YASKAWA

YRC1000micro
INSTRUCTIONS

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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
YRC1000micro INSTRUCTIONS
YRC1000micro OPERATOR'S MANUAL
YRC1000micro MAINTENANCE MANUAL
YRC1000micro ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

The Americas YASKAWA Representative

- 24-hour Telephone Number: **(937) 847-3200**
  Use for urgent or emergency needs for technical support, service and/or replacement parts
- Routine Technical Inquiries: *techsupport@motoman.com*
  Allow up to 36 hours for response

Have the following information available when contacting the YASKAWA Representative:
- System
- Primary Application
- Software Version *(Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version})*
- Warranty ID *(Located on Robot Controller)*
- Robot Serial Number *(Located on Manipulator data plate)*
- Robot Sales Order Number *(Located on Robot controller data plate)*

Part Number: 181274-1CD
Revision: 23

MANUAL NO. RE-CTO-A222 23

DANGER

- This manual describes setup, diagnosis, maintenance, hardware, etc. of the YRC1000micro system. Read this manual carefully and be sure to understand its contents before handling the YRC1000micro. 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 “YRC1000micro INSTRUCTIONS”. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of “YRC1000micro 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. 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 your product.

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

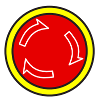
To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” and “CAUTION”.

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 button on the programming pendant or 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.

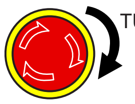
Fig. : Emergency Stop Button



- 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.
  – Enable the play mode enable function and use it for time when cannot lock out the safety fence.
  – Provide a means to easily open it from the inside for time when a safe fence was closed by any chance.

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 YRC1000micro 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 button is located on the upper right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.

DANGER

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety).
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

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.
- Return the programming pendant to a safe place 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.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the YRC1000micro controller, manipulator cables, the YRC1000micro programming pendant (optional), and the YRC1000micro programming pendant safety signal short circuit connector (optional).

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
YRC1000micro controller	YRC1000micro
YRC1000micro programming pendant	Programming pendant (optional)
Cable between the manipulator and the controller	Manipulator cable
YRC1000micro programming pendant safety signal short circuit connector	Programming pendant safety signal short circuit connector (optional)

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

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

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means that the cursor is moved to the object item and [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 YRC1000micro.

Fully comply with the precautions on the warning labels.

DANGER

- 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.

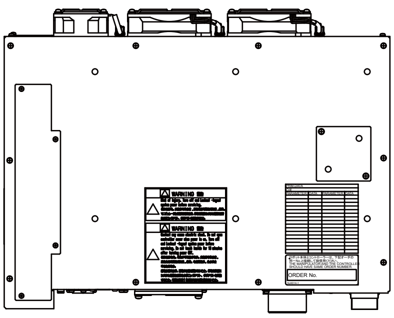
Collision hazard label

Crush hazard label

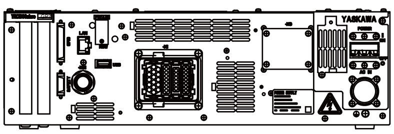
- The following warning labels are attached to YRC1000micro.

Observe the precautions on the warning labels.

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

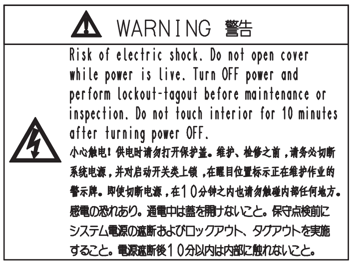


(Top View)

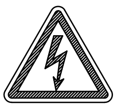


(Front View)

Injury Warning NP



Electric Shock Warning NP



Electric Shock Warning NP

Contents

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.

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
  – YRC1000micro INSTRUCTIONS
  – YRC1000micro MAINTENANCE MANUAL
  – YRC1000micro OPERATOR’S MANUAL
  – YRC1000micro 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.

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.

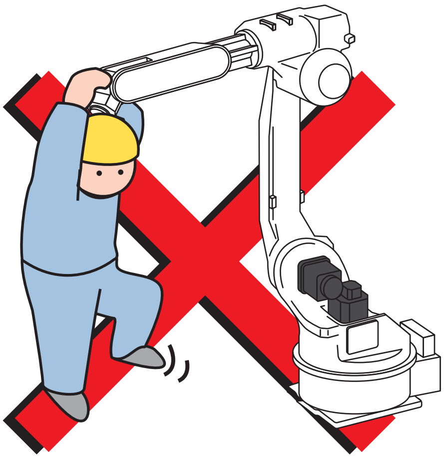
Failure to observe this instruction may cause contact with the manipulator, the YRC1000micro, the control panel, the workpiece, or the positioner, etc., which may result in personal injury.

- Make sure that the programming pendant or brake open switch will be prepared in the work area so that the manipulator moves the target axis without power for driving at an emergency or abnormal time.

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.

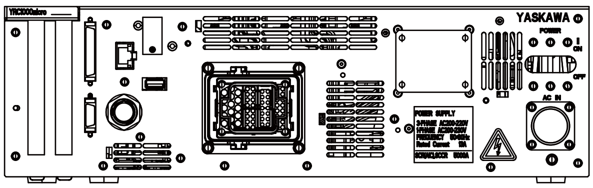


- Do not sit or lean on the YRC1000micro.

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 YRC1000micro 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 YRC1000micro 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/YRC1000micro.

- Emergency stop SW input (programming pendant)
- Enable SW input (programming pendant)
- Safeguarding interlock signal input (safety plug)
- External emergency stop SW input
- Protected stop signal input
- Overrun input (manipulator/external axis)
- General-purpose safety input (Enabled when the option board (JANCD-ASF32-E) is connected.)
- 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

1.5.1 Installation and Wiring Safety

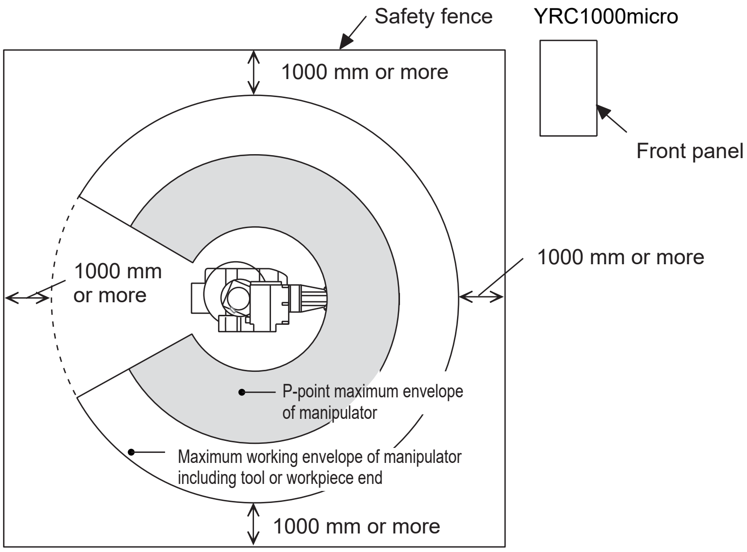
Refer to the MOTOMAN-☐☐☐ INSTRUCTIONS and the YRC1000micro INSTRUCTIONS for details on installation and wiring.

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 YRC1000micro, 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.

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.

- Lift, move, or install the YRC1000micro by two or more persons.
  - Approx. mass of YRC1000micro: 10.5 kg per unit
- Use a platform truck to carry theYRC1000micro.
  - Avoid jarring, dropping, or hitting the YRC1000micro during handling.

Failure to observe this instruction may cause falling or overturning of the YRC1000micro during transportation, which may result in personal injury and/or equipment damage.

- 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.

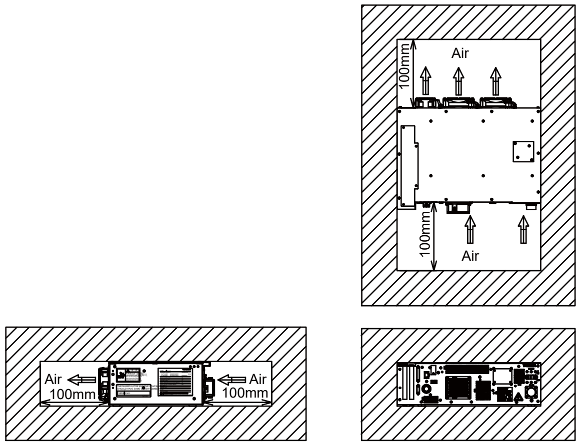
Failure to observe this instruction may cause overturning of the manipulator, which may result in personal injury and/or equipment damage.

WARNING

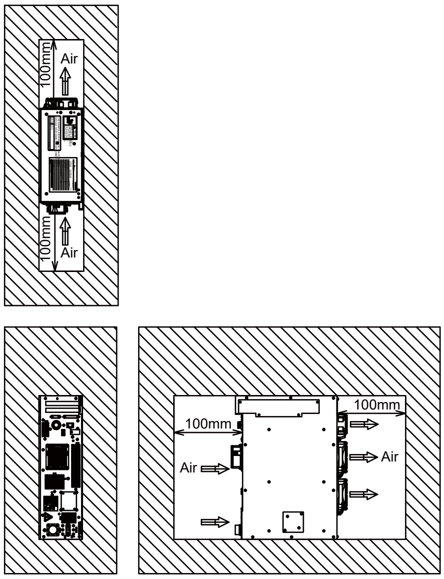
- Secure enough space for maintenance on the manipulator, the YRC1000micro, and other peripheral devices.

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

Instsallation space for YRC1000micro in horizontal position



Instsallation space for YRC1000micro in vertical position



- Install the YRC1000micro 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 YRC1000micro outside the safety fence around the manipulator.

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

WARNING

- Install the programing pendant outside the safety fence around the manipulator.

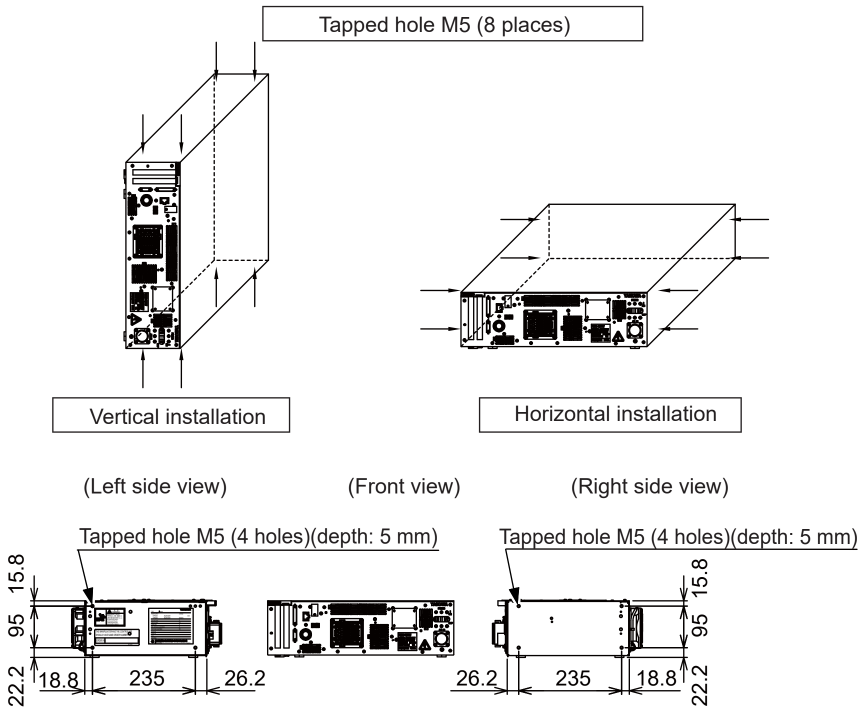
Failure to observe this instruction may cause contact with the manipulator, which may result in personal injury.

- 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.

- After installing the YRC1000micro, firmly anchor it to the floor or baseplate by using the screws and the tapped holes on the lateral bottom of the YRC1000micro.

Failure to observe this instruction may cause overturning of the YRC1000micro, which may result in personal injury and/or equipment damage.

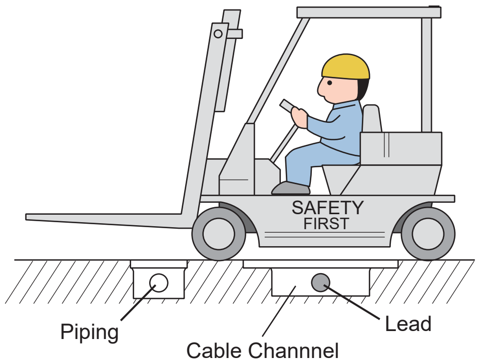


- Perform wiring to the YRC1000micro with a thorough understanding of and in accordance with the connection diagram.

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.

WARNING

- Run the piping, wiring, and cables for the YRC1000micro, 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.

1.5.2 Work Area Safety

Carelessness contributes to serious accidents in the work area.

To ensure safety, enforce the following precautions:

DANGER

- 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 14.1.1.1 "Connection of Safety Plug Signal (SAFF)"* .
- 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
• Make sure to incorporate the robot system into the user's system which has lockout/tagout function. That is to say, supply one or more devices to turn OFF the powersupply of the manipulator, servo track, and controller, and install them outside the enclosure in which the manipulator and servotrack are installed. The devices must be able to be locked out and tagged out. Turning the power ON improperly during work may result in electric shock or personal injury due to unexpected movement of the manipulator.
• 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.
• Perform teaching operation 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.
• 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 button on the programming pendant or 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.

DANGER

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety).
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

- 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 YRC1000micro 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 button is located on the upper right of the programming pendant.

Programming Pendant

- Persons operating or inspecting the manipulator should be trained as required by applicable laws and company policies.
- Refer to *chapter 1.2 "Special Training"* .

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 YRC1000micro power supply and inform the safety manager of the error.
- Return the programming pendant to a safe place 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.

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.

- If a warning label on the manipulator or the YRC1000micro 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 YRC1000micro.

Failure to observe this instruction may cause fire, mechanical failure, or malfunction, which may result in personal injury and/or equipment damage.

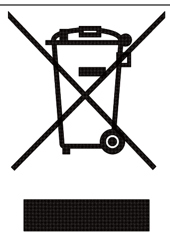
WARNING

- 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 wheelie 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

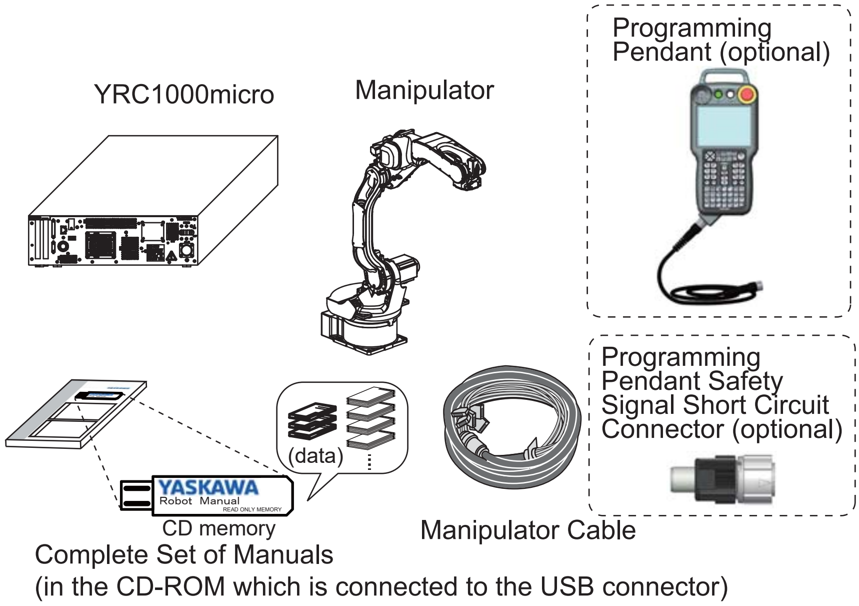
2.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

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

- Manipulator (parts included)
- YRC1000micro (parts included)
  For supplied parts, refer to *"YRC1000micro MAINTENANCE MANUAL (RE-CHO-A115) 5.3 Supplied Parts List"*.
- Manipulator Cable (between manipulator and the YRC1000micro)
- Complete Set of Manuals (in the CD-ROM which is connected to the USB connector)
- Programming pendant (optional)
- Programming pendant safety signal short circuit connector (optional)

Fig. 2-1: Standard Four (to Six) Items

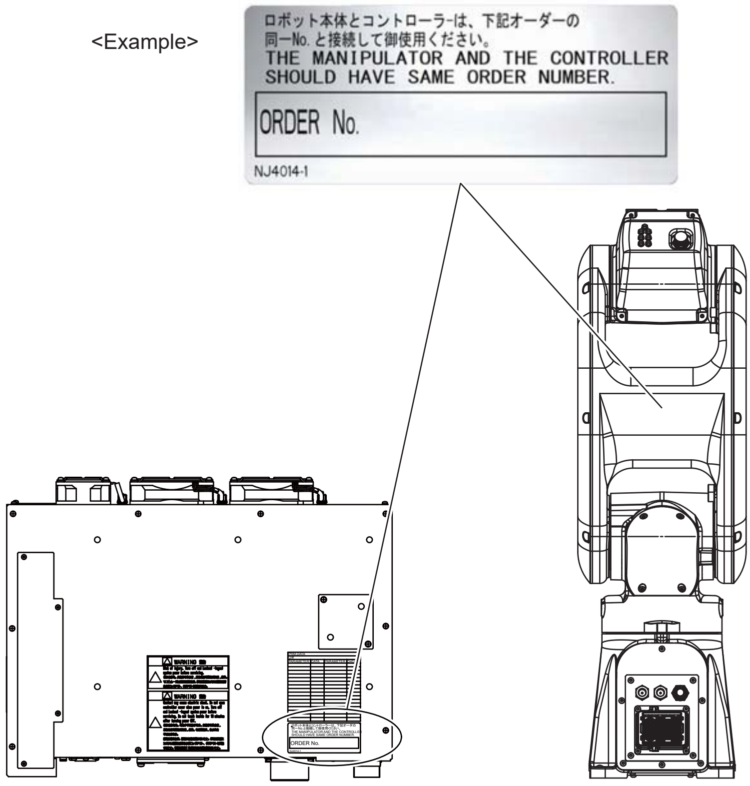


2.2 Order Number Confirmation

Confirm that the order number pasted on the manipulator and YRC1000micro are the same.

The order number plates are affixed to the figure below.

<Example>



*The GP8 model is used in this example.

3 Installation

3.1 Handling Procedure

WARNING

- Lift, move, or install the YRC1000micro by two or more persons.
  – Approx. mass of YRC1000micro: 10.5 kg per unit
- Use a platform truck to carry theYRC1000micro.
  – Avoid jarring, dropping, or hitting the YRC1000micro during handling.

Failure to observe this instruction may cause falling or overturning of the YRC1000micro during transportation, which may result in personal injury and/or equipment damage.

NOTICE

- Avoid excessive vibration or shock while transporting or moving the YRC1000micro.

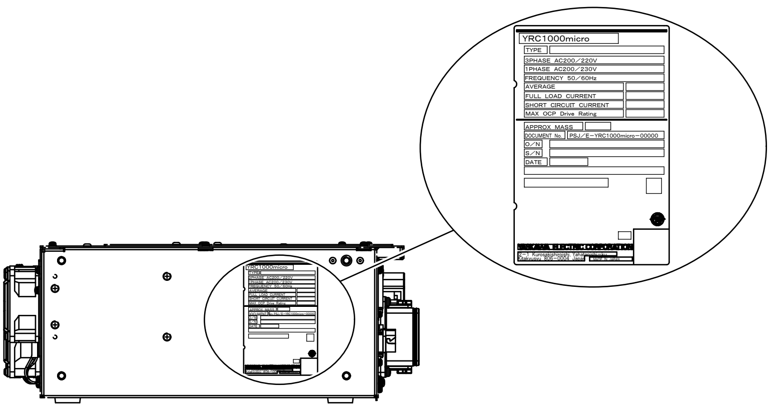
Failure to observe this instruction may adversely affect the performance of the YRC1000micro because it consists of precision components.

The mass of the YRC1000micro is indicated on the nameplate. The location and content of the nameplate is shown below.

Unpack and move the YRC1000micro by two or more persons.

Use a lifter to lift the YRC1000micro up to or put it down from the rack. Also, use a platform truck to carry the YRC1000micro

- If the YRC1000micro must be manually carried, lifted up, or put down, two persons must hold the bottom of the YRC1000micro firmly.



3.2 Place of Installation

he conditions listed below must be met before installing the YRC1000micro.

- Ambient temperature must be 0°C to 40°C during operation and -10°C to 60°C during transportation and maintenance. Temperature change must be 0.3°C/min or less.
- Humidity must be low with no condensation (10%RH~90%RH).
- The YRC1000micro has an open structure (IP20) and must be used in an environment* that meets the standard of pollution degree 2 specified in IEC60664-1.
  Also, prevent chemicals, cutting oil including coolant, anti-rust oil, and organic solvent from adhering to the programming pendant (optional).

  *The environment must be clean with only a minimal amount of dirt and dust, and free from cutting oil, organic solvent, oil fume, water, or salt.
  In particular, there should be no electrically-conductive dirt and dust.
- 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 YRC1000micro.)
- 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 36°C.)

NOTE

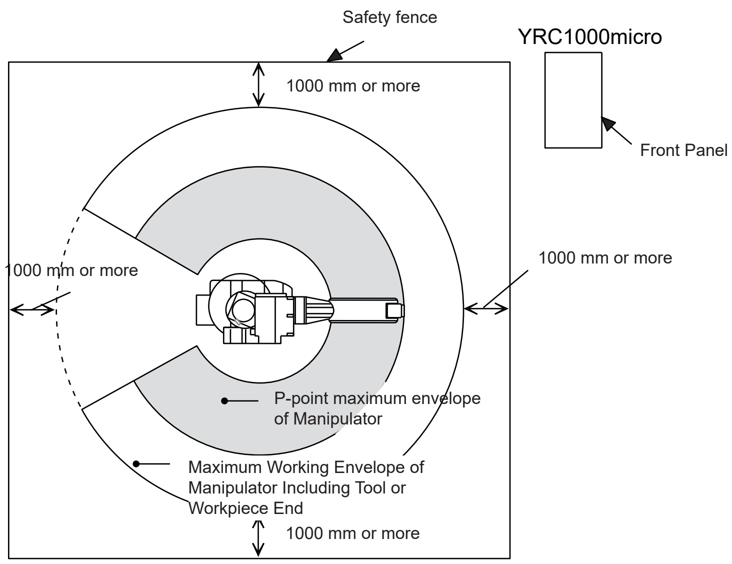
If the external electric noise applies, the alarm occurs and the manipulator may stop.

When the alarm occurs and the manipulator stops, “YRC1000micro MAINTENANCE MANUAL (RE-CHO-A115)” and reset the alarm.

3.3 Location

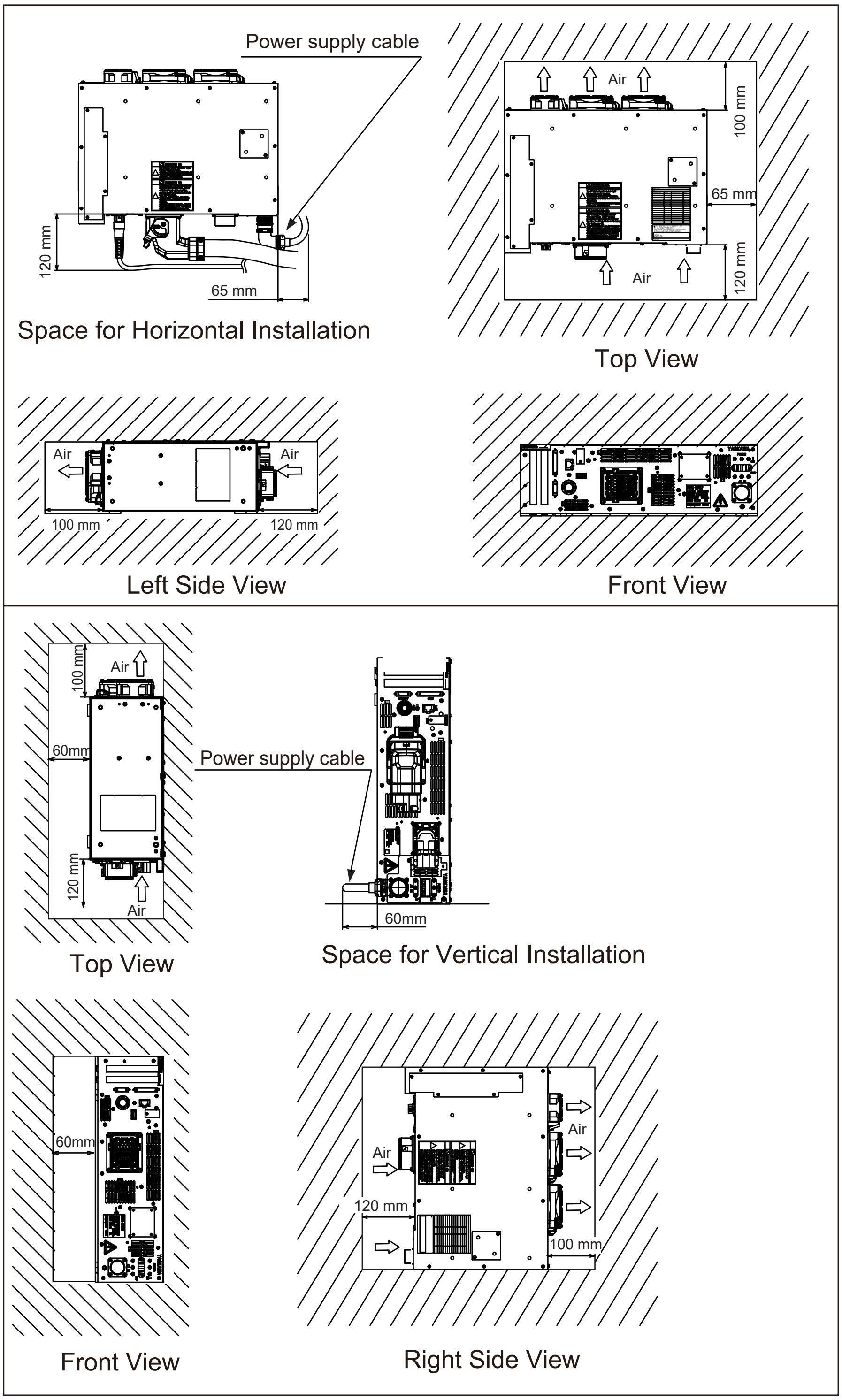
1. Install the YRC1000micro outside of the P-point maximum envelope of the manipulator (outside of the safety fence.)

Fig. 3-1: Location of YRC1000micro



- Install the YRC1000micro where the manipulator can be clearly seen during operation and can be operated safely.
- Install the YRC1000micro where its front panel can be operated easily.
- Install the YRC1000micro where it can be easily taken out of the rack for maintenance.
- Install the YRC1000micro where it can be inspected easily. (Make sure to secure the maintenance area.)
- Do not place any obstacles in the following:

  -within 100 mm from the rear panel (air outlet) of the YRC1000micro
  -within 100 mm from the front panel (air inlet) of the YRC1000micro


Power supply cable
120 mm
65 mm
Space for Horizontal Installation
Air
100 mm
65 mm
Air
120 mm
Top View
Air
Air
100 mm
120 mm
Left Side View
Front View
100 mm
Air
60mm
Power supply cable
120 mm
Air
60mm
Space for Vertical Installation
Top View
60mm
Front View
Air
Air
120 mm
100 mm
Right Side View

3.4 Installation Method

WARNING

- The length of the fixing screws for the YRC1000micro must be equal to or shorter than the thickness of the metal fitting + 5 mm.

If the length exceeds the above, the components inside the YRC1000micro may be damaged.

  – Required screw size: M5 (length: equal to or shorter than the thickness of the metal fitting + 5 mm or less)

  – Required screw material: mild steel or higher-strength material

- Fix all the 8 fixing points to install the YRC1000micro.
- The YRC1000micro is free-standing type. Avoid jarring, dropping, or hitting the YRC1000micro when installing it.

Failure to observe these cautions may result in personal injury or equipment damage.

- The YRC1000micro has an open structure (IP20) and must be used in an environment* that meets the standard of pollution degree 2 specified in IEC60664-1.
  Also, prevent chemicals, cutting oil including coolant, anti-rust oil, and organic solvent from adhering to the programming pendant (optional).

  *The environment must be clean with only a minimal amount of dirt and dust, and free from cutting oil, organic solvent, oil fume, water, or salt.
  In particular, there should be no electrically-conductive dirt and dust.

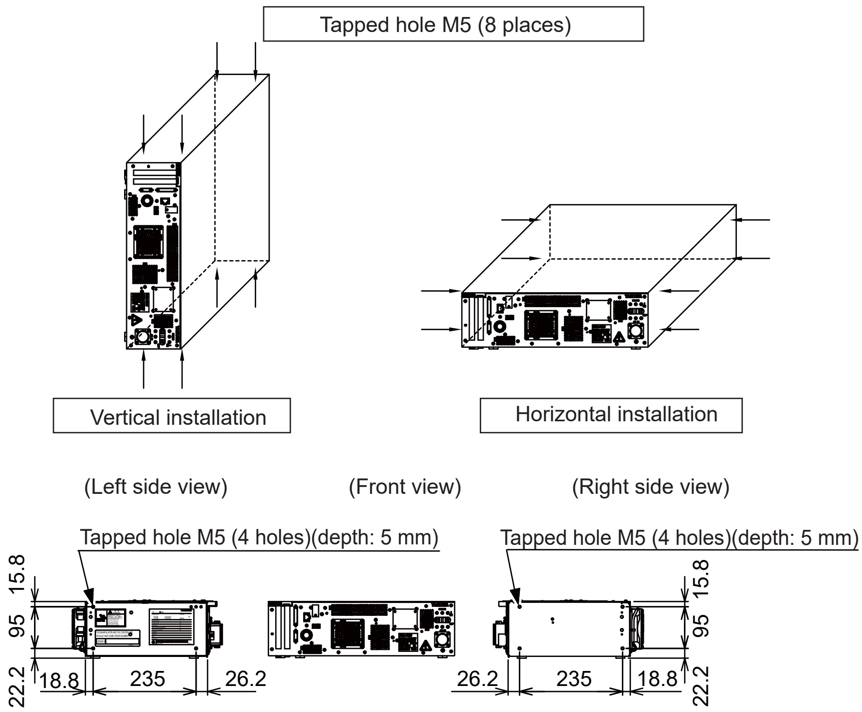
Failure to observe this caution may result in equipment damage.

- Do not get on top of the YRC1000micro.

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

■ Fixing Method

For the YRC1000micro in horizontal position, fix it to the rack by using the tapped holes on the right and left side of it.



4 Connection

WARNING

- Make sure to incorporate the robot system into the user's system which has lockout/tagout function.
  That is to say, supply one or more devices to turn OFF the power supply of the manipulator, servo track, and controller, and install them outside the enclosure in which the manipulator and servo track are installed. The devices must be able to be locked out and tagged out.

Turning the power ON improperly during work may result in electric shock or personal injury due to unexpected movement of the manipulator.

- The system must be grounded.

Failure to observe this instruction may result in fire and/or electric shock.
When the YRC1000micro equipped with the filter module is used and one phase of the three-phase power supply is grounded or one side of the single-phase power supply is grounded, leakage current may increase due to the characteristics of the noise filter, which may result in electric shock.

- Before wiring, make sure to turn OFF the primary power supply, and put up a warning sign. (e.g. DO NOT TURN THE POWER ON)

Failure to observe this warning may result in injury or electric shock.

- Do not remove the top panel of the YRC1000micro.

Failure to observe this warning may result in injury or electric shock.

- Any occurrence during wiring of the YRC1000micro emergency stop circuit is the user's responsibility. Do an operation check once the wiring is completed.

Failure to observe this warning may result in personal injury or mechanical failure.

- Wiring must be performed only by authorized personnel.

Incorrect wiring may result in fire or electric shock.

- Perform wiring in accordance with the rated capacity as specified in the Instructions.

Incorrect wiring may result in fire or mechanical failure.

- Do not handle the circuit board directly by hand.

The IC board may malfunction due to electrostatics.

NOTICE

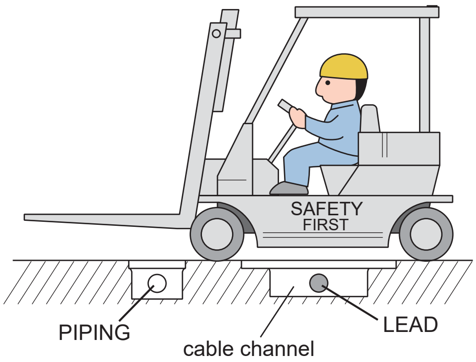
- Do not touch the circuit board directly by hand.

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 YRC1000micro. Another connects the YRC1000micro 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: YRC1000micro Cable Junction Diagram



4.2 Power Supply

4.2.1 Power Supply

NOTE

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

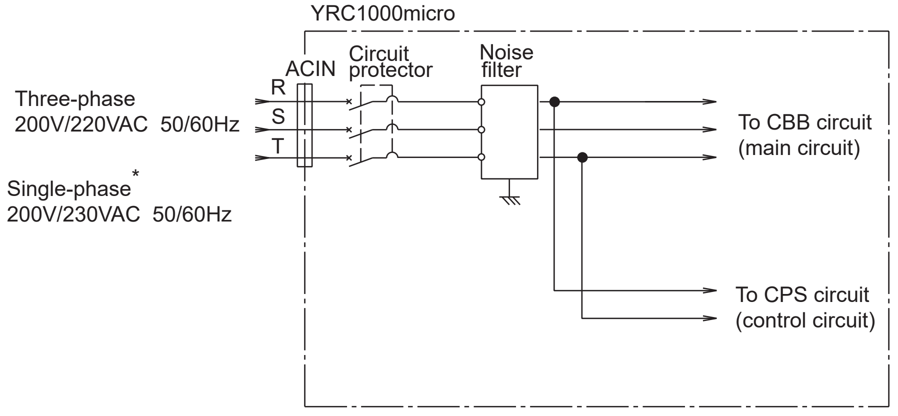
Connect the power supply to a stable power source that is not prone to power fluctuations.

The three-phase power supply comprising 200/220 VAC at 50/60 Hz is used.

The single-phase power supply comprising 200/230 VAC at 50/60 Hz can also be used for the following models:

- GP4, GP7, GP8, MotoMINI, HC10, HC10DT, HC10DTF, SG400, and SG650

Fig. 4-2: Input Power Connection



* Following models correspond single-phase
GP4, GP7, GP8, MotoMINI, HC10, HC10DT, HC10DTF, SG400, and SG650

WARNING

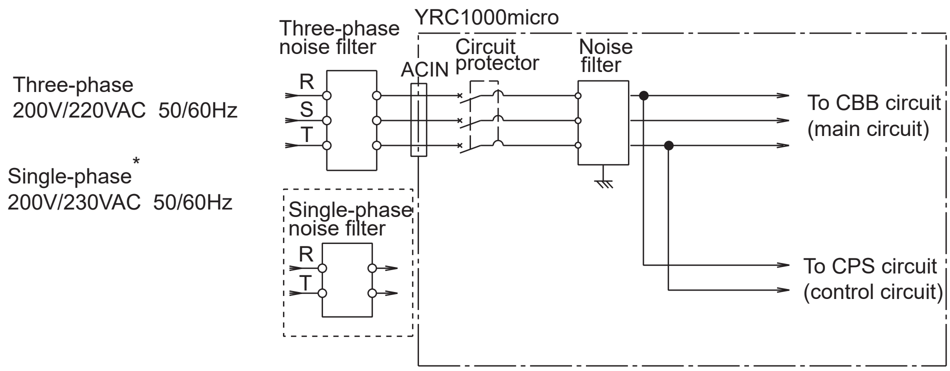
- The system must be grounded.

Failure to observe this instruction may result in fire and/or electric shock.
When the YRC1000micro equipped with the filter module is used and one phase of the three-phase power supply is grounded or one side of the single-phase power supply is grounded, leakage current may increase due to the characteristics of the noise filter, which may result in electric shock.

4.2.2 Noise Filter Installation

Insert the three-phase/single-phase noise filter into the primary station of the non-fuse breaker filter if noise coming from the power source is heard.

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



* Following models correspond single-phase
GP4, GP7, GP8, MotoMINI, HC10, HC10DT, HC10DTF, SG400, and SG650

⚠ WARNING

- The system must be grounded.

Failure to observe this instruction may result in fire and/or electric shock.
When the YRC1000micro equipped with the filter module is used and one phase of the three-phase power supply is grounded or one side of the single-phase power supply is grounded, leakage current may increase due to the characteristics of the noise filter, which may result in electric shock.

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 YRC1000micro inverter. Leakage breakers which cannot handle high frequencies may malfunction.

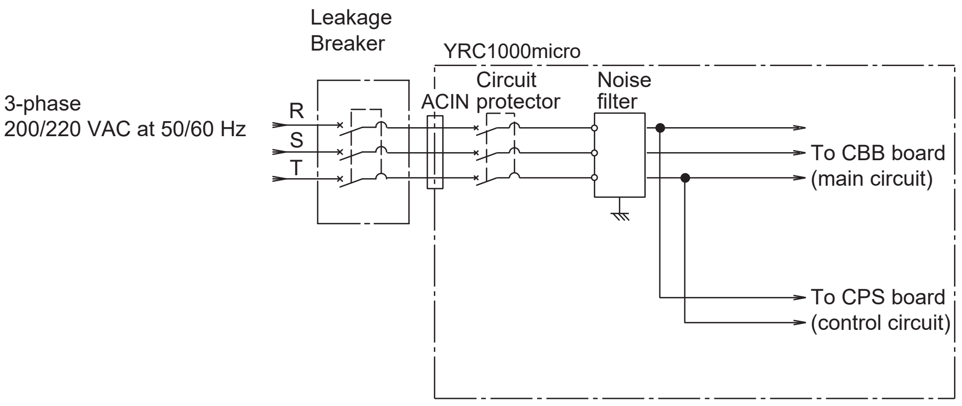
Table 4-1: Example of High Frequency Leakage Breaker

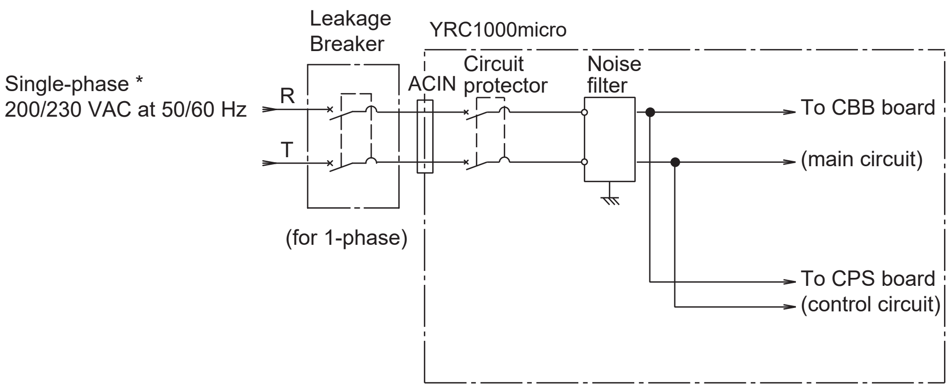
Maker	Model
Mitsubishi Electric Co., Ltd.	NV class (manufactured in 1988 or later)
Fuji Electric Co., Ltd.	EG, SG Series (manufactured in1984 or later)

In order to avoid malfunction, select a leakage breaker with a sensitivity current of 30 mA or more.

Even with a leakage breaker installed, there is still a possibility of some high frequency current leakage from the YRC1000micro inverter. However, this current leakage presents no safety risks.

Fig. 4-4: Connection of the Leakage Breaker





* Following models correspond single-phase
GP4, GP7, GP8, MotoMINI, HC10, HC10DT, HC10DTF, SG400, and SG650

4.2.4 Primary Power Supply Breaker Installation

Install the primary power supply breaker as shown below.

Install the breaker in a range of 0.6 m to 1.9 m or less from the work surface for easy operation.

WARNING

- Make sure to incorporate the robot system into the user's system which has lockout/tagout function.
  That is to say, supply one or more devices to turn OFF the power supply of the manipulator, servo track, and controller, and install them outside the enclosure in which the manipulator and servo track are installed. The devices must be able to be locked out and tagged out.
- When using in North America, use a circuit breaker/disconnect switch, etc. that conforms to UL489 and has a rated breaking capacity of 20 A or less.

Turning the power ON improperly during work may result in electric shock or personal injury due to unexpected movement of the manipulator.

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

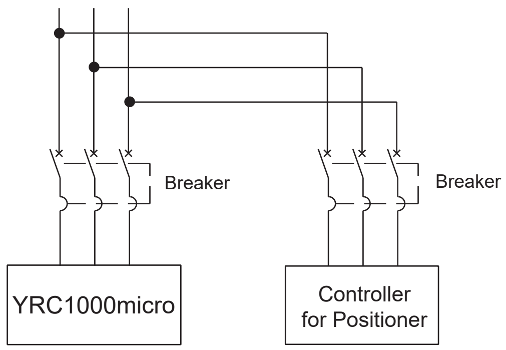


Table 4-2: YRC1000micro Circuit protector Capacity and Cable Size

YRC1000micro type	Capacity of circuit protector (A)	Cable size (size of terminal) (In case of Cabtyre cable (three cores)) (mm²)	Major manipulator type	Power capacity (kVA)
ERBR-100-06VX05-A0☐	16	3.5 (AWG12)	MotoMINI	0.5
ERBR-100-06VX8-A0☐	16	3.5 (AWG12)	GP4, GP7, GP8	1.0
ERBR-100-04SX650-A0☐	16	3.5 (AWG12)	SG400, SG650	1.0
ERBR-100-06VXH12-A0☐	16	3.5 (AWG12)	GP12	1.5

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 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.

SUPPLE-MENT

- 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.
- The power capacity of the manipulator which is not shown in the table above, refer to the table 5-1 “Basic Specifications” of Chapter 5 in the INSTRUCTIONS for the manipulator.

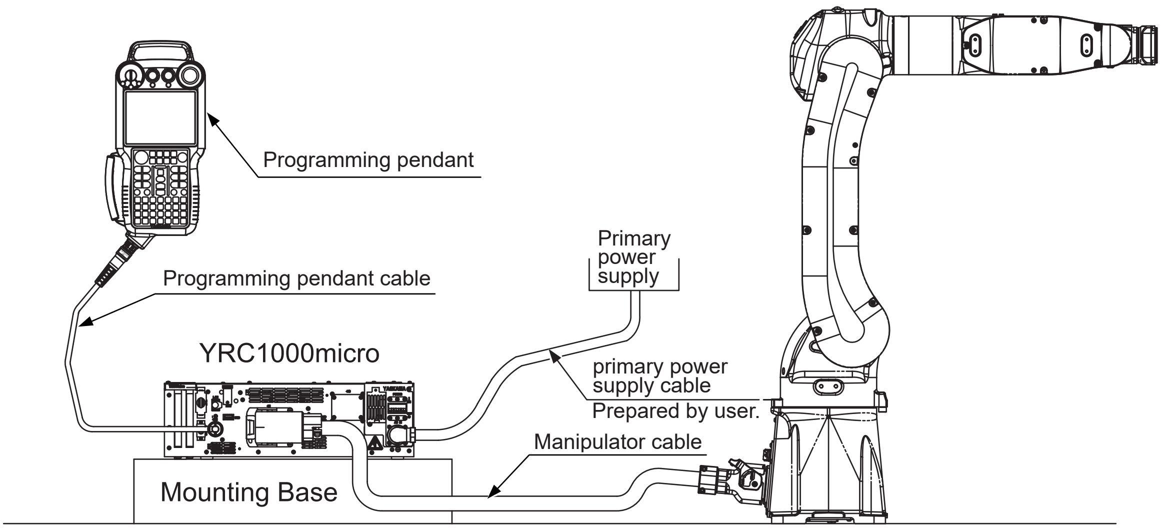
4.3 Connection Methods

A connection diagram between the manipulator and the YRC1000micro (manipulator cable), the primary power supply and the YRC1000micro (primary power supply cable), and between the YRC1000micro and the programming pendant (programming pendant cable) are shown below.

Please be noted that the programming pendant and the programming pendant cable are optional.

For their connection methods, refer to the following.

Fig. 4-6: Cable Connection



4.3.1 Connecting the Primary Power Supply

■ Power Cable Connection

1. Prepare the primary power supply cable by using the manipulator cable using the primary power supply-side connector delivered with the YRC1000micro.
   Refer to *table 4-3(a) "For Three-Phase Power Supply (ACIN)"* and *table 4-3(b) "For Single-Phase Power Supply (ACIN) (Only for GP4, GP7, GP8, MotoMINI, HC10, HC10DT, HC10DTF, SG400, and SG650)"* for the pin assignment of the YRC1000micro.

   Model of YRC1000micro Power Supply Connector (ACIN)
   • YRC1000micro-side connector: CE05-2A18-10PD-D
   • Primary power supply-side connector: CE05-8A18-10SD-D-BAS(R1)
   Manufactured by DDK
   (the supplied part of the YRC1000micro)
   When mounting the YRC1000micro vertically, prepare a straight type connector.

Fig. 4-7: Power Supply Connector (ACIN)

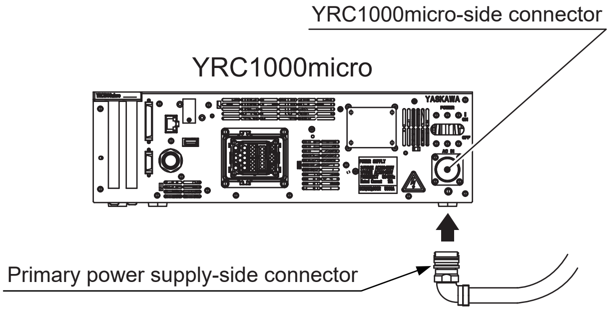


Table 4-3(a): For Three-Phase Power Supply (ACIN)

Pin No.	Signal Name	Description
A	L1	AC input (L1/R-phase)
B	L2	AC input (L2/S-phase)
C	L3	AC input (L3/T-phase)
D	P.E.	Protective grounding

Table 4-3(b): For Single-Phase Power Supply (ACIN) (Only for GP4, GP7, GP8, MotoMINI, HC10, HC10DT, HC10DTF, SG400, and SG650)

Pin No.	Signal Name	Description
A	L1	AC input (L1/R-phase)
B	N.C.	Not available
C	L3	AC input (L3/T-phase)
D	P.E.	Protective grounding

2. Confirm that the circuit protector of the YRC1000micro is turned OFF.
3. Confirm that the primary power supply is turned OFF.
4. Connect the primary power supply cable.

DANGER

- Before wiring the cable, make sure the primary power supply is turned OFF.
- Make sure to use the supplied connector for the primary power supply connection.
- Tighten the cable clamp to prevent the cable from breaking.

Failure to observe these cautions may result in electric shock or equipment failure.

(1) Grounding method:

– Perform grounding as countermeasures against noise and electric shock.
Grounding should be TT or TN in accordance with the wiring regulations of each country and the power supply system used.

– Follow the steps below:

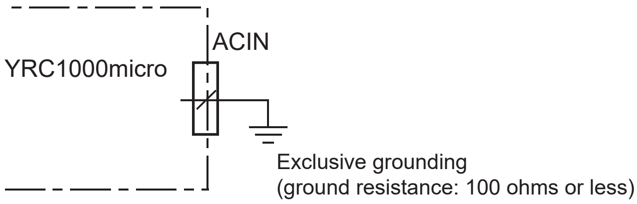
I) Connect the ground wire to the D terminal of the YRC1000micro power connector (ACIN).

II) Perform grounding in accordance with all relevant local and national electrical codes. The size of ground wire must the same as listed on *table 4-2 "YRC1000micro Circuit protector Capacity and Cable Size"* .

NOTE

The ground wire must be supplied by the user.

Fig. 4-8: Exclusive Grounding



> **NOTE**
>
> Do not connect the ground wire with the wires for the electric power source, the welder, etc.
>
> If using metallic ducts, metallic conduits, or cable trays for cabling, perform grounding in accordance with all relevant governmental regulations.

4.3.2 Connecting the Manipulator Cable

WARNING

- Before wiring the manipulator cable, make sure the primary power supply is turned OFF.
- Before remove the manipulator cable, make sure the primary power supply is turned OFF.

Failure to observe this instruction may result in electric shock and/or mechanical failure.

1. Remove the package, and take out the manipulator cable. Connect the cable to the connector on the back side of YRC1000micro.

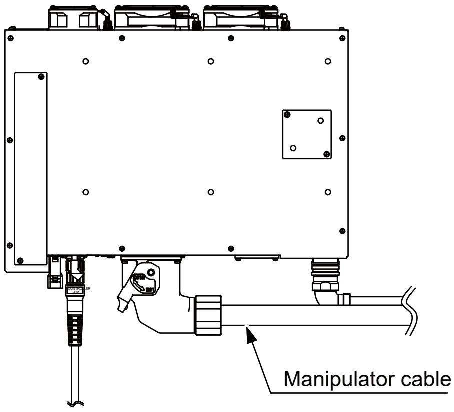
   (1) Confirm that the connector lever of manipulator cable is at the initial position. Then insert the manipulator cable straight into the connector on the front side of the YRC1000micro. (The connector is connected in the state that it is turned 90 degrees to the left.)

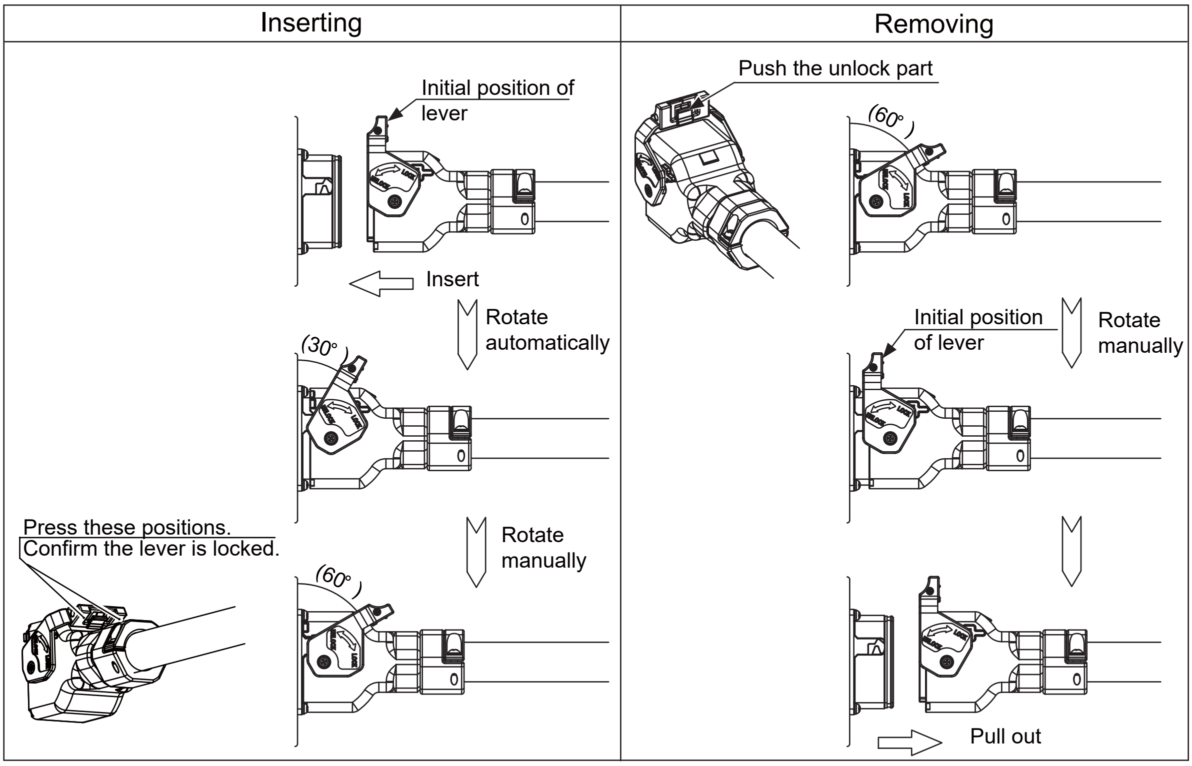
   – Insert the manipulator cable to a fixed depth, then the lever rotate about 30 degrees forward automatically.

   (2) Push the lever with the 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. 4-9: Connection of the Manipulator Cable





2. Connect the manipulator cable to the YRC1000micro.
   – Confirm the connector number of manipulator cable. Push the cable connector into the manipulator side connector firmly, and then tighten it securely.

WARNING

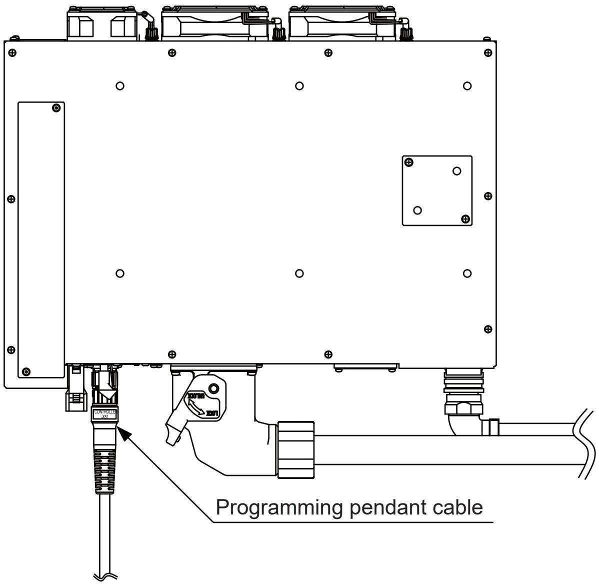
- The top panel of the YRC1000micro should be kept closed unless, its optional board is added or replaced.

Failure to observe this warning may result in electric shock or mechanical failure.

4.3.3 Connecting Programming Pendant (Optional)

1. Connect the programming pendant cable to the connector connection (-X81) on the front panel of the YRC1000micro.

Fig. 4-10: Connection of Programming Pendant Cables



The manipulator, YRC1000micro, and programming pendant connections are now complete.

NOTE

If the programming pendant is not used, connect the programming pendant safety signal short circuit connector to the connector connection (-X81).

DANGER

- When the programming pendant is not used, store it properly. Be sure that it is visually clear that the programming pendant is not connected to the YRC1000micro (e.g. store it a separate place from the YRC1000micro and manipulator).

If it is not clear that the programming pendant is disconnected from the YRC1000micro, an operator may press the emergency button of the programming pendant in an emergency to stop the manipulator.
This may result in personal injury and/or damage to the equipment because the manipulator will not stop.

Table 4-4: Specifications of Programming Pendant Cable

Outside diameter (mm)	Minimum bending radius (mm) (fixed part)
9.0 dia.	60

5 Turning ON and OFF the Power Supply

5.1 Turning ON the Main Power Supply

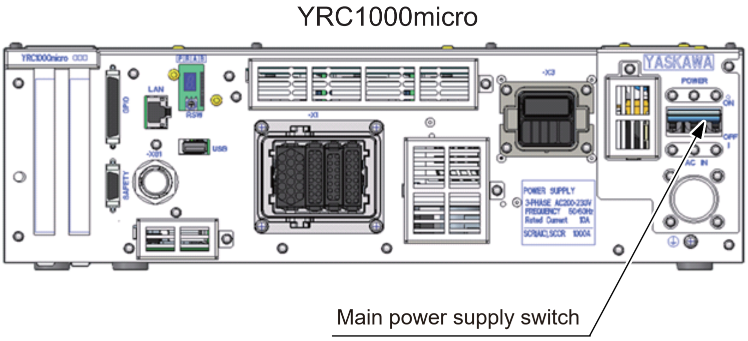
WARNING

- When turning ON the YRC1000micro 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 button is located on the upper right of the programming pendant.

The main power supply is turned ON when the main power supply switch of the YRC1000micro is turned to "ON" position, and then the initial diagnosis are performed in the YRC1000micro and the startup window is shown on the programming pendant screen.

Fig. 5-1: Main Power Supply



5.1.1 Initial Diagnosis

The initial diagnosis are performed in the YRC1000micro when main power is turned ON, and the startup window is shown on the programming pendant screen.

Fig. 5-2: Startup Window

NOTE

The start-up window on the programming pendant may change without any notification.

5.1.2 When Initial Diagnosis Are Complete

When the power supply is turned OFF, the YRC1000micro saves all condition data, including:

- Mode of operation
- Called job (active job if the YRC1000micro is in the play mode; edit job if the YRC1000micro 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.

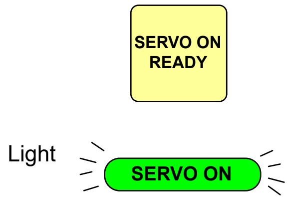
Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.

5.2 Turning ON the Servo Power

5.2.1 During Play Mode

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

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



NOTE

When the safety fence is open, the servo power supply cannot be turned ON.

5.2.2 Play Mode Enable Function

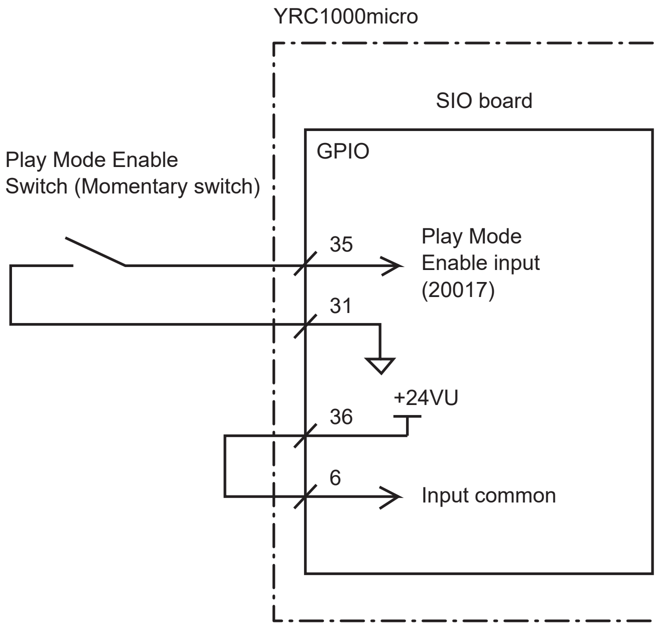
The Play Mode Enable is the confirmation function that enables the play mode. The operation mode can be changed from the teach mode to the play mode by changing the setting of the mode switch of the programming pendant from “TEACH” to “PLAY” first and inputting the play mode enable signal.

This function is available for YBS2.33.00A-00 or later.

5.2.2.1 Preparation of Switch

Install an external device (switch, etc.) used to input the play mode enable signal outside the safety fence and connect the device to the YRC1000micro so that the operator can change the operation mode to the play mode after moving to the outside of the safety fence. Prepare the external device by the user.

Fig. 5-4: Play Mode Enable Switch Connection Example



NOTE

Fig. 5-4 “Play Mode Enable Switch Connection Example” shows a connection example for the standard concurrent I/O (factory setting). If the customer needs to change the concurrent I/O setting, set the system input signal #40053 to turn ON when the Play Mode Enable switch is turned ON.

<Concurrent I/O setting example>
STR #2xxxx (input signal that connects the Play Mode Enable switch)
OUT #40053 (system input signal for Play Mode Enable)

SUPPLE-MENT

For details of connector connections, refer to *chapter 14.1.2 “Connection of GP I/O”* .

5.2.2.2 Settings

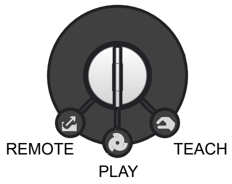
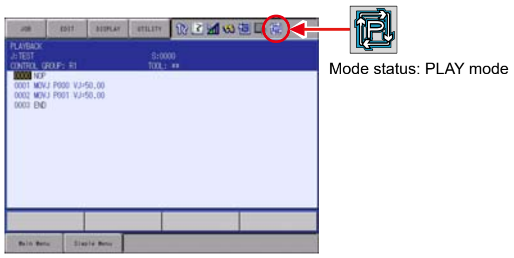
The play mode enable signal is disabled at factory setting. Set the parameter to enable the signal.

S2C1903: Play mode enable setting
0: Disable (factory setting)
1: Enable

Set S2C1903 to "1" and restart the YRC1000micro to enable the Play Mode Enable function.

5.2.2.3 Procedures for Operation Mode Change

■ Change of Operation Mode to PLAY Mode

	Operation	**Explanation**
1	Set the mode switch on the programming pendant to “PLAY”.  	The message “Input PLAY MODE ENABLE signal” is shown on the message area located bottom right of the programming pendant screen. The same message is also shown on the message area located bottom right of the programming pendant screen when the mode switch is set to “REMOTE”.
2	Press the Play Mode Enable switch (prepared by the customer) outside the safety fence.	The operation mode is changed to the play mode. The mode status icon located up right of the programming pendant screen changes to PLAY mode icon as shown below. 

WARNING

When the safeguarding interlock signal is opened (e.g., when the safety door is opened) during automatic operation, the manipulator stops in Category 1. To resume automatic operation, be sure to close the safeguarding interlock signal and then input the play mode enable signal. When resuming automatic operation by inputting the play mode enable signal, make sure that no operator is in the hazardous area.

Failure to perform these interlocking procedures may unintentionally restart automatic operations even if workers are present in the hazardous area, which may cause injury or damage to equipment.

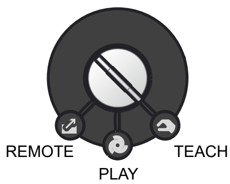
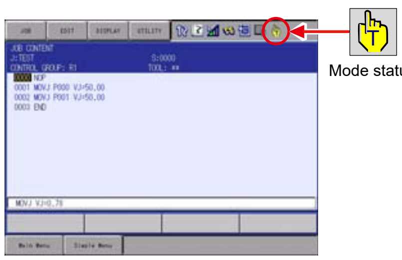
NOTE

Automatic operation will not resume, even if the safeguarding interlock signal is closed after the play mode enable signal is input.

NOTE

While the message “Input PLAY MODE ENABLE signal” is displayed on the message area of the programming pendant, the programming pendant cannot be operated. The programming pendant becomes operable when it receives the play mode enable signal.

■ Change of Operation Mode to TEACH Mode

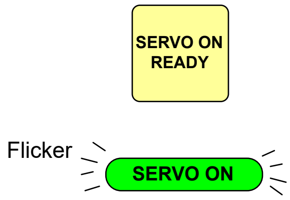
	Operation	Explanation
1	Set the mode switch on the programming pendant to “TEACH”. 	The operation mode is changed to the teach mode. The mode status icon located up right of the programming pendant screen changes to TEACH mode icon as shown below. 

NOTE

A system integrator or user shall perform a risk assessment of the system to determine whether or not to use the Play Mode Enable function.

5.2.3 During Teach Mode

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



2. The servo power is turned ON and [SERVO ON] lamp on the programming pendant lights 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.

SUPPLE-MENT

Servo Power ON/OFF --- Enable Switch

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

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

NOTE

When performing emergency stop using the 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 robot system are switched to valid or invalid depending on its operation mode. Particularly in teach mode, be aware that the safety plug signal input becomes invalid, and then perform the operation with great caution.

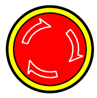
Operation Mode / Safety Signal	Teach Mode	Play Mode
External Emergency Stop (EXESP)	Valid	Valid
Programming Pendant Emergency Stop (PPESP)	Valid	Valid
Safety Fence (Safety plug)	Invalid	Valid
Programming Pendant Enable SW (PPDSW)	Valid	Invalid
Protected stop signal (ONEN)	Valid	Valid
Manipulator Overrun (OT)	Valid	Valid
Speed Limit	Valid	Invalid

5.3 Turning OFF the Power Supply

5.3.1 Turning OFF the Servo Power (Emergency Stop)

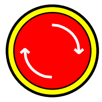
The manipulator cannot be operated when the emergency stop button is pressed and the servo power supply is turned OFF.

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



Programming Pendant

EMERGENCY STOP



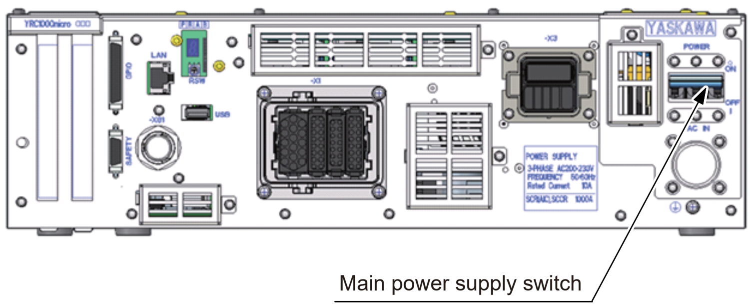
Door upper side

5.3.2 Turning OFF the Main Power

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

- When the main power switch of the YRC1000micro is turned to "OFF" position, the main power is turned OFF.

YRC1000micro



> **NOTE**
>
> When an hour glass pointer is appearing on the programming pendant screen, the data writing is in process.
>
> If turn the YRC1000micro 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 YRC1000micro 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.

Signal	Method of Stopping Manipulator Operation	
	Teach Mode	Play Mode
External Emergency Stop (EXESP)	Stop Category 0	Stop Category 1
Programming Pendant Emergency Stop (PPESP)	Stop Category 0	Stop Category 1
Safety Fence (Safety Plug) (SAFF)	—	Stop Category 1
Programming Pendant Enable Switch (PPDSW)	Stop Category 0	—
Protection Stop Signal (ONEN)	Stop Category 0	Stop Category 0
Manipulator Overrun (OT)	Stop Category 0	Stop Category 0
Programming Pendant (HOLD)	Stop Category 2	Stop Category 2

- : Invalid

Mode Change	Method of Stopping Manipulator Operation
Teach mode to play mode	Stop Category 0
Play mode to teach mode	Stop Category 1

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 button on the programming pendant or 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.

- 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 YRC1000micro 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 button is located on the upper right of the programming pendant.

DANGER

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety).
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

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.
- Return the programming pendant to a safe place 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.

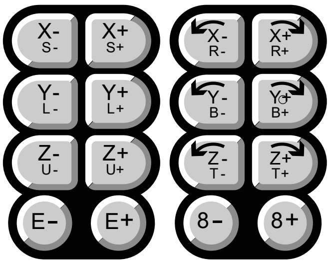
Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.

6.1 Movement of the Axes

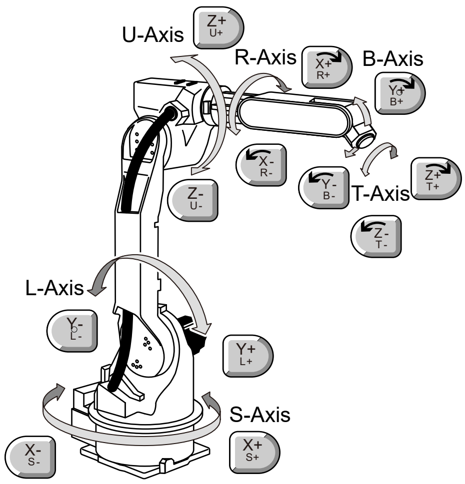
Move each axis of the manipulator by pressing the axis keys on the programming pendant.

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

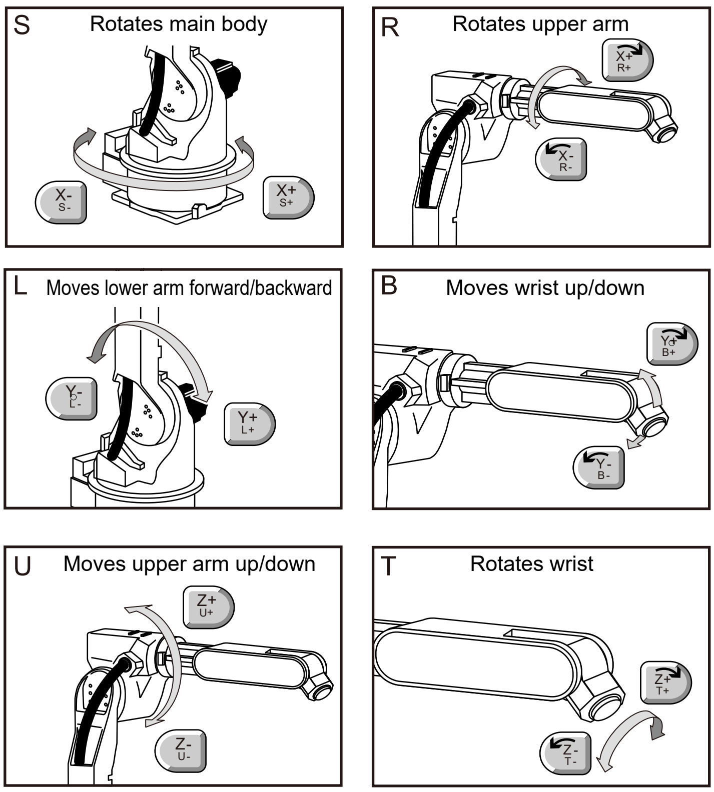
> **NOTE**
> Be sure to remove all items from the area before moving the manipulator.
> For details on the appropriate position of the fixture, the INSTRUCTIONS for the manipulator.



Axis Keys



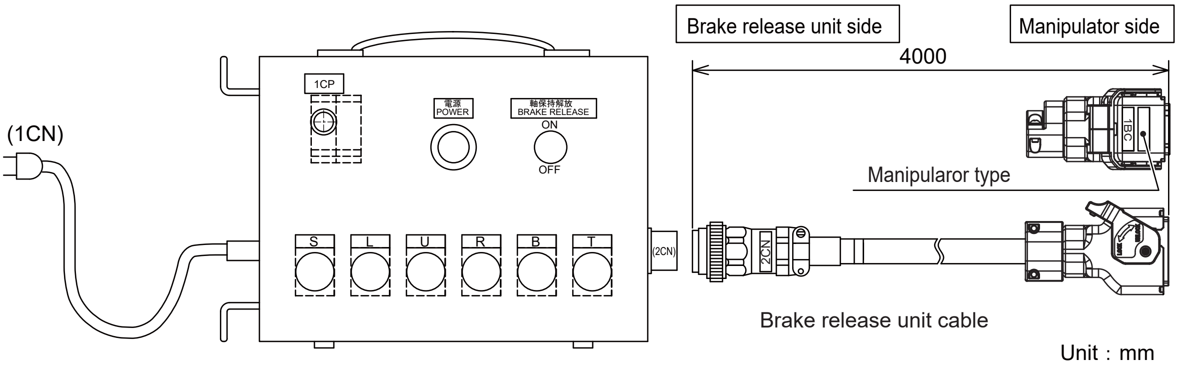
6-axis robot



6.2 Manual Brake Release Function

When the manipulator moves to unexpected places because of system or operation errors and the operation can not 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 can not be executed from the YRC1000micro 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.

System Up

7 Security System

7.1 Protection Through Security Mode Settings

The YRC1000micro modes setting are protected by a security system. The system allows the operation and the modification of settings depending on the level of the operator. Fully understand the operator's level to perform the proper operation and management.

7.1.1 Security Mode

There are five security modes "operation mode, editing mode, management mode, safety mode and one time manage mode". For the editing mode, management mode and safety mode, a user ID is required. For the editing mode and the management mode, the user ID must be 4 or more and 16 or less characters with number(s) and symbol(s). As for the safety mode, it must 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 your YASKAWA representative.

Table 7-1: Security Mode Descriptions

Security Mode	Explanation
Operation Mode	This mode allows basic operation of the robot (stopping, starting, etc.) for people operating the robot work on the line.
Editing Mode	This mode allows the operator to teach and edit jobs and robot settings.
Management Mode	This mode allows those authorized to set up and maintain robot system: parameters, system time and modifying user IDs.
Safety Mode	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 "YRC1000micro OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY FUNCTION (HW1484544)" for more details.
One Time Manage Mode	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.

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

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
JOB	JOB	Operation	Edit
	SELECT JOB	Operation	Operation
	CREATE NEW JOB[1)]	Edit	Edit
	MASTER JOB	Operation	Edit
	JOB CAPACITY	Operation	-
	RES. START (JOB)[1)]	Edit	Edit
	RES. STATUS[2)]	Operation	-
	CYCLE	Operation	Operation
	TRASH JOB LIST[3)]	Edit	Edit
	JOB EDIT (PLAY)	Edit	Edit
	PLAY EDIT JOB LIST	Edit	Edit
VARIABLE	BYTE	Operation	Edit
	INTEGER	Operation	Edit
	DOUBLE	Operation	Edit
	REAL	Operation	Edit
	STRING	Operation	Edit
	POSITION (ROBOT)	Operation	Edit
	POSITION (BASE)	Operation	Edit
	POSITION (ST)	Operation	Edit
	LOCAL VARIABLE	Operation	-
	FLAG	Operation	Edit
IN/OUT	EXTERNAL INPUT	Operation	Edit
	EXTERNAL OUTPUT	Operation	Edit
	GENERAL PURPOSE INPUT	Operation	Operation
	GENERAL PURPOSE OUTPUT	Operation	Operation
	SYSTEM INPUT	Operation	-
	SYSTEM OUTPUT	Operation	-
	RIN	Operation	-
	CPRIN	Operation	-
	REGISTER	Operation	Management
	AUXILIARY RELAY	Operation	-
	CONTROL INPUT	Operation	-
	PSEUDO INPUT SIG	Operation	Management
	NETWORK INPUT	Operation	-
	NETWORK OUTPUT	Operation	-
	ANALOG OUTPUT	Operation	-
	SV POWER STATUS	Operation	-
	LADDER PROGRAM	Management	Management
	I/O ALARM	Management	Management
	I/O MESSAGE	Management	Management
	TERMINAL	Operation	Edit
	I/O SIMULATION LIST	Management	Management
	SERVO ON FACTOR	Management	-
	SERVO OFF MONITOR	Operation	-

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

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
ROBOT	CURRENT POSITION	Operation	-
	COMMAND POSITION	Operation	-
	SERVO MONITOR	Management	-
	WORK HOME POS	Operation	Edit
	SECOND HOME POS	Operation	Edit
	DROP AMOUNT	Management	Management
	POWER ON/OFF POS	Operation	-
	TOOL	Edit	Edit
	INTERFERENCE	Management	Management
	SHOCK SENS LEVEL	Operation	Edit
	USER COORDINATE	Edit	Edit
	HOME POSITION	Management	Management
	MANIPULATOR TYPE	Management	-
	ANALOG MONITOR	Management	Management
	OVERRUN&S-SENSOR[1)]	Operation	Operation
	LIMIT RELEASE[1)]	Edit	Edit
	ARM CONTROL[1)]	Management	Management
	SHIFT VALUE	Operation	-
	SOFTLIMIT SETTING	Management	Management
	SHOCK SEN LV.(CURRENT)	Operation	-
SYSTEM INFO	VERSION	Operation	-
	MONITORING TIME	Operation	Management
	ALARM HISTORY	Operation	Management
	I/O MSG HISTORY	Operation	Management
	USER DEFINITION MENU	Operation	Edit
	SECURITY	Operation	Operation
	CPU RESET	Operation	Edit
EX.MEMORY	LOAD	Edit	-
	SAVE	Operation	-
	VERIFY	Operation	-
	DELETE	Operation	-
	DEVICE	Operation	Operation
	FOLDER	Operation	Management
	INITIALIZE[1)]	Operation	-

Table 7-2: Menu & Security Mode (Sheet 3 of 4)

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
PARAMETER	S1CxG	Management	Management
	S2C	Management	Management
	S3C	Management	Management
	S4C	Management	Management
	A1P	Management	Management
	A2P	Management	Management
	A3P	Management	Management
	A4P	Management	Management
	A5P	Management	Management
	A6P	Management	Management
	A7P	Management	Management
	A8P	Management	Management
	RS	Management	Management
	S1E	Management	Management
	S2E	Management	Management
	S3E	Management	Management
	S4E	Management	Management
	S5E	Management	Management
	S6E	Management	Management
	S7E	Management	Management
	S8E	Management	Management
SETUP	TEACHING COND.	Edit	Edit
	OPERATE COND.	Management	Management
	OPERATE ENABLE	Management	Management
	FUNCTION ENABLE	Management	Management
	JOG COND.	Management	Management
	PLAYBACK COND.	Management	Management
	FUNCTION COND.	Management	Management
	DISPLAY COLOR COND.	Edit	Edit
	DATE/TIME	Management	Management
	GRP COMBINATION[2)]	Management	Management
	SET WORD	Edit	Edit
	RESERVE JOB NAME	Edit	Edit
	USER ID	Edit	Edit
	SET SPEED	Management	Management
	KEY ALLOCATION	Management	Management
	JOG KEY ALLOC.	Edit	Management
	RES. START (CNCT)	Management	Management
	AUTO BACK SET	Management	Management
	WRONG DATA LOG	Edit	Management
	ENERGY SAVING FUNCTION	Edit	Management
	ENCODER MAINTENANCE	Edit	Management
SAFETY FUNC.	M-SAFETY SIGNAL ALLOC	Operation	Management
	TIMER DELAY SET	Operation	Management
	SAFETY LOGIC CIRCUIT	Operation	Management
PM	PM (REDUCER)	Operation	Management
	INSPECTION RECORD	Operation	Management
	OPERATING STATUS	Operation	Edit
	JOB MONITOR	Operation	Edit
	STEP DIAGNOSIS	Operation	Edit
	ROBOT MONITOR	Operation	Edit

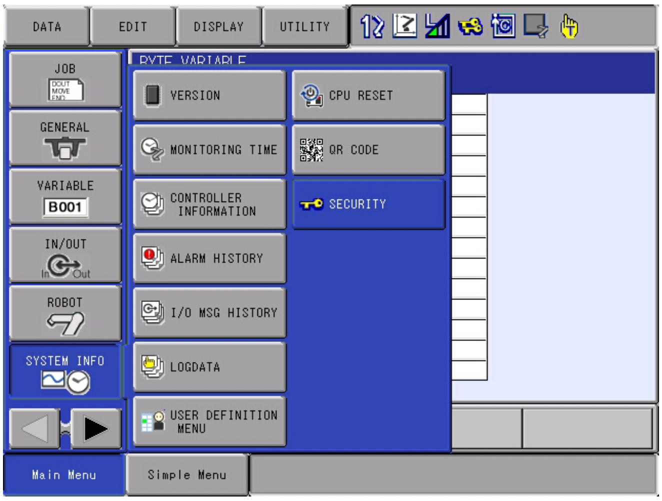
Table 7-2: Menu & Security Mode (Sheet 4 of 4)

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	**EDIT**
DISPLAY SETUP	CHANGE FONT	Operation	Operation
	CHANGE BUTTON	Operation	Operation
	INITIALIZE LAYOUT	Operation	Operation
	CHANGE WINDOW PATTERN	Operation	Operation
	TOUCH OPE. SETTING	Operation	Operation
GENERAL	WEAVING	Operation	Edit
	GENERAL DIAG.	Operation	Edit
COMMON TO ALL APPLICATIONS	I/O VARIABLE CUSTOMIZE	Operation	Operation

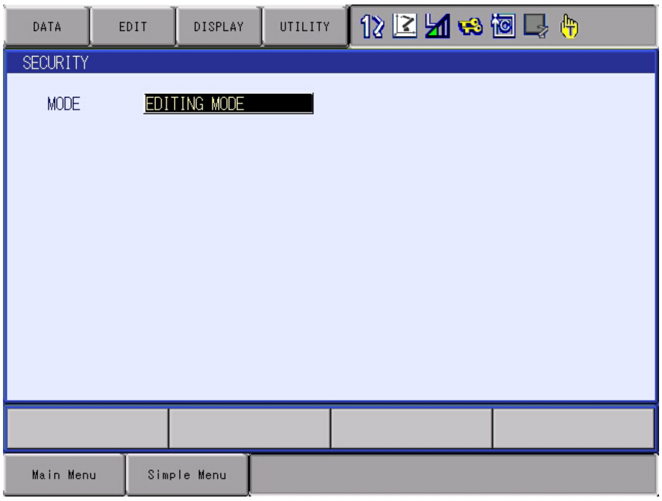
1 Displayed in the teach mode only.
2 Displayed in the play mode only.
3 Displayed when the job reconstruction function is valid.
*As for the menu and the security mode when the functional safety is valid, refer to "YRC1000micro OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY FUNCTION (HW1484544)" for more details.

7.1.1.1 Changing the Security Mode

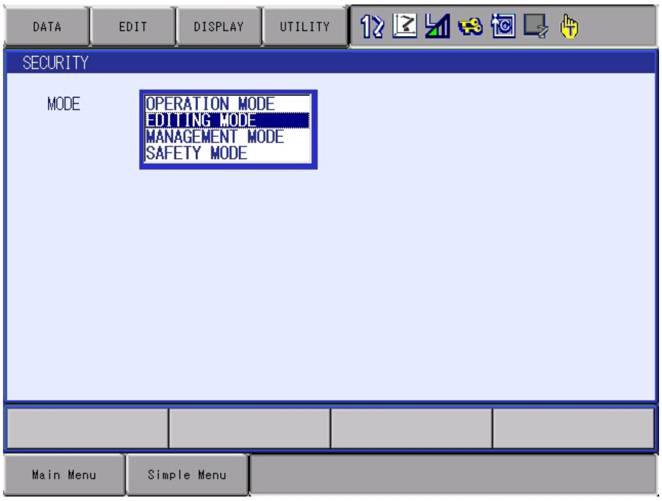
1. Select {SYSTEM INFO} under the main menu.
   – The sub menu appears.



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

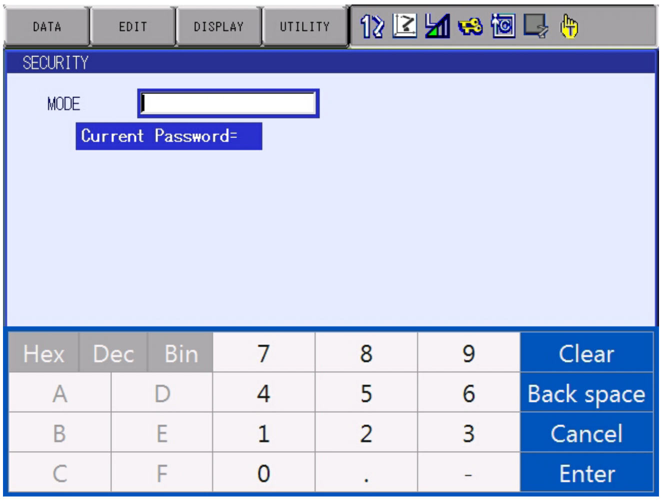


– Security mode can be selected from “OPERATION MODE”, “EDITING MODE”, “MANAGEMENT MODE” or “SAFETY MODE”.



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.

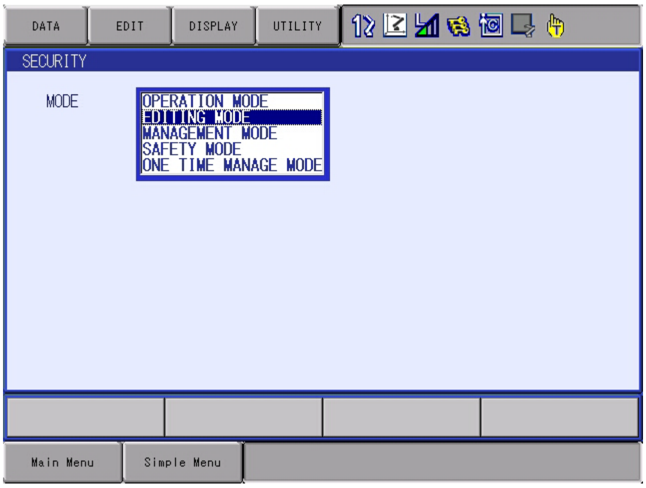
   – The following user ID numbers are set as default.
   Editing Mode: [0000000000000000]
   Management Mode: [9999999999999999]
   Safety Mode: [5555555555555555]

5. Press [ENTER].

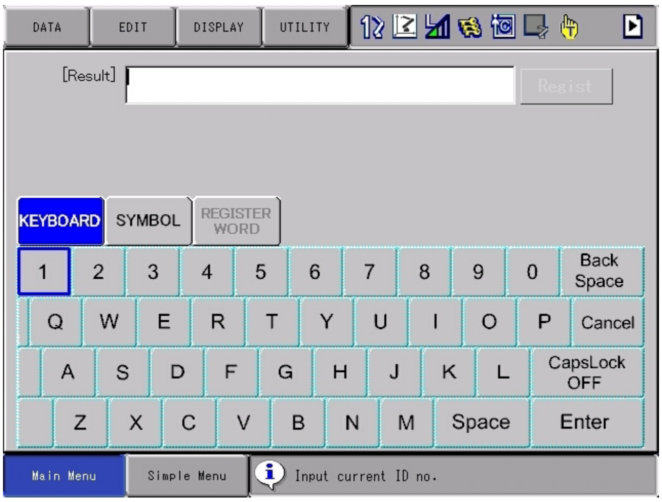
   – If the password is correct, the security mode will be changed.

■ 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”.



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



7.1.2 User ID

User ID is required for the operation of the editing mode, the management mode or the safety mode.

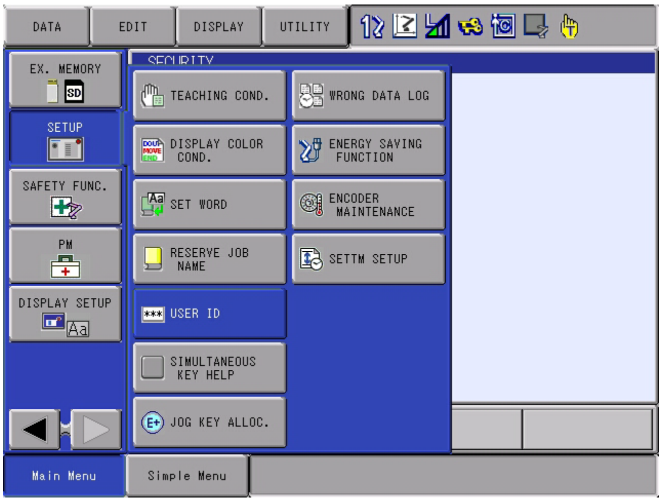
For the editing mode and the management mode, the user ID consists of 4 or more and 16 or less characters which are number(s) and symbol(s). For the safety mode, the user ID consists of 9 or more and 16 or less characters which are number(s) and symbol(s).

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

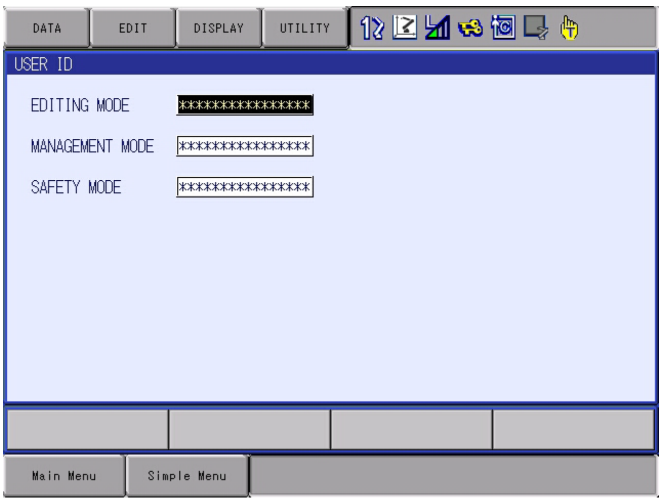
7.1.2.1 Changing a User ID

The user ID can be modified only in the editing mode, management mode or safety mode. Higher security modes can modify the user ID of lower security modes.

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

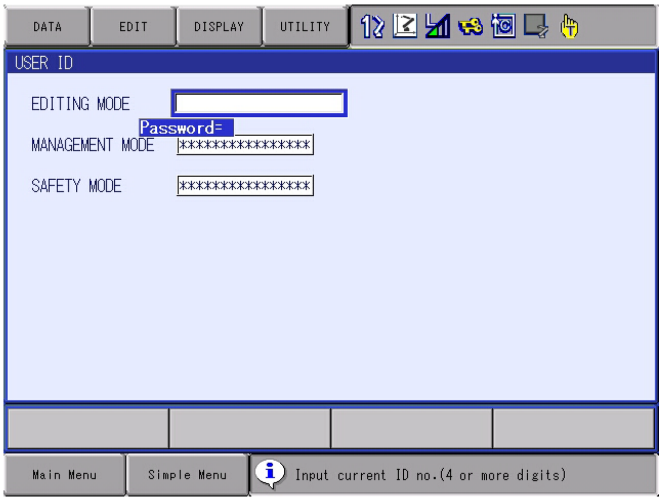


2. Select {USER ID}.
   – The USER ID window appears.



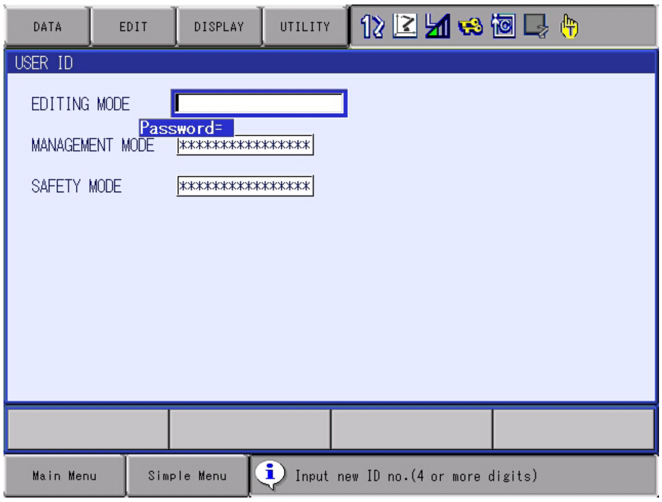
3. Select the desired ID.

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



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].

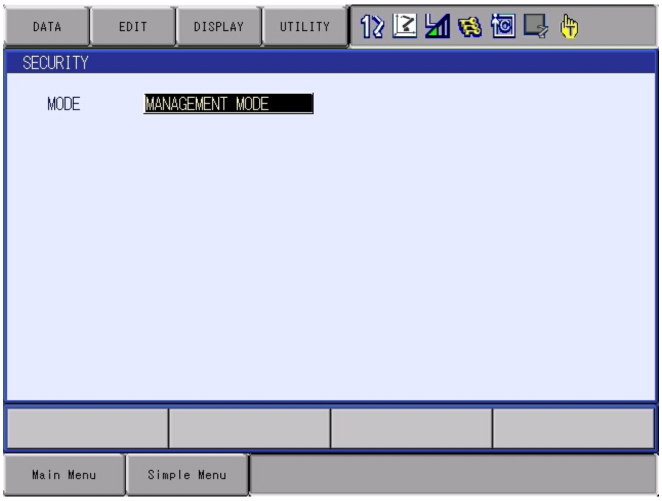
   – User ID is changed.

7.1.3 Main CPU SD Card ID

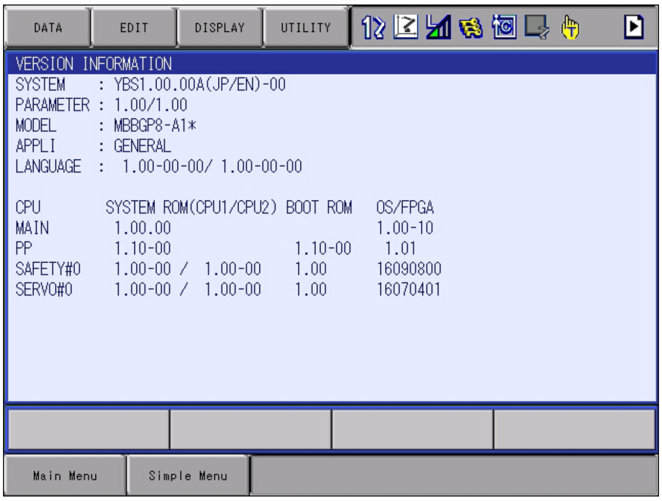
This section explains about the display of the Main CPU SD Card ID.

The main CPU SD Card ID is necessary to issue the one time security code.

1. Change the security mode to the management mode.

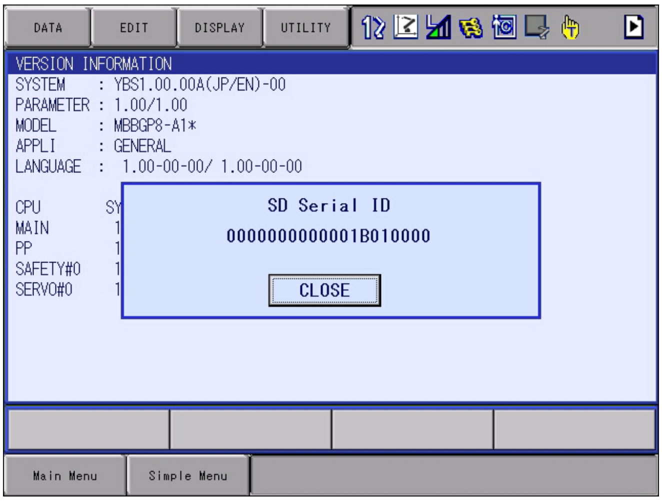


2. Select {SYSTEM INFO} in the main menu.
   – The sub menu appears.
3. Select {VERSION}.
   – VERSION window appears.



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.



8 System Setup

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 button on the programming pendant or 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.

- 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 YRC1000micro 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 button is located on the upper right of the programming pendant.

DANGER

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety).
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

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.
- Return the programming pendant to a safe place 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.

8.1.1 Home Position Calibration

NOTE

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

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

- Change the combination of the manipulator and YRC1000micro
- Replacement of the motor or absolute encoder
- Stored memory is cleaned. (by 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.

SUPPLE-MENT

Home Position

The home position is the position in which the pulse value is “0” for each axis and the posture at the position is the home position posture. See *chapter 8.1.3 “Home Position Posture of Manipulator”* .

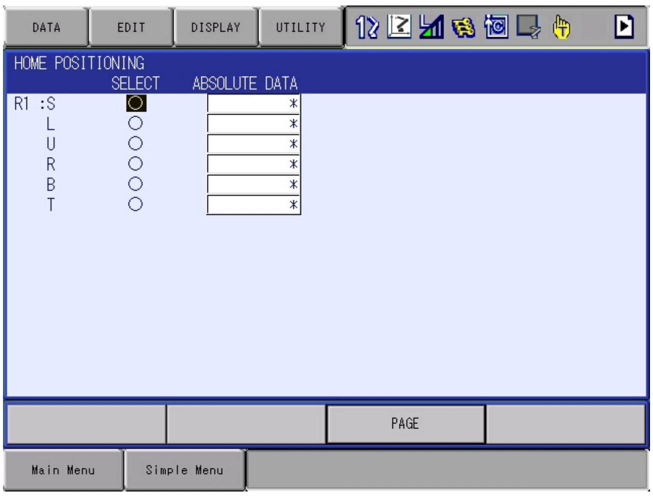
8.1.2 Calibrating Operation

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

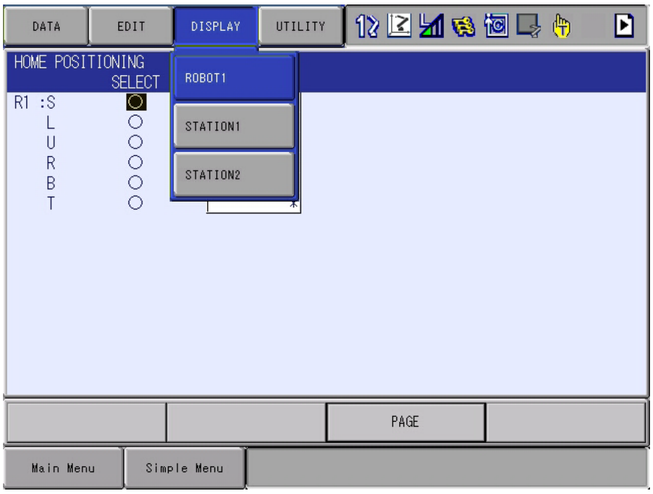
1. Select {ROBOT} under the main menu.
   – The sub menu appears

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

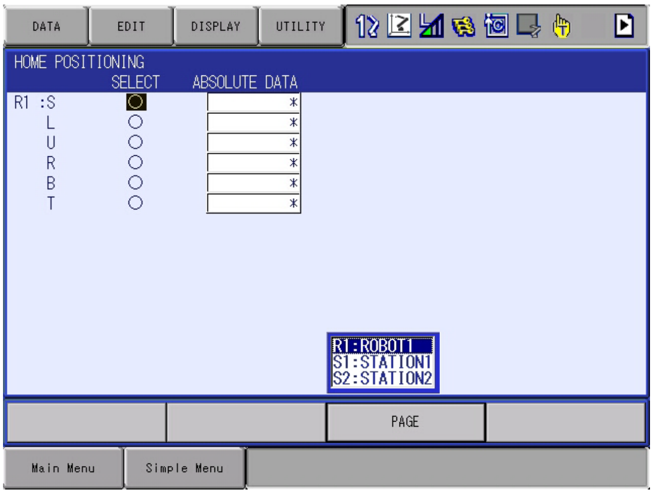


3. Select {DISPLAY} under the menu.

   – The pull-down menu appears.



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

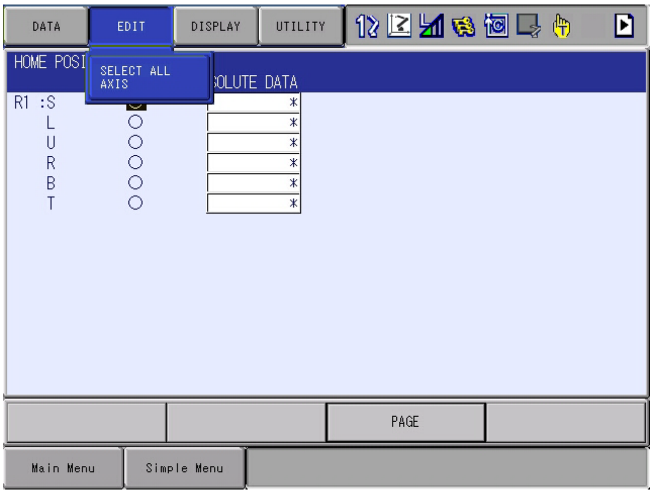


4. Select the desired control group.

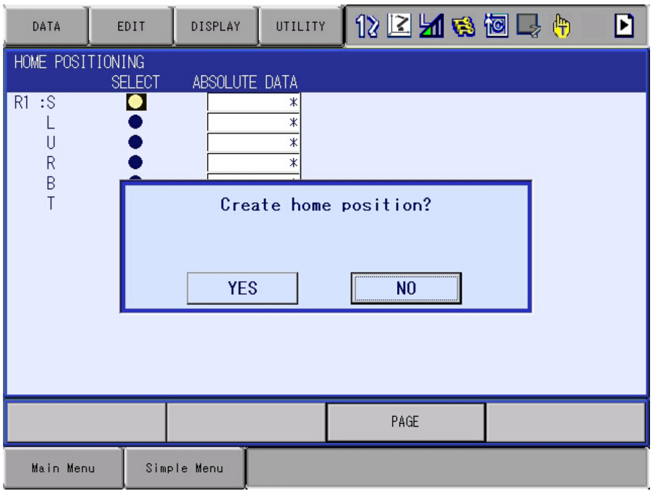
   – Select the control group for HOME POSITIONING.

   – The control group can also be selected by pressing [PAGE].

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



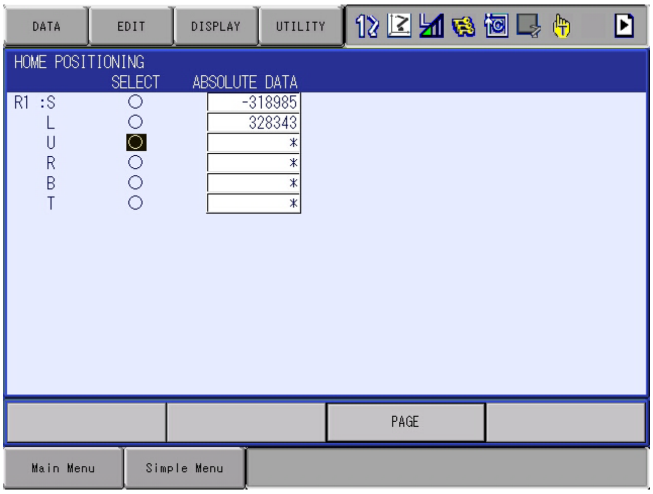
6. Select {SELECT ALL AXES}.
   – The confirmation dialog box appears.



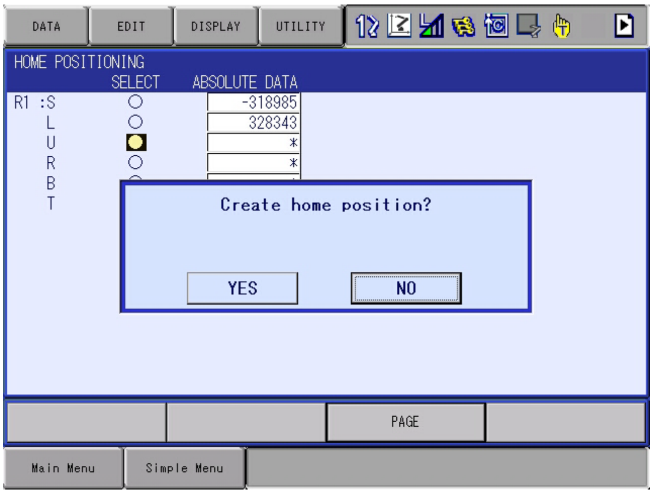
7. Select {YES}.
   – The position data of all axes which is shown are registered as home position. When {NO} is selected, the registration will be canceled.

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.



   – A confirmation dialog box appears.

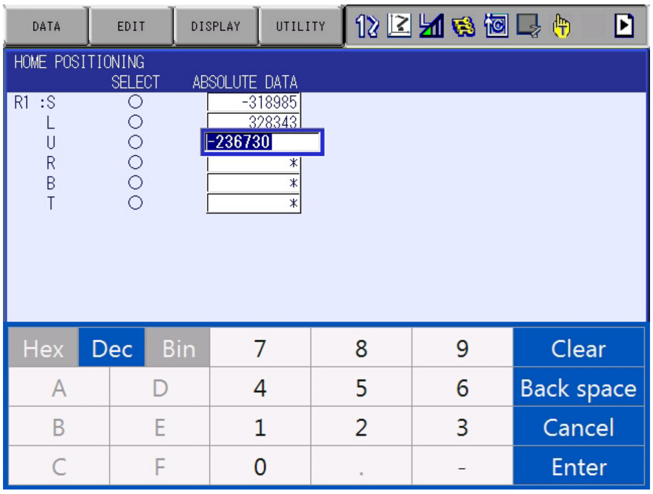


5. Select {YES}.
   – The position data of the axis which is shown is registered as home position. When {NO} is selected, the registration will be canceled.

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:

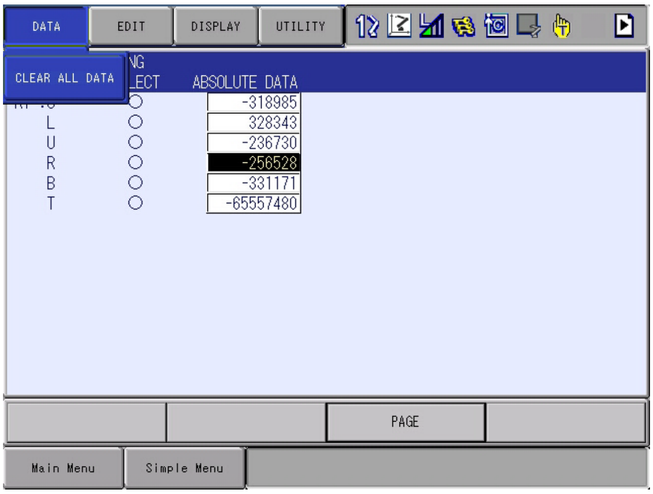
1. Select {ROBOT} under the main menu.
2. Select {HOME POSITION}.
3. Select the desired control group.
   – By performing the step 3 and 4 of the “Registering All Axes at One Time”, the HOME POSITIONING window is shown and the desired control group can be selected.
4. Select the absolute data to be registered.
   – The number can be entered.



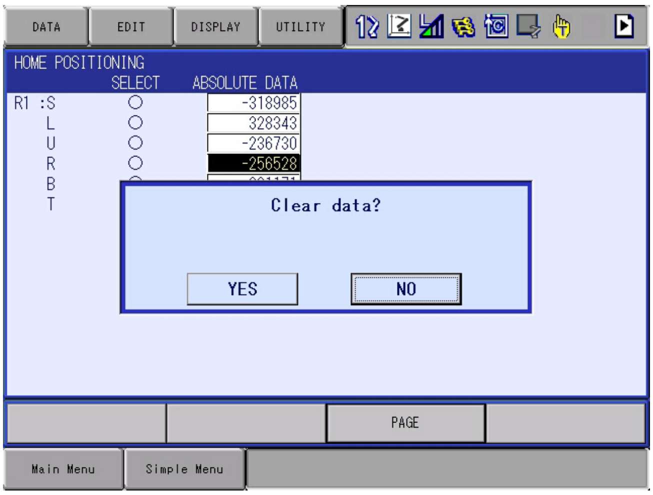
5. Enter the absolute data by using the numeric keys.
6. Press [ENTER].
   – Absolute data is modified.

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

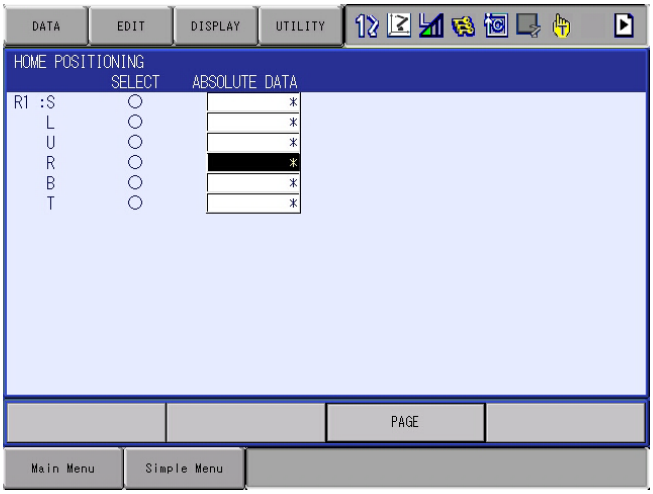


4. Select [CLEAR ALL DATA].
   – A confirmation dialog box appears.



5. Select {YES}.

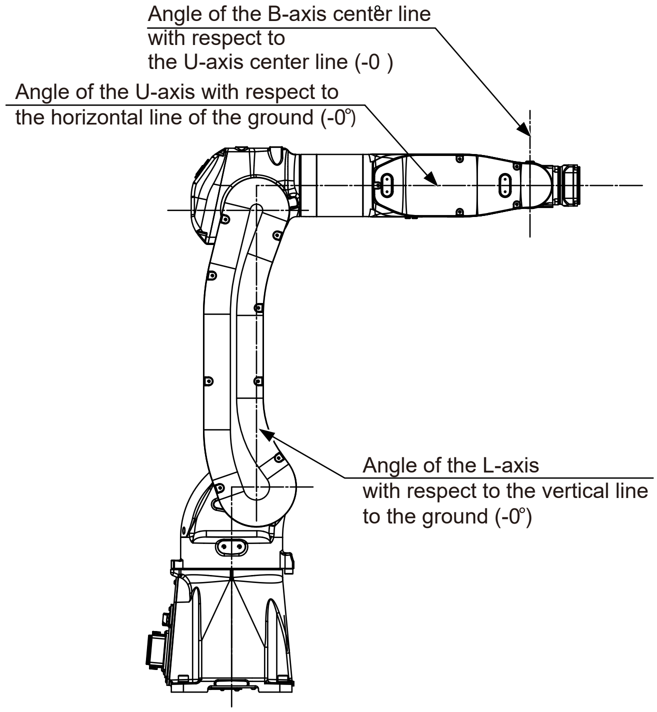
   – All absolute data are cleared.



   – 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 (Check Point)

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 button on the programming pendant or 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.

- 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 YRC1000micro 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 button is located on the upper right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.

DANGER

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety)
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

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.
- Return the programming pendant to a safe place 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.

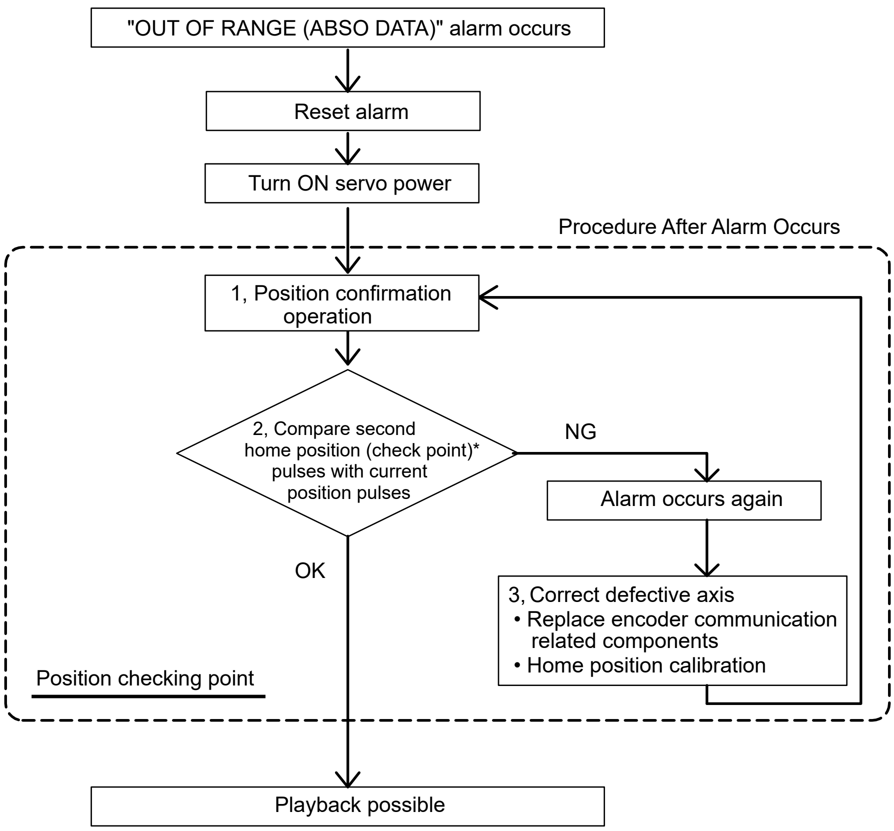
8.2.1 Purpose of Position Check Operation

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, alarm 4107 “OUT OF RANGE (ABSO DATA)” is issued when the controller power is turned ON.

There are two possible causes of this alarm:

- An error was found in the encoder communication related components.
- No error was found in the encoder communication related components, but 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 stall when playback is started. If the absolute data allowable range error alarm has occurred, playback and test runs will not function and the position must be checked.



1, Position Check

After the “OUT OF RANGE (ABSO DATA)” alarm occurs, move to the second home position using the axis keys and perform the position confirmation. For performing the position confirmation, refer to *chapter 8.2.3 “Procedure after the Alarm”*. Playback and test runs will not function unless “CONFIRM POSITION” is performed.

2, Pulse Difference Check

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

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

3, Alarm Occurrence

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

NOTE

- When the home position calibration for all the axes is performed at the same time, playback operations are possible without the position confirmation.
- For a system with a manipulator that has no brake, after the alarm occurs, there is a case that the playback operations are possible without the position confirmation. (However, as a rule, "CONFIRM POSITION" must be performed.)
  Under the above special conditions, the manipulator moves as follows:

After starting, the manipulator moves at low speed (1/10 of the maximum speed) to the step indicated by the cursor.

If it is stopped and restarted during this motion, the low speed setting is kept until the step at cursor is reached. Regardless of cycle setting, the manipulator stops after the cursor step is reached.

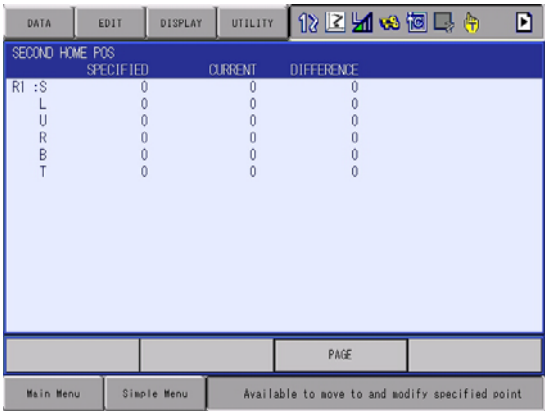
When starting the manipulator again after it is stopped, the manipulator operates at the programmed speed and cycle of the job.

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

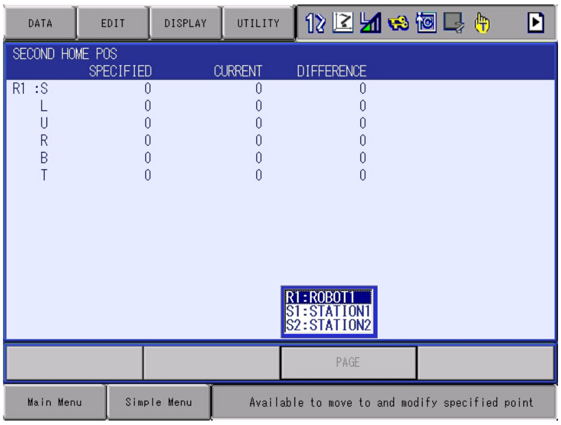
Apart from the “home position” of the manipulator, the second home position can be set up as a check point for absolute data. Perform the following steps to set the specified point.

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



3. Press [PAGE], or select “PAGE” to display the selection window for the control group.
   – The group axes by which the second home position is set is selected when there are two or more group axes.



4. Press the axis keys.
   – Move the manipulator to the new second home position.
5. Press [MODIFY] and [ENTER].
   – The second home position is changed.

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, perform the followings:

- Reset the alarm
- Turn Servo power ON

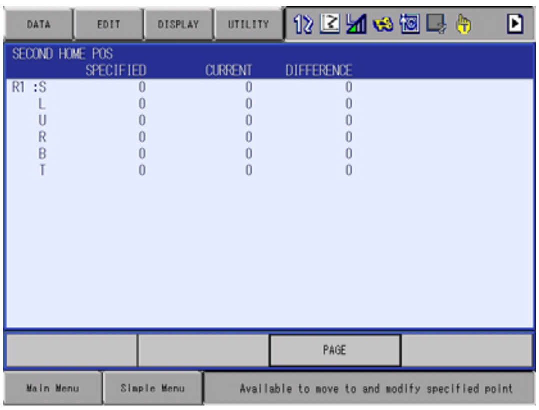
And then confirm the second home position. After the confirmation, if the encoder communication related components are found to be the cause of the alarm, perform the necessary operations, such as replacing the encoder communication related components, etc.

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

SUPPLE-MENT

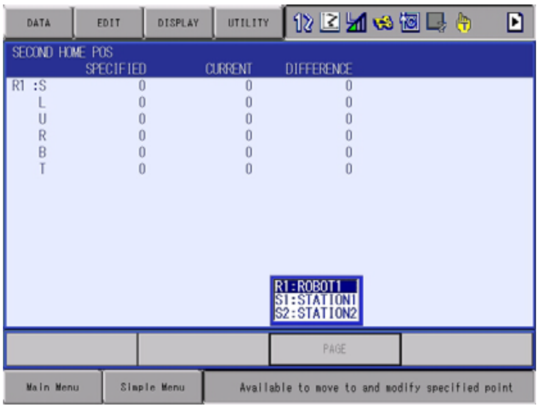
Refer to “YRC1000micro MAINTENANCE MANUAL (RE-CHO-A115) 7.7 Position Data When Power is Turned ON/OFF” for details on the “POWER ON/OFF POS” window.

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



3. Press the page key [PAGE], or select "PAGE" to display the selection window for the control group.

– The group axes by which the second home position is set is selected when there are two or more group axes.



4. Press [FWD].

   – TCP moves to the second home position. The robot moving speed is set as selected manual speed.

5. Select {DATA} under the menu.
6. Select {CONFIRM POSITION}.

   – The message “Home position checked” is shown.
   Pulse data of the second home position and current pulse data are compared. If the compared error is in allowed range, playback operation can be done.
   If the error is beyond the allowed range, the alarm occurs again.

8.2.4 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;

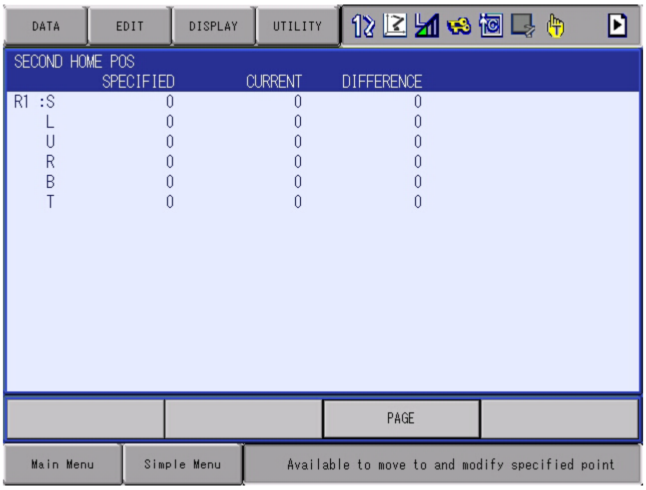
then confirm the second home position. After the confirmation, if the encoder communication related components are found to be the cause of the alarm, perform the necessary operation, such as replacing the encoder, etc.

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

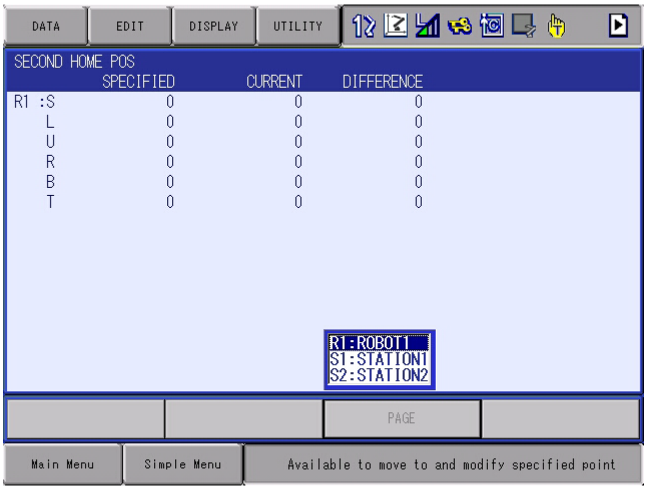
SUPPLE-MENT

For details on the “POWER ON/OFF POS” window, refer to “YRC1000micro MAINTENANCE MANUAL (RE-CHO-A115) 7.7 Position Data When Power is Turned ON/OFF”.

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



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



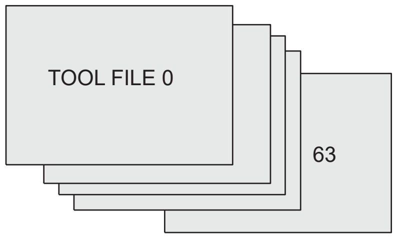
4. Press [FWD].
   – TCP moves to the second home position. The robot moving speed is set as selected manual speed.
5. Select {DATA} under the menu.
6. Select {CONFIRM POSITION}.
   – A message “Home position checked” appears.
   – Pulse data of the second home position and current pulse data are compared. If the compared error is in allowed range, playback operation can be done.
   – If the error is beyond the allowed range, the alarm occurs again.

8.3 Tool Data Setting

8.3.1 Registering Tool Files

8.3.1.1 Number of Tool Files

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

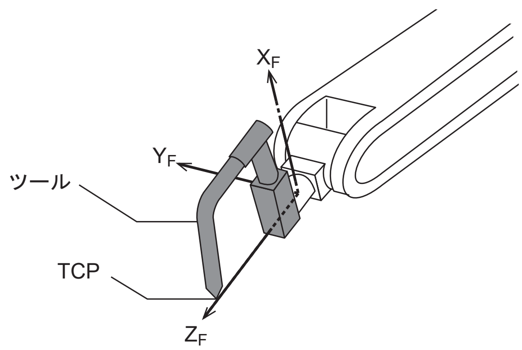


SUPPLE-MENT

Tool File Extension Function
Normally, one robot uses one kind of tool file. The tool file extension function can change many tool files to be used by one robot. Use the following parameter to set this function.
S2C333: TOOL NO. SWITCHING (1: enabled; 0: disabled)
For more details, refer to “YRC1000micro OPERATOR’S MANUAL (RE-CSO-A058) 8 Parameter”.

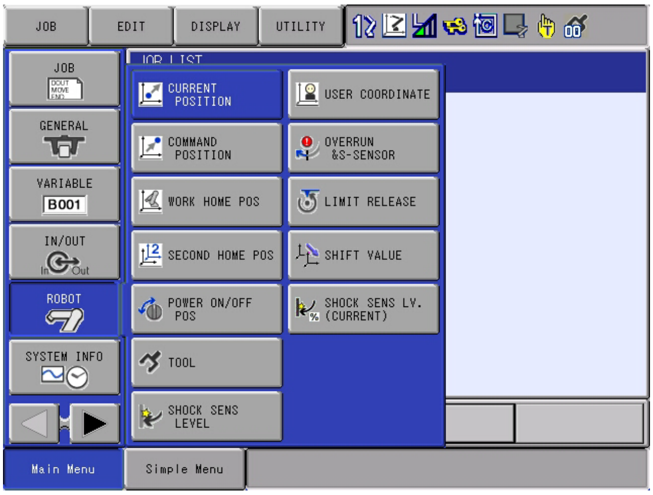
8.3.1.2 Registering Coordinate Data

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.

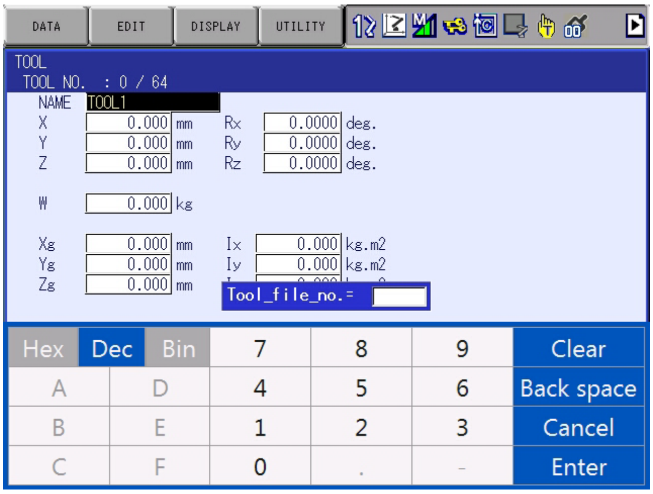


2. Select {TOOL}.

   (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].



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

3. Select the desired tool number.

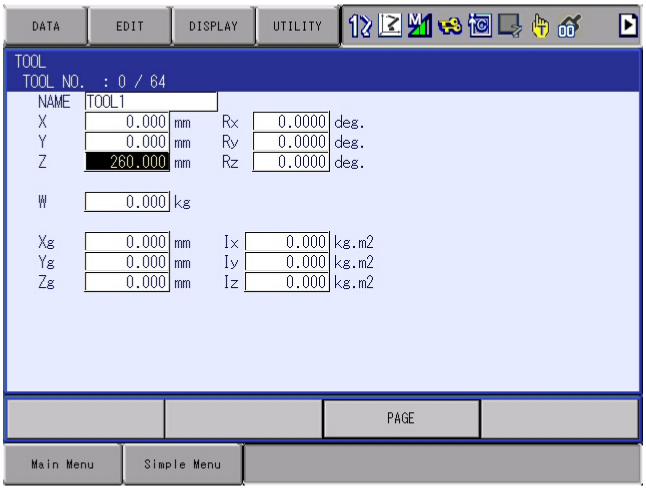
4. Place the cursor in the part to register the desired coordinate data and press [SELECT].

   – The number is ready to input.

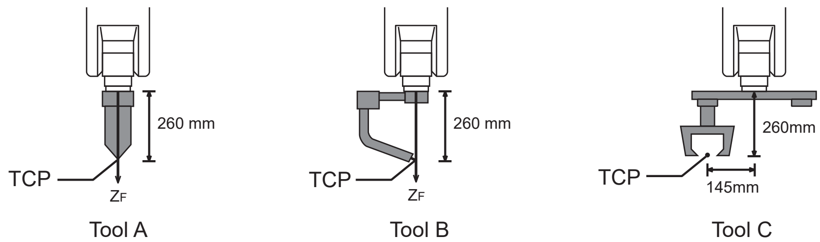
5. Input the coordinate data.

6. Press [ENTER].

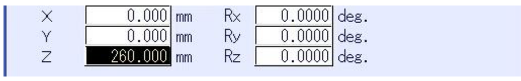
   – The coordinate data is registered.



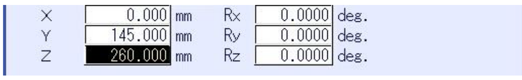
<Setting Example>



In case of Tool A, B



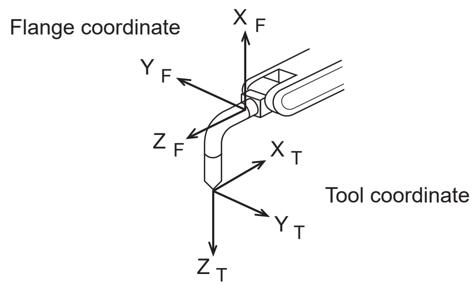
In case of Tool C



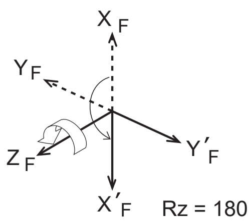
8.3.1.3 Registering Tool Posture Data

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.

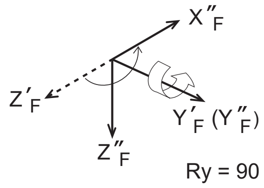


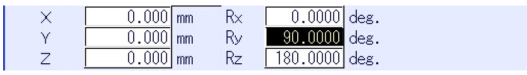
X	0.000	mm	Rx	0.0000	deg.
Y	0.000	mm	Ry	0.0000	deg.
Z	0.000	mm	Rz	180.0000	deg.

6. Press [ENTER].

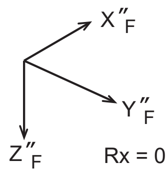
   – The rotation angle of Rz is registered.

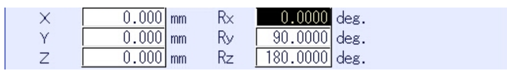
   In the same way, register the angle of Ry, Rx.
   Ry must be the input rotation angle around Y'$_F$ of flange coordinates.





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





8.3.1.4 Setting the Tool Load Information

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

Sets the tool load information by the design value of the tool.

> SUPPLE-MENT
> For more details on the tool load information, refer to *chapter 8.4.3 "Tool Load Information Setting"* .

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

> SUPPLE-MENT
> 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"* .

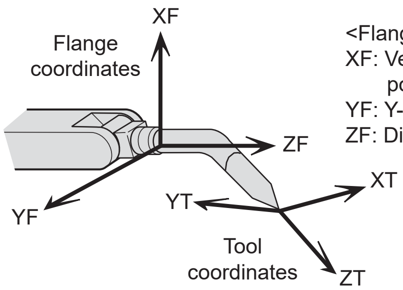
8.3.2 Tool Calibration

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 a hand 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.



<Flange coordinates>
XF: Vertically upward direction when the current position on the T-axis of the manipulator is "0"
YF: Y-axis complementing XF and ZF
ZF: Direction perpendicular to the flange face

8.3.2.2 Setting of Tool Calibration Method

There are three tool calibration methods which can be selected with the conversion method setting on the TOOL CALIBRATION window.

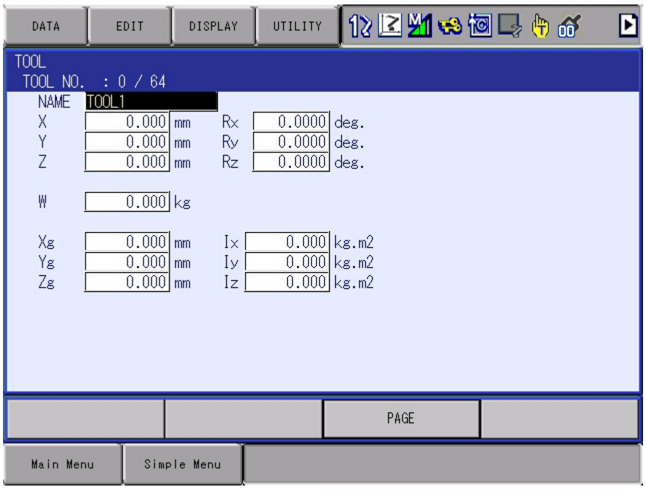
• Designation of tool calibration conversion method

"Coord" : 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.

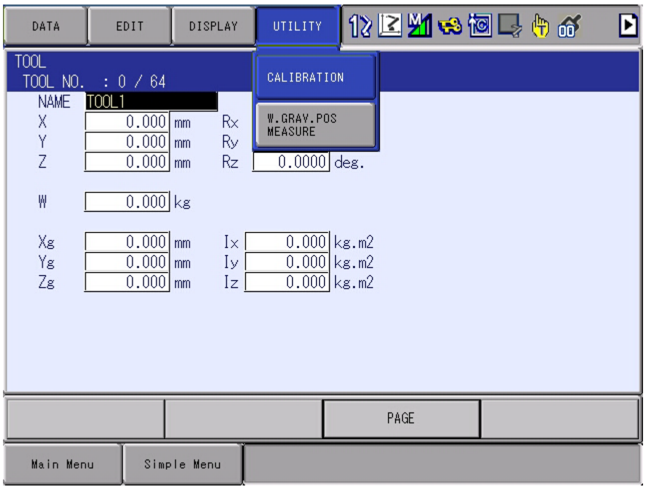
"Posture" : Calibrates only the posture.
"Tool Posture Data" calculated from the first calibration teaching point is registered in the tool file.
In this case, "Coordinates" will not be changed.
(the prior value is maintained.)

"Coord + Posture" : 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.

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 previous section *chapter 8.3.1.2 "Registering Coordinate Data"* , display the tool coordinate window for the desired tool number.

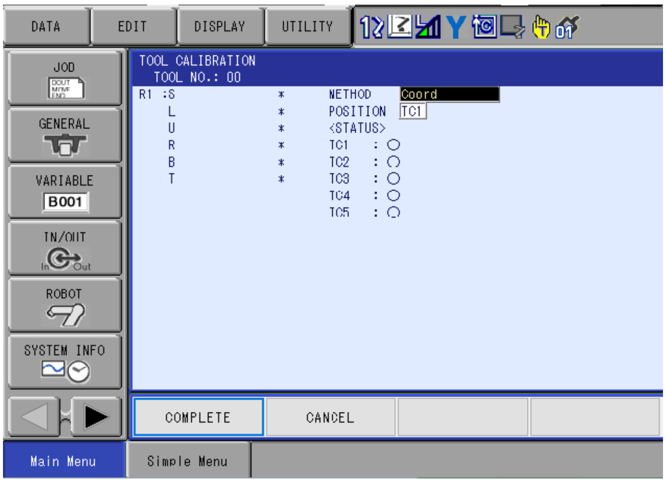


4. Select {UTILITY} under the menu.
   – The pull-down menu appears.



5. Select {CALIBRATION}.

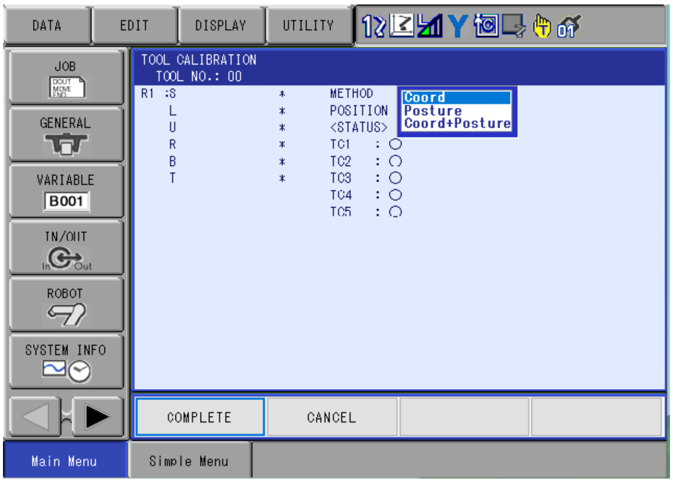
– The TOOL CALIBRATION window is shown.



6. Select "METHOD".

– The selection dialog box appears.

(1) Select the conversion method.



NOTE

- In case of "Coord", 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 "Posture", the coordinates are maintained.
- In case of "Coord + Posture", 5 teaching points need to be registered though only the first point is used for calculation.

SUPPLE-MENT

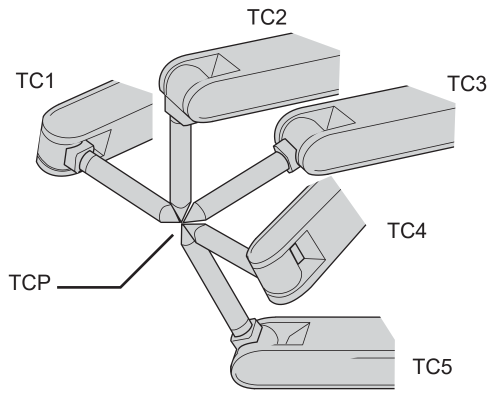
Tool calibration conversion method can also be set with a parameter. The setting on the TOOL CALIBRATION window is applied to the parameter setting.

S2C432 = 0: The conversion method is "Coord".
S2C432 = 1: The conversion method is "Posture".
S2C432 = 2: The conversion method is "Coord+Posture".

8.3.2.3 Teaching of Calibration Point

■ **Teaching for defining coordinates**

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



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

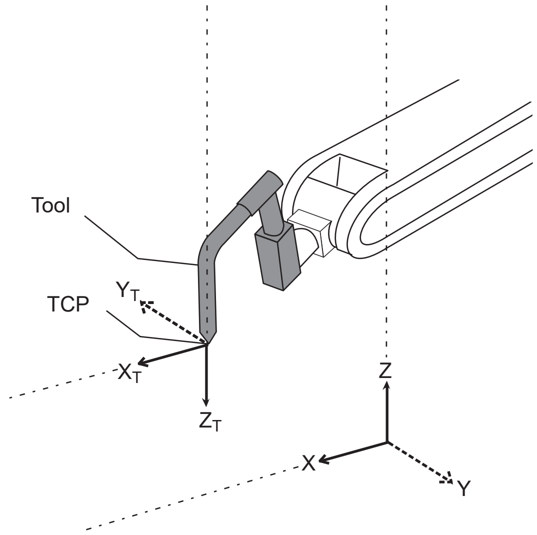
■ Teaching for defining posture

The calibration of tool posture data is performed with the first calibration teaching point (TC1).

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

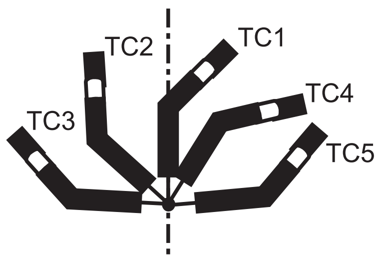
Tool posture data is automatically calculated with this TC1 posture.

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

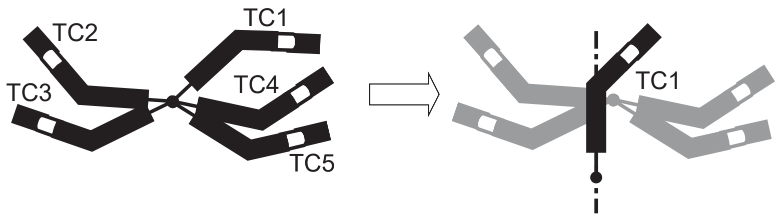


SUPPLE-MENT

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



If teaching in one place as the figure above is impossible due to the 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.

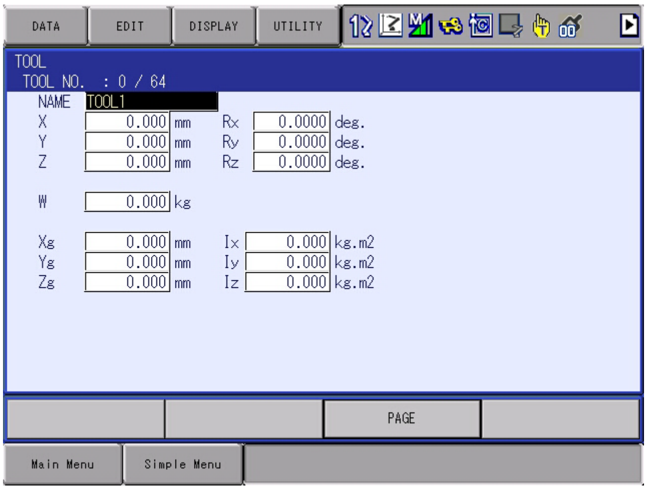


[S2C432 = 0 or 2] [S2C432 = 1]

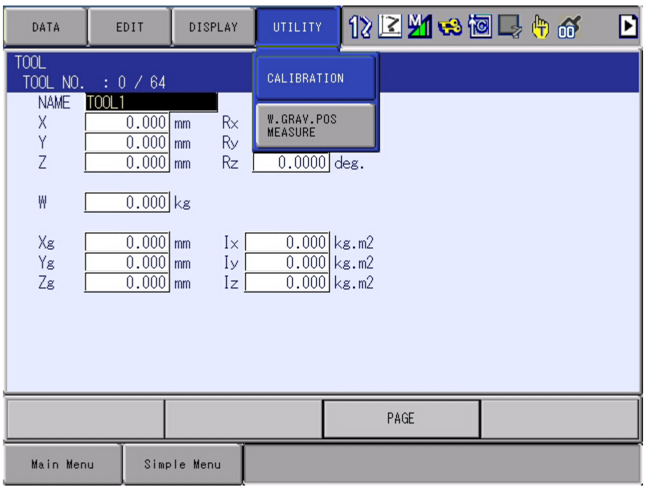
SUPPLE-MENT

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

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

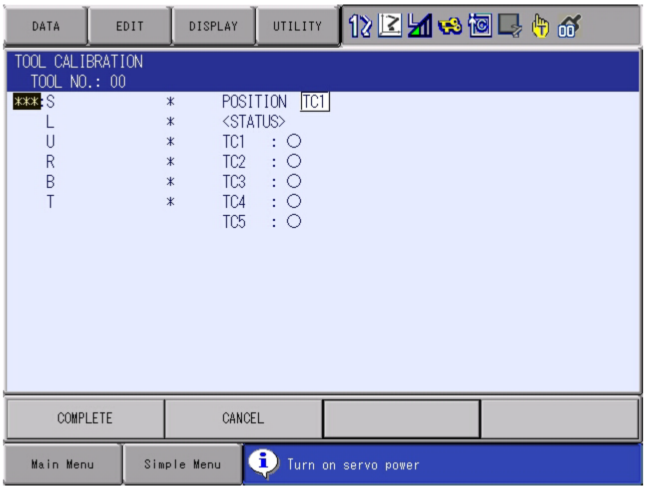


4. Select {UTILITY} under the menu.
   – The pull-down menu appears.



5. Select {CALIBRATION}.

   – The TOOL CALIBRATION window is shown.

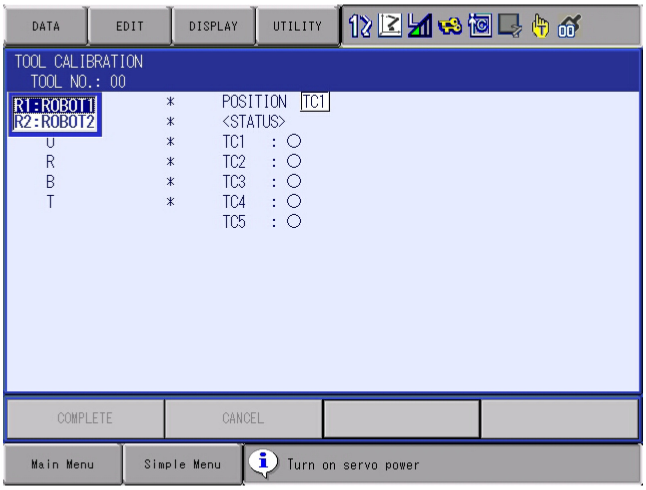


6. Select the robot.

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

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

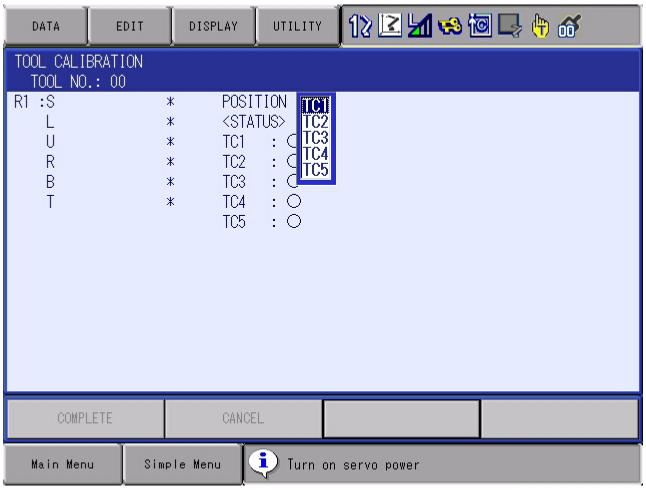
   (3) The robot is set.



7. Select “POSITION”.

– The selection dialog box is shown.

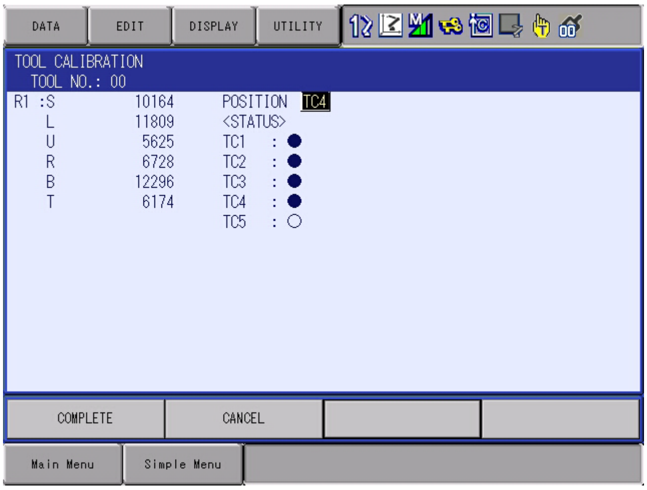
(1) Select the teaching point for calibration.



8. Move the manipulator using the axis key.

9. Press [MODIFY] and [ENTER].

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

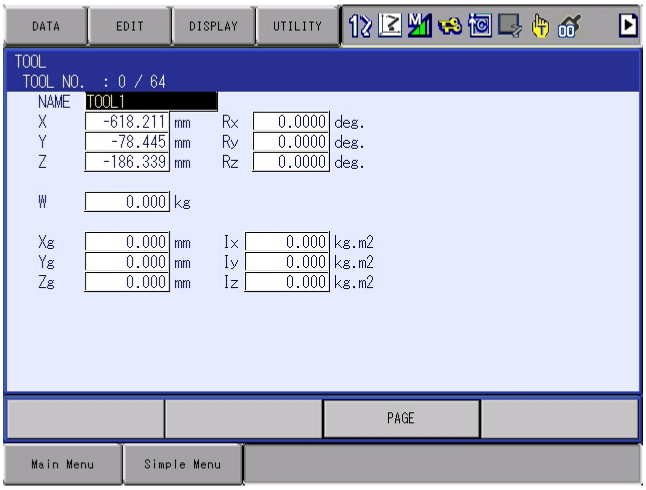


– To check the taught positions, call up the required window among TC1 to TC5 and press [FWD]. The manipulator moves to the set position.

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

10. Select “COMPLETE”.

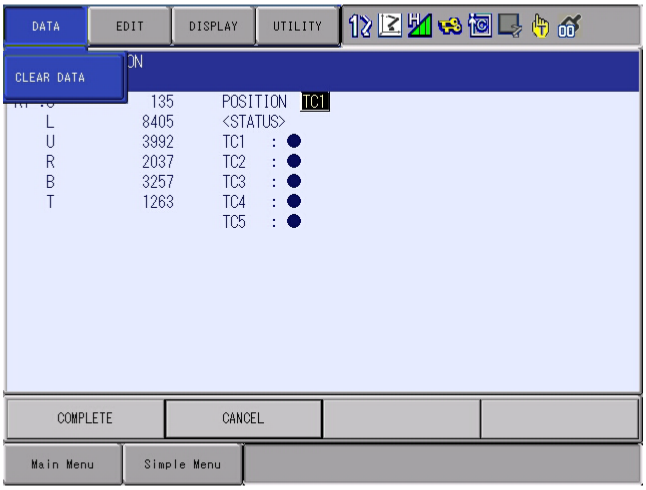
– Calibration data is registered in the tool file. Once the calibration is completed, the tool coordinate window is displayed on the screen.



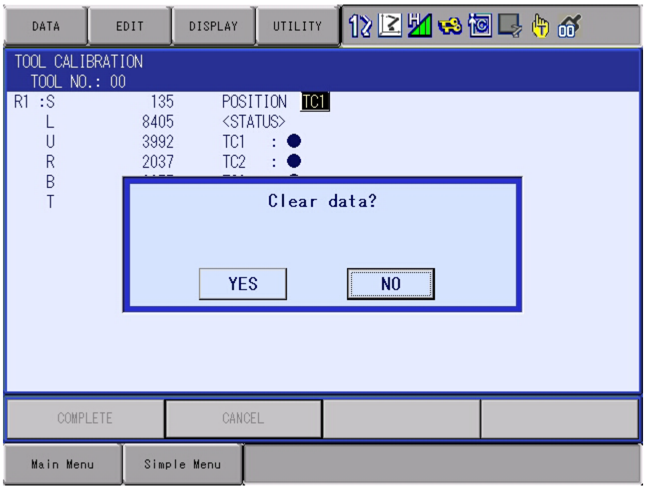
8.3.2.4 Clearing Calibration Data

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

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

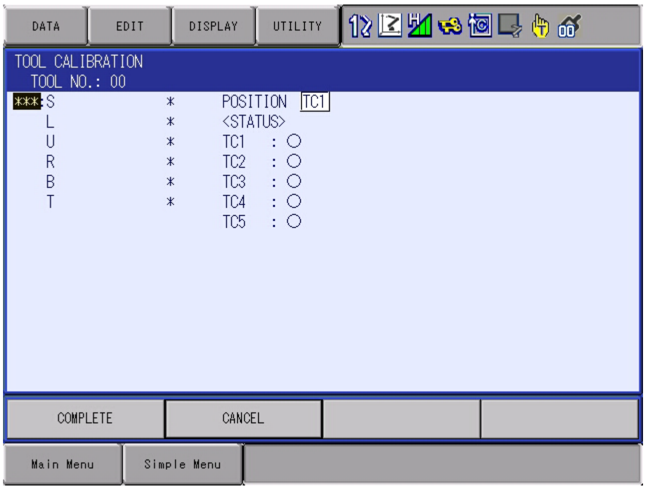


2. Select {CLEAR DATA}.
   – The confirmation dialog box is shown.



3. Select {YES}.

– All data is cleared.

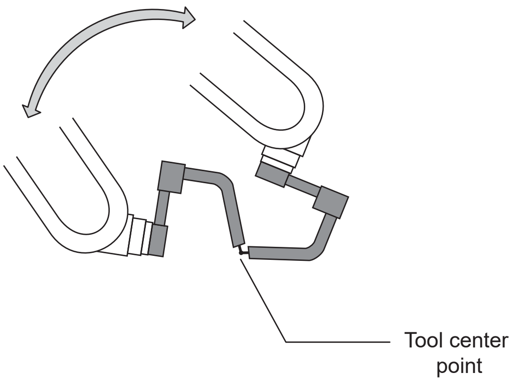


SUPPLE-MENT

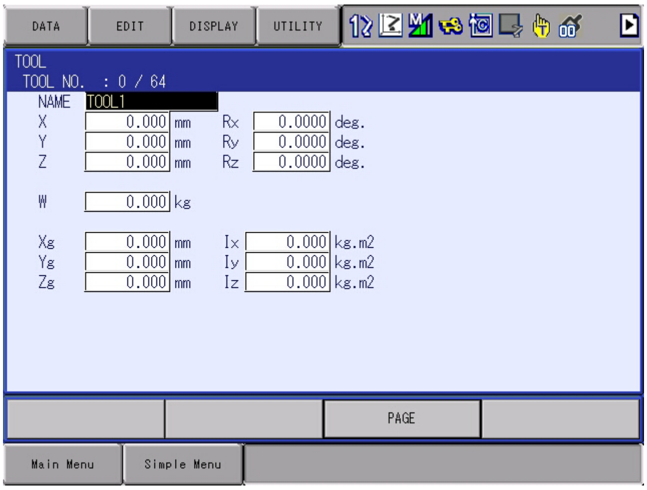
If tool angle data is required, input the data number in the tool coordinate window.
Refer to *chapter 8.3.1.3 "Registering Tool Posture Data"* for the operating instructions.

8.3.2.5 Checking the TCP

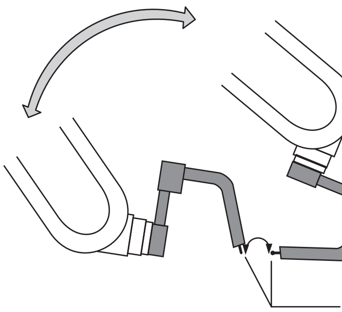
After registering the tool file, check if the TCP is correctly registered by performing a TCP fixed operation like the one shown below, in any coordinate system other than the joint.



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 “YRC1000micro OPERATOR'S MANUAL (RE-CSO-A058) 2.3.7 Motion about TCP”.

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?

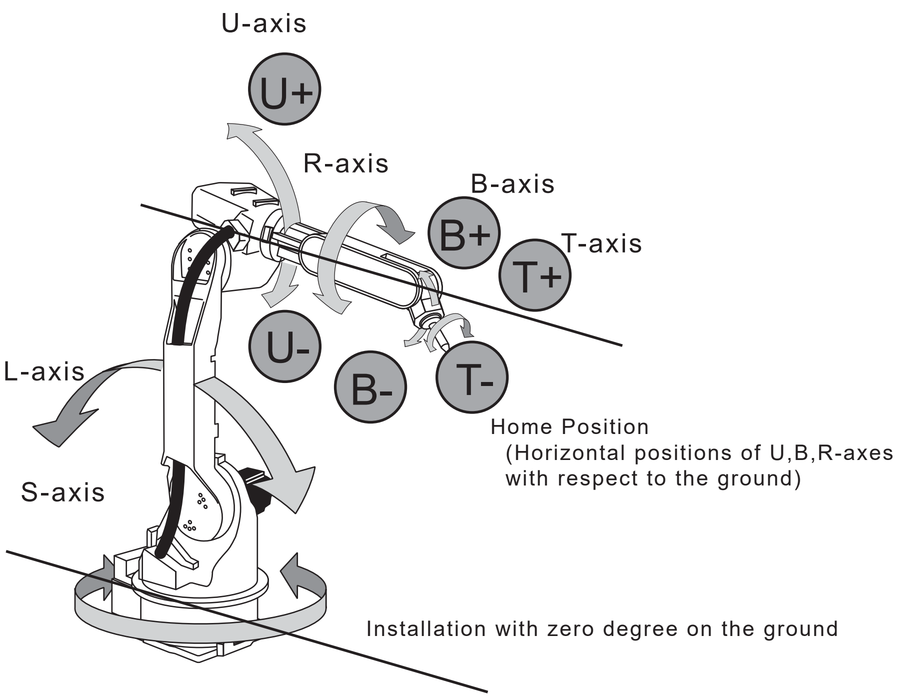
With this function, the user can register the load of tool, the position of the tools center of gravity and the moment of inertia at the center of gravity.

The tool load, the position of it's 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

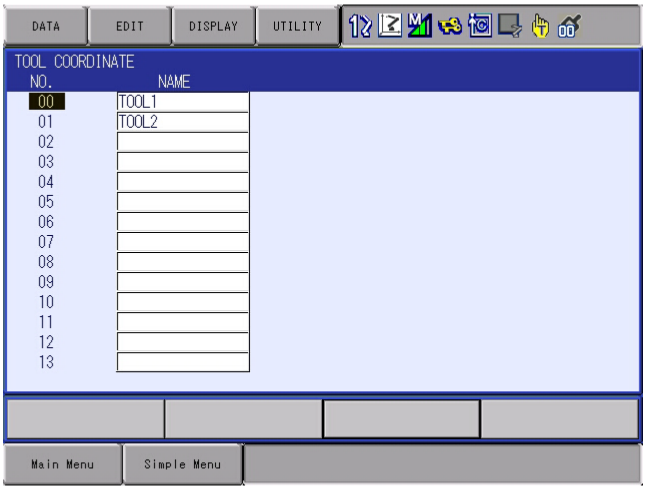
To measure the tool load and the center of gravity, move the manipulator to its home position (U-, B- and R-axes: horizontal to the ground) and operate the U-, B- and T-axes.

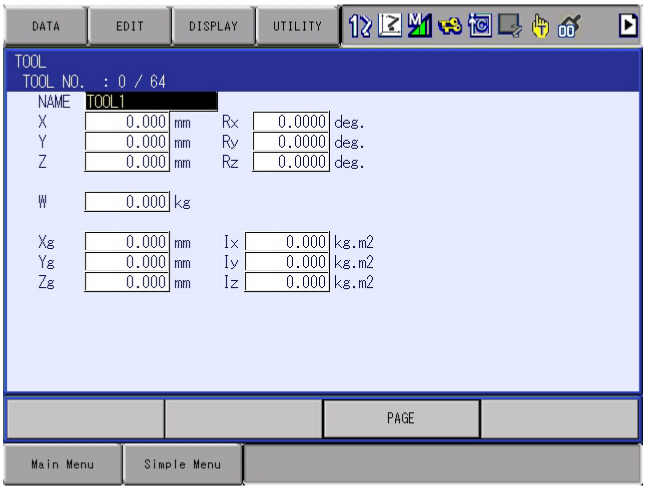


> **NOTE**
> To correctly measure the tool load or the center of gravity, remove the cables or wires connected to the tool.
> The measurement may not be performed properly because unnecessary loads are applied.

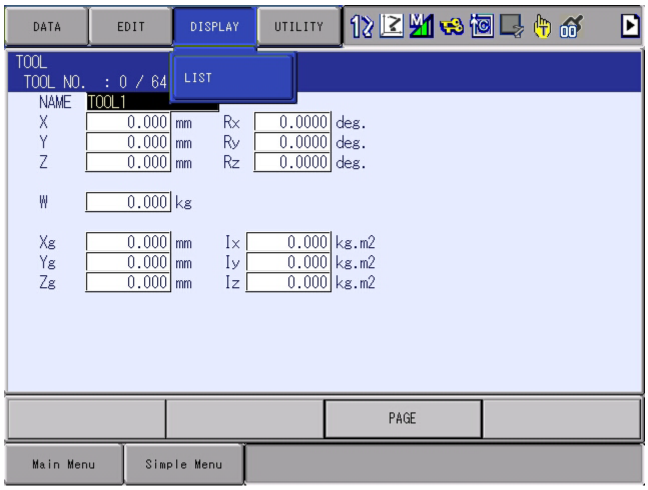
1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
   – The tool list window appears.
   – The tool list window is called up only when the file extension function is valid.

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





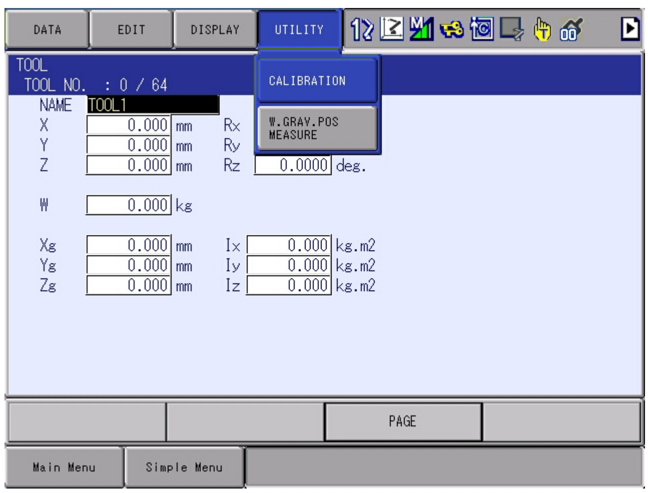
3. Select the desired tool number.
   - Move the cursor to the desired number in the tool list window and press [SELECT].
   - The tool coordinate window of the selected number is shown.
   - In the tool coordinate window, the number can be changed by pressing the [PAGE] or selecting [PAGE].
   - To switch the tool list window and the tool coordinate window, press {DISPLAY} → {LIST} or {DISPLAY} → {COORDINATE DATA}.



4. Write down the X, Y, and Z coordinate values, and then set them all to 0. (Restore the original values after the measurements are finished.)

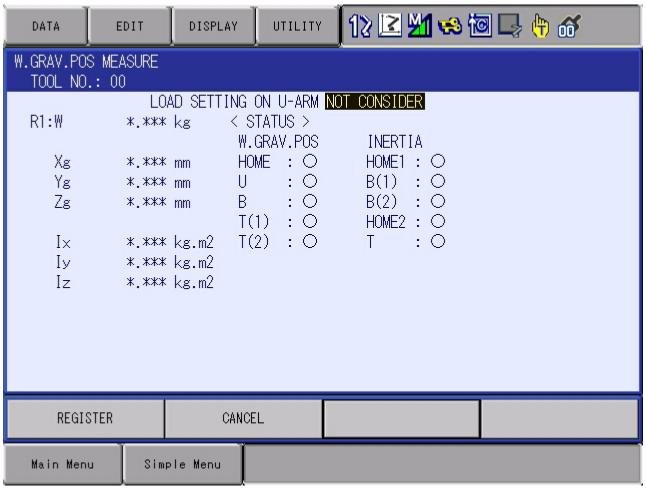
> NOTE
>
> If the X, Y, and Z coordinate values are not 0 when measuring the moment of inertia at the center of gravity in *chapter 8.3.3.3 "Measurement of the Moment of Inertia at the Center of Gravity"*, the estimated inertia may be smaller than the actual inertia.

5. Select {UTILITY} under the menu.



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

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



7. Press the [PAGE].

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

8. Press [FWD].

   – Press [FWD] once, and the manipulator moves to the home position (U-, B- and R-axes: horizontal to the ground).

9. Press [FWD] again.

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

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

① Measurement of the U-axis: U-axis home position +4.5 degrees → -4.5 degrees

② Measurement of the B-axis: B-axis home position +4.5 degrees → -4.5 degrees

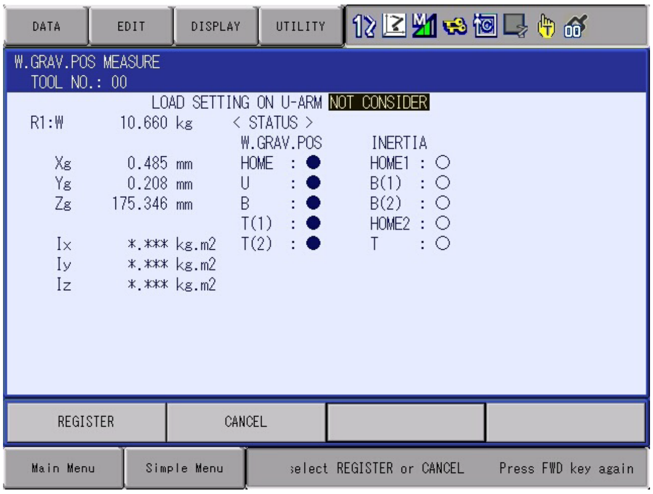
③ First measurement of the T-axis: T-axis home position +4.5 degrees → -4.5 degrees

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

SUPPLE-MENT

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

– When 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.



10. 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.

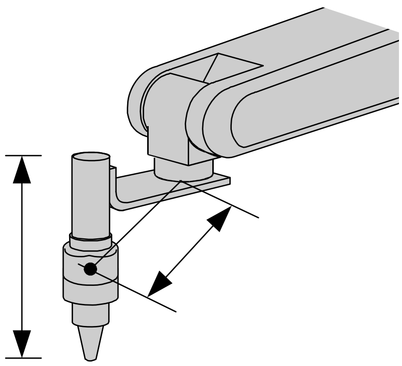
– Select “FWD” and the manipulator moves to the home position 1 and the measurement of the moment of inertia at the center of gravity starts.

8.3.3.3 Measurement of the Moment of Inertia at the Center of Gravity

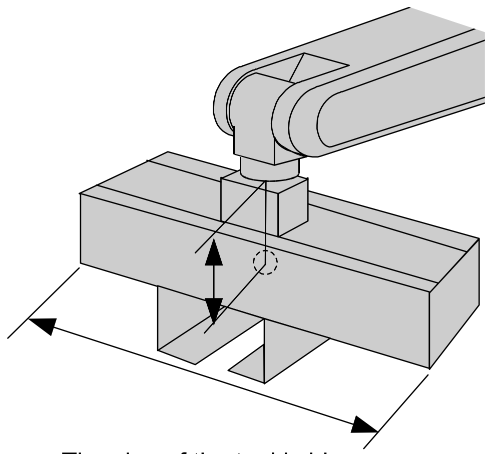
Measure the moment of inertia at the center of gravity.

SUPPLEMENT

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).



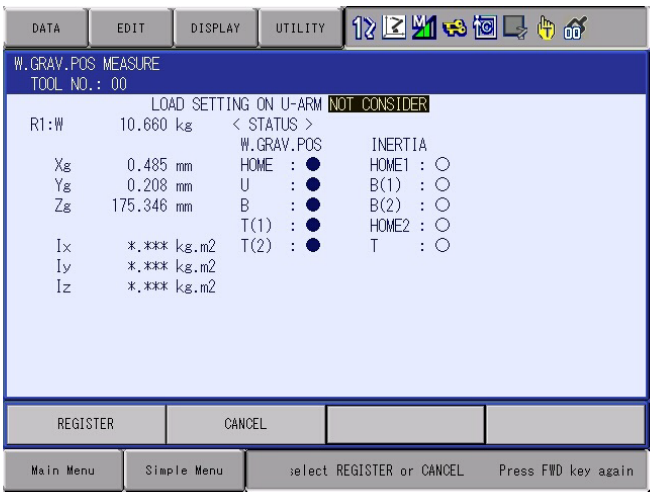
The size of the tool is not too big.
Measurement of the moment of inertia at center of gravity is not necessary.



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

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).



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.

2. Press [FWD] again.

   – 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, "○" 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

③ Measurement of the B-axis 2: B-axis home position +30 degrees→ -30 degrees

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

CAUTION

- To ensure the measurement accuracy when measuring the moment of inertia at the center of gravity, the manipulator may operate with a TCP speed in excess of the speed limit (250 mm/s). Secure an area in which the operation of the manipulator can be visually checked that is outside the range of movement and use the programming pendant in that area.

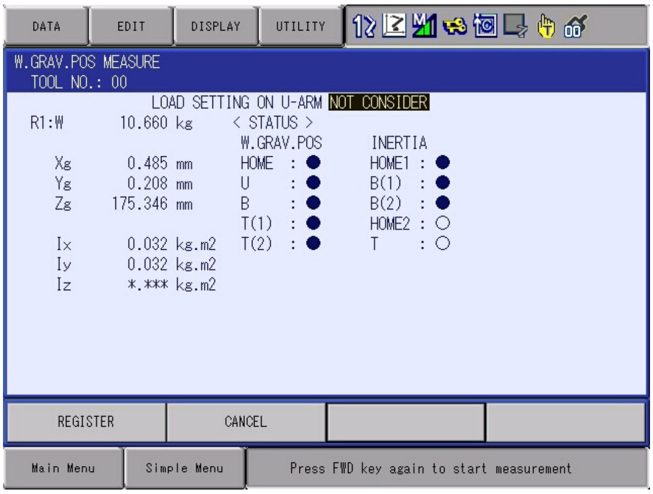
SUPPLE -MENT

- During the measurement, the [FWD] button must be kept pressed. If the button is released during the measurement or if it is released before "○" changes into "●", the measurement is aborted and the following message appears:
- "Stopped measurement"
  The measurement starts again from the home position1.

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).

> **NOTE** 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.



4. Press [FWD] again.

   – Press [FWD] again, and measurement of T-axis starts.

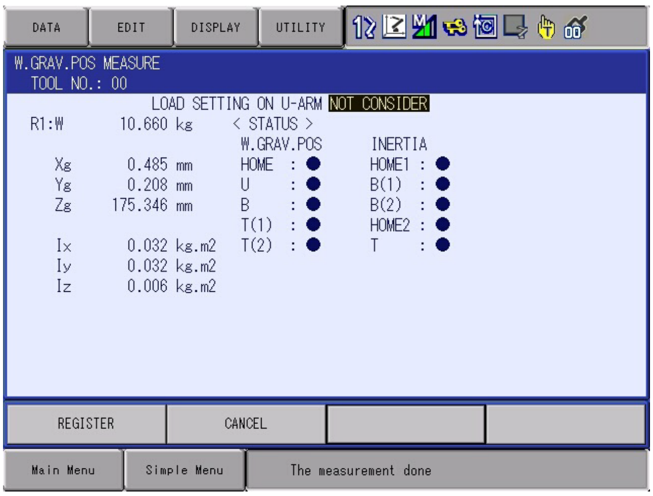
The manipulator moves in the order listed below. Once measurement is completed, “○” changes to “●”.

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

SUPPLE-MENT

- During the measurement, the [FWD] button must be kept pressed. If the button is released during the measurement or if it is released before “○” changes into “●”, the measurement is aborted and the following message appears:
- “Stopped measurement”
  The measurement starts again from the home position2.



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.

6. Set the X, Y, and Z coordinate values that were set to 0 in step 4 of *chapter 8.3.3.2 “Measurement of the Tool Load and the Center of Gravity”* to the values that were written down.

NOTE

If the X, Y, and Z coordinate values are not set to the correct values, interpolation motion is not correctly performed.

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 YRC1000micro controls robot motion according to the result. It is necessary to set the robot setup condition and the tool load information to request these accurately.

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

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

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

8.4.2 ARM CONTROL Window

CAUTION

- Correctly set the robot setup condition.
- 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

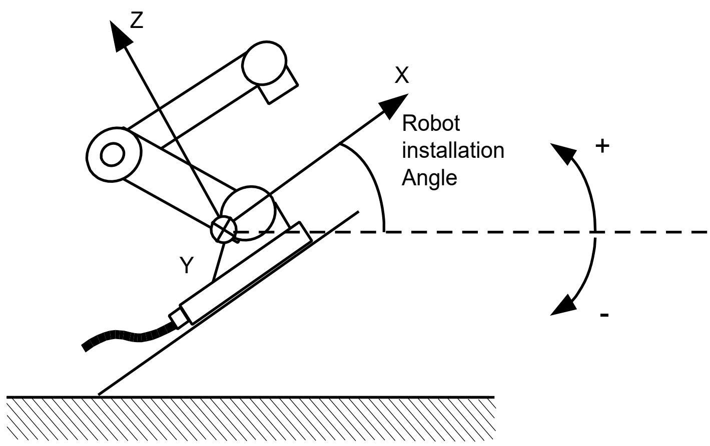
Fulfill the following robot setup condition to enable the ARM control.

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

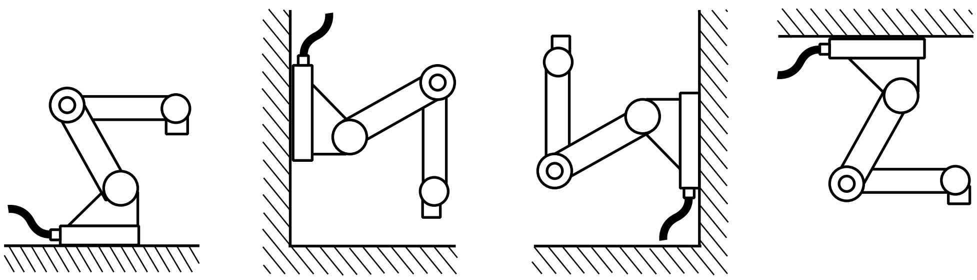
■ Robot installation angle

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>



0 degrees   -90 degrees   +90 degrees   180 degrees

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

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

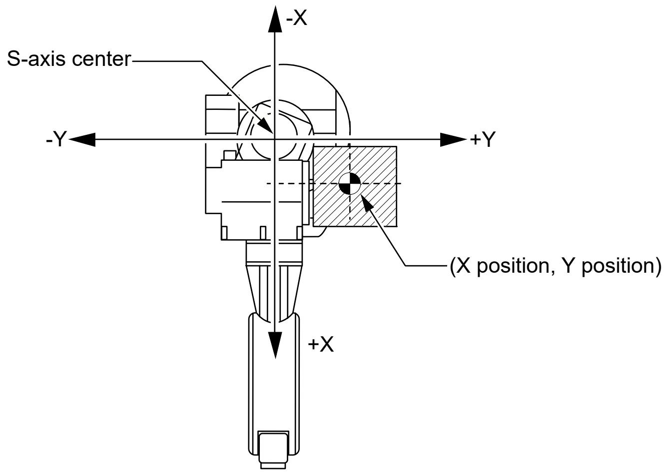
■ **S-HEAD PAYLOAD**

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.

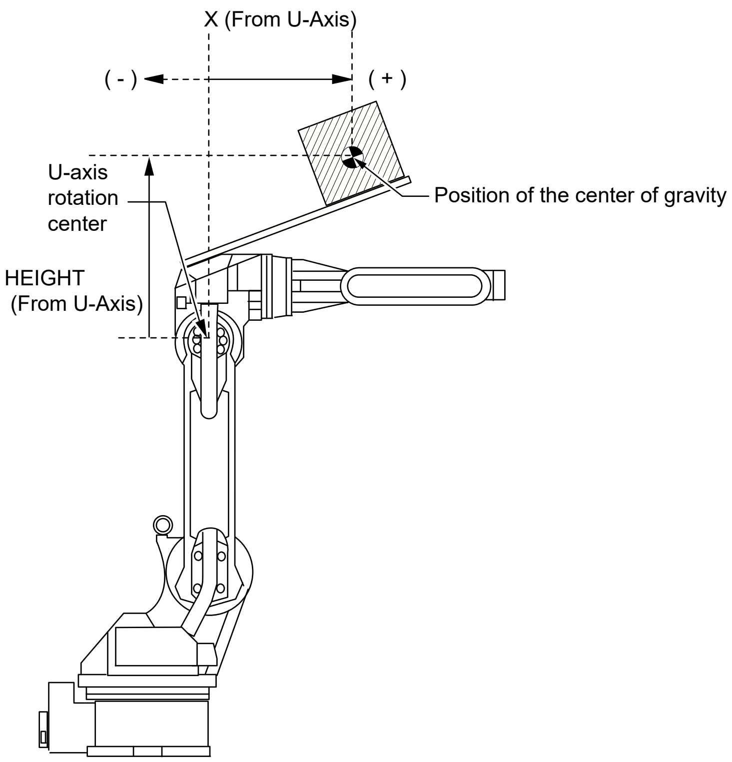
A standard value is set at the factory.

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.

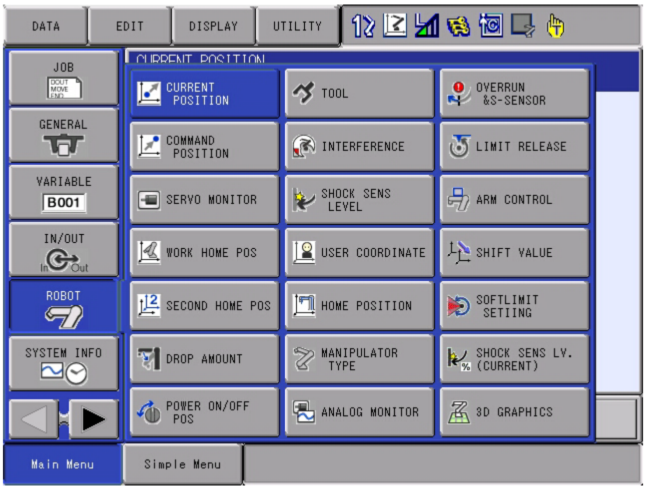
Fig. 8-2: Load on the U-Arm: Position of the Center of Gravity (Side View)



NOTE

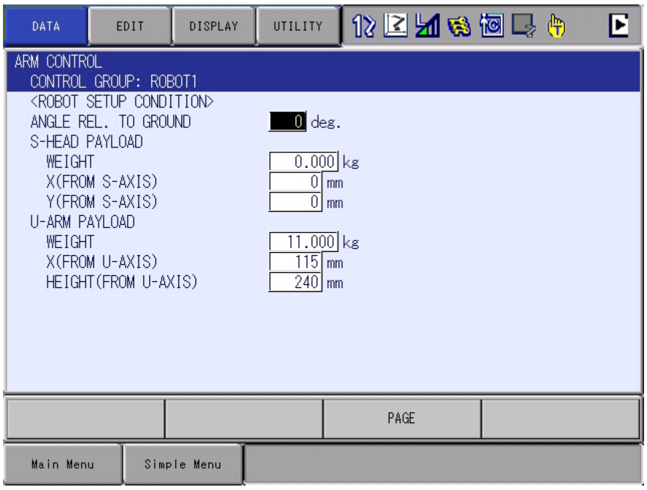
The ARM CONTROL window is displayed only when the security mode is set to the management mode.

1. Select {ROBOT} under the main menu.



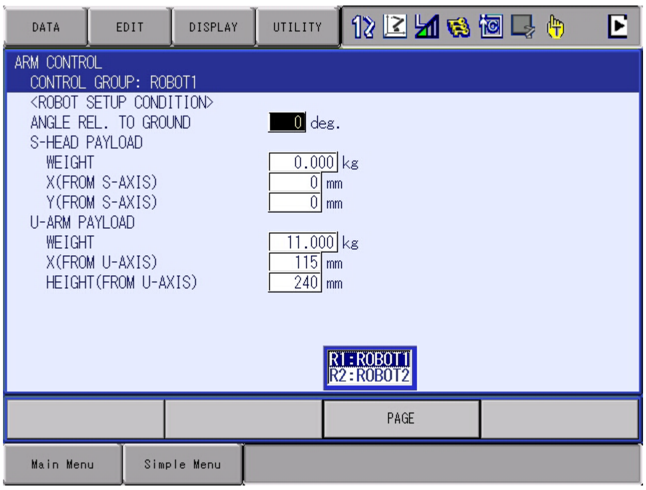
2. Select {ARM CONTROL}.

   – 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.

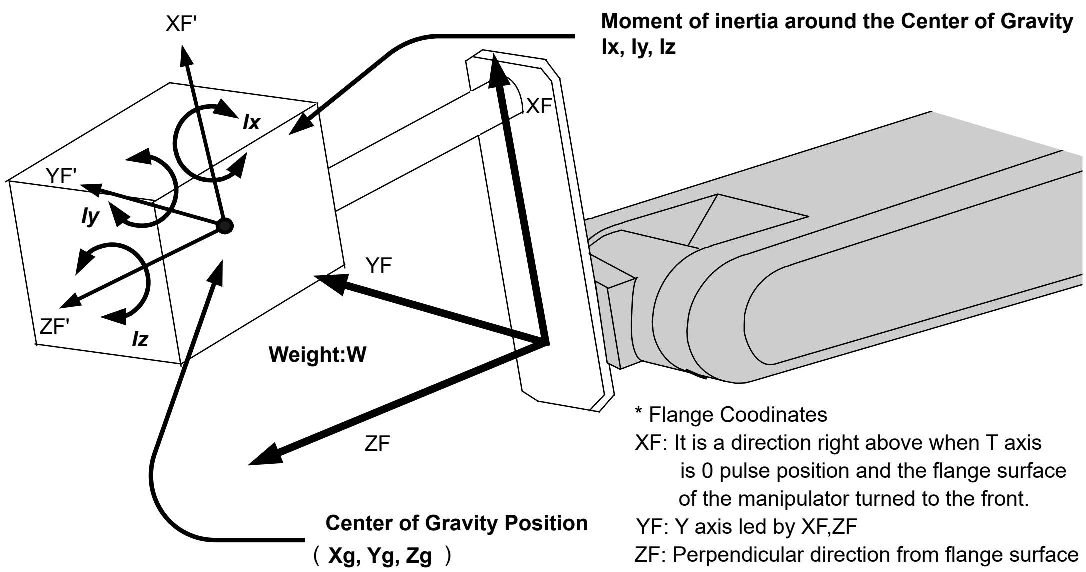
If the tool load information is not set correctly, the life of speed reducer may be shorter or the alarm may occur.

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.



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.)

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

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

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

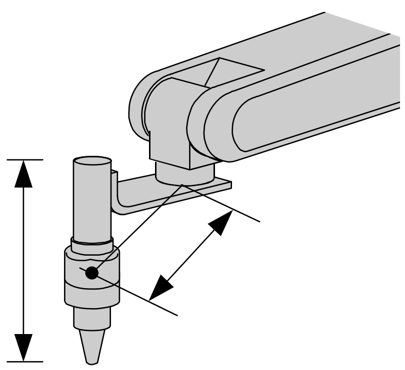
- **Moment of inertia at the center of gravity: Ix, Iy, Iz (Unit: kg·m^2)**
  It is an moment of inertia of the tool at the center of gravity position.

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

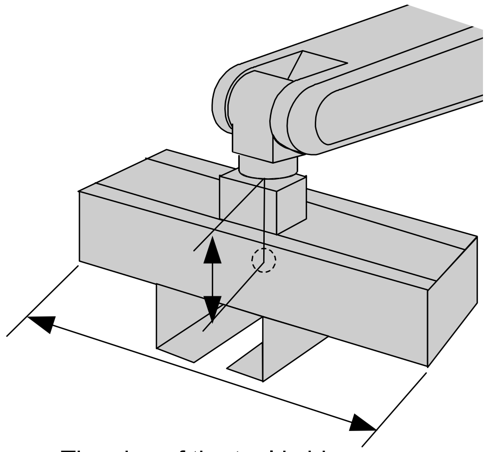
  It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual value.

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

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



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



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

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

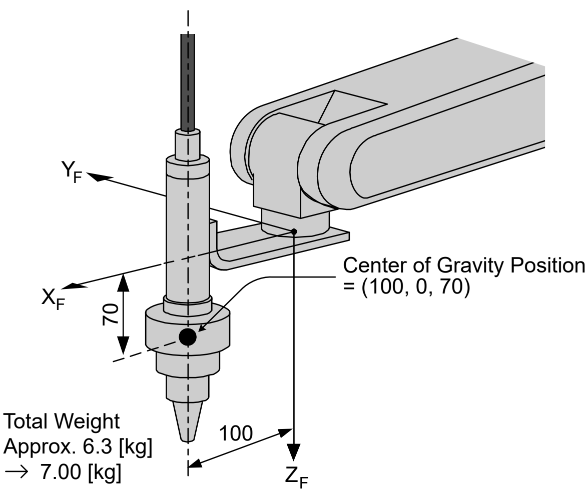
- Method to approximate the entire tool in hexahedron or cylinder.
- Method to calculate from each weight and center of gravity position of plural mass.

the following setting examples for details.

<Example 1>

In the example 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 tool is not too large.



<Setting>

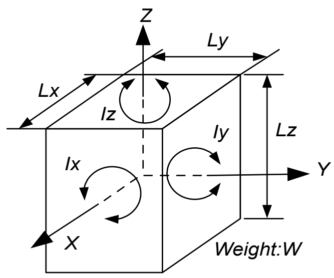
• W	:	7.000 kg
• Xg	:	100.000 mm
• Yg	:	0.000 mm
• Zg	:	70.000 mm
• Ix	:	0.000 kg •m^2
• Iy	:	0.000 kg •m^2
• Iz	:	0.000 kg •m^2

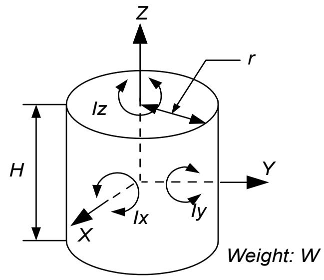
SUPPLE-MENT

- The own moment of inertia calculation for hexahedron and cylinder

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

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





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

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

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

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

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

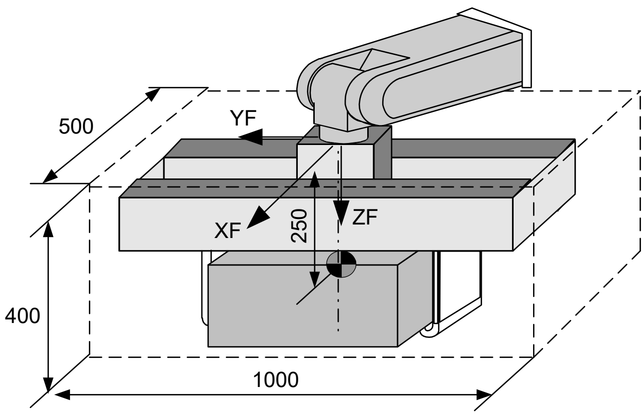
* Unit of Weight : [kg]
* Unit of Length : [m]
* Unit of Ix, Iy, Iz : [kg·m^2]

<Example 2>

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

Calculate the moment of inertia at the center of gravity roughly from the expression (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, 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 of tool:
Approx. 55 kg.

Weight of workpiece:
Approx. 40 kg.

Weight: W = 55 + 40 = 95

= approx. 100[kg]

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

(Xg, Yg, Zg) = (0,0,250)

Moment of inertia at the center of gravity:

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

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

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

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

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

<Setting>

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

SUPPLE -MENT

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.

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.

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

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

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

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

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

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

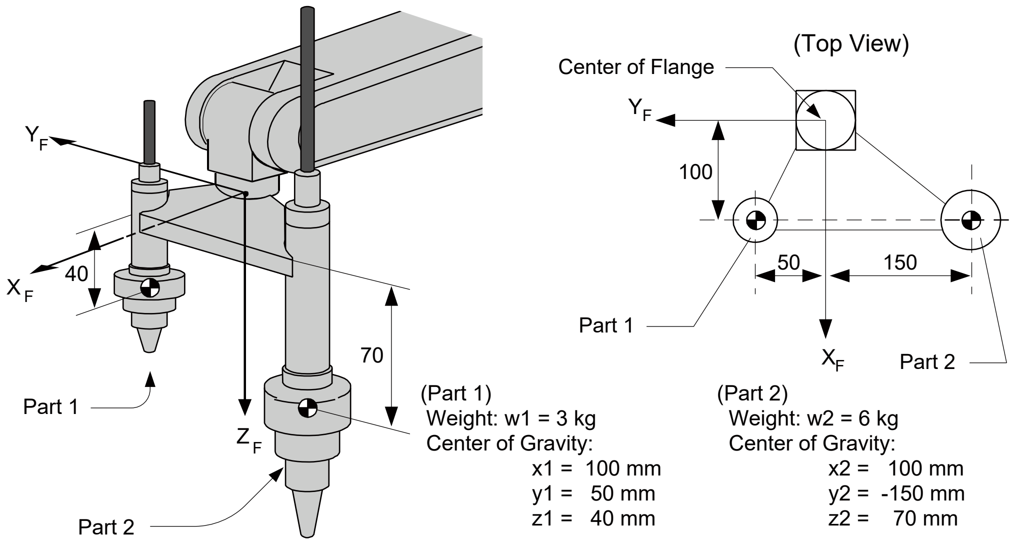
   $$Iz = \{w1 * ((x1 - xg)^2 + (y1 - yg)^2) * 10^{-6} + Icz1\} + \{w2 * ((x2 - xg)^2 + (y2 - yg)^2) * 10^{-6} + Icz$$
   $$.....................$$
   $$+ \{wi * ((xi - xg)^2 + (yi - yg)^2) * 10^{-6} + Iczi\}$$

<Example 3>

When there are two or more big mass 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 : $W = w1 + w2$

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

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

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

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

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

The moment of inertia at the center of gravity position:

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

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

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

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

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

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

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

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

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

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

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

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

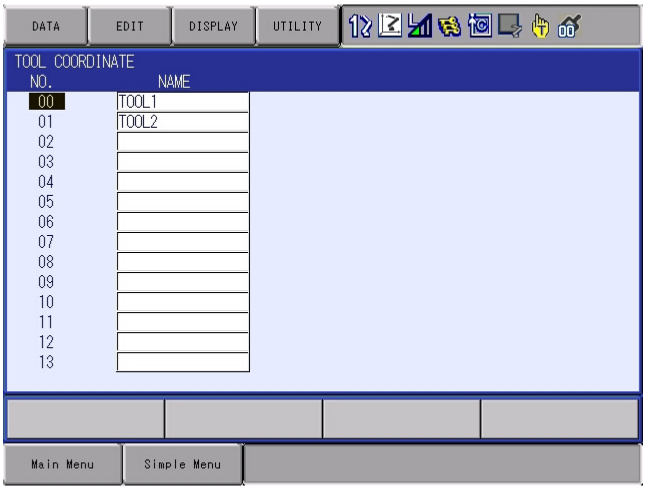
<Setting>

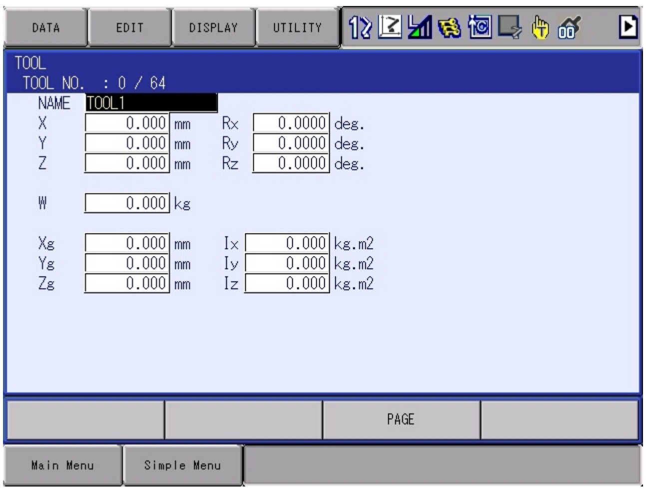
- W : 10.000 kg
- Xg : 100.000 mm
- Yg : -83.333 mm
- Zg : 60.000 mm
- Ix : 0.100 kg.m^2
- Iy : 0.010 kg.m^2
- Iz : 0.100 kg.m^2

8.4.3.3 Tool Load Information Registering

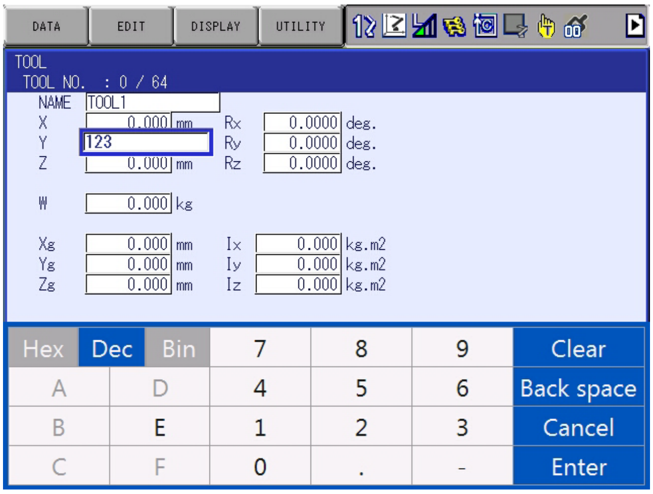
Tool load information is registered in the tool file.

1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
   - The tool coordinate list window appears.
   - The tool coordinate list window appears only when TOOL NO. SWITCH in the TEACHING CONDITION window is set to PERMIT.
   - When TOOL NO. SWITCH in the TEACHING CONDITION window is set to PROHIBIT, the tool window appears.





3. Select the desired tool number.
   (1) Move the cursor to the number of the desired tool, and press [SELECT] in the tool list window.
   (2) The tool coordinate window of the selected number appears.
   (3) Select the desired number in the tool coordinate window by pressing the [PAGE] or clicking on the [PAGE] button.
   (4) To switch the tool list window and the tool coordinate window, press {DISPLAY} → {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 = Payload

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

In this case, when an actual tool load is not 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.

NOTE

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.”

Once this message has been displayed, it will remain until one of below operations is done.

- Editing on the tool coordinate window.
- Executing automatic measurement of the tool load and the center of gravity.
- Loading settings (TOOL.CND) from external memory devices.

Even if it was deleted, it will be displayed again when a tool file the parameter of which is initial setting value is used.

• 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).

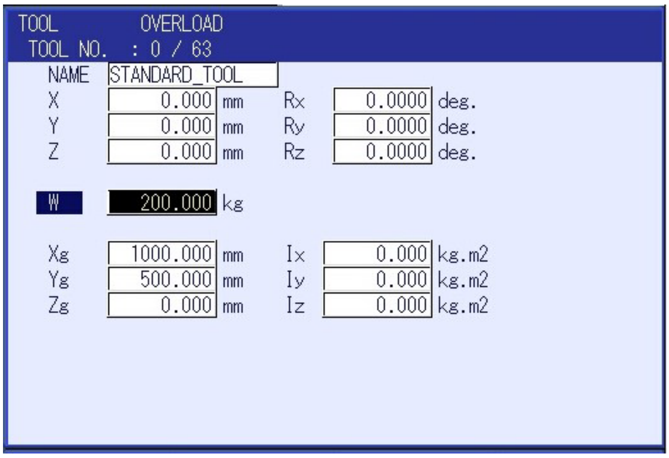
Moreover, set tool load information to the corresponding tool file respectively when total weight and the center of gravity position etc. of the tool is changed (when the system which exchange the tool by automatic tool changer).

8.4.3.4 Tool File Overload Check Function

This function provides notification of an overload when the tool information set in the tool file exceeds the permissible range.
This function is available for YBS3.00-00 or later.

The mass (W), center of gravity (Xg, Yg, Zg), and moment of inertia at the center of gravity (Ix, Iy, Iz) are checked, and if the manipulator is operated when a value exceeds the permissible values, the following message appears.
"Load settings in the tool no.** are out of permissible range. Check these settings." (** is the tool file number)
"OVERLOAD" also appears at the top of the tool file that exceeds the permissible range as shown in the following figure, and the item that exceeds the permissible range flashes.

This message appears when the manipulator is operated until the correct value is set in the tool file. The message is not reset by turning the control power supply OFF and ON.



NOTICE
• This function is not supported when there are multiple manipulators.

8.5 Work Home Position

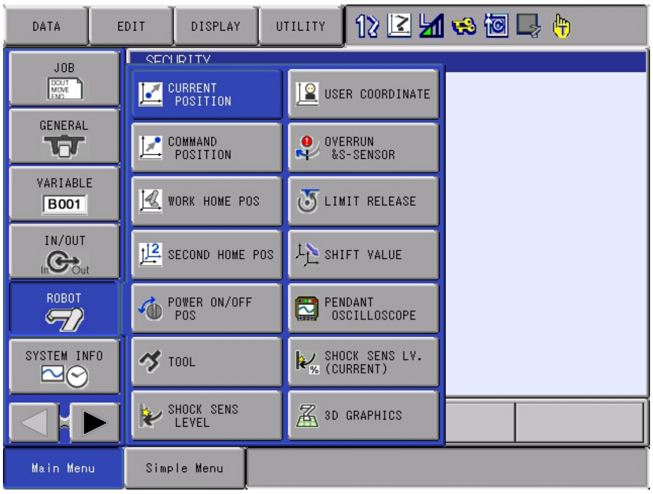
8.5.1 What is the Work Home Position?

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

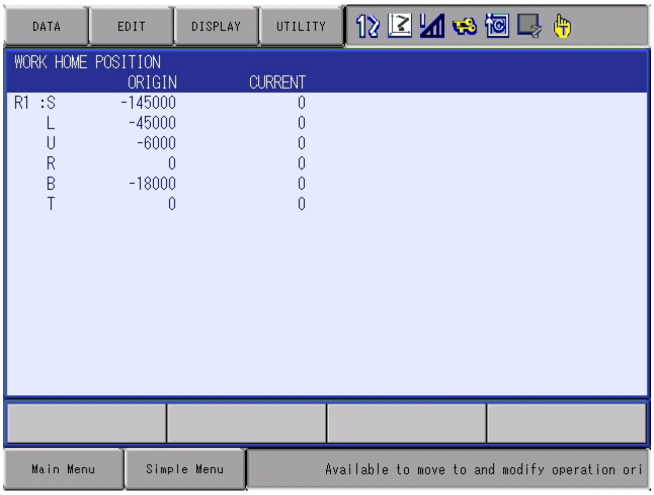
8.5.2.1 Work Home Position Window

1. Select {ROBOT} under the main menu.



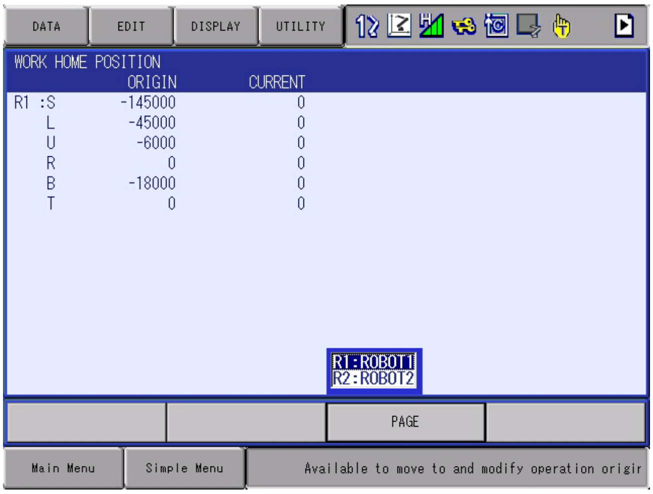
2. Select {WORK HOME POS}.

   – 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.

NOTE

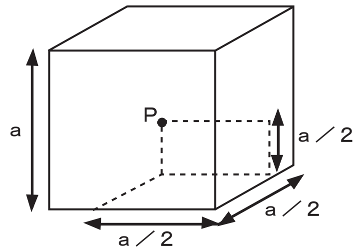
When the work home position is changed, the cubic interference area is automatically set as cube 64 to 63 in the base coordinate system.

• The cube 64 is for ROBOT1

• The cube 63 is for ROBOT2

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 *fig. 8-3*) 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)

Fig. 8-3: S3C1097: The work home position cube length of its sides (μm)



Specify whether "COMMAND POSITION" or "FEEDBACK POSITION" is to be set to the work home position cube signal's CHECK MEASURE in the interference area settings. "COMMAND POSITION" is the default setting.
For the INTERFERENCE AREA window, refer to *chapter 8.6 "Interference Area"* .

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:

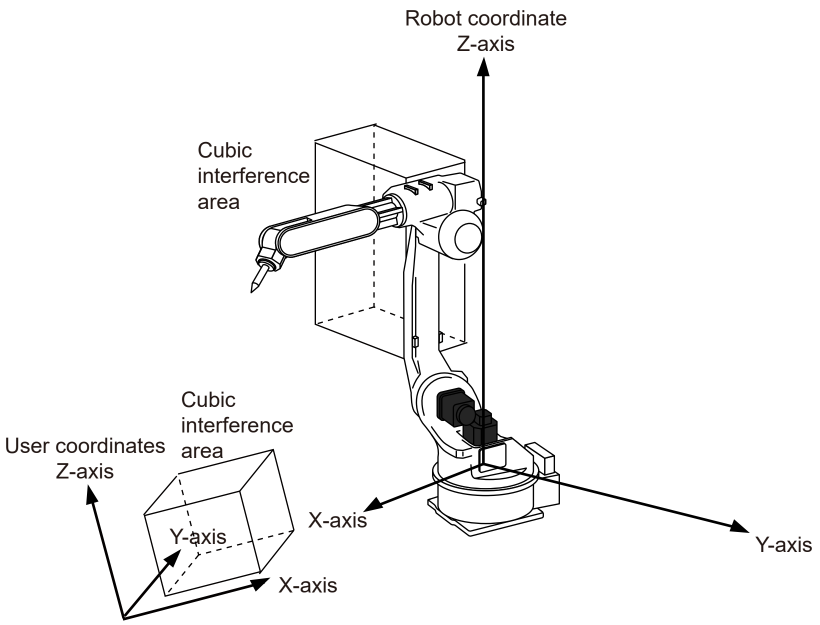
- Cubic Interference
- Outside of cubic area
- Axis Interference

The YRC1000micro 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

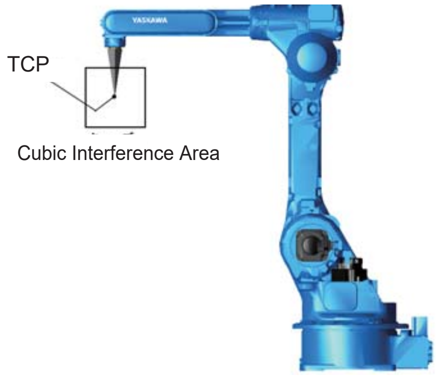
This area is a rectangular parallelepiped which is parallel to the base coordinate, robot coordinate, or user coordinate. The YRC1000micro judges whether the current position of the manipulator's TCP is inside or outside this area, and outputs this status as a signal.



■ **Types of Cubic Interference Area**

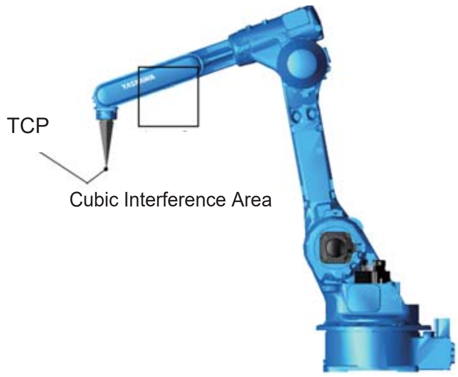
Two types of method to use the cubic interference area are as follows.

- 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



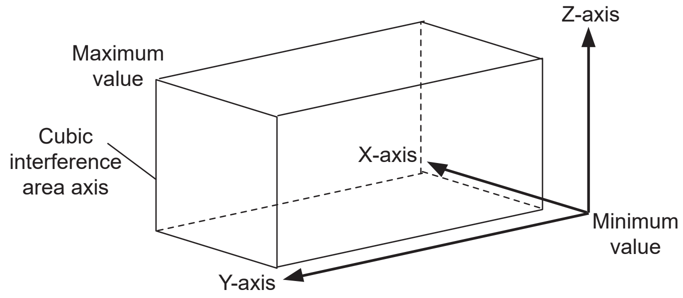
TCP is located outside the cube

- Cubic interference: Specified output signal = OFF
- Outside of cubic area: Specified output signal = ON

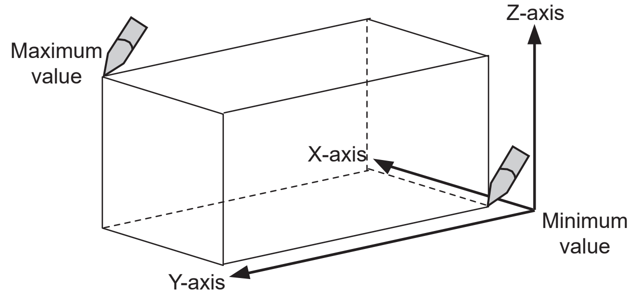
8.6.2.2 Cube Setting Method

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

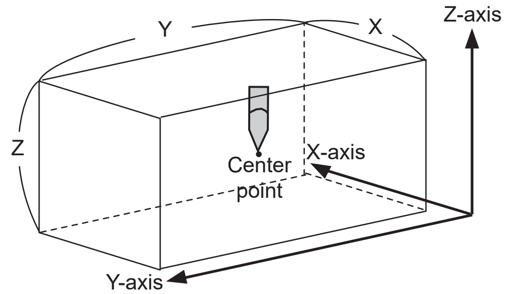
1. Enter the maximum and minimum values for the cube coordinates.



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

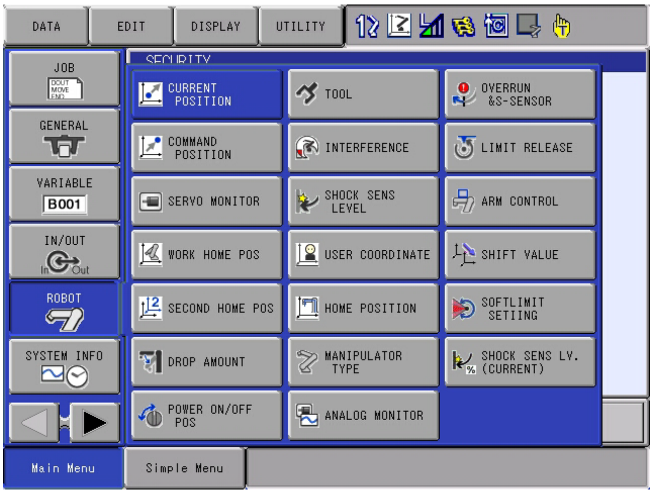


3. After entering the lengths of the three faces of the cube (axial length) using the Numeric keys, move the manipulator to the center point of the cube using the axis keys.

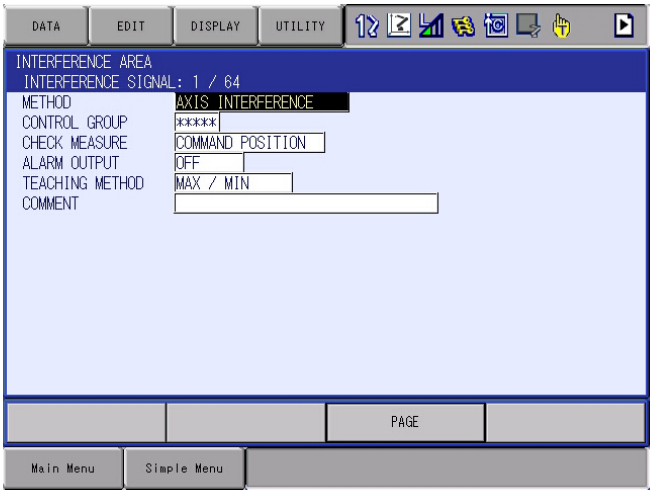


8.6.2.3 Setting Operation

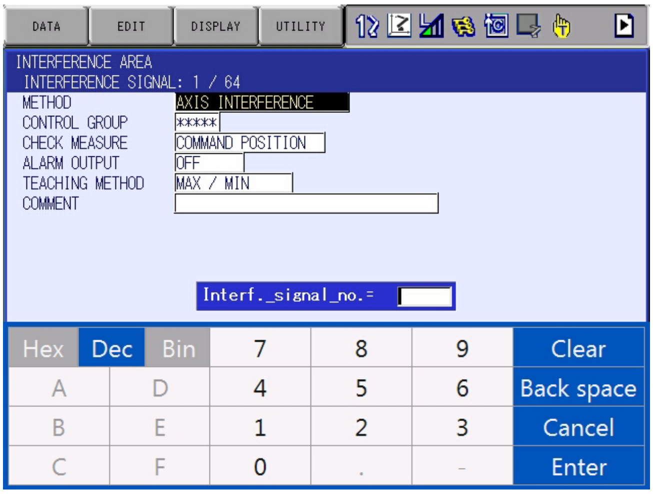
1. Select {ROBOT} under the main menu.



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

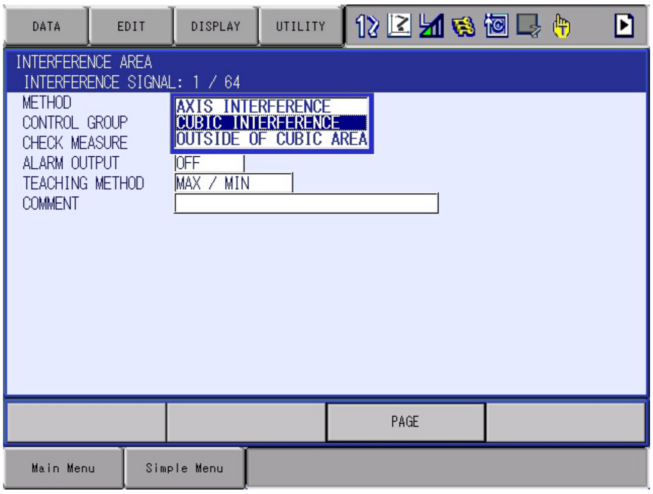


3. Select the desired cube number.
   - Select the desired cube number with the [PAGE] or by number input.
   - When selecting the cube number by number input, select [PAGE] to input the desired signal number.

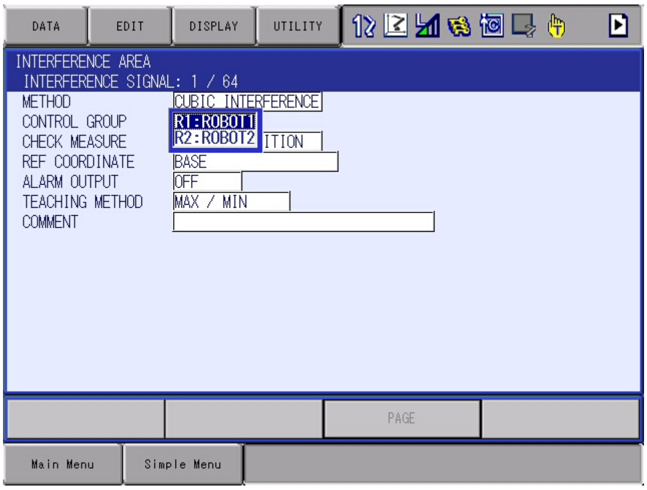


4. Select "METHOD".
   - A selection dialog box appears.

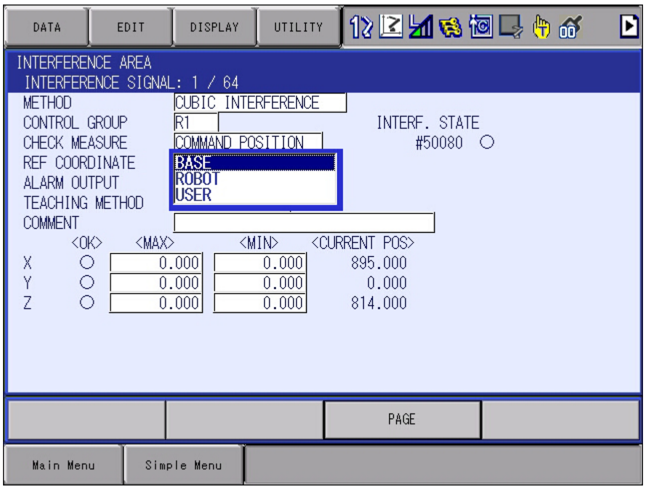
   (1) Select "CUBIC INTERFERENCE" or "OUTSIDE OF CUBIC AREA".



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

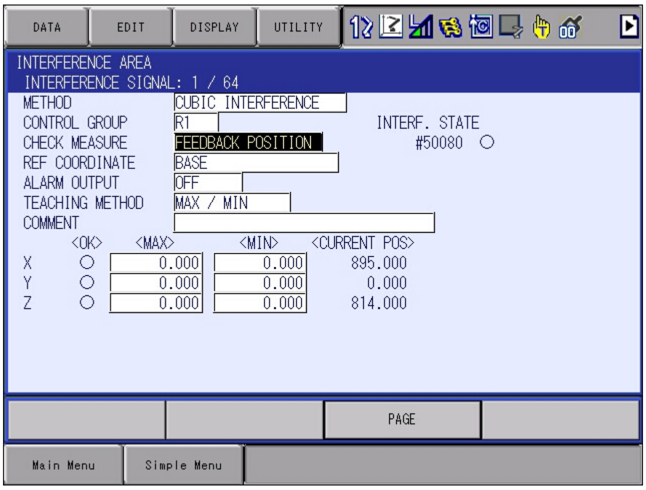


6. Select “REF COORDINATES”.
   – A selection box appears.
   (1) Select the desired coordinate.
   (2) If the user coordinates are selected, the number input line is displayed. Input the user coordinate number and press [ENTER].



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

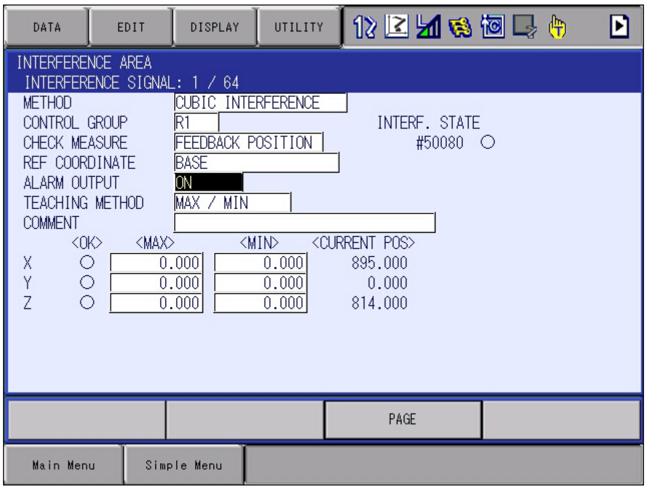
To stop the manipulator movement using the interference signal (use the cube interference signal for mutual interference between robots), set CHECK MEASURE to “COMMAND POSITION”.

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.

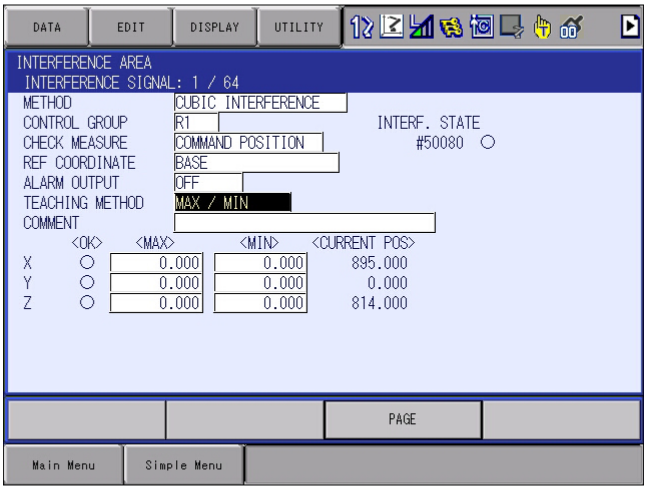
AL4902 CUBE INTERFERENCE (TCP)

■ Number Input of the Cube Coordinates

1. Select “METHOD”.

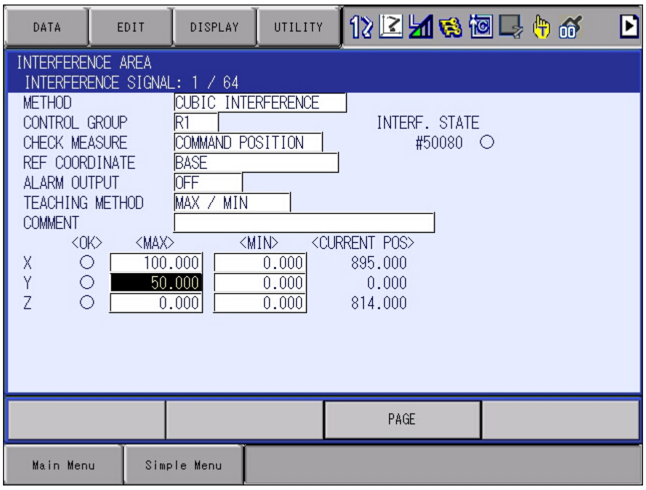
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.



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

   – The cubic interference area is set.

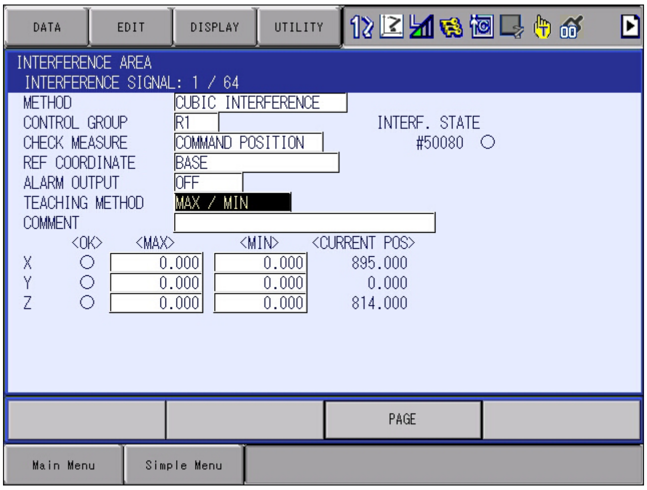


■ Teaching Corner

1. Select “METHOD”.

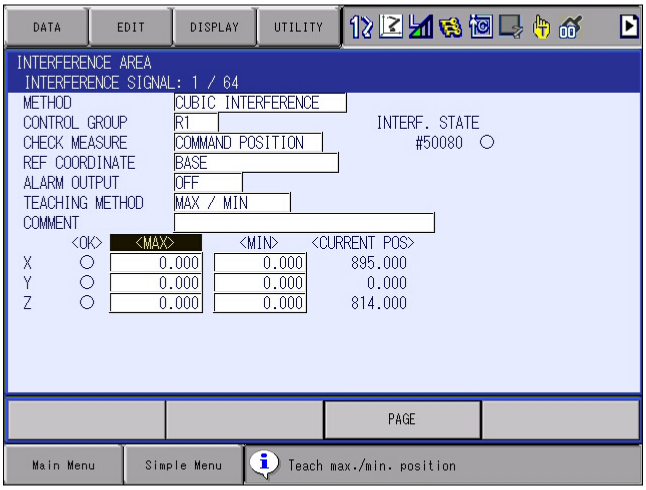
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.



2. Press [MODIFY].

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



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

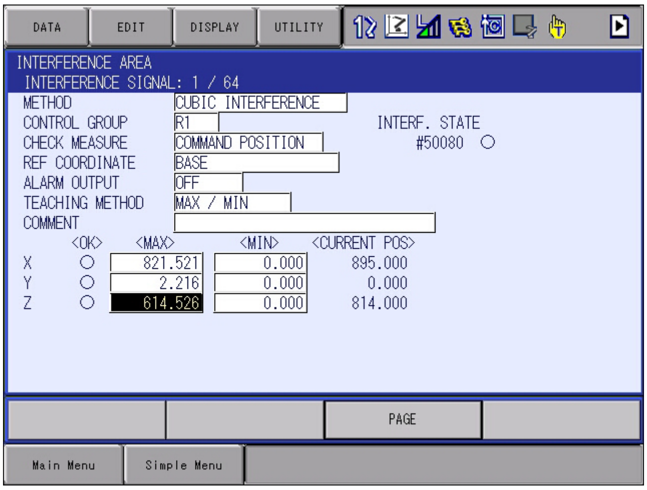
   – Move the cursor to “<MAX>” when changing the maximum value, and move cursor to “<MIN>” when changing the minimum value. The cursor only moves to either “<MIN>” or “<MAX>” at this time.

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.

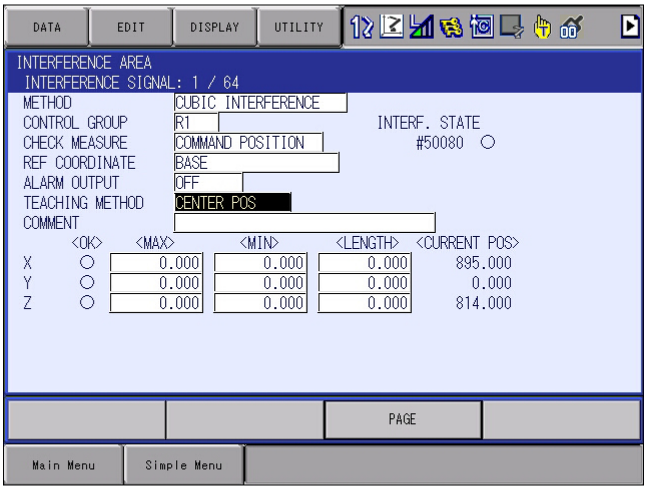


■ **Number Input of the Side of Cube and Teaching Center**

1. Select “METHOD”.

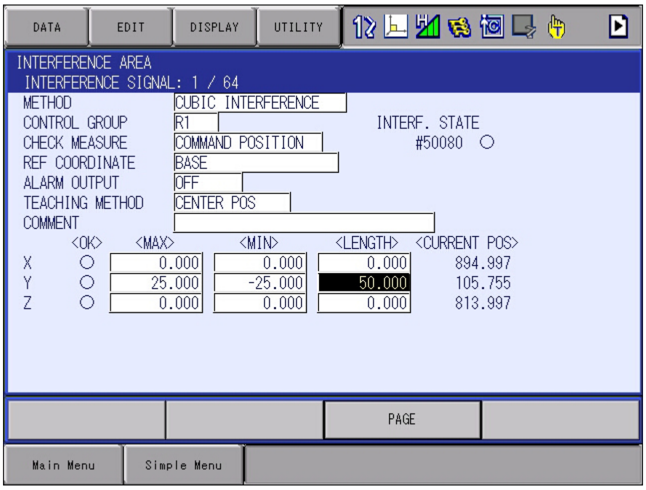
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “CENTER POS”.



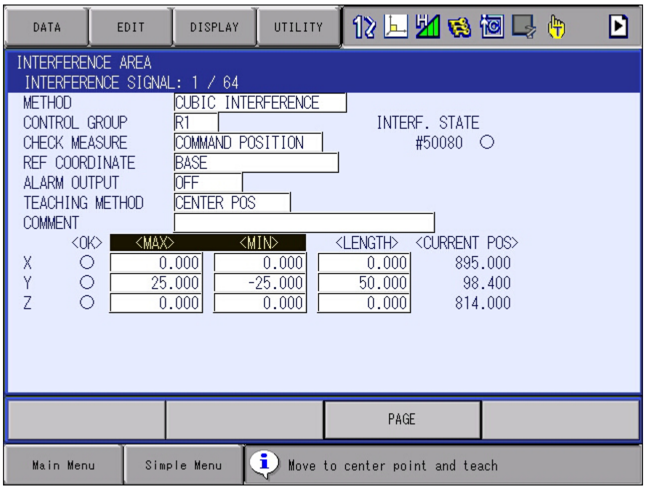
2. Input data for length of the cube, then press [ENTER].

   – 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.

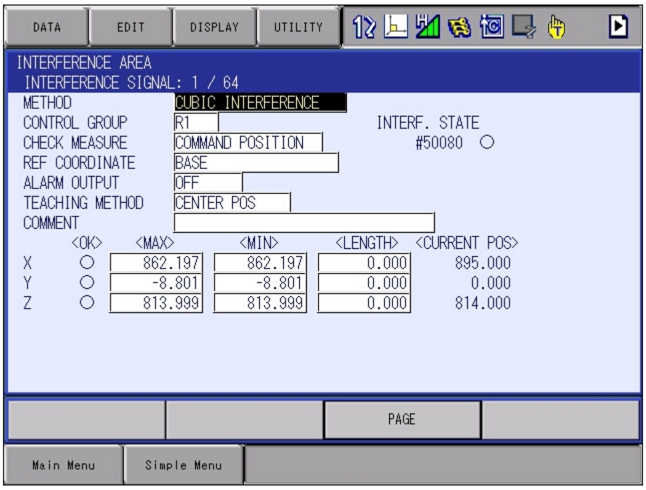


4. Move the manipulator using the axis keys.

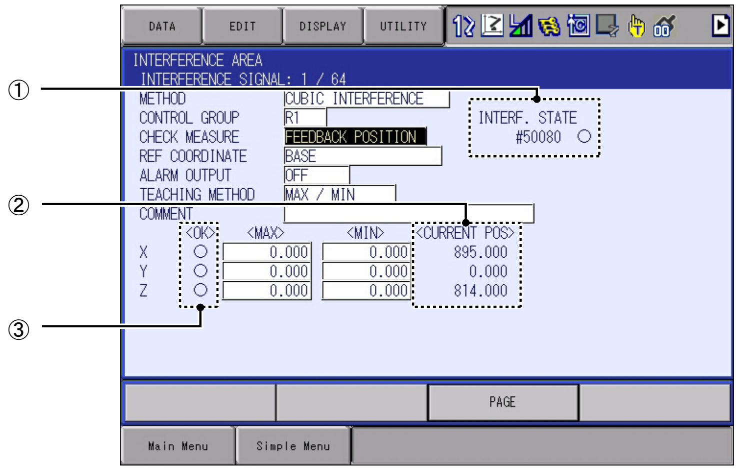
   – Move the manipulator to the center point of the cube using the axis keys.

5. Press [ENTER].

   – The current position is registered as the center point of the cube.



■ Current Position and Interference Area Judgment



① INTERF. STATE

Displays the signal status of the specific output signal (#50080 to #50157) “Cube/Axis interference in xx”.

“●”: Inside of the interference, “○”: Outside of the interference

② CURRENT POS

Displays the current robot position.

③ OK

“●”: within the range, “○”: out of the range, which is between “MAX” and “MIN” displayed the current value of the axis.
Only when METHOD is OUTSIDE OF CUBIC AREA

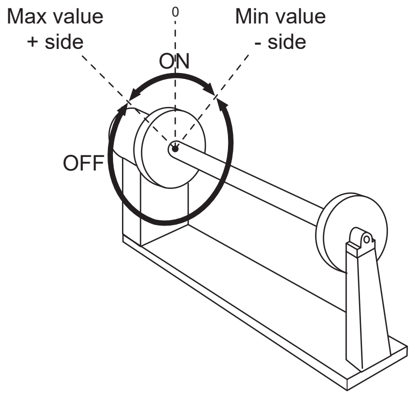
“○”: within the range, “●”: out of the range, which is between “MAX” and “MIN” displayed the current value of the axis.

8.6.3 Axis Interference Area

8.6.3.1 Axis Interference Area

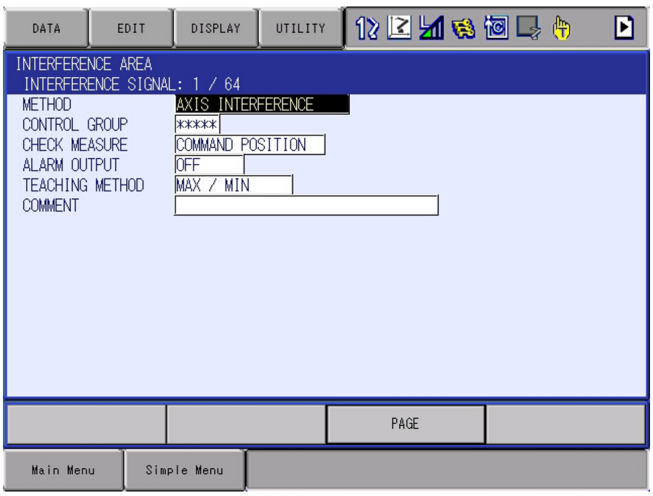
The axis interference area is a function that judges the current position of the each axis and outputs a signal. Once the maximum and minimum values have been set at the plus and minus sides of the axis to define the working range, a signal indicating whether the current position of the axis is inside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

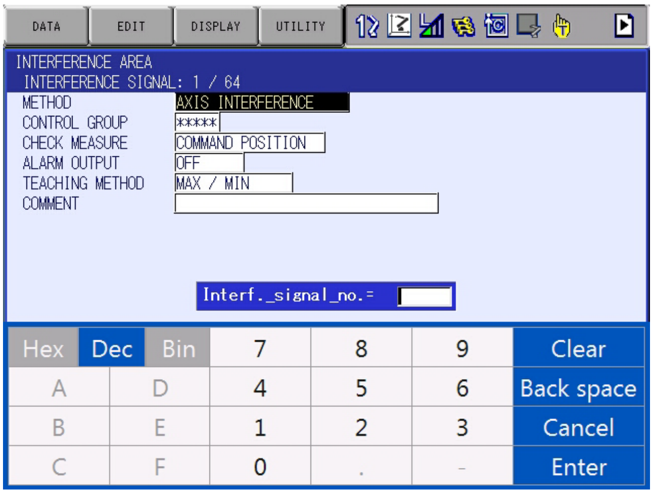
1. Select {ROBOT} under the main menu.
2. Select {INTERFERENCE}.
   – The INTERFERENCE AREA window appears.



3. Select the desired interference signal number.

   – Select the desired interference signal number using the [PAGE] or by number input.

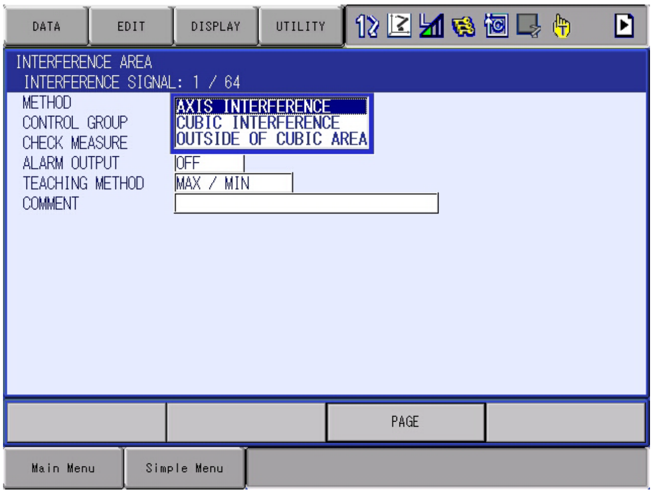
   – When selecting the desired interference signal number by number input, select [PAGE] to input the desired signal number.



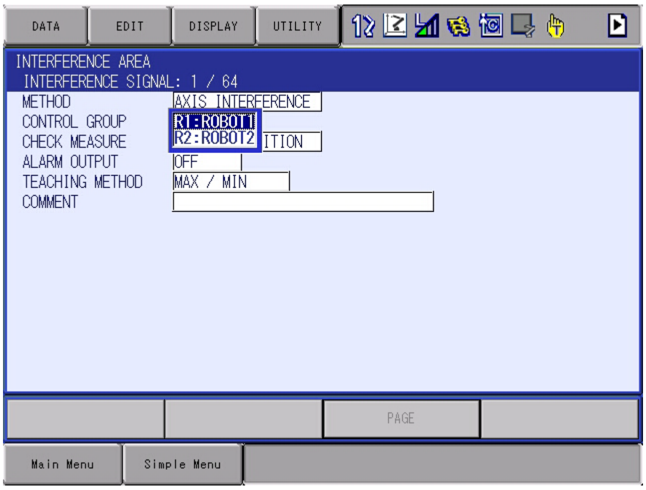
4. Select “METHOD”.

   – A selection dialog box appears.

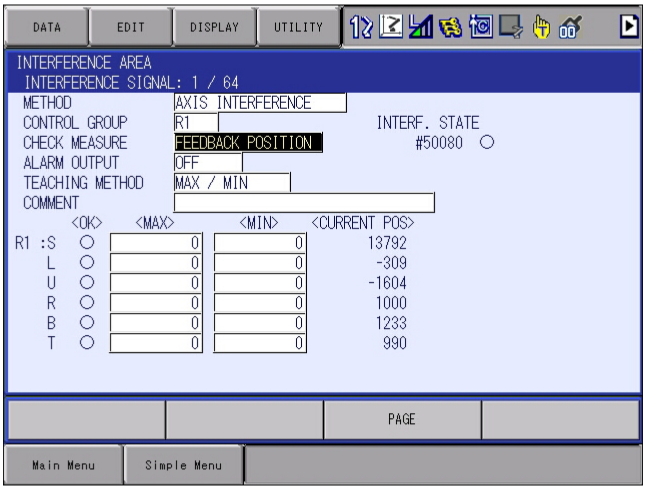
   (1) Select “AXIS INTERFERENCE”.



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

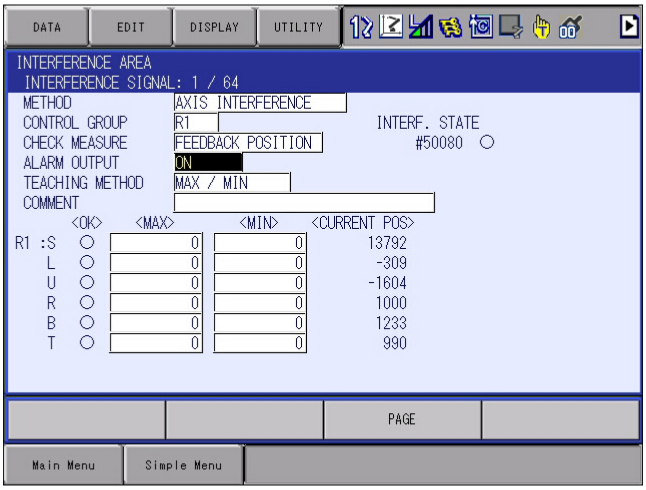


6. Select “CHECK MEASURE”.
   – Each time [SELECT] is pressed, “COMMAND POSITION” and “FEEDBACK POSITION” switch alternately.



7. Select “ALARM OUTPUT”.

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



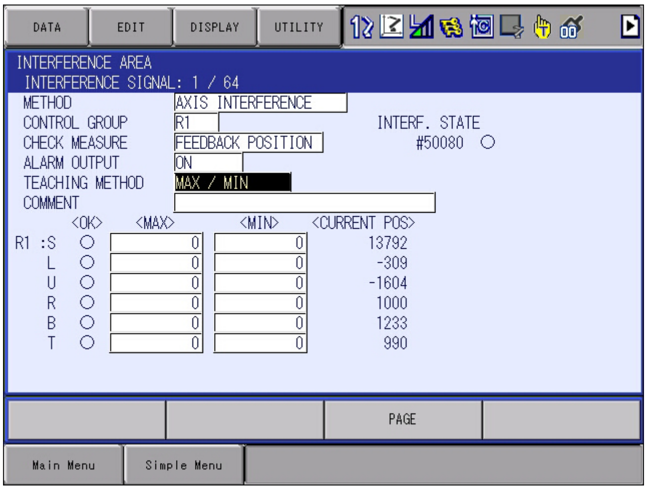
When selecting “ON” and if the manipulator’s axes approach inside the pre-defined interference area, the following alarm occurs and the manipulator stops immediately.

AL4901 AXIS INTERFERENCE

■ Number Input of the Axis Data Coordinates

1. Select “METHOD”.

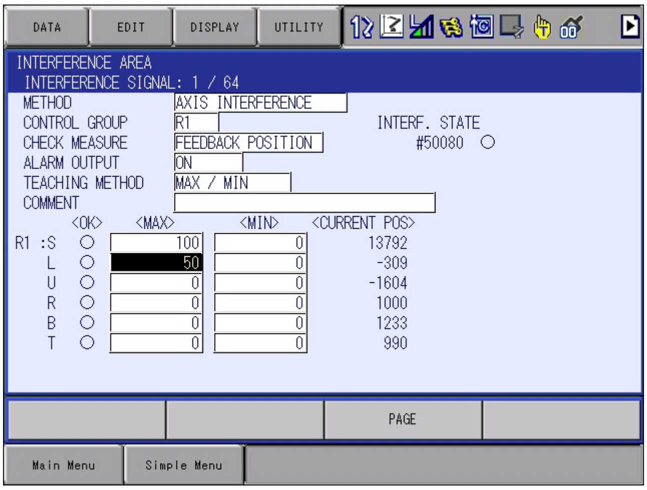
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.



   (2) Select “MAX/MIN”.

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

   – The axis interference area is set.

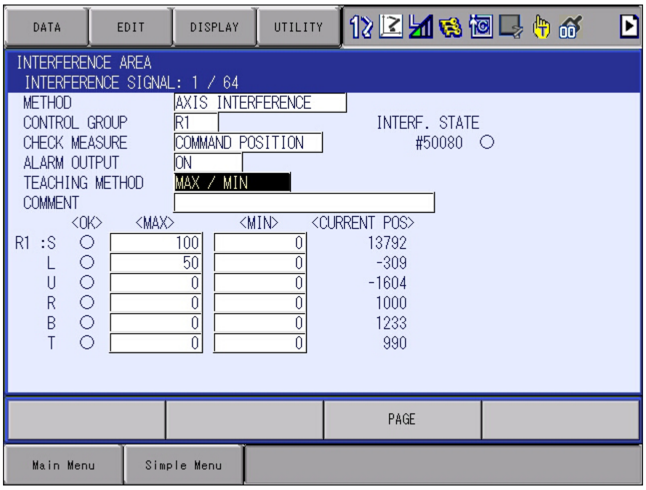


■ Teaching Corner

1. Select “METHOD”.

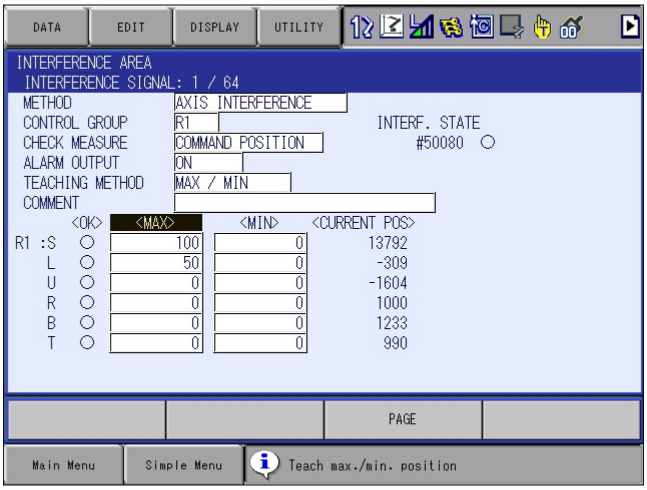
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.



2. Press [MODIFY].

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



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

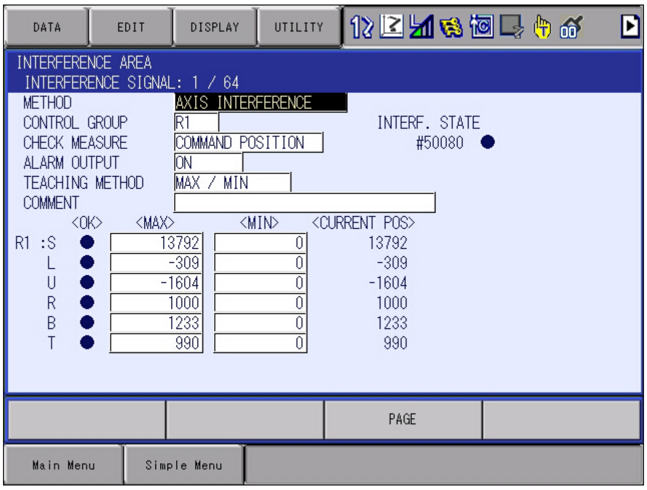
   – Move the cursor to “<MAX>” when changing the maximum value, and move cursor to “<MIN>” when changing the minimum value. The cursor only moves to either “<MIN>” or “<MAX>” at this time.

4. Move the manipulator using the axis keys.

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

5. Press [ENTER].

   – The cubic interference area is registered.

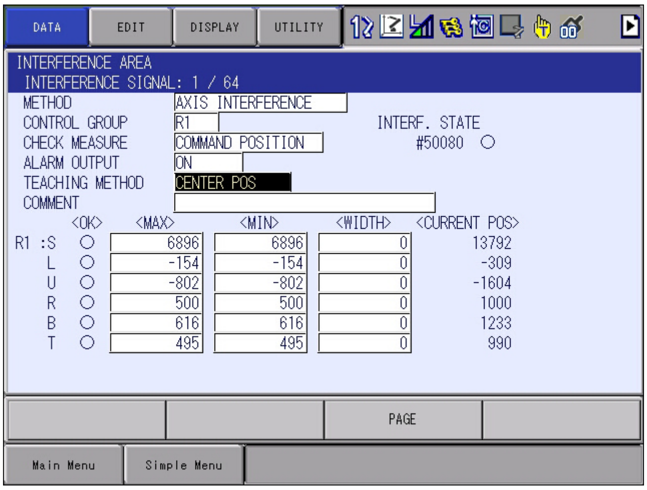


■ Number Input of Center Position (WIDTH) and Teaching Center

1. Select “METHOD”.

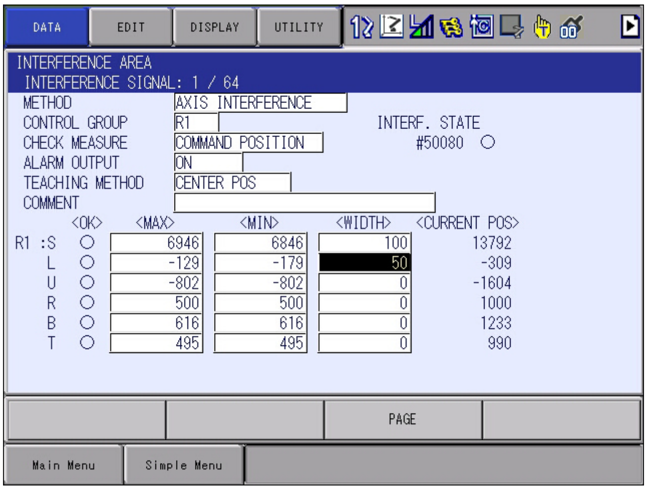
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “CENTER POS”.



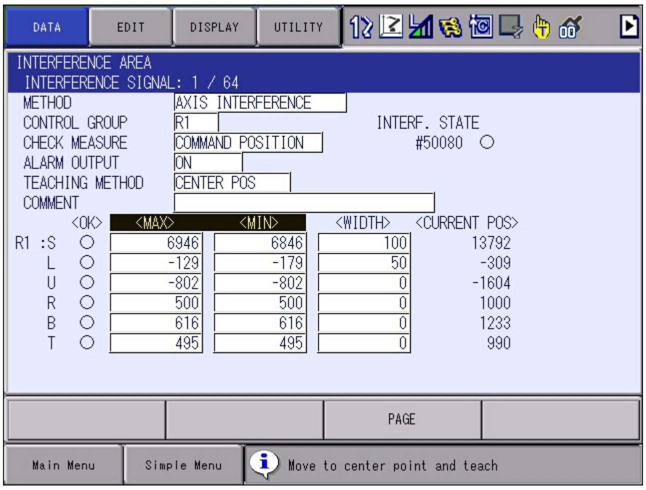
2. Input number for “WIDTH” data and press [ENTER].

   – “WIDTH” is set.



3. Press [MODIFY].

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

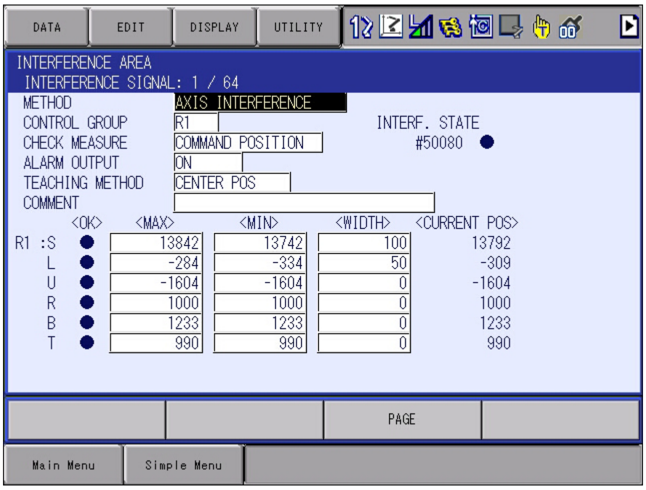


4. Move the manipulator using the axis keys.

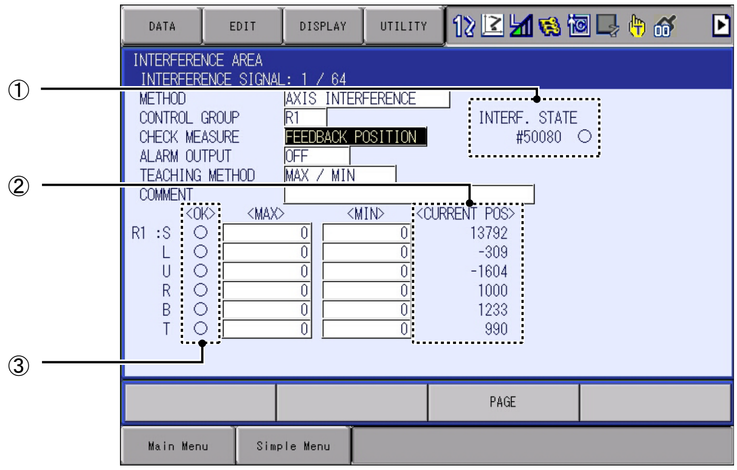
   – Move the manipulator to the center position of the cube using the axis keys.

5. Press [ENTER].

   – The center position of the cube is registered.



■ Current Position and Interference Area Judgment



① **INTERF. STATE**

Displays the signal status of the specific output signal (#50080 to #50157) “Cube/Axis interference in xx”.

“●”: Inside of the interference, “○”: Outside of the interference

② **CURRENT POS**

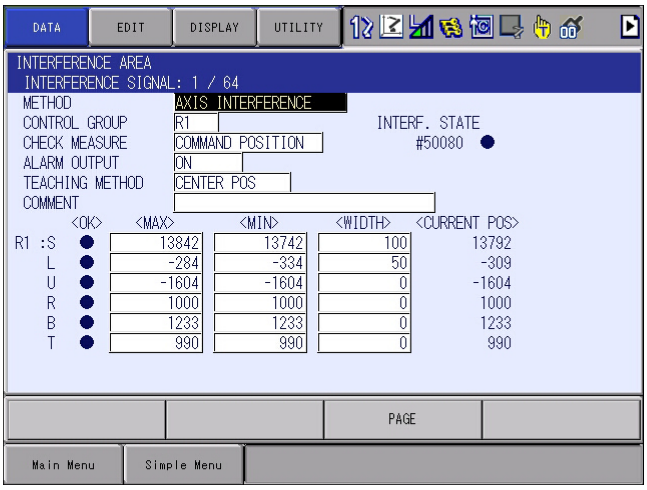
Displays the current robot position.

③ **OK**

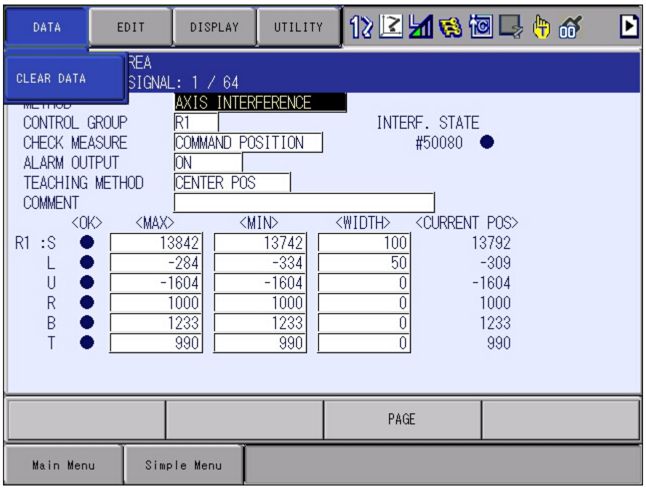
“●”: within the range, “○”: out of the range, which is between “MAX” and “MIN” displayed the current value of the axis.

8.6.4 Clearing the Interference Area Data

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

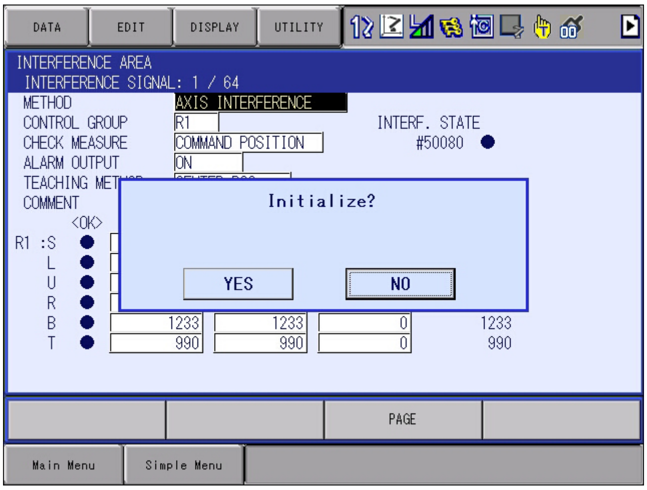


3. Select interference signal to be cleared.
   – Select the desired interference signal number to be cleared using the [PAGE] or by number input.
   – When selecting the desired interference signal number by number input, select [PAGE] to input the desired signal number.
4. Select {DATA} in the pull-down menu.



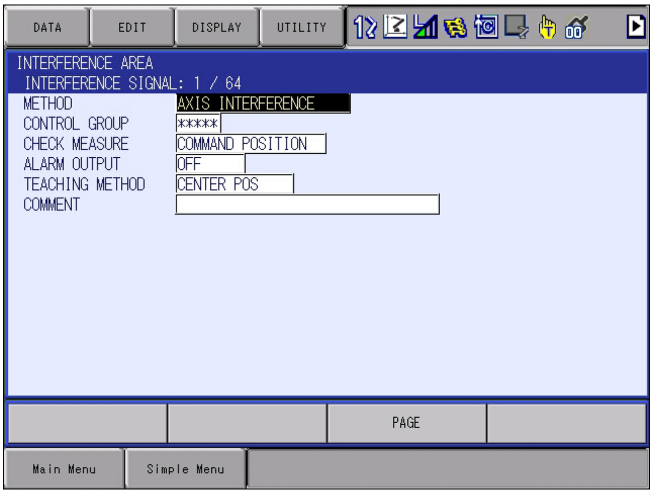
5. Select {CLEAR DATA}.

– The confirmation dialog box appears.



6. Select {YES}.

– All the data of the interference signal number are cleared.



8.7 Shock Detection Function

8.7.1 Shock Detection Function

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

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

WARNING

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 "Safety"* to *chapter 6 "Test of Program Operation"* for the safety measures in details.

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

8.7.2 Shock Detection Function Setting

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

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

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

The detection sensitivity is set by setting the detection level.

8.7.2.1 Shock Detection Level Setting

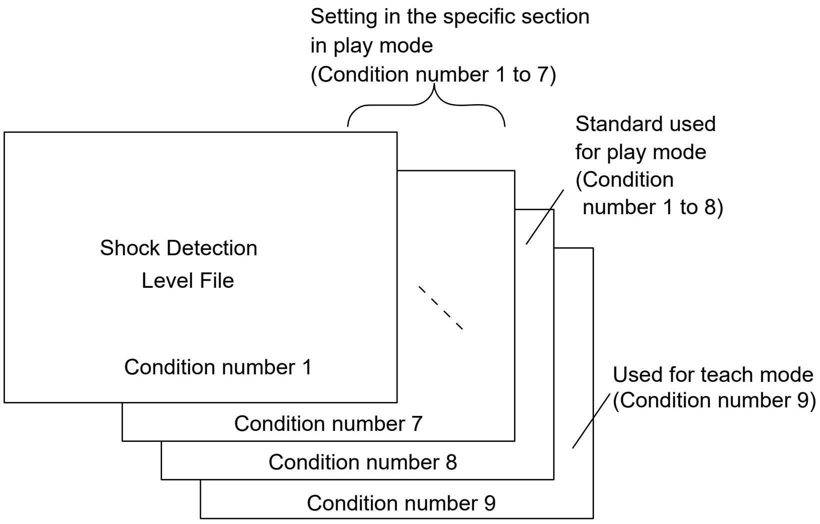
The shock detection level is set in the shock detection level set file.

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

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

The detection level is changed by a job instruction SHCKSET.

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



SUPPLE-MENT

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

SUPPLE-MENT

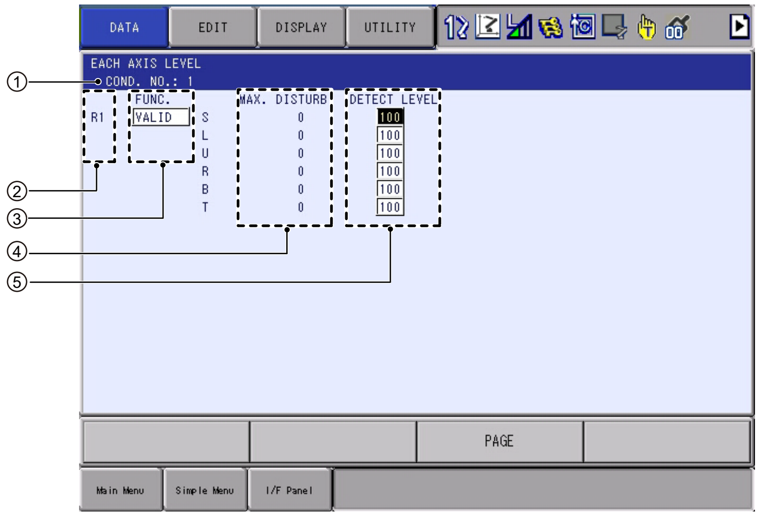
Teach Mode Each Axis Setting Function

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)



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} → {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 material handling: Set the total load information (weight, center of gravity, and the moment of inertia at the center of gravity) of the hand and the maximum load workpiece.
For other applications: Set the load information (weight, center of gravity, and the moment of inertia at the 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

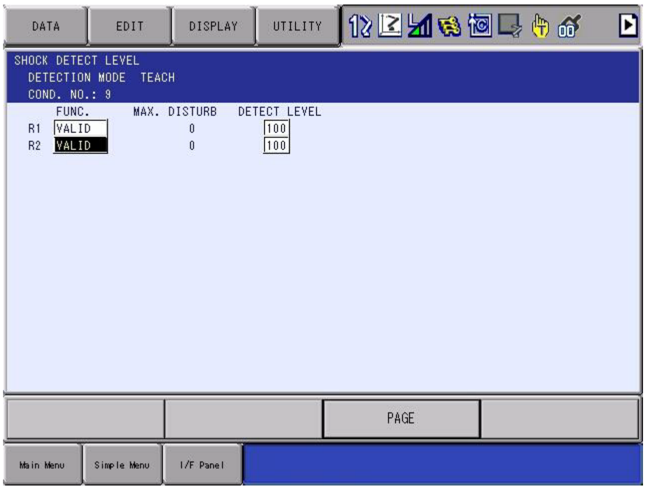
① Open the SHOCK DETECT LEVEL window.

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.



NOTE

- Perform all the jobs to use for 5 to 6 hours.
- 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.

NOTE

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.

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.
A cold start refers to starting the robot without a warm-up operation after it has not been operated for a long time.
In a cold start, an disturbance force is large for a certain period of time because the grease viscosity is high. An offset value is added to DETECT LEVEL for a certain period of time to avoid a false shock detection that may be caused by the large disturbance force.
Excluding special cases, the robot is set to the cold start state and a 20% offset value is added to DETECT LEVEL when the control power supply is turned ON and when the robot has stopped continuously for 30 minutes or longer. The cold start state is canceled after 60 minutes of operation.
Please note that 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. Whether it is in a cold start state or not can be checked on the EACH AXIS LEVEL (CURRENT) Window.
The offset value is 20% except for special models.

NOTE

The current DETECT LEVEL (sum of DETECT LEVEL and the offset value for cold start) can be confirmed under "Detection Level" on the EACH AXIS LEVEL (CURRENT) Window.
For the EACH AXIS LEVEL (CURRENT) Window, refer to *chapter 8.7.2.2 "EACH AXIS LEVEL (CURRENT) Window"* .

NOTE

DETECT LEVEL can be modified only when the security mode is set in the management mode.

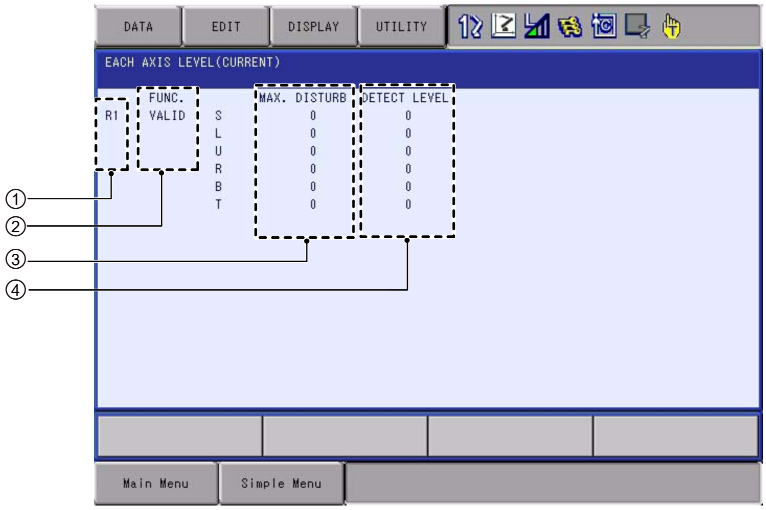
8.7.2.2 EACH AXIS LEVEL (CURRENT) Window

The shock detection levels that are currently set can be checked on this window.

The shock detection levels change for the following reasons.

- The shock detection levels were set by the shock detection level set file.
- The shock detection levels were set by executing the SHCKSET instruction.
- When the offset value is added during a cold start.
- Teach mode and play mode

The shock detection levels can be checked to determine if they are changing correctly by displaying the currently set shock detection levels.



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

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

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

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

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.
A cold start refers to starting the robot without a warm-up operation after it has not been operated for a long time.
In a cold start, an disturbance force is large for a certain period of time because the grease viscosity is high. An offset value is added to DETECT LEVEL for a certain period of time to avoid a false shock detection that may be caused by the large disturbance force.
Excluding special cases, the robot is set to the cold start state and a 20% offset value is added to DETECT LEVEL when the control power supply is turned ON and when the robot has stopped continuously for 30 minutes or longer.
The cold start state is canceled after 60 minutes of operation.
The currently set level at which a shock is detected is displayed under "Detection Level" on the EACH AXIS LEVEL (CURRENT) Window. When in cold start, the sum of DETECT LEVEL and offset value will be displayed in the window.

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 play back operation.

The additional items of the SHCKSET instruction are as follows.

```
SHCKSET  R1  SSL#(1)  AXIS1=100 AXIS2=100 AXIS3=100 AXIS4=100
         |     |      AXIS5=100 AXIS6=100 AXIS7=100 AXIS8=100
         ①     ②                |
                                ③
```

① **Robot Setting**

Specifies the manipulator (R1 to R2)/ station (ST1 to ST3) 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.

AXIS1 ↓ S-axis	AXIS2 ↓ L-axis	AXIS3 ↓ U-axis	AXIS4 ↓ R-axis	AXIS5 ↓ B-axis	AXIS6 ↓ T-axis

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.

■ 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

① Robot Setting

Specifies the manipulator (R1 to R2)/ station (ST1 to ST3) of which shock detection level is to be modified.

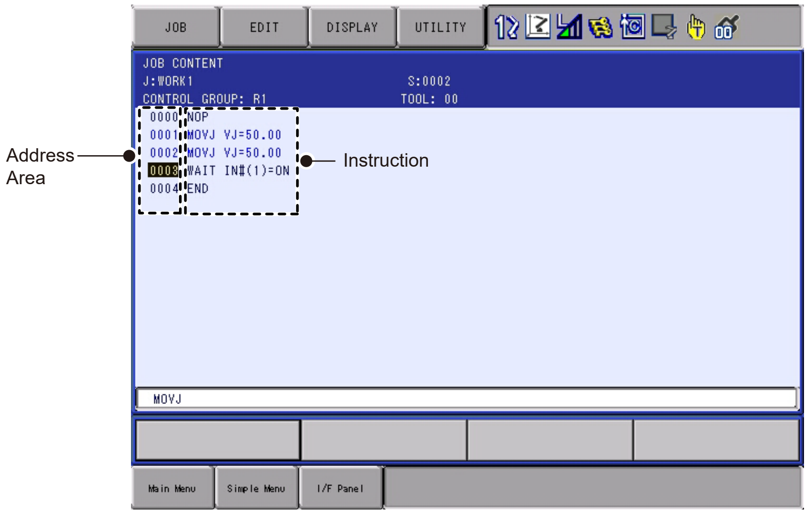
If nothing is specified, the modification will be applied to the shock detection level of the job control group of this instruction.

However, in case of coordinated job, the modification is applied to the shock detection level of the slave axis group.

■ Instruction Registration

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

1. Select {JOB} under the main menu.



2. Select {JOB}.

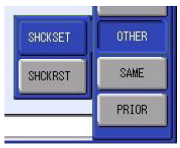
3. Move the cursor in the address area.

■ SHCKSET

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

2. Press [INFORM LIST].

   – The inform list dialog box is shown.



3. Select SHCKSET instruction.

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

   (2) Change the value of additional item and numerical data.

   (3) Press [INSERT] then [ENTER].

4. Change the value of additional item and numerical data.

   – < When registering the instruction as it is >
   Operate the step 5 when registering the instruction in the input buffer line as it is.

   – < When adding or changing the additional item >

   • When changing the shock detection level

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

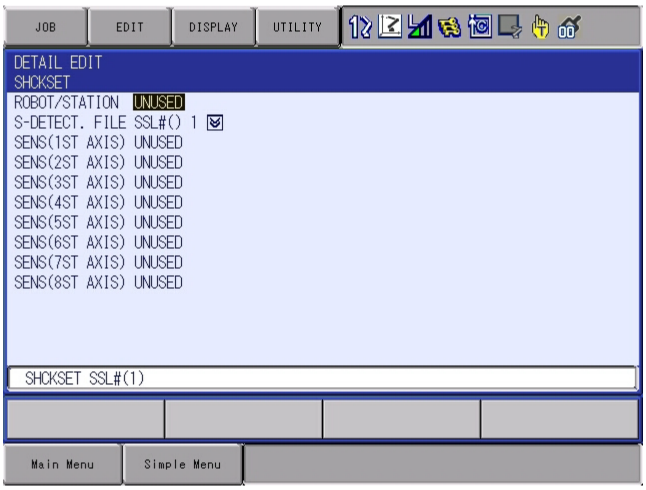
   • When the value is input with the numeric key

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

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

   • When the robot specification is added

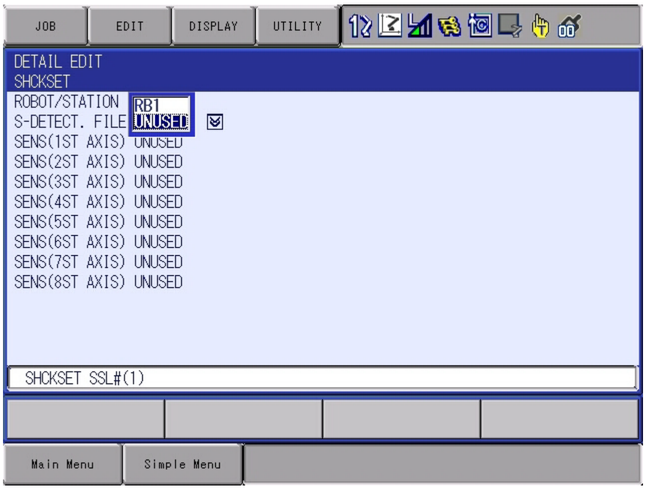
   (1) When the robot specification is added, move the cursor to the instruction in the input buffer line and press [SELECT] to display the DETAIL window.



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

   (3) The selection box appears.

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

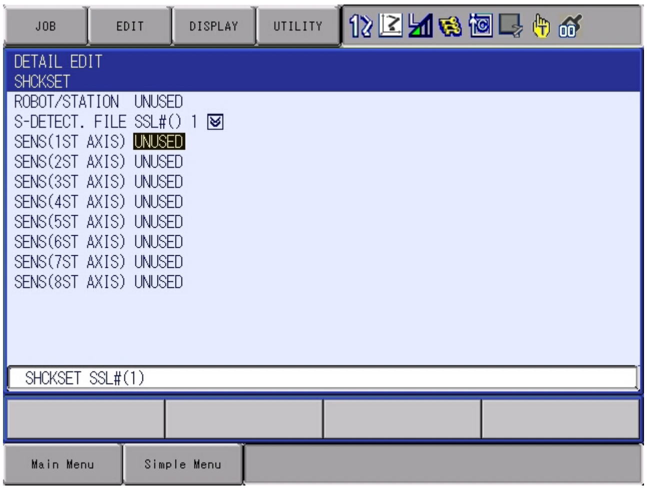


(5) When the addition of robot/station is completed, press [ENTER].

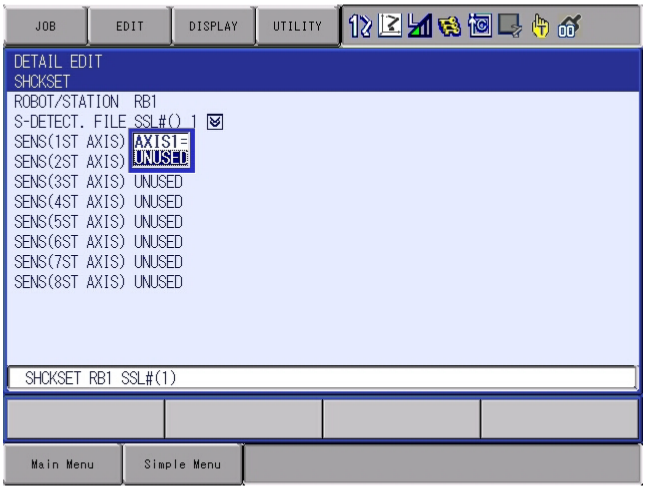
(6) The DETAIL window closes and the JOB CONTENT window appears.

• 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.



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



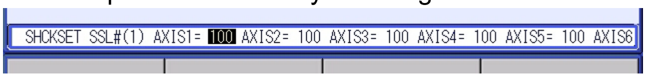
(3) The selection box appears, and select “AXIS=”.

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

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

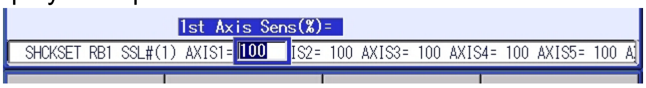
• When changing the shock detection level for the each axis

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



• When the value is input with the numeric key

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



(2) Input the numbers, and then press [ENTER]. The value in the input buffers is changed.

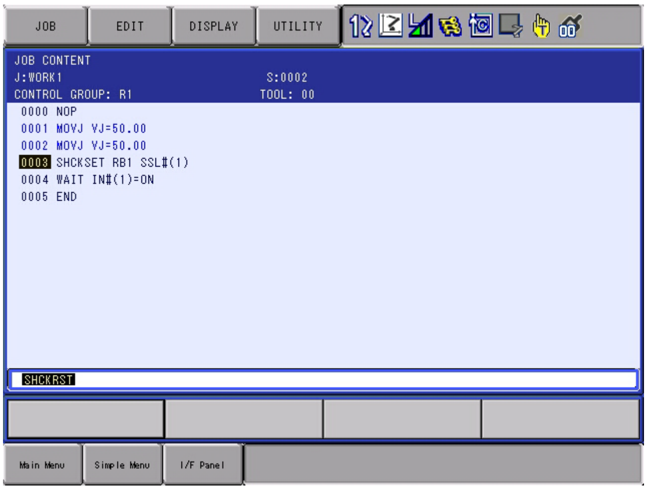
5. Press [INSERT] then [ENTER].

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

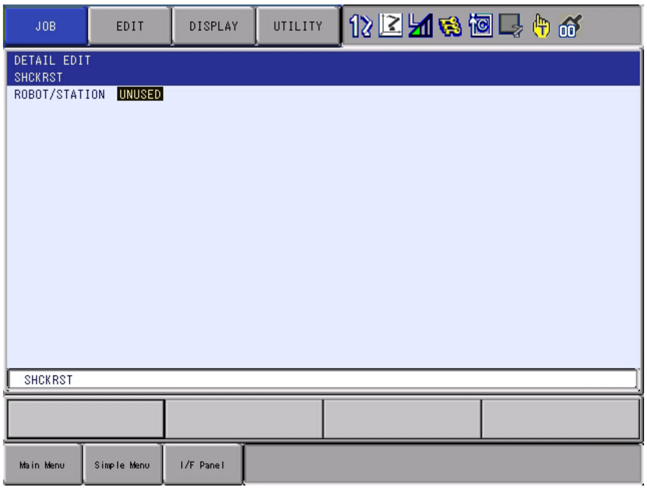
SHCKRST

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

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



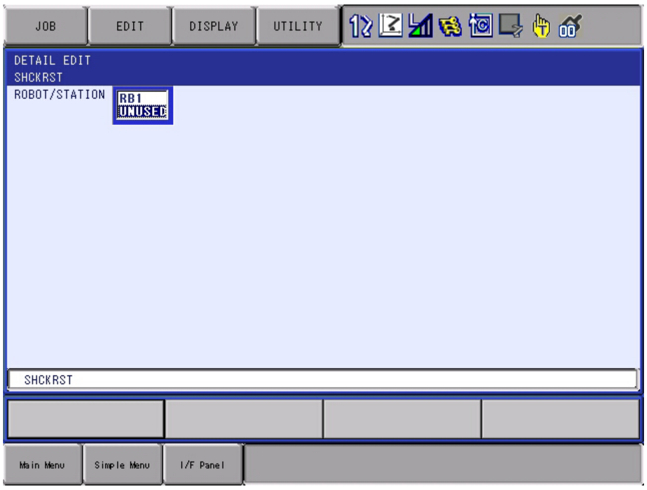
4. Change the value of the additional item.
   – < When registering the instruction as it is >
   Operate the step 5 when registering the instruction in the input buffer line as it is.
   – < When adding or changing the additional item >
   (1) When adding the robot specification, move the cursor to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



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

(3) The selection box appears.

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



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

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

5. Press [INSERT] then [ENTER].

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

8.7.2.6 Resetting the Shock Detected

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

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

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

> **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.

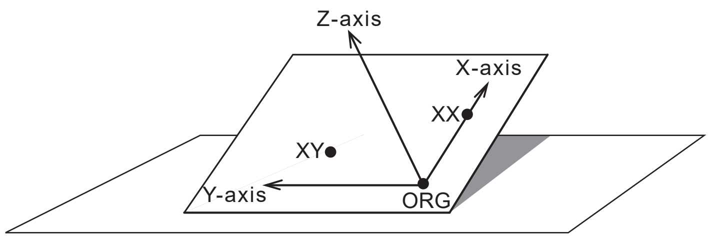
8.8 User Coordinates Setting

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.

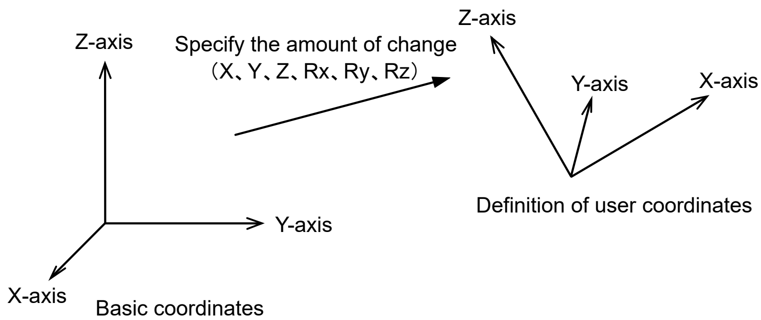


User coordinate definition point
ORG: Home position
XX: Point on the X-axis
XY: Point on the Y-axis

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

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

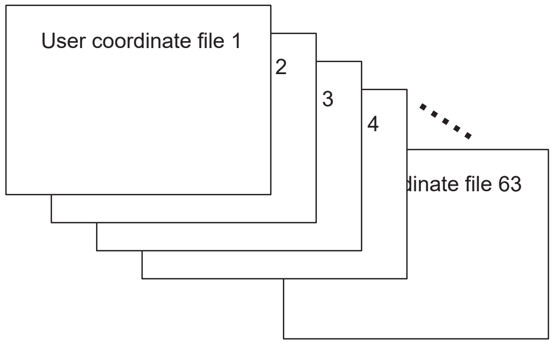
- Specify the amount of change from the basic coordinates
  User coordinates are defined by specifying the coordinates as a basic coordinates (base coordinates or user coordinates) and the amount of change of coordinate value from the basic coordinates. As shown in the following figure, the data X, Y,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



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.

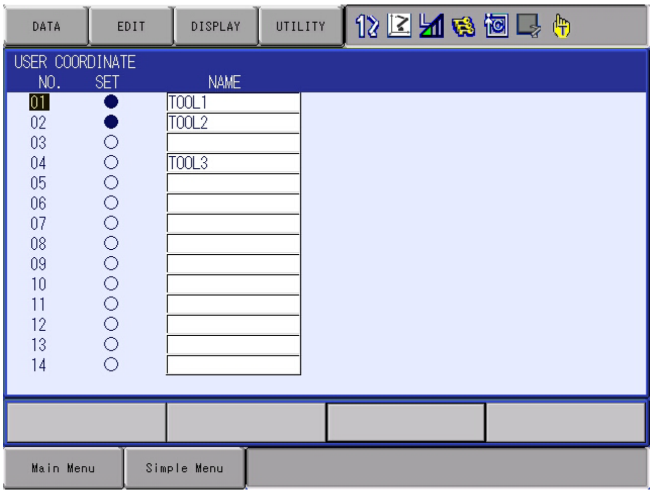
8.8.1.2 User Coordinates Files

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

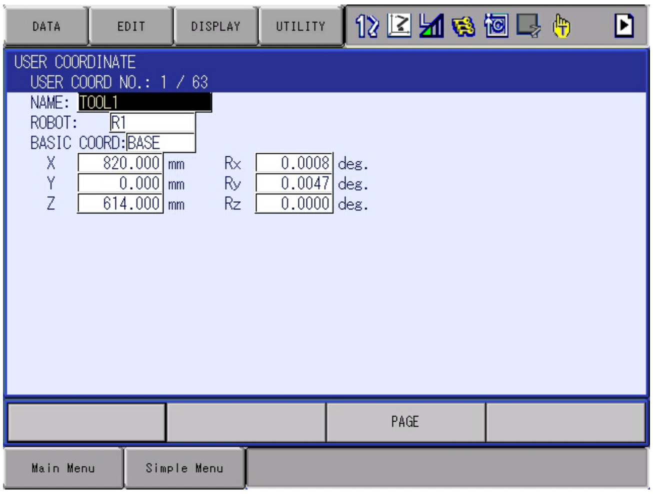


8.8.2 User Coordinate Setting

1. Select {ROBOT} under the main menu.
2. Select {USER COORDINATE}.
   (1) The USER COORDINATE window appears.

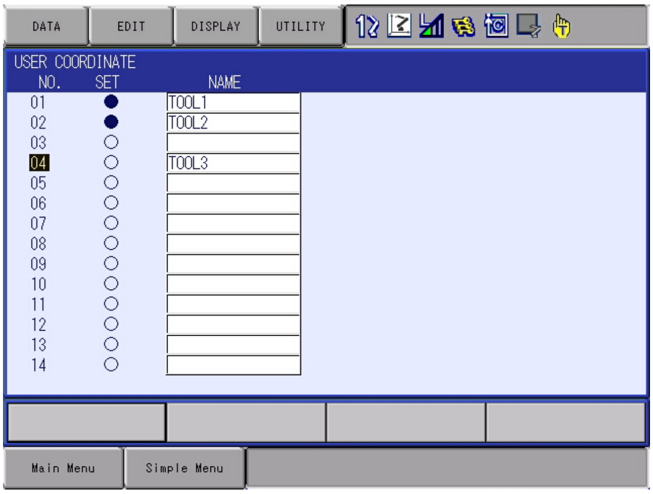


   (2) The "●" mark indicates that the user coordinates is completed to set and the "○" mark indicates that it is not completed.
   (3) To check the position of the user coordinates select {DISPLAY} → {COORDINATE DATA}.
   (4) The following window appears.



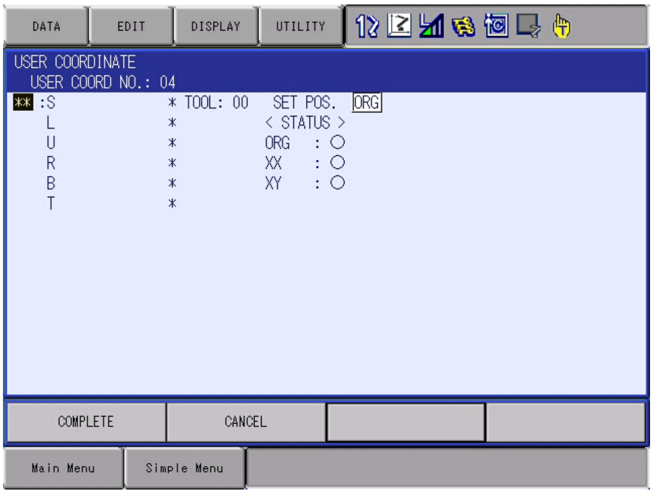
■ **Perform teaching by axis operations of the manipulator**

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



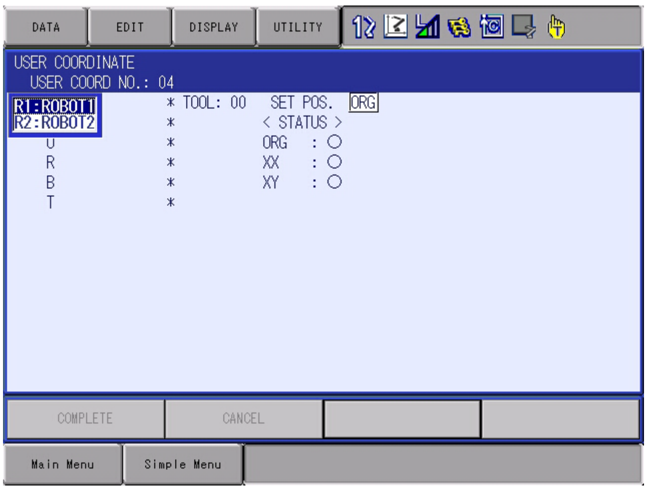
2. Press [SELECT].

– The user coordinate setup window is shown.



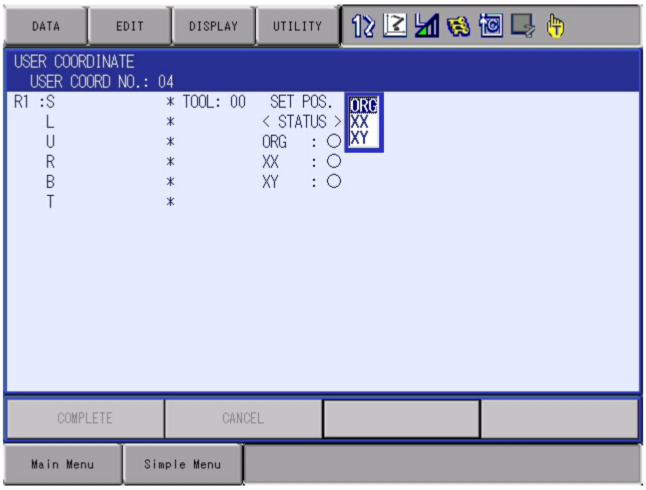
3. Select the robot.

– 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.

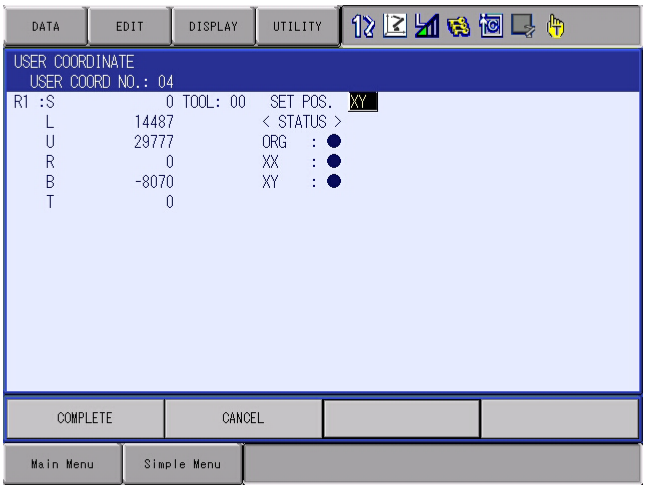


5. Move the manipulator to the desired position with the axis keys.
6. Press [MODIFY] then [ENTER].

   – 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.



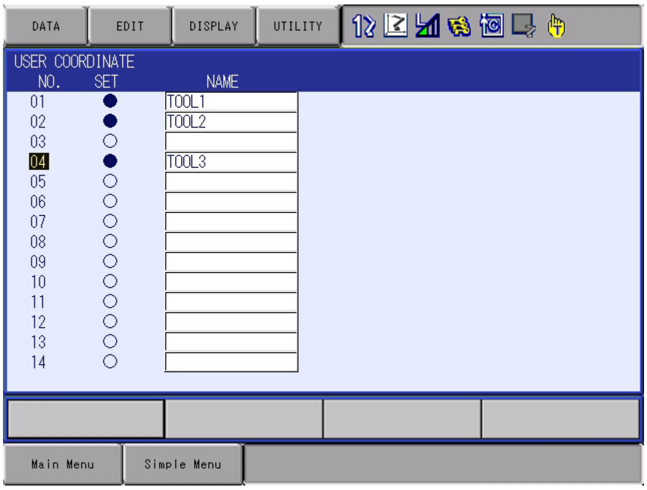
   – To check the taught positions, call up the required window among ORG to XY and press [FWD]. The manipulator moves to the set position.

   – 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}.

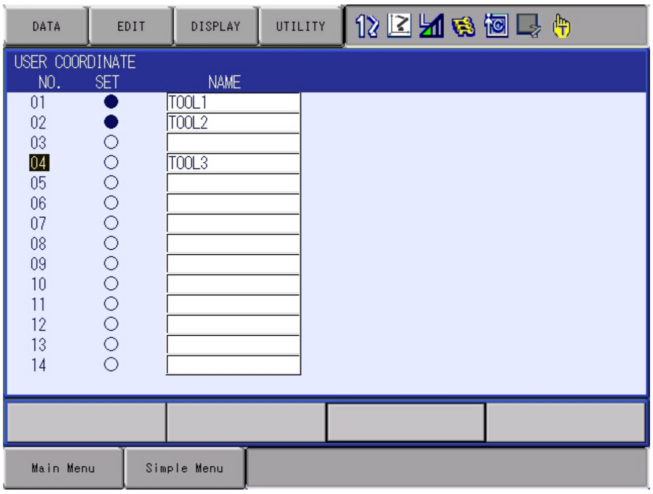
   – User coordinates are registered in the file.

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

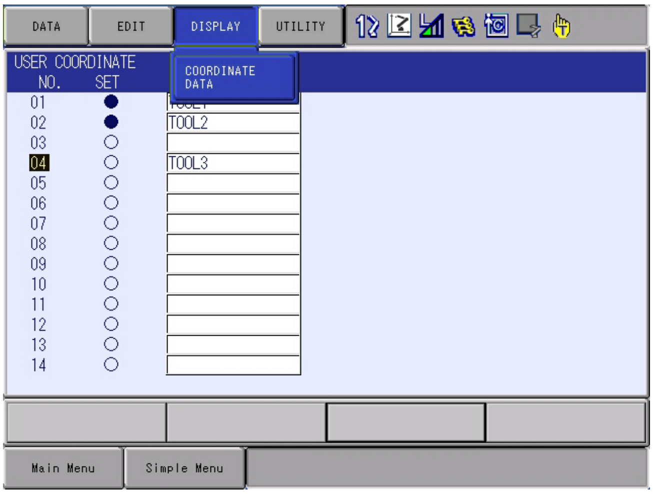


■ **Specify the amount of change from the basic coordinate**

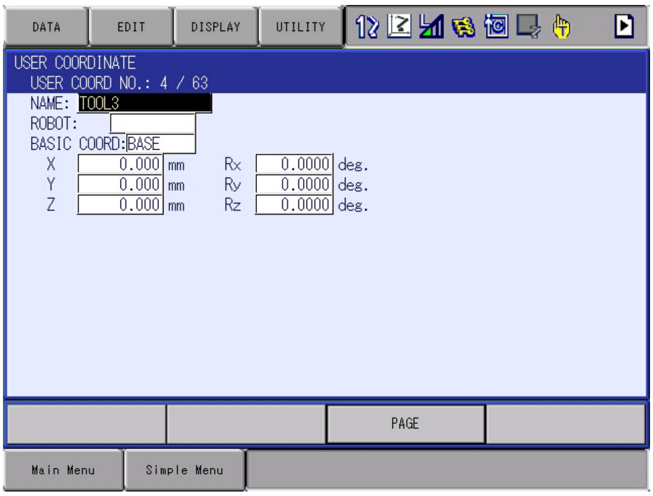
1. Move the cursor to the user coordinate number to be set.



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

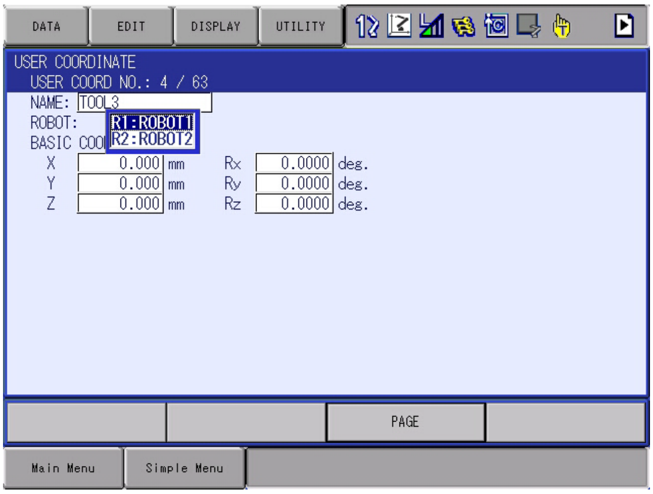


3. Select {COORDINATE VALUE}.



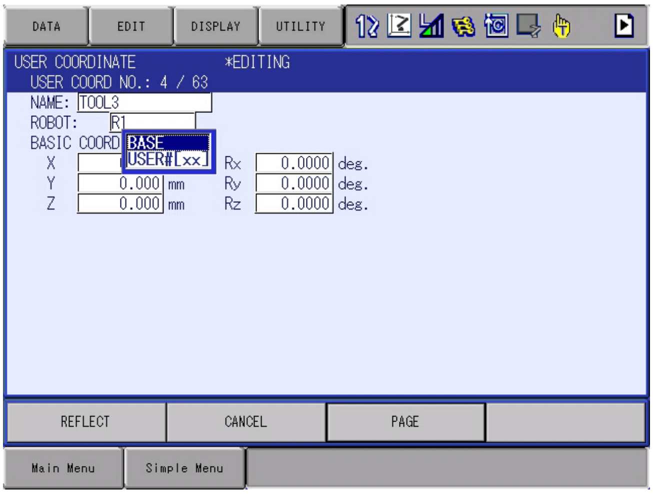
4. Select “ROBOT”.

   – Select the target robot.



5. Select “BASIC COORDINATE”.

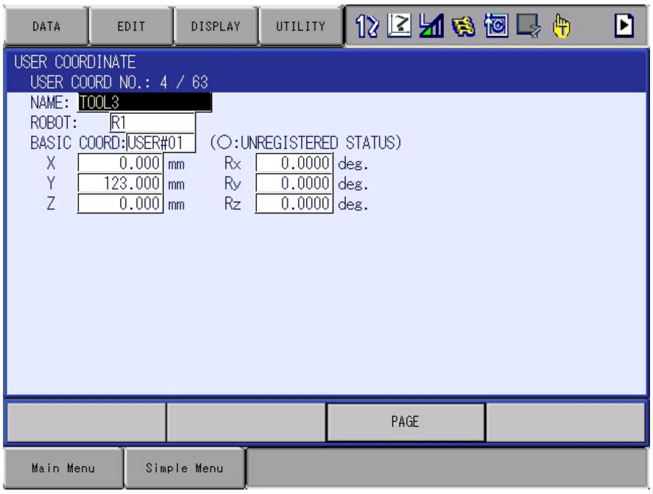
   – Select the base coordinate/user coordinate for the basic coordinate.



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.

– 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.

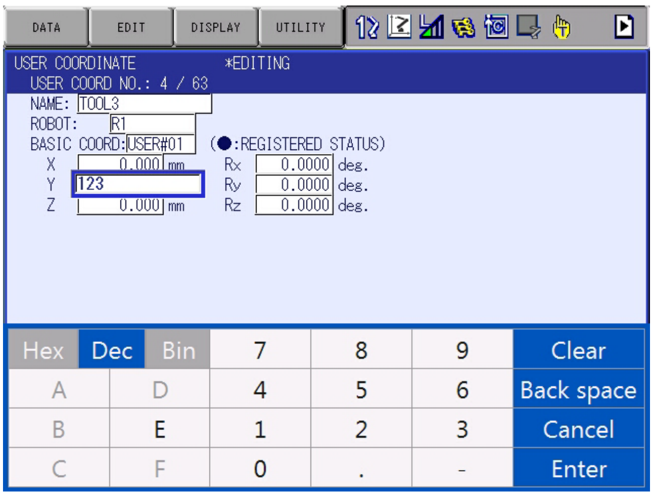


NOTE

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.

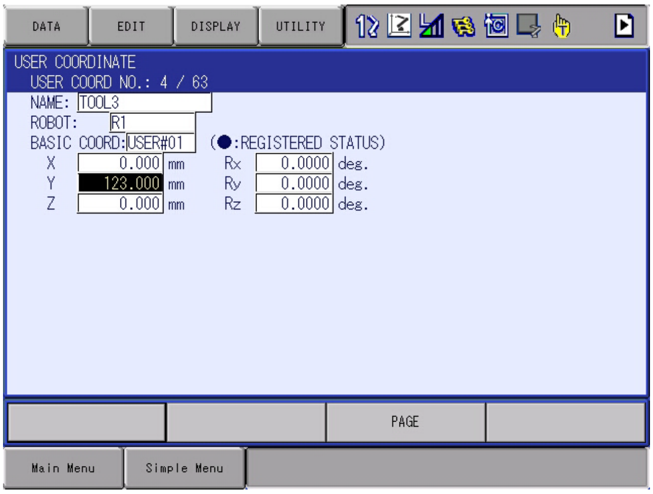
6. Select the item to be set and input the number.

   – Input the amount of change from the basic coordinate.



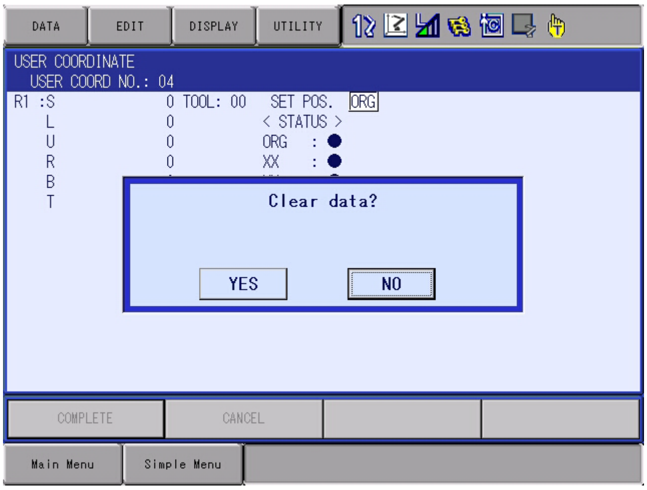
7. Select {REFLECT}.

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

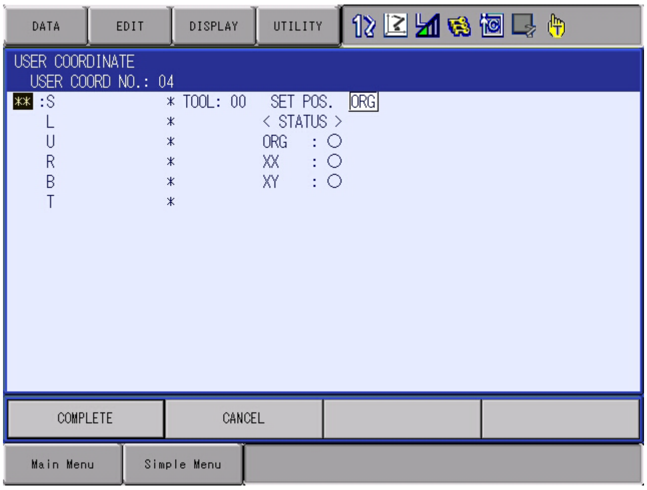


8.8.3 Clearing the User Coordinates

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



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



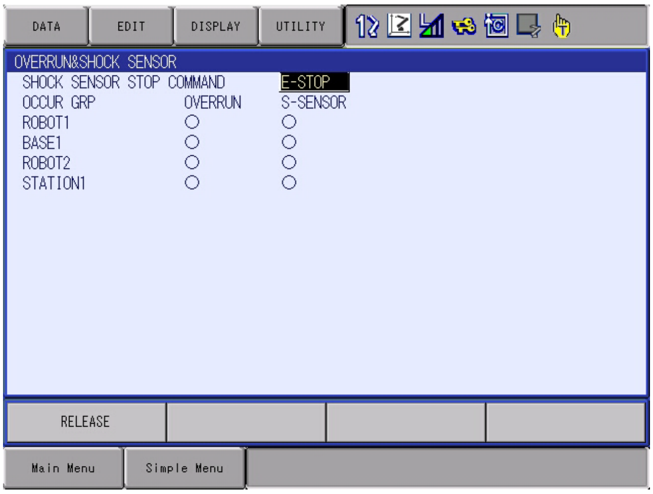
8.9 Overrun/Tool Shock Sensor Releasing

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.

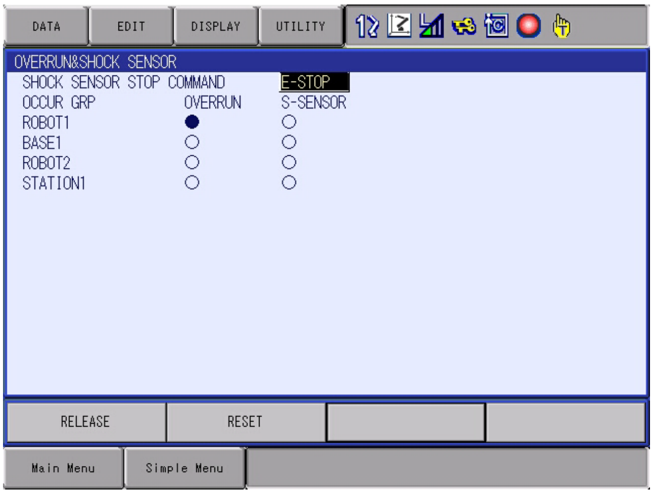
1. Select {ROBOT} under the main menu.
2. Select {OVERRUN & S-SENSOR}.
   - The OVERRUN & SHOCK SENSOR window appears.
   - Select either “EMERGENCY STOP” or “HOLD” to set the item “SHOCK SENSOR STOP COMMAND” which specifies the stop condition in the current shock sensor detection.
   - “E-STOP” and “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

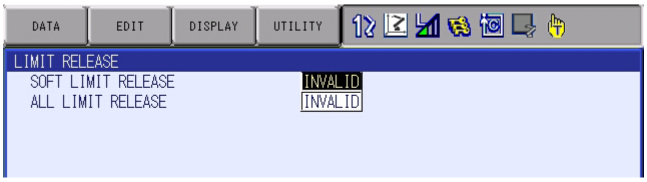
The switches that are set to detect the motion range of the manipulator are called limit switches. The operating range is monitored by the software in order to stop motion before these limit switches are reached. These software limits are called “soft limits”. The operating range of the manipulator is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

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

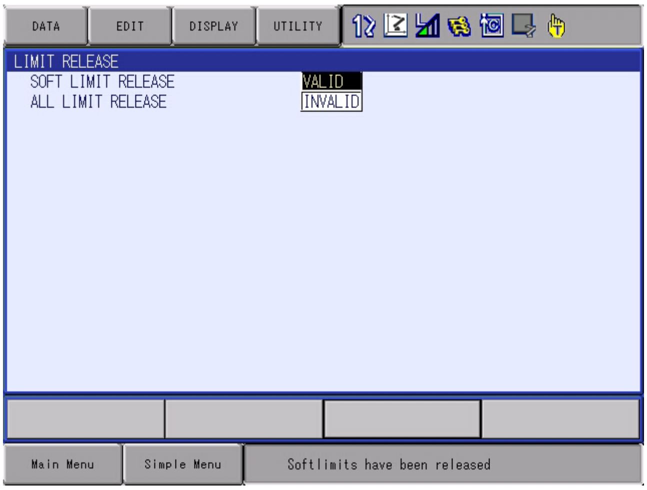
These soft limits are continually monitored by the system, and the manipulator automatically stops when the its TCP reaches a soft limit.

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.



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

NOTE

- The taught data cannot be registered when the soft limit is being released.
- The setting of “SOFT LIMIT RELEASE” becomes “INVALID” when the mode is changed to the play mode.
- For a robot with the self interference function set to valid, "SELF INTERFERENCE RELEASE" appears on the LIMIT RELEASE window and the self interference check can be canceled.

8.11 All Limit Release Function

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.

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

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

NOTE

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

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

3. Select “ALL LIMITS RELEASE”.
   - “VALID” and “INVALID” are displayed alternately every time [SELECT] is pressed.
   - When “ALL LIMIT RELEASE” is changed to “VALID”, a message “All limits have been released” is displayed. When the setting changes to “INVALID”, a message “All limits off released” is displayed for a few seconds.

8.12 Instruction Level Setting

8.12.1 Setting Contents

8.12.1.1 Instruction Set

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

Subset Instruction Set

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

Standard Instruction Set / Expanded Instruction Set

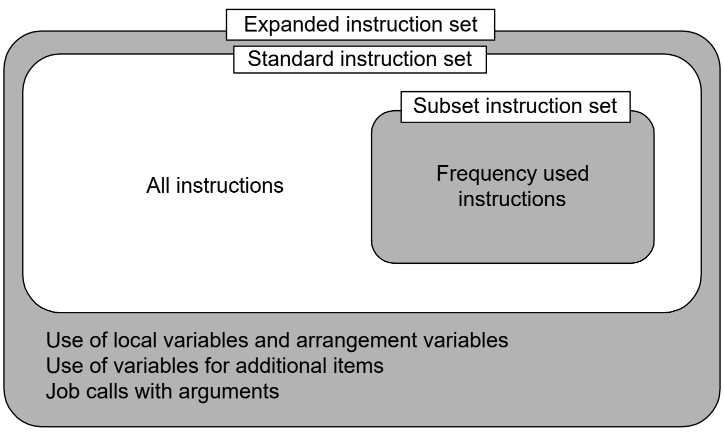
All the INFORM III instructions can be used. The number of additional items to be used in each instruction differ in the standard instruction set and expansion instruction set.

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

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

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

Fig. 8-5: Instruction Set



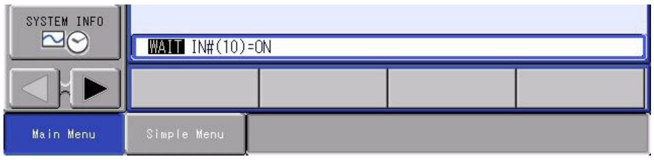
8.12.1.2 Learning Function

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

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

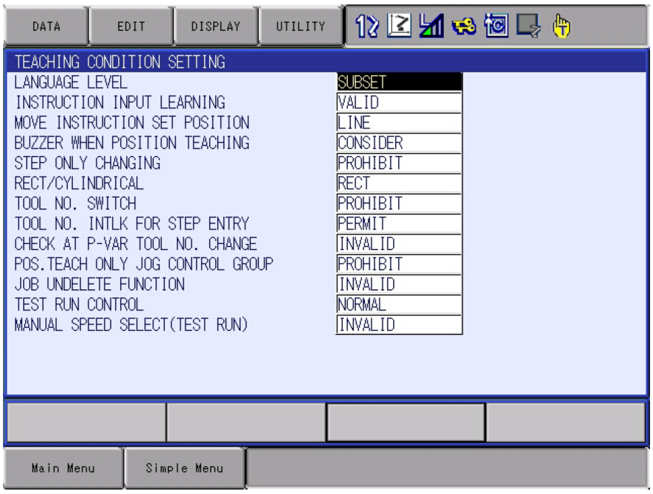
1. An instructions are registered.

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

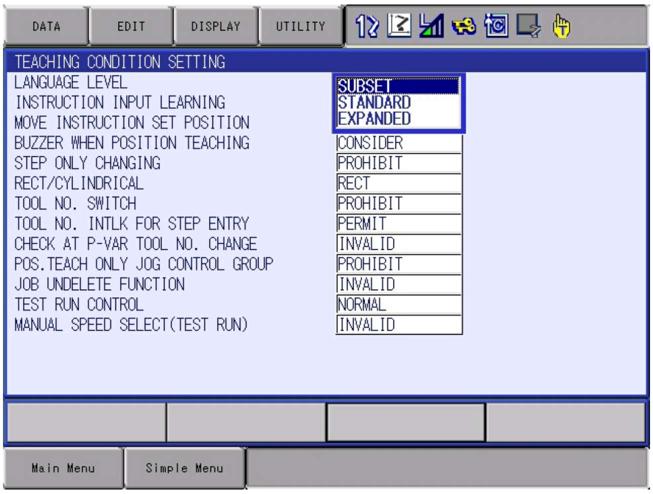


8.12.2 Setting the Instruction Set Level

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

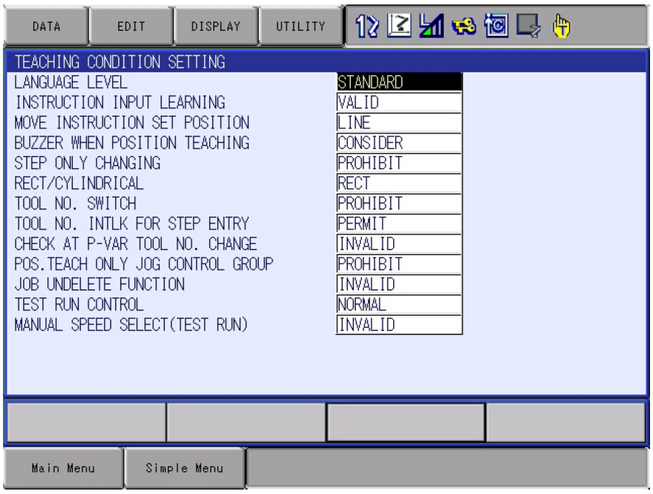


3. Select “LANGUAGE LEVEL”.
   – The selection list appears.



4. Select desired language level.

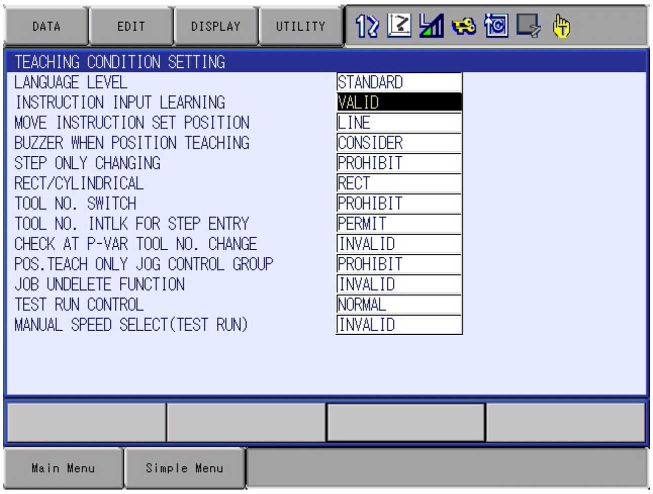
   – Language level is set.



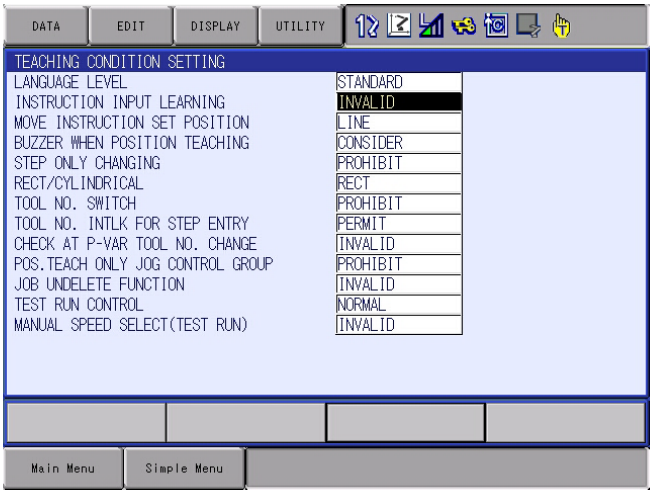
8.12.3 Setting the Learning Function

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

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



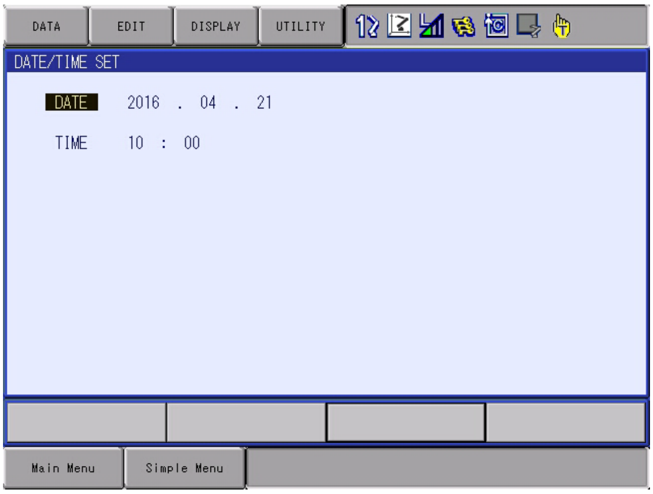
3. Select “INSTRUCTION INPUT LEARNING”.
   – “VALID” and “INVALID” are displayed alternately every time [SELECT] is pressed.



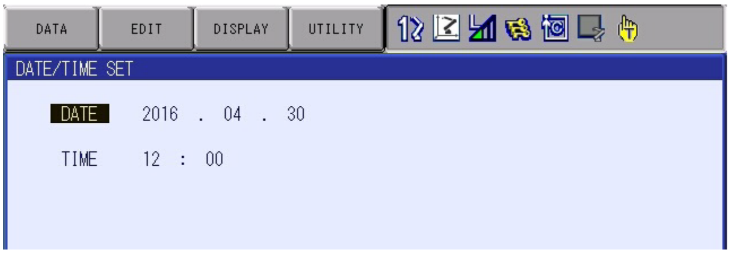
8.13 Setting the Controller Clock

The clock inside the YRC1000micro controller can be set as follows.

1. Select {SETUP} under the main menu.
2. Select {DATE/TIME}.
   – The DATE/TIME SET window appears.

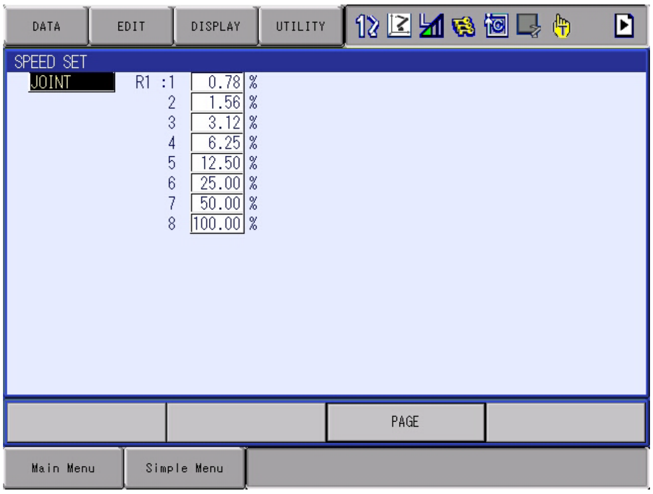


3. Select “DATE” or “TIME”.
   – The input buffer line appears.
4. Input the new date/time.
   – For instance, to set the date to April 30, 2016, input “2016.4.30”. To set the time at twelve o’clock, enter “12.00”.
5. Press [ENTER].
   – The date/time is changed.

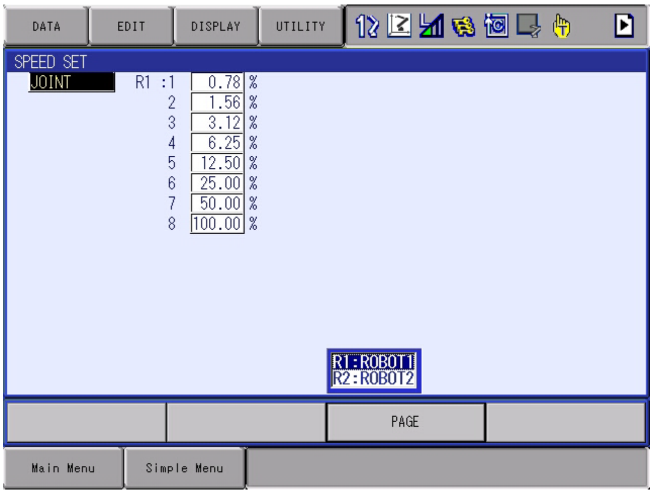


8.14 Setting the Play Speed

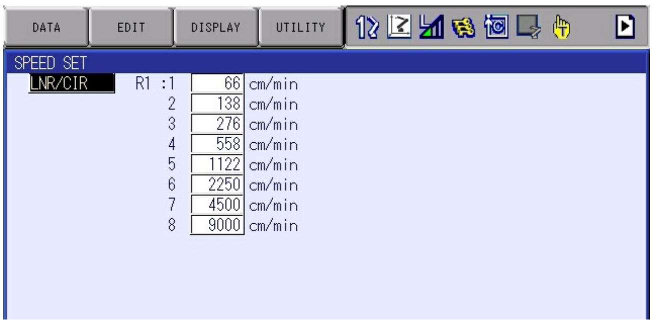
1. Select {SETUP} under the main menu.
2. Select {SET SPEED}.
   – The SPEED SET window is shown.



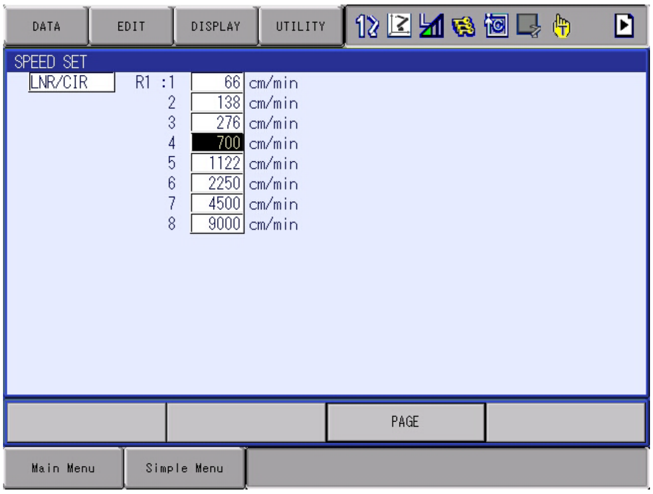
3. Press the [PAGE].
   – When two or more manipulators and stations exist in the system, use the [PAGE] to change the control group, or click on [PAGE] to select the desired control group.



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



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



8.15 Numeric Key Customize Function

8.15.1 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.

Function	Description
Manufacturer allocation	Allocated by YASKAWA. Allocating another function invalidates the function allocated by the manufacturer.
Instruction allocation	Allocates any instructions assigned by the user.
Job call allocation	Allocates job call instructions (CALL instructions). The jobs to be called are only those registered in the reserved job names. (Specified by the registration No.)
Display allocation	Allocates any displays assigned by the user.

8.15.2.2 Key Allocation (SIM)

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

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

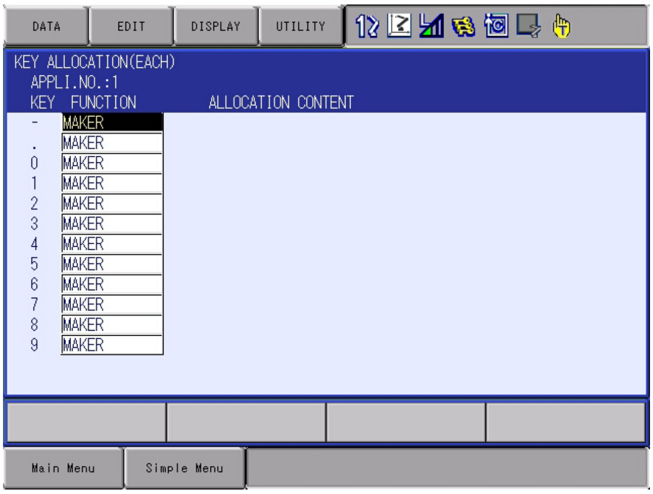
SUPPLE-MENT

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

8.15.3 Allocating Operation

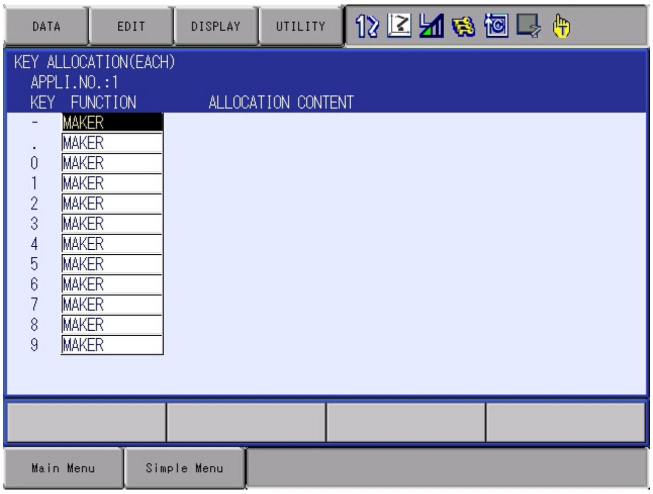
8.15.3.1 Allocation Window

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



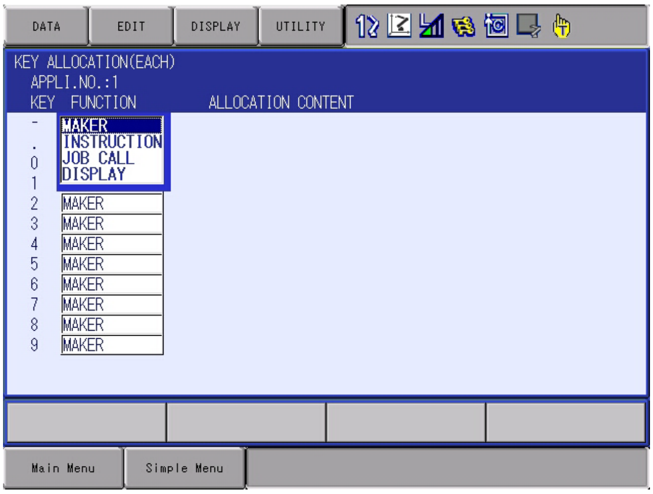
3. Select {DISPLAY}.
   – Pull-down menu appears.
   – To call up the KEY ALLOCATION (SIM) window, select {ALLOCATE SIM. KEY}.

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

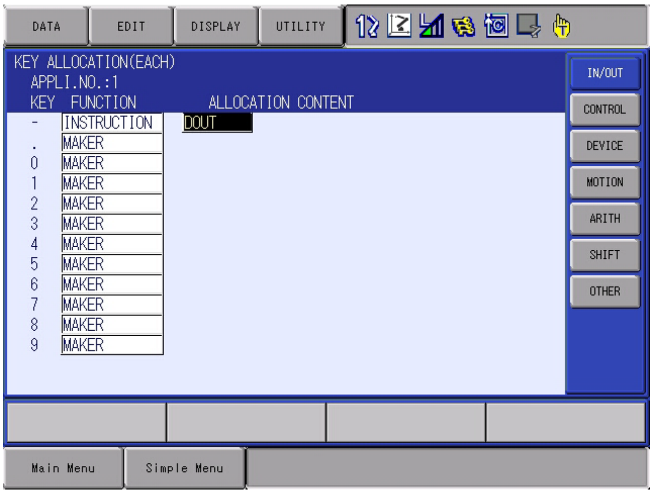
1. Set this function in the KEY ALLOCATION (EACH) window. Move the cursor to “FUNCTION” of the key to be allocated and press [SELECT].
   – Selection list appears.



2. Select “INSTRUCTION”.

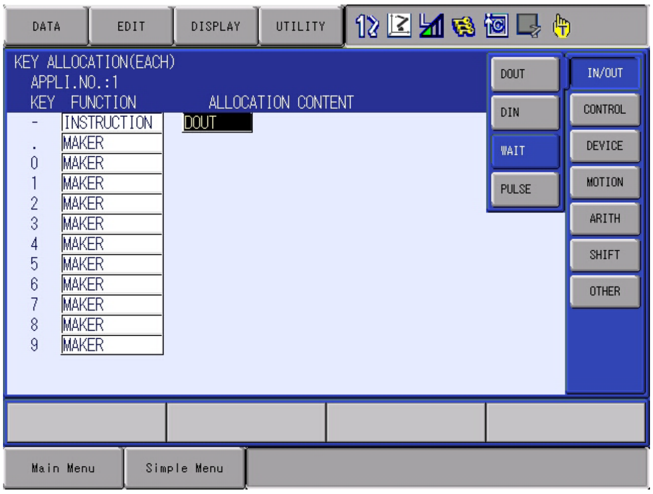
– The instruction is shown in the “ALLOCATION CONTENT”.

(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.

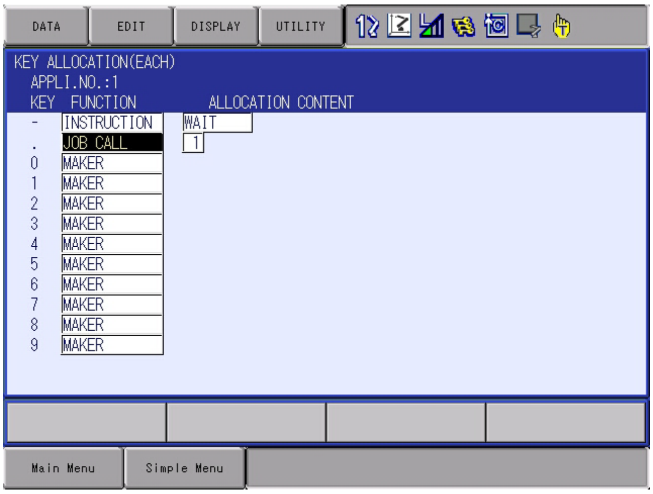
(3) When the instruction list dialog box is shown, select the instruction to be changed.



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.

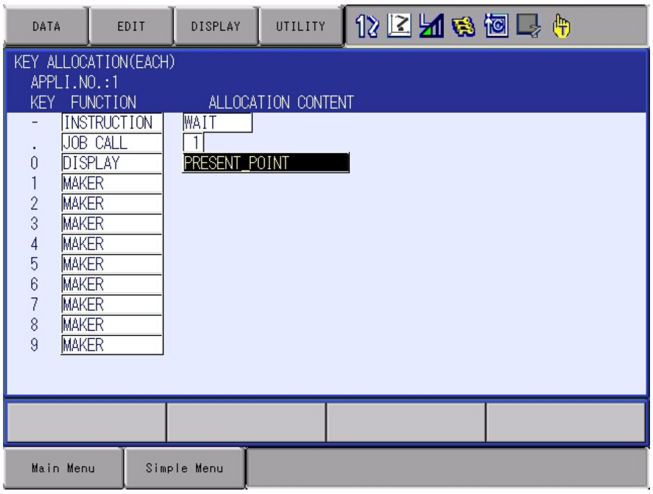
(2) Input the number to be changed, and press [ENTER].

8.15.3.4 Display Allocation

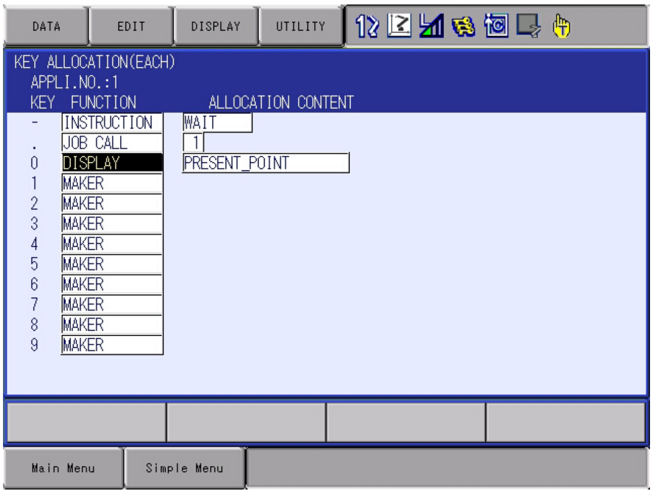
Set this function in the KEY ALLOCATION (EACH) window.

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.



SUPPLE-MENT

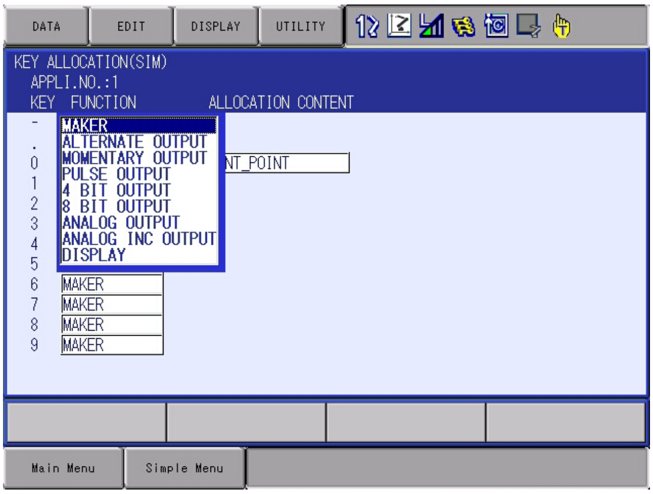
When allocate the display allocation to a key, key allocation (SIM) will be set to the display set.

Unable to allocate the display allocation and the another function to the same key.

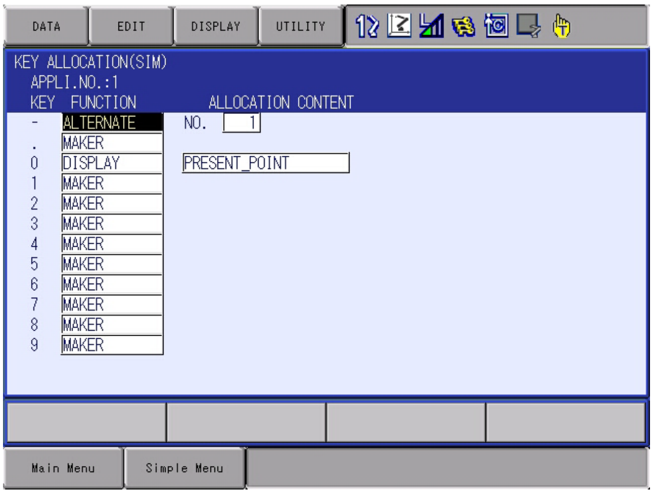
8.15.3.5 Alternate Output Allocation

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”.



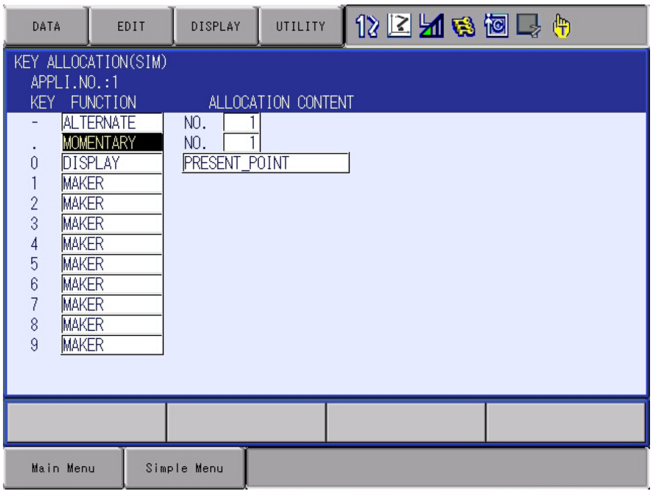
(1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.

(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”.



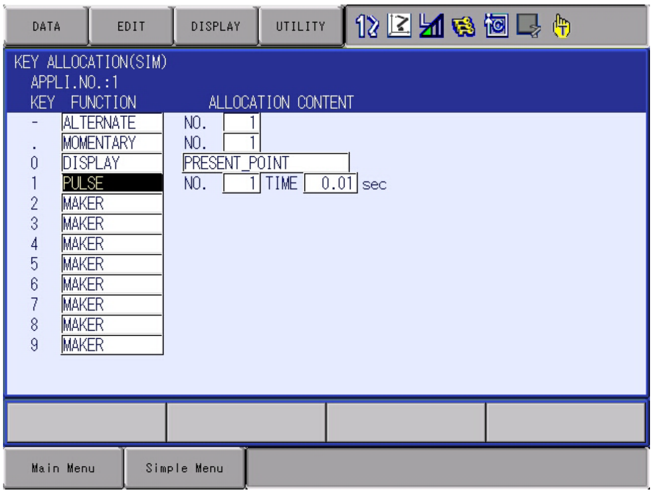
(1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.

(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”.



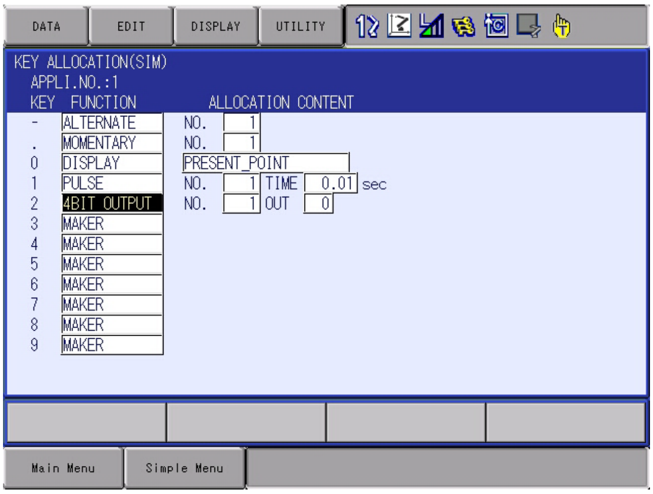
(1) To change the output No. or output time, move the cursor to the No. or time and press [SELECT]. Then numeric value can be entered.

(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”.



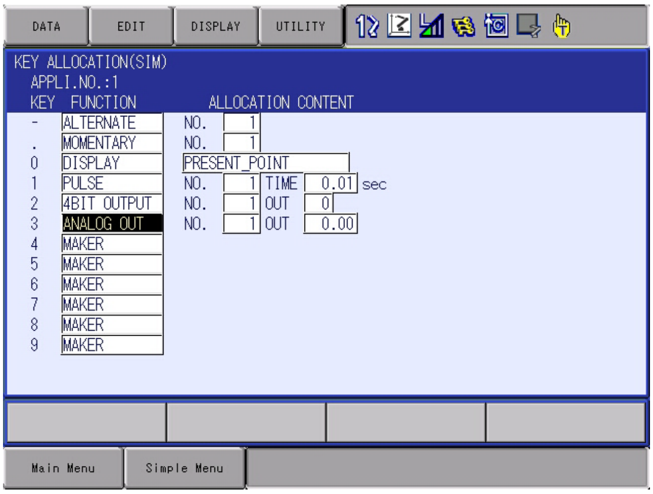
(1) To change the output No. or output value, move the cursor to the No. or value and press [SELECT]. Then numeric value can be entered.

(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”.



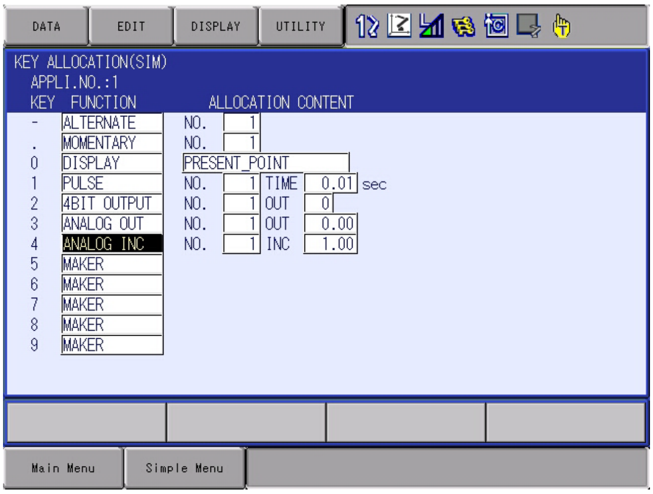
(1) To change the output port No. or output voltage value, move the cursor to the No. or voltage value and press [SELECT]. Then numeric value can be entered.

(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.

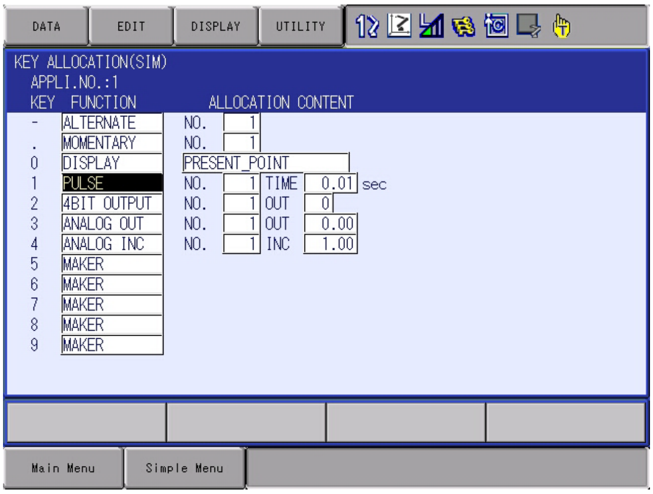
(2) Input the number or incremental value to be changed, and press [ENTER].

8.15.4 Allocation of I/O Control Instructions

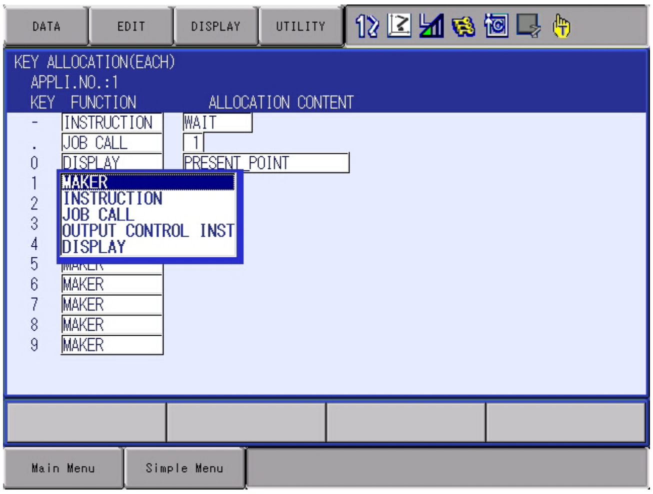
In key allocation (SIM), output control instructions can be allocated to the numeric keys that have been allocated one of the following I/O controls with key allocation (EACH).

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

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



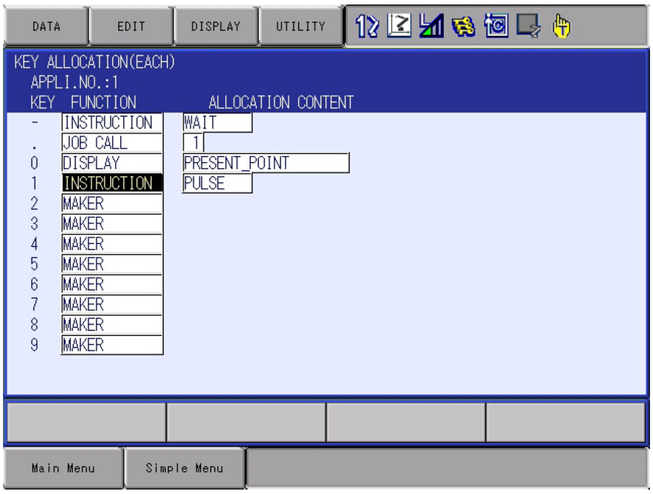
2. Move the cursor to the “FUNCTION” of the key that has been allocated with I/O control with key allocation (SIM) and press [SELECT].



   – 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.

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

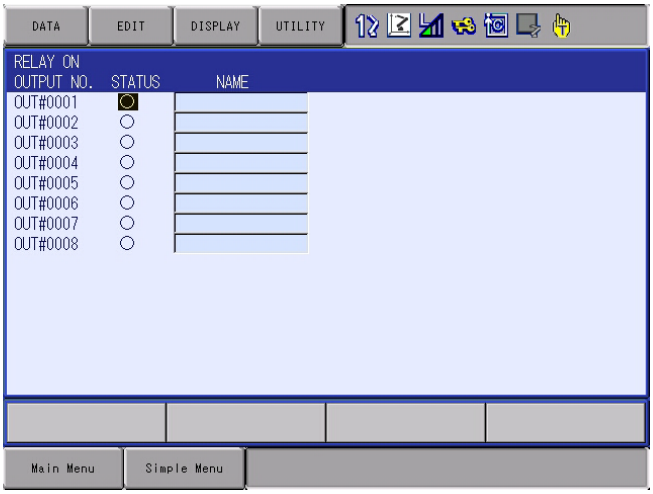
The status of GP output signals can be changed from the programming pendant by using either of the following two methods.

- 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.

> **NOTE**
> 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.

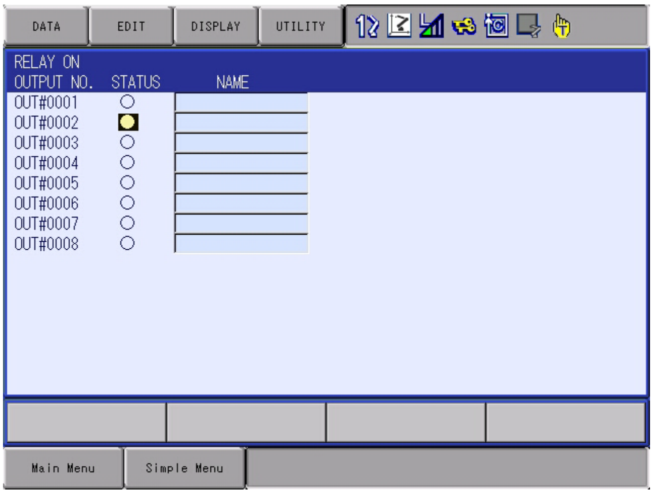
1. Select {IN/OUT} under the main menu.
2. Select {RELAY ON}.
   – The RELAY ON window appears.



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.)



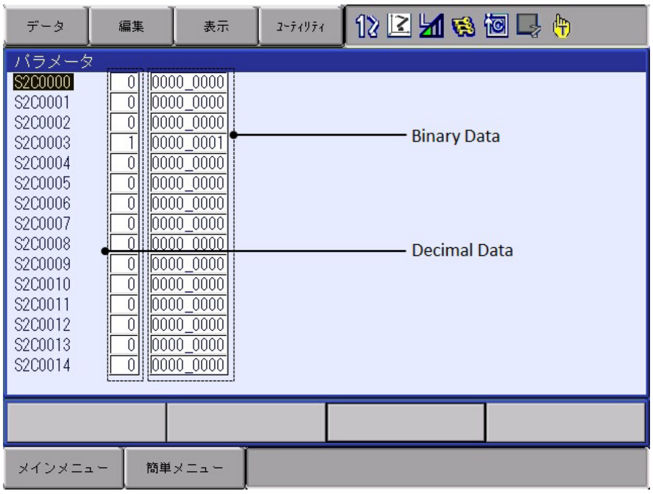
SUPPLE-MENT

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”.

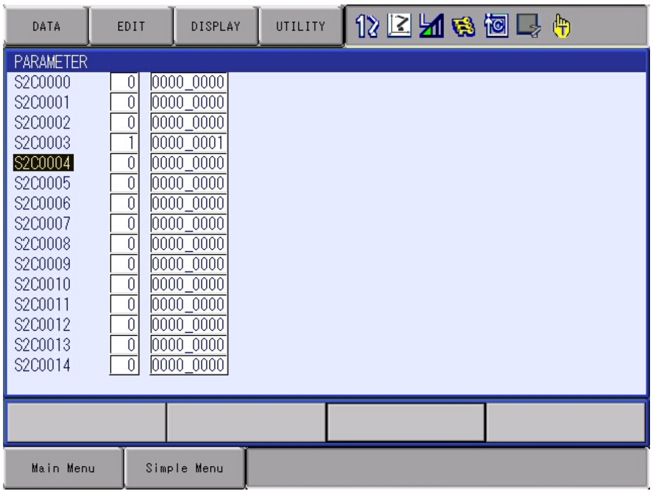
8.17 Changing the Parameter Setting

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.

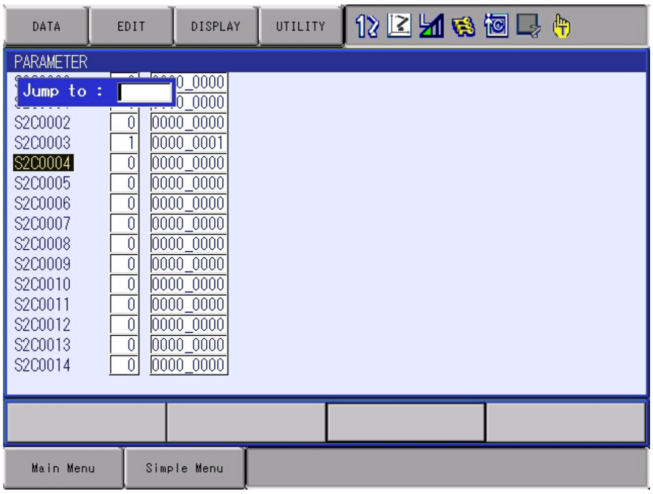


3. Move the cursor to the desired parameter number.

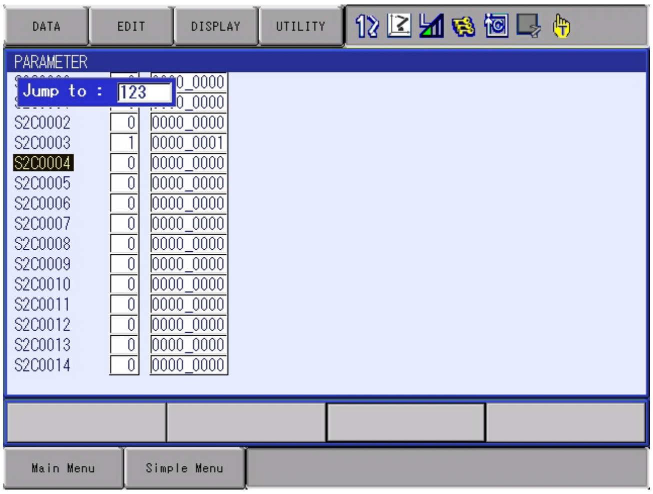


– When the desired parameter number is not in the current window, move the cursor in the following way:

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

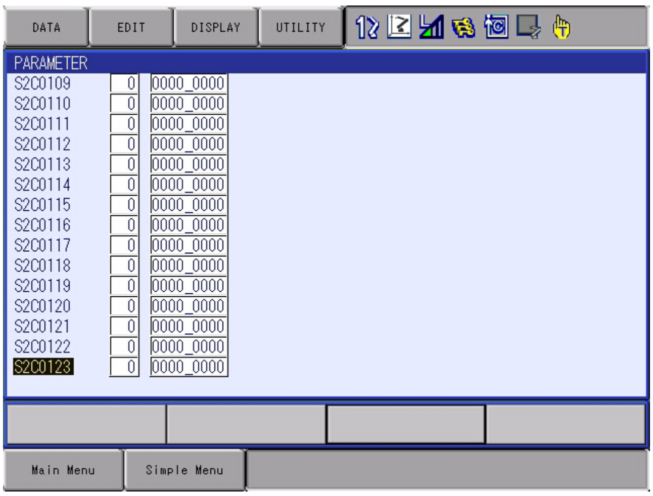


(2) Enter the desired parameter number with the numeric keys.



(3) Press [ENTER].

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



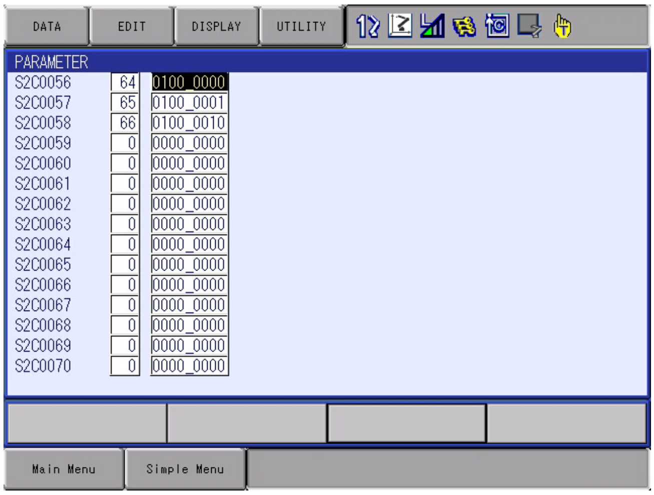
Set the parameters in the following manner.

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].

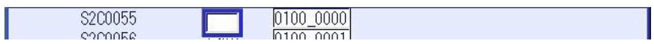
   (2) To enter a decimal setting, select the decimal figure.

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



2. Enter the value.

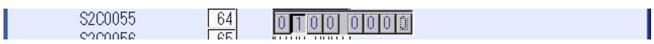
   – If a decimal figure is selected, enter a decimal value with the numeric keys.



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

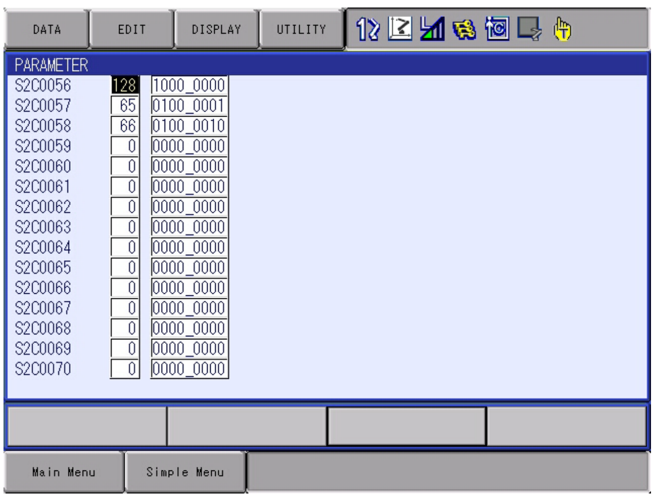
   – Each time [SELECT] is pressed, “0” and “1” alternate in the window.

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



3. Press [ENTER].

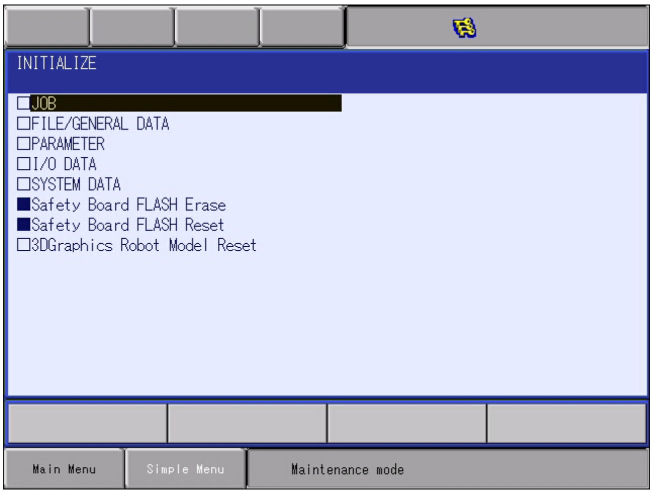
   – The new setting appears in the position where the cursor is located.



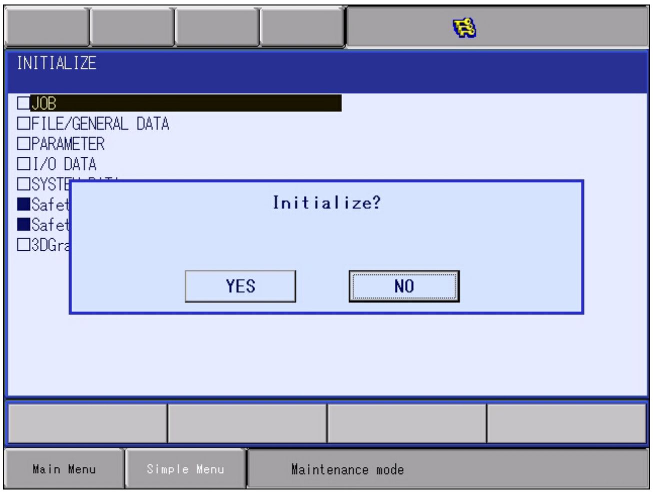
8.18 File Initialization

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.



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

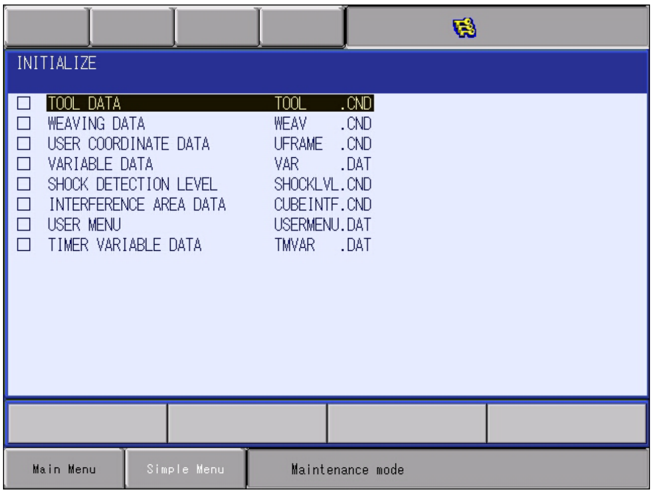
NOTE

When JOB is initialized, the following files are reset at the same time.
Be careful when initializing JOB.

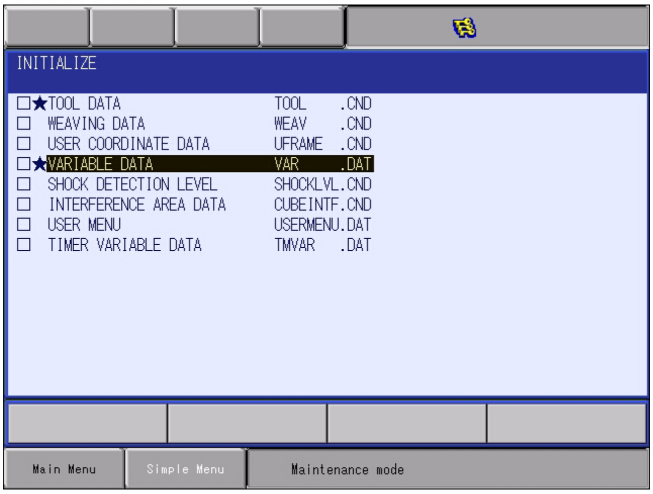
- User coordinates
- Memo play file
- Variable data
- Robot calibration data
- Conveyor calibration data

8.18.2 Initializing Data File

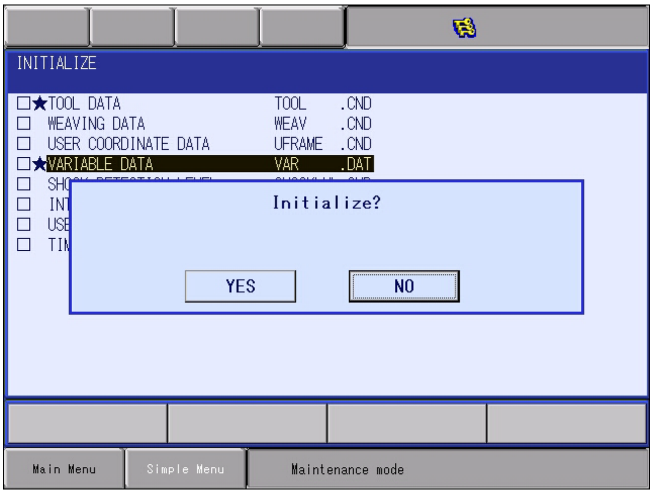
1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {FILE/GENERAL DATA}.
   – The INITIALIZE window appears.



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.

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}.

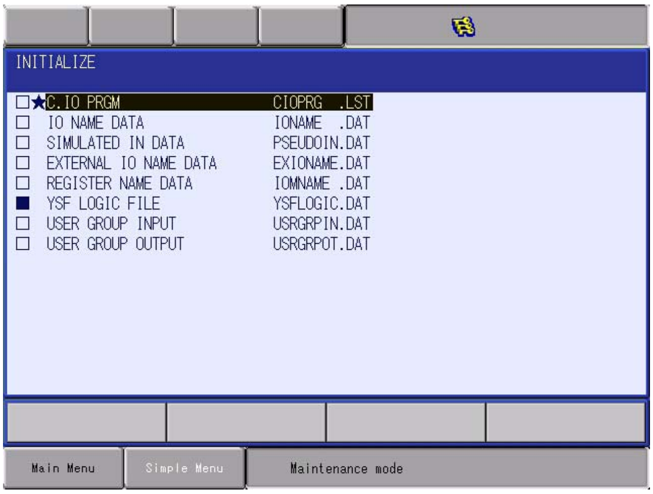
   – The selected parameter is initialized.

8.18.4 Initializing I/O Data

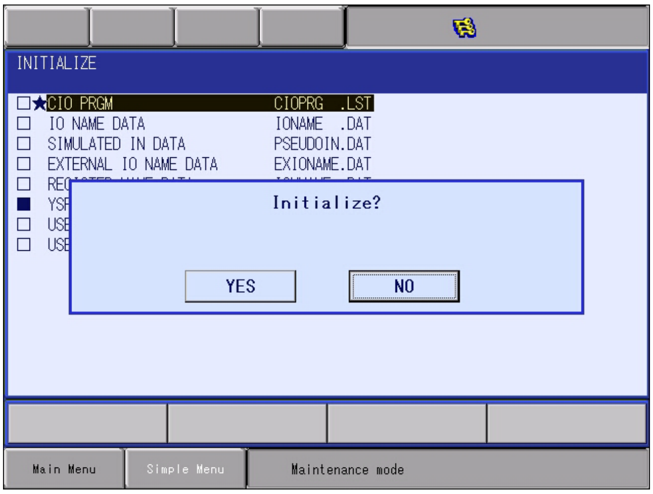
1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {I/O DATA}.

   – The I/O data selection window appears.

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.

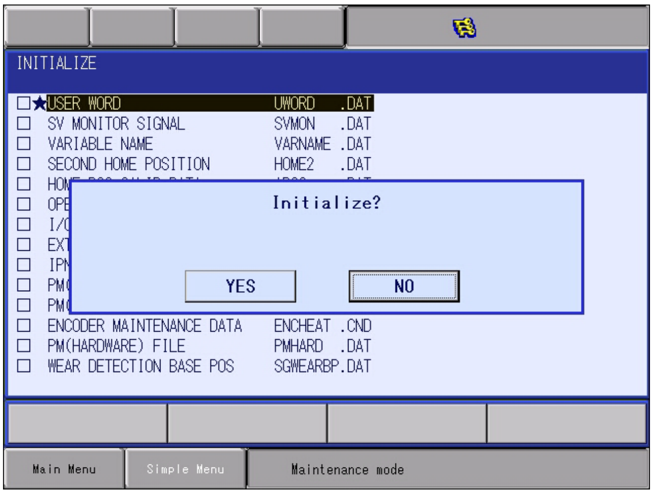
8.18.5 Initializing System Data

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

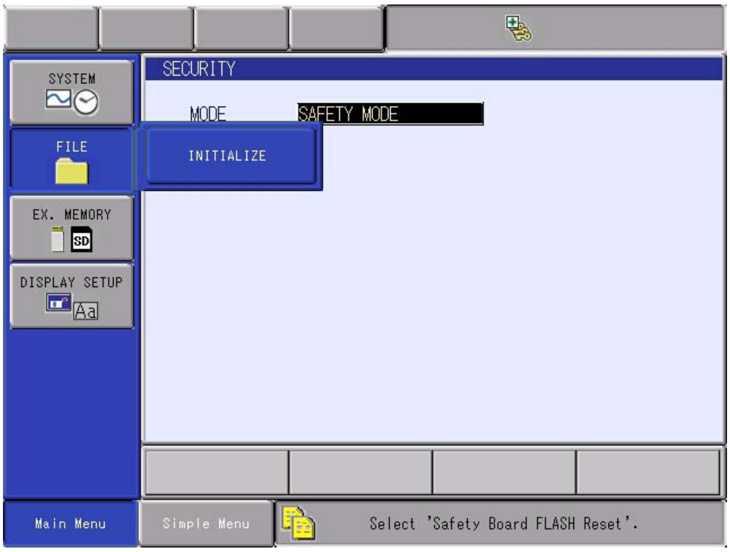
If the following alarm occurs when the control power supply is turned ON,

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

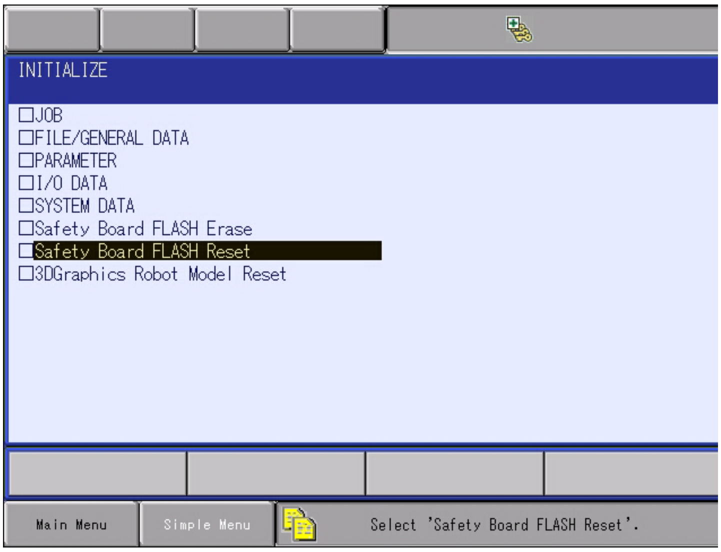
perform the following operations to re-set the data of the function safety board.

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.

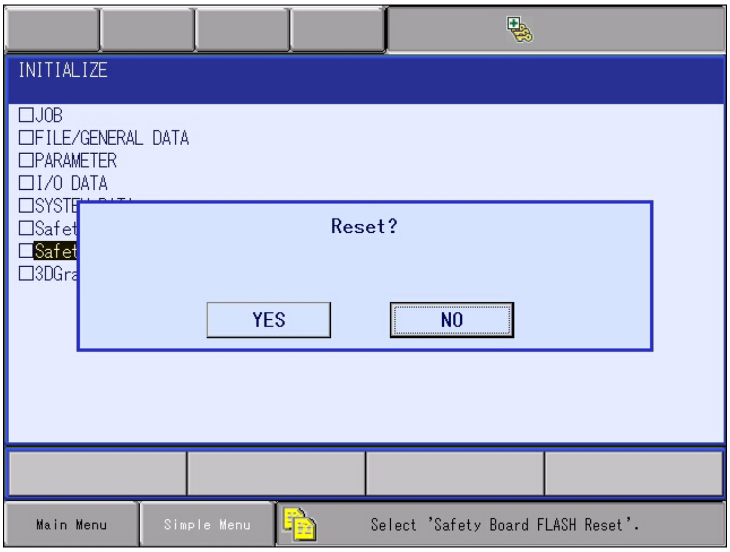


4. Move the cursor to {Safety Board FLASH Reset} and press [ENTER].



5. The dialog box “Reset?” is displayed. Select {YES}.

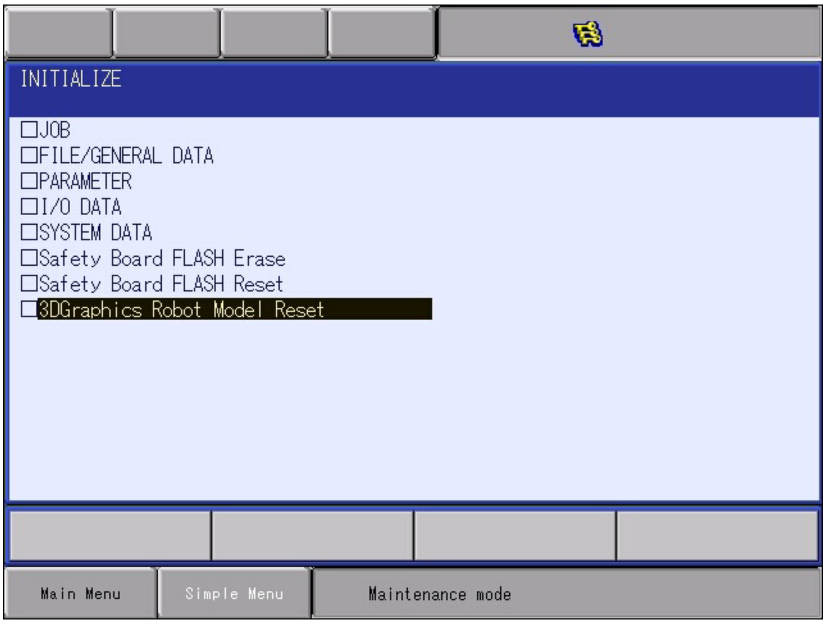
   – The data of the safety circuit board is re-set. A few seconds later, the buzzer sounds and the data setting is completed.



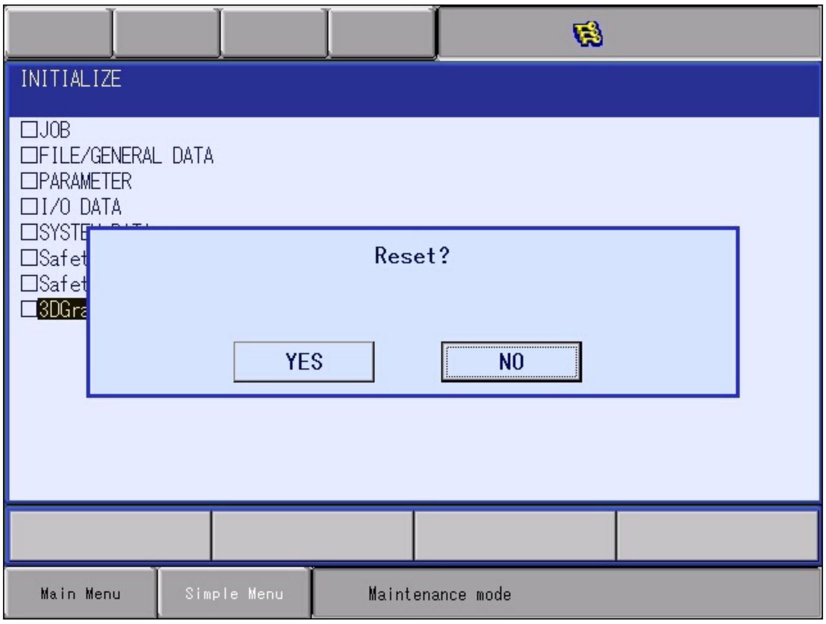
6. When the data reset is completed, turn the control power OFF and then turn the power ON again.

8.18.7 Reset 3DGraphics Robot Model

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 {3DGraphics Robot Model Reset}.
   – A confirmation dialog box appears.



6. Select {YES}.
   – The 3D graphic model is reset.

8.19 Display Setting Function

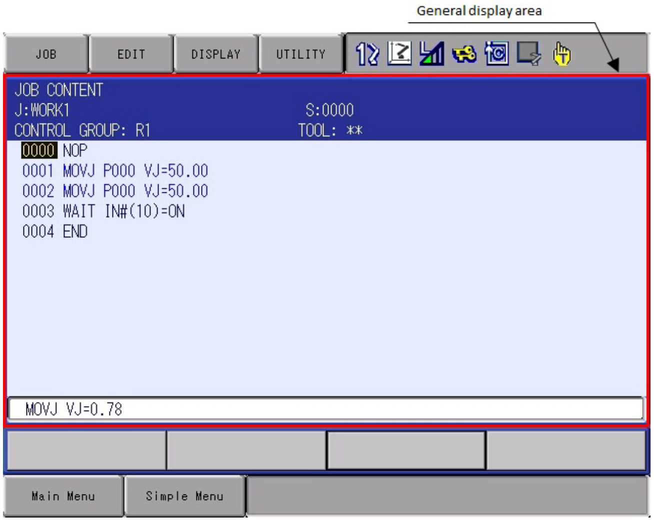
8.19.1 Font Size Setting

YRC1000micro enables changing the font size displayed on the screen.

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

8.19.1.1 Applicable Range for the Font Size Change

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



8.19.1.2 Settable Font Size

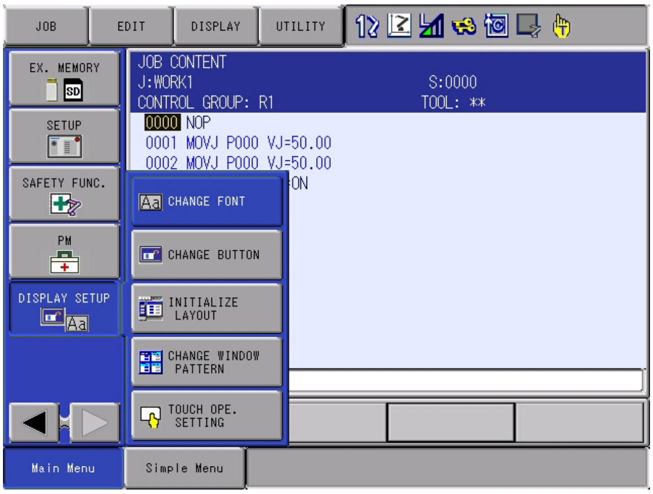
The following eight patterns of fonts are available in setting the size of fonts displayed on the screen.

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

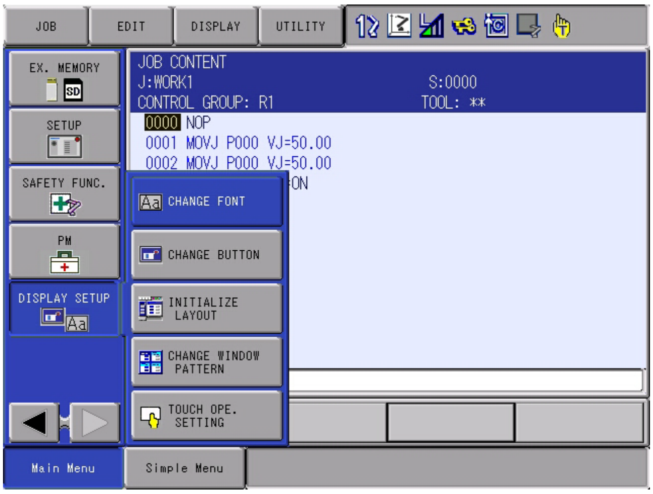
8.19.1.3 Setting the Font Size

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

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



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

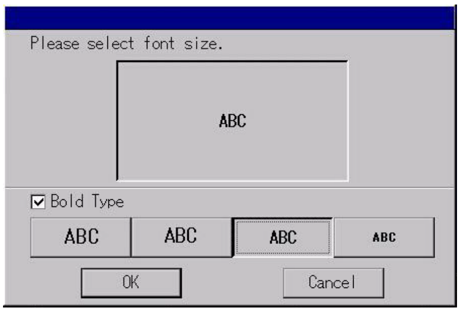


■ **To set the font size in the font size setting dialog box, follow the procedure below.**

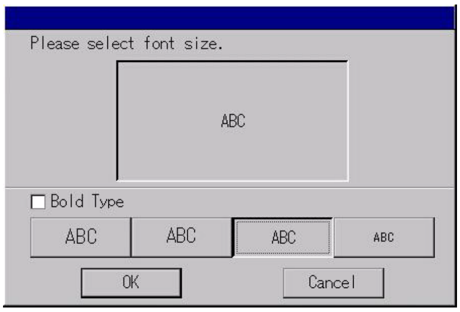
1. Specify the font style.

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

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

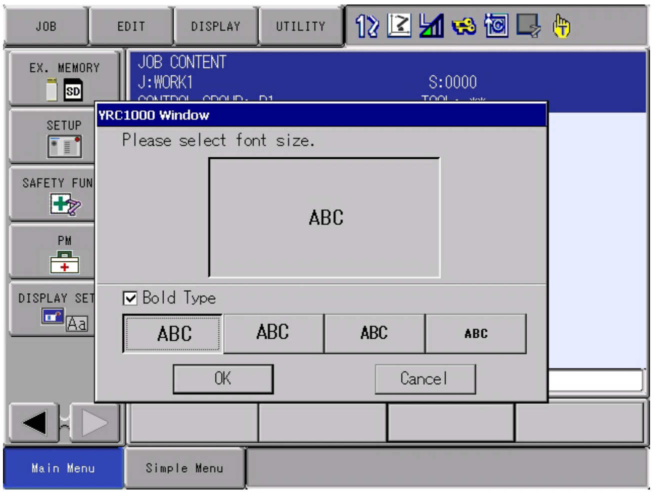


   • Clear the {Bold Type} check box as follows to set the font to the regular style.

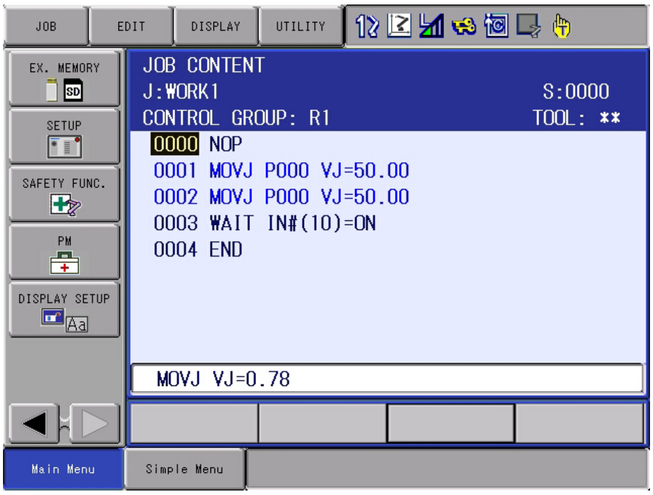


2. Specify the font size.

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

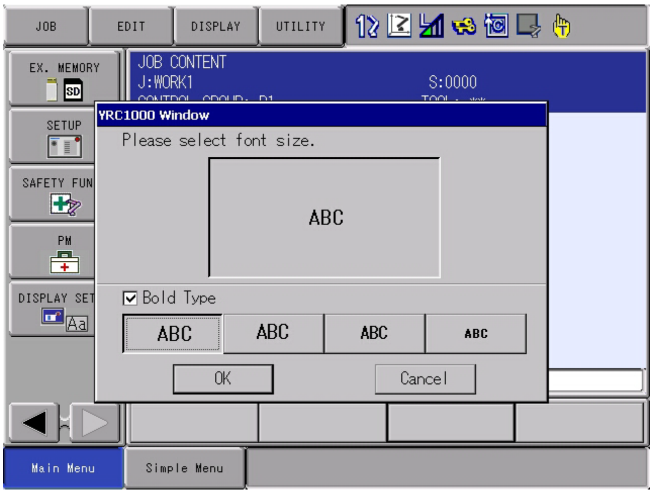


3. The font size setting dialog box is closed, and the screen displays the font specified in the dialog box.

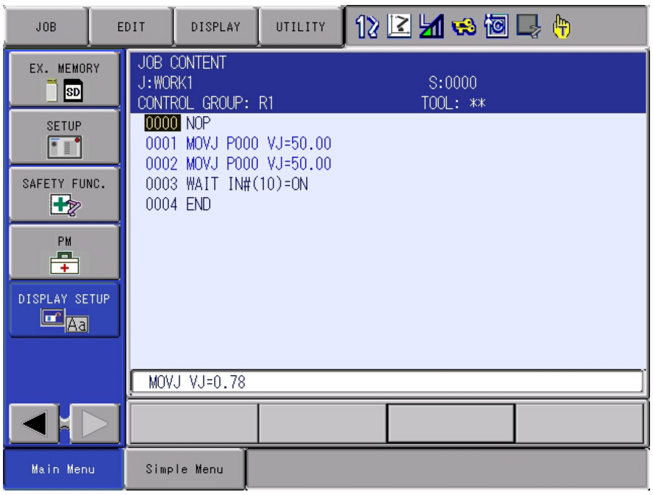


■ **To cancel the setting of the font size, follow the procedure below.**

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



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



NOTE

Do not turn OFF the YRC1000micro power supply when the font size is being changed (when the font size setting dialog box is on the screen).

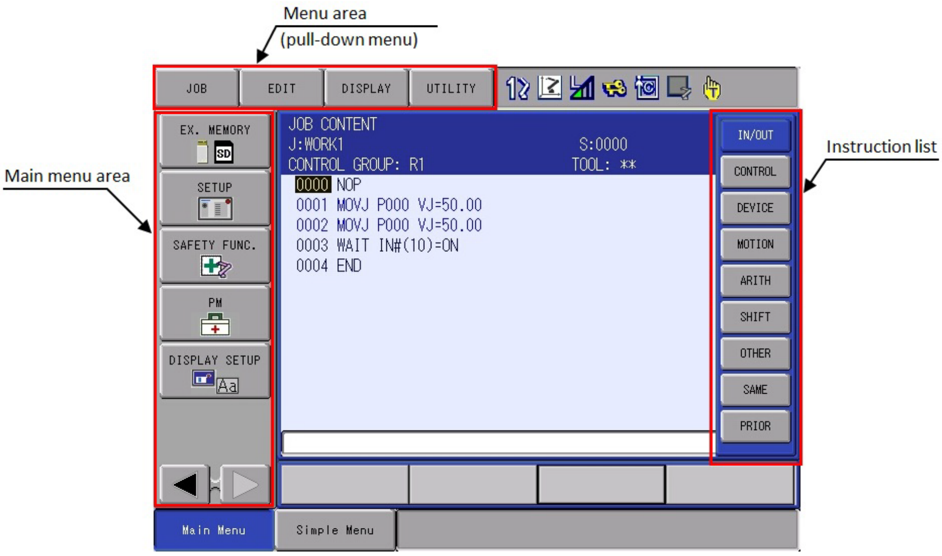
8.19.2 Operation Button Size Setting

YRC1000micro enables changing the size of operation buttons.

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

8.19.2.1 Applicable Range for the Button Size Change

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



8.19.2.2 Settable Button Size

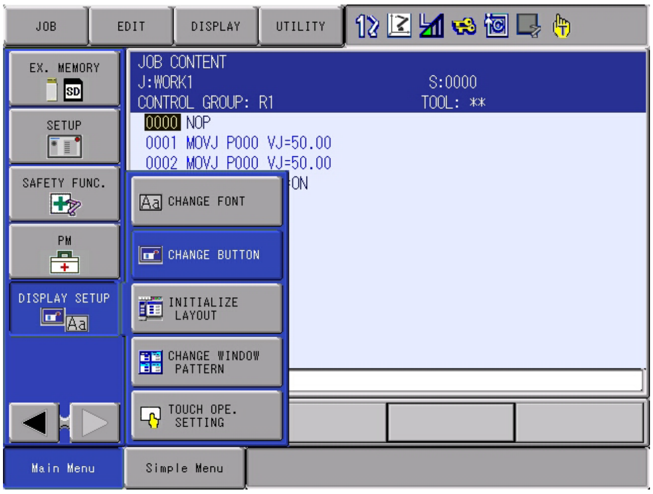
The following three sizes of buttons are available in setting the size of each operation button; the font style of the character string on buttons can also be specified.

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

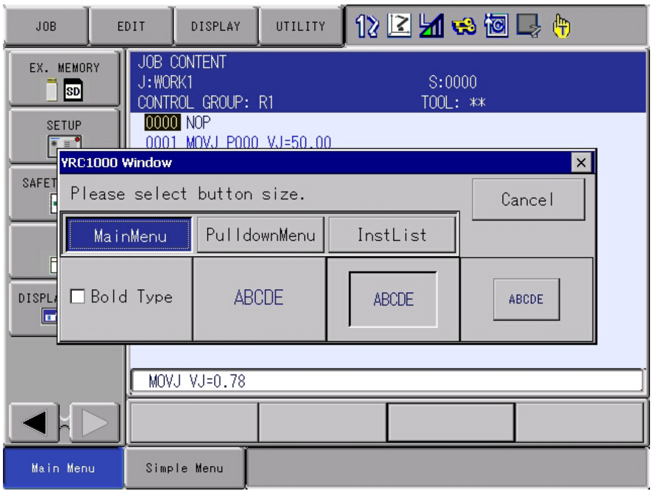
8.19.2.3 Setting the Button Size

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

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

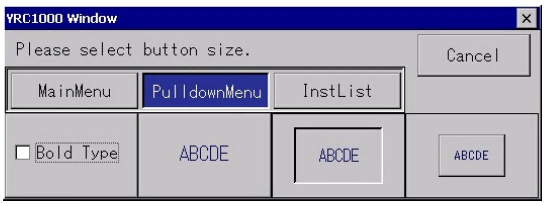


– The font size setting dialog box appears on the center of the current window.

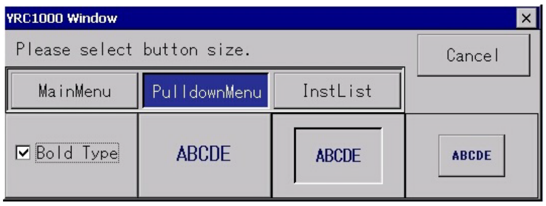


■ **To set the button size in the button size setting dialog box, follow the procedure below.**

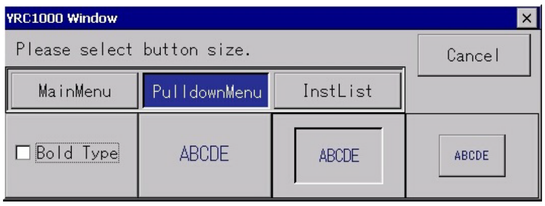
1. Specify the area to set the button size.
   (1) Select the desired area from the area setting buttons.
   (2) The buttons in the selected area is subject to size setting.
   (3) Note that only the last-selected button determines the area subject to size setting, even if settings are performed several times before then.



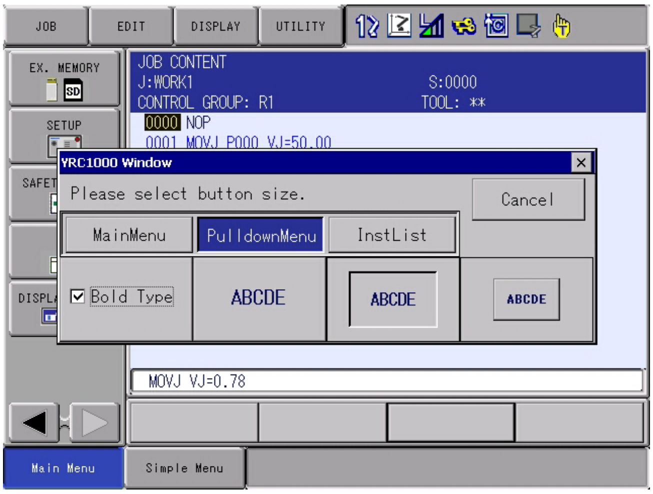
2. Specify the font style.
   – The {Bold Type} check box can be checked or unchecked alternately each time the check box is selected.
   • Check the {Bold Type} check box as follows to set the font to the bold style.



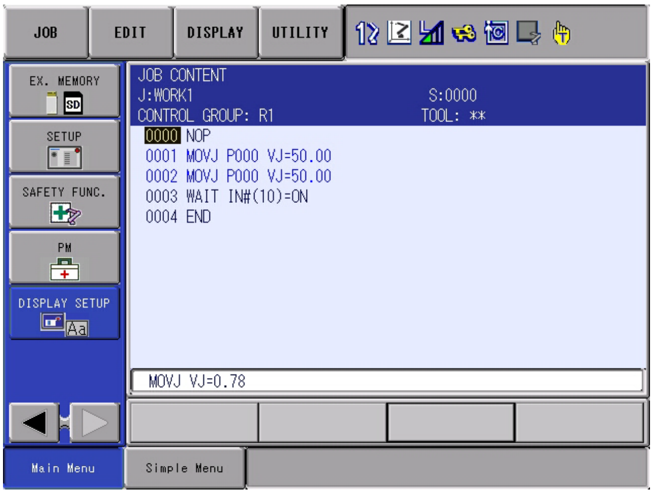
   • Clear the {Bold Type} check box as follows to set the font to the regular style.



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

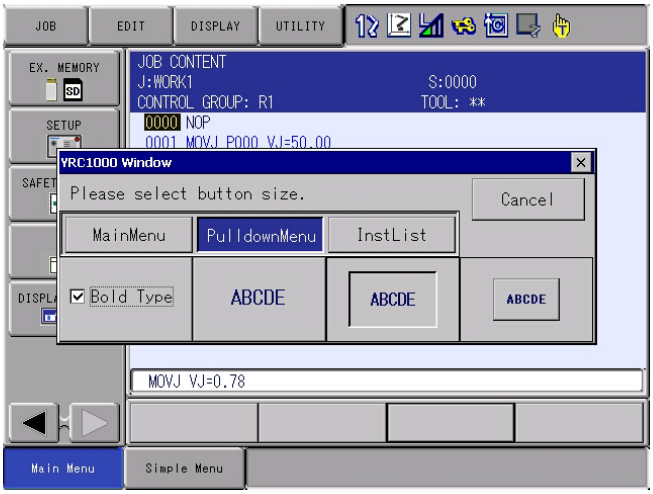


4. The font size setting dialog box is closed, and the screen displays the buttons specified in the dialog box.
   – The modification is applied only to the buttons in the area selected with the area setting button. (In this example, the change is applied only to the pull-down menu buttons in the menu area.)

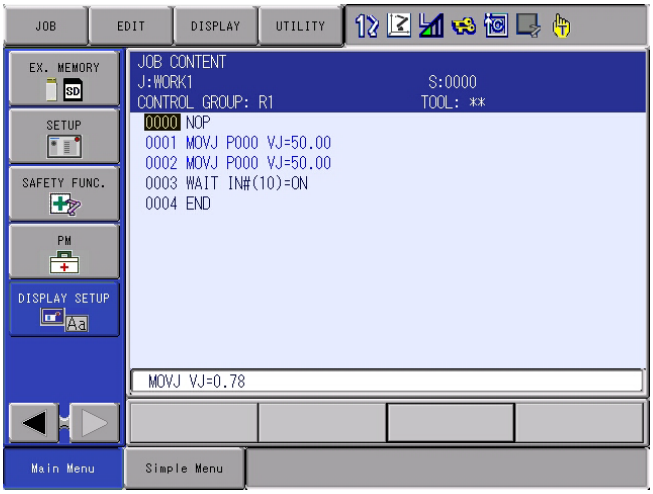


■ **To cancel the setting of the button size, follow the procedure below.**

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



– The dialog box closes without changing the button size.



NOTE

Do not turn OFF the YRC1000micro power supply when the button size is being changed (when the button size setting dialog box is on the screen, or when an hourglass is indicated in the middle of the screen).

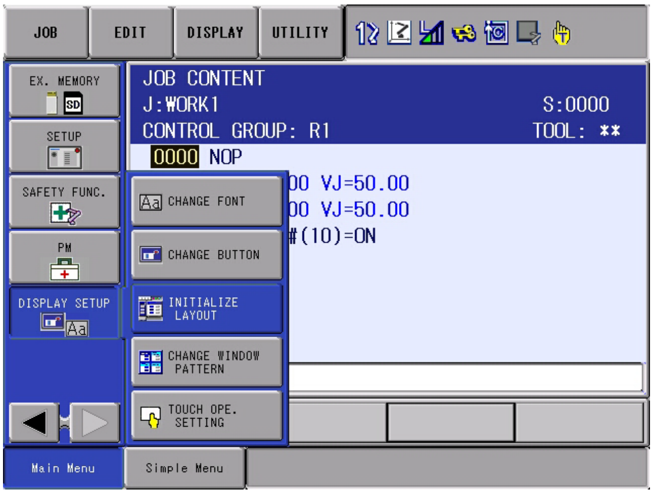
8.19.3 Initialization of Screen Layout

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

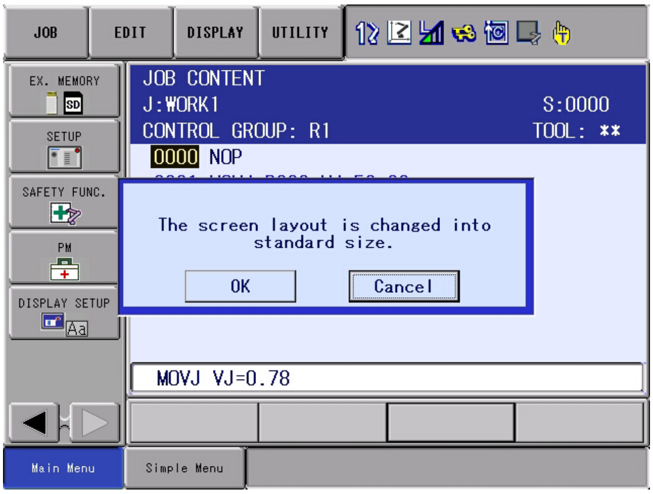
8.19.3.1 Initializing the Screen Layout

To initialize the screen layout, follow the procedure below.

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

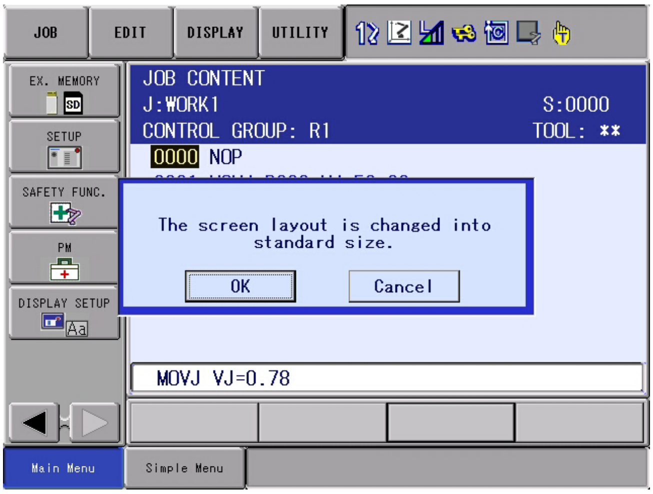


– A confirmation dialog box appears on the center of the current window.

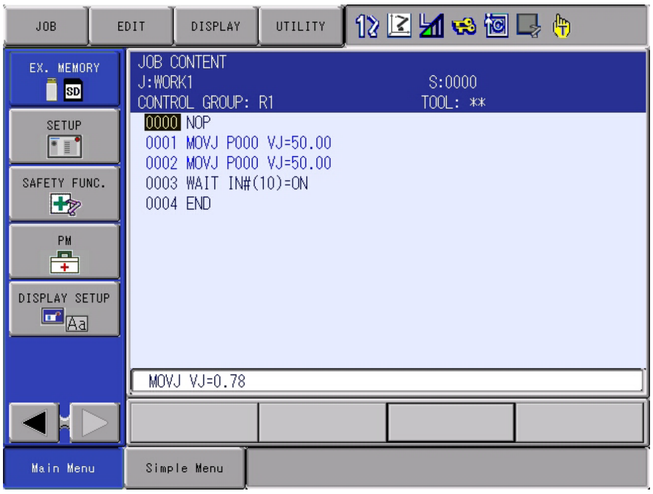


■ **To Initialize the screen layout, follow the procedure below.**

1. select {OK}.

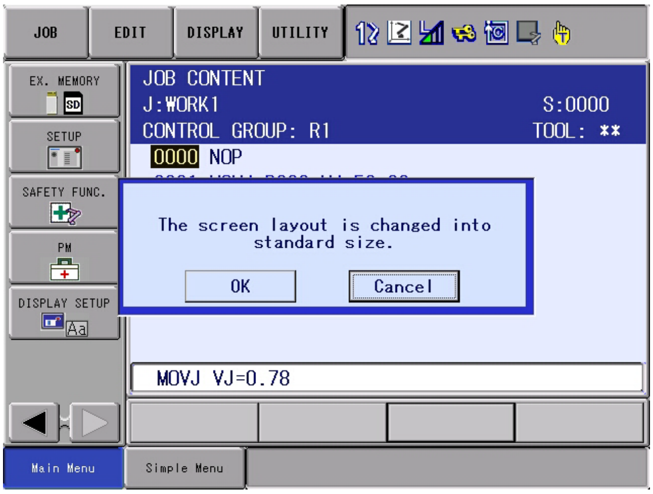


– The dialog box is closed, and the font/button sizes are collectively changed to the regular size.

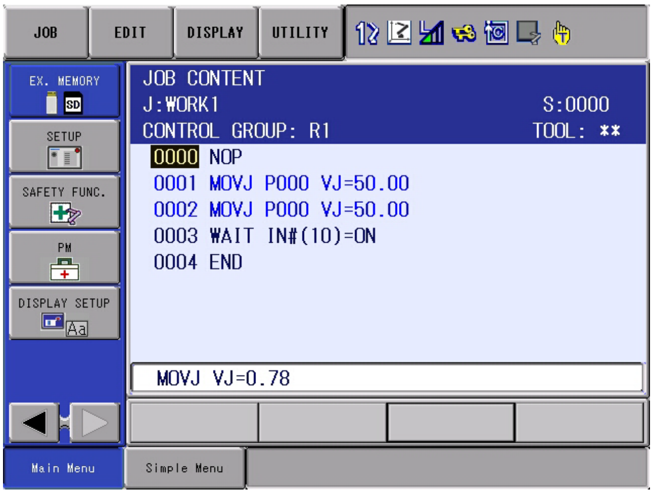


■ **To cancel the Initialized screen layout, follow the procedure below.**

1. Select {CANCEL}.



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



NOTE

Do not turn OFF the YRC1000micro 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

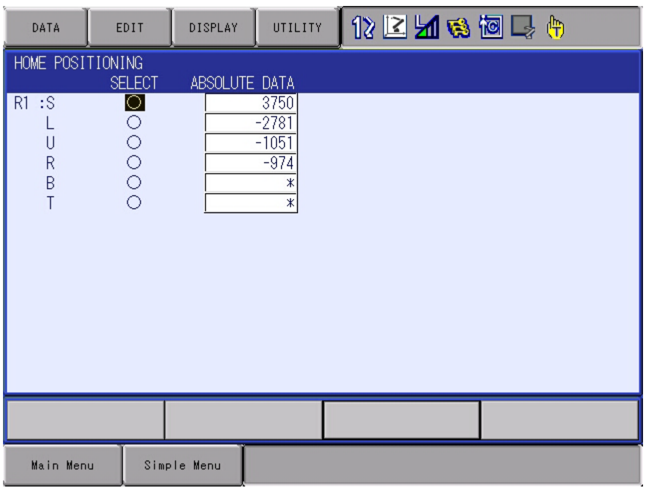
8.20.1 About Encoder Back-Up Error Recovery Function

A motor of the robot, the travel axis or the rotation station which is controlled by the YRC1000micro is connected with the back-up buttery in order to keep the position information even though the control power is disconnected. This buttery consumes buttery 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.

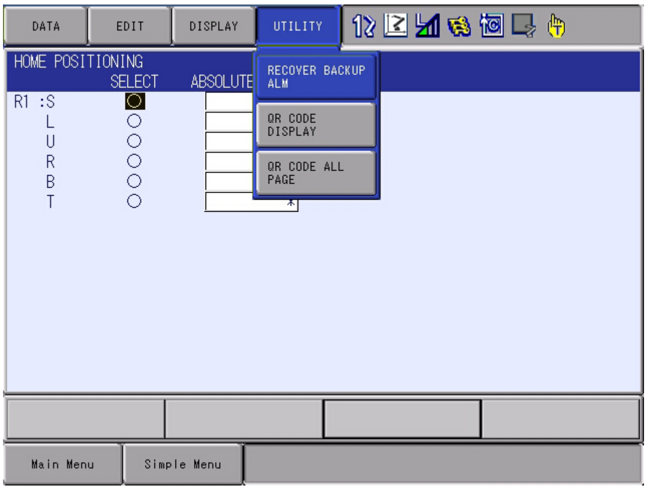
8.20.2 Encoder Back-Up Error Recovery Function Operation

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.

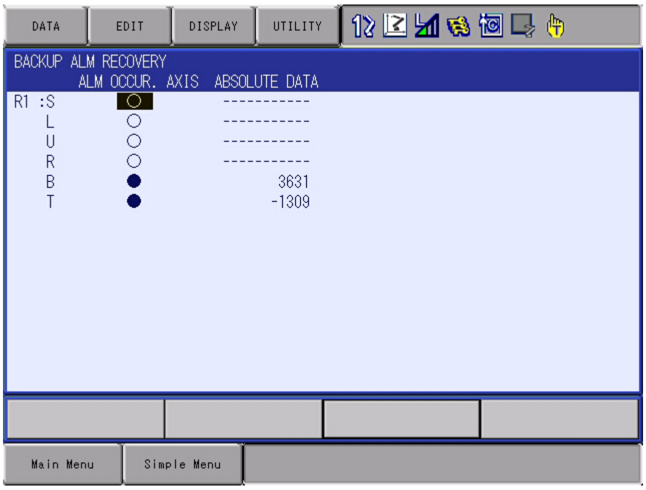


6. Select the control group.

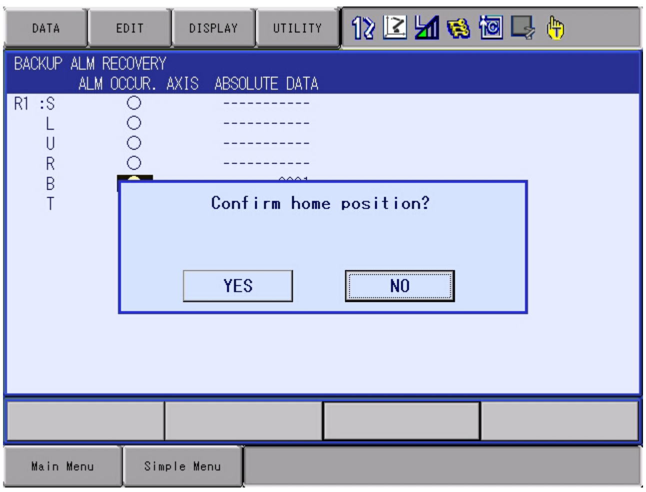
7. Select {UTILITY} in the menu.
   – The pull-down menu appears.



8. Select {BACKUP ALM RECOVERY} in the menu.
   – The back-up alarm recovery display appears.



9. Select the axis to be fixed.
   – Move the cursor over the axis to fix, and select it. The confirmation dialog appears.



10. Select {YES}.
    – The absolute data of the selected axis is recovered.
    – Select {NO} to cancel the operation.
11. Select the current position.
    – To display the current position window, refer to “YRC1000micro MAINTENANCE MANUAL (RE-CHO-A115) 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.

NOTE

- The accuracy of the performance of the life diagnosis is not guaranteed. Use this function as the one of the methods to determine the duration of life for the speed reducer.
- If the periodic grease replenishment and grease replacement are not performed, or the excessive pressure is applied to the speed reducer, such as the mechanical interference etc, it will be failed before reaching to the diagnosis period.
- The diagnosis is performed by executing the job in the play mode. When operating the robot in the teach mode (operation by the axis key, FWD operation and test operation), the life diagnosis function is not performed.

8.21.2.1 Diagnose by the Lifetime Calculation

■ **Outline**

This function calculates the torque and the speed of the each axis during the job operation, and diagnoses the time to replace the speed reducer by the lifetime calculation. The replacement time is informed by displaying the message and turning the replacement signal ON.

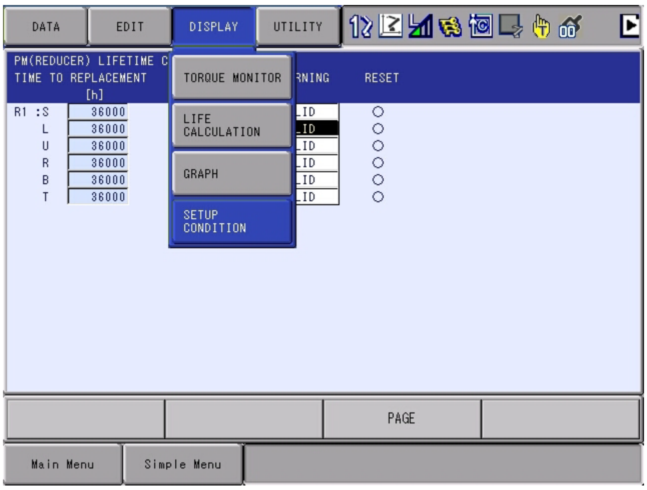
Operating the job in the play mode performs the diagnosis automatically.

NOTE This function is only available for the robot axes. As for the external axes, this function is not available.

■ **Set the Replacement Signal**

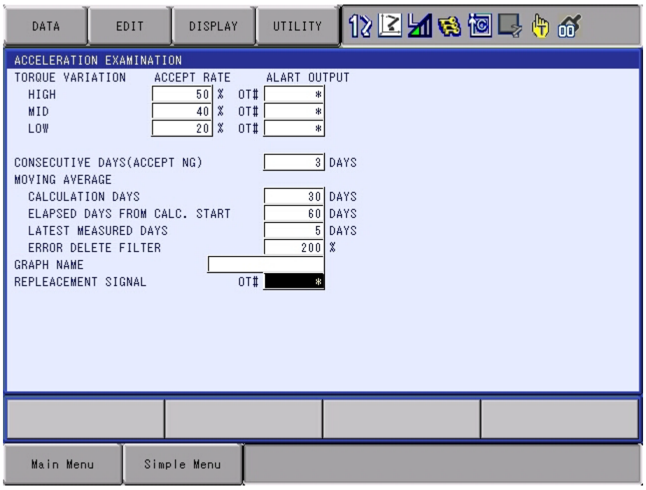
Set the GP output signal to notify the replacement time by following procedures.

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.



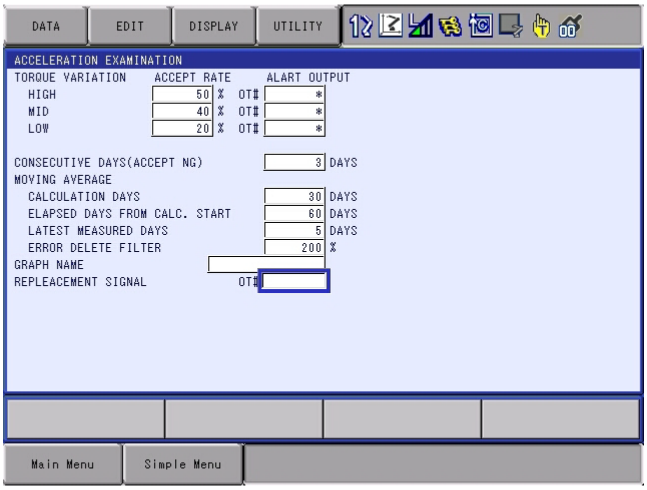
5. Select {=SETUP CONDITION}.

   – The condition setup window is appears.



6. Move the cursor to over the {=REPLACEMENT SIGNAL}, and select.

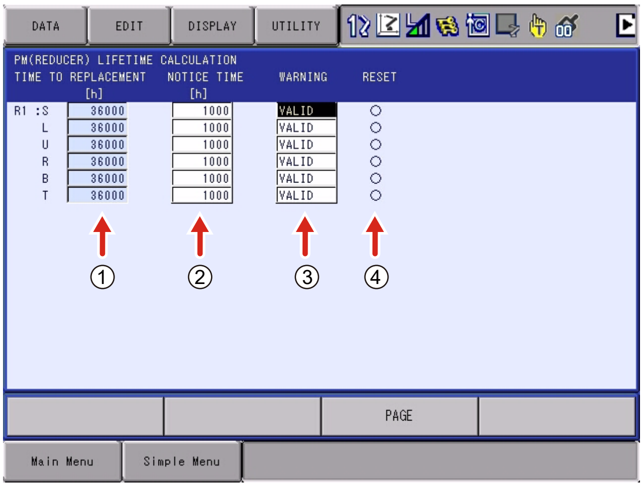
   – Able to enter the values.



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 the another window appears, select {DISPLAY}, and select the {=LIFE CALCULATION} in the pull down menu to display the lifetime calculation window.



Each item on the screen represents the following description.

① =TIME TO REPLACEMENT

Displays the rest of the lifetime to replace the speed reducer. The calculation of the subtraction of the number is operated automatically by performing the job in the play mode.

② =NOTICE TIME

By setting the time in this item, the replacement time is informed by displaying the message and turning the replacement signal ON before the "TIME TO REPLACEMENT" becomes "0".

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].

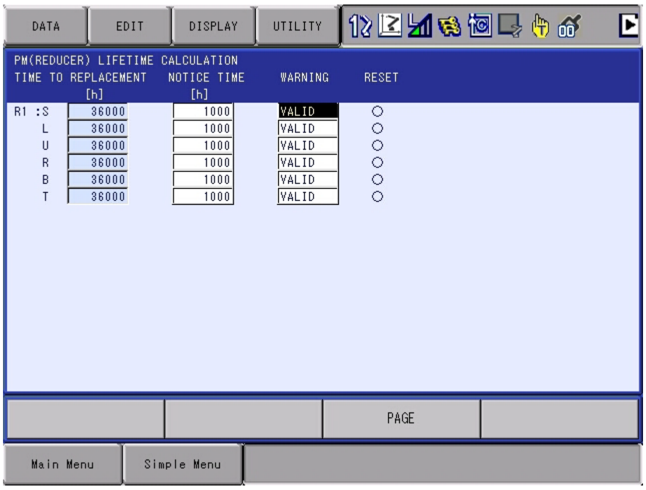
④ =RESET

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.

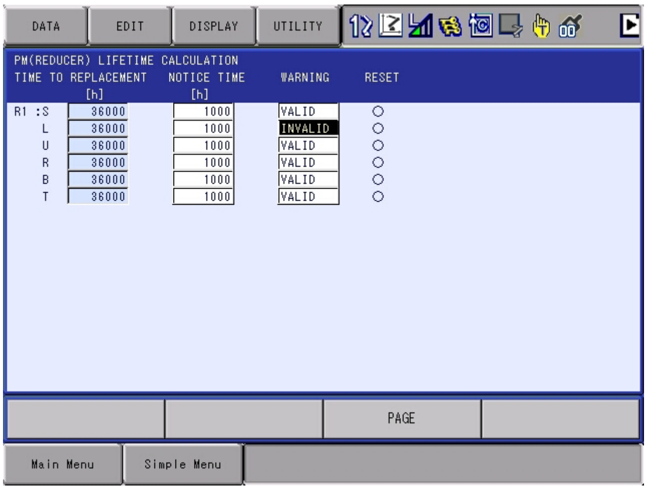
- **Invalidate the Replacement Signal and the Message Display**

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.



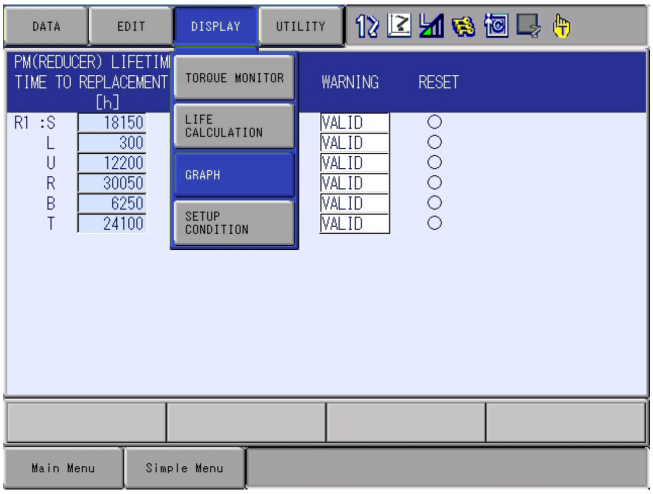
4. Move the cursor over the “=WARNING” to invalidate the desired axis, and select [Select]. [Invalid] and [Valid] will alternate each time when press the [Select].



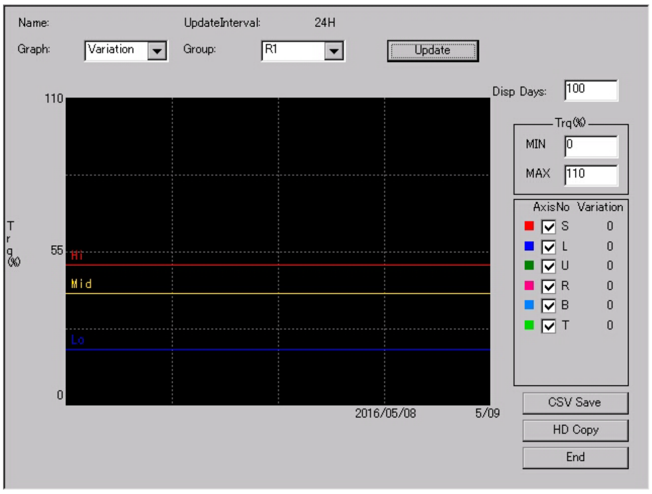
■ Graph Display

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.

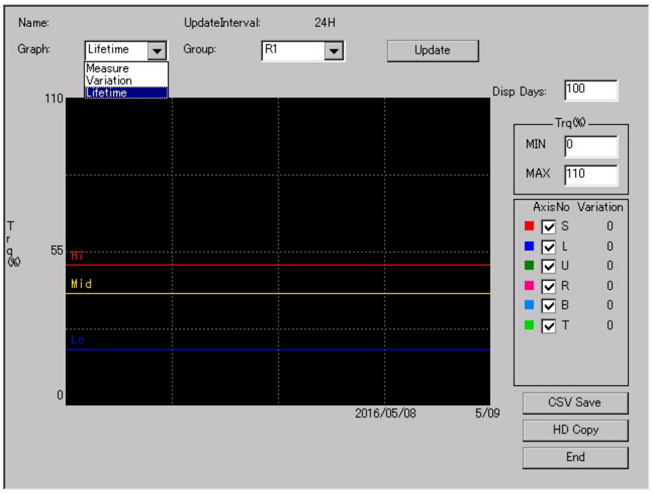


4. Select {GRAPH}.
   – The graph is shown.



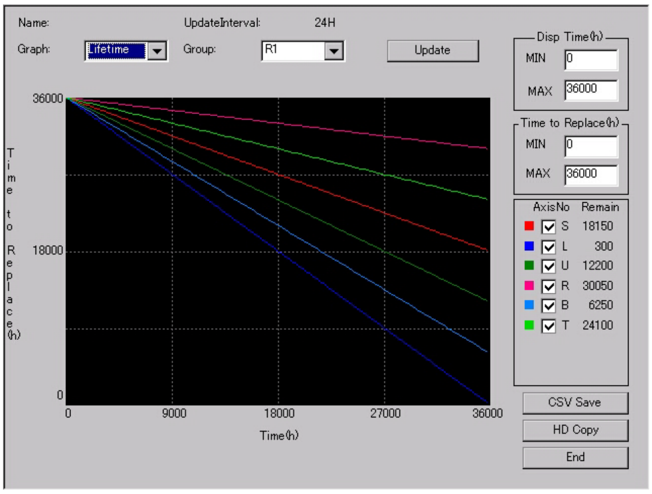
5. Select {GRAPH}.

– The pull down menu is shown.



6. Select {Lifetime}

– The calculation result is shown as a graph.

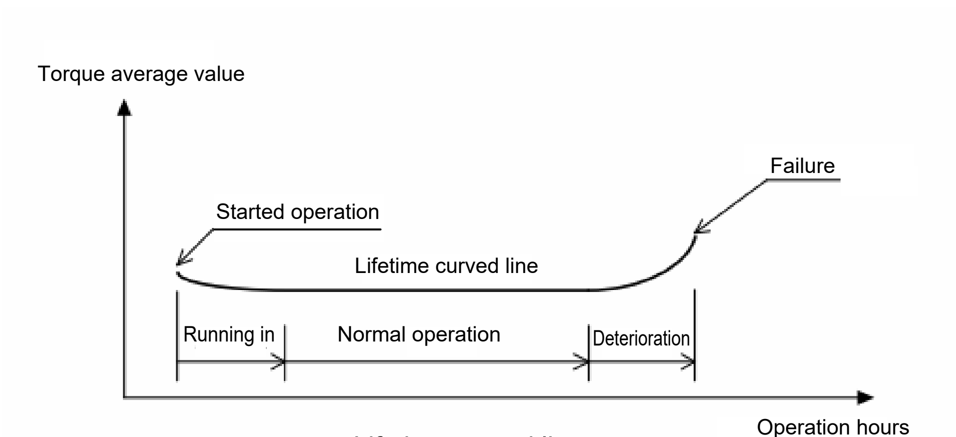


The vertical axis of the graph indicates the time to replace. The horizontal axis indicates the operation time.
To change the display range of the horizontal axis, modify the MIN and MAX values of display time.
To change the display range of the vertical axis, modify the MIN and MAX values of time to 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"* .

8.21.2.2 Diagnose by the Torque Average Value

- **Diagnosis Element**

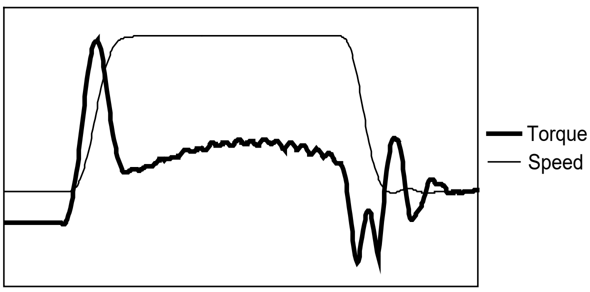
Monitors the torque waveform during the job operation, and calculates the average value of the vibration amplitude by extracting the waveform from the torque arising from the speed reducer. This data is called the torque average value, and it is the basis data to diagnose the lifetime. The following chart shows the lifetime curved line according to the torque average value and the operation hours.



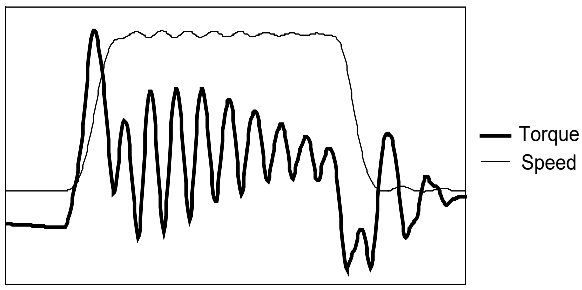
Lifetime curved line

As the condition of the speed reducer is changing to “deterioration” from “normal operation”, the torque element changes to “increase” from “normal”. It is estimated that the speed reducer is in the deterioration period as the number of the torque element is increasing by the deterioration of the speed reducer.

This function records the torque element arising from the deterioration of the speed reducer on a daily basis, and diagnoses the lifetime of the speed reducer by monitoring the change of the torque element.



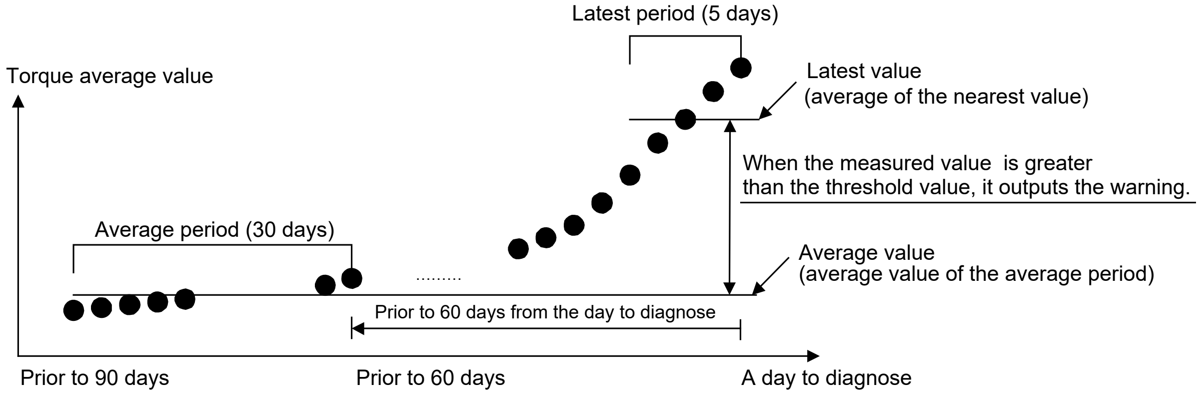
Torque and speed at the normal operation period



Torque and speed at the deterioration period

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.

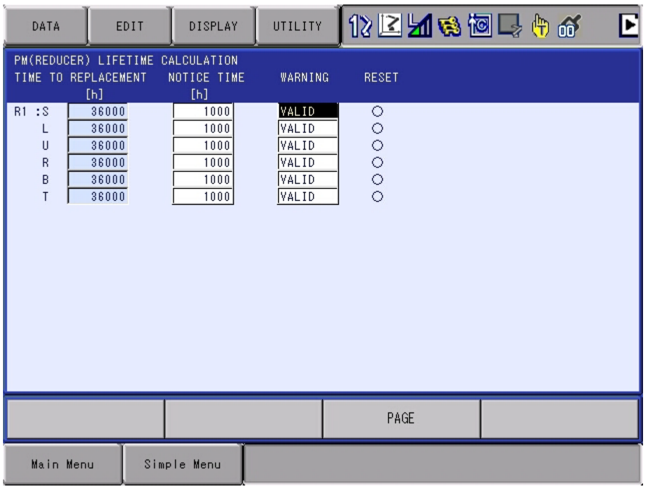
When the difference value between the latest value “the average value from the measured result of the five days (the initial value) including the day to diagnose” and the average value “the average of 30 days (the initial value) between prior to 60 days from the day to diagnose and prior to 90 days from 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.



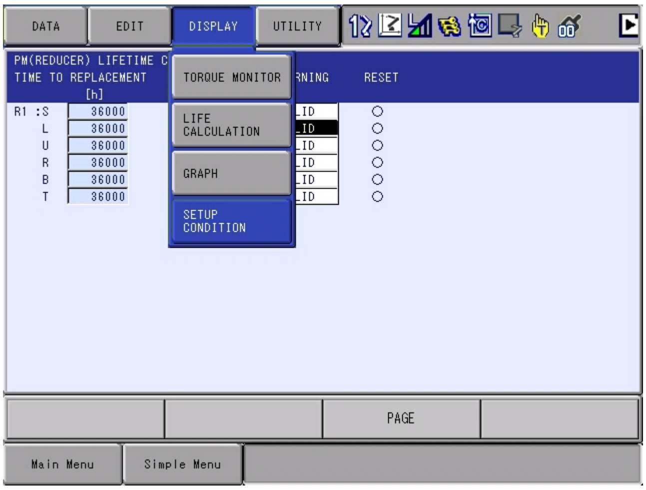
■ Setting Procedures

The setting procedures are described as follows.

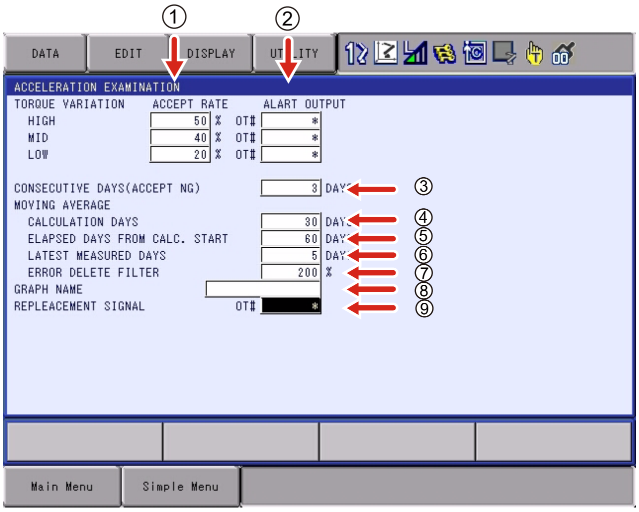
1. Change the security mode to the management mode.
2. Select {=PM} in the main menu.
3. Select {=PM(REDUCER)}.
   – The lifetime calculation window appears.



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.



6. Select {End} button.

Each item on the screen represents the following description.

① =TORQUE VARIATION ACCEPT RATE

It is determined as accept OK when the measured value (the latest value - the average value) is smaller than the set value or the equal value. It is determined as accept NG when the measured value is greater than the set value. The torque variation accept rate can be set as “High”, “Medium” or “Low”. The initial value of each item is 50%, 40% and 20%.

② =TORQUE VARIATION ALART OUTPUT

- =ACCEPT RATE HIGH
  The warning output signal is turned ON when the number of the day, which is determined as accept NG (the latest value - the average value > “=ACCEPT RATE HIGH”), is more than the number of the consecutive days. If unnecessary to output the signal, set the item “0”. The initial value of this item is “0”.
- =ACCEPT RATE MID, LOW
  The 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

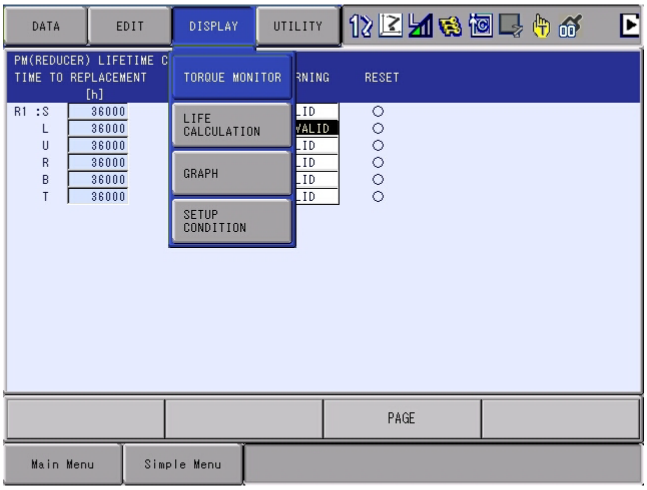
Even though the initial value is set, the accuracy of the life diagnosis is not guaranteed performance.

■ Data Confirmation

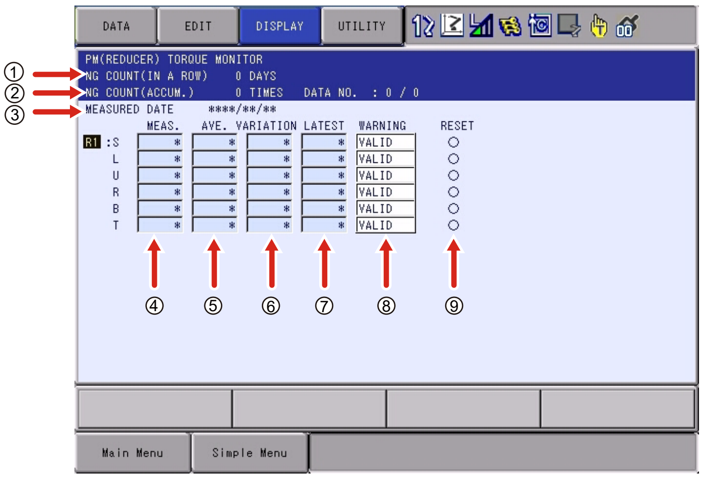
By operating a job in the play mode, a data (the torque element arising from the deterioration of the speed reducer) for each axis is recorded automatically on a daily basis, and the data is accumulated. It is unnecessary to prepare the job for this diagnosis.

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.



5. Press [PAGE] key.
   – Able to refer to the data of a date corresponding to the number by pressing the [PAGE] key. Modify the number as necessary.

SUPPLE-MENT

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.

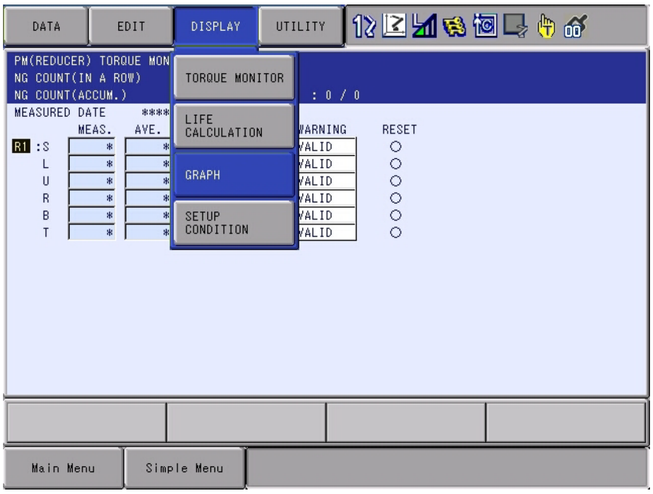
Move the cursor over the “=WARNING” of the desired axis to invalidate, and press [Select]. [Invalid] and [Valid] will alternate each time when pressing the [Select].

■ Graph Display

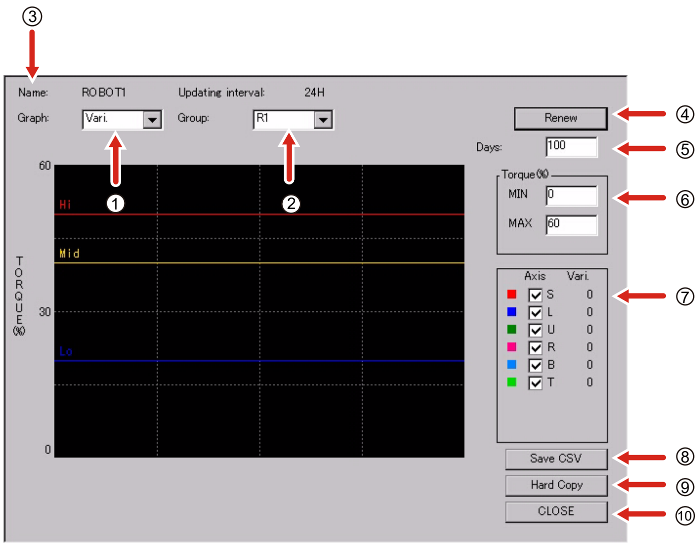
After the measurement, the variation can be checked by a graph.
The graph is updated every 24 hours automatically. The measured value and changes of the variation can be displayed on the programming pendant. Thus, the changes of the torque can be checked visually.
Use the graph display as the one of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

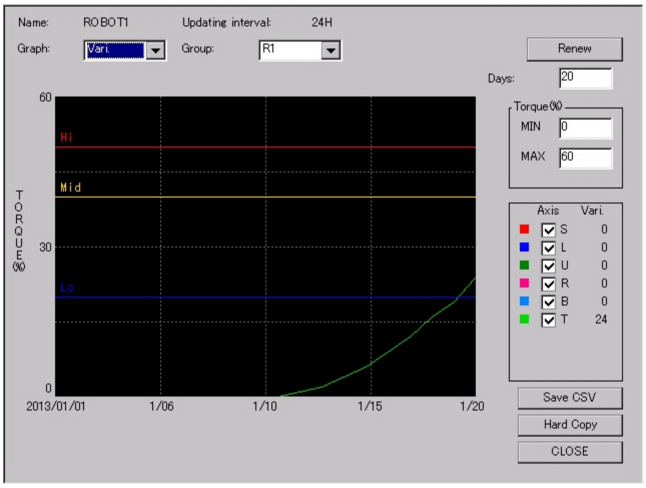
Each item on the screen represents the following description.

① =Graph

Select the {Graph}, and the pull down menu appears. Either “=Vari.” or “=Meas.” can be selected.

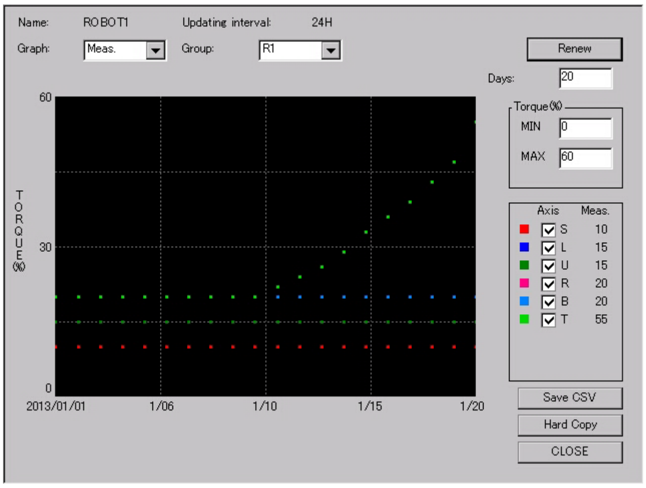
- When selecting “=Vari.”,
  the variation (=latest value - average value) appears on the graph.
  The line of each “Hi”, “Mid” and “Lo” appears.
  “Hi” means “the torque variation accept high”.
  “Mid” means “the torque variation accept medium”.
  “Lo” means “the torque variation accept low”.

  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.



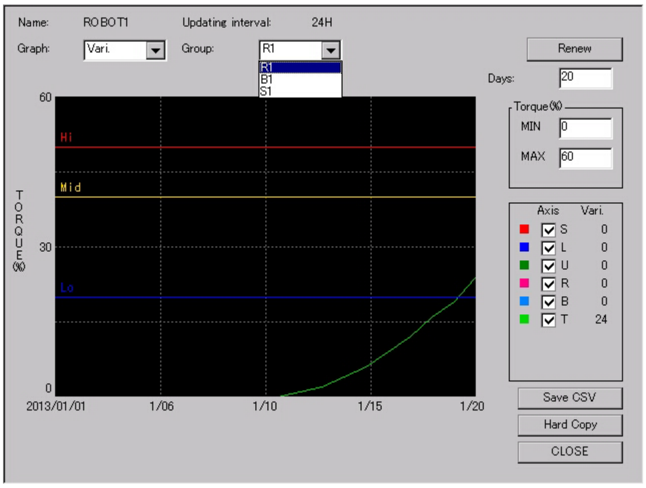
In the case of the graph above, it shows a “variation” > “Lo” of the T-axis, and the warning output signal, which is set by “torque variation low”, is ON.

- 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”

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

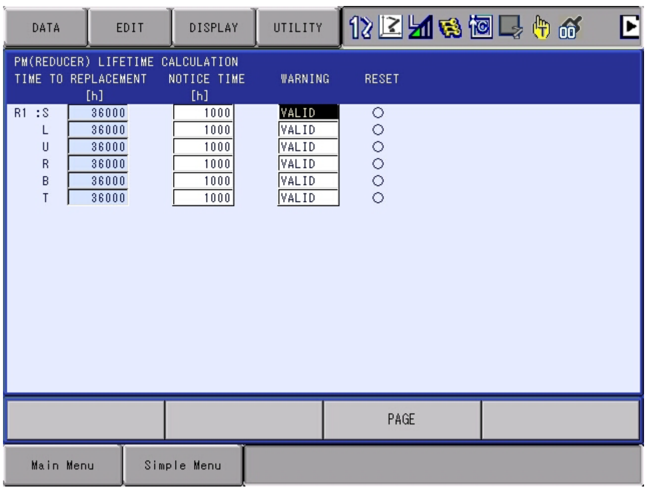
Pressing “=CLOSE” button closes the graph window.

8.21.2.3 After Replacement of the Speed Reducer

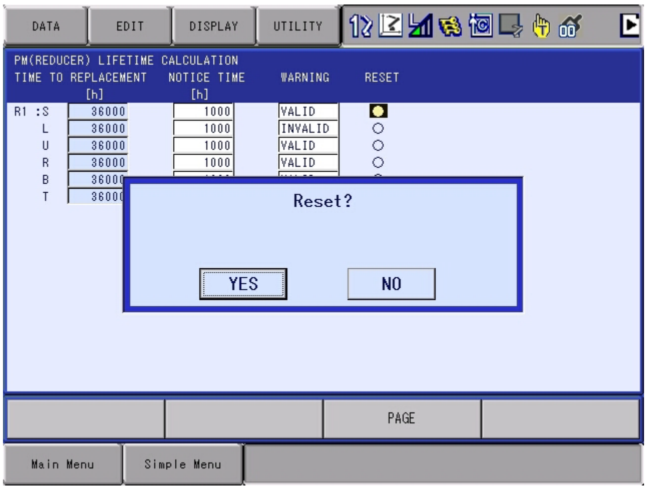
The lifetime diagnosis does not perform correctly if use the old data after replacement of the speed reducer. Thus, reset the data for the lifetime diagnosis, and prevent using the data before replacement day.

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.



5. Move the cursor over the “Reset” on the axis window of which speed reducer is replaced, and press {Select}.
   – The confirmation dialog appears.



6. Select {YES}.
   – The data of its axis is reset, and the replacement day is recorded into the “=INSPECTION RECORD” window.
   – The operation is canceled when select “No”.

The procedures above can be performed in the lifetime window or the torque monitor window.

The replacement day is recorded into the “INSPECTION RECORD” window by performing the procedures above.

8.21.3 Inspection Notice Function

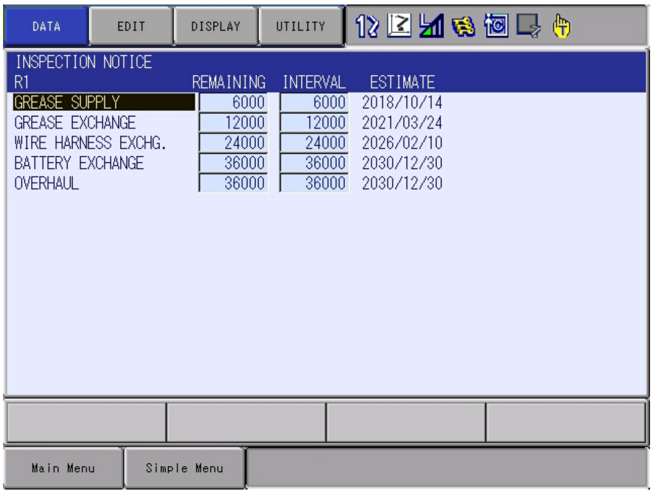
The inspection notice function turns the notice signal ON and displays the message when the inspection time has come.

Perform the inspection by the authorized personnel or your YASKAWA representative when the notice signal is turned ON.

8.21.3.1 Setting Procedures

.Perform the setting procedures as follows.

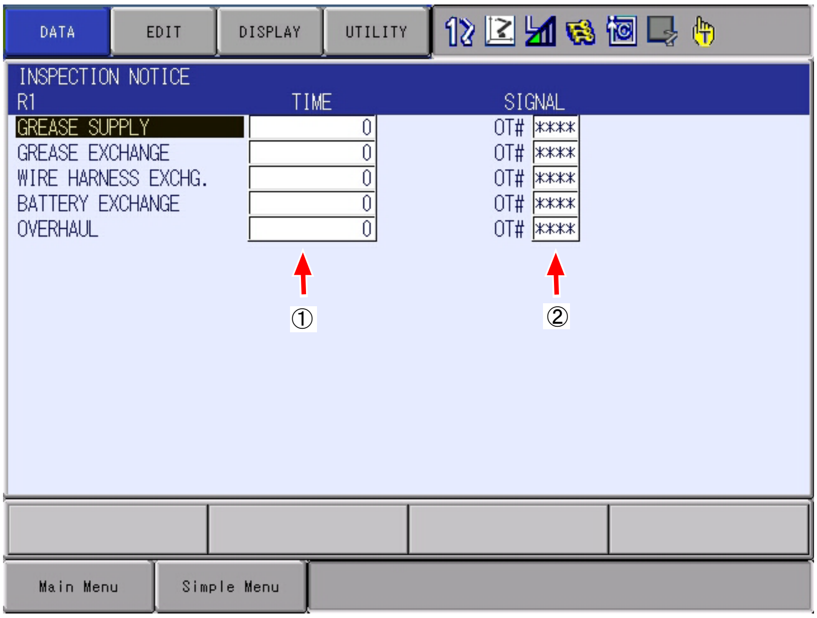
1. Change the security mode to the management mode.
2. Select {=PM} in the main menu.
3. Select {=INSPECTION NOTICE}.
   – The inspection notice window appears.



4. Select {DISPLAY} in the main menu.
   – {=SETUP CONDITION} is displayed in the pull down menu.

5. Select {=SETUP CONDITION}.

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



Each item on the screen represents the following description.

① TIME

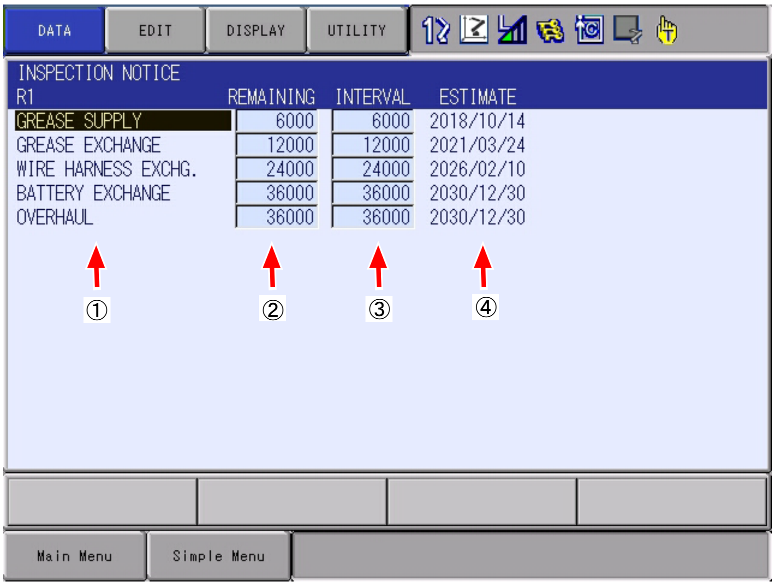
Before the remaining time to the inspection is “0”, the message is shown and the inspection signal is ON at the time which is set in this item. For example, if “100” is set, the message is shown and the signal is ON 100 hours before the remaining time to the inspection is “0”.
The time can be set in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

② SIGNAL

Set the GP output number which notifies the inspection time.

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.

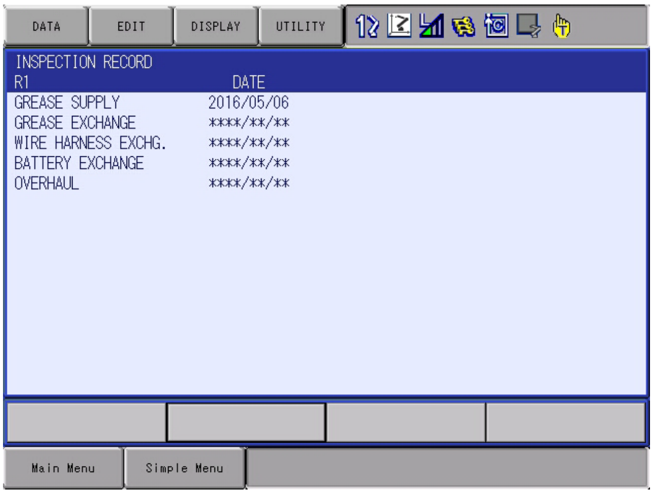
NOTE

When the inspection signal is turned ON or the message is displayed, perform the inspection by an authorized personnel or your YASKAWA representative. The message is displayed continuously until the YRC1000micro is inspected.

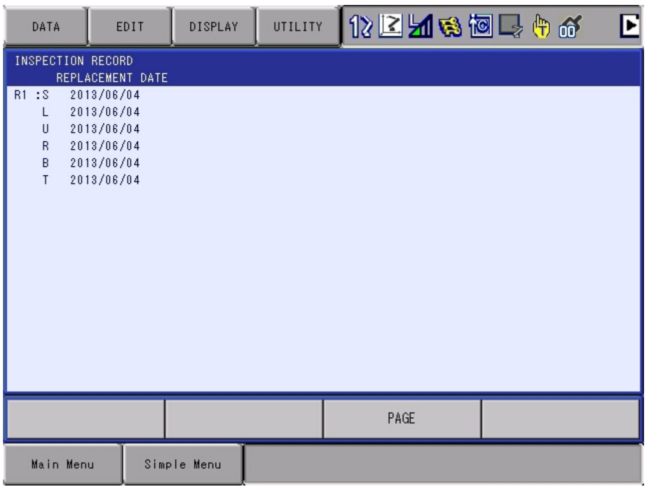
8.21.4 Record of Inspection Date and Replacement Date

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.

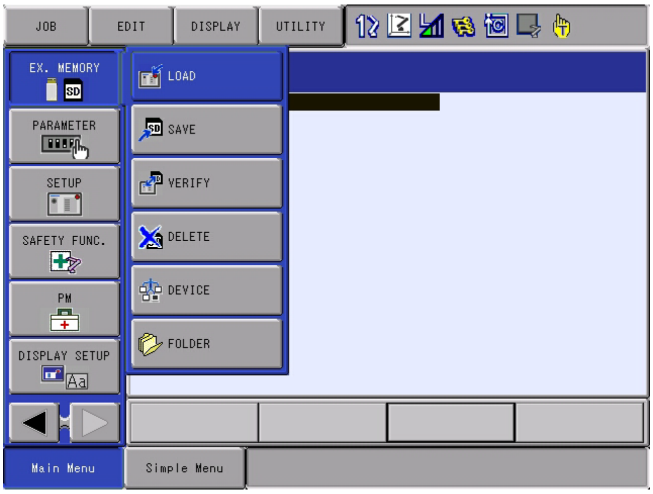


8.21.5 Management of the Data

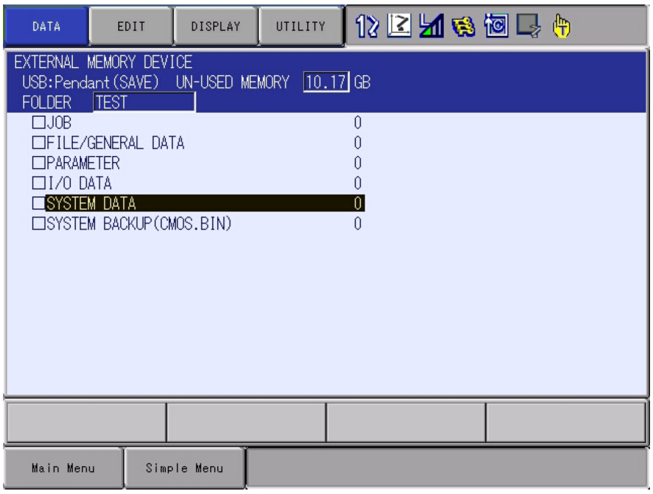
According to the torque average value, such as the speed reducer preventive maintenance data base, the preventive maintenance elements, the record of the inspection and replacement, can be loaded/saved into the external memory device.

As for the external device menu, refer to “YRC1000micro OPERATOR’S MANUAL (RE-CSO-A058) 7. External Memory Device” for more details.

1. Select {EX.MEMORY} in the main menu.
   – The external memory menu window appears.

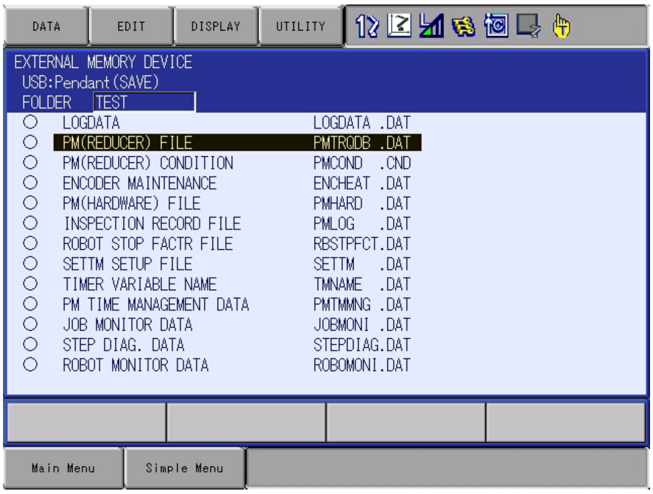


2. Select {LOAD} or {SAVE}.
   – The load window or the save window appears.



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.

Judgment display	Status
A	New - Used about half of its life span
B	Used about half of its life span
C	Used about half of its life span - Time to replace (reference)
D	Time to replace (reference)

■ **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.

- **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.

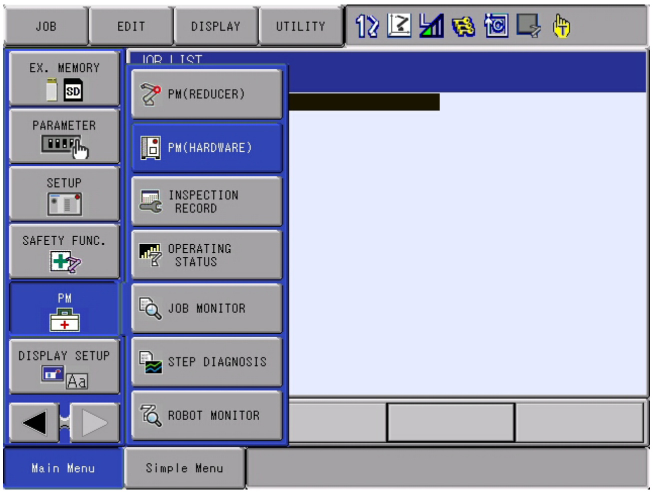
  For the used component, after recording the replacement date, the value 1 - 100% can be set as the leftover life.

- **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.

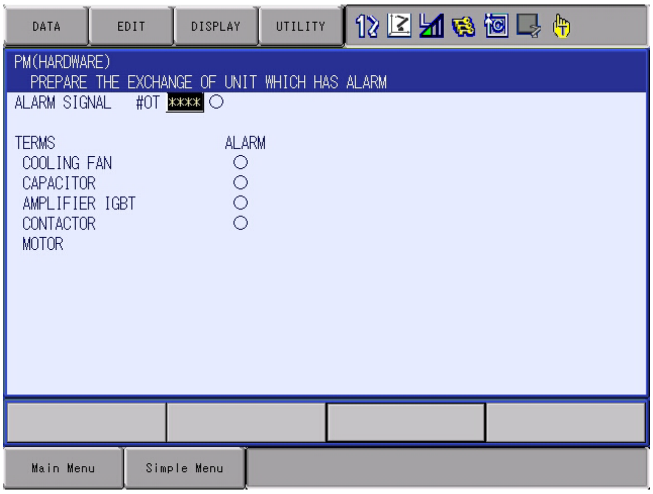
8.21.7 Setting of Preventive Maintenance for the Hardware

8.21.7.1 Setting of Replacement Time Display

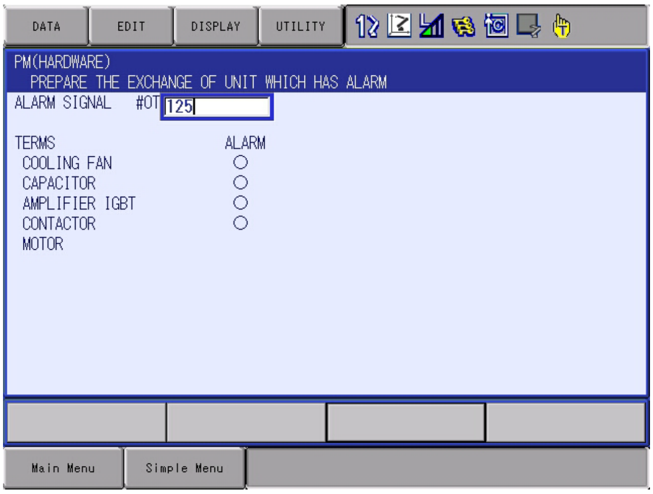
1. Select {=PM} in the main menu.
   – The sub menu appears.



2. Select {PM (HARDWARE)}.
   – Alarm signal setting and unit selection window appears.

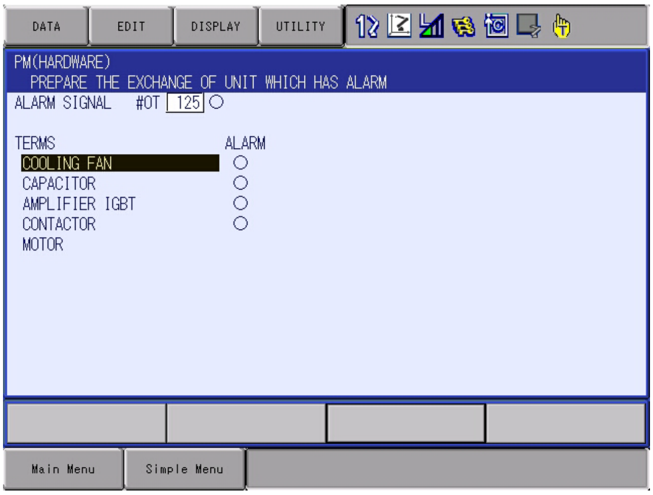


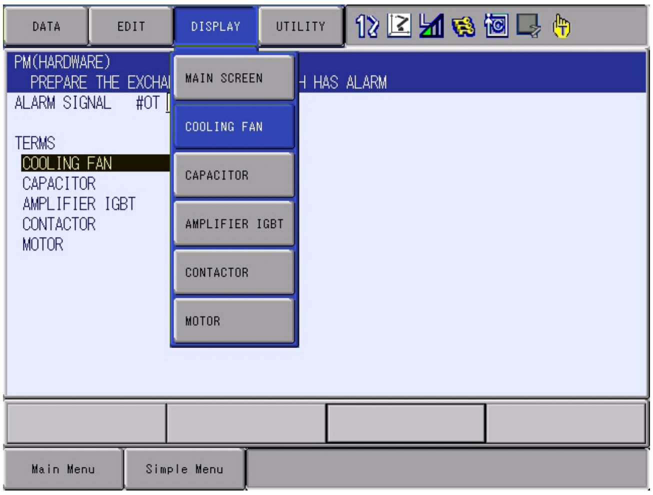
3. Input the numerical value of the alarm signal.
   When any of components in this controller comes to the replacement time, the GP output signal which is already set turns ON.



– * For example, 125 is input.

4. Select the unit.
   Or select the unit from {DISPLAY} in the menu.

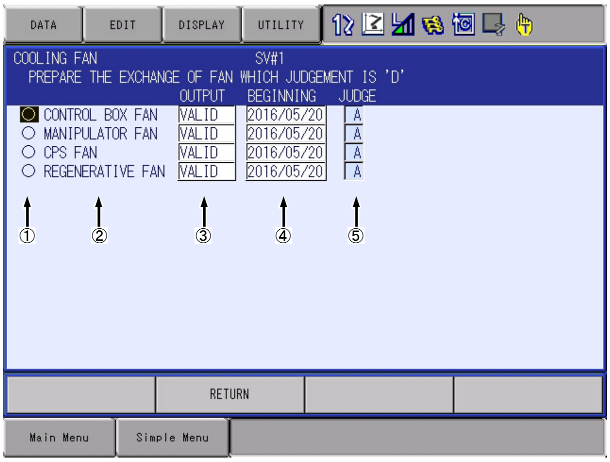




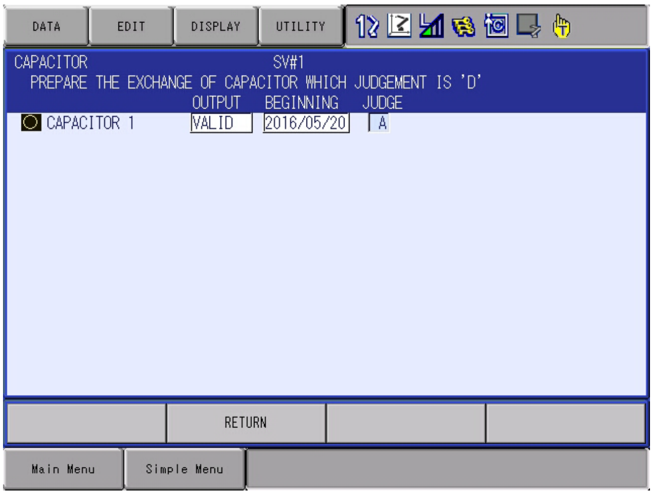
– * For example, {COOLING FAN} is selected.

5. The following information is displayed:
   Starting from the left,
   (1) " ● " is displayed when the replacement time is judged as D.
   (2) Component name
   (3) GP output signal valid/invalid
   (4) The first date of use
   (5) Leftover life judgment

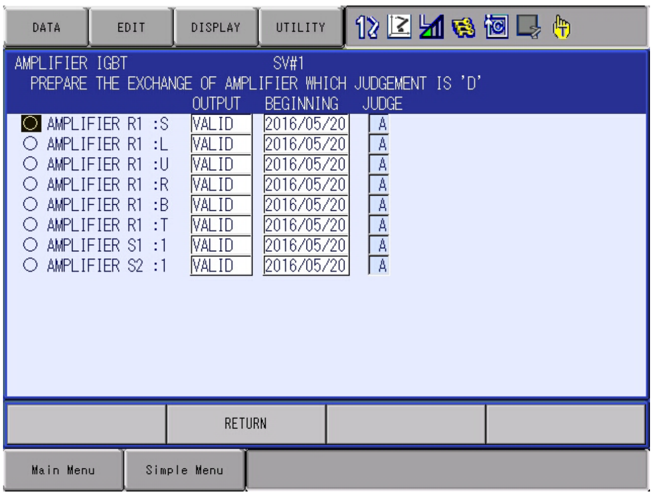
   – When {COOLING FAN} is selected:



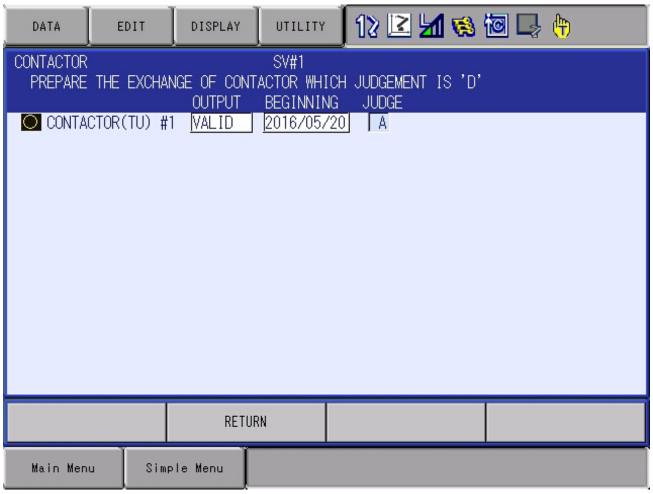
   – When {CAPACITOR} is selected:



   – When {AMPLIFIER IGBT} is selected:

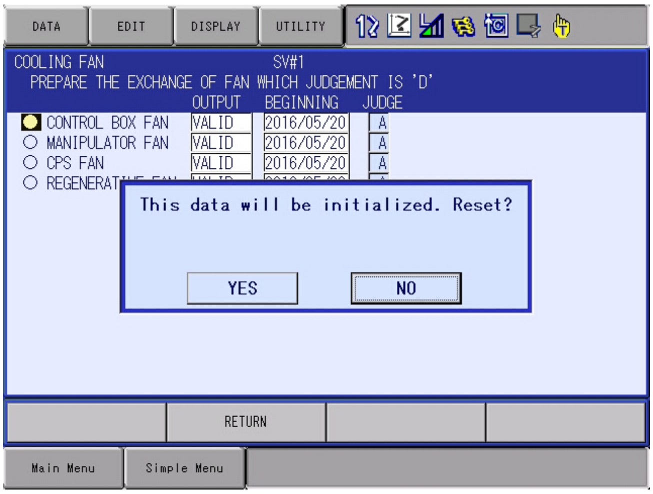


– When {CONTACTOR} is selected:



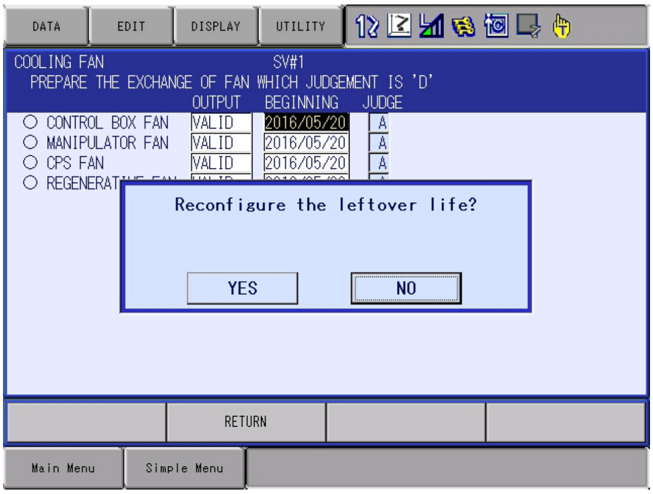
6. When replaced with a new component, select “O”.

– A confirmation dialog box appears. When replaced with a new component, select {YES}.

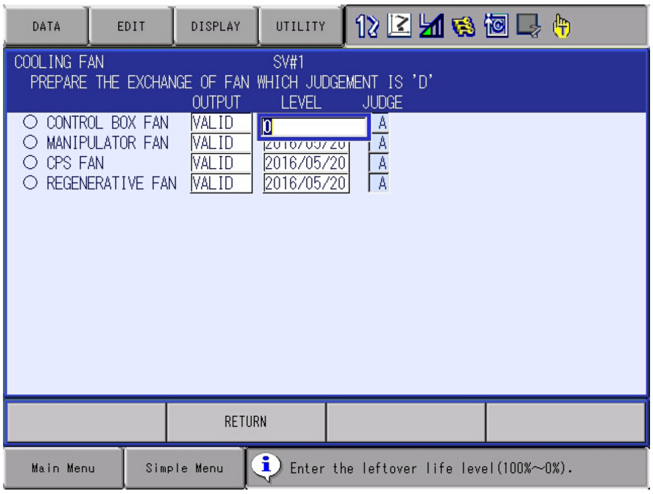


7. When replaced with an used component, select {BEGINNING}.

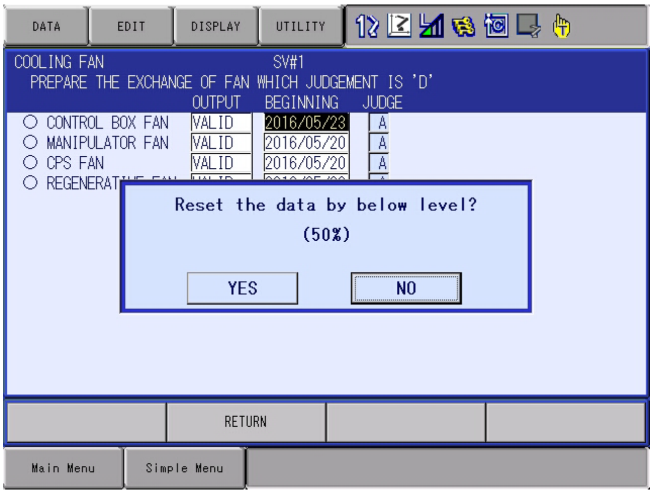
   – A window to input the numerical value appears. Input the replacement date using half-width characters like {2009.3.14}. After that, a following confirmation dialog box appears. When replaced with an used component, select {YES}.



8. When manually setting the approximate value to the leftover life, input the numerical value “0 - 100%”.



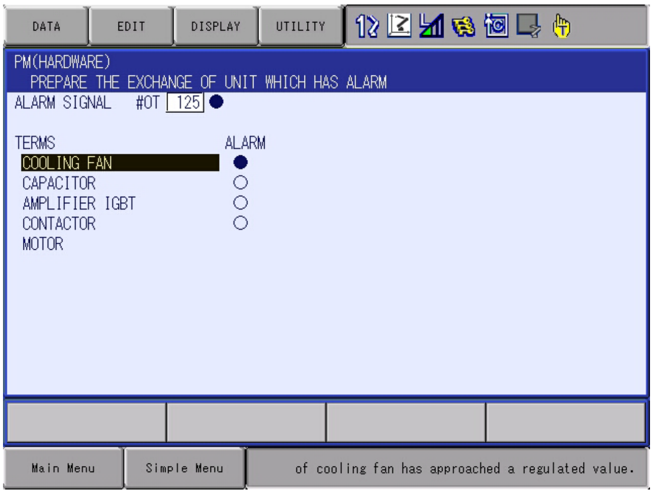
9. When the numerical value displayed in the confirmation dialog box is correct, select {YES}.



8.21.7.2 Mask of Replacement Time Display (Signal Display)

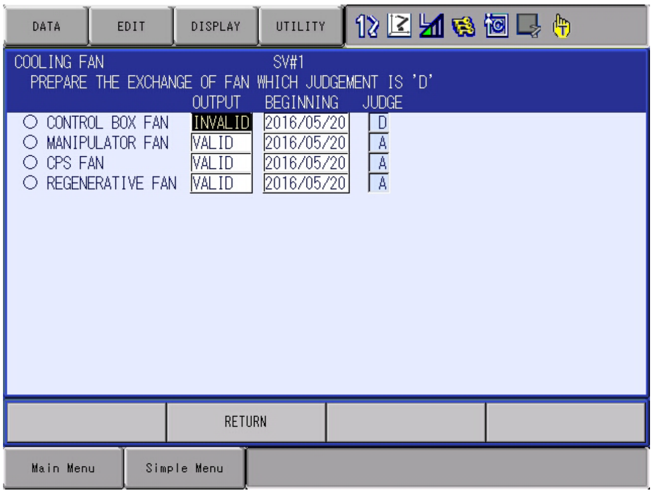
Perform the masking of the replacement time display according to the following procedures:

1. When any of the components comes to the replacement time, the message is displayed per unit.

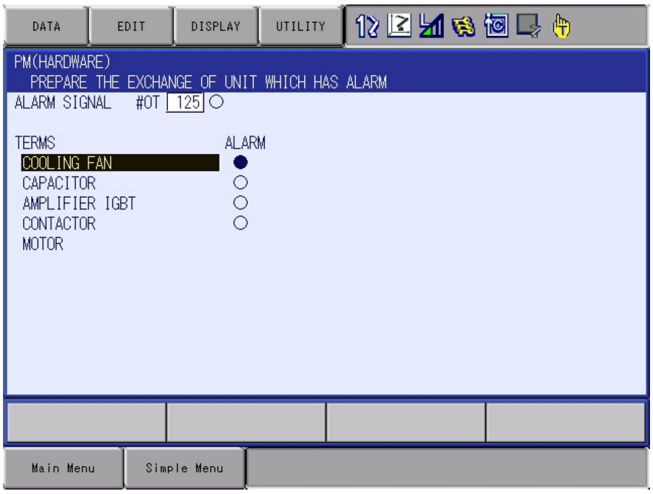


2. The message is also displayed per component.
   Invalidate the output.

   – After checking the components, invalidate the output.



3. The GP output signal is turned OFF. And the message turns to be hidden.However, the stepwise display remains D.

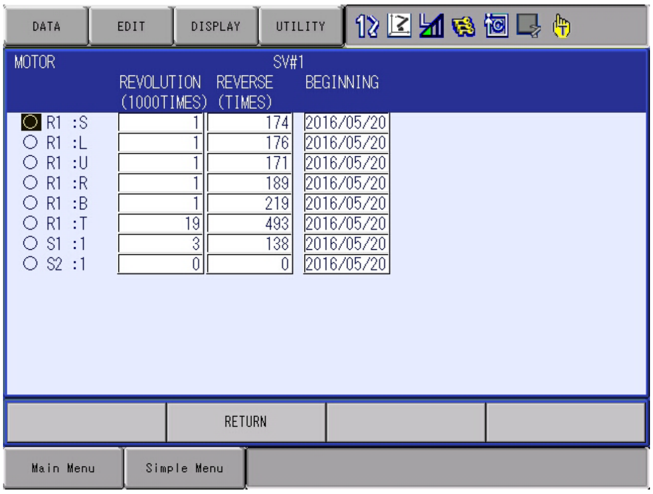


– * Before the replacement, perform the above operation in order to detect the multiple components because only one GP output of life diagnosis can be output for one controller.
The masking cycle is as follows:
Replacement time of a component, GP output ON, Checking the component and turning OFF the output of the component, GP output OFF, Replacement time of another component, GP output ON.

8.21.8 Display of the Numbers of Motor Revolution and Reverse Revolution

8.21.8.1 Display of the Numbers of Revolution and Reverse Revolution

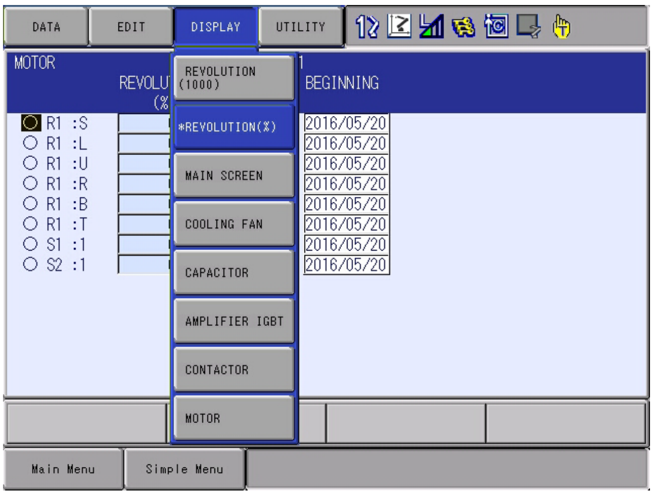
1. Select each menu in the following order. {=PM} in the main menu, {PM(HARDWARE)}, {MOTOR}.



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.

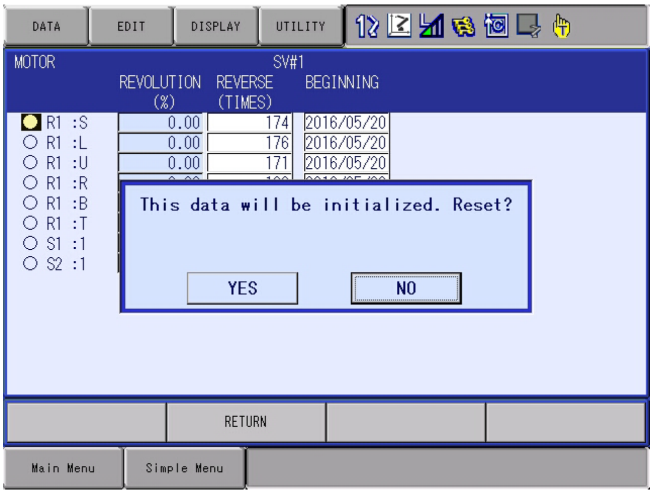
1. Select each menu in the following order. {PM} in the main menu, {PM(HARDWARE)}, {MOTOR}. And then select {DISPLAY} on the menu to select {REVOLUTION(%)}.



8.21.8.3 Resetting the Number of Revolution

Used when the motor replaced with a new one.

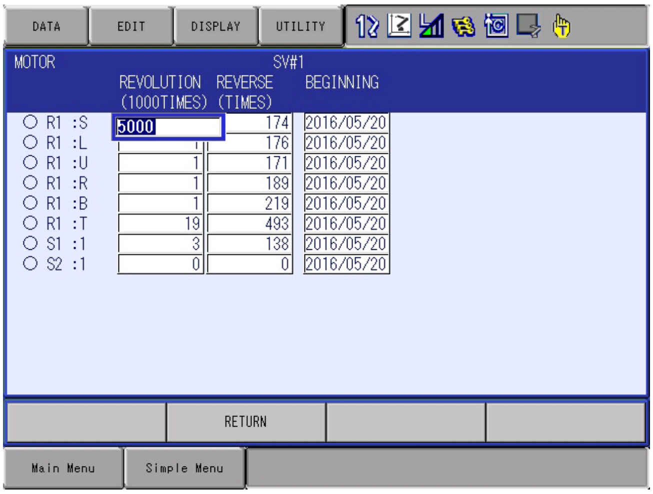
1. Select "○" of the axis to be reset by moving the cursor to it, and then select {YES}. on the dialog box.
   The day of the first use (BEGINNING) is automatically changed.



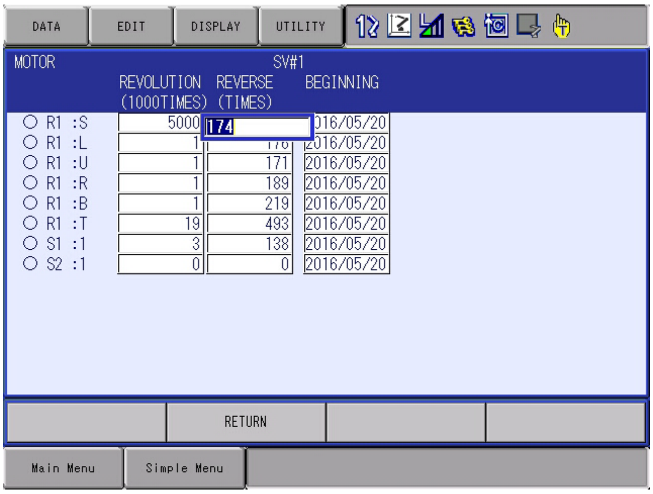
8.21.8.4 Changing the Numbers of Revolution and Reverse Revolution

Used when the motor replaced with an used one.

1. Select the number of the axis to be reset by moving the cursor to it, and then set the number.
   To set the day of the first use (BEGINNING), select the date of the axis to be reset by moving the cursor to it, and then set the date.



– * When changing the number of revolution.



– * When changing the number of reverse revolution.

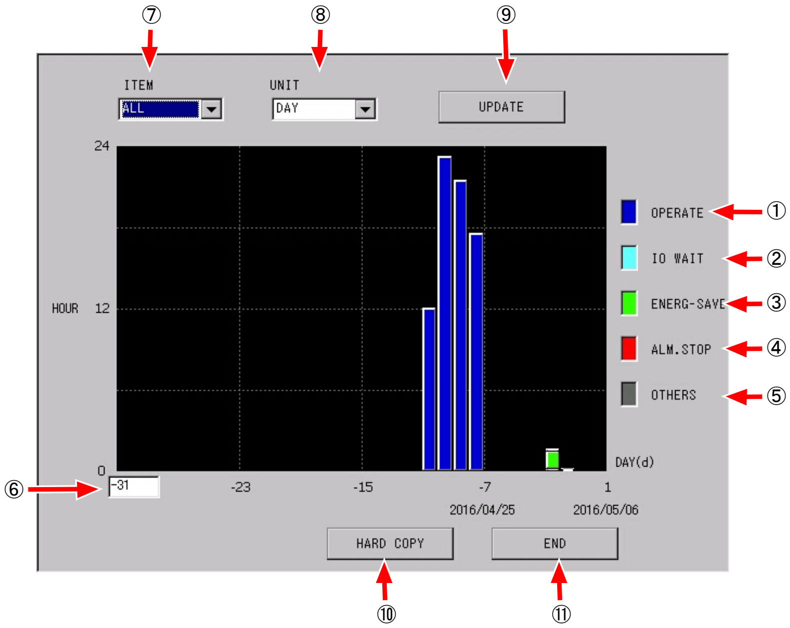
8.22 Operating Status Monitor Function

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.

⑥Set the range of horizontal axis of the graph

The range of horizontal axis can be changed by setting the numeric value.

⑦ITEM

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.

⑧UNIT

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.

⑨UPDATE

By pressing "UPDATE", the data can be updated.

⑩HARD 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

⑪END

By pressing “END”, the graph window is closed.

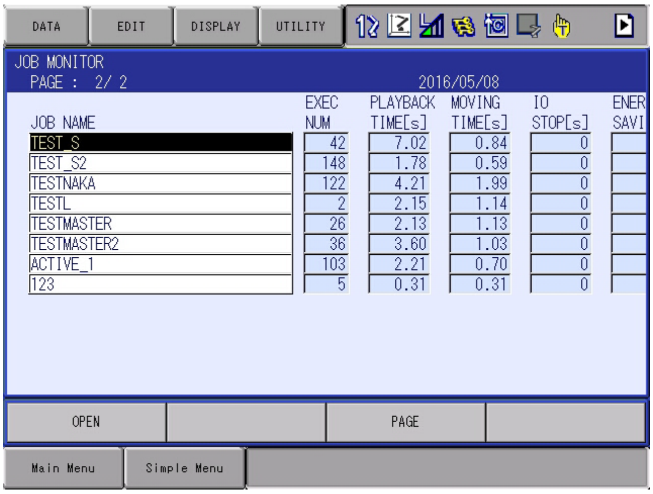
8.23 Job Monitor Function

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.

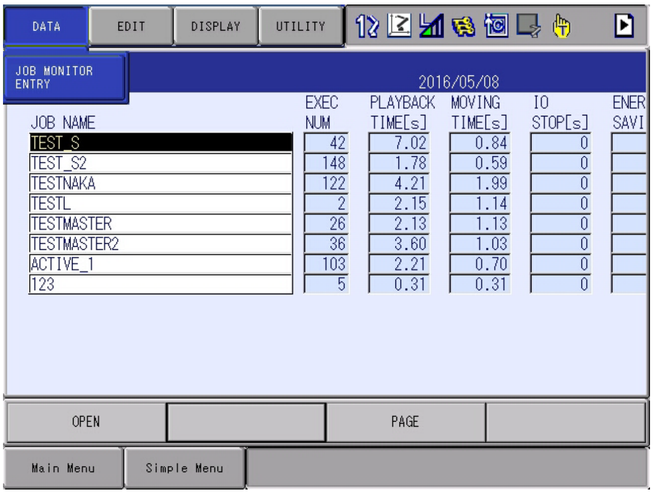
■ Job Registration

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.

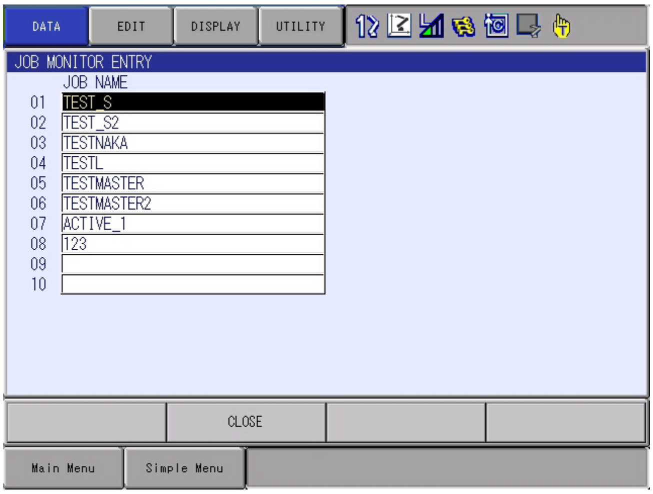


3. Select {DATA}.
   – The pull down menu is shown.



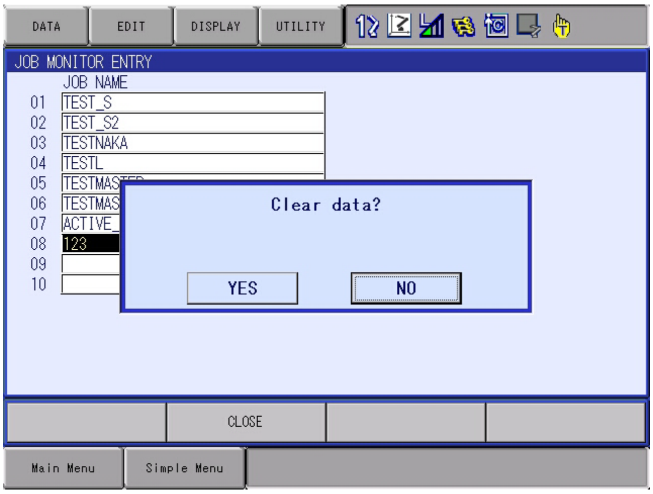
4. Select {JOB MONITOR ENTRY}.

   – The JOB MONITOR ENTRY window is shown.

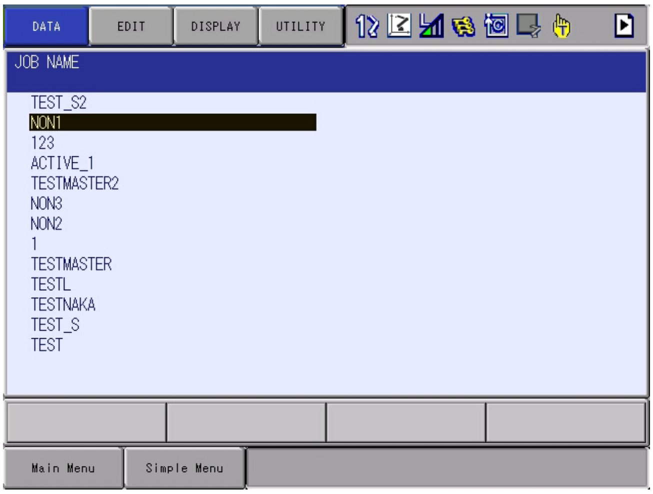


5. Job registration

   (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.



■ 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

:

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

<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

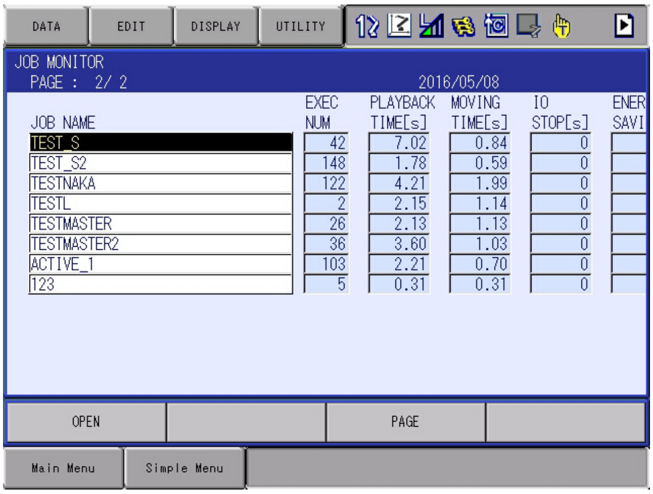
In this case, the job monitor data of TEST2 is not updated.

■ **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.

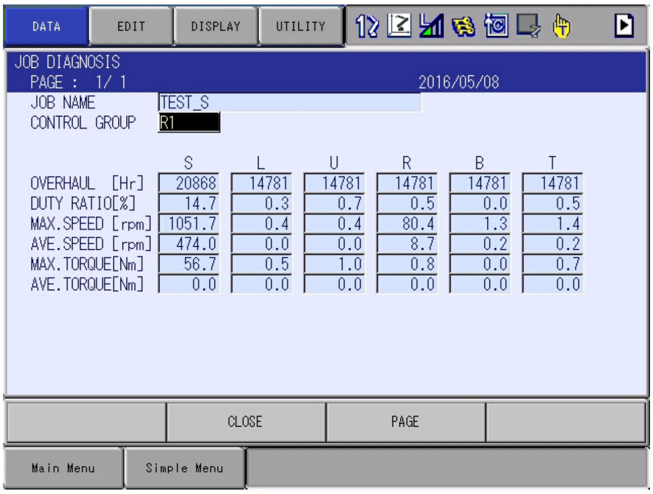
The data can be checked by following steps.

1. Select {=PM} in the main menu.
2. Select {JOB MONITOR}.
   – The JOB MONITOR window is shown

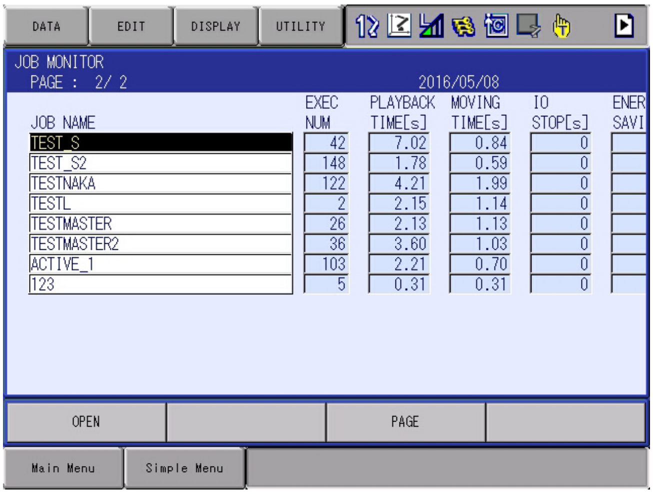


3. Press {PAGE}.
   – It is possible to check the data of the date whose number corresponds to the number of pressing {PAGE}. Modify if necessary. The data of the current day is updated with the latest data every time a job is executed. For the previous data, the average values of the day are shown. 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 "YRC1000micro OPERATOR'S MANUAL (RE-CSO-A058) 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.

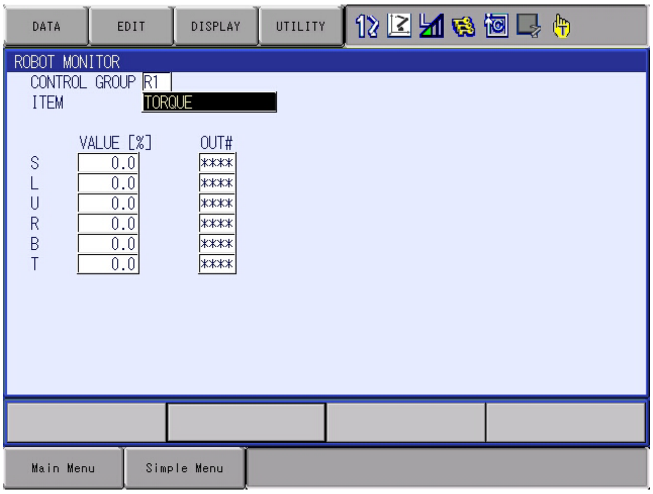
8.24 Robot Monitor Function

With this function, the threshold values are set for the following items.
TORQUE, DISTURB, SPEED FEEDBACK, and ERROR PULSE.
When the values is 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 GROUP”.
   – Select the control group in the pull down menu.
4. Set the “ITEM”.
   – Select the item (TORQUE, DISTURB, SPEED FEEDBACK, ERROR PULSE) in the pull down menu.

SUPPLE-MENT

TORQUE [%]:
Torque command for each axis. The rated torque of the motor is 100%.

DISTURB:
This is the external force applied to each axis during play-back or axis operation. If this value exceeds the level setting on the EACH AXIS LEVEL (CURRENT) Window, "Alarm 4315: COLLISION DETECT" will occur. For details, refer to *chapter 8.7 “Shock Detection Function”* .

SPEED FEEDBACK [rpm]:
Motor speed for each axis.

ERROR PULSE [pulse]:
Error between the motor command and the motor position for each axis.

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.

■ Setting example

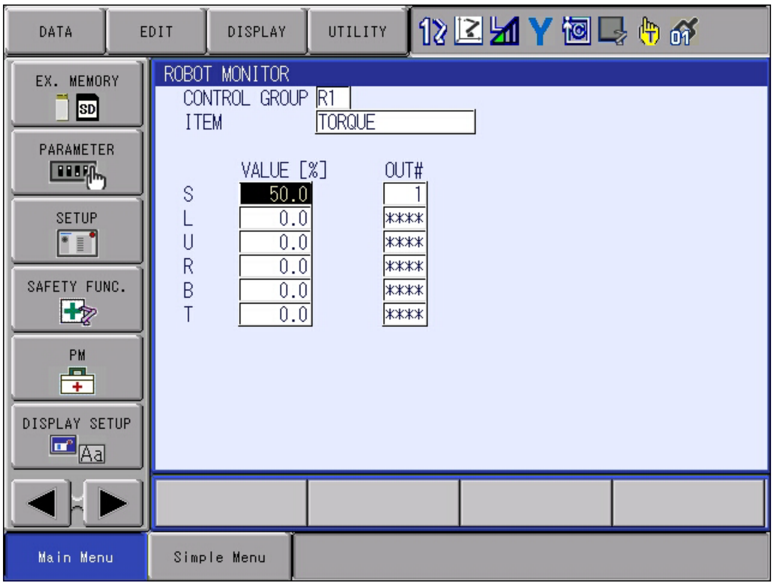
To turn ON GP output signal OUT#1 when the motor torque of the S-axis exceeds 50%, configure the following settings.

CONTROL GROUP: R1

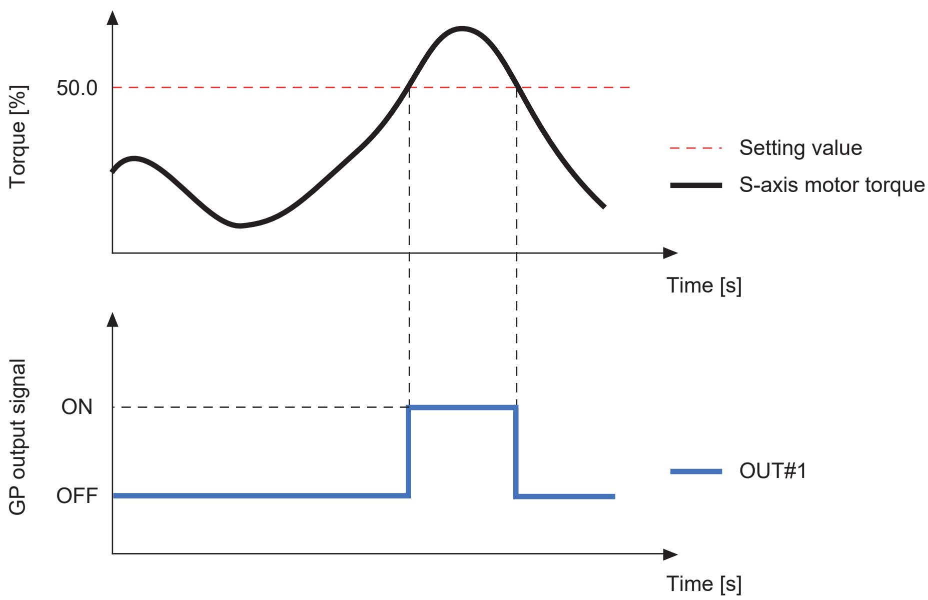
ITEM: Torque

S-Axis Setting Value: 50.0

OUT#: 1



As shown in the diagram below, when the S-axis motor torque reaches or exceeds the setting value, GP output signal OUT#1 will turn ON.



- **Management of Data**

The robot monitor data can be saved by the external memory menu. For details of the external memory menu, refer to “YRC1000micro OPERATOR'S MANUAL (RE-CSO-A058) 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

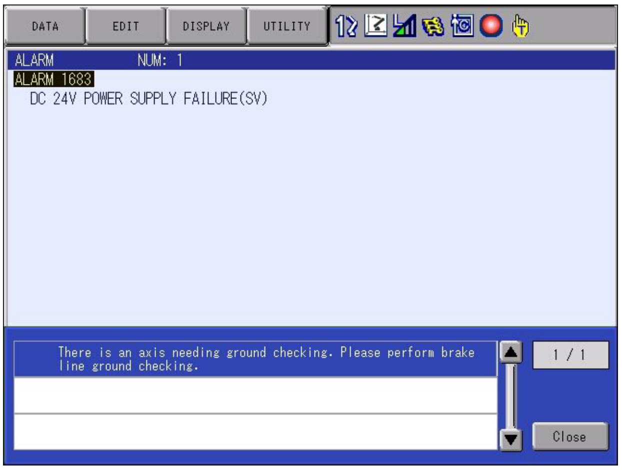
1. Condition of the controller
   The controller has restarted normally by restarting the controller after arising the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)”.
2. Mode
   Only teach mode
3. Security
   Management/Safety, Authority equal to or higher than the management mode is required.
4. Others
   - Must be SERVO OFF
   - The emergency signal is not input (Pendant, controller, external signal

8.25.3 Operation

8.25.3.1 Occurrence of a DC 24V Power Supply Failure (SERVO)

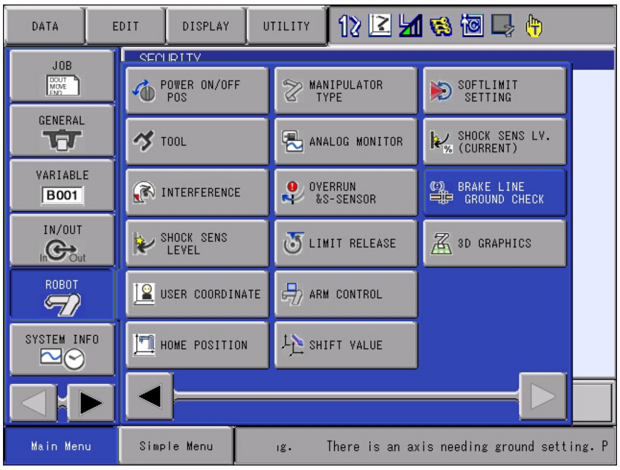
– When detecting either the ground fault or the short circuit of the brake line, the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)” occurs.

– Restart the control power, and perform the brake line ground check.

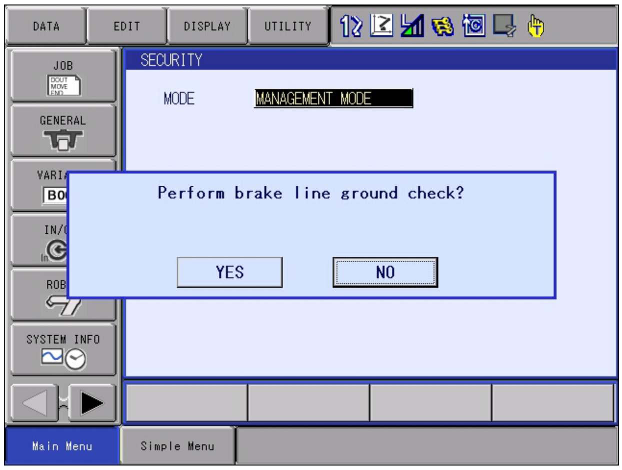


8.25.3.2 Brake Line Ground Check

1. Select {BRAKE LINE GROUND CHECK} in the sub-menu from {ROBOT} in the main menu.



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.

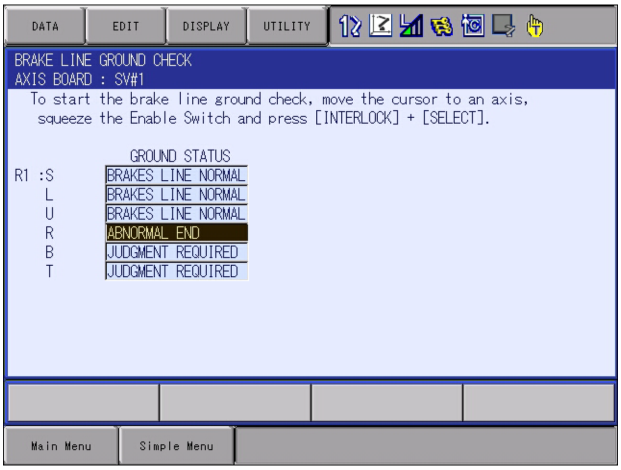
> NOTE
> On the brake line ground check window, the servo power cannot be turned ON with the standard operating procedure. If [SERVO ON READY] is pressed and the enable switch is turned ON, the message "Cannot carry out servo ON in Brake line ground check screen." will appear. This message does not affect the brake line ground check operation. Press [SELECT] while pressing down the [INTER LOCK] to perform the brake line ground check.

– 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] operation is released.
- The emergency button of the programming pendant or external signal is pressed.
- Enable switch is released or gripped further.
- 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

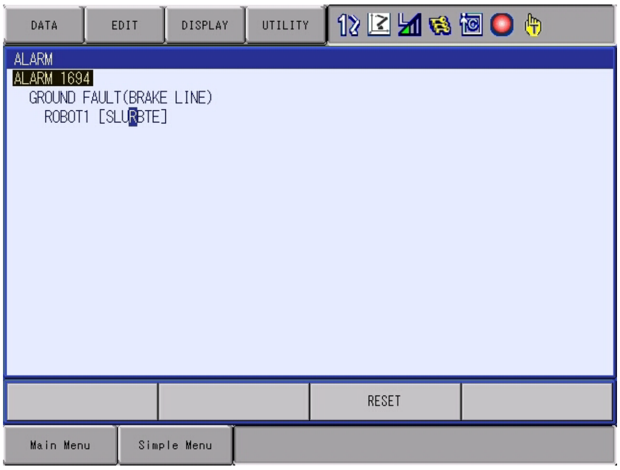
ABNORMAL END: The ground check is canceled.
(i.e. the dislocation of the axis is detected, and so on)

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.

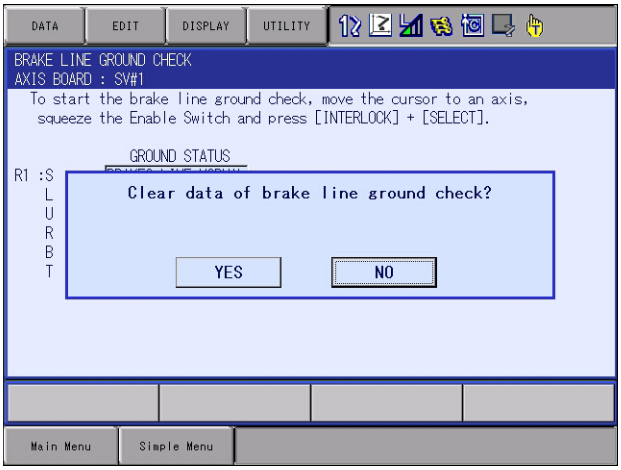


8.25.3.3 Initializing the Related Information

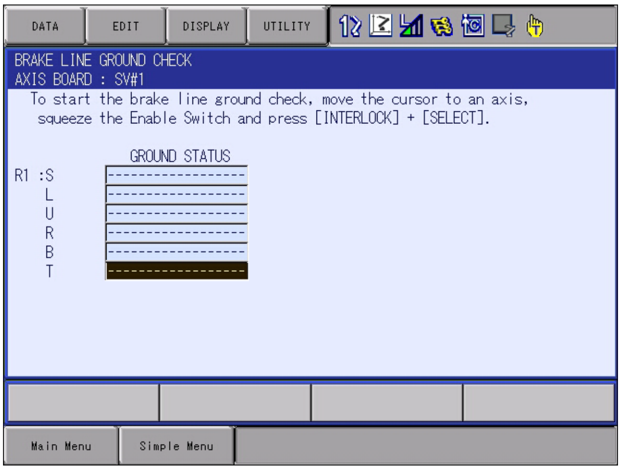
1. The sub menu {BRAKE LINE GROUND CHECK} appears after selecting the {ROBOT} in the main menu.
2. Select {DATA} in the menu.

   – 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 a safety logic circuit by the programming pendant.

It enables to set up the logical operations, such as stopping the manipulator and outputting the servo ON signal.

The contents of this function are described below, however, the GP safety I/O board which is the optional board is required to prevent losing the safety function.

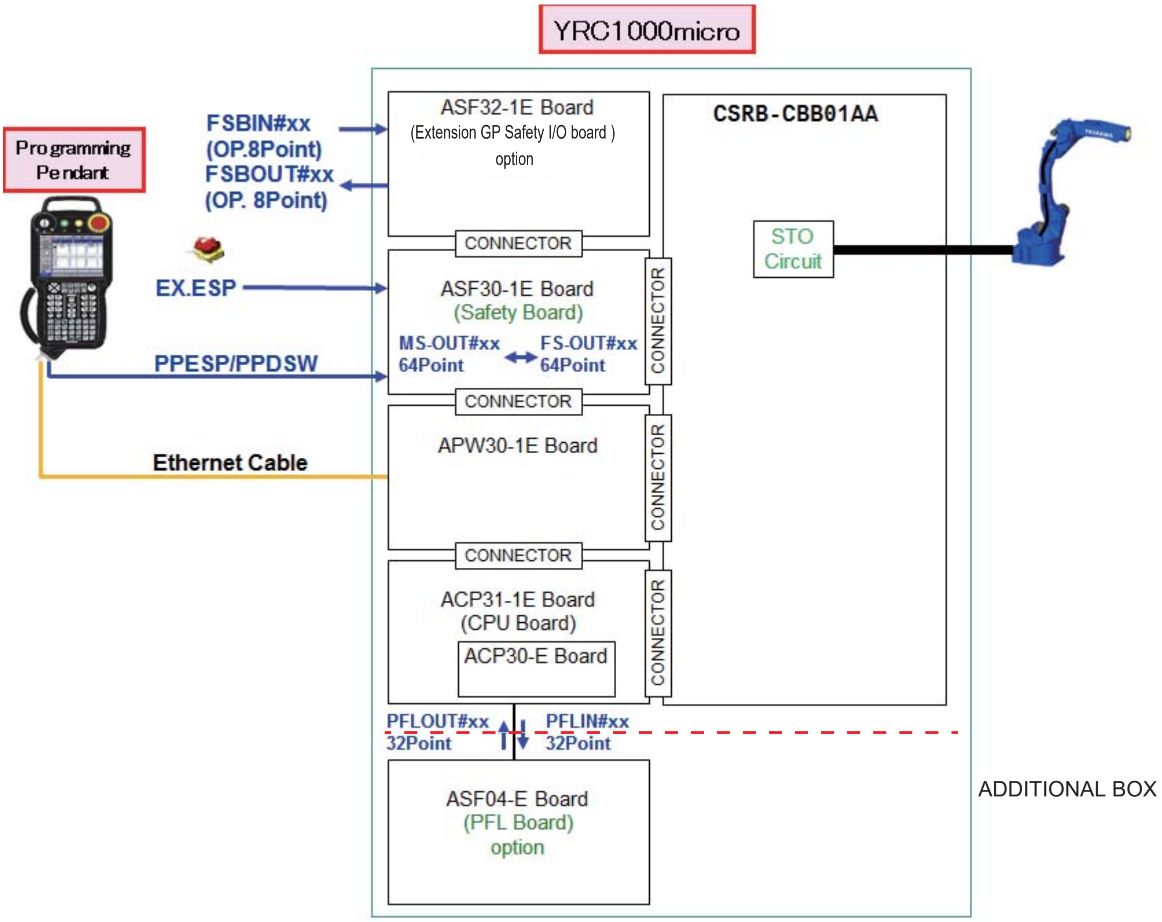
If a logic (AND, OR, etc.) is performed by using non-safety data and another safety signal without using the GP safety I/O board which is the optional board, the output result will be non-safety data.

If non-safety data 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 non-safety data.

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 2 ms 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.

Following is the example of configuration with the safety PLC.



NOTE

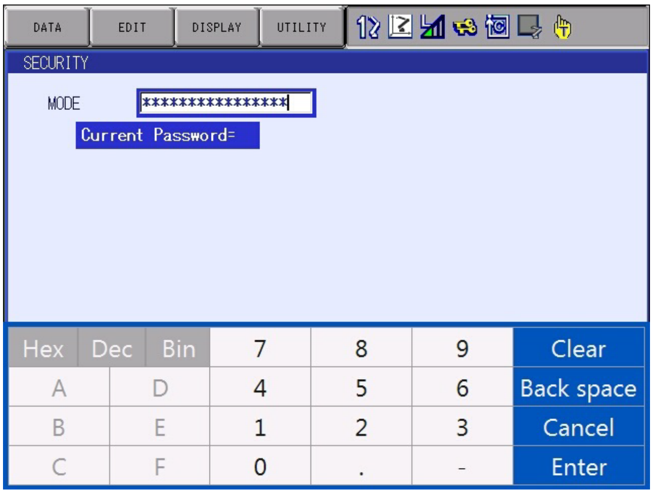
For the connection of the Extension GP Safety I/O board (optional), the board of JANCD-ASF32-1E(8 points available) can be connected to each safety circuit board (JANCD-ASF30-1E).

8.26.2 Changing the Security Mode

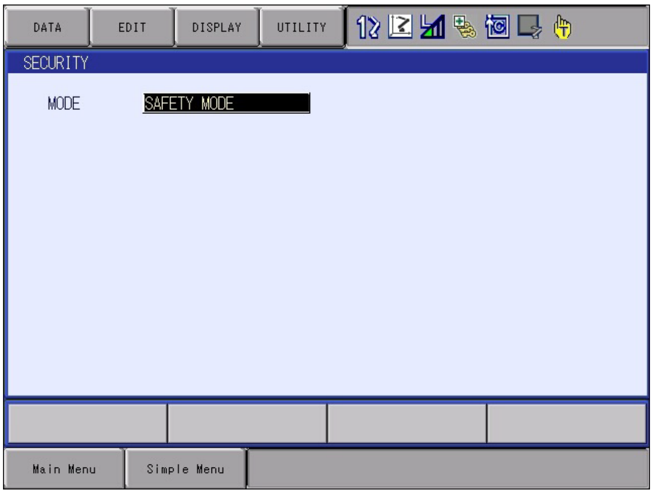
To create/edit the safety logic circuit, change the security mode to the safety mode.

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].



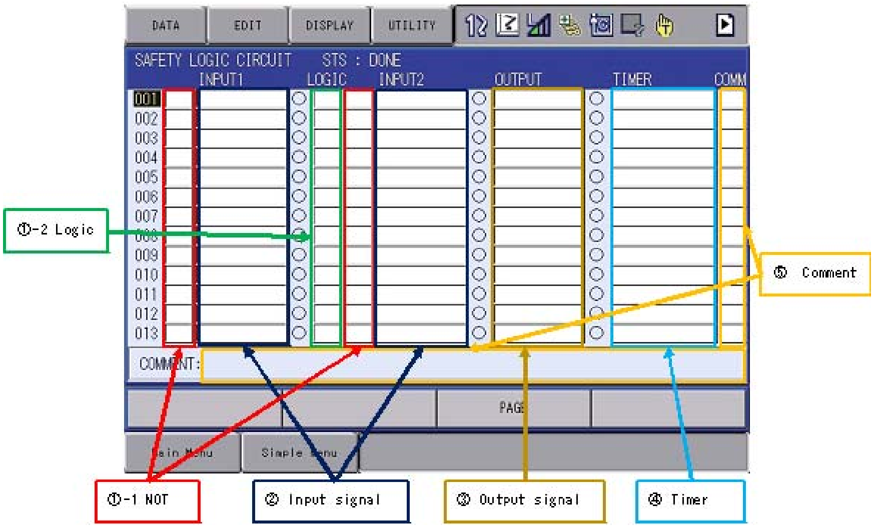
– When the entered password is correct, the mode is changed to {SAFETY MODE}. After changing to the safety mode, the icon on the status area is changed to .



> **NOTE**
> For the key pad of the numerical input, display (available) and hide (non-available) can be switched by selecting the “DISPLAY SETTING” in the main menu shown on the programming pendant.
> At factory setting, the key pad is set as display (available).

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.



①. Logic

No.	Display	Contents	Note
1	NOT	Negative (reverse of signal)	
2	DSU	Detection of signal rising edge	
3	DSD	Detection of signal falling edge	
4	AND	Logic AND	
5	OR	Logic OR	

②. Input signal 1/ Input signal 2 (Signal1/Signal2)

No.	Display	Contents	Note
1	EXESP	External emergency stop input signal (●: Under emergency stop [release]/○: Not under emergency stop [short circuit])	
2	#n FSBIN[x]	GP safety input signal (8 points) (●: OFF [release]/ ○ : ON [short circuit])	This signal is shown when the optional GP safety I/O board is connected.
3	#n FSBOUT[x]	GP safety output signal (8 points)) (●: ON status/ ○ : OFF status)	This signal is shown when the GP safety I/O board (option) is connected.

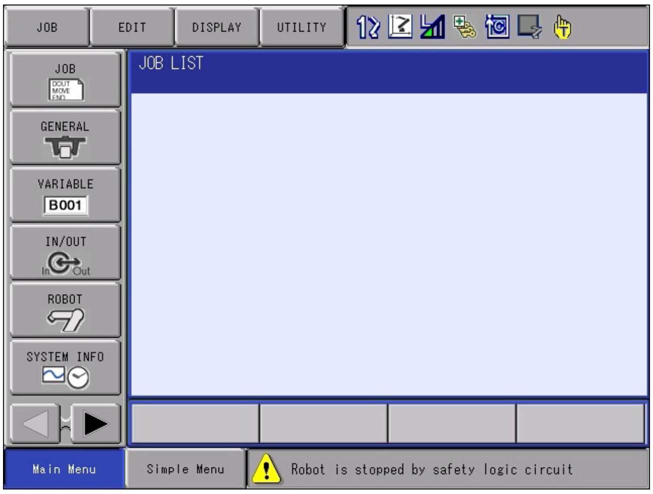
No.	Display	Contents	Note
4	FS-OUT[x]	Functional safety output in the safety logic circuit 64 points (●: ON status/ ○ : OFF status)	This signal is shown when the functional safety function (option) is enabled.
5	HOLD	Hold (●: OFF (Hold signal is not input.)/○: ON (Hold signal is being input.))	
6	MS-OUT[x]	Machine safety output used in the safety logic circuit (64 points) (●: ON status/ ○ : OFF status)	
7	PBESP	Controller emergency stop signal (●: Under emergency stop [release]/○: Not under emergency stop [short circuit])	
8	#n PFLIN[x]	Output signal to PFL board (ASF04-E) 32 points (●: ON status/ ○ : OFF status)	This signal is shown when the optional PFL board(ASF04-E) is connected.
9	#n PFLOUT[x]	Input signal from PFL board (ASF04-E) 32 points (●: ON status/ ○ : OFF status)	This signal is shown when the optional PFL board(ASF04-E) is connected.
10	PLAY	Play mode (●: Play mode/ ○ : Not play mode)	
11	PPDSW	PP enable switch signal (●: Released [release]/ ○ : Grip [short circuit])	
12	PPESP	PP emergency stop signal (●: Under emergency stop [release]/○: Not under emergency stop [short circuit])	
13	R[x]	Work area 128 points (auxiliary relay) (●: ON status/ ○ : OFF status)	
14	REMOTE	Remote mode (●: Remote mode/ ○ : Not remote mode)	
15	S-EXDSW	External enable switch signal in the safety logic circuit (●: ON (servo ON enabled)/ ○ : OFF (servo OFF status)	
16	S-EXESP	External emergency stop signal in the safety logic circuit (●: Release/ ○ : Press (emergency stop status)	
17	S-FST	Full speed mode in the safety logic circuit (●: Full speed mode/ ○ : Safety speed)	Refer to *chapter 8.26.3.1 "Full Speed Mode"* .
18	S-SAFF	Safety fence signal in the safety logic circuit (●: Close/ ○ : Open (servo OFF status))	
19	SAFF	Safety fence signal (●: Open/ ○ : Close)	
20	#n SFRON[x]	Servo ON/OFF signal 4 points (●: Servo ON/ ○ : Servo OFF)	
21	SPIN[x]	Specific input signal 32 points (●: ON status/ ○ : OFF status)	
22	SVON	Servo ON/OFF status (●: Servo ON/ ○ : Servo OFF)	
23	SVONRDY0	Servo ON ready (●: Servo ON available status/ ○ : Servo OFF)	
24	TEACH	Teach mode (●: Teach mode/ ○ : Not teach mode)	

n: The number of the safety circuit board (Maximum 2)

③. Output signal

No.	Display	Contents	Note
1	#n FSBOUT[x]	GP safety output signal (8 points) (●: ON status/ ○ : OFF status)	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"*.
2	MS-OUT[x]	Machine safety signal output signal in the safety logic circuit 64 points (●: ON output/ ○ : OFF output)	
3	#n PFLIN[x]	Output signal to PFL board (ASF04-E) 32 points (●: ON status/ ○ : OFF status)	This signal is shown when the optional PFL board(ASF04-E) is connected.
4	R[x]	Work area 128 point (auxiliary relay) (●: ON output/ ○ : OFF output)	
5	S-EXDSW	External enable switch signal in the safety logic circuit (●: ON (servo ON enabled)/ ○ : OFF (servo OFF status)	
6	S-EXESP	External emergency stop signal in the safety logic circuit (●: Release/ ○ : Press (emergency stop status)	
7	S-FST	Full speed test signal in the safety logic circuit (●: Full speed test/ ○ : Safety speed)	Refer to *chapter 8.26.3.1 "Full Speed Mode"*.
8	S-SAFF	Safety fence signal in the safety logic circuit (●: Close/ ○ : Open (servo OFF status))	
9	SVOFF CAT0	Turns OFF the servo power supply to the robot. (Category0 stopped) (●: Robot stop request/ ○ : Not robot stop request)	
10	SVOFF CAT1	Turns OFF the servo power supply to the robot. (Category1 stopped) (●: Robot stop request/ ○ : Not robot stop request)	

n: The number of the safety circuit board (Maximum 2)



NOTE

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

4. Timer

No.	Display	Contents	Note
1	TMR[8]	One shot pulse width timer 8 timer	
2	TM[4] OFF DELAY	OFF Delay timer 4 timer	
3	TM[4] ON DELAY	ON Delay timer 4 timer	

5.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.

Manual speed operation speed limit (initial value)		**Parameter (unit: 0.01%)**	
Inching	20%	S1CxG60 (initial value: 2000)	Limited to 250 mm/s
Low	50%	S1CxG61 (initial value: 5000)	
Mid	75%	S1CxG62 (initial value: 7500)	
High	100% (fixed value)	-	

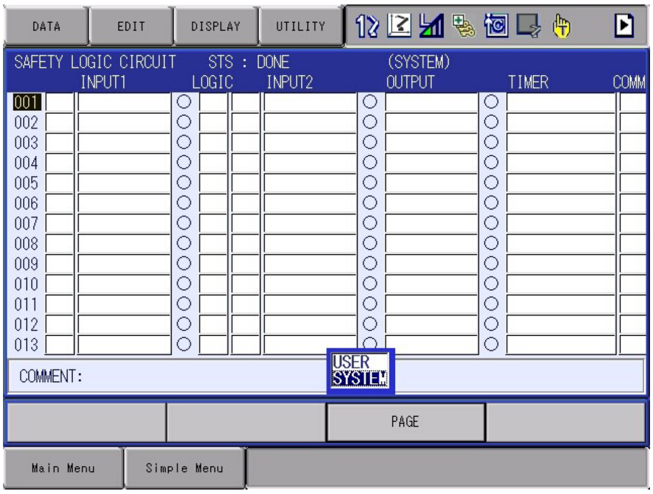
Note that the operation speed limit values in the above table are the percentages with respect to the manipulator’s maximum speed, not with respect to the taught speed. These are specified in order to control the operation speed so that it does not exceed the manipulator’s maximum speed during a test 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.

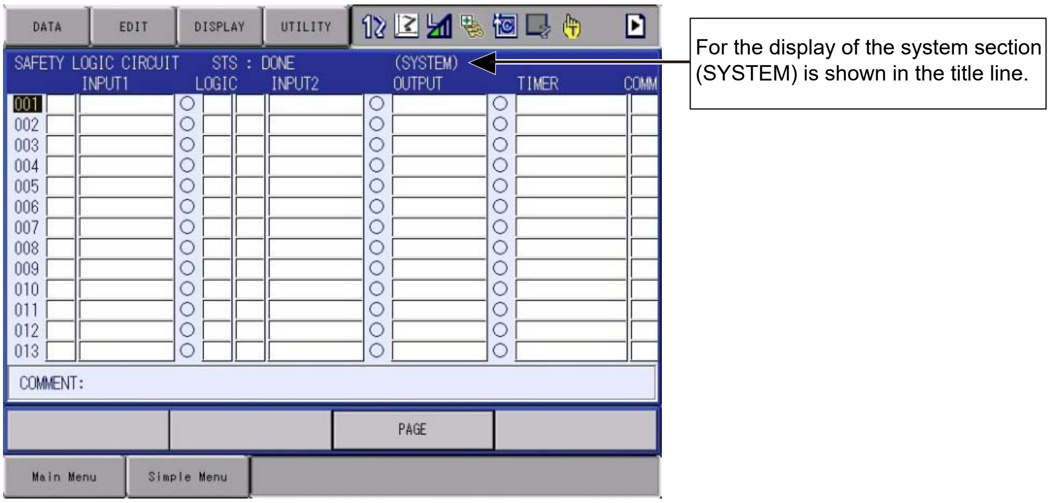
8.26.3.2 Switching Display of System and User Section

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.

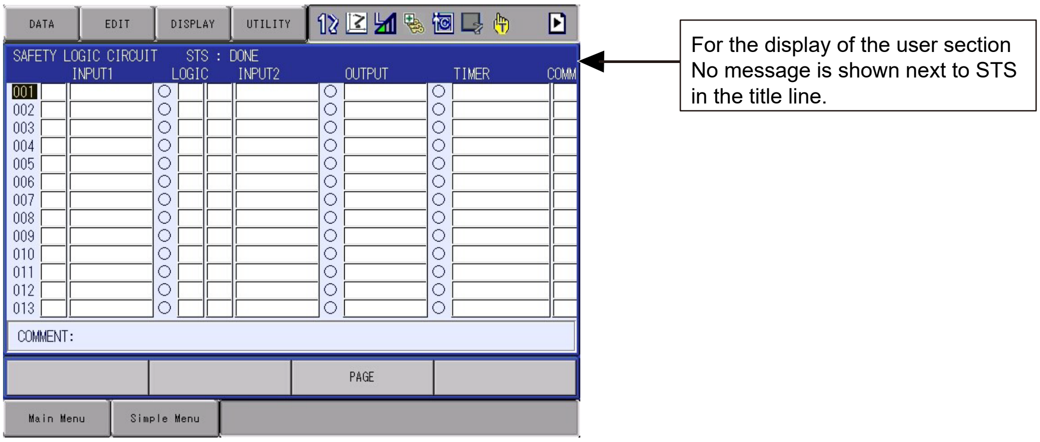


   SYSTEM: The system section of the safety logic circuit is shown.
   USER: The user section of the safety logic circuit is shown.

2. Display of the system section.
   (SYSTEM) is shown in the title line while the system section is shown.



3. Display of the user section.
   There is no message next to STS in the title line while the user section is shown.

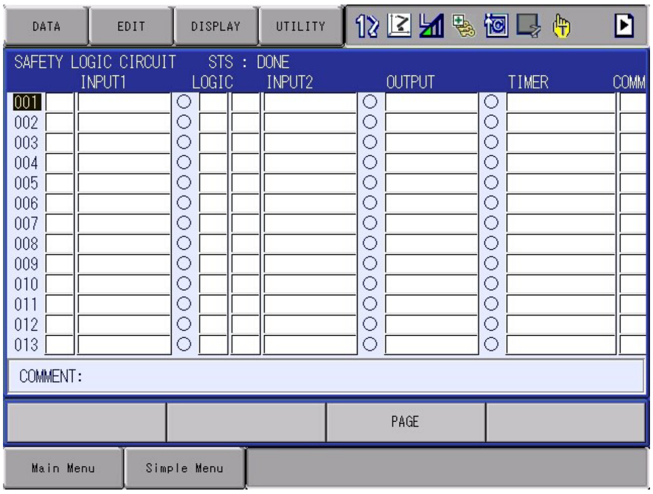


SUPPLE-MENT

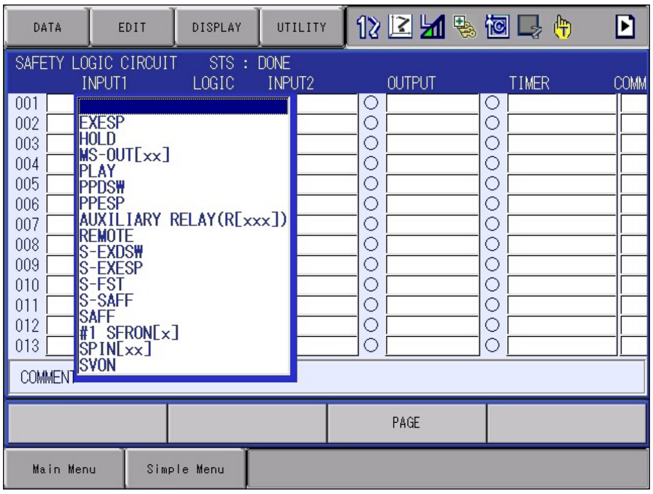
There is a case that the system section of the safety logic circuit is not defined at factory setting.

8.26.4 Safety Logic Circuit

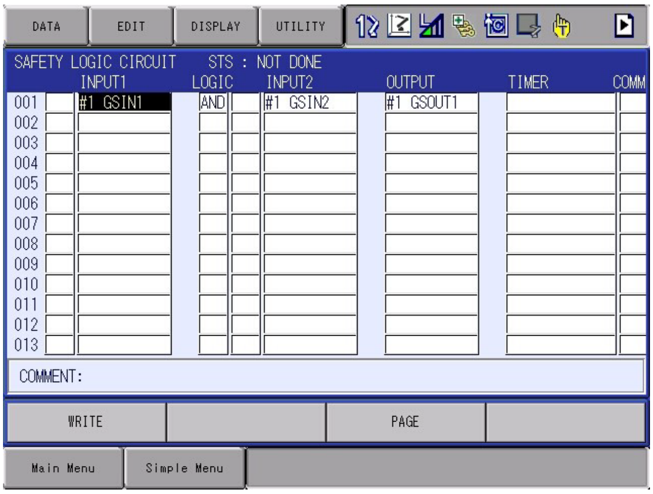
1. Display of the window.
   – Select {SAFETY LOGIC CIRCUIT} from {SAFETY FUNC.} in the main menu.



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.

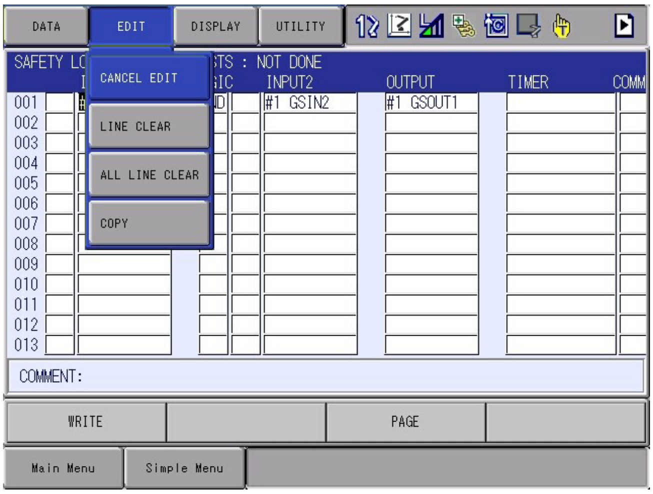


After creating the safety logic circuit, the status changes from “DONE” to “NOT DONE”. The “WRITE” button is shown on the left down corner of the screen.



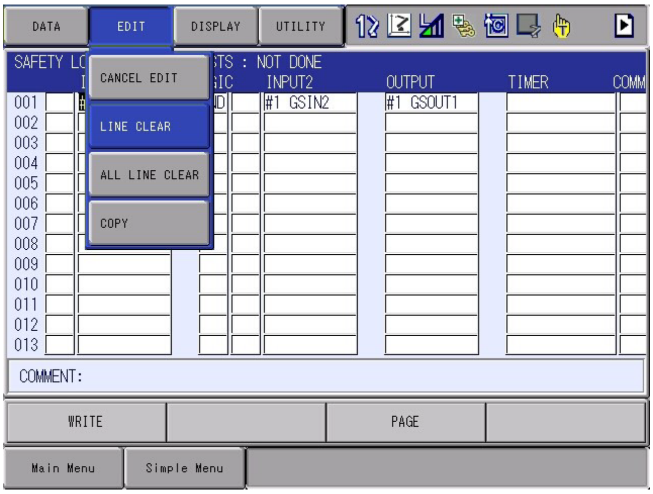
3. Canceling the edit

– To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.



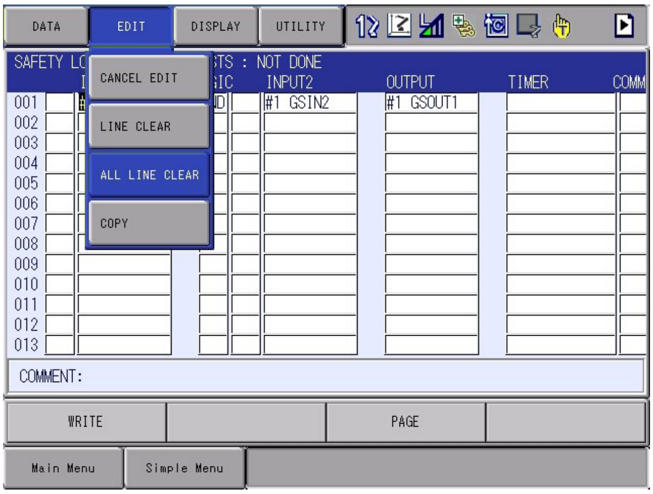
4. Line clear

– To clear the one line, select {LINE CLEAR} from {EDIT} in the pull-down menu.



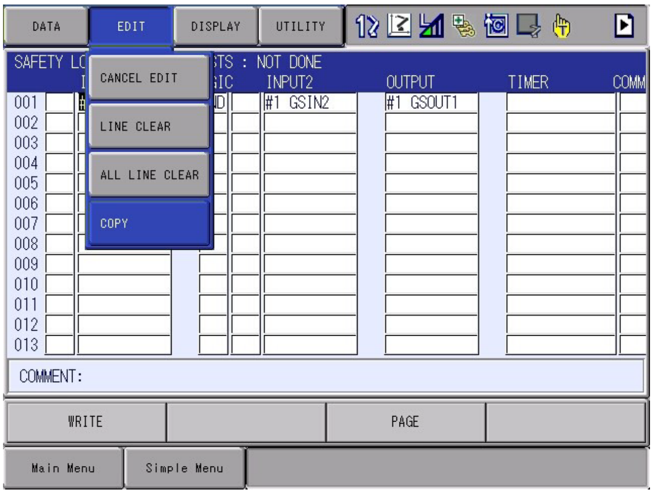
5. All line clear

– To clear the all line, select {ALL LINE CLEAR} from {EDIT} in the pull-down menu.

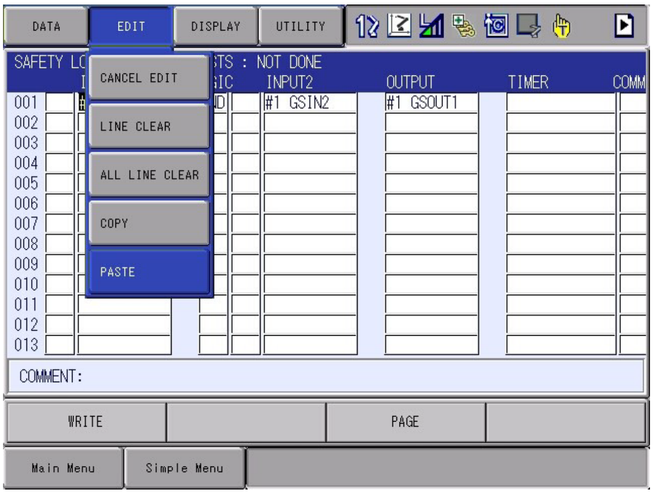


6. Copy

– 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.

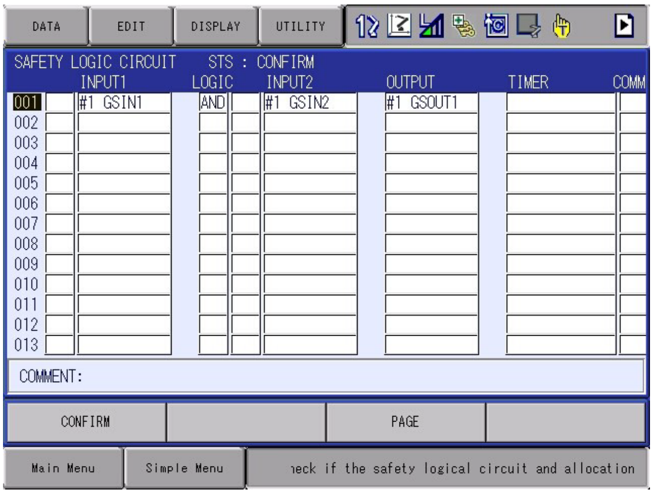


7. Transferring and updating the safety logic circuit file

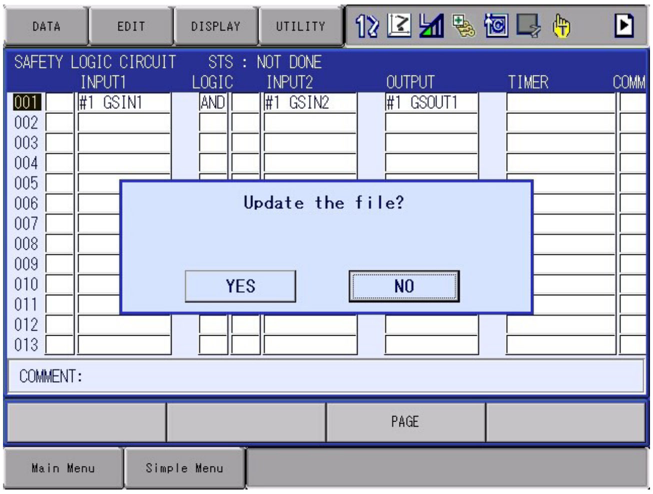
(1) After creating the safety logic circuit, select {WRITE}.

– 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.

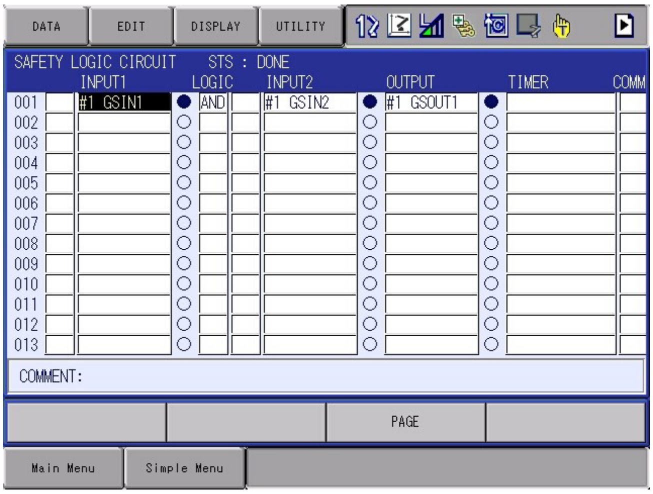
– When the transfer of the safety logic circuit file is successfully performed, the following window is shown.



(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”.



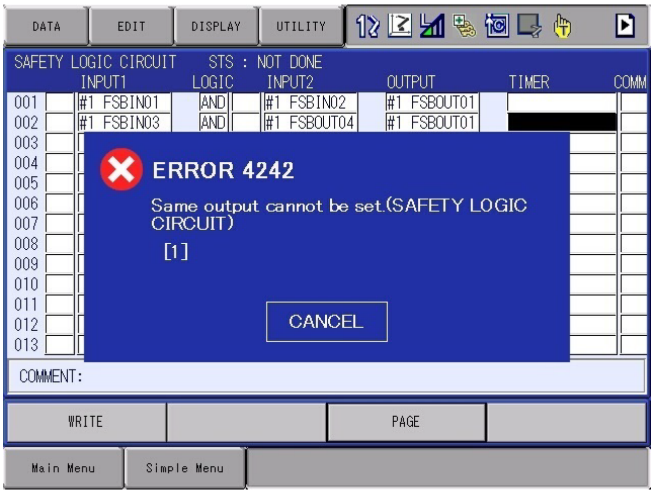
If press {NO}, the file will not be updated. The status remains “NOT DONE”.

NOTE

- 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.

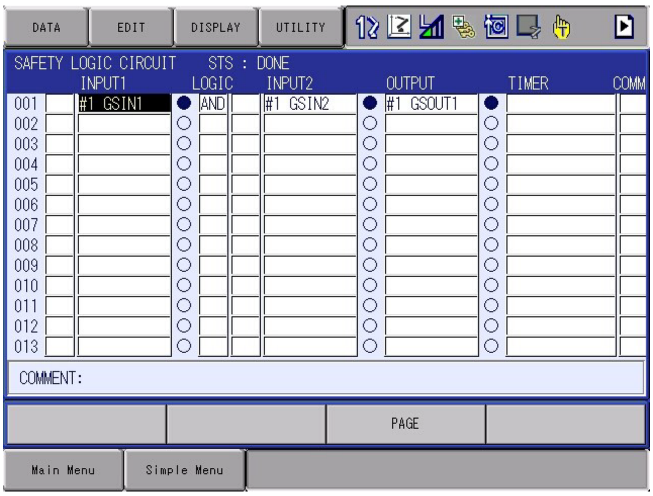
NOTE

When {WRITE} is selected, if the same output signals are set for two or more sections, the following error message shows up. So that, correct the safety logic circuit.



8. Execution of the safety logic circuit

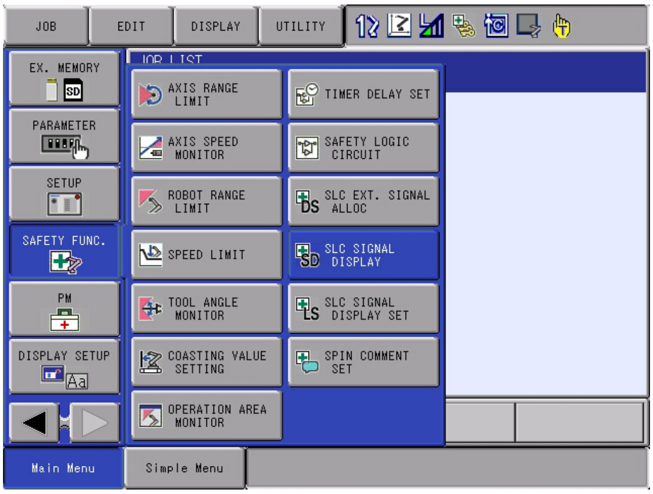
– When the write operation is completed, the safety logic circuit is executed. If the set signal is ON, " ● " is shown. If the set signal is OFF, "◯"is shown. The safety logic circuit is always executed except the write operation.



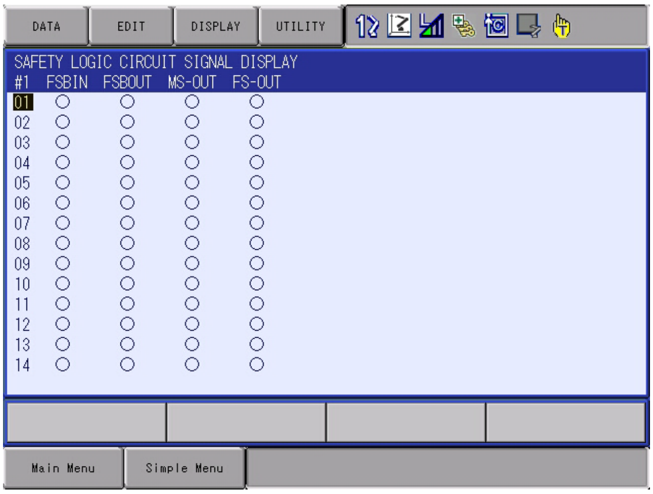
8.26.5 Signal List Window

The ON/OFF status list of the signals used in the safety logic circuit is shown.

1. Select {SAFETY FUNC.}-{SLC SIGNAL DISPLAY}



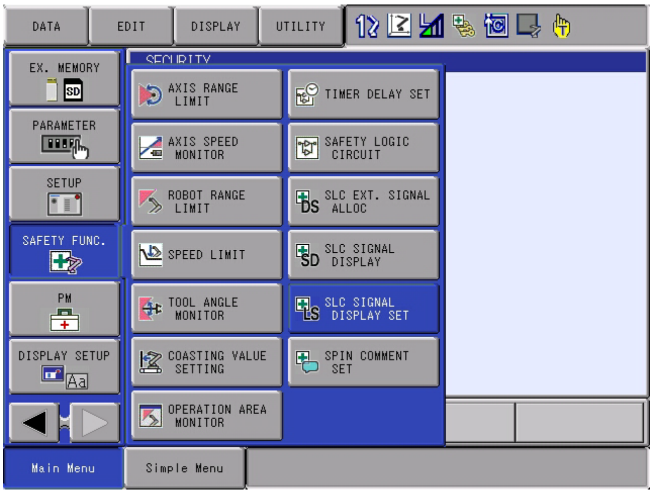
2. The signals used in the safety logic circuit is shown.



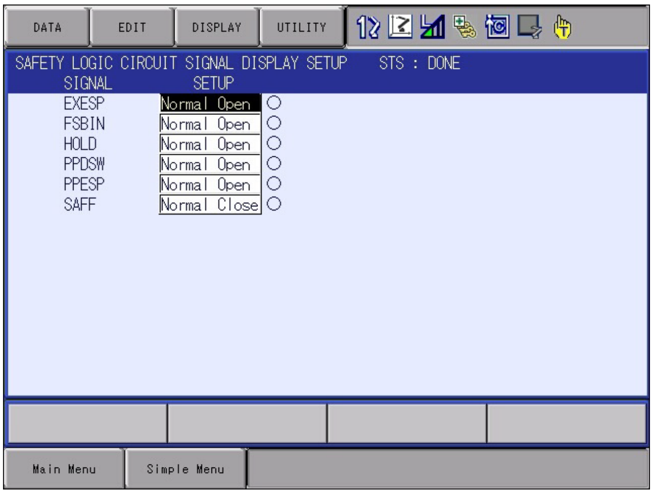
8.26.6 <Setting ON/OFF to the Input Signals

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}.

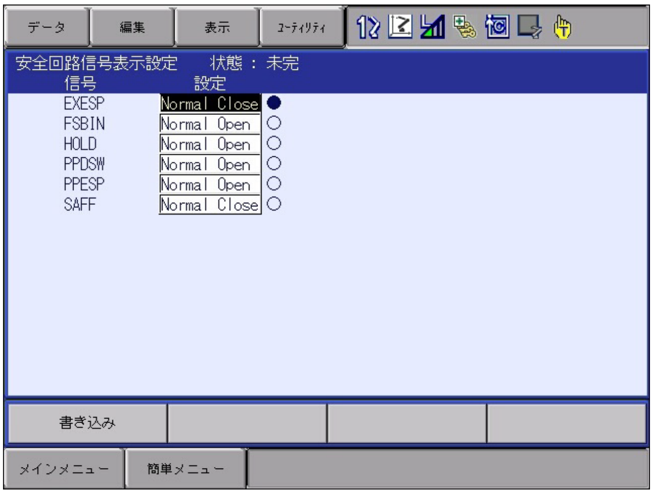


2. The ON/OFF status of input signals used in the safety logic circuit can be switched by pressing [SELECT] on the programming pendant

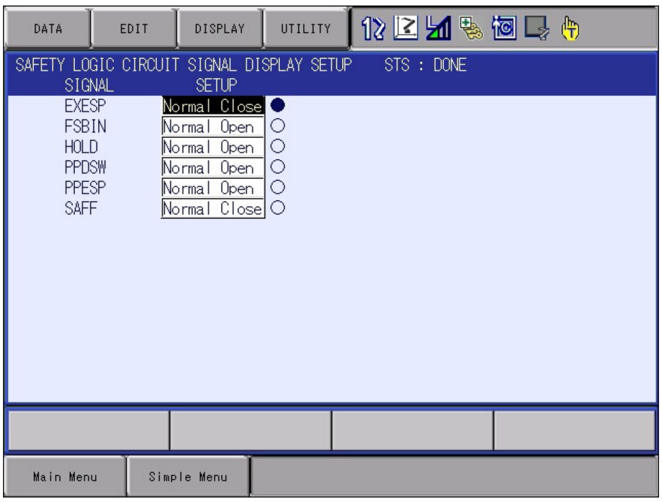


No.	Signal Name	Normal Open	Normal Close
1	EXESP	External emergency stop input signal (●: Under emergency stop/ ○ : Normal)	External emergency stop input signal (●: Normal/ ○ : Under emergency stop)
2	FSBIN	GP safety input signal (ASF32) (●: OFF [release]/ ○ : ON [short circuit])	GP safety input signal (ASF32) (●: ON [short circuit]/ ○ : OFF [release])
3	HOLD	Hold (●: ON (Hold signal is being input.)/ ○ : ON (Hold signal is not input.))	Hold (●: OFF (Hold signal is not input.)/ ○ : ON (Hold signal is being input.))
4	PPDSW	Programming pendant enable switch signal (●: Grip/ ○ : Not grip (servo OFF))	Programming pendant enable switch signal (●: Not grip (servo OFF)/ ○ : Grip)
5	PPESP	Programming pendant emergency stop signal (●: Under emergency stop/ ○ : Normal)	Programming pendant emergency stop signal (●: Normal/ ○ : Under emergency stop)
6	SAFF	Safety fence signal (●: Open (safety fence opened)/ ○ : Close)	Safety fence signal (●: Close/ ○ : Open (safety fence opened))

3. For example, when the EXESP signal is changed from “Normal Open” to “Normal Close”, the mark “●” indicates the external emergency stop signal is in the normal state (Normal Close) and the mark “○” indicates the external emergency stop signal is being input (Normal Open).



4. Select {WRITE} and then {CONFIRM} to enable the changed settings. When the data is updated correctly, the status on the title line is changed from “NOT DONE” to “DONE”.



NOTE

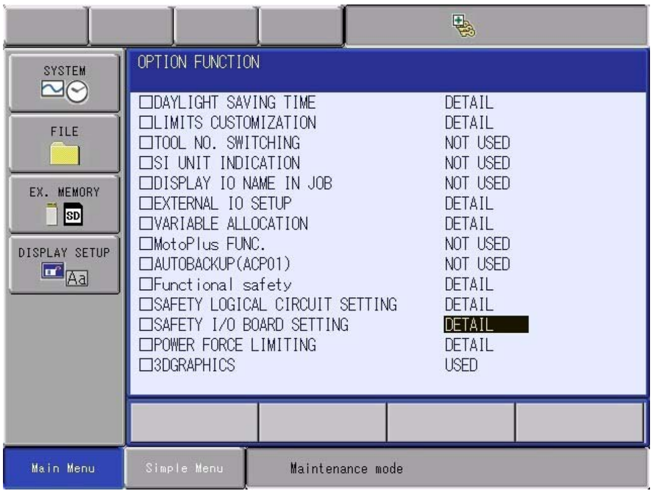
When the ON/OFF settings of the input signals are changed, outputting the signals that have been output normally may fail. This may lead to a serious accident. After changing the ON/OFF settings of the input signals, be sure to confirm the safety logic circuit operates normally.

8.26.7 Setting for the GP Safety I/O Signals

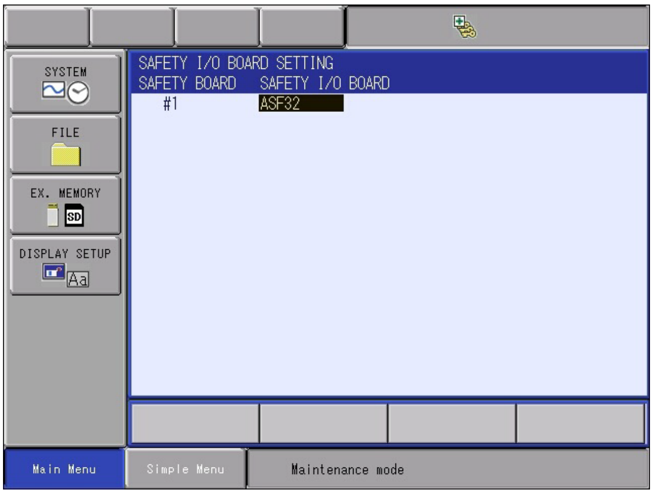
8.26.7.1 Preliminary setting for the GP Safety I/O Signal

When using the GP safety I/O signal (type: ASF32 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 ASF32.



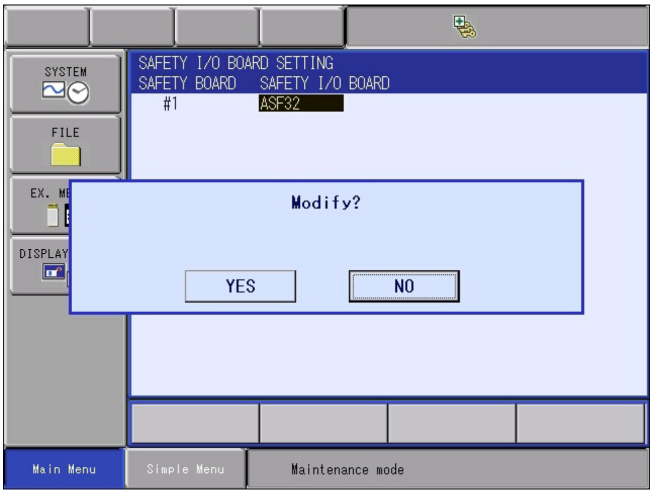
NOT USED: GP safety I/O board is not used.

JANCD-ASF32-1E: The I/O 8 points of GP safety I/O signal are available.

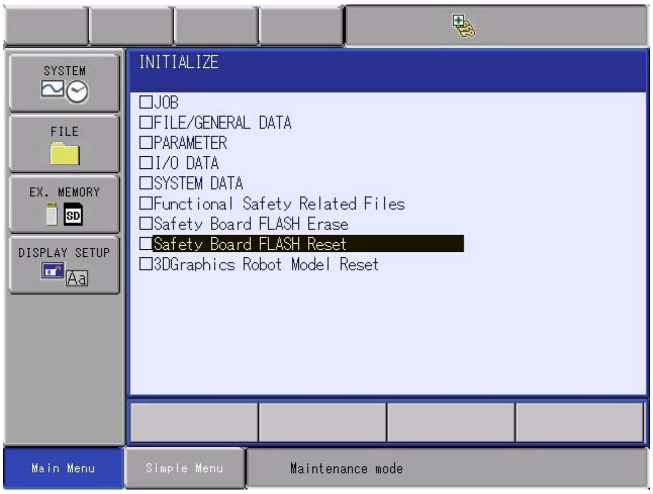
NOTICE

- 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”.

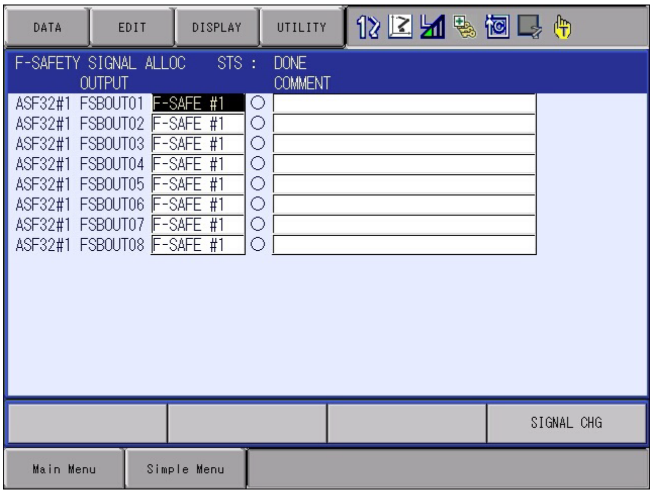


9. Turn OFF/ON the YRC1000micro.

8.26.7.2 Setting for the GP Safety Output Signals

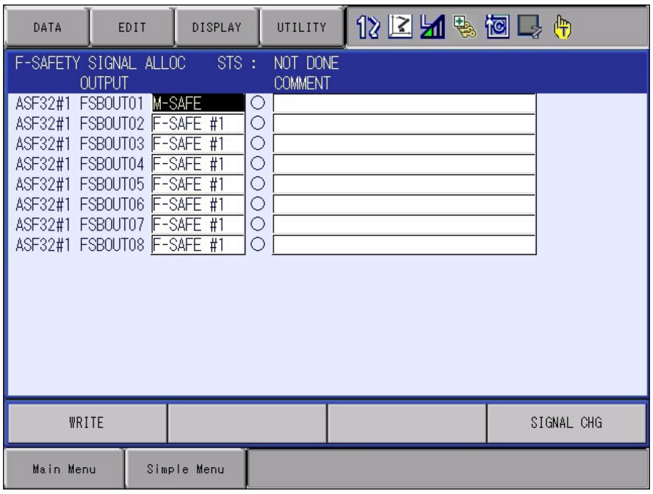
1. Select {SAFETY FUNC.}-{F-SAFETY SIGNAL ALLOC}.

   – The following window is shown. The mark at the center of the window indicates ON/OFF status. "◯" means OFF and "●" means ON.

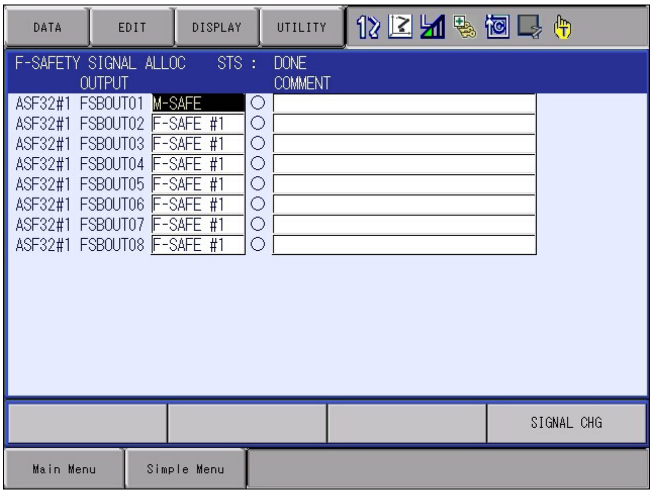


2. To use the GP safety output signals in the safety logic circuit, press [SELECT] on the programming pendant and set "M-SAFE".

   – The GP safety output signals allocated to "M-SAFE" 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”.

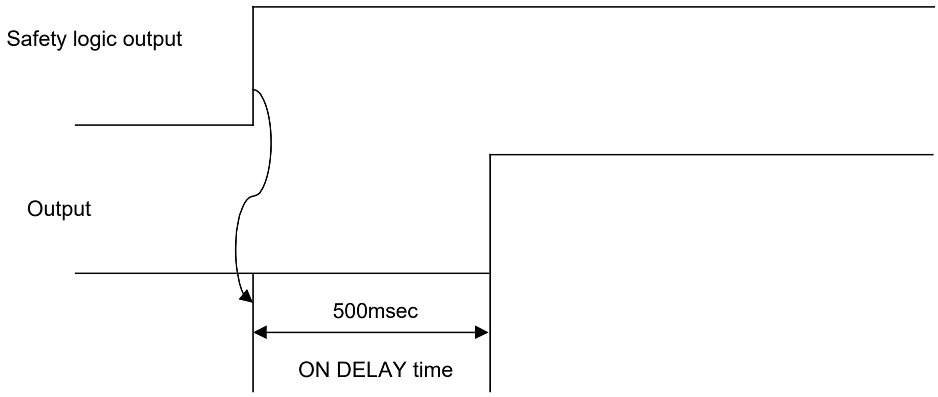


8.26.8 Timer Delay

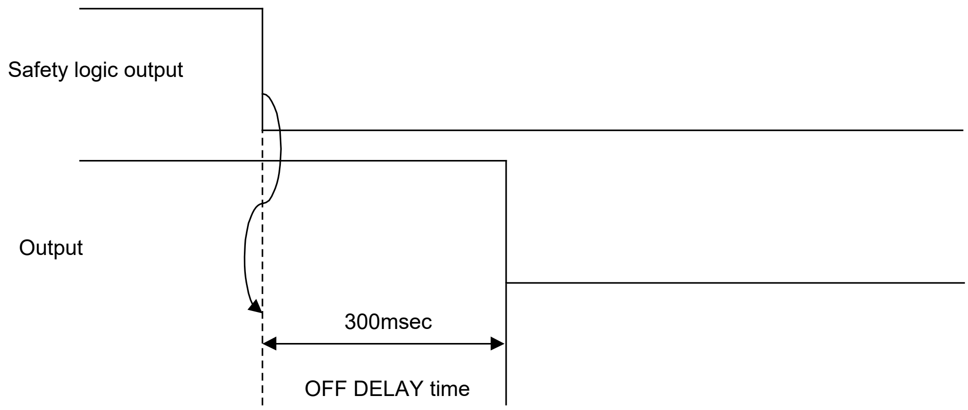
Set up the delay time of the output signal to use by the safety logic circuit.

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 500 msec to ON DELAY TIME,



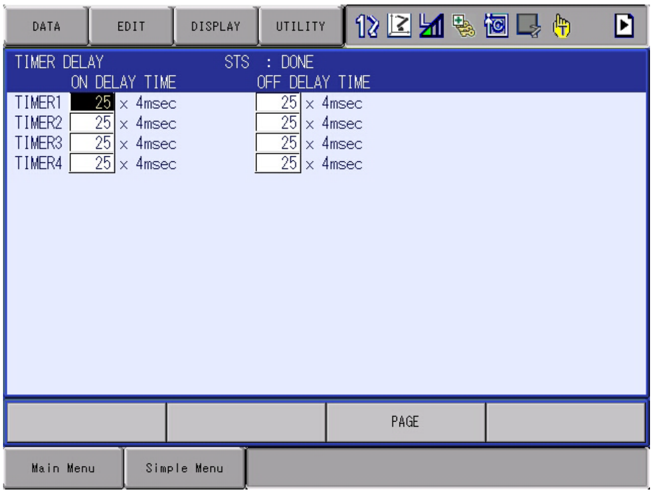
When setting the 300 msec to OFF DELAY TIME,



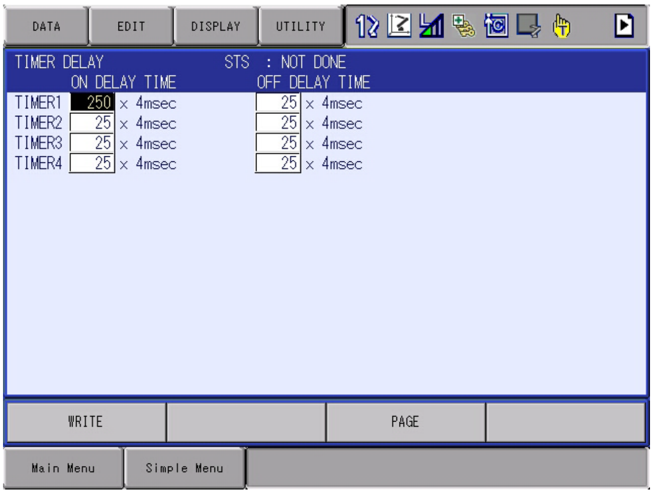
The initial value is 100(25 × 4)[msec].

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.

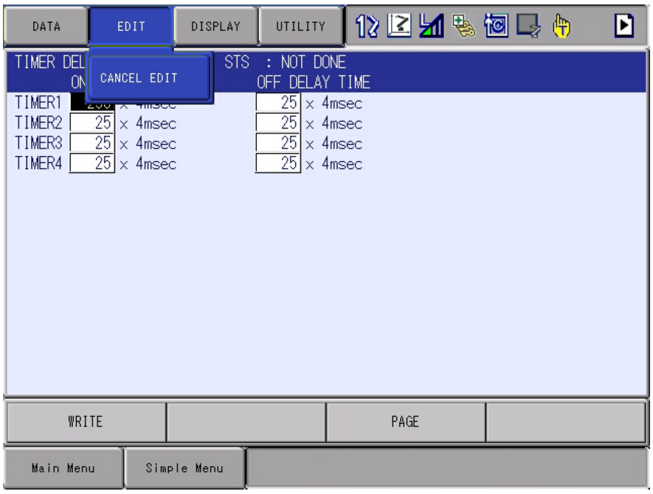


2. Set up the delay time.
   – Set the value of the delay timer to use.
   After the setting, the status changes from “DONE” to “NOT DONE”.
   {WRITE} is shown on the left down corner of the screen.



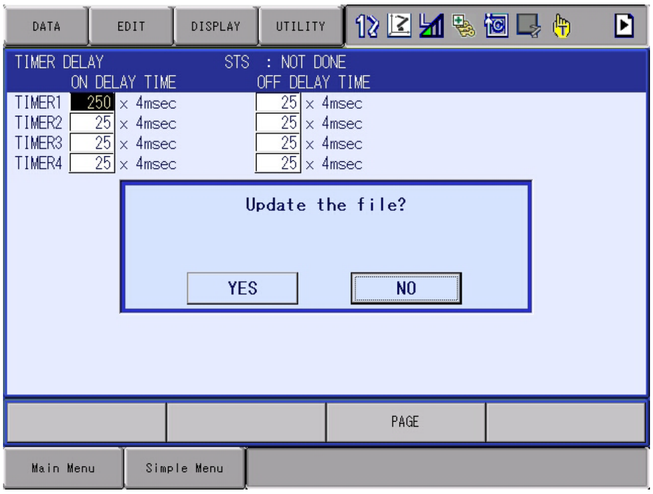
3. Canceling the edit

– To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.

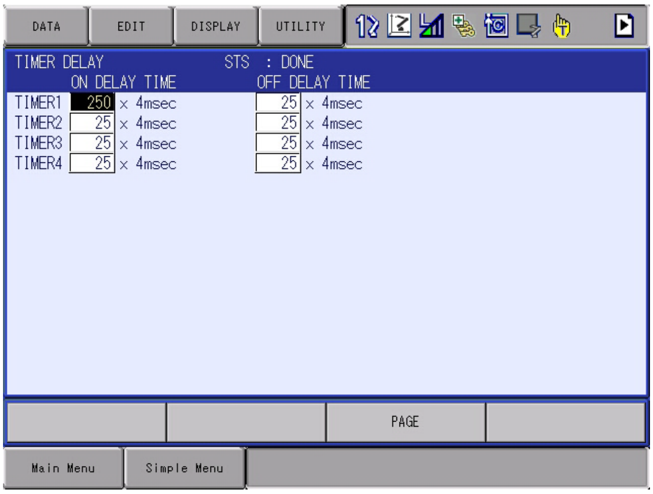


4. Transferring or updating the file

– 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.



– 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”.

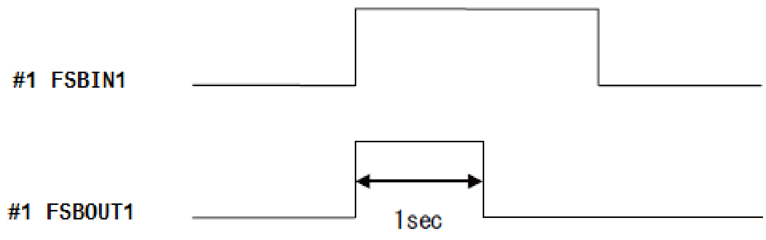


NOTE

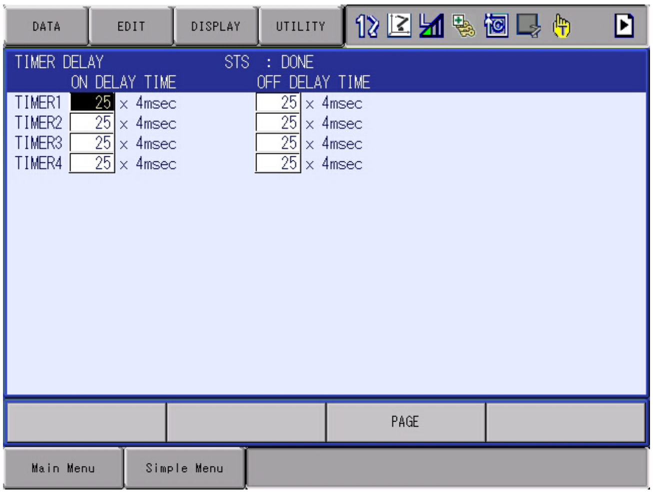
- If press {YES}. on the confirmation dialog, the all information related to the safety logic circuit is transferred as the safety logic circuit file to the safety circuit board and written in the FLASH ROM of the safety circuit board.
- If select {WRITE}, the all output signals output from the safety circuit board are turned OFF until the writing process is completed.

8.26.9 Timer

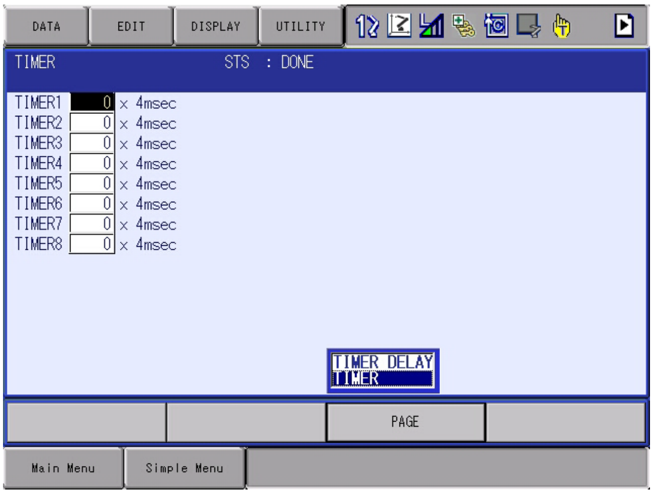
Set the width of the pulse output from the safety logic circuit by TIMER. When the GP safety input signal is ON, one-second one-shot signal is output from the GP safety output signal.



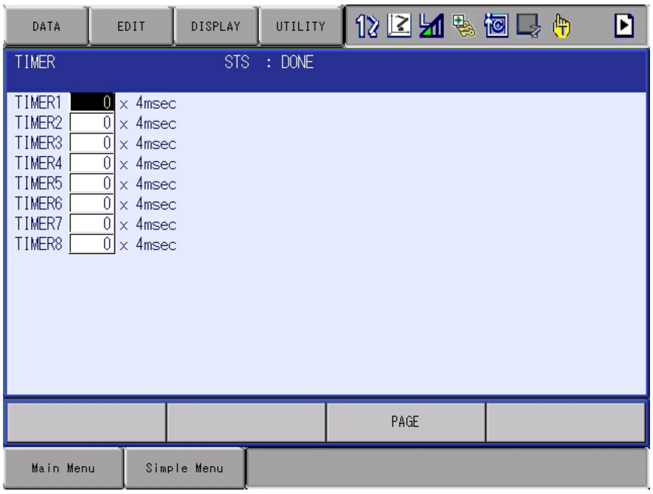
1. Select {SAFETY FUNC.}-{TIMER DELAY}.



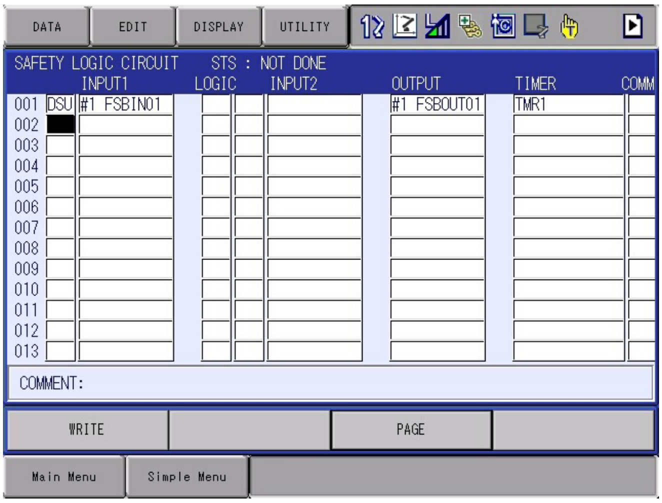
2. Select {PAGE}-{TIMER}.



3. Input “250” at TIMER1.



4. Create the following safety logic circuit.
   001 DSU #1FSBIN1 #1 FSBOUT1 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.

8.26.10 Output Signal

The following signals can either be hard-wired or be controlled by the safety logic circuit.

Expanded signal name	Hard-wired signal name	Explanation
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 signal. • When this signal is turned ON in the teach mode, the manipulator's operation speed can be increased to 100%.
S-SAFF	SAFF	• This is the safety fence 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.
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 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.

8.26.11 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.

Signal name	Message on the programming pendant
None	-
S-FST	Full-speed test mode. (Safety Logical Circuit)
EXESP	Robot is stopped by external emergency stop.
S-EXESP	Robot is stopped by external emergency stop. (Safety Logical Circuit)
None	-
S-EXDSW	EXDSW signal is OFF.(Safety Logical Circuit)
SAFF	Safety fence is open.
S-SAFF	Safety fence is open. (Safety Logical Circuit)

(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.

8.26.12 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.

40787	**40786**	**40785**	**40784**	**40783**	**40782**	**40781**	**40780**
Safety logic circuit Specific input 8 SPIN08	Safety logic circuit Specific input 7 SPIN07	Safety logic circuit Specific input 6 SPIN06	Safety logic circuit Specific input 5 SPIN05	Safety logic circuit Specific input 4 SPIN04	Safety logic circuit Specific input 3 SPIN03	Safety logic circuit Specific input 2 SPIN02	Safety logic circuit Specific input 1 SPIN01

40797	**40796**	**40795**	**40794**	**40793**	**40792**	**40791**	**40790**
Safety logic circuit Specific input 16 SPIN16	Safety logic circuit Specific input 15 SPIN15	Safety logic circuit Specific input 14 SPIN14	Safety logic circuit Specific input 13 SPIN13	Safety logic circuit Specific input 12 SPIN12	Safety logic circuit Specific input 11 SPIN11	Safety logic circuit Specific input 10 SPIN10	Safety logic circuit Specific input 9 SPIN09

40807	**40806**	**40805**	**40804**	**40803**	**40802**	**40801**	**40800**
Safety logic circuit Specific input 24 SPIN24	Safety logic circuit Specific input 23 SPIN23	Safety logic circuit Specific input 22 SPIN22	Safety logic circuit Specific input 21 SPIN21	Safety logic circuit Specific input 20 SPIN20	Safety logic circuit Specific input 19 SPIN19	Safety logic circuit Specific input 18 SPIN18	Safety logic circuit Specific input 17 SPIN17

40817	**40816**	**40815**	**40814**	**40813**	**40812**	**40811**	**40810**
Safety logic circuit Specific input 32 SPIN32	Safety logic circuit Specific input 31 SPIN31	Safety logic circuit Specific input 30 SPIN30	Safety logic circuit Specific input 29 SPIN29	Safety logic circuit Specific input 28 SPIN28	Safety logic circuit Specific input 27 SPIN27	Safety logic circuit Specific input 26 SPIN26	Safety logic circuit Specific input 25 SPIN25

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.

8.26.13 Output to the Control Status Signal

The following signals used in the safety logic circuit can be confirmed in the control status signals.

(1) MS-OUT[64]

(2) FS-OUT[64]

(3) #n FSBIN[8]

(4) #n FSBOUT[8]

(5) #n PFLIN[32]

(6) #n PFLOUT[32]

80687	80686	80685	80684	80683	80682	80681	80680
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF32#1	ASF32#1	ASF32#1	ASF32#1	ASF32#1	ASF32#1	ASF32#1	ASF32#1

80697	80696	80695	80694	80693	80692	80691	80690
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF32#1	ASF32#1	ASF32#1	ASF32#1	ASF32#1	ASF32#1	ASF32#1	ASF32#1

81327	81326	81325	81324	81323	81322	81321	81320
Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit
MS-OUT8	MS-OUT7	MS-OUT6	MS-OUT5	MS-OUT4	MS-OUT3	MS-OUT2	MS-OUT1

81337	81336	81335	81334	81333	81332	81331	81330
Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit
MS-OUT16	MS-OUT15	MS-OUT14	MS-OUT13	MS-OUT12	MS-OUT11	MS-OUT10	MS-OUT9

81347	81346	81345	81344	81343	81342	81341	81340
Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit
MS-OUT24	MS-OUT23	MS-OUT22	MS-OUT21	MS-OUT20	MS-OUT19	MS-OUT18	MS-OUT17

81357	81356	81355	81354	81353	81352	81351	81350
Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit	Safety Logic Circuit
MS-OUT32	MS-OUT31	MS-OUT30	MS-OUT29	MS-OUT28	MS-OUT27	MS-OUT26	MS-OUT25

81367	81366	81365	81364	81363	81362	81361	81360
Safety Logic Circuit MS-OUT40	Safety Logic Circuit MS-OUT39	Safety Logic Circuit MS-OUT38	Safety Logic Circuit MS-OUT37	Safety Logic Circuit MS-OUT36	Safety Logic Circuit MS-OUT35	Safety Logic Circuit MS-OUT34	Safety Logic Circuit MS-OUT33

81377	81376	81375	81374	81373	81372	81371	81370
Safety Logic Circuit MS-OUT48	Safety Logic Circuit MS-OUT47	Safety Logic Circuit MS-OUT46	Safety Logic Circuit MS-OUT45	Safety Logic Circuit MS-OUT44	Safety Logic Circuit MS-OUT43	Safety Logic Circuit MS-OUT42	Safety Logic Circuit MS-OUT41

81387	81386	81385	81384	81383	81382	81381	81380
Safety Logic Circuit MS-OUT56	Safety Logic Circuit MS-OUT55	Safety Logic Circuit MS-OUT54	Safety Logic Circuit MS-OUT53	Safety Logic Circuit MS-OUT52	Safety Logic Circuit MS-OUT51	Safety Logic Circuit MS-OUT50	Safety Logic Circuit MS-OUT49

81397	81396	81395	81394	81393	81392	81391	81390
Safety Logic Circuit MS-OUT64	Safety Logic Circuit MS-OUT63	Safety Logic Circuit MS-OUT62	Safety Logic Circuit MS-OUT61	Safety Logic Circuit MS-OUT60	Safety Logic Circuit MS-OUT59	Safety Logic Circuit MS-OUT58	Safety Logic Circuit MS-OUT57

81407	81406	81405	81404	81403	81402	81401	81400
Safety Logic Circuit FS-OUT8	Safety Logic Circuit FS-OUT7	Safety Logic Circuit FS-OUT6	Safety Logic Circuit FS-OUT5	Safety Logic Circuit FS-OUT4	Safety Logic Circuit FS-OUT3	Safety Logic Circuit FS-OUT2	Safety Logic Circuit FS-OUT1

81417	81416	81415	81414	81413	81412	81411	81410
Safety Logic Circuit FS-OUT16	Safety Logic Circuit FS-OUT15	Safety Logic Circuit FS-OUT14	Safety Logic Circuit FS-OUT13	Safety Logic Circuit FS-OUT12	Safety Logic Circuit FS-OUT11	Safety Logic Circuit FS-OUT10	Safety Logic Circuit FS-OUT9

81427	81426	81425	81424	81423	81422	81421	81420
Safety Logic Circuit FS-OUT24	Safety Logic Circuit FS-OUT23	Safety Logic Circuit FS-OUT22	Safety Logic Circuit FS-OUT21	Safety Logic Circuit FS-OUT20	Safety Logic Circuit FS-OUT19	Safety Logic Circuit FS-OUT18	Safety Logic Circuit FS-OUT17

81437	81436	81435	81434	81433	81432	81431	81430
Safety Logic Circuit FS-OUT32	Safety Logic Circuit FS-OUT31	Safety Logic Circuit FS-OUT30	Safety Logic Circuit FS-OUT29	Safety Logic Circuit FS-OUT28	Safety Logic Circuit FS-OUT27	Safety Logic Circuit FS-OUT26	Safety Logic Circuit FS-OUT25

81447	81446	81445	81444	81443	81442	81441	81440
Safety Logic Circuit FS-OUT40	Safety Logic Circuit FS-OUT39	Safety Logic Circuit FS-OUT38	Safety Logic Circuit FS-OUT37	Safety Logic Circuit FS-OUT36	Safety Logic Circuit FS-OUT35	Safety Logic Circuit FS-OUT34	Safety Logic Circuit FS-OUT33

81457	81456	81455	81454	81453	81452	81451	81450
Safety Logic Circuit FS-OUT48	Safety Logic Circuit FS-OUT47	Safety Logic Circuit FS-OUT46	Safety Logic Circuit FS-OUT45	Safety Logic Circuit FS-OUT44	Safety Logic Circuit FS-OUT43	Safety Logic Circuit FS-OUT42	Safety Logic Circuit FS-OUT41

81467	81466	81465	81464	81463	81462	81461	81460
Safety Logic Circuit FS-OUT56	Safety Logic Circuit FS-OUT55	Safety Logic Circuit FS-OUT54	Safety Logic Circuit FS-OUT53	Safety Logic Circuit FS-OUT52	Safety Logic Circuit FS-OUT51	Safety Logic Circuit FS-OUT50	Safety Logic Circuit FS-OUT49

81477	81476	81475	81474	81473	81472	81471	81470
Safety Logic Circuit FS-OUT64	Safety Logic Circuit FS-OUT63	Safety Logic Circuit FS-OUT62	Safety Logic Circuit FS-OUT61	Safety Logic Circuit FS-OUT60	Safety Logic Circuit FS-OUT59	Safety Logic Circuit FS-OUT58	Safety Logic Circuit FS-OUT57

81647	81646	81645	81644	81643	81642	81641	81640
PFL function Input signal PFLIN8 ASF04#1	PFL function Input signal PFLIN7 ASF04#1	PFL function Input signal PFLIN6 ASF04#1	PFL function Input signal PFLIN5 ASF04#1	PFL function Input signal PFLIN4 ASF04#1	PFL function Input signal PFLIN3 ASF04#1	PFL function Input signal PFLIN2 ASF04#1	PFL function Input signal PFLIN1 ASF04#1

81657	81656	81655	81654	81653	81652	81651	81650
PFL function Input signal PFLIN16 ASF04#1	PFL function Input signal PFLIN15 ASF04#1	PFL function Input signal PFLIN14 ASF04#1	PFL function Input signal PFLIN13 ASF04#1	PFL function Input signal PFLIN12 ASF04#1	PFL function Input signal PFLIN11 ASF04#1	PFL function Input signal PFLIN10 ASF04#1	PFL function Input signal PFLIN9 ASF04#1

81667	81666	81665	81664	81663	81662	81661	81660
PFL function Input signal PFLIN24 ASF04#1	PFL function Input signal PFLIN23 ASF04#1	PFL function Input signal PFLIN22 ASF04#1	PFL function Input signal PFLIN21 ASF04#1	PFL function Input signal PFLIN20 ASF04#1	PFL function Input signal PFLIN19 ASF04#1	PFL function Input signal PFLIN18 ASF04#1	PFL function Input signal PFLIN17 ASF04#1

81677	81676	81675	81674	81673	81672	81671	81670
PFL function Input signal PFLIN32 ASF04#1	PFL function Input signal PFLIN31 ASF04#1	PFL function Input signal PFLIN30 ASF04#1	PFL function Input signal PFLIN29 ASF04#1	PFL function Input signal PFLIN28 ASF04#1	PFL function Input signal PFLIN27 ASF04#1	PFL function Input signal PFLIN26 ASF04#1	PFL function Input signal PFLIN25 ASF04#1

81687	81686	81685	81684	81683	81682	81681	81680
PFL function Output signal PFLOUT8 ASF04#1	PFL function Output signal PFLOUT7 ASF04#1	PFL function Output signal PFLOUT6 ASF04#1	PFL function Output signal PFLOUT5 ASF04#1	PFL function Output signal PFLOUT4 ASF04#1	PFL function Output signal PFLOUT3 ASF04#1	PFL function Output signal PFLOUT2 ASF04#1	PFL function Output signal PFLOUT1 ASF04#1

81697	81696	81695	81694	81693	81692	81691	81690
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT16	PFLOUT15	PFLOUT14	PFLOUT13	PFLOUT12	PFLOUT11	PFLOUT10	PFLOUT9
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81707	81706	81705	81704	81703	81702	81701	81700
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT24	PFLOUT23	PFLOUT22	PFLOUT21	PFLOUT20	PFLOUT19	PFLOUT18	PFLOUT17
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81717	81716	81715	81714	81713	81712	81711	81710
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT32	PFLOUT31	PFLOUT30	PFLOUT29	PFLOUT28	PFLOUT27	PFLOUT26	PFLOUT25
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81767	81766	81765	81764	81763	81762	81761	81760
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT8	PFLOUT7	PFLOUT6	PFLOUT5	PFLOUT4	PFLOUT3	PFLOUT2	PFLOUT1
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

81777	81776	81775	81774	81773	81772	81771	81770
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT16	PFLOUT15	PFLOUT14	PFLOUT13	PFLOUT12	PFLOUT11	PFLOUT10	PFLOUT9
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

81787	81786	81785	81784	81783	81782	81781	81780
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT24	PFLOUT23	PFLOUT22	PFLOUT21	PFLOUT20	PFLOUT19	PFLOUT18	PFLOUT17
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

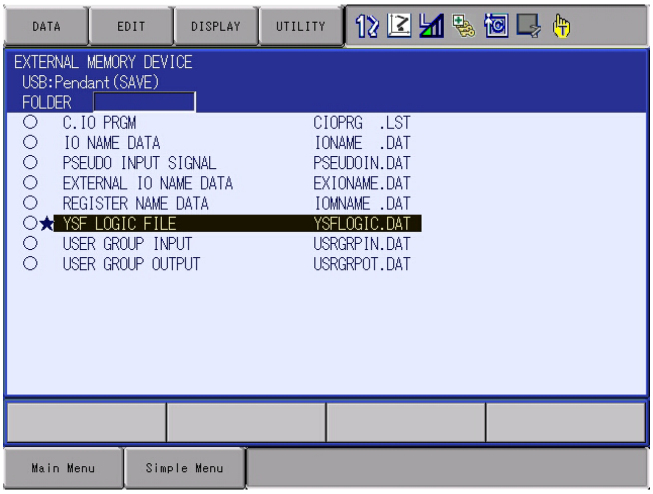
81797	81796	81795	81794	81793	81792	81791	81790
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT32	PFLOUT31	PFLOUT30	PFLOUT29	PFLOUT28	PFLOUT27	PFLOUT26	PFLOUT25
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

8.26.14 Saving or Loading the File

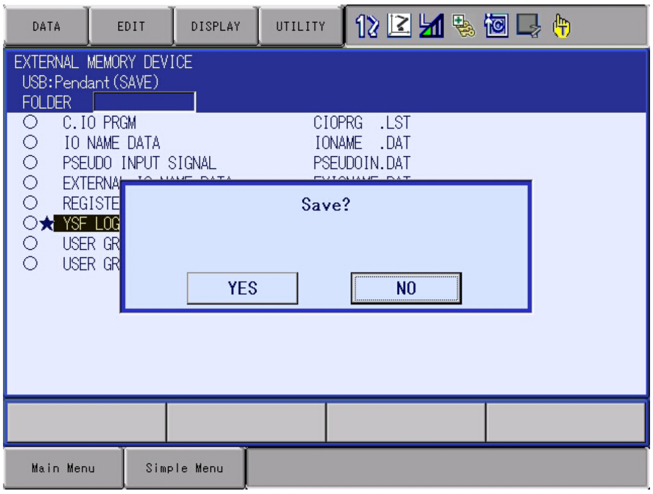
8.26.14.1 Saving the File

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}.

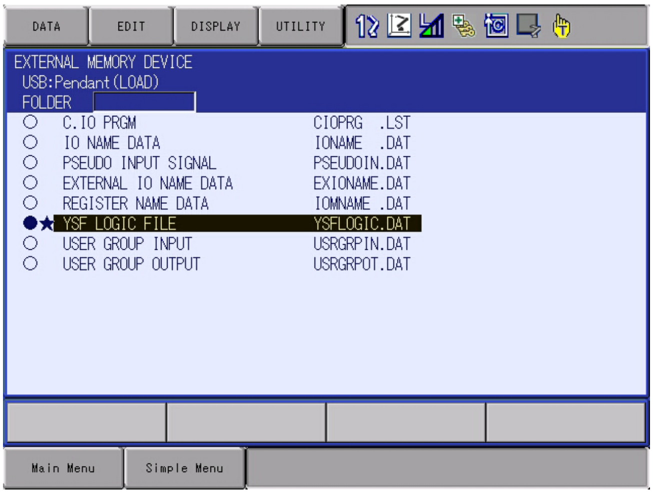


4. The safety logic circuit file (file name:YSFLOGIC.DAT) is saved in the specified device.

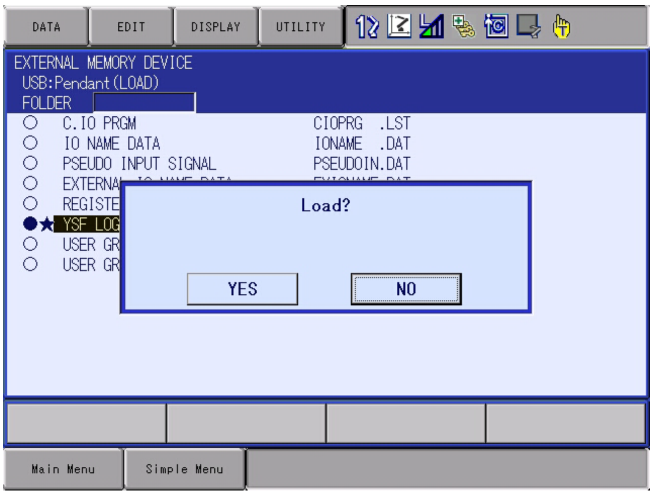
8.26.14.2 Loading the File

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.

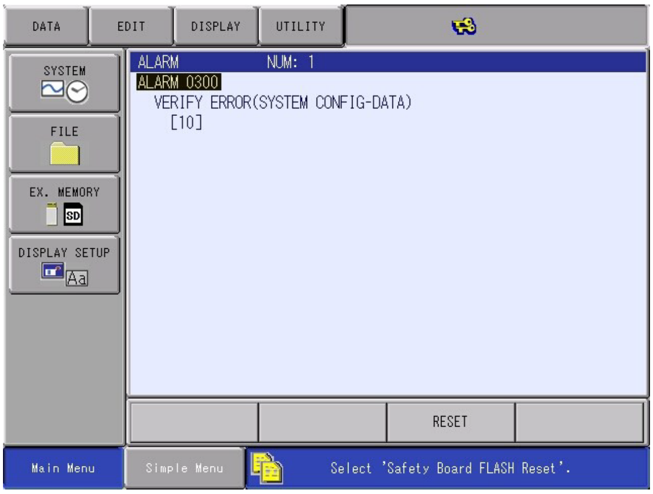
NOTE

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.

8.26.15 Initializing the Safety Logic Circuit File

If the following alarm is shown when starting the YRC1000micro, 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.

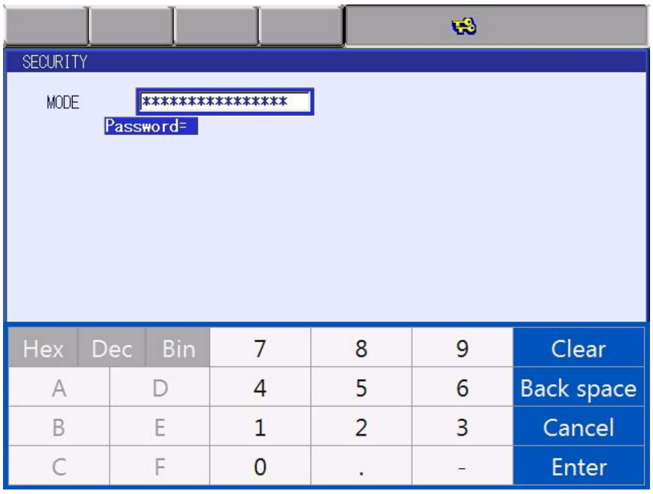
When the alarm occurs, perform the following procedures to restore.



8.26.15.1 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}.

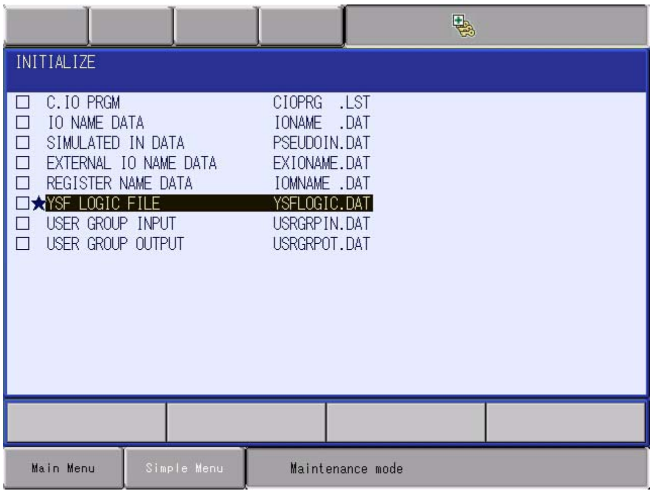


3. When the entered password is correct, the mode is changed to {SAFETY MODE}.
   – After changing to the safety mode, the icon shown on the status area becomes  .

4. Select the file to be initialized.

   (1) Select each menu in the following order.
   {FILE}, {INITIALIZE}, {I/O DATA}.

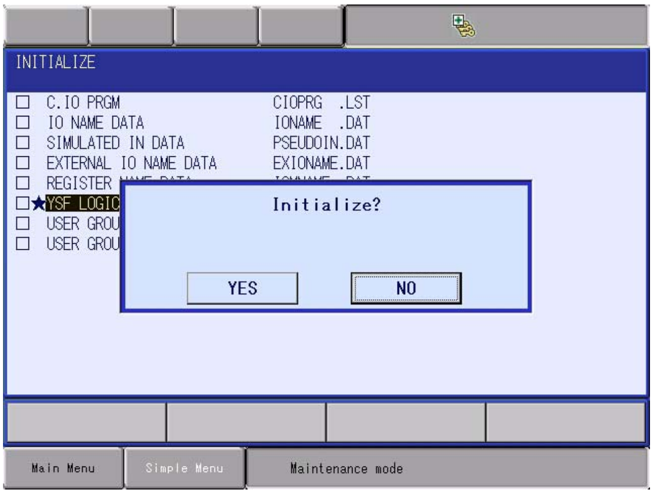
   (2) The I/O data file list is shown, and then select “YSF LOGIC FILE”.



5. Perform the initialization.

   (1) Select {ENTER}.

   – The confirmation dialog appears.



   (2) Select {YES}.

   – The file written in the FLASH ROM of the safety circuit board is initialized.

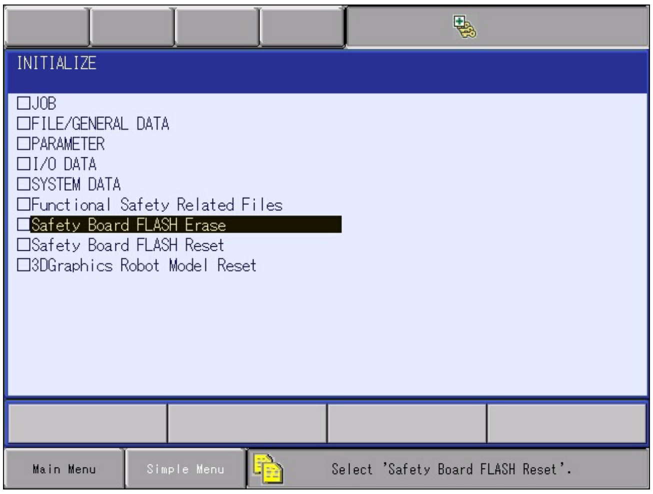
8.26.15.2 Safety Circuit Board FLASH ROM Data Erase and Reset

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}.



(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.

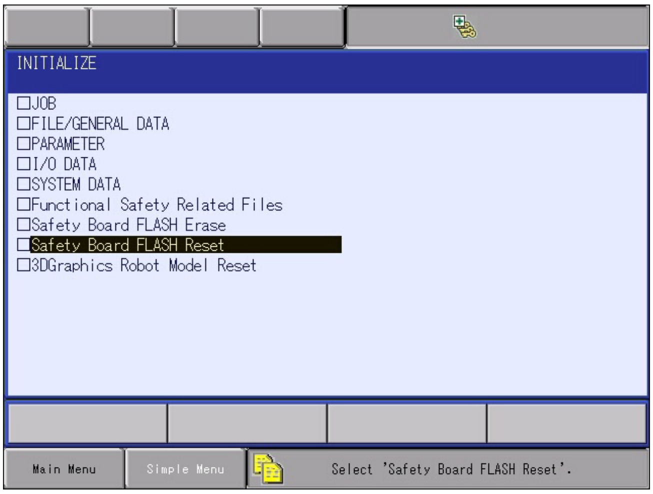
NOTE

After performing the “Safety Circuit Board FLASH Erase”, and turning the YRC1000micro 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}



    (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.

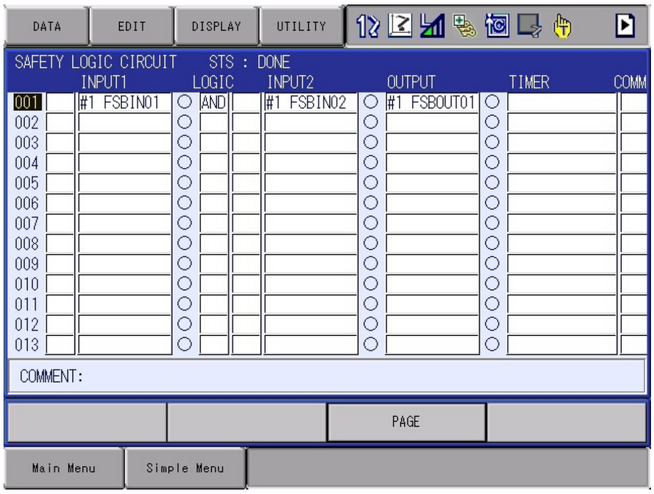
8.26.16 Example of Safety Logic Circuit

The followings are the examples of the safety logic circuit.

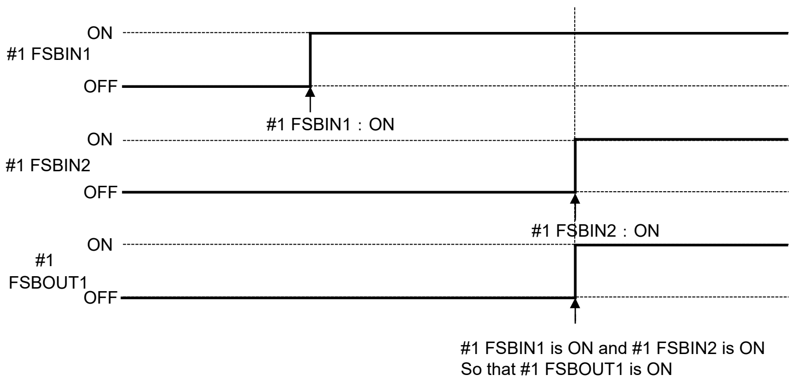
<The safety logic circuit: example 1>

This is the example of the setting to output from the GP safety output signal1(#1 FSBOUT1) while the GP safety input signal1(#1 FSBIN1) is ON and also 2(#2 FSBIN2) is ON.

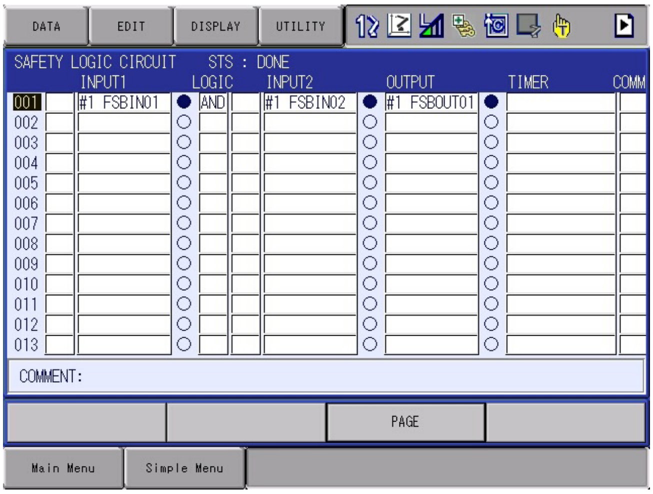
1. The following safety logic circuit is created.
   - Signal1 : GP safety input signal1(#1 FSBIN1)
   - Signal2 : GP safety input signal2(#2 FSBIN2)
   - Logic : AND
   - Output signal : GP safety output signal1(#1 FSBOUT1)



2. The time chart is shown.



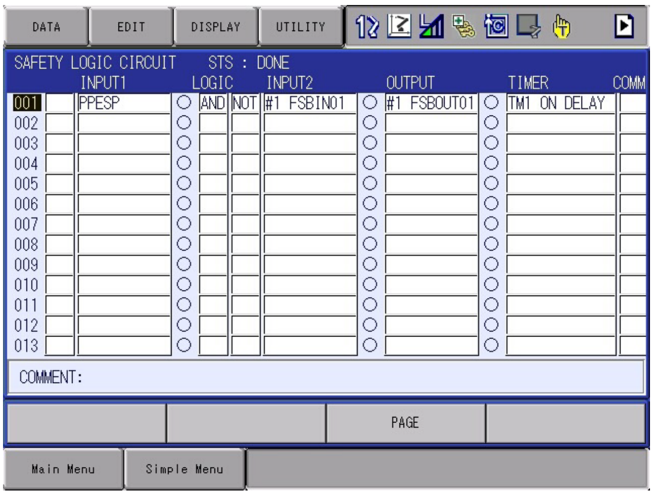
3. Verifying the safety logic circuit.
   Switch ON the GP safety signal “1” and “2”.
   The mark “◯” becomes “ ● “.



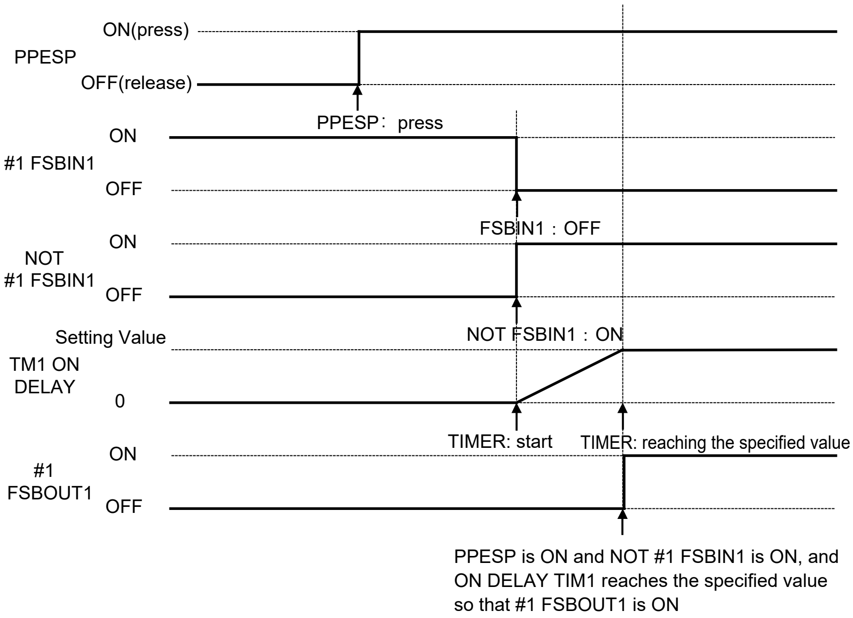
<The safety logic circuit: example 2>

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 FSBOUT1) is turned ON.

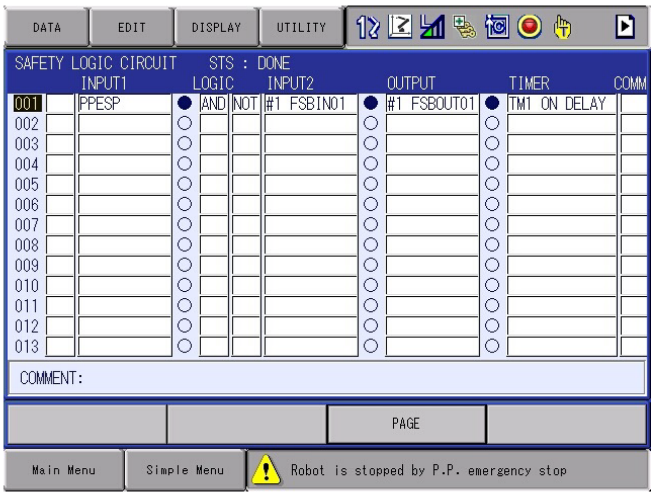
1. The following safety logic circuit is created.
   - Signal 1 : Programming pendant emergency stop (PPESP)
   - Signal 2 : NOT GP safety input signal 1 (#1 FSBIN1)
   - Logic : AND
   - Output signal : GP safety output signal 1 (#1 FSBOUT1)
   - Timer : ON delay timer1 (TM1 ON DELAY) 1 second



2. The time chart is shown.



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.

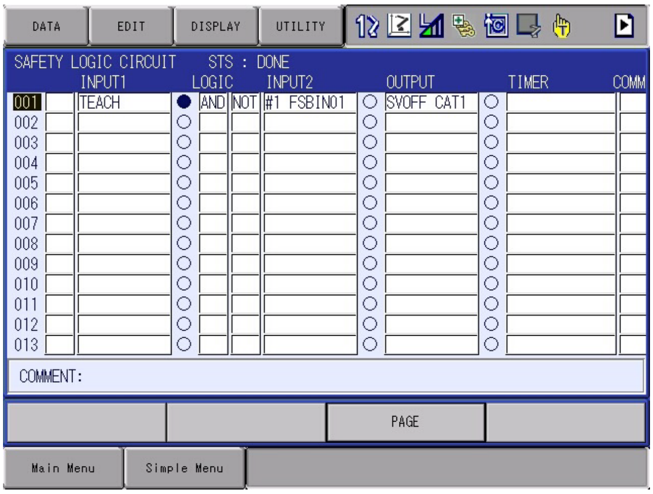


<The safety logic circuit: example 3>

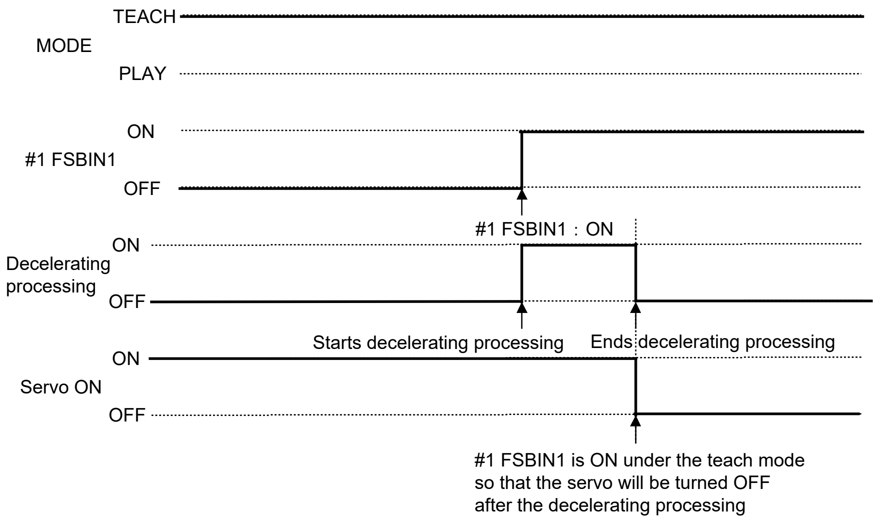
In the following example, when the GP safety input signal1 (#1 FSBIN1)is ON under the teaching mode, the manipulator decelerates and stops its operation.

1. The following safety logic circuit is created.

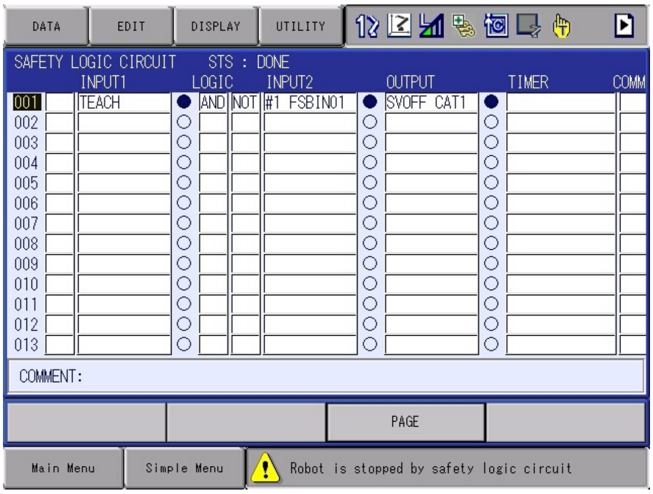
   - Signal 1 : Teach mode (TEACH)
   - Signal 2 : GP safety input signal 1 (#1 FSBIN1)
   - Logic : AND
   - Output signal : Manipulator deceleration to a stop (SVOFF CAT1)



2. The time chart is shown.

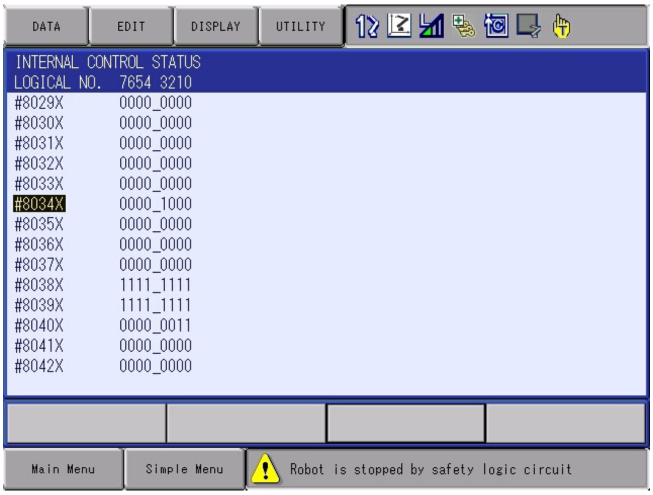


3. Verifying the safety logic circuit.
   Set up the teach mode, and turn the servo ON. After that, when the GP safety signal 1 is turned ON, the mark “◯” becomes “●”and the manipulator decelerates and stops its operation. If the manipulator stops its operation by the safety logic circuit, the message “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 YRC1000micro, 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

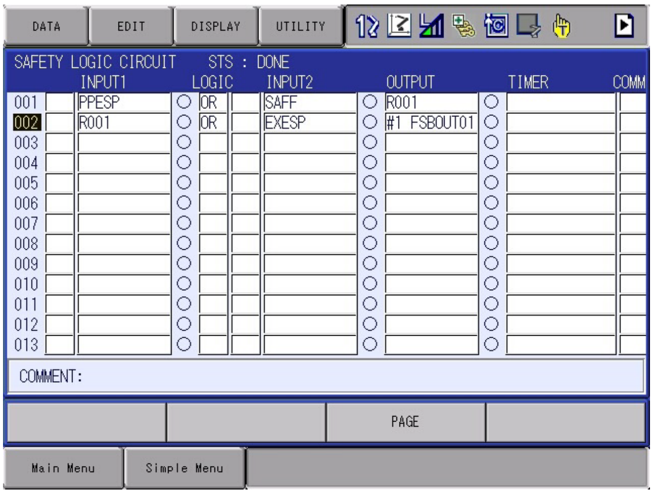
When the manipulator is stopped by the safety logic circuit signal, “Robot is stopped by safety logic circuit” is shown on the message area of the programming pendant.
The control status signal #80343(Robot stopped by safety logic circuit) is turned ON.

<The safety logic circuit: example 4>

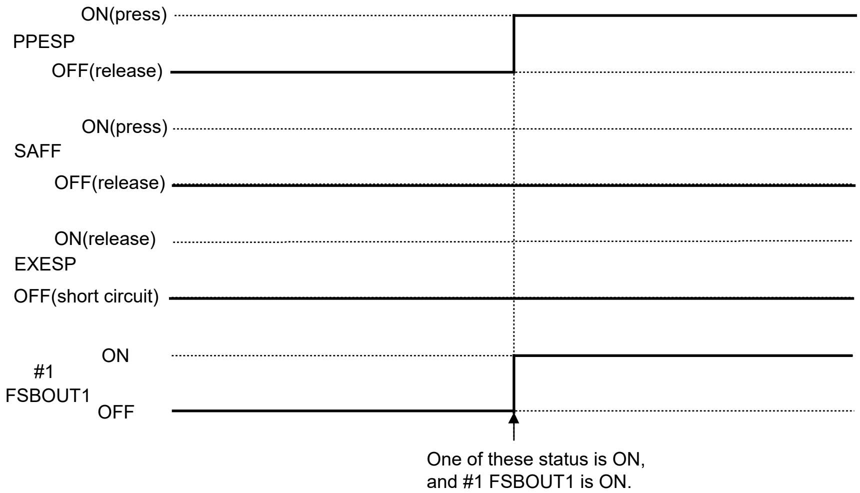
The setting example by using the auxiliary relay is described below. While either status of the programming pendant emergency stop (PPESP), safety fence (SAFF) or external emergency stop (EXESP) is stopped, the GP safety output signal 1 (#1 FSBOUT1) is turned ON.

1. The following safety logic circuit is created

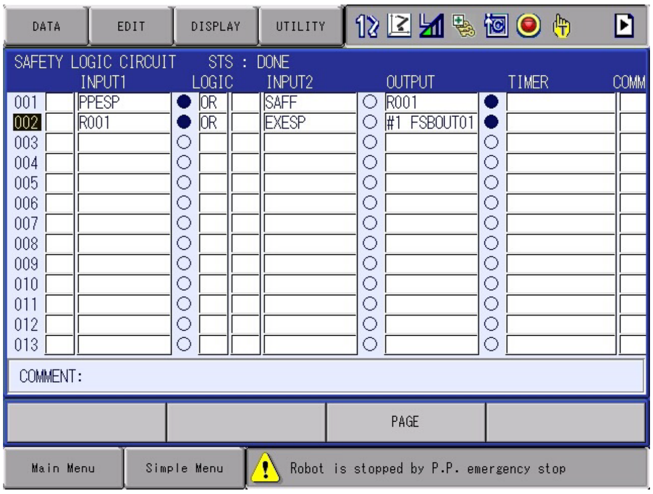
   - Signal 1 : Programming pendant emergency stop (PPESP)
   - Signal 2 : Safety fence (SAFF)
   - Signal 3 : External emergency stop (EXESP)
   - Logic : OR
   - Output signal : GP safety output signal 1 (#1 FSBOUT1)
     The display of “#1 FSBOUT1” indicates “FSBOUT1” of the first safety circuit board connected to the first safety board.



2. The time chart is shown.



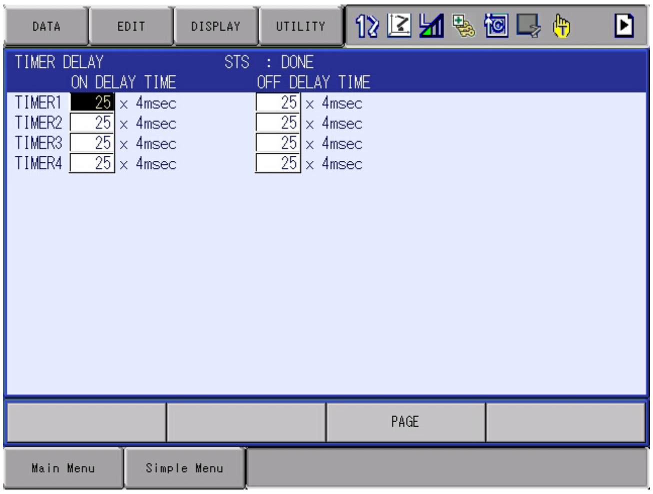
3. Verifying the safety logic circuit.
   When either the programming pendant emergency stop, safety fence, or the external emergency stop is input, the mark “○” of the GP safety output signal 1 becomes “●”.



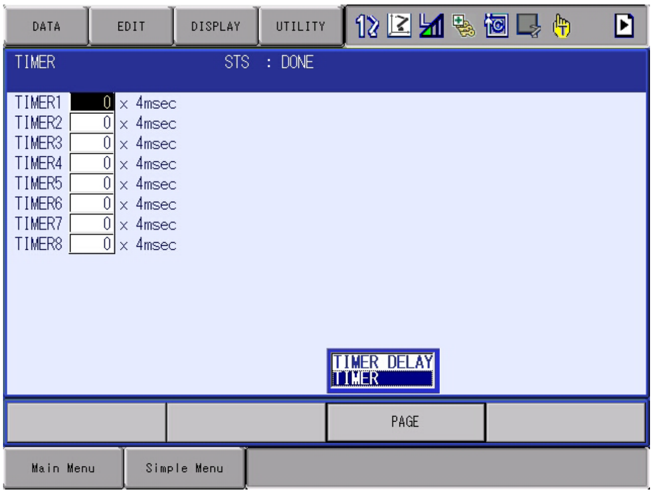
<The safety logic circuit: example 5>

The one-second one-shot output signal is created by the safety logic circuit. In the following example, the GP safety output signal (#1 FSBOUT1) is ON for one second.

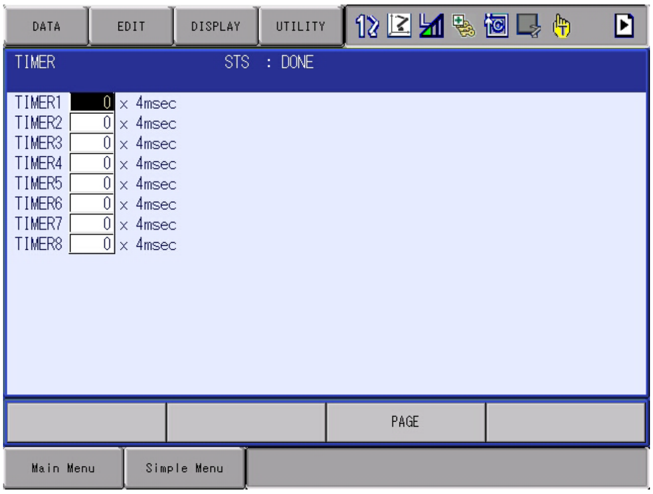
1. Select {SAFETY FUNC.} - {TIMER DELAY}.



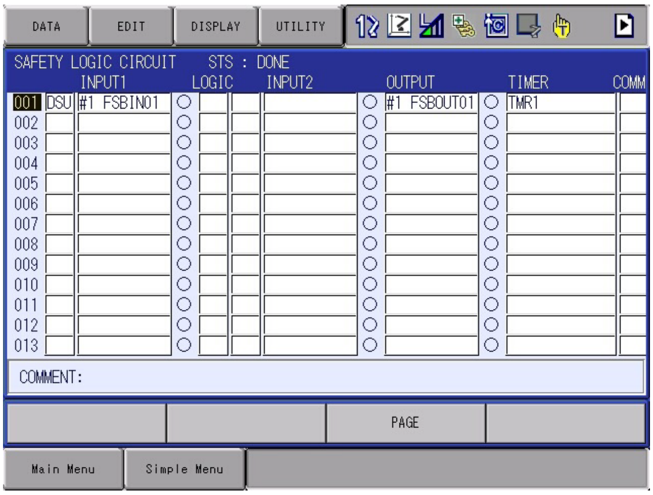
2. Select {PAGE} - {TIMER}.



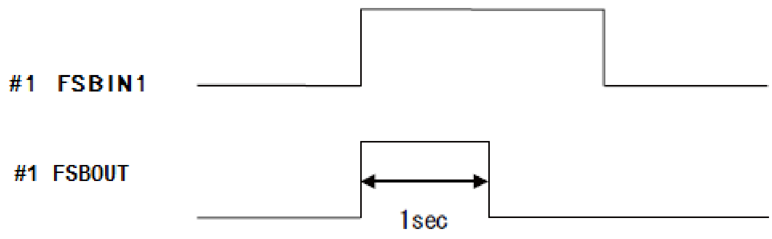
3. Input “250” at TIMER1.



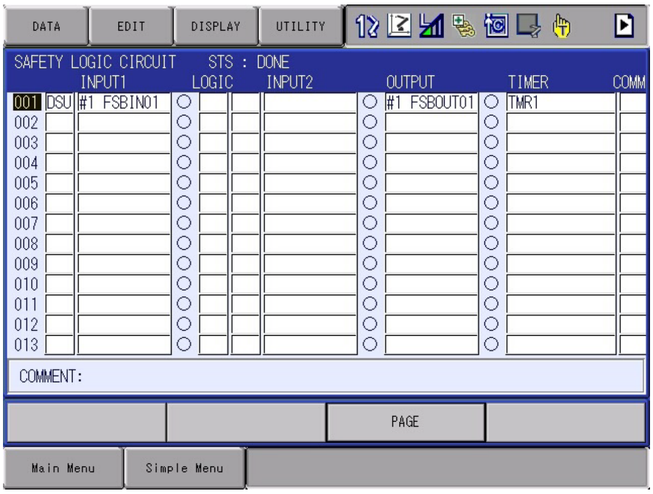
4. Create the following safety logic circuit.
   001 DSU #1FSBIN1 #1 FSBOUT1 TMR1



– When #1 FSBIN 1 signal is turned ON, #1 FSBOUT 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.

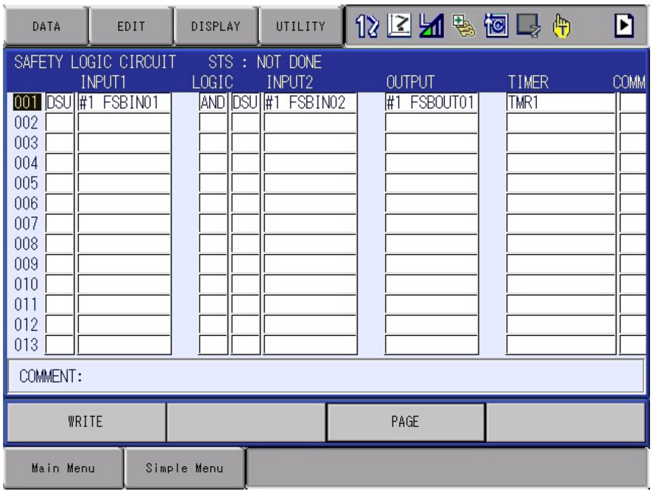
NOTICE

- When using the DSU or DSD instruction, the signal status turns to "●"only for 4 ms while the conditions are satisfied, but it is too short for visual check. Thus, display *chapter 8.26.5 "Signal List Window"* and the SAFETY LOGIC CIRCUIT window together to check the ON/OFF status of the input signal.

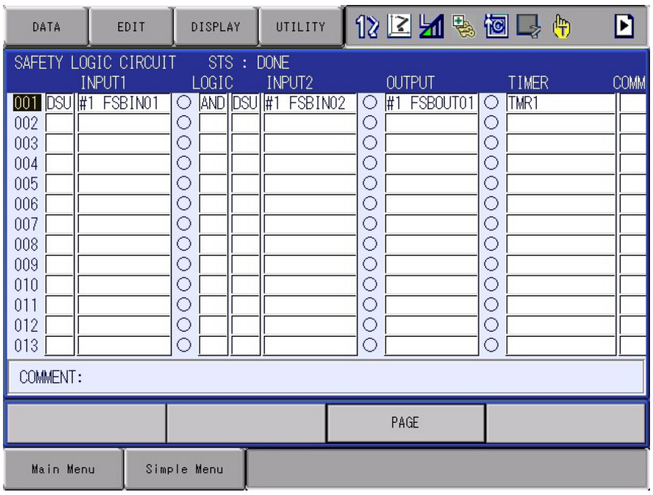
<The safety logic circuit: example 6>

The following is the setting example of the one-second one-shot output signal when two signals are turned ON at the same time.

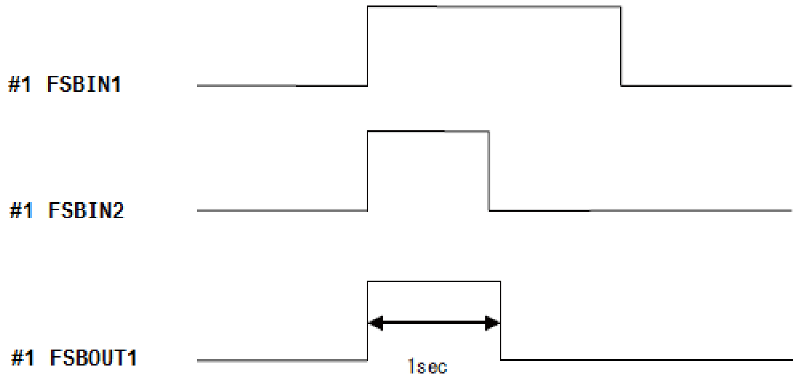
1. The following safety logic circuit is created.
   001 DSU #1 FSBIN1 AND DSU #1 FSBIN2 #1 FSBOUT1 TMR1



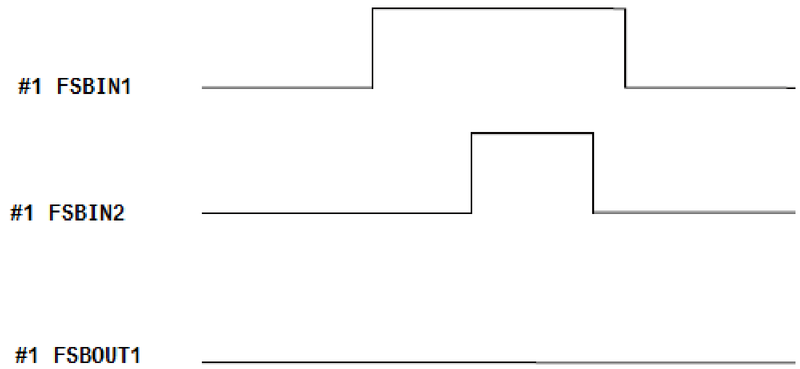
2. Select {WRITE} and then {CONFIRM} to enable the changed settings. When the data is updated correctly, the status on the title line is changed from "NOT DONE" to "DONE".



• When #1 FSBIN 1 signal and #1 FSBIN 2 signal are turned ON at the same time, #1FSBOUT1 signal is ON for one second.



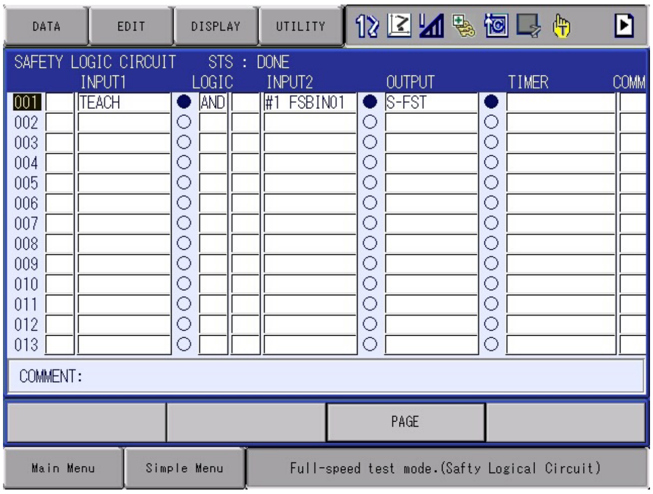
• When #1 FSBIN 1 signal and #1 FSBIN 2 signal are not turned ON at the same time, #1FSBOUT1 signal remains OFF.



<The safety logic circuit: example 7>

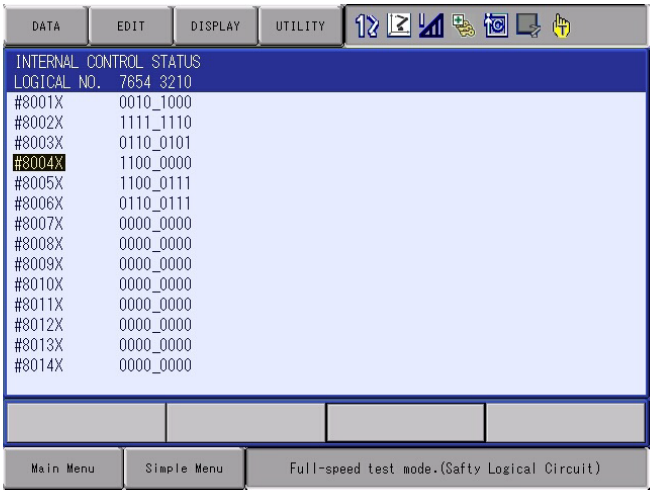
The input of the full speed test (S-FST) signal is set in the following example. After turning ON the GP safety input signal (FSBIN1) under the teach mode, the safety logic circuit, in which the full speed test output is turned ON, is set.

1. The following safety logic circuit is created.
   01 TEACH AND FSBIN1 S-FST



2. When FSBIN1 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.



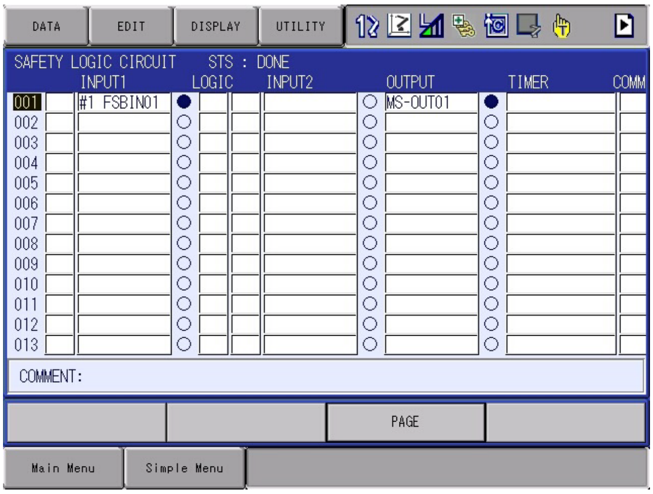
NOTE

S-FST signal is enabled only in the teach mode.

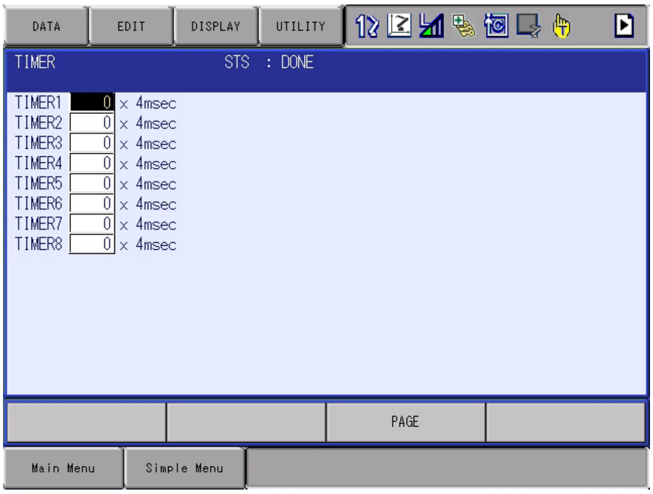
<The safety logic circuit: example 8>

The method to use MS-OUT signal is explained in the following.

1. The following safety logic circuit is created.
   01 #1 FSBIN1 MS-OUT01



2. When FSBIN1 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.



8.26.17 Alarm List of the Safety Logic Circuit

Alarm Number	Sub-code	Message	Remedy
300		VERIFY ERROR (SYSTEM CONFIG-DATA)	
	10	Safety circuit board save data error	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 8.26.15.2 "Safety Circuit Board FLASH ROM Data Erase and Reset"* for more details to restore.
4776		M-SAFETY YSF LOGIC FILE SIGNAL ERR	
	0	Start-up, in reading information from the FlashROM of ASF01 board, ASF01 board has detected an undefined signal.	The error of the safety logic circuit is detected when startup. Check the safety logic circuit because an invalid I/O signal is used by the safety logic signal.
	1	In the receiving information on safe logic circuit information, ASF01 board has detected an undefined signal.	The error is detected when updating the file. Check the safety logic circuit because an invalid I/O signal is used by the safety logic signal.
4777		TRANSMISSION ERROR (M-SAF FILE)	
	1	Safe logic circuit information transmission error was detected.	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.
	2	Timer delay information transmission error was detected.	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.
	3	M-safety signal alloc information transmission error was detected.	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.
	4	Safety signal board alloc information transmission error was detected.	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.
	253	M-safety command reception time out was detected.	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.
	254	Safe logic circuit write error was detected.	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 8.26.15.2 "Safety Circuit Board FLASH ROM Data Erase and Reset"* for more details.
	255	Safe logic circuit cancel error was detected.	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 8.26.15.2 "Safety Circuit Board FLASH ROM Data Erase and Reset"* for more details.

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

Displayed Item	Secondary Indication
EX.SERVO OFF1 (HOLD STOP)	System input signal number (#40065)
EX.SERVO OFF2 (CATEGORY0 STOP)	System input signal number (#40066)
EX.SERVO OFF3 (CATEGORY1 STOP)	System input signal number (#40064)
TEACH -> PLAY MODE CHANGE	None
PLAY -> TEACH MODE CHANGE	None
MAIN CPU ALARM	None
PARAMETER CHANGE	None
INST SVOFF	None
COMMAND SVON	None
HOME POSITIONING CHANGE	None
DATA FALSE RESTORE	None
TOOL FILE CHANGE	None
TOOL CALIBLATION	None
ENCODER RESET	None
ROBOT DETACHMENT	None
GROUND FAULT (BRAKE LINE)	None
MANUAL FULL SPEED	None
SERVO OFF QUE	None
SERVO ON ERROR	None
SERVO OFF ERROR	None

Table 8-2: The List of the Servo OFF Factors by Safety Circuit Board Instructions

Displayed Item	Secondary Indication	Description of the Signal
PP EMERGENCY STOP		Programming Pendant emergency stop
PP ENABLE SWITCH		Programming Pendant enable switch
EXTERNAL EMERGENCY STOP		External emergency stop
SAFETY FENCE		Safety fence
PROTECTED STOP (ONEN)		Protection stop
RDY0 OFF		RDY0 OFF Servo OFF request from the main CPU
CATEGORY1 REQUEST		Category 1 stop request from the main CPU
SERVO COMMUNICATION ERROR		Servo OFF by M3 communication error of the main CPU or among the servo circuit boards
CATEGORY0 SAFETY LOGIC CIRCUIT		Category 0 stop request from the safety logic circuit
CATEGORY0 FUNCTION SAFETY		Category 0 stop request from the functional safety
CATEGORY1 SAFETY LOGIC CIRCUIT		Category 1 stop request from the safety logic circuit
ASF30 ALARM		Alarm of the machine safety
CATEGORY0 STOP		The time of the machine safety category 0 stop timer is up, and switch OFF the servo of the machine safety.
CATEGORY1 STOP		The time of the machine safety category 1 stop timer is up. The machine safety servo category 0 stop timer must be started.
OVER TRAVEL1		Servo OFF by the over travel signal 1
STO OFF1		Turn OFF the servo power to the control groups that are connected to the STO1.

Table 8-3: The List of the Holding Factors

Displayed Item	Secondary Indication
HOLD	None
EX.HOLD (SPECIFIC. IN TRMNL BLOCK)	System input signal number #40067
INDIVIDUAL HOLD	System input signal number #40270 to #40287 TASK#0 to TASK#15
HOLD (SHOCK SENSOR)	None
HOLD (DATA TRANSMISSION)	None
HOLD (API CTL)	None
HOLD (API)	None
HOLD (HIGH SPEED ES)	None
SKIP WAIT INST (STOP PLAYBACK)	Task number TASK#0 to TASK#15
GUN TEACH SIG. OFF (STOP PLAYBACK)	System input signal number #41231
GUN TEACH STEPOVER (STOP PLAYBACK)	None
ALARM STOP QUE	None

8.27.1.2 The Robot Stop Factor Record Number

- One screen: maximum 37 factors
- History number: 20 histories

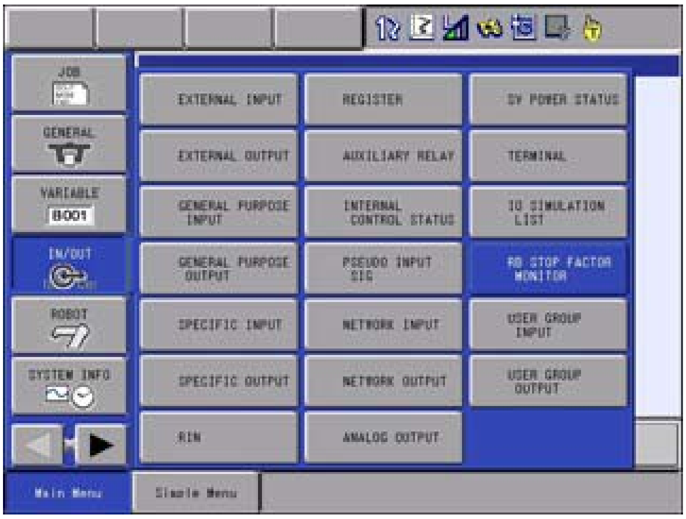
If exceeds the number above, the old data will be deleted, and the new data will be recorded.

8.27.2 Operation

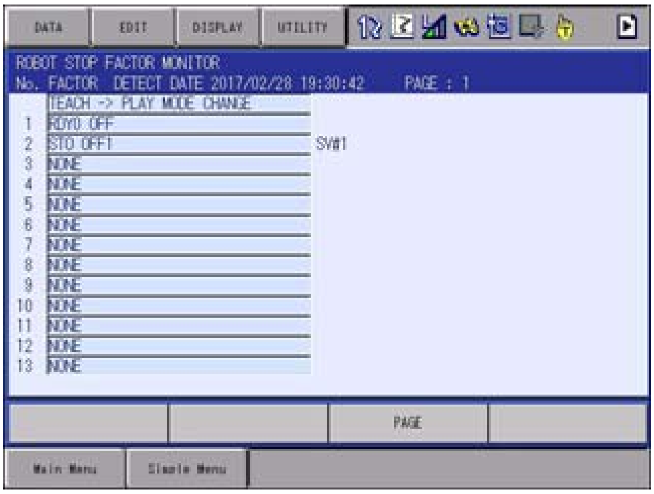
8.27.2.1 Displaying the Robot Stop Factor Monitor

The RB STOP FACTOP MONITOR can be referred by following procedures.

1. Select {ROB STOP FACTOR MMONITOR} under the {IN/OUT} in the main menu.



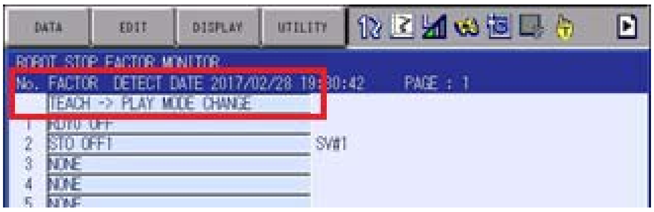
– The RB STOP FACTOR MONITOR window appears.



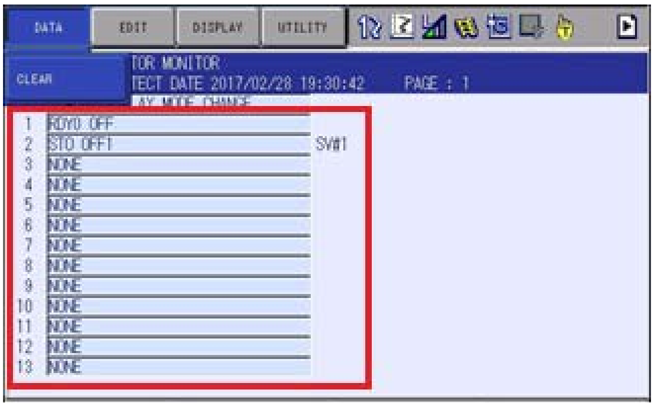
– The following items are displayed on the RB STOP FACTOR MONITOR window.

  • DETECT TIME: Shows the time when the robot stop factor was detected.

  • The factor detected by the main CPU is displayed on the first line.



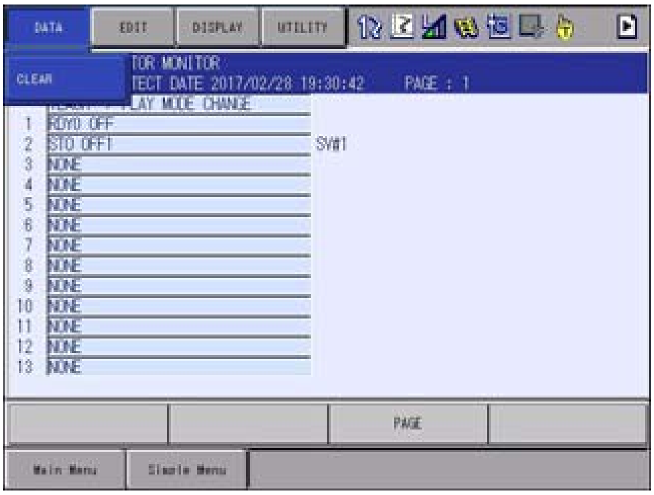
  • The factor(s) detected by the safety circuit board is (are) displayed from the second line on the screen.



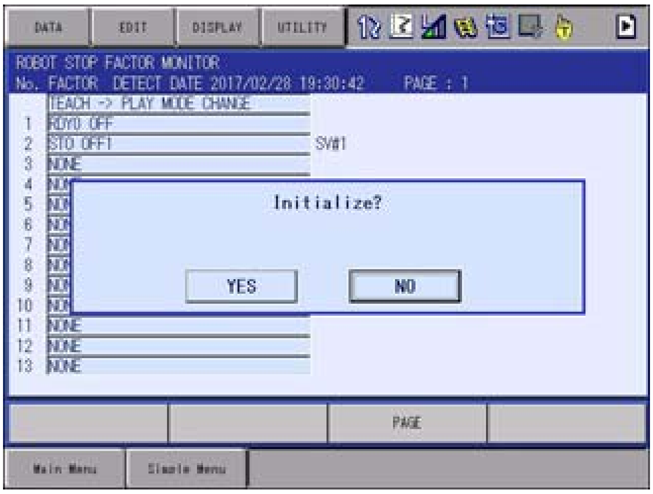
– The data on the first page is the latest one, and the page 20 is the oldest data.

8.27.2.2 Clear the Robot Stop Factor Information

1. Select {DATA} from the pull-down menu on the RB STOP FACTOR MONITOR window when the security mode is the management or higher mode. {CLEAR} is displayed.



2. Select {CLEAR}, and the confirmation dialog “Initialize?” appears. Press {YES}., and the all information of the robot stop factor is cleared.



NOTE

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.

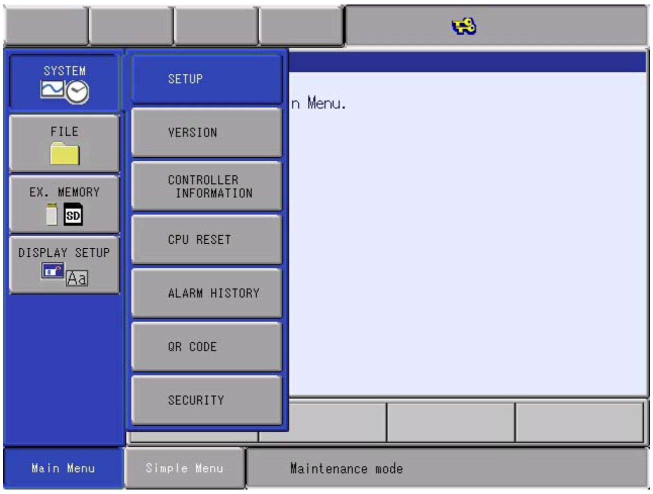
8.28 Robot Detachment Function

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.

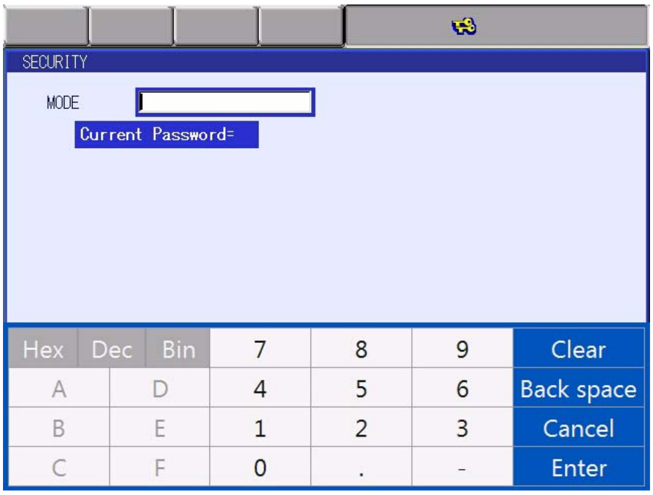
2. Select {SYSTEM} under the main menu.
   – Sub menu is shown.



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.



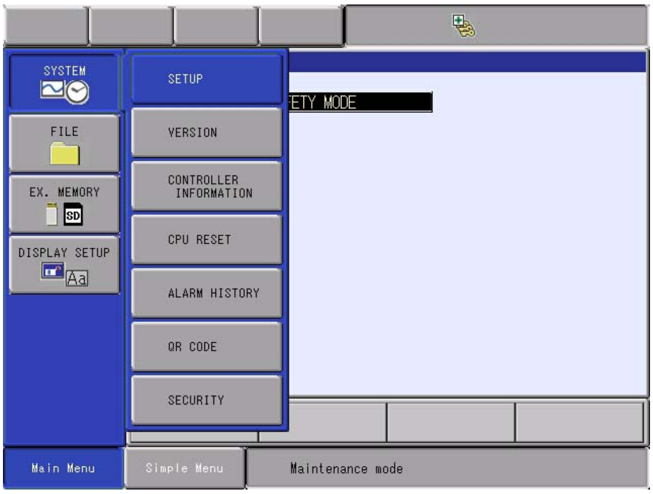
6. Input the password for safety mode and press [ENTER].
   – When the correct password is input, security mode is changed.

8.28.2 Setting Robot Detachment Function

Operator can set or modify the setting items for robot detachment function in detail setting screen.

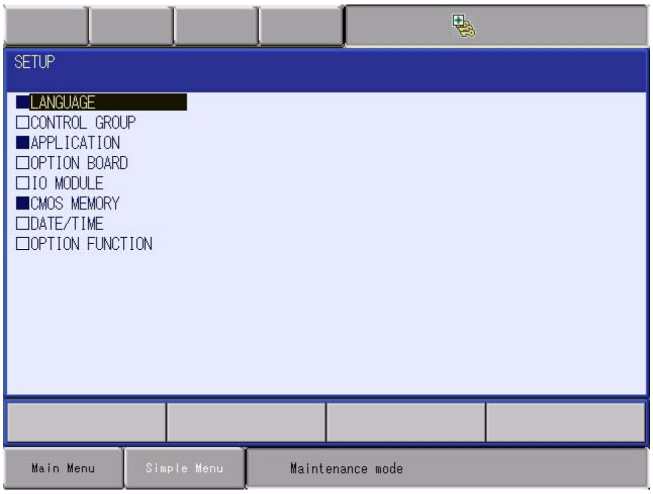
The specified parameters are to be set automatically according to the setting contents in detail setting screen.

1. Select {SYSTEM} under the main menu.
   – Sub menu is shown.



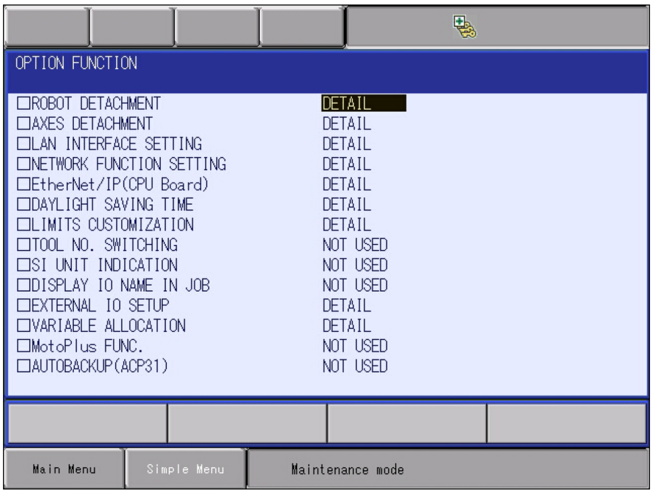
2. Select {SETUP}.

   – “SETUP” screen is shown.



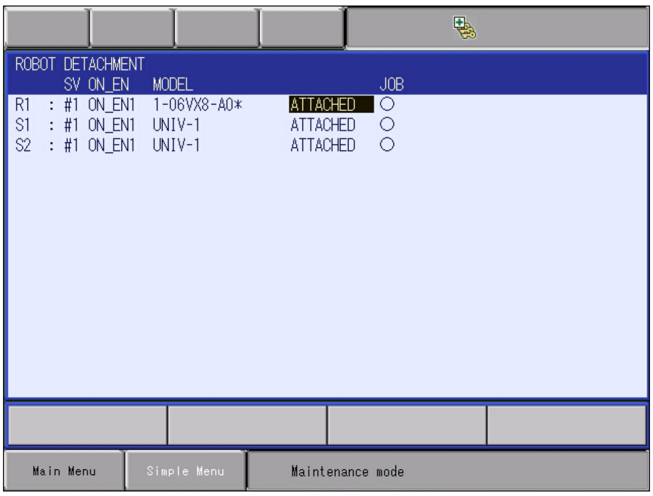
3. Move the cursor to {OPTION FUNCTION} and select.

   – “OPTION FUNCTION” screen is shown.

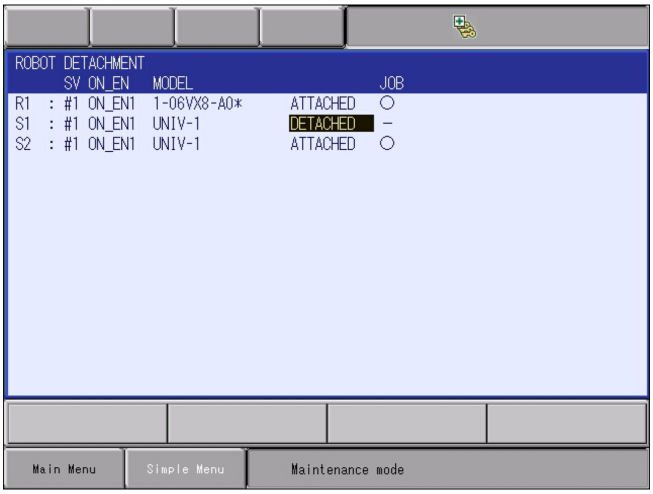


4. Move the cursor to {ROBOT DETACHMENT} and select.

   – 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.

9. If the message "Select 'Safety Board FLASH Reset'" is shown on the message area of the programming pendant, perform a data reset with the procedure in *chapter 8.18.6.2 "FLASH Data Reset"* .

8.29 Axes Detachment Function

8.29.1 Outline

The axes detachment function is to invalid the connection of specific axes by setting in maintenance mode. When the axes detachment function is set, the system can be started without any alarm even if some axes are not connected physically during setup or motor exchange.

8.29.2 Setting Maintenance Mode

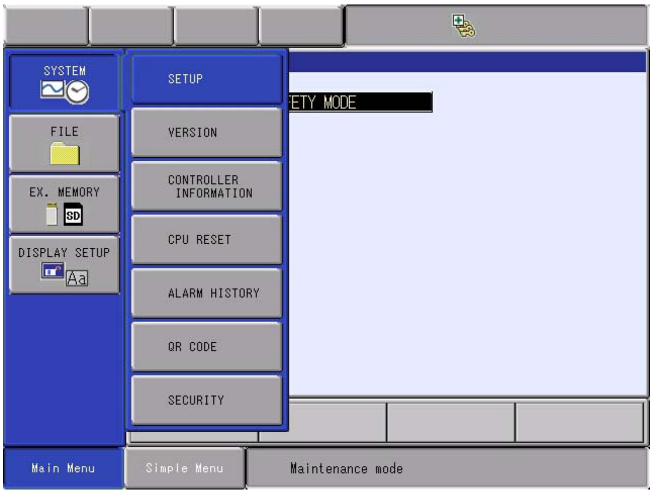
Start the maintenance mode and set the security mode to the safety mode. (Refer to *chapter 8.28.1 "Setting Maintenance Mode"* .)

8.29.3 Setting Axes Detachment Function

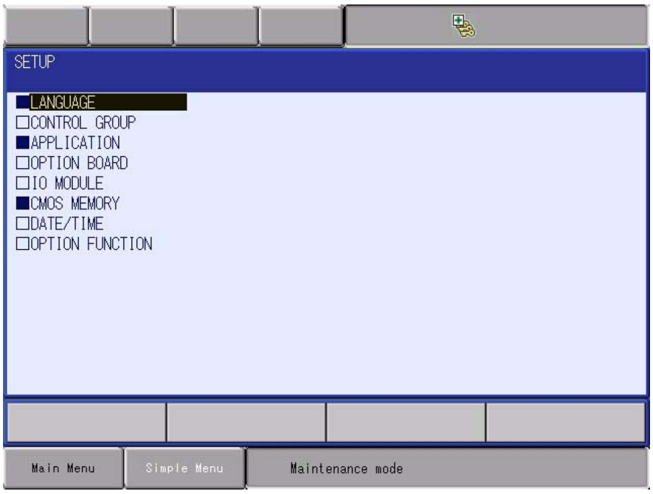
Operator can set or modify the setting items for axes detachment function in detail setting screen.

The specified parameters are to be set automatically according to the setting contents in detail setting screen.

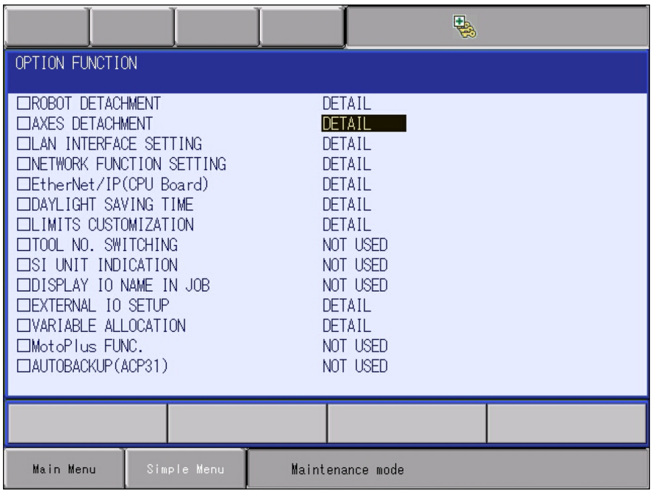
1. Select {SYSTEM} under the main menu.
   – Sub menu is shown.



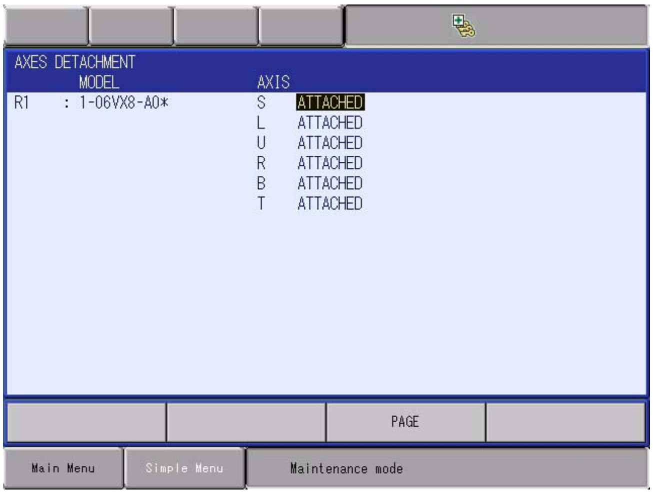
2. Select {SETUP}.
   – Setting selection screen is shown.



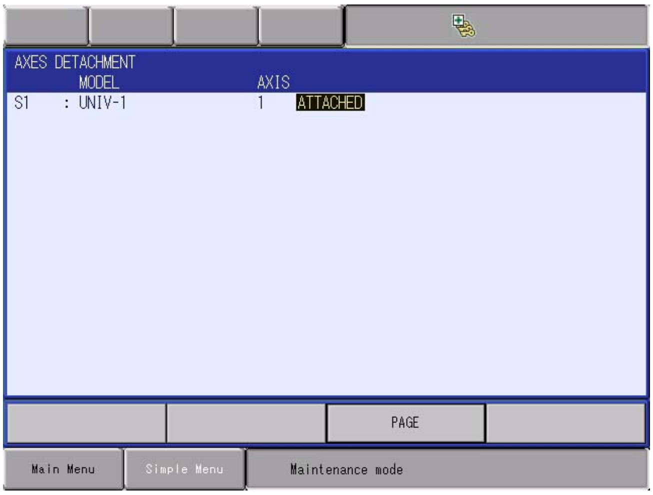
3. Move the cursor to {OPTION FUNCTION} and select.
   – “OPTION FUNCTION” screen is shown.



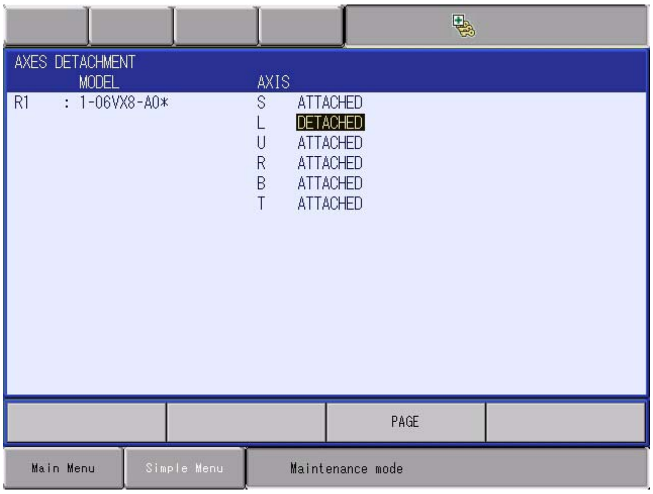
4. Move the cursor to {AXES DETACHMENT} and select.
   – Detail setting screen for axes detachment function is shown.



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.
9. If the message "Select 'Safety Board FLASH Reset'" is shown on the message area of the programming pendant, perform a data reset with the procedure in *chapter 8.18.6.2 “FLASH Data Reset”* .

8.29.4 Specific Output and Messages

When the system is started in online mode and any axes (at least one axis) are detached, the following specific output and message are output all the time.

- Specific output #50913 “AXES DETACHMENT”
- Message is displayed

The following message is output in the bottom right message area on the window of the programming pendant.

“Axes detachment has been set [sub code]”

The control group including the detached axis is shown in [sub code].

8.29.5 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

SUPPLE-MENT

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.

Operation	**Alarm**
Playback	"ERROR 2762 This operation is not allowed, for axes detachment has been set." "ALARM4916/4917 WRONG JOB EXEC OF DETACHED AXIS"
Test run	"ERROR 2762 This operation is not allowed, for axes detachment has been set."
Job registration (insertion, modification, deletion)	"ERROR 2763 Cannot modify, for axes detachment has been set."
Second home position registration	"ERROR 2763 Cannot modify, for axes detachment has been set."
Home position registration	"ERROR 2763 Cannot modify, for axes detachment has been set."
Work home position registration	"ERROR 2763 Cannot modify, for axes detachment has been set."

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.

- 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.

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.

For example, specify the start position and size of a GP I/O (#0xxxx or #1xxxx) area to allow the signals to be specified as IGU#(x) or OGU#(x). These user groups can be used in the job as shown next. The input range for data is two's complement (setting range from negative to positive).

SET D000 127

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 8, PARITY: NONE

The input range when the length is "8" is -128 to 127.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OGU#(6)							

ON

SET D000 32767

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: NONE

The input range when the length is "16" is -32768 to 32767.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OGU#(6)							

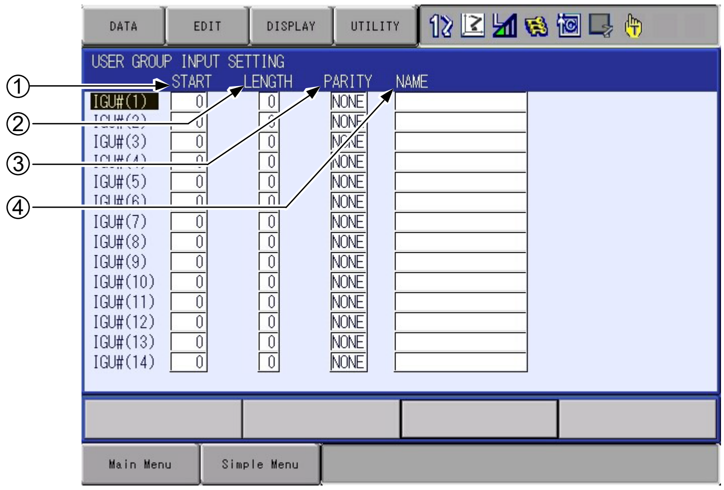
ON

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.

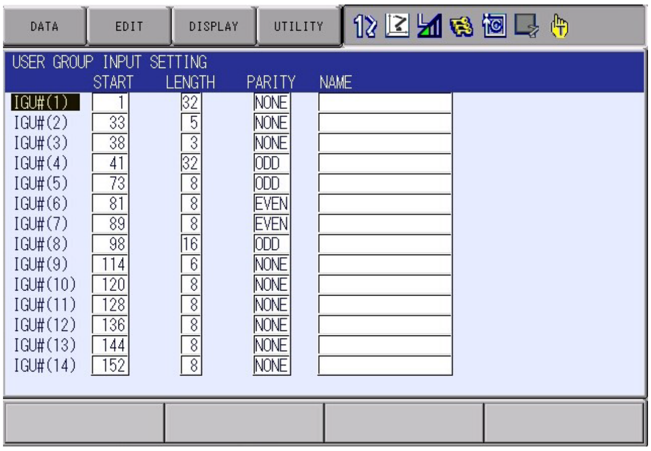
② **LENGTH**
Specify the number of the signals which is allocated to one group (1 to 32). When the parity check is specified, the parity bit is the highest bit. When the length is 1, the parity check cannot be specified.

③ **PARITY**
Set the parity check to detect errors in data.
NONE : The parity check is not performed.
ODD : The parity check is performed with an odd number of ones.
EVEN : The parity check is performed with an even number of ones.

④ **NAME**
The group signal name is set.

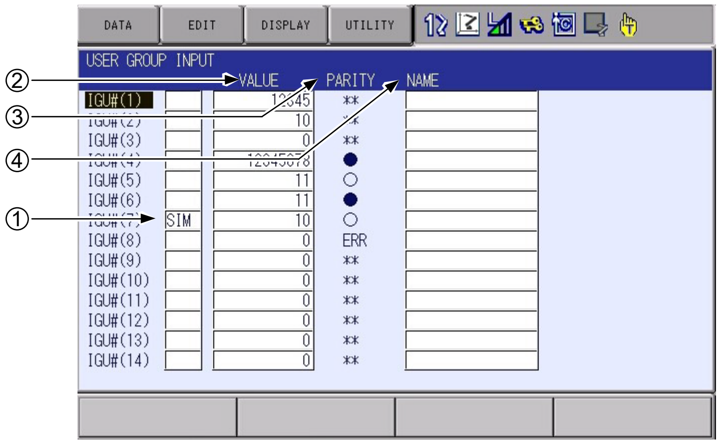
<Setting Example>

A setting example is shown below.



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 "Changing Signal Status from GP Input Status Window" in chapter 13.2 of "YRC1000micro OPTIONS INSTRUCTIONS FOR Concurrent I/O (RE-CKI-A469)".

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**

Set the parity check to detect errors in data.
The status of the parity bit

✱✱ : The parity check is not performed.

○ : The parity check is performed with an odd number of ones.

● : The parity check is performed with an even number of ones.

ERR : Parity error

④**NAME**

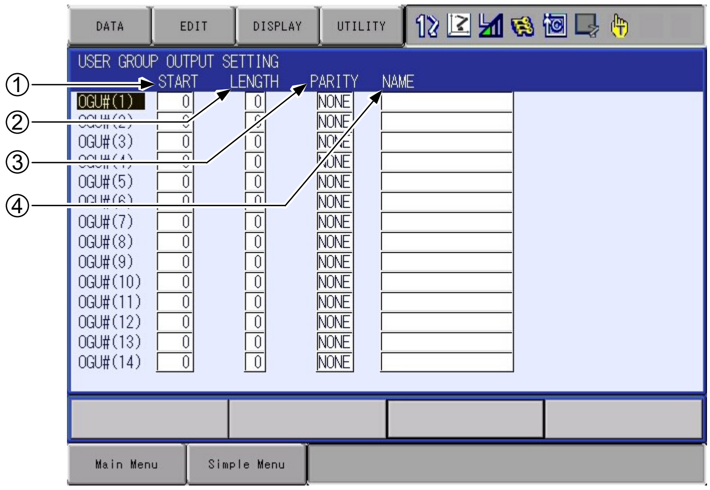
The group signal name

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.



① **START**
Specify the first number of the GP output signal to be allocated.

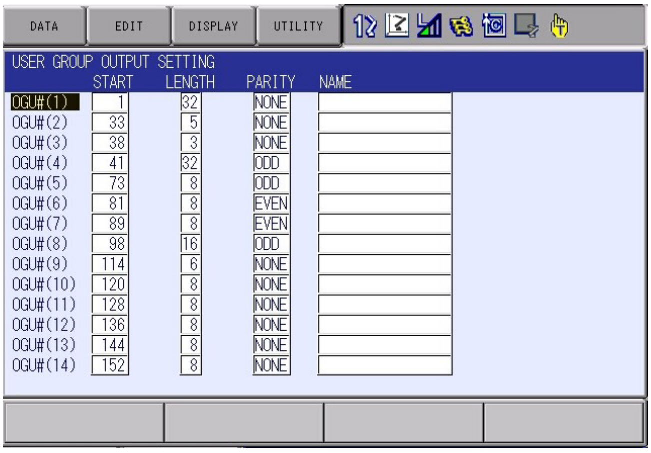
② **LENGTH**
Specify the number of the signals which is allocated to one group (1 to 32). When the parity check is specified, the parity bit is the highest bit. When the length is 1, the parity check cannot be specified.

③ **PARITY**
Set the parity check to detect errors in data.
NONE : The parity check is not performed.
ODD : The parity check is performed with an odd number of ones.
EVEN : The parity check is performed with an even number of ones.

④ **NAME**
The group signal name is set.

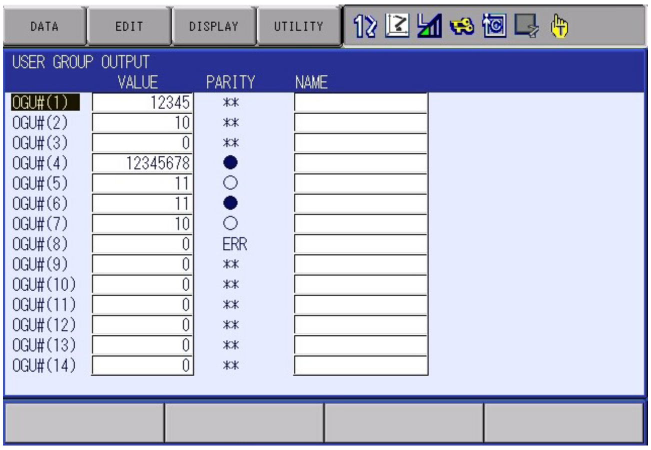
<Setting Example>

A setting example is shown below.



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.



1 **VALUE**

The output status of the user group.

2 **PARITY**

The status of the parity bit

** : No parity check

○ : 0

● : 1

ERR : Parity error

3 **NAME**

The group signal name

8.30.4 Examples of Use

This section gives several examples of use.

SET D000 255
DOUT OGU#(6) D000
<User group output settings: OGU#(6)>
START: 40, LENGTH: 8, PARITY: NONE
The input range when the length is "8" is -128 to 127.

NOTE

If a number is set outside the setting range, the alarm "4465: OVER BINARY RANGE(PARITY CHECK)" occurs and the user group output setting value does not change.

SET D000 65535
DOUT OGU#(6) D000
<User group output settings: OGU#(6)>
START: 40, LENGTH: 16, PARITY: NONE
The input range when the length is "16" is -32768 to 32767.

NOTE

If a number is set outside the setting range, the alarm "4465: OVER BINARY RANGE(PARITY CHECK)" occurs and the user group output setting value does not change.

SET D000 63

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 8, PARITY: EVEN

The input range when the length is "8" is -64 to 63.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OGU#(6)							

ON

SET D000 63

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 8, PARITY: ODD

The input range when the length is "8" is -64 to 63.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OGU#(6)							

ON

SET D000 300

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: EVEN

The input range when the length is "16" is -16384 to 16383.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OGU#(6)							

ON

SET D000 300

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: ODD

The input range when the length is "16" is -16384 to 16383.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OGU#(6)							

ON

SET D000 -2147483648

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 32, PARITY: NONE

The input range when the length is "32" is -2147483648 to 2147483647.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OT#(63)	OT#(62)	OT#(61)	OT#(60)	OT#(59)	OT#(58)	OT#(57)	OT#(56)
OT#(71)	OT#(70)	OT#(69)	OT#(68)	OT#(67)	OT#(66)	OT#(65)	OT#(64)
OGU#(6)							

ON

SET D000 -1

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 32, PARITY: NONE

The input range when the length is "32" is -2147483648 to 2147483647.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OT#(63)	OT#(62)	OT#(61)	OT#(60)	OT#(59)	OT#(58)	OT#(57)	OT#(56)
OT#(71)	OT#(70)	OT#(69)	OT#(68)	OT#(67)	OT#(66)	OT#(65)	OT#(64)
OGU#(6)							

ON

SET D000 65535

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: ODD

The input range when the length is "16" is -16384 to 16383.

NOTE

If a number is set outside the setting range, the alarm "4465: OVER BINARY RANGE (PARITY CHECK)" occurs and the user group output setting value does not change.

SET D000 65535

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: EVEN

The input range when the length is "16" is -16384 to 16383.

NOTE

If a number is set outside the setting range, the alarm "4465: OVER BINARY RANGE (PARITY CHECK)" occurs and the user group output setting value does not change.

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.

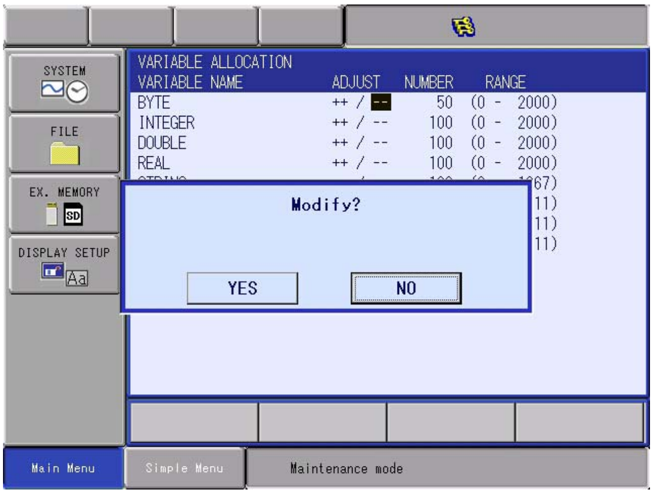
The number can be changed by selecting “++” / “--” or inputting the number directly. The changeable minimum and maximum value are shown in “RANGE”. Since the global variable shares the determined section/area, the value shown in “RANGE” is changed along with the setting value.

- When the “++” is selected, the allocation is increased by the increment of 50.

- When the “--” is selected, the allocation is decreased by the decrement of 50.

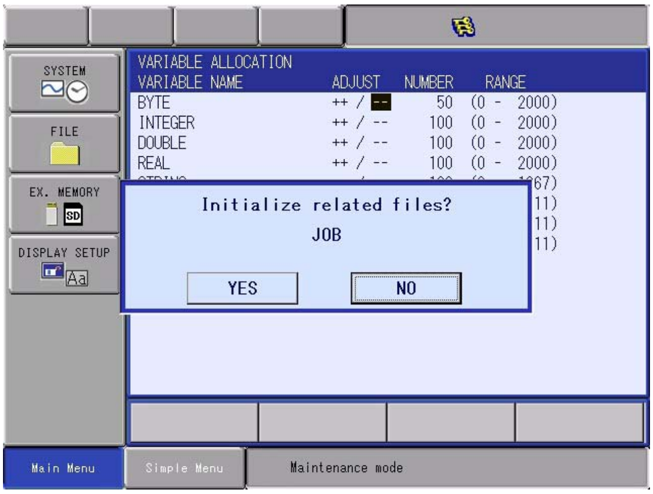
7. Press [ENTER].

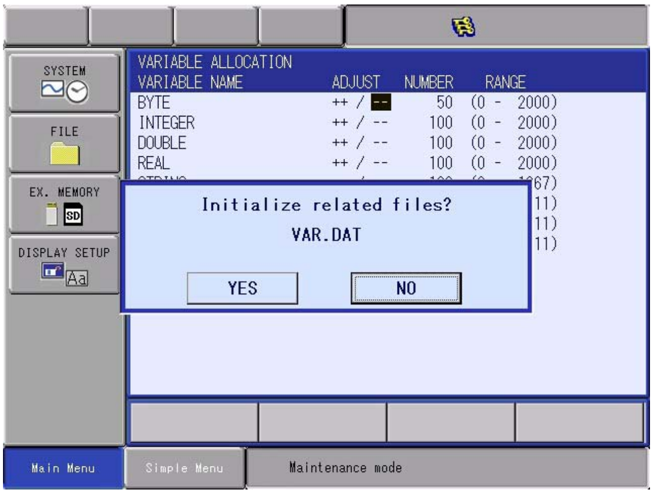
   – The confirmation dialog of the parameter change shows up.

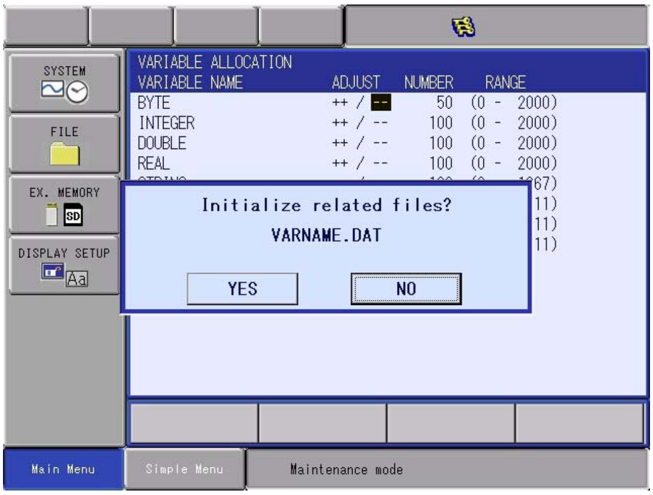


8. Select {YES}.

   – 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.

NOTE

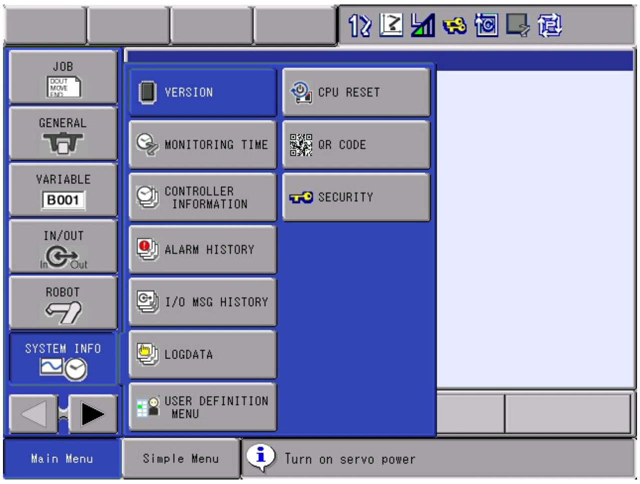
When the position variable allocation is changed, not only the data of job variable/variable name but also the following files are cleared. Be sure to handle the data properly.

- User coordinate
- Robot calibration data
- Conveyor calibration data

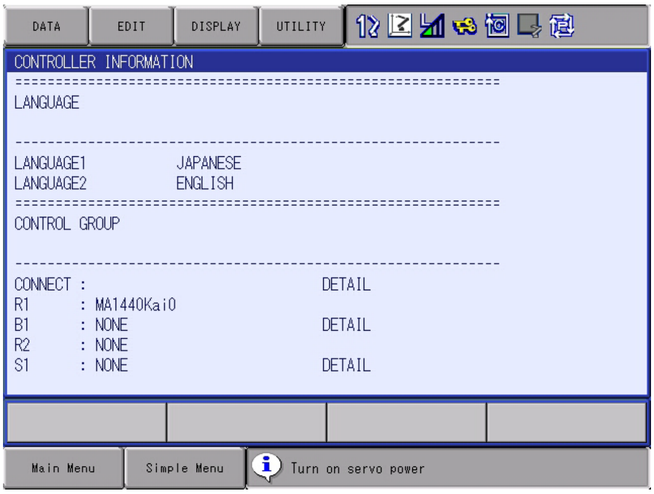
8.32 Controller Information Display Function

The configured information in this robot system can be checked by the following procedures.

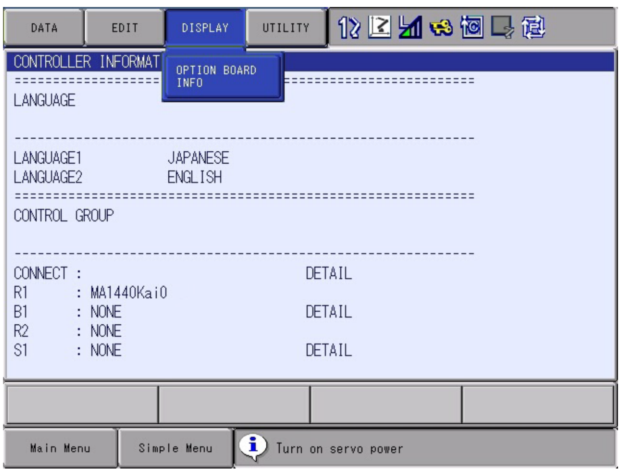
1. Select {SYSTEM INFO} in the main menu.



2. Select {CONTROLLER INFORMATION}.
   – The CONTROLLER INFORMATION window is shown.

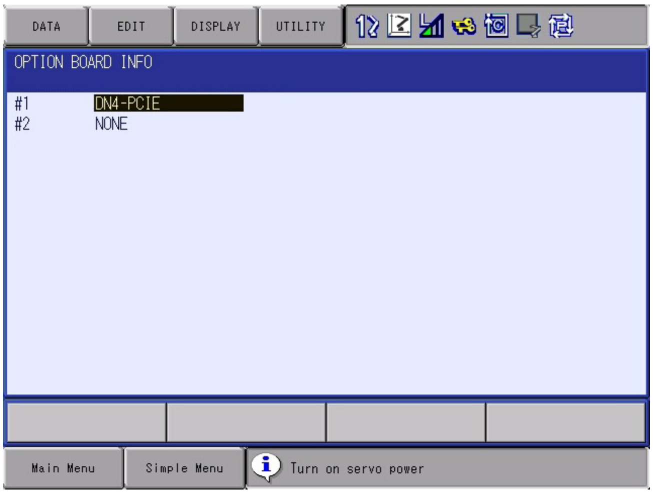


3. Select {DISPLAY}.



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.

NOTE

While the CONTROLLER INFORMATION window is shown, the following display is shown by performing the bilingual operation ({SHIFT} + {AREA} on the programming pendant are pressed).
Select {SYSTEM INFO} - {CONTROLLER INFORMATION} once again.

8.33 Manual Brake Release Function

8.33.1 Outline of Function

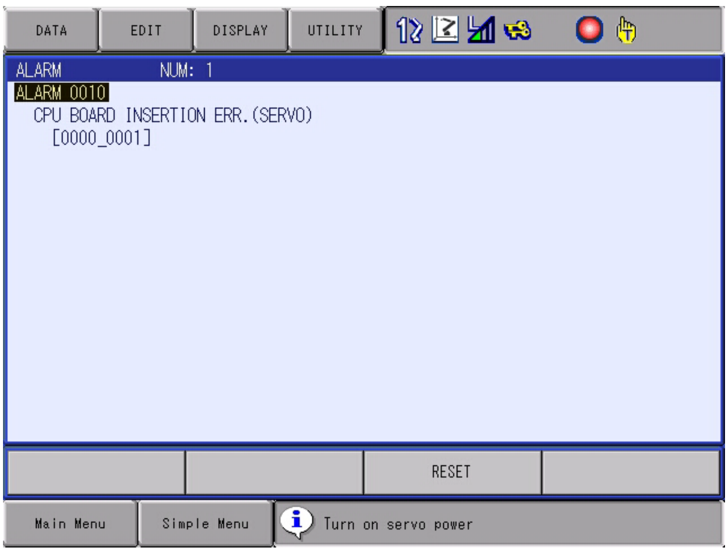
The manual brake release function allows forcible release of each motor brakes of the manipulator and external axes by programming pendant operation.

However, conditions shown below should be followed.

■ Operating Conditions

1. YRC1000micro Status
   The YRC1000micro has to be launched correctly[1)].
2. Mode: Mode switch on the programming pendant
   The function can be used in all modes: Remote / Play / Teach.
3. Security Mode
   The function can be used in all modes: Operation / Editing / Management / Safety.
4. Others
   - Servo power is OFF
   - Emergency stop is OFF
     (programming pendant, external signals)

Fig. 8-6: Alarm Window



1 Basically, the manual brake release function is available even at alarm occurrence.
However, the manual brake release function cannot be used if the communication failure between each board occurs due to a board failure, etc.

<Example>
The manual brake release cannot be performed at occurrence of the alarm 0010 as shown in fig. 8-6, since the communication with the servo board becomes unavailable.

■ **Restrictions**

Due to the hardware configuration, the brake release can be performed only by the following units:

- Group of the S-, L-, and U-axes (the first, second, and third axes)
- Group of the R-, B-, and T-axes (the fourth, fifth, and sixth axes)
- The E-axis or the first external axis, etc. (the seventh axis)
- The first or the second external axis, etc. (the eighth axis)

DANGER

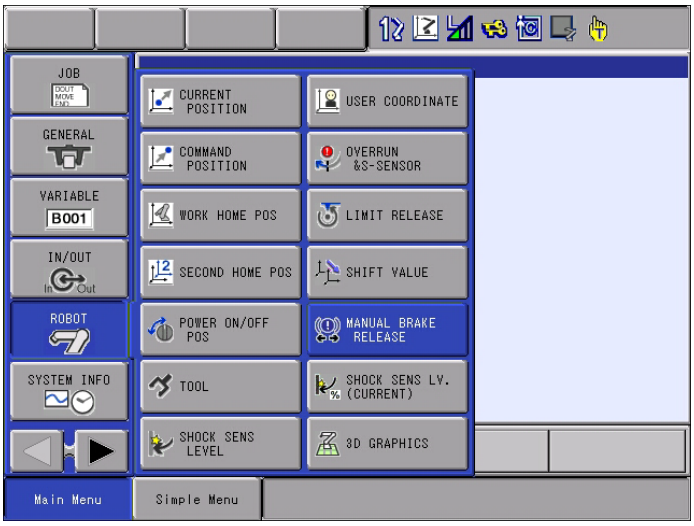
- Before performing brake-release operation for a manipulator, carefully read the MOTOMAN-□□□ INSTRUCTIONS of the manipulator, and securely fix the axis whose brake will be released.

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.

- Use great caution when manually releasing the brake because the brakes of up to 3 axes are released.

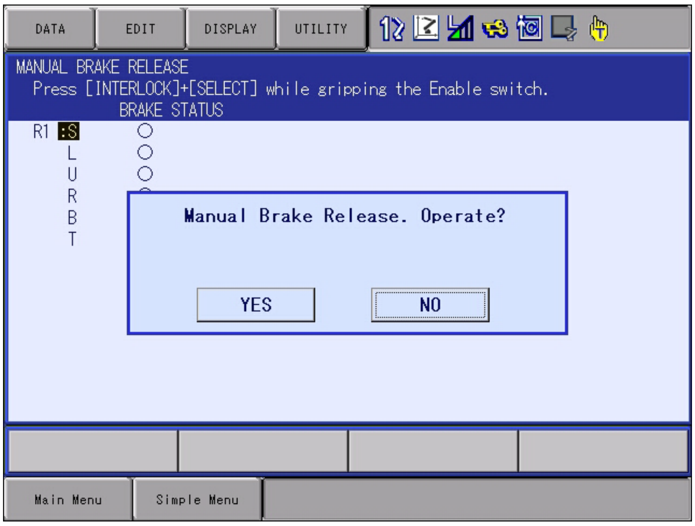
8.33.2 Manual Brake Release Operation

1. Select [ROBOT] under the main menu, then select [MANUAL BRAKE RELEASE] under the submenu.
   – [MANUAL BRAKE RELEASE] is shown under the submenu of the main menu [ROBOT].



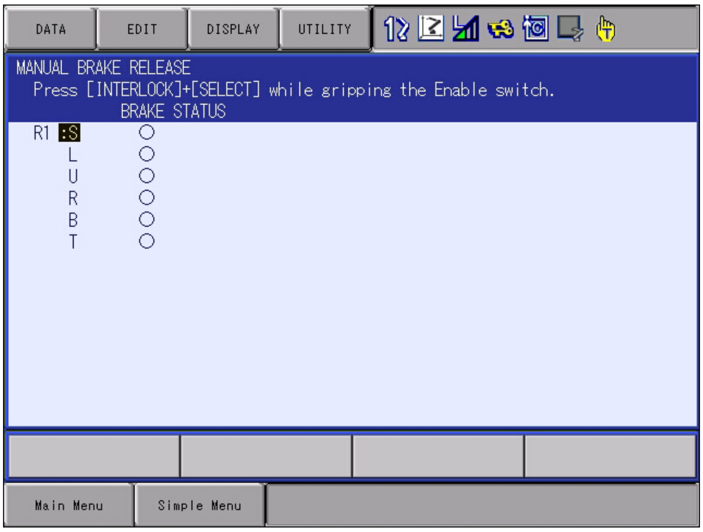
2. Select "YES".

– To avoid careless operation mistake, a warning message appears when [MANUAL BRAKE RELEASE] menu is selected.

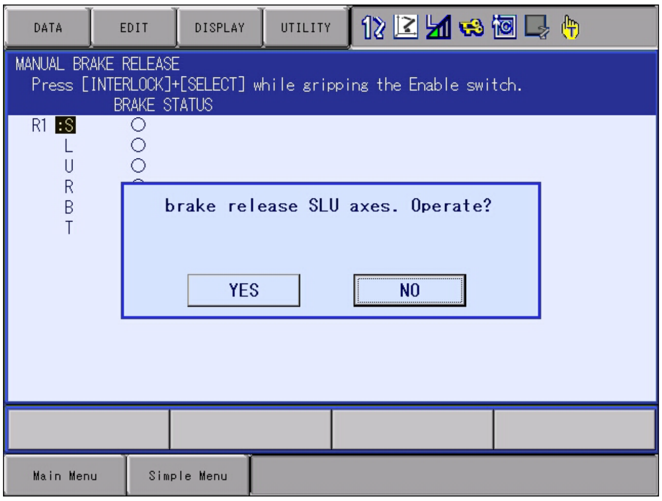


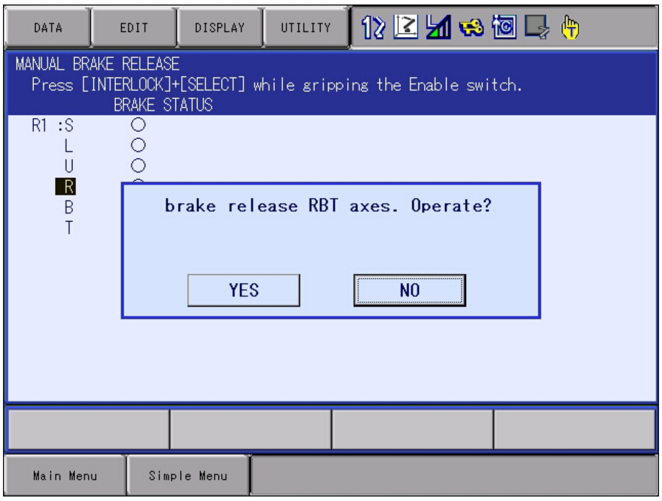
– Select "YES" to display [MANUAL BRAKE RELEASE] window.

– Select "NO" to return to the main menu.

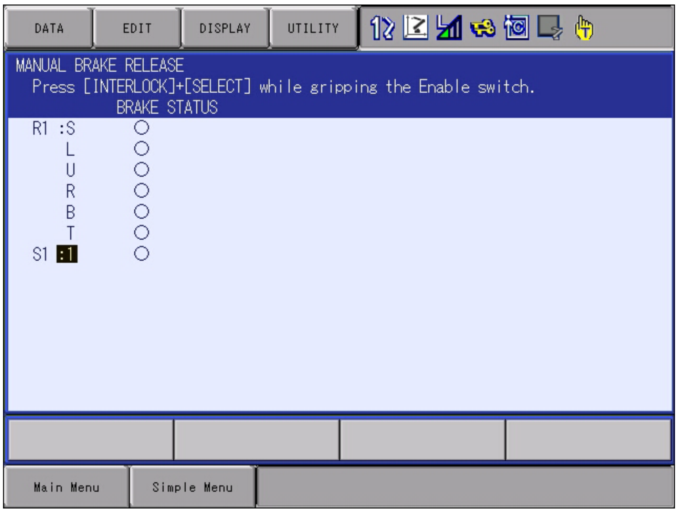


3. Move the cursor to the axis whose brake is to be released. Then press [INTERLOCK] + [SELECT] while gripping the enable switch.
   – Since the brakes of multiple axes will be released if the S-, L-, or U-axis (the first, second, or third axis) or the R-, B-, or T-axis (the fourth, fifth, or sixth axes) is selected, one of the following confirmation dialog boxes appears.





– If the E-axis or the first external axis, or the second external axis (the seventh or eighth axis) is selected, the brake is released and the BRAKE STATUS is displayed.
BRAKE STATUS ○: Brake locked ●:Brake released



– The brake is locked under one of the following conditions:

• When [SELECT] is released.

Also, see the following CAUTION.

• When the emergency stop button on the programming pendant or on the external device is pressed.

• When Enable switch is released or gripped further.

• When the window is switched from the Manual Brake Release window to another window.

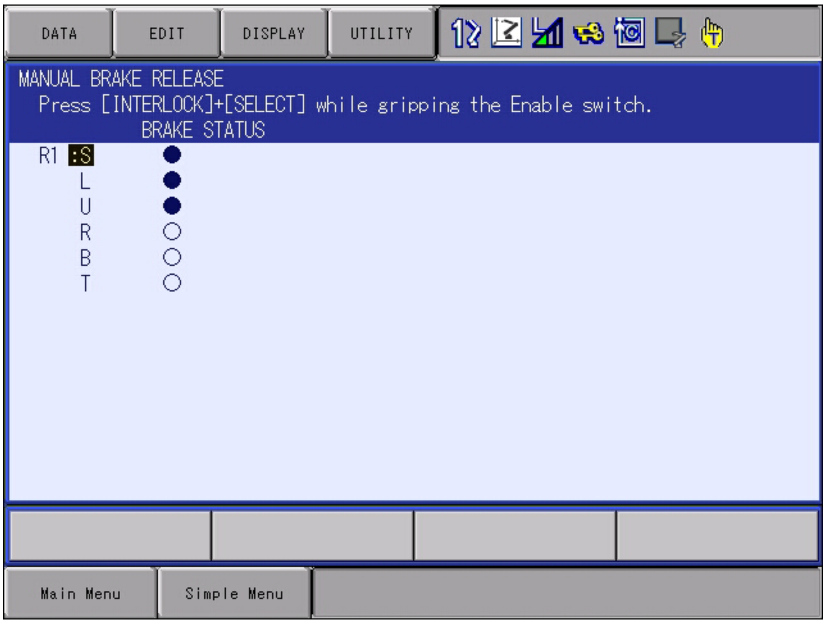
CAUTION

• Brake can be released by pressing [INTERLOCK] + [SELECT] while gripping Enable switch.
Note that the brake remains released even though only [INTERLOCK] is released at this time.

4. Select {YES} in the selection dialog box.

   – Select {NO} or press [CANCEL] to close the confirmation dialog box without releasing the brake.
   After that, press [INTERLOCK] + [SELECT] while gripping the enable switch to display the confirmation dialog box again. Proceed to the step 4.

   – When {YES} is selected, the brake is not released immediately. Do not move the cursor, and press [INTERLOCK] + [SELECT] while gripping the enable switch again to release the brakes of the 3 axes including the axis at which the cursor points.



BRAKE STATUS ○: Brake locked ●:Brake released

   – When the axis whose brake is to be released is changed by moving the cursor, proceed to the step 3.

   – The brake is locked under one of the following conditions:

   • When [SELECT] is released.
   Also, see the following CAUTION.

   • When the emergency stop button on the programming pendant or on the external device is pressed.

   • When Enable switch is released or gripped further.

   • When the window is switched from the Manual Brake Release window to another window.

   • When the inter lock connector is pulled out.

CAUTION

- Brake can be released by pressing [INTERLOCK] + [SELECT] while gripping Enable switch.
  Note that the brake remains released even though [INTERLOCK] is released at this time.

– The brake is locked under one of the following conditions:

- When [SELECT] is released.

  Also, see the following ⚠ CAUTION.

- When the emergency stop button on the programming pendant or on the external device is pressed.
- When Enable switch is released or gripped further.
- When the window is switched from the Manual Brake Release window to another window.

⚠ CAUTION
• Brake can be released by pressing [INTERLOCK] + [SELECT] while gripping Enable switch. Note that the brake remains released even though [INTERLOCK] is released at this time.

8.33.3 Warning Message Display

If the manual brake release is performed under the following conditions, the warning message appears in the message area bottom right of the window.

In this case, the brake release cannot be performed.

- Servo power is turned ON.
- Emergency stop button on the programming pendant is pressed.
- External emergency stop signal is input.

8.34 Step Diagnosis Function

This function displays the load ratio of each axis for one step. With this function, the following items are shown: job name, line, step, axis, and result (load ratio) when the motor torque load ratio exceeds the threshold value during play mode.

■ Measurement of Data

This function measures the data for all jobs. Measurements start automatically when playback is performed for a job. The load ratio of each axis is automatically updated every time the step is switched or the job is stopped (END, HOLD, PAUSE, Emergency stop).

■ Setting

The job name and step number are displayed when the load ratio exceeds the threshold value specified for the motor torque of each axis by parameter.

Settings can be changed to display a message when the load ratio exceed the threshold value.

NO.	Meaning	Setting Value	Note
S1CxG1400	Load ratio threshold value	0 (units: %)	The ratio is set as 100% when the value is 0.
S2C1339	Step diagnosis message displayed	0 (DISABLE) 1 (ENABLE)	A message is displayed when this setting is enabled and the load ratio exceed the threshold value.

NOTE

The message is not displayed even if S2C1339 is set to 1 under the following conditions.

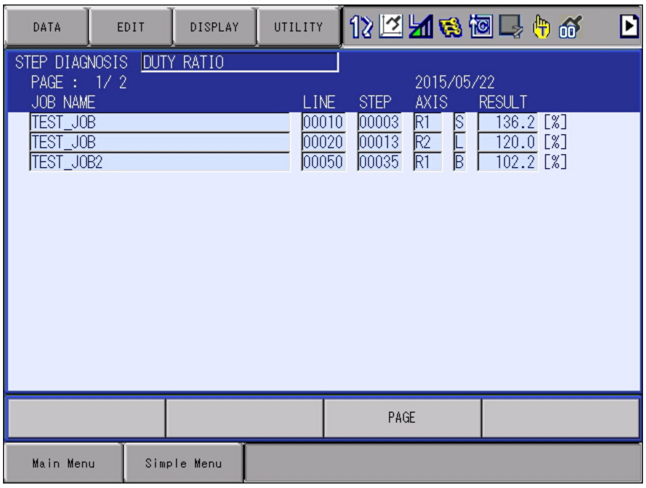
- When turning the control power supply ON and OFF.
- When the date is changed.

■ **Confirmation of Data**

The job name, line, step, axis, result (load ratio) when the load ratio exceeds the threshold value is displayed.

Use the following procedure to confirm the data.

1. Select {PM} in the main menu.
2. Select {STEP DIAGNOSIS}.
   – The STEP DIAGNOSIS window is shown.
   The maximum 50 measured data appears on the window.



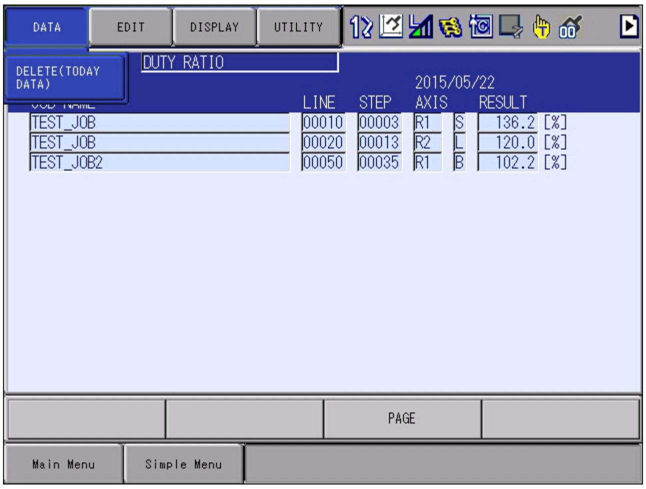
3. Press {PAGE}
   – It is possible to check the data of the date whose number corresponds to the number of pressing {PAGE}. Modify if necessary.
   The data of the maximum 50 days can be checked.

■ Management of Data

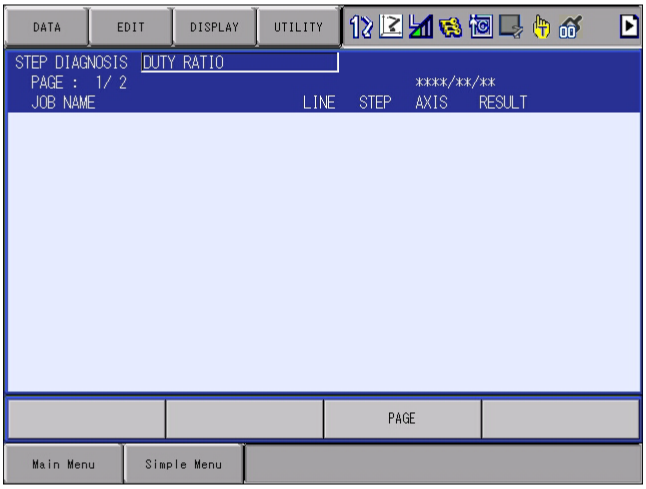
Use the following procedure to delete the measurement data for the current day.

> **NOTE**
>
> • The measurement data for the current day can be deleted when the security mode is set to management mode or higher.

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



2. Select {DELETE (TODAY DATA)}
   – The measurement data for the current day is deleted.



The step diagnosis data can be saved by the external memory menu.

For details of the external memory menu, refer to chapter 7 “External Memory Device” in “YRC1000micro OPERATOR’S MANUAL (RE-CSO-A058)”.

1. Select {EX.MEMORY} in the main menu.
2. Select {SAVE}.
3. Select “SYSTEM DATA”.
4. Select “STEP DIAGNOSIS DATA”.
   – The selected system data is displayed with “★”.
5. Press [ENTER].
6. Select {YES}.
   – “STEP DIAGNOSIS DATA” is saved.

8.35 Overload Detection Function

There may be a negative impact on the service life of the robot if the tool information in the tool file is incorrectly set. This function detects the overload that occurs in this state.
This function is available for YBS3.00-00 or later.

If the generated torque of each axis exceeds the upper limit value, a system output signal for overload detection is output and the following message appears.
"Robot might be getting overload. Check its load or settings of tool file."

<System Outputs>

51247	51246	51245	51244	51243	51242	51241	51240
SOUT#0992	SOUT#0991	SOUT#0990	SOUT#0989	SOUT#0988	SOUT#0987	SOUT#0986	SOUT#0985
DETECT OVERLOAD R8	DETECT OVERLOAD R7	DETECT OVERLOAD R6	DETECT OVERLOAD R5	DETECT OVERLOAD R4	DETECT OVERLOAD R3	DETECT OVERLOAD R2	DETECT OVERLOAD R1

This message and the system output signals continue until the operations listed below. The message is not reset by turning the control power supply OFF and ON.

- Editing on the tool coordinate window.
- Executing automatic measurement of the tool load and the center of gravity.
- Loading settings (TOOL.CND) from external memory devices.

9 System Backup

For the YRC1000micro, the system data or its software 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 YRC1000micro

For the YRC1000micro, two types of system data, CMOS.BIN and CMOSBK.BIN, can be collectively backed up.

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.

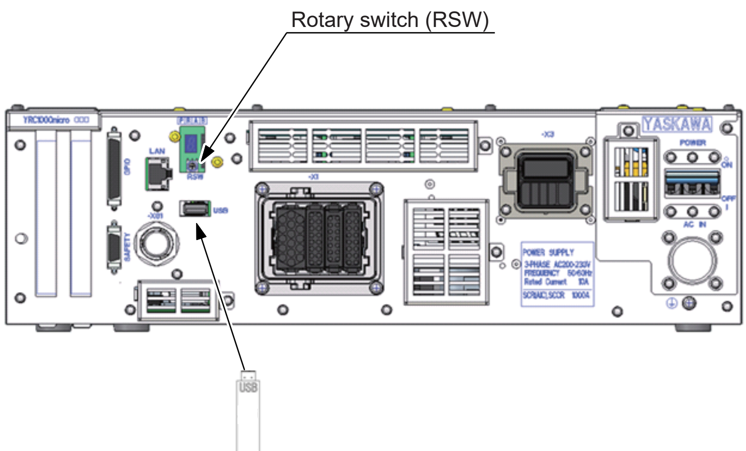
Load: Perform in the maintenance mode.
(the management mode or higher mode)

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 "Saving Data" in chapter 7.3 of "YRC1000micro OPERATOR'S MANUAL (RE-CSO-A058)".

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

The YRC1000micro enables the backing up of CMOS.BIN files and CMOS.BIN + system software without the programming pendant, as the programming pendant is optional. When performing this operation, change the rotary switch on the front panel of the YRC1000micro as follows, and then connect the USB memory.

The YRC1000micro cannot format a USB memory by using the controller.



Rotary switch	Operation mode	Remarks
0	Normal operation mod	
5	Upgrade mode	Refer to YRC1000micro UPGRADE PROCEDURE MANUAL (HW1484484).
A	Backup of the CMOS.BIN file	*chapter 9.6 "Automatic Backup Function"*
B	Backup of the CMOS.BIN + system software	*chapter 9.7 "Loading the Backup Data from the SD Card"*

9.1.1.2 CMOSBK.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 9.6*.

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 YRC1000micro 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>

No.	Manufacturer	Model	Capacity
1	Hagiwara Solutions	NSD6-512MS(P01SEI-YE	512MB
2	Hagiwara Solutions	NSD6-001GH(A01SDI	1GB
3	Hagiwara Solutions	NSD6-002GH(A01SDI	2GB
4	Hagiwara Solutions	NSD6-004GH(B20SEI	4GB
5	Hagiwara Solutions	NSD6-008GH(B20SEI	8GB
6	Hagiwara Solutions	NSD6-016GH(B20SEI	16GB
7	Hagiwara Solutions	NSD4-032GH(B00MG)	32GB

< Recommended USB Memory>

No.	Manufacturer	Model	Remarks
1	Hagiwara Solutions	UBA2-xxxGSRB (TBAIA)	1GB, 2GB, and 4GB are available. “xxx” indicates “001” for “1GB”, “002” for “2GB” and “004” for “4GB”.

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.

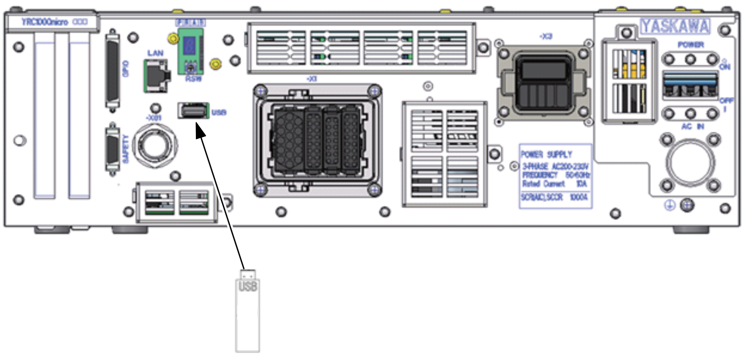
NOTE

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.

The USB memory can be connected to the USB connected on the CPU board (JANCD-ACP31-1E).
Forcible insertion may result in the damage of the USB memory and the USB connector



NOTICE

- In case the USB memory is not recognized or an error message appears, pull out it and try inserting it again.

9.2 Backup by CMOS.BIN

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

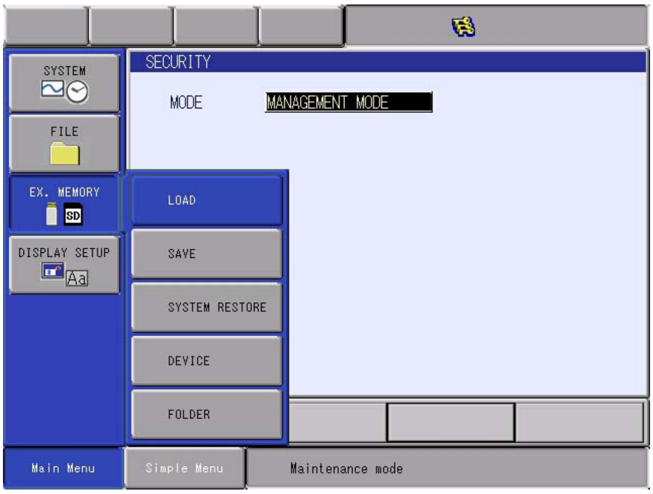
The chart below shows the availability of CMOS save/CMOS load in each security mode in the maintenance mode.

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

9.2.1 CMOS.BIN Save

Follow the procedures below to save CMOS.BIN in the maintenance mode.

1. Turn ON the YRC1000micro 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.

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

5. Select {CMOS}.

   – The confirmation dialog box appears.

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.

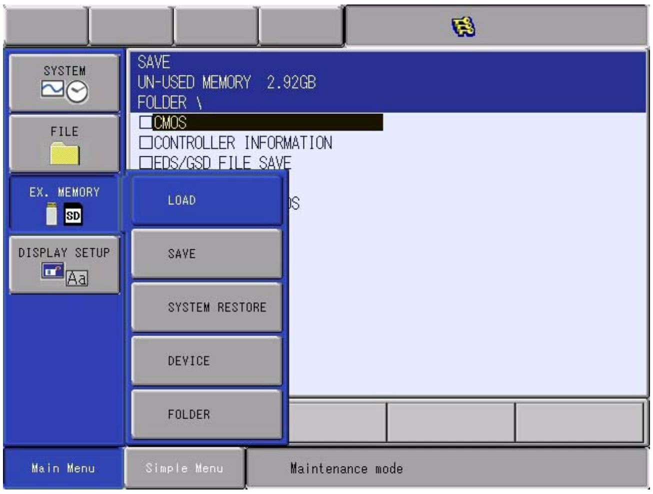
NOTE

When not using the data stored in the portable memory device, make sure to keep the device under an appropriate management.

9.2.2 CMOS.BIN Load

Follow the procedures below to load CMOS.BIN.

1. Turn ON the YRC1000micro 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.

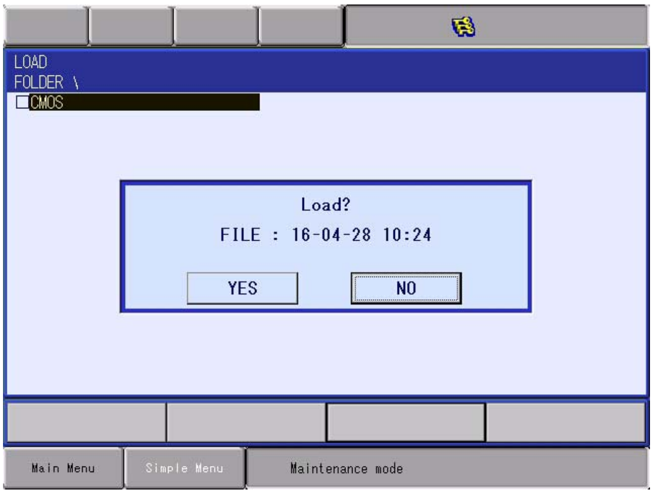


5. Select {LOAD}.
   – The load display appears.

   – The items marked with “■” cannot be selected.

6. Select {CMOS}.

   – The confirmation dialog box appears.



7. Select {YES}.

   – The loaded CMOS.BIN file contents are reflected in the data inside the robot.

NOTICE

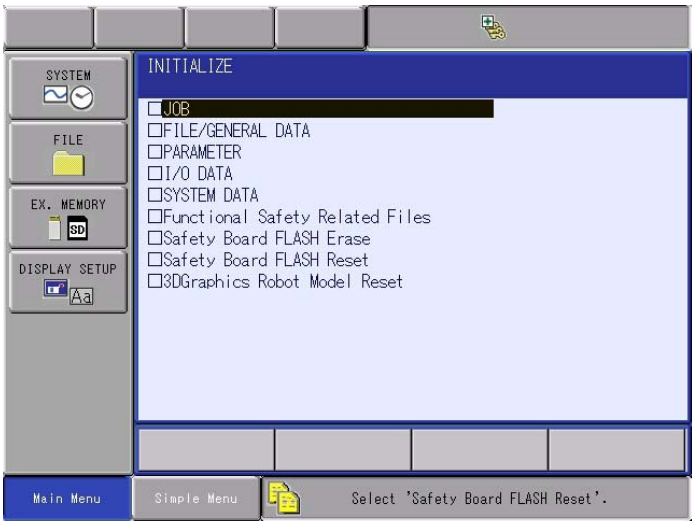
When the “CMOS load” is performed, the current CMOS data is replaced with the CMOS data (the contents of “CMOS.BIN”) in the selected device. Therefore, before performing the load, make sure to perform the “CMOS Save” of the CMOS data to be loaded.

   – When the message "Loading system data. Don't turn the power off." on the human interface display area disappears, the loading process is complete.
   When the loading process for the CMOS.BIN file is complete, the message "Select 'Safety Board FLASH Reset'" on the human interface display area appears. Perform "Safety Board FLASH Reset" by referring to the following procedure.

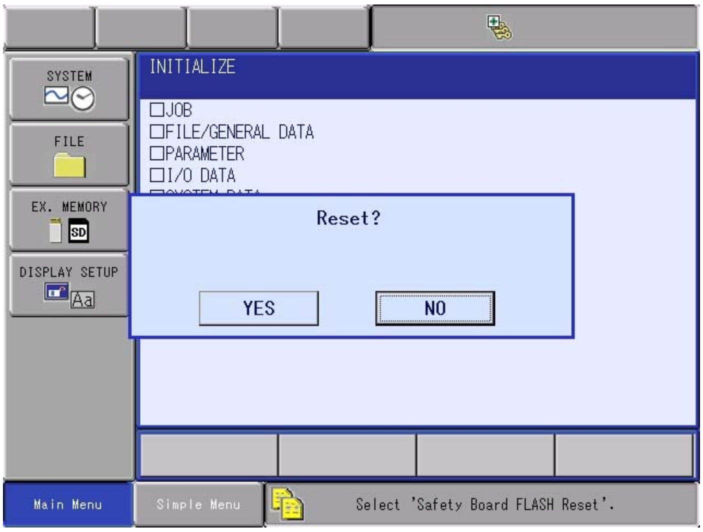
8. Change the security to the safety mode.

9. Select {FILE} - {INITIALIZE} under the main menu.

   – The INITIALIZE window appears.



   – A confirmation dialog box appears.

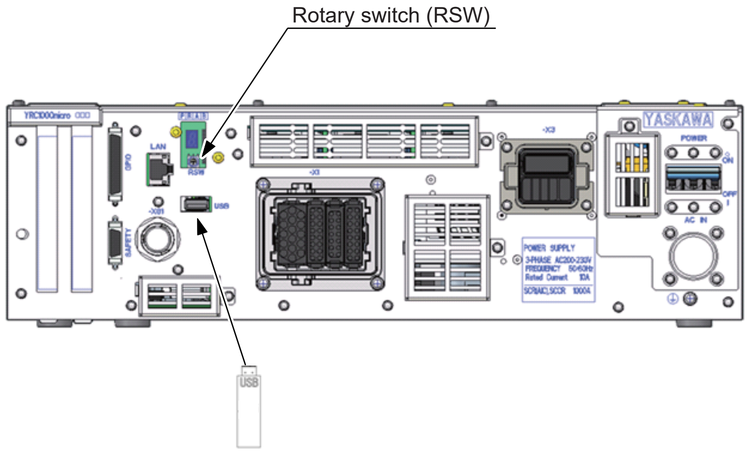


10. Select {YES}.

   – When the message "Select 'Safety Board FLASH Reset'" on the human interface display area disappears, the safety board FLASH data reset is complete.

9.3 Saving a CMOS.BIN File When the Programming Pendant is not Used

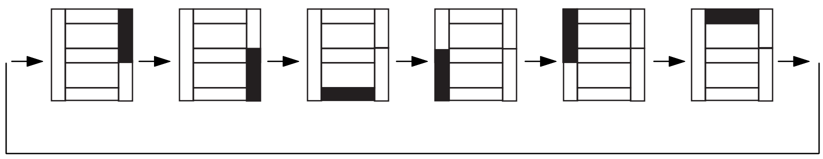
1. Change the rotary switch (RSW) on the front panel of the YRC1000micro "0" to "A". When changing the rotary switch, use a precision screwdriver (flathead, 2 mm). Then connect the USB memory to the YRC1000micro.



2. Turn on the YRC1000micro power supply.

   – The saving process of a CMOS.BIN file to the root directory of the USB memory starts.

   – -While saving the data, the 7SegLed rotates every second and displays as shown below.



   – When the process is complete, the 7SegLed repeats the full-ON state and the full-OFF state every second.

NOTE

- The CMOS.BIN file is written in the root directory of the USB memory. In case CMOS.BIN file is already in the root directory of the USB memory, the file is forcibly overwritten.
- While saving the data to the USB memory, do not disconnect the USB memory. It may result in the corruption of the file contents or damage to the USB memory.
- Two or more USB memories cannot be used simultaneously for one USB connector.

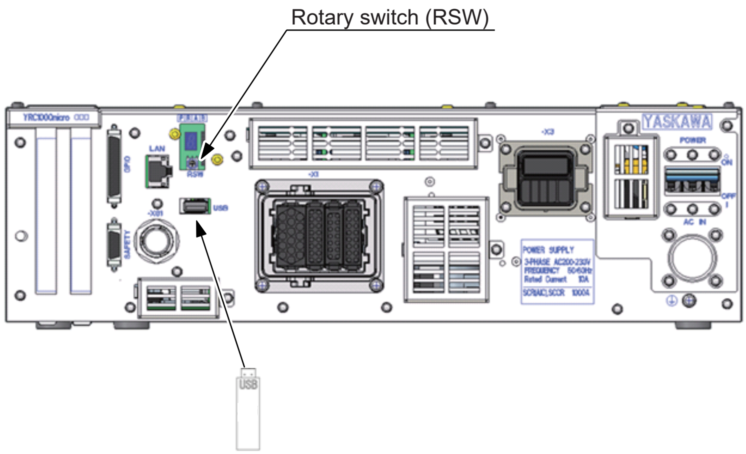
3. When the saving process of the CMOS.BIN file is complete, turn OFF the YRC1000micro power supply.
   However, if there is an access lamp on the USB memory, make sure to confirm that the access lamp is off before turning OFF the YRC1000micro power supply.

   – Return the rotary switch (RSW) on the front panel of the YRC1000micro from "A" to "0".

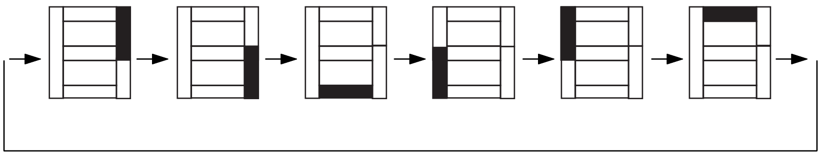
   – Disconnect the USB memory.

9.4 Saving a CMOS.BIN + System Software When the Programming Pendant is not Used

1. Change the rotary switch (RSW) on the front panel of the YRC1000micro from "0" to "B". When changing the rotary switch, use a precision screwdriver (flathead, 2 mm). Then connect the USB memory to the YRC1000micro.YRC1000micro



2. Turn on the YRC1000micro power supply.
   – The saving process of a CMOS.BIN + System software file to the USB memory starts.
   – -While saving the data, the 7SegLed rotates every second and displays as shown below.



   – When the process is complete, the 7SegLed repeats the full-on state and the full-off state every second.

- The CMOS.BIN file is written in the root directory of the USB memory. When there is a CMOS.BIN file in the root directory of the USB memory, the file is forcibly overwritten.
- When saving the data to the USB memory, do not disconnect the USB memory. It may result in the corruption of the file contents or damage to the USB memory.
- Two or more USB memories cannot be used simultaneously for one USB connector.

3. When the process is complete, turn OFF the YRC1000micro power supply.
   However, if there is an access lamp on the USB memory, make sure to confirm that the access lamp is off before turning OFF the YRC1000micro power supply.

   – Return the rotary switch (RSW) on the front panel of the YRC1000micro "B" to "0".

   – Disconnect the USB memory.

9.5 7SegLED Error Display

When the following error number appears on the 7SegLED, confirm the details of the error, and resolve the problem. The error number appears repeatedly.

7SegLED display	Errors and countermeasures
E0001	No USB is inserted in the YRC1000micro. Insert a USB, and then perform the operation again.
E0010	RC_SETUP.INI file does not exist in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0011	A file registered in the RC_SETUP.INI file in the SD card in the JANCD-ACP31-1E board does not exist. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0020	File open error occurred in the USB in the YRC1000micro. Turn the YRC1000micro power OFF and ON again. If this error occurs again, turn OFF the YRC1000micro power and replace the USB.
E0021	File read error occurred in the USB in the YRC1000micro. Turn the YRC1000micro power OFF and ON again. If this error occurs again, turn OFF the YRC1000micro power and replace the USB.
E0022	File close error occurred in the USB in the YRC1000micro. Turn the YRC1000micro power OFF and ON again. If this error occurs again, turn OFF the YRC1000micro power and replace the USB.
E0023	File access error occurred in the USB in the YRC1000micro. Turn the YRC1000micro power OFF and ON again. If this error occurs again, turn OFF the YRC1000micro power and replace the USB.
E0030	The SD card in the JANCD-ACP31-1E board is set to LOCK (write prohibited). Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0031	Failed to write a file into the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0032	Failed to delete a file in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0033	File open error occurred in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0034	File write error occurred in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0035	File close error occurred in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0036	File access error occurred in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0040	Failed to delete a directory in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0041	Attempted to create directories more than the specified number of layers of the hierarchy in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.

7SegLED display	Errors and countermeasures
E0042	Failed to acquire the directory information from the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0043	Failed to access a file/directory in the SD card in the JANCD-ACP31-1E board because the number of characters in the path of the file/directory exceeded the specified number. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0044	Failed to create a directory in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0050	Failed to change the name of a file in the SD card in the JANCD-ACP31-1E board. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0051	Failed to write a file in the SD card in the JANCD-ACP31-1E board into contiguous clusters in the FAT. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card.
E0700	Error code for YASKAWA. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card in the JANCD-ACP31-1E board.
E0800	Error code for YASKAWA. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card in the JANCD-ACP31-1E board.
E0801	Error code for YASKAWA. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card in the JANCD-ACP31-1E board.
E0881	Error code for YASKAWA. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card in the JANCD-ACP31-1E board.
E0882	Error code for YASKAWA. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card in the JANCD-ACP31-1E board.
E9xxx	Error code for YASKAWA. Turn the YRC1000micro power OFF and ON again. If this error occurs again, replace the SD card in the JANCD-ACP31-1E board.

x: Indicates the number from 0 to 9.

9.6 Automatic Backup Function

9.6.1 Automatic Backup Function

9.6.1.1 Objective

With the automatic backup function, the data saved in the YRC1000micro 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 inserted in the programming pendant
- USB Memory connected to the ACP31 board
- The SD card of the ACP31 board
- The RAM AREA of the ACP31 board (It will display, when the high speed Ethernet server function is effective.)

NOTE: The automatic backup function is enabled only while the YRC1000micro power supply is ON whereas it isn't while in the maintenance mode or the power supply is OFF.

9.6.1.2 Outline

The automatic backup function saves the internally stored data in a single file in advance for the smooth restoration from unexpected troubles of the YRC1000micro.

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 YRC1000micro and when inputting signals are also available for some specific versions.

With the automatic backup function, all the part where the internal data is stored in the physical memory area is collectively saved. If there is any data which is in the middle of changing while executing the automatic backup function, the data might not be usable for restoration because of its inconsistency. Therefore, the function is terminated with an error during the play back operation or while the manipulator is in motion so that the automatic backup cannot be operated. Set the automatic backup function to be executed while the manipulator is not in the playback status and while the manipulator is stopped.

The automatic backup function has the following functions and features.

No	Function/Feature	Explanation
1	Cyclic backup In the teach mode, the data in memory is backed up in a specified cycle from a specified starting time.	This function backs up as much of the latest data as possible during editing. The backup data saved in the SD card can be loaded to the YRC1000micro in case of data loss so that the damage can be minimized.
2	Backup when switching modes When switching the mode from the teach mode to the play mode, the data in memory is backed up.	The editing data is backed up when editing is completed. The latest data is automatically backed up with this mode.
3	Backup when start-up When the YRC1000micro is start-up, the data in memory is backed up.	When the YRC1000micro starts up, the data in memory is backed up. Since the editing/playback operation is usually completed when the YRC1000micro power is turned OFF, the latest data is automatically backed up with this mode.
4	Backup when inputting specified signals The data in memory is backed up when a specified signal (#40560) is input.	The data in memory is backed up by the signal from the host at the intended timing. Although the above mentioned items 1 to 3 are designed to back up the data automatically, this function backs up the data in accordance with the instruction from the host.
5	Backup while robot program is stopped The backup during playback is disabled. However, in the play mode, the backup is enabled if the robot is stopped. (“Cyclic backup” and “Backup when inputting specified signals”)	Backs up the variables for essential data.
6	Backup and retry at low priority The data in memory is backed up at low priority so that this operation does not affect the other operations. When other operations affect the backup operation, the backup is suspended and retried later.	The backup operation hardly affects the other operations so that the programming pendant can be used even during the backup operation.
7	Backup in binary The data is saved as binary data.	Backup in binary allows the system to be easily and speedily restored.
8	Setting of items Parameters can limit the settings of the backup condition.	Unnecessary settings can be avoided with this setting.

9.6.2 Settings for Automatic Backup

To set the automatic backup function, set each item at the automatic backup display.

> **NOTE**
>
> Four ways to perform the automatic backup are available: “Cyclic”, “Backup when switching modes”, “Backup when start-up”, and “Backup inputting specified signals”.
>
> 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.

9.6.2.1 The SD Card inserted in the Programming Pendant

To use the automatic backup function, insert the SD card into the SD card slot on the programming pendant.

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, the “Check the media insertion” error occurs. 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.

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.

9.6.2.2 USB Memory connected to the ACP31 Board

The USB memory connected to the ACP31 board can also be used as the backup device for the automatic backup function. The USB memory connected to the ACP31 board can be used in the same manner as the SD card inserted in the programming pendant.

For the USB memory for automatic backups, refer to "Recommended USB Memory" in *chapter 9.1.2 “Device”*.

9.6.2.3 The SD Card of the ACP31 Board

Set the following procedures in advance to back up to the SD card of the ACP31 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 (ACP31)}, and change the “NOT USED” to “USED”.
   – 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 ACP31. 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 {SETUP}-{AUTO BACKUP SET}.
9. If the device is set to "SD: Pendant" or another value and that device is not connected, the "Check the media insertion" error occurs. 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 ACP31 board should be done while the robot is not operating.

When access to SD card of the ACP31 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 ACP31 board takes three to ten minutes.)

9.6.2.4 RAMDISK on the ACP31 Board

RAMDISK will be shown when the high speed Ethernet server function is effective. Refer to “YRC1000micro OPTIONS INSTRUCTIONS FOR ETHERNET FUNCTION (HW1484452)” for more details.

9.6.2.5 YRC1000micro Status and Automatic Backup

Backup Timing	**YRC1000micro Status**		**Automatic Backup**	
			SD card ready to save the data	**Absence or insufficient capacity of the SD card**
From a specified starting time	Teach mode	Editing (Accessing to the memory)	Retry	Retry
		When editing is interrupted	Backup	Error
	Play mode Remote mode	Executing jobs	Disabled	Disabled
		When stopped	Backup	Error
When a specified signal (#40560) is input	Teach mode	Editing (Accessing to the memory)	Error	Error
		When editing is interrupted	Backup	Error
	Play mode Remote mode	Executing jobs	Disabled	Disabled
		When stopped	Backup	Error
When switching the mode from the teach mode to the play mode	-		Backup	Error
When the YRC1000micro starts up	-		Backup	Error

* Retry is not performed when an error occurs.

* An error can be indicated by a message depending on setting.

- **Reserve Time Backup**
  While the data in the YRC1000micro 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 YRC1000micro starts up**
  Since the automatic backup process is added to the YRC1000micro start-up process, a few extra seconds are needed to start up the YRC1000micro.

- **Backup when Specific Signal is Input**
  While the YRC1000micro 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.

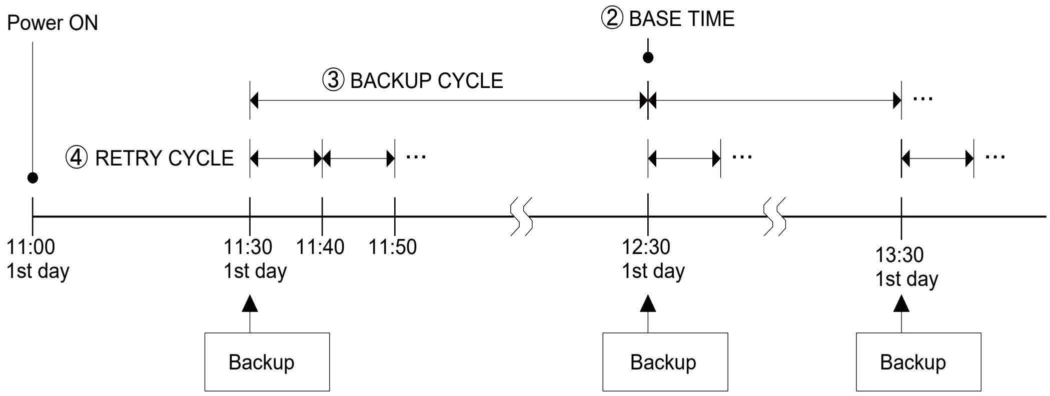
9.6.2.6 Setting Examples

- **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)

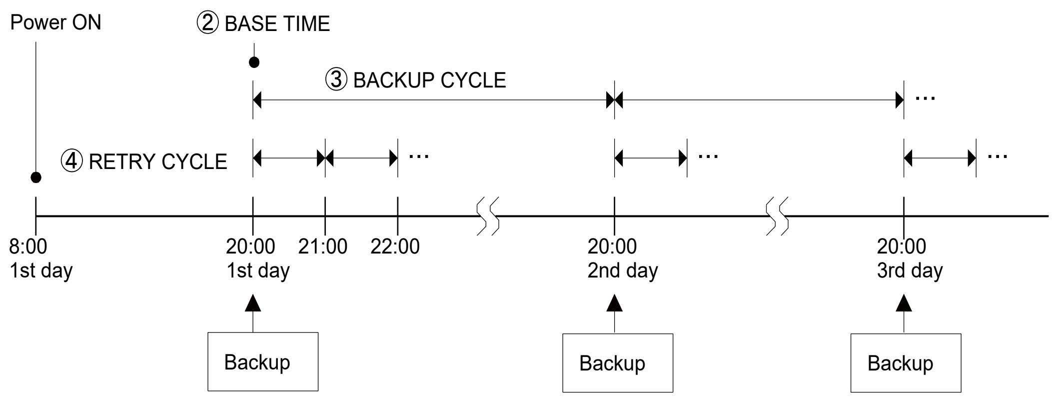


- **Setting Example 2**
  The following diagram shows a setting example with the following conditions:

  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.

9.6.2.7 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 YRC1000micro is started up)
- SPECIFIC INPUT BACKUP
  (VALID/INVALID of the backup when inputting specified signals)
- GP.OUT NO. ON ERROR
- DISPLAY AT EMERGENCY
- DURING ALARM OCCURENCE
- DEVICE
  (Setting of the device to store the automatic backup file)
- STORED FILE SETTING
  (It is possible to set when “SD: Pendant” or "USB1: Controller" is set in DEVICE.)

NOTE

When the “SD: Pendant” , "USB1: Controller", or “SD: Controller” is selected on the auto backup display, the capacity of the device will be checked. Therefore, a few seconds may be needed to open the setting window. For the “SD: Pendant” or "USB1: Controller", an error will occur without inserting the respective media.

When executing “ARRANGE”, the files “CMOSBK.BIN” and “CMOSBK??.BIN” (?? denotes figures) in the SD card or USB memory are changed in name or deleted. If a certain file of this type is needed to be saved before changed in name or deleted, evacuate it into a PC, etc. beforehand.

While an error occurring, the setting of the each item on the auto backup set display cannot be changed.

1. Turn ON the YRC1000micro.

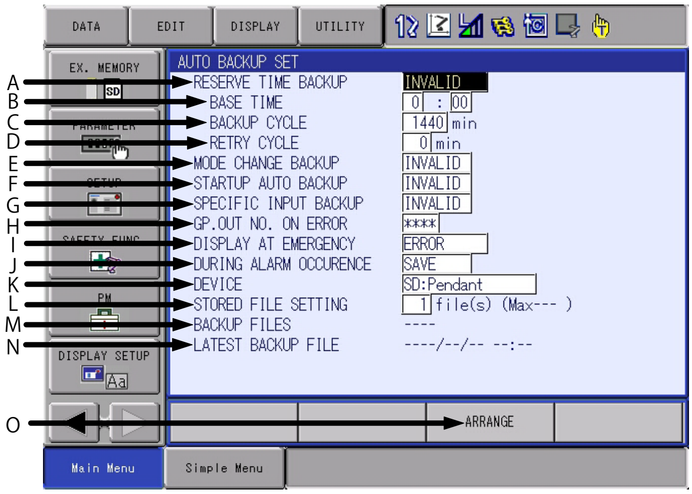
   – Insert the SD card to the programming pendant, when the backup is set on the SD card inserted in the programming pendant. If the YRC1000micro is set to make backups to the USB memory connected to the ACP31 board, connect the USB memory to the ACP31 board.

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.

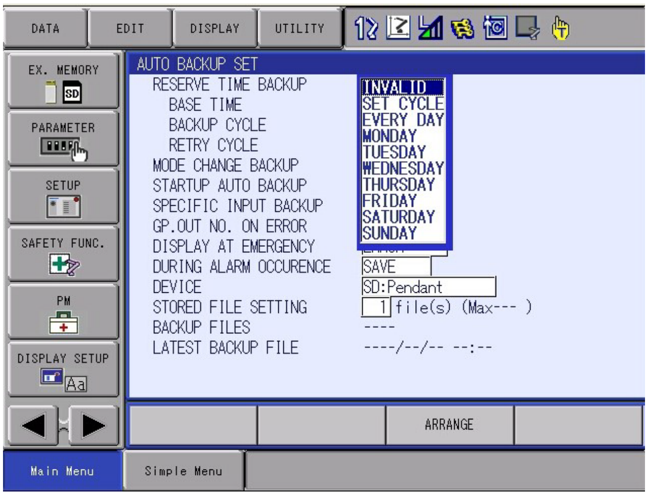


A. RESERVE TIME BACKUP

Pressing [SELECT] displays the following list. Select the item from "SET CYCLE", "EVERY DAY", or the day of the week ("MONDAY" to "SUNDAY").

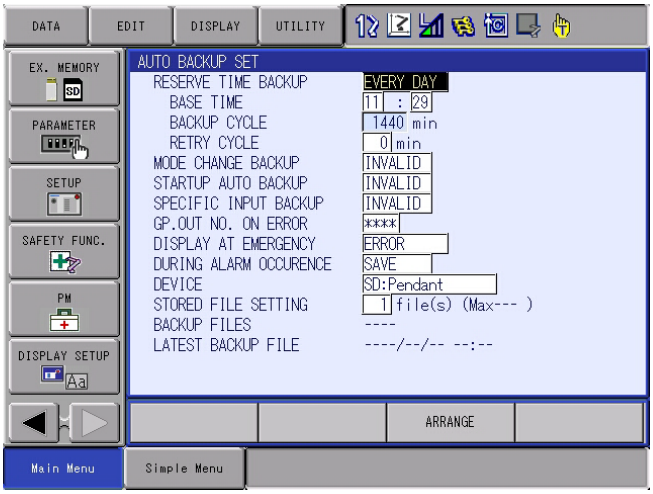
Please note that after setting the base time, the backup cycle, and the retry cycle, select the item from "SET CYCLE", "EVERY DAY", or the day of the week ("MONDAY" to "SUNDAY").

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.

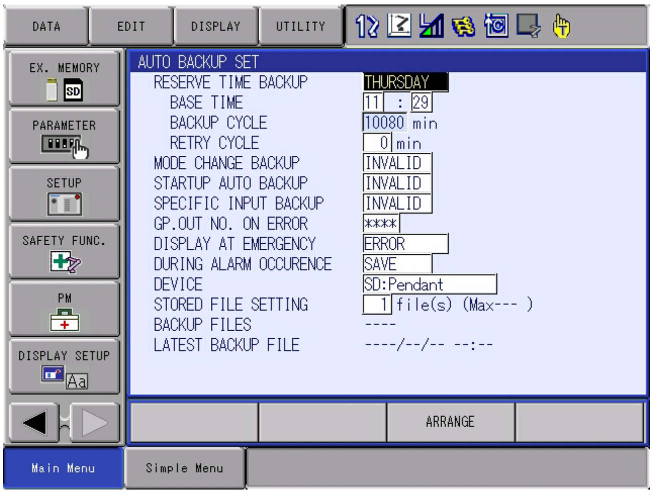


"INVALID": RESERVE TIME BACKUP is not performed.
"SET CYCLE": The automatic backup is performed every BACKUP CYCLE based on the specified BASE TIME.
"EVERY DAY": The automatic backup is performed at the specified BASE TIME every day.
"MONDAY" to "SUNDAY": The automatic backup is performed at the specified 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 YRC1000micro 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. GP.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.

The Device Name in Display	Explanation
SD: Pendant	Set the backup to the SD card inserted in the programming pendant.
SD: Controller	Set the backup to the SD card of the ACP31 board. When the “SD: Controller” of the device name is not shown, refer to *chapter 9.6.2.3 “The SD Card of the ACP31 Board”* .
RAMDISK	It will be shown when the optional function of High Speed Ethernet Server function is effective. It can back up by the YRC1000micro high speed Ethernet server function command. Refer to “YRC1000micro OPTIONS INSTRUCTIONS FOR ETHERNET FUNCTION (HW14834452)”.
USB1: Controller	Set the backup to the USB memory connected to the ACP31 board.

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 in the Programming Pendant or USB memory connected to the ACP31 board when this window is displayed. (Max is 100.)
The settings range from 1 to (Max).

M. BACKUP FILES

Indicates the existence of the files or the number of backup files stored in the SD card inserted in the Programming Pendant or USB memory connected to the ACP31 board when this window is displayed.

N. LATEST BACKUP FILE

Indicates the date of the latest file in the SD card inserted in the Programming Pendant or USB emory connected to the ACP31 board when this window is displayed.

O. ARRANGE

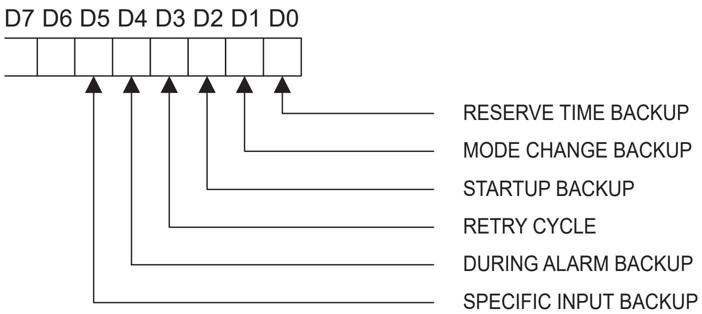
When "ARRANGE" is executed, the files with the name "CMOSBK.BIN" and "CMOSBK??.BIN" (?? denotes figures) on the selected device that exceed the maximum number of stored files are deleted.
The ?? (figures) part of the remaining "CMOSBK??.BIN" files is changed so that the number of remaining files does not exceed the maximum number of stored files.
Save any files with this name that should be kept to a PC or other device before deletion.
To reduce the number of files that are already backed up, change "STORED FILE SETTING" to the desired number of files and then select "ARRANGE".

5. Set the desired item, and press [ENTER].

- **Window Settings**

RS parameter can restrict the settings of some items in the automatic backup window.

When setting the bit of RS096 parameter shown below to “1”, the corresponding items are restricted. The restricted items are indicated with “INVALID” in the display and inputting/modification to the item becomes impossible. Also, the automatic backup does not function with the restricted items.



- **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.

9.6.3 Limiting the Automatic Backup File Creation

9.6.3.1 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
S2C682	Limits the backup file creation executed by the automatic backup function to once a day.	0 (Invalid) 1 (Valid)

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 9.6.2.7 "AUTO BACKUP FUNCTION SET Window"* .

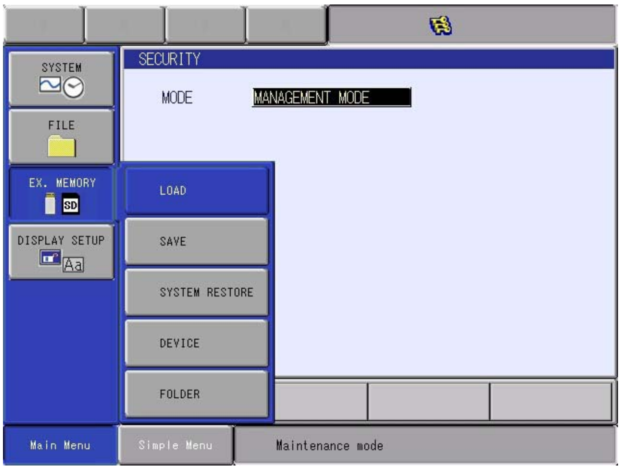
9.7 Loading the Backup Data from the SD Card

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.

9.7.1 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 ACP31 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 ACP31 board.)
   – The backup data is stored under the file name “CMOSBK.BIN” or “CMOSBK??.BIN” (?? denotes figures.)
2. Turn ON the YRC1000micro 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.



– When set the {SYSTEM}- {SETUP}- {OPTIONAL FUNCTION}- {AUTO BACKUP (ACP31)} as “USE”, the following sub menu appears.

5. Select {SYSTEM RESTORE}.

– The BACKUP FILE LIST display appears.

6. Select the file to be loaded.
   - The dialog box appears for the AIF/ACP31 board replacement confirmation.

   - Selecting {YES} initializes the system monitoring time.
   - Selecting {NO} to complete the loading process.
7. Select clear the system monitoring time or not. .

   - 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 YRC1000micro CMOS.
8. Select {YES}.
9. Turn the power on, while pressing the [MAIN MENU].
10. Change the security mode to the management or higher mode.

11. Select {EX. MEMORY} in the main menu.
    – The sub menu will appear.

12. Select {SYSTEM RESTORE (ACP31)}.
    – The backup-file list display will appear.

13. Select desired date file.
    - The AIF/ACP31 board dialog will appear.

    - Select {YES} when exchanged the AIF/ACP31 board. If not, select {NO}.
    - When select {YES}, cumulative time display will be initialized. For selecting {NO}, cumulative time display will continue.

14. Select from the confirmation dialog box.
    - The dialog box appears for the loading confirmation.

    - Select {YES} to initialize the system monitoring time and loading process is executed.
    - Select {NO} to continue counting the system monitoring time and loading process is executed.
      When loading process is executed, the memory device or SD card mounted on the ACP31 board is updated to the content of the file selected “CMOSBK.BIN” or “CMOSBK??.BIN” (?? denotes figures).

CAUTION

Note that by executing “SYSTEM RESTORE” or “SYSTEM RESTORE (ACP31)”, the current CMOS data in the YRC1000micro 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.

9.7.2 Safety Board FLASH ROM Data Reset

When the procedures described in *chapter 9.7 “Loading the Backup Data from the SD Card”* are completed, the message "Select 'Safety Board FLASH Reset" appears. Then, change the security to the safety mode and execute the operation described in *chapter 8.26.15.2 “Safety Circuit Board FLASH ROM Data Erase and Reset”* .

9.8 Error List

9.8.1 Error Contents

Error No.	Data	Message	Cause
0770	*	During robot or station operation	The automatic backup would not work when a manipulator or a station is in motion.
3390		File not found	The file to be loaded no longer exists.
3460	*	Cannot backup the media	
	1		Insufficient capacity of the on backup media (e.g., SD card).
	2		Cannot access backup media (e.g., SD card).
3463	*	Cannot store the backup data. The value specified for STORED FILE SETTING exceeds the maximum number	Confirm that the value specified for STORED FILE SETTING does not exceed the maximum number.
3501	*	Check the media insertion	Cannot access backup media (e.g., SD card).
3550	*	Under automatic backup operation. Operate after the backup is completed.	The automatic backup window cannot be called to display while the automatic backup is being processed.
3551	*	Under automatic backup operation. Operate \“SORT FILE\” after the backup is completed.	The file arrangement cannot be operated during the automatic backup operation.
3560	*	Failed in sorting backup file.	Failed to re-arrange the backup file for another reason than the access to backup media (e.g., SD card).
3580	*	Under backup file access. Operate after the access is completed.	To display another window and then display the automatic backup window again after “ARRANGE” operation, “ARRANGE” process should be completely finished.
3581	*	Under backup file access. Operate \“SORT FILE\” after the access is completed.	The previous “ARRANGE” process should be completely finished to perform the next “ARRANGE” operation.

10 Upgrade Function

10.1 Functional Overview

YRC1000micro applies two software for the CPU configuration: a software for ACP31 (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, YRC1000micro can upgrade the software for the programming pendant if the combination of the software for ACP31 and the programming pendant is invalid.

10.2 Upgrade Procedure

10.2.1 Confirmation of Software Version

The compatibility of the versions of ACP31 and the programming pendant are automatically checked in 20 seconds after the YRC1000micro power supply is turned on.

- In case the versions of ACP31 and the programming pendant matches.

1. Automatic upgrade process completes and the communication process between ACP31 and the programming pendant is restarted.

2. Initial window appears approx. 60 seconds later.

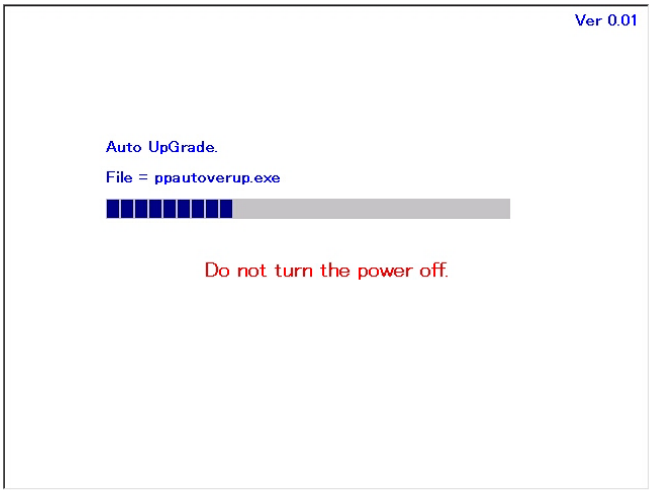
SUPPLE-MENT

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 for general purpose 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 ACP31 or the pendant application version of the programming pendant is not compatible to the one of ACP31, 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 ACP31 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 ACP31 starts again after restart of the programming pendant is done.
2. Initial window appears approx. 60 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 YRC1000micro without the auto upgrade process, press all of the [Interlock]+[5]+[Select] keys on the programming pendant at the same time to start.

NOTE

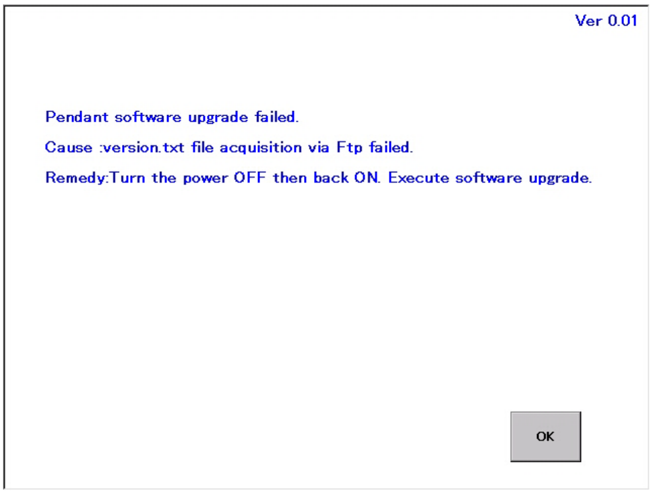
DO NOT turn off the main power supply during automatic upgrade process.

In case the main power supply is turned off, exercise the following process.

- Turn on the main power supply of YRC1000micro.
  – 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 “YRC1000micro UPGRADE PROCEDURE MANUAL (HW1484484)” 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.



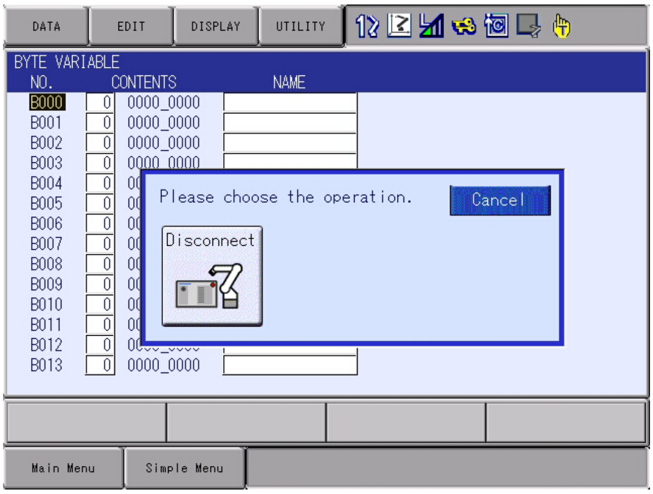
- Turn on the main power supply of YRC1000micro.
  – Automatic upgrade might be exercised again.
- In case error occurs during automatic upgrade process.
  (1) Prepare SD card or USB memory for upgrading.
  (2) Press [2]+[8]+[HIGH SPEED] of the programming pendant at the same time.
  - Upgrade of the OS of Programming Pendant
  (3) Press [INTERLOCK]+[8]+[SELECT] of the programming pendant at the same time and upgrade.
  - Refer to “YRC1000micro UPGRADE PROCEDURE MANUAL (HW1484484)” for detail.

11 Programming Pendant

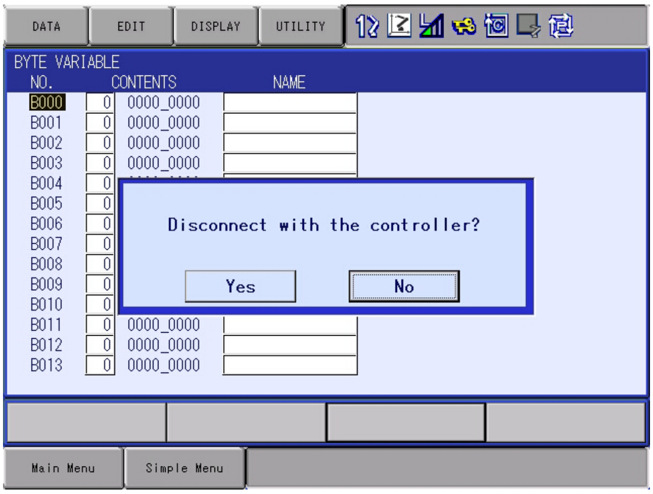
11.1 Disconnection Function

Disconnection function enables to cut off the communication between the programming pendant and the controller. Disconnection function enables only in remote mode.

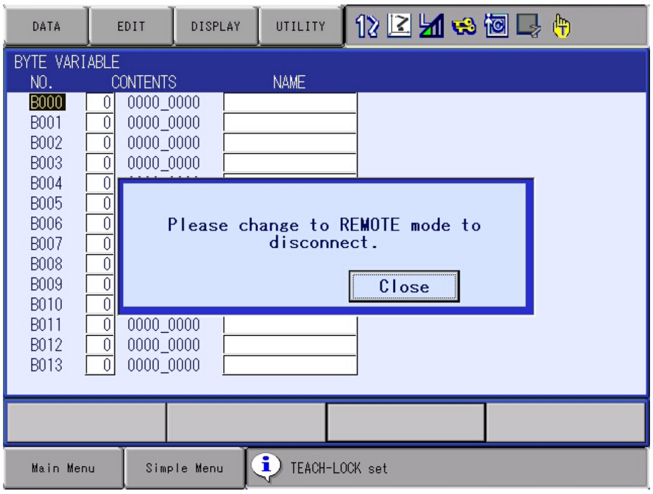
1. Change the mode key to management mode.
2. Long press [Simple Menu] key to show the pop-up menu.



3. Select “Disconnect” button, and the confirmation dialog appears.

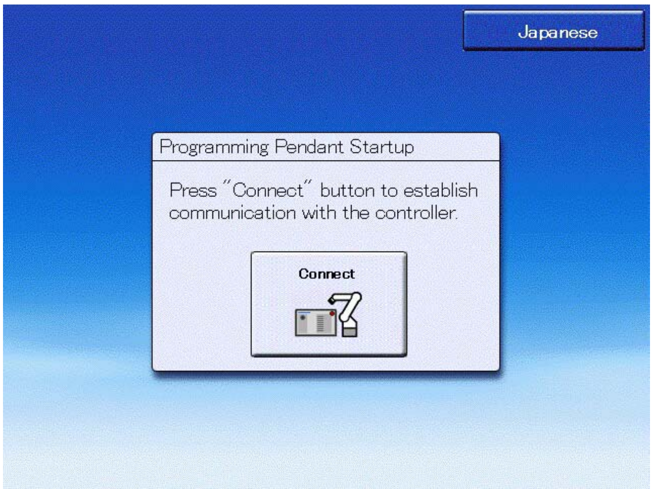


– An error dialog appears if {Disconnect the Communication} is selected in other than remote mode.



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” button.



CAUTION

- While the programming pendant startup window is displayed (while communication between the YRC1000micro 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 YRC1000micro cannot be changed by using the Mode Switch. To change the mode of the YRC1000micro, press “Connect” button in the startup window to connect the YRC1000micro 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.

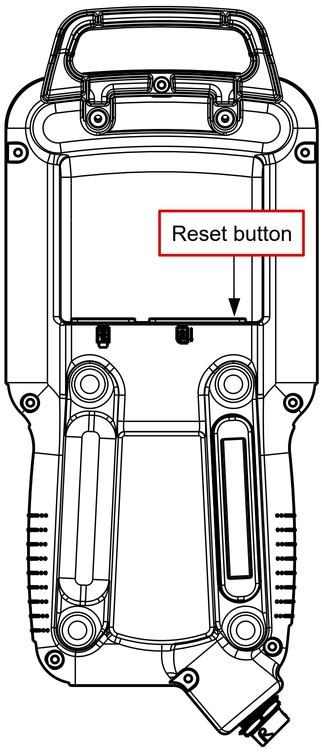
If unable to operate the robot by the programming pendant causing from the communications error of the programming pendant, recover the programming pendant by following procedures.

1. Confirmation of the 7SEG-LED display on the JANCD-ACP31-1E
   – Check the 7SEG-LED display on the JANCD-ACP31-1E.

SUPPLE-MENT

- 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

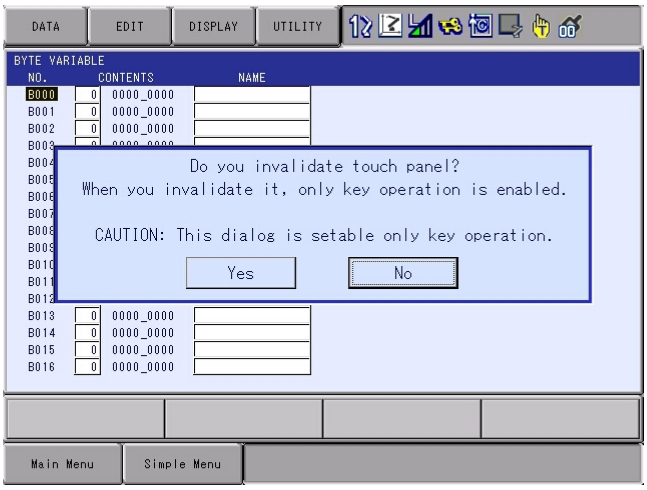
The touch panel invalidate function enables to invalidate the touch panel operation of the programming pendant (key operation is still valid).

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.

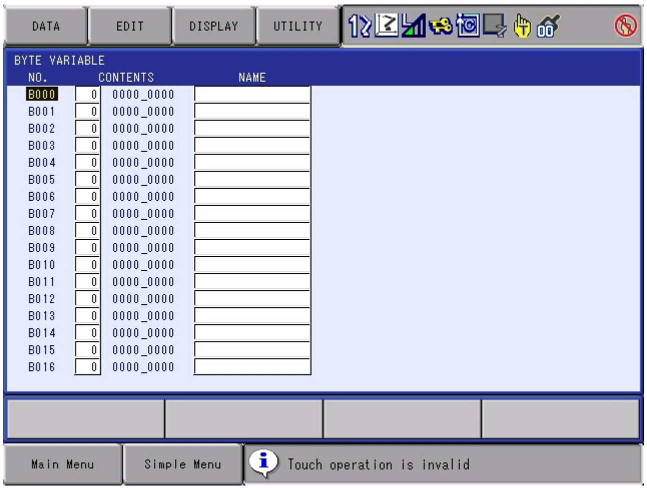
■ Invalidate the Touch Panel

1. Push down the [INTER LOCK]+[AUX] keys at the same time.
   The confirmation dialog to invalidate the touch panel appears.



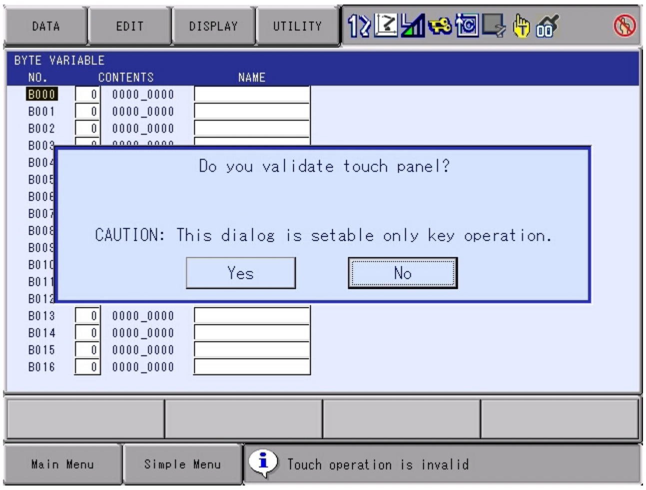
2. Move the focus area over the {YES} on the confirmation dialog by using [←] key.

3. Press [Select] key. The touch panel becomes invalid.
   When the touch panel is invalid, an icon, which shows the invalidating the touch panel, is displayed on the status area, and the message “Touch operation is invalid” is displayed on the message area.



Validate the Touch Panel

1. Push down the [INTER LOCK]+[AUX] keys at the same time.
   The confirmation dialog to validate the touch panel appears.



2. Move the focus area over the {YES} on the confirmation dialog by using [←] key.
3. Press [Select].
   The touch panel become valid.

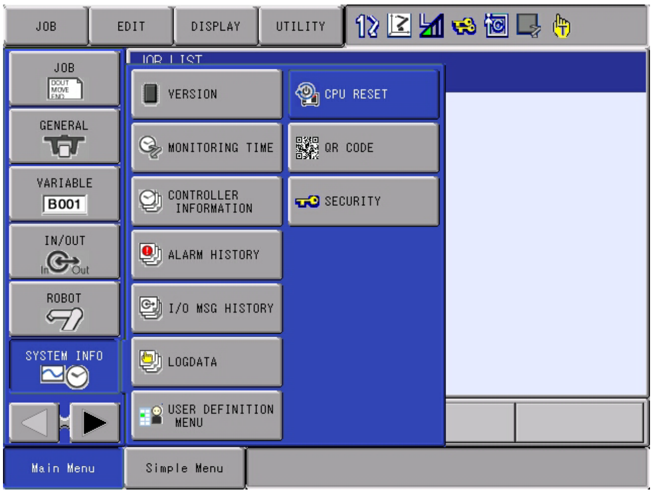
NOTE

- 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.

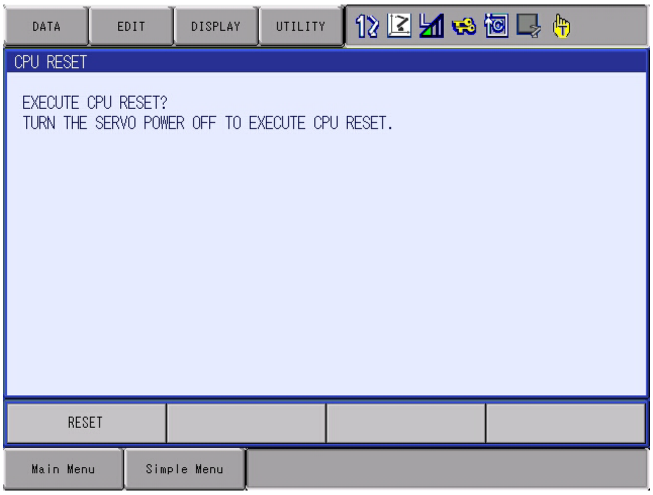
11.4 Reboot Robot System

After change a parameter, repair or maintenance, following 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.

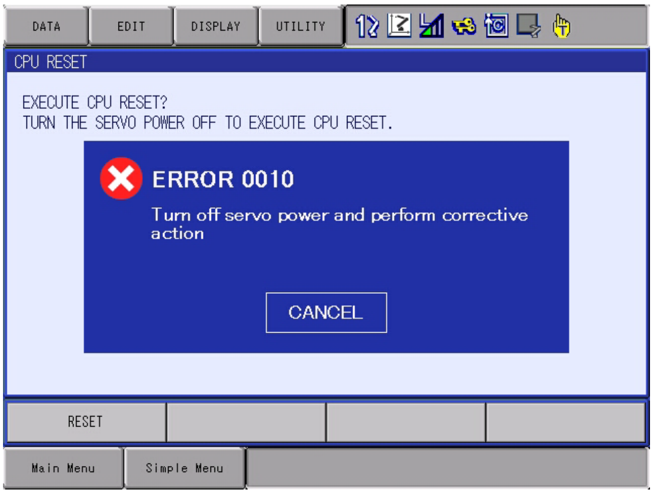


2. Confirm the servo power is OFF and select {RESET}.



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.

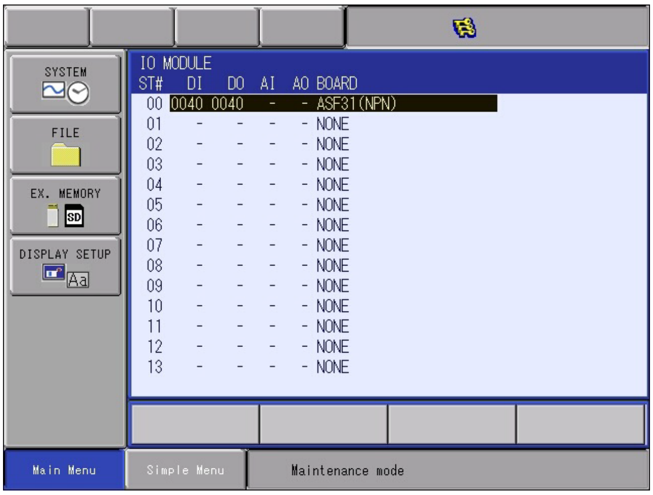
SUPPLE-MENT	Addition operation must be performed in the management mode. In the operation mode or editing mode, only reference of status setting is possible.

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

4. Select {SETUP}.
   – The SETUP window appears.
   – The items marked with “■” cannot be selected.

5. Select {IO MODULE}.

   – The current status of the mounted I/O module is shown.



6. Confirm the status of mounted I/O module.

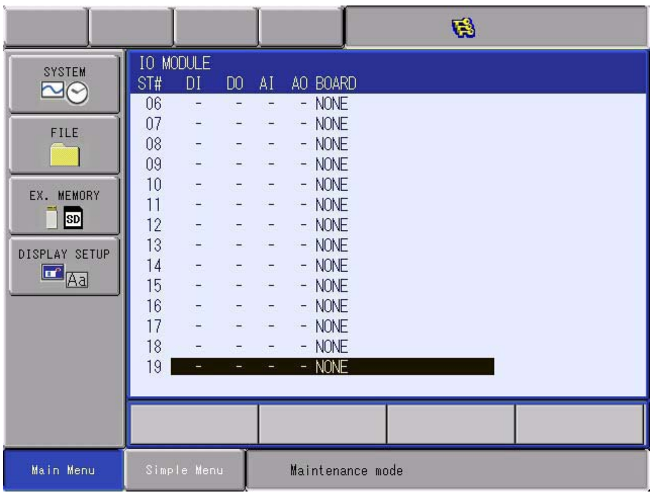
ST#	Station address of I/O module
DI	Number of contact input points1)
DO	Number of contact output points1)
AI	Number of analog input points1)
AO	Number of analog output points1)
BOARD	Circuit board type2)

   – 1) A hyphen, -, indicates that the corresponding I/O section is not mounted.

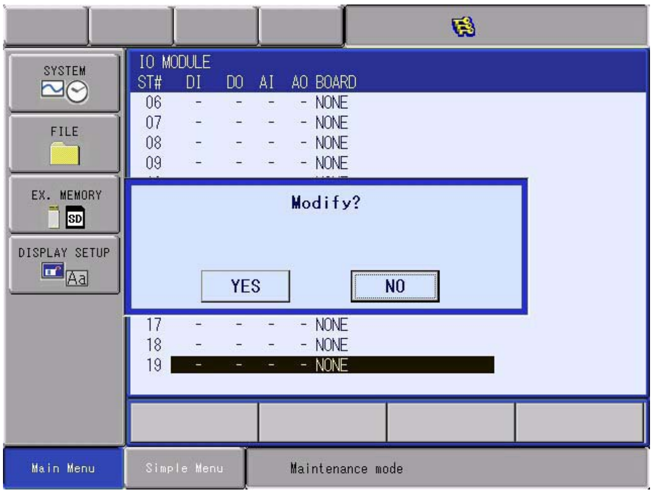
   – 2) If the system cannot recognize the circuit board type, a row of stars (*****) are shown. No problem will occur as long as the values displayed in DI, DO, AI, and AO are correct.

7. Press [ENTER] twice.

   – Confirm the statuses of the mounted I/O modules for the other stations.



8. Press [ENTER].
   – The confirmation dialog box is shown.



9. Select {YES}.
   – The system parameters are then set automatically according to the current mounted hardware status, and the window will be changed to the external I/O setup window.

   A message “Select ‘Safety Board FLASH Reset’” in the human interface area. However, do not select/perform Safety Board FLASH Reset at this point.

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.

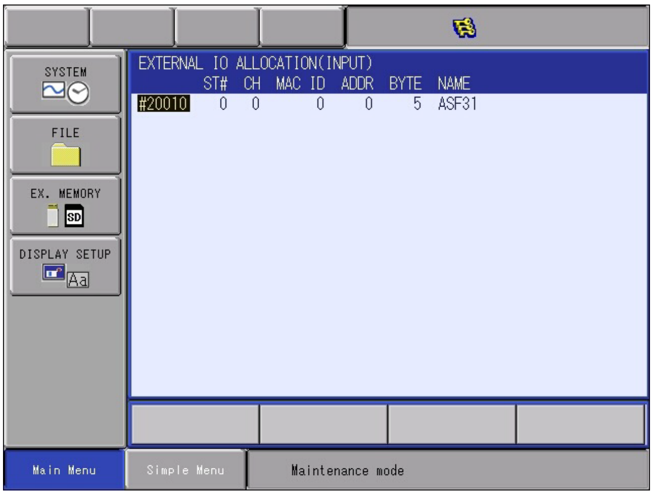
2. Select “AUTO” or “MANUAL” under the ALLOCATION MODE.
   – The selected menu appears.

NOTE

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.

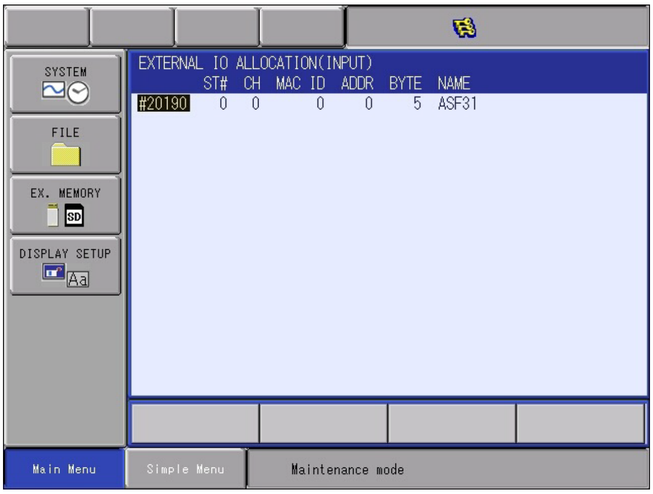


5. Select the external input signal number (at the change source) to be changed. (In the setting example, select “#20010”.)

   – 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.

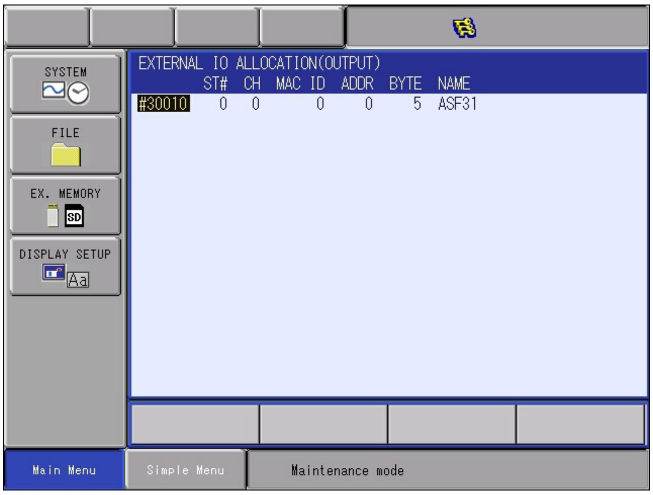


7. Likewise, select/modify the number of the external input signal.

   – Repeat select/modify until it becomes the desired allocation.

8. Press [ENTER].

   – The External Output Signals Allocation window appears.

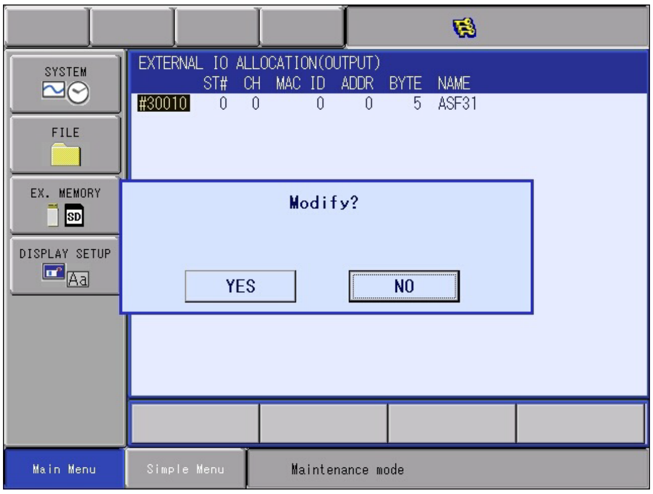


9. Like the case of the external input signal, select/modify the external output signal.

   – Repeat select/modify until it becomes the desired allocation.

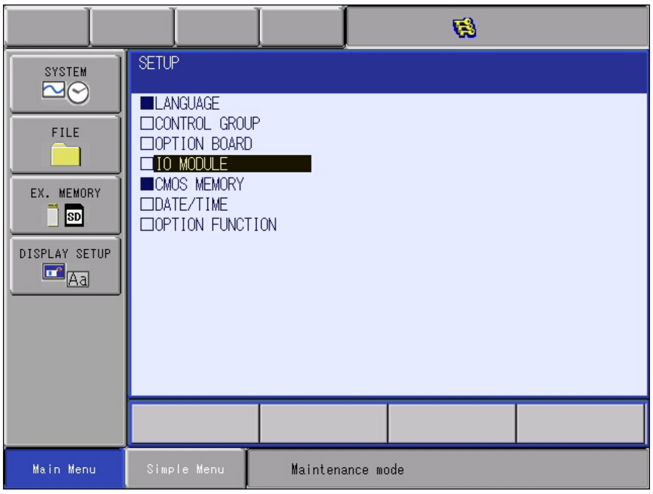
10. Press [ENTER].

   – The confirmation dialog box appears.



11. Select {YES}.

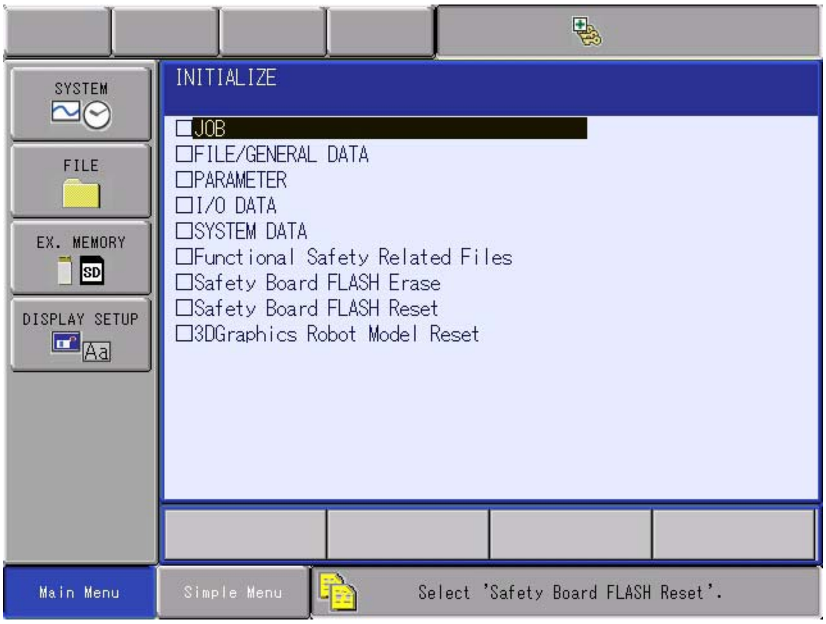
   – The settings are confirmed, and the SETUP window reappears.



12. Change the security mode to safety mode

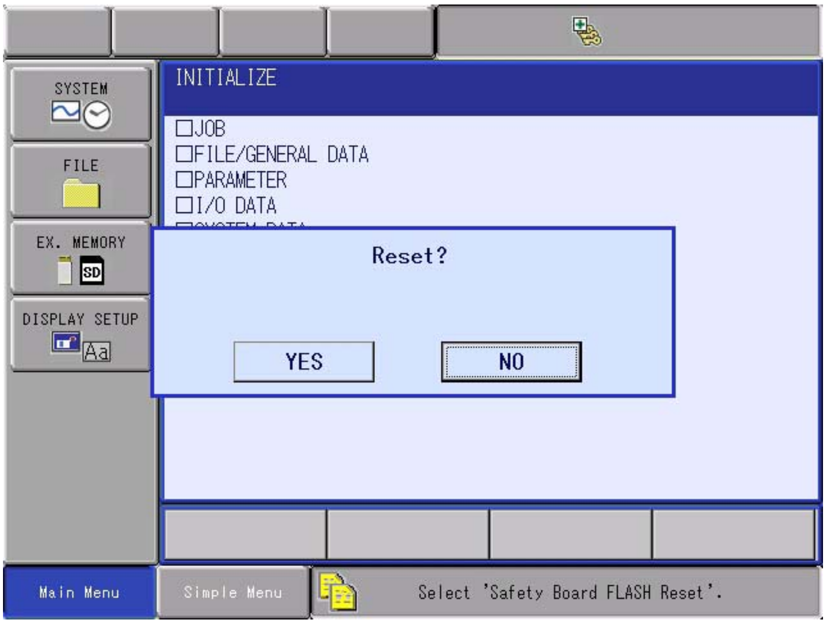
13. Select {FILE} - {INITIALIZE} under the main menu.

– The initialize window appears.



14. Select “Safety Board FLASH Reset”.

– A confirmation dialog box appears.

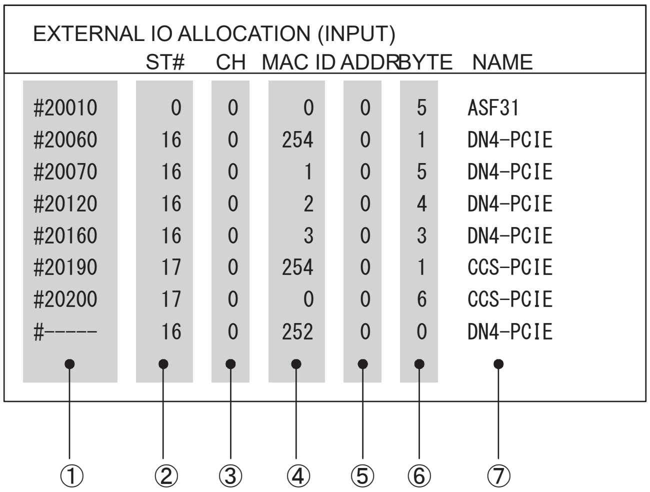


15. Select {YES}.

– When a message “Select ‘Safety Board FLASH Reset’” in the human interface area disappeared resetting of Safety Board FLASH Reset is complete.

■ 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.



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 YRC1000micro station number allocated to each I/O board. The displayed contents include the following:

0 : Safety IO I/F board (JANCD-ASF3□-1E)
16 : The first field bus board
(Normally, optional board inserted into the optional slot at the left side.)
17 : The second field bus board
(Normally, optional board inserted into the optional slot at the right side.)

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

④ 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

⑤ 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.

⑥ BYTE

Indicates the size (number of bytes) inside each I/O area.

⑦ 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.

SUPPLE-MENT

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

When adding a base and a station axis, set the following items:

- TYPE

  Select one in the type list.

  - In case of base axis (B1,B2)

    Select one of RECT-X, -Y, -Z, -XY, -XZ, -YZ or -XYZ.

  - In case of station axis (S1,S2, S3)

    Select UNIV-* ("*" represents the number of axes) when using a mechanism other than the registered type as a station axis.

- CONNECTION

  In the CONNECTION window, specify the SERVOPACK which is connected with each axis group, the contactor which is used for the SERVOPACK, and the overrun signal (OT).

- AXIS TYPE

  Select from the axis type list.

  - In case of TURN-* type

    No need to select (The axis type is set as TURN type.)

  - In case of RECT-* type

    Select BALL-SCREW type or RACK & PINION type.

  - In case of UNIV-* type

    Select BALL-SCREW type, RACK & PINION type or TURN type.

- MECHANICAL SPECIFICATION

  - If axis type is ball-screw type, set the following items:
    - MOTION RANGE (+) [mm]
    - MOTION RANGE (-) [mm]
    - REDUCTION RATIO (numerator)
    - REDUCTION RATIO (denominator)
    - BALL-SCREW PITCH [mm/r]

- If axis type is rack & pinion type, set the following items.
  - MOTION RANGE (+) [mm]
  - MOTION RANGE (-) [mm]
  - REDUCTION RATIO (numerator)
  - 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

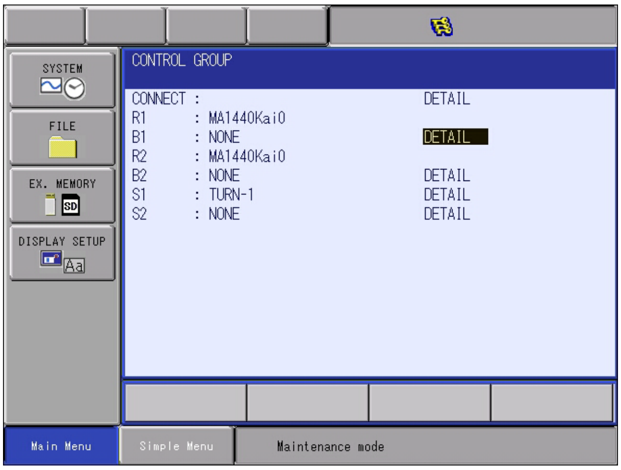
Select the type of base axis to be added/modified.

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.

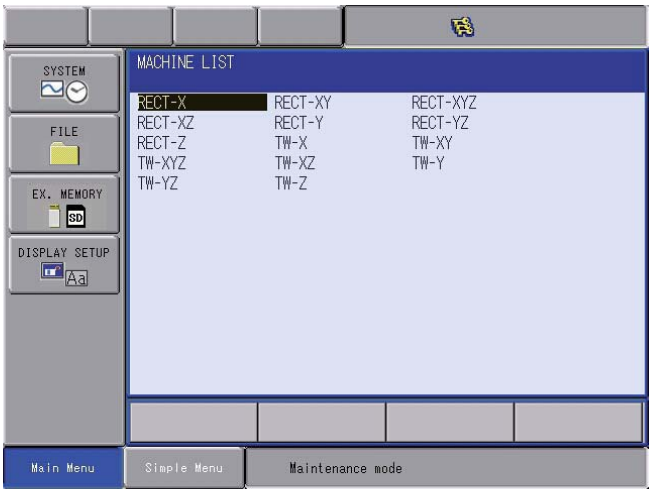
5. Select {CONTROL GROUP}.

   – The current control group type is displayed.



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

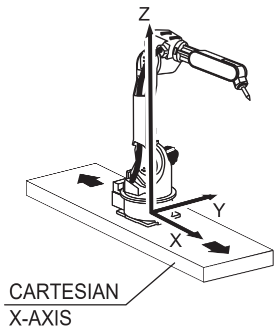
   – The MACHINE LIST window is displayed.



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

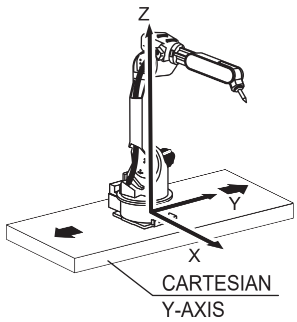
7. Select one in the type list.
   – After the type selection, the window returns to the CONNECT window.

RECT-X



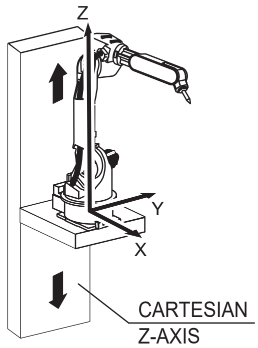
Base axis direction of travel coincides with robot coordinate X-Axis.

RECT-Y



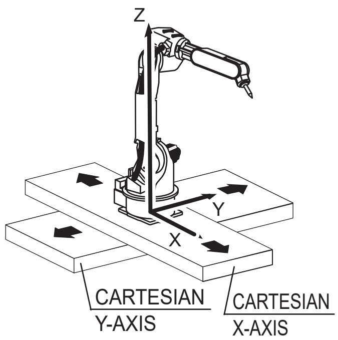
Base axis direction of travel coincides with robot coordinate Y-Axis.

RECT-Z



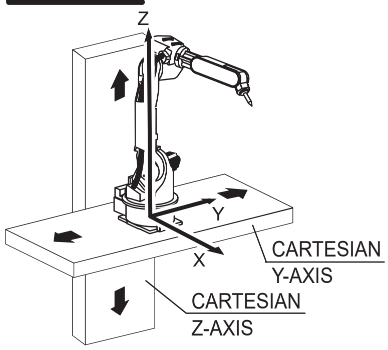
Base axis direction of travel coincides with robot coordinate Z-Axis.

RECT-XY



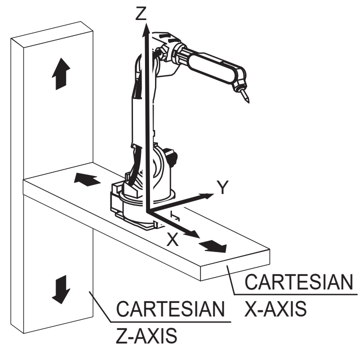
Base 1st and 2nd axes directions of travel coincide with robot coordinate X-Axis and Y-Axis, respecitively.

RECT-YZ



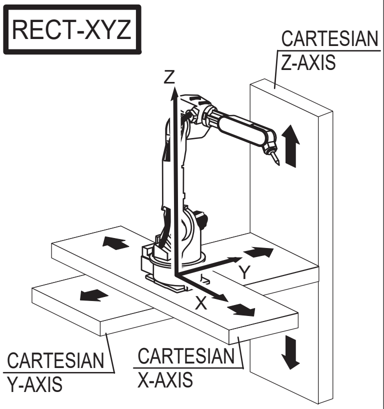
Base 1st and 2nd axes directions of travel coincide with robot coordinate Y-Axis and Z-Axis, respectively.

RECT-XZ



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

RECT-XYZ

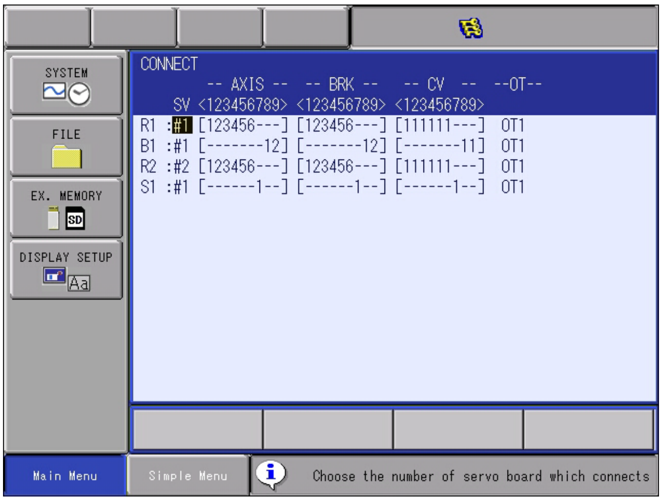


Base 1st, 2nd, and 3rd axes directions of travel coincide with robot coordinate X-Axis, Y-Axis, and Z-Axis, respectively.

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.

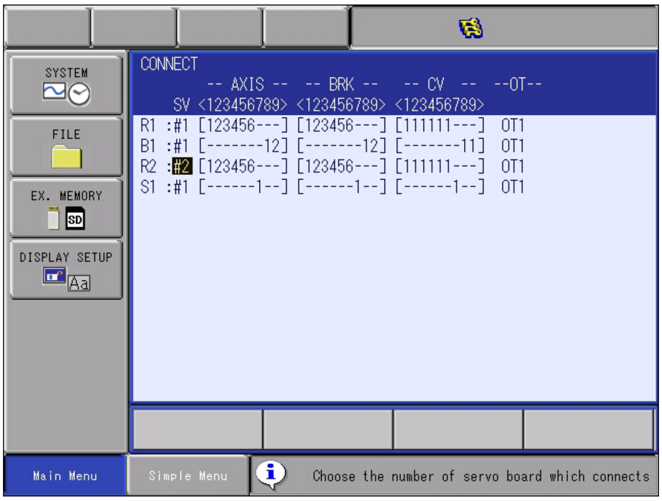
1. Confirm the type of each control group in the CONNECT window.



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.



   – 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 described in the step 2 in the previous page, B1 (Base) is connected in the following manner:

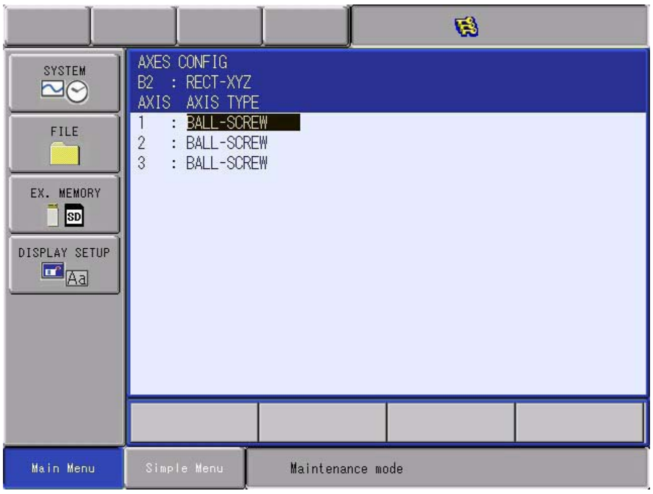
1st axis	→	SERVO Board (SV #1),	Connector (8CN),
		Brake Connector (BRK8),	Converter (CV #1)
2nd axis	→	SERVO Board (SV #1),	Connector (9CN)
		Brake Connector (BRK9),	Converter (CV #1)
Overrun	→	(OT1)	

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.
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.

12.3.1.3 Axis Configuration Setting

The axis type is specified in the AXES CONFIG window.

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



2. Select the axis type to be modified.
   (1) The settable axis type is displayed.

   (2) Select “BALL-SCREW” when the servo track is ball-screw type, and “RACK&PINION” when the servo track is rack & pinion type. After the selection, the window returns to the AXES CONFIG window.
   (3) Select the axis type.
3. Press [ENTER] in the AXES CONFIG window.
4. The setting in the AXES CONFIG window is completed and the window moves to the MECHANICAL SPEC window.

12.3.1.4 Mechanical Specification Setting

The mechanical data is specified in the MECHANICAL SPEC window.

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

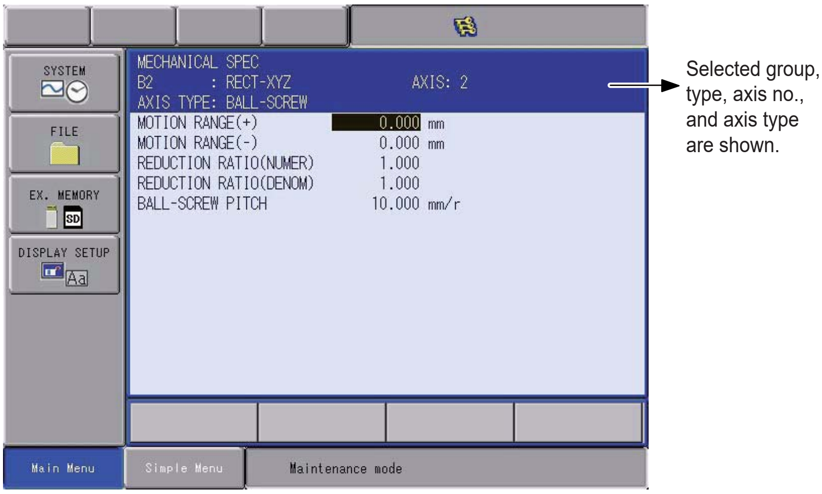
The MECHANICAL SPEC window (in case of the BALL-SCREW type)

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

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.

– BALL-SCREW PITCH : Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

The MECHANICAL SPEC window (in case of the RACK&PINION type)



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

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.>If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

– PINION DIAMETER : Input the diameter of a pinion. (Unit: mm)

2. Select the item to be modified.
   - Point the cursor to the item subject for setting value modification, and press [SELECT].
3. Modify the settings.
   - The selected item is in the input status.
     Input the setting value, and press [ENTER].
4. Press [ENTER] in the MECHANICAL SPEC window.
   - After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner.
   - When [ENTER] is pressed in the MECHANICAL SPEC window for the last axis, the setting in the MECHANICAL SPEC window is completed and the window moves to the MOTOR SPEC window.

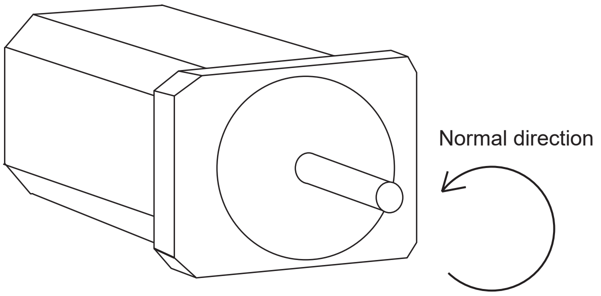
12.3.1.5 Motor Specification Setting

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.)

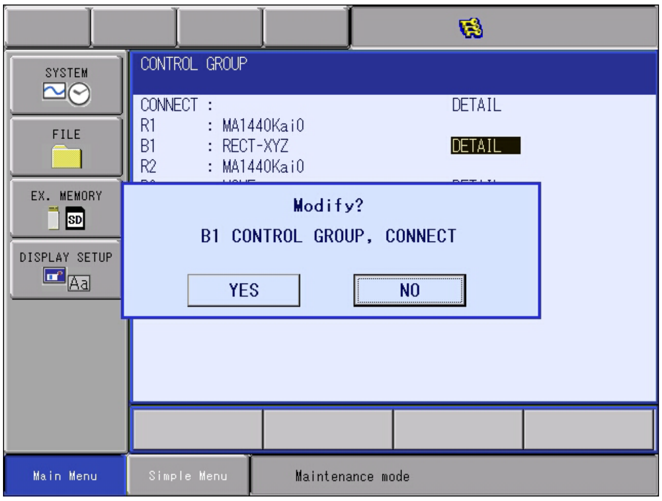
Fig. 12-1: AC Servo Motor



   – MAX. RPM : Input rated rotation speed of a motor. (Unit: rpm)
   – ACCELARATION TIME : Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
   – INERTIA RATIO : The initial value is set at 300 in case of servo track; 0 in case of rotation axis. However, if the following phenomenon occurs in motion, deal with the following procedure.
   – <Phenomenon1>
     During motion, the axis moves unsteady on advance direction.
     → Confirm the motion with increasing this ratio in each 100.

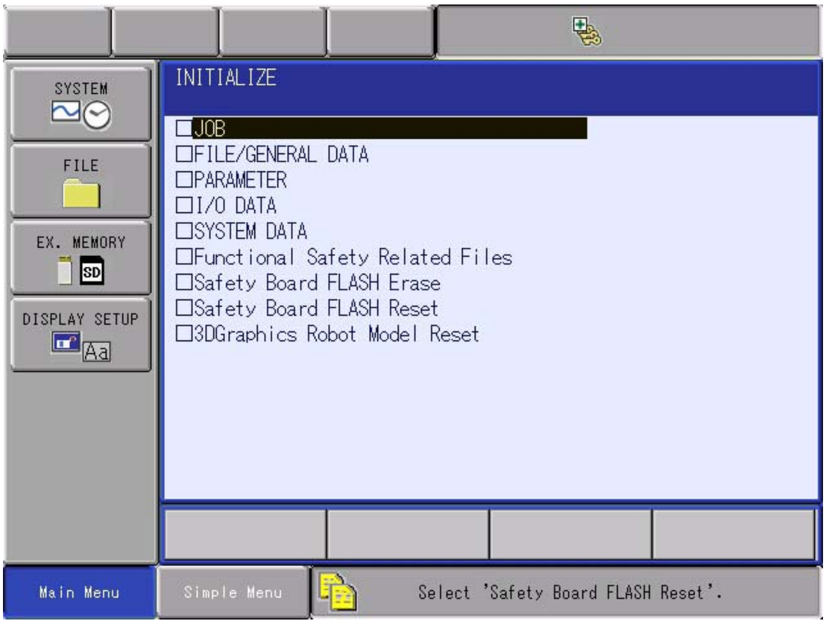
- <Phenomenon2>
  During pause, the motor makes a lot of noise.
  → Confirm the motion with decreasing this ratio in each 100.

3. Modify the settings.
4. Press [ENTER] in the MOTOR SPEC window.
   - After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner.
   - When [ENTER] is pressed in the MOTOR SPEC window for the last axis, the setting in the MOTOR SPEC window is completed and the confirmation dialog box appears.

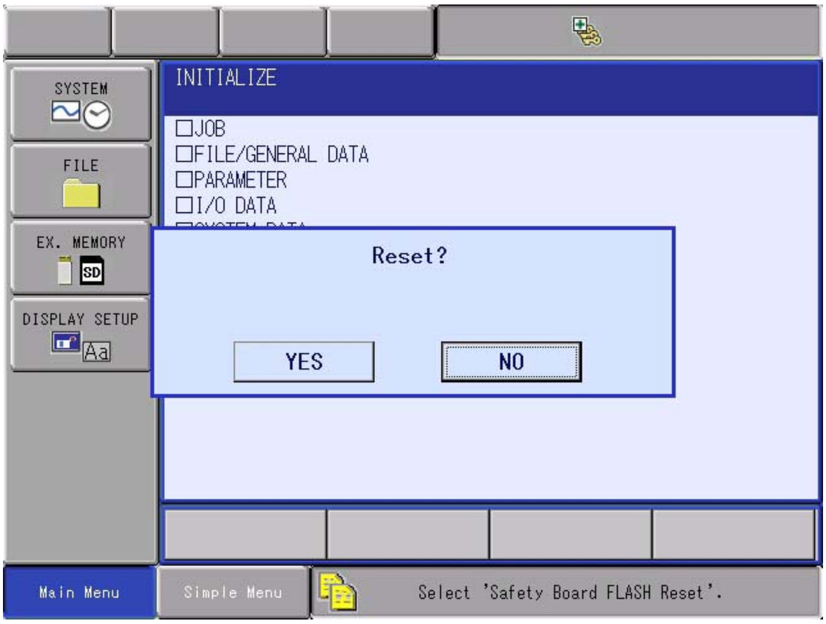


   - If {YES} is selected, the system parameter is set automatically.
5. Initialize the related files.
   - To add and modify the base axis in completed.
6. Change the security mode to safety mode.

7. Select {FILE} - {INITIALIZE} under the main menu.
   – The initialize window appears.



8. Select “Safety Board FLASH Reset”.
   – A confirmation dialog box appears.



9. Select {YES}.
   – When a message “Select ‘Safety Board FLASH Reset’” in the human interface area disappeared resetting of Safety Board FLASH Reset is complete.

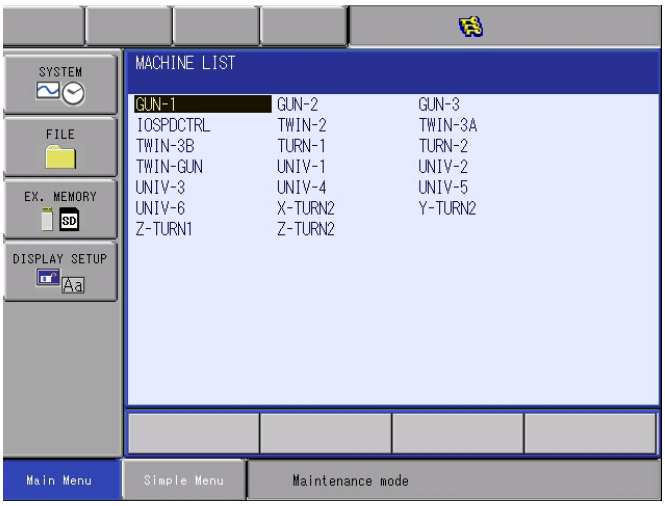
12.3.2 Station Axis Setting

12.3.2.1 Selection of Station Axis Type

Select the type of station axis to be added/modified.

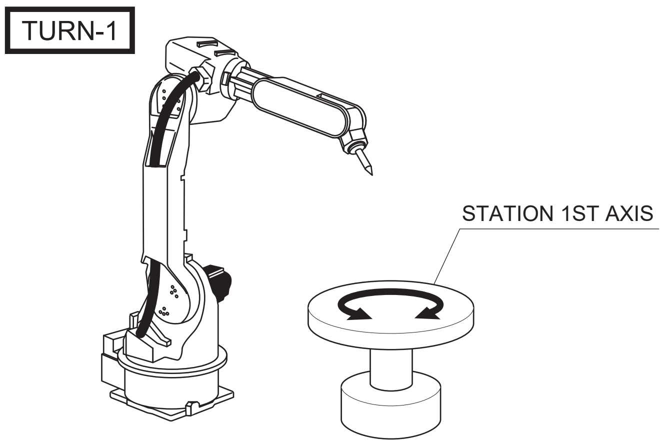
1. Confirm the type of control group in CONTROL GROUP window.
   – The CONTROL GROUP window appears.

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



TURN-1: TURN 1 AXIS STATION
TURN-2: TURN 2 AXIS STATION
UNIV-1: UNIVERSAL 1 AXIS STATION
UNIV-2: UNIVERSAL 2 AXIS STATION
...

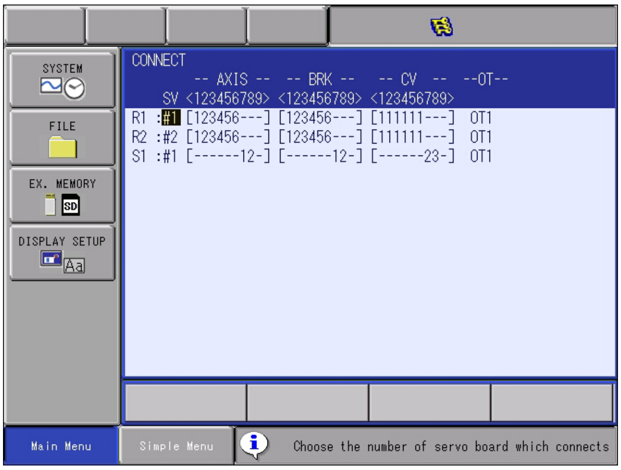
3. Select desired type in the type list.
   – After the type selection, the window returns to CONNECT window.
   – Select “UNIV” (universal) when using a mechanism other than the registered type (such as a servo track) as a station axis. When “UNIV” is selected, interpolation motion (linear, circular, 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.



   - 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:

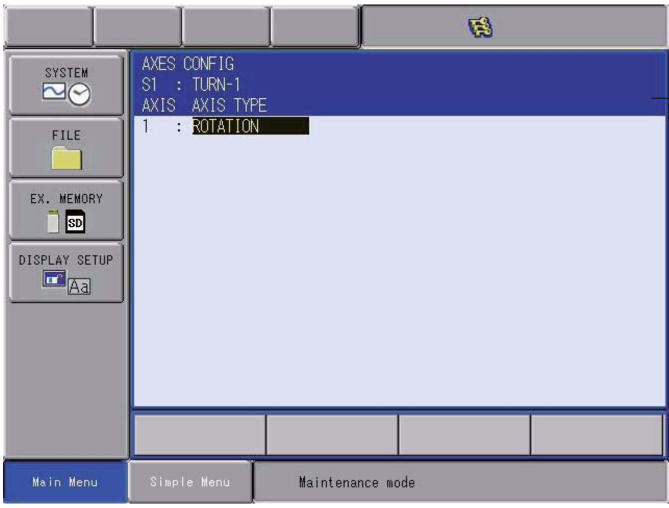
1st axis	→	SERVO Board (SV #1),	Connector (7CN),
		Brake Connector (BRK7),	Converter (CV #2)
2nd axis	→	SERVO Board (SV #1),	Connector (8CN),
		Brake Connector (BRK8),	Converter (CV #3)
Overrun	→	(OT1)	

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.
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)



when axis type is "ROTATION", the axis type cannot be changed.

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

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

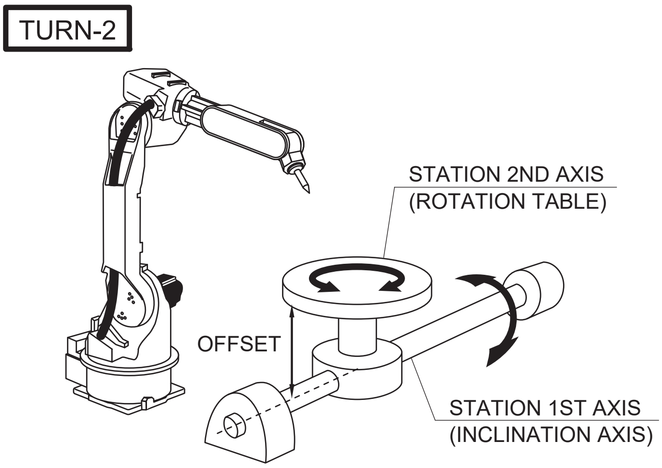
The mechanical data is specified in the MECHANICAL SPEC window.

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

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

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

– OFFSET : Offset should be specified at "TURN-2" type only. Input length between the center of bending axis (1st axis) and the turning table (2nd axis). (Unit: mm)



• The MECHANICAL SPEC window (In case of the BALL-SCREW type)

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

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.

– BALL-SCREW PITCH : Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

• The MECHANICAL SPEC window (In case of the RACK&PINION type)

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

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.>If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

– PINION DIAMETER : Input the diameter of a pinion. (Unit: mm)

• The MECHANICAL SPEC window (In case of the ROTATION type)

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

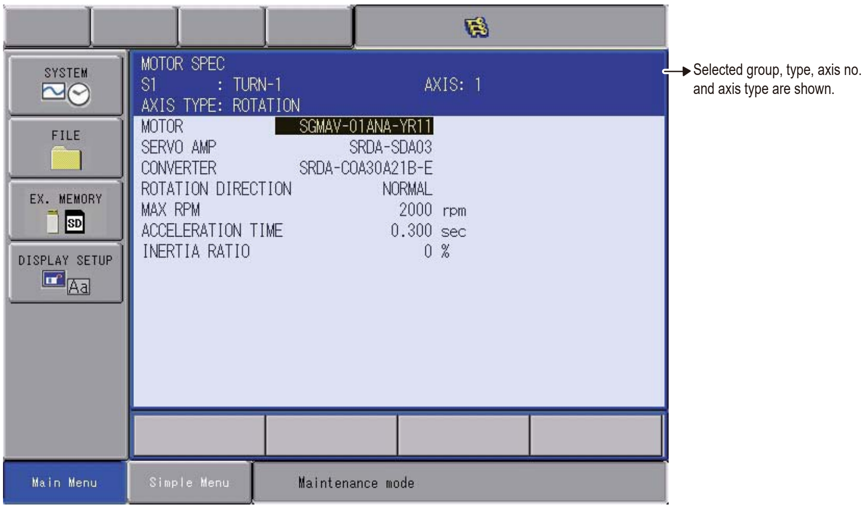
– REDUCTION RATIO : Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

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

12.3.2.5 Motor Specification Setting

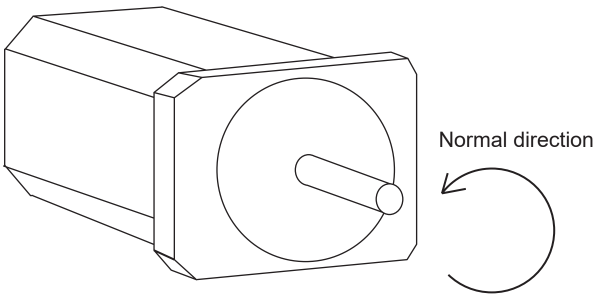
The motor data is specified in the MOTOR SPEC window.

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.)

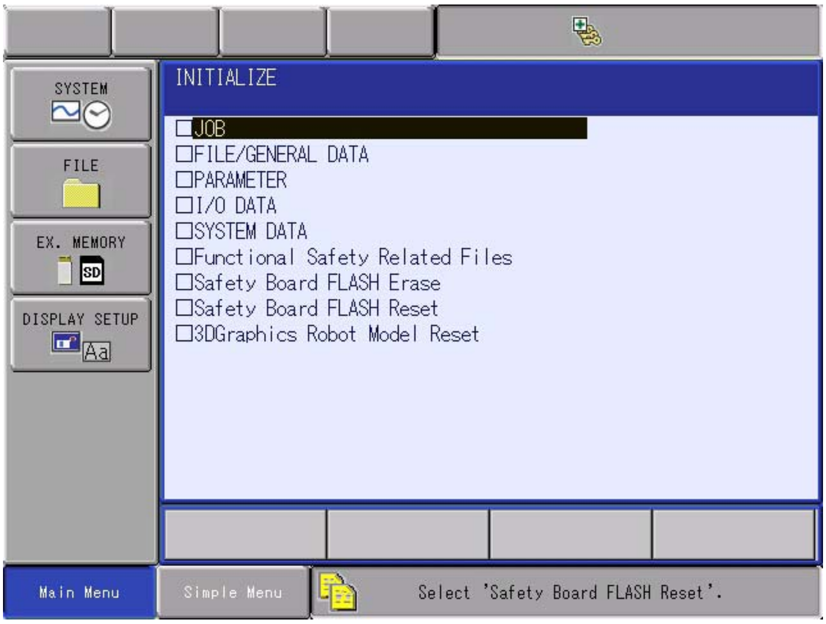
Fig. 12-2: AC Servo Motor



   – MAX. RPM : Input rated rotation speed of a motor. (Unit: rpm)
   – ACCELARATION SPEED : Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)

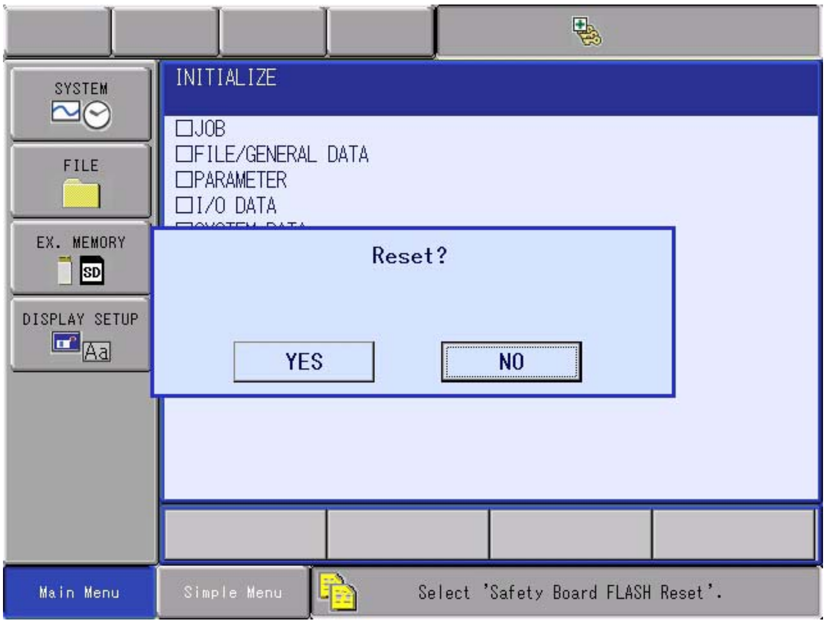
- INERTIA RATIO : The initial value is set at 300 in case of servo track; 0 in case of rotation axis. However, if the following phenomenon occurs in motion, deal with the followed procedure.
- <Phenomenon1> During motion, the axis moves unsteady on advance direction.
  → Confirm the motion with increasing this ratio in each 100.
- <Phenomenon2> During pause, the motor makes a lot of noise.
  → Confirm the motion with decreasing this ratio in each 100.

3. Modify the settings.
   A message “Select ‘Safety Board FLASH reset’” is shown on the human inter face area after adding/changing of the station axis operation, perform “Safety Board FLASH reset” by following the procedures below.
4. Change the security mode to the safety mode.
5. Select {FILE} - {INITIALIZE}under the main menu.



6. Select “Safety board FLASH Reset”.

– A confirmation dialog box



7. Select {YES}.
   – When the message “Select ‘Safety Board FLASH Reset’” in the human interface area disappeared resetting of Safety Board FLASH Reset is complete.

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.

13 YRC1000micro Specification

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 YRC1000micro, 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.

DANGER

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety).
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

WARNING

- When turning ON the YRC1000micro 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 button is located on the upper 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.
- Return the programming pendant to a safe place 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

Controller	**Dust/Splash-proof construction**	IP20
	Dimensions	425(W) ×125 (H) ×280 (D) mm (without protrusion part)
	Cooling system	Direct cooling
	Power supply	-Single-phase 200/230 V AC (+10% to -15%) 50/60 Hz (±2%) -Three-phase 200/220 V AC (+10% to -15%) 50/60 Hz (±2%) The specification of power supply differs depending on the type of YRC1000micro.
	SCCR	5.0 kA
	Grounding	Grounding resistance: 100 Ω or less, exclusive grounding
	Noise level	Less than 60 dB
	Digital I/O	Specific signal (hardware) 7 inputs and 1 outputs General signals (standard, max.) 8 inputs and 8 outputs (Transistor: 8 outputs, Relay: 0 outputs)
	Positioning system	By serial communication (absolute encoder)
	Drive unit	SERVOPACK for AC servomotors
	Memory capacity	200,000 steps, 10,000 instructions
Ambient conditions	**Ambient temperature**	0°C to + 40°C (during operation) -10°C to + 60°C (during transit and storage) Temperature change: 0.3°C/min or less
	Relative humidity	10%RH to 90%RH (non-condensing)
	Allowable altitude	2000 m or less (To use the YRC1000micro 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 36°C.)
	Vibration acceleration	0.5G or less
	Others	Free from corrosive gas or liquid, or explosive gas Must be used in an environment* that meets the standard of pollution degree 2 specified in IEC60664-1 *The environment must be clean with only a minimal amount of dirt and dust, and free from cutting oil, organic solvent, oil fume, water, or salt In particular, there should be no electrically-conductive dirt and dust Free from excessive electrical noise (plasma) Free from strong microwave, UV light, X-ray or radiation

13.2 Function List

Programming Pendant Operation	**Coordinate System**	Joint, Rectangular/Cylindrical, Tool, User Coordinates
	Modification of Teaching Points	Adding, Deleting, Correcting (Robot axes and external axes respectively can be corrected.)
	Inching Operation	Possible
	Path Confirmation	Forward/Reverse step, Continuous feeding
	Speed Adjustment	Fine adjustment possible during operating or pausing
	Timer Setting	Possible every 0.01 s
	Short-cut Function	Direct-open function, Multi-window
	Interface	SD card slot, USB connector (USB2.0) (At Programming Pendant)
	Application	General
Safety Feature	**Essential Measures**	JIS (Japanese Industrial Standard)
	Running Speed Limit	User definable
	Enable Switch	3 position type. Servo power can be turned on at the middle position only. (Located on programming pendant)
	Collision proof Frames	S-axis frame (doughnut-sector), Cubic frame
	Self-Diagnosis	Classifies error and two types of alarms (major and minor) and displays the data
	User Alarm Display	Possible to display alarm messages for peripheral device
	Machine Lock	Test-run of peripheral devices without robot motion
Maintenance Function	**Operation Time Display**	Control power-on time, Servo power-on time, Playback time, Operation time, Work time
	Alarm Display	Alarm message, troubleshooting, previous alarm records
	I/O Diagnosis	Simulated enabled/disabled output possible
	T.C.P. Calibration	Automatically calibrates parameters for end effectors using a master positioner

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

13.3 Programming Pendant

Material	Reinforced thermoplastic enclosure with a detachable suspending strap
Dimensions	152(W) × 300(H) × 49.5(D) mm (excluding protrusions)
Protection Class	IP54
Displayed Units	TFT Color liquid crystal display, VGA (640 × 480)
	Touch panel
Operated Units	Three-position enable switch, start switch, hold switch, and mode select switch (with key, three mode) Type of the key for the mode select switch: AS6-SK-132 (manufactured by IDEC Corp.) * Two keys are shipped with the programming pendant.
Cable Length	Standard: 8 m, maximum (optional): 20 m (Optional: can be extended by 4, 8 or 12 m to the standard :8 m cable)
Others	Provided with SD card slot (SD/SDHC/SDXC type) USB connector (USB2.0) X 1

Refer to *chapter 13.1 "Specification List"* for the ambient conditions.

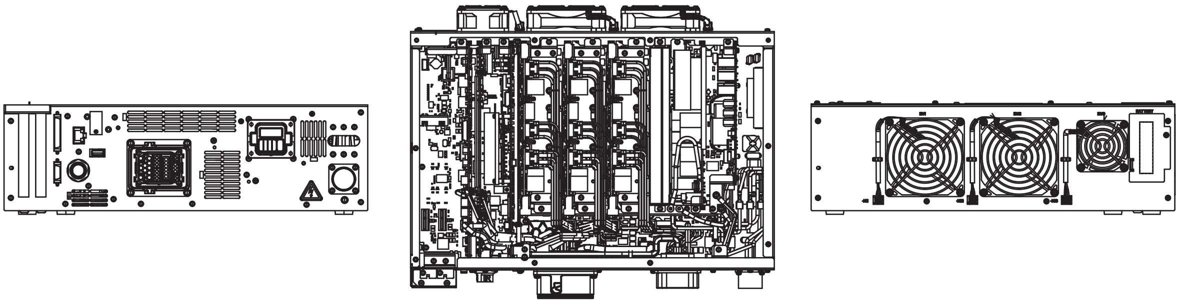
13.4 Equipment Configuration

This section explains the configuration of the YRC1000micro equipment.

13.4.1 Arrangement of Units and Circuit Boards

■ **Configuration**

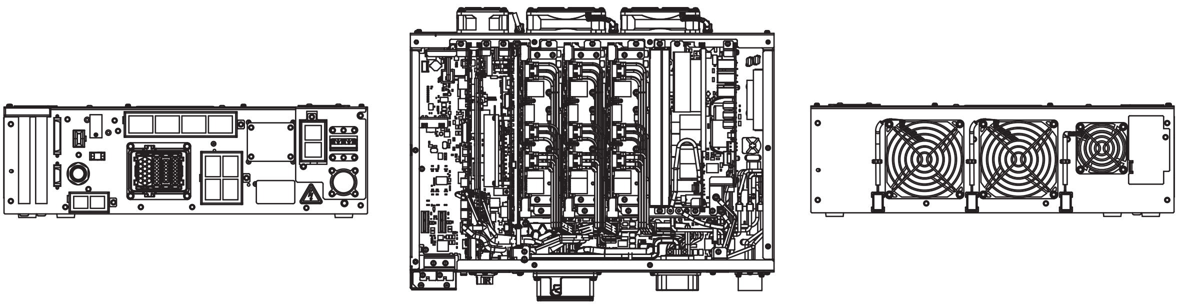
Fig. 13-1(a): Configuration (ERBR-100-xxxxxxx-A00)



Front View Inside View Back View

YRC1000micro	**Major manipulator type**
For Japan/North America/Asia	
ERBR-100-06VX05-A00	MotoMINI
ERBR-100-06VX8-A00	GP4
	GP7
	GP8
ERBR-100-06VXH12-A00	GP12
ERBR-100-04SX650-A00	SG400
	SG650

Fig. 13-1(b): Configuration (ERBR-100-xxxxxxx-A01) (Environmental resistance model)



Front View Inside View Back View

YRC1000micro (Environmental resistance model)	**Major manipulator type**
For Japan/North America/Asia	
ERBR-100-06VX05-A01	MotoMINI
ERBR-100-06VX8-A01	GP4
	GP7
	GP8
ERBR-100-06VXH12-A01	GP12
ERBR-100-04SX650-A01	SG400
	SG650

13.5 About external axis addition

YRC1000micro can add an external axis by adding an external axis kit. Available external axis motors are ΣV and Σ7 series made of YASKAWA. Also, the available motor capacity can be used in applications such as the travel axis, rotation axis.

The external axis can be driven for a total of two axes (two-axis motor total capacity: applicable up to 1200 W)

1st axis: 400 W-1000 W
2nd axis: 50 W-200 W

In addition, make sure that it does not exceed the motor rated rotation speed, and that an alarm (overload etc.) does not appear.

The external axis connector is -X3. (See *fig. 13-2 "External axis connector position"*)
The external axis connector is a two-axis connector.
For external two axes, branch for one axis and connect with Terminal BOX. (See *fig. 13-3 "External axis cable connection in case of two axes"*)
Since the external axis cable (including Terminal BOX) is a dedicated cable, please contact your YASKAWA representative.

Fig. 13-2: External axis connector position

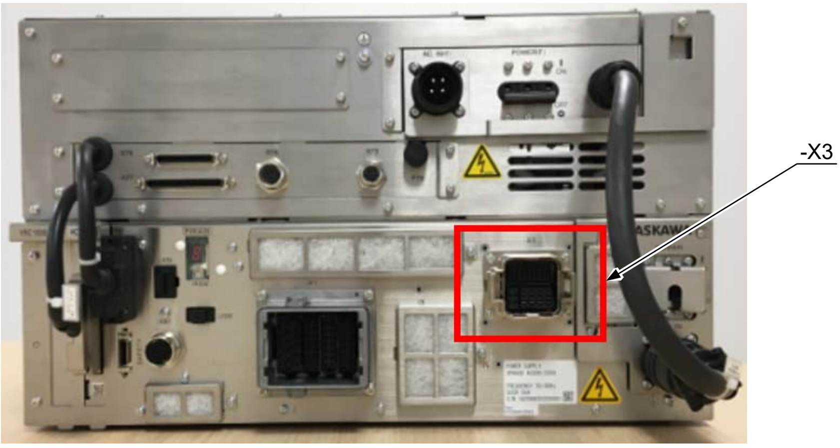
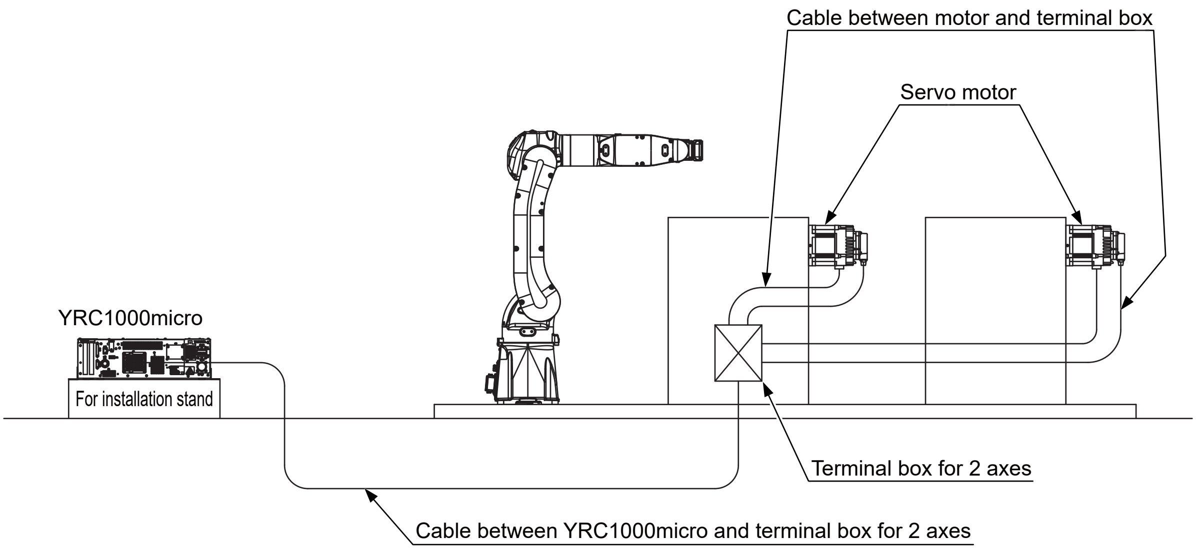


Fig. 13-3: External axis cable connection in case of two axes



14 Description of Units and Circuit Boards

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 programming pendant, or 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.

DANGER

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety).
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

WARNING

- When turning ON the YRC1000micro 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 button is located on the upper 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.
- Return the programming pendant to a safe place 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.

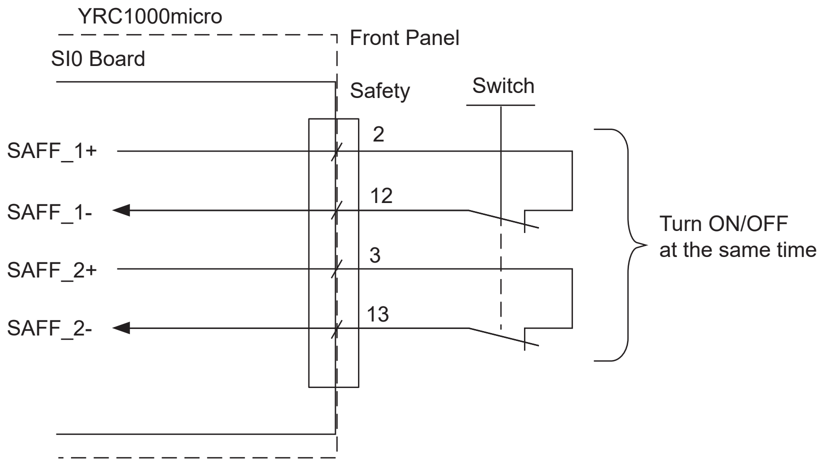
- Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

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.

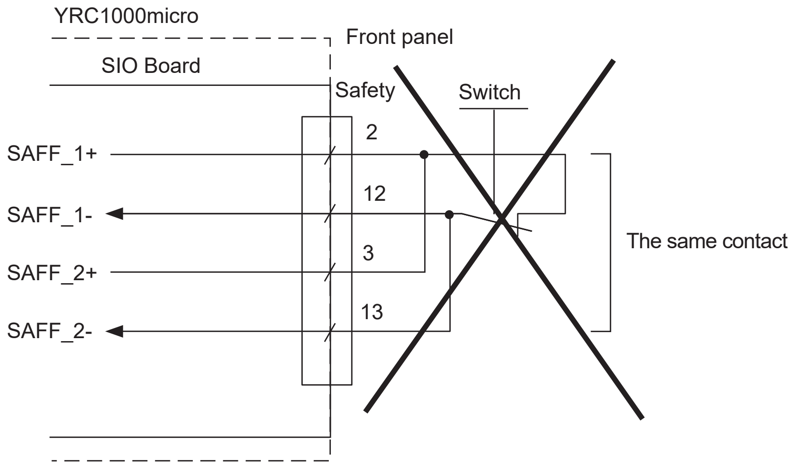
■ Cautions for connection of dual input signals

NOTICE

- To the dualized specific signal, connect the switch (contact) that turns the signal ON and OFF simultaneously.
- If the timing of turning ON and OFF between the dualized signals, a disagreement alarm occurs.
  If one of the signals becomes abnormal, an alarm occurs.



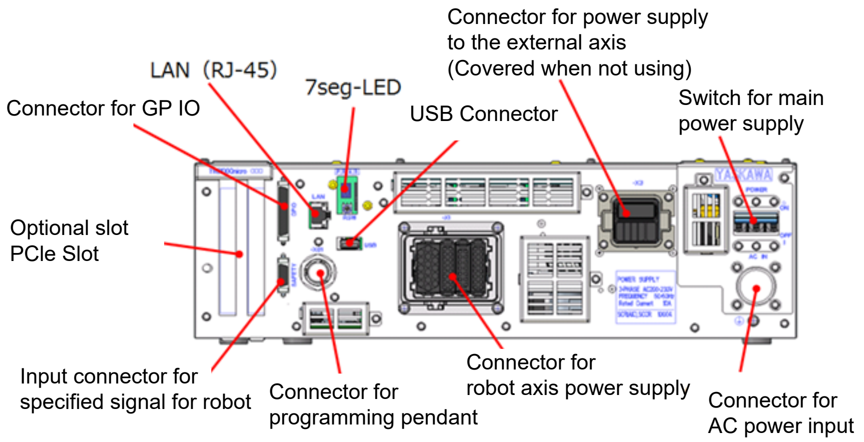
- Do not connect two signals to the same contact point.
  (Prepare two independent contact points)
- An alarm occurs due to the judgment of the safety circuit.



14.1 Connection for Connector on Front Panel

Connectors are arranged on the front panel of the YRC1000micro for the various signal connections.

Fig. 14-1: Front Panel View of the YRC1000micro

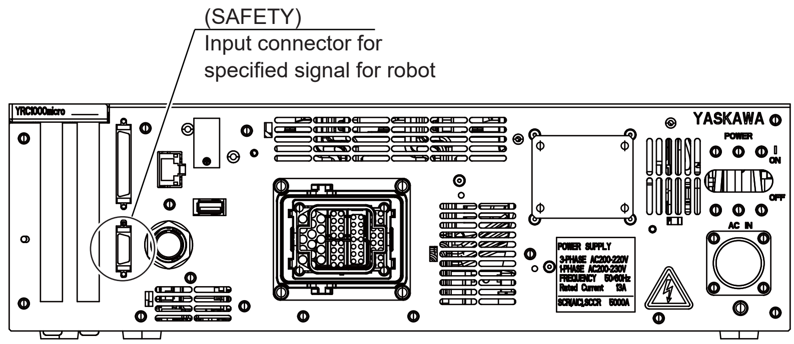


14.1.1 Connection of Robot Specific Input Signal

A connector to input the robot specific signal is arranged on the front panel of the YRC1000micro.

For the connections, refer to figure below.

Fig. 14-2: Location of the Input Connector for the Robot System Signal



- Pin Assignment of the pin for the Robot Specific Signal Input Connector (SAFETY)
  Connector types used when preparing the cable for connecting to the robot specific signal are listed below.

Table 14-1: Pin Assignment of the Pin for the Robot Specific Signal Input Connector (SAFETY)

Item	Type	Remarks
The YRC1000micro-side connector	10220-52A2PL	Mnufactured by Sumitomo 3M Limited
Cable-side connector	110120-3000PE (Connector body) 10320-52A0-008 (Shell jackscrew type) 10320-52F0-008 (Shell single action lock type)	

Upon shipment of the YRC1000micro, a dummy connector which short-circuits each specific signal is attached.

To input a specific signal, prepare the appropriate connector for the signal.

For unused signals, connect a jumper cable as when the YRC1000micro is shipped.

Pin No.	Signal Name	Dual Input	Details	Setting when shipped
1	Not used			
2	SAFF_1+	○	Safety plug This is the signal to turn OFF the servo power when the gate of the safety fence opens. Connect the interlock signal such as the safety plug, etc. which is mounted on the gate of the safety fence. When the interlock signal is OPEN, the servo power turns OFF and the servo power cannot be turned ON. This signal is disabled in the teach mode.	This signal is connected by a jumper cable in the dummy connector.
12	SAFF_1-	○		
3	SAFF_2+	○		
13	SAFF_2-	○		
4	EXESP_1+	○	External emergency stop This signal is used to connect the emergency stop switch for the external devices, etc. When the contact is OPEN, the servo power is turned OFF and execution of the job is stopped. While the signal is being input, the servo power cannot be turned ON	This signal is connected by a jumper cable in the dummy connector.
14	EXESP_1-	○		
5	EXESP_2+	○		
15	EXESP_2-	○		
6	ONEN_1+	○	Protection Stop Signal For safety, connect this signal line when using the function to immediately turn OFF the servo power to all of the control groups that are connected to the robot controller when the servo power is turned ON. If the contact is OPEN, the servo power will turn OFF.	This signal is connected by a jumper cable in the dummy connector.
16	ONEN_1-	○		
7	ONEN_2+	○		
17	ONEN_2-	○		
8	Not used			
9	ESPOUT_1+		Emergency stop button contact output While using the programming pendant, this signal is used to output the contact of the emergency stop button.	Open
19	ESPOUT_1-			
10	ESPOUT_2+			
20	ESPOUT_2-			
11	Not used			
18	Not used			

14.1.1.1 Connection of Safety Plug Signal (SAFF)

This is the signal to turn OFF the servo power when the gate of the safety fence opens.

Connect the interlock signal such as the safety plug, etc. which is mounted on the gate of the safety fence.

When the interlock signal is OPEN, the servo power turns OFF and the servo power cannot be turned ON.

As this is disabled in the teach mode, make sure that nobody enters inside the safety fence.

Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector.

When operating a manipulator, prepare a new connector and wire the safety fence signal.

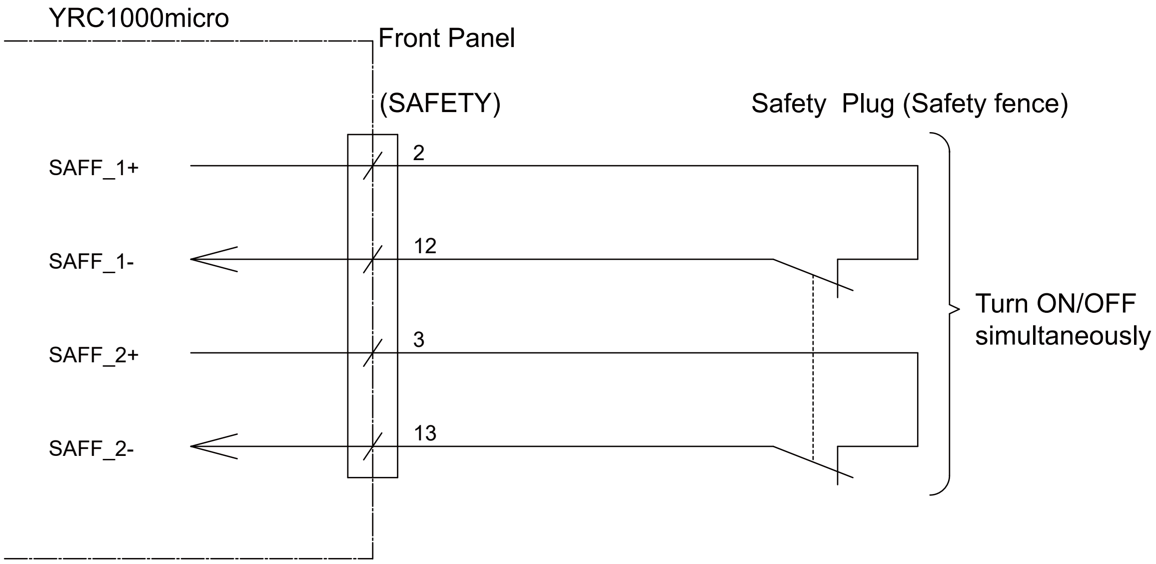
For the unused robot specific input signal, connect a jumper cable as when the YRC1000micro is shipped.

DANGER

- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

Fig. 14-3: Connection of Safety Plug (Safety Fence) (SAFETY)

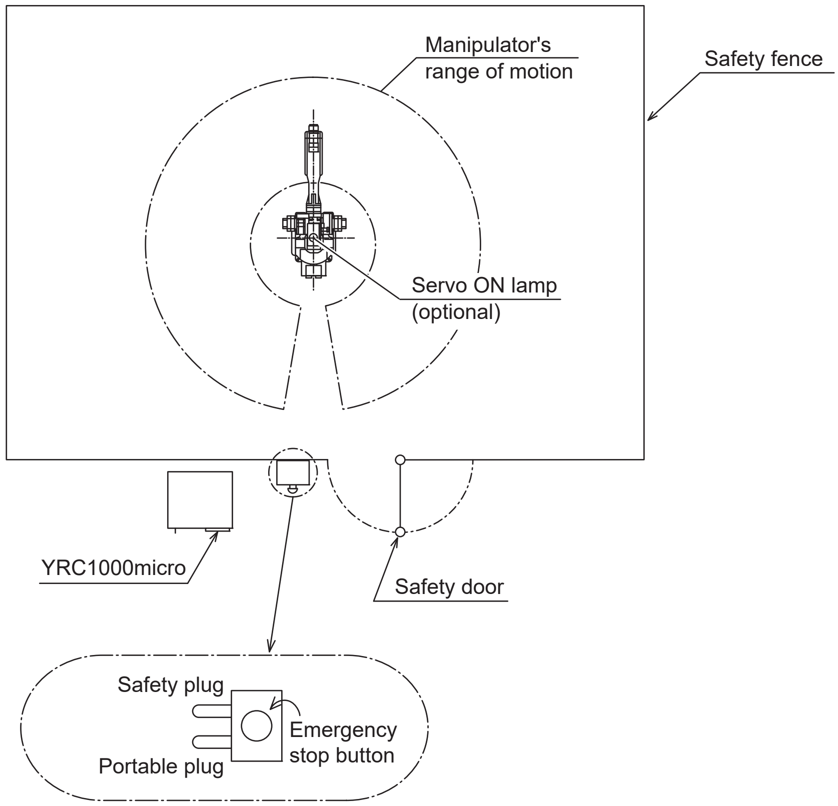


■ **Installation example of safety plug**

Install a safety fence and a door with the interlock function around the manipulator so that an operator cannot enter inside the fence unless the door is opened. And at the same time make sure that the interlock function stops the manipulator operation when the door is opened.

The safety plug input signal is the signal to connect this interlock signal.

Fig. 14-4: Installation Example of Safety Plug



While the servo power is ON and the interlock signal is input, the servo power is turned OFF.
(The servo power cannot be turned ON while the interlock signal is being input.)

Note that the servo power does not turn OFF only in the teach mode.
(The servo power can be turned ON even while the interlock signal is input.)

14.1.1.2 Connection of External Emergency Stop Signal (EXESP)

This signal is used to connect the emergency stop switch for the external devices, etc.

When the contact is OPEN, the servo power is turned OFF and execution of the job is stopped.

While the signal is being input, the servo power cannot be turned ON

Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector.

When operating the manipulator, prepare a new connector and wire the safety fence signal.

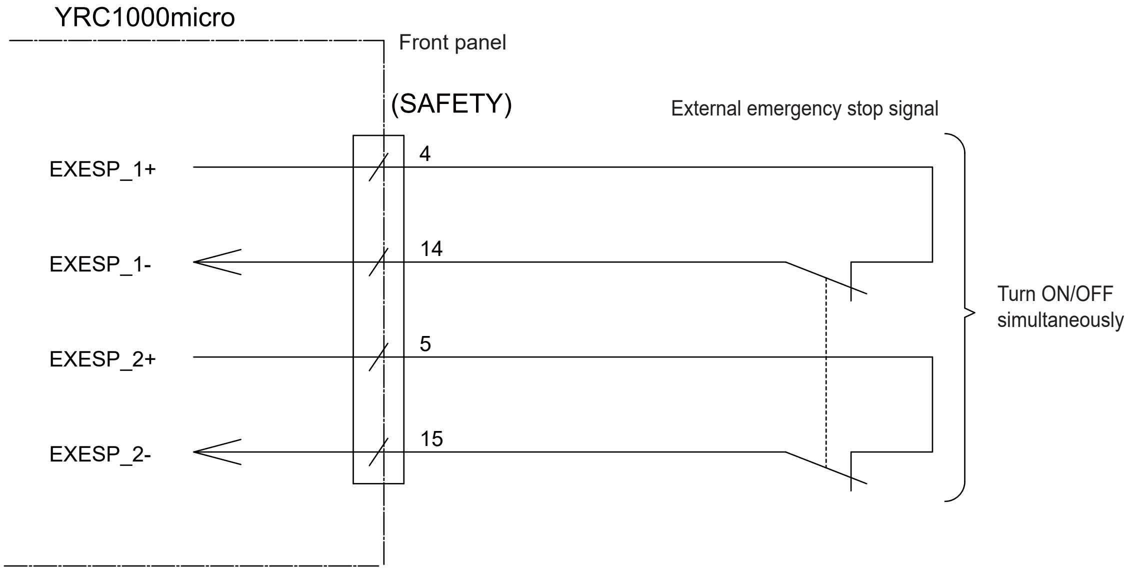
For unused robot specific input signals, connect a jumper cable as when the YRC1000micro is shipped.

DANGER

- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

Fig. 14-5: Connection for External Emergency Stop Signal (EXESP)



14.1.1.3 Protection Stop (ONEN) Signal Connection

For safety, connect this signal line when using the function to immediately turn OFF the servo power to all of the control groups that are connected to the robot controller when the servo power is turned ON.

If the contact is OPEN, the servo power will turn OFF.

Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector.

As this signal is not used as standard specifications, connect a jumper cable to a robot specific input signal, as when the YRC1000micro is shipped.

The protected stop signal is dualized for safety purpose. Connect the protected stop signals in such a way that the signals turn ON and OFF simultaneously.

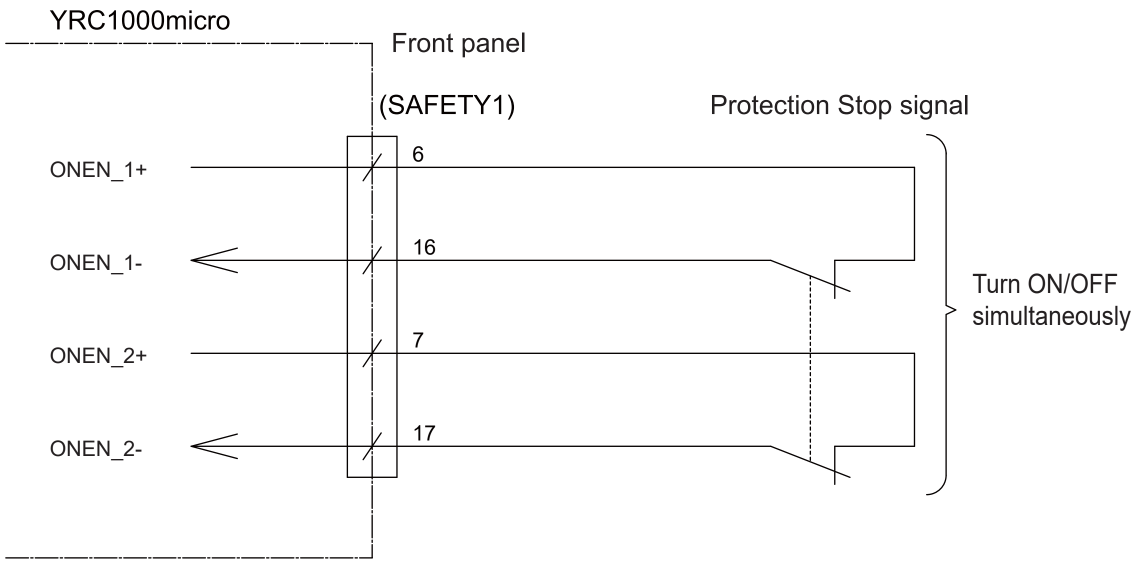
If one of the protected stop signals turns ON, an alarm will occur.

DANGER

- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

Fig. 14-6: Protection Stop (ONEN) Signal Connection



14.1.1.4 Connection of Emergency Stop Button Contact Output Signal (ESPOUT)

This signal is used to output the emergency button contact when the programming pendant is used.

This emergency stop output is always enabled regardless of whether the YRC1000micro power supply is ON/OFF

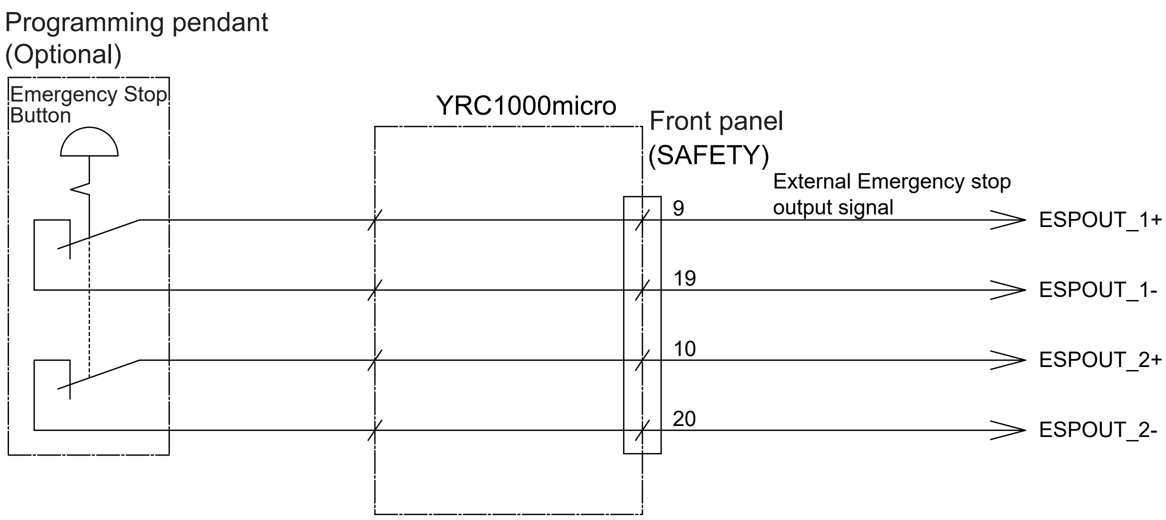
(State output signal: Normal Close contact)

NOTICE

- Do not use the emergency stop button with 24 VAC, 250 mA 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. 14-7: Connection for Emergency Stop Button Contact Signal (ESPOUT)

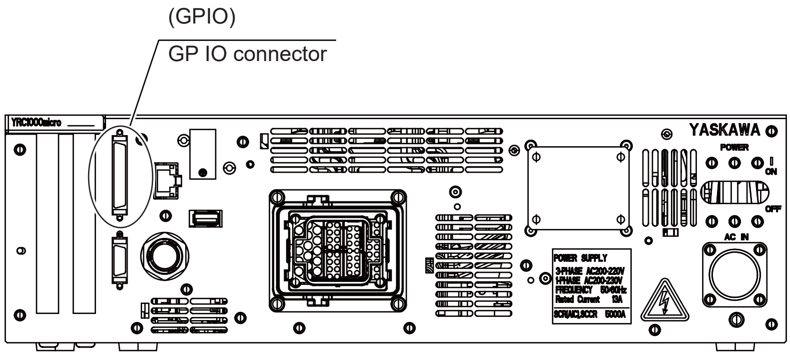


14.1.2 Connection of GP I/O

The Direct-in signal is equipped on the front panel of the YRC1000micro as its standard specification. And this signal is used when inputting a highly responsive signal for digital I/O (robot GP I/O) for search function, etc.

- GP I/O point: 8 inputs and 8 outputs
- Direct-in point: 4 inputs

Fig. 14-8: Position of GP I/O Connector



The GP I/O signal is used mainly in the motion job of the manipulator and used as a timing signal between the manipulator and peripheral devices.

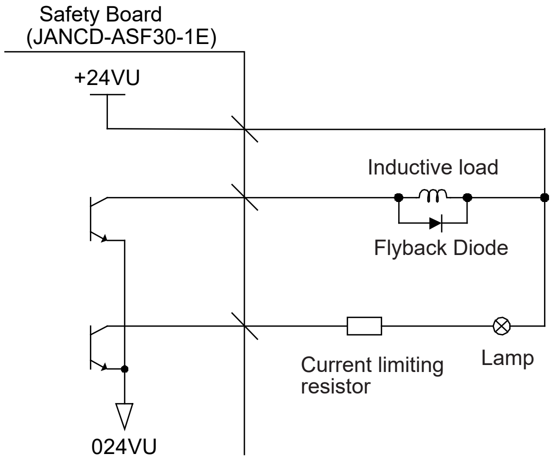
Connector types used when preparing a cable for connecting to the GP I/O and Direct-in signal are listed below.

Item	Type	Remarks
The YRC1000micro-side connector	10250-52A2PL	Mnufactured by Sumitomo 3M Limited
Cable-side connector	10150-3000PE (Connector body) 10350-52A0-008 (Shell jackscrew type) 10350-52F0-008 (Shell single-action lock type)	

For the details of the pin assignment, refer to *fig. 14-11 "Connection Diagram of GPIO Connector"* .

NOTE

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.

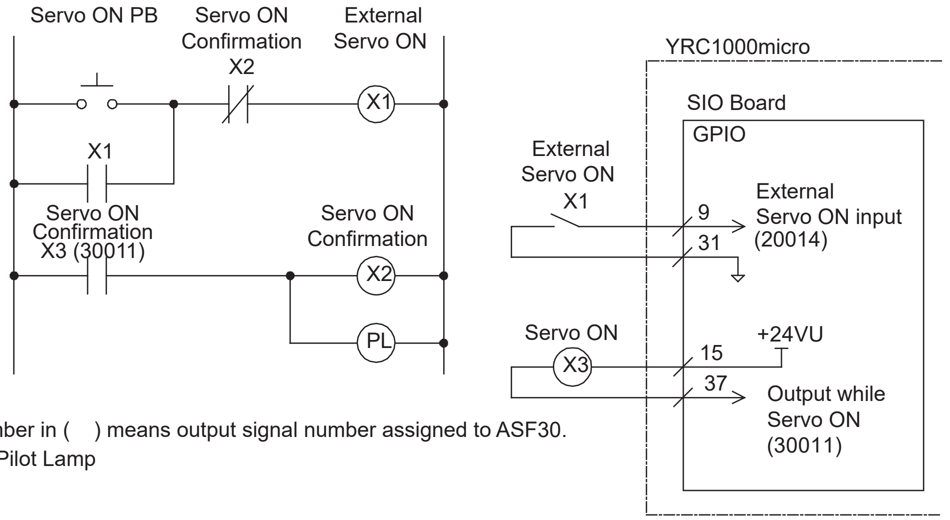


Refer to *chapter 14.2 "Specific I/O Signal List"* about the maximum current of the transistor and the relay output circuits.

■ 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 figure below.

Fig. 14-9: Example of Servo ON Sequence Circuit from External Device



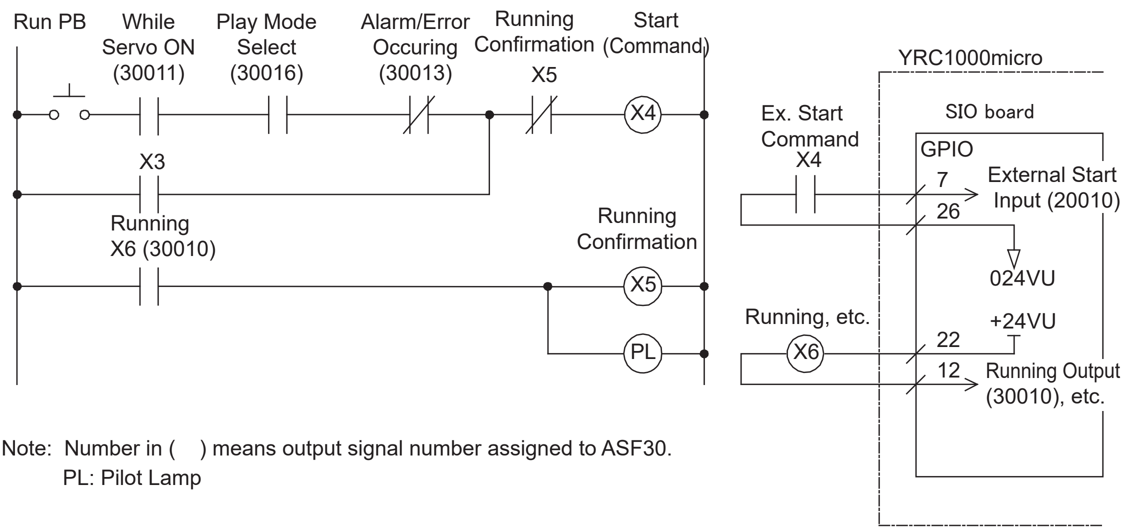
Note: Number in ( ) means output signal number assigned to ASF30.
PL: Pilot Lamp

Note: Above mentioned circuit is ASF30 circuit as an example

■ Example of Start (Start-up) Sequence Circuit from External Device

Only the rising edge of the external start signal is valid. This signal can start the manipulator operation. 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. 14-10: Example of Start Sequence Circuit from External Device



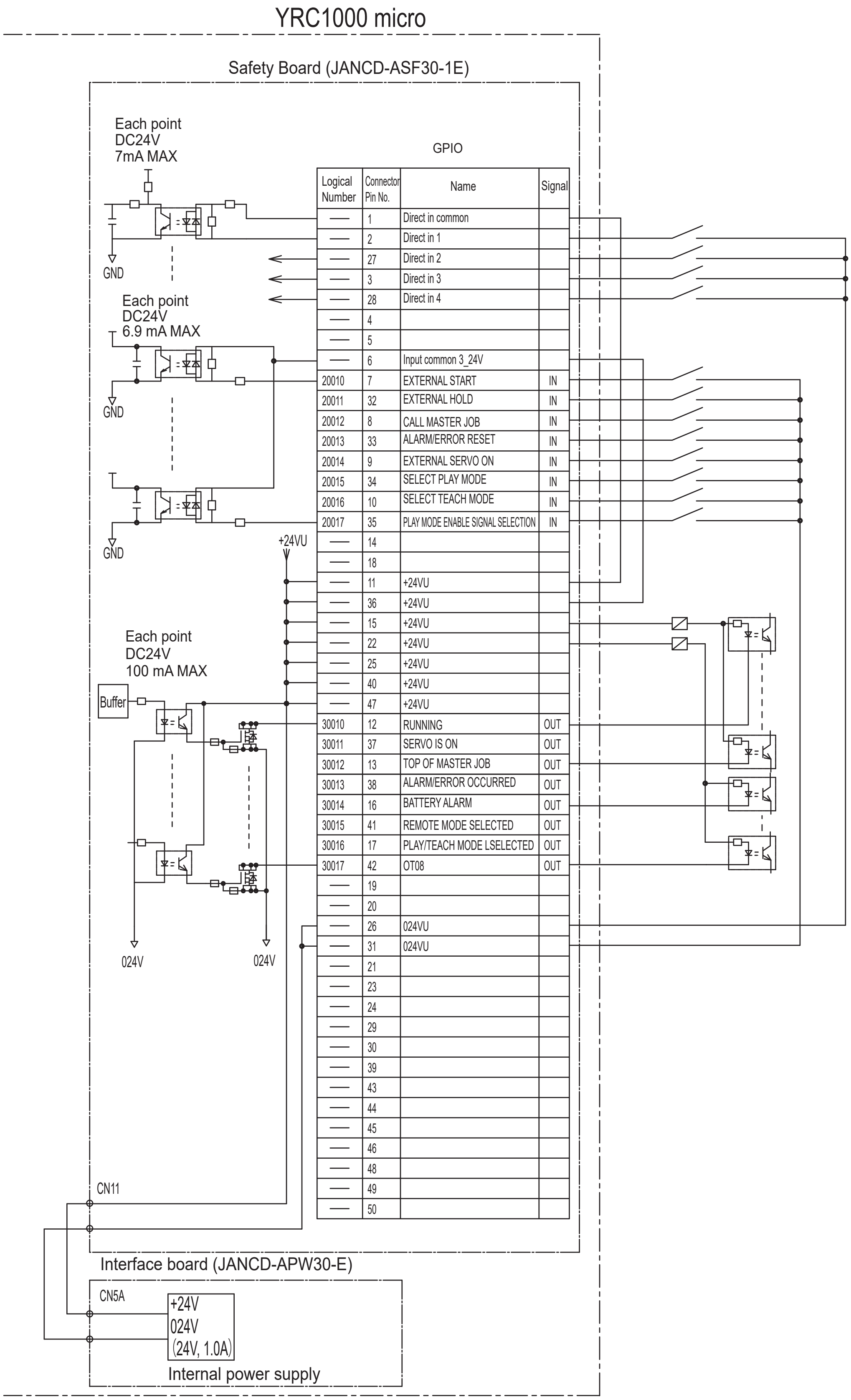
Note: Number in ( ) means output signal number assigned to ASF30.
PL: Pilot Lamp

Note: Above mentioned circuit is ASF30 circuit as an example

■ Connection of JANCD-ASF30-☐E Safety Board (NPN Specification)

Refer to "YRC1000micro SUPPLEMENTARY INSTRUCTIONS (HW1485245)" for connection of the JANCD-ASF31-☐E safety board (PNP specification).

Fig. 14-11: Connection Diagram of GPIO Connector



Logical Number	Connector Pin No.	Name	Signal
—	1	Direct in common	
—	2	Direct in 1	
—	27	Direct in 2	
—	3	Direct in 3	
—	28	Direct in 4	
—	4		
—	5		
—	6	Input common 3_24V	
20010	7	EXTERNAL START	IN
20011	32	EXTERNAL HOLD	IN
20012	8	CALL MASTER JOB	IN
20013	33	ALARM/ERROR RESET	IN
20014	9	EXTERNAL SERVO ON	IN
20015	34	SELECT PLAY MODE	IN
20016	10	SELECT TEACH MODE	IN
20017	35	PLAY MODE ENABLE SIGNAL SELECTION	IN
—	14		
—	18		
—	11	+24VU	
—	36	+24VU	
—	15	+24VU	
—	22	+24VU	
—	25	+24VU	
—	40	+24VU	
—	47	+24VU	
30010	12	RUNNING	OUT
30011	37	SERVO IS ON	OUT
30012	13	TOP OF MASTER JOB	OUT
30013	38	ALARM/ERROR OCCURRED	OUT
30014	16	BATTERY ALARM	OUT
30015	41	REMOTE MODE SELECTED	OUT
30016	17	PLAY/TEACH MODE LSELECTED	OUT
30017	42	OT08	OUT
—	19		
—	20		
—	26	024VU	
—	31	024VU	
—	21		
—	23		
—	24		
—	29		
—	30		
—	39		
—	43		
—	44		
—	45		
—	46		
—	48		
—	49		
—	50		

* Cannot be connected to an external power supply.

14.2 Specific I/O Signal List

Inputing/Outputing of the specific signal is available only when the PSEUDO INPUT SIGNAL: 87013 is turned OFF.

And if above mentioned 87013 is turned ON, each signal can be used as GPIO.

For the details, refer to “YRC1000micro OPTIONS INSTRUCTIONS FOR Concurrent I/O (RE-CKI-A469) 7 Pseudo Input Signals”.

Table 14-2: Specific Input (Press Tending, Cutting, and Other Applications)

Logical Number	**Input Name / Function**
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20011	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.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1]. This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20014	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.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at “REMOTE”. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at “REMOTE”. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
20017	PLAY MODE ENABLE SIGNAL SELECTION To change the operation mode from the teach mode to the play mode, change the mode key of the programming pendant from “TEACH” to “PLAY” or “REMOTE” and input the play mode enable signal from an external device. If the mode key of the programming pendant is set at “REMOTE” and the teach mode is selected, select the play mode and input the play mode enable signal by using an external device to change the operation mode to the play mode. Refer to *chapter 5.2.2 “Play Mode Enable Function”* for the play mode enable function.

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.

Table 14-3: Specific Output (Press Tending, Cutting, and Other Applications)

Logical Number	**Output Name / Function**
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for YRC1000micro status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]*1*
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015	REMOTE 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.
30016	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.

1 This signal is not output during operation.

A

B

C

D

E

F

G

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K

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M

N

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R

S

T

U

V

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X

YRC1000micro
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