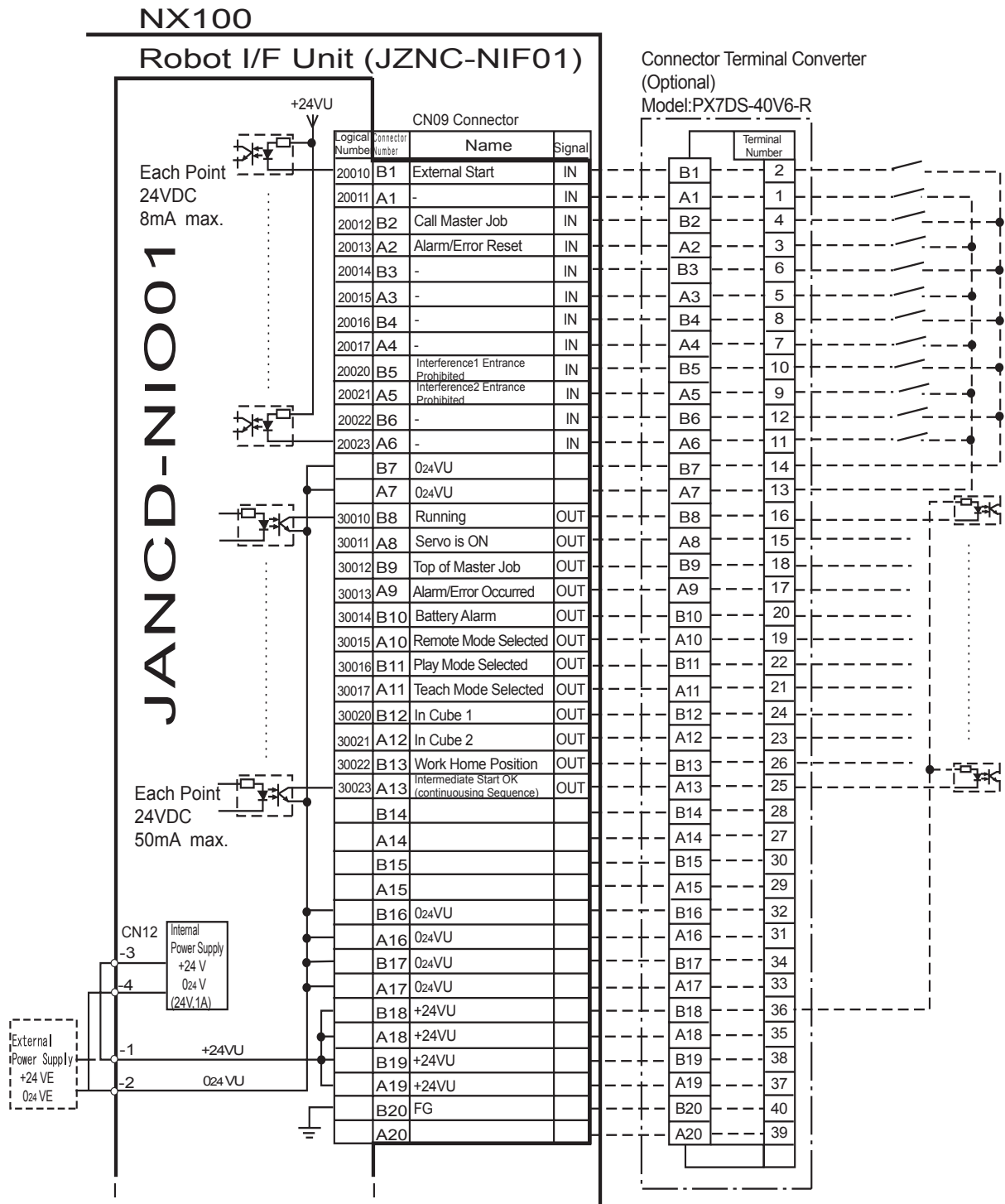
System Output List NIO01 (Arc Welding)

| Logical Number | Output Name / Function   | Logical Number | Output Name / Function   |
|----------------|--|----------------|--|
| 30010          | <b>RUNNING</b><br>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.  | 30021          | <b>IN CUBE 2</b><br>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.   |
| 30011          | <b>SERVO IS ON</b><br>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 NX100 status diagnosis for an external start.     | 30022          | <b>WORK HOME POSITION (IN CUBE 48)*1</b><br>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.   |
| 30012          | <b>TOP OF MASTER JOB</b><br>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. *2   | 30023          | <b>INTERMEDIATE START OK</b><br>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. |
| 30013          | <b>ALARM/ERROR OCCURRED</b><br>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.   | 30024          | <b>GAS SHORTAGE (MONITOR)</b><br>This signal stays ON while the gas shortage signal from the welding power supply is ON.   |
| 30014          | <b>BATTERY ALARM</b><br>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. | 30025          | <b>WIRE SHORTAGE (MONITOR)</b><br>This signal status ON while the wire shortage signal from the welding power supply is ON.  |
| 30015 to 30017 | <b>REMOTE/PLAY/TEACH MODE SELECTED</b><br>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.  | 30026          | <b>WIRE STICKING (MONITOR)</b><br>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.   |
| 30020          | <b>IN CUBE 1</b><br>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.   | 30027          | <b>ARC SHORTAGE (MONITOR)</b><br>This signal stays ON while the arc shortage signal from the welding power supply is ON.   |

\*1 The work home position cube and Cube 48 are same.

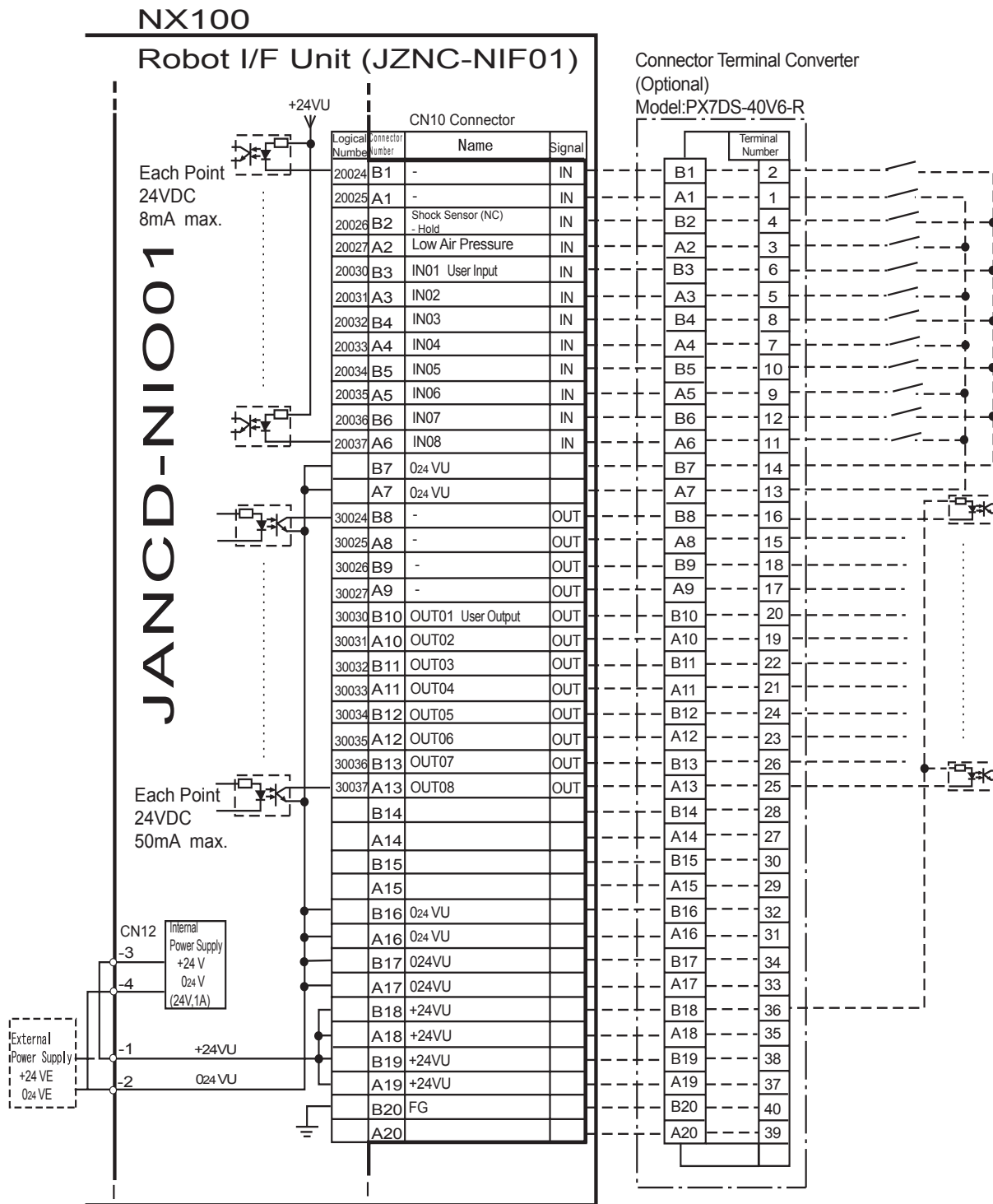
\*2 This signal is not output during operation.

## 12.6.2 Handling



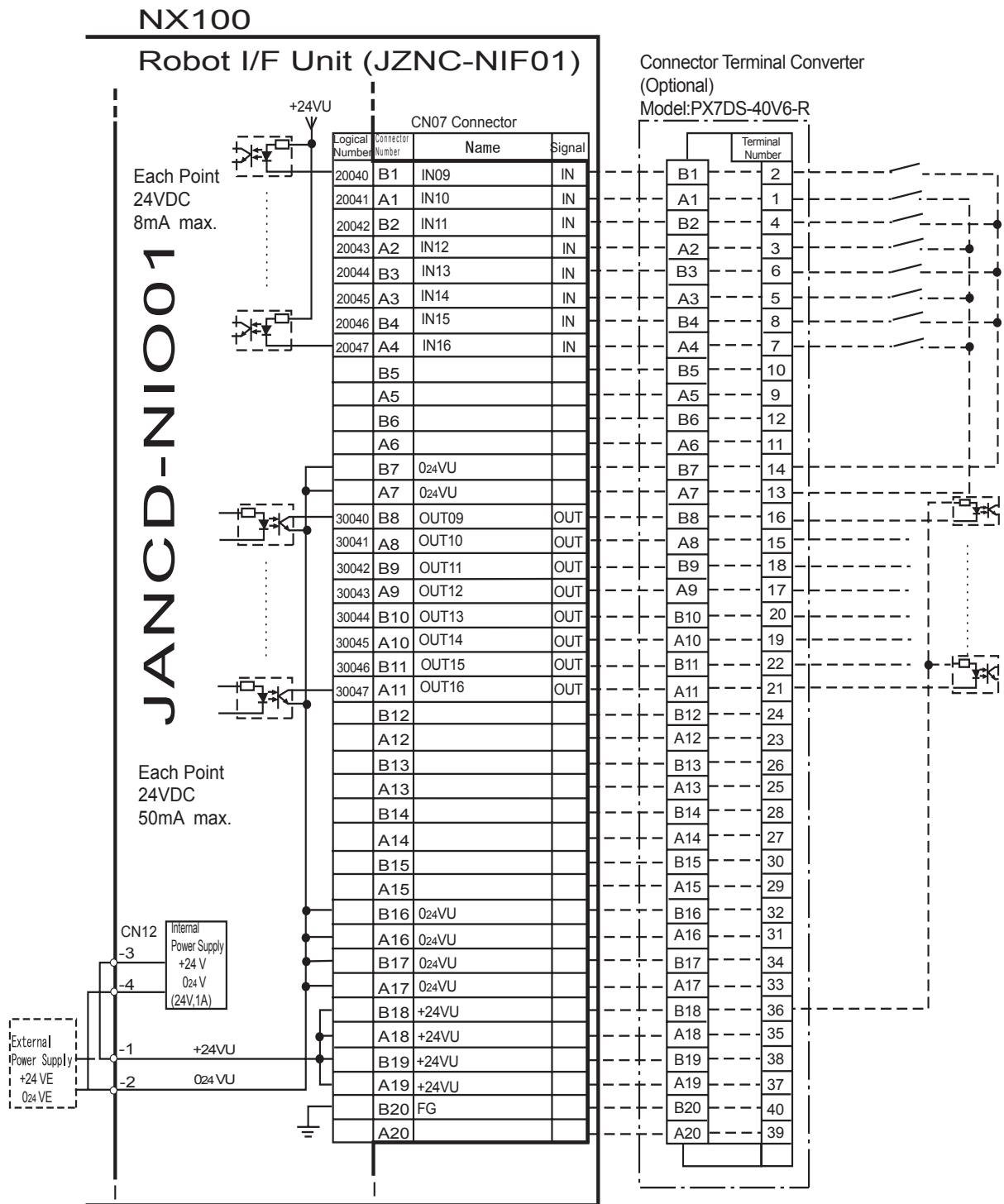
\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when a external power supply is used.

JANCD-NIO01 (CN09 Connector) I/O Allocation and Connection Diagram (For Handling)



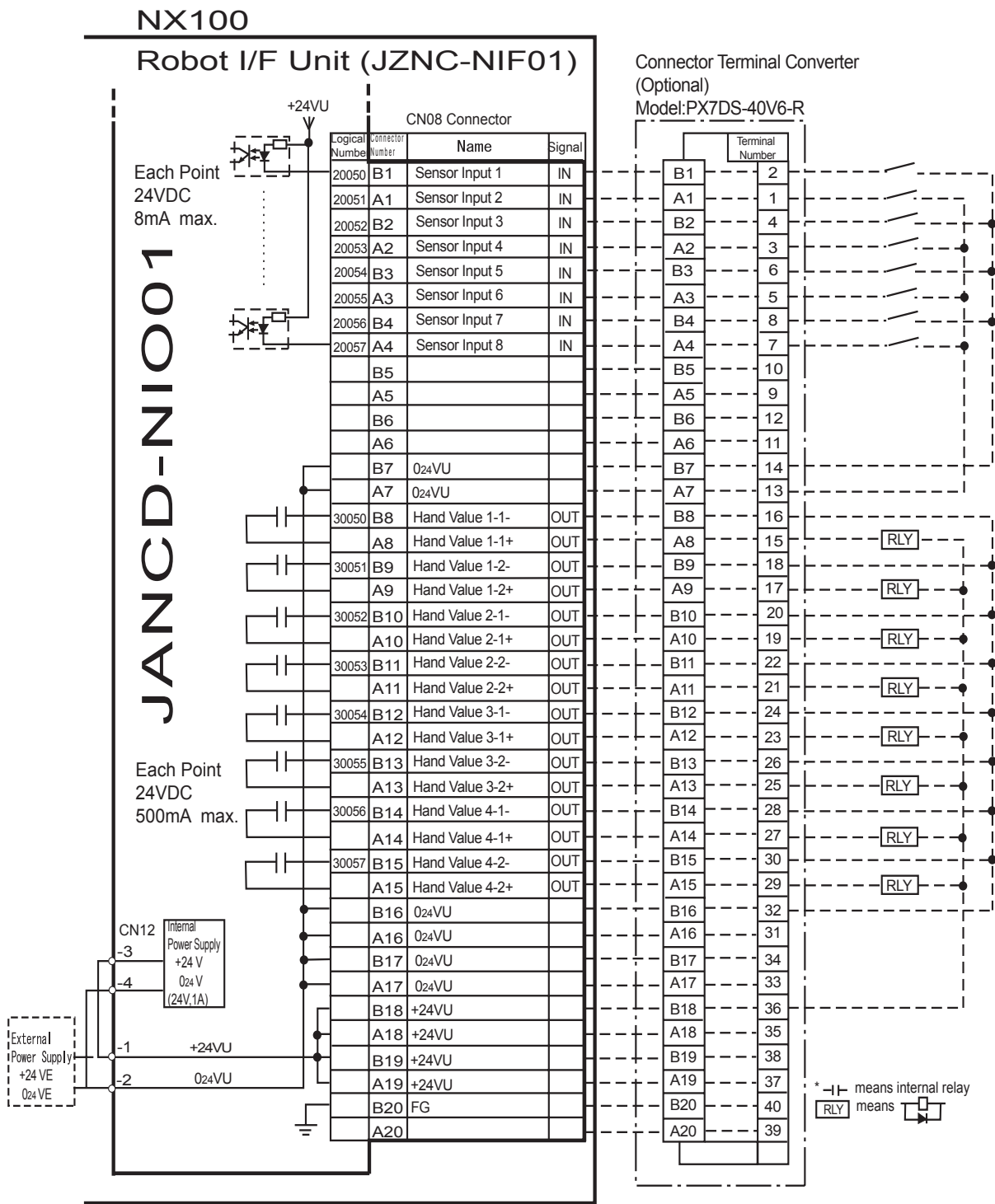
\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN10 Connector) I/O Allocation and Connection Diagram (For Handling)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when a external power supply is used.

JANCD-NIO07 (CN07 Connector) I/O Allocation and Connection Diagram (For Handling)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN08 Connector) I/O Allocation and Connection Diagram (For Handling)

System Input List NIO01 (Handling)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function  |
|----------------|---|----------------|--|
| 20010          | EXTERNAL START<br>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.                                     | 20021          | INTERFERENCE 2 ENTRANCE PROHIBITED<br>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.  |
| 20012          | CALL MASTER JOB<br>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). | 20026          | TOOL SHOCK SENSOR<br>This is normally ON (NC) signal input. When it turns OFF, an NX100 displays 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. |
| 20013          | ALARM/ERROR RESET<br>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.  | 20027          | LOW AIR PRESSURE<br>This signal is normally OFF (NO). When it turns ON, XRC displays user alarm in the PLAY mode or displays user message in the teach mode.   |
| 20020          | INTERFERENCE 1 ENTRANCE PROHIBITED<br>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.   | 20050 to 20057 | SENSOR INPUT 1 - 8<br>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 "9.7 Interference Area."



## 12.6 User I/O Signal Assignment

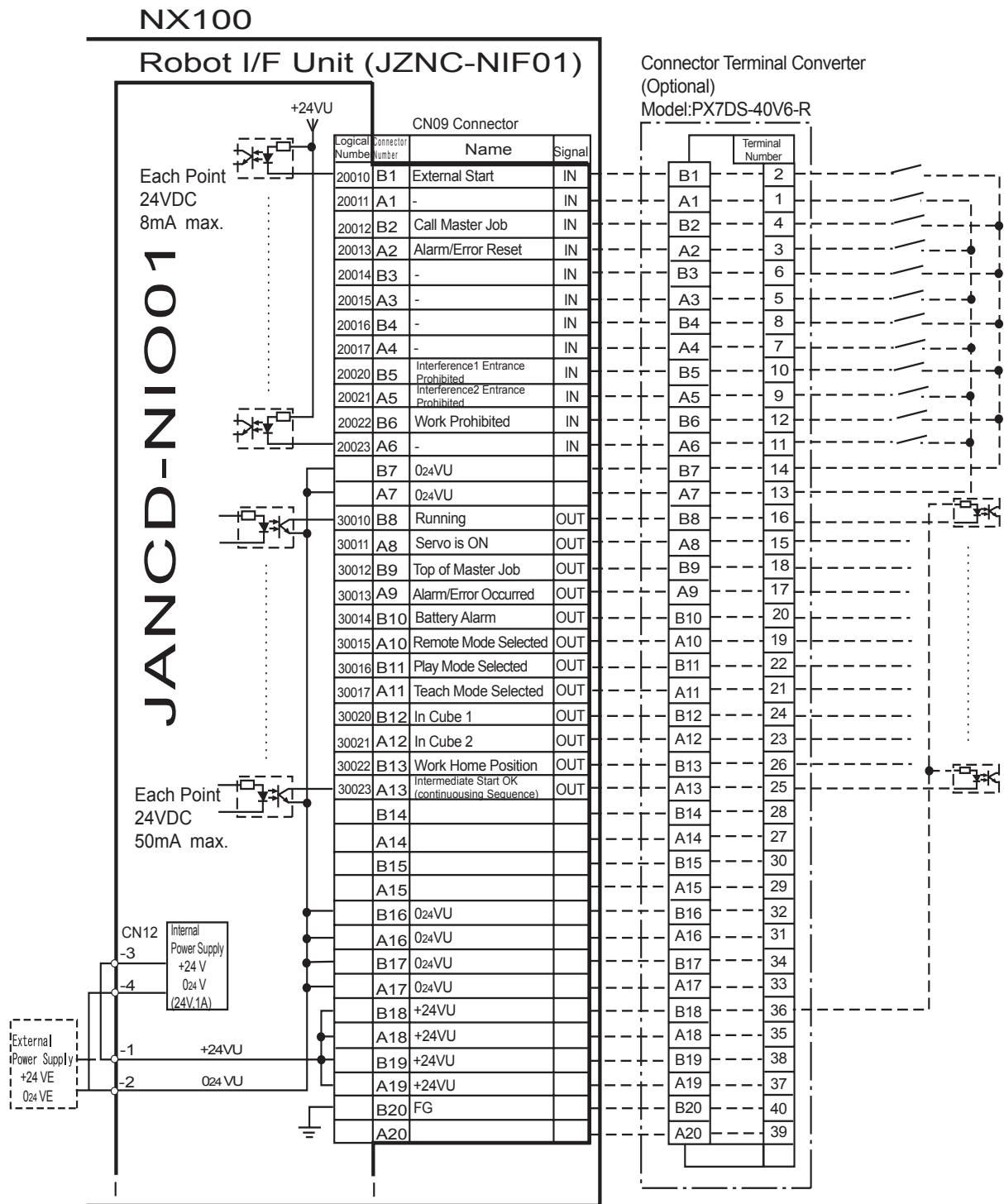
System Output List NIO01 (Handling)

| Logical Number | Output Name / Function   | Logical Number | Output Name / Function   |
|----------------|--|----------------|--|
| 30010          | <b>RUNNING</b><br>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.  | 30021          | <b>IN CUBE 2</b><br>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.   |
| 30011          | <b>SERVO IS ON</b><br>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 NX100 status diagnosis for an external start.     | 30022          | <b>WORK HOME POSITION (IN CUBE 48)*1</b><br>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.   |
| 30012          | <b>TOP OF MASTER JOB</b><br>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. *2   | 30023          | <b>INTERMEDIATE START OK</b><br>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. |
| 30013          | <b>ALARM/ERROR OCCURRED</b><br>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.   | 30050 to 30057 | <b>HAND VALVE 1-4</b><br>These outputs are controlled by the HAND handling specific instructions. Hand valves 1 to 4 correspond to HAND 1 to 4.  |
| 30014          | <b>BATTERY ALARM</b><br>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 | <b>REMOTE/PLAY/TEACH MODE SELECTED</b><br>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          | <b>IN CUBE 1</b><br>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.   |                |  |

\*1 The work home position cube and Cube 48 are same.

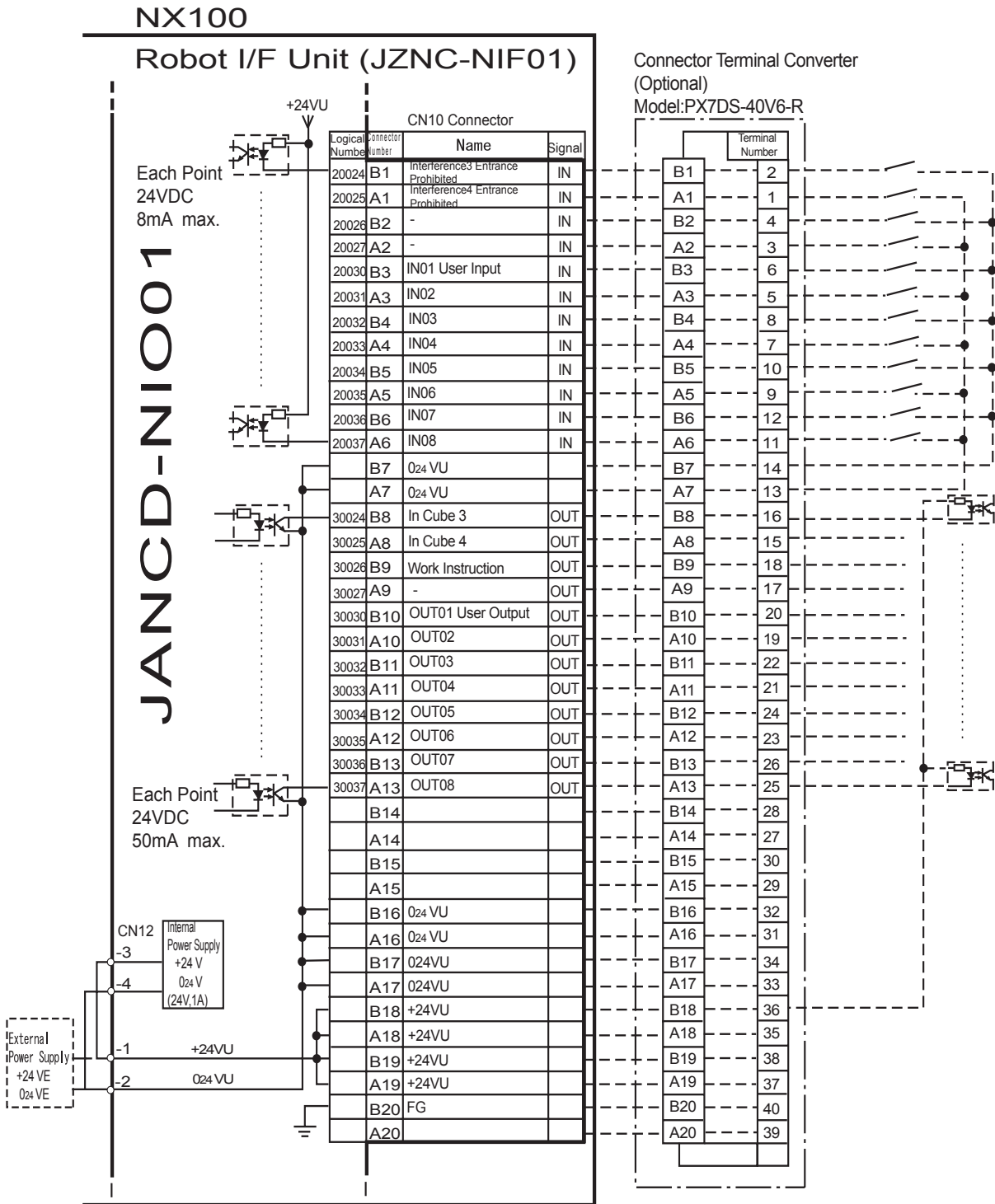
\*2 This signal is not output during operation.

### 12.6.3 General Application



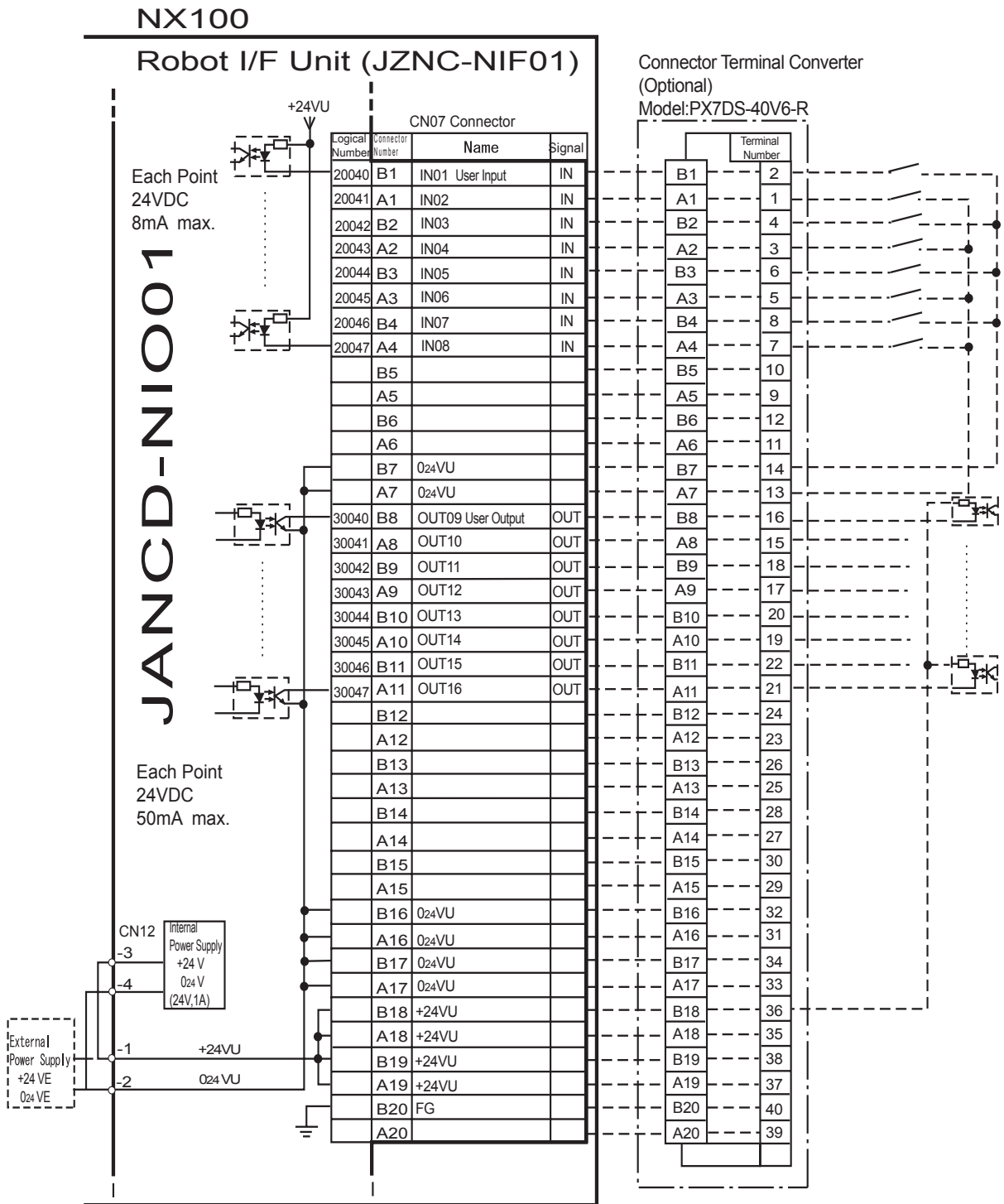
\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when a external power supply is used.

JANCD-NIO01 (CN09 Connector) I/O Allocation and Connection Diagram (For General Application)



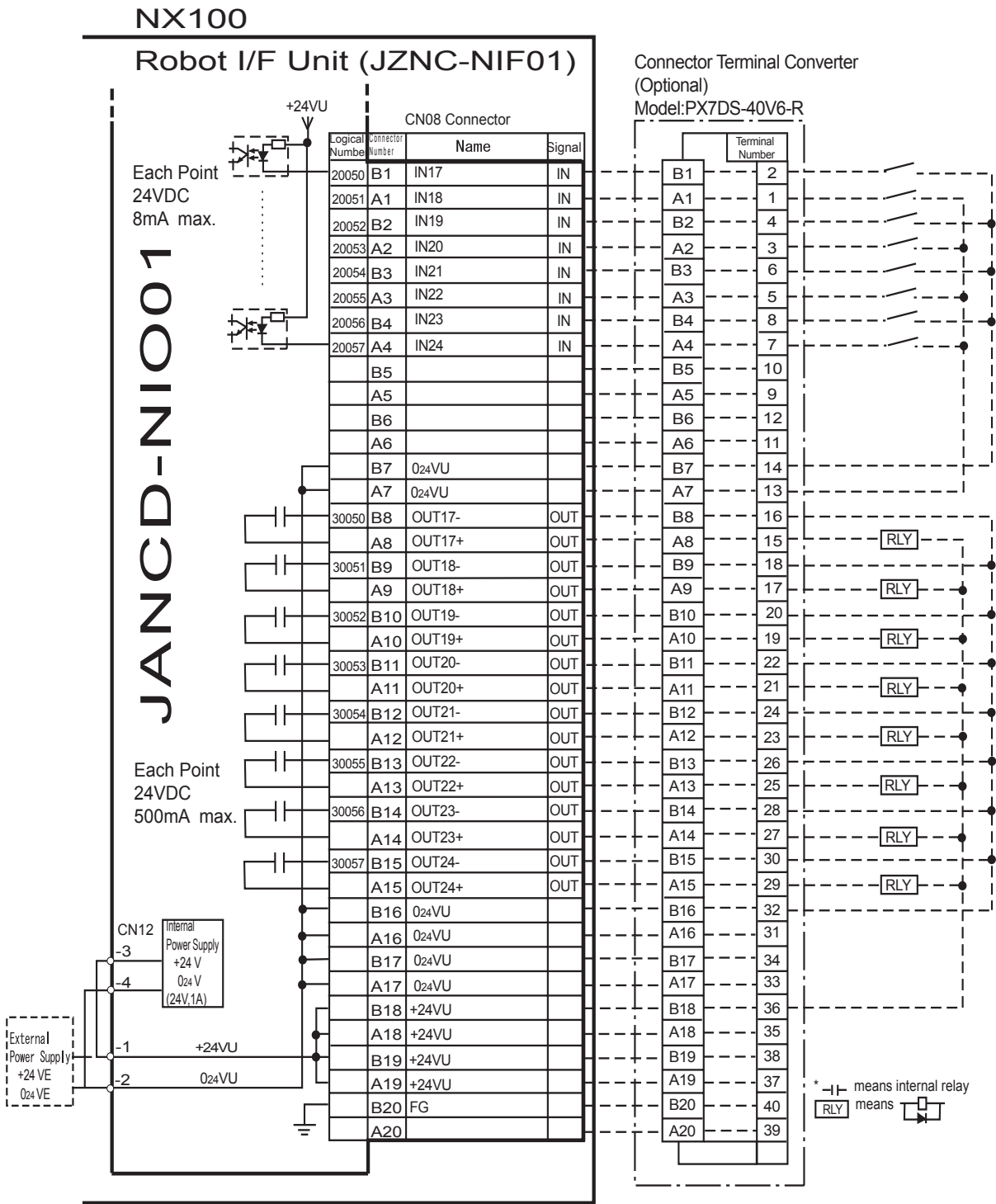
\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when a external power supply is used.

JANCD-NIO01 (CN10 Connector) I/O Allocation and Connection Diagram (For General Application)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN07 Connector) I/O Allocation and Connection Diagram (For General Application)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN08 Connector) I/O Allocation and Connection Diagram (For General Application)

System Input List NIO01 (General application)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function  |
|----------------|---|----------------|--|
| 20010          | EXTERNAL START<br>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.   | 20021          | INTERFERENCE 2 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 2 <sup>2</sup> 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. |
| 20012          | CALL MASTER JOB<br>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 <sup>*1</sup> . This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display). | 20022          | WORK PROHIBITED (Tool ON Prohibited)<br>Even if TOOLON instruction is executed, XRC doesn't output to external while this signal is ON.  |
| 20013          | ALARM/ERROR RESET<br>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.  | 20024          | INTERFERENCE 3 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 3 <sup>2</sup> 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. |
| 20020          | INTERFERENCE 1 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 1 <sup>2</sup> 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<br>If the manipulator attempts to enter the cube 4 <sup>2</sup> 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 "9.7 Interference Area."

## 12.6 User I/O Signal Assignment

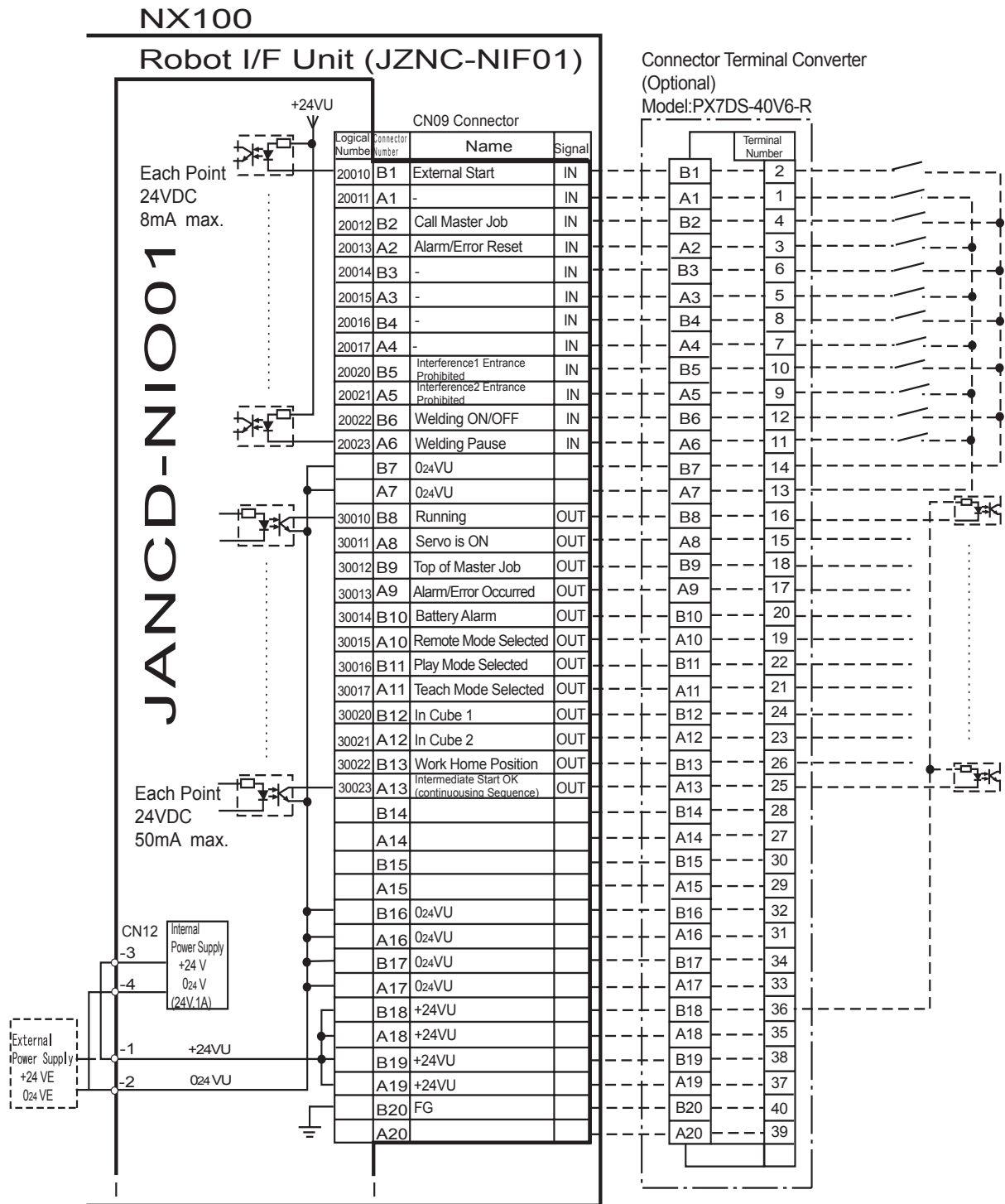
System Output List NIO01 (General application)

| Logical Number | Output Name / Function   | Logical Number | Output Name / Function   |
|----------------|--|----------------|--|
| 30010          | <b>RUNNING</b><br>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.  | 30021          | <b>IN CUBE 2</b><br>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.   |
| 30011          | <b>SERVO IS ON</b><br>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 XRC status diagnosis for an external start.       | 30022          | <b>WORK HOME POSITION (IN CUBE 48)*1</b><br>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.   |
| 30012          | <b>TOP OF MASTER JOB</b><br>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.*2  | 30023          | <b>INTERMEDIATE START OK</b><br>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. |
| 30013          | <b>ALARM/ERROR OCCURRED</b><br>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.   | 30024          | <b>IN CUBE 3</b><br>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.   |
| 30014          | <b>BATTERY ALARM</b><br>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. | 30025          | <b>IN CUBE 4</b><br>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.   |
| 30015 to 30017 | <b>REMOTE/PLAY/TEACH MODE SELECTED</b><br>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.  | 30026          | <b>WORK COMMAND</b><br>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.                                |
| 30020          | <b>IN CUBE 1</b><br>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.   |                |  |

\*1 The work home position cube and Cube 48 are same.

\*2 This signal is not output during operation.

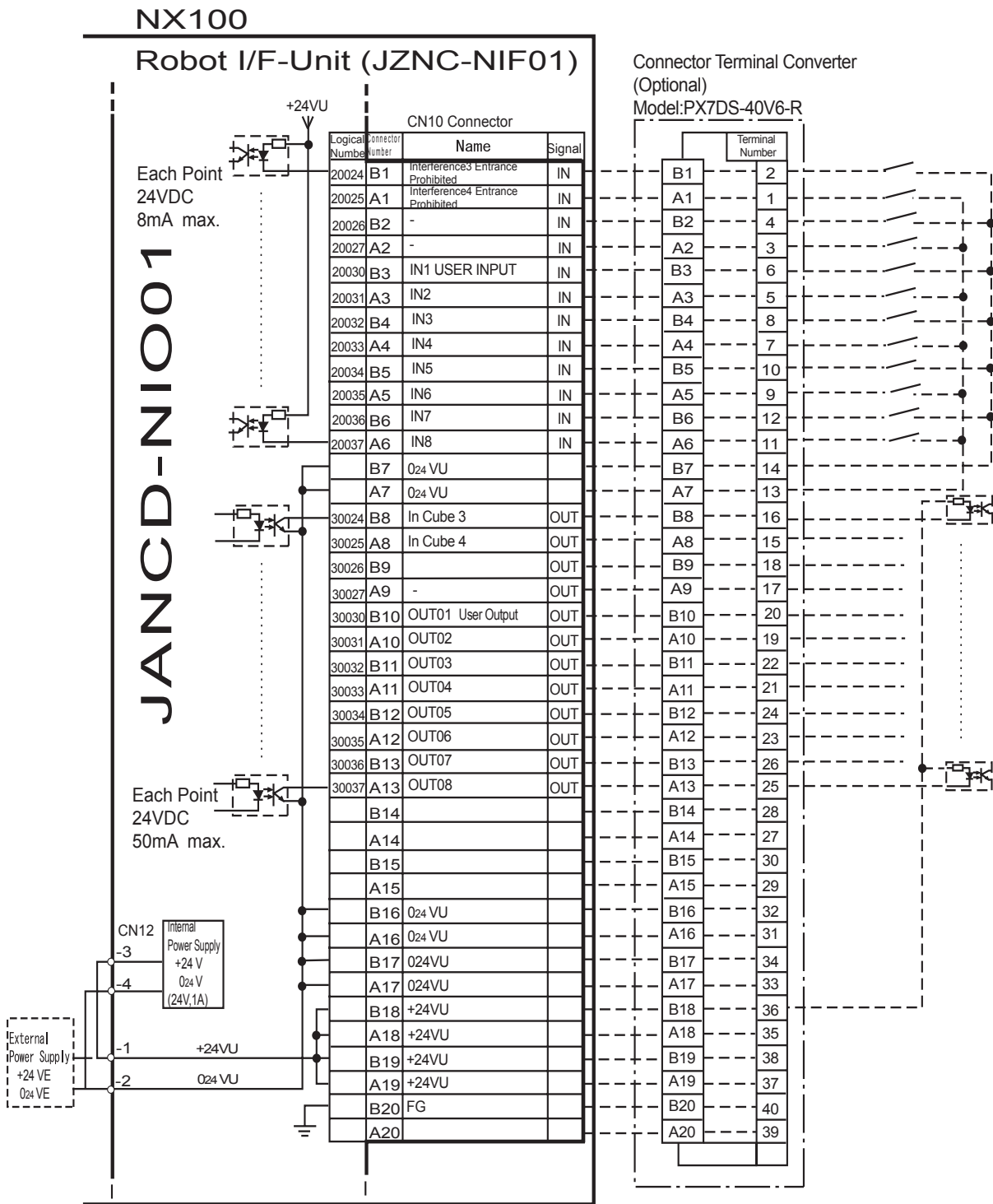
## 12.6.4 Spot Welding



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

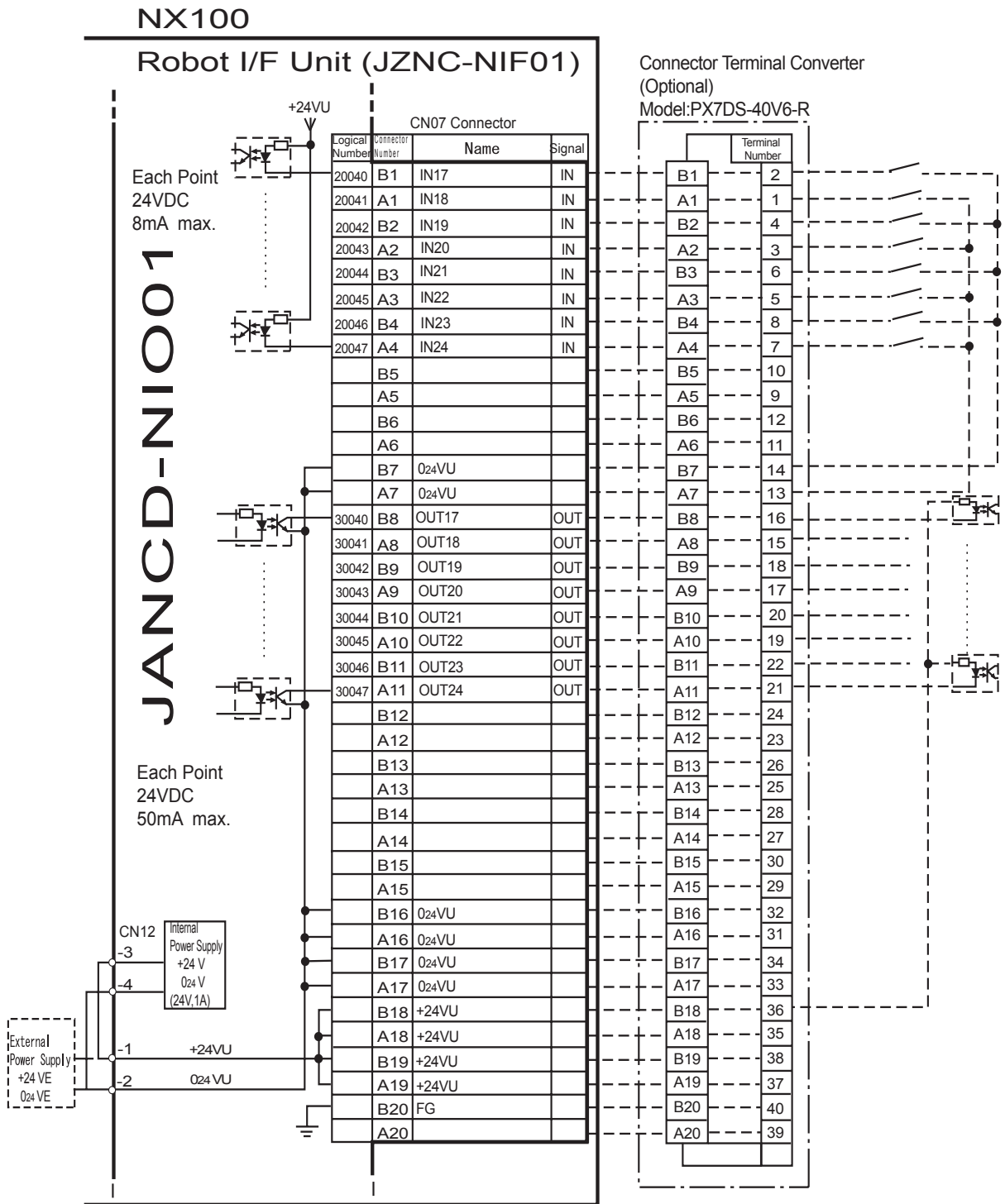
JANCD-NIO01 (CN09 Connector) I/O Allocation and Connection Diagram (For Spot Welding)





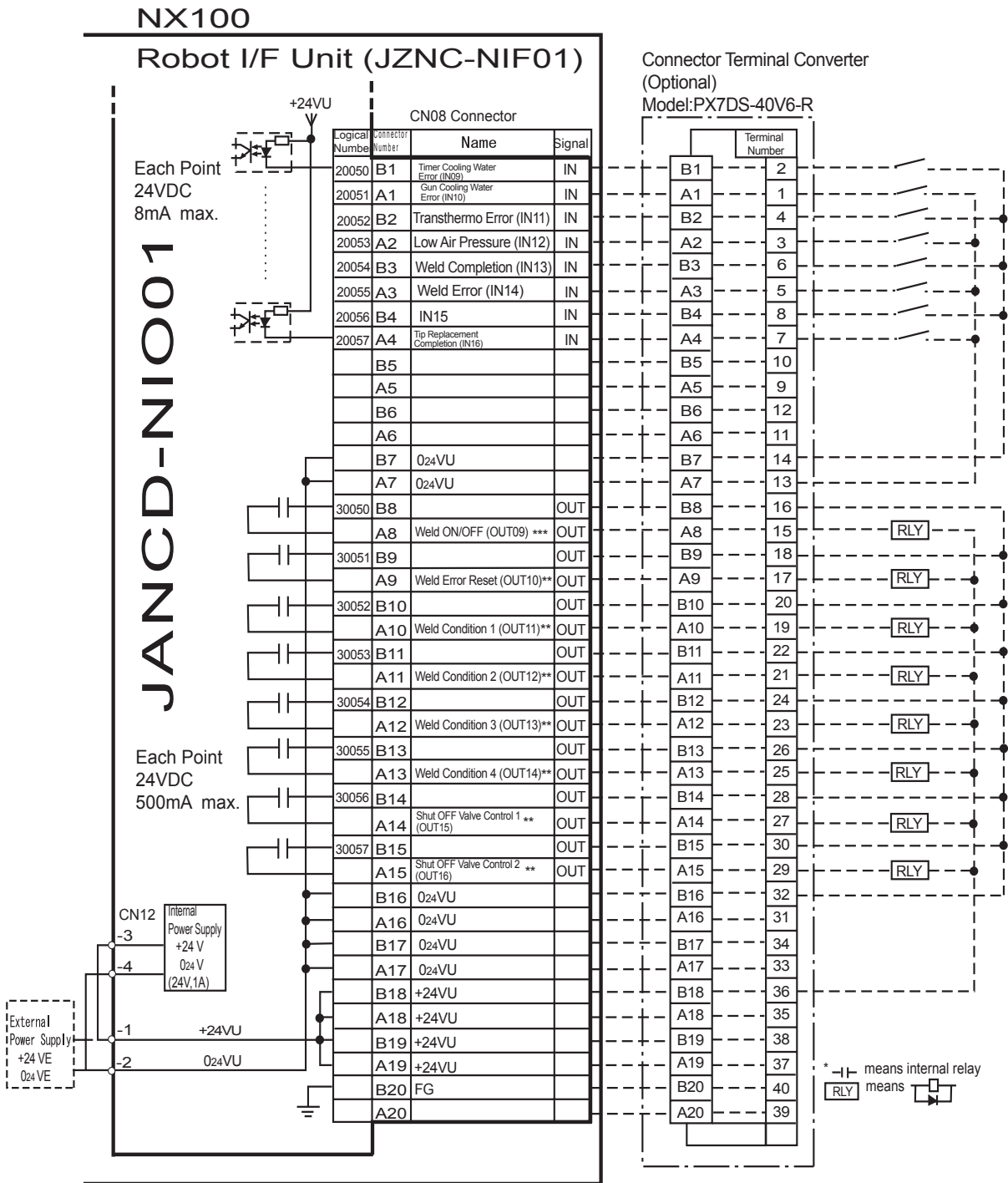
\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when an external power supply is used.

JANCD-NIO01 (CN10 Connector) I/O Allocation and Connection Diagram (For Spot Welding)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 and -4 when a external power supply is used.

JANCD-NIO01 (CN07 Connector) I/O Allocation and Connection Diagram (For Spot Welding)



\* Remove Jumper-pin between CN12-1 and -3, CN12-2 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 NIO01 and System Output List NIO01 for detail.

\*\*\* This assignment can be changed at the PSEDU input display. Refer to System Input List NIO01 and System Output List NIO01 for detail.

JANCD-NIO01 (CN08 Connector) I/O Allocation and Connection Diagram (For Spot Welding)

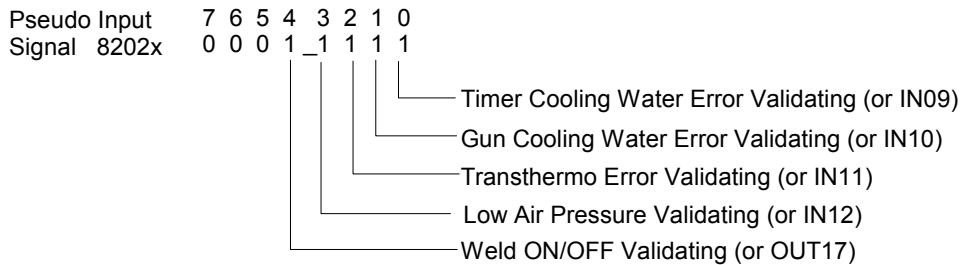
System Input List NIO01 (Spot Welding)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function   |
|----------------|---|----------------|---|
| 20010          | EXTERNAL START<br>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.                                     | 20024          | INTERFERENCE 3 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 3 <sup>2</sup> 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.  |
| 20012          | CALL MASTER JOB<br>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). | 20025          | INTERFERENCE 4 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 4 <sup>2</sup> 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.  |
| 20013          | ALARM/ERROR RESET<br>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.  | 20040<br>*4    | TIMER COOLING WATER ERROR<br>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.  |
| 20020          | INTERFERENCE 1 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 1 <sup>2</sup> 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.                              | 20041<br>*4    | GUN COOLING WATER ERROR<br>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.   |
| 20021          | INTERFERENCE 2 ENTRANCE PROHIBITED<br>If the manipulator attempts to enter the cube 2 <sup>2</sup> 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.                              | 20042<br>*4    | TRANSTHERMO ERROR<br>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.  |
| 20022          | WELDING ON/OFF (From sequencer)<br>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.   | 20043<br>*4    | LOW AIR PRESSURE<br>When air pressure is reduced and this input is turned ON, an alarm occurs. The servo power supply remains ON.   |
| 20023          | WELDING PAUSE (From sequencer)<br>This signal is used to move the manipulator to the home position when an error occurs in the Power Source or the gun.<br>The robot ignores the spot welding instruction and operates playback motion.   | 20044<br>*3    | WELD COMPLETION<br>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. |

System Input List NIO01 (Spot Welding)

| Logical Number | Input Name / Function   | Logical Number | Input Name / Function   |
|----------------|---|----------------|---|
| 20045<br>*3    | WELDING ERROR<br>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.   | *3             | GUN SHORT OPEN DETECTION<br>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. |
| *3             | STICK DETECTION<br>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. | *3             | GUN PRESSURE DETECTION<br>This signal indicates that a gun is in pressing status.   |
| *3             | GUN FULL OPEN DETECTION<br>This signal indicates that the stroke of the double stroke gun is full open.   | 20047<br>*3    | TIP REPLACE COMPLETION<br>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 "9.7 Interference Area."
- \*3 This signal can be allocated to any user I/O signal at the I/O allocation display in operation condition.
- \*4 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 user I/O signal described in parentheses.



System Output List NIO01 (Spot Welding)

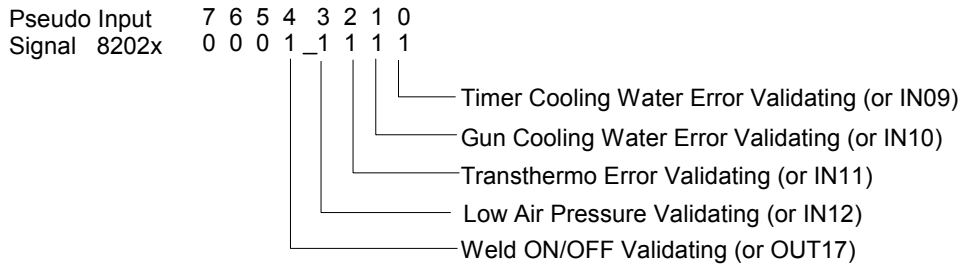
| Logical Number | Output Name / Function   | Logical Number       | Output Name / Function   |
|----------------|--|----------------------|--|
| 30010          | <b>RUNNING</b><br>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.  | 30023                | <b>INTERMEDIATE START OK</b><br>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. |
| 30011          | <b>SERVO IS ON</b><br>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 NX100 status diagnosis for an external start.     | 30024                | <b>IN CUBE 3</b><br>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.   |
| 30012          | <b>TOP OF MASTER JOB</b><br>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.*2  | 30025                | <b>IN CUBE 4</b><br>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.   |
| 30013          | <b>ALARM/ERROR OCCURRED</b><br>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.   | 30050<br>*4          | <b>WELD ON/OFF</b><br>Outputs a signal input from the interlock panel, etc. considering the robot status.  |
| 30014          | <b>BATTERY ALARM</b><br>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. | 30051<br>*3          | <b>WELD ERROR RESET</b><br>This signal commands the reset error status of the Power Source. This is operated with the programming pendant operation.   |
| 30015 to 30017 | <b>REMOTE/PLAY/TEACH MODE SELECTED</b><br>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.  | 30052 to 30055<br>*3 | <b>WELD CONDITION (Level signals)</b><br>1(1), 2(2), 4(3), 8(4), 16(5), 32(6), 64(7), 128(8)<br>Sets the welding conditions for the Power Source.<br>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).  |
| 30020          | <b>IN CUBE 1</b><br>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.   | *3                   | <b>WELDING COMMAND</b><br>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.  |
| 30021          | <b>IN CUBE 2</b><br>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.   | *3                   | <b>STROKE CHANGE1</b><br><b>SINGLE SOLENOID</b><br><b>DOUBLE SOLENOID</b><br>This is a signal, when a double stroke gun is used, to change the open stroke of the welding gun.   |
| 30022          | <b>WORK HOME POSITION (IN CUBE 48)*1</b><br>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.   | *3                   | <b>GUN PRESSURE INSTRUCTION</b><br>This outputs a gun pressure instruction.  |

12.6 User I/O Signal Assignment

System Output List NIO01 (Spot Welding)

| Logical Number | Output Name / Function   | Logical Number       | Output Name / Function   |
|----------------|--|----------------------|--|
| 30040<br>*3    | TIP REPLACE REQUEST<br>This signal is output when the stored number of welding reaches the number of welding set for the tip replacement.  | 30506 to 30507<br>*3 | SHUT OFF VALVE CONTROL<br>This signal is ON and water flows into the gun tool.<br>This signal is OFF and water does not flow into the gun tool.<br>This signal is used to prevent water leakage in the case of a sticking tip. |
| 30041          | PRESSURE COMPLETION<br>When the first step pressure in welding has been completed, this signal is sent.<br>The signal is sent to the Power Source timer when completing the applying pressure. |                      |  |

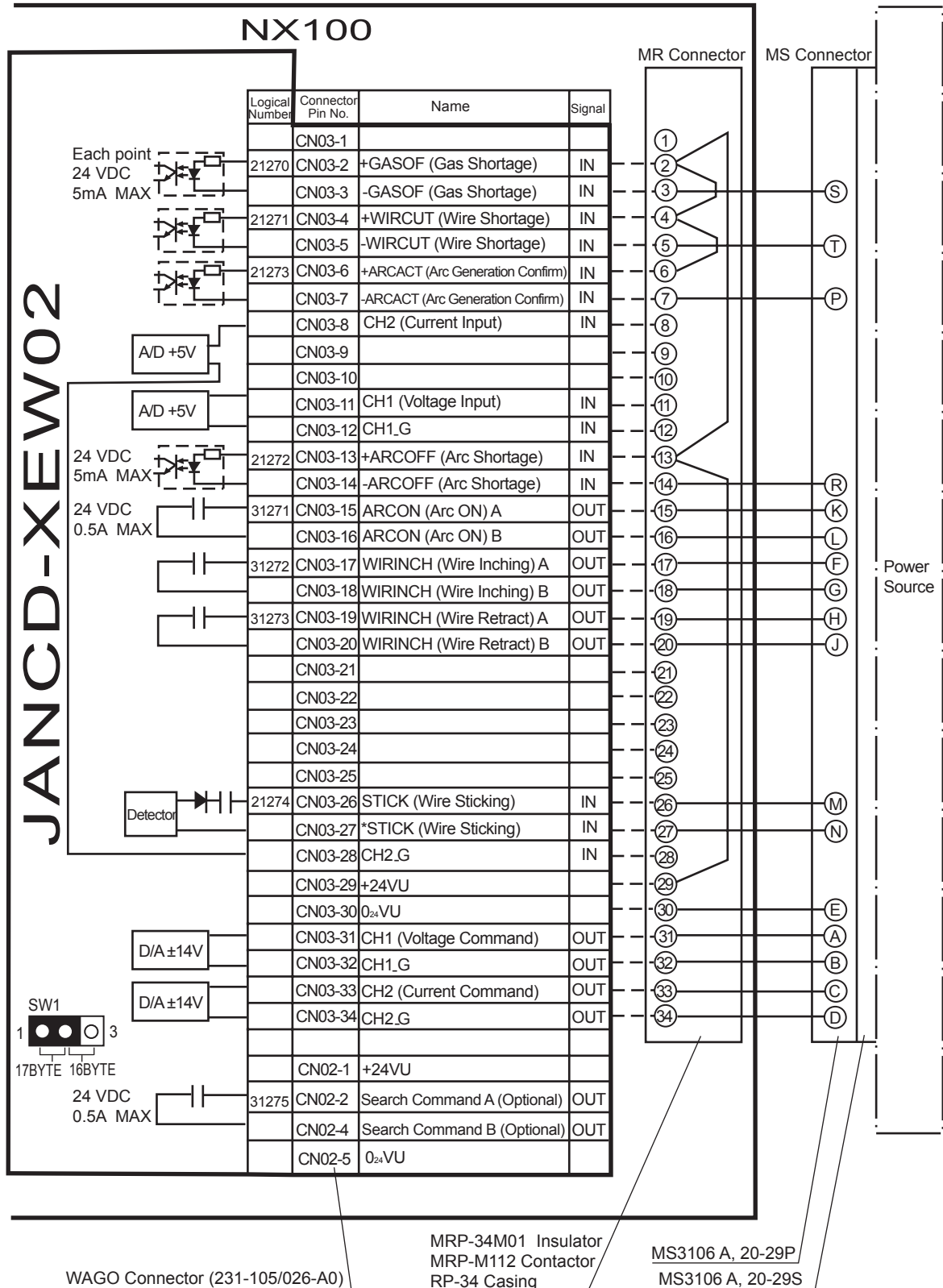
- \*1 The work home position cube and Cube 24 are same.
- \*2 This signal is not output during operation.
- \*3 This signal can be allocated to any user I/O signal at the I/O allocation display in operation condition.
- \*4 This signal can be select "USE" or "NOT USE" by pseudo input signal "8202x". If "NOT USE" is selected, this signal can be used as the user I/O signal described in parentheses.



## 12.6.5 JANCD-XEW02 Circuit Board (Standard)

### ■ Arc Welding

JANCD-XEW02 Circuit Board: Analog outputs ×2 ports, Analog inputs × 2 ports + Status signal I/O of a Welder





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**A**

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# NX100

# INSTRUCTIONS

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MANUAL NO. RE-CTO-A211   
© Printed in Japan November 2004 03-10