MOTOMAN-MH900, DX200 CONTROLLER INSTRUCTIONS

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

MOTOMAN INSTRUCTIONS

MOTOMAN-MH900: INSTRUCTIONS
DX200 CONTROLLER FOR THE MH900: INSTRUCTIONS
DX200 CONTROLLER FOR THE MH900: MAINTENANCE
DX200 CONTROLLER (for each purpose): OPERATOR’S

The DX200 CONTROLLER operator’s manual above corresponds to a specific usage. Be sure to use the appropriate manual.

Part Number: 182582-1CD
Revision: 0
Safety

Summary of Warning Information

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notice.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by Yaskawa. Address any questions regarding the safe and proper operation of the equipment to Yaskawa Customer Support.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MH900, DX200 Controller.

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

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

WARNING

Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

CAUTION

Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

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

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

**WARNING**

- This manual explains setup, diagnosis, maintenance, hardware, etc. of the MH900, DX200 Controller. Read this manual carefully and be sure to understand its contents before handling the MH900, DX200 Controller.

- General information related to safety are described in Chapter 1. “Safety”. To ensure correct and safe operation, carefully read Chapter 1. “Safety” of these instructions.

Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.
WARNING

• Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the controller 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 button is located on the right of the programming pendant.

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

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

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

Fig. : Emergency Stop Button

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

Injury may result from unintentional or unexpected manipulator motion.

Fig. : Release of Emergency Stop
WARNING

- Maintenance and inspection must be performed by specified personnel.
  Failure to observe this caution may result in electric shock or injury. For disassembly or repair, contact a Yaskawa representative.

CAUTION

- Read and understand the Explanation of Warning Labels in the DX200 Instructions before operating the manipulator.
- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place 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 is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

- 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 with manipulator movement.
  - Check for damage to insulation and sheathing of external wires.

- Always return the programming pendant to the hook on the cabinet of the DX200 after use.
  The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.
• 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.

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

NOTE
Explanation of Warning Labels

The following warning labels are attached to the controller.
Always follow the warnings on the labels.
Also, an identification label with important information is placed on the body of the controller. Prior to operating the controller, confirm the contents.
All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment.

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 equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment 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 all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Check the E-Stop button at the operator station for proper operation before programming. The equipment must be in Emergency Stop (E-Stop) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before 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.
- Any modifications to the controller unit can cause severe personal injury or death, as well as damage to the robot. Do not make any modifications to the controller unit. Making any changes without the written permission from Yaskawa will void the warranty.
- Some operations require standard passwords and some require special passwords.
- The equipment allows modifications to the software for maximum performance. Care must be taken when making modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
Safeguarding Tips

CAUTION

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system 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 equipment, the operator’s manuals, the system equipment, and options and accessories should be permitted to operate this equipment.

- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
- The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-2012, section 4.2.5, Sources of Energy, 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).

Mechanical Safety Devices

CAUTION

The safe operation of this equipment 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 R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

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

**WARNING**

Turn the power OFF, disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

- Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by Yaskawa-trained, qualified personnel.

**National Safety Standard**

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association  
900 Victors Way  
P.O. Box 3724  
Ann Arbor, Michigan 48106  
TEL: (734) 994-6088  
FAX: (734) 994-3338  
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment.

NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Definition of Terms Used Often in This Manual

The Yaskawa Motoman MH900, DX200 Controller is a Yaskawa industrial robot product.

A Motoman usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
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<th>Equipment</th>
<th>Manual Designation</th>
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<td>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
<tr>
<td>HC10 manipulator</td>
<td>Manipulator</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
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<th>Manual Designation</th>
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<tbody>
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<td>Programming Pendant</td>
<td>Character Keys</td>
</tr>
<tr>
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<td>Symbol Keys</td>
</tr>
<tr>
<td></td>
<td>The keys which have characters or symbols printed on them are denoted with [ .], ex. [ENTER]</td>
</tr>
<tr>
<td>Axis Keys</td>
<td>[Axis Keys] and [Number Keys] are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Number Keys</td>
<td></td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a &quot;+&quot; sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td>Displays</td>
<td>The menu displayed in the programming pendant is denoted with { }, ex. {JOB}</td>
</tr>
</tbody>
</table>

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or bland names for each company or corporation. The indications of (R) and ™ are omitted.
Customer Support Information

If assistance is needed with any aspect of the MH900, DX200 Controller system, please contact your local Yaskawa Customer Support (see back cover for details.)

When contacting Yaskawa Customer Support please have the following information:

- System: MH900, DX200 Controller
- Primary Application: 
- Software Version: 
  Located on programming pendant by selecting {Main Menu} - {System Info} - {Version}
- Robot Serial Number: 
  Located on robot data plate
- Robot Sales Order Number: 
  Located on controller data plate

WARNING

- Maintenance and inspection must be performed by specified personnel.
  Failure to observe this caution may result in electric shock or injury.

- For disassembly or repair, contact your Yaskawa representative.
- Do not remove the motor, and do not release the brake.
  Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

NOTE

Use e-mail for routine inquiries only. If there is an urgent or emergency need for service, replacement parts, or information, contact Yaskawa Customer Support.
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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.

The user is responsible for ensuring all local, state, and national codes, regulations rules, or laws relating to safety and safe operating conditions.

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

Other related laws are:
- Occupational Safety and Health Act in USA
- Factory Act (Gewerbeordnung) in Germany
- Health and Safety at Work, etc. Act in UK
- EC Machinery Directive 98/37/EC
Teaching maintenance of the robot must conform to:

- Industrial Safety and Health Law
- Enforcement Order of Industrial Safety and Health Law
- Ordinance of Industrial Safety and Health Law

Other related laws are:

- Occupational Safety and Health Act in USA
- Factory Act (Gewerbeordnung) in Germany
- Health and Safety at Work, etc. Act in UK
- EC Machinery Directive 98/37/EC

Prepare

- SAFETY WORK REGULATIONS based on concrete policies for safety management complying with related laws.

Observe

- JIS B 8433-1:2007
  (ISO 10218-1:2006)
- INDUSTRIAL ROBOT- SAFETY REQUIREMENTS for safe operation of the robot. (Japan Only) (JIS B 8433)

Reinforce the

- SAFETY MANAGEMENT SYSTEM by designating authorized workers and safety managers, as well as giving continuing safety education.

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

Workers employed in the above operations are requested to attend special training through Yaskawa.

### 1.2 Special Training

- Persons who teach or inspect the manipulator must undergo required training before using the manipulator.

**NOTE**

- For more information on training, inquire at the nearest Yaskawa branch office.
  Telephone numbers are on the back cover of this manual.
1.3 Motoman Manual List

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

The following manuals are necessary to ensure proper operation.

- MOTOMAN-□□□ INSTRUCTIONS
- DX200 INSTRUCTIONS
- DX200 OPERATOR’S MANUAL

Ensure all manuals are on hand.

If any manuals are missing, contact the local branch office.

Telephone numbers are on the back cover of this manual.
1.4 Personnel Safety

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

Everyone working with the MOTOMAN (safety administration, installation, operation, and maintenance personnel) are responsible for ensuring safety of all personnel.

**WARNING**

- Avoid any dangerous actions near the Motoman. Contact with the manipulator or peripheral equipment can cause injury.

- Take safety precautions by placing signs such as “Flammable,” “High Voltage,” “Waiting,” and “Off-limits to Unauthorized Personnel” in necessary areas in the factory.

Failure to observe this warning may result in fire, electric shock.

- Strictly observe the following items:
  - Always wear approved work clothes (no loose-fitting clothes).
  - Do not wear gloves soiled with chemicals, oils, organic solvents, etc. 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

- Do not allow unauthorized persons to approach the manipulator or associated peripheral equipment.

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

CAUTION

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

- Never sit or lean on the controller. Failure to observe this caution may result in injury or equipment damage.

- Never touch the buttons inadvertently on the controller or other controllers. Failure to observe this caution may result in injury or damage by unexpected movement of the manipulator.

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

The followings are safety functions of Motoman/controller.

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

These safety functions conform to the following safety standards.

- EN ISO 13849-1:2008 + AC:2009 Cat.4 / PL e

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

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

1.5.1 Installation and Wiring Safety

Refer to the MOTOMAN-□□□□ Instructions manual and the controller 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 per below to install the manipulator:
  Confirm the area is large enough to fully extend the manipulator arm with a tool and will not reach a side wall, safeguards, or the controller.

Failure to observe this caution may result in injury or damage from unexpected movement of the manipulator.
1 Safety
1.5 Motoman Safety

WARNING

- Ground per 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.

- Lift the Motoman with a crane using a wire rope threaded through the shipping bolts and positioners and lift the body in an upright posture per the manipulator instruction manual.
Failure to observe this caution may cause the manipulator to turn downward, potentially causing injury or damage to equipment.

- When lifting the controller, check the following:
  - As a rule, use a wire rope threaded through the eye-bolts for handling the controller.
  - Make sure to use wire that is strong enough to handle the weight of the controller.

```
<table>
<thead>
<tr>
<th>Controller</th>
<th>Approximate Weight (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200</td>
<td>500</td>
</tr>
</tbody>
</table>
```

- Make sure to securely fasten eye bolts.
Failure to observe this caution may result in injury or damage to equipment.
1 Safety
1.5 Motoman Safety

**CAUTION**

- If storing the manipulator temporarily before installation, make 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.

- Make sure there is sufficient room for maintenance on the manipulator, the controller, and other peripheral equipment.

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

- Make 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 controller 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 manipulator instruction manual.

Failure to observe this caution may result in injury or damage to equipment.
1 Safety
1.5 Motoman Safety

CAUTION

- Secure the position of the controller after setting up.
  - Attach the controller to the floor or rack, etc., using the screw holes on the bottom of the controller.

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

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

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

- Take precautions when wiring and piping between the controller, manipulator, and peripheral equipment. Run the piping, wiring, or cables through a pit or use a protective cover, so to prevent stepping on by personnel or ran 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 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. Equip the gate with a safeguarding safety interlock.
- Make sure the interlock operates correctly before use.

Failure to observe these warnings 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.

Leaving tools and loose equipment on the floor around the manipulator, controller, or welding fixture, etc., because injury or damage to equipment can occur if the manipulator contacts objects or equipment left in the work area.
1.5.3 Operation Safety

**WARNING**

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

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

- Never exceed the rating capacity of the manipulator (capacity is available in the specifications section of the manipulator manual.) Failure to observe this warning may result in injury or damage to equipment.

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

- Observe the following warnings when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Make sure to use a lockout device for safeguarding when going inside.
  - Make sure no closes the safeguarding and display a sign when performing operations inside the safeguards.
  - Always view the manipulator from the front.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator moves toward personnel unexpectedly.
  - Ensure there is 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 pressing the emergency stop button on the programming pendant and the external control device, etc. and confirm the servo lamp turns OFF. Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

• Prior to performing the following operations, make sure no one is in the P-point maximum envelope of the manipulator when:
  – Turning ON the controller power
  – Moving the manipulator with the programming pendant
  – Running the system in 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. An emergency stop button is on the programming pendant.
1 Safety
1.5 Motoman Safety

**CAUTION**

- Perform the following inspection procedures prior to teaching the manipulator. If there are any problems, correct the problem immediately and perform all other necessary tasks.
  - Check for problems with manipulator movement.
  - Check for damage to insulation and sheathing of external wires.

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

Leaving the programming pendant on the manipulator, a fixture, or the floor, may activate the Enable Switch, and cause the servo power to turn ON. If the manipulator starts its operation, the manipulator or a tool can collide with the programming pendant during manipulator movement, possibly causing injury or equipment damage.

**NOTE**

- Make sure to provide training to people operating or inspecting the manipulator per applicable laws and company policies.
  - Refer to section 1.2 “Special Training” on page 1-2
1.6 Notes for Moving and Transferring the Motoman

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

**CAUTION**

- Attach the instructions to the controller cabinet so that all users have access to necessary manuals. See section 1.3 “Motoman Manual List” on page 1-3 for a complete list of manuals.

If any manuals are missing, contact your Yaskawa representative.

- Make sure warning labels are clean and are readable on the manipulator and the controller.

If warning labels are not readable clean the labels so they are readable. Contact a Yaskawa representative if requiring new warning labels.

- When transferring a Motoman Yaskawa recommends contacting a representative on the back cover of this manual.

Incorrect installation or wiring may result in personal injury and property damage.

1.7 Notes on Motoman Disposal

**DANGER**

- Never modify the manipulator or controller.

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

**CAUTION**

- When disposing of the Motoman, follow the applicable national/local laws and regulations.

- Anchor the manipulator well, even when temporarily storing it before disposal.

Failure to observe this precaution may result in injury due to the manipulator falling.
2 Product Confirmation

2.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

Standard delivery includes the following five items (Yaskawa provides optional equipment information separately):

- Manipulator
- Controller
- Programming Pendant
- Manipulator Cable (Between Manipulator and Controller)
- Complete Set of Manuals on CD-ROM's

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

Confirm that the order number pasted on the manipulator and the controller are the same.

See figure below for where the order number plates are located.

<Example>

THE MANIPULATOR AND THE CONTROLLER SHOULD HAVE THE SAME ORDER NUMBER.

ORDER NO. S78796-1
3 Installation

3.1 Handling Procedure

**CAUTION**

- Authorized personnel are to operate the crane, sling, and forklift only.

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 controller may adversely affect the performance of the controller.

### 3.1.1 Using a Crane to Move the Controller

Check the following before handling the controller:

- 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 and securely fasten the eye bolts before lifting the controller.

---

**Table 3-1: Approx. Weight of Controller**

<table>
<thead>
<tr>
<th>Models Available for Controller</th>
<th>Approx. Weight (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH900 model</td>
<td>500</td>
</tr>
</tbody>
</table>

---
3.1.2 Using a Forklift to Move the Controller

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

- Ensure installation site is a safe work environment.
- Make sure of transportation of controller to installation location is possible.
- Before moving equipment let people know equipment will be moving in their area.
- Make sure controller cannot shift or fall during handling.
- Transport the controller at the lowest possible height.
- Avoid jarring, dropping, or hitting the controller during handling.
- When moving the controller, make sure to move at a safe speed.
3.2 Place of Installation

The controller requires the following conditions for installation:

• Ambient temperature:
  – During Operation: 0 to 45°C (32 to 113°F) during operation
  – During Transportation and Maintenance: -10 to 60°C (14 to 140°F)
  – Temperature Change: 0.3°C per minute or less

• Humidity: 10 to 90% RH with no condensation

• Only a small amount of dirt, dust, cutting oil, organic solvent, oil fume, water, salt, etc. in the place
  (Especially, avoid adhesion of chemicals, cutting oil including coolant, rust preventive oil, organic solvent, etc. to the programming pendant.)

• Free from flammable or corrosive liquid, gas, etc.

• Free from excessive shock, vibration, etc. (vibration: 0.5G or less)

• Free from large electrical noise
  (An electrical noise source such as a TIG welding device must not be placed close to the controller.)

• Free from excessive microwaves, ultraviolet rays, X-rays, or radiation

• Altitude: 1000m or less
  (To use the controller at the altitude over 1000m, calculate the maximum ambient temperature by decreasing it by 1% per 100m. The maximum allowable altitude is 2000m. When the altitude is 2000m, the maximum ambient temperature during operation is 40.5°C.

If the external electric noise applies, the alarm occurs and the manipulator may stop.

When the alarm occurs and the manipulator stops, refer to controller maintenance manual and reset the alarm.
3.3 Location

When installing controller make sure controller is:

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

*Fig. 3-1: Location of Controller*

• in a location where the manipulator is easily visible.
• inspected easily with door open.

• at least 500mm from the nearest wall to allow maintenance access.
### 3.4 Mounting the Controller

**CAUTION**

- Do not climb on top of the controller.

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

Attach the controller to the floor using mounting holes on the bottom side of the controller.

Refer to the Manipulator Manual for information concerning installing the manipulator.
4 Connection

WARNING

- Ground the system.
Failure to ground equipment may result in injury from fire or electric shock.

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

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

- Close door to turn ON power. Interlocks prevent turning ON power.
Failure to observe this caution may result in fire and electric shock.

- Any occurrence during wiring while the Controller is in the emergency stop mode is the user's responsibility. Do an operation check once completing wiring.
Failure to observe this caution could lead to injury or mechanical failure.

- Authorized personnel must perform wiring.
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.

- Make sure power circuit screws are tight.
Loose power circuit wires can cause fire and electric shock.

- Do not handle the circuit board directly by hand.
The I 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. Do not run high voltage power lines in parallel to the controller signal cables. If running parallel cables is unavoidable, use metal ducts or conduit to isolate electrical signal interference. Run the power cables perpendicular across the signal cables if cables require crossing.

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

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

*Fig. 4-1(a): Controller Cable Junction Diagram*

- When installing the power cable and encoder cable of the manipulator cable are in the same cable duct, separate the two cables from each other or install a separator between the two cables.

*Fig. 4-1(b): Example for the cable arrangement in the duct*
4.2 Power Supply

4.2.1 Three-Phase Power Supply

The three-phase power supply consists of 200/220VAC at 60Hz and 200VAC at 50Hz.

Fig. 4-2: Input Power Connection

- 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.

4.2.2 Noise Filter Installation

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

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

Fig. 4-3: Connection of Three-Phase Noise Filter
4.2.3 Leakage Breaker Installation

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

Table 4-1: Example of High Frequency Leakage Breaker

<table>
<thead>
<tr>
<th>Maker</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitsubishi Electric Co., Ltd.</td>
<td>NV series (manufactured since 1988)</td>
</tr>
<tr>
<td>Fuji Electric Co., Ltd.</td>
<td>EG, SG Series (manufactured since 1984), or EW Series.</td>
</tr>
</tbody>
</table>

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

Fig. 4-4: Connection of the Leakage Breaker
4.2 Power Supply

4.2.4 Primary Power Supply Breaker Installation

Install the primary power supply breaker as shown below.

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

![Diagram of power supply breaker installation]

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

<table>
<thead>
<tr>
<th>Manipulator</th>
<th>Power capacity (kVA)</th>
<th>Cable size (in case of Cabtyre cable (three cores)) (mm²)</th>
<th>Capacity of disconnection Controller (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH900</td>
<td>34</td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>

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

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

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

*NOTE*

The power capacity shown above is for a continuous rating value.

Power capacity is much larger when the robot rapidly accelerates compared to a continuous rating value.
4.3 Connection Methods

The figure below shows a connection diagram for the manipulator, manipulator cable, primary power cable and programming pendant.

Fig. 4-6: Cable Connection

4.3.1 Connecting the Primary Power Supply

1. Open the front door of the controller.

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

Fig. 4-7: Rotating the Key Clockwise
2. Confirm that the primary power supply is OFF.

**WARNING**

- Use cable clamp when connecting primary power supply.
  - Ensure cable clamps are tight to prevent dust or water from entering.

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

3. Connect the primary power supply cable.

(1) Draw the primary power supply cable in from the cable entrance on the back of the controller and fix it firmly with the cable clamp so that it does not shift or slip out of place.
(2) Connect a ground wire to reduce noise and prevent electric shock.

I) Connect the ground wire to the ground terminal (screw) of the switch in the bottom left side of the expansion cabinet.

Fig. 4-10: Connection of the Ground Wire

II) Perform grounding in accordance with all relevant local and national electrical codes. The size of ground wire must be the same as listed on Table 4-2 “Controller Power Capacity, Cable Sizes, and Breaker Capacities” on page 4-5.

The customer must prepare the ground wire.
4 Connection

4.3 Connection Methods

Fig. 4-11: Exclusive Grounding

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

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

(3) Connect the primary power supply cable.

Fig. 4-12: Connection of the Primary Power Supply Cable

4. Close the controller doors.

(1) Close the doors gently.

(2) Rotate the door locks counterclockwise 90 degrees.
4 Connection

4.3 Connection Methods

**Fig. 4-13: Rotating the Key Counterclockwise**

- Counterclockwise 90°
- Door lock
- Flathead screwdriver
4.3.2 Connecting the Manipulator Cable

The manipulator comes with seven manipulator cables: one encoder cable (Fig. 4-14(a)) and six power cables (Fig. 4-14(b))

In this manual, connection location identifies which cable to use.

Table 4-3: Encoder Cable Part Numbers

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Length</th>
<th>Part Number</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>166312-*</td>
<td>4M (157 in.)</td>
<td>166312-*</td>
<td>15M (708 in.)</td>
</tr>
<tr>
<td>2</td>
<td>5M (196 in.)</td>
<td>6</td>
<td>20M (787 in.)</td>
</tr>
<tr>
<td>3</td>
<td>7M (275 in.)</td>
<td>7</td>
<td>25M (984 in.)</td>
</tr>
<tr>
<td>4</td>
<td>10M (393 in.)</td>
<td>8</td>
<td>30M (1181 in.)</td>
</tr>
</tbody>
</table>
4. Connection

4.3 Connection Methods

**Fig. 4-14(b): Power Cables**

- **Controller Side**
- **Manipulator Side**

**Table 4-4(a): Power Cable Part Numbers**

<table>
<thead>
<tr>
<th>Connector Location on Manipulator</th>
<th>Connector Location on Controller</th>
<th>Part Number*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BC</td>
<td>X21</td>
<td>178444-*</td>
</tr>
<tr>
<td>3BC</td>
<td>X22</td>
<td>178445-*</td>
</tr>
<tr>
<td>4BC</td>
<td>X23</td>
<td>178446-*</td>
</tr>
<tr>
<td>5BC</td>
<td>X24</td>
<td>178447-*</td>
</tr>
<tr>
<td>6BC</td>
<td>X25</td>
<td>178448-*</td>
</tr>
<tr>
<td>7BC</td>
<td>X26</td>
<td>178449-*</td>
</tr>
</tbody>
</table>

1 Indicates part number for cable length see Fig. 4-4(b) “Power Cable Last Number of Part Number”

**Table 4-4(b): Power Cable Last Number of Part Number**

<table>
<thead>
<tr>
<th>Part Number*</th>
<th>Length</th>
<th>Part Number*</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4M (157 in.)</td>
<td>5</td>
<td>15M (708 in.)</td>
</tr>
<tr>
<td>2</td>
<td>5M (196 in.)</td>
<td>6</td>
<td>20M (787 in.)</td>
</tr>
<tr>
<td>3</td>
<td>7M (275 in.)</td>
<td>7</td>
<td>25M (984 in.)</td>
</tr>
<tr>
<td>4</td>
<td>10M (393 in.)</td>
<td>8</td>
<td>30M (1181 in.)</td>
</tr>
</tbody>
</table>
4.3.3 Connection to the Manipulator

1. Verify the numbers on the manipulator 2BC power cable with the connector number on the manipulator by referring to Fig. 4-14(b) and Fig. 4-15(a).

Fig. 4-15(a): Manipulator Cable Connectors (Manipulator Side)

2. Align holes and pins between 2BC cable connector and the manipulator and attach. Refer to Fig. 4-14(b)

3. Repeat step 1 and step 2 with manipulator power cables in the following order: 3BC, 4BC, 5BC, 6BC, and 7BC.

4. Repeat step 1 with 1BC manipulator cable.

5. Align the main key position of the manipulator and install cable by referring to Fig. 4-14(a) and Fig. 4-15(a).

NOTICE

Make sure to press the levers until they click in place.
4 Connection
4.3 Connection Methods

4.3.4 Connection to the Controller

**CAUTION**

- Do not cover or tangle cables.
- Keep cables as straight as possible.

Failure to observe these cautions can result in minor or moderate injury from heat of cables.

1. Verify the numbers on the manipulator X21 power cable with the connector number on the controller by referring to Fig. 4-14(b) and Fig. 4-15(b).

*Fig. 4-15(b): Manipulator Cable Connection (Controller Side)*

2. Align holes and pins between manipulator X21 power cable and the controller then attach. Refer to Fig. 4-14(b).

3. Repeat step 1 and step 2 with manipulator power cables in the following order; X22, X23, X24, X25, and X26.

4. Repeat step 1 with X11 manipulator cable.

5. Align the main key position of the manipulator and install cable by referring to Fig. 4-14(a) and Fig. 4-15(a).

*Make sure to press the lever until it clicks in place between the plugs and connectors.*
4.3.5 Connecting the Programming Pendant

**WARNING**

- Always close the door of the controller except for maintenance.
- Make sure to rotate all the door locks counterclockwise.

If dust or water enter inside the controller, electric shock or breakdown of the controller may result.

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

*Fig. 4-16: Connecting the Programming Pendant*

The manipulator, controller, and the programming pendant connections are now complete.
4.3.6 User I/O Cable Connection

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

**Table 4-5: I/O Cable Connections**

<table>
<thead>
<tr>
<th>Connection Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect user I/O signal to I/O terminal blocks</td>
<td>User connects universal I/O signal using terminal blocks mounted on the bottom of the controller inside the controller's front door.</td>
</tr>
<tr>
<td>Connect safety plug and system external signal for external emergency stop, etc.</td>
<td>Connect safety plug and system external signal for external emergency stop, etc. to machine safety terminal block circuit board which mounts to the front side of the controller's front door.</td>
</tr>
<tr>
<td>Directly connect user I/O signal to the universal I/O circuit board (JANCD-YIO21-E)</td>
<td>User connects user I/O signal to the universal I/O circuit board (JANCD-YIO21-E) directly.</td>
</tr>
</tbody>
</table>

1. Remove covering plates from I/O cable openings on the bottom panel of the right-side controller cabinet.

*Fig. 4-17: I/O Cover Plates.*

2. Cut a hole on each covering plate and deliver the user I/O cable. Use a cable gland, etc. to prevent any particles from entering. For the drawing length of the cable, refer to *Fig. 4-18* and *Table 4-6* since it varies depending on the connecting part.

*Fig. 4-18: I/O Cable Installation*
### Table 4-6: I/O Connections

<table>
<thead>
<tr>
<th>Connection</th>
<th>Drawing Length</th>
<th>Cable Terminal Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect user I/O signal to I/O terminal blocks connected to universal I/O circuit board (JANCD-YIO21-E)</td>
<td>Drawing length: 1m (Cable length for terminal processing is included)</td>
<td>Unshielded Refer to &quot;Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)&quot; in section 14.7 &quot;Universal I/O Circuit Board (JANCD-YIO21-E)&quot;.</td>
</tr>
<tr>
<td>Connect safety plug and system external signal for external emergency stop, etc. to machine safety terminal block circuit board (JANCD-YFC22-E)</td>
<td>Drawing length: 1.5m (Cable length for terminal processing is included)</td>
<td>Unshielded Refer to &quot;Wiring Procedure of the Terminal Block&quot; in section 14.6 &quot;Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)&quot;.</td>
</tr>
<tr>
<td>Directly connect user I/O signal to universal I/O circuit board (JANCD-YIO21-E)</td>
<td>Drawing length: 1m (Cable length for terminal processing is included)</td>
<td>Connector Refer to &quot;Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)&quot; in section 14.7 &quot;Universal I/O Circuit Board (JANCD-YIO21-E)&quot;.</td>
</tr>
</tbody>
</table>

3. Route the user system external signal cable and universal I/O signal cable from the cable openings on the bottom of the controller to the universal I/O signal circuit board. Then, connect the universal I/O signal cable to the connector on the universal I/O signal circuit board. For the details of the connection, refer to "Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)" in section 14.7 "Universal I/O Circuit Board (JANCD-YIO21-E)".

Fig. 4-19: Routing Cables from Cable Opening Controller Bottom (Direct Connection to JANCD-YIO21-E)
4. Route the system external signal cables for the external emergency stop, etc. drawn in step 2, to the right side of the controller from the bottom side of the controller as shown by the red line in the figure below. And then, connect the cables to the machine safety terminal block circuit board (JANCD-YFC22-E). For details of the connection, refer to "Wiring Procedure of the Terminal Block" in section 14.6 "Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)" on page 14-14

Fig. 4-20: Routing System External Signal Cable.
5. Route the universal I/O signal cables described above mentioned in step 2 to the bottom duct in front of the I/O terminal blocks. Then, connect them to each of the I/O terminal block that are connected to the universal I/O circuit board (JANCD-YIO21-E). For the details of the connection, refer to "Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)" in section 14.7 “Universal I/O Circuit Board (JANCD-YIO21-E)” on page 14-37.

Fig. 4-21: Route Universal I/O Signal From the Bottom Side of Controller..
5 Turning ON and OFF the Power Supply

5.1 Turning ON the Main Power Supply

WARNING

• Confirm that nobody is present in the P-point maximum envelope of the manipulator when turning ON the controller power supply. Failure to observe this caution could result in injury caused by accidental contact with the manipulator.

• Press the emergency stop button immediately if any problems occur.

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

Turning ON the main power supply switch on the front of the controller to the "ON" position, and the initial diagnosis and the current setting position begins.

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

5.1 Turning ON the Main Power Supply

5.1.1 Initial Diagnosis

The controller performs an initial diagnosis when turning ON the main power, and the startup window displays on the programming pendant screen.

*Fig. 5-2: Startup Window*

5.1.2 When Initial Diagnoses are Complete

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

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

*Fig. 5-3: Initial Window*

---

**CAUTION**

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
  - After operation, remove the key and have system manager store.

Improper or unintended manipulator operation may result in injury. Dropping the programming pendant with the key inserted in the mode select switch may cause damage.
5.2 Turning ON the Servo Power

5.2.1 During Play Mode

Turning ON the safety plug, workers safety is secure.

- Close safeguards, press the [SERVO ON READY] button on the programming pendant to turn ON the servo power supply. [SERVO ON] lamp lights, when the servo power turns ON.

When the safeguarding is open, the servo power supply cannot turn 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 turns ON and [SERVO ON] lamp lights on the programming pendant when the operator grips the Enable switch..
The Valid / Invalid setting of safety signals in operation modes.
The robotic system safety function switches to valid or invalid depending
on operation modes. Particularly in teach mode, be aware the
safeguarding (safety plug) signal input becomes invalid. Perform the
operation with caution.

<table>
<thead>
<tr>
<th>Safety Signal</th>
<th>Operation Mode</th>
<th>Play Mode</th>
<th>Teach Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller Emergency Stop (PBESP)</td>
<td>Valid</td>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>External Emergency Stop (EXESP)</td>
<td>Valid</td>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>Programing Pendant Emergency Stop (PPESP)</td>
<td>Valid</td>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>Safeguarding (safety plug) (SAFF)</td>
<td>Valid</td>
<td>Invalid</td>
<td></td>
</tr>
<tr>
<td>Programing Pendant Enable SW (PPDSW)</td>
<td>Invalid</td>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>External Enable SW (EXDSW)</td>
<td>Invalid</td>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>Servo Power Enable (ONEN)</td>
<td>Valid</td>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>Manipulator Overrun (OT)</td>
<td>Valid</td>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>External Axis Overrun (EXOT)</td>
<td>Valid</td>
<td>Valid</td>
<td></td>
</tr>
<tr>
<td>Speed Limit</td>
<td>Invalid</td>
<td>Valid</td>
<td></td>
</tr>
</tbody>
</table>
5.3 Turning OFF the Power Supply

5.3.1 Turning OFF the Servo Power (Emergency Stop)

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

- Press the emergency stop button and the servo power supply turns off.
  An emergency stop button is on the right side of the programming pendant.
- The brake operates once the servo power supply turns OFF, and the manipulator can no longer operate. Emergency stop mode works in any mode. (Teach mode, Play mode, Remote mode)

![Programming Pendant]

5.3.2 Turning OFF Main Power

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

- When turning “OFF” the main power switch on the controller, the main power turns OFF.

![Main Power Switch]

---

**NOTE**

Do Not turn the power supply OFF when the hour glass pointer appears on the programming pendant screen.

Data writing is in process when an hour glass pointer appears on the programming pendant screen and turning OFF the power supply may break the data.
5.3 Turning OFF the Power Supply

### 5.3.3 Stopping Manipulator Operation

The following three categories are stop functions of the manipulator.

- **Stop Category 0**
  - Removes the motor power source to the servo motor causing the motor to stop
  - Once removing power, the manipulator and the external axis decelerate by the brake.
  - This Stop Category may cause the manipulator and external axis to run off the operation path (Path).

- **Stop Category 1**
  - The controller decelerates and stops the manipulator and external axis on their operational path.
  - After stopping the controller locks the brake and removes power from the manipulator and the external axis.

- **Stop Category 2**
  - The controller decelerates and stops the manipulator and external axis on their operational path.
  - In this stop condition motor power is still present and retains stop position.

Besides the safety signals, the controller robotic system stops the manipulator by the above three stop categories.

---

**WARNING**

- Do a risk assessment of the whole system due to increased stopping distance and stopping time before using a stop category 1.

When using stop category 1, the stopping distance and stopping time are longer than those with a stop category 0.
5 Turning ON and OFF the Power Supply

5.3 Turning OFF the Power Supply

See Table 5-2 on the methods for stopping the manipulator by each stop signal.

Table 5-2: Stopping the Manipulator by Stop Signal

<table>
<thead>
<tr>
<th>Safety Signal</th>
<th>Mode</th>
<th>Operation Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Stop Category 0</td>
</tr>
<tr>
<td>Controller Emergency Stop (PBESP)</td>
<td>Teach</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>External Emergency Stop (EXESP)</td>
<td>Teach</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Programming Pendant Emergency Stop (PPESP)</td>
<td>Teach</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Safety fence (safety plug) (SAFF)</td>
<td>Teach</td>
<td>Invalid</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Programming Pendant Enable SW (PPDSW)</td>
<td>Teach</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Servo Power Enable (ONEN)</td>
<td>Teach</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Manipulator Overrun (OT)</td>
<td>Teach</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>External Axis Overrun (EXOT)</td>
<td>Teach</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Programming Pendant (HOLD)</td>
<td>Teach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Mode Switch (Teach mode to play mode) (PP KEY SW)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mode Switch (Play mode to teach mode) (PP KEY SW)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6 Testing Program Operation

![WARNING]

- Test the emergency stop button(s), confirming that the SERVO ON lamp turns OFF before operating the manipulator.

Injury or damage to machinery may result if the manipulator does not stop in case of an emergency.

- Observe the following warnings when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Make sure to use a lockout device for safeguarding when going inside.
  - Make sure no closes the safeguarding and display a sign when performing operations inside the safeguards.
  - Always view the manipulator from the front.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator moves toward personnel unexpectedly.
  - Ensure there is a place to retreat to in case of emergency.
  - Improper or unintentional manipulator operation can result in injury.

Improper or unintentional manipulator operation can result in injury.

- Make sure to be in a safe place and no one is within the P-point maximum envelope of the manipulator.
  - Turning ON the controller 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.
## Testing Program Operation

### CAUTION

- Perform the following inspection procedures prior to teaching the manipulator. If there are any problems, correct the problem immediately and perform all other necessary tasks.
  - Check for problems with manipulator movement.
  - Check for damage to insulation and sheathing of external wires.

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

Leaving the programming pendant on the manipulator, a fixture, or the floor, may activate the Enable Switch, and cause the servo power to turn ON. If the manipulator starts its operation, the manipulator or a tool can collide with the programming pendant during manipulator movement, possibly causing injury or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
  - After operation, remove the key and have system manager store.

Improper or unintended manipulator operation may result in injury. Dropping the programming pendant with the key inserted in the mode select switch may cause damage.
### 6.1 Preparation for Startup Checklist

Before startup, make sure the following items have been completed.

**Table 6-1: Checklist: Preparation for Startup**

<table>
<thead>
<tr>
<th>Date</th>
<th>Initials</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>“Check List Before Applying Power” has been completed and main power has been turned on and tagged in.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main power is turned on and tagged in.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Controller is on and successfully boots up to the main menu with no errors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Servos “click” on both in PLAY mode (when pressing the SERVO ON READY button) and TEACH MODE (holding Enable Switch after pressing the SERVO ON READY button).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All axis have been tested and are movable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Home position has been set.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emergency stop buttons work as intended.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All needed jobs for general operation have been programmed/added to the pendant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All needed jobs for general operation have been validated in TEACH mode and PLAY mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All needed accessories or end of arm tooling are mounted in the correct places (either on the manipulator or in the operation area).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The correct tool file is selected for each job.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All safety items (door locks, light curtains, E-Stop buttons, etc.) are installed, active, and functional.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All operators of the system have been trained on how to use the teach pendant and run jobs for general operation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The correct security level (Operation Mode, Editing Mode, or Management Mode) has been set on the pendant based on customer needs (Operation Mode is generally recommended to prevent programming changes).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All auxiliary equipment (such as other assembly line machines interacting with the system) are functioning as intended for general operation and synced up correctly with the system if necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All items for operation (controller, pendant, additional operator buttons, etc.) are set up in a safe area to use when the system is operating.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The area of operation is clear of all items not needed for general operation.</td>
</tr>
</tbody>
</table>
6.2 Troubleshooting at Startup

The following table lists actions to take for problems at startup.

*Table 6-2: Troubleshooting at Startup*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Actions to Take</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulator performance is excessively “jerky” or uneven</td>
<td>Make sure the tool file settings on the pendant are correct. Make sure the selected tool file matches the tool attached to the manipulator.</td>
</tr>
<tr>
<td>Manipulator does not move when green start button is set to PLAY or when Enable Switch and Axis Keys are used in TEACH mode.</td>
<td>Make sure all E-Stop buttons have been reset and the SERVO ON READY button has a green light.</td>
</tr>
<tr>
<td>Pendant Alarms/Errors</td>
<td>Refer to the controller manual OR use pendant to select the error for more information.</td>
</tr>
</tbody>
</table>
6.3 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**

Remove all items from the area before moving the manipulator.

Refer to the INSTRUCTION MANUAL for the appropriate position of the fixture.

- **U-Axis**: Moves wrist up/down
- **R-Axis**: Rotates upper arm
- **B-Axis**: Moves wrist up/down
- **T-Axis**: Rotates lower arm
- **L-Axis**: Moves lower arm forward/backward
- **S-Axis**: Rotates main body
- **E-Axis**: Rotates upper arm
6.4 Manual Brake Release Function

The brake release unit allows moving the arbitrary axis manually by releasing the brakes.

**CAUTION**

- When releasing the brake, pay attention to surroundings. The robot arm may move under its own weight, and personal injury or equipment damage may result.

- Release the brake for one axis at a time. If releasing brakes of multiple axes out of necessity, the robot arm may move in an unexpected way. Pay attention to surroundings. Personal injury or equipment damage may result.

Table 6-3: Brake Release Unit (Separate Unit Type)

<table>
<thead>
<tr>
<th>Unit</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1CP</td>
<td>T B R U L (2CN)</td>
</tr>
<tr>
<td>POWER</td>
<td>S OFF BRAKE RELEASE ON (1CN)</td>
</tr>
</tbody>
</table>

Power supply cable: 2 m (standard)
Weight: 3 kg

Use the brake release with the state that the motor servo is on and execution cannot occur with the controller.

To purchase the Manual Brake Release function, contact the local Yaskawa branch office listed on the back cover.
7 Security System

7.1 Protection Through Security Mode Settings

A security system protects the controller modes. The security system gives the ability to operate and change settings in relation to permissions. Make sure operators have proper training in relation to their permission level.

7.1.1 Security Mode

There are five security modes:

Table 7-1: Security Mode Descriptions

<table>
<thead>
<tr>
<th>Security Mode</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Mode</td>
<td>This mode allows basic operation of the robot (stopping, starting, etc.) for people operating the robot work on the line.</td>
</tr>
<tr>
<td>Editing Mode</td>
<td>This mode allows the operator to teach and edit jobs and robot settings.</td>
</tr>
<tr>
<td>Management Mode</td>
<td>This mode allows those authorized to set up and maintain robot system: parameters, system time and modifying user IDs.</td>
</tr>
<tr>
<td>Safety Mode</td>
<td>This mode allows the operator to setup the safety function, and able to edit the files related to the safety function. When the optional function “functional safety” is valid, the security is changed to the safety mode to edit the some files, such as the tool file. Refer to “DX200 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY BOARD OPERATION” (165988-1CD) for more details.</td>
</tr>
<tr>
<td>One Time Manage Mode</td>
<td>This mode allows to operator to maintain the mode which is higher than the management mode. The loading limitation of the batch data (CMOS.BIN), the parameter batch data (ALL.PRM) and the functional definition parameter (FD.PRM) are removed.</td>
</tr>
</tbody>
</table>

7.1.1.1 User ID

- **Operation Mode**: Does not require a user ID
- **Editing Mode**: user ID needs to be four or more but less than 16 or less characters with number(s) and symbol(s).
- **Management Mode**: user ID needs to be four or more but less than 16 or less characters with number(s) and symbol(s).
- **Safety Mode**: user ID needs to be nine or more but less than 16 or less characters with number(s) and symbol(s).
- **One Time Manage Mode**: Requires security code from Yaskawa
## 7.1 Protection Through Security Mode Settings

### 7.1.1.2 Menus

**Table 7-2: Menu & Security Mode**  
*Sheet 1 of 4*

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOB</td>
<td>JOB</td>
<td>DISPLAY Operation EDIT Editing</td>
</tr>
<tr>
<td></td>
<td>SELECT JOB</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td></td>
<td>CREATE NEW JOB¹</td>
<td>DISPLAY Editing</td>
</tr>
<tr>
<td></td>
<td>MASTER JOB</td>
<td>DISPLAY Operation Editing</td>
</tr>
<tr>
<td></td>
<td>JOB CAPACITY</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>RES. START (JOB)¹</td>
<td>DISPLAY Editing</td>
</tr>
<tr>
<td></td>
<td>RES. STATUS²</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>CYCLE</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td></td>
<td>TRASH JOB LIST³</td>
<td>DISPLAY Editing</td>
</tr>
<tr>
<td></td>
<td>JOB EDIT (PLAY)</td>
<td>DISPLAY Editing</td>
</tr>
<tr>
<td></td>
<td>PLAY EDIT JOB LIST</td>
<td>DISPLAY Editing</td>
</tr>
<tr>
<td>VARIABLE</td>
<td>BYTE</td>
<td>DISPLAY Operation EDIT</td>
</tr>
<tr>
<td></td>
<td>INTEGER</td>
<td>DISPLAY Operation Editing</td>
</tr>
<tr>
<td></td>
<td>DOUBLE</td>
<td>DISPLAY Operation EDIT</td>
</tr>
<tr>
<td></td>
<td>REAL</td>
<td>DISPLAY Operation EDIT</td>
</tr>
<tr>
<td></td>
<td>STRING</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td></td>
<td>POSITION (ROBOT)</td>
<td>DISPLAY Operation EDIT</td>
</tr>
<tr>
<td></td>
<td>POSITION (BASE)</td>
<td>DISPLAY Operation EDIT</td>
</tr>
<tr>
<td></td>
<td>POSITION (ST)</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td></td>
<td>LOCAL VARIABLE</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>TIMER</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td>IN/OUT</td>
<td>EXTERNAL INPUT</td>
<td>DISPLAY Operation EDIT</td>
</tr>
<tr>
<td></td>
<td>EXTERNAL OUTPUT</td>
<td>DISPLAY Operation EDIT</td>
</tr>
<tr>
<td></td>
<td>UNIVERSAL INPUT</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td></td>
<td>UNIVERSAL OUTPUT</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td></td>
<td>SPECIFIC INPUT</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>SPECIFIC OUTPUT</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>RIN</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>REGISTER</td>
<td>DISPLAY Operation Management</td>
</tr>
<tr>
<td></td>
<td>AUXILIARY RELAY</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>CONTROL INPUT</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>PSEUDO INPUT SIG</td>
<td>DISPLAY Operation Management</td>
</tr>
<tr>
<td></td>
<td>NETWORK INPUT</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>NETWORK OUTPUT</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>ANALOG OUTPUT</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>SV POWER STATUS</td>
<td>DISPLAY Operation -</td>
</tr>
<tr>
<td></td>
<td>LADDER PROGRAM</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>I/O ALARM</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>I/O MESSAGE</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>TERMINAL</td>
<td>DISPLAY Operation EDIT</td>
</tr>
<tr>
<td></td>
<td>I/O SIMULATION LIST</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td></td>
<td>SERVO ON FACTOR</td>
<td>Management -</td>
</tr>
<tr>
<td></td>
<td>RB STOP FACTOR MONITOR</td>
<td>DISPLAY Operation -</td>
</tr>
</tbody>
</table>
### 7. Security System

#### 7.1 Protection Through Security Mode Settings

**Table 7-2: Menu & Security Mode (Sheet 2 of 4)**

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DISPLAY</td>
<td></td>
</tr>
<tr>
<td>ROBOT</td>
<td>CURRNT POSITION</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>COMMAND POSITION</td>
<td>Operation</td>
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## Table 7-2: Menu & Security Mode (Sheet 3 of 4)

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7 Security System
7.1 Protection Through Security Mode Settings
## Table 7-2: Menu & Security Mode  (Sheet 4 of 4)

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1. Displayed in Teach Mode only.
2. Displayed in the Play Mode only.
3. Displayed when the job reconstruction function is valid.

* When the functional safety is valid, refer to the "DX200 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY BOARD OPERATION" (165988-1CD) for the Menu and Security Mode.
7.1.1.3 Changing the Security Mode

1. Select {SYSTEM INFO} under Main Menu.
   – The sub menu appears.

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

NOTE: Depending on the system icons for the Main Menu, such as arc welding system, differ.
Security System
7.1 Protection Through Security Mode Settings

– Security mode allows the selection of “OPERATION MODE,” “EDITING MODE,” “MANAGEMENT MODE,” or “SAFETY MODE.”

3. Select the security mode to change.
– Selecting a security mode lower than the current security level requires a password.

4. Enter the password.
– The following user ID numbers are set as default.
  Editing Mode: [0000000000000000]
  Management Mode: [9999999999999999]
  Safety Mode: [5555555555555555]

5. Press [ENTER].
– If the password is correct, the security mode will change.
7-8 Security System
7.1 Protection Through Security Mode Settings

- **Changing the Mode to One Time Management Mode**
  1. Change to MANAGEMENT MODE.
     - When changing to the management mode, security mode is selectable from “OPERATION MODE,” “EDITING MODE,” “MANAGEMENT MODE,” “SAFETY MODE,” or “ONE TIME MANAGE MODE”.
  2. Select “ONE TIME MANAGE MODE”.
     - A character string input keypad displays. Requires security code from Yaskawa.
     - If the password is correct, the security mode changes.

7.1.2 User ID

A request for a User ID occurs when operating in editing mode, management mode, or safety mode.

- **Editing Mode**: user ID needs to be four or more but less than 16 or less characters with number(s) and symbol(s).
- **Management Mode**: user ID needs to be four or more but less than 16 or less characters with number(s) and symbol(s).
- **Safety Mode**: user ID needs to be nine or more but less than 16 or less characters with number(s) and symbol(s).
7.1 Protection Through Security Mode Settings

7.1.2.1 Changing User ID

To change the user ID, the controller must be in either editing mode, management mode or safety mode. Higher security modes can make changes the user ID of to lower security modes.

1. Select {SETUP} under the Main Menu.
   - The sub menu appears.

2. Select {USER ID}.
   - The USER ID window appears.
3. Select the desired ID.
   – The character input line appears, and a message “Input current ID no. (4 or more digits)” appears.
   (As for the safety mode, 9 or more digits)

4. Input the current ID and press [ENTER].
   – After entering the correct user ID, a request for a new ID appears.
   “Input the new ID no. (4 or more digits)” appears.
   (As for the safety mode, 9 or more digits)

5. Input the new ID and press [ENTER].
   – Changes USER ID.
8 System Setup

WARNING

• Use caution when changing settings that can result in improper manipulator operation. Various setting may cause compatibility issues between the controller and the manipulator performance characteristics which may cause personal injury and/or equipment damage.

• Observe the following precautions to safeguarding system settings:
  – Maintain supervisory control of user functions.
  – Create a data backup each time control settings change.
8.1 Home Position Calibration

**WARNING**

- Before operating the manipulator, check that the SERVO ON lamp on the programming pendant goes out when pressing the emergency stop button on the programming pendant and the external control device, etc. and confirm the servo lamp turns OFF.

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

- Observe the following warnings when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Make sure to use a lockout device for safeguarding when going inside.
  - Make sure no closes the safeguarding and display a sign when performing operations inside the safeguards.
  - Always view the manipulator from the front.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator moves toward personnel unexpectedly.
  - Ensure there is a place to retreat to in case of emergency.
  - Improper or unintentional manipulator operation can result in injury.

Improper or unintended manipulator operation may result in injury.

- Prior to performing the following operations, make sure no one is in the P-point maximum envelope of the manipulator when:
  - Turning ON the controller power
  - Moving the manipulator with the programming pendant
  - Running the system in 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.

  - A emergency stop button is on the programming pendant.
8 System Setup
8.1 Home Position Calibration

![CAUTION]

- Perform the following inspection procedures prior to teaching the manipulator. If there are any problems, correct the problem immediately and perform all other necessary tasks.
  - Check for problems with manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
  - Always return the programming pendant to its specified position after use.

Leaving the programming pendant on the manipulator, a fixture, or the floor, may activate the Enable Switch, and cause the servo power to turn ON. If the manipulator starts its operation, the manipulator or a tool can collide with the programming pendant during manipulator movement, possibly causing injury or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
  - After operation, remove the key and have system manager store.

Improper or unintended manipulator operation may result in injury. Dropping the programming pendant with the key inserted in the mode select switch may cause damage.
8 System Setup

8.1 Home Position Calibration

8.1.1 Home Position Calibration

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 controller
- Replacement of the motor or absolute encoder
- Clearing stored memory (by replacement of YIF01-□ E 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 section 8.1.3 “Home Position of the Robot.”
8.1.2 Calibrating Operation

8.1.2.1 Registering All Axes at One Time

1. Select {ROBOT} under the Main Menu.
   - The sub menu appears

2. Select {HOME POSITION}.
   - The HOME POSITIONING window appears.
3. Select {DISPLAY} on the top of the window.
   – The pull-down menu appears.

4. Select the desired control group.
   – Select the control group for the HOME POSITIONING.
   – Pressing [PAGE] also allows selecting the control group.
8.1 Home Position Calibration

5. Select {EDIT} on top of the window.
   - The pull-down menu appears.

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

7. Select {YES}.
   - Registers the position data of all axes as the home position.
   - Pressing {NO} cancels the registration.
8.1.2.2 Registering Individual Axes

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

2. Select {HOME POSITION}.

3. Select the desired control group.
   
   – Perform step 3 and step 4 of section 8.1.2.1 “Registering All Axes at One Time” to select the desired control group.

4. Select the axis to register.
   
   – Move the cursor to the axis to register, and select it.

   ![Image of the interface showing the selection of an axis]

   – A confirmation dialog box appears.

   ![Image of the confirmation dialog box]

5. Select {YES}.
   
   – Registers the position data of the selected axis.

   – Pressing {NO} cancels the registration.
8.1.2.3 Changing the Absolute Data

Perform the following to change the absolute data of the axis after completing the home position calibration:

1. Select {ROBOT} under the Main Menu.
2. Select {HOME POSITION}.
3. Select the desired control group.
   – Perform step 3 and step 4 of section 8.1.2.1 “Registering All Axes at One Time” to select the desired control group.
4. Select the ABSOLUTE DATA to register.

```
<table>
<thead>
<tr>
<th>DATA</th>
<th>EDIT</th>
<th>DISPLAY</th>
<th>UTILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOME POSITI</td>
<td>SELECT</td>
<td>ABSOLUTE DATA</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td>L</td>
<td>[27221]</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>R</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>T</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

5. Enter the ABSOLUTE DATA using the numeric keys.
6. Press [ENTER].
   – Modifies ABSOLUTE DATA.
8.1.2.4 Clearing ABSOLUTE DATA

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

2. Select {HOME POSITION}.
   – Perform step 3 and step 4 of section 8.1.2.1 “Registering All Axes at One Time” to select the desired control group.

3. Select {DATA} under the Main Menu.
   – The pull-down menu appears

4. Select [CLEAR ALL DATA].
   – A confirmation dialog box appears.

5. Select {YES}.
   – All ABSOLUTE DATA is cleared
   – When selecting {NO}, the registration will be canceled.
8.1.3 Home Position of the Robot

Refer to the "MANIPULATOR INSTRUCTIONS" for the correct Home Position.
8.2 Setting the Second Home Position (Check Point)

**WARNING**

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

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

- Before operating the manipulator, check that the SERVO ON lamp on the programming pendant goes out when pressing the emergency stop button on the programming pendant and the external control device, etc. and confirm the servo lamp turns OFF. Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

- Observe the following warnings when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Make sure to use a lockout device for safeguarding when going inside.
  - Make sure no closes the safeguarding and display a sign when performing operations inside the safeguards.
  - Always view the manipulator from the front.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator moves toward personnel unexpectedly.
  - Ensure there is a place to retreat to in case of emergency.
  - Improper or unintentional manipulator operation can result in injury.

Improper or unintended manipulator operation may result in injury.

- Prior to performing the following operations, make sure no one is in the P-point maximum envelope of the manipulator when:
  - Turning ON the controller power
  - Moving the manipulator with the programming pendant
  - Running the system in 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.

- A emergency stop button is on the programming pendant.
8 System Setup
8.2 Setting the Second Home Position (Check Point)

![CAUTION]

- Perform the following inspection procedures prior to teaching the manipulator. If there are any problems, correct the problem immediately and perform all other necessary tasks.
  - Check for problems with manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
  - Always return the programming pendant to its specified position after use.

Leaving the programming pendant on the manipulator, a fixture, or the floor, may activate the Enable Switch, and cause the servo power to turn ON. If the manipulator starts its operation, the manipulator or a tool can collide with the programming pendant during manipulator movement, possibly causing injury or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
  - After operation, remove the key and have system manager store.

Improper or unintended manipulator operation may result in injury. Dropping the programming pendant with the key inserted in the mode select switch may cause damage.
8.2 Setting the Second Home Position (Check Point)

8.2.1 Purpose of Position Check Operation

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

There are two possible causes of this alarm:

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

If there is an error with the PG system, the manipulator may stall when playback is started. If the absolute data allowable range error alarm has occurred, playback and test runs will not function and the position must be checked.

"OUT OF RANGE (ABSO DATA)" alarm occurs

1. Reset alarm
2. Turn ON servo power

Procedure After Alarm Occurs

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

NG

3. Correct defective axis
   - Replace PG system
   - Home position calibration

OK

Playback possible

• Position checking point

① Position Check

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

8.2 Setting the Second Home Position (Check Point)

② Pulse Difference Check

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

- The allowable range pulse is the number of pulses per rotation of the
  motor (PPR data).
- The initial value of the second home position is the home position
  (where all axes are at pulse 0). The second home position can be
  changed. For details, refer to section 8.2.2 “Procedure for the
  Second Home Position Setting (Check Point)” on page 8-16.

③ Alarm Occurrence

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

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

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

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

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

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

2. Select {SECOND HOME POS}.
   – The SECOND HOME POS window appears.
   A message “Available to move to and modify specified point” is displayed.

3. Press the [PAGE], or select [PAGE] to display the selection window for the control group.
8 System Setup
8.2 Setting the Second Home Position (Check Point)

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

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

5. Press [MODIFY], then [ENTER].
   - The second home position is changed.
8.2.3 Procedure after the Alarm

**WARNING**

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

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

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

- Reset the alarm;
- Turn ON the servo power;
then confirm the second home position. After the confirmation, if the PG system is found to be the cause of the alarm, perform the necessary operation, such as replacing the PG, etc.

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

**NOTE**

For details on the “POWER ON/OFF POS” window, refer to section 7.7 “Position Data When Power is Turned ON/OFF” in the controller manual.

1. Select {ROBOT} under the main menu.
   - The sub menu appears.
2. Select {SECOND HOME POS}.
   - The SECOND HOME POS window appears.
3. Press the [PAGE], or select [PAGE] to display the selection window for the control group.
   - When there are two or more group axes, select the group axes to which the second home position is to be specified.

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

5. Select {DATA} under the menu.

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

8.3.1 Registering Tool Files

8.3.1.1 Number of Tool Files

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

8.3.1.2 Registering Coordinate Data

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

**NOTE**

Tool File Extension Function

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

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

For more details, refer to chapter 8 “Parameter” in DX200 OPERATOR’S MANUAL.
8 System Setup
8.3 Tool Data Setting

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

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

3. Select the desired tool number.

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

5. Input the coordinate data.

6. Press [ENTER].
The coordinate data is registered.

### 8.3 Tool Data Setting

#### 8.3.1.3 Registering Tool Angle

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

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

---

In case of Tool A, B

<table>
<thead>
<tr>
<th>X</th>
<th>0.000 mm</th>
<th>Rx</th>
<th>0.0000 deg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>0.000 mm</td>
<td>Ry</td>
<td>0.0000 deg.</td>
</tr>
<tr>
<td>Z</td>
<td>260.000 mm</td>
<td>Rz</td>
<td>0.0000 deg.</td>
</tr>
</tbody>
</table>

In case of Tool C

<table>
<thead>
<tr>
<th>X</th>
<th>0.000 mm</th>
<th>Rx</th>
<th>0.0000 deg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>145.000 mm</td>
<td>Ry</td>
<td>0.0000 deg.</td>
</tr>
<tr>
<td>Z</td>
<td>260.000 mm</td>
<td>Rz</td>
<td>0.0000 deg.</td>
</tr>
</tbody>
</table>
1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
3. Select the desired tool number.
   – In the same way as shown in Explanation 2, 3 in section 8.3.1.2 "Registering Coordinate Data" on page 8-20, display the desired tool coordinate window.
4. Select the desired coordinate axis to modify.
   – First, select Rz.
5. Input the tool pose data.
   – Input rotation angle around ZF of the flange coordinates.

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

   In the same way, register the angle of Ry, Rx.
   Ry must be the input rotation angle around Y'F flange coordinates.
8.3.1.4 Setting the Tool Load Information

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

---

**NOTE**

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

If the design value is uncertain, use of the “Automatic Measurement of the Tool Load and the Center of Gravity” enable to set the tool load information easily.

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**NOTE**

For more details on “Automatic Measurement of the Tool Load and the Center of Gravity”, refer to section 8.3.3 “Automatic Measurement of the Tool Load and the Center of Gravity” on page 8-33.

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8.3.2 Tool Calibration

8.3.2.1 Tool Calibration

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

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

8.3.2.2 Setting of Tool Calibration Method

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

S2C432: Designation of tool calibration method

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

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

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

- In case of S2C432=0 (only coordinates is calibrated), tool posture data is overwritten with 0.
  (When the coordinates calculated from tool calibration is registered in the tool file in which the tool posture data is already registered, the tool posture data will be deleted.)

- In case of S2C432=1 (only posture is calibrated), the coordinates are maintained.

- In case of S2C432=1, 5 teaching points need to be registered though only the first point is used for calculation.
8.3.2.3 Teaching of Calibration Point

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

  [Diagram of robot with TC1 to TC5]

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

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

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

  Tool posture data is automatically calculated with this TC1 posture.

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

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

- There are 64 tool files numbered 0 to 63.
- In a basic system with one manipulator and one tool, the tool file for tool No.0 is used.

If there is more than one tool, for example when using a multi-hand, use the tool numbers in the order of 0, 1, 2, etc.

1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
3. Select the desired tool number.
8 System Setup
8.3 Tool Data Setting

– In the same way as shown in the instruction 2 and 3 of the section 8.3.1.2 "Registering Coordinate Data" on page 8-20, display the desired tool coordinate window.

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

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

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

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

(3) The robot is set.

7. Select “POSITION”.
   – The selection dialog box is shown.

   (1) Select the teaching point for calibration.

8. Move the manipulator using the axis key.

9. Press [MODIFY] and [ENTER].
   – Taught position is registered.
   Repeat 7 to 9 operation to teach TC1 to TC5.
8.3 Tool Data Setting

MH900, DX200 Controller

8.3.1 Tool Data Marker

- Indicates that teaching is completed and indicates that it is not completed.

To check the taught positions, call up the required window among TC1 to TC5 and press [FWD]. The manipulator moves to the set position.

- If there is a difference between the current position of the manipulator and the shown position data, “TC☐” next to “POSITION” in the window flashes.

10. Select “COMPLETE”.

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

8.3.2.4 Clearing Calibration Data

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

1. Select {DATA} under the pull-down menu.
8 System Setup
8.3 Tool Data Setting

– The pull-down menu appears.

2. Select {CLEAR DATA}.
– The confirmation dialog box is shown.

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

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

1. Press [COORD].
   
   Select any coordinate system except “\text{JOINT}” by pressing [COORD].

2. Select desired tool number.

   Show the tool coordinate window of the desired tool by pressing the [PAGE] or selecting it in the tool list window.

3. Move the R, B, or T axes using the axis key.

   - If tool angle data is required, input the data number in the tool coordinate window.

   Refer to section 8.3.1.3 “Registering Tool Angle” on page 8-22 for the operating instructions.
8.3 Tool Data Setting

By pressing the axis keys for the R, B, and T axes, change the manipulator pose without changing the TCP position. If this operation shows a large TCP error, adjust the tool data.

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

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

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

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

**NOTE**

This function can be used where the manipulator is installed level on the ground. For the conditions required for manipulator installation, refer to section 8.4 “ARM Control”.

For details on the TCP fixed operation, see section 2.8.1 “Motion about TCP” in OPERATOR’S MANUAL.
8.3.3.2 Measurement of the Tool Load and the Center of Gravity

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

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

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

If the file extension function is invalid, the tool coordinate window appears.
3. Select the desired tool number.
   - Move the cursor to the desired number in the tool list window and press [SELECT].
   - The tool coordinate window of the selected number is shown.
   - In the tool coordinate window, the number can be changed by pressing the [PAGE] or selecting [PAGE].
   - To switch the tool list window and the tool coordinate window, press (DISPLAY) \rightarrow (LIST) or (DISPLAY) \rightarrow (COORDINATE DATA).
4. Select {UTILITY} under the menu.

5. Select {W.GRAV.POS MEASURE}.
   – The window for the automatic measurement of the tool load and the center of gravity is shown.

6. Press the [PAGE].
   – In a system with several manipulators, use the [PAGE] to change the group to be controlled.

7. Press [FWD].

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

The manipulator moves in the order listed below. Once measurement is completed, "0" changes to "●".

1. Measurement of the U-axis: U-axis home position +4.5 degrees → -4.5 degrees
2. Measurement of the B-axis: B-axis home position +4.5 degrees → -4.5 degrees
8 System Setup
8.3 Tool Data Setting

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

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

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

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

9. Select “REGISTER”.

– The measured data is registered in the tool file, and the tool coordinate window appears.

– Select “CANCEL” to call up the tool list window without registering the measured data in the tool file.
8.4 ARM Control

8.4.1 ARM Control

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

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

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

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

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

8.4.2 ARM CONTROL Window

![CAUTION]

- Correctly set the robot setup condition.

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

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

Set the robot setup condition when setting up the manipulator.

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

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

8.4.2.1 Robot Setup Condition

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

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

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

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

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

Only rotation angle around Y axis of the robot coordinates can be set in the robot installation angle.

* Contact Yaskawa representative when robots is installed to incline Y axis of the robot coordinates relative to ground.
### S-head payload
Set the weight and the center of gravity position roughly when the equipment such as transformer is installed at the S-head.

It is not necessary to set these values when there is no installed load on the S-head.

**WEIGHT (unit: kg)**
The weight of the installed load is set.

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

**X (From S-Axis), Y (From S-Axis) (unit: mm)**
The center of gravity position of the installed load is set by the distance in the direction of X and the direction of Y from S axis center here. It can be set with a rough value.

The direction of X and Y applies to the robot coordinates. The value is set by a negative number when the position is in “-” direction.

![S axis center](image)

### 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 larger value though it does not care about a rough value. (Raise the unit of each by 0.5 to 1 kg)

**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 about the rough value.
8 System Setup
8.4 ARM Control

X (From U-Axis) is horizontal distance from U axis rotation center to the center of gravity position of the load. Set negative number when there is mass side in the back from U-axis rotation center.

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

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

**NOTE**

ARM CONTROL window is displayed only when the security mode is set in the management mode.
1. Select {ROBOT} under the main menu.

2. Select {ARM CONTROL}.
   – The ARM CONTROL window appears.

3. Press the page key , or select [PAGE].
   – Select the desired control group when there are two or more group axes.

4. Select the desired item.

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

**CAUTION**

- Set the tool load information correctly.

The speed reducer longevity might decrease or the alarm might occur when the tool load information is not set correctly.

To set the tool load information correctly, following message appears when inputting the information.

“Input correct tool information. Using robot with wrong tool information may result in premature failure of the robot.”

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

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

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

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

8.4.3.1 Tool Load Information

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

- **Flange Coordinates**
  - \( X_F \): It is a direction right above when \( T \) axis is 0 pulse position and the flange surface of the manipulator turned to the front.
  - \( Y_F \): \( Y \) axis led by \( X_F, Z_F \)
  - \( Z_F \): Perpendicular direction from flange surface

- **Moments of inertia around the Center of Gravity**
  - \( I_x, I_y, I_z \)

- **Weight**: \( W \)

- **Center of Gravity Position**
  - \( (X_g, Y_g, Z_g) \)
8.4.3.2 How to Calculate Tool Load Information

- **Weight: W (Unit: kg)**
  The total weight of the installing tool is set.

  It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual load. (Round up the value with each fraction between 0.5 to 1 kg for small and medium size manipulator, and 1 to 5 kgs for large manipulator.)

- **Center of gravity position: xg, yg, zg (Unit: mm)**
  The center of gravity position of the installed tool is set as the position in the flange coordinates.

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

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

- **Moment of inertia at the center of gravity: lx, ly, lz (Unit: kg·m²)**
  It is an moment of inertia of the tool at the center of gravity position.

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

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

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

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

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

The size of the tool is big. 
Setting the moment of inertia at center of gravity is necessary.
Rough value of the moment of inertia at the center of gravity can be calculated by the following methods.

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

Refer to the following setting examples for details.

<Example 1>

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

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

<Setting>

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

\[
I_x = \frac{L_y^2 + L_z^2}{12} \cdot W
\]

\[
I_y = \frac{L_x^2 + L_z^2}{12} \cdot W
\]

\[
I_z = \frac{L_x^2 + L_y^2}{12} \cdot W
\]

* Unit of Weight : [kg]
* Unit of Length : [m]
* Unit of Ix, Iy, Iz : [kg m^2]
<Example 2>

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

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

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

\[
\begin{align*}
\text{Weight:} & \quad W = 55 + 40 = 95 \\
& \quad = \text{approx. } 100 \text{[kg]} \\
\text{Center of gravity:} & \quad (X_g, Y_g, Z_g) = (0, 0, 250) \\
\text{Moment of inertia at the center of gravity:} & \\
\text{The hexahedron of } 0.500 \times 0.400 \times 1.000 \text{[m]} \text{ which encloses the entire tool + workpiece is assumed.} \\
\text{By the expression to calculate the own moment of inertia of hexahedron,} \\
I_x & = (L_y^2 + L_z^2 / 12) \times W \\
& = ((0.400^2 + 1.000^2) / 12) \times 100 = 9.667 = \text{approx. } 10.000 \\
I_y & = (L_x^2 + L_z^2 / 12) \times W = ((0.500^2 + 0.400^2) / 12) \times 100 = 3.417 \\
& = \text{approx. } 3.500 \\
I_z & = (L_x^2 + L_y^2 / 12) \times W = ((0.500^2 + 1.000^2) / 12) \times 100 = 10.417 \\
& = \text{approx. } 10.500 \\
\end{align*}
\]

<Setting>

- \( W \) : 100.000 kg
- \( X_g \) : 0.000 mm
- \( Y_g \) : 0.000 mm
- \( Z_g \) : 250.000 mm
- \( I_x \) : 10.000 kg.m^2
- \( I_y \) : 3.500 kg.m^2
- \( I_z \) : 10.500 kg.m^2
How to calculate “Center of gravity position” and “moment of inertia at center of gravity” for plural mass

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

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

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

   
   wi    : Weight of the i-th parts [kg]
   (xi, yi, zi)     : Center of gravity position of the i-th parts
                   (On flange coordinates) [mm]
   Icxi, Icyi, Iczi : Own moments of inertia of the i-th parts [kg*m²]

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

   \[ xg = \frac{\sum_{i} w_i \cdot x_i}{\sum_{i} w_i} \]
   \[ yg = \frac{\sum_{i} w_i \cdot y_i}{\sum_{i} w_i} \]
   \[ zg = \frac{\sum_{i} w_i \cdot z_i}{\sum_{i} w_i} \]

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

   \[ Ix = \frac{\sum_{i} w_i \cdot ((y_i - yg)^2 + (z_i - zg)^2)}{10^6} + Icxi \]
   \[ Iy = \frac{\sum_{i} w_i \cdot ((x_i - xg)^2 + (z_i - zg)^2)}{10^6} + Icyi \]
   \[ Iz = \frac{\sum_{i} w_i \cdot ((x_i - xg)^2 + (y_i - yg)^2)}{10^6} + Iczi \]
<Example 3>

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

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

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

This example shows the calculation with the method 2.

**Weight :**

\[ W = w_1 + w_2 \]

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

**Center of gravity**

\[ X_g = \frac{w_1 \times x_1 + w_2 \times x_2}{w_1 + w_2} \]

\[ = \frac{3 \times 100 + 6 \times 100}{3+6} = 100.0 \text{[mm]} \]

\[ Y_g = \frac{3 \times 50 + 6 \times (-150)}{3+6} = -83.333 \text{[mm]} \]

\[ Z_g = \frac{3 \times 40 + 6 \times 70}{3+6} = 60.0 \text{[mm]} \]

**The moment of inertia at the center of gravity position:**

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

\[ + (w_2 \times ((y_2 - Y_g)^2 + (z_2 - Z_g)^2) \times 10^{-6} + I_{cx2}) \]

\[ = 3 \times ((50 - (-83))^2 + (40 - 60)^2) \times 10^{-6} \]

\[ + 6 \times (((-150) - (-83))^2 + (70 - 60)^2) \times 10^{-6} \]

\[ = 0.082 = \text{approx. } 0.100 \]

\[ I_y = 3 \times ((100 - 100)^2 + (40 - 60)^2) \times 10^{-6} \]

\[ + 6 \times ((100 - 100)^2 + (70 - 60)^2) \times 10^{-6} \]

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

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

<Setting>

- W : 10.000 kg
- Xg : 100.000 mm
- Yg : -83.333 mm
- Zg : 60.000 mm
- Ix : 0.100 kg.m²
- Iy : 0.010 kg.m²
- Iz : 0.100 kg.m²

8.4.3.3 Tool Load Information Registering

Tool load information is registered in the tool file.

1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
   - The tool coordinate list window appears.
   - The tool coordinate list window appears only when TOOL NO. SWITCH in the TEACHING CONDITION window is set to PERMIT.
   - When TOOL NO. SWITCH in the TEACHING CONDITION window is set to PROHIBIT, the tool window appears.
3. Select the desired tool number.
   (1) Move the cursor to the number of the desired tool, and press [SELECT] in the tool list window.
   (2) The tool coordinate window of the selected number appears.
   (3) Select the desired number in the tool coordinate window by pressing the [PAGE] or clicking on the [PAGE] button.
   (4) To switch the tool list window and the tool coordinate window, press {DISPLAY} \(\rightarrow\) {LIST} or {DISPLAY} \(\rightarrow\) {COORDINATE DATA}.

4. Select the desired item to register and input the value.
   – The window can be scrolled with the cursor.
   – The menu enters the state of a numeric input if the cursor is on the desired item to register and the [SELECT] is pressed.

5. Press [ENTER].
   – The input value is registered.
   – The servo power is automatically turned OFF when editing the value while the servo power is ON, followed by a message “Servo off by changing data” displayed for three seconds.
• When the data setting is not done
  It is considered that data is not set correctly in tool load information in the following cases.
    • When the weight (W) is “0”.
    • When the center of gravity position (Xg, Yg, Zg) are all “0”.

In these cases, the manipulator is controlled by the initial setting values (vary according to each robot model) which were set to the parameter before shipping.

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

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

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

To set the tool load information correctly, following message appears when the playback operation is executed by using the initial setting value.

“Using robot without setting tool info. may result in premature failure of the robot. Set W, Xg, Yg, and Zg in the tool file.”

• Switch of the tool file

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

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

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

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

8.5.2 Setting Work Home Position

8.5.2.1 Work Home Position Window

1. Select {ROBOT} under the main menu.

2. Select {WORK HOME POS}.
   – The WORK HOME POSITION window is appears.

3. Press the [PAGE].
8.5 Work Home Position

When two or more manipulators exist in the system, use the [PAGE] to change the control group, or click on [PAGE] to select the desired control group.

8.5.2.2 Registering/Changing the Work Home Position

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

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

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

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

NOTE

Fig. 8-2: S3C1097: The work home position cube length of its sides (μm)

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

8.5.2.3 Returning to the Work Home Position

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

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

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

8.6.1 Interference Area

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

• Cubic Interference Area
• Axis Interference Area

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

8.6.2 Cubic Interference Area

8.6.2.1 Cubic Interference Area

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

8.6.2.2 Cube Setting Method

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

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

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

8.6.2.3 Setting Operation

1. Select {ROBOT} under the main menu.

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

3. Select the desired cube number.
   – Select the desired cube number with the [PAGE] or by number input.
   – When selecting the cube number by number input, select [PAGE] to input the desired signal number.
4. Select “METHOD”.
   – “AXIS INTERFERENCE” and “CUBIC INTERFERENCE” are displayed alternately every time [SELECT] is pressed. If “CUBIC INTERFERENCE” is selected, the window is changed.

5. Select “CONTROL GROUP”.
   (1) A selection dialog box appears.
   (2) Select the desired control group.

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

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

- “COMMAND POSITION”: When the command position (which is displayed on the current position window) is in the interference area, the signal is turned ON.

- “FEEDBACK POSITION”: When the actual position of the manipulator is in the interference area, the signal is turned ON.

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

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

- When using the interference signal to inform an external unit of the actual manipulator position, use the “FEEDBACK POSITION” setting to enable the signal output in more accurate timing.
2. Select “ALARM OUTPUT.”
   - Each time [SELECT] is pressed, “OFF” and “ON” are displayed alternately.

   ![Interference Area Interface](image)

When selecting “ON” and if the manipulator’s TCP approaches inside the pre-defined interference area, the following alarm occurs and the manipulator stops immediately.

**AL4902 CUBE INTERFERENCE (TCP)**

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

   ![Interface with X, Y, Z coordinates](image)

   2. Input number for “MAX” and “MIN” data and press [ENTER].
– The cubic interference area is set.
### Teaching Corner

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

![Teaching Corner Interface](image.png)

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

![Teaching Corner Message](image.png)

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

4. Move the manipulator using the axis keys.
   - Move the manipulator to the maximum or minimum position of the cube using the axis keys.

5. Press [ENTER].
– The cubic interference area is registered.
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8.6 Interference Area

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

2. Input data for length of the cube, then press [ENTER].
   - The length is set.

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

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

5. Press [ENTER].
   – The current position is registered as the center point of the cube.
8.6 Interference Area

8.6.3 Axis Interference Area

8.6.3.1 Axis Interference Area

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

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

8.6.3.2 Setting Operation

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

3. Select the desired interference signal number.
   - Select the desired interference signal number using the [PAGE] or by number input.
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When selecting the desired interference signal number by number input, select [PAGE] to input the desired signal number.

4. Select “METHOD”.

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

5. Select “CONTROL GROUP”.

A selection box appears. Select the desired control group.

6. Select “CHECK MEASURE”.

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

7. Select “ALARM OUTPUT”.

– Each time [SELECT] is pressed, “OFF” and “ON” are displayed alternately.

When selecting “ON” and if the manipulator’s axes approach inside the pre-defined interference area, the following alarm occurs and the manipulator stops immediately:

AL4901 AXIS INTERFERENCE
Number Input of the Axis Data Coordinates

1. Select “METHOD”.

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

   (2) Select “MAX/MIN”.

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

   – The axis interference area is set.
Teaching Corner

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

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

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

4. Move the manipulator using the axis keys.
   – Move the manipulator to the maximum or minimum position of the cube using the axis keys.

5. Press [ENTER].
The cubic interference area is registered.
Number Input of Center Position (WIDTH) and Teaching Center

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

2. Input number for “WIDTH” data and press [ENTER].
   – “WIDTH” is set.
3. Press [MODIFY].

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

4. Move the manipulator using the axis keys.

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

5. Press [ENTER].

   – The center position of the cube is registered.
8.6.4 Clearing the Interference Area Data

1. Select {ROBOT} under the main menu.
2. Select {INTERFERENCE}.
   – The INTERFERENCE AREA window is shown.
3. Select interference signal to be cleared.
   – Select the desired interference signal number to be cleared using the [PAGE] or by number input.
   – When selecting the desired interference signal number by number input, select [PAGE] to input the desired signal number.
4. Select {DATA} in the pull-down menu.
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5. Select (CLEAR DATA).
   – The confirmation dialog box appears.

6. Select (YES).
   – All the data of the interference signal number are cleared.
8.7 Shock Detection Function

8.7.1 Shock Detection Function

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

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

WARNING

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

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

8.7.2 Shock Detection Function Setting

At the factory default setting, the threshold value is set to detect a collision without a miss even when the manipulator is operating at the maximum speed, on the assumption that the tool file is correctly set. To detect a collision during normal operation, check the following points:

- The tool’s load and moment do not exceed the rated values.
- The actual tool load and the tool file setting value are the same.
- The U-arm payload information and the set weight of U-arm payload in the ARM CONTROL window are the same.

In addition, detection sensitivity can be decreased for only a specific section where a contact task is performed.

The detection sensitivity is set by setting the detection level.

8.7.2.1 Shock Detection Level Setting

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

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

- Condition numbers 1 to 7 are used when the detection level is changed in a specific section in play mode.
- Condition number 8 is used as standard in play mode: this function is operated by the detection level set in this file during playback operation.
- Condition number 9 is for teach mode: the shock detection function applies the detection level set here when the manipulator is operated in teach mode.
- Condition numbers 1 to 8 are set for each axis and condition 9 is set for each group.
The detection level is changed by a job instruction SHCKSET.

- After the instruction is executed, the shock will be detected by the specified detection level when the condition number is specified with the SHCKSET instruction.
- The detection level is returned to standard level when the SHCKRST instruction is executed.

```
NOTE
- The detection level of condition number 8 (a standard in play mode) is adopted in play mode excluding the range between SHCKSET and SHCKRST in the job.
- Teach Mode Each Axis Setting Function
  Usually, the detection level setting of teach mode is set for each group.
  By using this function, the detection level can be set for each axis.
S2C869: Teach Mode Each Axis Setting Function (1: VALID, 0: INVALID)
```
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8.7 Shock Detection Function

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

Robot Select
Select the manipulator whose detection level is to be changed.

Function Select
Specifies VALID/INVALID of the shock detection function. The shock detection function is specified for each manipulator.
1. Select the manipulator whose function is to be enabled or disabled.
2. Move the cursor to “VALID” or “INVALID” and press [SELECT]. Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately. The change is available for all the condition numbers.

Max. Disturbance Force
Indicates the maximum disturbance force to the manipulator when the manipulator is moved in play back operation or axis operation.
Refer to this value when inputting the detection level value in (5).
The maximum disturbance force can be cleared by selecting {DATA} → {CLEAR MAX VALUE} in the menu.

Detection Level (Level range: 1 to 500)
Specifies the shock detection level. Set a value larger than the maximum disturbance force.
The value set by default (the level 100) enables the function without false detection even if the manipulator is operated at the maximum speed.
To change DETECT LEVEL, move the cursor to the subject manipulator, and press [SELECT] to display the numeric input status; input the value with a numeric key and press [ENTER]. To increase the detection sensitivity, set the level to small value, and to decrease the sensitivity, set the level to large value.
Method of Shock Detection Level File Setting
1. Select {ROBOT} under the main menu.
2. Select {SHOCK SENS LEVEL}.
   – The EACH AXIS LEVEL window appears.
   – Perform either of the following operations to display the page of desired condition number:
     (1) Press [PAGE] in the window. Enter the desired condition number using numeric keys and press [ENTER]. Then the page of the condition number appears.
     (2) Press the [PAGE] to change the condition number.
3. Level setting for the condition numbers 1 to 8.
   Level setting values can be set for each axis on the EACH AXIS LEVEL window.
   Perform the following “Disturbance force measurement”, then perform “Setting all levels at once”.

Disturbance force measurement
1. Mount the tool, workpiece, external equipment, and equipment on the arm to the manipulator.
2. Set the tool file correctly.
   For spot welding: Set the gun load information (weight and center of gravity). To use the gun change function, while removing the gun, switch to the tool file with which the load information without a gun is set.
   For handling: Set the total load information (weight and center of gravity) of the hand and the maximum load workpiece.
   For other applications: Set the load information (weight and center of gravity) of the tool.
3. Set the detection level values of all the axes to 100.
   (1) Open the SHOCK DETECT LEVEL window.
   (2) Select {DATA}, then {CLEAR MAX VALUE}.
   (4) Perform the JOB.

Setting all levels at once
1. Open the SHOCK DETECT LEVEL window.
2. Select {DATA}, then {CHANGE EVERY LEVEL}.
3. Enter 120 in the coefficient (%) by which the max. disturbance force is multiplied.
   The following calculated value A or B, whichever is larger, is set to the DETECT LEVEL.
   A: (Max. disturbance force) x (coefficient = 120%)
   B: (Max. disturbance force) + 15
   <Example>
   When the max. disturbance force is 80, the DETECT LEVEL is 96.
   When the max. disturbance force is 10, the DETECT LEVEL is 25.
4. Level setting for the condition number 9.
   The level setting for the condition number 9 is for the teach mode.
   This setting is made for each group.
   Refer to the max. disturbance force to set the DETECT LEVEL.

   - Perform all the jobs to use for 5 to 6 hours.
   - For handling application, if a work job is performed both with holding a workpiece and without holding a workpiece, measure both patterns.
   - In the event of a collision while measuring the max. disturbance force, clear the max. disturbance force by selecting {DATA}, then {CLEAR MAX VALUE}. Then try again.
   - The max. disturbance force is cleared when the power is turned ON/OFF. Therefore, DO NOT set the level based on the max. disturbance force immediately after turning ON/OFF the power.
   - When the teaching point, operation speed, operation position, etc. of a job are greatly changed due to teaching modification, etc., measure the max. disturbance force and set the DETECT LEVEL again.
   - When the load of tool or workpiece is greatly modified, measure the max. disturbance force and set the DETECT LEVEL again.
   - To avoid false detection during manipulator operation, set the following calculated value A or B, whichever is larger, to the DETECT LEVEL. An emergency stop of the manipulator due to the false detection may become a factor to damage the speed reducers and tools.

   • A: \( \text{Max. disturbance force} \times (\text{coefficient} = 120\%) \)
   • B: \( \text{Max. disturbance force} + 15 \)

   <Example>
   When the max. disturbance force is 80, set the DETECT LEVEL to 96 or more.
   When the max. disturbance force is 10, set the DETECT LEVEL to 25 or more

   **NOTE**
   - DO NOT set the level based on the max. disturbance force immediately after turning ON/OFF the power.
8.7 Shock Detection Function

### 8.7.2.2 EACH AXIS LEVEL (CURRENT) Window

Able to confirm the current detection level.

<table>
<thead>
<tr>
<th>DATA</th>
<th>EDIT</th>
<th>DISPLAY</th>
<th>UTILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **Robot Select**
   Select the manipulator to display the detection level.

2. **Function Select**
   Displays the valid/invalid status of the shock detection function.

3. **Max. Disturbance Force**
   Indicates the maximum disturbance force to the manipulator when the manipulator is moved in play back operation or axis operation. The maximum disturbance force can be cleared by selecting (DATA) → (CLEAR MAX VALUE) in the menu.

4. **Detection Level**
   Displays the shock detection level. When the maximum disturbance force exceeds this set value, the shock is detected.

- To adjust to the change in the grease viscosity at a cold start, the offset value is automatically added to DETECT LEVEL until the robot has operated for a certain period of time. Thus, at a cold start, the shock detection will be performed only when the value is more than or equal to the sum of DETECT LEVEL and the offset value. The offset value varies depending on the manipulator type.

- DETECT LEVEL can be modified only when the security mode is set in the management mode.
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8.7.2.3 Tool Load Information Setting
To increase the accuracy of shock detection, set the tool load information in the tool file. Refer to section 8.4.3 “Tool Load Information Setting” on page 8-43 for details of the tool load information setting.

8.7.2.4 U-Arm Payload Setting
To perform shock detection more accurately, set the U-arm payload. See section 8.4.2 “ARM CONTROL Window” on page 8-38 for details of the U-arm payload setting.

8.7.2.5 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 playback operation. The additional items of the SHCKSET instruction are as follows.

<table>
<thead>
<tr>
<th>SHCKSET</th>
<th>R1</th>
<th>SSL#(1)</th>
<th>AXIS1=100</th>
<th>AXIS2=100</th>
<th>AXIS3=100</th>
<th>AXIS4=100</th>
<th>AXIS5=100</th>
<th>AXIS6=100</th>
<th>AXIS7=100</th>
<th>AXIS8=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Robot Setting</td>
<td>Specifies the manipulator of which shock detection level is to be modified. If nothing is specified, the modification is applied to the shock detection level of the job control group in this instruction. However, in case of coordinated job, the modification is applied to the shock detection level of the slave axis group.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Shock Detection Level Condition Number (1 to 7)</td>
<td>Specifies the shock detection level condition number in which the detection level in playback mode is set.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Changing the Shock Detection Level for Each Axis</td>
<td>(Setting range: 1 to 500) Change the shock detection level specified in the changing the shock detection level for the each axis. If the shock detection level is not specified, the level will be the detection level specified in the shock detection level condition number. As for the manipulator with six axes, each axis indicates as follows.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AXIS1</th>
<th>AXIS2</th>
<th>AXIS3</th>
<th>AXIS4</th>
<th>AXIS5</th>
<th>AXIS6</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>L-axis</td>
<td>U-axis</td>
<td>R-axis</td>
<td>B-axis</td>
<td>T-axis</td>
</tr>
</tbody>
</table>
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8.7 Shock Detection Function

If the non-existing axis in the system was specified to change the shock detection level for each axis, the its specified shock detection level is invalid.
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- **SHCKRST instruction**

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

  The additional item of the SHCKRST instruction is as follows.

  \[
  \text{SHCKRST } R1
  \]

  \[
  \text{Robot Setting}
  \]

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

- **Instruction Registration**

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

  1. Select \{JOB\} under the main menu.

  ![Instruction Registration Diagram]

  2. Select \{JOB\}.

  3. Move the cursor in the address area.
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**SHCKSET**

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

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

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

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

4. Change the value of additional item and numerical data.
   - <When registering the instruction as it is>
     Operate the step 5 when registering the instruction in the input buffer line as it is.
   - <When adding or changing the additional item>
     • **When changing the shock detection level**
       (1) When changing the shock detection level, move the cursor to the shock detection level condition number; hold down [SHIFT] and press the up/down cursor key to change the condition number.

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

       (2) Press [ENTER] to change the number in the input buffer line.
• When the robot specification is added

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

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

(3) The selection box appears.

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

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

(6) The DETAIL window closes and the JOB CONTENT window
appears.
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8.7 Shock Detection Function

• When the shock detection level for the each axis change is added

(1) Move the cursor over the instruction in the input buffer line, and select [Select] to display the DETAIL EDIT window.

![DETAIL EDIT Window](image1)

(2) Move the cursor to “UNUSED” of any “SENS(AXIS)” to change the detection level, and press [SELECT].

![DETAIL EDIT Window](image2)

(3) The selection box appears, and select “AXIS=“.

(4) Press [ENTER] after adding the items.

(5) The JOB CONTENT window appears, after closing the DETAIL EDIT window.

![JOB CONTENT Window](image3)
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- When changing the shock detection level for the each axis
  1. When changing the shock detection level for the each axis, move
     the cursor to the shock detection level; hold down [SHIFT] and
     press the up/down cursor key to change the level.

- When the value is input with the numeric key
  1. When the value is input with the numeric key, press [SELECT] to
     display the input buffer line.
  2. Input the numbers, and then press [ENTER]. The value in the
     input buffers is changed.

5. Press [INSERT] then [ENTER].
   - The instruction displayed in the input buffer line is registered.

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

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

(3) The selection box appears.

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

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

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

5. Press [INSERT] then [ENTER].
   – The instruction displayed in the input buffer line is registered.
8.7.2.6 Resetting the Shock Detected

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

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

1. Press [SELECT].
   - The alarm is reset when “RESET” is selected on the alarm display, and the shock detection status is released.

2. Operation after resetting the detection status.
   - In teach mode, the JOG operation of the manipulator is enabled by resetting the status.
   - In the play mode, move the manipulator once to the safety position in the teach mode to check the damage though the playback operation is possible after resetting the status.

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

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

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

1. Press [SELECT].
   - The alarm is reset when “RESET” is selected on the alarm display, and the shock detection status is released.

2. Operation after resetting the detection status.
   - In teach mode, the JOG operation of the manipulator is enabled by resetting the status.
   - In the play mode, move the manipulator once to the safety position in the teach mode to check the damage though the playback operation is possible after resetting the status.
8.7.3 High-Sensitivity Shock Detection Function (For Arc Welding Application Only)

This function is designed to reduce the damage caused by a collision by bringing the manipulator to an emergency stop when the tool or manipulator collides with peripheral equipment. By increasing the sensitivity to a collision, the damage caused by a collision can be reduced, compared to the normal shock detection function.

To use this function, it is necessary to set the robot setup conditions and the tool load information correctly.

The robot setup conditions include the weight and the center of gravity position of the load installed at each part of robot, etc.

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

---

**WARNING**

This function does not completely avoid damage to the peripheral devices; moreover, it does not guarantee the user’s safety.

Make sure to prepare safety measures such as safeguarding etc.

Refer to chapter 1 “Safety” at page 1-1 to chapter 6 “Testing Program Operation” for the safety measures in details.

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

---

8.7.3.1 Manipulator Type for High-Sensitivity Shock Detection Function

The following manipulator types for arc welding support the high-sensitivity shock detection function. To enable this function, read the tool load information prepared by Yaskawa on the MAKER INITIAL VALUE window.

Types for high-sensitivity shock detection function

8.7.3.2 Setting for High-Sensitivity Shock Detection Function

To enable the high-sensitivity shock detection function, perform the settings ① and ② as shown below. The function is enabled only with the setting ①, but perform both ① and ② to make the shock detection more accurate.

① Reading the tool load information from the MAKER INITIAL VALUE window

To enable the high-sensitivity shock detection function, read the tool load information prepared by Yaskawa on the MAKER INITIAL VALUE window. Since this function works on the assumption that the tool file is correctly set, read the tool load which is the same as the actual load on the MAKER INITIAL VALUE window. When the tool other than the tool for high-sensitivity indicated in section 8.7.3.6 “Explanation of Maker Initial Value” on page 8-101 is used, DO NOT use this function.

② Setting the U-arm payload

To perform shock detection more accurately, set the U-arm payload
8.7 Shock Detection Function

referring to section 8.4.2 "ARM CONTROL Window" on page 8-38. The U-arm payload prepared by Yaskawa can be read on the MAKER INITIAL VALUE window. Read the same data as the actual U-arm payload on the MAKER INITIAL VALUE window.

8.7.3.3 Reading the Tool Load Information on the MAKER INITIAL VALUE Window

1. Change the “SECURITY MODE” to the “MANAGEMENT MODE”, then select {ROBOT} under the main menu.
2. Select {TOOL}.
   – The TOOL window appears.
3. Select the desired tool number.
4. Select {DATA} under the menu.
   – The pull-down menu appears.
5. Select {READING}.
   – The MAKER INITIAL VALUE window appears.
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6. Select the number of the maker initial value to be read.
   – A confirmation dialog box appears.
   – Select a maker initial value other than the “STANDARD” to enable the high-sensitivity shock detection function.

7. Select {YES}.
   – The tool load information is read into the tool file, and the TOOL window appears.
   When “NO” is selected, the tool load information is NOT read into the tool file, and the TOOL window appears.
8.7.3.4 Explanation of Maker Initial Value

- The high-sensitivity shock detection function is enabled when a maker initial value other than the “STANDARD” is selected. The read tool load information cannot be changed because it is used for the high-sensitivity shock detection function. When the standard torch is read, the function is disabled and the tool load information becomes editable.

- In the case of using multiple tool files, when the tool file is switched, the tool load information is also switched. When switching the tool file only to switch the TCP (when the weight or the center of gravity position, etc. of the whole tool installed at the flange does not change), perform the same settings to the tool load information of each file.

In addition, when the total weight or the center of gravity position of the tool changes (with the system in which the tool is exchanged by a tool changer, etc.), set the tool load information for each tool file.

NAME
The name of tool load information prepared by Yaskawa is indicated. When using the tool in the following figure, select 300R BUILT MODEL, 308R BUILT MODEL, or 308RR UNIV MODEL.
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8.7.3.5 Reading the U-Arm Payload

1. Change the “SECURITY MODE” to the “MANAGEMENT MODE”.
2. Select {ARM CONTROL}.
   – The ARM CONTROL window appears.

The high-sensitivity shock detection function works on the assumption that the tool file is correctly set.

- To perform shock detection more accurately, read the tool load which is the same as the actual load on the MAKER INITIAL VALUE window.
3. Select {DATA} under the menu.
   – The pull-down menu appears.
4. Select {READING}.
   - The MAKER INITIAL VALUE window appears.

5. Select the number of the MAKER INITIAL VALUE to be read.
   - A confirmation dialog box appears.
6. Select {YES}.

- The U-arm payload is read into the ARM CONTROL window, and the ARM CONTROL window appears. When {NO} is selected, the ARM CONTROL window appears without the U-arm payload being read into the ARM CONTROL window.

8.7.3.6 Explanation of Maker Initial Value

① NAME
The name of U-arm payload information prepared by Yaskawa is indicated.
When using the U-arm payload in the following figure, select from the MAKER INITIAL VALUE window.

To perform shock detection more accurately, even when the U-arm payload information prepared by Yaskawa and the actual payload are the same, DO NOT read the payload information if the robot types are different.
8.8 User Coordinate Setting

8.8.1 User Coordinates

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

  ![Diagram of User Coordinates](image)

  **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.

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

  ![Diagram of User Coordinate Files](image)
8.8.2 User Coordinate Setting

8.8.2.1 Selecting the User Coordinate File
1. Select {ROBOT} under the main menu.
2. Select {USER COORDINATE}.
3. Select the user coordinate number.

(1) The USER COORDINATE window appears.

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

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

(4) The following window appears.
8.8.2.2 Teaching the User Coordinates

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

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

3. Move the manipulator to the desired position with the axis keys.

4. Press [MODIFY] then [ENTER].
   - Taught position is registered.
   - Repeat the steps 2 to 4 to teach ORG, XX and XY.
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8.8 User Coordinate Setting

- “●” indicates that teaching is completed and “○” indicates that it is not completed.

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

- If there is a difference between the current position of the manipulator and the displayed position data, “ORG”, “XX”, or “XY” flashes.

5. Select “COMPLETE”.

- User coordinates are registered in the file.

- Once the user coordinate setting is completed, the following window appears.
8.8.2.3 Clearing the User Coordinates

1. Select {DATA} under the pull-down menu.
2. Select {CLEAR DATA}.
   - The confirmation dialog box appears.
3. Select {YES}.
   - All data is cleared.
8.9 Overrun/Tool Shock Sensor Releasing

**CAUTION**

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

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

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

![OVERRUN & SHOCK SENSOR Window](image-url)
8 System Setup
8.9 Overrun/Tool Shock Sensor Releasing

- If “RELEASE” is selected, overrun or tool shock sensor is released and “CANCEL” indication will be displayed.

4. Select “ALM RST”.
- The alarm is reset and manipulator can be moved with the axis keys.

After releasing the overrun or tool shock sensor, if “CANCEL” is selected or the window is changed to the other one, the release of the overrun or tool shock sensor will be canceled.
8.10 Soft Limit Release Function

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

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

These soft limits are continually monitored by the system, and the manipulator automatically stops when its TCP reaches a soft limit.

When the manipulator is stopped at a soft limit, temporarily release the soft limit by the following procedure, then move the manipulator away from the soft limit in a direction opposite to the earlier operation direction.

1. Select {ROBOT} under the main menu.
2. Select {LIMIT RELEASE}.
   - The LIMIT RELEASE window appears.

3. Select “SOFT LIMIT RELEASE”.
   - Each time [SELECT] is pressed, “VALID” and “INVALID” switch alternately.
   - When “SOFT LIMIT RELEASE” is set to “VALID”, a message “Soft limits have been released” appears.

   ![LIMIT RELEASE Window]

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

   ![LIMIT RELEASE Window (INVALID)]

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

CAUTION

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

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

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

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

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

8.12.1 Setting Contents

8.12.1.1 Instruction Set

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

Subset Instruction Set

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

Standard Instruction Set / Expanded Instruction Set

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

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

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

When instructions are executed, for example during playback, all the instructions can be executed regardless of the instruction set used.
8 System Setup
8.12 Instruction Level Setting

8.12.1.2 Learning Function

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

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

1. An instructions are registered.

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

8.12.2 Setting the Instruction Set Level

1. Select {SETUP} under the main menu.

2. Select {TEACHING COND}.
   – The TEACHING CONDITION window appears.
3. Select “LANGUAGE LEVEL”.
   – The selection list appears.

4. Select desired language level.
   – Language level is set.
8.12.3 Setting the Learning Function

The learning function is set at “VALID” by default.

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

The clock inside the controller can be set as follows.

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

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

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

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

![SPEED SET Window](image)
8 System Setup
8.14 Setting the Play Speed

5. Select the speed to modify.
   – The input buffer line appears.
6. Input the speed value.
7. Press [ENTER].
   – The speed is modified.
8.15 Numeric Key Customize Function

8.15.1 What is the Numeric Key Customize Function?

With this function, the user can set the function of an application that has been allocated to the numeric keys of the programming pendant to the other function.

Since any frequently used operation can be allocated to the numeric keys on the programming pendant, decreased key operations reduce the teaching time.

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

8.15.2 Allocatable Functions

There are two allocation methods as follows:

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

8.15.2.1 Key Allocation (EACH)

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

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

#### 8.15.2.2 Key Allocation (SIM)

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

#### Allocating Operation

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

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

#### 8.15.2.3 Allocation Window

1. Select {SETUP} under the main menu.
2. Select {KEY ALLOCATION}.
   - The KEY ALLOCATION (EACH) window appears.
3. Select {DISPLAY}.
8 System Setup

8.15 Numeric Key Customize Function

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

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

8.15.2.4 Instruction Allocation

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

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

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

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

---

8.15.2.5 Job Call Allocation

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

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

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

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

8.15.2.6 Display Allocation
Set this function in the KEY ALLOCATION (EACH) window.
1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – Selection list appears.
2. Select [DISPLAY].
3. Move the cursor to “ALLOCATION CONTENT” and press [SELECT].
   – Character input is available.
4. Input the name of the reserved window and press [ENTER].
   – The reserved name input to the “ALLOCATION CONTENT” is shown.
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8.15 Numeric Key Customize Function

5. Open the window for allocation.

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

![Diagram of numeric key setup]

When allocate the display allocation to a key, key allocation (SIM) will be set to the display set.
Unable to allocate the display allocation and the another function to the same key.

8.15.2.7 Alternate Output Allocation

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

![Diagram of alternate output allocation]

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8.15 Numeric Key Customize Function

2. Select “ALTERNATE OUTPUT”.
   – The output No. is displayed in the “ALLOCATION CONTENT”.

![Diagram showing key allocation settings]

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

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

8.15.2.8 Momentary Output Allocation

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

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

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

![Diagram showing key allocation settings]

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

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

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

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

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

   ![Image of KEY ALLOCATION screen]

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

   (2) Input the number or time to be changed, and press [ENTER].
8.15.2.10 Group (4-bit/8-bit) Output Allocation

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

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

2. Select “4 BIT OUTPUT” or “8 BIT OUTPUT”.
   – The output No. and output value are displayed in the “ALLOCATION CONTENT”.

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

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

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

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

2. Select “ANALOG OUTPUT”.
   - The output port number and the output voltage value are displayed in the “ALLOCATION CONTENT”.

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

(2) Input the number or voltage value to be changed, and press [ENTER]
8.15.2.12 Analog Incremental Output Allocation

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

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

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

(2) Input the number or incremental value to be changed, and press [ENTER].
8.15 Numeric Key Customize Function

8.15.3 Allocation of I/O Control Instructions

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

<table>
<thead>
<tr>
<th>Function</th>
<th>Output Control Instruction allowed to be Allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate output allocation</td>
<td>DOUT OT# (No.) ON</td>
</tr>
<tr>
<td>Momentary output allocation</td>
<td>PULSE OT# (No.) T = output time</td>
</tr>
<tr>
<td>Pulse output allocation</td>
<td>DOUT OGH (No.) output value</td>
</tr>
<tr>
<td>Group output allocation (4-bit)</td>
<td>DOUT OG# (No.) output value</td>
</tr>
<tr>
<td>Group output allocation (8-bit)</td>
<td>AOUT AO# (No.) output voltage value</td>
</tr>
</tbody>
</table>

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

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

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

   ![Image of key allocation screen]

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

8.15.4 Execution of Allocation

8.15.4.1 Executing the Instruction/Output Control Allocation
1. Press the key allocated for instruction allocation or output control allocation.
   – The allocated instruction is displayed in the input buffer line.

   ![Image of instruction displayed]

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

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

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

8.15.4.3 Executing the Display Allocation
1. Press the key allocated for the display allocation.
   – The allocated display appears.
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8.15 Numeric Key Customize Function

8.15.4.4 Executing the I/O Control Allocation

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

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

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

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

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

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

1. Select (IN/OUT) under the main menu.
2. Select (RELAY ON).
   - The RELAY ON window appears.

3. Select the desired signal to change the output status.
   - Select the status (● or O) of the desired signal.
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8.16 Changing the Output Status

4. Press [INTERLOCK] + [SELECT].

– The output status is changed. (●: status ON; ○: status OFF.)

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

**NOTE**
### 8.17 Changing the Parameter Setting

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

1. Select {PARAMETER} under the main menu.
2. Select the parameter type.
   - The PARAMETER window appears. Select the desired parameter.
3. Move the cursor to the desired parameter number.
   - When the desired parameter number is not in the current window, move the cursor in the following way:
MH900, DX200 Controller

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8.17 Changing the Parameter Setting

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

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

(3) Press [ENTER].

(4) The cursor moves to the selected parameter number.
8.17 Changing the Parameter Setting

Set the parameters in the following manner.

1. Select the parameter data to be set.
   (1) Move the cursor to the parameter number data (decimal or binary) in the PARAMETER window, and press [SELECT].
   (2) To enter a decimal setting, select the decimal figure.
   (3) To enter a binary setting, select the binary figure.

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

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

8.18.1 Initializing Job File

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

5. Select {JOB}.
   - A confirmation dialog box appears.
8. System Setup
8.18 File Initialization

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

When JOB is initialized, the following files are reset at the same time. Be careful when initializing JOB.

- User coordinates
- Memory play file
- Spot monitor data
- Variable data
- System definition parameter (S4D)
- Robot calibration data
- Conveyor calibration data.

8.18.2 Initializing Data File

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

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

8. Select {YES}.
   - The selected data file/general data are initialized.
8.18.3 Initializing Parameter File

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.

2. Change the security mode to the management mode.

3. Select {FILE} under the main menu.

4. Select {initialize}.

5. Select {PARAMETER}.

   - The parameter selection window appears.

6. Select the parameter to be initialized.

   - The selected parameter is marked with "★".

   - The parameters marked with "■" cannot be selected.
7. Press [ENTER].
   – A confirmation dialog box appears.

8. Select {YES}.
   – The selected parameter is initialized.
8.18.4 Initializing I/O Data

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select (INITIALIZE).
5. Select {I/O DATA}.
   - The I/O data selection window appears.
6. Select data to be initialized.
   - The selected data is marked with "★".
   - The I/O data marked with "●" cannot be selected.
8. Press [ENTER].
   – A confirmation dialog box appears.

8. Select {YES}.
   – The selected data is initialized.
8.18.5 Initializing System Data

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.

2. Change the security mode to the management mode.

3. Select {FILE} under the main menu.

4. Select {INITIALIZE}.

5. Select {SYSTEM DATA}.

   – The system data selection window appears.

   ![System Data Selection Window]

6. Select the parameter to be initialized.

   – The selected data is marked with "★".

   – The system data marked with "●" cannot be selected.
7. Press [ENTER].
   – A confirmation dialog box appears.

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

8.19 Display Setting Function

8.19.1 Font Size Setting
The controller enables changing the font size displayed on the screen. The fonts displayed on the screen can be selected from eight patterns of fonts in the font size setting dialog box.

8.19.1.1 Applicable Range for the Font Size Change
Changing the font size is allowed in the general display area indicated in the following figure:

![General display area]

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

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

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

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

2. The font size setting dialog box appears on the center of the current window.
8 System Setup
8.19 Display Setting Function

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

1. Specify the font style.
   - The {Bold Type} check box can be checked or unchecked alternately each time the check box is selected.
   - Check the {Bold Type} check box as follows to set the font to the bold style.

   ![Font setting dialog box with bold style]

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

   ![Font setting dialog box with regular style]

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

- **To cancel the setting of the font size, follow the procedure below.**
  1. Select (Cancel) in the font size setting dialog box.
  2. The dialog box closes without changing the font size.
8.19 Display Setting Function

8.19.2 Operation Button Size Setting

The controller enables changing the size of operation buttons.

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

8.19.2.1 Applicable Range for the Button Size Change

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

8.19.2.2 Settable Button Size

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

<table>
<thead>
<tr>
<th>Button Size</th>
<th>Font Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Small</td>
<td>Regular</td>
</tr>
<tr>
<td></td>
<td>Bold</td>
</tr>
<tr>
<td>2 Regular</td>
<td>Regular</td>
</tr>
<tr>
<td></td>
<td>Bold</td>
</tr>
<tr>
<td>3 Large</td>
<td>Regular</td>
</tr>
<tr>
<td></td>
<td>Bold</td>
</tr>
</tbody>
</table>
8.19.2.3 Setting the Button Size

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

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

   - The font size setting dialog box appears on the center of the current window.
To set the button size in the button size setting dialog box, follow the procedure below.

1. Specify the area to set the button size.
   (1) Select the desired area from the area setting buttons.
   (2) The buttons in the selected area is subject to size setting.
   (3) Note that only the last-selected button determines the area subject to size setting, even if settings are performed several times before then.

2. Specify the font style.
   – The {Bold Type} check box can be checked or unchecked alternately each time the check box is selected.
   • Check the {Bold Type} check box as follows to set the font to the bold style.
   • Clear the {Bold Type} check box as follows to set the font to the regular style.
3. Specify the button size.
   - Select a button from the three buttons in the dialog box.

4. The font size setting dialog box is closed, and the screen displays the buttons specified in the dialog box.
   - The modification is applied only to the buttons in the area selected with the area setting button. (In this example, the change is applied only to the pull-down menu buttons in the menu area.)
To cancel the setting of the button size, follow the procedure below.
1. Select (Cancel) in the button size setting dialog box.

- The dialog box closes without changing the button size.

Do not turn OFF the controller power supply when the button size is being changed (when the button size setting dialog box is on the screen, or when an hourglass is indicated in the middle of the screen).
8.19.3 Initialization of Screen Layout

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

8.19.3.1 Initializing the Screen Layout

To initialize the screen layout, follow the procedure below.

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

   - A confirmation dialog box appears on the center of the current window.
To initialize the screen layout, follow the procedure below.

1. select {OK}.

- The dialog box is closed, and the font/button sizes are collectively changed to the regular size.
To cancel the Initialized screen layout, follow the procedure below.
1. Select {CANCEL}.

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

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

### 8.19.4 Layout Storage

The settings of the font or button sizes are saved in the programming pendant. The screen displays the font/button size specified last time with the current programming pendant.
8.20 Encoder Back-up Error Recovery Function

8.20.1 About Encoder Back-up Error Recovery Function

A motor of the robot, the travel axis or the rotation station which is controlled by the controller is connected with the back-up battery in order to keep the position information even though the control power is disconnected. This battery consumes battery power through time, and the alarm “4312 ENCODER BATTERY ERROR” occurs when the voltage becomes lower than 2.8V. If the battery is not replaced and keep consuming more battery power, it will cause the loss of the position information. In addition, the alarm “4311 ENCODER BACK-UP ERROR” occurs. Meanwhile, there would be a gap between the manipulator position and the position of the absolute encoder.

This function allows to recover the absolute data by moving the axis operation to the home position from the position information where the axis is lost.

8.20.2 Encoder Back-up Error Recovery Function Operation

1. Press {SELECT}.
   – When select the “RESET” in the alarm display, the alarm is reset. The manipulator can be move by the axis operation key.

2. Adjust the alarm occurring axis to the home position mark of the each manipulator axis by the axis operation key.

3. Change the security mode to the management mode.
   – Refer to section 7.1.1 “Security Mode” on page 7-1 for the operation of the changing the security mode.

4. Select {ROBOT} in the main menu.

5. Select {HOME POSITIONING}.
   – The home positioning display appears. The absolute data of the axis which is occurring the encoder back-up error appears with the “*” which indicates the undefined state.

6. Select the control group.
7. Select {UTILITY} in the menu.
   – The pull-down menu appears.

8. Select {BACKUP ALM RECOVERY} in the menu.
   – The back-up alarm recovery display appears.

9. Select the axis to be fixed.
   – Move the cursor over the axis to fix, and select it. The confirmation dialog appears.
10. Select {YES}.
   - The absolute data of the selected axis is recovered.
   - Select {NO} to cancel the operation.
11. Select the current position.
   - To display the current position window, refer to DX200 MAINTENANCE MANUAL section 7.8.1 “Current Position Window”.
12. Confirm the current position.
   - Confirm the recovered current position, and modify the followings depending on its values.
   (1) The pulse number is approximately “0”.
       • Recovered normally.
   (2) The pulse number is approximately “4096”.
       • Move the recovered axis to the 4096 pulse position, and register the individual axis to calibrate the home position.
   (3) The pulse number is approximately “-4096”.
       • Move the recovered axis to the -4096 pulse position, and register the individual axis to calibrate the home position.
       As for the registering the individual axis, refer to section 8.1.2 “Calibrating Operation” on page 8-5.
8 System Setup
8.21 Preventive Maintenance Function

8.21 Preventive Maintenance Function

8.21.1 Preventive Maintenance Function
The preventive maintenance function contains the function which provides
the information of diagnosis the duration of life for the speed reducer and
the function which informs the inspection time of the robot. Furthermore, it
contains the function which provides the information of the life span of the
controller components. Use these functions for the preventive
maintenance for the robot.
The followings are the features.

- Preventive maintenance function for the speed reducer
- Inspection notice function
- Preventive maintenance function for the hardware

8.21.2 Preventive Maintenance Function for the Speed Reducer
Diagnoses the duration of life for the speed reducer by using the both
methods of the lifetime calculation and the torque average value. The
diagnosis is executed by operating the job in the play mode. It is
unnecessary to prepare the job for this diagnosis.

- The accuracy of the performance of the life diagnosis is
  not guaranteed. Use this function as the one of the
  methods to determine the duration of life for the speed
  reducer.
- If the periodic grease replenishment and grease
  replacement are not performed, or the excessive
  pressure is applied to the speed reducer, such as the
  mechanical interference etc. it will be failed before
  reaching to the diagnosis period.
- The diagnosis is performed by executing the job in the
  play mode. When operating the robot in the teach mode
  (operation by the axis key, FWD operation and test
  operation), the life diagnosis function is not performed.

8.21.2.1 Diagnose by the Lifetime Calculation

- **Outline**
  This function calculates the torque and the speed of the each axis during
  the job operation, and diagnoses the time to replace the speed reducer by
  the lifetime calculation. The replacement time is informed by displaying
  the message and turning the replacement signal ON.

  Operating the job in the play mode performs the diagnosis automatically.

  This function is only available for the robot axes. As for the
  external axes, this function is not available.

  **Set the Replacement Signal**
  Set the universal output signal to notify the replacement time by following
  procedures.
  1. Change the security mode to the management mode.
2. Select (=PM) in the main menu.
3. Select (=RM(REDUCER)).
4. Select (Display) in the menu.
   – (=SETUP CONDITION) appears under the pull down menu.

5. Select (=SETUP CONDITION).
   – The condition setup window is appears.
6. Move the cursor to over the \{=REPLACEMENT SIGNAL\}, and select.
   – Able to enter the values.

7. Enter the universal output signal.

**Lifetime Calculation Window**

1. Select \{=RM\} in the main menu.
2. Select \{=RM(REDUCTER)\}.
   – The lifetime calculation window appears. In the case of the another window appears, select \{Display\}, and select the \{=LIFE CALCULATION\} in the pull down menu to display the lifetime calculation window.

Each item on the screen represents the following description.

① =TIME TO REPLACEMENT
Displays the rest of the lifetime to replace the speed reducer. The calculation of the subtraction of the number is operated automatically by performing the job in the play mode.

② =NOTICE TIME
By setting the time in this item, the replacement time is informed by displaying the message and turning the replacement signal ON before the "TIME TO REPLACEMENT" becomes "0".
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For example, when setting with “100”, the message will be displayed 100 hours before the “TIME TO REPLACEMENT” becomes “0”, and the replacement signal will be turned ON as well.

For example, when setting with “-100”, the message will be displayed 100 hours after the “TIME TO REPLACEMENT” became “0”, and the replacement signal will be turned ON as well.

⑥ =WARNING
Select this item to invalidate the notification signal and displaying the message. [Invalid] and [Valid] will alternate each time when pressing the [Select].

⑩ =RESET
Select this item after replacing the speed reducer. Addition to the message is deleted, and the replacement signal is OFF, “TIME TO REPLACEMENT” is reset.

Invalid the Replacement Signal and the Message Display
Able to invalidate the replacement signal and the message display in each axis. Invalidate the replacement signal and the message display by the following procedures, in the case of the speed reducer seems to operate normally even though the replacement signal is turned ON.

1. Change the security mode to the management mode.
2. Select {=RM} in the main menu.
3. Select {=RM(REDUCER)}.
   – The lifetime calculation window appears. In the case of the another window appears, select (Display), and select the (=LIFE CALCULATION) in the pull down menu to display the lifetime calculation window.
8.21 Preventive Maintenance Function

4. Move the cursor over the “=WARNING” to invalidate the desired axis, and select [Select]. [Invalid] and [Valid] will alternate each time when press the [Select].

8.21.2.2 Diagnose by the Torque Average Value

**Diagnosis Element**
Monitors the torque waveform during the job operation, and calculates the average value of the vibration amplitude by extracting the waveform from the torque arising from the speed reducer. This data is called the torque average value, and it is the basis data to diagnose the lifetime. The following chart shows the lifetime curved line according to the torque average value and the operation hours.

As the condition of the speed reducer is changing to “deterioration” from “normal operation”, the torque element changes to “increase” from “normal”. It is estimated that the speed reducer is in the deterioration period as the number of the torque element is increasing by the deterioration of the speed reducer.
This function records the torque element arising from the deterioration of the speed reducer on a daily basis, and diagnoses the lifetime of the speed reducer by monitoring the change of the torque element.

By operating a job in the play mode, a data (the torque element arising from the deterioration of the speed reducer) for each axis is recorded automatically on a daily basis, and the data is accumulated.

When the difference value between the latest value “the average value from the measured result of the five days (the initial value) including the day to diagnose” and the average value “the average of 30 days (the initial value) between prior to 60 days from the day to diagnose and prior to 90 days from the day to diagnose” becomes the threshold value or more, it determines the speed reducer is almost failure, and outputs the warning. The average value is indicated with %, and 100% indicates the standard torque.
Setting Procedures
The setting procedures are described as follows.
1. Change the security mode to the management mode.
2. Select \{=RM\} in the main menu.
3. Select \{=RM(REDUCER)\}.
   - The lifetime calculation window appears.
4. Select \{Display\} in the menu.
   - The \{=SETUP CONDITION\} appears in the pull down menu.
5. Select {=SETUP CONDITION}.
   – The setup window appears.
   – Modify the condition as necessary.

   ![Setup Window]

6. Select {End} button.

Each item on the screen represents the following description.

① =TORQUE VARIATION ACCEPT RATE

It is determined as accept OK when the measured value (the latest value - the average value) is smaller than the set value or the equal value. It is determined as accept NG when the measured value is greater than the set value. The torque variation accept rate can be set as “High”, “Medium” or “Low”. The initial value of each item is 50%, 40% and 20%.

② =TORQUE VARIATION ALART OUTPUT

• =ACCEPT RATE HIGH
   The warning output signal is turned ON when the number of the day, which is determined as accept NG (the latest value - the average value > “=ACCEPT RATE HIGH”), is more than the number of the consecutive days. If unnecessary to output the signal, set the item “0”. The initial value of this item is “0”.

• =ACCEPT RATE MID, LOW
   The universal output signal, which is set by “=ACCEPT RATE MID” and “=ACCEPT RATE LOW”, is turned ON when it is determined as follows.
   The latest value - the average value > “=ACCEPT RATE MID”.
   The latest value - the average value > “=ACCEPT RATE LOW”.
   If unnecessary to output the signal, set the item “0”. The initial value of this item is “0”.

③ =CONSECUTIVE DAYS (ACCEPT NG)

It is determined as the speed reducer is almost failure, when the number of the day, which is determined as tolerance NG (the latest value - the average value > “=ACCEPT RATE HIGH”), is more than the number of this item. The initial value of this item is “3” (days).
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④ =CALCULATION DAYS
Set the period to calculate the average value. The initial value of this item is “30” (days).

⑤ =ELAPSED DAYS FROM CALC. START
Set the period to calculate the average value from the day to diagnose. The initial value of this item is “60” (days).

⑥ =LATEST MEASURED DAYS
Set the period to calculate the latest value. The initial value of this item is “5” (days).

⑦ =ERROR DELETE FILTER
Use to delete the error when calculate the average value. The following values (torque average) are excepted from the calculation of the average value.

- The average from the previous day exists.
  
The average from the previous day / any measurement value of the average period×100 > filter setting value
  
The any measurement value of the average period / the average from the previous day×100 > filter setting value
- The average from the previous day does not exist.
  
The latest value / any measurement value of the average period×100 > filter setting value
  
The any measurement value of the average period / the latest value×100 > filter setting value

The initial value of this item is “200” (%).

⑧ =GRAPH NAME
Able to register the name of the graph.

⑨ =REPLACEMENT SIGNAL
Use this item to calculate the lifetime. Refer to “Set the Replacement Notice Signal”.

Even though the initial value is set, the accuracy of the life diagnosis is not guaranteed performance.
Data Confirmation
By operating a job in the play mode, a data (the torque element arising from the deterioration of the speed reducer) for each axis is recorded automatically on a daily basis, and the data is accumulated. It is unnecessary to prepare the job for this diagnosis.

Able to refer the data by following procedures.
1. Select (=RM) in the main menu.
2. Select (=RM(REDUCTER)).
3. Select (Display).
   – The pull down menu appears.
4. Select (=TORQUE MONITOR).
   – The torque monitor window appears.
   – Able to refer the data of a date corresponding to the number by pressing the [PAGE] key. Modify the number as necessary.

Unable to measure the torque average value because the axis of the measured value indicating “?” is not operating, or the motion speed is less than the reference speed.
Each item on the screen represents the following description.

① =NG COUNT (IN A ROW)
Shows the number of the variation days, which is higher than the value of the torque variation “HIGH”. The warning output signal, which is set by “=ACCEPT RATE HIGH”, is turned ON when the number of the day above is more than the number of the consecutive accept NG days.

② =NG COUNT (ACCUM.)
Shows the total number of the variation days, which is higher than the value of the torque variation “HIGH”. The number of “=NG COUNT (IN A ROW)” is reset as “0”, when a day does not exceed the torque variation. However, this “=NG COUNT (ACCM.)” will not be reset.

③ =MEASURED DATE
Shows the date of the measurement or the updated speed reducer diagnosis database.

④ =MEAS.
Shows the measured torque average.

⑤ =AVE.
Shows the arithmetic mean of the average period (certain number of the days, which is calculated in the past, based on the MEASURED DATE). However, the measured values excepted in the =ERROR DELETE FILTER are not included.

⑥ =VARIATION (The Determining Value)
Shows the difference value between the latest value and the average value. When this value exceeds the value, which is set at the torque variation, it is determined as accept NG.

⑦ =LATEST
Shows the arithmetic mean of the latest period (certain number of the days included the measured day).

⑧ =WARNING
Select this item to invalidate the warning output signal. [Invalid] and [Valid] will alternate each time when press the [Select].

⑨ =RESET
Select this item after replacement of the speed reducer. The warning output signal will be turned OFF, and the old data will not be used for the lifetime diagnosis.
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**Invalidate the Warning Output Signal**
Able to invalidate for each axis. Invalidate the warning output signal by the following procedures, in the case of the speed reducer seems to operate normally even though the warning output signal is turned ON.

1. Select {=RM} in the main menu.
   – The sub menu appears.
2. Select {=RM(REDUCER)}.
   – The lifetime calculation window appears.
3. Select {Display}.
   – The pull down menu appears.
4. Select {=TORQUE MONITOR}.
   – The torque monitor window appears.

Move the cursor over the “=WARNING” of the desired axis to invalidate, and press [Select]. [Invalid] and [Valid] will alternate each time when pressing the [Select].

**Graph Display**
Able to confirm the variation by a graph after the measurement. The graph is updated every 24 hours automatically. The measured value and changes of the variation can be displayed on the programming pendant. Thus, able to confirm the changes of the torque visually. Use the graph display as the one of the methods to determine the duration of life for the speed reducer.

The graph can be displayed by the following procedures.
1. Select {=RM} in the main menu.
2. Select {=RM(REDUCER)}.
3. Select {Display}.
   – The pull down menu appears.
4. Select {=GRAPH}.
   – The graph appears.

5. Select {CLOSE}.
   – Return to the lifetime calculation window.

Each item on the screen represents the following description.

① =Graph
Select the {Graph}, and the pull down menu appears. Either “=Var” or “=Meas.” can be selected.

• When selecting “=Vari.”, the variation (=latest value - average value) appears on the graph. The line of each “Hi”, “Mid” and “Lo” appears. “Hi” means “the torque variation accept high”. “Mid” means “the torque variation accept medium”. “Lo” means “the torque variation accept low”.

When changing “the torque variation accept high”, “the torque variation accept medium” or “the torque variation accept low” on the each setting window, the lines for “Hi”, “Mid” and “Lo” on the graph also correspond to the setting values.
In the case of the graph above, it shows a “variation” > “Lo” of the T-axis, and the warning output signal, which is set by “torque variation low”, is ON.

- When selecting “=Meas.”, the measured value is displayed on the graph.

⑤ =Group
Select (=Group), and the pull down menu appears. Select the group to display.

⑥ =Name
The names set in the each setting window are displayed.

⑦ =Renew
Pressing the “=Renew” button updates the latest data.

⑧ =Days
Set the number of the days between 5 and 150 days to be displayed. The latest data is displayed on the right side of the graph, and the old data set by “=Days” is displayed on the left side of the graph.
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⑥ = Torque

The minimum value and the maximum value of the vertical axis can be set. “MIN” is the minimum value, and “MAX” is the maximum value.

⑦ = Axis

Removing the tick in the box hides the axis on the screen.

⑧ = Save CSV

Pressing the “CSV” button saves the variation and measured value into the external memory device as CSV format. As for the external device, it can be saved into both CF card and USB, but the data is priority saved into the CF card. The followings are the name for a file and a folder to be saved.

File name: “the name which is set in the each setting window” + “year/month/day” + “hour/minute/second”. CSV
Folder name: “SR LIFE DIAGNOSIS”

⑨ = Hard COPY

Pressing the “=Hard COPY” button saves the hard copy of the screen as JPG format into the CF card.

The following is a name for the file.

File name: “year/month/day” + “hour/minute/second”. JPG

⑩ = CLOSE

Pressing “=CLOSE” button closes the graph window.

8.21.2.3 After Replacement of the Speed Reducer

The lifetime diagnosis does not perform correctly if use the old data after replacement of the speed reducer. Thus, reset the data for the lifetime diagnosis, and prevent using the data before replacement day.

Perform the following procedures after replacement of the speed reducer.

1. Change the security mode to the management mode.
2. Select {=RM} in the main menu.
3. Select {=RM(REDUCTER)}. 
4. Select {Display}, select the {=LIFE CALCULATION} or {=TORQUE MONITOR} in the pull down menu.
   – The lifetime calculation window or the torque monitor window appears.

5. Move the cursor over the “Reset” on the axis window of which speed reducer is replaced, and press {Select}.
   – The confirmation dialog appears.

6. Select “Yes”.
   – The data of its axis is reset, and the replacement day is recorded into the “=INSPECTION RECORD” window.
   – The operation is canceled when select “No”.

The procedures above can be performed in the lifetime window or the torque monitor window.

The replacement day is recorded into the “INSPECTION RECORD” window by performing the procedures above.
8.21.3 Inspection Notice Function

The inspection notice function turns the notice signal ON and displays the message when the inspection time has come.

Perform the inspection by the authorized personnel or Yaskawa representative (the list on the back cover) when the notice signal is turned ON.

8.21.3.1 Inspection Signal

Set the universal output signal for the inspection time as the following procedures.

1. Change the security mode to the management mode.
2. Select {=RM} in the main menu.
3. Select {=INSPECTION NOTICE}.
   - The inspection notice window appears.

   ![Inspection Notice Window](image)

4. Select {=Setup} in the main menu.
   - {=SETUP CONDITION} is displayed in the pull down menu.
5. Select {=SETUP CONDITION}.
   - {=SETUP CONDITIONS} window appears.

   ![Setup Conditions Window](image)
6. Move the cursor over the "=INSPECTION SIGNAL", and select.
   – It becomes the numeric value input status.

![Image of the inspection notice window](image)

7. Enter the universal output number.

8.21.3.2 The Inspection Notice Window

1. Select (=RM) in the main menu.
2. Select (=INSPECTION NOTICE).
   – The inspection notice window appears.

![Image of the inspection notice window](image)

Each item on the screen represents the following description.

① =TIME TO INSPECTION

The rest of the time to inspection is displayed. When the servo power is turned ON, it calculates the subtraction automatically. When this item become "0", the inspection notice signal is turned ON, and the message is displayed.
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② INTERVAL

The inspection interval is displayed.

When the inspection signal is turned ON or the message is displayed, perform the inspection by an authorized personnel or the Yaskawa representative (listed on the back cover of this instruction manual). The message is displayed continuously until the controller is inspected.

8.21.4 Record of the Inspection Day • the Replacement Day

Able to confirm the inspection day and the replacement day by following procedures.

1. Select {=RM} in the main menu.
2. Select {=INSPECTION RECORD}.
3. Select {Display}, and select {=INSPECTION DATE} in the pull down menu.
   - Able to confirm the inspection day.
4. Select {Display}, and select {=REPLACEMENT DATE} in the pull down menu.
   - Able to confirm the replacement day.
8.21.5 Management of the Data

According to the torque average value, such as the speed reducer preventive maintenance data base, the preventive maintenance elements, the record of the inspection and replacement, can be loaded/saved by the external memory device.

As for the external device menu, refer to Chapter 7 External Memory Devices of DX200 OPERATOR’S MANUAL for more details.

1. Select {External memory} in the main menu.
   – The external memory menu window appears.

2. Select {Load} or {Save}.
   – The load window or the save window appears.
3. Select the {System data}.
   - The system data selection window appears.
     (The following is an example of a window.)

4. Select the system data to load or save.
   - For the speed reducer preventive maintenance data base, select “={PM(REDUCER)FILE}”.
   - For the speed reducer preventive maintenance condition, select “={PM(REDUCER)CONDITION}”.
   - For the record of the inspection and replacement date, select “={INSPECTION RECORD FILE}”.

   The selected system data is displayed with “★”.

5. Press “Enter”.
   - The confirmation dialog appears.

6. Select “Yes”.
   - The selected system data is saved.
8.21 Preventive Maintenance Function

8.21.6 Preventive Maintenance for the Hardware

This function estimates the life span of the controller components by calculating the consumed amount with considering the usage environment and the load, and outputs general signals to be the reference for the replacement time.

The function overview is described below.

8.21.6.1 Target Components for Diagnosis

Regarding the following, calculations of the consumed amount and outputs of the general signals to be the reference for the replacement time are performed.

- Cooling fan*
- Capacitor
- Amplifier IGBT
- Contactor
- Motor (numbers of revolution and reverse revolution are displayed)

*Even though a fan is one of target components, some models do not have the fan. Refer to the INSTRUCTIONS for the each manipulator to confirm if it has the fan.

8.21.6.2 Replacement Time Display

- **Stepwise Display of Replacement Time**
  
  For each component, a judgment from A to D is displayed, and it can be used as the reference for the replacement time.

<table>
<thead>
<tr>
<th>Judgment display</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>New - Used about half of its life span</td>
</tr>
<tr>
<td>B</td>
<td>Used about half of its life span</td>
</tr>
<tr>
<td>C</td>
<td>Used about half of its life span - Time to replace (reference)</td>
</tr>
<tr>
<td>D</td>
<td>Time to replace (reference)</td>
</tr>
</tbody>
</table>

- **Signal Output of Replacement Time**

  If any of the components is judged as D, ON signal is output from the general output which is set as “Alarm signal” of the file.

  However, only one signal for this general signal can be output for one controller.
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- **Mask of Signal Output**
  The general output signals can be masked for each component.

  If any of the components is judged as D, ON signal is output from the general output which is set as “Alarm signal” of the file. This signal is output continuously, so the signal to inform the replacement time of the component cannot output newly. Therefore, the signal of the replacement time for other components can be output by masking the signal output of the component which is already judged as D and turning OFF the general output signal temporarily.

  Even if the masking is performed, D remains to be displayed for the component judged that it should be replaced.

### 8.21.6.3 Replacement of Component

- **Record of Replacement Date of Component**
  When the component is replaced, the replacement date (year, month, day) can be recorded. It can be used for the reference for the next replacement time or for the estimation of the failure mode by the failure time.

- **Life Span Setting at Replacement of Component**
  A new component or an used one, whichever it is replaced with, the life span setting can be performed.

  For the used component, after recording the replacement date, the value 1 - 100% can be set as the leftover life.

- **Display of the Numbers of Motor Revolution and Reverse Revolution**
  The accumulated values are displayed regarding the number of each motor revolution and the number of reverse revolution of positive and negative revolution. They can be used as the reference for the replacement time of the speed reducer or motor.
8.21.7 Setting of Preventive Maintenance for the Hardware

8.21.7.1 Setting of Replacement Time Display

1. Select {PM} in the main menu.
   – The sub menu appears.
   – * The operation icons on the main menu vary depending on the system usage.
2. Select {PM (HARDWARE)}.
   – Alarm signal setting and unit selection window appears.
3. Input the numerical value of the alarm signal. When any of components in this controller comes to the replacement time, the general output signal which is already set turns ON.

- * For example, 125 is input.

4. Select the unit.
   Or select the unit from {DISPLAY} in the menu.

- * For example, {COOLING FAN} is selected.
5. The following information is displayed:
   Starting from the left,
   (1) “●” is displayed when the replacement time is judged as D.
   (2) Component name
   (3) General output signal valid/invalid
   (4) The first day of use
   (5) Leftover life judgment

   – When (COOLING FAN) is selected:

   – When (CAPACITOR) is selected:

   – When (AMPLIFIER IGBT) is selected:
6. When replaced with a new component, select “O”.
   - A confirmation dialog box appears. When replaced with a new component, select “YES”.

7. When replaced with an used component, select (BEGINNING).
   - A window to input the numerical value appears. Input the replacement date using half-width characters like \{2009.3.14\}. After that, a following confirmation dialog box appears. When replaced with an used component, select “YES”.

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- When (CONTACTOR) is selected:
8. When manually setting the approximate value to the leftover life, input the numerical value “0 - 100%”.

9. When the numerical value displayed in the confirmation dialog box is correct, select “YES”.

8.21.7.2 Mask of Replacement Time Display (Signal Display)

Perform the masking of the replacement time display according to the following procedures:

1. When any of the components comes to the replacement time, the message is displayed per unit.
2. The message is also displayed per component. Invalidate the output.
   – After checking the components, invalidate the output.

3. The general output signal turns OFF. And the message turns to be hidden. However, the stepwise display remains D.
   – * Before the replacement, perform the above operation in order to detect the multiple components because only one general output of life diagnosis can be output for one controller. That is, “Replacement time of component → Turn ON the general output → Check the component and invalidate the output → Turn OFF the general output → Replacement time of other component → Turn ON the general output”.
8.21.8 Display of the Numbers of Motor Revolution and Reverse Revolution

8.21.8.1 Display of the Numbers of Revolution and Reverse Revolution

1. Select {PM} in Main Menu → {PM(HARDWARE)} → {MOTOR}.

8.21.8.2 Percent Display of the Number of Motor Revolution

At the motor rated number of revolution, it displays how many percent it has operated with 100% representing the case it operates 20000 hours.

1. After select {PM} in Main Menu → {PM(HARDWARE)} → {MOTOR}, select {DISPLAY} on the menu → {REVOLUTION(%)}. 
8.21.8.3 Resetting the Number of Revolution

Used when the motor replaced with a new one.

1. Select "O" of the axis to be reset by moving the cursor to it, and then select "YES" on the dialog box. The day of the first use (BEGINNING) is automatically changed.

8.21.8.4 Changing the Numbers of Revolution and Reverse Revolution

Used when the motor replaced with an used one.

1. Select the number of the axis to be reset by moving the cursor to it, and then set the number.

To set the day of the first use (BEGINNING), select the date of the axis to be reset by moving the cursor to it, and then set the date.
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– * When changing the number of revolution.

– * When changing the number of reverse revolution.
8.22 Break Line Ground Judgment Function

8.22.1 About the break Line Ground Judgment Function

If the current flowing through the break line exceeds the capacity of the control power supply unit, the DC 24V power supply will be disconnected by the protective circuit of the control power supply unit; then an alarm “1683 DC24V POWER SUPPLY FAILURE(SV)” occurs.

This function identifies the position where the ground fault occurred after arising the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)”. It is able to identify which axis break line does the ground fault occur by inspecting the each axis from the programming pendant.

Identify the ground fault of the break line by the following methods.

(1) Turn the servo ON the group which the ground fault occurs.

(2) Discharge the any axis break, and then confirm if the DC 24V power supply will be disconnected.

8.22.2 Operating Condition

1. Condition of the controller
   The controller has restarted normally by restarting the controller after arising the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)”.

2. Mode
   - Only teach mode

3. Security
   - All security mode, such as Operation, Edit and Management mode

4. Others
   - Must be SERVO OFF
   - The emergency signal is not input (Pendant, controller, external signal)
   - The servo power is not disconnected by the servo power supply individual control function.
8.22.3 Operation

8.22.3.1 Arising the DC 24V Power Supply Failure (SERVO)

– When detecting either the ground fault or the short circuit of the break line, the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)” occurs.

– Restart the control power, and perform the break line ground check.

8.22.3.2 Break Line Ground Check

1. Select {BREAK LINE GROUND CHECK} in the sub-menu from {ROBOT} in the main menu.
2. Press “YES”.
   – The confirmation dialog appears due to prevent the mis-operation.
   – Select “YES”, then the break line ground check appears.
   – Select “NO”, the window returns to the previous window.

3. Move the cursor over the axis to perform the break line ground check, and press [SERVO ON READY]. Grip the enable switch and long press [SELECT] while pressing down the [INTER LOCK] to perform the break line ground check.
   – Perform the break line ground check to the every single axis displayed on the screen.
   – The break line ground check is canceled in the case of following conditions.
     • [SELECT] is detached.
     • The emergency button of the programming pendant, controller or external signal is pressed.
     • The servo power is disconnected by the servo power supply individual control function.
     • The servo alarm occurs.

JUDGMENT REQUIRED: The ground check is not performed
BREAKS LINE NORMAL: The break line is normal.
8.22 Break Line Ground Judgment Function

DETECTED GROUND: The ground fault or short circuit of the break line

ABNORMAL END: The ground check is cancelled.
(i.e. the dislocation of the axis is detected, and so on)

4. Detecting the Break Line Ground Fault
   – When the break line ground fault or the short circuit is detected, the alarm “1694 GROUND FAULT (BRAKE LINE)” occurs.
   – Inspect the break line of the axis which raised the alarm.
   – Restart the control power, and perform the break line ground check to the rest of the axes.

8.22.3.3 Initializing the Related Information
   1. The sub menu (BREAK LINE GROUND CHECK) appears after selecting the (ROBOT) in the main menu.
   2. Select (DATA) in the menu.
      – The pull-down menu appears.
3. Select {CLEAR}.
   - The confirmation dialog appears.

4. Press “YES”.
   - The related information of the break line ground check is initialized.
   - {BREAK LINE GROUND CHECK} does not appear in the {Main Menu} until the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)” occurs.
8.23 Safety Logic Circuit

8.23.1 Outline

The safety logic circuit is a function to create the safety logic circuit on the programming pendant. It enables to set up the logical operations, such as stopping the manipulator and outputting the servo ON signal.

The followings are the contents of this function.

(1) Executes the safety logic circuit by the machine safety logic circuit board (type:YSF21-E) corresponded to the secure authentication.

(2) The safety logic circuit is composed by two inputs and one output circuit or one input and one output circuit, and can be set up to 128 lines.

(3) The safety logic circuit with 128 lines is operated in every 4ms cycle.

(4) The safety logic circuit is referred by the all modes regardless the security mode, and it can be edit only when the security mode is higher than “SAFETY MODE” plus under the teach mode and the servo is OFF.

(5) In the safety logic circuit expansion function, by using the optional safety PLC and the safety logic circuit, the safety PLC can also control the function that has been attained by the hard-wired signal. This enables less wiring.

The safety logic circuit expansion function is applicable from software version DN1.80-00. To use the safety logic circuit expansion function, refer to section 8.23.4 “The Safety Logic Circuit Expansion Function”.
### 8.23.2 Set up the Safety Logic Circuit

In order to set up the safety logic circuit, the security mode needs to be changed to safety mode. Before creating the safety logic circuit, the following procedures need to be set in the window as shown below.

- M-SAFETY SIGNAL ALLOC
- SAFETY SIG. BOARD ALLOC
  (displayed when the optional safety field bus function is valid)
- TIMER DELAY SET
  (need to be set when using the timer delay)

These items above are displayed by selecting the {SAFETY FUNC.} in the main menu. The setup information is written in the file.

#### 8.23.2.1 Changing the Security Mode

1. Displaying the window.
   - Select {SECURITY} from {SYSTEM INFO} in the main menu.
2. Change to the safety mode.
   - Select {SAFETY MODE}. 

![Safety Logic Circuit Setup](image-url)
8 System Setup

8.23 Safety Logic Circuit

- Enter the password for the safety mode, and then press [ENTER].

![Password Input](image1)

- When the entered password is correct, the mode is changed to {SAFETY MODE}. After changing to the safety mode, the icon is displayed on the status area.

![SAFETY MODE Icon](image2)
8.23.2.2 Allocating the Machine Safety Signal

1. Displaying the window.
   - Select {M-SAFETY SIGNAL ALLOC} from {SAFETY FUNC.} in the main menu.

2. Set up the universal safety signal.
   - In the controller, the two points of the universal safety input signal and the two points of the universal safety output signal are present from I/O board (type: YSF22 □ -E), and these signals can be used at the safety logic circuit.
   - Set the “USE” for the input and output signal(s) to use.
   - After the setting, the status changes from “DONE” to “NOT DONE”.
   - The “WRITE” button is displayed on the left down corner of the screen.
3. Canceling the edit

– To start over the editing, select (CANCEL EDIT) from (EDIT) in the pull-down menu.

4. Transferring or updating the file

– After editing, select (WRITE) button. The file is transferred to the machine safety circuit board (type:YSF21-E). When the file transfer is done correctly, the confirmation dialog “Update the file?” appears.
Press “YES”, and then the file is updated. The file transferred to the machine safety circuit board (type:YSF21-E) is written in the FLASH ROM. The status becomes “DONE” from “NOT DONE”.

If press “NO”, the file will not be updated. The status remains “NOT DONE”.

- If press “YES” on the confirmation dialog, the all window information, such as {M- SAFETY SIGNAL ALLOC}, {SAFETY SIG. BOARD ALLOC}, {TIMER DELAY SET}, and {SAFETY LOGIC CIRCUIT} are updated. The written file in the FLASH ROM of the machine safety circuit board is also updated.
- When performing (WRITE), the universal safety and the safety field bus output signals, which are sent from the machine safety circuit board, are turned OFF till the writing processing is finished.
8.23.2.3 Allocating the Safety Signal Board

This window is displayed when the optional safety field bus is valid.

1. Displaying the window.
   
   – Select {SAFETY SIG. BOARD ALLOC} from {SAFETY FUNC.} in the main menu.

2. Set up the safety field bus signal.
   
   – In the controller, the 64 points of the safety input signal and the 64 points of the safety output signal are present from the safety PLC, and these signals can be used at the safety logic circuit. Set the "USE" for the input and output signal(s) to use. After the setting, the status changes from "DONE" to "NOT DONE". The "WRITE" button is displayed on the left down corner of the screen.
8.23 Safety Logic Circuit

3. Canceling the edit

– To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.
4. Transferring or updating the file

– After editing, select {WRITE} button.

   The file is transferred to the machine safety circuit board (type:YSF21-E). When the file transfer is done correctly, the confirmation dialog “Update the file?” appears.

   ![Update the file dialog]

– Press “YES”, and then the file is updated.

   The file transferred to the machine safety circuit board (type:YSF21-E) is written in the FLASH ROM. The status becomes “DONE” from “NOT DONE”.

   ![File updated]

If press “NO”, the file will not be updated. The status remains “NOT DONE”.

   ![File not updated]
8.23 Safety Logic Circuit

8.23.2.4 Timer Delay

Set up the delay time of the output signal to use by the safety logic circuit.

In the TIMER DELAY, there are “ON DELAY TIME” to delay the ON output and “OFF DELAY TIME” to delay the OFF output. It can be four timer settings.

When setting the 500msec to ON DELAY TIME,

When setting the 300msec to OFF DELAY TIME,

The initial value is 100(25 × 2)[msec]. It is able to set every 4msec up to 399,996 (99,999 × 25)[msec].

1. Displaying the window.

• If press “YES” on the confirmation dialog, the all window information, such as {M-SAFETY SIGNAL ALLOC}, {SAFETY SIG. BOARD ALLOC}, {TIMER DELAY SET}, and {SAFETY LOGIC CIRCUIT} are updated. The written file in the FLASH ROM of the machine safety circuit board is also updated.

• When performing {WRITE}, the universal safety and the safety field bus output signals, which are sent from the machine safety circuit board, are turned OFF till the writing processing is finished.
8 System Setup
8.23 Safety Logic Circuit

– Select {TIMER DELAY} from {SAFETY FUNC.} in the main menu.

2. Set up the delay time.
– Set the value of the delay timer to use.
After the setting, the status changes from “DONE” to “NOT DONE”. The “WRITE” button is displayed on the left down corner of the screen.
3. Canceling the edit
   – To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.

4. Transferring or updating the file
   – After editing, select {WRITE} button. The file is transferred to the machine safety circuit board (type:YSF21-E). When the file transfer is done correctly, the confirmation dialog “Update the file?” appears.
Press “YES”, and then the file is updated. The file transferred to the machine safety circuit board (type:YSF21-E) is written in the FLASH ROM. The status becomes “DONE” from “NOT DONE”.

If press “NO”, the file will not be updated. The status remains “NOT DONE”.

If press “YES” on the confirmation dialog, the all window information, such as {M-SAFETY SIGNAL ALLOC}, {SAFETY SIG. BOARD ALLOC}, {TIMER DELAY SET}, and {SAFETY LOGIC CIRCUIT} are updated. The written file in the FLASH ROM of the machine safety circuit board is also updated.

When performing {WRITE}, the universal safety and the safety field bus output signals, which are sent from the machine safety circuit board, are turned OFF till the writing processing is finished.
8.23.2.5 Safety Logic Circuit

1. Displaying the window.
   – Select (SAFETY LOGIC CIRCUIT) from (SAFETY FUNC.) in the main menu.

2. Set up the safety logic circuit
   – Create the safety logic circuit. The setting items are “INPUT1”, “LOGIC”, “INPUT2”, “OUTPUT” and “TIMER”.
   – The SIGNAL1 and SIGNAL2 must be set.
   – When setting the signal 1 or the signal 2, LOGIC also must to be set.
   – OUTPUT also must be set. The same output signal cannot be set to the multiple logic circuit.
After the setting, the status changes from “DONE” to “NOT DONE”. The “WRITE” button is displayed on the left down corner of the screen.

3. Canceling the edit
   – To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.
4. Line clear
   - To clear the one line, select {LINE CLEAR} from {EDIT} in the pull-down menu.

5. All line clear
   - To clear the all line, select {ALL LINE CLEAR} from {EDIT} in the pull-down menu.
6. Copy

– Choose the desired area to make a copy, and select {COPY} from {EDIT} in the pull-down menu.

– Go to the area to paste, select {PASTE} from {EDIT} in the main menu to paste.
7. Transferring or updating the file

- After editing, select [WRITE] button. If there is a blank line in the safety logic board, it will be filled automatically.

The file is transferred to the machine safety circuit board (type: YSF21-E). When the file transfer is done correctly, the confirmation dialog “Update the file?” appears.

- Press “YES”, and then the file is updated. The file transferred to the machine safety circuit board (type: YSF21-E) is written in the FLASH ROM. The status becomes “DONE” from “NOT DONE”.

If press “NO”, the file will not be updated. The status remains “NOT DONE”.

![Diagram](image-url)
If press “YES” on the confirmation dialog, the all window information, such as {M-SAFTY SIGNAL ALLOC}, {SAFTY SIG. BOARD ALLOC}, {TIMER DELAY SET}, and {SAFTY LOGIC CIRCUIT} are updated. The written file in the FLASH ROM of the machine safety circuit board is also updated.

When performing {WRITE}, the universal safety and the safety field bus output signals, which are sent from the machine safety circuit board, are turned OFF till the writing processing is finished.
### Setup the Signal1 and Signal2

The signal 1 and signal 2 are the signals to be used by the safety logic circuit. The following table shows the usable input signals. When add “NOT” in the beginning of the signal name, it becomes a negative logic of the input signal.

○ / ● shows the status of the input signal during the safety logic circuit operation.

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>Abbreviation</th>
<th>Logic</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Play mode</td>
<td>PLAY</td>
<td>Not play mode</td>
<td>Play mode</td>
</tr>
<tr>
<td>2</td>
<td>Teach mode</td>
<td>TEACH</td>
<td>Not teach mode</td>
<td>Teach mode</td>
</tr>
<tr>
<td>3</td>
<td>Programming pendant emergency stop</td>
<td>PPEST</td>
<td>Not under emergency stop</td>
<td>Under emergency stop (Emergency stop button is pressed) (Release)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[Short circuit]</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Programming pendant enable switch</td>
<td>PPDSW</td>
<td>Grip</td>
<td>Released (Release)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[Short circuit]</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Controller emergency stop</td>
<td>PBESP</td>
<td>Not under emergency stop</td>
<td>Under emergency stop (Emergency stop button is pressed) (Release)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[Short circuit]</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>External emergency stop</td>
<td>EXESP</td>
<td>Not under emergency stop</td>
<td>Under emergency stop (Emergency stop button is pressed) (Release)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[Short circuit]</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>External enable switch</td>
<td>EXDSW</td>
<td>Grip</td>
<td>Released (Release)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[Short circuit]</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Safeguarding</td>
<td>SAFF</td>
<td>Close</td>
<td>Open (Release)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[Short circuit]</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Servo ON status</td>
<td>SVON</td>
<td>Servo OFF</td>
<td>Servo ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[Short circuit]</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Universal safety input signal 1,2</td>
<td>GSIN1, GSIN2</td>
<td>OFF [Short circuit]</td>
<td>ON (Release)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Safety field bus input 1 to 64</td>
<td>SFBIN1 to SFBIN64</td>
<td>OFF [Short circuit]</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Auxiliary relay</td>
<td>R1 to R128</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two points of the input signal are present for each YSF22□-E circuit board. YSF22□-E circuit board can be connected up to eight boards.

Can be used when the optional safety field bus function is valid.

Can be used as the work area.
### Logic

The usable logical signals are shown below.

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>Abbreviation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logic OR</td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Logic AND</td>
<td>AND</td>
<td></td>
</tr>
</tbody>
</table>

### Output Signal

The usable output signals are shown below.

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>Abbreviation</th>
<th>Logic</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Universal safety input signal 1, 2</td>
<td>GSIN1, GSIN2</td>
<td>OFF</td>
<td>ON Two points of the input signal are present for each YSF22-E circuit board. YSF22-E circuit board can be connected up to eight boards.</td>
</tr>
<tr>
<td>2</td>
<td>Manipulator stop immediately</td>
<td>SVOFF CAT0</td>
<td>OFF</td>
<td>ON -</td>
</tr>
<tr>
<td>3</td>
<td>Manipulator deceleration to a stop</td>
<td>SVOFF CAT1</td>
<td>OFF</td>
<td>ON -</td>
</tr>
<tr>
<td>4</td>
<td>Safety field bus input 1 to 64</td>
<td>SFBIN1 to SFBIN64</td>
<td>OFF</td>
<td>ON Can be used when the optional safety field bus function is valid.</td>
</tr>
<tr>
<td>5</td>
<td>Auxiliary relay</td>
<td>R1 to R128</td>
<td>OFF</td>
<td>ON Can be used as the work area.</td>
</tr>
</tbody>
</table>

**NOTE**

In the case of teach mode, the manipulator stops immediately as the controller system when the one of the following signals, PPEST, PPDSW, PBESP, or EXDSW is inputted.

**SIGNAL1:** Teach mode (TEACH)

**SIGNAL2:** Programming pendant enable switch (PPDSW)

**LOGIC:** AND

**OUTPUT:** Manipulator deceleration to a stop (SVOFF CAT1)

If create the safety logic circuit shown above, the manipulator will stop immediately as the controller system. (Manipulator does not decelerate.)
When the manipulator is stopped by the safety logic circuit signal, the message “Robot is stopped by safety logic circuit” appears on the message area of the programming pendant. Also, the control status signal “#80343” is turned ON.

The same output signal cannot be used.
8 System Setup
8.23 Safety Logic Circuit

- **Timer**

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>Abbreviation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ON delay timer1 to ON delay timer4</td>
<td>TIM1 ON DELAY ~ TIM4 ON DELAY</td>
<td>The value set in the timer delay.</td>
</tr>
<tr>
<td>2</td>
<td>OFF delay timer1 to OFF delay timer4</td>
<td>TIM1 OFF DELAY ~ TIM4 OFF DELAY</td>
<td></td>
</tr>
</tbody>
</table>

- **Feedback Signal (Signal Name: GSEDM1, 2) of Universal Output Signal**

The setting of whether to use or not to use the signal and the polarity setting of the feedback signal (signal name: GSEDM1, 2) of the universal output signal can be set in the following window.

1. Turn ON the power of controller while pressing “Main Menu” key of the programming pendant.
2. Select {SYSTEM} - {SECURITY} and change the security mode to the safety mode.
3. Select {SYSTEM} - {SETTING} - {OPTION FUNCTION} - {Machine Safety function}. Then the following window appears and the setting change becomes possible.
Whether the universal input signals (signal name: GSIN1, 2) are used, whether the universal output signals (signal name: GSOUT1, 2) are used, and the polarity of the universal output signals can be set.

1. Select {DETAIL} of Machine Safety.

- The DETAIL settings window of the machine safety function appears. If the two or more YSF22 boards exist in the robot coordinated specifications, press [PAGE] on the pendant and perform the settings of the second pages and the later.

It is possible to change the content of the setting each time the [SELECT] is pressed.

The relation of the polarity of universal output signals (signal name: GSOUT1, 2) and the universal output signals is as follows:

<table>
<thead>
<tr>
<th>Polarity of GSOUT Feedback signal</th>
<th>Output of GSOUT signal</th>
<th>Feedback signal from external devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronization is performed (SYNC.)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Synchronization is not performed (OUT OF SYNC.)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
8 System Setup

8.23 Safety Logic Circuit

- Press [ENTER].
- The confirmation dialog box of parameter change appears.

2. Select {YES}.
- If {YES} is selected, the system parameter is set automatically, and then the OPTION FUNCTION window appears.

Feedback Signal

(1) With feedback signal connection

Intaken as a feedback signal(*) of the devices driven by the universal safety output signal (GSOUT) (safety relay, contactor, etc.), and detects the wire sticking.

(*) It connects the contact B with forced guide normally.
### 8.23 Safety Logic Circuit

#### (2) Without feedback signal connection

When feedback signal is not intaken, errors (wire sticking, etc.) of the devices driven by the universal safety output signal (GSOUT) (safety relay, contactor, etc.) is not detected. Perform the error detection (signal mismatch) with the receiving side devices (safety PLC, etc.).

It is possible to use either one of the dual safety output signals and use it as a universal output signal. (cf. drive of lamp) The 1ch and 2ch are controlled simultaneously, so they cannot be used as different signals.
8.23.3 Performing the Safety Logic Circuit

The safety logic circuit is always performed except updating the file. Confirm that the status is "DONE". When setting signal is turned ON, the mark "●" is displayed, and when setting signal is turned OFF, the mark "○" is displayed.

8.23.4 The Safety Logic Circuit Expansion Function

8.23.4.1 Setting for the Safety Logic Circuit Expansion Function

When using the safety logic circuit expansion function, start the maintenance mode and perform the following settings.

1. Start the maintenance mode.
   – While pressing the main menu key on the programming pendant, turn ON the controller. The maintenance window is displayed.
2. Change the security.
   – Select {SYSTEM}→{SECURITY}→{SAFETY MODE}.

3. Change to the safety mode.
   – Enter the password for the safety mode and press [ENTER] on the
     programming pendant.

4. When the entered password is correct, the mode is changed to
   {SAFETY MODE}. After changing to the safety mode, the icon  is
   displayed on the status area.
5. After changing to the safety mode, select {SYSTEM}-{SETTING}-{OPTION FUNCTION}-{SAFETY LOGICAL EXPANSION}.

6. Press the select key on the programming pendant to enable {SAFETY LOGICAL EXPANSION}. If the general safety I/O board (type: YSF24-E) is connected to the controller, select "USED".

<Setting for SAFETY LOGICAL EXPANSION>
ENABLE: The safety logic circuit expansion function is available.
DISABLE: The safety logic circuit expansion function is not available.

<Setting for SERVO ON ENABLE SIGNAL>
ENABLE: S-SVON_EN signal is available in the safety logic circuit expansion function. For details on this function, refer to chapter 8.23.4.7.
DISABLE: S-SVON_EN signal is not available in the safety logic circuit expansion function. When this signal is disabled, the signal name is not displayed on the safety logic circuit.

<Setting for GENERAL SAFETY I/O BOARD (type: YSF24-E)>
USED: Input and output signals of the general safety I/O board (type: YSF24-E board) is available both on the functional safety board and in the safety logic circuit expansion function. For details on this function, refer to chapter 8.23.4.10.
NOT USED: Input and output signals of the general safety I/O board (type: YSF24-E board) is available only on the functional safety board.
8. Press [Enter] on the programming pendant and select “YES” to update the data.

8. After the update, select {FILE}-{INITIALIZE}-{Machine Safety Board FLASH Reset}. The initialization is completed when a bleep sounds. Also, the message on the programming pendant disappears. If the message, “Select 'Machine Safety Board FLASH Reset'," appears in the message area on the programming pendant, reset the FLASH data of the functional safety board.

<The window when the functional safety function is disabled>
8 System Setup

8.23 Safety Logic Circuit

9. Turn OFF/ON the controller.

8.23.4.2 Outline of the Safety Logic Circuit Expansion Function

In the safety logic circuit expansion function, input and output signals and logic (instructions) available in the logic circuit are expanded. Also, the signal that has been attained by the hardware can be also attained by the safety PLC (optional function). The machine safety board monitors the hard-wired signal at all times. Therefore the safety function to turn OFF the servo power supply to the manipulator when an error is detected is still maintained.

Also, by using MS-OUT signal (the output data from the machine safety board) and FS-OUT signal (the output data from the functional safety board), the data can be transferred between the machine safety board and the functional safety board (optional).

The following is the signal flow in the safety logic circuit expansion function.
When using the safety PLC, enable the optional safety field bus function.

**WARNING**

- Compared to the hard-wired signal, the output signal from the safety PLC (optional) requires time to be transmitted to the machine safety board (type: YSF21-E) to stop the manipulator. Therefore, to start detecting the signal on the machine safety board is a little delayed. When stopping the manipulator by the output signal from the safety PLC, consider the delayed time and perform enough risk assessment for the robot system.
8.23.4.3 Setting the Comment

Comments (up to 32 characters) can be input in the following windows.

1. Select {SAFETY FUNC.}-{SAFETY LOGIC CIRCUIT} to display the safety logic circuit window on the programming pendant.

2. Select {SAFETY FUNC.}-{SAFETY SIG. BOARD ALLOC} to display the safety signal board allocation window on the programming pendant. The sub menu of {SAFETY SIG. BOARD ALLOC} is displayed only when the optional safety field bus is enabled.
Adding Input and Output Signals and Instructions in Safety Logic Circuit Expansion Function

The following is the explanation of the expanded input and output signals and logic (instructions) available in the safety logic circuit.

### 1. Logic

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Standard</th>
<th>Expansion Function</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Safety Field Bus Disabled</td>
<td></td>
<td>Safety Field Bus Enabled</td>
</tr>
<tr>
<td>1</td>
<td>NOT</td>
<td>Negative</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>2</td>
<td>DSU</td>
<td>Detection of signal rising edge</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>3</td>
<td>DSD</td>
<td>Detection of signal falling edge</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>4</td>
<td>AND</td>
<td>Logic AND</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>5</td>
<td>OR</td>
<td>Logic OR</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

○: Already supported in the standard function  ●: Additional instruction
### 2. Input signal 1/ Input signal 2

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Standard</th>
<th>Expansion Function</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Safety Field Bus Disabled</td>
<td>Safety Field Bus Enabled</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>EXDSW</td>
<td>External enable switch signal (●: Servo OFF [release]/ ○: Servo ON available [short circuit])</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>2</td>
<td>EXESP</td>
<td>External emergency stop input signal (●: Under emergency stop [release]/ ○: Not under emergency stop [short circuit])</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>3</td>
<td>#n FSBIN[x]</td>
<td>Functional safety universal input 8 points (YSF24-E) (●:OFF [release]/ ○:ON [short circuit])</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>4</td>
<td>#n FSBOUT[x]</td>
<td>Functional safety universal output 8 points (YSF24-E) (●:ON status/ ○:OFF status)</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>5</td>
<td>FS-OUT[x]</td>
<td>Functional safety output in the safety logic circuit 64 point (●:ON status/ ○:OFF status)</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>6</td>
<td>FST</td>
<td>Full speed mode (●: Full speed mode/ ○: Safety speed)</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>7</td>
<td>#n GSIN[x]</td>
<td>Machine safety universal input 2 points (YSF22B-E) (●:OFF [release]/ ○:ON [short circuit])</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>8</td>
<td>#n GSOUT[x]</td>
<td>Machine safety universal output 2 points (YSF22B-E) (●:ON output/ ○:OFF output)</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>9</td>
<td>HOLD</td>
<td>Hold (●:OFF (Hold signal is not input.)/ ○:ON (Hold signal is being input.))</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>10</td>
<td>MS-OUT[x]</td>
<td>Machine safety output used in the safety logic circuit (64 points) (●:ON status/ ○:OFF status)</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>11</td>
<td>#n ONEN[x]</td>
<td>Servo power supply individual control input status (●: Individual servo OFF status/ ○: Normal status)</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>12</td>
<td>PBESP</td>
<td>Controller emergency stop signal (●: Under emergency stop [release]/ ○: Not under emergency stop [short circuit])</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>13</td>
<td>PLAY</td>
<td>Play mode (●: Play mode/ ○: Not play mode)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>14</td>
<td>PPDSW</td>
<td>PP enable switch signal (●: Released [release]/ ○:Grip [short circuit])</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>15</td>
<td>PPESP</td>
<td>PP emergency stop signal (●: Under emergency stop [release]/ ○: Not under emergency stop [short circuit])</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>16</td>
<td>PROFISafe</td>
<td>PROFI-Safe communication status (●: Normal communication/ ○: Abnormal communication)</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
</tbody>
</table>

*Appears only when the optional PROFI-Safe is enabled.*
<table>
<thead>
<tr>
<th>No.</th>
<th>Symbol</th>
<th>Description</th>
<th>Status 1</th>
<th>Status 2</th>
<th>Status 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>R[x]</td>
<td>Workpiece area 128 points</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>18</td>
<td>REMOTE</td>
<td>Remote mode</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>19</td>
<td>S-EXDSW</td>
<td>External enable switch signal</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>20</td>
<td>S-EXESP</td>
<td>External emergency stop signal</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>21</td>
<td>S-FST</td>
<td>Full speed mode in the safety logic circuit</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>22</td>
<td>S-SAFF</td>
<td>Safeguarding signal</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>23</td>
<td>#n S-ONEN[x]</td>
<td>Servo power supply individual control input in the safety logic circuit 4 points</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>24</td>
<td>S-SVON_EN</td>
<td>Servo ON enable signal</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>25</td>
<td>SAFF</td>
<td>Safeguarding signal</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>26</td>
<td>SFBIN[x]</td>
<td>Safety field bus input signal 64 points</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>27</td>
<td>SFBOUT[x]</td>
<td>Safety field bus output signal 64 points</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>28</td>
<td>#n SFRON[x]</td>
<td>Servo ON/OFF status of valid contactor signal</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>29</td>
<td>SPIN[x]</td>
<td>Specific input 32 points</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>30</td>
<td>SVON</td>
<td>Servo ON/OFF status</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>31</td>
<td>SVONRDY0</td>
<td>Servo ON ready</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>32</td>
<td>TEACH</td>
<td>Teach mode</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

○: Already supported in the standard function  ●: Additional instruction
n: Number of machine safety I/O board (type: YSF22-E) (up to eight boards)
### 3. Output signal

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Standard</th>
<th>Expansion Function</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Safety Field Bus Disabled</td>
<td>Safety Field Bus Enabled</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>#n GSOUT[x]</td>
<td>Machine safety universal output 2 points (YSF22B-E)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:ON output/ ○:OFF output)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>MS-OUT[x]</td>
<td>Machine safety output in the safety logic circuit 64 points</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:ON output/ ○:OFF output)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>R[x]</td>
<td>Workpiece area 128 point</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:ON output/ ○:OFF output)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S-EXDSW</td>
<td>External enable switch signal</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:ON (servo ON enabled)/ ○:OFF (servo OFF status))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S-EXESP</td>
<td>External emergency stop signal</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Release/ ○:Press (emergency stop status))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S-FST</td>
<td>Full speed mode in the safety logic circuit</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Full speed mode/ ○:Safety speed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>#n S-ONEN[x]</td>
<td>Servo power supply individual control input</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in the safety logic circuit 4 points</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Individual servo OFF status/ ○:Normal status)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>S-SAFF</td>
<td>Safeguarding signal</td>
<td>-</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Close/ ○:Open (servo OFF status))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>S-SVON_EN</td>
<td>Servo ON enable signal</td>
<td>-</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Servo ON enabled status/ ○:Servo OFF)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SFBOUT[x]</td>
<td>Safety field bus output signal</td>
<td>○</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td></td>
<td>64 points</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:ON output/ ○:OFF output)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>SVOFF CAT0</td>
<td>Turns OFF the power supply to the manipulator. (Cat0 stopped)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Request stop/ ○:Not request stop)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>SVOFF CAT1</td>
<td>Turns OFF the power supply to the manipulator. (Cat1 stopped)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Request stop/ ○:Not request stop)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

○: Already supported in the standard function  ●: Additional instruction
n: Number of machine safety I/O board (type: YSF22-E) (up to eight boards)

**Note:**
When using the S-FSY signal in the safety logic circuit, the hard-wired FST signal input in the YSF22 board is ignored. When using the hard-wired FST signal, delete the S-FST signal used in the safety logic circuit.
### 4. Timer

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Standard Function</th>
<th>Expansion Function</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TMR[8]</td>
<td>One shot pulse width timer</td>
<td>8 timer</td>
<td>-</td>
<td>● ●</td>
</tr>
<tr>
<td>2</td>
<td>TM[4] OFF DELAY</td>
<td>OFF Delay timer</td>
<td>-</td>
<td>○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TM[4] ON DELAY</td>
<td>ON Delay timer</td>
<td>-</td>
<td>○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

○: Already supported in the standard function  ●: Additional instruction

---

**WARNING**

If there is an error in the safety I/O signal connection, the safety function is damaged and a serious accident may happen. When setting or changing the safety I/O signal connection, be sure to confirm it operates correctly.

---

### 8.23.4.5 Output Signal

The following is the explanation of the output signals expanded in the safety logic circuit function.

<table>
<thead>
<tr>
<th>Expanded signal name</th>
<th>Hard-wired signal name</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| S-EXDSW              | EXDSW                  | • This is the external enable switch signal and functions only in the teach mode.  
|                      |                        | • When both the S-EXDSW signal and the enable switch on the programming pendant are ON, the servo power can be turned ON.  
|                      |                        | • When the S-EXDSW signal is not used in the safety logic circuit, the machine safety board regards this as the short-circuit status.  
|                      |                        | • The machine safety board monitors the hard-wired EXDSW signal at all times only in the teach mode. When one of the EXDSW signal, the S-EXDSW signal and the enable switch on the programming pendant is OFF, the servo power supply is turned OFF.  
|                      |                        | • The control status signal #80036 is turned ON/OFF. |
| S-EXESP              | EXESP                  | • This is the external emergency stop input signal.  
|                      |                        | • When the S-EXDSW signal is turned OFF, the signal performs the similar control to the EXESP signal when it is turned OFF.  
|                      |                        | • When the S-EXESP signal is not used in the safety logic circuit, the machine safety board regards this as the short-circuit status.  
|                      |                        | • The hard-wired EXESP signal is always monitored. When either the EXESP signal or the S-EXESP signal is OFF, the servo power supply is turned OFF.  
|                      |                        | • The control status signal #80025 is turned ON/OFF. |
8.23 Safety Logic Circuit

8.23.4.6 Message of Output Signals

The signals input by the hard-wired and the safety logic circuit display the following messages on the programming pendant.

<table>
<thead>
<tr>
<th>Signal name</th>
<th>Message on the programming pendant</th>
</tr>
</thead>
<tbody>
<tr>
<td>FST</td>
<td>Full-speed test mode.</td>
</tr>
<tr>
<td>S-FST</td>
<td>Full-speed test mode. (Safety Logical Circuit)</td>
</tr>
<tr>
<td>EXESP</td>
<td>Robot is stopped by external emergency stop.</td>
</tr>
<tr>
<td>S-EXESP</td>
<td>Robot is stopped by external emergency stop. (Safety Logical Circuit)</td>
</tr>
<tr>
<td>EXDSW</td>
<td>EXDSW signal is OFF.</td>
</tr>
<tr>
<td>S-EXDSW</td>
<td>EXDSW signal is OFF. (Safety Logical Circuit)</td>
</tr>
<tr>
<td>SAFF</td>
<td>Safety guard is open.</td>
</tr>
<tr>
<td>S-SAFF</td>
<td>Safety guard is open. (Safety Logical Circuit)</td>
</tr>
<tr>
<td>#x ONEN</td>
<td>Servo on enable signal (ON-EN) is OFF.</td>
</tr>
<tr>
<td>#x S-ONEN</td>
<td>Servo on enable signal (ON-EN) is OFF. (Safety Logical Circuit)</td>
</tr>
<tr>
<td>(None)</td>
<td>(The hard-wired signal does not have this function.)</td>
</tr>
<tr>
<td>S-SVON_EN</td>
<td>SERVO ON ENABLE signal is OFF. (Safety Logical Circuit)</td>
</tr>
</tbody>
</table>

(Note) The upper line: the message by the hard-wired signal
The lower line: the message by the safety logic circuit
8.23.4.7 Enable Switch Link Function

This function is enabled only in the teach mode.

Normally in the teach mode, the servo power is turned ON when the enable switch is gripped while the servo ON LED on the programming pendant is flashing. However in this function, when the S-SVON_EN signal is enabled, the servo power is not turned ON unless the enable switch is gripped and the S-SVON_EN signal is turned ON.

The following is an example of using the optional safety PLC.

1. The enable switch signal on the programming pendant and the teach mode information are output to the safety PLC by the safety logic circuit. The value output from the safety PLC is input in the S-SVON_EN signal of the safety logic circuit.

2. When the S-SVON_EN signal is turned ON, the servo power is ON and when the enable switch is released, the signal is OFF.

The Servo ON/OFF Status When the Servo On Enable (S-SVON_EN) Signal is Enabled

<table>
<thead>
<tr>
<th>MODE</th>
<th>EXDSW</th>
<th>PPDSW</th>
<th>S-EXDSW</th>
<th>S-SVON_EN</th>
<th>Servo ON/OFF Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEACH</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>Servo ON</td>
</tr>
<tr>
<td>TEACH</td>
<td>ON</td>
<td>ON</td>
<td>Not Used</td>
<td>ON</td>
<td>Servo ON</td>
</tr>
<tr>
<td>TEACH</td>
<td>ON</td>
<td>ON</td>
<td>Not Used</td>
<td>OFF</td>
<td>Servo OFF</td>
</tr>
<tr>
<td>TEACH</td>
<td>ON</td>
<td>OFF</td>
<td>Not Used</td>
<td>ON</td>
<td>Servo OFF</td>
</tr>
</tbody>
</table>

*Note: Not Used means no circuit is configured in the safety logic circuit.
8.23.4.8 Signal List Window

The ON/OFF status list of signals used in the safety logic circuit is displayed.

1. Select {SAFETY FUNC.}→{SLC SIGNAL DISPLAY}.

WARNING

Configure the optional safety PLC circuit so that the servo ON enable (S-SVON_EN) signal is turned OFF by releasing the enable switch on the programming pendant when this function is enabled.
8. The signals used in the safety logic circuit are displayed. When the optional field bus function is enabled, its signals are also displayed.

8.23.4.9 Setting ON/OFF to the Input Signals

The ON/OFF status of input signals used in the safety logic circuit can be switched.

1. Select {SAFETY FUNC.}-{SLC SIGNAL DISPLAY SET}. 
8 System Setup

8.23 Safety Logic Circuit

2. The ON/OFF status of input signals used in the safety logic circuit can be switched by pressing the select key on the programming pendant.

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>Normal Open</th>
<th>Normal Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EXDSW</td>
<td>External enable switch signal</td>
<td>External enable switch signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Servo OFF/ ○:Servo ON enabled)</td>
<td>(●:Servo ON enabled/ ○:Servo OFF)</td>
</tr>
<tr>
<td>2</td>
<td>EXESP</td>
<td>External emergency stop input signal</td>
<td>External emergency stop input signal</td>
</tr>
<tr>
<td>3</td>
<td>FSBIN</td>
<td>Universal safety input signal (YSF24B-E)</td>
<td>Universal safety input signal (YSF24B-E)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:OFF [release]/ ○:ON [short circuit])</td>
<td>(●:ON [short circuit]/ ○:OFF [release])</td>
</tr>
<tr>
<td>4</td>
<td>GSIN</td>
<td>Machine safety universal safety input signal</td>
<td>Machine safety universal safety input signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(YSF22B-E)</td>
<td>(YSF22B-E)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:OFF [release]/ ○:ON [short circuit])</td>
<td>(●:ON [short circuit]/ ○:OFF [release])</td>
</tr>
<tr>
<td>5</td>
<td>HOLD</td>
<td>Hold</td>
<td>Hold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:ON (Hold signal is being input.)/ ○:ON</td>
<td>(●:OFF (Hold signal is not input.)/ ○:ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Hold signal is not input.))</td>
<td>(Hold signal is being input.)</td>
</tr>
<tr>
<td>6</td>
<td>PBESP</td>
<td>Controller emergency stop signal</td>
<td>Controller emergency stop signal</td>
</tr>
<tr>
<td>7</td>
<td>PPDSW</td>
<td>Programming pendant enable switch signal</td>
<td>Programming pendant enable switch signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●:Grip/ ○:Not grip (servo OFF))</td>
<td>(●:Not grip (servo OFF)/ ○:Grip)</td>
</tr>
<tr>
<td>8</td>
<td>PPESP</td>
<td>Programming pendant emergency stop signal</td>
<td>Programming pendant emergency stop signal</td>
</tr>
<tr>
<td>9</td>
<td>SAFF</td>
<td>Safeguarding signal</td>
<td>Safeguarding signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(●: Open (safeguarding opened)/ ○:Close)</td>
<td>(●:Close/ ○:Open (safeguarding opened))</td>
</tr>
</tbody>
</table>
3. For example, when the EXESP signal is changed from “Normal Open” to “Normal Close”, the mark “●” indicates the external emergency stop signal is in the normal state (Normal Close) and the mark “○” indicates the external emergency stop signal is being input (Normal Open).

4. Select “WRITE” and then “CONFIRM” to enable the changed settings. When the data is updated correctly, the status on the title line is changed from NOT DONE to DONE.

When the ON/OFF settings of the input signals are changed, outputting the signals that have been output normally may fail. This may lead to a serious accident. After changing the ON/OFF settings of the input signals, be sure to confirm the safety logic circuit operates normally.
8.23.4.10 Setting for the Universal Safety Output Signals

The general safety output signals (type: YSF24-E) that have been used only on the optional functional safety board can be also used in the safety logic circuit.

1. Select {SAFETY FUNC.}-(F-SAFETY SIGNAL ALLOC) to display the following window. The marks at the right end indicates OFF/ON status. The mark "○" means OFF and the mark "●" means ON.

2. To use the universal safety output signals in the safety logic circuit, press the select key on the programming pendant and set “YSF21-E”. The universal safety output signals allocated to “YSF21-E” are available in the safety logic circuit. However, if the setting is “NOT USED”, the signals are available only on the functional safety board as usual.
3. Select “WRITE” and then “CONFIRM” to enable the changed settings. When the data is updated correctly, the status on the title line is changed from NOT DONE to DONE.

8.23.4.11 Setting for the Safety Signal Allocation Board

This window is displayed only when the optional safety field bus function is enabled.

1. Select {SAFETY FUNC.}- {SAFETY SIG. BOADR ALLOCATION}. The marks at the right end indicates OFF/ON status. The mark “○” means OFF and the mark “●” means ON. Also, comments (up to 32 characters) can be input.
2. The default setting is “NOT USED”. Press the select key on the programming pendant and select one of “NOT USED”, “YSF21-E” and “YSF25-E #n”. When the functional safety board (optional) is disabled, “YSF25-E #n” is not displayed.

<When the functional safety board is disabled>

NOT USED : Not available in the safety logic circuit and on the functional safety board.
YSF21-E : Available in the safety logic circuit.

Up to eight functional safety boards can be connected in the controller. When using a functional safety board, specify its board number.
YSF25-E #1 means the first functional safety board to be used.
3. In the following setting, SFBOUT01 to SFBOUT04 are available in the safety logic circuit and SFBOUT05 to SFBOUT08 are available on the functional safety board as the first board. After changing the setting, the status in the title line becomes “NOT DONE” and “WRITE” menu is displayed. Update the data.

4. When the data update is completed, the status in the title line becomes “DONE” and the “WRITE” menu disappears.

5. When either “NOT USED” or “YSF25-E #n” is set, the output signal in the safety logic circuit is not available.
8.23.4.12 Update and Execution of the Safety Logic Circuit

1. Select {SAFETY FUNC.}-{SAFETY LOGIC CIRCUIT}. The safety logic circuit can be created or edited.

The following is an example to create the safety logic circuit. After the setting is changed, the status in the title line becomes “NOT DONE” and “WRITE” menu is displayed.

001 PPDSW SFBOUT01
002 TEACH SFBOUT02
003 SFBIN01 S-SVON_EN

• While the safety logic circuit is edited, all the output signals are OFF.
• When updating any of the followings, 1. to 5. are also update.
  1. “SAFETY LOGIC CIRCUIT”
  2. “SAFETY LOGIC CIRCUIT EXT. SIGNAL ALLOC”
  3. “TIMER DELAY SET”
  4. “M-SAFETY SIGNAL ALLOC” (Displayed only when the safety field bus function is enabled.
  5. “F-SAFETY SIGNAL ALLOC” (Displayed only when the functional safety function is enabled.)
2. After creating the safety logic circuit is completed, press “WRITE” to display “CONFIRM” as shown below.

3. After “CONFIRM” menu is displayed, press “CONFIRM” to display the following dialog. Then select “YES”. If “No” is selected, the window returns to the status in the 1. procedure.
4. When the file update is completed, the status in the title line is changed to “DONE” and the safety logic circuit is executed. While the safety logic circuit is executed, the signal status (“○” or “●”) is displayed.

8.23.4.13 Sample of the Safety Logic Circuit Expansion Function

a. Create the one-second one-shot output signal in the safety logic circuit. Create the safety logic circuit in which the machine safety universal safety output (#1 GSOUT1) signal is ON for one second.

1. Select {SAFETY FUNC.}-{TIMER DELAY}. The safety logic circuit is being executed.
2. Select \{PAGE\}-{TIMER}.

3. Input “250” at TIMER1.

4. Create the following safety logic circuit.
   001  DSU  #1GSIN1  #1 GSOUT1  TMR1
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When #1 GSIN1 signal is ON, #1 GSOUT1 is ON for one second.

When the data is updated correctly, the status in the title line is changed from "NOT DONE" to "DONE".

5. To enable the changed settings, press "WRITE" and then "CONFIRM". When the data is updated correctly, the status in the title line is changed from "NOT DONE" to "DONE".

When using the DSU or DSD instruction, be sure to set TMR to TIMER for the output signal. If "WRITE" is pressed without setting TMR to TIMER for the output signal, "ERROR 4241: Safety logic circuit is not set" is displayed on the programming pendant as shown in the following window.
8.23. Safety Logic Circuit

b. Create the one-second one-shot output signal in the safety logic circuit for when two signals are turned ON simultaneously.

1. Create the following safety logic circuit.
   001 DSU #1 GSIN1 AND DSU #1 GSIN2 #1 GSOUT1 TMR1

2. To enable the changed setting, select “WRITE” and then “CONFIRM”. When the data is updated correctly, the status on the title line is changed from NOT DONE to DONE.
3. When #1 GSIN1 signal and #1 GSIN2 are simultaneously turned ON, #1 GSOUT1 is ON for one second.

4. When #1 GSIN1 signal and #1 GSIN2 are not simultaneously turned ON, #1 GSOUT1 remains OFF.
Servo power individual control function by the safety PLC (optional)

1. While pressing the main menu key on the programming pendant, start the maintenance mode.

2. Select (SYSTEM)→(SETTING)→(CONTROL GROUP). Then confirm which ON ENABLE signal each control group is allocated to.

In the above example, the allocation of the control groups is as follows.

The control group R1 is allocated to ON ENABLE1 signal (ON_EN1).
The control group S1 is allocated to ON ENABLE2 signal (ON_EN2).
The control group S2 is allocated to ON ENABLE3 signal (ON_EN3).
The control group S3 is allocated to ON ENABLE4 signal (ON_EN4).

3. Output the input1 (SFBIN01) from the safety PLC (optional) to S-ONEN1. At this time, short-circuit the hard-wired ON_ENABLE1 signal.

4. Create the safety logic circuit as follows.

   01 SFBIN01  #1 S-ONEN1

5. When #1 S-ONEN1 is turned ON, the servo power of R1 is turned OFF. Also, the message “SERVO ON ENABLE signal is OFF. (Safety Logical Circuit)” is displayed on the programming pendant.
d. Output of the specific input signal to the safety PLC (optional)

Create the logic circuit in which the specific input1 (#40780) signal is output to the safety PLC.

1. Press {SAFETY FUNC.}-{M-SAFETY SIGNAL ALLOC} and set YSF21-E to SFBOUT01.

2. Create the safety logic circuit.

<table>
<thead>
<tr>
<th>Input</th>
<th>Logic</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>#40780</td>
<td>SPIN01</td>
<td>SFBOUT01</td>
</tr>
</tbody>
</table>

3. When #40780 is turned OFF, SFBOUT01 is turned OFF. Also, when #40780 is turned ON, SFBOUT01 is turned ON.
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8.23 Safety Logic Circuit

e. Input of full speed test (S-FST) signal

Set the safety logic circuit in which the full speed test output is turned ON after the machine safety universal safety signal (GSIN1) is ON in the teach mode.

1. Create the following safety logic circuit.

   \[
   \text{01 TEACH AND GSIN1 S-FST}
   \]

2. When GSIN1 signal is turned ON, S-FST signal is turned ON.

3. When S-FST signal is turned ON, the message “Full-speed test mode. (Safety Logical Circuit)” appears on the programming pendant. Also the control status signal #80047 is turned ON.

S-FST signal is enabled only in the teach mode.
f. How to use MS-OUT signal
The following is the explanation to use MS-OUT signal.

1. Create the following safety logic circuit.
   01 #1 GSIN1  MS-OUT01

2. When GSIN1 signal is turned ON, MS-OUT01 signal is turned ON.

3. The MS-OUT01 signal created in the safety logic circuit can be used as an input signal, etc. to set each axis motion range in the functional safety (optional function).

8.23.4.14 Saving or Loading the File
Refer to chapter 8.23.5.

8.23.4.15 Alarm List of the Safety Logic Circuit
Refer to chapter 8.23.8.
8.23.4.16 Specific Input Signals allocated to SPIN[xx]

32 signals input in the SPIN[xx] are allocated to specific input signals #40780 to #40817. The signals input in the SPIN[xx] are available in the safety logic circuit.

WARNING

- SPIN is non-safety data. If a logic (AND, OR, etc.) is performed by using SPIN and another safety signal, the output result will be non-safety data. If SPIN is used for an application in which safety is required, the safety function will not be maintained. Thus, make sure to properly perform a risk evaluation of the robot system before using SPIN.
8.23.4.17 Output to the Control Status Signal

The following signals used in the safety logic circuit can be confirmed in the control status signals.

1. SFBIN[64]
2. SFBOUT[64]
3. MS-OUT[64]
4. FS-OUT[64]
5. #n FSBIN[8]
6. #n FSOUT[8]
### System Setup

#### 8.23 Safety Logic Circuit

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## 8.23 Safety Logic Circuit

### MH900, DX200 Controller

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### 8.2.3 Safety Logic Circuit

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|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
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| YSF24#6 | YSF24#6 | YSF24#6 | YSF24#6 | YSF24#6 | YSF24#6 | YSF24#6 | YSF24#6 | YSF24#7 | YSF24#7 | YSF24#7 | YSF24#7 | YSF24#7 | YSF24#7 | YSF24#7 | YSF24#7 | YSF24#8 | YSF24#8 | YSF24#8 | YSF24#8 | YSF24#8 | YSF24#8 | YSF24#8 |
## 8.23 Safety Logic Circuit

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### 8.23 Safety Logic Circuit

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8.23.5 Saving or Loading the File

8.23.5.1 Saving the File

In order to save the file, which is set in the safety logic circuit, select {I/O DATA} by going to {SAVE} from {EX. MEMORY} in the main menu. Perform the saving the file after confirming the either the CompactFlash or USB memory stick is inserting to the programming pendant.

1. Displaying the window.
   – Select {I/O DATA}, by going to {SAVE} from {EX. MEMORY} in the main menu.
   – The signal list relative to the I/O data is displayed, and then select “YSF LOGIC FILE”.

   ![Diagram 1](image1.png)

   – The confirmation dialog appears, and select “YES”.

   ![Diagram 2](image2.png)

   – The safety logic circuit file (file name:YSFLOGIC.DAT) is saved in the specified device.
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8.23.5.2 Loading the File

In order to load the safety logic circuit file (file name: YSFLOGIC.DAT), select {I/O DATA} by going to {LOAD} from {EX. MEMORY} in the main menu. Perform the saving the file after confirming the either the CompactFlash or USB memory stick is inserting to the programming pendant.

1. Displaying the window.
   - Select {I/O DATA}, by going to {LOAD} from {EX. MEMORY} in the main menu.
   - The signal list relative to the I/O data is displayed, and then select “YSF LOGIC FILE”.

   ![Image showing the window with options to load the file]

   - The confirmation dialog appears, and select “YES”.

   ![Image showing the confirmation dialog]

   - The safety logic circuit file (file name: YSFLOGIC.DAT) is loaded from the specified device.
8.23.6 Initializing the Safety Logic Circuit File

If the following alarm shown below appears when starting the controller, it will become the management mode. The alarm occurs when the file does not match the file written in the FLASH ROM of the machine safety circuit board (type: YSF21-E). For example, if the machine safety circuit board is replaced with the spared part, the alarm will occur.

When the alarm occurs, perform the following procedures to restore.

When loading the safety logic circuit file, the file is not transferred to the machine safety circuit board (type: YSF21-E). Thus, perform {WRITE} in the one of the following windows, such as {M-SAFETY SIGNAL ALLOC}, {TIMER DELAY SET}, {SAFETY LOGIC CIRCUIT} or {SAFETY SIG. BOARD ALLOC}. The all display information above are updated, and the file written in the FLASH ROM of the machine safety circuit board is also updated.
8.23.6.1 Initializing the Safety Logic Circuit File

1. Displaying the window.
   – Select {SECURITY} from {SYSTEM} in the main menu.

2. Changing to the safety mode.
   – Select {SAFETY MODE}.

   ![Displaying the window with security menu]

   – Enter the password for the safety mode, and press {ENTER}.

   ![Entering the password for safety mode]

3. When the entered password is correct, the mode is changed to {SAFETY MODE}. After changing to the safety mode, the icon is displayed on the status area.

4. Select the file to be initialized.
   – Select {I/O DATA} by going to {INITIALIZE} from {FILE} in the main menu.
   – The I/O data file list is displayed, and then select “YSF LOGIC FILE”.
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8.23 Safety Logic Circuit

5. Perform the initialization.
   – Select {ENTER}.
   – The confirmation dialog appears.

   ![Initialization Confirmation Dialog]

   – Select {YES}.
   – The file written in the FLASH ROM of the machine safety circuit board (type: YSF21-E) is initialized.

8.23.6.2 Machine Safety Flash Data Erase or Reset

Erase the safety logic circuit file (file name: YSFLOGIC.DAT) written in the FLASH ROM of the machine safety circuit board (type: YSF21-E) by selecting “Machine Safety Board FLASH Erase”.

By selecting the “Machine Safety Board FLASH Reset”, the machine safety circuit board (type: YSF21-E) is transferred and saved in the FLASH ROM of the machine safety circuit board (type: YSF21-E).

- **Machine Safety Board FLASH Erase**
  1. Displaying the window.
     – Select {Machine Safety Board FLASH Erase} by going to {INITIALIZE} from {FILE} in the manmenu.

   ![Machine Safety Board FLASH Erase Menu]
8.23 Safety Logic Circuit

- The confirmation dialog appears, and select (YES).
- The safety logic circuit file (file name: YSFLOGIC.DAT) written in the FLASH ROM of the machine safety circuit board (type: YSF21-E) is erased.

**NOTE**

After performing the “Machine Safety Board FLASH Erase”, and turning the controller power supply ON/OFF. Next time when turning the power supply ON, the alarm “0300: VERIFY ERROR (SYSTEM CONFIG-DATA)” occurs. Therefore, when performing the “Machine Safety Board FLASH Erase”, the “Machine Safety FLASH Restart” needs to be performed as well.

### Machine Safety FLASH Reset

1. Displaying the window.
   - Select (Machine Safety Board FLASH Reset) by going to {INITIALIZE} from {FILE} in the man menu.

   ![Initial Setting](image)

   - The confirmation dialog appears, and select (YES).
   - The safety logic circuit file (file name: YSFLOGIC.DAT) is transferred and written in the FLASH ROM of the machine safety circuit board (type: YSF21-E).
8.23.7 Example of Safety Logic Circuit

The followings are the examples of the safety logic circuit.

<The safety logic circuit: example 1>

1. The first universal input safety signal of the I/O circuit board (type:YSF22 ■ -E) “1” is ON (#1 GSIN1), and the first universal input safety signal of the I/O circuit board (type:YSF22 ■ -E) “2” is ON (#1 GSIN2). The signal is outputted from the I/O circuit board (type:YSF22 ■ -E) “1” (#1 GSOUT1) of the first universal output safety signal.

   - Signal 1: Universal safety input signal 1 (#1 GSIN1)
   - Signal 2: Universal safety input signal 2 (#1 GSIN2)
   - Logic: AND
   - Output signal: Universal output signal 1 (#1 GSOUT1)

2. Displays the time chart.

   #1 GSIN1: ON
   #1 GSIN2: ON

   #1 GSIN1 and #1 GSIN2 are ON, so that #1 GSOUT1 will be ON.
3. Verifying the safety logic circuit.
   Switch ON the universal safety signal "1" and "2". The mark "○" becomes "●".
<The safety logic circuit: example 2>

1. The emergency button of the programming pendant is pressed, and the first universal input safety signal of the I/O circuit board (type: YSF22 enge-E) “1” is OFF, and the I/O circuit board (type: YSF22 enge-E) of the first universal output safety signal is ON after one second passed.

   - Signal 1: Programming pendant emergency button (PPESP)
   - Signal 2: NOT machine safety universal input signal 1 (#1 GSIN1)
   - Logic: AND
   - Output signal: Machine universal output signal 0 (#1 GSOUT0)
   - Delay timer: ON delay timer1 (TM1 ON DELAY) 1 second

2. Displays the time chart.
3. Verifying the safety logic circuit.
   Confirm that the mark “○” becomes “●” when pressing the programming pendant and switching the universal safety signal ON.
   The mark “○” of the universal safety output signal 1 becomes “●” after one second passed.
<The safety logic circuit: example 3>

1. When the first universal input safety signal of the I/O circuit board (type: YSF22 □-E) “1” is ON (#1 GSIN1) and under the teaching mode, the manipulator will decelerate and stop.
   - Signal 1: Teach mode (TEACH)
   - Signal 2: Universal safety input signal 1 (#1 GSIN1)
   - Logic: AND
   - Output signal: Manipulator deceleration to a stop (SVOFF CAT1)

2. Displays the time chart.

Under the teach mode and #1 GSIN1 is ON, so that the servo will be turned ON after the decelerating processing.
3. Verifying the safety logic circuit.
   Set up the teach mode, and turn the servo ON. When switching the universal safety signal ON, the mark “○” of the universal safety output signal 1 becomes “●”.

SIGNAL1: Teach mode (TEACH)
SIGNAL2: Programming pendant enable switch (PPDSW)
LOGIC: AND
OUTPUT: Manipulator deceleration to a stop (SVOFF CAT1)

If create the safety logic circuit shown above, the manipulator will stop immediately as the controller system. (Manipulator does not decelerate.)
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The safety logic circuit: example 4

1. The setting example by using the auxiliary relay is described below.
When the any one of the status of the programming pendant emergency stop, controller emergency stop or external emergency stop is stopped, the first universal output safety signal “1” of the I/O circuit board (type: YSF22 -E) is ON.

- Signal 1: Programming pendant emergency stop (PPESP)
- Signal 2: Controller emergency stop (PPESP)
- Signal 3: External emergency stop (EXESP)
- Logic: AND
- Output signal: Universal safety output signal(#1 GSOUT1)
The display “#1 GSOUT1” indicates the “#1 GSOUT1” of the first I/O circuit board (type: YSF22 -E).

2. Displays the time chart.

<table>
<thead>
<tr>
<th>PPESP</th>
<th>PBESP</th>
<th>EXESP</th>
<th>#1 GSOUT1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON(press)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFF (release)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ON(press)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OFF (release)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ON (release)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OFF (short-circuit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One of these status is ON, and turn #1GSOUT1 ON
3. Verifying the safety logic circuit.
When the one of the programming pendant emergency stop, controller emergency stop or the external emergency stop is inputted, the mark "○" of the universal safety output signal 1 becomes "●".
### 8.23.8 Alarm List of the Safety Logic Circuit

<table>
<thead>
<tr>
<th>Alarm Number</th>
<th>Sub-code</th>
<th>Message</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>VERIFY ERROR (SYSTEM CONFIG-DATA)</td>
<td>The safety logic circuit files in the file written in the Main CPU circuit board (type: YCP21-E) and the machine safety circuit board (type: YSF21-E) does not match. Refer to section 8.23.6.2 &quot;Machine Safety Flash Data Erase or Reset&quot; on page 8-271 for more details to restore.</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Machine Safety board save data error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4776</td>
<td>M-SAFETY YSF LOGIC FILE SIGNAL ERR</td>
<td>Start-up, in reading information from the FlashROM of YSF21 board, YSF21 board has detected an undefined signal. The error of the safety logic circuit is detected when startup. Check the safety logic circuit because an invalid I/O signal is used by the safety logic signal.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>In the receiving information on safe logic circuit information, YSF21 board has detected an undefined signal. The error is detected when updating the file. Check the safety logic circuit because an invalid I/O signal is used by the safety logic signal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4777</td>
<td>TRANSMISSION ERROR (M-SAF FILE)</td>
<td>Safe logic circuit information transmission error was detected. An alarm occurred while transferring the safety logic circuit file to the machine safety circuit board (type: YSF21-E). Reset the alarm, and re-send the safety logic circuit file.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Timer delay information transmission error was detected. An alarm occurred while transferring the safety logic circuit file to the machine safety circuit board (type: YSF21-E). Reset the alarm, and re-send the safety logic circuit file.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M-safety signal alloc information transmission error was detected. An alarm occurred while transferring the safety logic circuit file to the machine safety circuit board (type: YSF21-E). Reset the alarm, and re-send the safety logic circuit file.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Safety signal board alloc information transmission error was detected. An alarm occurred while transferring the safety logic circuit file to the machine safety circuit board (type: YSF21-E). Reset the alarm, and re-send the safety logic circuit file.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>253</td>
<td>M-safety command reception time out was detected. No response from the machine safety circuit board (type: YSF21-E) while transferring the safety logic circuit file. Reset the alarm, and re-send (perform the writing) the safety logic circuit file. If the alarm occurs again, replace the machine safety circuit board (type: YSF21-E).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>254</td>
<td>Safe logic circuit write error was detected. Failure to transfer the safety logic circuit file to the machine safety circuit board (type: YSF21-E). Please re-send the safety logic circuit file. If the alarm occurs again, refer to chapter 8.23.6.2 for more details.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>255</td>
<td>Safe logic circuit cancel error was detected. Failure to sending the cancel command while transferring the safety logic circuit file to the machine safety circuit board (type: YSF21-E). Please re-send the safety logic circuit file. If the alarm occurs again, refer to chapter 8.23.6.2 for more details.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.24 Robot Stop Factor Monitor Function

8.24.1 Outline

The robot stop factor monitor function is a function to detect a robot stop, which is caused by the servo OFF or the hold and so on. The factors, which caused to stop the robot, are stored in chronological order and displayed on the screen.

8.24.1.1 The Robot Stop Factor

This function detects the servo OFF status caused by the machine safety circuit board instructions or the main CPU instructions and the hold status caused by programming pendant operations or signals. The detection items are described as follows.

<table>
<thead>
<tr>
<th>Displayed Item</th>
<th>Secondary Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX.SERVO OFF1 (HOLD STOP)</td>
<td>System input signal number (#40065)</td>
</tr>
<tr>
<td>EX.SERVO OFF2 (CATEGORY0 STOP)</td>
<td>System input signal number (#40066)</td>
</tr>
<tr>
<td>EX.SERVO OFF3 (CATEGORY1 STOP)</td>
<td>System input signal number (#40064)</td>
</tr>
<tr>
<td>TEACH -&gt; PLAY MODE CHANGE</td>
<td>None</td>
</tr>
<tr>
<td>PLAY -&gt; TEACH MODE CHANGE</td>
<td>None</td>
</tr>
<tr>
<td>MAIN CPU ALARM</td>
<td>None</td>
</tr>
<tr>
<td>PARAMETER CHANGE</td>
<td>None</td>
</tr>
<tr>
<td>INST SVOFF</td>
<td>None</td>
</tr>
<tr>
<td>COMMAND SVON</td>
<td>None</td>
</tr>
<tr>
<td>HOME POSITIONING CHANGE</td>
<td>None</td>
</tr>
<tr>
<td>DATA FALSE RESTORE</td>
<td>None</td>
</tr>
<tr>
<td>TOOL FILE CHANGE</td>
<td>None</td>
</tr>
<tr>
<td>TOOL CALIBRATION</td>
<td>None</td>
</tr>
<tr>
<td>ENCODER RESET</td>
<td>None</td>
</tr>
<tr>
<td>ROBOT DETACHMENT</td>
<td>None</td>
</tr>
<tr>
<td>GROUND FAULT (BRAKE LINE)</td>
<td>None</td>
</tr>
<tr>
<td>MANUAL FULL SPEED</td>
<td>None</td>
</tr>
<tr>
<td>SERVO OFF QUE</td>
<td>None</td>
</tr>
<tr>
<td>SERVO ON ERROR</td>
<td>None</td>
</tr>
<tr>
<td>SERVO OFF ERROR</td>
<td>None</td>
</tr>
</tbody>
</table>
### Table 8-2: The List of the Servo OFF Factors by Machine Safety Circuit Board Instructions

<table>
<thead>
<tr>
<th>Displayed Item</th>
<th>Secondary Indication</th>
<th>Description of the Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP EMERGENCY STOP</td>
<td></td>
<td>Programming pendant emergency stop</td>
</tr>
<tr>
<td>PP ENABLE SWITCH</td>
<td></td>
<td>Programming pendant enable switch</td>
</tr>
<tr>
<td>PANEL BOX EMERGENCY STOP</td>
<td></td>
<td>Controller emergency stop</td>
</tr>
<tr>
<td>EXTERNAL EMERGENCY STOP</td>
<td></td>
<td>External emergency stop</td>
</tr>
<tr>
<td>EXTERNAL ENABLE SWITCH</td>
<td></td>
<td>External enable switch</td>
</tr>
<tr>
<td>SAFETY FENCE</td>
<td></td>
<td>Safety guard</td>
</tr>
<tr>
<td>EXTERNAL SERVO ON</td>
<td></td>
<td>External servo ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Displayed only when the level (S1D71=0) is specified</td>
</tr>
<tr>
<td>RDY0 OFF</td>
<td></td>
<td>RDY0OFF Servo OFF request from the main CPU</td>
</tr>
<tr>
<td>CATEGORY1 REQUEST</td>
<td></td>
<td>Category 1 stop request from the main CPU</td>
</tr>
<tr>
<td>M3 COMMUNICATION ERROR</td>
<td></td>
<td>Servo OFF by M3 communication error of the main CPU or among the servo circuit boards</td>
</tr>
<tr>
<td>CATEGORY0 SAFETY LOGIC CIRCUIT</td>
<td></td>
<td>Category 0 stop request from the safety logic circuit</td>
</tr>
<tr>
<td>CATEGORY0 FUNCTION SAFETY</td>
<td></td>
<td>Category 0 stop request from the machine safety</td>
</tr>
<tr>
<td>CATEGORY1 SAFETY LOGIC CIRCUIT</td>
<td></td>
<td>Category 1 stop request from the safety logic circuit</td>
</tr>
<tr>
<td>CATEGORY1 FUNCTION SAFETY</td>
<td></td>
<td>Category 1 stop request from the machine safety</td>
</tr>
<tr>
<td>YSF21 ALARM</td>
<td></td>
<td>Alarm of the machine safety</td>
</tr>
<tr>
<td>CATEGORY0 STOP</td>
<td></td>
<td>The time of the machine safety category 0 stop timer is up, and switch OFF the servo of the machine safety.</td>
</tr>
<tr>
<td>CATEGORY1 STOP</td>
<td></td>
<td>The time of the machine safety category 1 stop timer is up.</td>
</tr>
<tr>
<td>OVER TRAVEL1</td>
<td>Circuit board No.</td>
<td>Servo OFF by the over travel signal 1</td>
</tr>
<tr>
<td>OVER TRAVEL2</td>
<td>Circuit board No.</td>
<td>Servo OFF by the over travel signal 2</td>
</tr>
<tr>
<td>OVER TRAVEL3</td>
<td>Circuit board No.</td>
<td>Servo OFF by the over travel signal 3</td>
</tr>
<tr>
<td>OVER TRAVEL4</td>
<td>Circuit board No.</td>
<td>Servo OFF by the over travel signal 4</td>
</tr>
<tr>
<td>CONTACTOR OR STO OFF1</td>
<td>Circuit board No.</td>
<td>Servo OFF of the contactor 1 or STO1 from the main CPU</td>
</tr>
<tr>
<td>CONTACTOR OR STO OFF2</td>
<td>Circuit board No.</td>
<td>Servo OFF of the contactor 2 or STO2 from the main CPU</td>
</tr>
</tbody>
</table>
**Table 8-2: The List of the Servo OFF Factors by Machine Safety Circuit Board Instructions**

<table>
<thead>
<tr>
<th>Displayed Item</th>
<th>Secondary Indication</th>
<th>Description of the Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTACTOR OR STO OFF3</td>
<td>SV#1 to SV#8</td>
<td>Servo OFF of the contactor 3 or STO3 from the main CPU</td>
</tr>
<tr>
<td>CONTACTOR OR STO OFF4</td>
<td>SV#1 to SV#8</td>
<td>Servo OFF of the contactor 4 or STO4 from the main CPU</td>
</tr>
<tr>
<td>ON ENABLE1</td>
<td>SV#1 to SV#8</td>
<td>Servo OFF of the control group connected to ON_ENABLE1</td>
</tr>
<tr>
<td>ON ENABLE2</td>
<td>SV#1 to SV#8</td>
<td>Servo OFF of the control group connected to ON_ENABLE2</td>
</tr>
<tr>
<td>ON ENABLE3</td>
<td>SV#1 to SV#8</td>
<td>Servo OFF of the control group connected to ON_ENABLE3</td>
</tr>
<tr>
<td>ON ENABLE4</td>
<td>SV#1 to SV#8</td>
<td>Servo OFF of the control group connected to ON_ENABLE4</td>
</tr>
<tr>
<td>CATEGORY ON ENABLE1</td>
<td>SV#1 to SV#8</td>
<td>The time of the category 0 is up after inputting the ON_ENABLE1 signal, then switch OFF the servo of the machine safety.</td>
</tr>
<tr>
<td>CATEGORY ON ENABLE2</td>
<td>SV#1 to SV#8</td>
<td>The time of the category 0 is up after inputting the ON_ENABLE2 signal, then switch OFF the servo of the machine safety.</td>
</tr>
<tr>
<td>CATEGORY ON ENABLE3</td>
<td>SV#1 to SV#8</td>
<td>The time of the category 0 is up after inputting the ON_ENABLE3 signal, then switch OFF the servo of the machine safety.</td>
</tr>
<tr>
<td>CATEGORY ON ENABLE4</td>
<td>SV#1 to SV#8</td>
<td>The time of the category 0 is up after inputting the ON_ENABLE4 signal, then switch OFF the servo of the machine safety.</td>
</tr>
<tr>
<td>2ND CONTACTOR1</td>
<td>SV#1 to SV#8</td>
<td>2NDSF1 The time of an auxiliary contactor 1 in the secondary contactor is up, and switch OFF the servo of the machine safety.</td>
</tr>
<tr>
<td>2ND CONTACTOR2</td>
<td>SV#1 to SV#8</td>
<td>2NDSF2 The time of an auxiliary contactor 2 in the secondary contactor is up, and switch OFF the servo of the machine safety.</td>
</tr>
<tr>
<td>2ND CONTACTOR3</td>
<td>SV#1 to SV#8</td>
<td>2NDSF3 The time of an auxiliary contactor 3 in the secondary contactor is up, and switch OFF the servo of the machine safety.</td>
</tr>
<tr>
<td>2ND CONTACTOR4</td>
<td>SV#1 to SV#8</td>
<td>2NDSF4 The time of an auxiliary contactor 4 in the secondary contactor is up, and switch OFF the servo of the machine safety.</td>
</tr>
</tbody>
</table>
8.24.1.2 The Robot Stop Factor Record Number

- One screen: maximum 37 factors
- History number: 20 histories

If exceeds the number above, the old data will be deleted, and the new data will be recorded.

Table 8-3: The List of the Holding Factors

<table>
<thead>
<tr>
<th>Displayed Item</th>
<th>Secondary Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOLD</td>
<td>None</td>
</tr>
<tr>
<td>EX.HOLD (SPECIFIC. IN TRMNL BLOCK)</td>
<td>System input signal number #40067</td>
</tr>
<tr>
<td>EX.HOLD (SPECIFIC. IN SIGNAL)</td>
<td>None</td>
</tr>
<tr>
<td>INDIVIDUAL HOLD</td>
<td>System input signal number #40270 to #40287 TASK#0 to TASK#15</td>
</tr>
<tr>
<td>HOLD (SHOCK SENSOR)</td>
<td>None</td>
</tr>
<tr>
<td>HOLD (DATA TRANSMISSION)</td>
<td>None</td>
</tr>
<tr>
<td>HOLD (API CTL)</td>
<td>None</td>
</tr>
<tr>
<td>HOLD (API)</td>
<td>None</td>
</tr>
<tr>
<td>HOLD (HIGH SPEED ES)</td>
<td>None</td>
</tr>
<tr>
<td>SKIP WAIT INST (STOP PLAYBACK)</td>
<td>Task number TASK#0 to TASK#15</td>
</tr>
<tr>
<td>GUN TEACH SIG. OFF (STOP PLAYBACK)</td>
<td>System input signal number #41231</td>
</tr>
<tr>
<td>GUN TEACH STEPOVER (STOP PLAYBACK)</td>
<td>None</td>
</tr>
<tr>
<td>ALARM STOP QUE</td>
<td>None</td>
</tr>
</tbody>
</table>
8.24.2 Operation

8.24.2.1 Displaying the Robot Stop Factor Monitor

The RB STOP FACTOR MONITOR can be referred by following procedures.

1. Select {ROB STOP FACTOR MONITOR} under the {IN/OUT} in the main menu.

- The RB STOP FACTOR MONITOR window appears.

- The following items are displayed on the RB STOP FACTOR MONITOR window.
  
  - DETECT TIME: Shows the time when the robot stop factor was detected.
8 System Setup

8.24 Robot Stop Factor Monitor Function

- The factor detected by the main CPU is displayed on the first line.

```
ROBOT STOP FACTOR MONITOR
No. FACTOR DETECT DATE 2012/02/13 17:25:08  PAGE : 1
1: TEACH -> PLAY MODE CHANGE
2: ROBO OFF
3: CONTACTOR OR STD OFF
4: SH1
5: NONE
```

- The factor(s) detected by the machine safety is (are) displayed from the second line on the screen.

```
ROBOT STOP FACTOR MONITOR
No. FACTOR DETECT DATE 2012/02/13 17:25:08  PAGE : 1
1: ROBO OFF
2: CONTACTOR OR STD OFF
3: SH1
4: NONE
```

- The data on the first page is the latest one, and the page 20 is the oldest data.

8.24.2.2 Clear the Robot Stop Factor Information

1. Select {DATA} from the pull-down menu on the RB STOP FACTOR MONITOR window when the security mode is the management or higher mode. {CLEAR} is displayed.
2. Select {CLEAR}, and the confirmation dialog “Initialize?” appears. Press “YES”, and the all information of the robot stop factor is cleared.

The robot stop factor information is not saved when turning the power supply OFF. Therefore, it will be initialized when turning the power supply ON again. If it is necessary to save the data, please store the data into the external memory devices before turning the power supply OFF.
8 System Setup

8.25 Robot Detachment Function

8.25.1 Setting Maintenance Mode

This mode is used for setting up and maintenance of the robot system.

1. Turn the power ON while pressing {MAIN MENU} button.
   – Maintenance mode screen starts up.

2. Select {SYSTEM} under the main menu.
   – Sub menu is shown.
3. Select {SECURITY}.
   – Mode selection screen is shown.

![Mode Selection Screen]

4. Press [SELECT] to select the mode.
   – Mode selection list is shown.

![Mode Selection List]

5. Move the cursor to {SAFETY MODE} and select.
   – Password input box is shown.

![Password Input Box]
8.25.2 Setting Robot Detachment Function

Operator can set or modify the setting items for robot detachment function in detail setting screen. The specified parameters are to be set automatically according to the setting contents in detail setting screen.

1. Select {SYSTEM} under main menu.
   – Sub menu is shown.

6. Input the password for safety mode and press [ENTER].
   – When the correct password is input, security mode is changed.
8. System Setup

8.25 Robot Detachment Function

2. Select {SETUP}.
   – "SETUP" screen is shown.

   ![SETUP Screen]

3. Move the cursor to {OPTION FUNCTION} and select.
   – "OPTION FUNCTION" screen is shown.

   ![OPTION FUNCTION Screen]

4. Move the cursor to {ROBOT DETACHMENT} and select.
   – Detail setting screen for robot detachment function is shown.

   ![Robot Detachment Screen]
5. Change the setting contents.
   – Move the cursor to the target group and select to change the setting.
   – Select “ATTACHED” or “DETACHED”.

6. Change the setting item on JOB.
   – Move the cursor to the JOB setting item and select.
     Every pressing the [SELECT] switches the indication between “๑” and “-”.

   – Description for the setting items on JOB
     When “-” is selected: The JOB including detached group cannot be started up.

     When “๑” is selected: The JOB including detached group can be started up. However, the detached axes cannot be operated.
8. Press [ENTER].

– Confirmation message for parameter change is shown.

8. Select “YES” to confirm the change.

– System parameters are to be set automatically, then the screen returns to the option function screen.
8.26 Axes Detachment Function

8.26.1 Outline

The axes detachment function is to invalid the connection of specific axes by setting in maintenance mode. When the axes detachment function is set, the system can be started without any alarm even if some axes are not connected physically during setup or motor exchange.

8.26.2 Setting Maintenance Mode

Start the maintenance mode and set the security mode to the safety mode. (Refer to chapter 8.25.1.)

8.26.3 Setting Axes Detachment Function

Operator can set or modify the setting items for axes detachment function in detail setting screen.

The specified parameters are to be set automatically according to the setting contents in detail setting screen.

1. Select {SYSTEM} under the main menu.
   - Sub menu is shown.

2. Select {SETUP}.
   - Setting selection screen is shown.

   ![Setting Menu](image)
3. Move the cursor to {OPTION FUNCTION} and select.
   – “OPTION FUNCTION” screen is shown.

4. Move the cursor to {AXES DETACHMENT} and select.
   – Detail setting screen for axes detachment function is shown.

5. By pressing [PAGE], the target group for setting is switched.
6. Change the setting contents.
   – Move the cursor to the target axis and select to change the setting.
   – Select “ATTACHED” or “DETACHED”.

7. Press [ENTER].
   – Confirmation message for parameter change is shown.

8. Select “YES” to confirm the change.
   – System parameters are to be set automatically, then the screen returns to the option function screen.

8.26.4 Specific Output and Messages

When the system is started in online mode and any axes (at least one axis) are detached, the following specific output and message are output all the time.

- Specific output #50913 “AXES DETACHMENT”

- Message is displayed
  The following message is output in the bottom right message area on the window of the programming pendant.

  “Axes detachment has been set [sub code]”

  The control group including the detached axis is shown in [sub code].
8.26 Axes Detachment Function

8.26.5 Restrictions

1. Operation with restrictions

When the axes detachment function is set, the following operations are restricted. If these operations are tried to be performed, an error or an alarm occurs.

Playback
Test run
Job registration (insert/modify/delete jobs in the target control group)
Variable registration
Second home position registration
Home position registration
Work home position registration

Followings are the errors/alarms which may occur by the axes detachment.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playback</td>
<td>“ERROR 2762 This operation is not allowed, for axes detachment has been set.”</td>
</tr>
<tr>
<td></td>
<td>“ALARM4916/4917 WRONG JOB EXEC OF DETACHED AXIS”</td>
</tr>
<tr>
<td>Test run</td>
<td>“ERROR 2762 This operation is not allowed, for axes detachment has been set.”</td>
</tr>
<tr>
<td>Job registration (insertion, modification, deletion)</td>
<td>“ERROR 2763 Cannot modify, for axes detachment has been set.”</td>
</tr>
<tr>
<td>Second home position registration</td>
<td>“ERROR 2763 Cannot modify, for axes detachment has been set.”</td>
</tr>
<tr>
<td>Home position registration</td>
<td>“ERROR 2763 Cannot modify, for axes detachment has been set.”</td>
</tr>
<tr>
<td>Work home position registration</td>
<td>“ERROR 2763 Cannot modify, for axes detachment has been set.”</td>
</tr>
</tbody>
</table>

Use the robot detachment function (chapter 8.25) when performing the playback operation in the state that the specific manipulator, the base, or the station is detached.
2. Operation without restrictions

![CAUTION]

- While the axes detachment function is set, even if try to move the manipulator to the taught position, the manipulator may not be moved to the right position or operated in the right posture because the specific axes don't operate. When performing the operations mentioned below while the axes detachment function is set, be very careful to the manipulator’s motion and the interference between the manipulator and the peripheral devices.

The axes detachment function doesn't restrict the following operations, though be careful when performing.

- Jog operation (link, cartesian, user, tool, cylindrical, and I/O jog)
- Next/Back operation
- Variable movement
- Second home position movement
- Work home position return

3. Restriction in using with other function

Before using the following function, be sure to release the axes detachment function.

- Functional safety function
  If there is any detached axis, safety monitoring cannot be performed.
9 System Backup

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

9.1 System Backup with Controller

For the controller, two types of collective backup are available: CMOS.BIN and CMOSBK.BIN.

9.1.1 Function Types of Data

9.1.1.1 CMOS.BIN

For the normal backup, use this data.

Save: Perform in the normal or maintenance mode.

Load: Perform in the maintenance mode.

(The management mode or higher mode)

The loading/saving procedures in the maintenance mode, refer to chapter 9.2 “Backup by CMOS.BIN” at page 9-4.

As for saving in the normal mode, refer to DX200 OPERATOR’S MANUAL section 7.3.0.2 “Saving Data”.

Target Area: All areas of the internally stored data.

(Note that the monitoring time is not loaded.)

9.1.1.2 CMOSBK.BIN

This data is used in the automatic backup function.

Save: Saves with the preset conditions in the normal mode.

Load: Perform for the system restoration in the maintenance mode

(The management mode or higher mode)

For details, refer to chapter 9.3 “Automatic Backup Function” at page 9-8.

Target Area: All areas of the internally stored data.

(Note that the monitoring time is not loaded.)

9.1.2 Device

For the backup of the controller system, the CompactFlash or the USB memory is used. (The USB slot of the programming pendant is not available in the automatic backup function.)

The following tables show the recommended CompactFlash and USB memory.

<Recommended CompactFlash>

<table>
<thead>
<tr>
<th>No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hagiwara Solutions</td>
<td>MCF10P-256MS-YE</td>
<td>256MB</td>
</tr>
<tr>
<td>2</td>
<td>Hagiwara Solutions</td>
<td>MCF10P-512MS</td>
<td>512MB</td>
</tr>
<tr>
<td>3</td>
<td>Hagiwara Solutions</td>
<td>MCF10P-A01GS</td>
<td>1GB</td>
</tr>
<tr>
<td>4</td>
<td>Hagiwara Solutions</td>
<td>MCF10P-A02GS</td>
<td>2GB</td>
</tr>
</tbody>
</table>
9 System Backup
9.1 System Backup with Controller

<Recommended USB Memory>

<table>
<thead>
<tr>
<th>No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hagiwara Solutions</td>
<td>UBA2-xxxGSRB (TBAIA)</td>
<td>1GB, 2GB, and 4GB are available. “xxx” indicates “001” for “1GB”, “002” for “2GB” and “004” for “4GB”.</td>
</tr>
</tbody>
</table>

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

Approx. 26 MByte

Note that the free space for one working file is needed in addition to the free space for the stored files when using the automatic backup function.

Also, it is recommended to store the backup data in two or more media cards to minimize problems if the media is damaged.

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

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

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

When using the USB memory, insert it in the USB slot of the CPU circuit board. Be careful about the insertion direction of the connector: The USB memory should be inserted slowly with the upper surface right. Forcible
insertion may cause the damage of the USB memory and the USB connector.

* There are two USB connectors. The left side is for USB1 and the right side is for USB2.
9.2 Backup by CMOS.BIN

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

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

<table>
<thead>
<tr>
<th>Security</th>
<th>CMOS Save</th>
<th>CMOS Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Mode</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Editing Mode</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Management Mode</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Safety Mode</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>

9.2.1 CMOS.BIN Save

Follow the procedures below to save CMOS.BIN in the maintenance mode.

1. Turn ON the controller power supply while pressing [MAIN MENU].

2. Insert a CompactFlash into the CompactFlash slot on the programming pendant.
    - when USB memory is used instead of CompactFlash, mount USB memory and select one among “USB: PENDANT”, “USB1: CONTROLLER” and “USB2: CONTROLLER” in the {DEVICE}.

3. Select (FD/PC CARD) under the main menu.
    - The sub menu appears.
4. Select {SAVE}.
   – The save display appears.

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

   ![Confirmation Dialog Box]

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

### 9.2.2 CMOS.BIN Load

Follow the procedures below to load CMOS.BIN.

1. Turn ON the controller power supply while pressing [MAIN MENU].
2. Change the security mode to the maintenance mode or higher mode.
3. Insert a CompactFlash into the CompactFlash on the programming
   pendant.
   – When USB memory is used instead of CompactFlash, mount USB
     memory and select one among “USB: PENDANT”, “USB1: CONTROLLER”
     and “USB2: CONTROLLER” in the {DEVICE}.
4. Select {FD/PC CARD} under the main menu.
   – The sub menu appears.
5. Select {LOAD}.
   – The load display appears.

   ![Load Display Image]

   – The items marked with “■” cannot be selected.

6. Select {CMOS}.
   – The confirmation dialog box appears.

   ![Confirmation Dialog Box Image]

7. Select {YES}.
   – The loaded CMOS.BIN file contents are reflected in the data inside the robot.

---

**CAUTION**

When the “CMOS load” is performed, the current CMOS data is replaced with the CMOS data (the contents of “CMOS.BIN”) in the CompactFlash. Therefore, before performing the load, make sure to perform the “CMOS Save” of the CMOS data to be loaded.
9.3 Automatic Backup Function

9.3.1 Automatic Backup Function

9.3.1.1 Objective

With the automatic backup function, the data saved in the controller such as system setting or operational condition are collectively backed up in the CompactFlash, which is stored in the programming pendant, or the selected device at the automatic backup window.

- speed ethernet server function is effective.)

DN1.50-00 or higher: The automatic backup function is expanded. In order to use the automatic backup extension function, set the following parameter.

For the setting of the automatic backup extension function, refer to chapter 9.3.2.7 “AUTO BACKUP EXTENSION FUNCTION SET Window”.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Content</th>
<th>Initial Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C737</td>
<td>Automatic backup extension</td>
<td>1</td>
</tr>
</tbody>
</table>

Able to back up to the following devices.

- The CompactFlash of the programming pendant
- The CompactFlash of the YCP21 board

The RAM AREA of the YCP21 board (It will display, when the high speed ethernet server function is effective.)

The automatic backup function is enabled only while the controller power supply is ON whereas it isn’t while in the maintenance mode or the power supply is OFF.

9.3.1.2 Outline

The automatic backup function saves the internally stored data in a single file in advance for the smooth restoration from unexpected troubles of the controller.

The teaching operation is one of the factors that changes the internally stored data. Thus, a mode which backs up the latest data after the teaching operation is prepared. To confirm the termination of the teaching operation, check the mode key whether it is changed from teach mode to play mode.

Other than the teaching operation, the present position of the robot or the value of a variable can be pointed out as the factors to change the internally stored data. These data, however, are changed after each operation and have very little need to be retained permanently. Accordingly, backing up these data at regular interval should be well enough to operate and the mode to back up the data at regular interval is also prepared.

Furthermore, the mode to back up the data when starting up the controller and when inputting signals are also available for some specific versions.
With the automatic backup function, all the part where the internal data is stored in the physical memory area is collectively saved. If there is any data which is in the middle of changing while executing the automatic backup function, the data might not be usable for restoration because of its inconsistency. Therefore, the function is terminated with an error during the play back operation or while the manipulator is in motion so that the automatic backup cannot be operated. Set the automatic backup function to be executed while the manipulator is not in the playback status and while the manipulator is stopped.

The automatic backup function has the following functions and features.

<table>
<thead>
<tr>
<th>No</th>
<th>Function/Feature</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cyclic backup</td>
<td>In the teach mode, the data in memory is backed up in a specified cycle from a specified starting time.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This function backs up as much of the latest data as possible during editing. The backup data saved in the CompactFlash can be loaded to the controller in case of data loss so that the damage can be minimized.</td>
</tr>
<tr>
<td>2</td>
<td>Backup when switching modes</td>
<td>When switching the mode from the teach mode to the play mode, the data in memory is backed up.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The editing data is backed up when editing is completed. The latest data is automatically backed up with this mode.</td>
</tr>
<tr>
<td>3</td>
<td>Backup when start-up</td>
<td>When the controller starts up, the data in memory is backed up.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When the controller starts up, the data in memory is backed up. Since the editing/playback operation is usually completed when the controller power is turned OFF, the latest data is automatically backed up with this mode.</td>
</tr>
<tr>
<td>4</td>
<td>Backup when inputting specified signals</td>
<td>The data in memory is backed up when a specified signal (#40560) is input.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The data in memory is backed up by the signal from the host at the intended timing. Although the above mentioned items 1 to 3 are designed to back up the data automatically, this function backs up the data in accordance with the instruction from the host.</td>
</tr>
<tr>
<td>5</td>
<td>Backup while robot program is stopped</td>
<td>The backup during playback is disabled. However, in the play mode, the backup is enabled if the robot is stopped. (&quot;Cyclic backup&quot; and &quot;Backup when inputting specified signals&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Backs up the variables for essential data.</td>
</tr>
<tr>
<td>6</td>
<td>Backup and retry at low priority</td>
<td>The data in memory is backed up at low priority so that this operation does not affect the other operations. When other operations affect the backup operation, the backup is suspended and retried later.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The backup operation hardly affects the other operations so that the programming pendant can be used even during the backup operation.</td>
</tr>
<tr>
<td>7</td>
<td>Backup in binary</td>
<td>The data is saved as binary data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Backup in binary allows the system to be easily and speedily restored.</td>
</tr>
<tr>
<td>8</td>
<td>Setting of items</td>
<td>Parameters can limit the settings of the backup condition.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unnecessary settings can be avoided with this setting.</td>
</tr>
</tbody>
</table>
9.3.2 Settings for Automatic Backup

To set the automatic backup function, set each item at the automatic backup display.

- **The CompactFlash of the Programming Pendant**

  To use the automatic backup function, insert CompactFlash in the CompactFlash slot on the programming pendant. Only while the controller power supply is OFF, the CompactFlash can be inserted or removed.

  When the data could not be saved in CompactFlash during an automatic backup due to the absence or insufficient capacity of the CompactFlash, an error message “Cannot backup CompactFlash” appears. At the same time, the signal “occurrence of error” is output, but the robot program will not be stopped. Check if CompactFlash is inserted and if it has enough capacity, and take the necessary actions. If no actions are taken while the error occurs, the data cannot be saved.

  Yaskawa recommends that the data be saved in two or more CompactFlash to minimize problems if the CompactFlash should be damaged.

  Regarding the Compact Flash for auto backup, refer to “Recommended CompactFlash” in section 9.1.2 “Device” on page 9-1.

  Storage capacities needed for CompactFlash are as follows:

  \[(\text{The number of stored files} + 1) \times \text{approx. 26MByte}\]

  The number of storable files is automatically calculated and the MAX value is shown when AUTO BACKUP SET display appears.
9 System Backup
9.3 Automatic Backup Function

9.3.2.2 The CompactFlash of the YCP21 Board

Set the following procedures in advance to back up to the CompactFlash of the YCP21 board. If the following procedures are not done, “CF: Controller” would not be shown on the device list of the auto backup set display.

1. Turn ON the Power supply while pressing the {MAIN MENU} on the programming pendant.
2. After starting maintenance mode, change the security mode to the management or higher mode.
3. Select {SYSTEM} in the main menu.
   – When the sub menu will appear, select {SETTING}-{OPTION FUNCTION}. The list of the optional function will appear.
4. Select {Automatic backup (YCP21)}, and change the “UNUSE” to “USE”.
   – Select {YES}, when the confirmation dialog appears.
   – Select {YES}, when the confirmation dialog appears, and ask “initialized related files?” or “CMOSBK. BIN?”
   – It will allocate automatic backup to the CompactFlash of the YCP21. During allocating, the message of do not turn the power off appears.
   – The message of the maintenance mode will appear, when finished allocating.
5. Turn ON the power supply again.
6. The online window appears on the programming pendant.
7. Change the security mode to the management mode.
8. Select {CONTROLLER SET}-{SET AUTO BACKUP}.
9. It would be error without inserting the CompactFlash in the programming pendant, when the device is set on the CompactFlash in the programming pendant. Push down the [cancel], when the error occurs.

Select the device, and change to “CF: Controller”.

Backup setting to the CompactFlash of the YCP21 board should be done while the robot is not operating.

When access to CompactFlash of the YCP21 by using other than the auto backup function, the auto backup function and the exclusive process would be run. Therefore, the save time of the auto backup will extend.

(Normally, it takes about three minutes to finish backing-up. However, duplication access to the CompactFlash of the YCP21 board takes three to ten minutes.)
### 9.3.2.3 RAMDISK on the YCP21 Board

RAMDISK will be shown when the high speed ethernet server function is effective. Refer to the controller’s HIGH-SPEED ETHERNET SERVER FUNCTION manual for more details.

### 9.3.2.4 Controller Status and Automatic Backup

<table>
<thead>
<tr>
<th>Backup Timing</th>
<th>Controller Status</th>
<th>Automatic Backup</th>
</tr>
</thead>
<tbody>
<tr>
<td>From a specified starting time</td>
<td>Teach mode</td>
<td>Editing (Accessing to the memory)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When editing is interrupted</td>
</tr>
<tr>
<td></td>
<td>Play mode</td>
<td>Executing jobs</td>
</tr>
<tr>
<td></td>
<td>Remote mode</td>
<td>When stopped</td>
</tr>
<tr>
<td>When a specified signal (#40560) is input</td>
<td>Teach mode</td>
<td>Editing (Accessing to the memory)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When editing is interrupted</td>
</tr>
<tr>
<td></td>
<td>Play mode</td>
<td>Executing jobs</td>
</tr>
<tr>
<td></td>
<td>Remote mode</td>
<td>When stopped</td>
</tr>
<tr>
<td>When switching the mode from the teach mode to the play mode</td>
<td>-</td>
<td>Backup</td>
</tr>
<tr>
<td>When the controller starts up</td>
<td>-</td>
<td>Backup</td>
</tr>
</tbody>
</table>

* Retry is not performed when an error occurs.
* An error can be indicated by a message depending on setting.
9 System Backup
9.3 Automatic Backup Function

- **Reserve Time Backup**
  While the data in the controller memory is being edited or overwritten, the automatic backup is not performed at the specified backup starting time and is suspended and retried later. To start the backup at the reserved time, set to the time when the robot program is stopped and no job or file is edited.

- **Backup when Switching from Teach Mode to Play Mode**
  When the mode is repeatedly switched from the teach mode to the play mode or vice versa within 1 to 2 seconds, backup starts after the last time the mode is switched.

  Execute the job after three second since starting the back-up.

- **Backup when the Controller starts up**
  Since the automatic backup process is added to the controller start-up process, a few extra seconds are needed to start up the controller.

- **Backup when Specific Signal is Input**
  While the controller memory is edited such as overwriting, the backup operation becomes an error even if there is an input to a specific signal (#40560). To start the specific input backup, perform it while the robot program is stopped and a job or file is not being modified.

  Also, since the signal input is executed at rising detection, turn the signal to “0” if it is already “1”, then return to “1” again.

  Execute the job after three second since starting the back-up.

- **Overwriting Limit in CompactFlash**
  The number of times that the CompactFlash can be overwritten is limited to approx. 100,000 times. Because frequent backup operations may shorten the life of CompactFlash, the number of backup times should be minimized as much as possible.
### 9.3.2.5 Setting Examples

- **Setting Example 1**
  The following diagram shows a setting example with the following conditions:
  - BASE TIME: 12:30
  - BACKUP CYCLE: 60 (minutes)
  - RETRY CYCLE: 10 (minutes)

- **Setting Example 2**
  The following diagram shows a setting example with the following conditions:
  - BASE TIME: 20:00
  - BACKUP CYCLE: 1440 (minutes) (24 hours)
  - RETRY CYCLE: 60 (minutes)

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

- **Settings**
  Select the following items on the AUTO BACKUP SET display and set values for the automatic backup.

  - **RESERVE TIME BACKUP** (VALID/INVALID of the cyclic backup)
  - **BASE TIME**
  - **BACKUP CYCLE**
  - **RETRY CYCLE**
  - **MODE CHANGE BACKUP** (VALID/INVALID of the backup when switching the mode from teach mode to play mode)
  - **STARTUP AUTO BACKUP** (VALID/INVALID of the backup when the controller is started up)
  - **SPECIFIC INPUT BACKUP** (VALID/INVALID of the backup when inputting specified signals)
  - **UNIV.OUT NO. ON ERROR**
  - **DISPLAY AT EMERGENCY**
  - **DURING ALARM OCCURRENCE**
  - **STORED FILE SETTING** (It is possible to set when CF: pend is set on the device.)

When the “CF: pend” or “CF:Controller” is selected on the auto backup display, the capacity of the CompactFlash card in the specified device will be checked. Therefore, a few seconds may be needed to open the setting window. For the “CF: Pendant”, an error may occur without setting in the CompactFlash card.

When changing the settings of “STORED FILE SETTING” or executing “ARRANGE”, the files “CMOSBK.BIN” and “CMOSBK???.BIN” (? denotes figures) in the CompactFlash card are changed in name or deleted. If a certain file of this type is needed to be saved before changed in name or deleted, evacuate it into a PC, etc. beforehand.

While an error occurring, the setting of the each item on the auto backup set display cannot be changed.
9.3 Automatic Backup Function

1. Turn ON the controller.
   - Insert the CompactFlash to the programming pendant, when the backup is set on the CompactFlash of the programming pendant.

2. Change the security mode to the management or higher mode.

3. Select {SETUP} under the main menu.

4. Select {AUTO BACKUP SET}.
   - The AUTO BACKUP SET display appears.

A. RESERVE TIME BACKUP
   Set the backup function to valid or invalid in a specified cycle from a specified starting time.
   Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.
   The reserve time can be set by inputting values in B, C and D in the display.
   Every time values are set to these three items, reset the RESERVE TIME BACKUP to VALID.
   If these settings are incorrect, the RESERVE TIME BACKUP cannot be reset to VALID.
   If so, check and then change the values to the correct settings.

B. BASE TIME
   Specify the reference time to start reserve time backup.
   The time elapsed from the reference time for a BACKUP CYCLE period is recognized as the BACKUP TIME.
   The first automatic backup is performed at the first BACKUP TIME after the power of the controller is turned ON.
   The automatic backup after the first time, is performed at the interval of BACKUP CYCLES.
   The reference time ranges from 0:00 to 23:59.

C. BACKUP CYCLE
   Specify the length of time for a cycle to back up. After the first backup, the next backup is performed automatically in the time specified in the BACKUP CYCLE.
   Set the backup cycle in units of minutes. The cycle setting ranges from 10 to 9999 minutes, and is longer than the RETRY CYCLE.
D. RETRY CYCLE
Specify the length of time for a cycle to retry backing up when the backup operation is suspended.
After being suspended, the backup is retried in the time specified in the RETRY CYCLE.
Set the retry cycle in units of minutes. The cycle setting ranges from 0 to 255, and is shorter than the BACKUP CYCLE.
When it is set to 0, retry will not be performed.

E. MODE CHANGE BACKUP
Set the automatic backup function to be valid or invalid when the mode is switched from teach mode to play mode.
Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

F. STARTUP AUTO BACKUP
Set the backup function to be valid or invalid when the power of the controller is turned ON.
Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

G. SPECIFIC INPUT BACKUP
Set the backup function to be valid or invalid when specific input signal (# 40560) is input (rising edge from 0 to 1).
Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

H. UNIV. OUT NO. ON ERROR
Set “1” to the specified user output signal which was specified in this chapter when the automatic backup error occurs.
The term “automatic backup error” here means that the backup is not performed successfully before the next backup (including retry operation) starts.

I. DISPLAY AT EMERGENCY
Set the method of notification of the automatic backup error to “ERROR” or “MESSAGE.”
Each time [SELECT] is pressed, “ERROR” and “MESSAGE” are displayed alternately.

J. DURING ALARM OCCURRENCE
Set the backup function to be valid or invalid when an alarm occurs.
Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.
K. DEVICE
Press {SELECT} to display the device list.

<table>
<thead>
<tr>
<th>The Device Name in Display</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: pendant</td>
<td>Set the backup to the CompactFlash of the programming pendant.</td>
</tr>
<tr>
<td>CF: controller</td>
<td>Set the backup to the CompactFlash of the YCP21 board. When the “CF: controller” of the device name is not shown, refer to 9.3.2.2 the CompactFlash of the YCP21.</td>
</tr>
<tr>
<td>RAMDISK</td>
<td>It will be shown when the optional function of High Speed Ethernet Server function is effective. It can back up by the controller high speed ethernet server function command. Refer to the [controller Instruction HIGH-SPEED ETHERNET SERVER FUNCTION].</td>
</tr>
<tr>
<td>USB1: controller</td>
<td>Set the backup to the USB memory of the YCP21 board.</td>
</tr>
<tr>
<td>USB2: controller</td>
<td>Set the backup to the USB memory of the YCP21 board.</td>
</tr>
</tbody>
</table>

L. STORED FILE SETTING
Set the number of files to be stored by the automatic backup function. The number mentioned on the right side of this item with "(Max)" indication is the maximum number of files that can be stored in the CompactFlash inserted when this window is displayed. The settings range from 1 to (Max). When this setting value is changed, the backup file arrangement starts. (Max is 100.)

M. BACKUP FILES
Indicates the existence of the files or the number of backup files stored in the CompactFlash inserted when this window is displayed.

N. LATEST BACKUP FILE
Indicates the date of the latest file in the CompactFlash inserted when this window is displayed.

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

ARRANGE will not be displayed when the device of the CF: controller is set on.

5. Set the desired item, and press [ENTER].
## Window Settings
RS parameter can restrict the settings of some items in the automatic backup window.

When setting the bit of RS096 parameter shown below to “1”, the corresponding items are restricted. The restricted items are indicated with “INVALID” in the display and inputting/modification to the item becomes impossible. Also, the automatic backup does not function with the restricted items.

![Diagram of RS parameters](image)

- **D7 D6 D5 D4 D3 D2 D1 D0**
- **D5** RESERVE TIME BACKUP
- **D4** MODE CHANGE BACKUP
- **D3** STARTUP BACKUP
- **D2** RETRY CYCLE
- **D1** DURING ALARM BACKUP
- **D0** SPECIFIC INPUT BACKUP

## Output the Backup Processing Status
Able to confirm the backup processing status by the system output signal.

- **<#50766> It is creating the auto backup data.**
  When this signal is turned ON, it is creating the backup data. Some operations are limited. For example, the start signal is not accepted.

- **<#50767> It is transferring the backup data.**
  When this signal is turned ON, writes the data to the CompactFlash after creating the backup data. Do not remove the CompactFlash from the programming pendant during this period.
9.3.2.7 AUTO BACKUP EXTENSION FUNCTION SET Window

**Settings**

Automatic backup setting is performed by setting the following items on the AUTO BACKUP SET window:

- **RESERVE TIME BACKUP**
  (Setting for performing the backup on what day of the week, every day, or in a specific cycle)

- **BASE TIME**

- **BACKUP CYCLE**

- **RETRY CYCLE**

- **MODE CHANGE BACKUP**
  (VALID/INVALID of the backup when switching the mode from the teach mode to the play mode)

- **STARTUP AUTO BACKUP**
  (VALID/INVALID of the backup when the controller is started up)

- **SPECIFIC INPUT BACKUP**
  (VALID/INVALID of the backup when inputting specified signals)

- **UNIV.OUT NO. ON ERROR**

- **DISPLAY AT EMERGENCY**

- **DURING ALARM OCCURRENCE**

- **DEVICE**
  (Setting of the device to store the automatic backup file)

- **STORED FILE SETTING**
  (It is possible to set when “CF:Pendant” is set in DEVICE.)

**NOTE**

When the “CF: pendant” or “CF:Controller” is selected on the auto backup display, the capacity of the CompactFlash card in the specified device will be checked. Therefore, a few seconds may be needed to open the setting window. For the “CF: Pendant”, an error may occur without setting in the CompactFlash card.

When changing the settings of “STORED FILE SETTING” or executing “ARRANGE”, the files “CMOSBK.BIN” and “CMOSBK???.BIN” (?? denotes figures) in the CompactFlash card are changed in name or deleted. If a certain file of this type is needed to be saved before changed in name or deleted, evacuate it into a PC, etc. beforehand.

While an error occurring, the setting of the each item on the auto backup set display cannot be changed.
1. Turn ON the controller.
   – Insert the CompactFlash to the programming pendant, when the backup is set on the CompactFlash of the programming pendant.

2. Change the security mode to the management or higher mode.

3. Select {PARAMETER} in the main menu.

4. Select {S2C}.
   – The parameter setting window appears. Set the value of S2C737 to “1”.

5. Select {SETUP} under the main menu.

6. Select {AUTO BACKUP SET}.
   – The AUTO BACKUP SET display appears.

A. RESERVE TIME BACKUP
   Pressing [SELECT] displays the following list. Select the item from "SET CYCLE", "EVERY DAY", or the day of the week ("MONDAY" to "SUNDAY").

   Please note that after setting the base time, the backup cycle, and the retry cycle, select the item from "SET CYCLE", "EVERY DAY", or the day of the week ("MONDAY" to "SUNDAY").

   If "SET CYCLE", "EVERY DAY", or the day of the week ("MONDAY" to "SUNDAY") is set before setting one of the base time, the backup cycle, and the retry cycle, "INVALID" is selected for RESERVE TIME BACKUP.
9 System Backup
9.3 Automatic Backup Function

“INVALID” : RESERVE TIME BACKUP is not performed.
“SET CYCLE” : The automatic backup is performed every BACKUP CYCLE based on the specified BASE TIME.
“EVERY DAY” : The automatic backup is performed at the specified BASE TIME every day.
“MONDAY” to “SUNDAY” : The automatic backup is performed at the specified BASE TIME every week.

– Setting example for the automatic backup at 11:29 every day

– Setting example for the automatic backup at 11:29 on every Thursday

B. BASE TIME
Specify the reference time to start the automatic backup. The reference time ranges from 0:00 to 23:59.

C. BACKUP CYCLE
Specify the backup cycle to perform the cyclic back up. Set the backup cycle in units of minutes. The cycle setting ranges from 10 to 9999 minutes. After the first backup, the following backups are performed automatically in every BACKUP CYCLE. When “EVERY DAY” or the day of the week (“MONDAY” to “SUNDAY”) for RESERVE TIME BACKUP is selected, BACKUP CYCLE cannot be input.
9 System Backup
9.3 Automatic Backup Function

D. RETRY CYCLE

Every time the automatic backup is implemented, the memory data in the controller is obtained, and the data is compared with the original memory data. If they are not the same, the retry of the automatic backup is implemented. However, please note that when the device is not inserted and the automatic backup is failed, for example, the retry is not executed.

Set the retry cycle in units of minutes. The cycle setting ranges from 0 to 255, and should be shorter than the BACKUP CYCLE. If the value is the same as or longer than the BACKUP CYCLE, RESERVE TIME BACKUP cannot set to “VALID”.

When it is set to 0, retry will not be performed.

E. MODE CHANGE BACKUP

Set the automatic backup function to be valid or invalid when the mode is switched from teach mode to play mode.

Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

F. STARTUP AUTO BACKUP

Set the backup function to be valid or invalid when the power of the controller is turned ON.

Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

G. SPECIFIC INPUT BACKUP

Set the backup function to be valid or invalid when specific input signal (#40560) is input (rising edge from 0 to 1).

Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

H. UNIV. OUT NO. ON ERROR

Set “1” to the specified user output signal which was specified in this chapter when the automatic backup error occurs.

The term “automatic backup error” here means that the backup is not performed successfully before the next backup (including retry operation) starts.

I. DISPLAY AT EMERGENCY

Set the method of notification of the automatic backup error to “ERROR” or “MESSAGE.”

Each time [SELECT] is pressed, “ERROR” and “MESSAGE” are displayed alternately.

J. DURING ALARM OCCURRENCE

Set the backup function to be valid or invalid when an alarm occurs.

Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.
9 System Backup
9.3 Automatic Backup Function

K. DEVICE
Press (SELECT) to display the device list.

<table>
<thead>
<tr>
<th>The Device Name in Display</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: pendant</td>
<td>Set the backup to the CompactFlash of the programming pendant.</td>
</tr>
<tr>
<td>CF: controller</td>
<td>Set the backup to the CompactFlash of the YCP21 board. When the “CF: controller” of the device name is not shown, refer to section 9.3.2.2 the CompactFlash of the YCP21.</td>
</tr>
<tr>
<td>RAMDISK</td>
<td>It will be shown when the optional function of High Speed Ethernet Server function is effective. It can back up by the controller high speed ethernet server function command. Refer to the [controller Instruction HIGH-SPEED ETHERNET SERVER FUNCTION].</td>
</tr>
<tr>
<td>USB1: controller</td>
<td>Set the backup to the USB memory of the YCP21 board.</td>
</tr>
<tr>
<td>USB2: controller</td>
<td>Set the backup to the USB memory of the YCP21 board.</td>
</tr>
</tbody>
</table>

L. STORED FILE SETTING
Set the number of files to be stored by the automatic backup function.
The number mentioned on the right side of this item with “(Max)” indication is the maximum number of files that can be stored in the Compact-Flash inserted when this window is displayed.
The settings range from 1 to (Max). When this setting value is changed, the backup file arrangement starts. (Max is 100.)

M. BACKUP FILES
Indicates the existence of the files or the number of backup files stored in the CompactFlash inserted when this window is displayed.

N. LATEST BACKUP FILE
Indicates the date of the latest file in the CompactFlash inserted when this window is displayed.

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

ARRANGE will not be displayed when the device of the CF: controller is set on.

7. Set the desired item, and press [ENTER].
9.3 Automatic Backup Function

- **Window Settings**
  RS parameter can restrict the settings of some items in the automatic backup window.

  When setting the bit of RS096 parameter shown below to “1”, the corresponding items are restricted. The restricted items are indicated with “INVALID” in the display and inputting/modification to the item becomes impossible. Also, the automatic backup does not function with the restricted items.

- **Output the Backup Processing Status**
  Able to confirm the backup processing status by the system output signal.

  <#50766> It is creating the auto backup data. When this signal is turned ON, it is creating the backup data. Some operations are limited. For example, the start signal is not accepted.

  <#50767> It is transferring the backup data. When this signal is turned ON, writes the data to the CompactFlash after creating the backup data. Do not remove the CompactFlash from the programming pendant during this period.

**NOTE**

When the value of the parameter S2C737 is changed from “0” to “1” or “1” to “0”, the setting details of RESERVE TIME BACKUP are not taken over, but the others are.
9 System Backup
9.3 Automatic Backup Function

9.3.3 Limiting the Automatic Backup File Creation

9.3.3.1 Setting to Limit the Automatic Backup File Creation

It is applicable from version DN1.60-00 to limit the backup file creation executed by the automatic backup function to once a day.

To limit the backup file creation to once a day, set the following parameter.

<table>
<thead>
<tr>
<th>Parameter number</th>
<th>Contents</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S0C682</td>
<td>Limits the backup file creation executed by the automatic backup function to once a day.</td>
<td>0 (Invalid) 1 (Valid)</td>
</tr>
</tbody>
</table>

When the automatic backup function is requested to start in the state of limiting the automatic backup file to once a day, an error occurs to notify that the backup has not been processed.

To avoid the above error, set DISPLAY AT EMERGENCY to “message”.

For the setting of DISPLAY AT EMERGENCY, refer to chapter 9.3.2.6 “AUTO BACKUP SET Display” and chapter 9.3.2.7 “AUTO BACKUP EXTENSION FUNCTION SET Window”.

NOTE
9.4 Loading the Backup Data from the CompactFlash

To restore the backup memory in the auto backup function is done in the maintenance mode. Otherwise, restore from the CompactFlash of the programming pendant or USB memory when backup is done at the optional high speed ethernet server function command. Prepare either of the CompactFlash or the USB memory to make copies.

9.4.1 Loading Procedure

To restore from the CompactFlash of the programming pendant, perform the following procedures No.1 to 8. To restore from the CompactFlash on the YCP21 board, perform the following procedures from No.9. For the USB memory, select one among the “USB: pendant”, “USB1: controller” and “USB2: controller” in the {EX. MEMORY} -{DEVICE} to restore.

1. Insert the CompactFlash with the backup data in the CompactFlash slot on the programming pendant. (When selecting “USB1: controller” or “USB2: controller”, insert it in the YCP21 board.)
   – The backup data is stored under the file name “CMOSBK.BIN” or “CMOSBK???.BIN” (?? denotes figures.)
2. Turn ON the controller power supply while pressing [MAIN MENU].
3. Change the security mode to the management or higher mode.
4. Select {EX. MEMORY} under the main menu.
   – The sub menu appears.
9 System Backup
9.4 Loading the Backup Data from the CompactFlash

– When set the (SYSTEM)- (SETUP)- (OPTIONAL FUNCTION)-
  (AUTO BACKUP (YCP21)) as “USE”, the following sub menu
  appears.

5. Select (SYSTEM RESTORE).
  – The BACKUP FILE LIST display appears.
6. Select the file to be loaded.
   - The dialog box appears for the YIF/YCP21 board replacement confirmation.
     ![Dialog Box]
     – Select {YES} if the YIF/YCP21 board has been replaced, or select {NO} if it has not been replaced.
     – Selecting {YES} initializes the system monitoring time.
     – Selecting {NO} continues the counting of the current system’s monitoring time.

7. Select from the confirmation dialog box.
   - The dialog box appears for the loading confirmation.
     ![Dialog Box]
     – Select {YES} in the loading confirmation dialog box to start loading the contents of “CMOSBK.BIN” or “CMOSBK???.BIN” (?? denotes figures) from the CompactFlash to the controller CMOS.

8. Select {YES}.
9. Turn the power on, while pressing the [MAIN MENU].
10. Change the security mode to the management or higher mode.
11. Select (External memory) in the main menu.
   - The sub menu will appear.
12. Select {SYSTEM RESTORE (YCP21)}.
   - The backup-file list display will appear.
13. Select desired date file.
   – The YIF/YCP21 board dialog will appear.
   – Select [YES] when exchanged the YIF/YCP21 board. If not, select [NO].
   – When select [YES], cumulative time display will be initialized. For selecting [NO], cumulative time display will continue.

14. Select from the confirmation dialog box.
   – The dialog box appears for the loading confirmation.
   – Selecting [YES] in the confirmation dialog starts loading the content of [CMOSBK.BIN] to CMOS of the YCP21 board.
15. Select [YES].

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
</table>
| Note that executing “SYSTEM RESTORE” or “SYSTEM RESTORE (YCP21)” replaces the current CMOS data with the data of the file “CMOSBK.BIN” or “CMOSBK???.BIN” (?? denotes figures) in the CompactFlash.

After “CMOSBK.BIN” has been loaded, check if the new data is the same as the previously saved data in the CMOS, and call the master job to confirm that the current manipulator position is correct and safe. Then, start moving the manipulator. |
## 9.5 Error List

### 9.5.1 Error Contents

<table>
<thead>
<tr>
<th>Error No.</th>
<th>Data</th>
<th>Message</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>0770</td>
<td>*</td>
<td>The robot or the station is in motion.</td>
<td>The automatic backup would not work when the robot or a manipulator is in motion.</td>
</tr>
<tr>
<td>3390</td>
<td></td>
<td>File not found</td>
<td>The file to be loaded no longer exists.</td>
</tr>
<tr>
<td>3430</td>
<td>*</td>
<td>I/O error on the drive</td>
<td>The capacity of the CompactFlash is 128MB. Change the CompactFlash to 256MB.</td>
</tr>
<tr>
<td>3460</td>
<td>*</td>
<td>Cannot backup CompactFlash</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Insufficient capacity of the CompactFlash</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Cannot access the CompactFlash</td>
<td></td>
</tr>
<tr>
<td>3501</td>
<td>*</td>
<td>Confirm the status of CompactFlash.</td>
<td>Cannot access the CompactFlash</td>
</tr>
<tr>
<td>3550</td>
<td>*</td>
<td>The automatic backup is executed. Try it later.</td>
<td>The automatic backup window cannot be called to display while the automatic backup is being processed.</td>
</tr>
<tr>
<td>3551</td>
<td>*</td>
<td>The automatic backup is executed. Arrange the file after it is finished.</td>
<td>The file arrangement cannot be operated during the automatic backup operation.</td>
</tr>
<tr>
<td>3560</td>
<td>*</td>
<td>Failed to re-arrange the backup file.</td>
<td>Failed to re-arrange the backup file for another reason than the access to CompactFlash.</td>
</tr>
<tr>
<td>3580</td>
<td>*</td>
<td>Accessing to backup file. Try it later.</td>
<td>To display another window and then display the automatic backup window again after &quot;ARRANGE&quot; operation, &quot;ARRANGE&quot; process should be completely finished.</td>
</tr>
<tr>
<td>3581</td>
<td>*</td>
<td>Accessing to backup file. Try &quot;ARRANGE&quot; operation later.</td>
<td>The previous &quot;ARRANGE&quot; process should be completely finished to perform the next &quot;ARRANGE&quot; operation.</td>
</tr>
</tbody>
</table>
10 Upgrade Function

10.1 Functional Overview

The controller applies two software for the CPU configuration: a software for YCP21 (for the main CPU board) and a software for YPP (for programming pendant). The system works only with the combination of certain versions due to a compatibility problem of each software. Therefore, with the system version NS3.00 and the subsequent versions, the controller can upgrade the software for YPP if the combination of the software for YCP21 and YPP is invalid.

10.2 Upgrade Procedure

10.2.1 Confirmation of Software Version

The compatibility of the versions of YCP21 and YPP are automatically checked in 20 seconds after the controller power supply is turned on.

• In case the versions of YCP21 and YPP matches.

1. Automatic upgrade process completes and the communication process between YCP21 and YPP is restarted.
2. Initial window appears approx. 45 seconds later.
10.2.2 Automatic Upgrade of YPP

In case that the pendant application version of YPP is older than the one of YCP21 or the pendant application version of YPP is not compatible to the one of YCP21, the YPP is automatically upgraded.

Not only the application software but the OS of the Programming Pendant is also upgraded automatically. (OS: Operating System)

1. After the automatic upgrade process is completed, the communication process between YCP21 and YPP is restarted.
   - Some upgraded software require restart.
     In this case restart is done automatically and the communication process between YPP and YCP21 starts again.
2. Initial window appears approx. 45 seconds later.

- Every time the OS is upgraded automatically, restart is done. There is no need of calibrating because the calibration data is taken over.
- To start the controller without the auto upgrade process, press all of the [Interlock]+[5]+[Select] keys at the same time to start.
DO NOT turn off the main power supply during automatic upgrade process.

In case the main power supply is turned off, exercise the following process.

• Turn on the main power supply of the controller.
  – Automatic upgrade might be exercised again.

• In case error occurs during automatic upgrade process.
  (1) Prepare CF for upgrading or USB memory.
  (2) Press [2], [8] and [HIGH SPEED] at the same time.
  - Upgrade of the OS of Programming Pendant
  (3) Press [INTERLOCK], [8] and [SELECT] at the same time.
  (4) Exercise manual upgrading.
    - Refer to “DX200 Upgrade Procedure” (165560-1CD).

• If no recovery is made with all the procedure above, replace the pendant.
10.3 Error Message

If Error occurs while automatic upgrading, exercise the following procedure.

- Turn on the main power supply of the controller.
  - Automatic upgrade might be exercised again.
- In case error occurs during automatic upgrade process.
  1. Prepare CF for upgrading or USB memory.
  2. Press [2], [8] and [HIGH SPEED] at the same time.
     - Upgrade of the OS of Programming Pendant
  3. Press [INTERLOCK], [8] and [SELECT] at the same time.
  4. Exercise manual upgrading.
     - Refer to “DX200 Upgrade Procedure” (165560-1CD) for details.
11 Programming Pendant

11.1 Disconnection Function

Disconnection function enables to cut off the communication between the programming pendant and the controller.

1. Long press [Simple Menu] key to show the pop-up menu.

2. Select "Disconnect" button, and the confirmation dialog appears.
3. Select “YES” to disconnect the communication between the controller and the programming pendant. After disconnecting the communication, the message is displayed.

4. Press “OK” on the message dialog, otherwise the window is closed automatically after 10 seconds since the window appears on the screen, and then the programming pendant startup window is displayed.
   When connecting the controller and the programming pendant again, press “Connect to DX200” button.
11 Programming Pendant
11.2 Reset Function

Reset function enables to restart only the programming pendant while the main power supply of the controller is ON.

If unable to operate the robot by the programming pendant causing from the communications error of the programming pendant, recover the programming pendant by following procedures.

5. Confirmation of the LED (DS1) display on the JANCD-YIF01-□E
   - Check the LED display on the JANCD-YIF01-□E.

   • Check that an alphabet letter or a number is displayed on the LED display.
   • Check that a dot is displayed at the lower right of the LED. If it is, check that the dot is blinking or lighted.
   • If the displayed alphabet or the number is continuously changing, write down them in order.

6. Reset the programming pendant
   - Open the CF slot cover on the programming pendant.
   - There is a small hole below the CF insertion slot. Insert a spit to press inside the hole.
   - The programming pendant is rebooted and it starts connecting to the controller again.
11.3 Touch Panel Invalidate Function

The touch panel invalidate function enables to invalidate the touch panel operation of the programming pendant (key operation is still valid).

Even if the touch panel is failure, it is able to prevent the mis-operation by using this function.

Operate the following procedures to valid/invalid the touch panel.

- **Invalidate the Touch Panel**
  1. Push down the [INTER LOCK]+[AUX] keys at the same time. The confirmation dialog to invalidate the touch panel appears.
  2. Move the focus area over the “YES” on the confirmation dialog by using [←] key.

When the touch panel is invalid, an icon, which shows the invalidating the touch panel, is displayed on the status area, and the message “Touch operation is invalid” is displayed on the message area.
Validate the Touch Panel

1. Push down the [INTER LOCK]+[AUX] keys at the same time. The confirmation dialog to validate the touch panel appears.

   Validate the Touch Panel
   1. Push down the [INTER LOCK]+[AUX] keys at the same time. The confirmation dialog to validate the touch panel appears.
   2. Move the focus area over the “YES” on the confirmation dialog by using [←] key.
   3. Press [Select]. The touch panel become valid.

   • In the case of invalidating the touch panel, the touch panel invalidating status continues even though the power supply is turned ON/OFF.
   • To validate the touch panel again, push down the [INTER LOCK]+[AUX] keys at the same time, and then validate the touch panel on the confirmation dialog.
12 Modification of System Configuration

12.1 Addition of I/O Modules

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

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

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the “SECURITY MODE” to the “MANAGEMENT MODE”.
3. Select {SYSTEM} under the main menu.
   - The system window appears.
4. Select {SETUP}.
   - The SETUP window appears.
   - The items marked with “■” cannot be selected.
5. Select {IO MODULE}.
12 Modification of System Configuration

12.1 Addition of I/O Modules

- The current status of the mounted I/O module is shown.

![Image of I/O module status](image)

6. Confirm the status of mounted I/O module.

- Confirm that each station (ST#) window is the same as the I/O module’s actual mounting status.

- The following information is shown for each station.

<table>
<thead>
<tr>
<th>ST#</th>
<th>Station address of I/O module</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI</td>
<td>Number of contact input points^1</td>
</tr>
<tr>
<td>DO</td>
<td>Number of contact output points^1</td>
</tr>
<tr>
<td>AI</td>
<td>Number of analog input points^1</td>
</tr>
<tr>
<td>AO</td>
<td>Number of analog output points^1</td>
</tr>
<tr>
<td>BOARD</td>
<td>Circuit board type^2</td>
</tr>
</tbody>
</table>

1) A hyphen, -, indicates that the corresponding I/O section is not mounted.
2) If the system cannot recognize the circuit board type, a row of stars (*****) are shown. No problem will occur as long as the values displayed in DI, DO, AI, and AO are correct.

7. Press [ENTER].

- Confirm the statuses of the mounted I/O modules for the other stations.

![Image of I/O module status](image)

8. Press [ENTER].
12.1 Addition of I/O Modules

- The confirmation dialog box is shown.

9. Select {YES}.

- The system parameters are then set automatically according to the current mounted hardware status, and the window will be changed to the external I/O setup window.

If there is a difference between the displayed contents and the actual mounted status, confirm the status again. If the status is correct, the I/O module may be defective: in such a case, contact your Yaskawa representative.
12.2 Allocating External I/O Signal

- Allocation of the external I/O signal

The DX200 exchanges I/O data with the I/O interface by using external I/O signal area (#2xxxx #3xxxx). The allocation of the external-I/O signal area and I/O interface used to be unchangeable since they have been allocated to the signals from lower to higher numbers in bytes (8 points unit) by system software. With the function of allocating the external-I/O signal, the change is possible and a user can specify the signals in byte (8 points unit) to allocate.

1. The EXTERNAL IO SETUP window appears.
2. Select “AUTO” or “MANUAL” under the ALLOCATION MODE.
   – The selected menu appears.

   ![Diagram of allocation mode selection]

   When the allocation mode is changed from “MANUAL” to “AUTO”, the set allocation data is discarded, and reallocation in the Auto mode takes place.
   If it is necessary to save the set allocation data, save it using the external memory menu in advance.
3. Select the allocation mode to set.
   - To operate the I/O signal allocation automatically, select the allocation mode “AUTO”.
   - To operate the I/O signal allocation manually, select the allocation mode “MANUAL”.
   - Selected allocation mode appears.

4. Select “DETAIL” under the “EXTERNAL IO ALLOCATION”.
   - The External Input Signals Allocation window appears.
   - When select the “AUTO”, skip the following procedures from No. 5 to No. 7. Operate from the procedure No. 8.
   - S for the allocation mode “MANUAL”, operate the following procedures.
5. Select the external input signal number (at the change source) to be changed. (In the setting example, select “#20010”.)
   – The select menu appears.

6. Select “MODIFY”, and input the external input signal number (at the change destination) to be changed. (In the setting example, enter ‘20190’.)
   – The external I/O signal is changed.

7. Likewise, select/modify the number of the external input signal.
   – Repeat select/modify until it becomes the desired allocation.
8. Press [ENTER].
   - The External Output Signals Allocation window appears.

9. Like the case of the external input signal, select/modify the external output signal.
   - Repeat select/modify until it becomes the desired allocation.

10. Press [ENTER].
    - The confirmation dialog box appears.
12 Modification of System Configuration

12.2 Allocating External I/O Signal

11. Select {YES}.

– The settings are confirmed, and the SETUP window reappears.
Explanation about the External I/O Signal Allocation Window

The details of the window are explained using the window example. The range over which the cursor can move is the hatched area of the figure.

<table>
<thead>
<tr>
<th>EXTERNAL I/O ALLOCATION (INPUT)</th>
<th>ST#</th>
<th>CH MAC ID ADDR BYTE NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>#20010</td>
<td>14</td>
<td>0 0 0 5</td>
</tr>
<tr>
<td>#20060</td>
<td>16</td>
<td>0 0 1 1</td>
</tr>
<tr>
<td>#20070</td>
<td>16</td>
<td>0 2 6 4</td>
</tr>
<tr>
<td>#20120</td>
<td>16</td>
<td>0 3 10 3</td>
</tr>
<tr>
<td>#20160</td>
<td>16</td>
<td>0 254 0 1</td>
</tr>
<tr>
<td>#20190</td>
<td>17</td>
<td>0 1 6</td>
</tr>
<tr>
<td>#20200</td>
<td>17</td>
<td>0 0 1</td>
</tr>
</tbody>
</table>

① External I/O signal numbers

Indicates the beginning number of the external I/O signals allocated to each I/O area. On the allocation window, the set values of these items are used and displayed in ascending order. The following contents are displayed.

#20010 to #25120: The number of the signal allocated to the beginning of each I/O area, in the input signals

#30010 to #35120: The number of the signal allocated to the beginning of each I/O area, in the output signals

#$-----: Unallocated I/O area

② ST#

Indicates the DX200 station number allocated to each I/O board. The displayed contents include the following:

0 : General I/O board (JANCD-YIO21)

1 to 13: Optional I/O board which is connected to the JANCD-YSF21 using a serial communication cable (The serial communication station number is determined by the rotary switch setting on each board.)

16 : The first field bus board

(Normally, optional board inserted into CN1 of the riser card in the CPU rack.)

17 : The second field bus board

(Normally, optional board inserted into CN2 of the riser card in the CPU rack.)

③ CH

Indicates the channel number (network communication system) on the board. The following contents are displayed.

0: I/O area for channel 1
1: I/O area for channel 2
### Modification of System Configuration

#### 12.2 Allocating External I/O Signal

**MAC ID**

Indicates the network communication station number set in the channel concerned on the board concerned. Regarding station numbers that cannot be displayed, or station numbers that do not need to be displayed, '0' is displayed. The following contents are displayed.

- **0**: No station number, or network communication station number '0'
  - Scanner station of EtherNet/IP board (PCU-ETHIO)
- **1 to 251**: Network communication station number '1' to '251'
  - Adapter station of EtherNet/IP board (PCU-ETHIO)
  - (Scanner allocation number sequence)
- **252**: Unallocated I/O area of channel 1
- **253**: Unallocated I/O area of channel 2
- **254**: Communication status area of channel 1
- **255**: Communication status area of channel 2

**ADDR**

Indicates the offset address from the beginning of each I/O area when the inside of each I/O area is further divided into multiple parts.

**BYTE**

Indicates the size (number of bytes) inside each I/O area.

**NAME**

Indicates the name of each I/O board.
### Allocation example of external I/O signal

**<Example System>**

The following shows a system of setting example. I/O interface must be recognized in the I/O module setting window. The communication slots #0 to #15 are recognized as ST#00 to ST#15 of I/O module. PCI slot #1 and #2 are recognized as ST#16 and ST#17 of I/O module.

**I/O Interface**

- **Communication slot #0**
  - GPIO board JANCD-YI021-E
  - Input: 40 points
  - Output: 40 points

- **PCI slot #1**
  - Optional IO board CC-Link J61BT11N
  - (1 CC-Link station occupied setting)
  - Input: 16 points
  - Output: 16 points

**I/O module setting**

<table>
<thead>
<tr>
<th>ST#</th>
<th>DI</th>
<th>DO</th>
<th>AI</th>
<th>AO</th>
<th>BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>0040</td>
<td>0040</td>
<td>0040</td>
<td>0040</td>
<td>YSF21 (YI021 NPN)</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>
<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>0024</td>
<td>0024</td>
<td>-</td>
<td>-</td>
<td>J61BT11N/SLAVE</td>
</tr>
<tr>
<td>17</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NONE</td>
</tr>
<tr>
<td>18</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NONE</td>
</tr>
<tr>
<td>19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NONE</td>
</tr>
</tbody>
</table>

Board status: 8 points
System area: 8 points
Secure the area by adding above points
Modification of System Configuration

12.2 Allocating External I/O Signal

< Setting example: Automatic setting >

When the automatic setting is performed by external IO allocation, IO data is allocated to the external IO signals from lower to higher numbers.

I/O module setting

<table>
<thead>
<tr>
<th>ST#</th>
<th>DI</th>
<th>DO</th>
<th>AI</th>
<th>AO</th>
<th>BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>YSF21 (Y1021 NPN)</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>
<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>J61BT11N (SLAVE)</td>
</tr>
<tr>
<td>17</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NONE</td>
</tr>
<tr>
<td>18</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NONE</td>
</tr>
<tr>
<td>19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NONE</td>
</tr>
</tbody>
</table>

In this case, the following contents are shown in the external IO setting window.

External IO allocation setting

EXTERNAL IO ALLOCATION (INPUT)

<table>
<thead>
<tr>
<th>ST#</th>
<th>CH</th>
<th>MAC ID</th>
<th>ADDR</th>
<th>BYTE</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>#20010</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5    YSF21</td>
</tr>
<tr>
<td>#20060</td>
<td>16</td>
<td>254</td>
<td>0</td>
<td>1    J61BT11N</td>
<td></td>
</tr>
<tr>
<td>#20070</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>2    J61BT11N</td>
<td></td>
</tr>
</tbody>
</table>

EXTERNAL IO ALLOCATION (OUTPUT)

<table>
<thead>
<tr>
<th>ST#</th>
<th>CH</th>
<th>MAC ID</th>
<th>ADDR</th>
<th>BYTE</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>#30010</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5    YSF21</td>
</tr>
<tr>
<td>#30060</td>
<td>16</td>
<td>254</td>
<td>0</td>
<td>1    J61BT11N</td>
<td></td>
</tr>
<tr>
<td>#30070</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>2    J61BT11N</td>
<td></td>
</tr>
</tbody>
</table>
12 Modification of System Configuration
12.2 Allocating External I/O Signal

< Setting example: Allocating the CC-Link board data only by manual setting >

IO data of the CC-Link can be allocated from the top while data of the board status/system area allocated to different area.

I/O module setting

In this case, the following contents are shown in the external I/O setting window.

External IO allocation setting

<table>
<thead>
<tr>
<th>EXTERNAL IO ALLOCATION (INPUT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST#</td>
</tr>
<tr>
<td>#20010</td>
</tr>
<tr>
<td>#20100</td>
</tr>
</tbody>
</table>

Input data (16 points)
Board status (8 points)

<table>
<thead>
<tr>
<th>EXTERNAL IO ALLOCATION (OUTPUT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST#</td>
</tr>
<tr>
<td>#30010</td>
</tr>
<tr>
<td>#30100</td>
</tr>
</tbody>
</table>

Output data (16 points)
System area (8 points)
12.3 Addition of Base and Station Axes

To add the base and station axes, mount all hardware correctly and then execute maintenance mode.

**NOTE**

Addition operation must be performed in the management mode.

In the operation mode or editing mode, only reference of status setting is possible.

When adding a base and a station axis, set the following items:

- **TYPE**
  - Select one in the type list.
    - In case of base axis (B1, B2, B3...B8)
      Select one of RECT-X, -Y, -Z, -XY, -XZ, -YZ or -XYZ.
    - In case of station axis (S1, S2, S3, S4, S5...S24)
      Select UNIV-* ("*" represents the number of axes) when using a mechanism other than the registered type as a station axis.

- **CONNECTION**
  - In the CONNECTION window, specify the SERVOPACK which is connected with each axis group, the contactor which is used for the SERVOPACK, and the overrun signal (OT).

- **AXIS TYPE**
  - Select from the axis type list.
    - In case of TURN-* type
      No need to select (The axis type is set as TURN type.)
    - In case of RECT-* type
      Select BALL-SCREW type or RACK & PINION type.
    - In case of UNIV-* type
      Select BALL-SCREW type, RACK & PINION type or TURN type.

- **MECHANICAL SPECIFICATION**
  - If axis type is ball-screw type, set the following items:
    - MOTION RANGE (+) [mm]
    - MOTION RANGE (-) [mm]
    - REDUCTION RATIO (numerator)
    - REDUCTION RATIO (denominator)
    - BALL-SCREW PITCH [mm/r]
  - If axis type is rack & pinion type, set the following items.
    - MOTION RANGE (+) [mm]
    - MOTION RANGE (-) [mm]
    - REDUCTION RATIO (numerator)
12.3 Addition of Base and Station Axes

- REDUCTION RATIO (denominator)
- PINION DIAMETER [mm]

- If axis type is turn type, set the following items.
  - MOTION RANGE (+) [deg]
  - MOTION RANGE (-) [deg]
  - REDUCTION RATIO (numerator)
  - REDUCTION RATIO (denominator)
  - OFFSET (1st and 2nd axis) [mm]

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

* Select MOTOR, AMPLIFIER and CONVERTER from each type list on the display.
12 Modification of System Configuration

12.3 Addition of Base and Station Axes

12.3.1 Base Axis Setting

12.3.1.1 Selection of Base Axis Type

Select the type of base axis to be added/modified.

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.

2. Change the "SECURITY MODE" to the "MANAGEMENT MODE".

3. Select {SYSTEM} under the main menu.
   – The system window appears.

4. Select {SETUP}.
   – The SETUP window appears.
   – Note that the items marked with "■" cannot be set.
5. Select {CONTROL GROUP}.
   – The current control group type is displayed.

   ![Control Group Selection](image1)

6. Move the cursor to the type of control group to be modified, and press [SELECT].
   – The MACHINE LIST window is displayed.

   ![Machine List](image2)

   RECT-X: traverse X-axis base
   RECT-Y: traverse Y-axis base
   RECT-Z: traverse Z-axis base
   RECT-XZ: traverse XZ-axis base
   RECT-XY: traverse XY-axis base
   RECT-XYZ: traverse XYZ-axis base

   (See the figures on the next page)
7. Select one in the type list.

   – After the type selection, the window returns to the CONNECT window.

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

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

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

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

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

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

- **RECT-XYZ**
  
  Base 1st, 2nd, and 3rd axes directions of travel coincide with robot coordinate X-Axis, Y-Axis, and Z-Axis, respectively.
12.3.1.2 Connection Setting

In the CONNECT window, it is specified that each axis of each control group is connected to which connector of the SERVO board, which break of the contactor unit, which converter, and which overrun signal.

1. Confirm the type of each control group in the CONNECT window.
   - The connection status of each control group is displayed.

[CONNECT(STO) window]

[CONNECT (CONTACTOR) window]
2. Select the connection item of a desired control group.
   – The settable items are displayed.
   – Select an item to change the setting. Select {Cancel} to return to the CONNECT window.

[CONNECT (STO) window]

– Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [ ] represent axis numbers, and indicate which axis is connected to which connector.

– Specify which break (BRK) of each control group is connected to.
The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which break.

– Specify which converter (CV) each axis of each control group is connected to.
The numbers in [ ] represent the converter numbers, and indicate which axis is connected to which converter.

– Specify which on enable signal (ON_EN) each control group is connected to.

– Specify which overrun signal (OT) each control group is connected to.
12.3 Addition of Base and Station Axes

- Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
  The numbers in [ ] represent axis numbers, and indicate which axis is connected to which connector.

- Specify which break (BRK) of the contactor unit each axis of each control group is connected to.
  The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which break.

- Specify which converter (CV) each axis of each control group is connected to.
  The numbers in [ ] represent the converter numbers, and indicate which axis is connected to which converter.

- Specify which overrun signal (OT) each control group is connected to.

- In this example, B1 (Base) is connected in the following manner:

  1st axis → SERVO Board (SV #2), Connector (7CN),
  Contact Unit (TU #1), break Connector (BRK7),
  Converter (CV #1)

  2nd axis → SERVO Board (SV #2), Connector (8CN)
  Contact Unit (TU #1), break Connector (BRK8)
  Converter (CV #2)

  3rd axis → SERVO Board (SV #2), Connector (9CN)
  Contact Unit (TU #1), break Connector (BRK9)
  Converter (CV #3)

  Overrun → (OT2)
12 Modification of System Configuration
12.3 Addition of Base and Station Axes

3. Therefore, when an overrun alarm occurs, the subcode is indicated by the control group.
   However, select “NOT CONNECT” if an overrun switch is not installed to the control group or the allocation of the external axis overrun signal is not needed.
   Regarding the connection of the external axis overrun signal, refer to chapter 14.7 “Universal I/O Circuit Board (JANCD-YIO21-E)” at page 14-37.

4. Select a desired item.

5. Press [ENTER] in the CONNECT window.
   – The setting in the CONNECT window is completed and the window moves to the AXES CONFIG window.

An error message Error 8217 “Cannot change setting. Check the setting of spot high speed spec.” may appear when press [ENTER] in the CONNECT window.

**NOTE**

When the error message appears, invalid SPOT HIGH SPEED SPEC or review the configuration of the control group by referring to section 9.12 “High Speed Spot Welding Function” at DX200 OPERATOR’S MANUAL FOR SPOT WELDING USING MOTOR GUN.
12.3.1.3 Axis Configuration Setting

The axis type is specified in the AXES CONFIG window.

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

2. Select the axis type to be modified.
   (1) The settable axis type is displayed.
   (2) Select “BALL-SCREW” when the servo track is ball-screw type,
       and “RACK&PINION” when the servo track is rack & pinion type.
       After the selection, the window returns to the AXES CONFIG window.
   (3) Select the axis type.


4. The setting in the AXES CONFIG window is completed and the
   window moves to the MECHANICAL SPEC window.
12.3.1.4 Mechanical Specification Setting

The mechanical data is specified in the MECHANICAL SPEC window.

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

The MECHANICAL SPEC window (in case of the BALL-SCREW type)

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

- **REDUCTION RATIO**: Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.

- **BALL-SCREW PITCH**: Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

The MECHANICAL SPEC window (in case of the RACK&PINION type)

- **MOTION RANGE**: Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)
12 Modification of System Configuration

12.3 Addition of Base and Station Axes

- **REDUCTION RATIO**: Input the numerator and the denominator. 
  <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

- **PINION DIAMETER**: Input the diameter of a pinion. (Unit: mm)

2. Select the item to be modified.

- Point the cursor to the item subject for setting value modification, and press [SELECT].

3. Modify the settings.

- The selected item is in the input status. 
  Input the setting value, and press [ENTER].


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

- When [ENTER] is pressed in the MECHANICAL SPEC window for the last axis, the setting in the MECHANICAL SPEC window is completed and the window moves to the MOTOR SPEC window.

12.3.1.5 Motor Specification Setting

The motor data is specified in the MOTOR SPEC window.

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

- The motor specification of each axis is displayed.

![Motor Specification Setting](image)
2. Select the desired item.
   − When a numerical value is selected, the number input buffer line appears.
   − When MOTOR (or SERVO AMP or CONVERTER) is selected, the list window of MOTOR (SERVO AMP, or CONVERTER) appears.
   − ROTATION DIRECTION: Set the rotation direction to which the current position is increased. (The counterclockwise view from the loaded side is the normal rotation.)

Fig. 12-1: AC Servo Motor

   − MAX. RPM: Input maximum rotation speed of a motor. (Unit: rpm)
   − ACCELERATION TIME: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
   − INERTIA RATIO: The initial value is set at 300 in case of servo track; 0 in case of rotation axis.
   However, if the following phenomenon occurs in motion, deal with the followed procedure.
   − <Phenomenon1>
     During motion, the axis moves unsteady on advance direction.
     → Confirm the motion with increasing this ratio in each 100.
   − <Phenomenon2>
     During pause, the motor makes a lot of noise.
     → Confirm the motion with decreasing this ratio in each 100.

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

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

5. Initialize the related files.
   – To add and modify the base axis in completed.
12.3.2 Station Axis Setting

12.3.2.1 Selection of Station Axis Type

Select the type of station axis to be added/modified.

1. Confirm the type of control group in CONTROL GROUP window.
   - The CONTROL GROUP window appears.

2. Select the type of control group to be modified.
   - The MACHINE LIST window appears.
12.3 Addition of Base and Station Axes

3. Select desired type in the type list.
   - After the type selection, the window returns to CONNECT window.
   - Select "UNIV" (universal) when using a mechanism other than the registered type (such as a servo track) as a station axis. When "UNIV" is selected, interpolation motion (linear, circular, etc.) is not supported.

12.3.2.2 Connection Setting

In the CONNECT window, it is specified that each axis of each control group is connected to which connector of the SERVO board, which break of the contactor unit, which converter, and which overrun signal.

1. Confirm the type of each control group in the CONNECT window.
2. Connection status of each control group is displayed. Select the connection item of desired control group.
   - The settable items are displayed.
   - Select an item to change the setting. Select {Cancel} to return to the CONNECT window.

[CONNECT (STO) window]
12 Modification of System Configuration
12.3 Addition of Base and Station Axes

– Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [ ] represent axis numbers, and indicate which axis is connected to which connector.

– Specify which break (BRK) of each control group is connected to.
The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which break.

– Specify which converter (CV) each axis of each control group is connected to.
The numbers in [ ] represent the converter numbers, and indicate which axis is connected to which converter.

– Specify which on enable signal (ON_EN) each control group is connected to.

– Specify which overrun signal (OT) each control group is connected to.

[CONNECT (CONTACTOR) window]

– Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [ ] represent axis numbers, and indicate which axis is connected to which connector.

– Specify which break (BRK) of the contactor unit each axis of each control group is connected to.
The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which break.

– Specify which converter (CV) each axis of each control group is connected to.
The numbers in [ ] represent the converter numbers, and indicate which axis is connected to which converter.

– Specify which overrun signal (OT) each control group is connected to.
12 Modification of System Configuration
12.3 Addition of Base and Station Axes

− In this example, S1 (Station) is connected in the following manner:

1st axis → SERVO Board (SV #1), Connector (7CN),
Contactor Unit (TU #1), break Connector (BRK7),
Converter (CV #2)

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

Overrun → (OT2)

3. An overrun signal is allocated to a control group. Therefore, when an overrun alarm occurs, the subcode is indicated by the control group. However, select "NOT CONNECT" if an overrun switch is not installed to the control group or the allocation of the external axis overrun signal is not needed. Regarding the connection of the external axis overrun signal, refer to section 14.7.1 “Universal I/O Circuit Board (JANCD-YIO21-E)” on page 14-37.

4. Select a desired item.

5. Press [ENTER] in the CONNECT window.
   − The setting in the CONNECT window is completed and the window moves to the AXES CONFIG window.
12.3.2.3 Axis Configuration Setting

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

1. Confirm axis type of each axis in the AXES CONFIG window.
   - The axis type of each axis is displayed.
     • The AXES CONFIG window (in case of the TURN type)

   • The AXES CONFIG window (in case of the UNIVERSAL type)
2. Select the axis type to be modified.
   – The selectable axis type is displayed.

3. Select the desired axis type.

4. Press [ENTER] in the AXES CONFIG window
   – The setting in the AXES CONFIG window is completed and the window moves to the MECHANICAL SPEC window.
12.3.2.4 Mechanical Specification Setting

The mechanical data is specified in the MECHANICAL SPEC window.

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

   – The mechanical specification of axis is shown.

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

   - **REDUCTION RATIO**: Input the numerator and the denominator. 
     <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

   - **OFFSET**: Offset should be specified at “TURN-2” type only. 
     Input length between the center of bending axis (1st axis) and the turning table (2nd axis). (Unit: mm)
12 Modification of System Configuration
12.3 Addition of Base and Station Axes

- The MECHANICAL SPEC window (In case of the BALL-SCREW type)

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

- REDUCTION RATIO: Input the numerator and the denominator. The reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.

- BALL-SCREW PITCH: Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

- The MECHANICAL SPEC window (In case of the RACK&PINION type)

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

- REDUCTION RATIO: Input the numerator and the denominator. The reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

- PINION DIAMETER: Input the diameter of a pinion. (Unit: mm)
12.3 Addition of Base and Station Axes

- The MECHANICAL SPEC window (In case of the ROTATION type)

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

- REDUCTION RATIO: Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

2. Modify the settings.


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

The motor data is specified in the MOTOR SPEC window.

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

   ![Motor Specification Window](image)

2. Select a desired item.
   - When a numerical value is selected, the number input buffer line appears.
     When MOTOR (or SERVO AMP or CONVERTER) is selected, the list window of MOTOR (SERVO AMP or CONVERTER) appears.
   - When the type is selected, the window returns to the MOTOR SPEC window.
   - ROTATION DIRECTION: Set the rotation direction to which the current position is increased. (The counterclockwise view from the loaded side is the normal rotation.)

![AC Servo Motor Diagram](image)

   - MAX. RPM: Input maximum rotation speed of a motor. (Unit: rpm)
   - ACCELERATION SPEED: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
   - INERTIA RATIO: The initial value is set at 300 in case of servo track; 0 in case of rotation axis. However, if the following phenomenon occurs in motion, deal with the followed procedure.
12 Modification of System Configuration

12.3 Addition of Base and Station Axes

- <Phenomenon1> During motion, the axis moves unsteady on advance direction.
  ➔ Confirm the motion with increasing this ratio in each 100.

- <Phenomenon2> During pause, the motor makes a lot of noise.
  ➔ Confirm the motion with decreasing this ratio in each 100.

3. Modify the settings.

---

**CAUTION**

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

- When the data, motion range for example, should be changed after the addition of a base axis or station axis, the change can be done in the same procedure as shown above. In this case, the control axis configuration is not changed so the job file data should not be initialized.
13 DX200 Specification

![WARNING]

Make sure that there is no one within the P-point maximum envelope of the manipulator and that you are in a safe place before turning ON the DX200 power.

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

- Always set the teach lock before starting teaching.
- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
  - Ensure that you have a place to retreat to in case of emergency.

Improper or unintentional manipulator operation can result in injury.

- Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop buttons on the right of the front door of the DX200 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 DX200 and the programming pendant.
• Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.
  – Check for problems in manipulator movement.
  – Check for damage to 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, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.

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

Improper or unintended manipulator operation may result in injury. Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.
## 13.1 Specification List

<table>
<thead>
<tr>
<th>Controller</th>
<th>Dust/Splash-proof Construction</th>
<th>IP54 (The back fan is IP2X.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>1935(W) × 730(H) × 520(D) mm</td>
<td></td>
</tr>
<tr>
<td>Cooling System</td>
<td>Indirect cooling</td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td>3-phase, 200V/220V AC (+10% to -15%) at 60Hz(±2%)</td>
<td>200V AC (+10% to -15%) at 50Hz(±2%)</td>
</tr>
<tr>
<td>Grounding</td>
<td>Grounding resistance: 100Ω or less Exclusive grounding</td>
<td></td>
</tr>
<tr>
<td>Noise Level</td>
<td>Less than 62 dB</td>
<td></td>
</tr>
<tr>
<td>Digital I/O</td>
<td>Specific signal (hardware) 25 inputs and 7 outputs General signals (standard, max.) 40 inputs and 40 outputs (Transistor: 32 outputs, Relay: 8 outputs)</td>
<td></td>
</tr>
<tr>
<td>Positioning System</td>
<td>By serial communication (absolute encoder)</td>
<td></td>
</tr>
<tr>
<td>Drive Unit</td>
<td>SERVOPACK for AC servomotors</td>
<td></td>
</tr>
<tr>
<td>Acceleration/ Deceleration</td>
<td>Software servo control</td>
<td></td>
</tr>
<tr>
<td>Memory Capacity</td>
<td>200,000 steps, 10,000 instructions</td>
<td></td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>0°C to +45°C (During operation) -10°C to +60°C (During transit and storage)</td>
<td></td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>10% to 90%RH (non-condensing)</td>
<td></td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>0.5G or less</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Free from corrosive gas or liquid, or explosive gas Free from exposure to water, oil, or dust Free from excessive electrical noise (plasma)</td>
<td></td>
</tr>
</tbody>
</table>
### 13.2 Function List

<table>
<thead>
<tr>
<th>Programming Pendant Operation</th>
<th>Coordinate System</th>
<th>Joint, Rectangular/Cylindrical, Tool, User Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modification of Teaching Points</td>
<td>Adding, Deleting, Correcting (Robot axes and external axes respectively can be corrected.)</td>
<td></td>
</tr>
<tr>
<td>Inching Operation</td>
<td>Possible</td>
<td></td>
</tr>
<tr>
<td>Path Confirmation</td>
<td>Forward/Reverse step, Continuous feeding</td>
<td></td>
</tr>
<tr>
<td>Speed Adjustment</td>
<td>Fine adjustment possible during operating or pausing</td>
<td></td>
</tr>
<tr>
<td>Timer Setting</td>
<td>Possible every 0.01 s</td>
<td></td>
</tr>
<tr>
<td>Short-cut Function</td>
<td>Direct-open function, Multi-window</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>CF card slot, USB port (USB1.1) (At Programming Pendant)</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Arc welding, Spot welding, Handling, General, Others</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Feature</th>
<th>Essential Measures</th>
<th>JIS (Japanese Industrial Standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running Speed Limit</td>
<td>User definable</td>
<td></td>
</tr>
<tr>
<td>Enable Switch</td>
<td>3 position type. Servo power can be turned on at the middle position only. (Located on programming pendant)</td>
<td></td>
</tr>
<tr>
<td>Collision proof Frames</td>
<td>S-axis frame (doughnut-sector), Cubic frame (user coordinate)</td>
<td></td>
</tr>
<tr>
<td>Self-Diagnosis</td>
<td>Classifies error and two types of alarms (major and minor) and displays the data</td>
<td></td>
</tr>
<tr>
<td>User Alarm Display</td>
<td>Possible to display alarm messages for peripheral device</td>
<td></td>
</tr>
<tr>
<td>Machine Lock</td>
<td>Test-run of peripheral devices without robot motion</td>
<td></td>
</tr>
<tr>
<td>Door Interlock</td>
<td>A door can be opened only when a circuit breaker is OFF.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance Function</th>
<th>Operation Time Display</th>
<th>Control power-on time, Servo power-on time, Playback time, Operation time, Work time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alarm Display</td>
<td>Alarm message, troubleshooting, previous alarm records</td>
</tr>
<tr>
<td></td>
<td>I/O Diagnosis</td>
<td>Simulated enabled/disabled output possible</td>
</tr>
<tr>
<td></td>
<td>T.C.P. Calibration</td>
<td>Automatically calibrates parameters for end effectors using a master positioner</td>
</tr>
</tbody>
</table>
### Programing Functions

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

### 13.3 Programming Pendant

<table>
<thead>
<tr>
<th>Material</th>
<th>Reinforced thermoplastic enclosure with a detachable suspending strap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>169(W) × 314.5(H) × 50(D) mm (excluding protrusions)</td>
</tr>
<tr>
<td>Displayed Units</td>
<td>TFT Color liquid crystal display, VGA (640 × 480)</td>
</tr>
<tr>
<td>Operated Units</td>
<td>Three-position enable switch, start switch, hold switch, and mode select switch (with key, three mode) Type of the key for the mode select switch: AS6-SK-132 (manufactured by IDEC Corp.) * Two keys are shipped with the programming pendant.</td>
</tr>
<tr>
<td>Others</td>
<td>Provided with CF (Compact Flash) card slot USB port (USB1.1) X 1</td>
</tr>
</tbody>
</table>
13.4 Equipment Configuration

The DX200 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 DX200 equipment.

13.4.1 Arrangement of Units and Circuit Boards

The arrangements of units and circuit boards are as shown.

Fig. 13-1: Inside Controller (Front)
MH900, DX200 Controller

13 DX200 Specification
13.4 Equipment Configuration

**Fig. 13-2: Inside Controller (Back and Doors)**

- Internal Circulation Fan
- Backside Duct Fan
- Backside Resistor Fan
- Capacitor Unit
- Regenerative Resistor

**Fig. 13-3: Machine PC Safety Board and Reactor Cabinet**

- Machine PC Safety Board
- Line Reactor
- Machine PC Safety Board
- Reactor Cabinet
13.4.2 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 DX200. Make sure the door of the DX200 is closed when it’s used to keep this cooling system effective.

*Fig. 13-4: Cooling System View 1*

*Fig. 13-5: Cooling System View 2*
14 Description of Units and Circuit Boards

WARNING

• Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop buttons on the right of the front door of DX200 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 DX200 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:
  – Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
  – Ensure that you have a place to retreat to in case of emergency.

Improper or unintentional manipulator operation can result in injury.

• When turning ON the power to DX200, be sure that there is no one within the P-point maximum envelope of the manipulator, and that you are in a safe place.

Injury may result from collision with the manipulator to anyone entering the P-point maximum envelope of the manipulator. Always press the emergency stop button immediately if there are problems.
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, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.

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

Improper or unintended manipulator operation may result in injury.

Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.
Cautions for Connection of Dual Input Signals

**CAUTION**

- Connect the switch (contact) that turns the dual signals ON and OFF simultaneously.
- If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs. Refer to the figure below.

![Diagram](image)

1. Connect the switch (contact) that turns the dual signals ON and OFF simultaneously.
2. If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs. Refer to the figure below.

**CAUTION**

- Do not connect two signals to the same contact point. (Prepare two individual contact points)
- Since the power supply for each signal is reversed, it will short-circuit and may cause breakdown of DX200 Unit if the signals are connected to the same contact point.

![Diagram](image)
14 Description of Units and Circuit Boards

14.1 Power ON Unit (JZRCR-YPU71-□)

The power ON unit consists of the power ON control circuit board (JARCR-YPC21-1) and the main circuit contactor and the line filter. It turns the main circuit control contactor ON and OFF using the signal for the servo power control from the machine safety I/O logic circuit board, and supplies power (3-phase AC200/220V) to the converter.

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

Fig. 14-1: Power ON unit Configuration (JZRCR-YPU71-□)
14.2 Axes Control Circuit Board

14.2.1 Major Axes Control Circuit Board (SRDA-EAXA21A)

The major axes control circuit board controls the servomotors of the manipulator’s six axes. It also controls the converter and the PWM amplifiers. Mounting the external axes control circuit board (SRDA-EAXB21A) makes it possible to control the servomotor of nine axes, including the robot axes.

The major axes control circuit board (SRDA-EAXA21A) also has the following functions.

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

![Fig. 14-2: Major Axes Control Circuit Board (SRDA-EAXA21A)](image-url)
14.2.2 External Axes Control Circuit Board (SRDA-EAXB21A)

An external axes control circuit board (SRDA-EAXB21A) is used to control the S, L, and U axes servomotors of the MH900 robot. It is mounted on the major axes control circuit board.

*Fig. 14-3: External Axes Control Circuit Board (SRDA-EAXB21A)*
14.3 CPU Unit (JZNC-YRK21-1E)

14.3.1 CPU Unit Configuration

CPU unit consists of circuit board racks (flame, back circuit board, PCI riser circuit board), CPU circuit board, robot I/F circuit board and the machine safety CPU circuit board. The JZNC-YRK21-1E CPU unit contains only circuit board racks and CPU circuit boards. Be sure that it does not contain robot I/F circuit board and the machine safety CPU circuit board.

Fig. 14-4: CPU Unit Configuration (JZNC- YRK21-1E)
14-8

14 Description of Units and Circuit Boards

14.3 CPU Unit (JZNC-YRK21-1E)

14.3.2 Unit and Circuit Board in the CPU Unit

14.3.2.1 CPU Circuit Board (JANCD-YCP21-E)

This circuit board (JANCD-YCP21-E) performs to control the entire system, display to the programming pendant, control the operating keys, control operation and calculate interpolation.

14.3.2.2 Robot I/F Circuit Board (JANCD-YIF01- □ E)

The robot I/F circuit board (JANCD-YIF01- □ E) controls the entire robotic system. It is connected to the CPU circuit board (JANCD-YCP21-E) with a PCI bus interface on the back circuit board, and to the major axes control circuit board (SRDA-EAXA21A) with high-speed serial transmissions.

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

14.3.2.3 Machine Safety CPU Circuit Board

This circuit board (JANCD-YSF21-E) performs I/O processing or diagnosis processing for the safety sequence, and it is connected with the CPU circuit board (JANCD-YCP21-E) by the PCI Express bus I/F in the back circuit board.

It is also connected with the machine safety I/O logic circuit board by the high speed serial communications (two lines).
14.4 Control Power Supply Unit (JZNC-YPS21-E)

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

Fig. 14-5: Control Power Supply Unit JZNC-YPS21-E
## Description of Units and Circuit Boards

### 14.4 Control Power Supply Unit (JZNC-YPS21-E)

<table>
<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td>Rating Input Voltage: 200/220VAC</td>
</tr>
<tr>
<td></td>
<td>Voltage Fluctuation Range: +10% to -15% (170 to 242VAC)</td>
</tr>
<tr>
<td></td>
<td>Frequency: 50/60Hz ± 2Hz (48 to 62Hz)</td>
</tr>
<tr>
<td><strong>Output Voltage</strong></td>
<td>DC + 5V</td>
</tr>
</tbody>
</table>

### Indicator

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>Color</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE</td>
<td>Green</td>
<td>Lights with power supply input. Lights out when internal live part completes discharge. (Power supply status: being input)</td>
</tr>
<tr>
<td>POWER ON</td>
<td>Green</td>
<td>Lights when PWR_OK output signal is ON. (Power supply status: being output)</td>
</tr>
<tr>
<td>+5V</td>
<td>Red</td>
<td>Lights with +5V over-current (ON when abnormal)</td>
</tr>
<tr>
<td>+24V</td>
<td>Red</td>
<td>Lights with +24V over-current (ON when abnormal)</td>
</tr>
<tr>
<td>FAN</td>
<td>Red</td>
<td>Lights when FAN error occurs.</td>
</tr>
<tr>
<td>OHT</td>
<td>Red</td>
<td>Lights when unit interior overheats</td>
</tr>
</tbody>
</table>

### Control Power ON/OFF

To turn ON the DX200 controller power, turn ON the non-fuse breaker of the controller so that the control power supply is turned ON. If the controller is not located at the workplace, the control power supply can be turned ON/OFF by an external device, etc. after the non-fuse breaker of the controller is turned ON. It is operated by the external switch connected with CN152 of the Control power supply unit as shown in the following figure. (CN152-1 and CN152-2 are short-circuited when shipment)

Fig. 14-6: Connection to Control Power Supply Unit

![Connection to Control Power Supply Unit](attachment:image.png)

See chapter 14.8 "Control Circuit Board (JANCD-YBK21-3E)" at page 14-43 for wiring of CN152 connector.
14 Description of Units and Circuit Boards

14.5 Machine Safety I/O Logic Circuit Board (JANCD-YSF22 □-E)

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

It processes external safety signals with the dual processing circuits and control ON/OFF of the main circuit control contactor of the power ON unit according to conditions.

Followings are the main functions of Machine Safety I/O Logic Unit.

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

Fig. 14-7: Machine Safety I/O Logic Board (JANCD-YSF22 □-E)

If the F1 fuse becomes blown, it will cause a damage on the inner circuit of the board. Replace the board instead of replacing the fuse.
(There is no attached spare of the fuse.)
14.5.2 Connection for Tool Shock Sensor (SHOCK)

14.5.2.1 To Connect the Tool Shock Sensor Directly to the Tool Shock Sensor Signal Line

1. Disconnect the minus SHOCK (-) and +24V2 pin terminal from the DINAMIC connector, the machine safety I/O logic circuit board (YSF22-CN215). The pin terminal for the shock sensor is attached on the right side of the controller.

2. Connect the minus SHOCK (-) and +24V2 pin terminals to the signal line of the tool shock sensor. Use the following pin terminals for preparing the end of the signal line.

<table>
<thead>
<tr>
<th>Pin Terminal Name</th>
<th>Pin Terminal Model</th>
<th>Signal Line Terminal Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHOCK-</td>
<td>TMEDN-630809-MA</td>
<td>TMEDN-630809-FA (manufactured by NICHIFU Co., Ltd.)</td>
</tr>
<tr>
<td>+24V2</td>
<td>TMEDN-630809-FA</td>
<td>TMEDN-630809-MA (manufactured by NICHIFU Co., Ltd.)</td>
</tr>
</tbody>
</table>

![Fig. 14-8: Direct Connection to Tool Shock Sensor Signal Line](image-url)

The pin terminal for the shock sensor is attached on the right side of the controller.
14 Description of Units and Circuit Boards
14.5 Machine Safety I/O Logic Circuit Board (JANCD-YSF22-E)

14.5.2.2 To Connect the Tool Shock Sensor with the Cable that is Built into the Manipulator

1. Disconnect the minus SHOCK (-) and +24V2 pin terminal from the DINAMIC connector, the machine safety I/O logic circuit board (YSF22 -CN215). The pin terminal for the shock sensor is attached on the right side of the controller.

2. Connect the minus SHOCK (-) pin terminal to the plus SHOCK(+) pin terminal of the manipulator.

---

**NOTE**

Cable that is built into the manipulator is not connected to shocks sensor because the tool shock sensor is a option. For connecting the tool shock sensor, refer to the wiring diagrams in the INSTRUCTIONS for the manipulator.

---

**Fig. 14-9: Connection with Manipulator Cable**

- **DX200**
- **Machine safety I/O logic circuit board (JANCD-YSF22-E)**
- **CN215**
- **A3**: SHOCK+
- **B3**: SHOCK-

- **+24V2**
- **TMEDN-630809-FA (NICHIFU)**
- **TMEDN-630809-MA (NICHIFU)**

---

When the tool shock sensor input signal is used, the stopping method of the robot can be specified. The stopping methods are hold stop and servo power supply OFF. Selection of the stopping method is set in the display of the programing pendant. Refer to explanations in chapter 8 “System Setup” for details.

---
14.6 Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)

The machine safety terminal block circuit board (JANCD-YFC22-E) is for the system external signal to connect with the safety I/O signals.

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

Fig. 14-10: Machine Safety Terminal Block
Table 14-1(a): JANCD-YFC22-E Details for the Connection Terminal

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Connection No. (MXT)</th>
<th>Dual input</th>
<th>Function</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAFF1+</td>
<td>-1</td>
<td>Applicable</td>
<td>Safety Plug</td>
<td>Short-circuit with a jumper cable</td>
</tr>
<tr>
<td>SAFF1-</td>
<td>-2</td>
<td></td>
<td>Used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is input, the servo power turns OFF. While the signal is turned ON. The servo power cannot be turned ON. Note that these signals are disabled in teach mode.</td>
<td></td>
</tr>
<tr>
<td>SAFF2+</td>
<td>-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAFF2-</td>
<td>-4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXESP1+</td>
<td>-5</td>
<td>Applicable</td>
<td>External Emergency Stop</td>
<td>Short-circuit with a jumper cable</td>
</tr>
<tr>
<td>EXESP1-</td>
<td>-6</td>
<td></td>
<td>Used to connect the emergency stop switch of an external device. If the signal is input, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON.</td>
<td></td>
</tr>
<tr>
<td>EXESP2+</td>
<td>-7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXESP2-</td>
<td>-8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXDSW1+</td>
<td>-9</td>
<td>Applicable</td>
<td>External Enable Switch</td>
<td>Short-circuit with a jumper cable</td>
</tr>
<tr>
<td>EXDSW1-</td>
<td>-10</td>
<td></td>
<td>Used to connect a Enable switch other than the one on the programming pendant when two people are teaching.</td>
<td></td>
</tr>
<tr>
<td>EXDSW2+</td>
<td>-11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXDSW2-</td>
<td>-12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FST1+</td>
<td>-13</td>
<td>Applicable</td>
<td>Full-speed Test</td>
<td>Open</td>
</tr>
<tr>
<td>FST1-</td>
<td>-14</td>
<td></td>
<td>Used to reset the slow speed limit for the test run in the teach mode. If this signal input circuit is short-circuited, the speed of the test run becomes the speed of the playback (taught speed). If this signal’s circuit is open, the status SSP input signal determines the safety speed: The first slow speed (16%) or second slow speed (2%).</td>
<td></td>
</tr>
<tr>
<td>FST2+</td>
<td>-15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FST2-</td>
<td>-16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSP+</td>
<td>-17</td>
<td></td>
<td>Slow Speed Mode Selection</td>
<td>Short-circuit with a jumper cable</td>
</tr>
<tr>
<td>SSP-</td>
<td>-18</td>
<td></td>
<td>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%)</td>
<td></td>
</tr>
<tr>
<td>EXHOLD+</td>
<td>-19</td>
<td></td>
<td>External Hold</td>
<td>Short-circuit with a jumper cable</td>
</tr>
<tr>
<td>EXHOLD-</td>
<td>-20</td>
<td></td>
<td>Used to connect the temporary stop switch of an external device. If the signal is input, the job is stopped. While the signal is input, starting and axis operations are disabled.</td>
<td></td>
</tr>
<tr>
<td>EXSVON+</td>
<td>-21</td>
<td></td>
<td>External Servo ON</td>
<td>Open</td>
</tr>
<tr>
<td>EXSVON-</td>
<td>-22</td>
<td></td>
<td>Use to connect the servo ON switch of an external operation device. If the signal is input, the servo power supply is turned ON.</td>
<td></td>
</tr>
<tr>
<td>SYSRUN+</td>
<td>-23</td>
<td></td>
<td>SYSRUN signal</td>
<td>Open</td>
</tr>
<tr>
<td>SYSRUN-</td>
<td>-24</td>
<td></td>
<td>Use to determine the normal/abnormal condition of the DX200 controller by SYSRUN signal.</td>
<td></td>
</tr>
</tbody>
</table>
### Table 14-1(b): JANCD-YFC22-E Details for the Connection Terminal

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Connection No. (MXT)</th>
<th>Dual input</th>
<th>Function</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONEN11+</td>
<td>-25</td>
<td>Applicable</td>
<td>Servo ON Enable</td>
<td>Short-circuit with a jumper cable</td>
</tr>
<tr>
<td>ONEN11-</td>
<td>-26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN12+</td>
<td>-27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN12-</td>
<td>-28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN21+</td>
<td>-29</td>
<td>Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN21-</td>
<td>-30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN22+</td>
<td>-31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN22-</td>
<td>-32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN31+</td>
<td>-33</td>
<td>Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN31-</td>
<td>-34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN32+</td>
<td>-35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN32-</td>
<td>-36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN41+</td>
<td>-37</td>
<td>Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN41-</td>
<td>-38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN42+</td>
<td>-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN42-</td>
<td>-40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT21+</td>
<td>-41</td>
<td>-</td>
<td>External Axes Overrun</td>
<td>Open</td>
</tr>
<tr>
<td>OT21-</td>
<td>-42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT22+</td>
<td>-43</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT22-</td>
<td>-44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT31+</td>
<td>-45</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT31-</td>
<td>-46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT32+</td>
<td>-47</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT32-</td>
<td>-48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT41+</td>
<td>-49</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT41-</td>
<td>-50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT42+</td>
<td>-51</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT42-</td>
<td>-52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUESP3+</td>
<td>-53</td>
<td>-</td>
<td>Emergency Stop Button Contact Output</td>
<td>Open</td>
</tr>
<tr>
<td>PUESP3-</td>
<td>-54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUESP4+</td>
<td>-55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUESP4-</td>
<td>-56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBESP3+</td>
<td>-57</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBESP3-</td>
<td>-58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBESP4+</td>
<td>-59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBESP4-</td>
<td>-60</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Wiring Procedure of the Terminal Block
For your safety, appropriate work must be done by following the instructions below.

1. Tool: Screwdriver
   - For the connection, be sure to use a screwdriver of an applicable size and configuration.

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

2. Applicable Wires
   (1) The length of the exposed conductor (L) should be as follows:

   ![Diagram showing wire connection]

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

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

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

3. Wire Connection

   ![Diagram showing wire connection]

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

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

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

(4) Check if the wire is connected firmly by pulling the wire softly.
14 Description of Units and Circuit Boards

14.6 Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)

14.6.1 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**

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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.

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

**NOTE**

Fig. 14-11: Connection for Safety Plug
Installation of Safety Plug

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

If the servo power is ON when the interlock signal is input, the servo power turns OFF. The servo power cannot be turned ON while the interlock signal is input. However, the servo power does not turn OFF when the door is opened only during the teach mode. In this case, the servo power can be turned ON while the interlock signal is input.
14.6 Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)

14.6.2 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**

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using. If the cables are not removed, injury or damage to machinery may result and the external emergency stop will not work even if the signal is input.

---

*Fig. 14-13: Connection for External Emergency Stop*

---

*Fig. 14-13: Connection for External Emergency Stop*
14.6.3 External Enable Switch

This signal is used to connect Enable switch other than the one on the programming pendant when two people are teaching. In the condition of the external enable switch ON, when turn the enable switch ON/OFF by the programming pendant, the servo power is also turned ON/OFF. However, when turn the external enable switch ON after turning the enable switch ON by the programming pendant, the servo power is not turned ON.

**CAUTION**

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

---

*Fig. 14-14: Connection for External Enable Switch*
14.6.4 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 the speed of the playback (taught speed).

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%).

• Setting Method

1. Short-circuit terminal numbers 13 and 14 of the machine safety terminal block circuit board (JANCD-YFC22-E), and 15 and 16 as well. (Normally, each terminal is unwired.)
2. The message “Full-speed test mode” is displayed as follows when the setting is finished.

- Operation Speed

When the full-speed test mode is set, operation speed is set depending on the setting of manual speed as follows.

At the time of setting the full-speed mode, the setting of manual speed shifts to Inching automatically.

When changing the setting of manual speed, make sure that there is no person around the manipulator and pay great attention to perform the operation.

<table>
<thead>
<tr>
<th>Manual speed</th>
<th>Limit of operation speed (default value)</th>
<th>Parameter (Unit: 0.01%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inching</td>
<td>20%</td>
<td>S1CxG60 (default value: 2000)</td>
</tr>
<tr>
<td>Slow</td>
<td>50%</td>
<td>S1CxG61 (default value: 5000)</td>
</tr>
<tr>
<td>Medium</td>
<td>75%</td>
<td>S1CxG62 (default value: 7500)</td>
</tr>
<tr>
<td>Fast</td>
<td>100% (fixed value)</td>
<td>-</td>
</tr>
</tbody>
</table>
14 Description of Units and Circuit Boards

14.6 Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)

14.6.5 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%)

CAUTION

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

Fig. 14-16: Connection for Slow Speed Mode Selection
14.6.6 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**

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

*Fig. 14-17: Connection for External Hold*
14.6.7 **External Servo ON**

This signal is used to connect the servo ON switch of an external operation device. If the signal is input, the servo power supply is turned ON.

*Fig. 14-18: Connection for External Servo ON*
14.6.8 SYSRUN Signal Output

This signal is used to check whether the DX200’s status is normal or abnormal. This signal is output on the following conditions.

![Connection Diagram for SYSRUN Signal Output](image)

Because the pulse signal is outputted from the specific output signal (#50911) to the external device for each 100ms, it is also able to check whether the DX200’s control circuit board is normal or abnormal.

Refer to section 4.12 “Specific Output Signals” of “DX200 OPTIONS INSTRUCTIONS FOR CONCURRENT I/O” manual for more details.
14 Description of Units and Circuit Boards

14.6 Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)

14.6.9 Connection for Servo-ON Enable Input

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

For safety reasons, dual circuits are used for the Servo-ON Enable input signals. Connect the signal 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 chapter 8 “Servo Power Supply Individual Control Function” of “Independent/Coordinated Function Instructions Manual” for the usage of the Servo-ON Enable signals.

Fig. 14-20: Connection for Servo-ON Enable Input
14.6.10 External Axes Overrun

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, the machine safety signal error occurs.

For the setting of the external axis overrun, refer to section 12.3.1.2 “Connection Setting” on page 12-20.

CAUTION

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

Fig. 14-21: Connection for External Axis Overrun
The following figure shows the external axis overrun wiring of the factory default setting when the external axes are connected to the DX200.

Please refer to the following figure to connect the external axes overrun signal to wire in the another route. On that occasion, confirm the external axes overrun setting to connect. (Refer to section 12.3.1.2 “Connection Setting” on page 12-20.)

Fig. 14-22: Connection for External Axis Overrun (Multiple Lines)
14.6.11 Emergency Stop Output

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

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

**CAUTION**

- Do not use the emergency stop button with 24 VAC, 0.5 A or more. Failure to observe this instruction may result in damage to equipment.

**Fig. 14-23: Output of Emergency Button**

![Diagram showing the output connections for emergency stop buttons on the DX200 controller and the programming pendant.](image-url)
14.6.12 Universal Safety Input

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

*Fig. 14-24: Universal Safety Input*

14.6.13 Universal Safety Output

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

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

The signal is outputted as the dual signals, and inputs the status of the driven devices by the output signal as the monitoring signal.

For the example of use of the universal safety output signal, refer to section 8.23 “Safety Logic Circuit”.

*Fig. 14-25: Example of Use of Universal Safety Output Signal*
14.6 Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)

- Rated output value is DC24V and less than 50mA. Avoid excessive load when connect.
- When connect the inductive load, such as the safety relay, with the output circuit, use of the built-in protective circuit for the surge suppressor or connect the flyback diode in parallel to the inductive load to suppress the surge voltage. It may cause the damage on the output circuit.
- The feedback signal must be inputted to the DX200 when use the universal safety output signal.
**14.6.14 Connection for Direct-in**

- **Direct-in (Servo) 1 to 6**
  
  This signal is used to input a responsive signal in search functions.

---

**Fig. 14-26: Connection for Direct-in (Servo) 1 to 6**

The part of wiring is that if there is a slave for the coordinated control side major axes control circuit board (SRDA-EAXA21A).
14.6.15 Universal Input (Servo)

Connect when use the universal signal.

Fig. 14-27: Universal Input (Servo)

14.6.16 Universal Output (Servo)

Connect when use the universal signal.

Fig. 14-28: Universal Output (Servo)
14.7 Universal I/O Circuit Board (JANCD-YIO21-E)

14.7.1 Universal I/O Circuit Board (JANCD-YIO21-E)

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

Refer to chapter 14.13 “Universal I/O Signal Assignment” at page 14-48 for more details on signal allocation.

For the connection of the robot’s universal I/O signal connectors, and the I/O signal related to start and stop, refer to “Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)” at page 14-38 and “Specific I/O Signal Related to Start and Stop” at page 14-40.

Fig. 14-29: Universal I/O Circuit Board (JANCD-YIO21-E)
Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)

Please refer to the figure below when you manufacture the cable connecting with robot universal I/O connector (CN306, 307, 308, 309) of robot universal I/O circuit board (JANCD-YIO21-E). Unshielded twisted pair cable must be used. (The cable side connector and the I/O terminal block are the options)

Fig. 14-30: Robot Universal I/O Connector (CN306, 307, 308, 309) Connection
When connecting an inductive load to the output circuit, connect a flyback (snubber) diode in parallel to the inductive load to suppress the surge voltage. Not using the flyback (snubber) diode may damage the output circuit. When connecting the load with a large inrush current such as the lamp, connect the current limiting resistor in series to the load, so that the output current does not exceed its maximum value. Exceeding the maximum output current value may damage the output circuit.

Refer to section 14.13 “Universal I/O Signal Assignment” from page 14-44 to 14-70 about the maximum current of the transistor and the relay output circuits.
### Specific I/O Signal Related to Start and Stop

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

- **Servo ON** (depending on application: JANCD-YIO21-E)
- **External Servo ON** (common to all application: JANCD-YFC22-E)
- **External Start** (depending on application: JANCD-YIO21-E)
- **Operating** (depending on application: JANCD-YIO21-E)
- **External Hold** (common to all application: JANCD-YFC22-E)
- **External Emergency Stop** (common to all application: JANCD-YFC22-E)

---

**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.

**Fig. 14-31: Example of the Servo ON Sequence Circuit from the External Device**

```
Servo ON PB | X2
Servo power ON | X3 (30011)
Servo ON confirmation |
Servo ON command |

Note: Number in (   ) means the output signal number assigned to YIO21.
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.

**Fig. 14-32: Example of Start Sequence Circuit from the External Device**

```
Run PB | X3
Servo ON (30011)
While Servo ON (30016)
Selecting play mode (30016)
Alarm/Error occurring (30013)
Running confirmation X5

Note: Number in (   ) means the output signal number assigned to YIO21.
PL: Pilot Lamp
```
14 Description of Units and Circuit Boards
14.7 Universal I/O Circuit Board (JANCY-YIO21-E)

- Connection of External Power Supply for I/O

At factory setting, the internal power supply for I/O is used. If the external power supply for I/O is used, connect it with following procedure.

1. Remove the wire connected between CN303-1 to -3 and CN303-2 to -4 of the universal I/O circuit board.

2. Connect +24V of the external power supply to CN303-1 and 0V to CN303-2 of the robot I/O unit.

For the connection of the CN303 connector, refer to chapter 14.12 “WAGO Connector” at page 14-47.

Fig. 14-33: Connection of External Power Supply for I/O

- The internal power supply of 24V of about 1.5A of DX200 can be used for I/O. Use external 24V power supply for higher currents and to isolate the circuit inside and outside the DX200.

- Power supply circuit for I/O (+24 VU, 024 VU) has 3.15A fuses (F1, F2).

- Install the external power supply outside the DX200 to avoid electric noise problems.

- If the internal power supply is selected and the external power supply is connected to CN303-1 to -3 and CN303-2 to -4, do not connect the line of the external power supply to the +24VU and 0VU terminals. The unit may malfunction if the external power supply is also connected.
14.8 Control Circuit Board (JANCD-YBK21-3E)

14.8.1 Control Circuit Board (JANCD-YBK21-3E)

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

Fig. 14-34: break Control Circuit Board (JANCD-YBK21-3E)
14.9 Converter (SRDA-COA □ A21 □ -E)

The converter (SRDA-COA □ A21 □ -E) exchanges the power supply (3-phase: AC200/220V) supplied by the power ON unit for DC power supply and supplies the power to the amplifier module (PWM amplifiers).

*Fig. 14-35: Converter (SRDA-COA □ A21 □ -E)*

The Type of the converter is different before middle of 2015. Please check it by a Type sticker of the following figure.
14.10 Capacitor Module (SRDA-CUA AA)

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

There are two type of the capacitors shown below.

- Small capacity: SRDA-CUA492AA
  SRDA-CUA662AA (Before middle of 2015)

- Medium / Large capacity: SRDA-CUA133AA

_Fig. 14-36: Capacitor Module (SRDA-CUA AA)_
14 Description of Units and Circuit Boards

14.11 Amplifier Module (SRDA-SDA □ A01A-E)

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

Fig. 14-37(a): Amplifier Module

Fig. 14-37(b): Amplifier Module Arrangement Example
14.12 WAGO Connector

The control power supply unit: CN152 on (JZNC-YPS21-E), and CN303 on the universal I/O circuit board (JANCD-YIO21-E) are equipped with a connector made by WAGO.

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

The tools (total 3, 2 types) are supplied with the DX200.

Use them with the appropriate sizes of connectors.

The wiring procedure is described as follows:

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

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.

---

<table>
<thead>
<tr>
<th>Connector to be applied</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control power supply unit:</td>
<td>Max cable outside diameter: 4.1mm dia.</td>
</tr>
<tr>
<td>(JANC-YPS21-E) CN152</td>
<td>Stripped length: 8-9mm</td>
</tr>
<tr>
<td>Universal I/O unit:</td>
<td>Max cable outside diameter: 3.4mm dia.</td>
</tr>
<tr>
<td>(JANCD-YIO21-E) CN303</td>
<td>Stripped length: 7mm</td>
</tr>
</tbody>
</table>

---

Wiring tool for WAGO connector
(DX200 Supplied parts - 2 types)
14.13 Universal I/O Signal Assignment

14.13.1 Arc Welding

Fig. 14-38: JANCD-YIO21-E (CN308 (8TX) Connector) I/O Allocation and Connection Diagram (For Arc Welding)

DX200

Universal I/O circuit board (JANCD-YIO21-E)

Connector Terminal Converter
(Optional)
Model:TIFS553YS

Each Point
24VDC
6.9 mA (TYP)

External Power Supply

Internal

Power Supply

0VE
024VU

Each Point
24VDC
50mA (max.)

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
14 Description of Units and Circuit Boards

14.13 Universal I/O Signal Assignment

Fig. 14-39: JANCD-YIO21-E (CN309 (9TX) Connector) I/O Allocation and Connection Diagram (For Arc Welding)

Each Point 24VDC 50mA (TYP)

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 A1</td>
<td>A1</td>
<td>IN</td>
</tr>
<tr>
<td>2003 A2</td>
<td>A2</td>
<td>IN</td>
</tr>
<tr>
<td>2003 A3</td>
<td>A3</td>
<td>IN</td>
</tr>
<tr>
<td>2003 A4</td>
<td>A4</td>
<td>IN</td>
</tr>
<tr>
<td>2003 A5</td>
<td>A5</td>
<td>IN</td>
</tr>
<tr>
<td>2003 A6</td>
<td>A6</td>
<td>IN</td>
</tr>
<tr>
<td>2003 A16</td>
<td>A16</td>
<td>OUT</td>
</tr>
<tr>
<td>2003 A17</td>
<td>A17</td>
<td>OUT</td>
</tr>
<tr>
<td>2003 A18</td>
<td>A18</td>
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<td>2003 B19</td>
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<tr>
<td>2003 B20</td>
<td>B20</td>
<td>OUT</td>
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</table>

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when an external power supply is used.
14 Description of Units and Circuit Boards
14.13 Universal I/O Signal Assignment

MH900, DX200 Controller

Fig. 14-40: JANCD-YIO21-E (CN306 (6TX) Connector) I/O Allocation and Connection Diagram (For Arc Welding)

DX200

Universal I/O circuit board (JANCD-YIO21-E)

Connector Terminal Converter (Optional)
Model: TIFS553YS

Each Point
24VDC 6.9mA (TYP)

Each Point
24VDC 50mA (max.)

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

Each Point
24VDC 6.9mA (TYP)

Each Point
24VDC 50mA (max.)

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

Each Point
24VDC 6.9mA (TYP)

Each Point
24VDC 50mA (max.)

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
14 Description of Units and Circuit Boards

14.1 Universal I/O Signal Assignment

**Universal I/O Signal Assignment**

### CN307 Connector

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
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<tr>
<td>B1</td>
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<td>B2</td>
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<td>B3</td>
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<td>B4</td>
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<td>B11</td>
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<td>OUT</td>
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<td>B12</td>
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<td>B13</td>
<td>OUT19-</td>
<td>OUT</td>
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<tr>
<td>B14</td>
<td>OUT19+</td>
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</tr>
<tr>
<td>A15</td>
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<td></td>
</tr>
</tbody>
</table>

**Each Point 24VDC 6.9mA (TYP)**

**Each Point 24VDC 500mA (max.)**

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

**Connector Terminal Converter (Optional)**

Model: TIFS553YS

* Refers to internal relay

**DX200**

Universal I/O circuit board (JANCD-YIO21-E)
<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START</td>
</tr>
<tr>
<td></td>
<td>Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).</td>
</tr>
<tr>
<td>20013</td>
<td>ALARM/ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE</td>
</tr>
<tr>
<td></td>
<td>The play mode is selected when the mode key on the programming pendant is set at &quot;REMOTE&quot;. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE</td>
</tr>
<tr>
<td></td>
<td>The teach mode is selected when the mode key of the programming pendant is set at &quot;REMOTE&quot;. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20022</td>
<td>WORK PROHIBITED (Arc Generation Prohibited)</td>
</tr>
<tr>
<td></td>
<td>Arc generation is prohibited while this signal is ON. Arc generation starts when this signal turns OFF inside the arc-generation area. Use this signal to confirm teaching.</td>
</tr>
<tr>
<td>20023</td>
<td>WORK RESPONSE (Pseudo Arc ON Response)</td>
</tr>
<tr>
<td></td>
<td>This signal is used as a pseudo signal in cases that &quot;Arc Generation Confirmation&quot; signal is not equipped on a welding power supply. Wire this signal ON normally (short to OV).</td>
</tr>
<tr>
<td>20026</td>
<td>WEAVING PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>Weaving is prohibited while this signal is ON. Use this signal to check taught steps and movements without performing the weaving operation.</td>
</tr>
<tr>
<td>20027</td>
<td>SENSING PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>Arc sensing is prohibited while this signal is ON. Use this signal to check taught steps and movements if an arc sensor is mounted.</td>
</tr>
</tbody>
</table>

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

2 See chapter 8.6 "Interference Area" at page 8-57.
### Table 14-3: Specific Output (Arc Welding)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>RUNNING</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td>SERVO IS ON</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX200 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td>TOP OF MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called. ¹)</td>
</tr>
<tr>
<td>30013</td>
<td>ALARM/ERROR OCCURRED</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td>BATTERY ALARM</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td>REMOTE/PLAY/TEACH MODE SELECTED</td>
</tr>
<tr>
<td></td>
<td>This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td>IN CUBE 1</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td>IN CUBE 2</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td>WORK HOME POSITION (IN CUBE 64)²)</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.</td>
</tr>
<tr>
<td>30023</td>
<td>INTERMEDIATE START OK</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30024</td>
<td>GAS SHORTAGE (MONITOR)</td>
</tr>
<tr>
<td></td>
<td>This signal stays ON while the gas shortage signal from the welding power supply is ON.</td>
</tr>
<tr>
<td>30025</td>
<td>WIRE SHORTAGE (MONITOR)</td>
</tr>
<tr>
<td></td>
<td>This signal status ON while the wire shortage signal from the welding power supply is ON.</td>
</tr>
<tr>
<td>30026</td>
<td>WIRE STICKING (MONITOR)</td>
</tr>
<tr>
<td></td>
<td>The wire sticking check is conducted automatically when the arc turns OFF. If wire sticking is detected, this signal remains ON until the wire sticking is released.</td>
</tr>
<tr>
<td>30027</td>
<td>ARC SHORTAGE (MONITOR)</td>
</tr>
<tr>
<td></td>
<td>This signal stays ON while the arc shortage signal from the welding power supply is ON.</td>
</tr>
</tbody>
</table>

¹) This signal is not output during operation.
²) The work home position cube and Cube 64 are the same.
### Description of Units and Circuit Boards

#### 14.13 Universal I/O Signal Assignment

**MH900, DX200 Controller**

#### 14.13.2 Handling

Fig. 14-42: JANCD-YIO21-E (CN308 (8TX) Connector) I/O Allocation and Connection Diagram (For Handling)

DX200

**Universal I/O circuit board (JANCD-YIO21-E)**

<table>
<thead>
<tr>
<th>Signal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>B1</td>
<td>External Start</td>
</tr>
<tr>
<td>2011</td>
<td>A1</td>
<td>-</td>
</tr>
<tr>
<td>2012</td>
<td>B2</td>
<td>Call Master Job</td>
</tr>
<tr>
<td>2013</td>
<td>A2</td>
<td>Alarm/Error Reset</td>
</tr>
<tr>
<td>2014</td>
<td>B3</td>
<td>-</td>
</tr>
<tr>
<td>2015</td>
<td>A3</td>
<td>Select Play Mode</td>
</tr>
<tr>
<td>2016</td>
<td>B4</td>
<td>Select Teach Mode</td>
</tr>
<tr>
<td>2017</td>
<td>A4</td>
<td>-</td>
</tr>
<tr>
<td>2020</td>
<td>B5</td>
<td>Interference Entrance Prohibited</td>
</tr>
<tr>
<td>2021</td>
<td>A5</td>
<td>Interference Entrance Prohibited</td>
</tr>
<tr>
<td>2022</td>
<td>A6</td>
<td>-</td>
</tr>
<tr>
<td>2023</td>
<td>B7</td>
<td>024VU</td>
</tr>
<tr>
<td>2030</td>
<td>B8</td>
<td>Running</td>
</tr>
<tr>
<td>2031</td>
<td>A8</td>
<td>Servo is ON</td>
</tr>
<tr>
<td>2032</td>
<td>B9</td>
<td>Top of Master Job</td>
</tr>
<tr>
<td>2033</td>
<td>A9</td>
<td>Alarm/Error Occurred</td>
</tr>
<tr>
<td>2034</td>
<td>B10</td>
<td>Battery Alarm</td>
</tr>
<tr>
<td>2037</td>
<td>A10</td>
<td>Remote Mode Selected</td>
</tr>
<tr>
<td>2038</td>
<td>B11</td>
<td>Play Mode Selected</td>
</tr>
<tr>
<td>2037</td>
<td>A11</td>
<td>Teach Mode Selected</td>
</tr>
<tr>
<td>2040</td>
<td>B12</td>
<td>In Cube 1</td>
</tr>
<tr>
<td>2042</td>
<td>A12</td>
<td>In Cube 2</td>
</tr>
<tr>
<td>2042</td>
<td>B13</td>
<td>Work Home Position</td>
</tr>
<tr>
<td>2043</td>
<td>A13</td>
<td>Intermediate Start Or (continuousing Sequence)</td>
</tr>
<tr>
<td>2044</td>
<td>B14</td>
<td></td>
</tr>
<tr>
<td>2045</td>
<td>A14</td>
<td></td>
</tr>
<tr>
<td>2046</td>
<td>B15</td>
<td></td>
</tr>
<tr>
<td>2047</td>
<td>A15</td>
<td></td>
</tr>
<tr>
<td>2048</td>
<td>B16</td>
<td>024VU</td>
</tr>
<tr>
<td>2049</td>
<td>A16</td>
<td>024VU</td>
</tr>
<tr>
<td>2050</td>
<td>B17</td>
<td>024VU</td>
</tr>
<tr>
<td>2051</td>
<td>A17</td>
<td>024VU</td>
</tr>
<tr>
<td>2052</td>
<td>B18</td>
<td>+24VU</td>
</tr>
<tr>
<td>2053</td>
<td>A18</td>
<td>+24VU</td>
</tr>
<tr>
<td>2054</td>
<td>B19</td>
<td>+24VU</td>
</tr>
<tr>
<td>2055</td>
<td>A19</td>
<td>+24VU</td>
</tr>
<tr>
<td>2056</td>
<td>B20</td>
<td>FG</td>
</tr>
<tr>
<td>2057</td>
<td>A20</td>
<td></td>
</tr>
</tbody>
</table>

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

Connector Terminal Converter (Optional)

Model: TIFS553YS

**Diagram:**

- **Each Point 24VDC 6.9mA (TYP)**
- **Each Point 24VDC 50mA (max.)**

**Diagram Details:**

- **+24VU**
- **024VU**
- **+24V**
- **0**
- **External Power Supply**
- **+24VE**
- **-1**
- **-2**
- **-3**
- **-4**
- **+24VU**
- **024VU**

---

*Refer to the full document for detailed specifications and connections.*
Fig. 14-43: JANCD-YIO21-E (CN309 (9TX) Connector) I/O Allocation and Connection Diagram
(For Handling)

MH900, DX200 Controller
14 Description of Units and Circuit Boards
14.1 Universal I/O Signal Assignment

DX200
Universal I/O circuit board (JANCD-YIO21-E)

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>B1</td>
<td>IN</td>
</tr>
<tr>
<td>2005</td>
<td>A1</td>
<td>IN</td>
</tr>
<tr>
<td>2006</td>
<td>B2</td>
<td>IN</td>
</tr>
<tr>
<td>2007</td>
<td>A2</td>
<td>A2</td>
</tr>
<tr>
<td>2003</td>
<td>A3</td>
<td>IN01</td>
</tr>
<tr>
<td>2001</td>
<td>A3</td>
<td>IN02</td>
</tr>
<tr>
<td>2002</td>
<td>B4</td>
<td>IN03</td>
</tr>
<tr>
<td>2003</td>
<td>A4</td>
<td>IN04</td>
</tr>
<tr>
<td>2004</td>
<td>B5</td>
<td>IN05</td>
</tr>
<tr>
<td>2005</td>
<td>A5</td>
<td>IN06</td>
</tr>
<tr>
<td>2006</td>
<td>B6</td>
<td>IN07</td>
</tr>
<tr>
<td>2007</td>
<td>A6</td>
<td>IN08</td>
</tr>
<tr>
<td>2008</td>
<td>A7</td>
<td>024VU</td>
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<tr>
<td>2009</td>
<td>B7</td>
<td>024VU</td>
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<tr>
<td>2010</td>
<td>A8</td>
<td>024VU</td>
</tr>
<tr>
<td>2011</td>
<td>B8</td>
<td>024VU</td>
</tr>
<tr>
<td>2012</td>
<td>A9</td>
<td>024VU</td>
</tr>
<tr>
<td>2013</td>
<td>B9</td>
<td>024VU</td>
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<tr>
<td>2014</td>
<td>A10</td>
<td>OUT01</td>
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<tr>
<td>2015</td>
<td>B10</td>
<td>OUT01</td>
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<td>2016</td>
<td>A11</td>
<td>OUT02</td>
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<tr>
<td>2017</td>
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<td>2018</td>
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<td>OUT03</td>
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<td>B12</td>
<td>OUT03</td>
</tr>
<tr>
<td>2020</td>
<td>A13</td>
<td>OUT04</td>
</tr>
<tr>
<td>2021</td>
<td>B13</td>
<td>OUT04</td>
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<td>2022</td>
<td>A14</td>
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</tr>
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<td>2023</td>
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<td>2024</td>
<td>A15</td>
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<td>A16</td>
<td>OUT07</td>
</tr>
<tr>
<td>2027</td>
<td>B16</td>
<td>OUT07</td>
</tr>
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<td>2028</td>
<td>A17</td>
<td>OUT08</td>
</tr>
<tr>
<td>2029</td>
<td>B17</td>
<td>OUT08</td>
</tr>
</tbody>
</table>

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

Connector Terminal Converter
(Optional)
Model: TIFS553YS

Each Point 24VDC
6.9mA (TYP)

Each Point 24VDC
50mA (max.)

Internal Power Supply 24V, 1A
External Power Supply 24V, 1A

Shock Sensor (NC)
Hold
Low Air Pressure

User Output
5-30 of 552
**MH900, DX200 Controller**

14 Description of Units and Circuit Boards

14.13 Universal I/O Signal Assignment

**Fig. 14-44: JANCD-YIO21-E (CN306 (6TX) Connector) I/O Allocation and Connection Diagram (For Handling)**

**DX200**

Universal I/O circuit board (JANCD-YIO21-E)

**CN306 Connector**

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0040</td>
<td>B1</td>
<td>IN09</td>
</tr>
<tr>
<td>0041</td>
<td>A1</td>
<td>IN10</td>
</tr>
<tr>
<td>0042</td>
<td>B2</td>
<td>IN11</td>
</tr>
<tr>
<td>0043</td>
<td>A2</td>
<td>IN12</td>
</tr>
<tr>
<td>0044</td>
<td>B3</td>
<td>IN13</td>
</tr>
<tr>
<td>0045</td>
<td>A3</td>
<td>IN14</td>
</tr>
<tr>
<td>0046</td>
<td>B4</td>
<td>IN15</td>
</tr>
<tr>
<td>0047</td>
<td>A4</td>
<td>IN16</td>
</tr>
<tr>
<td>0048</td>
<td>B5</td>
<td></td>
</tr>
<tr>
<td>0049</td>
<td>A5</td>
<td></td>
</tr>
<tr>
<td>0050</td>
<td>B6</td>
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<td>0051</td>
<td>A6</td>
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<td>0052</td>
<td>B7</td>
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</tr>
<tr>
<td>0053</td>
<td>A7</td>
<td>024VU</td>
</tr>
<tr>
<td>0054</td>
<td>B8</td>
<td>OUT09</td>
</tr>
<tr>
<td>0055</td>
<td>A8</td>
<td>OUT10</td>
</tr>
<tr>
<td>0056</td>
<td>B9</td>
<td>OUT11</td>
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<td>0057</td>
<td>A9</td>
<td>OUT12</td>
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<td>0058</td>
<td>B10</td>
<td>OUT13</td>
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<td>0059</td>
<td>A10</td>
<td>OUT14</td>
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<td>0060</td>
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<td>OUT15</td>
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<td>OUT16</td>
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</tr>
<tr>
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<td>A18</td>
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</tr>
<tr>
<td>0076</td>
<td>B19</td>
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<td>A19</td>
<td></td>
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</tr>
<tr>
<td>CN303-3</td>
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<td></td>
</tr>
<tr>
<td>CN303-4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Connector Terminal Converter (Optional)**

Model: TIFS553YS

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

**DX200**

Each Point
24VDC
6.9mA (TYP)

Each Point
24VDC
50mA (max.)

**Internal Power Supply**

+24V

**External Power Supply**

+24VE

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
Fig. 14-45: JANCD-YIO21-E (CN307 (7TX) Connector) I/O Allocation and Connection Diagram (For Handling)

DX200

Universal I/O circuit board (JANCD-YIO21-E)

Connector Terminal Converter (Optional)
Model: TIFS553YS

<table>
<thead>
<tr>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>IN</td>
</tr>
<tr>
<td>A1</td>
<td>Sensor Input 1</td>
</tr>
<tr>
<td>B2</td>
<td>Sensor Input 2</td>
</tr>
<tr>
<td>A2</td>
<td>Sensor Input 3</td>
</tr>
<tr>
<td>B3</td>
<td>Sensor Input 4</td>
</tr>
<tr>
<td>A3</td>
<td>Sensor Input 5</td>
</tr>
<tr>
<td>B4</td>
<td>Sensor Input 6</td>
</tr>
<tr>
<td>A4</td>
<td>Sensor Input 7</td>
</tr>
<tr>
<td>B5</td>
<td>Sensor Input 8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>B1</td>
<td>IN</td>
</tr>
<tr>
<td>A1</td>
<td>A1</td>
<td>Sensor Input 1</td>
</tr>
<tr>
<td>B2</td>
<td>B2</td>
<td>Sensor Input 2</td>
</tr>
<tr>
<td>A2</td>
<td>A2</td>
<td>Sensor Input 3</td>
</tr>
<tr>
<td>B3</td>
<td>B3</td>
<td>Sensor Input 4</td>
</tr>
<tr>
<td>A3</td>
<td>A3</td>
<td>Sensor Input 5</td>
</tr>
<tr>
<td>B4</td>
<td>B4</td>
<td>Sensor Input 6</td>
</tr>
<tr>
<td>A4</td>
<td>A4</td>
<td>Sensor Input 7</td>
</tr>
<tr>
<td>B5</td>
<td>B5</td>
<td>Sensor Input 8</td>
</tr>
</tbody>
</table>

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
### Universal I/O Signal Assignment

#### Logical Number

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START</td>
</tr>
<tr>
<td></td>
<td>Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).</td>
</tr>
<tr>
<td>20013</td>
<td>ALARM/ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE</td>
</tr>
<tr>
<td></td>
<td>The play mode is selected when the mode key on the programming pendant is set at &quot;REMOTE&quot;. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE</td>
</tr>
<tr>
<td></td>
<td>The teach mode is selected when the mode key of the programming pendant is set at &quot;REMOTE&quot;. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube 1 area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube 2 area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20026</td>
<td>TOOL SHOCK SENSOR</td>
</tr>
<tr>
<td></td>
<td>This is normally ON (NC) signal input. When it turns OFF, an DX200 displays a message “HAND TOOL SHOCK SENSOR OPERATING” and a HOLD is applied. The releasing in teach mode is done on the handling application diagnostic display. Set tool shock sensor function “NOT USE” on the handling applications diagnostic display if this signal is not be used.</td>
</tr>
<tr>
<td>20027</td>
<td>LOW AIR PRESSURE</td>
</tr>
<tr>
<td></td>
<td>This signal is normally OFF (NO). When it turns ON, DX200 displays user alarm in the PLAY mode or displays user message in the teach mode.</td>
</tr>
<tr>
<td>20050 to 20057</td>
<td>SENSOR INPUT 1 - 8</td>
</tr>
<tr>
<td></td>
<td>Inputs 1 to 8 are monitored with the HSEN handling specific instructions. Sensor inputs 1 to 8 correspond to HSEN 1 to 8.</td>
</tr>
</tbody>
</table>

1. A master job is a job (program) which can be called by CALL MASTER JOB. Other functions are the same as for normal jobs. Normally, the parent job, which manages the child jobs called up immediately after the power is turned ON, is set as the master job.
2. See chapter 8.6 “Interference Area” at page 8-57.
### Table 14-5: Specific Output (Handling)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>RUNNING</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td>SERVO IS ON</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX200 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td>TOP OF MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.¹</td>
</tr>
<tr>
<td>30013</td>
<td>ALARM/ERROR OCCURRED</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td>BATTERY ALARM</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td>REMOTE/PLAY/TEACH MODE SELECTED</td>
</tr>
<tr>
<td></td>
<td>This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td>IN CUBE 1</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td>IN CUBE 2</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td>WORK HOME POSITION (IN CUBE 64)²</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.</td>
</tr>
<tr>
<td>30023</td>
<td>INTERMEDIATE START OK</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30050 to 30057</td>
<td>HAND VALVE 1-4</td>
</tr>
<tr>
<td></td>
<td>These outputs are controlled by the HAND handling specific instructions. Hand valves 1 to 4 correspond to HAND 1 to 4.</td>
</tr>
</tbody>
</table>

¹ This signal is not output during operation.
² The work home position cube and Cube 64 are the same.
**14.13.3 General Application**

Fig. 14-46: JANCD-YI021-E (CN308 (8TX) Connector) I/O Allocation and Connection Diagram (For General Application)

DX200

Universal I/O circuit board (JANCD-YI021-E)

Each Point 24VDC 6.9mA (TYP)

<table>
<thead>
<tr>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Start</td>
<td>IN</td>
</tr>
<tr>
<td>Call Master Job</td>
<td>IN</td>
</tr>
<tr>
<td>Alarm/Error Reset</td>
<td>IN</td>
</tr>
<tr>
<td>Select Play Mode</td>
<td>IN</td>
</tr>
<tr>
<td>Select Teach Mode</td>
<td>IN</td>
</tr>
<tr>
<td>Interference Entrance Prohibited</td>
<td>IN</td>
</tr>
<tr>
<td>Interference Entrance Prohibited</td>
<td>IN</td>
</tr>
<tr>
<td>Work Prohibited</td>
<td>IN</td>
</tr>
<tr>
<td>024VU</td>
<td>A7</td>
</tr>
<tr>
<td>Running</td>
<td>B8</td>
</tr>
<tr>
<td>servo is ON</td>
<td>A8</td>
</tr>
<tr>
<td>Top of Master Job</td>
<td>B9</td>
</tr>
<tr>
<td>Alarm/Error Occurred</td>
<td>A9</td>
</tr>
<tr>
<td>Battery Alarm</td>
<td>B10</td>
</tr>
<tr>
<td>Remote Mode Selected</td>
<td>B11</td>
</tr>
<tr>
<td>Play Mode Selected</td>
<td>B11</td>
</tr>
<tr>
<td>Teach Mode Selected</td>
<td>B11</td>
</tr>
<tr>
<td>In Cube 1</td>
<td>B12</td>
</tr>
<tr>
<td>In Cube 2</td>
<td>B12</td>
</tr>
<tr>
<td>Work Home Position</td>
<td>B13</td>
</tr>
<tr>
<td>Interference 1 Entrance Prohibited</td>
<td>IN</td>
</tr>
<tr>
<td>Interference 2 Entrance Prohibited</td>
<td>IN</td>
</tr>
<tr>
<td>Select Play Mode</td>
<td>B14</td>
</tr>
<tr>
<td>Select Teach Mode</td>
<td>B15</td>
</tr>
</tbody>
</table>

Each Point 24VDC 50mA (max.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Power Supply Power Supply</td>
<td>+24V</td>
</tr>
<tr>
<td>+24VE</td>
<td>CN308-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>B11</td>
<td>B11 External Start</td>
</tr>
<tr>
<td>A1</td>
<td>A1 Call Master Job</td>
</tr>
<tr>
<td>A2</td>
<td>A2 Alarm/Error Reset</td>
</tr>
<tr>
<td>A3</td>
<td>A3 Select Play Mode</td>
</tr>
<tr>
<td>A4</td>
<td>A4 Select Teach Mode</td>
</tr>
<tr>
<td>A5</td>
<td>A5 Interference Entrance Prohibited</td>
</tr>
<tr>
<td>A6</td>
<td>A6 Interference Entrance Prohibited</td>
</tr>
<tr>
<td>A7</td>
<td>A7 024VU</td>
</tr>
<tr>
<td>A8</td>
<td>A8 Running</td>
</tr>
<tr>
<td>A9</td>
<td>A9 Servo is ON</td>
</tr>
<tr>
<td>B7</td>
<td>B7 Top of Master Job</td>
</tr>
<tr>
<td>B9</td>
<td>B9 Alarm/Error Occurred</td>
</tr>
<tr>
<td>B10</td>
<td>B10 Battery Alarm</td>
</tr>
<tr>
<td>B11</td>
<td>B11 Remote Mode Selected</td>
</tr>
<tr>
<td>B12</td>
<td>B12 Play Mode Selected</td>
</tr>
<tr>
<td>B13</td>
<td>B13 Teach Mode Selected</td>
</tr>
<tr>
<td>B14</td>
<td>B14 In Cube 1</td>
</tr>
<tr>
<td>B15</td>
<td>B15 In Cube 2</td>
</tr>
<tr>
<td>B16</td>
<td>B16 Work Home Position</td>
</tr>
</tbody>
</table>

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
### Description of Units and Circuit Boards

#### 14.13 Universal I/O Signal Assignment

Fig. 14-47: JANCD-YIO21-E (CN309 (9TX) Connector) I/O Allocation and Connection Diagram (For General Application)

### Universal I/O circuit board (JANCD-YIO21-E)

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Signal Name</th>
<th>Connector Terminal Converter (Optional) Model: TIFS553YS</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>IN1 User Input</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>IN02</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>IN03</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>IN04</td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td>IN05</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>IN06</td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>IN07</td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>IN08</td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td>IN09</td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>IN10</td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td>In Cube 3</td>
<td></td>
</tr>
<tr>
<td>A8</td>
<td>A8</td>
<td></td>
</tr>
<tr>
<td>B9</td>
<td>In Cube 4</td>
<td></td>
</tr>
<tr>
<td>A9</td>
<td>A9</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td>OUT01 User Output</td>
<td></td>
</tr>
<tr>
<td>A10</td>
<td>A10</td>
<td></td>
</tr>
<tr>
<td>B11</td>
<td>OUT02</td>
<td></td>
</tr>
<tr>
<td>A11</td>
<td>A11</td>
<td></td>
</tr>
<tr>
<td>B12</td>
<td>OUT03</td>
<td></td>
</tr>
<tr>
<td>A12</td>
<td>A12</td>
<td></td>
</tr>
<tr>
<td>B13</td>
<td>OUT04</td>
<td></td>
</tr>
<tr>
<td>A13</td>
<td>A13</td>
<td></td>
</tr>
<tr>
<td>B14</td>
<td>OUT05</td>
<td></td>
</tr>
<tr>
<td>A14</td>
<td>A14</td>
<td></td>
</tr>
<tr>
<td>B15</td>
<td>OUT06</td>
<td></td>
</tr>
<tr>
<td>A15</td>
<td>A15</td>
<td></td>
</tr>
<tr>
<td>B16</td>
<td>OUT07</td>
<td></td>
</tr>
<tr>
<td>A16</td>
<td>A16</td>
<td></td>
</tr>
<tr>
<td>B17</td>
<td>OUT08</td>
<td></td>
</tr>
<tr>
<td>A17</td>
<td>A17</td>
<td></td>
</tr>
<tr>
<td>B18</td>
<td>OUT09</td>
<td></td>
</tr>
<tr>
<td>A18</td>
<td>A18</td>
<td></td>
</tr>
<tr>
<td>B19</td>
<td>OUT10</td>
<td></td>
</tr>
<tr>
<td>A19</td>
<td>A19</td>
<td></td>
</tr>
<tr>
<td>B20</td>
<td>FG</td>
<td></td>
</tr>
<tr>
<td>A20</td>
<td>A20</td>
<td></td>
</tr>
</tbody>
</table>

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
**Fig. 14-48: JANCD-YIO21-E (CN306 (6TX) Connector) I/O Allocation and Connection Diagram (General Application)**

### Universal I/O Circuit Board (JANCD-YIO21-E)

<table>
<thead>
<tr>
<th>CN306 Connector</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B1</strong></td>
<td>IN09</td>
<td>IN</td>
</tr>
<tr>
<td><strong>A1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B2</strong></td>
<td>IN10</td>
<td>IN</td>
</tr>
<tr>
<td><strong>A2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B3</strong></td>
<td>IN11</td>
<td>IN</td>
</tr>
<tr>
<td><strong>A3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B4</strong></td>
<td>IN12</td>
<td>IN</td>
</tr>
<tr>
<td><strong>A4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B5</strong></td>
<td>IN13</td>
<td>IN</td>
</tr>
<tr>
<td><strong>A5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B6</strong></td>
<td>IN14</td>
<td>IN</td>
</tr>
<tr>
<td><strong>A6</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B7</strong></td>
<td>IN15</td>
<td>IN</td>
</tr>
<tr>
<td><strong>A7</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B8</strong></td>
<td>OUT09</td>
<td>OUT</td>
</tr>
<tr>
<td><strong>A8</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B9</strong></td>
<td>OUT10</td>
<td>OUT</td>
</tr>
<tr>
<td><strong>A9</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B10</strong></td>
<td>OUT11</td>
<td>OUT</td>
</tr>
<tr>
<td><strong>A10</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B11</strong></td>
<td>OUT12</td>
<td>OUT</td>
</tr>
<tr>
<td><strong>A11</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B12</strong></td>
<td>OUT13</td>
<td>OUT</td>
</tr>
<tr>
<td><strong>A12</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B13</strong></td>
<td>OUT14</td>
<td>OUT</td>
</tr>
<tr>
<td><strong>A13</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B14</strong></td>
<td>OUT15</td>
<td>OUT</td>
</tr>
<tr>
<td><strong>A14</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B15</strong></td>
<td>OUT16</td>
<td>OUT</td>
</tr>
<tr>
<td><strong>A15</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each Point 24VDC 6.9mA (TYP)

Each Point 24VDC 50mA (max.)

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

Connector Terminal Converter (Optional)
Model: TIFS553YS
Terminal Number 537 of 552

DX200

MH900, DX200 Controller 14 Description of Units and Circuit Boards 14.13 Universal I/O Signal Assignment
Fig. 14-49: JANCD-YIO21-E (CN307 (7TX) Connector) I/O Allocation and Connection Diagram
(For General Application)
### Description of Units and Circuit Boards

#### 14.13 Universal I/O Signal Assignment

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START&lt;br&gt;Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB&lt;br&gt;Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job(^1). This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).</td>
</tr>
<tr>
<td>20013</td>
<td>ALARM/ERROR RESET&lt;br&gt;After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE&lt;br&gt;The play mode is selected when the mode key on the programming pendant is set at &quot;REMOTE&quot;. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE&lt;br&gt;The teach mode is selected when the mode key of the programming pendant is set at &quot;REMOTE&quot;. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED&lt;br&gt;If the manipulator attempts to enter the cube (^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED&lt;br&gt;If the manipulator attempts to enter the cube (^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20022</td>
<td>WORK PROHIBITED (Tool ON Prohibited)&lt;br&gt;Even if TOOLON instruction is executed, DX200 doesn’t output to external while this signal is ON.</td>
</tr>
<tr>
<td>20024</td>
<td>INTERFERENCE 3 ENTRANCE PROHIBITED&lt;br&gt;If the manipulator attempts to enter the cube (^3) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20025</td>
<td>INTERFERENCE 4 ENTRANCE PROHIBITED&lt;br&gt;If the manipulator attempts to enter the cube (^4) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
</tbody>
</table>

---

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

\(^2\) See chapter 8.6 "Interference Area" at page 8-57.
### Table 14-7: Specific Output (General Application)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>RUNNING</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td>SERVO IS ON</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX200 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td>TOP OF MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.</td>
</tr>
<tr>
<td>30013</td>
<td>ALARM/ERROR OCCURRED</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td>BATTERY ALARM</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td>REMOTE/PLAY/TEACH MODE SELECTED</td>
</tr>
<tr>
<td></td>
<td>This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td>IN CUBE 1</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td>IN CUBE 2</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td>WORK HOME POSITION (IN CUBE 64)</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the robot is in the start position.</td>
</tr>
<tr>
<td>30023</td>
<td>INTERMEDIATE START OK</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30024</td>
<td>IN CUBE 3</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30025</td>
<td>IN CUBE 4</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30026</td>
<td>WORK COMMAND</td>
</tr>
<tr>
<td></td>
<td>This signal provides the command for the general tool to operate. TOOL ON instruction execution or the [TOOL ON] key in the programming pendant turns this signal ON and TOOL OFF instruction execution or the [TOOL OFF] key in the programming pendant turns it OFF. However, it remains OFF while the WORK PROHIBITED signal (2022) is input or while the robot is stopped.</td>
</tr>
</tbody>
</table>

1. This signal is not output during operation.
2. The work home position cube and Cube 64 are the same.
### 14.13.4 Spot Welding

Fig. 14-50: JANCD-YIO21-E (CN308 (8TX) Connector) I/O Allocation and Connection Diagram (For Spot Welding)

DX200

Universal I/O circuit board (JANCD-YIO21-E)

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0101</td>
<td>B1</td>
<td>External Start</td>
</tr>
<tr>
<td>0102</td>
<td>B2</td>
<td>Call Master Job</td>
</tr>
<tr>
<td>0103</td>
<td>B3</td>
<td>Alarm/Error Reset</td>
</tr>
<tr>
<td>0104</td>
<td>B4</td>
<td>Select Play Mode</td>
</tr>
<tr>
<td>0105</td>
<td>B5</td>
<td>Select Teach Mode</td>
</tr>
<tr>
<td>0106</td>
<td>A4</td>
<td>-</td>
</tr>
<tr>
<td>0107</td>
<td>A5</td>
<td>Interference Entrance</td>
</tr>
<tr>
<td>0108</td>
<td>A6</td>
<td>Interference Entrance</td>
</tr>
<tr>
<td>0109</td>
<td>A7</td>
<td>Welding ON/OFF</td>
</tr>
<tr>
<td>0110</td>
<td>A8</td>
<td>Welding Pause</td>
</tr>
<tr>
<td>0111</td>
<td>A9</td>
<td>024VU</td>
</tr>
<tr>
<td>0112</td>
<td>A10</td>
<td>024VU</td>
</tr>
<tr>
<td>0113</td>
<td>A11</td>
<td>024VU</td>
</tr>
<tr>
<td>0114</td>
<td>A12</td>
<td>024VU</td>
</tr>
<tr>
<td>0115</td>
<td>A13</td>
<td>024VU</td>
</tr>
<tr>
<td>0116</td>
<td>A14</td>
<td>024VU</td>
</tr>
<tr>
<td>0117</td>
<td>A15</td>
<td>024VU</td>
</tr>
<tr>
<td>0118</td>
<td>A16</td>
<td>024VU</td>
</tr>
<tr>
<td>0119</td>
<td>A17</td>
<td>024VU</td>
</tr>
<tr>
<td>0120</td>
<td>A18</td>
<td>024VU</td>
</tr>
<tr>
<td>0121</td>
<td>A19</td>
<td>024VU</td>
</tr>
<tr>
<td>0122</td>
<td>A20</td>
<td>024VU</td>
</tr>
</tbody>
</table>

* Remove jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
**Fig. 14-51: JANCD-YIO21-E (CN309 (9TX) Connector) I/O Allocation and Connection Diagram (For Spot Welding)**

**Universal I/O circuit board (JANCD-YIO21-E)**

**DX200**

**Connector Terminal Converter (Optional)**

**Model:** TIFS553YS

Each Point

24VDC

6.9mA (TYP)

Each Point

24VDC

50mA (max.)

**CN309 Connector**

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Signal Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>B2</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>B3</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>A3</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>B4</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>A4</td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td>B5</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>A5</td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>B6</td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>A6</td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td>B7</td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>A7</td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td>B8</td>
<td></td>
</tr>
<tr>
<td>A8</td>
<td>A8</td>
<td></td>
</tr>
<tr>
<td>B9</td>
<td>B9</td>
<td></td>
</tr>
<tr>
<td>A9</td>
<td>A9</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td>B10</td>
<td></td>
</tr>
<tr>
<td>A10</td>
<td>A10</td>
<td></td>
</tr>
<tr>
<td>B11</td>
<td>B11</td>
<td></td>
</tr>
<tr>
<td>A11</td>
<td>A11</td>
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</tr>
<tr>
<td>B12</td>
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<td>A12</td>
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<td>B13</td>
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<td>B14</td>
<td>B14</td>
<td></td>
</tr>
<tr>
<td>A14</td>
<td>A14</td>
<td></td>
</tr>
<tr>
<td>B15</td>
<td>B15</td>
<td></td>
</tr>
<tr>
<td>A15</td>
<td>A15</td>
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</tr>
<tr>
<td>B16</td>
<td>B16</td>
<td></td>
</tr>
<tr>
<td>A16</td>
<td>A16</td>
<td></td>
</tr>
<tr>
<td>B17</td>
<td>B17</td>
<td></td>
</tr>
<tr>
<td>A17</td>
<td>A17</td>
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</tr>
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<td>B18</td>
<td>B18</td>
<td></td>
</tr>
<tr>
<td>A18</td>
<td>A18</td>
<td></td>
</tr>
<tr>
<td>B19</td>
<td>B19</td>
<td></td>
</tr>
<tr>
<td>A19</td>
<td>A19</td>
<td></td>
</tr>
<tr>
<td>B20</td>
<td>B20</td>
<td>FG</td>
</tr>
<tr>
<td>A20</td>
<td>A20</td>
<td></td>
</tr>
</tbody>
</table>

* Remove jumper-pin between CN303-1 and -3, CN303-2 and -4 when using an external power supply.
Universal I/O circuit board (JANCD-YIO21-E)

Each Point
24VDC
6.9mA (TYP)

Each Point
24VDC
50mA (max.)

Connector Terminal Converter
(Optional)
Model: TIFS553YS

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4
when a external power supply is used.
14 Description of Units and Circuit Boards

14.13 Universal I/O Signal Assignment

Fig. 14-53: JANCD-YIO21-E (CN307 (7TX) Connector) I/O Allocation and Connection Diagram (For Spot Welding)

DX200

Universal I/O circuit board (JANCD-YIO21-E)

Each Point 24VDC 6.9mA (TYP)

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Logical Number</th>
<th>Connector Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>B1</td>
<td>A1</td>
<td>24VDC</td>
<td>IN</td>
</tr>
<tr>
<td>2001</td>
<td>A1</td>
<td>A1</td>
<td>24VDC</td>
<td>IN</td>
</tr>
<tr>
<td>2002</td>
<td>B2</td>
<td>A2</td>
<td>Error</td>
<td>IN</td>
</tr>
<tr>
<td>2003</td>
<td>A2</td>
<td>A2</td>
<td>Low Air Pressure</td>
<td>IN</td>
</tr>
<tr>
<td>2004</td>
<td>B3</td>
<td>B3</td>
<td>IN13</td>
<td>IN</td>
</tr>
<tr>
<td>2005</td>
<td>A3</td>
<td>A3</td>
<td>IN14</td>
<td>IN</td>
</tr>
<tr>
<td>2006</td>
<td>B4</td>
<td>B4</td>
<td>IN15</td>
<td>IN</td>
</tr>
<tr>
<td>2007</td>
<td>A4</td>
<td>A4</td>
<td>IN16</td>
<td>IN</td>
</tr>
<tr>
<td>B5</td>
<td>A5</td>
<td>A5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>A6</td>
<td>A6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>B7</td>
<td>024VU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td>A8</td>
<td>A8</td>
<td>Weld OFF</td>
<td>OUT</td>
</tr>
<tr>
<td>B9</td>
<td>A9</td>
<td>A9</td>
<td>Weld Error</td>
<td>OUT</td>
</tr>
<tr>
<td>B10</td>
<td>A10</td>
<td>A10</td>
<td>Weld Condition 1</td>
<td>OUT1</td>
</tr>
<tr>
<td>B11</td>
<td>A11</td>
<td>A11</td>
<td>Weld Condition 2</td>
<td>OUT2</td>
</tr>
<tr>
<td>B12</td>
<td>A12</td>
<td>A12</td>
<td>Weld Condition 3</td>
<td>OUT3</td>
</tr>
<tr>
<td>B13</td>
<td>A13</td>
<td>A13</td>
<td>Weld Condition 4</td>
<td>OUT4</td>
</tr>
<tr>
<td>B14</td>
<td>A14</td>
<td>A14</td>
<td>Weld Condition 5</td>
<td>OUT5</td>
</tr>
<tr>
<td>B15</td>
<td>A15</td>
<td>A15</td>
<td>Tip Change Request</td>
<td>OUT6</td>
</tr>
</tbody>
</table>

Each Point 24VDC 500mA (max.)

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Logical Number</th>
<th>Connector Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>A1</td>
<td>B1</td>
<td>024VU</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>A2</td>
<td>B2</td>
<td>024VU</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>A3</td>
<td>B3</td>
<td>024VU</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>A4</td>
<td>B4</td>
<td>024VU</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>A5</td>
<td>B5</td>
<td>FG</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>A6</td>
<td>B6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Connector Terminal Converter (Optional)
Model: TIFS553YS

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

** This assignment can be changed at the I/O assignment display.

*** Refer to System Input List YIU01 and System Output List YIU01 for detail.
### Table 14-8: Specific Input (Spot Welding) (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START</td>
</tr>
<tr>
<td></td>
<td>Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job(^1). This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).</td>
</tr>
<tr>
<td>20013</td>
<td>ALARM/ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE</td>
</tr>
<tr>
<td></td>
<td>The play mode is selected when the mode key on the programming pendant is set at “REMOTE”. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE</td>
</tr>
<tr>
<td></td>
<td>The teach mode is selected when the mode key of the programming pendant is set at “REMOTE”. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube (^1) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube (^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20022</td>
<td>WELDING ON/OFF (From sequencer)</td>
</tr>
<tr>
<td></td>
<td>This signal inputs the welding ON/OFF selector switch status from the sequencer in the interlock unit. The WELD ON/OFF signal is output to the Power Source according to this signal and the manipulator status.</td>
</tr>
<tr>
<td>20023</td>
<td>WELDING PAUSE (From sequencer)</td>
</tr>
<tr>
<td></td>
<td>This signal is used to move the manipulator to the home position when an error occurs in the Power Source or the gun. The robot ignores the spot welding instruction and operates playback motion.</td>
</tr>
<tr>
<td>20024</td>
<td>INTERFERENCE 3 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube (^3) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20025</td>
<td>INTERFERENCE 4 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube (^4) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20050 (^3)</td>
<td>TIMER COOLING WATER ERROR</td>
</tr>
<tr>
<td></td>
<td>This signal monitors the status of timer cooling water. The manipulator displays alarm and stops when this signal is input. The servo power remains ON.</td>
</tr>
<tr>
<td>20051 (^3)</td>
<td>GUN COOLING WATER ERROR</td>
</tr>
<tr>
<td></td>
<td>This signal monitors the status of gun cooling water. The manipulator displays alarm and stops when this signal is input. The servo power supply remains ON.</td>
</tr>
</tbody>
</table>
14 Description of Units and Circuit Boards

14.13 Universal I/O Signal Assignment

Table 14-8: Specific Input (Spot Welding) (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20052</td>
<td>TRANSTHERMO ERROR</td>
</tr>
<tr>
<td>3)</td>
<td>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.</td>
</tr>
<tr>
<td>20053</td>
<td>LOW AIR PRESSURE</td>
</tr>
<tr>
<td>3)</td>
<td>When air pressure is reduced and this input is turned ON, an alarm occurs. The servo power supply remains ON.</td>
</tr>
<tr>
<td>4)</td>
<td>WELD COMPLETION</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>4)</td>
<td>WELDING ERROR</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>4)</td>
<td>STICK DETECTION</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>4)</td>
<td>GUN FULL OPEN DETECTION</td>
</tr>
<tr>
<td></td>
<td>This signal indicates that the stroke of the double stroke gun is full open.</td>
</tr>
<tr>
<td>4)</td>
<td>GUN SHORT OPEN DETECTION</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>4)</td>
<td>GUN PRESSURE DETECTION</td>
</tr>
<tr>
<td></td>
<td>This signal indicates that a gun is in pressing status.</td>
</tr>
<tr>
<td>4)</td>
<td>TIP REPLACE COMPLETION</td>
</tr>
<tr>
<td></td>
<td>When this signal is input after tip replacement, the TIP REPLACE REQUEST signal turns OFF, and the stored number of welding is cleared.</td>
</tr>
</tbody>
</table>

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

2 See chapter 8.6 “Interference Area” at page 8-57.

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

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

---

Pseudo Input Signal 8202x

<table>
<thead>
<tr>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

- Timer Cooling Water Error Validating (or IN09)
- Gun Cooling Water Error Validating (or IN10)
- Transthermo Error Validating (or IN11)
- Low Air Pressure Validating (or IN12)
- Weld ON/OFF Validating (or OUT09)
### Table 14-9: Specific Output (Spot Welding) (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>RUNNING</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td>SERVO IS ON</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX200 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td>TOP OF MASTER JOB</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.¹</td>
</tr>
<tr>
<td>30013</td>
<td>ALARM/ERROR OCCURRED</td>
</tr>
<tr>
<td></td>
<td>This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td>BATTERY ALARM</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td>REMOTE/PLAY/TEACH MODE SELECTED</td>
</tr>
<tr>
<td></td>
<td>These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td>IN CUBE 1</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td>IN CUBE 2</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td>WORK HOME POSITION (IN CUBE 64)²</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a work home position area. Use this signal to evaluate whether the robot is in the start position.</td>
</tr>
<tr>
<td>30023</td>
<td>INTERMEDIATE START OK</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30024</td>
<td>IN CUBE 3</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30025</td>
<td>IN CUBE 4</td>
</tr>
<tr>
<td></td>
<td>This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30050</td>
<td>WELD ON/OFF ³</td>
</tr>
<tr>
<td></td>
<td>Outputs a signal input from the interlock panel, etc. considering the robot status.</td>
</tr>
<tr>
<td>30051</td>
<td>WELD ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>This signal commands the reset error status of the Power Source. This is operated with the programming pendant operation.</td>
</tr>
</tbody>
</table>
14 Description of Units and Circuit Boards

14.13 Universal I/O Signal Assignment

Table 14-9: Specific Output (Spot Welding) (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30052 to 30056</td>
<td>WELD CONDITION (Level signals)</td>
</tr>
<tr>
<td></td>
<td>1(1), 2(2), 4(3), 8(4), 16(5), 32(6), 64(7), 128(8)</td>
</tr>
<tr>
<td></td>
<td>Sets the welding conditions for the Power Source.</td>
</tr>
<tr>
<td></td>
<td>The output format can be selected as binary or discrete (bit number). It can handle up to 255 conditions. Most-significant bit is the parity bit (when specified).</td>
</tr>
</tbody>
</table>

4) WELDING COMMAND |
| This signal outputs execution command signal to the Power Source. This signal is not necessary for a Power Source which is executed using the WELDING CONDITION signal. |

4) STROKE CHANGE1 |
| SINGLE SOLENOID |
| DOUBLE SOLENOID |
| This is a signal, when a double stroke gun is used, to change the open stroke of the welding gun. |

4) GUN PRESS COMMAND |
| This outputs gun press command. |

1 This signal is not output during operation. |
2 The work home position cube and Cube 64 are the same. |
3 This signal can be select "USE" or "NOT USE" by pseudo input signal "8202x". If "NOT USE" is selected, this signal can be used as the universal I/O signal described in parentheses. |
4 This signal can be allocated to any universal I/O signal at the I/O allocation display in operation condition. |
14 Description of Units and Circuit Boards

14.13 Universal I/O Signal Assignment

14.13.5 JANCD-YEW01-E Circuit Board (Option)

14.13.5.1 Arc Welding

This circuit board is a welder I/F circuit board for the welding, and it is an optional for the DX200. It is necessary to use this circuit board when operating the instructions by the analog instruction to the welder.
14.14 List of the Equipment Configuration by Model

For the models which are not in Table 14-10 and Table 14-11, refer to “DX200 INSTRUCTIONS SUPPLEMENT FOR Controller Specification List.

Table 14-10: DX200 Parts List for the MH900

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Model</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Amplifier Module</td>
<td>1)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Control power supply unit</td>
<td>JZNC-yps21-e</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Converter</td>
<td>SRDA-COA30A21B-E</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CPU unit</td>
<td>JZNC-YRK21-1E</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPU circuit board</td>
<td>JANCD-ycp21-e</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Back board</td>
<td>JANCD-ybb21-e</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PCI raiser board</td>
<td>JANCD-ybb22-e</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Robot I/F circuit board</td>
<td>JANCD-yif01-e</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Machine safety CPU circuit board</td>
<td>JANCD-ysf21-e</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Machine safety I/O logic circuit board</td>
<td>JANCD-ysf22-e</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Machine safety terminal circuit board</td>
<td>JANCD-yfc22-e</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Universal I/O circuit board</td>
<td>JANCD-yio21-e</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Power ON unit</td>
<td>JZRCR-ypu7-e</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Major axes control circuit board</td>
<td>SRDA-EAXA21A</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Brake circuit board</td>
<td>JANCD-ybk21-3E</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Heat exchanger</td>
<td>TCSIP-16A4Y-0C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interior fan</td>
<td>4715MS-22W-B50-BA2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exterior fan</td>
<td>4715TS-22W-B50-BA2</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Backside duct fan</td>
<td>4715MS-22T-B50-B00 or 11938MB-B2N-EA-01</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Power ON unit fuse</td>
<td>0215010MXP 10A, 250V</td>
<td>Time lag fuse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GP25 2.5A, 250V</td>
<td>Alarm Fuse</td>
</tr>
<tr>
<td></td>
<td>Universal I/O circuit board fuse</td>
<td>02173.15P 3.15A, 250V</td>
<td>Rapid cut fuse</td>
</tr>
<tr>
<td></td>
<td>Machine safety logic circuit board</td>
<td>0217001P 1A, 250V</td>
<td>Rapid cut fuse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0217002P 2A, 250V</td>
<td>Rapid cut fuse</td>
</tr>
<tr>
<td></td>
<td>Brake circuit board fuse</td>
<td>02173.15P 3.15A, 250V</td>
<td>Rapid cut fuse</td>
</tr>
<tr>
<td></td>
<td>Major axes control circuit board</td>
<td>HM10 1A, 250V</td>
<td>Micro fuse</td>
</tr>
<tr>
<td>16</td>
<td>Battery</td>
<td>ER6VC3N 3.6V</td>
<td></td>
</tr>
</tbody>
</table>

1 The type of the amplifier module depends on the manipulator model. For details, see the table “Amplifier Module List.”
### Table 14-11: Amplifier Module List

<table>
<thead>
<tr>
<th>Component</th>
<th>MH900</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amplifier module</strong></td>
<td></td>
</tr>
<tr>
<td>AMP1 R</td>
<td>SRDA-SDA71A01A-E</td>
</tr>
<tr>
<td>AMP2 B</td>
<td>SRDA-SDA71A01A-E</td>
</tr>
<tr>
<td>AMP3 T</td>
<td>SRDA-SDA71A01A-E</td>
</tr>
<tr>
<td>AMP4 *</td>
<td>SRDA-SDA14A01A-E</td>
</tr>
<tr>
<td>AMP5 *</td>
<td>SRDA-SDA14A01A-E</td>
</tr>
<tr>
<td>AMP6 *</td>
<td>SRDA-SDA14A01A-E</td>
</tr>
<tr>
<td><strong>Middle cabinet amplifiers</strong></td>
<td></td>
</tr>
<tr>
<td>AMP7 S</td>
<td>SGDM-1EAC-NX1</td>
</tr>
<tr>
<td>AMP8 L</td>
<td>SGDM-1EAC-NX1</td>
</tr>
<tr>
<td>AMP9 U</td>
<td>SGDM-1EAC-NX1</td>
</tr>
<tr>
<td><strong>Capacitor module</strong></td>
<td>SRDA-CUA133AA</td>
</tr>
</tbody>
</table>