YRC1000 INSTRUCTIONS

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

MOTOMAN INSTRUCTIONS

Please have the following information available when contacting Yaskawa Customer Support:

- System
- 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)

Part Number: 178642-1CD
Revision: 10
DANGER

- This manual describes setup, diagnosis, maintenance, hardware, etc. of the YRC1000 system. Read this manual carefully and be sure to understand its contents before handling the YRC1000. Any matter, including operation, usage, measures, and an item to use, not described in this manual must be regarded as "prohibited" or "improper".

- General information related to safety are described in "Chapter 1. Safety" of "YRC1000 INSTRUCTIONS". To ensure correct and safe operation, carefully read "Chapter 1. Safety" of "YRC1000 INSTRUCTIONS".

CAUTION

- 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.

- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

- 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.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the YRC1000.

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”.

**NOTICE**
NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

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

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

**NOTE**
To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” and “CAUTION”.
• Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  – Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  – Disconnect the safety plug of the safety fence. (when in the play mode or in the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button

• Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  – Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  – Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

• Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  – Turning ON the YRC1000 power
  – Moving the manipulator by using the programming pendant
  – Running the system in the check mode
  – Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

• Read and understand the Explanation of the Warning Labels before operating the manipulator.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

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

In this manual, the equipment is designated as follows.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
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<tr>
<td>YRC1000 Controller</td>
<td>YRC1000</td>
</tr>
<tr>
<td>YRC1000 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

WARNING

• Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  – Check for a problem in manipulator movement.
  – Check for damage to insulation and sheathing of external wires.
• Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.
Descriptions of the programming pendant keys, buttons, and displays are shown as follows:

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<th>Manual Designation</th>
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<tr>
<td>Programming Pendant</td>
<td></td>
</tr>
<tr>
<td>Character Keys /Symbol Keys</td>
<td>The keys which have characters or symbols printed on them are denoted with [ ]. e.g. [ENTER]</td>
</tr>
<tr>
<td>Axis Keys /Numeric Keys</td>
<td>[Axis Key] and [Numeric Key] are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, e.g. [SHIFT]+[COORD].</td>
</tr>
<tr>
<td>Mode Switch</td>
<td>Mode Switch can select three kinds of modes that are denoted as follows: REMOTE, PLAY or TEACH. (The switch names are denoted as symbols)</td>
</tr>
<tr>
<td>Button</td>
<td>The three buttons on the upper side of the programming pendant are denoted as follows: START, HOLD, or EMERGENCY STOP. (The button names are denoted as symbols)</td>
</tr>
<tr>
<td>Displays</td>
<td>The menu displayed in the programming pendant is denoted with { }. e.g. {JOB}</td>
</tr>
</tbody>
</table>

Description of the Operation Procedure

In the explanation of the operation procedure, the expression “Select • • •” means that the cursor is moved to the object item and the [SELECT] is pressed, or that the item is directly selected by touching the screen.
Registered Trademark

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

Explanation of Warning Labels

The following warning labels are attached to the manipulator and YRC1000. Fully comply with the precautions on the warning labels.

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

- The following warning labels are attached to YRC1000. Observe the precautions on the warning labels. Failure to observe this warning may result in injury or damage to equipment.
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1 Safety

1.1 For Your Safety

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

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

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

---

**DANGER**

- Teaching operation and maintenance operation of the robot must conform to:
  - Industrial Safety and Health Law
  - Order for Enforcement of the Industrial Safety and Health Law
  - Industrial Safety and Health Regulations
  - Technical Standards for Electrical Facilities

Other related laws and regulations 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 2006/42/EC

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

- Observe
  - JIS B 8433-1: 2015 “Robots for industrial environments-Safety requirements” (ISO 10218-1: 2011)
    for safe operation of the robot. (JIS B 8433 is for Japan only)

- Reinforce the
  - SAFETY MANAGEMENT SYSTEM
  by designating authorized operators and safety managers for the robot, as well as giving continuing safety education and training.

- Teaching operation and maintenance operation of the robot are specified as “Hazardous Operations” in the Industrial Safety and Health Act (for Japan only).

Personnel engaged in these operations must receive special training offered by YASKAWA.
1.2 Special Training

DANGER

- Personnel engaged in operation, maintenance, or management of the robot must receive required training before using the robot.
- For more information on training, contact your YASKAWA representative. The telephone numbers of our offices are listed on the back cover of this manual.

1.3 MOTOMAN Manual List

DANGER

- For safety, make sure to have the following manuals for MOTOMAN on hand, read them thoroughly and understand the contents of them:
  - MOTOMAN-□□□ INSTRUCTIONS
  - YRC1000 INSTRUCTIONS
  - YRC1000 MAINTENANCE MANUAL
  - YRC1000 OPERATOR’S MANUAL (GENERAL) (SUBJECT SPECIFIC)
  - YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)
- Confirm that you have all the above manuals on hand. If any of them is missing, contact your YASKAWA representative. The telephone numbers of our offices are listed on the back cover of this manual.
1.4 Personnel Safety

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

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

**WARNING**

- In the vicinity of the area where the MOTOMAN is installed, avoid any dangerous actions, such as entering the manipulator’s operating range without due care.

Failure to observe this instruction may cause contact with the manipulator or peripheral equipment, which may result in personal injury.

- Strictly observe the safety precautions and signs in the factory, such as “Flammable”, “High Voltage”, “Danger”, “Off-limits to Unauthorized Personnel”.

Failure to observe this instruction may result in fire, electric shock, and/or personal injury caused by contact with the manipulator or other equipment.

- Strictly observe the following precautions about clothing:
  - Always wear approved work clothes (no loose-fitting clothes).
  - To prevent misoperation, do not wear gloves when operating the MOTOMAN.
  - Do not let the underwear, shirts, or neckties hang out from the work clothes.
  - Do not wear large accessories, such as earrings, rings, or necklaces.
  - Always wear protective safety equipment, such as hard hats, safety shoes (with slip-proof soles), face shields, safety glasses, and gloves as necessary.

Failure to observe this instruction may result in personal injury.

- The following must be understood and strictly observed by all personnel as rules:
  - Unauthorized personnel other than the operator must not approach the area where the MOTOMAN is installed.
  - Do not let unauthorized personnel other than the operator approach the area where the MOTOMAN is installed.

Failure to observe this instruction may cause contact with the manipulator, the YRC1000, the control panel, the workpiece, or the positioner, etc., which may result in personal injury.
1 Safety
1.4 Personnel Safety

**WARNING**

- Do not forcibly move an axis of the manipulator. Do not hang from or get on the manipulator.

Failure to observe this instruction may result in personal injury and/or equipment damage.

- Do not sit or lean on the YRC1000.

Failure to observe this instruction may result in personal injury and/or equipment damage.

- Do not turn a switch or press a button, etc. on the YRC1000 or other control panels without due care.

Failure to observe this instruction may cause unexpected movement of the manipulator, which may result in personal injury and/or equipment damage.

- Do not let unauthorized personnel touch the YRC1000 or the programming pendant while the power is ON.

Failure to observe this instruction may cause unexpected movement of the manipulator, which may result in personal injury and/or equipment damage.
1.5 MOTOMAN Safety

The followings are safety functions of MOTOMAN/YRC1000.

- Emergency stop SW input (controller/programming pendant)
- Enable SW input (programming pendant)
- Safeguarding interlock signal input (safety plug)
- External emergency stop SW input
- Servo power enable input
- Overrun input (manipulator/external axis)
- General-purpose safety input (including external enable SW input)
- Safety logic circuit

These safety functions conform to the following safety standards.

- EN ISO 13849-1: 2015 Cat.3/PLe
- EN 62061 (IEC 61508) SIL CL3

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

- Emergency stop SW: 500 times/year
- Enable SW (programming pendant): 2000 times/year
- External enable SW: 2000 times/year
1 Safety
1.5 MOTOMAN Safety

1.5.1 Installation and Wiring Safety

the MOTOMAN INSTRUCTIONS and the YRC1000 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**

- As the installation site for the manipulator, select an area such as the following:
  - Confirm that the area is large enough so that the fully-extended manipulator arm with the tool will not reach the wall, the safety fence, the YRC1000, etc.

Failure to observe this instruction may cause contact with the manipulator, which may result in personal injury and/or equipment damage.

- Make sure that the maximum operating range of the manipulator including the ends of the tool and the workpiece can be clearly recognized by lines marked on the floor or color-coding of the floor.

- Perform grounding in accordance with all applicable electrical codes and technical standards for electrical facilities.

Failure to observe this instruction may result in fire and/or electric shock.
1 Safety
1.5 MOTOMAN Safety

WARNING

- Operation of the crane, sling, or forklift must be performed only by authorized personnel. Failure to observe this instruction may result in personal injury and/or equipment damage.

- Use a crane, in principle, to transport the manipulator.
  - Before lifting the manipulator, make sure to securely fix the manipulator by using the shipping bolts and brackets and set the manipulator’s posture for transportation as described in the MOTOMAN-Instructions of the manipulator.
  - Lift the manipulator by using a two-leg bridle sling hooked to the eyebolts attached to the shipping brackets or the manipulator body.

Failure to observe this instruction may cause overturning of the manipulator during transportation, which may result in personal injury and/or equipment damage.

- When transporting the YRC1000, confirm the following:
  - Use a crane, in principle, to transport the YRC1000.
  - Use a bridle sling strong enough to handle the weight of the YRC1000.

Failure to observe this instruction may cause falling or overturning of the YRC1000 during transportation, which may result in personal injury and/or equipment damage.

Confim that the eyebolts are securely fastened before transportation, and then use the eyebolts to transport the YRC1000.

Failure to observe this instruction may cause falling or overturning of the YRC1000 during transportation, which may result in personal injury and/or equipment damage.

### Table 1-1: Approx. Weight of YRC1000

<table>
<thead>
<tr>
<th>Models Available for YRC1000</th>
<th>Specification</th>
<th>Approx. Weight [Kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-Capacity Model</td>
<td>For Japan</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>For Asia, For North America, For Europe</td>
<td>70</td>
</tr>
<tr>
<td>Medium/Large-Capacity Model</td>
<td>For Japan</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>For Asia, For North America, For Europe</td>
<td>85</td>
</tr>
</tbody>
</table>
1 Safety
1.5 MOTOMAN Safety

**WARNING**

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

Failure to observe this instruction may cause overturning of the manipulator, which may result in personal injury and/or equipment damage.

**WARNING**

- Secure enough space for maintenance on the manipulator, the YRC1000, and other peripheral devices.

Failure to observe this instruction may result in personal injury during maintenance.

![YRC1000 External Dimensions (Unit: mm)](image)

YRC1000 Maintenance Area (Unit: mm)

- Install the YRC1000 and the positioner control panel, etc. in a place from where the movement of the manipulator can easily be checked visually and the manipulator can be operated safely.

Failure to observe this instruction may cause improper operation, which may result in personal injury.

- Install the YRC1000 outside the safety fence around the manipulator.

Failure to observe this instruction may cause contact with the manipulator, which may result in personal injury.

- To install the manipulator, use the bolts and screws of the types and sizes specified in the MOTOMAN-□□□ INSTRUCTIONS of the manipulator.

Failure to observe this instruction may cause overturning of the manipulator, which may result in personal injury and/or equipment damage.
### WARNING

- After installing the YRC1000, firmly anchor it to the floor or baseplate by using the screws and the screw holes on the lateral bottom of the YRC1000.

Failure to observe this instruction may cause overturning of the YRC1000, which may result in personal injury and/or equipment damage.

- Perform wiring to the YRC1000 with a thorough understanding of and in accordance with the connection diagram.

Failure to observe this instruction may cause improper wiring and/or unexpected movement of the manipulator, which may result in personal injury and/or equipment damage.

- Run the piping, wiring, and cables for the YRC1000, the manipulator, the positioner control panel, peripheral devices, etc. in a pit so that they are not stepped on by personnel or run over by a forklift.

Failure to observe this instruction may cause personnel to trip over exposed piping, wiring, or a cable, which may result in personal injury. Failure to observe this instruction may also cause damage to piping, wiring, or a cable and unexpected movement of the manipulator, which may result in personal injury and/or equipment damage.
1.5 MOTOMAN Safety

1.5.2 Work Area Safety

Carelessness contributes to serious accidents in the work area.

To ensure safety, enforce the following precautions:

---

**DANGER**

- When the power supplies of the manipulator and the YRC1000 are turned ON at start-up, be sure to confirm the following:
  - Safety protection devices such as the emergency stop circuit, the safety plug, etc. operate normally.
  - Each axis operates normally in the teach mode.
  - The manipulator operates normally at the speed limit or less in the teach mode. (Speed limit: 250 mm/s at the TCP or the flange)
  - The teaching function and the playback function operate normally.
- The manipulator may stop its movement while waiting for a condition to be satisfied during operation. In this case, the manipulator starts its movement again immediately after the condition is satisfied, thus it is dangerous to come close to the manipulator even if it is not moving. Make sure to clearly indicate that the manipulator is in operation by using a pilot lamp and/or an audible alert so that the operator does not come close to the manipulator, or make sure that the manipulator stops its operation if the operator comes close to it.
- Install safety fences around the manipulator to prevent any accidental contact with the manipulator while the power is ON. Display a warning sign stating “Off-Limits During Operation” at the entrance of the safety fence. The gate of the safety fence must be equipped with a safety interlock (safety plug) to turn the servo power OFF when the gate opens. Make sure that the interlock operates properly before use. For details of installation, refer to chapter 14.7.1 “Safety Plug”.
- For areas not enclosed by safety fences, use a photoelectric sensor, a safety light curtain, etc. to make sure that the manipulator stops its operation if the operator enters its operating range.

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

---

**CAUTION**

- Store industrial tools, etc. in a safe location outside the manipulator’s operating range.

If an industrial tool, etc. is left unattended on the manipulator, on a fixture, or on the floor, etc., the manipulator may come in contact with the industrial tool left unattended, which may result in damage to the manipulator and/or the fixture.
- If the light in the operator’s working space is not bright enough, provide the space with appropriate lighting.
1.5.3 Operation Safety

**DANGER**

- While performing inspection and maintenance, wiring, or attaching a tool to the manipulator, etc., make sure to turn OFF the power supply of the YRC1000 and the tool, and keep the switch of the power supply locked so that unauthorized personnel cannot turn ON the power supply. In addition, display a warning sign stating "Energizing Prohibited".

Turning ON the power supply without due care during inspection and maintenance, etc., may cause electric shock or unexpected movement of the manipulator, which may result in personal injury.

- Use the MOTOMAN only within the specifications described in the manuals for MOTOMAN. Failure to observe this instruction may result in personal injury and/or equipment damage.

- Without a compelling reason, perform operations in the teach mode only when no person is present in the area enclosed by the safety fences.

- Perform operations in the teach mode from outside the manipulator's operating range whenever possible.

- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.
1.5 MOTOMAN Safety

**DANGER**

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence.
    (when in the play mode or in the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

- Make sure that all safety protection devices are activated before starting a job in the play mode.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  - Turning ON the YRC1000 power
  - Moving the manipulator by using the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation.

- Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.
WARNING

• Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  – Check for a problem in manipulator movement.
  – Check for damage to insulation and sheathing of external wires.

• After installing the manipulator, replacing parts, modifying the taught job, or modifying the robot system by changing the tool or a peripheral device, etc., make sure to perform the first operation of the manipulator at low speed, and confirm that there is no abnormal noise, abnormal vibration, or abnormal operation. If an error occurs, immediately turn OFF the YRC1000 power supply and inform the safety manager of the error.

• Always return the programming pendant to the hook on the YRC1000 cabinet after use

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

DANGER

• Personnel engaged in teaching or inspection, etc. of the MOTOMAN must receive special training required by applicable laws and regulations.

  – Refer to chapter 1.2 “Special Training”
1.6 Notes for Moving and Transferring the MOTOMAN

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

**DANGER**

- When relocating, transferring, or selling the MOTOMAN, make sure that the MOTOMAN is always accompanied by its manuals so that all users have access to necessary manuals. See chapter 1.3 “MOTOMAN Manual List” for a list of the manuals.

If any of them is missing, contact your YASKAWA representative. The telephone numbers of our offices are listed on the back cover of this manual.

- If a warning label on the manipulator or the YRC1000 is dirty and unreadable, clean the label to make it clearly readable. If a warning label has come off, put the label back in place. Note that some local laws and regulations may prohibit equipment operation if safety labels are not in place.

Contact your YASKAWA representative if you require new warning labels.

- After the MOTOMAN is relocated, inspection by your YASKAWA representative is recommended.

If installation or wiring of a device is incorrect, personal injury and/or equipment damage may result.
1.7 Notes on MOTOMAN Disposal

**DANGER**

- Do not modify the manipulator or the YRC1000. Failure to observe this instruction may cause fire, mechanical failure, or malfunction, which may result in personal injury and/or equipment damage.

**WARNING**

- Take precautionary measures to prevent the manipulator from overturning, such as anchoring it firmly, etc., even when temporarily storing it before disposal. Failure to observe this instruction may cause overturning of the manipulator, which may result in personal injury.

**NOTICE**

- When disposing of or recycling the MOTOMAN, follow the applicable national/local laws and regulations.

This symbol is applicable for EU member states only. The wheeie bin symbol on this product, manual or its packaging indicates that at the end of life the product should enter the recycling system. It must be disposed at an appropriate collection point for electrical and electronic equipment (EEE) and should not be put in the normal waste stream.
2 Product Confirmation

2.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

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

- Manipulator (accessories included)
- YRC1000 (spareparts included)
- Programming Pendant
- Manipulator Cable (between Manipulator and YRC1000)
- Complete Set of Manual
  (in the CD-ROM which is connected to the USB connector)

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

Confirm that the order number pasted on the manipulator and YRC1000 are the same.

The order number plates are affixed to the figure below.
3 Installation

3.1 Handling Procedure

### WARNING

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

Failure to observe this instruction may result in personal injury and/or equipment damage.

### NOTICE

- Avoid excessive vibration or shock while transporting or moving the YRC1000.

Failure to observe this instruction may adversely affect the performance of the YRC1000 because it consists of precision components.

3.1.1 Using a Crane to Move the Controller

Check the following before handling the YRC1000:

- Confirm the weight of the controller before handling, and use a wire rope with a rating that is greater than the weight of the controller.

- Install eyebolts for handling and confirm they are securely fastened before hoisting.

<table>
<thead>
<tr>
<th>Models Available for YRC1000</th>
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<td>70</td>
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<tr>
<td></td>
<td>For North America, For Europe</td>
<td></td>
</tr>
<tr>
<td>Medium/Large-Capacity Model</td>
<td>For Japan</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>For Asia,</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>For North America, For Europe</td>
<td></td>
</tr>
</tbody>
</table>

YRC1000
3.1.2 Using a Forklift to Move the Controller

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

- Confirm that there is a safe work environment and that the YRC1000 can be transported safely to the installation site.
- Inform people along the forklift route that equipment is being moved in their area.
- Secure the controller so it cannot shift or fall during handling.
- Transport the controller at the lowest possible height.
- Avoid jarring, dropping, or hitting the controller during handling.
- When carrying the controller, operate the forklift at a safe speed.

Fig. 3-1: Using Forklift

![Diagram showing the use of a forklift with protective padding, tiedown straps, pallet, and forklift control elements.](image-url)
3.2 Place of Installation

The conditions listed below must be met before installing the YRC1000:

- Ambient temperature must be 0 to 45°C (32 to 113°F) during operation and -10 to 60°C (14 to 140°F) during transportation and maintenance. Temperature change must be 0.3°C/min or less.
- Humidity must be low with no condensation (10~90%RH).
- Only a small amount of dirt, dust, cutting oil, organic solvent, oil fume, water or salt 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 YRC1000.)
- Free from excessive microwaves, ultraviolet rays, X-rays, or radiation.
- Altitude: 1000 m or less (To use the DX100 at the altitude over 1000 m, calculate the maximum ambient temperature by decreasing it by 1% per 100 m. The maximum allowable altitude is 2000 m. When the altitude is 2000 m, the maximum ambient temperature during operation is 40.5°C.)

NOTE
If the external electric noise applies, the alarm occurs and the manipulator may stop.
When the alarm occurs and the manipulator stops, “YRC1000 MAINTENANCE MANUAL (RE-CHO-A114)” and reset the alarm.
3.3 Location

1. Install the YRC1000 outside of the P-point maximum envelope of the manipulator (outside of the safeguarding.)

*Fig. 3-2: Location of YRC1000*

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

3. Install the controller at least 300mm from the nearest wall to allow maintenance access.
3 Installation
3.4 Mounting the Controller

**WARNING**

- Do not sit or lean on the YRC1000.
Failure to observe this instruction may result in personal injury and/or equipment damage.

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

![Diagram of controller mounting](image)

**NOTE**

For details on installation of the manipulator, the INSTRUCTIONS for the manipulator.
3.5 Procedure of Stacking the Controllers

It is possible to stack the YRC1000 controllers. Follow the procedures below when stacking the YRC1000 controllers.

1. Remove the four eyebolts (4 places) on the top of the YRC1000 to be stacked lower level.

2. Lift the controller by using the crane, and stack the controllers. Refer to chapter 3.1.1 "Using a Crane to Move the Controller", when using the crane.

**WARNING**

- Keep the YRC1000 lifted by the crane until the YRC1000 is stacked and fixed securely.

Failure to observe this instruction may result in personal injury and/or equipment damage.
3. After stacking the controllers, remove the grommets inside (A-A section “a” part) of the upper controller. Install the M12 bolts (length: 35 mm), spring washers and washers for temporarily.

4. Remove the back board and the plate on the back of the upper controller. When remove the back board, remove the connector cover which fixed with the back board together. A fixing screw for the back board is also on the inside of connector cover. Refer to the following figure and remove the fixing screw.

**NOTICE**

- Removing the back board from the YRC1000 must be performed by two operators, and make sure that one of operators keep holding the removed back board with due care to prevent damage to the internal cables.

Failure to observe this instruction may result in damage to the cables.
5. After stacking the controllers, remove the grommets inside (A-A section “b” part) of the upper controller. Install the M12 bolts (length: 35 mm), spring washers and washers for temporarily.

6. After confirming the stacking the controllers, tighten the temporarily M12 bolts firmly. (a, b parts: tighten the 4 places) (tightening torque: 35 N-m)

7. Reinstall the removed back board and plate at procedure No.4.

8. Remove the wire lifting the controller by the crane, and stacking is completed.
4 Connection

4 Connection

**WARNING**

- The system must be grounded.
  Failure to observe this instruction may result in fire and/or electric shock. Especially in the case where the YRC1000 for European standards is used in Japan, difference in conditions related to electricity such as grounding methods may cause increase in leakage current, which may result in electric shock.
- Before wiring, make sure to turn OFF the primary power supply and use tagout (e.g., "DO NOT TURN THE POWER ON").
  Failure to observe this instruction may result in electric shock and/or personal injury.
- Do not touch any part inside the YRC1000 for at least five minutes after turning OFF the power supply. In addition, confirm that the charge lamps (orange LED) on the converter and the inverter unit are turned OFF.
  Failure to observe this instruction may result in electric shock and/or personal injury due to residual voltage in the capacitor.
- While the power is ON, make sure that the protective cover of the breaker is mounted and the front door of the YRC1000 is closed.
  Failure to observe this instruction may result in fire and/or electric shock.
- Wiring of the emergency stop circuit must be performed under the responsibility of the user. Make sure to perform operation check after wiring.
  Failure to observe this instruction may result in personal injury and/or mechanical failure.
- Wiring must be performed only by authorized personnel.
  Failure to observe this instruction may result in fire and/or electric shock.
- Perform wiring in accordance with the rated capacity as specified in this INSTRUCTIONS.
  Failure to observe this instruction may result in fire and/or mechanical failure.
- Make sure to securely tighten the terminal screws on the main circuit and the control circuit.
  Failure to observe this instruction may result in fire and/or electric shock.
Connection

**NOTICE**

- Engine generators cannot be used to supply power because the medium- and large-capacity YRC1000 regenerates power. Use commercial power supply for operations, including test operations.

Applicable models: Medium- and large-capacity YRC1000 (YRC1000 with 200 V and 400 V specifications for use with manipulator models with payload exceeding 25 kg.)

If an engine generator is used to supply power, the converter cannot sufficiently discharge regenerated power and an alarm may occur. The alarm is more likely to occur in high-speed regeneration due to an instantaneous, large regenerative current.

**NOTICE**

- Do not touch the circuit board directly by hand.
Failure to observe this instruction may result in malfunction of the IC due to static electricity.
4.1 Notes on Cable Junctions

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

- Confirm the connector and cable numbers to prevent mis-connection and equipment damage. One connects the manipulator and YRC1000. Another connects the YRC1000 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: YRC1000 Cable Junction Diagram*
4.2 Power Supply

4.2.1 Three-Phase Power Supply

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

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

Provide the three-phase power supply as follows.

Table 4-1: Power Supply Specification

<table>
<thead>
<tr>
<th>YRC1000 type</th>
<th>Power supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Japan ERAR-1000-xxxxxxx-A0x</td>
<td>3-phase 200 to 240 VAC (+10% to -15%) at 50/60 Hz (±2%)</td>
</tr>
<tr>
<td>For Asia ERAR-1000-xxxxxxx-A1x</td>
<td>3-phase 380 to 440 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing)</td>
</tr>
<tr>
<td>For Europe ERAR-1000-xxxxxxx-E1x</td>
<td>3-phase 200 to 240 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing)</td>
</tr>
<tr>
<td>For North America ERAR-1000-xxxxxxx-B1x</td>
<td>3-phase 380 to 480 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing)</td>
</tr>
</tbody>
</table>

A specification of connectable power supply differs depending on the controller type. Confirm the specification of power supply corresponding to the controller’s model by the rated label on the door of YRC1000.

WARNING

- For the power supply of 380 to 480 VAC, make sure to ground the neutral point of the power supply. Failure to observe this instruction may result in fire and/or damage to equipment.
4 Connection
4.2 Power Supply

Fig. 4-2: Input Power Connection

WARNING

- The system must be grounded.

Failure to observe this instruction may result in fire and/or electric shock. Especially in the case where the YRC1000 for European standards is used in Japan, difference in conditions related to electricity such as grounding methods may cause increase in leakage current, which may result in electric shock.
4.2 Power Supply

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 YRC1000 inverter. Leakage breakers which cannot handle high frequencies may malfunction.

*Table 4-2: 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 class (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 YRC1000 inverter. However, this current leakage presents no safety risks.

*Fig. 4-4: Connection of the Leakage Breaker*
4.2.4 Primary Power Supply Breaker Installation

Install the primary power supply breaker as shown below.

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

Table 4-3: YRC1000 Power Capacity, Cable Sizes, and Breaker Capacities (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Manipulator</th>
<th>Power capacity (kVA)</th>
<th>Cable size (size of terminal) (In case of Cabtyre cable (three cores))</th>
<th>Capacity of breaker in YRC1000 (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>For Japan, For North America</td>
<td>For Japan: 200 V</td>
</tr>
<tr>
<td>GP7</td>
<td>1.0</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>AR900</td>
<td>1.0</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>GP8</td>
<td>1.0</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>AR700</td>
<td>1.0</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>GP12</td>
<td>1.5</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>AR1440</td>
<td>1.5</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>AR1440E</td>
<td>1.5</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>GP25</td>
<td>2.0</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>AR1730</td>
<td>2.0</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>GP25-12</td>
<td>2.0</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>AR2010</td>
<td>2.0</td>
<td>3.5 (M5) 3.5 (M8)</td>
<td>15</td>
</tr>
<tr>
<td>GP20HL</td>
<td>3.5</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
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<td>AR3120</td>
<td>3.5</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP50</td>
<td>4.5</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP35L</td>
<td>4.5</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP88</td>
<td>4.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP80</td>
<td>4.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP110</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP100</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP130</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP180</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP165</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP180-120</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP165-105</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP200S</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP215</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP225</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
</tbody>
</table>
### Table 4-3: YRC1000 Power Capacity, Cable Sizes, and Breaker Capacities (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Manipulator</th>
<th>Power capacity (kVA)</th>
<th>Cable size (size of terminal) (In case of Cabtyre cable (three cores)) (mm²)</th>
<th>Capacity of breaker in YRC1000 (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>For Japan, For Asia, For Europe</td>
<td>For North America</td>
</tr>
<tr>
<td>SP210</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP250</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP235</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP280</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP165R</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP150R</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP200R</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP185R</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP110H</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP180H</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP180H-110</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP225H</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP110B</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>SP100B</td>
<td>5.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>PH130RF</td>
<td>7.5</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>PH130F</td>
<td>7.5</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP400</td>
<td>7.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP600</td>
<td>7.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>GP400R</td>
<td>7.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
<tr>
<td>PL500</td>
<td>8.0</td>
<td>5.5 (M5) 5.5 (M8)</td>
<td>30</td>
</tr>
</tbody>
</table>

The maximum load value (payload, operation speed, and frequency, etc.) is displayed. However, the power capacity is different depending on work conditions. Inquire at the nearest branch office listed on the back cover for information when selecting the transformer.

**NOTE**

The power capacity shown above is the continuous rating value. When the manipulator is rapidly accelerated, the power capacity of several times the continuous rating value may be needed instantly.

The power capacity is changed when using an external axis. For details of the power capacity with an external axis, please contact to your YASKAWA representative or check the rated value name plate on the controller.
4.3 Connection Methods

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

**Fig. 4-6: Cable Connection**

4.3.1 Connecting the Primary Power Supply

1. Open the front door of the YRC1000.
   
   (1) Using a flathead screwdriver, rotate the door locks on the front of the YRC1000 (one place) 90 degrees clockwise.

   **Fig. 4-7: Rotating the Key Clockwise**

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

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

YRC1000
2. Confirm that the primary power supply is OFF.
3. Connect the primary power supply cable.
   – Run the primary power supply cable from the cable entrance on left side of YRC1000 and fix it firmly with the cable clamp so that it won’t shift or slip out of place.

   *Fig. 4-9: Cable Clamp*

   ![Cable Clamp](image)

   **WARNING**
   - Make sure to use a cable clamp to connect the primary power supply cable to the YRC1000.
   - Make sure to tightly fasten the cable clamp to prevent the ingress of dust, dirt, or water.
   Failure to observe this instruction may result in electric shock and/or mechanical failure.

   (1) Pull off the primary cover of the switch which is on the upper left side of the YRC1000.

   *Fig. 4-10: Pulling Off the Cover*

   ![Pulling Off the Cover](image)
4 Connection
4.3 Connection Methods

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

I) Connect the ground wire to the ground terminal (screw) which is on the upper left side of YRC1000.

Fig. 4-11: Connection of the Ground Wire

II) Perform D class grounding (with the ground resistance of 100 ohm or less) in accordance with all relevant local and national electrical codes. The size of ground wire must be the same as listed on table 4-3 "YRC1000 Power Capacity, Cable Sizes, and Breaker Capacities".

NOTE The customer must prepare the ground wire.

Fig. 4-12: Exclusive Grounding

When performing D class grounding (with the ground resistance of 100 ohm or less) to operate the YRC1000, be sure to use the leakage breaker. (Refer to chapter 4.2.3 "Leakage Breaker Installation".)

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

Ground in accordance with all relevant governmental regulations when using metallic ducts, metallic conduits, and cable tray to construct the cable.
(3) Connect the primary power supply cable.

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

(4) Install the cover.

*Fig. 4-14: Install the Cover*
4. Close the YRC1000 door.

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

*Fig. 4-15: Rotating the Key Counterclockwise*

**WARNING**

- Make sure to close the door and close all the door locks of the YRC1000 whenever it is used, except for maintenance.

Failure to observe this instruction may cause the ingress of dust, dirt, or water, which may result in electric shock and/or mechanical failure.
4.3.2 Connecting the Manipulator Cable

1. Remove the package, and take out the manipulator cable. Connect the cable to the connector on the back side of YRC1000.

   (1) Confirm that the connector lever of manipulator cable is at the initial position. Then insert the manipulator cable straight into the connector on the back side of YRC1000.

   – Insert the manipulator cable to a fixed depth, then the lever rotate about 30 degrees forward automatically.

   (2) Push the lever with hand and turn it 30 degrees approx. to lock it. Then press the positions as following figure to confirm the lever is locked.

When pull out the connector, push the unlock part of the lever to unlock and turn the lever about 60 degrees to return to the initial position. Then pull out the connector straight.

Fig. 4-16: Connection of the Manipulator Cable
4 Connection
4.3 Connection Methods

2. Connect the manipulator cable to the manipulator.
   – Confirm the connector number of manipulator cable. Push the cable connector into the manipulator side connector firmly, and tighten securely in the same procedure as step 1.
4 Connection
4.3 Connection Methods

4.3.3 Connecting the Programming Pendant

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

*Fig. 4-17: Connecting the Programming Pendant*

– The manipulator, YRC1000, and the programming pendant connections are now complete.
4 Connection
4.3 Connection Methods

4.3.4 User I/O Cable Connection

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

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect user I/O signal to I/O terminal blocks (TIFS553YS) that are connected to general-purpose I/O board (JANCD-AIO□□-E)</td>
<td>User connects general-purpose I/O signal through terminal blocks (TIFS553YS), that are mounted at the back side of the controller’s front door.</td>
</tr>
<tr>
<td>Connect safety plug and system external signal for external emergency stop, etc. to safety terminal block board (IM-YE250/5-80P)</td>
<td>Connect safety plug and system external signal for external emergency stop, etc. to safety terminal block board which is mounted on the back side of the controller’s front door.</td>
</tr>
<tr>
<td>Directly connect user I/O signal to general-purpose I/O board (JANCD-AIO□□-E)</td>
<td>User connects user I/O signal to general-purpose I/O board (JANCD-AIO□□-E) directly.</td>
</tr>
</tbody>
</table>

1. Remove covering plates from I/O cable openings on the back side panel or right side of the controller.

2. Make a hole on each covering plate and run the user I/O cable.
   - Use a cable gland, etc. to prevent any particles from getting inside the YRC1000.
   - For the drawing length of the cable, the table in the next page since it varies depending on the connecting part.

3. After running the cable through the I/O cable opening, set the covering plate back to the original position.
4. Draw the user system external signal cable and general-purpose I/O signal cable from the cable openings to the front part of the controller along its right side.

<table>
<thead>
<tr>
<th>Connection Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connect user I/O signal to I/O terminal blocks (TIFS553YS) connected to general-purpose I/O board (JANCD-AIO□-E)</strong></td>
</tr>
<tr>
<td>Drawing length: 1.5m (Cable length for terminal processing is included)</td>
</tr>
<tr>
<td>Connect safety plug and system external signal for external emergency stop, etc. to safety terminal block board (IM-YE250/5-80P)</td>
</tr>
<tr>
<td>Drawing length: 1.3m (Cable length for terminal processing is included)</td>
</tr>
<tr>
<td>Cable terminal process: Unshielded Refer to “Wiring Procedure of the Terminal Block” in chapter 14.7 “Safety Terminal Block Board (IM-YE250/5-80P)”</td>
</tr>
<tr>
<td>Directly connect user I/O signal to general-purpose I/O board (JANCD-AIO□-E)</td>
</tr>
<tr>
<td>Drawing length: 1.0m (Cable length for terminal processing is included)</td>
</tr>
<tr>
<td>Cable terminal process: Connector Refer to “Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)” in chapter 14.8</td>
</tr>
</tbody>
</table>

Run the cable through the front side of YRC1000 along its right side.
5. Run the general-purpose I/O signal cable through the I/O terminal block as shown by the red line in the figure below.

- For the details of the connection, refer to "Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)" in chapter 14.8 "General-Purpose I/O Board (JANCD-AI00□-E)"

Fix the cable by using the cable tie and the hole* on the right side of YRC1000.
* It is on the far side from the door and it is the second hole from the bottom.

Fix the cable on the door and right side by using the cable ties as the figure.
Note the following two points.
- No tension is found to the cables when the door is fully opened.
  (Cable length between fixing part of the door side and the right side: approximately 150mm)
- Be careful not to get stuck the cables between the main body of the controller and its door when the door is closed.
6. Run the system external signal cables such as the safety I/O signals through the safety terminal block board (IM-YE250/5-80P) as shown by the red line in the figure below.

- For the details of the connection, refer to “Wiring Procedure of the Terminal Block” in chapter 14.7 “Safety Terminal Block Board (IM-YE250/5-80P)”

Fix the cable by using the cable tie and the hole* on the right side of YRC1000.
* It is on the far side from the door and it is the second hole from the bottom.

Fix the cable on the door and right side by using the cable ties as the figure.
- No tension is found to the cables when the door is fully opened.
- (Cable length between fixing part of the door side and the right side: approximately 150mm)
- Be careful not to get stuck the cables between the main body of the controller and its door when the door is closed.
7. Run the general-purpose I/O signal cables through the general-purpose I/O board (JANCD-AIO0□-E) as shown by the red line in the figure below.

- For the details of the connection, refer to “Wiring Procedure of the Terminal Block” in chapter 14.8 “General-Purpose I/O Board (JANCD-AIO0□-E)”.

"Do not damage the cable by fixing too tight."
5 Turning ON and OFF the Power Supply

5.1 Turning ON the Main Power Supply

WARNING

- When turning ON the YRC1000 power, confirm that no person is present in the manipulator's operating range and that the operator is in a safe location.

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

The main power supply is turned ON when the main power supply switch on the front panel of the YRC1000 is turned to the “ON” position, and the initial diagnosis and the current position setting begin.

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

5.1.1 Initial Diagnosis

The initial diagnosis are performed in the YRC1000 when main power is turned ON, and the startup window is shown on the programming pendant screen.

*Fig. 5-2: Startup Window*

5.1.2 When Initial Diagnosis Are Complete

When the power supply is turned OFF, the YRC1000 saves all condition data, including:

- Mode of operation
- Called job (active job if the YRC1000 is in the play mode; edit job if the YRC1000 is in the teach mode) and the cursor position in the job.

*Fig. 5-3: Initial Window*

**WARNING**

- Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.
5 Turning ON and OFF the Power Supply
5.2 Turning ON the Servo Power

5.2.1 During Play Mode

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

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

![SERVO ON READY] Light

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

5.2.2 During Teach Mode

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

![SERVO ON READY] Flicker

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

3. The servo power is turned OFF and [SERVO ON] lamp turns OFF on the programming pendant when the operator releases the Enable switch. Perform the steps 1 and 2 to turn ON the servo power again.
### 5. Turning ON and OFF the Power Supply

#### 5.2 Turning ON the Servo Power

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

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

**NOTE**

When performing emergency stop on the front door of the YRC1000, programming pendant, or external signal, the servo power-on operation from the Enable switch is canceled. When turning the power back ON, follow the previously listed instructions.

- **The Valid / Invalid setting of safety signals in operation modes.**
  Safety functions of the robotic system are switched 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 great 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>Programming 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>Programming Pendant Enable SW (PPDSW)</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 is turned off.
  The emergency stop buttons are located on the front door of the YRC1000 and on the right side of the programming pendant.

- The brake operates once the servo power supply is turned OFF, and the manipulator can no longer operate.
  The emergency stop mode can be operated at any mode.
  (Teach mode, Play mode, Remote mode)

![Programming Pendant](Door upper side)

5.3.2 Turning OFF the Main Power

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

- When the main power switch on the front panel of YRC1000 is turned to the “OFF” position, the main power is turned OFF.

![YRC1000 Main Power Supply Switch](YRC1000)

**NOTE**

When an hour glass pointer is appearing on the programming pendant screen, the data writing is in process.

If turn the YRC1000 power supply OFF during the data writing, the data may be broken. Do not turn the power supply OFF when the hour glass pointer is seen on the programming pendant.
5.3.3 The Method of Stopping Manipulator Operation

The following 3 categories are stop functions of the manipulator.

- Stop Category 0
  The immediate insulation of the motor power source to servo motor causes the stop.
  After the motor power is insulated, the manipulator and the external axis decelerate by the brake and stop.
  The manipulator and the external axis may run off the operation path (Path).

- Stop Category 1
  The manipulator and the external axis are controlled on the operation path, decelerate and then stop.
  After the stop, the manipulator and the external axis are locked by the brake and the motor power is insulated.

- Stop Category 2
  The manipulator and the external axis are controlled on the operation path, decelerate and then stop.
  After the stop, the stop position is retained in a state that the motor power is being supplied.

Besides the safety signals, the YRC1000 robotic system stops the manipulator by the above three stop categories.

The method of stopping the manipulator by each stop signal is shown in the following table.
### Turning ON and OFF the Power Supply

#### 5.3 Turning OFF the Power Supply

<table>
<thead>
<tr>
<th>Safety Signal</th>
<th>Mode</th>
<th>Operation Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stop Category 0</td>
<td>Stop Category 1</td>
</tr>
<tr>
<td>Controller Emergency Stop (PBESP)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>External Emergency Stop (EXESP)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Programing Pendant Emergency Stop (PPESP)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Safeguarding (safety plug) (SAFF)</td>
<td>Teach Invalid</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Programing Pendant Enable SW (PPDSW)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Servo Power Enable (ONEN)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Manipulator Overrun (OT)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>External Axis Overrun (EXOT)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Programing Pendant (HOLD)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Mode Switch (Teach mode to play mode)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td>(PP KEY SW)</td>
<td>Play</td>
<td></td>
</tr>
<tr>
<td>Mode Switch (Play mode to teach mode)</td>
<td>Teach Valid</td>
<td>○</td>
</tr>
<tr>
<td>(PP KEY SW)</td>
<td>Play</td>
<td></td>
</tr>
</tbody>
</table>

- : Invalid

**WARNING**

When the stop category 1 is used, the stopping distance and the stopping time are longer than those with the stop category 0. Thus, when using the stop category 1, perform the risk assessment of the whole system by considering increased stopping distance and stopping time.
6 Test of Program Operation

DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  - Turning ON the YRC1000 power
  - Moving the manipulator by using the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.
WARNING

• Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  – Check for a problem in manipulator movement.
  – Check for damage to insulation and sheathing of external wires.

• Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

• Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator’s operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.
6.1 Movement of the Axes

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

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

**NOTE**
Be sure to remove all items from the area before moving the manipulator.
For details on the appropriate position of the fixture, the INSTRUCTIONS for the manipulator.

![Axis Keys](image)

![7-Axis manipulator](image)

7-Axis manipulator

- **T-Axis**: Rotates upper arm
- **B-Axis**: Rotates upper arm
- **R-Axis**: Rotates upper arm
- **U-Axis**: Rotates upper arm
- **L-Axis**: Rotates upper arm
- **S-Axis**: Rotates upper arm

![6-Axis manipulator](image)

6-Axis manipulator

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

When the manipulator moves to unexpected places because of system or operation errors and the operation cannot be maintained, using the brake release unit (optional) enables to release the brake of the arbitrary working axis of the manipulator and operate manually.

Table 6-1: Brake Release Unit (Separate Unit Type)

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

This brake release unit can be used in a state that the motor servo ON cannot be executed from the YRC1000 controller.

Be very careful about the followings when using.

**DANGER**

- Before performing brake-release operation for a manipulator, carefully read the MOTOMAN-□□□ INSTRUCTIONS of the manipulator, and securely fix the axis whose brake will be released.

When the brake is released, depending on the axis and its posture, the axis may fall down due to its own weight or may abruptly move upward due to the attached balancer or weight, which may result in personal injury and/or equipment damage.

- Release the brake of only one axis at one brake-release operation.

If the brakes of two or more axes must be released simultaneously out of necessity, pay careful attention to ensure the safety of the surrounding operation environment because the manipulator's arm may move in an unexpected way.

Failure to observe this instruction may result in personal injury and/or equipment damage.

In case of purchase, inquire at the nearest YASKAWA branch office listed on the back cover.
System Up
7 Security System

7.1 Protection through Security Mode Settings

The YRC1000 modes setting are protected by a security system. The system allows operation and modification of settings according to operator clearance. Be sure operators have the correct level of training for each level to which they are granted access.

7.1.1 Security Mode

There are five security modes “operation mode, editing mode, management mode, safety mode and one time manage mode”. Editing mode, management mode and safety mode require a user ID. For the editing mode and the management mode, the user ID should be 4 or more and 16 or less characters with number(s) and symbol(s). As for the safety mode, it should be 9 or more and 16 or less characters with number(s) and symbol(s).

(Significant numbers and symbols: “0 to 9”, “-”, “.”)

Operating the one time manage mode requires to enter the security code, which is issued by YASKAWA sales representative.

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 “YRC1000 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY FUNCTION (HW1483576)” 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 Security System
7.1 Protection through Security Mode Settings

<table>
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<th>Sub Menu</th>
<th>Allowed Security Mode</th>
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<td>JOB</td>
<td>Job</td>
<td>Display</td>
</tr>
<tr>
<td></td>
<td>Select Job</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Create New Job</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>Master Job</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Job Capacity</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Res. Start (Job)</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>Res. Status</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Cycle</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Trash Job List</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>Job Edit (Play)</td>
<td>Edit</td>
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<tr>
<td></td>
<td>Play Edit Job List</td>
<td>Edit</td>
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<tr>
<td>VARIABLE</td>
<td>Byte</td>
<td>Operation</td>
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<td></td>
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<td>Operation</td>
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<td></td>
<td>Double</td>
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<tr>
<td></td>
<td>Real</td>
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<tr>
<td></td>
<td>String</td>
<td>Operation</td>
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<tr>
<td></td>
<td>Position (Robot)</td>
<td>Operation</td>
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<tr>
<td></td>
<td>Position (Base)</td>
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<td></td>
<td>Position (ST)</td>
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<td></td>
<td>Local Variable</td>
<td>Operation</td>
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<tr>
<td></td>
<td>Flag</td>
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<td>IN/OUT</td>
<td>External Input</td>
<td>Operation</td>
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<tr>
<td></td>
<td>External Output</td>
<td>Operation</td>
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<tr>
<td></td>
<td>General Purpose Input</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>General Purpose Output</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>System Input</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>System Output</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Rin</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Cprin</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Register</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Auxiliary Relay</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Control Input</td>
<td>Operation</td>
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<td></td>
<td>Pseudo Input Sig</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Network Input</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Network Output</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Analog Output</td>
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<tr>
<td></td>
<td>Sv Power Status</td>
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<tr>
<td></td>
<td>Ladder Program</td>
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<td>IO Alarm</td>
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<td>IO Message</td>
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<td>Terminal</td>
<td>Operation</td>
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<tr>
<td></td>
<td>IO Simulation List</td>
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<td></td>
<td>Servo On Factor</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>Servo Off Factor</td>
<td>Operation</td>
</tr>
</tbody>
</table>
## 7 Security System
### 7.1 Protection through Security Mode Settings

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<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>COMMAND POSITION</td>
<td>Operation -</td>
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<tr>
<td></td>
<td>SERVO MONITOR</td>
<td>Management -</td>
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<tr>
<td></td>
<td>WORK HOME POS</td>
<td>Operation Edit</td>
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<tr>
<td></td>
<td>SECOND HOME POS</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>DROP AMOUNT</td>
<td>Management Management</td>
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<tr>
<td></td>
<td>POWER ON/OFF POS</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>TOOL</td>
<td>Edit Edit</td>
</tr>
<tr>
<td></td>
<td>INTERFERENCE</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>SHOCK SENS LEVEL</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>USER COORDINATE</td>
<td>Edit Edit</td>
</tr>
<tr>
<td></td>
<td>HOME POSITION</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>MANIPULATOR TYPE</td>
<td>Management -</td>
</tr>
<tr>
<td></td>
<td>ANALOG MONITOR</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>OVERRUN&amp;S-SENSOR&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Operation Operation</td>
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<tr>
<td></td>
<td>LIMIT RELEASE&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Edit Edit</td>
</tr>
<tr>
<td></td>
<td>ARM CONTROL&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>SHIFT VALUE</td>
<td>Operation -</td>
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<td></td>
<td>SOFTLIMIT SETTING</td>
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<td>INITIALIZE&lt;sup&gt;1&lt;/sup&gt;</td>
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### Table 7-2: Menu & Security Mode  (Sheet 4 of 4)

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<td>APPLICATIONS</td>
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</tbody>
</table>

1. Displayed in the teach mode only.
2. Displayed in the play mode only.
3. Displayed when the job reconstruction function is valid.

*As for the menu and the security mode when the functional safety is valid, refer to "YRC1000 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY BOARD OPERATION (HW1483576)" for more details.
7 Security System
7.1 Protection through Security Mode Settings

7.1.1 Changing the Security Mode

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

   ![Main Menu with SECURITY option selected]

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

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

   ![Security Mode Selection Window]

7 Security System
7.1 Protection through Security Mode Settings

– Security mode can be selected from "OPERATION MODE", "EDITING MODE", "MANAGEMENT MODE" or "SAFETY MODE".

3. Select the security mode to change.
– If the selected security mode is lower than the current security level, the password will be required.

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 be changed.
7 Security System
7.1 Protection through Security Mode Settings

- Procedures to Change the Mode to the One Time Management Mode

1. Change to the management mode.
   - When changing to the management mode, security mode can be selected from “OPERATION MODE”, “EDITING MODE”, “MANAGEMENT MODE”, “SAFETY MODE” or “ONE TIME MANAGE MODE”.

![Image](image1.png)

2. Select “ONE TIME MANAGE MODE”.
   - A character string input keypad is displayed. Input the one time security code, which is issued by YASKAWA sales representative.
   - If the password is correct, the security mode will be changed.

![Image](image2.png)
7. Security System
7.1 Protection through Security Mode Settings

7.1.2 User ID

User ID is requested when the editing mode, management mode or safety mode is operated.

The user ID should be 4 or more and 16 or less characters with number(s) and symbol(s) for the editing mode and the management mode. As for the safety mode, it should be 9 or more and 16 or less characters with number(s) and symbol(s).

(Significant numbers and symbols: "0 to 9", “-”, “.”).

7.1.2.1 Changing User ID

In order to change the user ID, the YRC1000 must be in the editing mode, the management mode or the 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.
7 Security System
7.1 Protection through Security Mode Settings

-- The character input line appears, and a message "Input ID no. (4 or more digits)" appears.
(As for the safety mode, 9 or more digits)

4. Input the current ID and press [ENTER].
-- When the correct user ID is entered, a new ID is requested to be input. "Input new ID no.(4 or more digits)" appears.
(As for the safety mode, 9 or more digits)

5. Input new ID and press [ENTER].
-- User ID is changed.
7.1.3 Main CPU SD Card ID

To display the Main CPU SD Card ID is described below.
The main CPU SD Card ID is necessary to issue the one time security code.

1. Change the security mode to the management mode.

2. Select (SYSTEM INFO) in the main menu.
   – The sub menu appears.

3. Select (VERSION).
   – VERSION window appears.
7 Security System
7.1 Protection through Security Mode Settings

4. Select (UTILITY) under the pull-down menu.
   – “SD Card ID” appears.

5. Select “SD Card ID”.
   – SD Card ID dialog of the main CPU appears.
WARNING

• Data related to the system's basic functions can be modified; however, inappropriate modification may cause fatal incident or failure for the manipulator or the whole system.

Before performing system setup, carefully read and understand the instructions, and make sure to observe the following precautions.

• System setup must be performed under the supervision of the administrator.

NOTICE

• Make sure to perform data storage and management whenever creating or modifying data. (Use our recommended SD card.)

• YASKAWA is not responsible for any incident or failure caused by inappropriate setting of data.
8.1 Home Position Calibration

**DANGER**

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode).

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

- Observe the following precautions when performing a teaching operation within the manipulator’s operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator’s operating range and that the operator is in a safe location before:
  - Turning ON the YRC1000 power
  - Moving the manipulator by using the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the manipulator’s operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.
WARNING

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

- Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

Failure to observe this instruction may result in injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.
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, it needs to be performed again for the following cases.

- Change in the combination of the manipulator and YRC1000
- Replacement of the motor or absolute encoder
- Clearing stored memory (by replacement of AIF01-1E 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.
8.1.2 Calibrating Operation

NOTE
Home position calibration screen is shown only in the security mode or the management mode.

8.1.2.1 Registering All Axes at One Time

1. Select (ROBOT) under the main menu.
   - The sub menu appears
   ![Sub menu image]

2. Select (HOME POSITION).
   - The HOME POSITIONING window appears.
   ![HOME POSITIONING window image]
3. Select `{DISPLAY}` under the menu.
   – The pull-down menu appears.

4. Select the desired control group.
   – Select the control group for HOME POSITIONING.
   – The control group can also be selected by pressing `[PAGE]`.
5. Select (EDIT) under the menu.
   – The pull-down menu appears.

6. Select (SELECT ALL AXES).
   – The confirmation dialog box appears.

7. Select (YES).
   – The position data of all axes which is shown are registered as home position. When (NO) is selected, the registration will be canceled.
8.1.2.2 Registering Individual Axes

1. Select ‘ROBOT’ under the main menu.
   – The sub menu appears.

2. Select ‘HOME POSITION’.

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

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

   ![Image of the interface showing how to select an axis]

   – A confirmation dialog box appears.

5. Select ‘YES’.
   – The position data of the axis which is shown is registered as home position. When ‘NO’ is selected, the registration will be canceled.
8.1.2.3 Changing the Absolute Data

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

1. Select (ROBOT) under the main menu.
2. Select (HOME POSITION).
3. Select the desired control group.
   - By performing the step 3 and 4 of the "Registering All Axes at One Time", the HOME POSITIONING window is shown and the desired control group can be selected.
4. Select the absolute data to be registered.
   - The number can be entered.
5. Enter the absolute data by using the numeric keys.
6. Press [ENTER].
   - Absolute data is modified.
8.1.2.4 Clearing Absolute Data

1. Select (ROBOT) under the main menu.
   - The sub menu appears
2. Select {HOME POSITION}.
   - By performing the step 2, 3 and 4 of the "Registering All Axes at One Time", the HOME POSITIONING window is shown and the desired control group can be selected.
3. Select {DATA} under the main menu.
   - The pull-down menu appears
4. Select [CLEAR ALL DATA].
   - A confirmation dialog box appears.
8 System Setup
8.1 Home Position Calibration

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

The home position posture of a commonly used 6-axis vertically-articulated manipulator is shown below.

*NOTE*  
The home position posture of each manipulator differs depending on its model. Refer to the INSTRUCTIONS for the manipulator corresponding to its model.
8.2 Setting the Second Home Position

DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode).

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  - Turning ON the YRC1000 power
  - Moving the manipulator by using the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.
8.2 Setting the Second Home Position

WARNING

- When performing the position check operation for the second home position (check point), pay careful attention to ensure the safety of the surrounding operation environment.

If the “OUT OF RANGE (ABSO DATA)” alarm occurs, an error in the encoder communication related components may be the cause of the alarm. In this case, the manipulator may move in an unexpected direction, which may result in personal injury and/or equipment damage.

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.

- Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

- Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator’s operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.
8.2 Setting the Second Home Position

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, the alarm no. 4107 “OUT OF RANGE (ABSO DATA)” is issued when the controller power is turned ON.

There are two possible causes of this alarm:

- Error in the encoder communication related components
- The manipulator was moved after the power supply was turned OFF.

If there is an error in the encoder communication related components, the manipulator may move in unexpected direction when playback is started. If the “OUT OF RANGE (ABSO DATA)” alarm occurs, to ensure the extensive safety, the position check operation for the second home position must be performed before the playback or test runs.

---

**Procedure After Alarm Occurs**

1. **Position check operation**

2. Compare second home position (check point)* pulses with current position pulses

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

3. Playback is possible

---

1. **Position Check**

   After the “OUT OF RANGE (ABSO DATA)” alarm occurs, move the manipulator to the second home position by using the axis keys and perform the position confirmation. Playback and test runs will not function unless “CONFIRM POSITION” is performed.
8.2 Setting the Second Home Position

2 Pulse Difference Check
The pulse number at the second home position is compared with that at the current position. If the difference of the two pulses 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 value can be changed. For details, refer to chapter 8.2.2 “Procedure for the Second Home Position Setting (Check Point)”.

3 Alarm Occurrence
If the alarm occurs again, there may be an error in the encoder communication related components, thus check the related components. After adjusting the erroneous axis, calibrate the home position of the axis and then perform the position check operation again.

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

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. Perform 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.

---

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.
   – 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**

- When performing the position check operation, pay careful attention to ensure the safety of the surrounding operation environment.

An error in the encoder communication related components may be the cause of the alarm. In this case, the manipulator may move in an unexpected direction, which may result in personal injury and/or equipment damage.

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 encoder communication related components are found to be the cause of the alarm, perform the necessary operation, such as replacing the encoder, etc.

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

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

For details on the "POWER ON/OFF POS" window, refer to "YRC1000 MAINTENANCE MANUAL (RE-CHO-A114) 7.7 Position Data When Power is Turned ON/OFF".
8.2 Setting the Second Home Position

3. Press the [PAGE], or select [PAGE] to open 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.

   ![Image of the selection window for the control group]

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

5. Select {DATA} under the menu.

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

8.3.1 Registering Tool Files

8.3.1.1 Number of Tool Files

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

Tool File Extension Function

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

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

For more details, refer to "YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051) 8 Parameter".

8.3.1.2 Registering Coordinate Data

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

2. Select {TOOL}.
   (1) Move the cursor to the number of the desired tool, and press {SELECT} in the tool list window.
   (2) The tool coordinate window of the selected number appears.
   - In the tool coordinate window, the tool number can be changed by pressing the [PAGE] 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.
8 System Setup
8.3 Tool Data Setting

6. Press [ENTER].

- The coordinate data is registered.

<Setting Example>

In case of Tool A, B

<p>| | | |</p>
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<tr>
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</tr>
<tr>
<td>Z</td>
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<td>0.000</td>
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</tbody>
</table>

In case of Tool C

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</tr>
<tr>
<td>Y</td>
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</tr>
<tr>
<td>Z</td>
<td>260.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>
8.3.1.3 Registering Tool Posture Data

The tool posture data is an 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 following order: Rz, Ry, Rx.

For the tool shown in the following figure, register Rz=180, Ry=90, Rx=0

1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
3. Select the desired tool number.
   – In the same way as shown in Explanation 2, 3 in chapter 8.3.1.2 "Registering Coordinate Data", open the desired tool coordinate window.
4. Select the desired coordinate axis to modify.
   – First, select Rz.
5. Input the tool posture data.
   – Input rotation angle around Z_F of the flange coordinates.
6. Press [ENTER].

- The rotation angle of Rz is registered.

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

\[ \text{Rx must be the input rotation angle around X'F of flange coordinates.} \]

\[ \text{SUPPLE} \]

For more details on the tool load information, refer to chapter 8.4.3 "Tool Load Information Setting".

\[ \text{SUPPLE} \]

For more details on "Automatic Measurement of the Tool Load and the Center of Gravity", refer to chapter 8.3.3 "Automatic Measurement of the Tool Load and the Center of Gravity".
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.
8.3.3 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.

*NOTE*

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

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 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.
8 System Setup
8.3 Tool Data Setting

1. Select (ROBOT) under the main menu.
2. Select (TOOL).
3. Select the desired tool number.
   – In the same way as shown in the instruction 2 and 3 of the chapter 8.3.1.2 “Registering Coordinate Data”, display the desired tool coordinate window.

4. Select (UTILITY) under the menu.
   – The pull-down menu appears.

• There are 64 tool files numbered 0 to 63.
• In a basic system with one manipulator and one tool, the tool file for tool No.0 is used.
• If there is more than one tool, for example when using a multihand, use the tool numbers in the order of 0, 1, 2, etc.
5. Select {CALIBRATION}.

– The TOOL CALIBRATION window is shown.

6. Select the robot.

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

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

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

8. Move the manipulator using the axis key.

9. Press [MODIFY] and [ENTER].
   – Taught position is registered.
   Repeat 7 to 9 operation to teach TC1 to TC5.
   “●” indicates that teaching is completed and “○” indicates that it is not completed.

8. System Setup
8.3 Tool Data Setting

- To check the taught positions, call up the required window among TC1 to TC5 and press [FWD]. The manipulator moves to the set position.
- If there is a difference between the current position of the manipulator and the shown position data, “TC□” next to “POSITION” in the window flashes.
10. Select "COMPLETE".

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

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

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

2. Select (CLEAR DATA).
   – The confirmation dialog box is shown.
8 System Setup
8.3 Tool Data Setting

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.

If tool angle data is required, input the data number in the tool coordinate window. Refer to chapter 8.3.1.3 “Registering Tool Posture Data” for the operating instructions.

8.3.2.5 Checking the TCP

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

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

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

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

For details on the TCP fixed operation, refer to “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 2.3.7 Control Point Operation.”
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, the position of the tool's center of gravity and the moment of inertia at the center of gravity.

The tool load, the position of its center of gravity and the moment of inertia at the center of gravity are measured and registered in a tool file.

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

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 (U-, B- and R-axes: horizontal to the ground) and operate the U-, B- and T-axes.

NOTE
To correctly measure the tool load or the center of gravity, remove the cables or wires connected to the tool. The measurement may not be performed properly because unnecessary loads are applied.
8 System Setup
8.3 Tool Data Setting

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 \texttt{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] once, and the manipulator moves to the home position (U-, B- and R-axes: horizontal to the ground).


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

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

1. Measurement of the U-axis: U-axis home position +4.5 degrees $\rightarrow$ -4.5 degrees
2. Measurement of the B-axis: B-axis home position +4.5 degrees $\rightarrow$ -4.5 degrees
3. First measurement of the T-axis: T-axis home position +4.5 degrees $\rightarrow$ -4.5 degrees
4. Second measurement of the T-axis: T-axis home position +60 degrees $\rightarrow$ +4.5 degrees $\rightarrow$ -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 must 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.
8 System Setup

8.3 Tool Data Setting

– When the measurement of the tool load and the center of gravity is completed (when all the measurement statuses of the tool load and the center of gravity has changed to “●”), the measured data appears on the screen.

9. Select “REGISTER”. (When measuring only the tool load and the center of gravity.)

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

– Select “CANCEL” to open the tool list window without registering the measured data in the tool file.

– Select “FWD” and the manipulator moves to the home position 1 and the measurement of the moment of inertia at the center of gravity starts.
8.3.3 Measurement of the Moment of Inertia at the Center of Gravity

Measure the moment of inertia at the center of gravity.

The moment of inertia at the center of gravity does not need to be measured when this data is small enough for the moment of inertia calculated from weight and the center of gravity position. However, the measurement 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).

1. Press [FWD].

   - Press [FWD], and the manipulator moves to the home position 1 (U-axis: horizontal to the ground, R-axis: rotating axis of B-axis is vertical to the ground, T-axis: T-axis home position +90 degrees).

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

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

NOTE
If the tool is interfered with during the measurement, operate the S-, L- and R-axes and move the manipulator to avoid the interference. Then move the axis to the home position 1.
   – Press [FWD] again, and measurement of B-axis 1 and B-axis 2 starts.

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

1. Measurement of the B-axis 1: B-axis home position +30 degrees → -30 degrees
2. Move to the measurement position of B-axis 2

When the measurement is completed, the measured data appears on the screen.

• During the measurement, the [FWD] button must 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 home position 1.

3. Press [FWD].
   – Press [FWD], and the manipulator moves to the home position 2 (R-axis: rotating axis of B-axis is horizontal to the ground, B-axis: vertical to the ground).

If the tool is interfered with during the measurement, operate the S-, L- and T-axes and move the manipulator to avoid the interference. Then move the axis to the home position 2.
8 System Setup
8.3 Tool Data Setting

   – Press [FWD] again, and measurement of T-axis starts.
   
   The manipulator moves in the order listed below. Once measurement is completed, “O” changes to “●”.

   ① Measurement of the T-axis: T-axis home position +30 degrees → -30 degrees
   When the measurement is completed, the measured data appears on the screen

   • During the measurement, the [FWD] button must 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 home position.

5. Select “REGISTER”. (When measuring only the tool load and the center of gravity.)
   – The measured data is registered in the tool file, and the tool coordinate window appears.
   – Select “CANCEL” to open the tool list window without registering the measured data in the tool file.
8.4 ARM Control

8.4.1 ARM Control

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

The moment of inertia and the gravity moment etc. of each axis are calculated by the ARM control function, and YRC1000 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

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<th>CAUTION</th>
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</table>

- Correctly set the robot setup condition.
- Perform the settings of the robot setup condition with due care so that all the units and values are correct.

Failure to observe this instruction may cause improper operation control, which may result in a shortened life of the speed reducer and/or an alarm occurrence.

- Perform this setting at the time of setting up the manipulator.
  If this setting is modified at another time out of necessity, check the path of the manipulator's operation for each job after the modification of this setting.

- Perform this setting at setup the manipulator.
  If the setting is modified out of necessity, check the path of manipulator's operation for each job afterwards.

Modifying the settings of the ARM control may slightly change the path of the manipulator's operation at the execution of a job. Make sure to check the path of the manipulator's operation before executing the job.

Failure to observe this instruction may cause collision between a tool and a fixture, etc., which may result in personal injury and/or equipment damage.
8.4.2.1 Robot Setup Condition

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

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

**Robot installation angle**

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

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

<Example>

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

**NOTE**

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

Set the weight and the position of the gravity center of the load roughly when a device such as a transformer is installed on the S-head.

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

- **WEIGHT (unit: kg)**
  Set the weight of the installed load.
  It is not required to set a correct value, and it is recommended to set a value slightly larger than the actual weight. (Round up the value with each fraction between 0.5 to 1 kg.)

- **X (FROM S-AXIS), Y (FROM S-AXIS) (unit: mm)**
  Set the position of the gravity center of the installed load by the distance from the S-axis center in the directions of X and Y.
  It can be set with a rough value.
  The directions of X and Y conform to the robot coordinates. When the position is in the negative direction, set a negative value.

*Fig. 8-1: Load on the S-Head (Top View)*
U-ARM PAYLOAD

Set the weight and the position of the gravity center of the load roughly when a device such as a motor for the wire feeder is installed on the U-arm.

A standard value is set at the factory.

Set "0" for the weight if no device is installed on the U-arm.

• WEIGHT (unit: kg)
  Set the weight of the installed load.
  It is not required to set a correct value, and it is recommended to set a value slightly larger than the actual weight. (Round up the value with each fraction between 0.5 to 1 kg.)

• X (FROM U-AXIS), HEIGHT (FROM U-AXIS) (unit: mm)
  Set the position of the gravity center of the installed load. It can be set with a rough value.
  X (FROM U-AXIS) is the horizontal distance from the U-axis rotation center to the position of the gravity center of the load.
  If the mass point is on the rear side with respect to the U-axis rotation center, set a negative value.
  HEIGHT (FROM U-AXIS) is the height in the vertical direction from the U-axis rotation center to the position of the gravity center of the load.

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

NOTE
The ARM CONTROL window is displayed only when the security mode is set to the management mode.
8 System Setup
8.4 ARM Control

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

**WARNING**

- After modifying the tool load information, check the path of the manipulator's operation for each job which uses the corresponding tool file.

Perform the settings of the tool load information after installing the tool and before teaching a job. If the tool load information is modified at another time, check the path of the manipulator's operation for each job which uses the corresponding tool file.

Modifying the tool load information may slightly change the path of the manipulator's operation at the execution of a job. Make sure to check the path of the manipulator's operation before executing the job. Failure to observe this instruction may cause collision between a tool and a fixture, etc., which may result in personal injury and/or equipment damage.

**CAUTION**

- Correctly set the tool load information.

If the tool load information is not set correctly, the life of speed reducer may be shorter or the alarm may occur.

Failure to observe this instruction may result in a shortened life of the speed reducer and/or an alarm occurrence.

The following message appears as a reminder when the tool load information is input. "Input correct tool information. Using robot with wrong tool information may result in premature failure of the robot."
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.

![Diagram of tool load information](image)

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/medium-capacity model manipulator, and 1 to 5 kgs for large-capacity model 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).

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.

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 \( \cdot \) m²
- Iy : 0.000 kg \( \cdot \) m²
- Iz : 0.000 kg \( \cdot \) m²
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 (the aforementioned 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 material handling application, etc., it is more effective to set tool load information on each workpiece and to switch the tool on each step according to the held workpiece. Set the tool load information in the state to hold the heaviest workpiece when using the tools without switching them.

Weight: \[ W = 55 + 40 = 95 \]
\[ = \text{approx. 100[kg]} \]
Center of gravity: Position at flange right under 250mm almost
(Xg, Yg, Zg) = (0, 0.250)

Moment of inertia at the center of gravity:

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

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

\[ I_x = \left( L_y^2 + L_z^2 \right) / 12 \times W \]
\[ = \left( (0.400^2 + 1.000^2) / 12 \right) \times 100 = 9.667 \approx 10.000 \]

\[ I_y = \left( L_x^2 + L_z^2 \right) / 12 \times W = \left( (0.500^2 + 0.400^2) / 12 \right) \times 100 = 3.417 \]
\[ = 3.500 \approx 3.500 \]

\[ I_z = \left( L_x^2 + L_y^2 \right) / 12 \times W = \left( (0.500^2 + 1.000^2) / 12 \right) \times 100 = 10.417 \]
\[ = 10.500 \]

<Setting>

• W : 100.000 kg
• Xg : 0.000 mm
• Yg : 0.000 mm
• Zg : 250.000 mm
• Ix : 10.000 kg.m²
• Iy : 3.500 kg.m²
• Iz : 10.500 kg.m²
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. above-mentioned supplement: “The own moment of inertia calculation for hexahedron and cylinder” for how to calculate the own moment of inertia.)

   wi : Weight of the i-th parts [kg]
   (xi, yi, zi) : Center of gravity position of the i-th parts (On flange coordinates) [mm]
   Icxi, Icyi, Iczi : Own moments of inertia of the i-th parts [kg*m^2]

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

   \[ x_g = \frac{w_1 \cdot x_1 + w_2 \cdot x_2 + \ldots + w_i \cdot x_i}{w_1 + w_2 + \ldots + w_i} \]
   \[ y_g = \frac{w_1 \cdot y_1 + w_2 \cdot y_2 + \ldots + w_i \cdot y_i}{w_1 + w_2 + \ldots + w_i} \]
   \[ z_g = \frac{w_1 \cdot z_1 + w_2 \cdot z_2 + \ldots + w_i \cdot z_i}{w_1 + w_2 + \ldots + w_i} \]

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

   \[ I_{x} = \{w_1 \cdot ((y_1 - y_g)^2 + (z_1 - z_g)^2) \cdot 10^{-6} + I_{cx1}\} + \{w_2 \cdot ((y_2 - y_g)^2 + (z_2 - z_g)^2) \cdot 10^{-6} + I_{cx2}\} + \ldots \]
   \[ + \{w_i \cdot ((y_i - y_g)^2 + (z_i - z_g)^2) \cdot 10^{-6} + I_{cxi}\} \]
   \[ I_{y} = \{w_1 \cdot ((x_1 - x_g)^2 + (z_1 - z_g)^2) \cdot 10^{-6} + I_{cy1}\} + \{w_2 \cdot ((x_2 - x_g)^2 + (z_2 - z_g)^2) \cdot 10^{-6} + I_{cy2}\} \]
   \[ + \ldots + \{w_i \cdot ((x_i - x_g)^2 + (z_i - z_g)^2) \cdot 10^{-6} + I_{cyi}\} \]
   \[ I_{z} = \{w_1 \cdot ((x_1 - x_g)^2 + (y_1 - y_g)^2) \cdot 10^{-6} + I_{cz1}\} + \{w_2 \cdot ((x_2 - x_g)^2 + (y_2 - y_g)^2) \cdot 10^{-6} + I_{cz2}\} + \ldots \]
   \[ + \{w_i \cdot ((x_i - x_g)^2 + (y_i - y_g)^2) \cdot 10^{-6} + I_{czi}\} \]
<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. (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:
\[
W = w_1 + w_2 = 3 + 6 = 9 \approx 10 \text{[kg]}
\]

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

The moment of inertia at the center of gravity position:
\[
I_x = \{w_1 \cdot ((y_1 - Y_g)^2 + (z_1 - Z_g)^2) \cdot 10^{-6} + I_{cxi}\}
+ \{w_2 \cdot ((y_2 - Y_g)^2 + (z_2 - Z_g)^2) \cdot 10^{-6} + I_{cxi}\}
= 3 \cdot (50 \cdot (-83))^2 + (40 \cdot 60)^2 \cdot 10^{-6}
+ 6 \cdot ((-150) \cdot (-83))^2 + (70 - 60)^2 \cdot 10^{-6}
= 0.082 \approx \text{approx. 0.100}
\]
\[
I_y = 3 \cdot ((100 - 100))^2 + (40 - 60)^2 \cdot 10^{-6}
+ 6 \cdot ((100 - 100))^2 + (70 - 60)^2 \cdot 10^{-6}
= 0.002 \approx \text{approx. 0.010}
\]
\[
I_z = 3 \cdot ((100 - 100))^2 + (50 \cdot (-83))^2 \cdot 10^{-6}
+ 6 \cdot ((100 - 100))^2 + ((-150) \cdot (-83))^2 \cdot 10^{-6}
= 0.080 \approx \text{approx. 0.100}
\]

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

<table>
<thead>
<tr>
<th>W</th>
<th>10.000 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xg</td>
<td>100.000 mm</td>
</tr>
<tr>
<td>Yg</td>
<td>-83.333 mm</td>
</tr>
<tr>
<td>Zg</td>
<td>60.000 mm</td>
</tr>
<tr>
<td>Ix</td>
<td>0.100 kg.m^2</td>
</tr>
<tr>
<td>Iy</td>
<td>0.010 kg.m^2</td>
</tr>
<tr>
<td>Iz</td>
<td>0.100 kg.m^2</td>
</tr>
</tbody>
</table>
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) → (LIST) or (DISPLAY) → (COORDINATE DATA).

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

5. Press [ENTER].
   – The input value is registered.
   – The servo power is automatically turned OFF when editing the value while the servo power is ON, followed by a message “Servo off by changing data” displayed for three seconds.
• When the data setting is not done

It is considered that data is not set correctly in tool load information in the following cases.

• When the weight (W) is “0”.
• When the center of gravity position (Xg, Yg, Zg) are all “0”.

In these cases, the manipulator is controlled by 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 System Setup
8.5 Work Home Position

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].
   - 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 as shown in fig. 8-3 "S3C1097: The work home position cube length of its sides (µm)"; the length of its sides (a in fig8-3) is determined by a parameter of S3C1097 (units: µm).

By changing the contents of this parameter, the size of the cube can be changed. (The initial value is 10cm)

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.

For the INTERFERENCE AREA window, refer to chapter 8.6 “Interference Area”.

![Diagram of work home position cube](image)
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 areas can be set up to 64 areas. Three types of methods to use each interference area are as follows:

- Cubic Interference
- Outside of cubic area
- Axis Interference

The YRC1000 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 YRC1000 judges whether the current position of the manipulator’s TCP is inside or outside this area, and outputs this status as a signal.
Types of Cubic Interference Area

Two types of method to use the cubic interference area are as follows.

- **Cubic Interference**
  Inside the specified cube is defined as the interference area. When the current position of manipulator's TCP is located inside the cube, the corresponding specific output signal is ON.

- **Outside of cubic area**
  Outside the specified cube is defined as the interference area. When the current position of manipulator's TCP is located outside the cube, the corresponding specific output signal is ON.

TCP is located inside the cube
  - Cubic interference: Specified output signal = ON
  - Outside of cubic area: Specified output signal = OFF

TCP is located outside the cube
  - Cubic interference: Specified output signal = OFF
  - Outside of cubic area: Specified output signal = ON
8.6.2.2 Cube Setting Method

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

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

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

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

1. Select {ROBOT} under the main menu.

2. Select {INTERFERENCE}.
   - The INTERFERENCE AREA window is shown.
3. Select the desired cube number.
   – Select the desired cube number with the [PAGE] or by number input.
   – When selecting the cube number by number input, select [PAGE] to input the desired signal number.

4. Select “METHOD”.
   – A selection dialog box appears.
   (1) Select “CUBIC INTERFERENCE” or “OUTSIDE OF CUBIC AREA”.

![Image of selection dialog box]
5. Select “CONTROL GROUP”.
   – A selection dialog box appears.
   (1) Select the desired control group.

6. Select “REF COORDINATES”.
   – A selection box appears.
   (1) Select the desired coordinate.
   (2) If the user coordinates are selected, the number input line is displayed. Input the user coordinate number and press [ENTER].
8 System Setup
8.6 Interference Area

7. 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.

**NOTE**

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

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

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

- Each time [SELECT] is pressed, "OFF" and "ON" are displayed alternately.

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”.

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

   – The cubic interference area is set.
Teaching Corner

1. Select “METHOD”.

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

   (2) Select “MAX/MIN”.

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

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

4. Move the manipulator using the axis keys.
   – Move the manipulator to the maximum or minimum position of the cube using the axis keys.
5. Press [ENTER].

- The cubic interference area is registered.
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.
8.6.3 Axis Interference Area

8.6.3.1 Axis Interference Area

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

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

8.6.3.2 Setting Operation

1. Select {ROBOT} under the main menu.
2. Select {INTERFERENCE}.
   
   – The INTERFERENCE AREA window appears.
3. Select the desired interference signal number.
   - Select the desired interference signal number using the [PAGE] or by number input.
   - When selecting the desired interference signal number by number input, select [PAGE] to input the desired signal number.

4. Select “METHOD”.
   - A selection dialog box appears.
   (1) Select “AXIS INTERFERENCE”.
5. Select “CONTROL GROUP”.
   – A selection box appears. Select the desired control group.

6. Select “CHECK MEASURE”.
   – Each time [SELECT] is pressed, “COMMAND POSITION” and “FEEDBACK POSITION” switch alternately.
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.
8 System Setup
8.6 Interference Area

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.
8 System Setup
8.6 Interference Area

- 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.
8 System Setup

8.6 Interference Area

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.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The shock detection function does not completely prevent damage to the peripheral devices or guarantee human safety. Make sure to take safety measures such as installing safety fences. For details on safety measures, refer to chapter 1 &quot;Safety&quot; to chapter 6 &quot;Test of Program Operation&quot;.</td>
</tr>
<tr>
<td>Failure to observe this instruction may cause contact with the manipulator, which may result in personal injury and/or equipment damage.</td>
</tr>
</tbody>
</table>

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.
8.7 Shock Detection Function

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.

- 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)
8.7 Shock Detection Function

1. **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.

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

3. **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.

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

5. **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 material 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.
The max. disturbance force to set the DETECT LEVEL.

- Perform all the jobs to use for 5 to 6 hours.
- For the material 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: (Max. disturbance force) x (coefficient = 120%)  
B: (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.
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.

NOTE

DETECT LEVEL can be modified only when the security mode is set in the management mode.
8.7.2.2 EACH AXIS LEVEL (CURRENT) Window

Able to confirm the current detection level.

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

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

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

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

---

**NOTE**
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.

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 chapter 8.4.3 “Tool Load Information Setting” 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 chapter 8.4.2 “ARM CONTROL Window” 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.

![SHCKSET instruction example](image)

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

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

3. **Changing the Shock Detection Level for Each Axis**
   *(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.

   ![Changing the Shock Detection Level for Each Axis example](image)

   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.
8 System Setup
8.7 Shock Detection Function

- **SHCKRST instruction**

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

  The additional item of the SHCKRST instruction is as follows.

  ```
  SHCKRST R1
  ```

  ① **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.
  2. Select {JOB}.
  3. Move the cursor in the address area.

  - **SHCKSET**

    1. Move the cursor to the immediately preceding line where the SHCKSET instruction is to be registered.
    2. Press [INFORM LIST].

      - The inform list dialog box is shown.
3. Select SHCKSET instruction.
   (1) SHCKSET instruction is shown in the input buffer line.

   ![SHCKSET instruction example]

   (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.

       ![SHCKSET example]

     • 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.

         ![Input buffer line example]

       (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.

       ![DETAIL window example]

       (2) Move the cursor to “UNUSED” of “ROBOT/STATION”, and press [SELECT].
       (3) The selection box appears.
8 System Setup
8.7 Shock Detection Function

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

![Image of DETAIL EDIT window]  

<table>
<thead>
<tr>
<th>ROBOT STATION</th>
<th>DETECT</th>
<th>FILE</th>
<th>SENS</th>
<th>Aktiv</th>
<th>Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td>10</td>
<td></td>
<td>UNRE</td>
<td>0</td>
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</tr>
</tbody>
</table>

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

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

- 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.

![Image of DETAIL EDIT window]  

<table>
<thead>
<tr>
<th>ROBOT STATION</th>
<th>DETECT</th>
<th>FILE</th>
<th>SENS</th>
<th>Aktiv</th>
<th>Axis</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>UNRE</td>
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<tr>
<td>10</td>
<td></td>
<td>UNRE</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(2) Move the cursor to “UNUSED” of any “SENS(AXIS)” to change the detection level, and press [SELECT].

(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.

• When changing the shock detection level for each axis

(1) When changing the shock detection level for 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.
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**SHCKRST**

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

2. Press [INFORM LIST].
   - The inform list appears.

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

4. Change the value of the additional item.
   - < When registering the instruction as it is >
     Operate the step 5 when registering the instruction in the input buffer line as it is.
   - < When adding or changing the additional item >

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

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

![Alarm Display](image)

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

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

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

**NOTE**

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

In this case, set the shock detection function "INVALID", or increase the detection level in teach mode and retreat the manipulator to a safety position.
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 prevent damage to the peripheral devices or guarantee human safety. Make sure to take safety measures such as installing safety fences. For details on safety measures, refer to chapter 1 “Safety” to chapter 6 “Test of Program Operation”.

Failure to observe this instruction may cause contact with the manipulator, which may result in personal injury and/or equipment damage.

8.7.3.1 Manipulator Type for High-Sensitivity Shock Detection Function

The manipulators 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. For corresponding manipulator types, contact YASKAWA representative.

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 chapter 8.7.3.6 “Explanation of Maker Initial Value” is used, DO NOT use this function.

2. **Setting the U-arm payload**

To perform shock detection more accurately, set the U-arm payload by referring to chapter 8.4.2 “ARM CONTROL Window”. 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.
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8.7 Shock Detection Function

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.
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.

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, 308R OUT MODEL, 500R BUILT MODEL, 508R BUILT MODEL or 508R OUT MODEL.

Fig. 8-5: Tool for High-Sensitivity Shock Detection
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.
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.

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

**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.

![Diagram showing U-arm payloads WFR42DX2 (BUILT) and WFR42DX2 (OUT)](image)

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 Coordinates Setting

8.8.1 User Coordinates

8.8.1.1 Methods for User Coordinates Setting

There are two methods for user coordinates setting as following.

- Perform teaching by axis operations of the manipulator
  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.

![Image of user coordinate definition point]

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

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

- Specify the amount of change from the basic coordinates
  User coordinates are defined by specifying the coordinates as a basic coordinates (base coordinates or user coordinates) and the amount of change of coordinate value from the basic coordinates. As shown in the following figure, the data X, Y, Z, Rx, Ry, Rz indicate the amount of change of coordinate value. These six data is registered in the user coordinates file.

![Image of user coordinates definition]

X, Y, Z are the amount of movement with respect to the basic coordinates. Rx, Ry, Rz are the rotation angle with respect to the basic coordinates.
User Coordinates Files
Up to 63 kinds of user coordinates can be registered. Each coordinates has a user coordinate No. and is called a user coordinate file.
8.8.2 User Coordinate Setting

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

(1) The USER COORDINATE window appears.

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

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

(4) The following window appears.
# System Setup

## 8.8 User Coordinates Setting

- **Perform teaching by axis operations of the manipulator**

1. Move the cursor to the user coordinate number to be set.

   - Move the cursor to the user coordinate number to be set.
   - Press [SELECT].
     - The user coordinate setup window is shown.

   3. 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.)
4. Select “SET POS”.
   – Select the teaching point.

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

6. Press [MODIFY] then [ENTER].
   – Taught position is registered.
   – Repeat the steps 2 to 4 to teach ORG, XX and XY.
   – “●” indicates that teaching is completed and “○” indicates that it is not completed.

   – To check the taught positions, call up the required window among ORG to XY and press [FWD]. The manipulator moves to the set position.
   – If there is a difference between the current position of the manipulator and the displayed position data, “ORG”, “XX”, or “XY” flashes.
7. Select (COMPLETE).
   - User coordinates are registered in the file.
   - Once the user coordinate setting is completed, the following window appears.
Specify the amount of change from the basic coordinate

1. Move the cursor to the user coordinate number to be set.

2. Select {DISPLAY} of the main menu.
   - The pull-down menu is shown.

3. Select {COORDINATE VALUE}.

4. Select “ROBOT”.
   – Select the target robot.

5. Select “BASIC COORDINATE”.
   – Select the base coordinate/user coordinate for the basic coordinate.

   **NOTE**
   The user coordinates number which is not yet registered or currently selected cannot be selected. Also, the user coordinates number which uses another user coordinates as the basic coordinates cannot be selected.
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8.8 User Coordinates Setting

– When the user coordinate is selected for the basic coordinate, 
“(● : REGISTERED STATUS)” or “(○ : UNREGISTERED STATUS)” is shown. ● indicates the user coordinates number which is fully registered. ○indicates the user coordinates number which is not yet registered.

If the user coordinates which specify another user coordinates number in unregistered status as the basic coordinates are used, the alarm no.4508 “SPECIFIED ERROR(COORDINATE) [18]” occurs.

To select the user coordinates for the basic coordinates, specify the registered user coordinates number as the basic coordinates.

6. Select the item to be set and input the number.

– Input the amount of change from the basic coordinate.
7. Select (REFLECT).

   – The user coordinate is created and registered in the user coordinate file.
8.8.3 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**

When operating the manipulator with the overrun or shock sensor released, pay careful attention to ensure the safety of the surrounding operation environment.

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

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

   - The control group in which overrun or shock sensor is detected is indicated with “●”.

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

4. Select “ALM RST”.

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

   **NOTE**

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

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

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

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

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

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

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

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

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

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

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

**CAUTION**

When operating the manipulator with all the limits released, pay careful attention to ensure the safety of the surrounding operation environment.

Since all the limits are released, the manipulator may move beyond its range of motion, which may result in damage to the manipulator or other equipment.

**NOTE**

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.
8 System Setup

8.11 All Limit Release Function

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.

Fig. 8-6: Instruction Set
8.12.1.2 Learning Function

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

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

1. An instruction is 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 Instruction Level Setting

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 YRC1000 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 April 30, 2016, input “2016.4.30”.
     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”.

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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 System Setup
8.15 Numeric Key Customize Function

8.15 Numeric Key Customize Function

8.15.1 About the Numeric Key Customize Function

With this function, the user can set the function of the specific keys for each application to the other function. The specific keys are allocated to the numeric keys on the programming pendant. Since any frequently used operation can be allocated to the numeric keys on the programming pendant, the number of key operations is decreased and which reduces the teaching time.

![NOTE]
The Numeric Key Customize Function is allowed to set only when the security mode is in the management mode or higher.

8.15.2 Allocatable Functions

There are two allocation methods as follows:

• Key Allocation (EACH)
• Key Allocation (SIM)

8.15.2.1 Key Allocation (EACH)

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

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

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

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate output allocation</td>
<td>Turns ON/OFF the specified GP 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 GP output signal when [INTERLOCK] and the allocated Numeric key are pressed at the same time.</td>
</tr>
<tr>
<td>Pulse output allocation</td>
<td>Turns ON the specified GP 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 GP 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.
8.15.3 Allocating Operation

8.15.3.1 Allocation Window

1. Select {SETUP} under the main menu.
2. Select {KEY ALLOCATION}.
   - The KEY ALLOCATION (EACH) window appears.
3. Select {DISPLAY}.
   - Pull-down menu appears.
   - To call up the KEY ALLOCATION (SIM) window, select {ALLOCATE SIM. KEY}.
4. Select (ALLOCATE SIM. KEY).
   - The KEY ALLOCATION (SIM) window appears.
   - In a system multiple applications, press the [PAGE] to change the window to the allocation window for each application, or click on [PAGE] to select the desired application number.

8.15.3.2 Instruction Allocation

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

- The instruction is shown in the "ALLOCATION CONTENT".

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

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

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

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

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

2. Select "JOB CALL".
   – The reserved job registration No. is shown in the "ALLOCATION CONTENT" (reserved job registration No.: 1 to 10).
   – The reserved job registration is performed in the reserved job name window.

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

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

8.15.3.4 Display Allocation

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

1. Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT].
   – Selection list appears.

2. Select [DISPLAY].

3. Move the cursor to "ALLOCATION CONTENT" and press [SELECT].
   – Character input is available.
4. Input the name of the reserved window and press [ENTER].
   - The reserved name input to the “ALLOCATION CONTENT” is shown.

5. Open the window for allocation.

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

**SUPPLEMENT**
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.
8.15.3.5 Alternate Output Allocation

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

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

2. Select "ALTERNATE OUTPUT".
   - The output No. is displayed in the "ALLOCATION CONTENT".

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

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

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

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

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

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

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

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

1. Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT].
   – A selection list appears.
2. Select "PULSE OUTPUT".
   – The output No. and output time are displayed in the "ALLOCATION CONTENT".

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

   (2) Input the number or time to be changed, and press [ENTER].
8.15.3.8 Group (4-bit/8-bit) Output Allocation

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

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

2. Select “4 BIT OUTPUT” or “8 BIT OUTPUT”.
   – The output No. and output value are displayed in the “ALLOCATION CONTENT”.

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

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

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

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

2. Select "ANALOG OUTPUT".
   - The output port number and the output voltage value are displayed in the "ALLOCATION CONTENT".

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

(2) Input the number or voltage value to be changed, and press [ENTER]
8.15.3.10 Analog Incremental Output Allocation

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

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

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

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

(2) Input the number or incremental value to be changed, and press [ENTER].
### 8.15.4 Allocation of I/O Control Instructions

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

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

1. **Allocation of I/O control instruction.**
   - Allocate the I/O control instruction with key allocation (SIM) following the aforementioned procedure.

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

- The instruction corresponding to the I/O control allocated by key allocation (SIM) is displayed in the “ALLOCATION CONTENT”.

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

8.15.5.1 Executing the Instruction/Output Control Allocation

1. Press the key allocated for instruction allocation or output control allocation.
   – The allocated instruction is displayed in the input buffer line.

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

8.15.5.2 Executing the Job Call Allocation

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

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

8.15.5.3 Executing the Display Allocation

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

8.15.5.4 Executing the I/O Control Allocation

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

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

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

- On the GP 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 GP output signals can be shown on the RELAY ON window and the number of the signals which are shown in the parameters S4C327 to S4C390 must be set in advance. If they are not set, the sub menu in the RELAY ON window will not be displayed.

1. Select {IN/OUT} under the main menu.
2. Select {RELAY ON}.
   - The RELAY ON window appears.

3. Select the desired signal to change the output status.
   - Select the status (● or ○) of the desired signal.
4. Press [INTERLOCK] + [SELECT].

   – The output status is changed. ( ●: status ON; ○: status OFF.)

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

The parameters are protected not to be changed easily. The following operations are allowed only for the operator who can set the security mode to the management mode or higher. The operations must be performed properly.

1. Select {PARAMETER} under the main menu.
2. Select the parameter type.
   - The PARAMETER window appears. Select the desired parameter.
3. Move the cursor to the desired parameter number.
When the desired parameter number is not in the current window, move the cursor in the following way:

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

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

3. Press [ENTER].

4. The cursor moves to the selected parameter number.
Set the parameters in the following manner.

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

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

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

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

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

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

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

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

8.18.1 Initializing Job File

1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant 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.
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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
   • Robot calibration data
   • Conveyor calibration data

8.18.2 Initializing Data File

1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant 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.
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8.18 File Initialization

8.18.3 Initializing Parameter File

1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant 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] on the programming pendant 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.
8. System Setup
8.18 File Initialization

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

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

8. Select {YES}.
   – The selected data is initialized.
8.18.5 Initializing System Data

1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant simultaneously.

2. Change the security mode to the management mode.

3. Select (FILE) under the main menu.

4. Select (INITIALIZE).

5. Select (SYSTEM DATA).
   – The system data selection window appears.

6. Select the parameter to be initialized.
   – The selected data is marked with “★”.
   – The system data marked with “■” cannot be selected.
7. Press [ENTER].
   – A confirmation dialog box appears.

8. Select ‘YES’.
   – The selected data is initialized.
8.18.6 Reset Safety Circuit Board FLASH Data

8.18.6.1 Saving Dual Data

The data related to the safety function is saved in the safety circuit board memory in a duplicated manner for safety.

When the control power is turned ON, check is performed to see that dual data sets are the same.

If they are different when the control power is turned ON, the following alarm occurs.

Alarm 0300: “VERIFY ERROR(SYSTEM CONFIG-DATA)[10]”

In the system with the functional safety function, a message “Select ‘Safety Board FLASH Reset’ in the maintenance mode” is displayed after the following operations.

Turning ON or OFF causes error in verification.

- The data related to the safety function is loaded from an external storage.
- A parameter related to the safety function is rewrote by setting operations in maintenance mode.
- The zeroing function is performed.
- Encoder is reset

In case one of the above mentioned operations is performed, re-set the data following the procedures shown in chapter 8.18.6.2 “FLASH Data Reset”.

In the maintenance mode, there are cases when parameters related to the safety function are rewrote by several setting operations. For this reason, the message “Select ‘Safety Board FLASH Reset’” may be displayed.
Perform the safety board FLASH reset operation by following the procedure shown in chapter 8.18.6.2.
8.18.6.2 FLASH Data Reset

If the following alarm occurs when the control power supply is turned ON, Alarm 0300: "VERIFY ERROR(SYSTEM CONFIG-DATA)[10]"
perform the following operations to re-set the data of the function safety board.

1. When the controller power is turned ON, Alarm 0300: "VERIFY ERROR(SYSTEM CONFIG-DATA)[10]" occurs and the maintenance mode is started up.

2. Select {SYSTEM} under the main menu. Then, press {SECURITY} to change the security mode to the safety mode.

3. Select {FILE} under the main menu. Then, select {INITIALIZE} under the sub menu.
   - INITIALIZE window appears.
4. Move the cursor to [Safety Board FLASH Reset] and press [ENTER].

5. The dialog box “Reset?” is displayed. Select [YES].

   - The data of the safety circuit board is re-set. A few seconds later, the buzzer sounds and the data setting is completed.

6. When the data reset is completed, turn the control power OFF and then turn the power ON again.
8.19 Display Setting Function

8.19.1 Font Size Setting

YRC1000 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:

![Font Size Setting Diagram]

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>

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

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

1. Select (DISPLAY SETUP) then (CHANGE FONT) under the main menu.

2. The font size setting dialog box appears on the center of the current window.
To set the font size in the font size setting dialog box, follow the procedure below.

1. Specify the font style.
   - The (Bold Type) check box can be checked or unchecked alternately each time the check box is selected.
   - Check the (Bold Type) check box as follows to set the font to the bold style.

   ![Font size setting dialog box (bold style)](image)

   - Clear the (Bold Type) check box as follows to set the font to the regular style.

   ![Font size setting dialog box (regular style)](image)

2. Specify the font size.
   - Select a button from the four buttons in the dialog box.

   ![Font size selection dialog box](image)
3. The font size setting dialog box is closed, and the screen displays the font specified in the dialog box.

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

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

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

YRC1000 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:

![Button Size Font Style]

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 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.
8 System Setup
8.19 Display Setting Function

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

   ![Image of button size selection 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.)

   ![Image of modified button display]
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.

   ![Button Size Setting Dialog](image1.png)

Do not turn OFF the YRC1000 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).

![NOTE](image2.png)
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.

![Confirmation dialog box](image)

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

![Confirmation dialog box](image)
To Initialize the screen layout, follow the procedure below.

1. select {OK}.

   - The dialog box is closed, and the font/button sizes are collectively changed to the regular size.
To cancel the Initialized screen layout, follow the procedure below.

1. Select (CANCEL).

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

**NOTE**
Do not turn OFF the YRC1000 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 YRC1000 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 lost 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 is used to recover the absolute data by moving the axis whose position information is lost to a position close to the home position by axis operation.

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 chapter 7.1.1.1 “Changing the Security Mode” for the operation of the changing the security mode.

4. Select {ROBOT} in the main menu.

5. Select {HOME POSITIONNING}.
   – 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.
8. 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 “YRC1000 MAINTENANCE MANUAL (R-CHO-A114) 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 chapter 8.1.2.2 “Registering Individual Axes”.
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 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.

- **Set the Replacement Signal**
  Set the GP 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 {PM(REDUCER)}.
  4. Select {DISPLAY} in the menu.
     - {=SETUP CONDITION} appears under the pull down menu.

- **NOTE**
  This function is only available for the robot axes. As for the external axes, this function is not available.
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8.21 Preventive Maintenance Function

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 GP output signal.
# Lifetime Calculation Window

1. Select {PM} in the main menu.
2. Select {PM(REDUCER)}.

   - The lifetime calculation window appears. In the case of 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”.

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.

③ =WARNING

Select this item to invalidate the notification signal and displaying the message. [Invalid] and [Valid] will alternate each time when pressing the [Select].

④ =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.
Invalidate 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 (=PM) in the main menu.
3. Select (=PM(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.
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].
Graph Display

The lifetime calculation can be checked in the graph. The shift of lifetime calculation is shown on the programming pendant, so that it is possible to check visually how the lifetime decreases. Use this function as a method to judge the lifetime of the speed reducer. The graph is shown by the following procedures.

1. Select {PM} of main menu.
2. Select {PM(REDUCER)}.
3. Select {DISPLAY}.
   - The pull down menu is shown.
4. Select {GRAPH}.
   - The graph is shown.
5. Select (GRAPH).
   - The pull down menu is shown.

6. Select (Lifetime)
   - The calculation result is shown as a graph.

The vertical axis of the graph indicates the time to replace. The horizontal axis indicates the operation time.
To change the display range of the horizontal axis, modify the MIN and MAX values of display time.
To change the display range of the vertical axis, modify the MIN and MAX values of time to replace.
By pressing {CSV Save}, the lifetime calculation data can be saved as a CSV format into the external memory device.
For the other operations, refer to chapter 8.21.2.2 “Diagnose by the Torque Average Value”.

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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 from "deterioration" to "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 `{PM}` in the main menu.
3. Select `{PM(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.

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 ALERT 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 GP 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).
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
The name of the graph can be registered.

⑨ = REPLACEMENT SIGNAL
Use this item to calculate the lifetime. Refer to “Set the Replacement Signal”.

NOTE
Even though the initial value is set, the accuracy of the life diagnosis is not guaranteed performance.
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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 to the data by following procedures.

1. Select (=PM) in the main menu.
2. Select (=PM(REDUCER)).
3. Select [DISPLAY].
   - The pull down menu appears.

4. Select (=TORQUE MONITOR).
   - The torque monitor window appears.

   - Able to refer to 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.
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 (=PM) in the main menu.
   – The sub menu appears.
2. Select (=PM(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

After the measurement, the variation can be checked by a graph. The graph is updated every 24 hours automatically. The measured value and changes of the variation can be displayed on the programming pendant. Thus, the changes of the torque can be checked visually. Use the graph display as one of the methods to judge the lifetime of the speed reducer.

The graph can be shown by the following procedures.

1. Select {=PM} in the main menu.
2. Select {=PM(REDUCER)}.
3. Select {DISPLAY}.
   – The pull down menu appears.
4. Select {=GRAPH}.
   – The graph appears.
5. Select {CLOSE}.
   – Return to the lifetime calculation window.
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Each item on the screen represents the following description.

① “Graph”

Select the “Graph”, and the pull down menu appears. Either “=Vari.” 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.
② =Group
Select (=Group), and the pull down menu appears. Select the group to display.

③ =Name
The names set in the each setting window are displayed.

④ =Renew
Pressing the “=Renew” button updates the latest data.

⑤ =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.

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 SD card and USB, but the data is priory save into the SD 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”
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⑨ =Hard COPY

Pressing the “=Hard COPY” button saves the hard copy of the screen as JPG format into the USB memory stick.

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 (=PM) in the main menu.
3. Select (=PM(REDUCER)).
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.
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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 Preventive Maintenance Function

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 Setting Procedures

Perform the setting procedures as follows.

1. Change the security mode to the management mode.
2. Select (=PM) in the main menu.
3. Select (=INSPECTION NOTICE).
   - The inspection notice window appears.
     - The inspection notice window appears.

4. Select (=DISPLAY) in the main menu.
   - (=SETUP CONDITION) is displayed in the pull down menu.
5. Select {=SETUP CONDITION}.

---

5. Select {=SETUP CONDITION}.  

---

{=SETUP CONDITION} window appears.  
Modify each items if necessary.

---

Each item on the screen represents the following description.

---

① TIME

Before the remaining time to the inspection is “0”, the message is shown and the inspection signal is ON at the time which is set in this item. For example, if “100” is set, the message is shown and the signal is ON 100 hours before the remaining time to the inspection is “0”.

The time can be set in the management mode.

---

② SIGNAL

Set the GP output number which notifies the inspection time.
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8.21.3.2 The Inspection Notice Window

1. Select (=PM) in the main menu.
2. Select (=INSPECTION NOTICE).

– The inspection notice window appears.

Each item on the screen represents the following description.

① Inspection items

The contents of the inspection are shown. The contents differ depending on the model of manipulators. For details of the contents, refer to the manipulator’s instruction manual corresponding to the model.

② REMAINING

The remaining time to the inspection is shown. When the servo power is ON, the measurement automatically starts and the numeric value is reduced. When the value is “0” in this item, the inspection signal is turned ON and the message is shown.

③ INTERVAL

The time interval of the inspection is shown.

④ ESTIMATE

The estimated date for the inspection is shown.

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 YRC1000 is inspected.
8.21.4 Record of Inspection Date and Replacement Date

The dates when the inspection or the replacement was done can be checked by following procedures.

1. Select (=PM) in the main menu.

2. Select (=INSPECTION RECORD).

3. Select (DISPLAY), and select (=INSPECTION DATE) in the pull down menu.
   – The inspection date can be checked.

4. Select (DISPLAY), and select (=REPLACEMENT DATE) in the pull down menu.
   – The replacement date can be checked.
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 into the external memory device.

As for the external device menu, refer to "YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051) 7. External Memory Devices" for more details.

1. Select {EX.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.
8.21.6 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 GP 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 GP 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 an 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 GP output which is set as "Alarm signal" of the file.
  However, only one signal for this GP signal can be output for one controller.
8 System Setup
8.21 Preventive Maintenance Function

- **Mask of Signal Output**
  The GP output signals can be masked for each component.

  If any of the components is judged as D, ON signal is output from the GP 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 GP 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.
   
   ![Main Menu]

   - * 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.

   ![Alarm Signal Setting Window]
3. Input the numerical value of the alarm signal. When any of components in this controller comes to the replacement time, the GP output signal which is already set turns ON.

<table>
<thead>
<tr>
<th>TERMS</th>
<th>COOLING FAN</th>
<th>CAPACITOR</th>
<th>AMPLIFIER</th>
<th>CONTACTOR</th>
<th>MOTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ALARM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- * 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) GP output signal valid/invalid
   (4) The first date of use
   (5) Leftover life judgment

   - When (COOLING FAN) is selected:

   - When (CAPACITOR) is selected:

   - When (AMPLIFIER IGBT) is selected:
– When (CONTACTOR) is selected:

6. When replaced with a new component, select "O".
   – A confirmation dialog box appears. When replaced with a new component, select "YES".
8. 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”.

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”.

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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.
   - After checking the components, invalidate the output.

2. The message is also displayed per component. Invalidate the output.
   - After checking the components, invalidate the output.
3. The GP output signal is turned 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 GP output of life diagnosis can be output for one controller. The masking cycle is as follows:
  Replacement time of a component, GP output ON, Checking the component and turning OFF the output of the component, GP output OFF, Replacement time of another component, GP output ON.
8 System Setup
8.21 Preventive Maintenance Function

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 each menu in the following order. (=PM) in the 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. Select each menu in the following order. {PM} in the main menu, {PM(HARDWARE)}, {MOTOR}. And then select (DISPLAY) on the menu to select (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.

![Diagram showing the process of resetting the number of revolution](image-url)
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.

   - * When changing the number of revolution.

   - * When changing the number of reverse revolution.
8.22 Operating Status Monitor Function

With this function, the operating status of the manipulator (Operation time, IO waiting time, energy saving time, time for stopping by the alarm) can be checked. The status can be checked consecutively for 5 days if measured by the hour, for 100 days if measured by the day, for 60 months if measured by the month.

### Graph of the Operating Status

The graph of the operating status is shown by the following steps.

1. Select {PM} in the main menu.
2. Select {OPERATING STATUS}.
   - The operating status window is shown.
3. Select {END}.
   - The initial window is shown again.

Each item on the screen represents the following description.

1. OPERATE
   Indicates the cumulative time for executing the move instruction.
2. IO WAIT
   Indicates the cumulative time for which the manipulator’s operation is stopped by the WAIT instruction or etc.
3. ENERG-SAVE
   Indicates the cumulative time for which the servo power is OFF by the energy saving function.
4. ALM.STOP
   Indicates the cumulative time until the next start after the occurrence of the alarm.
5. OTHERS
   Indicates the time other than above items no. 1 to no. 4.
Set the range of horizontal axis of the graph
The range of horizontal axis can be changed by setting the numeric value.

ITEM
Select {ITEM} and the pull down menu is shown.
"ALL", "OPERATE", "IO WAIT", "ALM.STOP" or "OTHERS" are selectable.
  • "ALL" is selected.
    OPERATE, IO WAIT, ALM.STOP and OTHERS are shown.
  • "OPERATE" is selected.
    OPERATE only is shown.
  • "IO WAIT" is selected.
    IO WAIT only is shown.
  • "ALM.STOP" is selected.
    ALM.STOP only is shown.
  • "OTHERS" is selected.
    OTHERS only is shown.

UNIT
Select {UNIT} and the pull down menu is shown.
"HOUR", "DAY", or "MONTH" are selectable.
  • "HOUR" is selected.
    The unit of the horizontal axis of the graph is the hour.
    For the item no. 6, the value can be set in the range from -96 to 0.
  • "DAY" is selected.
    The unit of the horizontal axis of the graph is the day.
    For the item no. 6, the value can be set in the range from -100 to -3.
  • "MONTH" is selected.
    The unit of the horizontal axis of the graph is the month.
    For the item no. 6, the value can be set in the range from -60 to -3.

UPDATE
By pressing "UPDATE", the data can be updated.

HARD COPY
By pressing "HARD COPY", the hard copy on the window can be save into
the USB memory stick as a JPG format. The file name to be saved is the
following.

File name: "year/month/date"_ "hour/minute/second".JPG

END
By pressing "END", the graph window is closed.
8 System Setup
8.23 Job Monitor Function

8.23 Job Monitor Function

With this function, the following items are shown. The number of job execution, the playback time, the moving time, the IO stop time, the energy saving time, the load ratio of each axis for each job.

Job Registration

For the job registered on the JOB MONITOR ENTRY window, the measurement is performed. A job is registered by the following steps. The maximum 10 jobs can be registered.

1. Select (=PM) in the main menu.
2. Select (JOB MONITOR).
   – The JOB MONITOR window is shown.
3. Select (DATA).
   – The pull down menu is shown.
4. Select {JOB MONITOR ENTRY}.
   – The JOB MONITOR ENTRY window is shown.

5. Job registration
   (1) The maximum 10 jobs can be registered. Move the cursor to the desired number and press [SELECT]. The job name window is shown. (If the number in which the job has already registered is selected, the dialog “Clear data?” shows up. Select {YES}.)

   (2) Move to the desired job and press [SELECT]. The job is registered in the JOB MONITOR ENTRY window.
8 System Setup
8.23 Job Monitor Function

- **Measurement of Data**

  When the playback is performed for the job registered in the JOB MONITOR ENTRY window, measurement automatically starts. The data is automatically updated every time the playback is performed. Measurement is performed for the section from NOP to END or RET of the registered job. And if the hold, the emergency stop or the alarm occurs during measurement, the measurement ends.

  Also, if 600 seconds pass after starting the measurement and the conditions mentioned above are not satisfied, the measurement ends.

  Following examples show the timing when measurement ends and the data is updated.

  **<Example 1> No RET in the section**
  
  TEST1.JBI
  
  NOP→ measurement starts
  
  MOVJ
  
  MOVJ
  
  : :
  
  END→ measurement ends

  **<Example 2> RET in the section**
  
  TEST2.JBI
  
  NOP→ measurement starts
  
  MOVJ
  
  MOVJ
  
  : RET→ measurement ends
  
  :
  
  END

  **<Example 3> The hold, the emergency stop or the alarm stop occurs during measurement.**
  
  TEST1.JBI
  
  NOP→ measurement starts
  
  MOVJ
  
  MOVJ→ measurement ends
  
  (The hold, the emergency stop or the alarm stop occurs)
  
  : :
  
  END
8 System Setup
8.23 Job Monitor Function

<Example 4> The registered job (TEST1.JBI) calls another registered job (TEST2.JBI) by CALL instruction or etc.

TEST1.JBI
NOP → measurement starts
MOVJ
MOVJ
CALL JOB: TEST2
: 
END → measurement starts

In this case, the job monitor data of TEST2 is not updated.

Data Check
The number of job execution, playback time, moving time, IO stop time, energy saving time are shown. Also, the lifetime of the speed reducer, the load ratio, the maximum speed, the average speed, the maximum torque and the average torque of each axes are shown.

The data can be checked by following steps.
1. Select {=PM} in the main menu.
2. Select [JOB MONITOR].
   – The JOB MONITOR window is shown

   ![JOB MONITOR Window]

3. Press (PAGE).
   – It is possible to check the data of the date whose number corresponds to the number of pressing (PAGE). Modify if necessary. The data of the current day is updated with the latest data every time a job is executed. For the previous data, the average values of the day are shown. The data of the maximum 50 days can be checked.
4. Move the cursor to the desired job name and press {OPEN}.
   - The JOB DIAGNOSIS window is shown. The lifetime of the speed
     reducer, the load ratio, the maximum speed, the average speed, the
     maximum torque and the average torque of each axes are shown.
   - It is possible to check the data of the date whose number
     corresponds to the number of pressing {PAGE}. Modify if
     necessary. The data of the current day is updated with the latest
     data every time a job is executed. For the previous data, the
     average values of the day are shown. The data of the maximum 50
     days can be checked.

5. Press {CLOSE}.
   - The JOB MONITOR window is shown again.
Management of Data
The job monitor data can be saved by the external memory menu. For details of the external memory menu, refer to “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 7. External Memory Devices”.

1. Select {EX.MEMORY} in the main menu.
2. Select {SAVE}.
3. Select “SYSTEM DATA”.
4. Select “JOB MONITOR DATA”.
   The selected system data is displayed with “★”.
5. Press [ENTER].
6. Select [YES].
   “JOB MONITOR DATA” is saved.
8.24 Robot Monitor Function

With this function, the threshold values are set for the following items:
Torque, collision detect external force value, speed FB, and error pulse.
When the values are equal to the threshold values or more, the GP output signal is turned ON.

- Setting the threshold value and GP output signal

Perform the setting of the threshold value and GP output signal in accordance with the following procedure. The data can be checked by following steps.

1. Select (=PM) in the main menu.
2. Select (ROBOT MONITOR).
   – The ROBOT MONITOR window is shown

3. Set the “CONTROL GOUP”.
   – Select the control group in the pull down menu.

4. Set the “ITEM”.
   – Select the item (Torque, collision detect external value, speed FB, error pulse) in the pull down menu.

5. Set the threshold value.
   – Move the cursor to “VALUE” of the desired axis and input the threshold value.

6. Set the GP output number.
   – Move the cursor to “OUT#” of the desired axis and input the GP output number.
Management of Data
The robot monitor data can be saved by the external memory menu.
For details of the external memory menu, refer to “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 7. External Memory Devices”.

1. Select {EX.MEMORY} in the main menu.
2. Select {LOAD} or {SAVE}.
   – The LOAD or SAVE window is shown.
3. Select “SYSTEM DATA”.
4. Select “ROBOT MONITOR DATA”.
   The selected system data is displayed with ”★”.
5. Press [ENTER].
6. Select [YES].
   – “ROBOT MONITOR DATA” is saved.
8.25 Brake Line Ground Judgment Function

8.25.1 About the Brake Line Ground Judgment Function

If the current flowing through the brake 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 brake line does the ground fault occur by inspecting the each axis from the programming pendant.

Identify the ground fault of the brake line by the following methods.
1. Turn the servo ON the group which the ground fault occurs.
2. Discharge the any axis brake, and then confirm if the DC 24V power supply will be disconnected.

8.25.2 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.


8.25.3 Operation

8.25.3.1 Occurrence of a DC 24V Power Supply Failure (SERVO)

– When detecting either the ground fault or the short circuit of the brake line, the alarm "1683 DC24V POWER SUPPLY FAILURE(SV)" occurs.

– Restart the control power, and perform the brake line ground check.

8.25.3.2 Brake Line Ground Check

1. Select {BRAKE LINE GROUND CHECK} in the sub-menu from {ROBOT} in the main menu.
8 System Setup
8.25 Brake Line Ground Judgment Function

2. Press "YES".
   – The confirmation dialog appears due to prevent the mis-operation.
   – Select "YES", then the brake line ground check appears.
   – Select "NO", the window returns to the previous window.

3. Move the cursor over the axis to perform the brake 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 brake line ground check.
   – Perform the brake line ground check to the every single axis displayed on the screen.
   – The brake 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.
JUDGEMENT REQUIRED: The ground check is not performed

BRAKES LINE NORMAL: The brake line is normal.

DETECTED GROUND: The ground fault or short circuit of the brake line

ABNORMAL END: The ground check is canceled.
(i.e. the dislocation of the axis is detected, and so on)

4. Detecting the Brake Line Ground Fault

- When the brake line ground fault or the short circuit is detected, the alarm "1694 GROUND FAULT (BRAKE LINE)" occurs.
- Inspect the brake line of the axis which raised the alarm.
- Restart the control power, and perform the brake line ground check to the rest of the axes.

8.25.3.3 Initializing the Related Information

1. The sub menu (BRAKE 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 brake line ground check is initialized.
   - (BRAKE LINE GROUND CHECK) does not appear in the main menu until the alarm "1683 DC24V POWER SUPPLY FAILURE(SV)" occurs.
8.26 Safety Logic Circuit

8.26.1 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.

- Executes the safety logic circuit by the safety circuit board corresponded to the secure authentication.
- The safety logic circuit consists of the system section and the user section.
- The system section of the safety logic circuit is the specific circuit of YASKAWA, so that the safety logic circuit cannot be edited. Meanwhile, for the user part, it is possible to edit.
- Both system and user section of the safety logic circuit consist of a circuit with 2 inputs and 1 output or a circuit with 1 input and 1 output.
- Both system and user section of the safety logic circuit consist of 128 lines.
- Both system and user section of the safety logic circuit are operated in every 2ms cycle.
- Both system and user section of the safety logic circuit can be referred by the all modes regardless the security mode, however the user section can be edit only when the security mode is "SAFETY MODE" plus under the teach mode and the servo is OFF.
- Conventionally, some functions were performed only by using hard-wired signals. With the YRC1000, by using an optional safety PLC and an optional safety logic circuit, these functions can be controlled from the safety PLC. This enables less wiring. Meanwhile, the signals which has been controlled by a hardware are also always monitored. Thus, the safety function, which turns OFF the servo power supply when the error is detected, is maintained.

The following is the example of configuration with the safety PLC.
For the connection of the GP safety I/O board (optional), either the board of JANCD-ASF02-E (8 points available) or JANCD-ASU03-E (16 points available) can be connected to each safety circuit board (JANCD-ASF01-E).

JANCD-ASF02-E: For both input and output, 8 points of GP safety I/O signal can be used.
JANCD-ASU03-E: For both input and output, 16 points of GP safety I/O signal can be used.
8.26.2 Changing the Security Mode

To create/edit the safety logic circuit, change the security mode to the safety mode.

1. Display of the window.
   – Select {SECURITY} from {SYSTEM INFO} in the main menu.

2. Change to the safety mode.
   – Select {SAFETY MODE}.
   – Enter the password for the safety mode, and then press [ENTER].
When the entered password is correct, the mode is changed to {SAFETY MODE}. After changing to the safety mode, the icon on the status area is changed to.

**NOTE**

For the key pad of the numerical input, display (available) and hide (non-available) can be switched by selecting the “SETTING OF WINDOW” in the main menu shown on the programming pendant. At factory setting, the key pad is set as display (available).
8 System Setup
8.26 Safety Logic Circuit

8.26.3 Available I/O Signals and Instructions in Safety Logic Circuit

The following is the explanation of the input and output signals and logic (instructions) available in the safety logic circuit.

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOT</td>
<td>Negative (reverse of signal)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DSU</td>
<td>Detection of signal rising edge</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>DSD</td>
<td>Detection of signal falling edge</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AND</td>
<td>Logic AND</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>OR</td>
<td>Logic OR</td>
<td></td>
</tr>
</tbody>
</table>

1. **Logic**

2. **Input signal 1 / Input signal 2 (Signal1/Signal2)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EXESP</td>
<td>External emergency stop input signal (●: Under emergency stop [release]/〇: Not under emergency stop [short circuit])</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>#n FSBIN[x]</td>
<td>GP safety input signal (8 or 16 points) (●: OFF [release]/〇: ON [short circuit])</td>
<td>This signal is shown when the optional GP safety I/O board is connected.</td>
</tr>
<tr>
<td>3</td>
<td>#n FSBOUT[x]</td>
<td>GP safety output signal (8 or 16 points) (●: ON status/〇: OFF status)</td>
<td>This signal is shown when the GP safety I/O board (option) is connected.</td>
</tr>
<tr>
<td>No.</td>
<td>Display</td>
<td>Contents</td>
<td>Note</td>
</tr>
<tr>
<td>-----</td>
<td>-----------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>FS-OUT[x]</td>
<td>Functional safety output in the safety logic circuit 64 points (●: ON status/〇: OFF status)</td>
<td>This signal is shown when the functional safety function (option) is enabled.</td>
</tr>
<tr>
<td>5</td>
<td>#n GSIN[x]</td>
<td>GP safety input signal 2 points (●: OFF [release]/〇: ON [short circuit])</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>#n GSOUT[x]</td>
<td>GP output signal 2 points (●: ON output/〇: OFF output)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>HOLD</td>
<td>Hold (●: OFF (Hold signal is not input.)/〇: ON (Hold signal is being input.))</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>MS-OUT[x]</td>
<td>Machine safety output used in the safety logic circuit (64 points)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>#n ONEN[x]</td>
<td>Servo power supply individual control input signal 4 points (●: Individual servo OFF status/〇: Normal status)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>PBESP</td>
<td>Controller emergency stop signal (●: Under emergency stop [release]/〇: Not under emergency stop [short circuit])</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>#n PFLIN[x]</td>
<td>Output signal to PFL board (ASF04-E) 32 points (●: ON status/〇: OFF status)</td>
<td>This signal is shown when the optional PFL board (ASF04-E) is connected.</td>
</tr>
<tr>
<td>12</td>
<td>#n PFLOUT[x]</td>
<td>Input signal from PFL board (ASF04-E) 32 points (●: ON status/〇: OFF status)</td>
<td>This signal is shown when the optional PFL board (ASF04-E) is connected.</td>
</tr>
<tr>
<td>13</td>
<td>PLAY</td>
<td>Play mode (●: Play mode/〇: Not play mode)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>PPDSW</td>
<td>PP enable switch signal (●: Released [release]/〇: Grip [short circuit])</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>PPESP</td>
<td>PP emergency stop signal (●: Under emergency stop [release]/〇: Not under emergency stop [short circuit])</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>PROFI Safe</td>
<td>PROFI Safe communication status (●: Communication OK/〇: Error communication)</td>
<td>Appears only when the optional PROFI Safe is enabled.</td>
</tr>
<tr>
<td>17</td>
<td>R[x]</td>
<td>Work area 128 points (auxiliary relay) (●: ON status/〇: OFF status)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>REMOTE</td>
<td>Remote mode (●: Remote mode/〇: Not remote mode)</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>S-EXDSW</td>
<td>External enable switch signal in the safety logic circuit (●: ON (servo ON enabled)/〇: OFF (servo OFF status))</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>S-EXESP</td>
<td>External emergency stop signal in the safety logic circuit (●: Release/〇: Press (emergency stop status))</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>S-FST</td>
<td>Full speed mode in the safety logic circuit (●: Full speed mode/〇: Safety speed)</td>
<td>Refer to chapter 8.26.3.1 “Full Speed Mode”.</td>
</tr>
<tr>
<td>22</td>
<td>S-SAFF</td>
<td>Safety fence signal in the safety logic circuit (●: Close/〇: Open (servo OFF status))</td>
<td></td>
</tr>
</tbody>
</table>
### 8.26 Safety Logic Circuit

#### 8. System Setup

**n**: The number of the safety circuit board (Maximum 8)

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>#n S-ON[x]</td>
<td>Servo power supply individual control input signal in the safety logic circuit 4 points</td>
<td>(●: Individual control group servo OFF status/ ○: Servo ON status/servo ON enabled status)</td>
</tr>
<tr>
<td>24</td>
<td>S-SVON_EN</td>
<td>Servo ON enable signal in the safety logic circuit</td>
<td>(●: Servo ON enabled status/ ○: Servo OFF)</td>
</tr>
<tr>
<td>25</td>
<td>SAFF</td>
<td>Safety fence signal</td>
<td>(●: Open/ ○: Close)</td>
</tr>
<tr>
<td>26</td>
<td>SFBIN[x]</td>
<td>Safety field bus input signal 64 points</td>
<td>(●: ON status/ ○: OFF status)</td>
</tr>
<tr>
<td>27</td>
<td>SFBOUT[x]</td>
<td>Safety field bus output signal 64 points</td>
<td>(●: ON status/ ○: OFF status)</td>
</tr>
<tr>
<td>28</td>
<td>#n SFRON[x]</td>
<td>Servo ON/OFF signal 4 points</td>
<td>(●: Servo ON/ ○: Servo OFF)</td>
</tr>
<tr>
<td>29</td>
<td>SPIN[x]</td>
<td>Specific input signal 32 points</td>
<td>(●: ON status/ ○: OFF status)</td>
</tr>
<tr>
<td>30</td>
<td>SVON</td>
<td>Servo ON/OFF status</td>
<td>(●: Servo ON/ ○: Servo OFF)</td>
</tr>
<tr>
<td>31</td>
<td>SVONRDY0</td>
<td>Servo ON ready</td>
<td>(●: Servo ON available status/ ○: Servo OFF)</td>
</tr>
<tr>
<td>32</td>
<td>TEACH</td>
<td>Teach mode</td>
<td>(●: Teach mode/ ○: Not teach mode)</td>
</tr>
</tbody>
</table>

- This signal is shown only when the enable switch link function is enabled. For details, refer to chapter 8.26.13 “Enable Switch Link Function”.

**n**: The number of the safety circuit board (Maximum 8)

### Output signal

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>#n FSBOUT[x]</td>
<td>GP safety output signal (8 or 16 points)</td>
<td>This signal is shown when the optional GP safety circuit board is connected. For details, refer to chapter 8.26.7 “Setting for the GP Safety I/O Signals”.</td>
</tr>
<tr>
<td>2</td>
<td>#n GSOUT[x]</td>
<td>GP output 2 points</td>
<td>(●: ON output/ ○: OFF output)</td>
</tr>
<tr>
<td>3</td>
<td>MS-OUT[x]</td>
<td>Machine safety signal output signal in the safety logic circuit 64 points</td>
<td>(●: ON output/ ○: OFF output)</td>
</tr>
</tbody>
</table>
### 8.26 Safety Logic Circuit

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>#n PFLIN[x]</td>
<td>Output signal to PFL board (ASF04-E) 32 points (●: ON status/ ○: OFF status)</td>
<td>This signal is shown when the optional PFL board (ASF04-E) is connected.</td>
</tr>
<tr>
<td>5</td>
<td>R[x]</td>
<td>Work area 128 point (auxiliary relay) (●: ON output/ ○: OFF output)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S-EXDSW</td>
<td>External enable switch signal in the safety logic circuit (●: ON (servo ON enabled)/ ○: OFF (servo OFF status))</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>S-EXESP</td>
<td>External emergency stop signal in the safety logic circuit (●: Release/ ○: Press (emergency stop status))</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>S-FST</td>
<td>Full speed test signal in the safety logic circuit (●: Full speed test/ ○: Safety speed)</td>
<td>Refer to chapter 8.26.3.1 “Full Speed Mode”.</td>
</tr>
<tr>
<td>9</td>
<td>#n S-ONEN[x]</td>
<td>Servo power supply individual control input signal in the safety logic circuit 4 points (●: Individual control group servo OFF status/ ○: Servo ON status/servo ON enabled status)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>S-SAFF</td>
<td>Safety fence signal in the safety logic circuit (●: Close/ ○: Open (servo OFF status))</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>S-SVON_EN</td>
<td>Servo ON enable signal in the safety logic circuit (●: Servo ON enabled status/ ○: Servo OFF)</td>
<td>This signal is shown only when the enable switch link function is enabled. For details, refer to chapter 8.26.13 “Enable Switch Link Function”.</td>
</tr>
<tr>
<td>12</td>
<td>SFBOUT[x]</td>
<td>Safety field bus output signal 64 points (●: ON output/ ○: OFF output)</td>
<td>This signal is shown when the optional safety field bus function is enabled.</td>
</tr>
<tr>
<td>13</td>
<td>SVOFF CAT0</td>
<td>Turns OFF the servo power supply to the robot. (Category0 stopped) (●: Robot stop request/ ○: Not robot stop request)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>SVOFF CAT1</td>
<td>Turns OFF the servo power supply to the robot. (Category1 stopped) (●: Robot stop request/ ○: Not robot stop request)</td>
<td></td>
</tr>
</tbody>
</table>

n: The number of the safety circuit board (Maximum 8)
It is possible to input up to 32 characters in one-byte (16 characters in two-byte).

### Timer

<table>
<thead>
<tr>
<th>No.</th>
<th>Display</th>
<th>Contents</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>
</tr>
<tr>
<td>2</td>
<td>TM[4] OFF DELAY</td>
<td>OFF Delay timer</td>
<td>4 timer</td>
</tr>
<tr>
<td>3</td>
<td>TM[4] ON DELAY</td>
<td>ON Delay timer</td>
<td>4 timer</td>
</tr>
</tbody>
</table>

When the robot is stopped by request stop from the safety logic circuit signal, the message “Robot is stopped by safety logic circuit” is shown on the message area of the programming pendant. And the control status signal #80343(servo OFF status by safety logic circuit) is turned ON.

Comment

It is possible to input up to 32 characters in one-byte (16 characters in two-byte).
8.26.3.1 Full Speed Mode

The full speed mode is the mode to perform a test run or a forward/backward operation of the job at the taught speed during the teach mode.

When the S-FST signal is turned ON during the teach mode, the full speed mode is activated.

When the full speed mode is selected, the servo power is turned OFF, and then the manual speed setting is automatically switched to the inching mode. In the same way, when the Enable Switch is released in the full speed mode, the manual speed setting is automatically switched to the inching mode.

The operation speed while the mode is set to the full-speed test mode is specified as follows according to the manual speed setting.

<table>
<thead>
<tr>
<th>Manual speed operation speed limit (initial value)</th>
<th>Parameter (unit: 0.01%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inching 20%</td>
<td>$S1CxG60$ (initial value: 2000)</td>
</tr>
<tr>
<td>Low 50%</td>
<td>$S1CxG61$ (initial value: 5000)</td>
</tr>
<tr>
<td>Mid 75%</td>
<td>$S1CxG62$ (initial value: 7500)</td>
</tr>
<tr>
<td>High 100% (fixed value)</td>
<td>-</td>
</tr>
</tbody>
</table>

Note that the operation speed limit values in the above table are the percentages with respect to the manipulator’s maximum speed, not with respect to the taught speed. These are specified in order to control the operation speed so that it does not exceed the manipulator’s maximum speed during a test run or a forward/backward operation.

DANGER

- When using the full-speed test function, the manipulator moves at a high speed. Thus, make sure to secure a place where the operator can visually check the manipulator’s movement in the area outside the manipulator’s operating range, and perform operations by using the programming pendant from that place.
8.26.3.2 Switching Display of System and User Section

1. Operation for switching display.
   By pressing [PAGE] shown on the programming pendant and selecting
   the USER or SYSTEM, the display of the system and user section of
   the safety logic circuit can be switched.

   SYSTEM: The system section of the safety logic circuit is shown.
   USER:      The user section of the safety logic circuit is shown.

2. Display of the system section.
   (SYSTEM) is shown in the title line while the system section is shown.

   For the display of the system section
   (SYSTEM) is shown in the title line.
3. Display of the user section.
There is no message next to STS in the title line while the user section is shown.

For the display of the user section
No message is shown next to STS in the title line.

There is a case that the system section of the safety logic circuit is not defined at factory setting.
8.26.4 Safety Logic Circuit

1. Display of the window.
   - Select {SAFETY LOGIC CIRCUIT} from {SAFETY FUNC.} in the main menu.

2. Create the safety logic circuit
   - Create the safety logic circuit. The setting items are "INPUT1", "LOGIC", "INPUT2" and "OUTPUT".
     Set "TIMER" and "COMMENT" if necessary.
   - The INPUT1 and INPUT2 must be set.
   - When setting the input 1 or 2, LOGIC is also must to be set.
   - OUTPUT is also must be set. The same output signal cannot be set to the multiple logic circuit.
After creating the safety logic circuit, the status changes from "DONE" to "NOT DONE". The "WRITE" button is shown 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.
8. System Setup
8.26 Safety Logic Circuit

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 and updating the safety logic circuit file

(1) After creating the safety logic circuit, select {WRITE}.
   - The safety logic circuit file is transferred to the safety circuit board.
   - If there is a blank line in the safety logic board, it will be filled automatically.
   - When the transfer of the safety logic circuit file is successfully performed, the following window is shown.

(2) When {CONFIRM} shown on the programming pendant is selected, the confirmation dialog of "Update the file?" is shown.
(3) Press “YES”, and then the file transferred to the safety circuit board 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 information related to the safety logic circuit is transferred to the safety circuit board as the safety logic circuit file and written in the FLASH ROM of the safety circuit board.
- If select (WRITE), the all output signals output from the safety circuit board are turned OFF until the writing process is completed.
8. Execution of the safety logic circuit

- When the write operation is completed, the safety logic circuit is executed. If the set signal is ON, "●" is shown. If the set signal is OFF, "○" is shown. The safety logic circuit is always executed except the write operation.
8.26.5 Signal List Window

The ON/OFF status list of the signals used in the safety logic circuit is shown.

1. Select {SAFETY FUNC.} - {SLC SIGNAL DISPLAY}

2. The signals used in the safety logic circuit is shown.
   - If the optional safety field bus function is enabled, its signals are also shown.

<The signal list when the safety field bus function (option) is enabled>
8.26.6 Setting ON/OFF to the Input Signals

The display of the ON/OFF status of input signals used in the safety logic circuit can be switched.

1. Select {SAFETY FUNC.}-{SLC SIGNAL DISPLAY SET}.

2. The ON/OFF status of input signals used in the safety logic circuit can be switched by pressing [SELECT] on the programming pendant.
8.26 Safety Logic Circuit

<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>EXESP</td>
<td>External emergency stop input signal (●: Under emergency stop/〇: Normal)</td>
<td>External emergency stop input signal (●: Normal/〇: Under emergency stop)</td>
</tr>
<tr>
<td>2</td>
<td>FSBIN</td>
<td>GP safety input signal (ASF02 or ASU03) (●: OFF [release]/〇: ON [short circuit])</td>
<td>GP safety input signal (ASF02 or ASU03) (●: ON [short circuit]/〇: OFF [release])</td>
</tr>
<tr>
<td>3</td>
<td>GSIN</td>
<td>GP safety input signal (ASF01) (●: OFF [release]/〇: ON [short circuit])</td>
<td>GP safety input signal (ASF01) (●: ON [short circuit]/〇: OFF [release])</td>
</tr>
<tr>
<td>4</td>
<td>HOLD</td>
<td>Hold (●: ON (Hold signal is being input)/〇: ON (Hold signal is not input.))</td>
<td>Hold (●: OFF (Hold signal is not input.)/〇: ON (Hold signal is being input.))</td>
</tr>
<tr>
<td>5</td>
<td>PBESP</td>
<td>Controller emergency stop signal (●: Under emergency stop/〇: Normal)</td>
<td>Controller emergency stop signal (●: Normal/〇: Under emergency stop)</td>
</tr>
<tr>
<td>6</td>
<td>PPDSW</td>
<td>Programming pendant enable switch signal (●: Grip/〇: Not grip (servo OFF))</td>
<td>Programming pendant enable switch signal (●: Not grip (servo OFF)/〇: Grip)</td>
</tr>
<tr>
<td>7</td>
<td>PPESP</td>
<td>Programming pendant emergency stop signal (●: Under emergency stop/〇: Normal)</td>
<td>Programming pendant emergency stop signal (●: Normal/〇: Under emergency stop)</td>
</tr>
<tr>
<td>8</td>
<td>SAFF</td>
<td>Safety fence signal (●: Open (safeguarding opened)/〇: Close)</td>
<td>Safety fence signal (●: Close/〇: 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 “〇” 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”.

![Safety Logic Circuit Table]

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.

**NOTE**
8.26.7 Setting for the GP Safety I/O Signals

8.26.7.1 Preliminary setting for the GP Safety I/O Signal

When using the GP safety I/O signal (type: ASF02 board/ASU03 board), start up the maintenance mode and perform the following operations.

1. Display of the window
   – Turn the power ON while pressing [MAIN MENU] on the programming pendant.

2. Change the security
   – When the maintenance mode is started, Select {SECURITY} from {SYSTEM}.

3. Change to the safety mode.
   (1) Select {SAFETY MODE}.
   (2) Input the password for the safety mode and press [ENTER].

4. When the correct password is input, the mode is changed to {SAFETY MODE}.
   – After changing to the safety mode, the icon shown on the status area is changed to .

5. After changing the security, select each menu in the following order. {SYSTEM},{SETUP},{OPTION FUNCTION},{SAFETY I/O BOARD SETTING}.
6. Press [SELECT] on the programming pendant and set the GP safety I/O board ASF02 or ASU03.

NOT USED: GP safety I/O board is not used.
JANCD-ASF02-E: The I/O 8 points of GP safety I/O signal are available.
JANCD-ASU03-E: The I/O 16 points of GP safety I/O signal are available.

NOTICE

• When starting up the robot system, confirm the function and wiring of the general-purpose safety I/O signals.

7. Press [ENTER] on the programming pendant and select {YES}. The data is updated.
8. After updating the data, select in the following order.
(FILE), (INITIALIZE), “Safety Board FLASH Reset”.

- When “bleep” sounds, the initialization is completed and the message on the programming pendant disappears. Also, if the message “Select ‘Safety Board FLASH reset’” is shown on the message area of the programming pendant, perform “Safety Board FLASH reset”.

<table>
<thead>
<tr>
<th>INITIALIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILE</td>
</tr>
<tr>
<td>GENERAL DATA</td>
</tr>
<tr>
<td>PARAMETER</td>
</tr>
<tr>
<td>I/O DATA</td>
</tr>
<tr>
<td>SYSTEM DATA</td>
</tr>
<tr>
<td>Safety Board FLASH Erase</td>
</tr>
</tbody>
</table>

9. Turn OFF/ON the YRC1000.
8.26.7.2 Setting for the GP Safety Output Signals

1. Select {SAFETY FUNC.}-{F-SAFETY SIGNAL ALLOC}.
   - The following window is shown. The mark at the center of the window indicates ON/OFF status. “○” means OFF and “●” means ON.

2. To use the GP safety output signals in the safety logic circuit, press [SELECT] on the programming pendant and set “ASF01-E”.
   - The GP safety output signals allocated to “ASF01-E” are available in the safety logic circuit. However, if the setting is “NOT USED”, the signals are available only on the functional safety circuit board.
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”.

![Diagram showing system setup with safety logic circuit settings]
8.26.8 Safety Signal Board Allocation

This window is shown only when the optional safety field bus function is enabled.

1. Select {SAFETY FUNC.}-{SAFETY SIG. BOADR ALLOCATION}.
   - The marks at the center of the window indicates OFF/ON status. "○" means OFF and the mark "●" means ON. Also, comments (up to 32 characters in one-byte, 16 characters in two-byte) can be input.

2. The initial status is set as "NOT USED". Press [SELECT] on the programming pendant and select one of "NOT USED", "SAFETY LOGIC CIRCUIT" or "FUNCTIONAL SAFETY".
   - When the functional safety (optional) is disabled, the menu of "FUNCTIONAL SAFETY" is not shown.

<When the functional safety circuit board is disabled>
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8.26 Safety Logic Circuit

<When the functional safety circuit board is enabled>

<table>
<thead>
<tr>
<th>DATA</th>
<th>EDIT</th>
<th>DISPLAY</th>
<th>UTILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAFETY SEG. BOARD ALLOC</td>
<td>OUTPUT</td>
<td>UNIT</td>
<td>COMMENT</td>
</tr>
<tr>
<td>SFBOUT01</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT02</td>
<td>M-SAFE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT03</td>
<td>F-SAFE #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT04</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT05</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT06</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT07</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT08</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT09</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT10</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT11</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT12</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT13</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFBOUT14</td>
<td>NOT USE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOT USED : Not available in the safety logic circuit and on the functional safety.
SAFETY LOGIC CIRCUIT : Available in the safety logic circuit.
FUNCTIONAL SAFETY : Available on the optional functional safety.

Up to eight safety circuit boards can be connected in the YRC1000. When using a safety circuit board, specify its board number.

3. In the following setting, SFBOUT01 to SFBOUT04 are available in the safety logic circuit and SFBOUT05 to SFBOUT08 are available in the functional safety function.

– After changing the setting, the status in the title line becomes “NOT DONE” and (WRITE) menu is shown. 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 "FUNCTIONAL SAFETY" is set, the output signal in the safety logic circuit is not available.

6. The display of input and output signal used in the safety field bust function can be switched by (SIGNAL CHG).
8.26.9 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.
   – 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".
     {WRITE} is shown 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}.
     The file is transferred to the safety circuit board. When the file transfer is done correctly, the confirmation dialog "Update the file?" appears.
8 System Setup
8.26 Safety Logic Circuit

- Press {YES}, and then the file is updated. The safety logic circuit file which has been transferred to the safety circuit board is written in the FLASH ROM. The status becomes "DONE" from "NOT DONE".

NOTE

- If press "YES" on the confirmation dialog, the all information related to the safety logic circuit is transferred as the safety logic circuit file to the safety circuit board and written in the FLASH ROM of the safety circuit board.
- If select {WRITE}, the all output signals output from the safety circuit board are turned OFF until the writing process is completed.
8.26.10  Timer

Set the width of the pulse output from the safety logic circuit by TIMER. When the GP safety input signal is ON, one-second one-shot signal is output from the GP safety output signal.

1. Select [SAFETY FUNC.]-[TIMER DELAY].

2. Select [PAGE]-[TIMER].
3. Input “250” at TIMER1.

4. Create the following safety logic circuit.
   001 DSU #1GSIN1 #1 GSOUT1 TMR1

5. When the edit is done, select (WRITE).
   – The safety logic circuit file is transferred to the safety circuit board.

6. If the transfer is correctly done, the confirmation dialog “Update the file?” shows up. Select (YES).
   – The safety logic circuit file is updated.
   – The safety logic circuit file which has been transferred to the safety circuit board is written in the FLASH ROM. The status becomes “DONE” from “NOT DONE”.

   **NOTE**
   • If press “YES” on the confirmation dialog, the all information related to the safety logic circuit is transferred as the safety logic circuit file to the safety circuit board and written in the FLASH ROM of the safety circuit board.
   • If select (WRITE), the all output signals output from the safety circuit board are turned OFF until the writing process is completed.
8.26.11 Output Signal

The following signals can either be hard-wired or be controlled by the safety logic circuit.

<table>
<thead>
<tr>
<th>Expanded signal name</th>
<th>Hard-wired signal name</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| S-EXDSW              | None                   | • 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 safety circuit board regards this as the short-circuit status. |
| S-EXESP              | EXESP                  | • This is the external emergency stop input signal.  
• When the S-EXDSW signal is turned OFF, the signal performs the same control as the EXESP signal is turned OFF.  
• 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.  
• When the S-EXESP signal is not used in the safety logic circuit, the safety circuit board regards this as the short-circuit status. |
| S-FST                | None                   | • This is the full speed mode signal.  
Refer to chapter 8.26.3.1 “Full Speed Mode”. |
| #n S-ONEN[x]         | ON ENABLE[x]           | This signal controls the servo power supply for each control group.  
(n indicates the number of the ASF01 board and x is 1 to 4. 4 points are available for one ASF01 board.)  
When the S-ONEN signal is input, the signal performs the same control as ON ENABLE signal.  
When the hard-wired signal (ON ENABLE) is input, the servo power supply for the appropriate control group is turned OFF.  
When the signal is turned ON, the servo ON is enabled. |
| S-SAFF               | SAFF                   | • This is the safeguarding signal and functions only in the play mode.  
• When the S-SAFF signal is turned OFF, the signal performs the same control as the SAFF signal. The hard-wired SAFF signal is always monitored. When either the SAFF signal or the S-SAFF signal is OFF, the servo power supply is turned OFF. |
| S-SVON_EN            | None                   | For details, refer to chapter 8.26.13 “Enable Switch Link Function”. |
| MS-OUT               | None                   | This is the data to transfer the data created in the safety logic circuit to the functional safety function (optional). |

NOTE
The signals which have been controlled by a hardware are also always monitored. Thus, the safety function, which turns OFF the servo power supply when the error is detected, is maintained.
8.26.12 Display of the Message on the Programming Pendant

When the signals input by hard-wired or the request stop from the safety logic circuit stop the manipulator's operation, the messages on the programming pendant are changed as in the following table to recognize which signal stops the manipulator.

<table>
<thead>
<tr>
<th>Signal name</th>
<th>Message on the programming pendant</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>-</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>None</td>
<td>-</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. (Safety Logical Circuit)</td>
</tr>
<tr>
<td>S-SAFF</td>
<td>Safety guard is open. (Safety Logical Circuit)</td>
</tr>
<tr>
<td>#x ONENn</td>
<td>Servo ON enable signal (ON-EN) is OFF.</td>
</tr>
<tr>
<td>#x S-ONENn</td>
<td>Servo ON enable signal (ON-EN) is OFF. (Safety Logical Circuit)</td>
</tr>
<tr>
<td>None</td>
<td>-</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 when the manipulator is stopped by the input of the hard-wired signal.

The lower line: the message when the manipulator is stopped by the signals input from the safety logic circuit.

None: The appropriate signals do not exist.
8.26.13 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.

8.26.13.1 Setting of the Enable Switch Link Function

When using the enable switch link function, start up the maintenance and perform the following operations.

1. Display of the window
   – Turn the power ON while pressing [MAIN MENU] on the programming pendant.

2. Change the security
   – When the maintenance mode is started, Select {SECURITY} from {SYSTEM}.

3. Change to the safety mode.
   (1) Select (SAFETY MODE).
   (2) Input the password for the safety mode and press [ENTER].

4. When the correct password is input, the mode is changed to (SAFETY MODE).
   – After changing to the safety mode, the icon shown on the status area is changed to 🗝.

5. After changing the security, select each menu in the following order. {SYSTEM}, {SETUP}, {OPTION FUNCTION}, {SAFETY LOGICAL CIRCUIT SETTING}.
6. Press [SELECT] on the programming pendant and enable \{SERVO ON ENABLE SIGNAL\}.

<Setting enable/disable of the servo ON enable signal>

- **Enabled**
  S-SVON_EN signal is available in the safety logic circuit function. For details, refer to chapter 8.26.5 “Signal List Window”.

- **Disabled**
  S-SVON_EN signal is not available in the safety logic circuit function. In this case, the signal name is not shown in the safety logic circuit.

8.26.13.2 Example of Use of the Enable Switch Link Function

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>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>Servo ON</td>
</tr>
<tr>
<td>TEACH</td>
<td>ON</td>
<td>Not Used</td>
<td>ON</td>
<td>Servo ON</td>
</tr>
<tr>
<td>TEACH</td>
<td>ON</td>
<td>Not Used</td>
<td>OFF</td>
<td>Servo OFF</td>
</tr>
<tr>
<td>TEACH</td>
<td>OFF</td>
<td>Not Used</td>
<td>ON</td>
<td>Servo OFF</td>
</tr>
</tbody>
</table>

*Note: Not Used means the S-EXDSW signal is not used as the output signal of the safety logic circuit.

**NOTICE**

- When this function is enabled, configure the circuit of the safety PLC (optional) to turn OFF the servo ON enable signal (S-SVON_EN) by releasing the Enable Switch of the programming pendant.

If the S-EXDSW signal is used as the output signal of the safety logic circuit while the servo ON enable (S-SVON_EN) signal is disabled,

- If the Enable switch on the programming pendant is turned ON after the S-EXDSW signal is turned ON, the servo power is supplied to the manipulator.
- If the S-EXDSW signal is turned ON after the Enable switch on the programming pendant is turned ON, the servo power is not supplied to the manipulator.
### 8.26.14 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.

<table>
<thead>
<tr>
<th>40787</th>
<th>40786</th>
<th>40785</th>
<th>40784</th>
<th>40783</th>
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<td>Specific input 7</td>
<td>Specific input 6</td>
<td>SPIN06</td>
<td>SPIN05</td>
<td>Specific input 4</td>
<td>Specific input 3</td>
<td>SPIN03</td>
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<td>SPIN07</td>
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<td>SPIN12</td>
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<td>Specific input 23</td>
<td>Specific input 22</td>
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<td>SPIN20</td>
<td>Specific input 19</td>
<td>Specific input 18</td>
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<td>Specific input 27</td>
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<td>SPIN28</td>
<td>SPIN27</td>
<td>SPIN26</td>
<td>SPIN25</td>
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</tbody>
</table>

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**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.
### 8.26.15 Output to the Control Status Signal

The following signals used in the safety logic circuit can be confirmed in the control status signals.

1. #n GSIN[2]
2. #n GSOUT[2]
3. SFBIN[64]
4. SFBOUT[64]
5. MS-OUT[64]
6. FS-OUT[64]
7. #n FSBIN[8] / #n FSBIN[16]
8. #n FSBOUT[8] / #n FSBOUT[16]
9. #n PFLIN[32]
10. #n PFLOUT[32]

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### 8.26 Safety Logic Circuit

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### 8.26 Safety Logic Circuit

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8-281
## System Setup
### 8.26 Safety Logic Circuit

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#### 8.26 Safety Logic Circuit

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### 8.26 Safety Logic Circuit

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<td>PFL function</td>
<td>PFL function</td>
<td>PFL function</td>
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</tr>
<tr>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
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<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
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<tr>
<td>PFLOUT16</td>
<td>PFLOUT15</td>
<td>PFLOUT14</td>
<td>PFLOUT13</td>
<td>PFLOUT12</td>
<td>PFLOUT11</td>
<td>PFLOUT10</td>
<td>PFLOUT9</td>
</tr>
<tr>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
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<table>
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<tr>
<th>81787</th>
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<th>81782</th>
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<td>PFL function</td>
<td>PFL function</td>
<td>PFL function</td>
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<tr>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
</tr>
<tr>
<td>PFLOUT24</td>
<td>PFLOUT23</td>
<td>PFLOUT22</td>
<td>PFLOUT21</td>
<td>PFLOUT20</td>
<td>PFLOUT19</td>
<td>PFLOUT18</td>
<td>PFLOUT17</td>
</tr>
<tr>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
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</tbody>
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<table>
<thead>
<tr>
<th>81797</th>
<th>81796</th>
<th>81795</th>
<th>81794</th>
<th>81793</th>
<th>81792</th>
<th>81791</th>
<th>81790</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFL function</td>
<td>PFL function</td>
<td>PFL function</td>
<td>PFL function</td>
<td>PFL function</td>
<td>PFL function</td>
<td>PFL function</td>
<td>PFL function</td>
</tr>
<tr>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
<td>Output signal</td>
</tr>
<tr>
<td>PFLOUT32</td>
<td>PFLOUT31</td>
<td>PFLOUT30</td>
<td>PFLOUT29</td>
<td>PFLOUT28</td>
<td>PFLOUT27</td>
<td>PFLOUT26</td>
<td>PFLOUT25</td>
</tr>
<tr>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
<td>ASF04#2</td>
</tr>
</tbody>
</table>
8.26.16 Saving or Loading the File

8.26.16.1 Saving the File

The safety logic circuit file can be saved into the SD card/USB memory stick of the programming pendant or the USB memory stick of the CPU board. Make sure the medium is inserted into the device of the save destination. Perform the following operations.

1. Display of the window.
   – Select each menu in the following order.
     (EX. MEMORY), {SAVE}, {I/O DATA}.

2. The signal list relative to the I/O data is displayed, and then select “YSF LOGIC FILE”.

3. The confirmation dialog appears, and select “YES”.

4. The safety logic circuit file (file name: YSFLOGIC.DAT) is saved in the specified device.
8.26.16.2 Loading the File

The safety logic circuit file can be loaded from the SD card/USB memory stick of the programming pendant or the USB memory stick of the CPU board. Make sure the medium is inserted into the device of the load destination. Perform the following operations.

1. Display of the window.
   - Select each menu in the following order.
     - {EX. MEMORY}, {LOAD}, {I/O DATA}.

2. The signal list relative to the I/O data is displayed, and then select “YSF LOGIC FILE”.

3. The confirmation dialog appears, and select “YES”.

4. The safety logic circuit file (file name:YSFLOGIC.DAT) is loaded from the specified device.

   **NOTE**
   When the safety logic circuit file is loaded, the file is not transferred to the safety circuit board. Select (WRITE) on the safety logic circuit window, and the file is written in the FLASH ROM of the safety circuit board. After the writing, the file is executed.
8.26.17 Initializing the Safety Logic Circuit File

If the following alarm is shown when starting the YRC1000, the mode is changed to the management mode. The alarm occurs when the file does not match the file written in the FLASH ROM of the safety circuit board. For example, if the safety circuit board is replaced with the spared part, the following alarm will occur.

When the alarm occurs, perform the following procedures to restore.

8.26.17.1 Initializing the Safety Logic Circuit File

1. Display the window.
   – Select {SEECURITY} from {SYSTEM} in the main menu.
2. Change the security.
   (1) Select {SAFETY MODE}.
(2) Enter the password for the safety mode, and press (ENTER).

3. When the entered password is correct, the mode is changed to (SAFETY MODE).
   – After changing to the safety mode, the icon shown on the status area becomes .
4. Select the file to be initialized.
   
   (1) Select each menu in the following order.
       (FILE), (INITIALIZE), (I/O DATA).
       
   (2) The I/O data file list is shown, and then select "YSF LOGIC FILE".

![Image of the file selection interface]

5. Perform the initialization.
   
   (1) Select (ENTER).
   
   – The confirmation dialog appears.

   ![Image of the confirmation dialog]

   (2) Select (YES).
   
   – The file written in the FLASH ROM of the safety circuit board is initialized.
8.26.17.2 Safety Circuit Board FLASH ROM Data Erase and Reset

A safety logic circuit file written in the FLASH ROM of the safety circuit board can be cleared. After erasing, a safety logic circuit file can be transferred to the safety circuit board and written in the FLASH ROM. These clear/reset operations are explained in the following.

- **Safety Circuit Board FLASH ROM Data Erase**
  1. Display of the window.
     1. Select each menu in the following order.
        (FILE), (INITIALIZE), (Safety Circuit Board FLASH Erase).

     ![Menu Display]

     (2) The confirmation dialog appears, and select (YES).
     - The safety logic circuit file written in the FLASH ROM of the safety circuit board is cleared.

     *NOTE*
     After performing the “Safety Circuit Board FLASH Erase”, and turning the YRC1000 power supply ON/OFF. Next time when turning the power supply ON, the alarm “0300: VERIFY ERROR (SYSTEM CONFIG-DATA) [10]” occurs. Therefore, when performing the “Safety Circuit Board FLASH Erase”, the “Safety FLASH Restart” needs to be performed as well.
**Safety FLASH Reset**

1. Displaying the window.

   (1) Select each menu in the following order.
   - (FILE), (INITIALIZE), (Safety Circuit Board FLASH Reset)

   ![Menu Image]

   (2) The confirmation dialog appears, and select (YES).
   - The safety logic circuit file is transferred and written in the FLASH ROM of the safety circuit board.
8.26.18 Example of Safety Logic Circuit

The followings are the examples of the safety logic circuit.

<The safety logic circuit: example 1>

This is the example of the setting to output from the GP safety output signal1(#1 GSOUT1) while the GP safety input signal1(#1 GSIN1) and 2(#2 GSIN2) are ON.

1. The following safety logic circuit is created.
   - Signal1 : GP safety input signal1(#1 GSIN1)
   - Signal2 : GP safety input signal2(#2 GSIN2)
   - Logic : AND
   - Output signal : GP safety output signal1(#1 GSOUT1)

   2. The time chart is shown.

   #1 GSIN1
   OFF
   ON #1 GSIN1 : ON
   OFF
   ON #1 GSIN2
   OFF #1 GSIN2 : ON
   OFF
   ON #1 GSOUT1
   OFF #1 GSIN1 is ON and #1 GSIN2 is ON
   So that #1 GSOUT1 is ON
3. Verifying the safety logic circuit.
   Switch ON the GP safety signal “1” and “2”.
   The mark “ ” becomes “ ● ”.

   <The safety logic circuit: example 2>

   In the following example, one second after the emergency button of the
   programming pendant (PPESP) is pressed and the GP safety input
   signal1 is OFF, the GP safety output signal1(#1 GSOUT1) is turned ON.

   1. The following safety logic circuit is created.
      • Signal 1   : Programming pendant emergency stop (PPESP)
      • Signal 2   : NOT  GP safety input signal 1
                     (#1 GSIN1)
      • Logic       : AND
      • Output signal : GP safety output signal 0
                       (#1 GSOUT0)
      • Timer       : ON delay timer1 (TM1 ON DELAY) 1 second
2. The time chart is shown.

```
ON (press)

PPESP
OFF (release)

ON #1 GSIN1
OFF

NOT #1 GSIN1
ON
OFF

Setting Value
TM1 ON DELAY
0
ON
OFF

PPESP is ON and NOT #1 GSIN1 is ON, and ON DELAY TIM1 reaches the specified value so that #1 GSOUT1 is ON
```

3. Verifying the safety logic circuit.
Confirm that the mark “◯” becomes “●” when pressing the programming pendant and switching the GP safety signal ON. The mark “◯” of the GP safety output signal 1 becomes “●” after one second passed.
8 System Setup
8.26 Safety Logic Circuit

The safety logic circuit: example 3>

In the following example, when the GP safety input signal1 (#1 GSIN1) is ON under the teaching mode, the manipulator decelerates and stops its operation.

1. The following safety logic circuit is created.
   - Signal 1 : Teach mode (TEACH)
   - Signal 2 : GP safety input signal 1 (#1 GSIN1)
   - Logic : AND
   - Output signal : Manipulator deceleration to a stop (SVOFF CAT1)

2. The time chart is shown.

   #1 GSIN1 is ON under the teach mode so that the servo will be turned OFF after the decelerating processing
3. Verifying the safety logic circuit.
   Set up the teach mode, and turn the servo ON. After that, when the GP safety signal 1 is turned ON, the mark "○" becomes "●" and the manipulator decelerates and stops its operation. If the manipulator stops its operation by the safety logic circuit, the message “Robot is stopped by safety logic circuit” is shown on the message area of the programming pendant.

   **NOTE**
   For the safety logic circuit of the YRC1000, even if the manipulator deceleration to a stop (SVOFF CAT1) is turned ON, the manipulator stops its operation instantly without decelerating. Under the play mode, if the manipulator deceleration to a stop (SVOFF CAT1) is turned ON, the manipulator decelerates and stops its operation.

   **NOTE**
   When the manipulator is stopped by the safety logic circuit signal, “Robot is stopped by safety logic circuit” is shown on the message area of the programming pendant. The control status signal #80343(Robot stopped by safety logic circuit) is turned ON.
8 System Setup
8.26 Safety Logic Circuit

The safety logic circuit: example 4

The setting example by using the auxiliary relay is described below.
While either status of the programming pendant emergency stop (PPESP), controller emergency stop (PBESP) or external emergency stop (EXESP) is stopped, the GP safety output signal 1 (#1 GSOUT1) is turned ON.

1. The following safety logic circuit is created
   • Signal 1 : Programming pendant emergency stop (PPESP)
   • Signal 2 : Controller emergency stop (PBESP)
   • Signal 3 : External emergency stop (EXESP)
   • Logic : OR
   • Output signal : GP safety output signal 1 (#1 GSOUT1)

   The display of “#1 GSOUT1” indicates “GSOUT1” of the first safety circuit board.

2. The time chart is shown.

<table>
<thead>
<tr>
<th>One Output</th>
<th>Output Signal 1 #1 GSOUT1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   #1 GSOUT1
   OFF

   One of these statuses is ON, and #1 GSOUT1 is ON.
3. Verifying the safety logic circuit.
   When either the programming pendant emergency stop, controller 
   emergency stop or the external emergency stop is input, the mark “〇” 
   of the GP safety output signal 1 becomes “●”.

---

<The safety logic circuit: example 5>

The one-second one-shot output signal is created by the safety logic 
 circuit. In the following example, the GP safety output signal (#1 GSOUT1) 
 is ON for one second.

1. Select {SAFETY FUNC.} - {TIMER DELAY}.
2. Select {PAGE} - {TIMER}.

3. Input “250” at TIMER1.

4. Create the following safety logic circuit.
   
   ```
   001  DSU  #1G$IN1  #1 G$OUT1  TMR1
   ```
8 System Setup
8.26 Safety Logic Circuit

- When #1 GSIN 1 signal is turned ON, #1 GSOUT 1 is ON for one second.

5. 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".

NOTE
When using the DSU/DSD instruction, the timer (TMR) must be set to the output signal. If (WRITE) is press without setting the timer (TMR) to the output signal, the error message "ERROR 4241: Safety logic circuit is not set correctly" is shown on the message area of the programming pendant.
The following is the setting example of the one-second one-shot output signal when two signals are turned ON at the same time.

1. The following safety logic circuit is created.
   001 DSU #1 GSIN1 AND DSU #1 GSIN2 #1 GSOUT1 TMR1

2. 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 #1 GSIN 1 signal and #1 GSIN 2 signal are turned ON at the same time, #1 GSOUT1 signal is ON for one second.

• When #1 GSIN 1 signal and #1 GSIN 2 signal are not turned ON at the same time, #1 GSOUT1 signal remains OFF.
In the following example, the servo power individual control function is set by the safety PLC (optional).

1. By pressing [MAIN MENU] on the programming pendant, start up the maintenance mode.

2. Select each menu in the following order. 
   (SYSTEM), (SETTING), (CONTROL GROUP). Check each control group is allocated to which ON ENABLE signal.

   *For the above example, the allocation of control group and ON ENABLE signal is the following.*

   - Control group R1 is allocated to ON ENABLE 1 signal (ON_EN1).
   - Control group S1 is allocated to ON ENABLE 2 signal (ON_EN2).
   - Control group S2 is allocated to ON ENABLE 3 signal (ON_EN3).
   - Control group S3 is allocated to ON ENABLE 4 signal (ON_EN4).

3. Output the input1 (SFBIN01) from the safety PLC (optional) to the S-ONEN 1. In this case, the hard-wired ON_ENABLE1 signal must short circuit.

4. The following safety logic circuit is created.

   01 SFBIN01 #1 S-ONEN1
5. When #1 S-ONEN1 is turned ON, the servo power of R1 is turned OFF.
   - The message “Servo ON enable signal (ON-EN) is OFF (Safety logic circuit)” is shown on the message area of the programming pendant.

   ![NOTE]

   - If the hard-wired ON_ENABLE signal and #n S-ONEN[x] signal of the safety logic circuit are used, the servo is turned ON only when the status of both signals is not the servo OFF. When the status of either signal or both signals is the servo OFF, the servo is not turned ON for the control group allocated to the ON_ENABLE signal.
   - For details of the servo power individual control function, refer to "YRC1000 OPTIONS INSTRUCTIONS FOR INDEPENDENT/COORDINATED CONTROL FUNCTION (HW1484042) 8. Servo Power Individual Control Function”.

   <The safety logic circuit: example 8>
   In the following example, the specific input signal is output to the safety PLC (optional). The logic circuit to output the specific input1(#40780) to the safety PLC is created.

   1. Select {SAFETY SIGNAL ALLOC} from {SAFETY FUNC.}.
      Set ASF01-E to SFBOUT01.

   2. The following safety logic circuit is created.
      01 SPIN01 SFBOUT1

   ![SFBOUT1]

   3. When #40780 is turned OFF, SFBOUT01 is also turned OFF.
      When #40780 is turned ON, SFBOUT01 is turned ON.
The input of the full speed test (S-FST) signal is set in the following example. After turning ON the GP safety input signal (GSIN1) under the teach mode, the safety logic circuit, in which the full speed test output is turned ON, is set.

1. The following safety logic circuit is created.

   01 TEACH AND GSIN1 S-F

   ![Safety Logic Circuit Example]

2. When GSIN1 signal is turned ON, S-FST signal is turned ON.

3. When S-FST signal is turned ON, "Full-speed test mode (Safety logic circuit)" is shown on the message area of the programming pendant. Also, the control status signal #80047 is turned ON.

   ![Full-Speed Test Mode]

**NOTE**

S-FST signal is enabled only in the teach mode.
8 System Setup
8.26 Safety Logic Circuit

The safety logic circuit: example 10

The method to use MS-OUT signal is explained in the following.

1. The following safety logic circuit is created.
   01 #1 GSIN1 MS-OUT01

2. When GSIN1 signal is turned ON, MS-OUT01 signal is turned ON.

3. The MS-OUT01 signal created by the safety logic circuit can be used as the input signal of AXIS RANGE LIMIT of the functional safety (optional), etc.
### 8.26.19 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>Safety circuit board save data error</td>
<td>The safety logic circuit files in the file written in the Main CPU circuit board and the safety circuit board do not match. Refer to chapter 8.26.17.2 “Safety Circuit Board FLASH ROM Data Erase and Reset” for more details to restore.</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 ASF01 board, ASF01 board has detected an undefined signal.</td>
<td>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>
</tr>
<tr>
<td></td>
<td></td>
<td>In the receiving information on safe logic circuit information, ASF01 board has detected an undefined signal.</td>
<td>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>
</tr>
<tr>
<td>4777</td>
<td>TRANSMISSION ERROR (M-SAF FILE)</td>
<td>Safe logic circuit information transmission error was detected.</td>
<td>An alarm occurred while transferring the safety logic circuit file to the safety circuit board. Reset the alarm, and re-send the safety logic circuit file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timer delay information transmission error was detected.</td>
<td>An alarm occurred while transferring the safety logic circuit file to the safety circuit board. Reset the alarm, and re-send the safety logic circuit file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M-safety signal alloc information transmission error was detected.</td>
<td>An alarm occurred while transferring the safety logic circuit file to the safety circuit board. Reset the alarm, and re-send the safety logic circuit file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Safety signal board alloc information transmission error was detected.</td>
<td>An alarm occurred while transferring the safety logic circuit file to the safety circuit board. Reset the alarm, and re-send the safety logic circuit file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M-safety command reception time out was detected.</td>
<td>No response from the safety circuit board 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 safety circuit board.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Safe logic circuit write error was detected.</td>
<td>Failure to transfer the safety logic circuit file to the safety circuit board. Please re-send the safety logic circuit file. If the alarm occurs again, refer to chapter 8.26.17.2 “Safety Circuit Board FLASH ROM Data Erase and Reset” for more details.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Safe logic circuit cancel error was detected.</td>
<td>Failure to sending the cancel command while transferring the safety logic circuit file to the safety circuit board. Please re-send the safety logic circuit file. If the alarm occurs again, refer to chapter 8.26.17.2 “Safety Circuit Board FLASH ROM Data Erase and Reset” for more details.</td>
</tr>
</tbody>
</table>
8.26.20 General-Purpose Safety Output Monitoring Signal

The DX200 or an earlier version of the controller had the dedicated connection terminal for the monitoring signal. However, for downsizing, the YRC1000 supports the monitoring signal by using the safety logic circuit instead of the dedicated connection terminal.

If the values of the functional safety general-purpose output signal and the general-purpose safety output monitoring signal are judged as NG for 500 ms or more, the following alarm occurs:

- When the GSOUT signal is NG
  Alarm 4767: M-SAF GENERAL OUT FB DIAG. ERROR
- When the FSBOUT signal is NG
  Alarm 4768: M-SAF GENERAL OUT FB DIAG. ERROR2

For monitoring of the contact point B, the judgment is made as follows.

<table>
<thead>
<tr>
<th>Output value of the general-purpose safety output signal (GSOUT, FSBOUT)</th>
<th>Input value of the general-purpose safety output monitoring signal (GSEDM, XEDM)</th>
<th>Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Close</td>
<td>OK</td>
</tr>
<tr>
<td>OFF</td>
<td>Open</td>
<td>NG</td>
</tr>
<tr>
<td>ON</td>
<td>Close</td>
<td>NG</td>
</tr>
<tr>
<td>ON</td>
<td>Open</td>
<td>OK</td>
</tr>
</tbody>
</table>

Specify whether to enable or disable the monitoring signal of the general-purpose safety output signal on the following window:

1. Turn ON the YRC1000 power while pressing [MAIN MENU] of the programming pendant.
2. Select (SYSTEM) - {SECURITY}, and then change the security mode to the safety mode.
3. Select (SYSTEM) - {SETUP} - “OPTION FUNCTION” - “SAFETY LOGICAL CIRCUIT SETTING”.
   - The following window appears.
4. Select “DETAIL” of GSOUT Feedback SETTING. The following window appears and the setting can be performed.

- The setting can be switched by pressing [SELECT]. If there are two or more ASF01 boards for the robot coordination system, press [PAGE] of the programming pendant and perform settings on the second page and after. After completing the setting, press [ENTER] of the programming pendant. The window returns to the following state.

<Setting of the safety monitoring signal>

**USED** : The monitoring signal is used for the general-purpose safety output signal.

**UNUSED** : The monitoring signal is not used for the general-purpose safety output signal.

**NOTE**

When the monitoring signal is set to “UNUSED”, the monitoring of the safety general-purpose output monitoring signal is disabled.
5. Select “DETAIL” of XOUT Feedback SETTING. The following window appears and the setting can be performed.

**NOTE**

Perform this step 5 only in the system where the safety I/O expansion board (optional) is enabled.

The setting can be switched by pressing [SELECT]. After completing the setting, press [ENTER] of the programming pendant. The window returns to the following state.
6. Press [ENTER] of the programming pendant again, and select {YES}. The data is updated.

7. After updating the data, select {FILE} - {INITIALIZE} - "Safety Board FLASH Reset", and select {YES}. At the sound of the beep, the re-setting is completed and the message on the programming pendant disappears.

8. Turn the YRC1000 power OFF and then ON again.
9. Select {SYSTEM} - {SECURITY}, and change the security mode to the safety mode.
10. Select {SAFETY FUNC.} - {SAFETY LOGIC CIRCUIT}.
   - The following window appears, and the setting of the safety logic circuit can be performed.

11. Perform the setting for the connected device to be monitored. Specify the monitoring signal corresponding to the used general-purpose safety output signal.

<table>
<thead>
<tr>
<th>General-purpose safety output signal</th>
<th>Feedback signal (monitoring signal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSOUT1</td>
<td>GSEDM1</td>
</tr>
<tr>
<td>GSOUT2</td>
<td>GSEDM2</td>
</tr>
<tr>
<td><strong>The following signals can be specified only in the system where the safety I/O expansion board (optional) is enabled.</strong></td>
<td></td>
</tr>
<tr>
<td>FSBOUT1 (XOUT1)</td>
<td>XEDM1</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT2)</td>
<td>XEDM2</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT3)</td>
<td>XEDM3</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT4)</td>
<td>XEDM4</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT5)</td>
<td>XEDM5</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT6)</td>
<td>XEDM6</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT7)</td>
<td>XEDM7</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT8)</td>
<td>XEDM8</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT9)</td>
<td>XEDM9</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT10)</td>
<td>XEDM10</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT11)</td>
<td>XEDM11</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT12)</td>
<td>XEDM12</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT13)</td>
<td>XEDM13</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT14)</td>
<td>XEDM14</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT15)</td>
<td>XEDM15</td>
</tr>
<tr>
<td>FSBOUT1 (XOUT16)</td>
<td>XEDM16</td>
</tr>
</tbody>
</table>
8 System Setup
8.26 Safety Logic Circuit

- When monitoring the connected device to which GSOUT1 and FSBOUT1 are connected:

  - After completing the setting, press {WRITE}.

12. After completing the writing, press {CONFIRM} and then {YES}.
13. The setting is completed when the status of the safety logic circuit turns to "DONE".

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

**COMMENT:**

<p>| | |</p>
<table>
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<tr>
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<tbody>
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</tbody>
</table>
8.27 Robot Stop Factor Monitor Function

8.27.1 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.

8.27.1.1 The Robot Stop Factor

This function detects the servo OFF status caused by the 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 8-1: The List of the Servo OFF Factors by Main CPU Instructions

<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 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>SAFETY FENCE</td>
<td></td>
<td>Safety fence</td>
</tr>
<tr>
<td>RDY0 OFF</td>
<td></td>
<td>RDY0 OFF</td>
</tr>
<tr>
<td>CATEGORY1 REQUEST</td>
<td></td>
<td>Category 1 stop request from the main CPU</td>
</tr>
<tr>
<td>SERVO 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 functional 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 functional safety</td>
</tr>
<tr>
<td>ASF01 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. The machine safety servo category 0 stop timer must be started.</td>
</tr>
<tr>
<td>OVER TRAVEL1</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF by the over travel signal 1</td>
</tr>
<tr>
<td>OVER TRAVEL2</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF by the over travel signal 2</td>
</tr>
<tr>
<td>OVER TRAVEL3</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF by the over travel signal 3</td>
</tr>
<tr>
<td>OVER TRAVEL4</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF by the over travel signal 4</td>
</tr>
<tr>
<td>CONTACTOR OR STO OFF1</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF of the contactor 1 or STO1 from the main CPU</td>
</tr>
<tr>
<td>CONTACTOR OR STO OFF2</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF of the contactor 2 or STO2 from the main CPU</td>
</tr>
<tr>
<td>CONTACTOR OR STO OFF3</td>
<td>Safety circuit board No. #1 to #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>Safety circuit board No. #1 to #8</td>
<td>Servo OFF of the contactor 4 or STO4 from the main CPU</td>
</tr>
</tbody>
</table>
8 System Setup
8.27 Robot Stop Factor Monitor Function

<table>
<thead>
<tr>
<th>Displayed Item</th>
<th>Secondary Indication</th>
<th>Description of the Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON ENABLE1</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF of the control group connected to ON_ENABLE1</td>
</tr>
<tr>
<td>ON ENABLE2</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF of the control group connected to ON_ENABLE2</td>
</tr>
<tr>
<td>ON ENABLE3</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF of the control group connected to ON_ENABLE3</td>
</tr>
<tr>
<td>ON ENABLE4</td>
<td>Safety circuit board No. #1 to #8</td>
<td>Servo OFF of the control group connected to ON_ENABLE4</td>
</tr>
<tr>
<td>CATEGORY ON ENABLE1</td>
<td>Safety circuit board No. #1 to #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>Safety circuit board No. #1 to #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>Safety circuit board No. #1 to #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>Safety circuit board No. #1 to #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>
</tbody>
</table>
### 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 INPUT SIGNAL)</td>
<td>System input signal number #40067</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>
8.27.1.2 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.

8.27.2 Operation

8.27.2.1 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.
8 System Setup
8.27 Robot Stop Factor Monitor Function

– The following items are displayed on the RB STOP FACTOR MONITOR window.

• DETECT TIME: Shows the time when the robot stop factor was detected.

![Robot Stop Factor Monitor](image)

• The factor detected by the main CPU is displayed on the first line.

![Robot Stop Factor Monitor](image)

• The factor(s) detected by the safety circuit board is (are) displayed from the second line on the screen.

![Robot Stop Factor Monitor](image)

– The data on the first page is the latest one, and the page 20 is the oldest data.
8.27.2 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.
8.28 Robot Detachment Function

8.28.1 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] on the programming pendant.
   – Maintenance mode screen starts up.

2. Select (SYSTEM) under the main menu.
   – Sub menu is shown.
3. Select {SECURITY}.
   – Mode selection screen is shown.

4. Press [SELECT] to select the mode.
   – Mode selection list is shown.

5. Move the cursor to (SAFETY MODE) and select.
   – Password input box is shown.
6. Input the password for safety mode and press [ENTER].
   – When the correct password is input, security mode is changed.

8.28.2 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 the main menu.
   – Sub menu is shown.
2. Select {SETUP}.
   – “SETUP” screen is shown.

3. Move the cursor to {OPTION FUNCTION} and select.
   – “OPTION FUNCTION” screen is shown.

4. Move the cursor to {ROBOT DETACHMENT} and select.
   – Detail setting screen for robot detachment function is shown.
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 " ○ " and " - ".

   – Description for the setting items on JOB
     When " - " is selected: The JOB including detached group cannot be started up.
     When " ○ " is selected: The JOB including detached group can be started up. However, the detached axes cannot be operated.
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.
8.29 Axes Detachment Function

8.29.1 Outline

With the axes detachment function, the connection of a specific axis can be disabled under the maintenance mode. In the case of setup or motor replacement where no axis is physically connected, by connecting the dummy connector (HW1471285-A) and enabling the axes detachment, the system can be started without any alarm from the specified axes.

8.29.2 Connecting the Dummy Connector

By referring to the INSTRUCTIONS of each manipulator, disconnect the encoder connector of the desired axis from the multi-port connector in the manipulator, and connect the dummy connector to the multi-port connector.

**DANGER**

- 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 perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

If the dummy connector is connected to a wrong port, or if the axes detachment is performed without connecting the dummy connector, the following alarm normally occurs when the control power supply is turned ON. In this case, immediately turn OFF the control power supply and connect the dummy connector to the correct port.

**AL1380: ENCODER ADDRESS VERIFY ERROR**

The dummy connector is necessary only for the encoders of the manipulator.
8.29.3 Setting Maintenance Mode

Start the maintenance mode and set the security mode to the safety mode. (Refer to chapter 8.28.1 “Setting Maintenance Mode”.)

8.29.4 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.
8 System Setup
8.29 Axes Detachment Function

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.

8.29.5 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].
8.29.6 Restrictions

- 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

Use the robot detachment function (chapter 8.28 “Robot Detachment Function”) when performing the playback operation in the state that the specific manipulator, the base, or the station is detached.

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>
8 System Setup
8.29 Axes Detachment Function

• Operation without restrictions
  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

• 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.

CAUTION
• While the axes detachment function is set, the manipulator may not be able to move to the taught position or operate in the right posture, because some axes do not move.
  When performing one of the following operations while the axes detachment function is set, pay careful attention to the movement of the manipulator and prevent interference between the manipulator and peripheral devices.
8.30 User Group Input and Output

8.30.1 Outline of the Function

The input and output of user group can be defined by one group of two or more GP I/O signals. The value of the group signal can be expressed in the numerical value.

8.30.2 User Group Input

8.30.2.1 User Group Input Setting

Set the security to the management mode.

1. Select (I/O) in the main menu.
2. Select (USER GROUP INPUT).
   – The USER GROUP INPUT window is shown.
3. Select (SETTING) of (DISPLAY) in the pull down menu.
   – The USER GROUP INPUT SETTING window is shown.

1. **START**
   Specify the first number of the GP input signal to be allocated.

2. **LENGTH**
   Specify the number of the signals which is allocated to one group (1 to 32). When the parity check is specified, the parity bit is the highest bit. When the length is 1, the parity check cannot be specified.

3. **PARITY**
   Specify the parity check.
   NONE : Parity check is not specified.
   ODD : Odd parity is specified
   EVEN : Even parity is specified.

4. **NAME**
   The group signal name is set.
4. The user group input is set.
8 System Setup
8.30 User Group Input and Output

8.30.2.2 Display of User Group Input

1. Select (I/O) in the main menu.
2. Select (USER GROUP INPUT).

- The USER GROUP INPUT window is shown.

1. **SIM**
   Normally, the input status of the user group cannot be changed by manual operation. However, the status can be set to be changeable for the operation check and etc. The status is changed every time an item is selected.
   - SIM : Manual operation is possible
   - (Blank) : Normal status

```
NOTE
All the GP input signals which belong to the group in the status of “SIM” are in the status of “SIM”.
For details of this status, refer to “YRC1000 OPTIONS INSTRUCTIONS FOR Concurrent I/O (RE-CKI-A467) 13.2.3 Changing Signal Status from GP Input Status Window”.
```

2. **VALUE**
   The input status of the user group.
   When the group in the “SIM” status is selected, the value can be changed.

3. **PARITY**
   The status of the parity bit
   - # # : No parity check
   - # 0 : 0
   - # 1 : 1
   - ERR : Parity error

4. **NAME**
   The group signal name
8.30.3 User Group Output

8.30.3.1 User Group Output Setting

Set the security to the management mode.
1. Select {I/O} in the main menu.
2. Select {USER GROUP OUTPUT}.
   – The USER GROUP OUTPUT window is shown.
3. Select {SETTING} of {DISPLAY} in the pull down menu.
   – The USER GROUP OUTPUT SETTING window is shown.
   – The USER GROUP INPUT SETTING window is shown.

START
Specify the first number of the GP output signal to be allocated.

LENGTH
Specify the number of the signals which is allocated to one group (1 to 32). When the parity check is specified, the parity bit is the highest bit. When the length is 1, the parity check cannot be specified.

PARITY
Specify the parity check.
NONE : Parity check is not specified.
ODD  : Odd parity is specified
EVEN : Even parity is specified.

NAME
The group signal name is set.
4. The user group output is set

<table>
<thead>
<tr>
<th>USER GROUP</th>
<th>START</th>
<th>LENGTH</th>
<th>PARITY</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>00.M(0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00.M(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00.M(2)</td>
<td>105</td>
<td>4</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>00.M(3)</td>
<td>106</td>
<td>3</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>00.M(4)</td>
<td>107</td>
<td>3</td>
<td>XXX</td>
<td></td>
</tr>
<tr>
<td>00.M(5)</td>
<td>110</td>
<td>3</td>
<td>XXX</td>
<td></td>
</tr>
<tr>
<td>00.M(6)</td>
<td>111</td>
<td>3</td>
<td>XXX</td>
<td></td>
</tr>
<tr>
<td>00.M(7)</td>
<td>112</td>
<td>3</td>
<td>XXX</td>
<td></td>
</tr>
<tr>
<td>00.M(8)</td>
<td>113</td>
<td>3</td>
<td>XXX</td>
<td></td>
</tr>
<tr>
<td>00.M(9)</td>
<td>114</td>
<td>3</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>00.M(10)</td>
<td>115</td>
<td>2</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>00.M(11)</td>
<td>116</td>
<td>2</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>00.M(12)</td>
<td>117</td>
<td>2</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>00.M(13)</td>
<td>118</td>
<td>2</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>00.M(14)</td>
<td>119</td>
<td>2</td>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>
8.30.3.2 Display of User Group Output

1. Select {I/O} in the main menu.
2. Select {USER GROUP OUTPUT}.
   – The USER GROUP OUTPUT window is shown.

<table>
<thead>
<tr>
<th>USER GROUP OUTPUT</th>
<th>PARITY</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The output status of the user group.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARITY</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>The status of the parity bit</td>
<td></td>
</tr>
</tbody>
</table>

- ✖️: No parity check
- ◯: 0
- ●: 1
- ERR: Parity error

<table>
<thead>
<tr>
<th>VALUE</th>
<th>PARITY</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>xx</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>xx</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>xx</td>
<td></td>
</tr>
</tbody>
</table>

3. NAME
   The group signal name
8.31 Variable Allocation

The number of the global variable allocation can be changed by performing the following operations. However, after performing this change operation, the data of the JOB, the user coordinate or etc. is initialized and the variable data or the variable name data saved before the change cannot be loaded. Thus, the following operations are allowed only for the administrator who can set the security mode to the management mode or higher.

1. By pressing [MAIN MENU] on the programming pendant, turn ON the power.
2. Change the security mode to the management mode.
3. Select (SYSTEM) in the main menu.
4. Select (SETUP).
5. Select (OPTION FUNCTION).
6. Select (DETAIL) of the variable allocation.

The DETAIL window of the variable allocation is shown.

The number can be changed by selecting "++" / "--" or inputting the number directly. The changeable minimum and maximum value are shown in "RANGE". Since the global variable shares the determined section/area, the value shown in "RANGE" is changed along with the setting value.

- When the "++" is selected, the allocation is increased by the increment of 50.
8 System Setup
8.31 Variable Allocation

- When the "--" is selected, the allocation is decreased by the decrement of 50.

7. Press [ENTER].

- The confirmation dialog of the parameter change shows up.
8. Select (YES).

- Select (YES) for the confirmation dialog. When a file needs to be initialized due to the change of the variable allocation, the confirmation dialog of initialization shows up. Select (YES) for all the confirmation dialog of initialization.
9. After the initialization of file is completed, the option function window is shown.

When the position variable allocation is changed, not only the data of variable/variable name but also the following files are cleared. Be sure to handle the data properly.

- User coordinate
- Memory play file
- Spot monitor data
- Robot calibration data
- Conveyor calibration data
8.32 Controller Information Display Function

The configured information in this robot system can be checked by the following procedures.

1. Select {SYSTEM INFO} in the main menu.

2. Select {CONTROLLER INFORMATION}.
   - The CONTROLLER INFORMATION window is shown.

3. Select {DISPLAY}.
4. Select {OPTION BOARD INFO}.
   – The OPTION BOARD INFO window is shown. Move the cursor to the option board to show the details.

5. Press [SELECT].
   – The setting contents of the option board information is shown.
While the CONTROLLER INFORMATION window is shown, the following display is shown by performing the bilingual operation ([SHIFT] and [AREA] on the programming pendant are pressed). Select (CONTROLLER INFORMATION) from (SYSTEM INFO) once again.
8.33 Power Supply Regeneration Monitor Function

Control panels for medium- and large-capacity YRC1000 models support power supply regeneration, and power supply regeneration monitor function described in this section can be used.

The amount of regenerated power and the operating status can be checked on the programming pendant with power supply regeneration monitor function.

8.33.1 Outline

When the manipulator’s arm decelerates, the motor becomes a generator that generates electrical energy. Then this electrical energy is returned to the primary power supply. This process is called “power supply regeneration”.

Consumption power is reduced by performing power supply regeneration.

NOTE
Control panels for small-capacity models do not support power supply regeneration.
For the types of control panels, refer to the YRC1000 models in chapter 13.4.1 “Arrangement of Units and Circuit Boards”.

8.33.2 Power Regeneration Window

The amount of regenerated power and the operating status can be checked on this window.

Use the following procedure to display the power supply regeneration window.

Select {ROBOT} → {REGENERATION} in the main menu.
– The power regeneration window appears.

The description of the window is given next.

1 Integrated value
Indicates the accumulated amount of regenerated power up to the present.
8 System Setup
8.33 Power Supply Regeneration Monitor Function

2 Today
Indicates the accumulated amount of regenerated power for today.

3 Yesterday
Indicates the accumulated amount of regenerated power for yesterday.

4 Regenerative energy
Displays an arrow when power is being regenerated.

5 Consumption energy
Displays an arrow when power is being consumed from the power supply.

6 Exit
Exits the power regeneration window.

NOTE
For a coordinated panel in which two or more control panels are connected and used, one system may include multiple control panels that support power supply regeneration.

In this case, the total amount of power regenerated by all control panels in the system is indicated on the power regeneration window.

NOTE
The amount of regenerated power will vary by the job of the robot.

For jobs with little regenerated power, the accumulated amount may not increase very much (e.g., only a few kWh per day).

The normal functioning of power supply regeneration can be checked with the regenerative energy arrow displayed on the power regeneration window.
8.33 Power Supply Regeneration Monitor Function

8.33.3 Regeneration Monitor Window

The amount of regenerated power for today and the accumulated amount of regenerated power can be checked on this window. For a system in which two or more control panels are connected, the data for each control panel can be checked.

Use the following procedure to display the regeneration monitor window.

1. Change the security mode to management mode or a higher mode.
   - For how to change the security mode, refer to chapter 7.1.1.1 “Changing the Security Mode”.
2. Select {ROBOT} → {REGENERATION SET} in the main menu.
   - The regeneration monitor window appears.

The description of the window is given next.

1. **TODAY**
   Indicates the accumulated amount of regenerated power for today for each control panel.

2. **YESTERDAY**
   Indicates the accumulated amount of regenerated power for yesterday for each control panel.

3. **INTEGRATED VALUE**
   Indicates the accumulated amount of regenerated power up to the present for each control panel.

4. **START DAY**
   Indicates the start date for measuring the accumulated amount of regenerated power.

   **NOTE**
   For a system in which two or more control panels are connected, the data for each control panel can be checked by pressing the (PAGE) key on the regeneration monitor window to change the page.

   For control panels that do not support power supply regeneration, “***” is shown for the values of today, yesterday, integrated value, and start day.
8.33 Power Supply Regeneration Monitor Function

8.33.4 Reset Time Setting

The time can be set that is used to reset the amount of regenerated power for today as described in chapter 8.33.3 “Regeneration Monitor Window”.

Once each day, the amount of regenerated power for today is reset to 0 at the set time, and the regenerated power starts being accumulated again from 0. Before the reset, the amount of regenerated power for yesterday is set to the amount of regenerated power for today, which eliminates the previous amount of regenerated power for yesterday. However, the reset does not affect the accumulated amount of regenerated power.

For a coordinated panel, all control panels in the system are reset.

Use the following procedure to display the reset time setting window.

1. Change the security mode to management mode or a higher mode.
   – For how to change the security mode, refer to chapter 7.1.1.1 “Changing the Security Mode”.

2. Select {ROBOT} → {REGENERATION SET} in the main menu.
   – The regeneration monitor window appears.

3. Select {DISPLAY} → {REGENERATION SET} from the pull-down menu.
   – The regeneration setting window appears.

NOTE
The default value for the reset time is 12:00 AM (00:00 on the window). If the reset time is not changed, the system is reset at 12:00 AM.
4. Select “00:00” (default value) and enter the new reset time.
   – The reset time can be set between 00:00 and 23:59.
   Example: To set 7:05 PM, enter “19.05”.

![Image showing the regeneration setting interface with an example input for 19.05]
8.33.5 Resetting the Amount of Regenerated Power for Today

Use the following procedure to discard the amount of regenerated power for today and store 0 as that amount. The amount of regenerated power for yesterday and the accumulated amount of regenerated power are not changed.

1. Change the security mode to management mode or a higher mode.
   - For how to change the security mode, refer to chapter 7.1.1.1 “Changing the Security Mode”.

2. Select (ROBOT) → (REGENERATION SET) in the main menu.
   - The regeneration monitor window appears.

3. Select (DATA) → (RESET(TODAY VALUE)) from the pull-down menu.

4. The “Clear data?” confirmation dialog box appears.
   - Select “Yes” to reset the amount of regenerated power for today to 0.

The amount of regenerated power for today is reset on only the control panel that is displaying data at that time.
9 System Backup

9.1 System Backup with YRC1000

For the YRC1000, 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 YRC1000

For the YRC1000, 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”.

As for saving in the normal mode, refer to “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 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”.

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 YRC1000 system, the SD card or the USB memory is used. (The USB connector of the programming pendant is not available in the automatic backup function.)

The following tables show the recommended SD card and USB memory.

<Recommended SD card>

<table>
<thead>
<tr>
<th>No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hagiwara Solutions</td>
<td>NSD6-512MH(A01SDI-YE)</td>
<td>512MB</td>
</tr>
<tr>
<td>2</td>
<td>Hagiwara Solutions</td>
<td>NSD6-001GH(A01SDI)</td>
<td>1GB</td>
</tr>
<tr>
<td>3</td>
<td>Hagiwara Solutions</td>
<td>NSD6-002GH(A01SDI)</td>
<td>2GB</td>
</tr>
<tr>
<td>4</td>
<td>Hagiwara Solutions</td>
<td>NSD6-004GH(B20SEI)</td>
<td>4GB</td>
</tr>
<tr>
<td>5</td>
<td>Hagiwara Solutions</td>
<td>NSD6-008GH(B20SEI)</td>
<td>8GB</td>
</tr>
<tr>
<td>6</td>
<td>Hagiwara Solutions</td>
<td>NSD6-016GH(B20SEI)</td>
<td>16GB</td>
</tr>
<tr>
<td>7</td>
<td>Hagiwara Solutions</td>
<td>NSD4-032GH(B00MG)</td>
<td>32GB</td>
</tr>
</tbody>
</table>
In order to save the batch data, the following free space per file is needed in the media.

Approx. 30M Byte

Note that the free space to store the two files is needed 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 SD card 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 connector of the CPU 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 result in the damage of the USB memory and the USB connector.
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>○</td>
<td>○</td>
</tr>
<tr>
<td>Safety Mode</td>
<td>○</td>
<td>○</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 YRC1000 power supply while pressing [MAIN MENU].
2. Insert a SD card into the SD card slot on the programming pendant.
   - when USB memory is used instead of SD card, mount USB memory and select “USB: PENDANT” or “USB1: CONTROLLER” in the {DEVICE}.
3. Select {EX. MEMORY} under the main menu.
   - The sub menu appears.
4. Select (SAVE).
   – The save display appears.

![Save Display]

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

5. Select (CMOS).
   – The confirmation dialog box appears.

![Confirmation Dialog Box]
6. Select {YES}.
   - Select {YES} to save the CMOS data into the SD card.
   - When saving the file, if the CMOS.BIN file exists in the SD card, the following confirmation dialog box appears.

7. Select {YES}.
   - The CMOS.BIN file is overwritten in the SD card.

**NOTE**
When not using the data stored in the portable memory device, make sure to keep the device under an appropriate management.
9.2 Backup by CMOS.BIN

9.2.2 CMOS.BIN Load

Follow the procedures below to load CMOS.BIN.

1. Turn ON the YRC1000 power supply while pressing [MAIN MENU].
2. Change the security mode to the maintenance mode or higher mode.
3. Insert a SD card into the SD card on the programming pendant.
   – When USB memory is used instead of SD card, mount USB memory and select “USB: Pendant” or “USB1: Controller” in the (DEVICE).
4. Select (EX. MEMORY) under the main menu.
   – The sub menu appears.
5. Select (LOAD).
   – The load display appears.
   – The items marked with “□” cannot be selected.
6. Select {CMOS}.
   - The confirmation dialog box appears.

   ![Confirmation dialog box]

   7. Select {YES}.
      - The loaded CMOS.BIN file contents are reflected in the data inside the robot.

---

**NOTICE**

When the “CMOS load” is performed, the current CMOS data is replaced with the CMOS data (the contents of “CMOS.BIN”) in the selected device. 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 Objective

With the automatic backup function, the data saved in the YRC1000 such as system setting or operational condition are collectively backed up in the SD card, which is stored in the programming pendant, or the selected device at the automatic backup window.

Able to back up to the following devices.

- The SD card of the programming pendant
- The SD card of the ACP01 board
- The RAM AREA of the ACP01 board (It will display, when the high speed Ethernet server function is effective.)

NOTE: The automatic backup function is enabled only while the YRC1000 power supply is ON whereas it isn’t while in the maintenance mode or the power supply is OFF.

9.3.2 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 YRC1000.

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 YRC1000 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.
9.3 Automatic Backup Function

The automatic backup function has the following functions and features.

<table>
<thead>
<tr>
<th>No</th>
<th>Function/Feature</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cyclic backup</td>
<td>In the teach mode, the data in memory is backed up in a specified cycle from a specified starting time. This function backs up as much of the latest data as possible during editing. The backup data saved in the SD card can be loaded to the YRC1000 in case of data loss so that the damage can be minimized.</td>
</tr>
<tr>
<td>2</td>
<td>Backup when switching modes</td>
<td>When switching the mode from the teach mode to the play mode, the data in memory is backed up. The editing data is backed up when editing is completed. The latest data is automatically backed up with this mode.</td>
</tr>
<tr>
<td>3</td>
<td>Backup when start-up</td>
<td>When the YRC1000 is start-up, the data in memory is backed up. When the YRC1000 starts up, the data in memory is backed up. Since the editing/playback operation is usually completed when the YRC1000 power is turned OFF, the latest data is automatically backed up with this mode.</td>
</tr>
<tr>
<td>4</td>
<td>Backup when inputting specified signals</td>
<td>The data in memory is backed up when a specified signal (#40560) is input. The data in memory is backed up by the signal from the host at the intended timing. Although the above mentioned items 1 to 3 are designed to back up the data automatically, this function backs up the data in accordance with the instruction from the host.</td>
</tr>
<tr>
<td>5</td>
<td>Backup while robot program is stopped</td>
<td>The backup during playback is disabled. However, in the play mode, the backup is enabled if the robot is stopped. (&quot;Cyclic backup&quot; and &quot;Backup when inputting specified signals&quot;) Backs up the variables for essential data.</td>
</tr>
<tr>
<td>6</td>
<td>Backup and retry at low priority</td>
<td>The data in memory is backed up at low priority so that this operation does not affect the other operations. When other operations affect the backup operation, the backup is suspended and retried later. The backup operation hardly affects the other operations so that the programming pendant can be used even during the backup operation.</td>
</tr>
<tr>
<td>7</td>
<td>Backup in binary</td>
<td>The data is saved as binary data. Backup in binary allows the system to be easily and speedily restored.</td>
</tr>
<tr>
<td>8</td>
<td>Setting of items</td>
<td>Parameters can limit the settings of the backup condition. Unnecessary settings can be avoided with this setting.</td>
</tr>
</tbody>
</table>
9.3 Automatic Backup Function

9.3.2 Settings for Automatic Backup

To set the automatic backup function, set each item at the automatic backup display.

Four ways to perform the automatic backup are available: “Cyclic”, “Backup when switching modes”, “Backup when start-up”, and “Backup inputting specified signals”.

NOTE

The automatic backup can be performed only when the robot is not during playback, and the robot is stopped.

Automatic backup function can be set from the command of the optional high speed Ethernet server function.

9.3.2.1 The SD Card of the Programming Pendant

To use the automatic backup function, insert the SD card into the SD card slot on the programming pendant. Only while the YRC1000 power supply is OFF, the SD card can be inserted or removed.

When the data could not be saved in the SD card during an automatic backup due to the absence or insufficient capacity of the SD card, an error message “Confirm the status of SD card” appears. At the same time, the signal “occurrence of error” can be output to an external device, but the robot program will not be stopped. Check if the SD card 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 the two or more SD cards to minimize problems if the SD card should be damaged.

Regarding the SD card for auto backup, refer to “Recommended SD card” in chapter 9.1.2 “Device”.

Storage capacities needed for SD card are as follows:

(The number of stored files + 1) X approx. 30MByte

The number of storable files is automatically calculated and the MAX value is shown when AUTO BACKUP SET display appears.
9.3.2.2 The SD Card of the ACP01 Board

Set the following procedures in advance to back up to the SD card of the ACP01 board. If the following procedures are not done, “SD: 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 (ACP01)}, 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 SD card of the ACP01. During allocating, the massage 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 SD card in the programming pendant, when the device is set on the SD card in the programming pendant. Push down the [cancel], when the error occurs.
10. Select the device, and change to “SD: Controller”.

NOTE
Backup setting to the SD card of the ACP01 board should be done while the robot is not operating.

When access to SD card of the ACP01 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 SD card of the ACP01 board takes three to ten minutes.)

9.3.2.3 RAMDISK on the ACP01 Board

RAMDISK will be shown when the high speed Ethernet server function is effective. Refer to “YRC1000 OPTIONS INSTRUCTIONS FOR HIGH-SPEED ETHERNET SERVER FUNCTION (HW1483358)” for more details.
9.3.4 YRC1000 Status and Automatic Backup

<table>
<thead>
<tr>
<th>Backup Timing</th>
<th>YRC1000 Status</th>
<th>Automatic Backup</th>
<th>SD card ready to save the data</th>
<th>Absence or insufficient capacity of the SD card</th>
</tr>
</thead>
<tbody>
<tr>
<td>From a specified starting time</td>
<td>Teach mode</td>
<td>Editing (Accessing to the memory)</td>
<td>Retry</td>
<td>Retry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>When editing is interrupted</td>
<td>Backup</td>
<td>Error</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Play mode</td>
<td>Executing jobs</td>
<td>Disabled</td>
<td>Disabled</td>
</tr>
<tr>
<td></td>
<td>Remote mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>When stopped</td>
<td>Backup</td>
<td>Error</td>
</tr>
<tr>
<td>When a specified signal (#40560) is input</td>
<td>Teach mode</td>
<td>Editing (Accessing to the memory)</td>
<td>Error</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>When editing is interrupted</td>
<td>Backup</td>
<td>Error</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Play mode</td>
<td>Executing jobs</td>
<td>Disabled</td>
<td>Disabled</td>
</tr>
<tr>
<td></td>
<td>Remote mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>When stopped</td>
<td>Backup</td>
<td>Error</td>
</tr>
<tr>
<td>When switching the mode from the teach mode to the play mode</td>
<td>-</td>
<td></td>
<td>Backup</td>
<td>Error</td>
</tr>
<tr>
<td>When the YRC1000 starts up</td>
<td>-</td>
<td></td>
<td>Backup</td>
<td>Error</td>
</tr>
</tbody>
</table>

* Retry is not performed when an error occurs.

* An error can be indicated by a message depending on setting.
9 System Backup
9.3 Automatic Backup Function

- **Reserve Time Backup**
  While the data in the YRC1000 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 YRC1000 starts up**
  Since the automatic backup process is added to the YRC1000 start-up process, a few extra seconds are needed to start up the YRC1000.

- **Backup when Specific Signal is Input**
  While the YRC1000 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”, return to “1” again.

  Execute the job after three second since starting the back-up.

- **Overwriting Limit in SD card**
  The number of times that the SD card can be overwritten is limited. Because frequent backup operations may shorten the life of SD card, 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)

**NOTE**
While a job is being executed, the automatic backup or retry is not performed. Also, after an error occurs in writing into the SD card, the retry is not performed until the next backup starting time.
9.3.2.6 AUTO BACKUP 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 YRC1000 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 “SD: Pendant” is set in DEVICE.)

---

**NOTE**

When the “SD: Pendant” or “SD: Controller” is selected on the auto backup display, the capacity of the SD card in the specified device will be checked. Therefore, a few seconds may be needed to open the setting window. For the “SD: Pendant”, an error may occur without setting in the SD card.

When changing the settings of “STORED FILE SETTING” or executing “ARRANGE”, the files “CMOSBK.BIN” and “CMOSBK???.BIN” (?? denotes figures) in the SD 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 System Backup
9.3 Automatic Backup Function

1. Turn ON the YRC1000.
   – Insert the SD card to the programming pendant, when the backup is set on the SD card of the programming pendant.

2. Change the security mode to the management mode.

3. Select (SETUP) under the main menu.

4. 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.
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 YRC1000 is turned ON.
Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

G. SPECIFIC INPUT BACKUP
Set the backup function to be valid or invalid when specific input signal (# 40560) is input (rising edge from 0 to 1).
Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

H. UNIV.OUT NO. ON ERROR
Set "1" to the specified user output signal which was specified in this chapter when the automatic backup error occurs.
The term "automatic backup error" here means that the backup is not performed successfully before the next backup (including retry operation) starts.

I. DISPLAY AT EMERGENCY
Set the method of notification of the automatic backup error to "ERROR" or "MESSAGE".
Each time [SELECT] is pressed, "ERROR" and "MESSAGE" are displayed alternately.

J. DURING ALARM OCCURENCE
Set the backup function to be valid or invalid when an alarm occurs.
Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

K. DEVICE
Press (SELECT) to display the device list.
9 System Backup
9.3 Automatic Backup Function

<table>
<thead>
<tr>
<th>The Device Name in Display</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD: Pendant</td>
<td>Set the backup to the SD card of the programming pendant.</td>
</tr>
<tr>
<td>SD: Controller</td>
<td>Set the backup to the SD card of the ACP01 board. When the “SD: Controller” of the device name is not shown, refer to chapter 9.3.2.2 “The SD Card of the ACP01 Board”.</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 YRC1000 high speed Ethernet server function command. Refer to “YRC1000 OPTIONS INSTRUCTIONS FOR HIGH-SPEED ETHERNET SERVER FUNCTION (HW1483358)”.</td>
</tr>
<tr>
<td>USB1: Controller</td>
<td>Set the backup to the USB memory of the ACP01 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 SD card 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 SD card inserted when this window is displayed.

N. LATEST BACKUP FILE
Indicates the date of the latest file in the SD card 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 SD card 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 SD: controller is set on.

5. Set the desired item, and press [ENTER].


9 System Backup
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 SD card after creating the backup data. Do not remove the SD card from the programming pendant during this period.
9.3.3 Limiting the Automatic Backup File Creation

9.3.3.1 Setting to Limit the Automatic Backup File Creation

It is applicable 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.

| Parameter number | Contents                                      | Setting value
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C682</td>
<td>Limits the backup file creation</td>
<td>0 (Invalid)</td>
</tr>
<tr>
<td></td>
<td>executed by the automatic backup function</td>
<td>1 (Valid)</td>
</tr>
<tr>
<td></td>
<td>to once a day.</td>
<td></td>
</tr>
</tbody>
</table>

NOTE
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 FUNCTION SET Window".
9.4 Loading the Backup Data from the SD Card

To restore the backup memory in the auto backup function is done in the maintenance mode. Otherwise, restore from the SD card of the programming pendant or USB memory when backup is done at the optional high speed Ethernet function command. Prepare either of the SD card or the USB memory to make copies.

9.4.1 Loading Procedure

To restore from the SD card of the programming pendant, perform the following procedures No.1 to 8. To restore from the SD card on the ACP01 board, perform the following procedures from No.9. For the USB memory, select “USB: Pendant” or “USB1: Controller” in the {EX. MEMORY} -{DEVICE} to restore.

1. Insert the SD card with the backup data in the SD card slot on the programming pendant. (When selecting “USB1: controller”, insert it in the ACP01 board.)
   - The backup data is stored under the file name “CMOSBK.BIN” or “CMOSBK???.BIN” (?? denotes figures.)
2. Turn ON the YRC1000 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.

![Screen capture of the security mode menu]

---

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9 System Backup

9.4 Loading the Backup Data from the SD Card

– When set the (SYSTEM)- (SETUP)- (OPTIONAL FUNCTION)- (AUTO BACKUP (ACP01)) as "USE", the following sub menu appears.

5. Select (SYSTEM RESTORE).

– The BACKUP FILE LIST display appears.
9. System Backup
9.4 Loading the Backup Data from the SD Card

6. Select the file to be loaded.
   – The dialog box appears for the AIF/ACP01 board replacement confirmation.
   - Select {YES} if the AIF/ACP01 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.
   – Select {YES} in the loading confirmation dialog box to start loading the contents of “CMOSBK.BIN” or “CMOSBK???.BIN” (?? denotes figures) from the SD card to the YRC1000 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.
9.4 Loading the Backup Data from the SD Card

11. Select {EX. MEMORY} in the main menu.
   – The sub menu will appear.
   ![Sub menu screen]

12. Select {SYSTEM RESTORE (ACP01)}.
   – The backup-file list display will appear.
   ![Backup-file list screen]
9 System Backup
9.4 Loading the Backup Data from the SD Card

13. Select desired date file.
   - The AIF/ACP01 board dialog will appear.
   - 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 ACP01 board.

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 ACP01 board.

15. Select [YES].
CAUTION

Note that by executing “SYSTEM RESTORE” or “SYSTEM RESTORE (ACP01)”, the current CMOS data in the YRC1000 is replaced with the data of the file “CMOSBK.BIN” or “CMOSBK???.BIN” (?? denotes figures) in the external memory device.

After “CMOSBK.BIN” has been loaded, confirm that the new data is the same as the previously saved data in the CMOS. In addition, call the master job to confirm that the current manipulator position is correct and safe. After that, start operating 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>During robot or station operation</td>
<td>The automatic backup would not work when a manipulator or a station is in motion.</td>
</tr>
<tr>
<td>3390</td>
<td></td>
<td>File not found</td>
<td>The file to be loaded no longer exists.</td>
</tr>
<tr>
<td>3460</td>
<td>*</td>
<td>Cannot backup the media</td>
<td>Insufficient capacity of the SD card</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>Cannot access the SD card</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3463</td>
<td>*</td>
<td>Cannot store the backup data.</td>
<td>Confirm that the value specified for STORED FILE SETTING does not exceed the maximum number.</td>
</tr>
<tr>
<td>3501</td>
<td>*</td>
<td>Check the media insertion</td>
<td>Cannot access the SD card</td>
</tr>
<tr>
<td>3550</td>
<td>*</td>
<td>Under automatic backup operation.</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>Under automatic backup operation.</td>
<td>The file arrangement cannot be operated during the automatic backup operation.</td>
</tr>
<tr>
<td>3560</td>
<td>*</td>
<td>Failed in sorting backup file.</td>
<td>Failed to re-arrange the backup file for another reason than the access to SD card.</td>
</tr>
<tr>
<td>3580</td>
<td>*</td>
<td>Under backup file access.</td>
<td>To display another window and then display the automatic backup window again after “ARRANGE” operation, “ARRANGE” process should be completely finished.</td>
</tr>
<tr>
<td>3581</td>
<td>*</td>
<td>Under backup file access.</td>
<td>The previous “ARRANGE” process should be completely finished to perform the next “ARRANGE” operation.</td>
</tr>
</tbody>
</table>
10 Upgrade Function

10.1 Functional Overview

YRC1000 applies two software for the CPU configuration: a software for ACP01 (for the main CPU board) and a software for the programming pendant. The system works only with the combination of certain versions due to a compatibility problem of each software.

Therefore, YRC1000 can upgrade the software for the programming pendant if the combination of the software for ACP01 and the programming pendant is invalid.

10.2 Upgrade Procedure

10.2.1 Confirmation of Software Version

The compatibility of the versions of ACP01 and the programming pendant are automatically checked in 15 seconds after the YRC1000 power supply is turned on.

- In case the versions of ACP01 and the programming pendant matches.

1. Automatic upgrade process completes and the communication process between ACP01 and the programming pendant is restarted.
2. Initial window appears approx. 50 seconds later.

The time until the initial window appears on the programming pendant may be longer if the system configuration includes an optional circuit board or if the Ethernet port of LAN2 or LAN3 is enabled, etc.
10.2.2 Automatic Upgrade of the Programming Pendant

In case that the pendant application version of the programming pendant is older than the one of SD card in ACP01 or the pendant application version of the programming pendant is not compatible to the one of ACP01, the programming pendant 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 ACP01 and the programming pendant is restarted.

   – The programming pendant is restarted depending on the upgraded software.
   
   In this case, the communication process between the programming pendant and ACP01 starts again after restart of the programming pendant is done.

2. Initial window appears approx. 50 seconds later.

   **NOTE**
   
   Every time the OS is upgraded automatically, restart is done. There is no need of calibrating because the calibration data is taken over.

   **NOTE**
   
   If start the YRC1000 without the auto upgrade process, press all of the [Interlock]+[5]+[Select] keys on the programming pendant 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 YRC1000.
  – Automatic upgrade might be exercised again.

• In case error occurs during automatic upgrade process.
  
  (1) Prepare SD card for upgrading or USB memory.
  (2) Press [2]+[8]+[HIGH SPEED] of the programming pendant at the same time.
    - Upgrade of the OS of Programming Pendant
  (3) Press [INTERLOCK]+[8]+[SELECT] of the programming pendant at the same time and upgrade.
    - Refer to “YRC1000 UPGRADE PROCEDURE MANUAL (HW1483594)” for detail.

• If no recovery is made with all the operation above, replace the programming pendant.
10.3 Error Message

If Error occurs while automatic upgrading, exercise the following procedure.

- Turn on the main power supply of YRC1000.
  - Automatic upgrade might be exercised again.
- In case error occurs during automatic upgrade process.
  1. Prepare SD card or USB memory for upgrading.
  2. Press [2]+[8]+[HIGH SPEED] of the programming pendant at the same time.
    - Upgrade of the OS of Programming Pendant
  3. Press [INTERLOCK]+[8]+[SELECT] of the programming pendant at the same time and upgrade.
    - Refer to “YRC1000 UPGRADE PROCEDURE MANUAL (HW1483594)” for detail.
11 Programming Pendant

11.1 Disconnection Function

Disconnection function enables to cut off the communication between the programming pendant and the controller. Disconnection function enables only in remote mode.

1. Change the mode key to management mode.

2. Long press [Simple Menu] key to show the pop-up menu.

3. Select “Disconnect” button, and the confirmation dialog appears.
11 Programming Pendant
11.1 Disconnection Function

– An error dialog appears if (Disconnect the Communication) is selected in other than remote mode.

4. Select “YES” to disconnect the communication between the controller and the programming pendant. After disconnecting the communication, the message is displayed.
5. 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 YRC1000" button.

---

**CAUTION**

- While the programming pendant startup window is displayed (while communication between the YRC1000 and the programming pendant is disconnected), the manipulator in operation cannot be stopped by using [HOLD]. To stop the manipulator's operation, press the emergency stop button.

- While the programming pendant startup window is displayed, the mode of the YRC1000 cannot be changed by using the Mode Switch. To change the mode of the YRC1000, press "Connect to YRC1000" button in the startup window to connect the YRC1000 and the programming pendant, and then turn the Mode Switch to the desired mode.
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.

1. Confirmation of the 7SEG-LED (DS1) display on the JANCD-ACP01-E
   - Check the 7SEG-LED display on the JANCD-ACP01-E.

   • Check that an alphabet letter or a number is displayed on the 7SEG-LED display.
   • Check that a dot is displayed at the lower right of the 7SEG-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.

2. Reset the programming pendant
   - Open the SD card slot cover on the programming pendant.
   - There is a small hole to the right of SD card insertion slot. Insert a spit into the hole to press the reset button.
   - 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.
11 Programming Pendant
11.3 Touch Panel Invalidate Function

- 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.

     ![Confirmation Dialog]

     ![Main Menu, Sub Menu, Touch operation is invalid]

     Do you validate touch panel?
     CAUTION: This dialog is settable only key operation.
     Yes  No

   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.
11.4 Reboot Robot System

After changing a parameter, repairing or maintenance, follow the procedure to reboot the robot system.

The robot system cannot be rebooted when the servo power is ON. Confirm that the servo power is OFF before rebooting.

1. Select {SYSTEM INFO} - {CPU RESET} in the main menu.

2. Confirm the servo power is OFF and select {RESET}.

   ![Screen capture of the main menu showing {SYSTEM INFO} and {CPU RESET} selected, with instructions to confirm the servo power is OFF before selecting {RESET}.

   ![Screen capture of the CPU RESET screen, showing instructions to execute CPU reset by turning the servo power OFF and selecting {RESET}.

---

11-7
3. The confirmation dialog appears. Select “YES” to reboot the robot system.

4. If the operation to reboot the robot system is performed when the servo power is ON, the following error message appears.
   - Select “CANCEL” to cancel the error message.
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.
   ![System Window Image]
4. Select (SETUP).
   - The SETUP window appears.
   - The items marked with "●" cannot be selected.
   ![Setup Window Image]
5. Select {I/O MODULE}.

   → The current status of the mounted I/O module is shown.

6. Confirm the status of mounted I/O module.

<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.
8. Press [ENTER].

   – The confirmation dialog box is shown.

   ![Confirmation Dialog Box]

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.

   **NOTE**
   If there is a difference between the displayed contents and the actual mounted status, confirm the status again. If the status is correct, the I/O module may be defective: in such a case, contact your YASKAWA representative.
12.2 Allocating External I/O Signal

1. The EXTERNAL IO SETUP window appears.

2. Select "AUTO" or "MANUAL" under the ALLOCATION MODE.
   The selected menu appears.

   When the allocation mode is changed from "MANUAL" to "AUTO", the set allocation data is discarded, and re-allocation 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.
12 Modification of System Configuration
12.2 Allocating External I/O Signal

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.

11. Select {YES}.
    – The settings are confirmed, and the SETUP window reappears.
12.2 Allocating External I/O Signal

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</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</td>
<td>ASF01</td>
</tr>
<tr>
<td>#20060</td>
<td>16</td>
<td>0</td>
<td>254</td>
<td>0</td>
<td>1</td>
<td>DN4-PCIE</td>
</tr>
<tr>
<td>#20070</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>DN4-PCIE</td>
</tr>
<tr>
<td>#20120</td>
<td>16</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>DN4-PCIE</td>
</tr>
<tr>
<td>#20160</td>
<td>16</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>DN4-PCIE</td>
</tr>
<tr>
<td>#20190</td>
<td>17</td>
<td>0</td>
<td>254</td>
<td>0</td>
<td>1</td>
<td>CCS-PCIE</td>
</tr>
<tr>
<td>#20200</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>CCS-PCIE</td>
</tr>
<tr>
<td>#-----</td>
<td>16</td>
<td>0</td>
<td>252</td>
<td>0</td>
<td>0</td>
<td>DN4-PCIE</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 YRC1000 station number allocated to each I/O board. The displayed contents include the following:

0: General I/O board (JANCD-AIO0□-E)

1 to 13: Optional I/O board which is connected to the JANCD-AIF01□-E 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
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12.2 Allocating External I/O Signal

⑥ 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 (CPU board)
- 1 to 251 : Network communication station number '1' to '251'
  - Adapter station of EtherNet/IP (CPU board)
  (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

⑦ 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.

⑧ BYTE
Indicates the size (number of bytes) inside each I/O area.

⑨ NAME
Indicates the name of each I/O board.
12.3 Addition of Base and Station Axes

To add the base and station axes, mount all hardware correctly and then execute maintenance mode.

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

When adding a base and a station axis, set the following items:

- **TYPE**
  Select one in the type list.
  - In case of base axis (B1,B2,B3...B8)
    Select one of RECT-X, -Y, -Z, -XY, -XZ, -YZ or -XYZ.
  - In case of station axis (S1,S2,S3,S4,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]
12 Modification of System Configuration
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• If axis type is rack & pinion type, set the following items.
  • MOTION RANGE (+) [mm]
  • MOTION RANGE (-) [mm]
  • REDUCTION RATIO (numerator)
  • REDUCTION RATIO (denominator)
  • PINION DIAMETER [mm]

• If axis type is turn type, set the following items.
  • MOTION RANGE (+) [deg]
  • MOTION RANGE (-) [deg]
  • REDUCTION RATIO (numerator)
  • REDUCTION RATIO (denominator)
  • OFFSET (1st and 2nd axis) [mm]

• MOTOR SPECIFICATION
  Set the following items.
  • MOTOR
  • SERVO AMP
  • CONVERTER
  • ROTATION DIRECTION [normal/reverse]
  • MAX. RPM [rpm]
  • ACCELERATION SPEED [sec]
  • INERTIA RATIO

* Select MOTOR, AMPLIFIER and CONVERTER from each type list on the display.
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” to the “MANAGEMENT MODE”.
3. Select {SYSTEM} under the main menu.
   – The system window appears.

4. Select {SETUP}.
   – The SETUP window appears.
   – Note that the items marked with " cannot be set.
5. Select (CONTROL GROUP).
   - The current control group type is displayed.

6. Move the cursor to the type of control group to be modified, and press [SELECT].
   - The MACHINE LIST window is displayed.
7. Select one in the type list.

   – After the type selection, the window returns to the 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 brake 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(STO) window]

   - <CONNECT (CONTACTOR) 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 brake (BRK) of the each control group is connected to.
     The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which brake.

   - 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

- **<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 brake (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 brake.

  - 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 à SERVO Board (SV #2), Connector (7CN), Contactor Unit (TU #1), brake Connector (BRK7), Converter (CV #1)

2nd axis à SERVO Board (SV #2), Connector (8CN) Contactor Unit (TU #1), brake Connector (BRK8) Converter (CV #2)

3rd axis à SERVO Board (SV #2), Connector (9CN) Contactor Unit (TU #1), brake Connector (BRK9) Converter (CV #3)

Overrun à (OT2)

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 14.7.5 “External Axes Overrun”.

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.

When the error message appears, invalid SPOT HIGH SPEED SPEC or review the configuration of the control group by referring to “YRC1000 OPERATOR’S MANUAL FOR SPOT WELDING USING MOTOR GUN (RE-CS0-A054)".
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)

   ![MECHANICAL SPEC window](image)

   As shown below, when the servo track is operated in the rotation direction set in chapter 12.3.1.5 “Motor Specification Setting” and the direction is the opposite of the positive (+) direction of the coordinates, set the numerator to a negative value.

   ![Rect-Y diagram](image)

   - **Y-AXIS**

   - **CARTESIAN**

   - **RECT-Y**

   - **When the positive operation direction of the servo track is the opposite of the positive direction of the coordinates**

   - **BALL-SCREW PITCH**: Input the traveling length when the ball-screw rotates once. (Unit: mm/r)
12 Modification of System Configuration
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The MECHANICAL SPEC window (in case of the RACK&PINION type)

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

- **REDUCTION RATIO**: Input the numerator and the denominator.
  
  <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

- **PINION DIAMETER**: Input the diameter of a pinion. (Unit: mm)

**NOTE**

As shown below, when the servo track is operated in the rotation direction set in chapter 12.3.1.5 “Motor Specification Setting” and the direction is the opposite of the positive (+) direction of the coordinates, set the numerator to a negative value.

When the positive operation direction of the servo track is the opposite of the positive direction of the coordinates.
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 Modification of System Configuration
12.3 Addition of Base and Station Axes

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.

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.)

![AC Servo Motor](image)

- MAX. RPM: Input maximum rotation speed of a motor. (Unit: rpm)
- ACCELERATION TIME: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
- INERTIA RATIO: The initial value is set at 300 in case of servo track; 0 in case of rotation axis. However, if the following phenomenon occurs in motion, deal with the following procedure.

- <Phenomenon1> During motion, the axis moves unsteady on advance direction.
  - Confirm the motion with increasing this ratio in each 100.
12.3 Addition of Base and Station Axes

- <Phenomenon2>
  During pause, the motor makes a lot of noise.
  ➔ Confirm the motion with decreasing this ratio in each 100.

3. Modify the settings.

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

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

5. Initialize the related files.
   - To add and modify the base axis in completed.
12.3 Addition of Base and Station Axes

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.
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 brake 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>

   - 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 brake (BRK) of the each control group is connected to.
   The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which brake.

   - 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

- <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 brake (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 brake.

- 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, S1 (Station) is connected in the following manner:

  1st axis → SERVO Board (SV #1), Connector (7CN),
  Contact Unit (TU #1), brake Connector (BRK7),
  Converter (CV #2)

  2nd axis → SERVO Board (SV #1), Connector (8CN),
  Contact Unit (TU #1), brake 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 chapter 14.7.5 “External Axes Overrun”.

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)

   ![AXES CONFIG window (TURN type)](image)

   - The axis type cannot be changed when axis type is "ROTATION".

   ![AXES CONFIG window (UNIVERSAL type)](image)

   - BALL SCREW: Traverse axis (ball-screw)
   - RACK & PINION: Traverse axis (rack&pinion)
   - ROTATION: Rotation axis
2. Select the axis type to be modified.
   – The settable axis type is displayed.

3. Select the desired axis type.

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

   ![Mechanical Specification Window]

   - **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)

![Mechanical Specification Diagram]
12 Modification of System Configuration
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- The MECHANICAL SPEC window (In case of the BALL-SCREW type)

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

- REDUCTION RATIO : Input the numerator and the denominator. (e.g.) If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.

- BALL-SCREW PITCH : Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

- The MECHANICAL SPEC window (In case of the RACK&PINION type)

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

- REDUCTION RATIO : Input the numerator and the denominator. (e.g.) If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

- PINION DIAMETER : Input the diameter of a pinion. (Unit: mm)
12 Modification of System Configuration
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.

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.)

Fig. 12-2: AC Servo Motor

- 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)
12 Modification of System Configuration

12.3 Addition of Base and Station Axes

- **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.

---

**NOTICE**

- 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.
DANGER

• 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 perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  – Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

• Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  – Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  – Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.
WARNING

- When turning ON the YRC1000 power, confirm that no person is present in the manipulator's operating range and that the operator is in a safe location.

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.

- Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

- Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.
### 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></td>
<td>598 (W) × 490 (H) × 427 (D) mm (without protrusion part)</td>
</tr>
<tr>
<td>Cooling system</td>
<td></td>
<td>Indirect cooling</td>
</tr>
<tr>
<td>Power supply</td>
<td></td>
<td>*3-phase 200 to 240 VAC (+10% to -15%) at 50/60 Hz (±2%) *3-phase 380 to 440 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing) *3-phase 380 to 480 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing) The specification of power supply differs depending on the type of YRC1000. Refer to table 4-1 “Power Supply Specification”.</td>
</tr>
<tr>
<td>Grounding</td>
<td></td>
<td>*For 200 to 240 VAC Grounding resistance: 100 Ω or less, exclusive grounding *For 380 to 440 VAC, 380 to 480 VAC Grounding resistance: 10 Ω or less, exclusive grounding</td>
</tr>
<tr>
<td>Noise level</td>
<td></td>
<td>Less than 60 dB</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>Specific signal (hardware)</td>
<td>19 inputs and 6 outputs General signals (standard, max.) 40 inputs and 40 outputs (Transistor: 32 outputs, Relay: 8 outputs)</td>
</tr>
<tr>
<td>Positioning system</td>
<td>By serial communication</td>
<td>(absolute encoder)</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>Ambient temperature</td>
<td>0°C to + 45°C (during operation) -10°C to + 60°C (during transit and storage) Temperature change: 0.3°C/min or less</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>10% to 90%RH (non-condensing)</td>
<td></td>
</tr>
<tr>
<td>Allowable altitude</td>
<td>1000 m or less</td>
<td>(To use the YRC1000 at the altitude over 1000 m, calculate the maximum ambient temperature by decreasing it by 1% per 100 m. The maximum allowable altitude is 2000 m. When the altitude is 2000 m, the maximum ambient temperature during operation is 40.5°C.)</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 dirt, dust, cutting oil (including coolant), organic solvent, oil fume, water, salt, chemicals or anti-rust oil Free from excessive electrical noise (plasma) Free from strong microwave, UV light, X-ray or radiation</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>SD card slot, USB connector (USB2.0) (At Programming Pendant)</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Arc welding, spot welding, material handling, press tending, cutting, and 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</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>Alarm Display</td>
<td>Alarm message, troubleshooting, previous alarm records</td>
<td></td>
</tr>
<tr>
<td>I/O Diagnosis</td>
<td>Simulated enabled/disabled output possible</td>
<td></td>
</tr>
<tr>
<td>T.C.P. Calibration</td>
<td>Automatically calibrates parameters for end effectors using a master positioner</td>
<td></td>
</tr>
</tbody>
</table>
13.3 Programming Pendant

Refer to chapter 13.1 “Specification List” for the ambient conditions.
13.4 Equipment Configuration

The YRC1000 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 YRC1000 equipment.

13.4.1 Arrangement of Units and Circuit Boards

*Fig. 13-1(a): Configuration for 200 to 240 VAC Specification (Small-Capacity Model 1)*

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000 For Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP7</td>
<td>AR900 ERAR-1000-06VX8-A00</td>
</tr>
<tr>
<td>GP8</td>
<td>AR700</td>
</tr>
<tr>
<td>GP12</td>
<td>AR1440</td>
</tr>
<tr>
<td>GP25</td>
<td>AR1730 ERAR-1000-06VXH25-A00</td>
</tr>
<tr>
<td>GP25-12</td>
<td>AR2010</td>
</tr>
</tbody>
</table>
13 YRC1000 Specification
13.4 Equipment Configuration

Fig. 13-1(b): Configuration for 200 to 240 VAC Specification
(Small-Capacity Model 2)

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Japan</td>
<td></td>
</tr>
<tr>
<td>AR1440E</td>
<td>ERAR-1000-07VXHE6-A00</td>
</tr>
</tbody>
</table>
Fig. 13-1(c): Configuration for 200 to 240 VAC Specification (Medium/Large-Capacity Model 1)

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP20HL</td>
<td>ERAR-1000-06VXHL20-A00</td>
</tr>
<tr>
<td>AR3120</td>
<td></td>
</tr>
<tr>
<td>GP50</td>
<td>ERAR-1000-06VX280-A00</td>
</tr>
<tr>
<td>GP35L</td>
<td></td>
</tr>
<tr>
<td>GP88</td>
<td></td>
</tr>
<tr>
<td>SP80</td>
<td></td>
</tr>
<tr>
<td>GP110</td>
<td></td>
</tr>
<tr>
<td>SP100</td>
<td></td>
</tr>
<tr>
<td>SP130</td>
<td></td>
</tr>
<tr>
<td>GP180</td>
<td></td>
</tr>
<tr>
<td>SP165</td>
<td></td>
</tr>
<tr>
<td>GP180-120</td>
<td></td>
</tr>
<tr>
<td>SP165-105</td>
<td></td>
</tr>
<tr>
<td>GP200S</td>
<td></td>
</tr>
<tr>
<td>GP215</td>
<td></td>
</tr>
<tr>
<td>GP225</td>
<td></td>
</tr>
<tr>
<td>SP210</td>
<td></td>
</tr>
<tr>
<td>GP250</td>
<td></td>
</tr>
<tr>
<td>SP235</td>
<td></td>
</tr>
<tr>
<td>GP280</td>
<td></td>
</tr>
<tr>
<td>GP165R</td>
<td></td>
</tr>
<tr>
<td>SP150R</td>
<td></td>
</tr>
<tr>
<td>GP200R</td>
<td></td>
</tr>
<tr>
<td>SP185R</td>
<td></td>
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<tr>
<td>SP110H</td>
<td></td>
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<tr>
<td>SP180H</td>
<td></td>
</tr>
<tr>
<td>SP180H-110</td>
<td></td>
</tr>
<tr>
<td>SP225H</td>
<td></td>
</tr>
<tr>
<td>GP400</td>
<td>ERAR-1000-06VX600-A00</td>
</tr>
<tr>
<td>GP600</td>
<td></td>
</tr>
<tr>
<td>GP400R</td>
<td></td>
</tr>
</tbody>
</table>
13.4 Equipment Configuration

Fig. 13-1(d): Configuration for 200 to 240 VAC Specification (Medium/Large-Capacity Model 2)

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP110B</td>
<td>ERAR-1000-07VXB110-A00</td>
</tr>
<tr>
<td>SP100B</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 13-1(e): Configuration for 200 to 240 VAC Specification
(Medium/Large-Capacity Model 3)

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Japan</td>
<td></td>
</tr>
<tr>
<td>PH130RF</td>
<td>ERAR-1000-06VRF130-A00</td>
</tr>
<tr>
<td>PH130F</td>
<td></td>
</tr>
<tr>
<td>PL500</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 13-2(a): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Small-Capacity Model 1)

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000</th>
<th>For Asia</th>
<th>For North America</th>
<th>For Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP7</td>
<td>ERAR-1000-06VX8-A10</td>
<td>ERAR-1000-06VX8-B15</td>
<td>ERAR-1000-06VX8-E10</td>
<td></td>
</tr>
<tr>
<td>AR900</td>
<td>GP8</td>
<td>AR700</td>
<td>GP12</td>
<td>AR1440</td>
</tr>
<tr>
<td>GP12</td>
<td>ERAR-1000-06VXH25-A10</td>
<td>ERAR-1000-06VXH25-B15</td>
<td>ERAR-1000-06VXH25-E10</td>
<td></td>
</tr>
<tr>
<td>AR1440</td>
<td>GP25</td>
<td>AR1730</td>
<td>GP25-12</td>
<td>AR2010</td>
</tr>
</tbody>
</table>
13 YRC1000 Specification
13.4 Equipment Configuration

Fig. 13-2(b): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Small-Capacity Model 2)

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Asia</td>
<td>For North America</td>
</tr>
<tr>
<td>AR1440E</td>
<td>ERAR-1000-07VXHE6-A10</td>
</tr>
</tbody>
</table>
Fig. 13-2(c): Configuration for 380 to 440 VAC, 380 to 480 VAC
Specification (Medium/Large-Capacity Model 1)

Model | For Asia | For North America | For Europe |
---|---|---|---|
GP200L | ERAR-1000-06VXHL20-A10 | ERAR-1000-06VXHL20-B15 | ERAR-1000-06VXHL20-E10 |
AR3120 | | | |
GP50 | ERAR-1000-06VX280-A10 | ERAR-1000-06VX280-B15 | ERAR-1000-06VX280-E10 |
GP35L | | | |
GP88 | | | |
SP80 | | | |
GP110 | | | |
SP100 | | | |
SP130 | | | |
GP180 | | | |
SP165 | | | |
GP180-120 | | | |
SP165-105 | | | |
GP200S | | | |
GP215 | | | |
GP225 | | | |
SP210 | | | |
SP250 | | | |
SP225 | | | |
GP280 | | | |
GP165R | | | |
SP150R | | | |
GP200R | | | |
SP185R | | | |
SP110H | | | |
SP180H | | | |
SP180H-110 | | | |
SP225H | | | |
GP400 | ERAR-1000-06VX600-A10 | ERAR-1000-06VX600-B15 | ERAR-1000-06VX600-E10 |
GP600 | | | |
GP400R | | | |
Fig. 13-2(d): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Medium/Large-Capacity Model 2)

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For Asia</td>
</tr>
<tr>
<td>GP110B</td>
<td>ERAR-1000-07VXB110-A10</td>
</tr>
<tr>
<td>SP110B</td>
<td></td>
</tr>
</tbody>
</table>

- JZNC-ARK5
- CSRA-CPS01KA IM-YE250/5-80PPI-EZ002-02
- TCMSY-31
- JZRCR-APU0C-Language
- SR-23A (or UZBC-B 23A)
- DC reactor PI-EZ002-0213
- AC reactor PI-EZ002-0213
- Breaker JZRC-APU0C-Language
- Converter CSRA-CV10D03A
- Single axis amplifier CSRA-SDB71HA
- Inverter unit CSRA-SDA01H01A
- Power supply contactor unit JZNC-ARK5
- CPU unit JZNC-ARK5
- Control power supply unit CSRA-CP501KA
- Safety terminal block board JANCD-ASF01-E
- General-purpose I/O board JANCD-AI00C-E
- Emergency stop button JANCD-AI00C-E
- Heat exchanger JANCD-ASF01-E
- Safety circuit board IM-YE250/5-80P
- Backside duct fan 09225VE-24P-CA-02
Fig. 13-2(e): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Medium/Large-Capacity Model 3)

<table>
<thead>
<tr>
<th>Model</th>
<th>YRC1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Asia</td>
<td>For North America</td>
</tr>
<tr>
<td>PH130RF</td>
<td>ERAR-1000-06VRF130-A10</td>
</tr>
<tr>
<td>PH130F</td>
<td></td>
</tr>
<tr>
<td>PL500</td>
<td></td>
</tr>
</tbody>
</table>
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 YRC1000. Make sure the door of the YRC1000 is closed to keep this cooling system effective.

*Fig. 13-3: Cooling System*
### Description of Units and Circuit Boards

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
</table>
| • 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 perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.  
  – View the manipulator from the front whenever possible.  
  – Always follow the predetermined operating procedure.  
  – Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.  
  – Ensure a safe place to retreat in case of emergency.  
Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.  
• Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.  
  – Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.  
  – Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode)  
If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result. |
WARNING

• When turning ON the YRC1000 power, confirm that no person is present in the manipulator's operating range and that the operator is in a safe location.

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

• Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  – Check for a problem in manipulator movement.
  – Check for damage to insulation and sheathing of external wires.

• Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

• Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.
Cautions for Connection of Dual Input Signals

**NOTICE**

• 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. The figure below.

• Do not connect two signals to the same contact point.
  (Prepare two individual contact points)

An alarm occurs due to the judgment of the safety circuit.
14. Description of Units and Circuit Boards

14.1 Power Supply Contactor Unit (JZRCR-APU0□-1)

The power supply contactor unit consists of the main circuit contactor. It turns the main circuit control contactor ON and OFF using the signal for the servo power control from the safety circuit board, and supplies power (three-phase) to the converter.

The power supply (single-phase) is supplied to the control power supply unit.

Fig. 14-1: Power Supply Contactor Unit (JZRCR-APU0□-1)

14.2 Control Power Supply Unit (CSRA-CPS01KA)

This unit (CSRA-CPS01KA) supplies the DC power (DC12V, DC24V, DC26V) for control (system, I/O, brake). It is also equipped with the input function for turning the control power supply ON and OFF.

Fig. 14-2: Control Power Supply Unit (CSRA-CPS01KA)
14 Description of Units and Circuit Boards

14.2 Control Power Supply Unit (CSRA-CPS01KA)

<table>
<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td>Rating Input Voltage: 200 to 480VAC</td>
</tr>
<tr>
<td></td>
<td>Voltage Fluctuation Range: ±10% to -15% (170 to 528VAC)</td>
</tr>
<tr>
<td></td>
<td>Frequency: 50/60Hz ± 2Hz (48 to 62Hz)</td>
</tr>
<tr>
<td><strong>Output Voltage</strong></td>
<td>DC + 12V</td>
</tr>
<tr>
<td></td>
<td>DC +24V (24V1: System, 24V2: I/O)</td>
</tr>
<tr>
<td></td>
<td>DC +26V</td>
</tr>
</tbody>
</table>

**Indicator**

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>Color</th>
<th>Status</th>
</tr>
</thead>
</table>
| POWER ON| White | Lights with +12V output  
(Power supply status: being output)                                        |
| +12V    | Red   | Lights with +12V low-voltage/over-current  
(ON when abnormal)                                                            |
| FAN     | Red   | Lights when FAN error occurs.                                          |
| OHT     | Red   | Lights when unit interior overheats.                                   |
| +24V    | Red   | Lights with +24V or +26V low-voltage/over-current  
(ON when abnormal)                                                            |
| SOURCE  | White | Lights with power supply input.  
Lights out when internal live part completes discharge.  
(Power supply status: being input)                                              |

**Control Power ON/OFF**

To turn ON the YRC1000 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. (CN152-3 and CN152-4 are short-circuited when shipment)

*Fig. 14-3: Connection to Control Power Supply Unit*

See chapter 14.10 “Robot General-Purpose I/O Signal Assignment” for wiring of CN152 connector.
14 Description of Units and Circuit Boards
14.3 CPU Unit (JZNC-ARK5□□□E)

14.3.1 CPU Unit Configuration

CPU unit consists of circuit board racks (flame, back circuit board, PCI riser circuit board), CPU board and the robot I/F circuit board.

The JZNC-ARK01-E CPU unit contains only circuit board racks and CPU boards. Be sure that it does not contain robot I/F circuit board.

Fig. 14-4: CPU Unit Configuration (JZNC-ARK5□□□E)
14.3.2 Unit and Circuit Board in the CPU Unit

14.3.2.1 CPU Board (JANCD-ACP01-E)

This circuit board (JANCD-ACP01-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-AIF01-□E)

The robot I/F circuit board (JANCD-AIF01-□E) controls the entire robotic system. It is connected to the CPU board (JANCD-ACP01-E) with a communication connector, and to the servo control board (CSRA-SDCA01AA) with a communication cable.

NOTE

Please do not change the factory setting of S1. (Factory setting is [0])
14.4 Converter (CSRA-CV□□□0□A)

The converter (CSRA-CV□□□0□A) exchanges the power supply supplied by the power ON unit for DC power supply and supplies the power to the inverter unit.

14.4.1 Converter (Small-Capacity Model)

There are two types converter as below.

<table>
<thead>
<tr>
<th>Input voltage</th>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-phase 200 to 240VAC</td>
<td>CSRA-CV05A00A</td>
<td></td>
</tr>
<tr>
<td>Three-phase 380 to 480VAC</td>
<td>CSRA-CV05D01A</td>
<td></td>
</tr>
</tbody>
</table>

*Fig. 14-5: Converter (CSRA-CV05□□□0□A)*
14.4.2 Converter (Medium/Large-Capacity Model)

There are two types converter as below.

<table>
<thead>
<tr>
<th>Input voltage</th>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-phase 200 to 240VAC</td>
<td>CSRA-CV10A02A</td>
<td></td>
</tr>
<tr>
<td>Three-phase 380 to 480VAC</td>
<td>CSRA-CV10D03A</td>
<td></td>
</tr>
</tbody>
</table>

*Fig. 14-6: Converter (CSRA-CV10□□□A)*

![Diagram of Converter](image-url)

(CN551) Main circuit power supply input
(CN552) Discharge resistor connection
(CN561) Monitor/alarm indicator
(CN560) +24V1 input

LED Charge lamp

(CN556) Main circuit power supply output

Servo control board communication

Grounding terminal

(CN555) DC reactor connection 2
(CN554) DC reactor connection 1
(CN560) +24V1 input

Main circuit power supply output
14.5 Inverter Unit (CSRA-SDA□□H01A)

14.5.1 Inverter Unit Configuration

The inverter unit consists of following circuit boards. (Refer to fig. 14-7 "Inverter Unit Configuration").

- Inverter
- Servo control board (CSRA-SDCA01AA)

Fig. 14-7: Inverter Unit Configuration
14.5 Inverter Unit (CSRA-SDA□□H01A)

14.5.2 Inverter

The inverter board and capacitor board exchange the DC power supply supplied by a converter for a 3-phase motor power source and outputs to each servo motor.

*Fig. 14-8: Inverter (Small-Capacity Model)*
14 Description of Units and Circuit Boards
14.5 Inverter Unit (CSRA-SDA□□\text{H01A})

Fig. 14-9: Inverter (Medium/Large-Capacity Model)
14.5 Servo Control Board (CSRA-SDCA01AA)

The servo control board controls the servomotors of the manipulator’s six axes and the servomotors of the three external axes (up to nine axes). It also controls the converter and the inverter.

The servo control board (CSRA-SDCA01AA) also has the following functions.

- brake power supply control circuit
- Shock sensor (shock) input circuit
- Direct-in circuit

Fig. 14-10: Servo Control Board (CSRA-SDCA01AA)
14.6 Safety Circuit Board (JANCD-ASF01-E)

14.6.1 Safety Circuit Board (JANCD-ASF01-E)

This circuit board contains dual processing circuits for safety signal and the I/O circuit for the un-safety signal.

It processes external safety signals with the dual processing circuits and control ON/OFF of the main circuit control contactor of the power supply contactor unit (JZRCR-APU0□-1) 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
- Safety terminal block board I/F

Fig. 14-11: Safety Circuit Board (JANCD-ASF01-E)
14.6.2 Connection for Tool Shock Sensor

- **To Connect the Tool Shock Sensor Directly to the Tool Shock Sensor Signal Line**

1. The minus SHOCK (-) pin is connected to the +24V2 pin on the inside of YRC1000’s door. Remove the minus SHOCK (-) pin from the +24V2 pin.

2. Connect the minus SHOCK (-) and +24V2 pin terminals to the signal lines of the tool shock sensor. Use the following pin terminals for preparing the end of the signal line.

<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. 14-12: Direct Connection to Tool Shock Sensor Signal Line**

The pin terminal for the shock sensor is attached on the inside of the YRC1000’s door.
14.6.2.1 To Connect the Tool Shock Sensor with the Cable That is Built into the Manipulator

1. The minus SHOCK (-) pin is connected to the +24V2 pin on the inside of YRC1000’s door. Remove the minus SHOCK (-) pin from the +24V2 pin.

2. Connect the minus SHOCK (-) pin to the plus SHOCK (+) pin of manipulator.

---

**NOTE**

The shock sensor is optional. In case of the standard specification, the cables for shock sensor of manipulator are not connected to the shock sensor. For wiring, refer to the internal connection diagram of instruction manual corresponding to the manipulator’s model.

---

**SUPPLEMENT**

When the tool shock sensor input signal is used, the stopping method of the manipulator 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.
14.7 Safety Terminal Block Board (IM-YE250/5-80P)

The safety terminal block board (IM-YE250/5-80P) is the terminal block board to connect the external signal such as the safety I/O signals. Connect the signals by following the instruction of each signal.

*Fig. 14-14: Safety Terminal Block Board*
### Table 14-1(a): IM-YE250/5-80P 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></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></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>OT2_1+</td>
<td>-9</td>
<td>Applicable</td>
<td>External Axes Overrun</td>
<td>Open</td>
</tr>
<tr>
<td>OT2_1-</td>
<td>-10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT2_2+</td>
<td>-11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT2_2-</td>
<td>-12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT3_1+</td>
<td>-13</td>
<td>Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT3_1-</td>
<td>-14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT3_2+</td>
<td>-15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT3_2-</td>
<td>-16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT4_1+</td>
<td>-17</td>
<td>Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT4_1-</td>
<td>-18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT4_2+</td>
<td>-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OT4_2-</td>
<td>-20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN1_1+</td>
<td>-21</td>
<td>Applicable</td>
<td>Servo ON Enable</td>
<td>Short-circuit with a jumper cable</td>
</tr>
<tr>
<td>ONEN1_1-</td>
<td>-22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN1_2+</td>
<td>-23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN1_2-</td>
<td>-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN2_1+</td>
<td>-25</td>
<td>Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN2_1-</td>
<td>-26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN2_2+</td>
<td>-27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN2_2-</td>
<td>-28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN3_1+</td>
<td>-29</td>
<td>Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN3_1-</td>
<td>-30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN3_2+</td>
<td>-31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN3_2-</td>
<td>-32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN4_1+</td>
<td>-33</td>
<td>Applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN4_1-</td>
<td>-34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN4_2+</td>
<td>-35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONEN4_2-</td>
<td>-36</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 14-1(b): IM-YE250/5-80P 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>ESPOUT1+</td>
<td>-37, -38</td>
<td>-</td>
<td>Emergency Stop Button Contact Output</td>
<td>Open</td>
</tr>
<tr>
<td>ESPOUT1-</td>
<td>-39, -40</td>
<td>-</td>
<td>Used to output a contact point of the emergency stop button on the programming pendant and the front door of the YRC1000 Control panel.</td>
<td></td>
</tr>
<tr>
<td>ESPOUT2+</td>
<td>-41</td>
<td>Applicable</td>
<td>General-purpose Safety Input</td>
<td>Open</td>
</tr>
<tr>
<td>ESPOUT2-</td>
<td>-42</td>
<td>Applicable</td>
<td>The general-purpose safety input signal is used in the safety logical circuit function.</td>
<td></td>
</tr>
<tr>
<td>GSIN1_1+</td>
<td>-43</td>
<td>Applicable</td>
<td>General-purpose Safety Input</td>
<td>Open</td>
</tr>
<tr>
<td>GSIN1_1-</td>
<td>-44</td>
<td>Applicable</td>
<td>The general-purpose safety input signal is used in the safety logical circuit function.</td>
<td></td>
</tr>
<tr>
<td>GSIN2_1+</td>
<td>-45</td>
<td>Applicable</td>
<td>General-purpose Safety Output</td>
<td>Open</td>
</tr>
<tr>
<td>GSIN2_1-</td>
<td>-46</td>
<td>Applicable</td>
<td>The general-purpose safety output signal is used in the safety logical circuit function. Also, inputs and uses the driven connection device status as the monitoring signal by the output signal.</td>
<td></td>
</tr>
<tr>
<td>GSOUT1_1+</td>
<td>-49</td>
<td>-</td>
<td>SYSRUN signal</td>
<td>Open</td>
</tr>
<tr>
<td>GSOUT1_1-</td>
<td>-50</td>
<td>-</td>
<td>Use to determine the normal/abnormal condition of the YRC1000 controller by SYSRUN signal.</td>
<td></td>
</tr>
<tr>
<td>GSOUT1_2+</td>
<td>-51</td>
<td>-</td>
<td>DC +24V2 output terminal</td>
<td>Open</td>
</tr>
<tr>
<td>GSOUT1_2-</td>
<td>-52</td>
<td>-</td>
<td>Rated current output: 150mA or less</td>
<td></td>
</tr>
<tr>
<td>GSOUT2_1+</td>
<td>-53</td>
<td>-</td>
<td>DC024V2 output terminal</td>
<td>Open</td>
</tr>
<tr>
<td>GSOUT2_1-</td>
<td>-54</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GSOUT2_2+</td>
<td>-55</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GSOUT2_2-</td>
<td>-56</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GSOUT2_2+</td>
<td>-57</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GSOUT2_2-</td>
<td>-58</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GSOUT1_2+</td>
<td>-59</td>
<td>-</td>
<td>Only For YASKAWA</td>
<td>Open</td>
</tr>
<tr>
<td>GSOUT1_2-</td>
<td>-60</td>
<td>-</td>
<td>This signal cannot be used, because this signal is only for YASKAWA.</td>
<td></td>
</tr>
<tr>
<td>24VAX</td>
<td>-61</td>
<td>-</td>
<td>DC +24V2 output terminal</td>
<td>Open</td>
</tr>
<tr>
<td>24VAX</td>
<td>-62</td>
<td>-</td>
<td>Rated current output: 150mA or less</td>
<td></td>
</tr>
<tr>
<td>24VAX</td>
<td>-63</td>
<td>-</td>
<td>DC024V2 output terminal</td>
<td>Open</td>
</tr>
<tr>
<td>024V2</td>
<td>-64</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>024V2</td>
<td>-65</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXDIN1</td>
<td>-66</td>
<td>-</td>
<td>Direct -in (Servo)</td>
<td>Open</td>
</tr>
<tr>
<td>AXDIN2</td>
<td>-67</td>
<td>-</td>
<td>Used to input the quick responding signals in the search function etc.</td>
<td></td>
</tr>
<tr>
<td>AXDIN3</td>
<td>-68</td>
<td>-</td>
<td>General-purpose input (Servo)</td>
<td>Open</td>
</tr>
<tr>
<td>AXDIN4</td>
<td>-69</td>
<td>-</td>
<td>Used to input the general-purpose signal from the external device. This signal is optional. This signal cannot be used in case of standard specification.</td>
<td></td>
</tr>
<tr>
<td>AXOUT1</td>
<td>-70</td>
<td>-</td>
<td>Only For YASKAWA</td>
<td>Open</td>
</tr>
<tr>
<td>AXOUT2</td>
<td>-71</td>
<td>-</td>
<td>This signal cannot be used, because this signal is only for YASKAWA.</td>
<td></td>
</tr>
</tbody>
</table>
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. Peeling Wires
   (1) The length of the exposed conductor (L) should be as follows:

   ![Diagram of peeling wires]

   – * The length of the exposed conductor for the terminal block (L)
     WAGO series 250 (with 5.0 mm pitch): 9-10 mm
   – * Applicable wire conductor: 0.2 mm² to 1.5 mm² (stranded wire)
   – * Applicable maximum wire outside diameter: 3.1 mm dia.

   (2) If the wire is bent or loose, make it straight as illustrated in the figure above.
3. Wire Connection

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

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

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

(4) Check if the wire is connected firmly by pulling the wire softly.
14.7 Safety Terminal Block Board (IM-YE250/5-80P)

14.7.1 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. Make sure that no person goes inside the safeguarding.

**DANGER**

- Jumper cables are attached at the factory. Make sure to remove the jumper cables before use.

If the jumper cables are not removed, this function will not be activated even if the signal is input, thus personal injury and/or equipment damage may result.

**SUPPLEMENT**

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.

*Fig. 14-15: Connection for Safety Plug*
Installation of Safety Plug

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

If the servo power is ON when the interlock signal is input, the servo power turns OFF. The servo power cannot be turned ON while the interlock signal is input. However, the servo power does not turn OFF when the door is opened only during the teach mode. In this case, the servo power can be turned ON while the interlock signal is input.
14.7.2 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.

**DANGER**

- Jumper cables are attached at the factory. Make sure to remove the jumper cables before use.

If the jumper cables are not removed, this function will not be activated even if the signal is input, thus personal injury and/or equipment damage may result.

*Fig. 14-17: Connection for External Emergency Stop*
14.7 Safety Terminal Block Board (IM-YE250/5-80P)

### 14.7.3 SYSRUN Signal Output

This signal is used to check whether the YRC1000’s status is normal or abnormal. This signal is output on the following conditions.

**Fig. 14-18: Connection for SYSRUN Signal Output**

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 YRC1000’s control circuit board is normal or abnormal.

Refer to “YRC1000 OPTIONS INSTRUCTIONS FOR CONCURRENT I/O (RE-CKI-A467) 4.12 Specific Output Signals” for more details.

**NOTE**

- 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.
14.7.4 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 servo systems. 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 “YRC1000 OPTIONS?INSTRUCTIONS FOR INDEPENDENT/COORDINATED CONTROL FUNCTION (HW’1484042) 8. Servo Power Supply Individual Control Function” for the usage of the Servo-ON Enable signals.

---

**DANGER**

- Jumper cables are attached at the factory. Make sure to remove the jumper cables before use.

If the jumper cables are not removed, this function will not be activated even if the signal is input, thus personal injury and/or equipment damage may result.
14 Description of Units and Circuit Boards
14.7 Safety Terminal Block Board (IM-YE250/5-80P)

Fig. 14-19: Connection for Servo-ON Enable Input

- **Servo-ON enable input signal (System 1)**
  - Turn ON/OFF at the same time
  - Remove the jumper cable

- **Servo-ON enable input signal (System 2)**
  - Turn ON/OFF at the same time
  - Remove the jumper cable

- **Servo-ON enable input signal (System 3)**
  - Turn ON/OFF at the same time
  - Remove the jumper cable

- **Servo-ON enable input signal (System 4)**
  - Turn ON/OFF at the same time
  - Remove the jumper cable

---

YRC1000

<table>
<thead>
<tr>
<th></th>
<th>Safety terminal block board (IM-YE250/5-80P)</th>
<th>Safety circuit board (JANCD-ASF01-E)</th>
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<td>36</td>
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</tbody>
</table>
14.7.5 External Axes Overrun

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 chapter 12.3.1.2 “Connection Setting”.

---

**DANGER**

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

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

---

**Fig. 14-20: 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 YRC1000.

Please refer to the following figure to connect the external axes overrun signal to wire in the another route. On that occasion, confirm the external axes overrun setting to connect. (Refer to chapter 12.3.1.2 “Connection Setting”.)

**Fig. 14-21: Connection for External Axis Overrun (Multiple Lines)**

![Diagram of Connection for External Axis Overrun](image-url)
14.7.6 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 YRC1000 main power supply status ON or OFF. (Status output signal: normally closed contact)

**NOTICE**

- Do not use the emergency stop button with 24 VAC, 0.1 A or more.
- When connect the inductive load, such as the relay, with the output circuit, use of the built-in protective circuit for the surge suppressor or connect the flyback diode in parallel to the inductive load to suppress the surge voltage.

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

*Fig. 14-22: Output of Emergency Button*
14.7.7 General-Purpose Safety Input

The general-purpose safety input signal is used in the safety logic circuit function.

Fig. 14-23: General-Purpose Safety Input

When use the external enable switch (EXDSW) or the full-speed test (FST), refer to chapter 8.29 “Axes Detachment Function”
### 14.7.8 General-Purpose Safety Output

The general-purpose 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.

For the example of use of the general-purpose safety output signal, refer to chapter 8.26 “Safety Logic Circuit”.

**Fig. 14-24: Example of Use of General-Purpose Safety Output Signal**

<table>
<thead>
<tr>
<th>YRC1000</th>
<th>Safety circuit board (JANCD-ASF01-E)</th>
<th>Safety terminal block board (IM-YE250/5-80P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN206</td>
<td>GSOUT1_1+</td>
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<td>50</td>
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<td></td>
<td>GSOUT1_2+</td>
<td>51</td>
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<td></td>
<td>GSOUT1_2-</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>GSOUT2_1+</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>GSOUT2_1-</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>GSOUT2_2+</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>GSOUT2_2-</td>
<td>56</td>
</tr>
</tbody>
</table>

**Note**

- 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.
- An error (e.g., relay contact sticking) of the device (e.g., safety relay, contactor) controlled by the general-purpose safety output signal (GSOUT) must be detected (signal inconsistency) by the controlled device (e.g., by using a safety PLC).
14.7 Safety Terminal Block Board (IM-YE250/5-80P)

14.7.9 Connection for Direct-In

- **Direct-In (Servo) 1 to 4**
  This signal is used to input a responsive signal in search functions.

*Fig. 14-25: Connection for Direct-In (Servo) 1 to 4*

Connect the jumper cable.

The part of wiring is that if there is a slave for the coordinated control side servo control board (CSRA-SDCA01AA).
14.7.10 General-Purpose Input (Servo)

Connect when use the general-purpose signal.
This signal cannot be used for standard specification because this signal is optional.

*Fig. 14-26: General-Purpose Input (Servo)*
Four digital I/O connectors for the robot general-purpose I/O are provided: 40 inputs and 40 outputs.

The I/Os are divided into two types: general-purpose I/O and specific I/O. The I/O assignment differs depending on the application. Specific I/O is a signal in which the part is decided in advance. Specific I/O is used when the external operation equipment such as positioner controller and centralized controller control the manipulator and related equipment as a system. General-purpose I/O are mainly used as timing signals for the manipulator and peripheral devices in jobs that require robot motion.

Refer to chapter 14.10 "Robot General-Purpose I/O Signal Assignment" for more details on signal allocation.

For the connection of the robot's general-purpose I/O signal connectors, and the I/O signal related to start and stop, refer to "Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)" and "Specific I/O Signal Related to Start and Stop".

There are two types of general-purpose I/O board as below.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN</td>
<td>JANCD-AIO01-E</td>
</tr>
<tr>
<td>PNP</td>
<td>JANCD-AIO02-E</td>
</tr>
</tbody>
</table>

Fig. 14-27: General-Purpose I/O Board (JANCD-AIO0□-E)
14 Description of Units and Circuit Boards

14.8 General-Purpose I/O Board (JANCD-AIO0□-E)

Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)

Please refer to the figure below when you manufacture the cable connecting with robot general-purpose I/O connector (CN306, 307, 308, 309) of robot general-purpose I/O board (JANCD-AIO0□-E). (The cable side connector and the I/O terminal block are optional.)

Fig. 14-28: Robot General-Purpose 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 chapter 14.10 “Robot General-Purpose I/O Signal Assignment” from page 14-44 to 14-70 about the maximum current of the transistor and the relay output circuits.
14 Description of Units and Circuit Boards
14.8 General-Purpose I/O Board (JANCD-AIO0□-E)

- Specific I/O Signal Related to Start and Stop
  The following signals are specific I/O signals related to start and stop.

  • Servo ON (depending on application: JANCD-AIO0□-E)
  • External Servo ON (common to all application: JANCD-AIO0□-E)
  • External Start (depending on application: JANCD-AIO0□-E)
  • Operating (depending on application: JANCD-AIO0□-E)
  • External Hold (common to all application: JANCD-AIO0□-E)
  • External Emergency Stop
     (common to all application: IM-YE250/5-80P)

  <Timing Chart>

<table>
<thead>
<tr>
<th>RUN</th>
<th>STOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

  Manipulator
  While Servo ON
  Servo ON
  External Start
  Operating
  External Hold
  Ext. E-Stop

  Note: Set T=100msec or more
  Note: External Hold
  At the factory default setting, the status turns to the hold status by turning ON the External Hold.

**NOTICE**

At the factory default setting, by setting the External Input signal (20011) ON, EX. HOLD (SPECIFIC. IN TERMNL BLOCK) (40067) turns ON.

By turning ON the pseudo input signal (87017) (External hold b-contact), when the External Input signal (20011) is turned OFF, switching of the External Hold to ON is enabled.

  <Timing Chart (87017 is turned ON)>

<table>
<thead>
<tr>
<th>RUN</th>
<th>STOP</th>
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</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

  Manipulator
  Operating
  External Hold
14 Description of Units and Circuit Boards
14.8 General-Purpose I/O Board (JANCD-AIO0□-E)

- **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. 14-29: Example of the Servo ON Sequence Circuit from the External Device*

![Servo ON Sequence Circuit Diagram]

Note: Number in ( ) means the output signal number assigned to AIO01.
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. 14-30: Example of Start Sequence Circuit from the External Device*

![Start Sequence Circuit Diagram]

Note: This circuit is example in case of AIO01.
14 Description of Units and Circuit Boards
14.8 General-Purpose I/O Board (JANCD-AIO0□-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 general-purpose 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 14.9 “WAGO Connector Wiring”.

---

**Fig. 14-31: Connection of External Power Supply for I/O**

- **In case of using internal power supply (The factory default settings)**
  - General-purpose I/O board (JANCD-AIO0□-E)
  - External Power Supply
  - +24V
  - 0V
  - 3.15A fuses (F1)

- **In case of using external power supply**
  - General-purpose I/O board (JANCD-AIO0□-E)
  - External Power Supply
  - +24V
  - 0V
  - 3.15A fuses (F1)

---

- The internal power supply of 24V of about 1.5A of YRC1000 can be used for I/O. Use external 24V power supply for higher currents and to isolate the circuit inside and outside the YRC1000.
- Power supply circuit for I/O (+24 VU) has 3.15A fuses (F1).
- Install the external power supply outside the YRC1000 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.

---

**NOTE**
14.9 WAGO Connector Wiring

The control power supply unit: CN152 on (CSRA-CPS01KA), and CN303 on the general-purpose I/O board (JANCD-AIO0□-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 YRC1000.

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.
14.10 Robot General-Purpose I/O Signal Assignment

Refer to the following figure for connection of JANCD-AIO01-E (NPN Specification). Refer to "YRC1000 OPTIONS INSTRUCTIONS STANDARD I/O SIGNAL ASSIGNMENT TABLE (PNP SPECIFICATION) (HW1484105)" for connection of JANCD-AIO02-E (PNP Specification).

14.10.1 Arc Welding

Fig. 14-32: JANCD-AIO01-E (CN308 Connector) I/O Allocation and Connection Diagram (for Arc Welding)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)
14. Description of Units and Circuit Boards

14.10 Robot General-Purpose I/O Signal Assignment

Fig. 14-33: JANCD-AIO01-E (CN309 Connector) I/O Allocation and Connection Diagram (for Arc Welding)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)

Each Point DC24V 6.8mA(TYP)

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<thead>
<tr>
<th>Number</th>
<th>Name</th>
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<td>IN</td>
</tr>
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<td>2003</td>
<td>B2</td>
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</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) (-X54)
Model: TIFSS5YS or TIFSSN53YS

Each Point DC24V 50mA(MAX)

CN303 Power Supply (+24V 24V, 15A)

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### 14 Description of Units and Circuit Boards

#### 14.10 Robot General-Purpose I/O Signal Assignment

**Fig. 14-34: JANDC-AIO01-E (CN306 Connector) I/O Allocation and Connection Diagram (for Arc Welding)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Signal</th>
<th>Logical Number</th>
<th>Connector Number</th>
</tr>
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Each Point DC24V 6.8mA(TYP)

Each Point DC24V 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

14.10 Robot General-Purpose I/O Signal Assignment

Fig. 14-35: JANCD-AIO01-E (CN307 Connector) I/O Allocation and Connection Diagram (for Arc Welding)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)

<table>
<thead>
<tr>
<th>Connector Terminal Converter (Optional) (X52) Model: TIFS553YS or TIFS5N53YS</th>
</tr>
</thead>
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<td>Each Point DC24V 6.8mA(TYP)</td>
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<td>2003 B3 IN21 IN</td>
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<td>2003 A3 IN22 IN</td>
</tr>
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<td>2004 B4 IN23 IN</td>
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<td>2004 A4 IN24 IN</td>
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<td>2005 A5</td>
</tr>
<tr>
<td>2005 B6</td>
</tr>
<tr>
<td>2005 A7 +24VU</td>
</tr>
<tr>
<td>2005 B8 +24VU</td>
</tr>
<tr>
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<tr>
<td>2006 A9 OUT18+ OUT</td>
</tr>
<tr>
<td>2007 B10 OUT19 OUT</td>
</tr>
<tr>
<td>2007 A10 OUT19+ OUT</td>
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<td>2015 B18 OUT24+ OUT</td>
</tr>
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<td>2015 A18 OUT24+ OUT</td>
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<td>2016 B19 OUT24+ OUT</td>
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<td>2016 A19 OUT24+ OUT</td>
</tr>
<tr>
<td>2017 B20 FG</td>
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<tr>
<td>2017 A20</td>
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</tbody>
</table>

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

Each Point DC24V 500mA(MAX)

- +24VU
- +24VE
- 024VU
- 024VE

- Each Point DC24V 6.8mA(TYP)
- +24VU
- +24VE
- 024VU
- 024VE

- Internal Power Supply
- External Power Supply

* means internal relay
+ means +24V
- means -24V
+24VU means +24V Unipolar
-24VU means -24V Unipolar
024VU means 0V to 24V Unipolar
+24VE means +24V Electrolytic
-24VE means -24V Electrolytic
024VE means 0V to 24V Electrolytic

-024VU means 0V to 24V Unipolar
+24V means +24V Unipolar
-24V means -24V Unipolar
024V means 0V to 24V Unipolar
### Table 14-2: Specific Input (Arc Welding)

<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>20011</td>
<td>EXTERNAL HOLD</td>
</tr>
<tr>
<td></td>
<td>The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.</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>20014</td>
<td>EXTERNAL SERVO ON</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of this signal is valid. This signal turns ON the servo power. Use this signal to turn ON the servo power from an external device.</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>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 “Arc Generation Confirmation” 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”.

---

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### Table 14-3: Specific Output (Arc Welding)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
</table>
| 30010 | RUNNING  
This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant. |
| 30011 | SERVO IS ON  
This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for YRC1000 status diagnosis for an external start. |
| 30012 | TOP OF MASTER JOB  
This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.¹ |
| 30013 | ALARM/ERROR OCCURRED  
This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF. |
| 30014 | BATTERY ALARM  
This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal. |
| 30015 to 30017 | REMOTE/PLAY/TEACH MODE SELECTED  
This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON. |
| 30020 | IN CUBE 1  
This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners. |
| 30021 | IN CUBE 2  
This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners. |
| 30022 | WORK HOME POSITION (IN CUBE 64)²  
This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position. |
| 30023 | INTERMEDIATE START OK  
This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together. |
| 30024 | GAS SHORTAGE (MONITOR)  
This signal stays ON while the gas shortage signal from the welding power supply is ON. |
| 30025 | WIRE SHORTAGE (MONITOR)  
This signal status ON while the wire shortage signal from the welding power supply is ON. |
| 30026 | WIRE STICKING (MONITOR)  
The wire sticking check is conducted automatically when the arc turns OFF. If wire sticking is detected, this signal remains ON until the wire sticking is released. |
| 30027 | ARC SHORTAGE (MONITOR)  
This signal stays ON while the arc shortage signal from the welding power supply is ON. |

¹ This signal is not output during operation.  
² The work home position cube and Cube 64 are the same.
14 Description of Units and Circuit Boards
14.10 Robot General-Purpose I/O Signal Assignment

14.10.2 Material Handling

Fig. 14-36: JANCD-AIO01-E (CN308 Connector) I/O Allocation and Connection Diagram (for Material Handling)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)

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<td>External Hold</td>
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<tr>
<td>Call Master Job</td>
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<td>Alarm/Error Reset</td>
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<td></td>
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<tr>
<td>External Servo ON</td>
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<tr>
<td>Select Play Mode</td>
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<tr>
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* 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
14.10 Robot General-Purpose I/O Signal Assignment

Fig. 14-37: JANCD-AIO01-E (CN309 Connector) I/O Allocation and Connection Diagram (for Material Handling)

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<td>A25</td>
<td>OUT</td>
</tr>
<tr>
<td>0062</td>
<td>B26</td>
<td>OUT</td>
</tr>
<tr>
<td>0063</td>
<td>A26</td>
<td>OUT</td>
</tr>
<tr>
<td>0064</td>
<td>B27</td>
<td>OUT</td>
</tr>
<tr>
<td>0065</td>
<td>A27</td>
<td>OUT</td>
</tr>
<tr>
<td>0066</td>
<td>B28</td>
<td>OUT</td>
</tr>
<tr>
<td>0067</td>
<td>A28</td>
<td>OUT</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

#### 14.10 Robot General-Purpose I/O Signal Assignment

**Fig. 14-38: JANCD-AIO01-E (CN306 Connector) I/O Allocation and Connection Diagram (for Material Handling)**

**YRC1000**

**General-purpose I/O board (JANCD-AIO01-E)**

Each Point DC24V 6.8mA (TYP)

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>20040</td>
<td>B1</td>
<td>IN08</td>
</tr>
<tr>
<td>20041</td>
<td>A1</td>
<td>IN10</td>
</tr>
<tr>
<td>20042</td>
<td>B2</td>
<td>IN11</td>
</tr>
<tr>
<td>20043</td>
<td>A2</td>
<td>IN12</td>
</tr>
<tr>
<td>20044</td>
<td>B3</td>
<td>IN13</td>
</tr>
<tr>
<td>20045</td>
<td>A3</td>
<td>IN14</td>
</tr>
<tr>
<td>20046</td>
<td>B4</td>
<td>IN15</td>
</tr>
<tr>
<td>20047</td>
<td>A4</td>
<td>IN16</td>
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<tr>
<td>A5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>24VU</td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td>24VU</td>
<td></td>
</tr>
<tr>
<td>A9</td>
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<td>OUT</td>
</tr>
<tr>
<td>B10</td>
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<tr>
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<td></td>
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</tr>
<tr>
<td>B24</td>
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Each Point DC24V 50mA (MAX)

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN303</td>
<td></td>
<td>+24VU</td>
</tr>
<tr>
<td>CN306</td>
<td></td>
<td>+24VE</td>
</tr>
<tr>
<td>CN303</td>
<td></td>
<td>-24VU</td>
</tr>
<tr>
<td>CN306</td>
<td></td>
<td>-24VE</td>
</tr>
</tbody>
</table>

**CN306 Connector**

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
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<td>A1</td>
<td>IN10</td>
</tr>
<tr>
<td>20042</td>
<td>B2</td>
<td>IN11</td>
</tr>
<tr>
<td>20043</td>
<td>A2</td>
<td>IN12</td>
</tr>
<tr>
<td>20044</td>
<td>B3</td>
<td>IN13</td>
</tr>
<tr>
<td>20045</td>
<td>A3</td>
<td>IN14</td>
</tr>
<tr>
<td>20046</td>
<td>B4</td>
<td>IN15</td>
</tr>
<tr>
<td>20047</td>
<td>A4</td>
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<tr>
<td>A5</td>
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</tr>
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<td>A14</td>
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<tr>
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</table>

**Connector Terminal Converter (Optional) (-X51)**

Model: TIFS553YS or TIFS5N53YS

* 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
14.10 Robot General-Purpose I/O Signal Assignment

Fig. 14-39: JANCD-AIO01-E (CN307 Connector) I/O Allocation and Connection Diagram (for Material Handling)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)

<p>| Connector Terminal Converter (Optional) (-X52) Model:TIFS553YS or TIFS5N53YS |
|-----------------------------|-------------------------|-----------------------------|</p>
<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
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<td>B2</td>
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<td>IN</td>
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<tr>
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<td>A2</td>
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<td>B3</td>
<td>B3</td>
<td>IN</td>
</tr>
<tr>
<td>A3</td>
<td>A3</td>
<td>IN</td>
</tr>
<tr>
<td>B4</td>
<td>B4</td>
<td>IN</td>
</tr>
<tr>
<td>A4</td>
<td>A4</td>
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<td>IN</td>
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<td>IN</td>
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<td>OUT</td>
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<tr>
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<td>OUT</td>
</tr>
<tr>
<td>B11</td>
<td>B11</td>
<td>OUT</td>
</tr>
<tr>
<td>A11</td>
<td>A11</td>
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<td>B12</td>
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<td>OUT</td>
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<td>A13</td>
<td>A13</td>
<td>OUT</td>
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<tr>
<td>B14</td>
<td>B14</td>
<td>OUT</td>
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<tr>
<td>A14</td>
<td>A14</td>
<td>OUT</td>
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<tr>
<td>B15</td>
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<td>A15</td>
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<td>B17</td>
<td>OUT</td>
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<td>A17</td>
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<tr>
<td>B18</td>
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<td>B20</td>
<td>OUT</td>
</tr>
<tr>
<td>A20</td>
<td>A20</td>
<td>OUT</td>
</tr>
</tbody>
</table>

Each Point DC24V 6.8mA(TYP)

Each Point DC24V 500mA(MAX)

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
### Table 14-4: Specific Input (Material Handling)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START</td>
</tr>
<tr>
<td></td>
<td>Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20011</td>
<td>EXTERNAL HOLD</td>
</tr>
<tr>
<td></td>
<td>The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.</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>20014</td>
<td>EXTERNAL SERVO ON</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of this signal is valid. This signal turns ON the servo power. Use this signal to turn ON the servo power from an external device.</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(^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20021</td>
<td>INTERFERENCE 2 ENTRANCE PROHIBITED</td>
</tr>
<tr>
<td></td>
<td>If the manipulator attempts to enter the cube 2(^2) area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.</td>
</tr>
<tr>
<td>20026</td>
<td>TOOL SHOCK SENSOR</td>
</tr>
<tr>
<td></td>
<td>This is normally ON (NC) signal input. When it turns OFF, an YRC1000 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, YRC1000 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”.

14-52
## Table 14-5: Specific Output (Material Handling)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td><strong>RUNNING</strong>&lt;br&gt;This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.</td>
</tr>
<tr>
<td>30011</td>
<td><strong>SERVO IS ON</strong>&lt;br&gt;This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for YRC1000 status diagnosis for an external start.</td>
</tr>
<tr>
<td>30012</td>
<td><strong>TOP OF MASTER JOB</strong>&lt;br&gt;This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.1)</td>
</tr>
<tr>
<td>30013</td>
<td><strong>ALARM/ERROR OCCURRED</strong>&lt;br&gt;This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.</td>
</tr>
<tr>
<td>30014</td>
<td><strong>BATTERY ALARM</strong>&lt;br&gt;This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.</td>
</tr>
<tr>
<td>30015 to 30017</td>
<td><strong>REMOTE/PLAY/TEACH MODE SELECTED</strong>&lt;br&gt;This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.</td>
</tr>
<tr>
<td>30020</td>
<td><strong>IN CUBE 1</strong>&lt;br&gt;This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30021</td>
<td><strong>IN CUBE 2</strong>&lt;br&gt;This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.</td>
</tr>
<tr>
<td>30022</td>
<td><strong>WORK HOME POSITION (IN CUBE 64)2)</strong>&lt;br&gt;This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.</td>
</tr>
<tr>
<td>30023</td>
<td><strong>INTERMEDIATE START OK</strong>&lt;br&gt;This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.</td>
</tr>
<tr>
<td>30050 to 30057</td>
<td><strong>HAND VALVE 1-4</strong>&lt;br&gt;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 Description of Units and Circuit Boards
14.10 Robot General-Purpose I/O Signal Assignment

14.10.3 Press Tending, Cutting, and Other Applications

Fig. 14-40: JANCD-AIO01-E (CN308 Connector) I/O Allocation and Connection Diagram (for Press Tending, Cutting, and Other Applications)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)

 Each Point DC24V 6.8mA(TYP)

<table>
<thead>
<tr>
<th>CN308 Connector</th>
<th>Terminal</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010 A1</td>
<td>External Start</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20011 A2</td>
<td>External Hold</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20012 A3</td>
<td>Call Master Job</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20013 A4</td>
<td>Alarm/Error Reset</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20014 A5</td>
<td>External Servo ON</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20015 A6</td>
<td>Select Play Mode</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20016 A7</td>
<td>Select Teach Mode</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20017 A8</td>
<td>Interference1 Entrance Prohibited</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20018 A9</td>
<td>Interference2 Entrance Prohibited</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>20019 A10</td>
<td>Select Play Mode</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20020 A11</td>
<td>Select Teach Mode</td>
<td>OUT</td>
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</tr>
<tr>
<td>20021 A12</td>
<td>Remote Mode Selected</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20022 A13</td>
<td>In Cube 1</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20023 A14</td>
<td>In Cube 2</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20024 A15</td>
<td>Work Position</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20025 A16</td>
<td>In Cube 1</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20026 A17</td>
<td>In Cube 2</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20027 A18</td>
<td>Work Home Position</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20028 A19</td>
<td>Work Home Position</td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>20029 A20</td>
<td>Remote Mode Selected</td>
<td>OUT</td>
<td></td>
</tr>
</tbody>
</table>

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

+24VU

Each Point DC24V 50mA(MAX)

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

Connector Terminal Converter (Optional) (-X53)
Model: TIFS553YS or TIFS5N53YS
14 Description of Units and Circuit Boards
14.10 Robot General-Purpose I/O Signal Assignment

Fig. 14-41: JANCD-AIO01-E (CN309 Connector) I/O Allocation and Connection Diagram (for Press Tending, Cutting, and Other Applications)

Each Point DC24V 6.8mA(TYP)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Signal Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>IN</td>
</tr>
<tr>
<td>B2</td>
<td>IN</td>
</tr>
<tr>
<td>B3</td>
<td>IN</td>
</tr>
<tr>
<td>B4</td>
<td>IN</td>
</tr>
<tr>
<td>A1</td>
<td>IN</td>
</tr>
<tr>
<td>A2</td>
<td>IN</td>
</tr>
<tr>
<td>A3</td>
<td>IN</td>
</tr>
<tr>
<td>A4</td>
<td>IN</td>
</tr>
<tr>
<td>B5</td>
<td>IN</td>
</tr>
<tr>
<td>A5</td>
<td>IN</td>
</tr>
<tr>
<td>A6</td>
<td>IN</td>
</tr>
<tr>
<td>A7</td>
<td>IN</td>
</tr>
<tr>
<td>B8</td>
<td>IN</td>
</tr>
<tr>
<td>B9</td>
<td>OUT</td>
</tr>
<tr>
<td>A9</td>
<td>OUT</td>
</tr>
<tr>
<td>B10</td>
<td>OUT</td>
</tr>
<tr>
<td>A10</td>
<td>OUT</td>
</tr>
<tr>
<td>B11</td>
<td>OUT</td>
</tr>
<tr>
<td>A11</td>
<td>OUT</td>
</tr>
<tr>
<td>B12</td>
<td>OUT</td>
</tr>
<tr>
<td>A12</td>
<td>OUT</td>
</tr>
<tr>
<td>B13</td>
<td>OUT</td>
</tr>
<tr>
<td>A13</td>
<td>OUT</td>
</tr>
<tr>
<td>B14</td>
<td>OUT</td>
</tr>
<tr>
<td>A14</td>
<td>OUT</td>
</tr>
<tr>
<td>B15</td>
<td>OUT</td>
</tr>
<tr>
<td>A15</td>
<td>OUT</td>
</tr>
<tr>
<td>B16</td>
<td>OUT</td>
</tr>
<tr>
<td>A16</td>
<td>OUT</td>
</tr>
<tr>
<td>B17</td>
<td>OUT</td>
</tr>
<tr>
<td>A17</td>
<td>OUT</td>
</tr>
<tr>
<td>B18</td>
<td>OUT</td>
</tr>
<tr>
<td>A18</td>
<td>OUT</td>
</tr>
<tr>
<td>B19</td>
<td>OUT</td>
</tr>
<tr>
<td>A19</td>
<td>OUT</td>
</tr>
<tr>
<td>B20</td>
<td>OUT</td>
</tr>
</tbody>
</table>

Each Point DC24V 50mA(MAX)

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Signal Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>+24VU</td>
<td>Each Point</td>
</tr>
<tr>
<td>024VU</td>
<td>Each Point</td>
</tr>
<tr>
<td>024VU</td>
<td>Each Point</td>
</tr>
<tr>
<td>024VU</td>
<td>Each Point</td>
</tr>
<tr>
<td>024VU</td>
<td>Each Point</td>
</tr>
</tbody>
</table>

Connector Terminal Converter (Optional) (+X54)
Model: TIFS553YS or TIFS5N53YS

* 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
14.10 Robot General-Purpose I/O Signal Assignment

Fig. 14-42: JANCD-AIO01-E (CN306 Connector) I/O Allocation and Connection Diagram (for Press Tending, Cutting, and Other Applications)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>A1</td>
<td>IN</td>
</tr>
<tr>
<td>2002</td>
<td>A2</td>
<td>IN</td>
</tr>
<tr>
<td>2003</td>
<td>A3</td>
<td>IN</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Connector Terminal Converter
(Optional) (-X51)
Model: TIFS553YS or TIFS5N53YS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>A1</td>
<td>IN</td>
</tr>
<tr>
<td>2002</td>
<td>A2</td>
<td>IN</td>
</tr>
<tr>
<td>2003</td>
<td>A3</td>
<td>IN</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Each Point DC24V 6.8mA(TYP)

-24VU

Each Point DC24V 50mA(MAX)

+24VU

* 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

#### 14.10 Robot General-Purpose I/O Signal Assignment

**Fig. 14-43: JANCD-AIO01-E (CN307 Connector) I/O Allocation and Connection Diagram (for Press Tending, Cutting, and Other Applications)**

- **YRC1000**
  - General-purpose I/O board (JANCD-AIO01-E)
  - Connector Terminal Converter (Optional) (-X52)
  - Model:TIFS553YS or TIFS5N53YS

**Each Point DC24V 6.8mA(TYP)**

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>CN307 Connector</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>+24V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-24V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Each Point DC24V 500mA(MAX)**

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>CN307 Connector</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>+24V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-24V</td>
<td></td>
<td></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.*

- **24VU**
  - Internal Power Supply
  - External Power Supply

- **B1**
  - RLY

- **A1**
  - RLY

- **B2**
  - RLY

- **A2**
  - RLY

- **B3**
  - RLY

- **A3**
  - RLY

- **B4**
  - RLY

- **A4**
  - RLY

- **B5**
  - RLY

- **A5**
  - RLY

- **B6**
  - RLY

- **A6**
  - RLY

- **B7**
  - RLY

- **A7**
  - RLY

- **B8**
  - RLY

- **A8**
  - RLY

- **B9**
  - RLY

- **A9**
  - RLY

- **B10**
  - RLY

- **A10**
  - RLY

- **B11**
  - RLY

- **A11**
  - RLY

- **B12**
  - RLY

- **A12**
  - RLY

- **B13**
  - RLY

- **A13**
  - RLY

- **B14**
  - RLY

- **A14**
  - RLY

- **B15**
  - RLY

- **A15**
  - RLY

- **B16**
  - RLY

- **A16**
  - RLY

- **B17**
  - RLY

- **A17**
  - RLY

- **B18**
  - RLY

- **A18**
  - RLY

- **B19**
  - RLY

- **A19**
  - RLY

- **B20**
  - RLY

- **A20**
  - RLY
### Table 14-6: Specific Input (Press Tending, Cutting, and Other Applications)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Input Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.</td>
</tr>
<tr>
<td>20011</td>
<td>EXTERNAL HOLD The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.</td>
</tr>
<tr>
<td>20012</td>
<td>CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job. 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 After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.</td>
</tr>
<tr>
<td>20014</td>
<td>EXTERNAL SERVO ON Only the rising edge of this signal is valid. This signal turns ON the servo power. Use this signal to turn ON the servo power from an external device.</td>
</tr>
<tr>
<td>20015</td>
<td>SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at “REMOTE”. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.</td>
</tr>
<tr>
<td>20016</td>
<td>SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at “REMOTE”. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.</td>
</tr>
<tr>
<td>20020</td>
<td>INTERFERENCE 1 ENTRANCE PROHIBITED 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 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) Even if TOOLON instruction is executed, YRC1000 doesn’t output to external while this signal is ON.</td>
</tr>
<tr>
<td>20024</td>
<td>INTERFERENCE 3 ENTRANCE PROHIBITED 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 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”.

---

14 Description of Units and Circuit Boards
14.10 Robot General-Purpose I/O Signal Assignment
### Table 14-7: Specific Output (Press Tending, Cutting, and Other Applications)

<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 YRC1000 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 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 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 (20022) 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 Description of Units and Circuit Boards
14.10 Robot General-Purpose I/O Signal Assignment

14.10.4 Spot Welding

Fig. 14-44: JANCD-AIO01-E (CN308 Connector) I/O Allocation and Connection Diagram (for Spot Welding)

YRC1000

General-purpose I/O board (JANCD-AIO01-E)

Each Point
DC24V
6.8mA(TYP)

Each Point
24VDC
50mA (max.)

CN308 Connector

<table>
<thead>
<tr>
<th>Terminal Number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>B1</td>
<td>External Start</td>
</tr>
<tr>
<td>20011</td>
<td>A1</td>
<td>External Hold</td>
</tr>
<tr>
<td>20012</td>
<td>B2</td>
<td>Call Master Job</td>
</tr>
<tr>
<td>20013</td>
<td>A2</td>
<td>Alarm/Error Reset</td>
</tr>
<tr>
<td>20014</td>
<td>B3</td>
<td>External Servo ON</td>
</tr>
<tr>
<td>20015</td>
<td>A3</td>
<td>Select Play Mode</td>
</tr>
<tr>
<td>20016</td>
<td>B4</td>
<td>Select Teach Mode</td>
</tr>
<tr>
<td>20017</td>
<td>A4</td>
<td>Select Teach Mode</td>
</tr>
<tr>
<td>20018</td>
<td>B5</td>
<td>Select Teach Mode</td>
</tr>
<tr>
<td>20019</td>
<td>A5</td>
<td>Select Teach Mode</td>
</tr>
<tr>
<td>20020</td>
<td>B6</td>
<td>Welding ON/OFF</td>
</tr>
<tr>
<td>20021</td>
<td>A6</td>
<td>Welding Pause</td>
</tr>
<tr>
<td>20022</td>
<td>B7</td>
<td>24VU</td>
</tr>
<tr>
<td>20023</td>
<td>A7</td>
<td>Running</td>
</tr>
<tr>
<td>20024</td>
<td>B8</td>
<td>Servo is ON</td>
</tr>
<tr>
<td>20025</td>
<td>A8</td>
<td>Top of Master Job</td>
</tr>
<tr>
<td>20026</td>
<td>B9</td>
<td>Alarm/Error Occurred</td>
</tr>
<tr>
<td>20027</td>
<td>A9</td>
<td>Battery Alarm</td>
</tr>
<tr>
<td>20028</td>
<td>B10</td>
<td>Remote Mode Selected</td>
</tr>
<tr>
<td>20029</td>
<td>A10</td>
<td>Play Mode Selected</td>
</tr>
<tr>
<td>20030</td>
<td>B11</td>
<td>Teach Mode Selected</td>
</tr>
<tr>
<td>20031</td>
<td>A11</td>
<td>In Cube 1</td>
</tr>
<tr>
<td>20032</td>
<td>B12</td>
<td>In Cube 2</td>
</tr>
<tr>
<td>20033</td>
<td>A12</td>
<td>Internal Start</td>
</tr>
<tr>
<td>20034</td>
<td>B13</td>
<td>External Hold</td>
</tr>
<tr>
<td>20035</td>
<td>A13</td>
<td>External Servo ON</td>
</tr>
<tr>
<td>20036</td>
<td>B14</td>
<td>24VU</td>
</tr>
<tr>
<td>20037</td>
<td>A14</td>
<td>Running</td>
</tr>
<tr>
<td>20038</td>
<td>B15</td>
<td>Servo is ON</td>
</tr>
<tr>
<td>20039</td>
<td>A15</td>
<td>Top of Master Job</td>
</tr>
<tr>
<td>20040</td>
<td>B16</td>
<td>Alarm/Error Occurred</td>
</tr>
<tr>
<td>20041</td>
<td>A16</td>
<td>Battery Alarm</td>
</tr>
<tr>
<td>20042</td>
<td>B17</td>
<td>Remote Mode Selected</td>
</tr>
<tr>
<td>20043</td>
<td>A17</td>
<td>Play Mode Selected</td>
</tr>
<tr>
<td>20044</td>
<td>B18</td>
<td>Teach Mode Selected</td>
</tr>
<tr>
<td>20045</td>
<td>A18</td>
<td>In Cube 1</td>
</tr>
<tr>
<td>20046</td>
<td>B19</td>
<td>In Cube 2</td>
</tr>
<tr>
<td>20047</td>
<td>A19</td>
<td>Internal Start</td>
</tr>
<tr>
<td>20048</td>
<td>B20</td>
<td>External Hold</td>
</tr>
<tr>
<td>20049</td>
<td>A20</td>
<td>External Servo ON</td>
</tr>
</tbody>
</table>

Connector Terminal Converter (Optional) (-X53)
Model: TIFS553YS or TIFS55N53YS

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
### 14.10 Robot General-Purpose I/O Signal Assignment

![Diagram](image)

**Fig. 14-45: JANCD-AIO01-E (CN309 Connector) I/O Allocation and Connection Diagram (for Spot Welding)**

<table>
<thead>
<tr>
<th>Connector Terminal Converter</th>
<th>(Optional) (-X54)</th>
<th>Model: TIFS553YS or TIFS5N53YS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connector Terminal Converter</strong></td>
<td><strong>(Optional) (-X54)</strong></td>
<td><strong>Model: TIFS553YS or TIFS5N53YS</strong></td>
</tr>
<tr>
<td><strong>CN309 Connector</strong></td>
<td><strong>YRC1000 General-Purpose I/O board</strong></td>
<td></td>
</tr>
</tbody>
</table>

Each Point DC24V 50mA (MAX)

Each Point DC24V 6.8mA (TYP)

- Remove jumper-pin between CN303-1 and -3, CN303-2 and -4 when an external power supply is used.

---

YRC1000 General-Purpose I/O board (JANCD-AIO01-E, CN309 Connector) I/O Allocation and Connection Diagram (for Spot Welding)
YRC1000

General-purpose I/O board (JANCD-AIO01-E)

Connector Terminal Converter
(Optional) (-X51)
Model:TIFS553YS or TIFS5N53YS

Each Point DC24V
6.8mA(TYP)

Each Point DC24V
50mA(MAX)

* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when an external power supply is used.
General-purpose I/O board (JANCD-AIO01-E)

Each Point DC24V 6.8mA(TYP)

Internal Power Supply +24V 024V 24V, 1.5A

Each Point DC24V 500mA(MAX)

Connector Terminal Converter (Optional) (X52)
Model: TIFS553YS or TIFS653YS

YRC1000

CN307 Connector

Terminal Number Connector Number Signal Name

024VU

B1 Welding ON/OFF Error (IN02) IN
B2 Welding ON/OFF Error (IN02) IN
B3 Low Pressure (IN12) IN
B4 IN13 IN
B5 Weld Error Reset (OUT08)** OUT
B6 Weld Error Reset (OUT08)** OUT
B7 024VU
B8 OUT
A8 Weld ON/OFF (OUT09)** OUT
A9 Weld ON/OFF (OUT09)** OUT
B9 OUT
A9 Weld Error Reset (OUT08)** OUT
A10 Weld Error Reset (OUT08)** OUT
A11 Weld Condition 1 (OUT10)** OUT
A12 Weld Condition 2 (OUT10)** OUT
A13 Weld Condition 3 (OUT10)** OUT
A14 Weld Condition 4 (OUT10)** OUT
A15 Weld Condition 5 (OUT10)** OUT
A16 Tip Change Request (OUT10)** OUT
B10 OUT
B11 OUT
B12 OUT
B13 OUT
B14 OUT
B15 OUT
B16 OUT
B17 OUT
B18 OUT
B19 OUT
B20 FG
A16 OUT
A17 OUT
A18 OUT
A19 OUT
A20 FG

YRC1000

Internal Power Supply +24V 024V 24V, 1.5A

External Power Supply +24V 024V

* Remove jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.
Table 14-8: Specific Input (Spot Welding)

<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>20011</td>
<td>EXTERNAL HOLD</td>
</tr>
<tr>
<td></td>
<td>The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.</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>20014</td>
<td>EXTERNAL SERVO ON</td>
</tr>
<tr>
<td></td>
<td>Only the rising edge of this signal is valid. This signal turns ON the servo power. Use this signal to turn ON the servo power from an external device.</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>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
14.10 Robot General-Purpose I/O Signal Assignment

<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”.
3) This signal can be set as “USE” or “NOT USE” by pseudo input signal “8202x”. If “NOT USE” is selected, this signal can be used as the universal I/O signal described in parentheses.
4) This signal can be allocated to any universal I/O signal at the I/O allocation display in operation condition.

Table 14-9: Specific Output (Spot 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 YRC1000 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>
</tbody>
</table>

14-65
14 Description of Units and Circuit Boards
14.10 Robot General-Purpose I/O Signal Assignment

Table 14-9: Specific Output (Spot Welding)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<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 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>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 3)</td>
<td>WELD ON/OFF</td>
</tr>
<tr>
<td></td>
<td>Outputs a signal input from the interlock panel, etc. considering the robot status.</td>
</tr>
<tr>
<td>30051 4)</td>
<td>WELD ERROR RESET</td>
</tr>
<tr>
<td></td>
<td>This signal commands the reset error status of the Power Source. This is operated with the programming pendant operation.</td>
</tr>
<tr>
<td>30052 to 30056 4)</td>
<td>WELD CONDITION (Level signals)</td>
</tr>
<tr>
<td></td>
<td>1(1), 2(2), 4(3), 8(4), 16(5), 32(6), 64(7), 128(8)</td>
</tr>
<tr>
<td></td>
<td>Sets the welding conditions for the Power Source. The output format can be selected as binary or discrete (bit number). It can handle up to 255 conditions. Most-significant bit is the parity bit (when specified).</td>
</tr>
<tr>
<td>4)</td>
<td>WELDING COMMAND</td>
</tr>
<tr>
<td></td>
<td>This signal outputs execution command signal to the Power Source. This signal is not necessary for a Power Source which is executed using the WELDING CONDITION signal.</td>
</tr>
</tbody>
</table>
Table 14-9: Specific Output (Spot Welding)

<table>
<thead>
<tr>
<th>Logical Number</th>
<th>Output Name / Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>4)</td>
<td>STROKE CHANGE1</td>
</tr>
<tr>
<td></td>
<td>SINGLE SOLENOID</td>
</tr>
<tr>
<td></td>
<td>DOUBLE SOLENOID</td>
</tr>
<tr>
<td></td>
<td>This is a signal, when a double stroke gun is used, to change the open stroke of the</td>
</tr>
<tr>
<td></td>
<td>welding gun.</td>
</tr>
<tr>
<td>4)</td>
<td>GUN PRESS COMMAND</td>
</tr>
<tr>
<td></td>
<td>This outputs gun press command.</td>
</tr>
<tr>
<td>30057</td>
<td>TIP REPLACE REQUEST</td>
</tr>
<tr>
<td></td>
<td>This signal is output when the stored number of welding reaches the number of</td>
</tr>
<tr>
<td></td>
<td>welding set for the tip replacement.</td>
</tr>
</tbody>
</table>

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.
**14.11 The List of the Equipment Configuration by Model**

Table 14-10(a): Equipment Configuration (for Small-Capacity Model 1-1)

<table>
<thead>
<tr>
<th>Component</th>
<th>For Japan</th>
<th>For Asia</th>
<th>For North America</th>
<th>For Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>YRC1000 type (last part)</strong> (ERAR-1000-xxxxxxx-□□□□)</td>
<td>A00</td>
<td>A10</td>
<td>B15</td>
<td>E10</td>
</tr>
<tr>
<td><strong>Input voltage</strong></td>
<td>200 to 240 VAC</td>
<td>380 to 440 VAC</td>
<td>380 to 480 VAC</td>
<td>380 to 440 VAC</td>
</tr>
<tr>
<td><strong>Dimension (W) x (H) x (D)</strong></td>
<td>598 mm × 490 mm × 427 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Breaker</strong></td>
<td>NF32-SVF 3P 15A</td>
<td>NF125-HVU 3P 15A</td>
<td>NF32-SVF 3P 15A</td>
<td></td>
</tr>
<tr>
<td><strong>Control power supply unit</strong></td>
<td>CSRA-CPS01KA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CPU unit</strong></td>
<td>JZNC-ARK01-E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CPU board</strong></td>
<td>JANCD-ACP01-E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Back board</strong></td>
<td>JANCD-ABB01-E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Riser board (PCIe/PCIe)</strong></td>
<td>JANCD-ABB02-E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Robot I/F board</strong></td>
<td>JANCD-AIF01-1E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Safety terminal block board</strong></td>
<td>IM-YE250/5-80P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>General-purpose I/O board</strong></td>
<td>JANCD-AIO01-E</td>
<td>JANCD-AIO02-E</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply contactor unit</strong></td>
<td>JZRCR-APU01-1</td>
<td>JZRCR-APU03-1</td>
<td>JZRCR-APU01-1</td>
<td></td>
</tr>
<tr>
<td><strong>Inverter unit</strong></td>
<td>Refer to table 14-10(b) “Equipment Configuration (for Small-Capacity Model 1-2)”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Servo control board</strong></td>
<td>CSRA-SDCA01AA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Single axis amplifier</strong></td>
<td>Refer to table 14-10(b).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Safety circuit board</strong></td>
<td>JANCD-ASF01-E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Converter</strong></td>
<td>CSRA-CV05A00A</td>
<td>CSRA-CV05D01A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Regenerative resistor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>SMVK500W7R0J/RO A6666</td>
<td>SMVK500W260J/RO A6667</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated value</strong></td>
<td>500 W</td>
<td>500 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resister value</strong></td>
<td>7 Ω</td>
<td>26 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DC reactor</strong></td>
<td>-</td>
<td>85R-15014A x2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Heat exchanger</strong></td>
<td>TCMSY-310DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cooling fan</strong></td>
<td>09225VE-24P-CA-02 x4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise filter</strong></td>
<td>-</td>
<td>NF3050C-SVB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Table 14-10(b): Equipment Configuration**
*(for Small-Capacity Model 1-2)*

<table>
<thead>
<tr>
<th>Model</th>
<th>Inverter unit</th>
<th>Single axis amplifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP7</td>
<td>CSRA-SDA01H01A</td>
<td>No amplifier</td>
</tr>
<tr>
<td>AR900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR700</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP12</td>
<td>CSRA-SDA02H01A</td>
<td>No amplifier</td>
</tr>
<tr>
<td>AR1440</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR1730</td>
<td></td>
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<td>AR1440E</td>
<td>CSRA-SDA02H01A</td>
<td>CSRA-SDB21HA</td>
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<td><strong>YRC1000 type (last part) (ERAR-1000-xxxxxxx-□□□)</strong></td>
<td>A00</td>
<td>A10</td>
<td>B15</td>
<td>E10</td>
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<td><strong>Input voltage</strong></td>
<td>200 to 240 VAC</td>
<td>380 to 440 VAC</td>
<td>380 to 480 VAC</td>
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<td><strong>Dimension (W) x (H) x (D)</strong></td>
<td>598 mm×490 mm×427 mm</td>
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<td><strong>Breaker</strong></td>
<td>NF32-SVF 3P 30A</td>
<td>NF32-SVF 3P 20A</td>
<td>NF125-HVU 3P 20A</td>
<td>NF32-SVF 3P 20A</td>
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<td><strong>Control power supply unit</strong></td>
<td>CSRA-CPS01KA</td>
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<tr>
<td><strong>CPU unit</strong></td>
<td>JZNC-ARK01-E</td>
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<tr>
<td><strong>CPU board</strong></td>
<td>JZNC-ACP01-E</td>
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<tr>
<td><strong>Back board</strong></td>
<td>JZNC-ABB01-E</td>
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<tr>
<td><strong>Riser board (PCIe/PCIe)</strong></td>
<td>JZNC-ABB02-E</td>
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<td><strong>Robot I/F board</strong></td>
<td>JZNC-AIF01-E</td>
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<td><strong>Safety terminal block board</strong></td>
<td>IM-YE250/5-80P</td>
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<td><strong>General-purpose I/O board</strong></td>
<td>JZNC-AIO01-E</td>
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<td><strong>Power supply contactor unit</strong></td>
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<td><strong>Inverter unit</strong></td>
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<td><strong>Single axis amplifier</strong></td>
<td>Refer to table 14-10(d).</td>
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<td>CSRA-CV10D03A</td>
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<tr>
<td><strong>AC reactor</strong></td>
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<td>SR-23A (or UZBC-B 23A)</td>
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<td>TCMSY-31□□DC</td>
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<td><strong>Cooling fan</strong></td>
<td>09225VE-24P-CA-02 x4</td>
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<td><strong>Noise filter</strong></td>
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<td>NF3050C-SVB</td>
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<td><strong>Power supply for manipulator fan</strong></td>
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<td>S8VK-T12024</td>
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<td><strong>Fan control relay</strong></td>
<td>LY2N-D2 DC24V</td>
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1 The power supply for the manipulator fan and fan control relay are installed only in the ERAR-1000-06VRF130-□□□ type controllers.
### Table 14-10(d): Equipment Configuration (for Medium and Large Capacity Model 1-2)

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