

- 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

DX200 INSTRUCTIONS

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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS

DX200 INSTRUCTIONS

DX200 OPERATOR'S MANUAL (for each purpose)

DX200 MAINTENANCE MANUAL (Volume 1) (Volume2)

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*)



MANDATORY

- This manual explains setup, diagnosis, maintenance, hardware, etc. of the DX200 system. Read this manual carefully and be sure to understand its contents before handling the DX200.
- General items related to safety are listed in Section 1. To ensure correct and safe operation, carefully read the section.



CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of your product.

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



DANGER

Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.



MANDATORY

Always be sure to follow explicitly the items listed under this heading.



PROHIBITED

Must never be performed.

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

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



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



WARNING

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
 - Turning ON the DX200 power
 - Moving the manipulator with the programming pendant
 - Running the system in the check mode
 - Performing automatic operations

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems. The emergency stop buttons are located on the right of the front door of the DX200 and the programming pendant.

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

Improper or unintended manipulator operation may result in injury.

- Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the DX200 and programming pendant are pressed. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

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

Fig. : Emergency Stop Button



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

Injury may result from unintentional or unexpected manipulator motion.

Fig. : Release of Emergency Stop





CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
 - Check for problems in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to its specified position after use.

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.

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

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

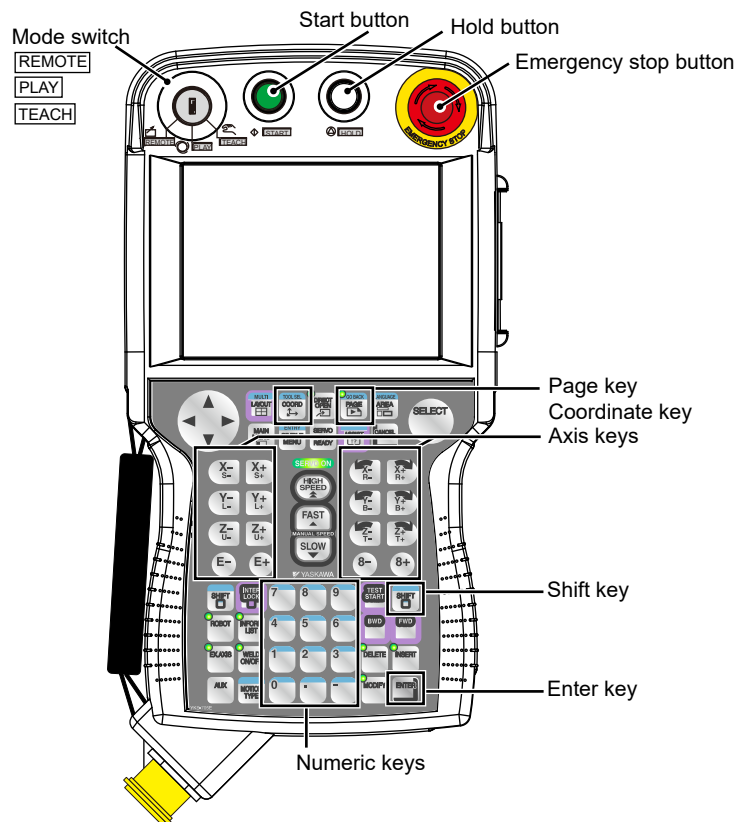
The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and manipulator cables.

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
DX200 Controller	DX200
DX200 Programming Pendant	Programming Pendant
Cable between the manipulator and the controller	Manipulator Cable

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.
	Button	The three buttons on the upper side of the programming pendant are denoted as follows: START, HOLD, or EMERGENCY STOP.
	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 DX200. 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.



⚠ WARNING
Moving parts
may cause
injury




⚠ WARNING
Do not enter
robot
work area.

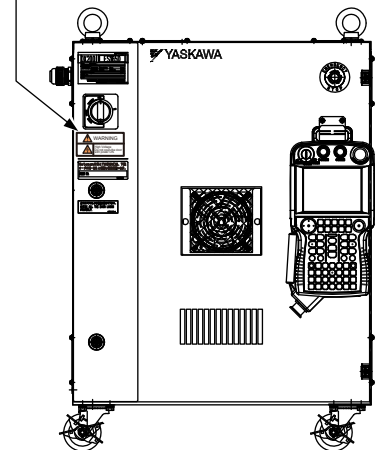
Refer to the manipulator manual for the warning label location.


- The following warning labels are attached to DX200.

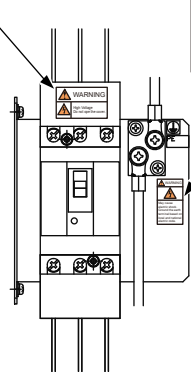
Observe the precautions on the warning labels.


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

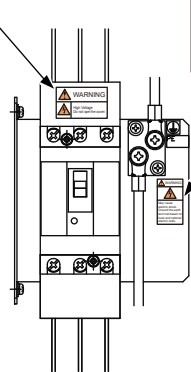
⚠ WARNING
 High Voltage
Do not open the door
with power ON.



⚠ WARNING
 High Voltage
Do not open the cover.



⚠ WARNING
 May cause
electric shock.
Ground the earth
terminal based on
local and national
electric code.



Internal Breaker

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1 Safety

1.1 For Your Safety

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

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

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



MANDATORY

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

Other related laws are:

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

- Prepare
 - SAFETY WORK REGULATIONS

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

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

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

- Reinforce the
 - SAFETY MANAGEMENT SYSTEM

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

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

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

1	Safety
1.2	Special Training

1.2 Special Training



MANDATORY

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

1.3 Motoman Manual List



MANDATORY

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

You should have the four manuals listed below:

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

Confirm that you have all these manuals on hand.

If any manuals are missing, contact your salesman from YASKAWA's local branch office.

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

- Avoid any dangerous actions in the area where the MOTOMAN is installed.

There is a danger of injury if there is contact with the manipulator or peripheral equipment.

- Please take strict safety precautions by placing signs such as "Flammable", "High Voltage", "Waiting", and "Off-limits to Unauthorized Personnel" in necessary areas in the factory.

Failure to observe these cautions may result in fire, electric shock, or injury due to contact with the manipulator and other equipment.

- Strictly observe the following items:

- Always wear protective safety equipment such as helmets, safety shoes (with slip-proof soles), face shields, safety glasses, and gloves as necessary.
- Always wear approved work clothes (no loose-fitting clothes).
- Do not wear gloves soiled with chemicals, oils, organic solvents, etc. when operating the MOTOMAN.
- Do not allow underwear, shirts, or neckties to hang out from the work clothes.
- Do not wear large jewelry, such as earrings, rings, or pendants.

Improper clothing may result in injury.

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

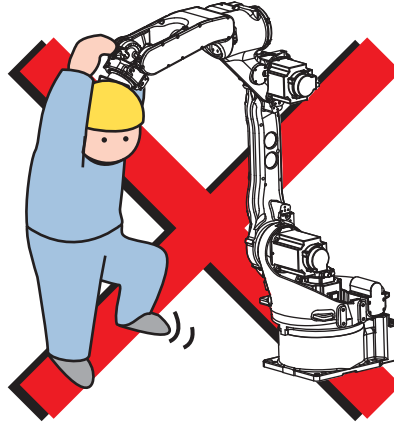
Failure to observe this caution may result in injury due to contact with DX200, controller, the workpiece, the positioner, etc.



CAUTION

- Never forcibly move the manipulator axes.

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

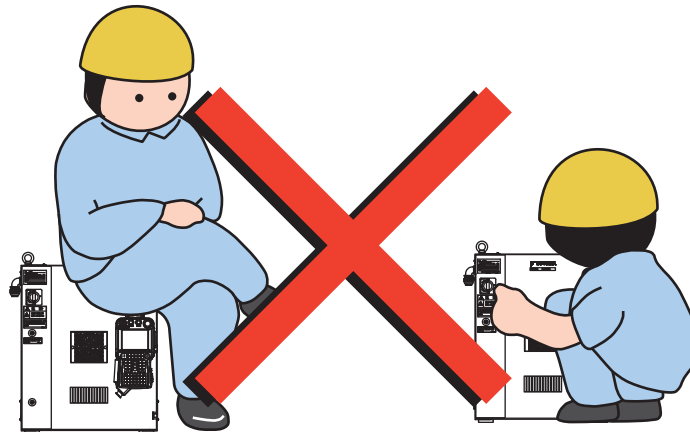


- Never sit or lean on DX200 controller.

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

- Never touch the buttons inadvertently on DX200 or other controllers.

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



- Never allow unauthorized personnel to touch the DX200 during operation.

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

1.5 Motoman Safety

The followings are safty functions of MOTOMAN / DX200.

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

These safety functions conform to the following safety standards.

- EN ISO 13849-1 Cat.3 / PL d
- EN 62061 (IEC 61508) SIL CL2

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


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

1.5.1 Installation and Wiring Safety

Refer to the MOTOMAN-□□□ Instructions manual and DX200 Instructions for details on installation and wiring.

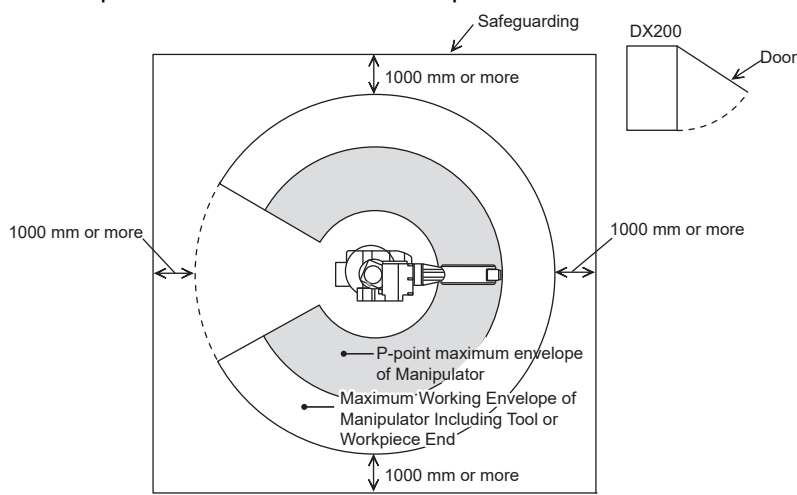
In planning installation, adapt an easy to observe arrangement to ensure safety. Take safety into consideration when planning the installation.

Observe the following when installing the manipulator:

WARNING

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

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



- Perform grounding in accordance with all applicable electrical codes. Failure to observe this caution may result in fire or electric shock.



CAUTION

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

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

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

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

- When lifting the DX200, please check the following:
 - As a rule, handling of DX200 must be performed using a crane with wire rope threaded through attached eyebolts.
 - Be sure to use wire that is strong enough to handle the weight of the DX200.

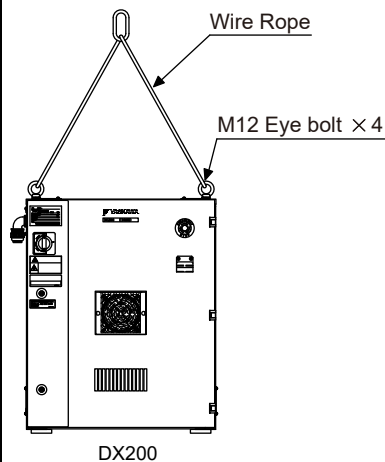


Table 1-1: Approx. Weight of DX200

Models Available for DX200	Approx. Weight (Kg)
Small capacity model	100
Medium /Large capacity model	100

- Be sure the eyebolts are securely fastened.

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

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

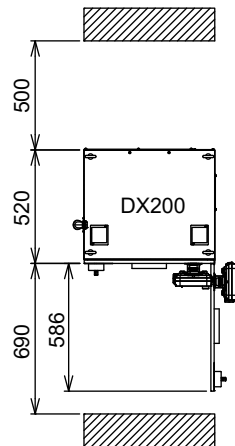
Failure to observe this precaution may result in injury of damage to equipment.



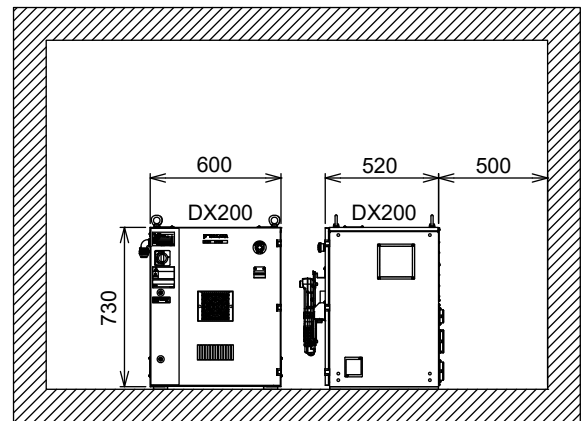
CAUTION

- Be sure there is sufficient room for maintenance on the manipulator, DX200, and other peripheral equipment.

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



DX200 Maintenance Area
(Unit: mm)



DX200 External Dimensions (Unit: mm)

- To ensure safety, be sure to operate the controller from a location where the manipulator is easily visible.

Operation by unauthorized personnel may result in injury or equipment damage.

- Install the DX200 outside the safeguarding of the manipulator's safety enclosure.

Failure to observe this precaution may result in injury or damage to equipment resulting from contact with the manipulator.

- Install the manipulator using bolts of the size and type specified for each MOTOMAN in the MOTOMAN INSTRUCTION MANUAL.

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

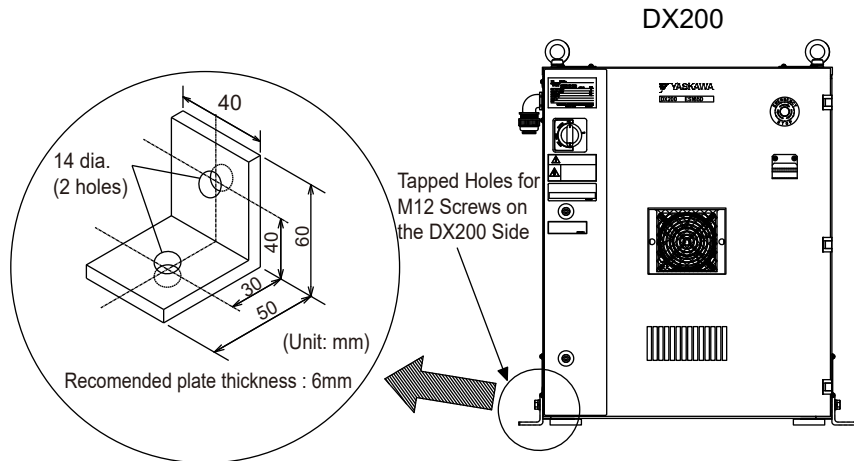


CAUTION

- Secure the position of the DX200 after setting up.

Attach the DX200 to the floor or rack, etc., using the screw holes on the bottom of the DX200.

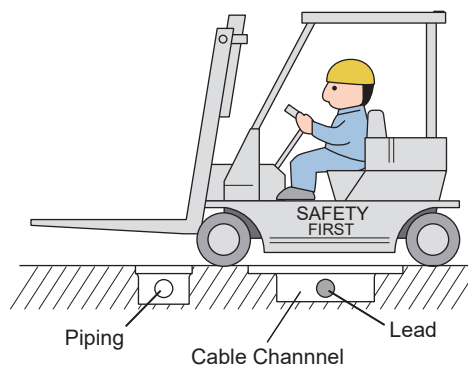
Failure to observe this caution could lead to injury or equipment damage if the DX200 should shift or fall.



- Be familiar with the connection diagram before wiring the DX200, and perform the wiring in accordance with the connection diagram.

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

- Take precautions when wiring and piping between the DX200, manipulator, and peripheral equipment. Run the piping, wiring, or cables through a pit or use a protective cover, so that they are not stepped on by personnel or run over by the forklift.



Operators and other personnel may stumble on exposed wiring or piping. Cable damage can cause unexpected manipulator motion resulting in injury or property damage.

1.5.2 Work Area Safety

Carelessness contributes to serious accidents in the work area.

To ensure safety, enforce the following precautions:



WARNING

- Install a safeguarding around the manipulator to prevent any accidental contact with the manipulator while the power is ON. Post a warning sign stating "Off-limits During Operation" at the entrance of the enclosure. The gate of the safeguarding must be equipped with a safety interlock. Be sure the interlock operates correctly before use.

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




CAUTION

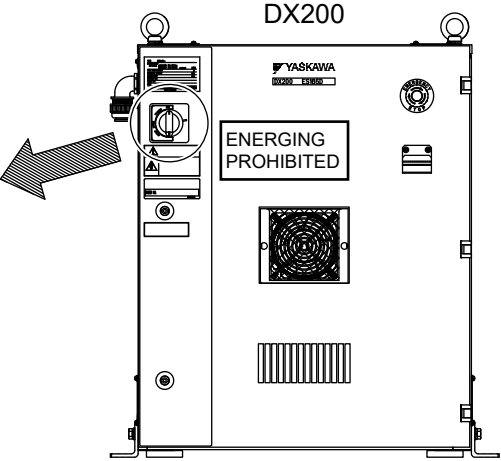
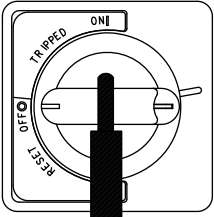
- Store tools and similar equipment in proper locations outside of the enclosure.

Tools and loose equipment should not be left on the floor around the manipulator, DX200, or welding fixture, etc., as injury or damage to equipment can occur if the manipulator comes in contact with objects or equipment left in the work area.

1.5.3 Operation Safety

**WARNING**

- When attaching a tool such as the welding torch to the manipulator, be sure to turn OFF the power supply of the DX200 and the tool, lock the switch, and display a warning sign.



PADLOCK

DX200

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

- Never exceed the rated capacity of the manipulator (capacity can be found in the specifications section of the manipulator manual.)
Failure to observe this caution may result in injury or damage to equipment.
- Teach jobs from outside the manipulator's work area whenever possible.
- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
 - Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
 - Always view the manipulator from the front.
 - Always follow the predetermined operating procedure.
 - Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
 - Ensure that you have a place to retreat to in case of emergency.

Improper or unintentional manipulator operation can result in injury.



WARNING

- Before operating the manipulator, check that the SERVO ON lamp on the programming pendant goes out when the emergency stop buttons on the front door of the DX200, on the programming pendant, and on the external control device, etc. are pressed. And confirm that the servo lamp is turned OFF.

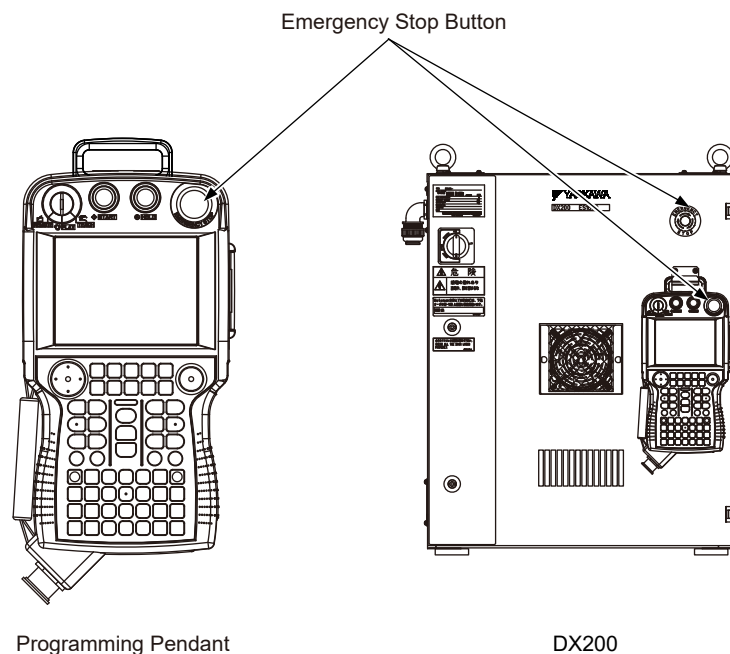
Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

- Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator when:
 - Turning ON the DX200 power
 - Moving the manipulator with the programming pendant
 - Running the system in the check mode
 - Performing automatic operations

Injury may result from contact with the manipulator if persons enter the P-point maximum envelope of the manipulator.

Press the emergency stop button immediately if there are problems.

The emergency stop buttons are located on the right of the front door of the DX200 and the programming pendant.





CAUTION

- Perform the following inspection procedures prior to teaching the manipulator. If problems are found, correct them immediately, and be sure that all other necessary tasks have been performed.
 - Check for problems in manipulator movement.
 - Check for damage to the insulation and sheathing of external wires.

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

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.



MANDATORY

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

1.6 Notes for Moving and Transferring the MOTOMAN

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



CAUTION

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

If any manuals are missing, contact your YASKAWA representative.

- If the warning labels on the manipulator and DX200 are illegible, clean the labels so that they can be read clearly. Note that some local laws may prohibit equipment operation if safety labels are not in place.

Contact your YASKAWA representative if you require new warning labels.

- When the MOTOMAN is transferred, it is recommended to check with your YASKAWA representative.

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

1.7 Notes on MOTOMAN Disposal



DANGER

- Do not modify the manipulator or the DX200.

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.

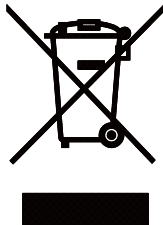


MANDATORY

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



PROHIBITED



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

2 Product Confirmation

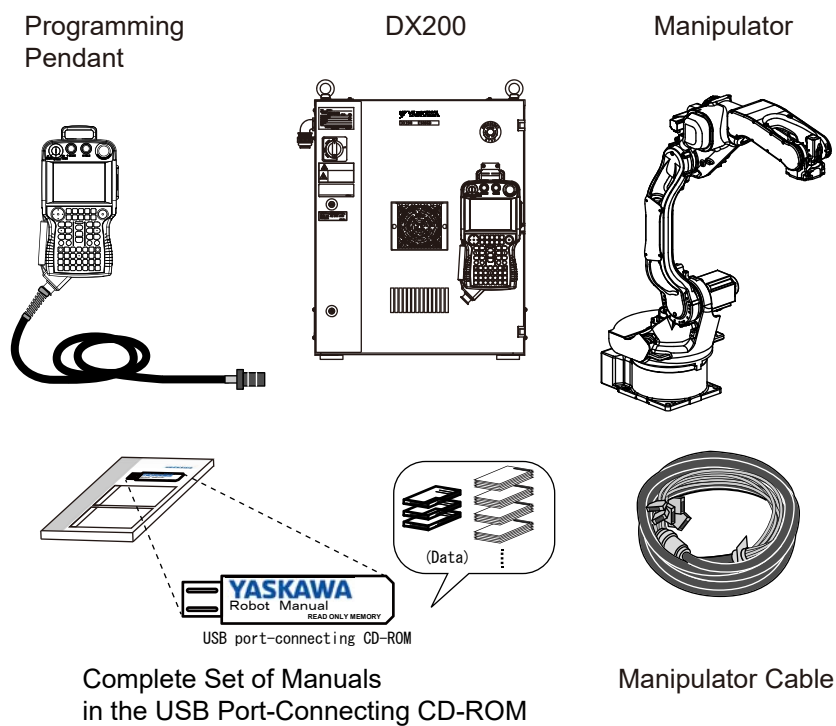
2.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

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

- Manipulator
- DX200
- Programming Pendant
- Manipulator Cable (Between Manipulator and DX200)
- Complete Set of Manuals (in the USB Port-Connecting CD-ROM)

Fig. 2-1: Standard Five Items

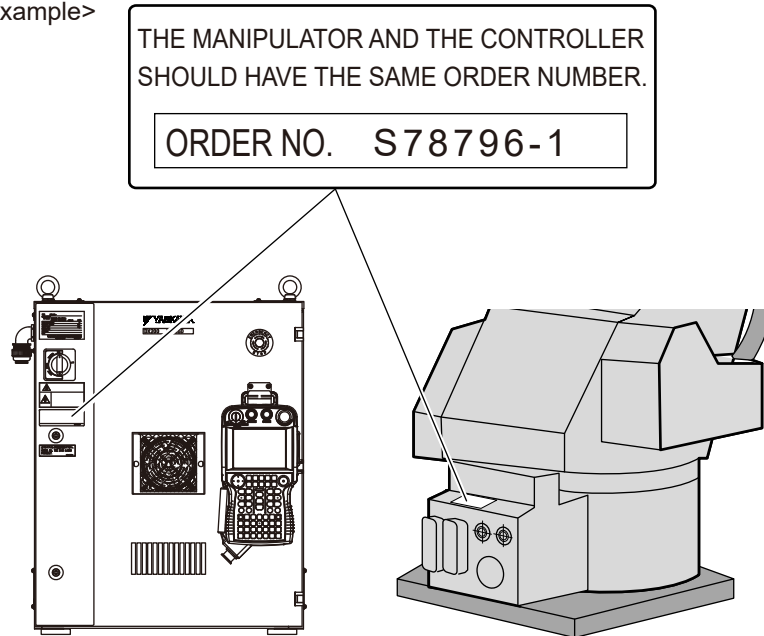


2.2 Order Number Confirmation

Confirm that the order number pasted on the manipulator and DX200 are the same.

The order number plates are affixed to the figure below.

<Example>



3 Installation

3.1 Handling Procedure



CAUTION

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

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

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

Excessive vibration or impacting the DX200 may adversely affect the performance of the DX200.

3.1.1 Using a Crane to Move the Controller

Check the following before handling the DX200:

- Confirm the weight of the controller before handling, and use a wire rope with a rating that is greater than the weight of the controller.
- Install eyebolts for handling and confirm they are securely fastened before hoisting.

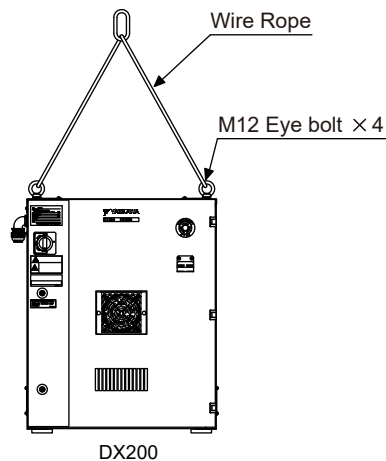


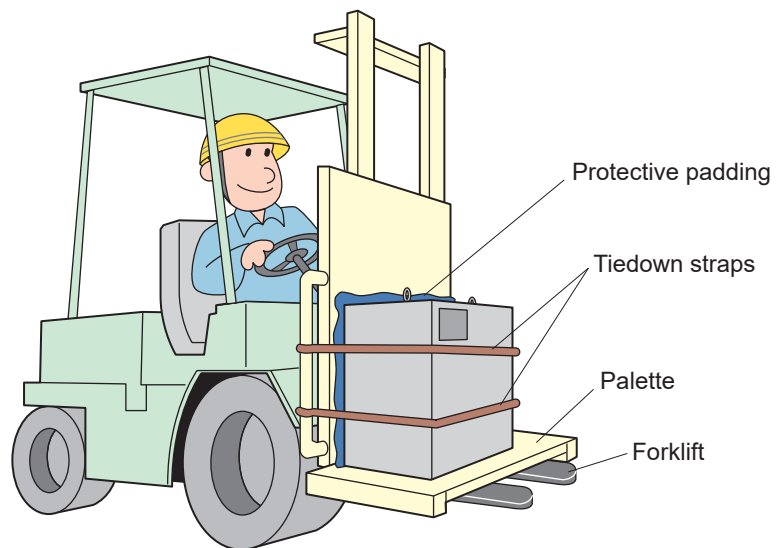
Table 3-1: Approx. Weight of DX200

Models Available for DX200	Approx. Weight (Kg)
Small capacity model	100
Medium /Large capacity model	100

3.1.2 Using a Forklift to Move the Controller

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

- Confirm that there is a safe work environment and that the DX200 can be transported safely to the installation site.
- Inform people along the forklift route that equipment is being moved in their area.
- Secure the controller so it cannot shift or fall during handling.
- Transport the controller at the lowest possible height.
- Avoid jarring, dropping, or hitting the controller during handling.
- When carrying the controller, operate the forklift at a safe speed.



3.2 Place of Installation

The conditions listed below must be met before installing the DX200:

- Ambient temperature: 0 to 45°C (32 to 113°F) during operation
-10 to 60°C (14 to 140°F) during transportation and maintenance
Temperature change: 0.3°C per minute or less
- Humidity: 10 to 90% RH with no condensation
- Only a small amount of dirt, dust, cutting oil, organic solvent, oil fume, water, salt, etc. in the place
(Especially, avoid adhesion of chemicals, cutting oil including coolant, rust preventive oil, organic solvent, etc. to the programming pendant.)
- Free from flammable or corrosive liquid, gas, etc.
- Free from excessive shock, vibration, etc. (vibration: 0.5G or less)
- Free from large electrical noise
(An electrical noise source such as a TIG welding device must not be placed close to the DX100.)
- Free from excessive microwaves, ultraviolet rays, X-rays, or radiation
- Altitude: 1000 m or less
(To use the DX100 at the altitude over 1000 m, calculate the maximum ambient temperature by decreasing it by 1% per 100 m. The maximum allowable altitude is 2000 m. When the altitude is 2000 m, the maximum ambient temperature during operation is 40.5°C.)

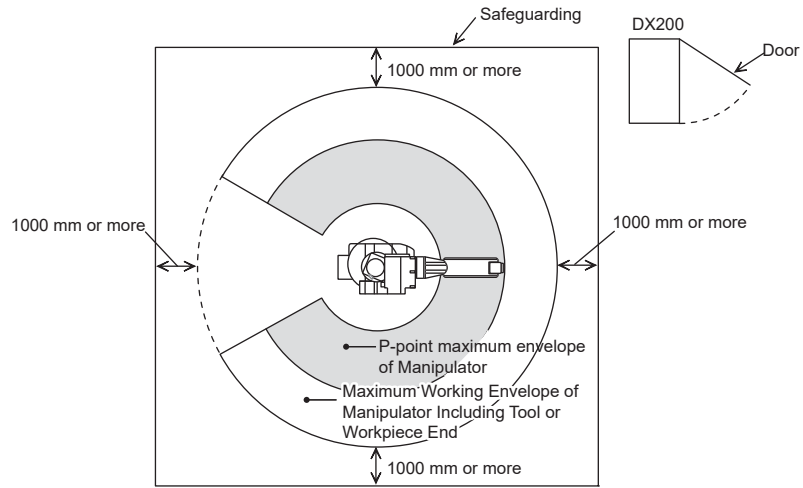


If the external electric noise applies, the alarm occurs and the manipulator may stop.
When the alarm occurs and the manipulator stops, refer to DX200 maintenance manual and reset the alarm.

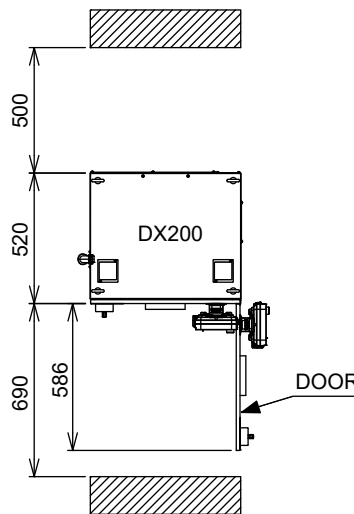
3.3 Location

1. Install the DX200 outside of the P-point maximum envelope of the manipulator (outside of the safeguarding.)

Fig. 3-1: Location of DX200



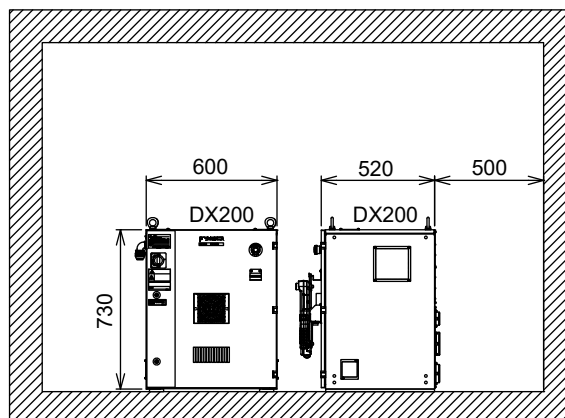
2. Install the controller in a location from which the manipulator is easily visible.
3. Install the controller in a location from which you can easily inspect it when the door is open.



3 Installation

3.4 Mounting the Controller

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



3.4 Mounting the Controller

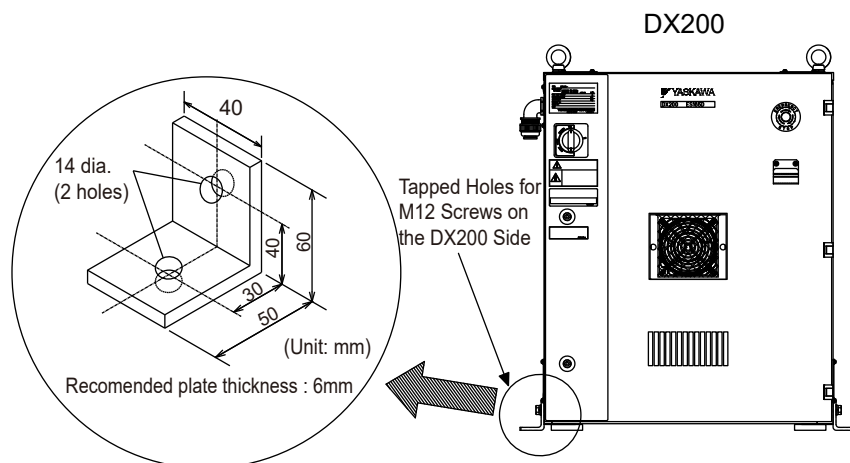


CAUTION

- Do not climb on top of the DX200.

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

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



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

3.5 Procedure of Stacking the Controllers

It is possible to stack the DX200 controllers.

■ **Note**

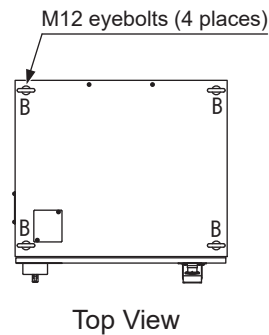
There are restrictions to stack the DX200 controllers. Please read through the following restrictions before installing the DX200.

* The following restrictions apply to both upper and lower controllers.

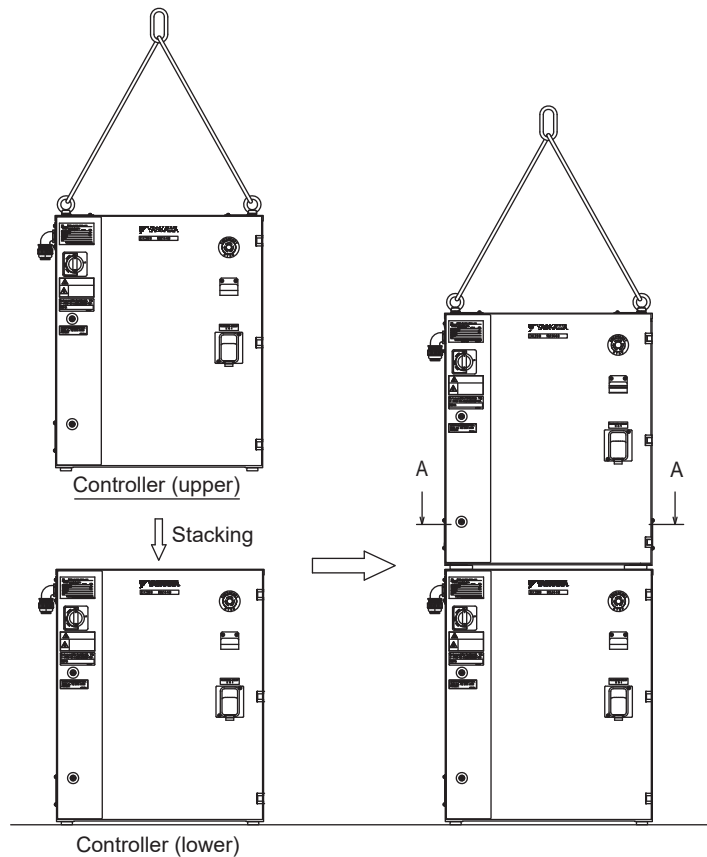
Restrictions: as for medium and large capacity controllers, the controllers only for the spot welding are able to be stacked. Other controllers, such as for handling, cannot be stacked. The controllers for the small capacity can be stacked regardless of the uses.

Follow the procedures below when stacking the DX200 controllers.

1. Remove the four eyebolts (4 places) on the top of the DX200 to be stacked lower level.



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



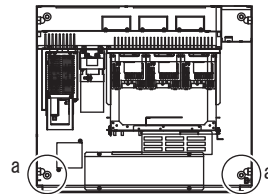
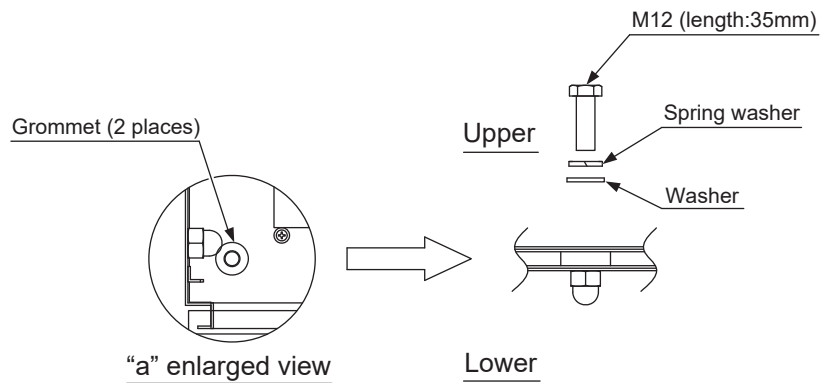


CAUTION

- Remove the crane after stacking and fixing the controllers.

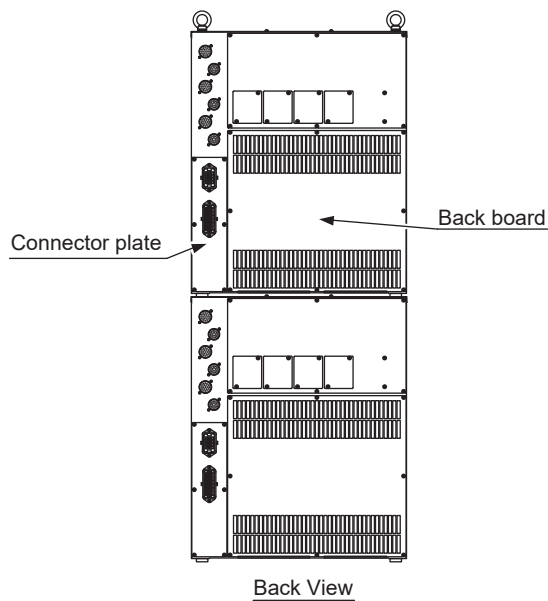
Failure to observe this caution may cause the personal injury or the equipment damage.

- After stacking the controllers, remove the grommets inside (A-A section "a" part) of the upper controller. Install the M12 bolts (length:35 mm), spring washers and washers for temporarily.



A-A Section View

- Remove the back board and connector plate on the back of the upper controller.



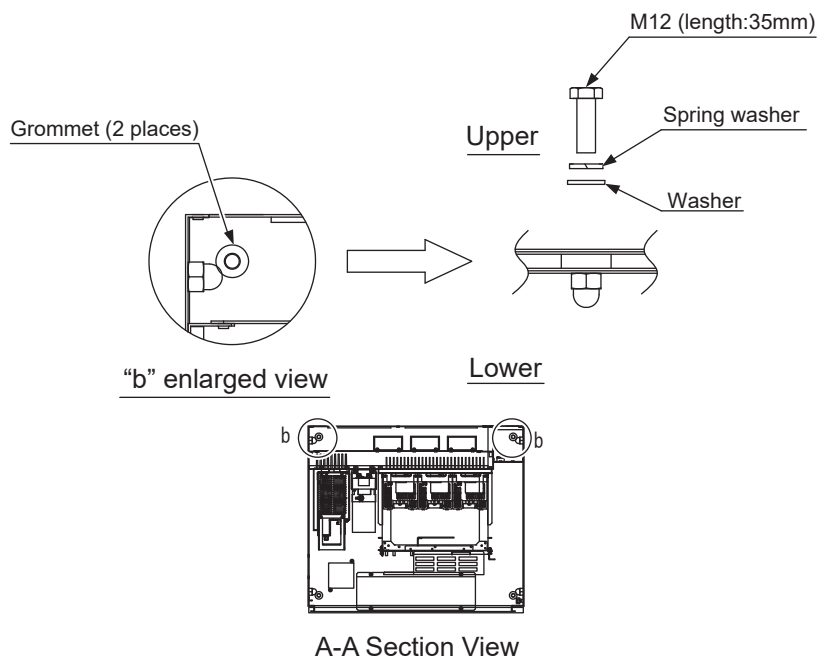
Back View



CAUTION

- When remove the connector plate from the controller, perform with the great caution to avoid damaging the internal cables.
- Failure to observe this caution may cause the cable damage.

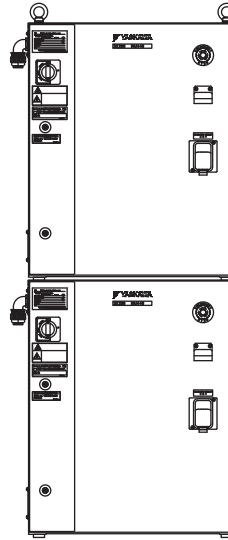
5. After stacking the controllers, remove the grommets inside (A-A section “b” part) of the upper controller. Install the M12 bolts (length:35 mm), spring washers and washers for temporarily.



6. After confirming the stacking the controllers, tighten the temporarily M12 bolts firmly. (a,b parts: tighten the 4 places)
(tightening torque: $4.2\text{N} \cdot \text{m}$)
7. Reinstall the removed back board and connector plate at procedure No.4.

3 Installation
3.5 Procedure of Stacking the Controllers

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



4 Connection



WARNING

- The system must be grounded.

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

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

Failure to observe this caution may result in injury and electric shock.

- Do not touch any board inside the controller for five minutes after turning OFF the power supply.

Capacitors inside the controller store electricity after power is turned OFF. Exercise caution whenever handling circuit boards. Failure to observe this caution may cause electrical shock.

- Power cannot be turned ON unless the door is closed. Interlocks prevent power from being turned ON.

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

- Any occurrence during wiring while the DX200 is in the emergency stop mode is the user's responsibility. Do an operation check once the wiring is completed.

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

- Wiring must be performed only by authorized personnel.

Incorrect wiring may cause fire and electric shock.

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

Incorrect wiring may cause fire or mechanical breakdown.

- Be sure the power circuit screws are securely tightened.

Loose power circuit wires can cause fire and electric shock.

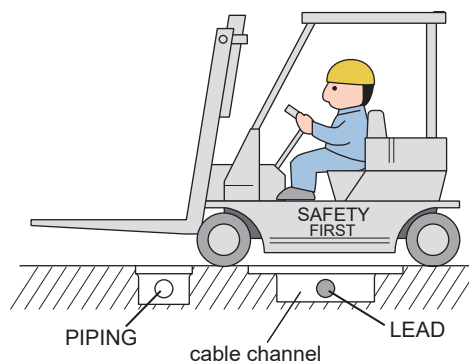
- Do not handle the circuit board directly by hand.

The IC board may malfunction due to electrostatics.

4.1 Notes on Cable Junctions

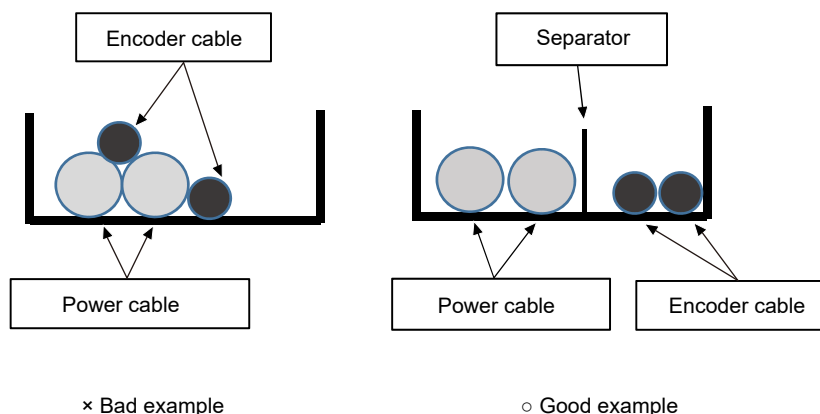
- The cables that connect the controller to peripheral device are low voltage circuits. Keep controller signal cables away from the primary power circuit. High voltage power lines should not be run in parallel to controller signal cables. If running parallel cables is unavoidable, use metal ducts or conduit to isolate electrical signal interference. If cables must be crossed, run the power cables perpendicular across the signal cables.
- Confirm the connector and cable numbers to prevent mis-connection and equipment damage. One connects the manipulator and DX200. Another connects the DX200 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: DX200 Cable Junction Diagram



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

Fig. 4-1(a): Example for the cable arrangement in the duct



4.2 Power Supply

4.2.1 Three-Phase Power Supply

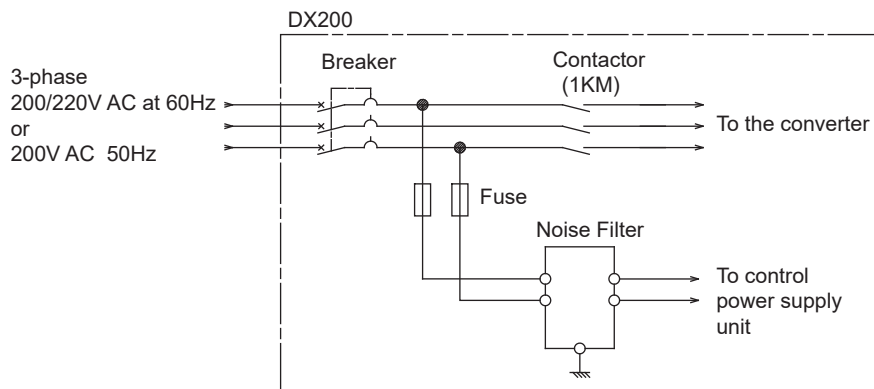
NOTE

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

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

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

Fig. 4-2: Input Power Connection

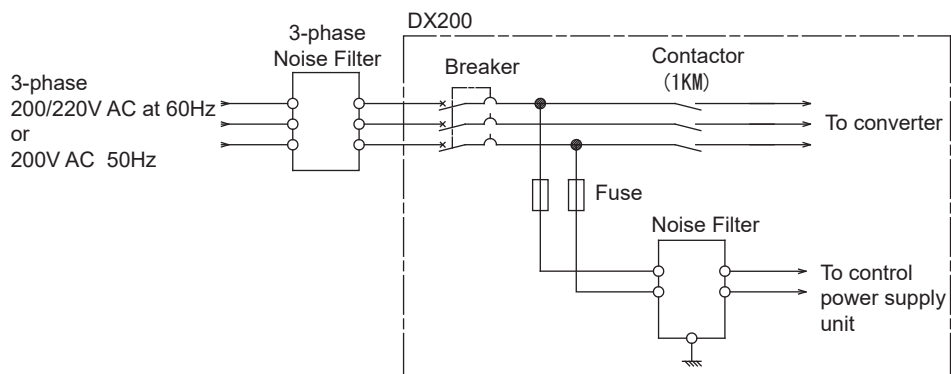


4.2.2 Noise Filter Installation

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

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

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



4.2.3 Leakage Breaker Installation

When connecting the leakage breaker to the controller power supply wiring, use a leakage breaker which can handle high frequencies from the DX200 inverter. Leakage breakers which cannot handle high frequencies may malfunction.

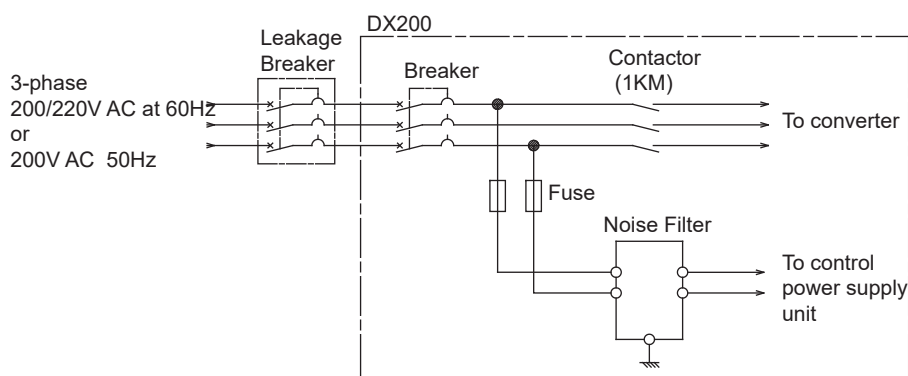
Table 4-1: Example of High Frequency Leakage Breaker

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

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 DX200 inverter. However, this current leakage presents no safety risks.

Fig. 4-4: Connection of the Leakage Breaker



4.2.4 Primary Power Supply Breaker Installation

Install the primary power supply breaker as shown below.

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

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

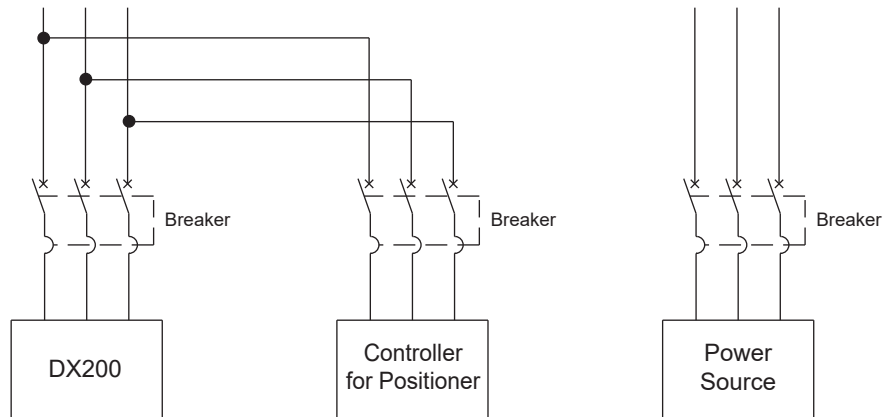


Table 4-2: DX200 Power Capacity, Cable Sizes, and Breaker Capacities

Manipulator	Power capacity (kVA)	Cable size (size of terminal) (In case of Cabtyre cable (three cores)) (mm ²)	Capacity of breaker in DX200 (A)
MA1440	1.5	3.5 (M5)	15
MH12	1.5	3.5 (M5)	15
MS210	5.0	5.5 (M5)	30

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

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

Short Circuit Current Rating (SCCR) of DX200 is 1.5 kA. (In the case of ANSI specification is 100 kA.)

Inquire at the nearest branch office for information when selecting the transformer.



For the models which are not in *table 4-2*, refer to “DX200 INSTRUCTIONS SUPPLEMENT FOR Controller Specification List: Japan/Asia Specification” (HW1482743).



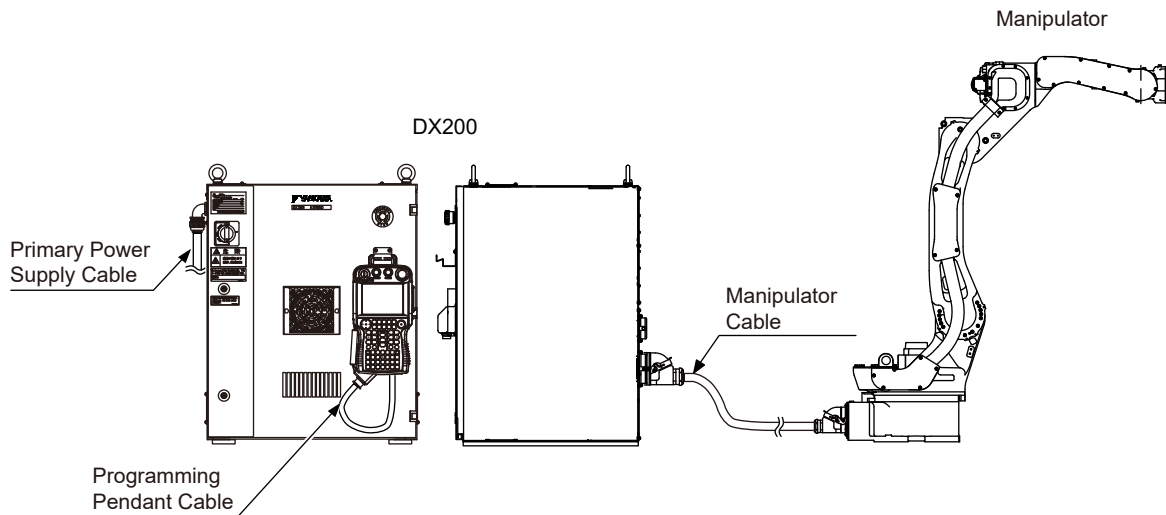
The power capacity shown above is the continuous rating value.

When the robot is rapidly accelerated, the power capacity of several times the continuous rating value may be needed instantly.

4.3 Connection Methods

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

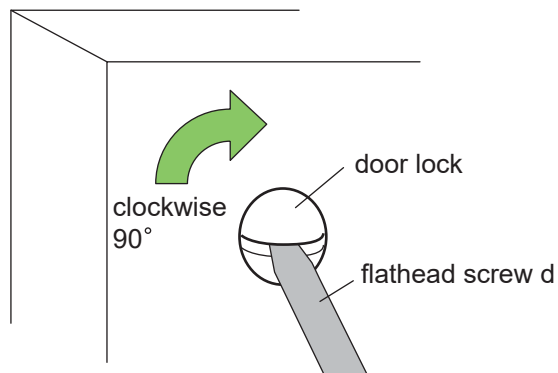
Fig. 4-6: Cable Connection



4.3.1 Connecting the Primary Power Supply

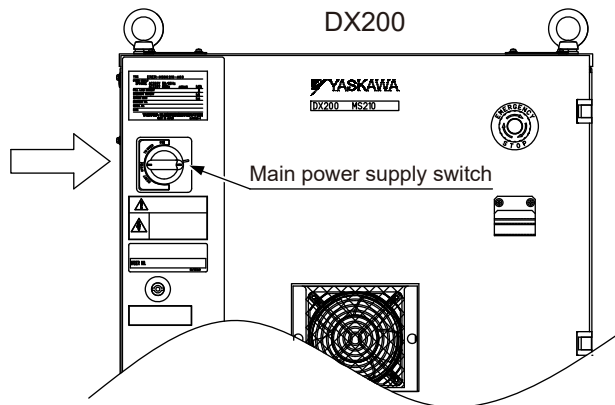
1. Open the front door of the DX200.
 - (1) Using a flathead screwdriver, rotate the door locks on the front of the DX200 (two places) 90 degrees clockwise.

Fig. 4-7: Rotating the Key Clockwise



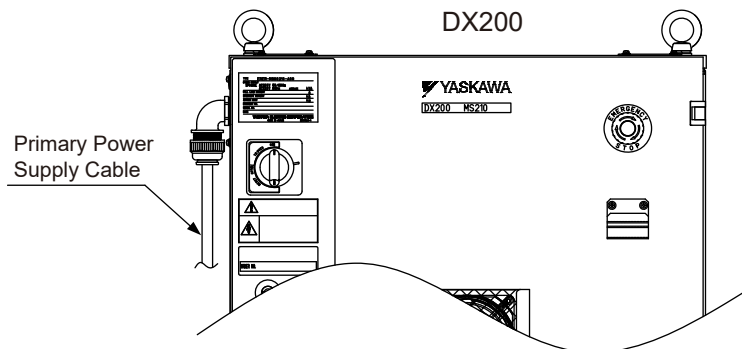
- (2) Rotate the main power supply switch to the "OFF" position and open the door gently.

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



2. Confirm that the primary power supply is OFF.
3. Connect the primary power supply cable.
 - Draw the primary power supply cable in from the cable entrance on top side of DX200 and fix it firmly with the cable clamp so that it won't shift or slip out of place.

Fig. 4-9: Cable Clamp



WARNING

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

Cable clamp must be used when connecting primary power supply.

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

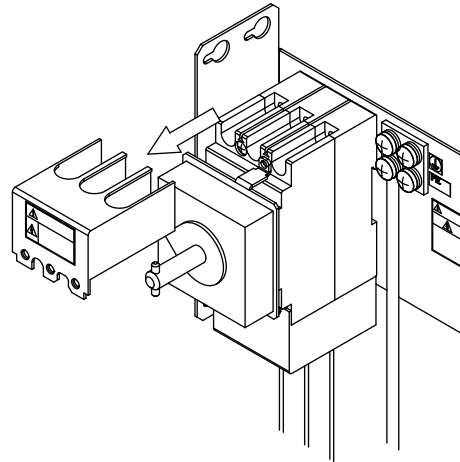
Failure to observe this caution may result in electric shock or breakdown of DX200.

4 Connection

4.3 Connection Methods

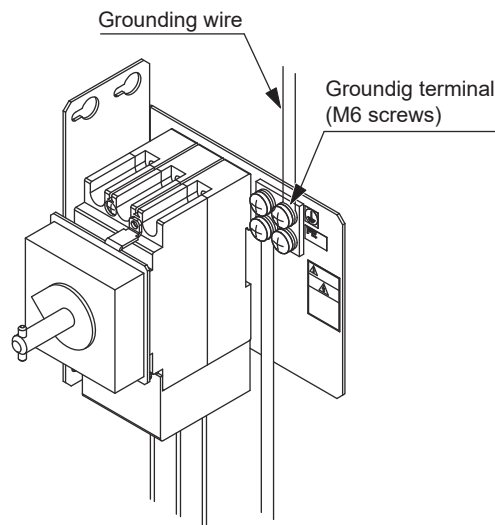
- (1) Pull off the primary cover of the switch which is on the upper right side of the DX200.

Fig. 4-10: Pulling Off the Cover



- (2) Connect a ground wire to reduce noise and prevent electric shock. Grounding should be TT or TN in accordance with the wiring regulations of each country and the power supply system used.
 - I) Connect the ground wire to the ground terminal (screw) of the switch which is on the upper left side of DX200.

Fig. 4-11: Connection of the Ground Wire



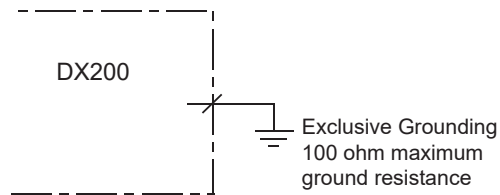
4 Connection
4.3 Connection Methods

- II) Perform grounding in accordance with all relevant local and national electrical codes. The size of ground wire must be the same as listed on *table 4-2 "DX200 Power Capacity, Cable Sizes, and Breaker Capacities"*.



The customer must prepare the ground wire.

Fig. 4-12: Exclusive Grounding

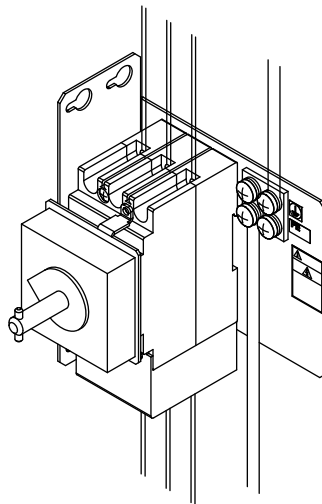


Don't connect the grounding wire with the wires for the electric power source, the welder, etc.

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

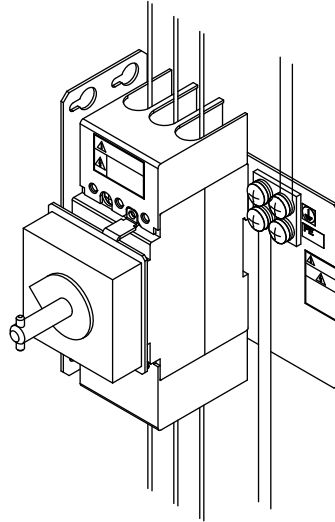
- (3) Connect the primary power supply cable.

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



(4) Install the cover.

Fig. 4-14: Install the Cover



4.3.2 Connecting the Manipulator Cable



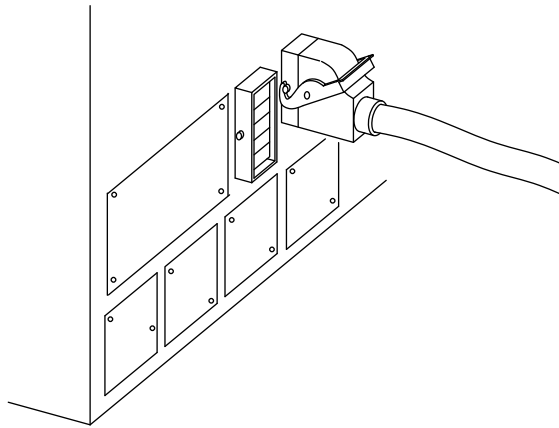
WARNING

- 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 connectors on the back side of DX200.

Fig. 4-15: Connection of the Manipulator Cable



For more information on connecting the manipulator cable, please refer to the Instruction Manual which corresponds to the particular DX200 model.

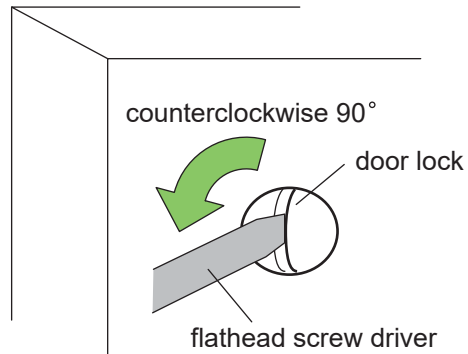
2. Connect the manipulator to the DX200.
 - Confirm the shape and size of the cable connector, the key fitting, and the position of the pins of the manipulator. Push the cable connector into the manipulator side connector firmly, and tighten securely.

4 Connection

4.3 Connection Methods

3. Close the DX200 door.
 - (1) Close the door gently.
 - (2) Rotate the door lock counterclockwise 90 degrees.

Fig. 4-16: Rotating the Key Counterclockwise



WARNING

Always close the door of the controller (DX200) except for maintenance.

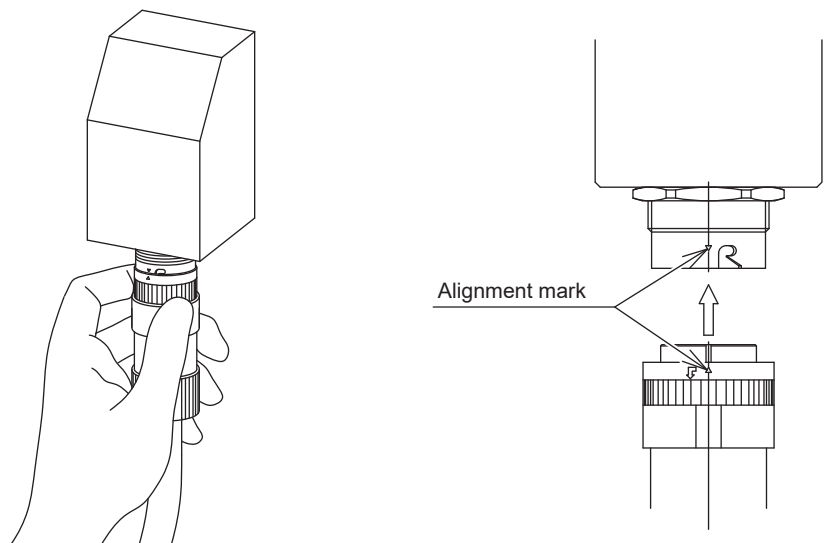
Make sure to rotate all the door locks counterclockwise.

If dust or water enter inside the controller, electric shock or breakdown of DX200 may result.

4.3.3 Connecting the Programming Pendant

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

Fig. 4-17: Connecting the Programming Pendant



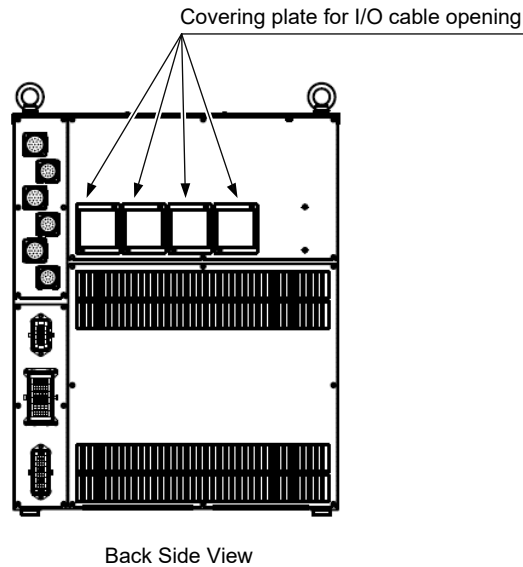
- The manipulator, DX200, and the programming pendant connections are now complete.

4.3.4 User I/O Cable Connection

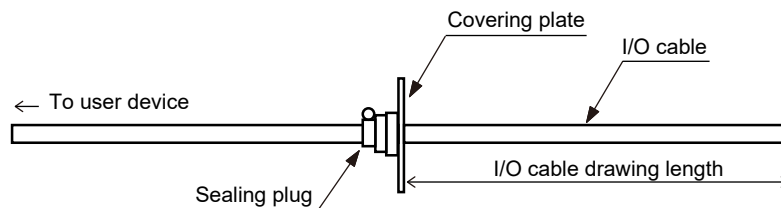
User can choose one I/O cable connection method out of following three ways.

Connect user I/O signal to I/O terminal blocks (TIFS553YS) that are connected to universal I/O circuit board (JANCD-YIO21-E)	User connects universal I/O signal through terminal blocks (TIFS553YS), that are mounted at the back side of the controller's front door.
Connect safety plug and system external signal for external emergency stop, etc. to machine safety terminal block circuit board (JANCD-YFC22-E)	Connect safety plug and system external signal for external emergency stop, etc. to machine safety terminal block circuit board which is mounted on the front side of the controller's front door.
Directly connect user I/O signal to universal I/O circuit board (JANCD-YIO21-E)	User connects user I/O signal to universal I/O circuit board (JANCD-YIO21-E) directly.

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



2. Cut a hole on each covering plate and deliver the user I/O cable. Use a cable gland, etc. to prevent any particles from entering. For the drawing length of the cable, refer to the following figure since it varies depending on the connecting part. After cables are delivered to each plate, set them back to the back side panel of the controller.



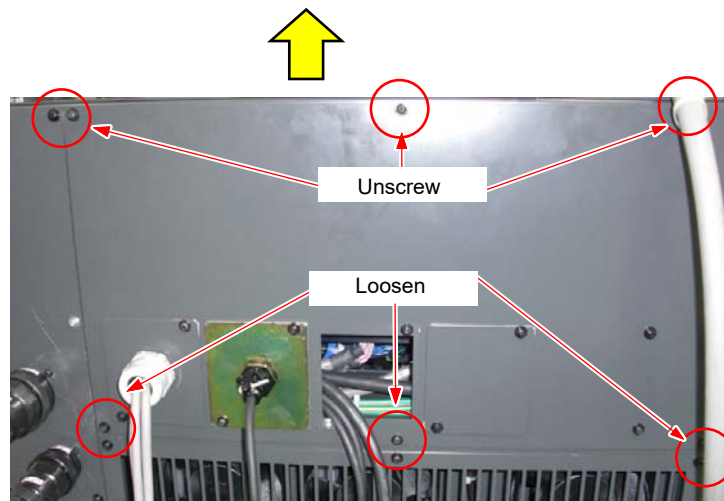
4 Connection

4.3 Connection Methods

Connect user I/O signal to I/O terminal blocks (TIFS553YS) connected to universal I/O circuit board (JANCD-YIO21-E)	Drawing length: 2m (Cable length for terminal processing is included)	Cable terminal process: Unshielded Refer to "Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)" in chapter 14.7 "Universal I/O Circuit Board (JANCD-YIO21-E)".
Connect safety plug and system external signal for external emergency stop, etc. to machine safety terminal block circuit board (JANCD-YFC22-E)	Drawing length: 1m (Cable length for terminal processing is included)	Cable terminal process: Unshielded Refer to "Wiring Procedure of the Terminal Block" in chapter 14.6 "Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)".
Directly connect user I/O signal to universal I/O circuit board (JANCD-YIO21-E)	Drawing length: 0.5m (Cable length for terminal processing is included)	Cable terminal process: Connector Refer to "Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)" in chapter 14.7 "Universal I/O Circuit Board (JANCD-YIO21-E)".

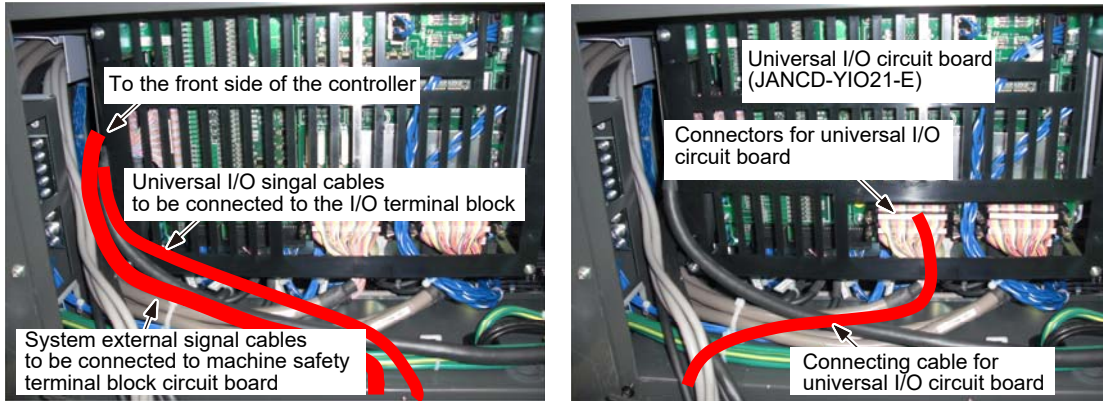
3. From the controller's back panel where I/O cable openings are provided, remove upper three screws and loosen lower three screws and then, remove the panel by pulling up. Be careful not to remove the lower three ones or the panel may fall off.

Pull up to remove



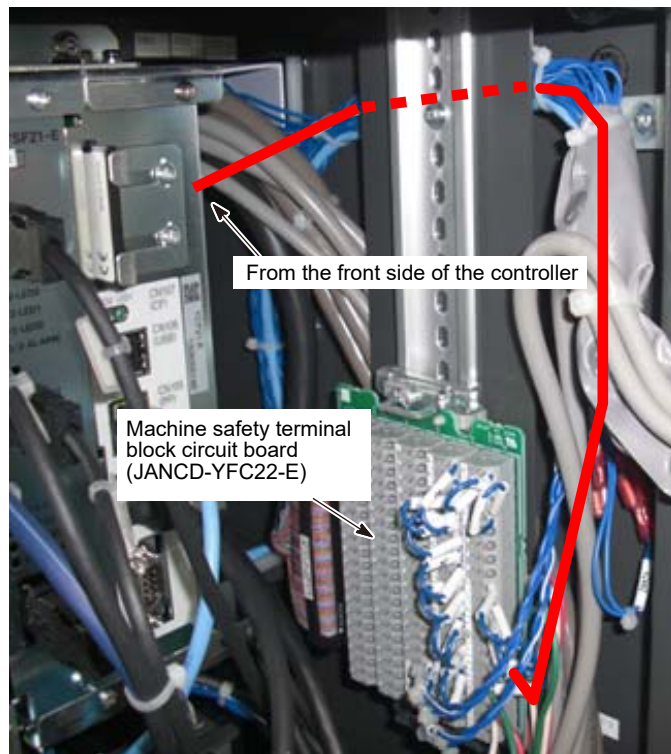
4 Connection
4.3 Connection Methods

4. Draw the user system external signal cable and universal I/O signal cable from the cable openings to the front part of the controller along its right side. And then, connect the universal I/O signal cable to the connector on the universal I/O signal circuit board. For the details of the connection, refer to “*Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)*” in chapter 14.7 “*Universal I/O Circuit Board (JANCD-YIO21-E)*” .



Back Side View

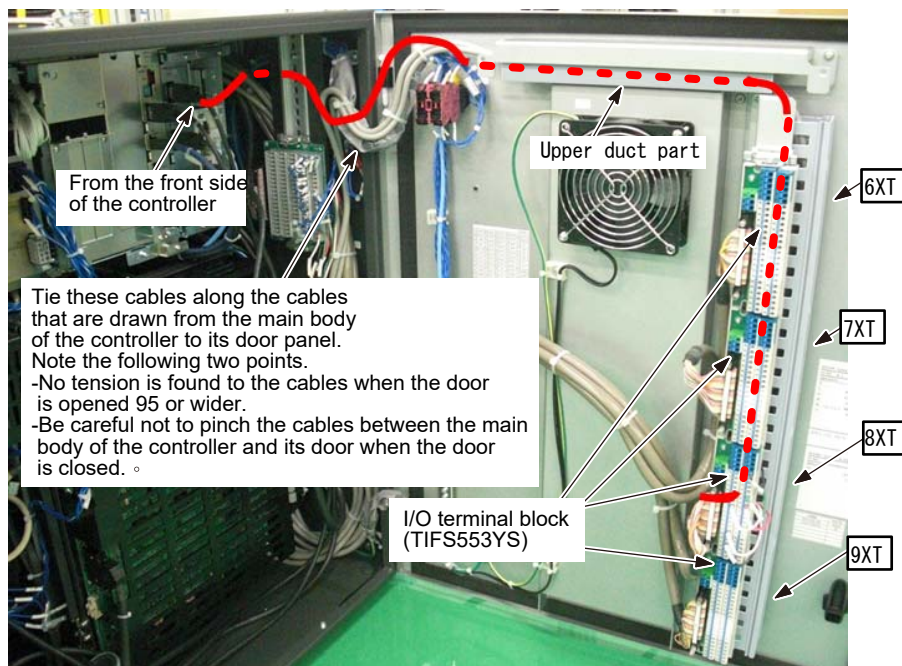
5. Draw the system external signal cables for external emergency stop, etc. drawn in the above mentioned step 2, to the front part of the controller along the space at the right side of the controller as shown by the red line in the figure below. And then, connect the cables to the machine safety terminal block circuit board (JANCD-YFC22-E). For the details of the connection, refer to “*Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)*” in chapter 14.7 “*Universal I/O Circuit Board (JANCD-YIO21-E)*” .



4 Connection

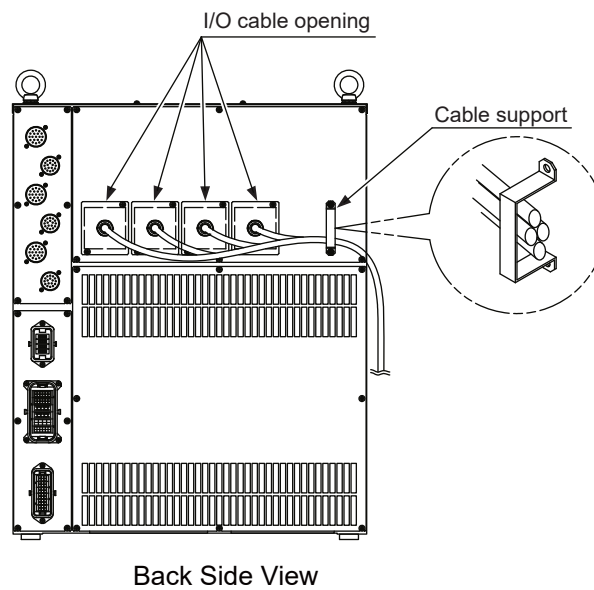
4.3 Connection Methods

6. Draw the universal I/O signal cables drawn in the above mentioned step 2 like the system external signal cables along the upper duct part as shown by the red line shown in the figure below. And then, connect them to each of the I/O terminal block (TIFS553YS) that are connected to the universal I/O circuit board (JANCD-YIO21-E). For the details of the connection, refer to “Wiring Procedure of the Terminal Block” in chapter 14.6 “Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)”.



7. Reassemble the controller back panel on which I/O cable openings are provided.
8. For the user cables drawn from the I/O cable openings on the back panel of the DX200, perform wirings by using the supplied cable support in the accessory kit. At this time, please do not cover the intake and exhaust area of the back panel.

Fig. 4-18: User I/O Wiring Connection



5 Turning ON and OFF the Power Supply

5.1 Turning ON the Main Power Supply



WARNING

- Confirm that nobody is present in the P-point maximum envelope of the manipulator when turning ON the DX200 power supply.

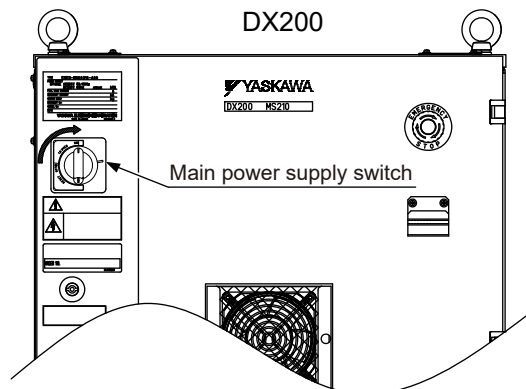
Failure to observe this caution could result in injury caused by accidental contact with the manipulator.

Press the emergency stop button immediately if any problems occur.

The emergency stop buttons are located on the right side of the front door of the DX200 and on the right side of the programming pendant.

The main power supply is turned ON when the main power supply switch on the front of the DX200 is turned to the "ON" position, and the initial diagnosis and the current position setting begin.

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



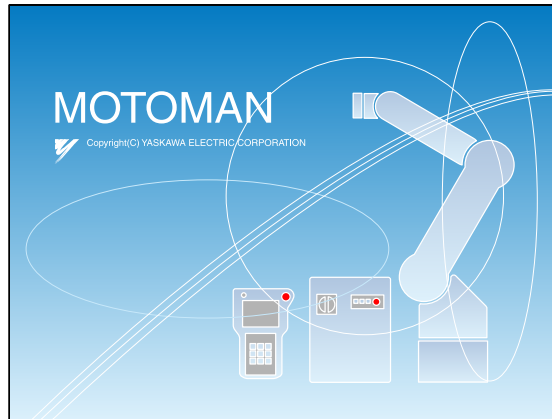
5 Turning ON and OFF the Power Supply

5.1 Turning ON the Main Power Supply

5.1.1 Initial Diagnosis

The initial diagnosis are performed in the DX200 when main power is turned ON, and the startup window is shown on the programming pendant screen.

Fig. 5-2: Startup Window



5.1.2 When Initial Diagnosis are Complete

When the power supply is turned OFF, the DX200 saves all condition data, including:

- Mode of operation
- Called job (active job if the DX200 is in the play mode; edit job if the DX200 is in the teach mode) and the cursor position in the job.

Fig. 5-3: Initial Window



CAUTION

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.

After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator operation may result in injury.

Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.

-
- 5 Turning ON and OFF the Power Supply
 - 5.2 Turning ON the Servo Power
-

5.2 Turning ON the Servo Power

5.2.1 During Play Mode

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

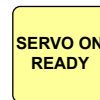
- When the safeguarding is closed, press [SERVO ON READY] on the programming pendant to turn ON the servo power supply. [SERVO ON] lamp will light, when the servo power is turned ON.



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

5.2.2 During Teach Mode

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



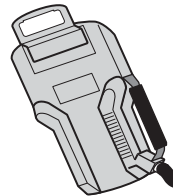
2. The servo power is turned ON and [SERVO ON] lamp on the programming pendant lights when the operator grips the Enable switch.



5 Turning ON and OFF the Power Supply
5.2 Turning ON the Servo Power

Servo Power ON/OFF --- Enable Switch

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



Release -> OFF



Squeeze -> ON



Squeeze Tightly -> OFF



When performing emergency stop on the front door of the DX200, programming pendant, or external signal, the servo power-on operation from the Enable switch is cancelled. When turning the power back ON, follow the previously listed instructions.

- **The Valid / Invalid setting of safety signals in operation modes.**
Safety functions of the robotic system are switched to valid or invalid depending on operation modes. Particularly in teach mode, be aware the safeguarding(safety plug) signal input becomes invalid. Perform the operation with great caution.

Operation Mode	Play Mode	Teach Mode
Safety Signal		
Controller Emergency Stop (PBESP)	Valid	Valid
External Emergency Stop (EXESP)	Valid	Valid
Programing Pendant Emergency Stop (PPESP)	Valid	Valid
Safeguarding (safety plug) (SAFF)	Valid	Invalid
Programing Pendant Enable SW (PPDSW)	Invalid	Valid
External Enable SW (EXDSW)	Invalid	Valid
Servo Power Enable (ONEN)	Valid	Valid
Manipulator Overrun (OT)	Valid	Valid
External Axis Overrun (EXOT)	Valid	Valid
Speed Limit	Invalid	Valid

-
- 5 Turning ON and OFF the Power Supply
 - 5.3 Turning OFF the Power Supply
-

5.3 Turning OFF the Power Supply

5.3.1 Turning OFF the Servo Power (Emergency Stop)

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

- Press the emergency stop button and the servo power supply is turned off.
The emergency stop buttons are located on the front door of the DX200 and on the right side of the programming pendant.
- The break operates once the servo power supply is turned OFF, and the manipulator can no longer operate.
The emergency stop mode can be operated at any mode.
(Teach mode, Play mode, Remote mode)



Programming Pendant

EMERGENCY STOP

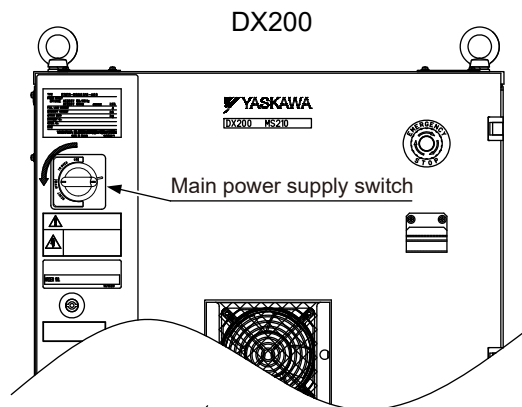


Door upper side

5.3.2 Turning OFF the Main Power

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

- When the main power switch on the front of DX200 is turned to the "OFF" position, the main power is turned OFF.



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

If turn the DX200 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 DX200 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.

5 Turning ON and OFF the Power Supply
5.3 Turning OFF the Power Supply

Safety Signal	Mode		Operation Mode		
			Stop Category 0	Stop Category 1	Stop Category 2
Controller Emergency Stop (PBESP)	Teach	Valid	○		
	Play	Valid		○	
External Emergency Stop (EXESP)	Teach	Valid	○		
	Play	Valid		○	
Programing Pendant Emergency Stop (PPESP)	Teach	Valid	○		
	Play	Valid		○	
Safety fence (safety plug) (SAFF)	Teach	Invalid	-	-	-
	Play	Valid		○	
Programing Pendant Enable SW (PPDSW)	Teach	Valid	○		
	Play	Invalid	-	-	-
Servo Power Enable (ONEN)	Teach	Valid	○		
	Play	Valid	○		
Manipulator Overrun (OT)	Teach	Valid	○		
	Play	Valid	○		
External Axis Overrun (EXOT)	Teach	Valid	○		
	Play	Valid	○		
Programing Pendant (HOLD)	Teach	Valid			○
	Play	Valid			○
Mode Switch (Teach mode to play mode) (PP KEY SW)			○		
Mode Switch (Play mode to teach mode) (PP KEY SW)				○	

- : Invalid



WARNING

- When the stop category 1 is used, the stopping distance and the stopping time are longer than those with the stop category 0. 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



WARNING

- Press the emergency stop button on the right of the front door of the DX200 and the programming pendant before operating the manipulator. Confirm that the SERVO ON lamp is turned OFF.

Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency. The emergency stop buttons are attached on the front door of the DX200 and right of the programming pendant.

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

Improper or unintentional manipulator operation can result in injury.

- Prior to performing the following operations, be sure that there is no one within the P-point maximum envelope of the manipulator, and be sure that you are in a safe place yourself.
 - Turning ON the DX200 power
 - Moving the manipulator with the programming pendant
 - Running the system in the check mode
 - Performing automatic operations

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



CAUTION

- Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.
 - Check for problems in manipulator movement.
 - Check for damage to the insulation and sheathing of external wires.
- Always return the programming pendant to its specified position after use.

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator operation may result in injury.

Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.

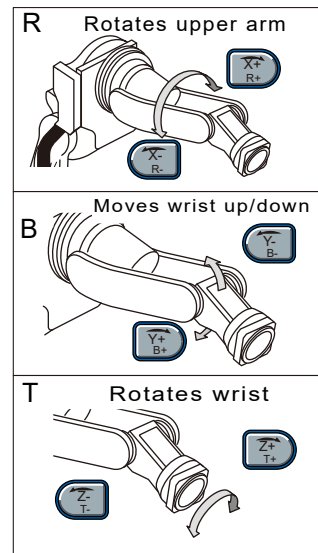
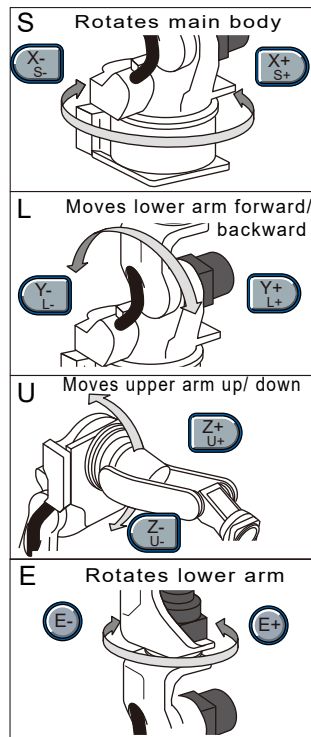
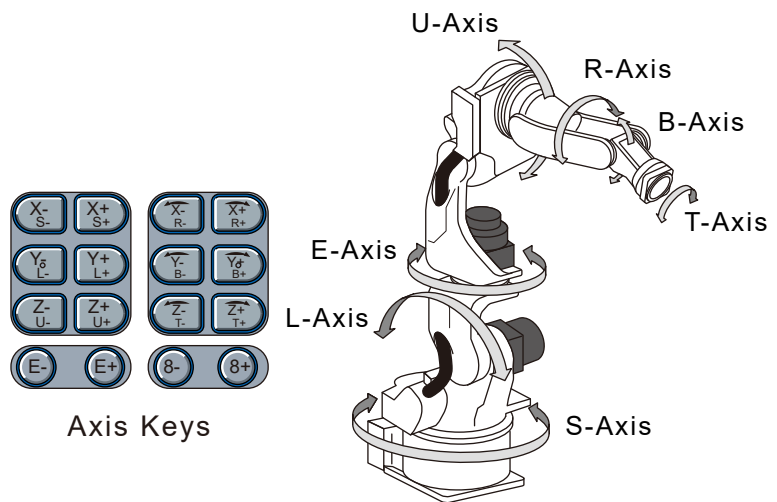
6.1 Movement of the Axes

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.



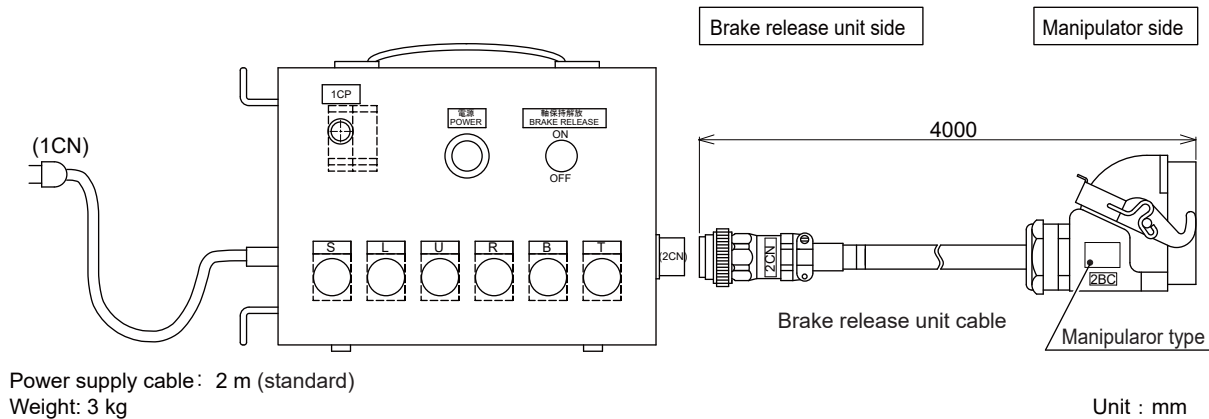
Be sure to remove all items from the area before moving the manipulator.
Refer to the INSTRUCTION MANUAL for the appropriate position of the fixture.



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)



This brake release unit can be used in a state that the motor servo ON can not be executed from the DX200 controller.

Be very careful about the followings when using.



CAUTION

- When releasing the brake, pay attention to surroundings. The robot arm may move under its own weight, and personal injury or equipment damage may result.
- Release the brake for one axis at a time. If the brakes of multiple axes are released out of necessity, the robot arm may move in an unexpected way. Pay attention to surroundings. Personal injury or equipment damage may result.

In case of purchase, inquire at the nearest YASKAWA branch office.

System Up

7 Security System

7.1 Protection Through Security Mode Settings

The DX200 modes setting are protected by a security system. The system allows operation and modification of settings according to operator clearance. Be sure operators have the correct level of training for each level to which they are granted access.

7.1.1 Security Mode

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

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

Operating the one time manage mode requires to enter the security code, which is issued by 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 “DX200 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY BOARD OPERATION (HW1481991)” 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	-
	TIMER	Operation	Edit
IN/OUT	EXTERNAL INPUT	Operation	Edit
	EXTERNAL OUTPUT	Operation	Edit
	UNIVERSAL INPUT	Operation	Operation
	UNIVERSAL OUTPUT	Operation	Operation
	SPECIFIC INPUT	Operation	-
	SPECIFIC OUTPUT	Operation	-
	RIN	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	Operation	Operation
	SERVO ON FACTOR	Management	-
	RB STOP FACTOR MONITOR	Operation	-

7 Security System
7.1 Protection Through Security Mode Settings

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
	CONTROLLER INFORMATION	Operation	-
	ALARM HISTORY	Operation	Management
	I/O MSG HISTORY	Operation	Management
	LOGDATA	Operation	Management
	USER DEFINITION MENU	Operation	Edit
	QR CODE	Operation	Operation
	SECURITY	Operation	Operation
EX. MEMORY	LOAD	Edit	-
	SAVE	Operation	-
	VERIFY	Operation	-
	DELETE	Operation	-
	DEVICE	Operation	Operation
	FOLDER	Operation	Management
	INITIALIZE ¹⁾	Operation	-
PARAMETER	S1CxG	Management	Management
	S2C	Management	Management
	S3C	Management	Management
	S4C	Management	Management
	A1P	Management	Management
	A2P	Management	Management
	A3P	Management	Management
	A4P	Management	Management
	A5P	Management	Management
	A6P	Management	Management
	A7P	Management	Management

7 Security System
7.1 Protection Through Security Mode Settings

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

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
PARAMETER	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
	LOGDATA COND.	Management	Management
	DATE/TIME	Management	Management
	GRP COMBINATION	Management	Management
	SET WORD	Edit	Edit
	RESERVE JOB NAME	Edit	Edit
	USER ID	Edit	Edit
	SET SPEED	Management	Management
	KEY ALLOCATION	Management	Management
	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
	SETTM SETUP	Edit	Management
SAFETY FUNC.	M-SAFETY SIGNAL ALLOC	Operation	Safety
	TIMER DELAY SET	Operation	Safety
	SAFETY LOGIC CIRCUIT	Operation	Safety
PM	PM (REDUCER)	Operation	Management
	PM (HARDWARE)	Management	Management
	INSPECTION NOTICE	Operation	Edit
	INSPECTION RECORD	Operation	Management
DISPLAY SETUP	CHANGE FONT	Operation	Operation
	CHANGE BUTTON	Operation	Operation
	INITIALIZE LAYOUT	Operation	Operation
	CHANGE WINDOW PATTERN	Operation	Operation

7 Security System
7.1 Protection Through Security Mode Settings

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

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
ARC WELDING	ARC START COND.	Operation	Edit
	ARC END COND.	Operation	Edit
	ARC AUX COND.	Operation	Edit
	POWER SOURCE COND.	Operation	Edit
	ARC WELD DIAG.	Operation	Edit
	WEAVING	Operation	Edit
	ARC MONITOR	Operation	Edit
	ARC MONITOR (SAMPL)	Operation	-
	APPLI COND.	Management	Management
HANDLING	HANDLING DIAGNOSIS	Operation	Edit
SPOT WELDING	WELD DIAGNOSIS	Operation	Edit
	I/O ALLOCATION	Management	Management
	GUN CONDITION	Management	Management
	SPOT POWER SOURCE COND.	Management	Management
	APPLICATION CONDITION SETTING	Management	Management
SPOT WELDING (MOTOR GUN)	WELD DIAGNOSIS	Operation	Edit
	GUN PRESSURE	Edit	Edit
	PRESSURE	Edit	Edit
	I/O ALLOCATION	Management	Management
	GUN CONDITION	Management	Management
	CLEARANCE SETTING	Operation	Edit
	SPOT POWER SOURCE COND.	Management	Management
	TIP INSTALLATION	Operation	Management
	APPLICATION CONDITION SETTING	Management	Management
GENERAL	WEAVING	Operation	Edit
	GENERAL DIAG.	Operation	Edit
PAINT	PAINT SYSTEM CONFIG.	Management	Management
	PAINT SPECIAL	Management	Management
	PAINT CONDITION	Operation	Edit
	CALIBRATION CONFIG.	Operation	Edit
	TIME CHART CONFIG.	Management	Management
	TIME CHART	Operation	Edit
	PAINT DATA CONFIG.	Operation	Edit
	PAINT OUTPUT TEST	Management	Management
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.

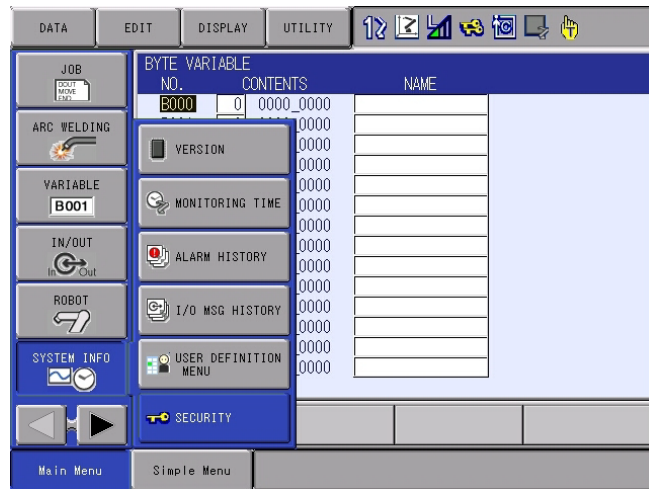
*As for the menu and the security mode when the functional safety is valid, refer to "DX200 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY BOARD OPERATION (HW1481991)" for more details.

7 Security System

7.1 Protection Through Security Mode Settings

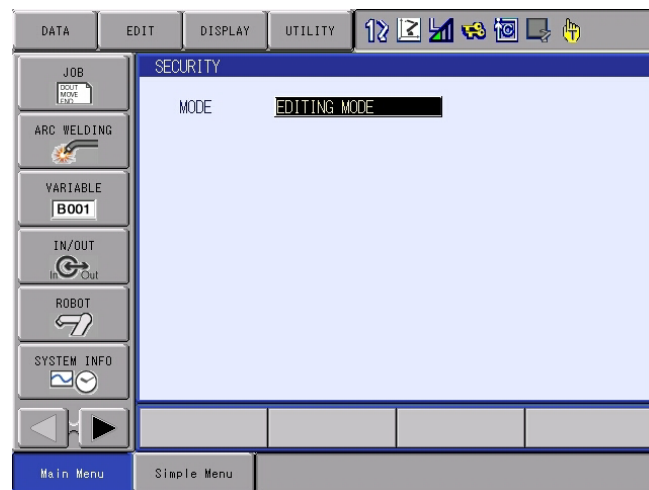
7.1.1.1 Changing the Security Mode

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



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

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



7 Security System

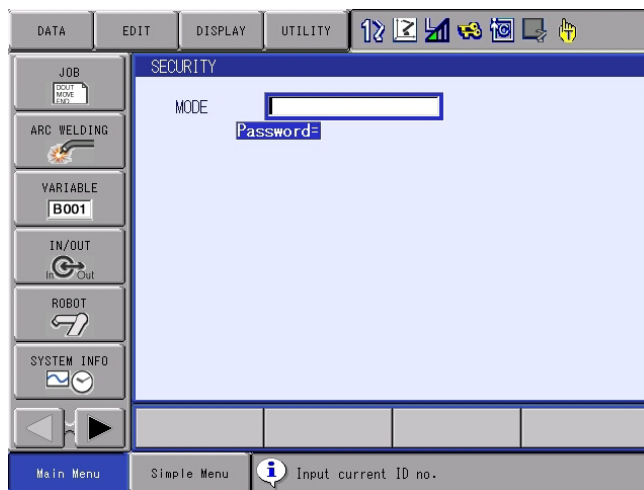
7.1 Protection Through Security Mode Settings

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



3. Select the security mode to change.

- If the selected security mode is lower than the current security level, the password will be required.



4. Enter the password.

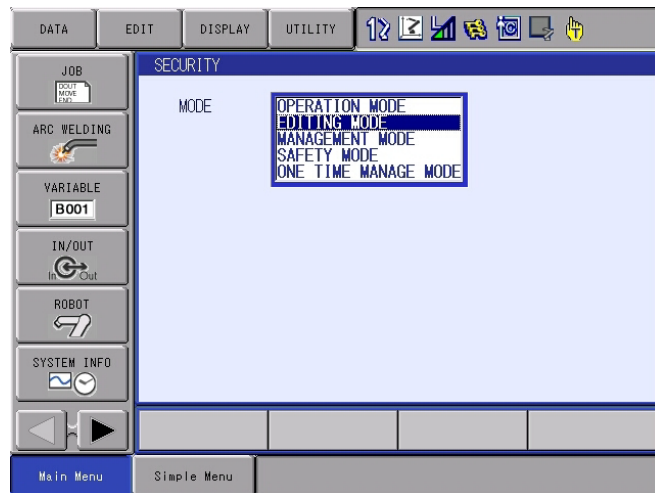
- The following user ID numbers are set as default.
Editing Mode: [0000000000000000]
Management Mode: [9999999999999999]
Safety Mode: [5555555555555555]

5. Press [ENTER].

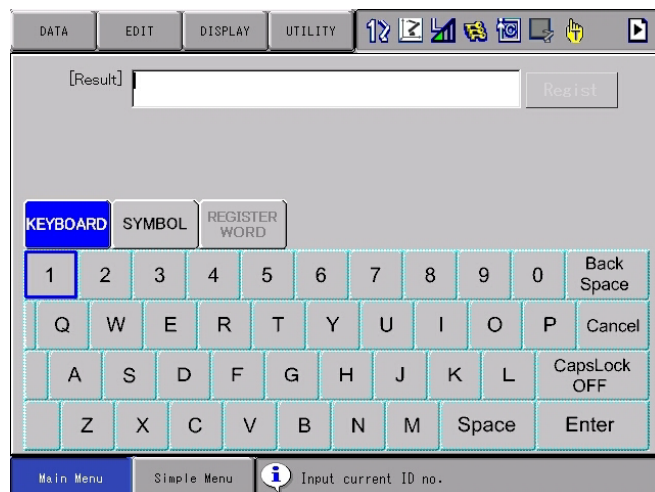
- If the password is correct, the security mode will be changed.

■ **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 Security System

7.1 Protection Through Security Mode Settings

7.1.2 User ID

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

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

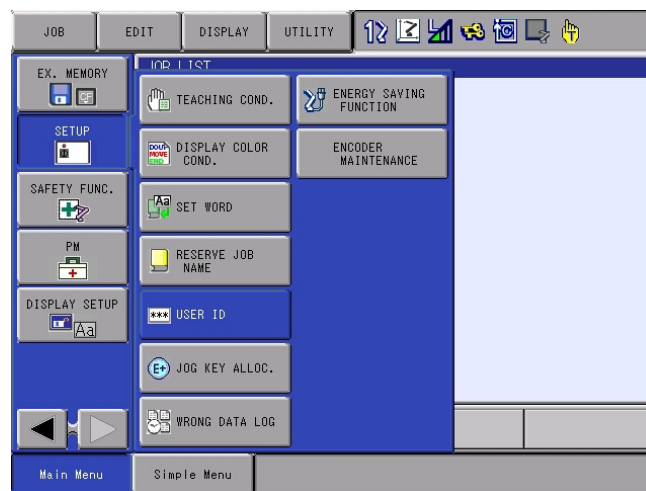
(Significant numbers and symbols: "0 to 9", "-", ".")

7.1.2.1 Changing User ID

In order to change the user ID, the DX200 must be in the editing mode, the management mode or the safety mode. Higher security modes can make changes the user ID of to lower security modes.

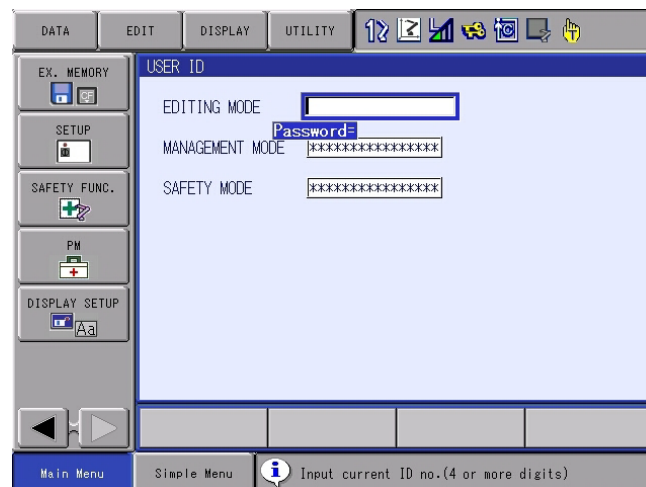
1. Select {SETUP} under the main menu.

– The sub menu appears.



2. Select {USER ID}.

– The USER ID window appears.

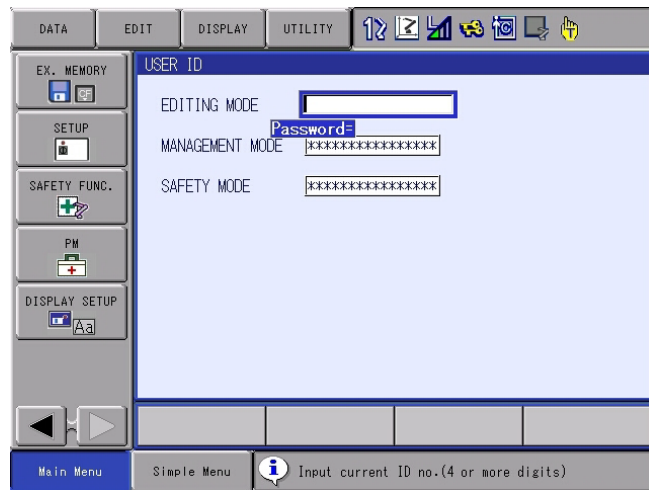


7 Security System

7.1 Protection Through Security Mode Settings

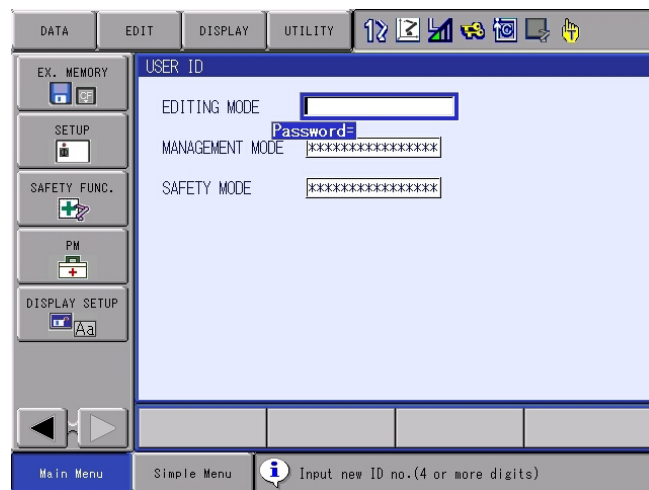
3. Select the desired ID.

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



4. Input the current ID and press [ENTER].

- 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.

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.
 - Make sure to perform data storage and management whenever creating or modifying data. (Use our recommended CompactFlash.)
 - YASKAWA is not responsible for any incident or failure caused by inappropriate setting of data.

8.1 Home Position Calibration



WARNING

- Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop buttons on the right of the front door of the DX200 and the programming pendant are pressed.

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

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

Improper or unintended manipulator operation may result in injury.

- Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator, and be sure that you are in a safe place when:
 - Turning ON the DX200 power.
 - Operating the manipulator with the programming pendant.

Injury may result from contact with the manipulator if persons enter the P-point maximum envelope of the manipulator.

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

Emergency stop buttons are located on the right of the front door of the DX200 and the programming pendant.



CAUTION

- Perform the following inspection procedures prior to teaching the manipulator. If problems are found, correct them immediately, and be sure that all other necessary tasks have been performed.
 - Check for problems in manipulator movement.
 - Check for damage to the insulation and sheathing of external wires.
- Always return the programming pendant to its specified position after use.

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator operation may result in injury.

- Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.

8.1.1 Home Position Calibration



Teaching and playback are not possible before the completion of the home position calibration.

In a system with two or more manipulators, the home position of all the manipulators must be calibrated before starting teaching or playback.

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

- Change in the combination of the manipulator and DX200
- Replacement of the motor or absolute encoder
- Clearing stored memory (by replacement of YIF01-□E circuit board, weak battery, etc.)
- Home position deviation caused by hitting the manipulator against a workpiece, etc.

To calibrate the home position, use the axis keys to calibrate the home position mark on each axis so that the manipulator can take its posture for the home position. There are two operations for home position calibration:

- All the axes can be moved at the same time: Recalibrate the home position by moving all the axes together if changing the combination of manipulator and circuit board.
- Axes can be moved individually: Recalibrate the home position for the individual axes that were affected by the replacement, if replacing the motor or absolute encoder.

If the absolute data of its posture for the home position is already known, set the absolute data again after completing home position registration.



Home Position

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

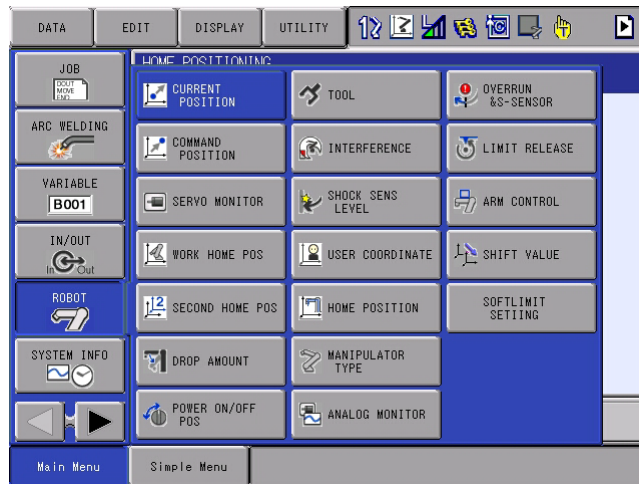
8.1.2 Calibrating Operation



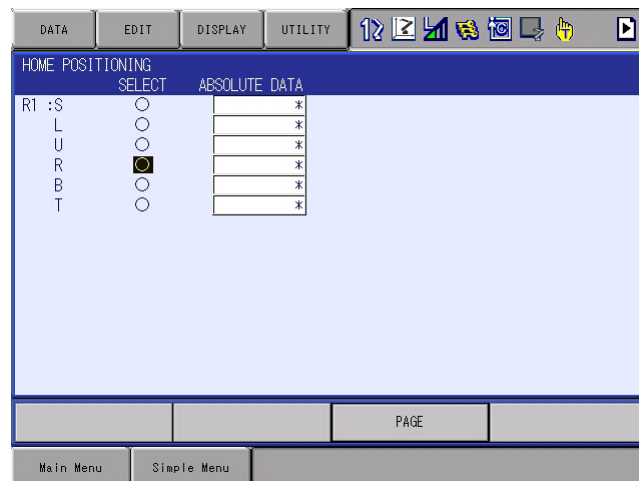
Home position calibration screen is displayed only in the security mode or the management mode.

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.

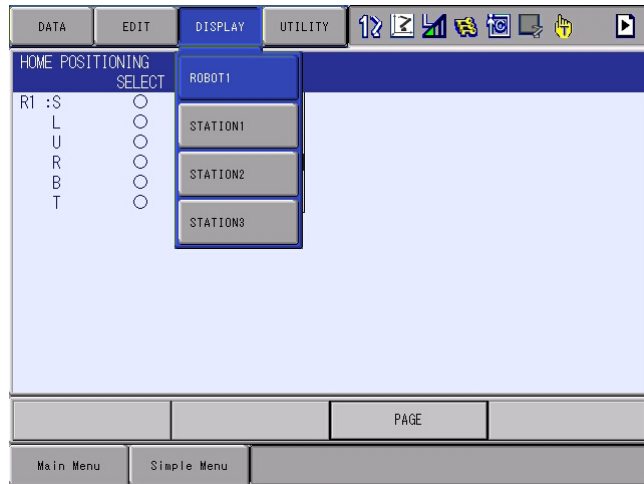


8 System Setup

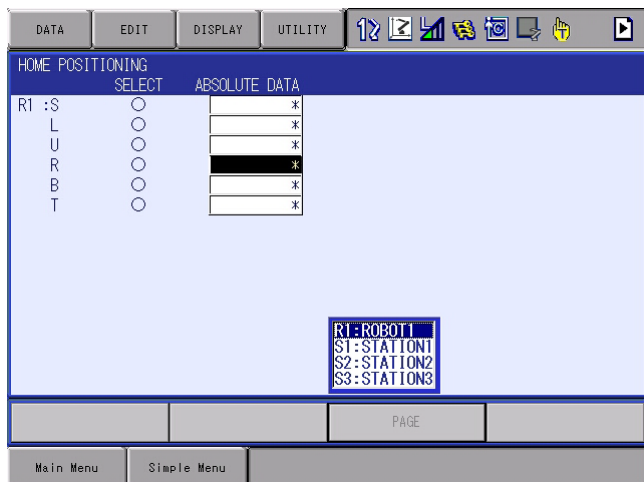
8.1 Home Position Calibration

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.



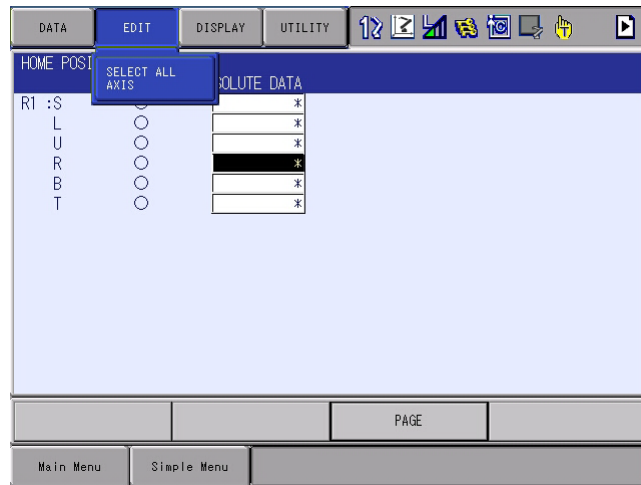
4. Select the desired control group.

- Select the control group for HOME POSITIONING.
- The control group can also be selected by pressing [PAGE].

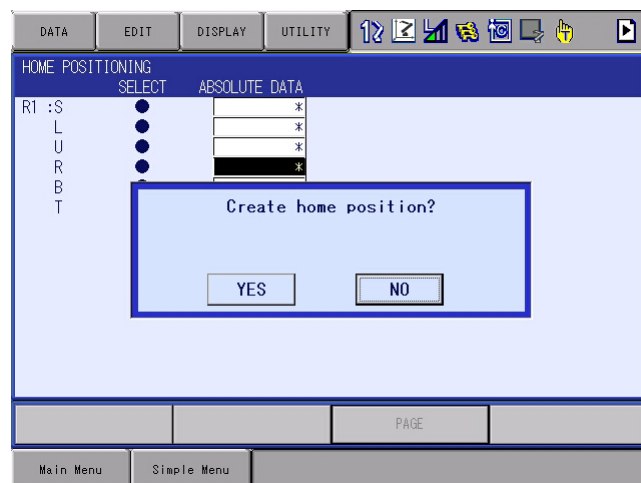
8 System Setup

8.1 Home Position Calibration

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



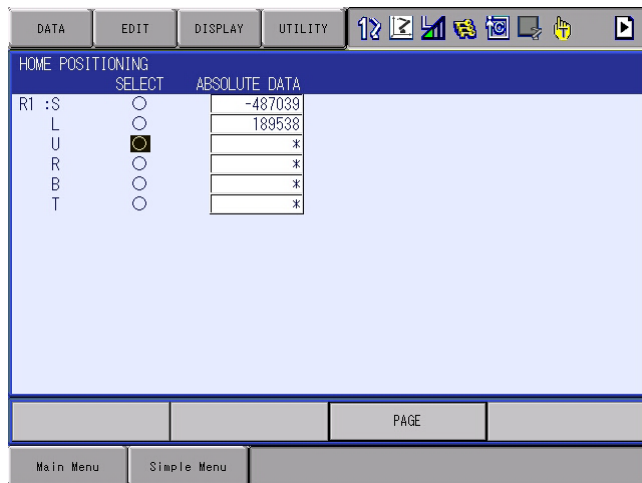
6. Select {SELECT ALL AXES}.
 - The confirmation dialog box appears.



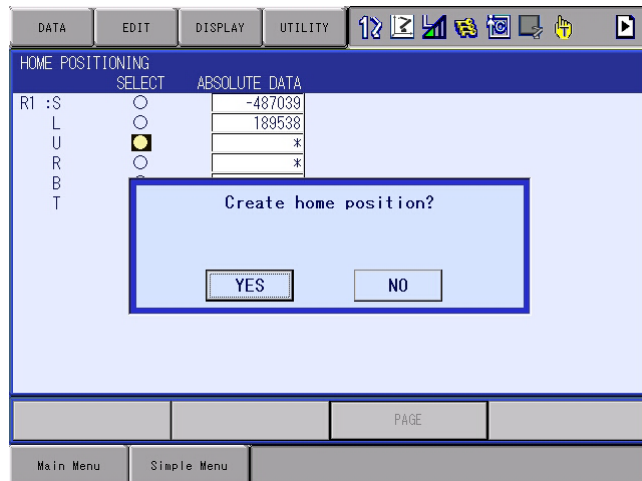
7. Select {YES}.
 - Displayed position data of all axes are registered as home position.
When {NO} is selected, the registration will be canceled.

8.1.2.2 Registering Individual Axes

1. Select {ROBOT} under the main menu.
 - The sub menu appears.
2. Select {HOME POSITION}.
3. Select the desired control group.
 - Perform the step 3 and 4 of the “Registering All Axes at One Time” to select the desired control group.
4. Select the axis to be registered.
 - Move the cursor to the axis to be registered, and select it.



- A confirmation dialog box appears.

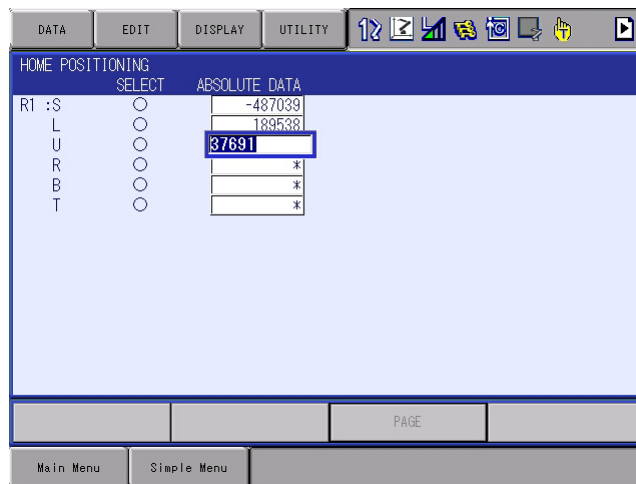


5. Select {YES}.
 - Displayed position data of the axis is registered as home position.
When {NO} is selected, the registration will be canceled.

8.1.2.3 Changing the Absolute Data

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

1. Select {ROBOT} under the main menu.
2. Select {HOME POSITION}.
3. Select the desired control group.
 - Perform the step 3 and 4 of the “Registering All Axes at One Time” to select the desired control group.
4. Select the absolute data to be registered.
 - The number can now be entered.



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

8.1.2.4 Clearing Absolute Data

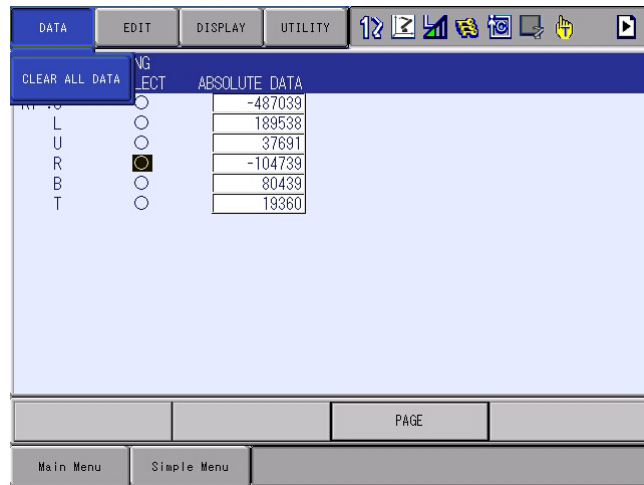
1. Select {ROBOT} under the main menu.
 - The sub menu appears
2. Select {HOME POSITION}.
 - Perform the step 3 and 4 of the “Registering All Axes at One Time” to select the desired control group.

8 System Setup

8.1 Home Position Calibration

3. Select {DATA} under the main menu.

– The pull-down menu appears



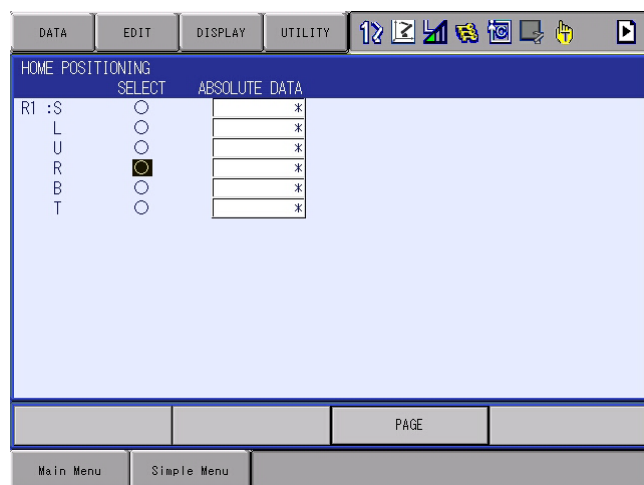
4. Select [CLEAR ALL DATA].

– A confirmation dialog box appears.



5. Select {YES}.

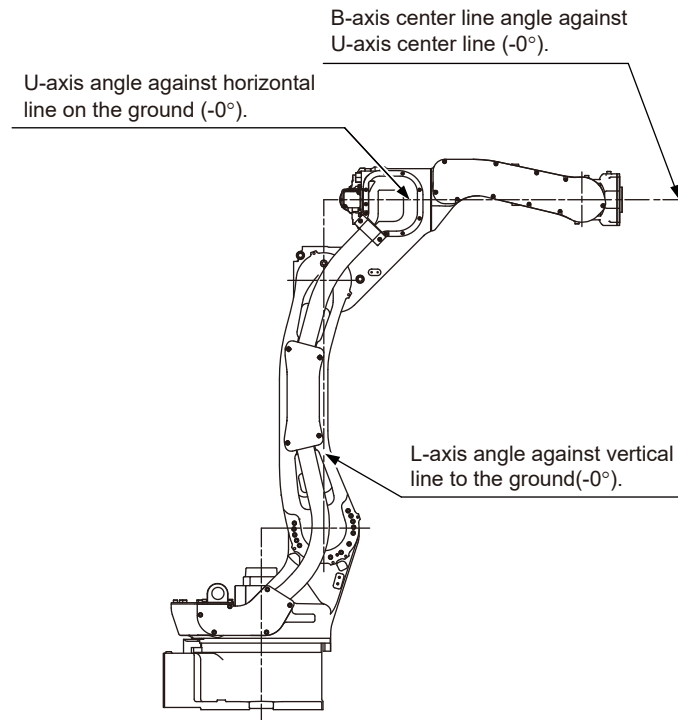
– All absolute data are cleared.



– When {NO} is selected, the registration will be canceled.

8.1.3 Home Position of the Robot

In case of VA1400, the home position are as follows.



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

8.2 Setting the Second Home Position (Check Point)



WARNING

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

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

- Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop buttons on the front door of DX200 and the programming pendant are pressed.

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

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

Improper or unintended manipulator operation may result in injury.

- Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator, and be sure that you are in a safe place when:
 - Turning ON the DX200 power
 - Moving the manipulator with the programming pendant
 - Running the system in the check mode
 - Performing automatic operations

Injury may result from contact with the manipulator if persons enter the P-point maximum envelope of the manipulator.

Press the emergency stop button immediately whenever there are problems.

- Emergency stop buttons are attached on the front door of the DX200 and the right side of the programming pendant.



CAUTION

- Perform the following inspection procedures prior to teaching the manipulator. If problems are found, correct them immediately, and be sure that all other necessary tasks have been performed.
 - Check for problems in manipulator movement.
 - Check for damage to the insulation and sheathing of external wires.
- Always return the programming pendant to its specified position after use.

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator operation may result in injury.

Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.

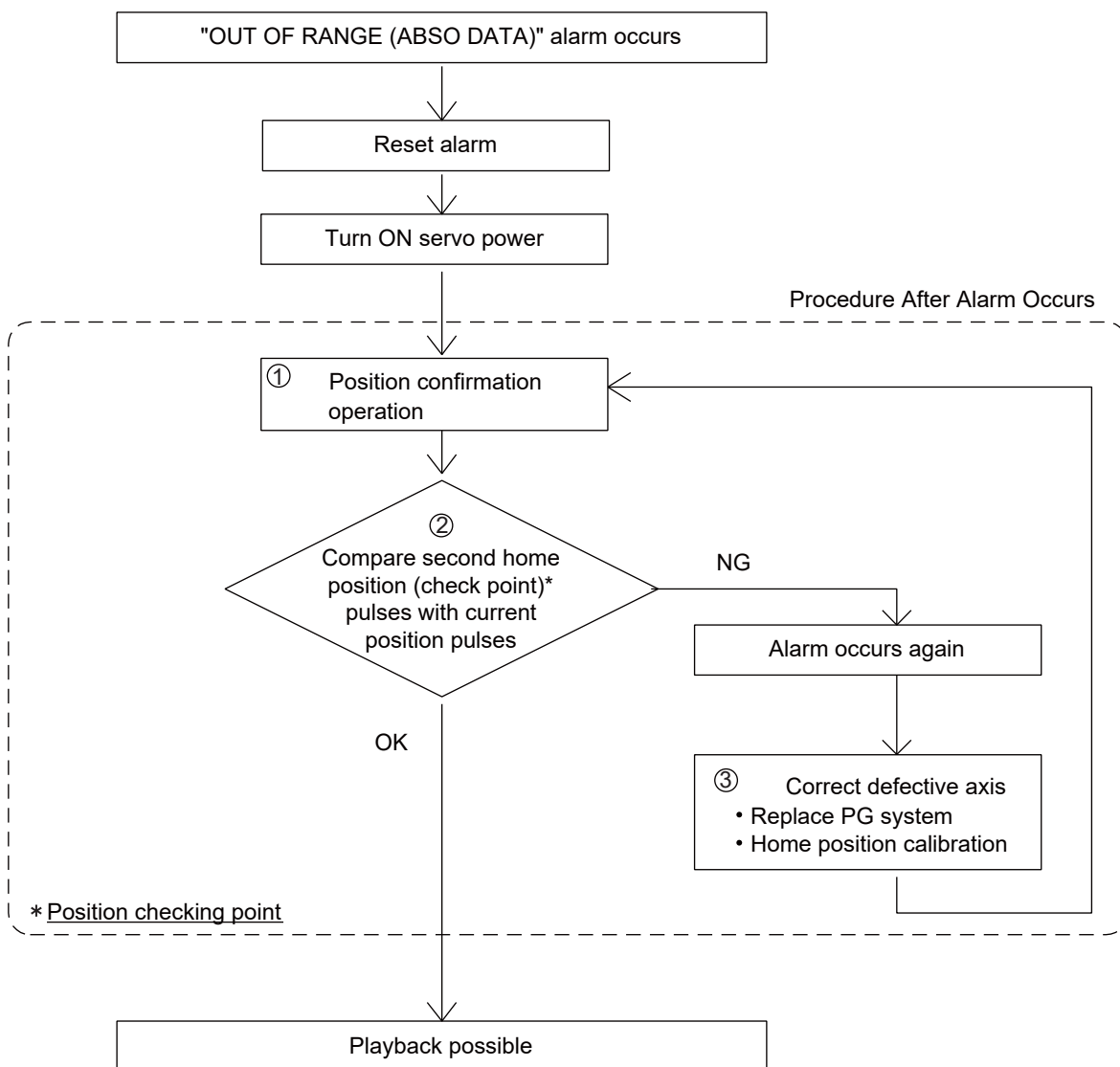
8.2.1 Purpose of Position Check Operation

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

There are two possible causes of this alarm:

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

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



① Position Check

After the "OUT OF RANGE (ABSO DATA)" alarm occurs, move to the second home position using the axis keys and perform the position confirmation. Playback 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 PG system. Check the system. After adjusting the erroneous axis, calibrate the home position of the axis, then check the position again.



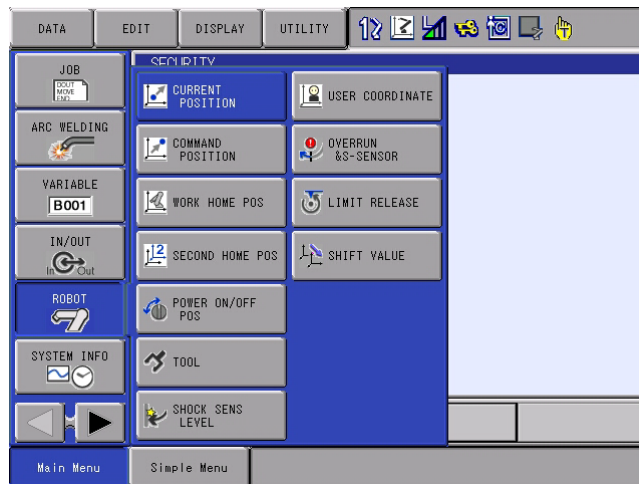
- Home position calibration of all the axes at the same time enables playback operations without having to check the position.
- Sometimes in a system with a manipulator with no break, it is possible to enable playback without position checking after the alarm occurs. **However, as a rule, always perform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

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

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

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

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



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

The screenshot shows the 'SECOND HOME POS' window. It has a top menu bar with 'DATA', 'EDIT', 'DISPLAY', and 'UTILITY'. The main area contains a table with the following data:

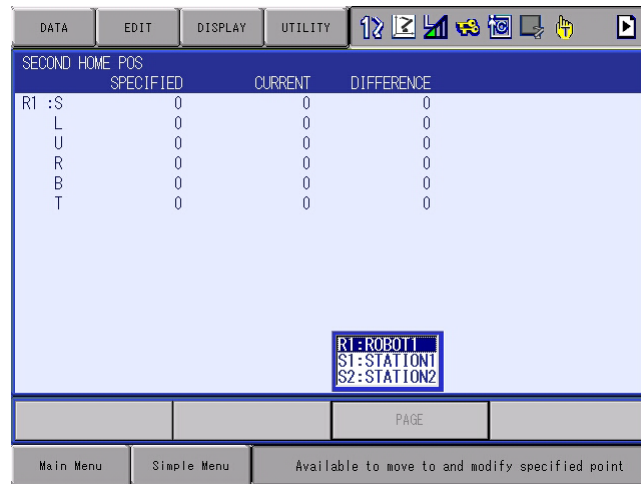
	SPECIFIED	CURRENT	DIFFERENCE
R1 :S	0	0	0
L	0	0	0
U	0	0	0
R	0	0	0
B	0	0	0
T	0	0	0

Below the table is a 'PAGE' button. At the bottom, there are 'Main Menu' and 'Simple Menu' buttons, and a status bar displaying the message 'Available to move to and modify specified point'.

8 System Setup

8.2 Setting the Second Home Position (Check Point)

3. Press the [PAGE], or select [PAGE] to display the selection window for the control group.
 - When there are two or more group axes, select the group axes to which the second home position is to be specified.



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

8.2.3 Procedure after the Alarm



WARNING

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

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

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

- Reset the alarm;
- Turn ON the servo power;

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

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



For details on the "POWER ON/OFF POS" window, refer to "7.7 Position Data When Power is Turned ON/OFF" in DX200 MAINTENANCE MANUAL.

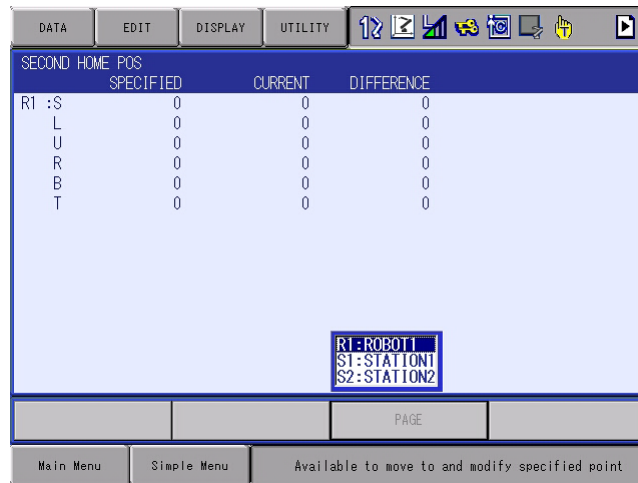
1. Select {ROBOT} under the main menu.
 - The sub menu appears.
2. Select {SECOND HOME POS}.
 - The SECOND HOME POS window appears.

DATA		EDIT		DISPLAY		UTILITY			
SECOND HOME POS									
	SPECIFIED	CURRENT		DIFFERENCE					
R1 :S	0	0		0					
L	0	0		0					
U	0	0		0					
R	0	0		0					
B	0	0		0					
T	0	0		0					
				PAGE					
Main Menu		Simple Menu		Available to move to and modify specified point					

8 System Setup

8.2 Setting the Second Home Position (Check Point)

3. Press the [PAGE], or select [PAGE] to display the selection window for the control group.
 - When there are two or more group axes, select the group axes to which the second home position is to be specified.



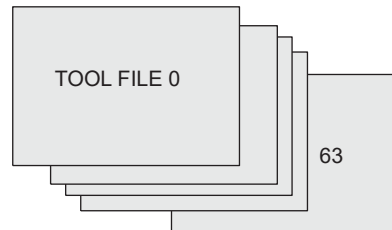
4. Press [FWD].
 - TCP moves to the second home position. The robot moving speed is set as selected manual speed.
5. Select {DATA} under the menu.
6. Select {CONFIRM POSITION}.
 - A message "Home position checked" appears.
 - Pulse data of the second home position and current pulse data are compared.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

8.3 Tool Data Setting

8.3.1 Registering Tool Files

8.3.1.1 Number of Tool Files

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

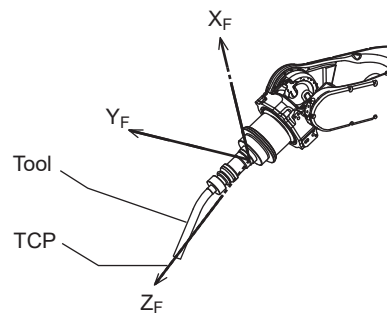


Tool File Extension Function

Normally, one robot uses one kind of tool file. The tool file extension function can change many tool files to be used by one robot. Use the following parameter to set this function. S2C333: TOOL NO. SWITCHING (1: enabled; 0: disabled) For more details, refer to “8 Parameter” in DX200 OPERATOR’S MANUAL.

8.3.1.2 Registering Coordinate Data

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



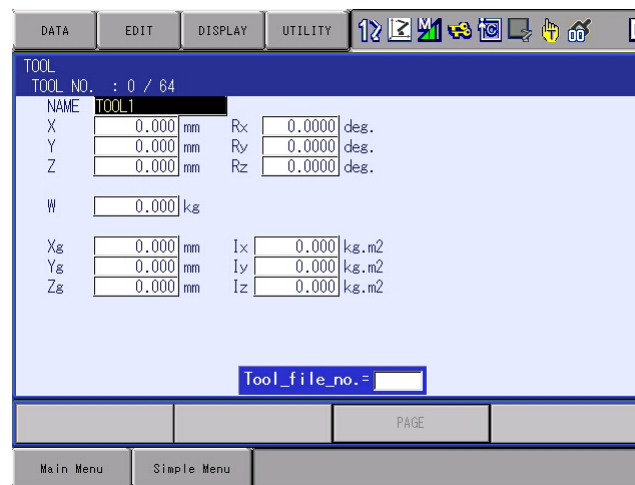
8 System Setup

8.3 Tool Data Setting

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



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



- 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.

8 System Setup

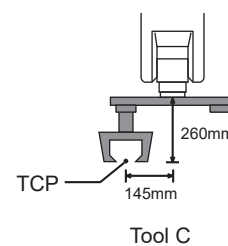
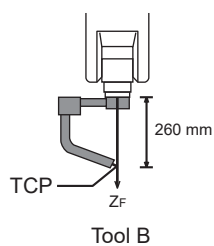
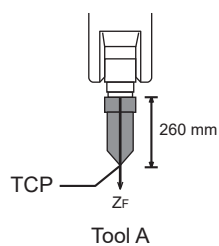
8.3 Tool Data Setting

6. Press [ENTER].

– The coordinate data is registered.

DATA				EDIT				DISPLAY				UTILITY			
TOOL															
TOOL NO. : 0 / 64															
NAME TOOL1															
X	0.000	mm	Rx	0.0000	deg.										
Y	0.000	mm	Ry	0.0000	deg.										
Z	260.000	mm	Rz	0.0000	deg.										
W	0.000	kg													
Xg	0.000	mm	Ix	0.000	kg.m2										
Yg	0.000	mm	Iy	0.000	kg.m2										
Zg	0.000	mm	Iz	0.000	kg.m2										
PAGE															
Main Menu				Simple Menu											

<Setting Example>



In case of Tool A, B

X	0.000	mm	Rx	0.0000	deg.
Y	0.000	mm	Ry	0.0000	deg.
Z	260.000	mm	Rz	0.0000	deg.

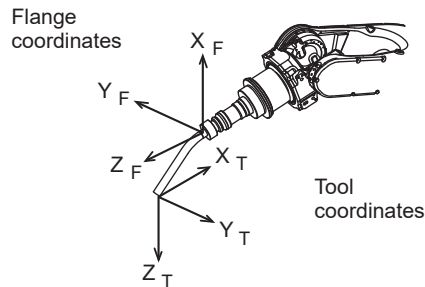
In case of Tool C

X	0.000	mm	Rx	0.0000	deg.
Y	145.000	mm	Ry	0.0000	deg.
Z	260.000	mm	Rz	0.0000	deg.

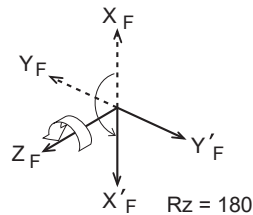
8.3.1.3 Registering Tool Angle

The tool pose data is angle data which shows the relation between the flange coordinates and the tool coordinates. The angle when the flange coordinates are rotated to meet to the tool coordinates becomes an input value. Clockwise toward the arrow is the positive direction. Register in the order of $R_z \rightarrow R_y \rightarrow R_x$.

In the following case, register $R_z=180$, $R_y=90$, $R_x=0$



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”*, display the desired tool coordinate window.
4. Select the desired coordinate axis to modify.
 - First, select R_z .
5. Input the tool pose data.
 - Input rotation angle around Z_F of the flange coordinates.



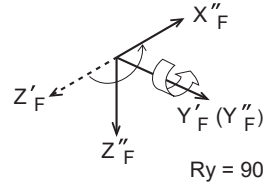
X	0.000	mm	Rx	0.0000	deg.
Y	0.000	mm	Ry	0.0000	deg.
Z	0.000	mm	Rz	180.0000	deg.

6. Press [ENTER].

- The rotation angle of R_z is registered.

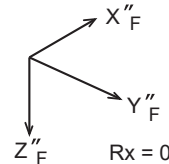
In the same way, register the angle of R_y , R_x .

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



X	0.000	mm	Rx	0.0000	deg.
Y	0.000	mm	Ry	90.0000	deg.
Z	0.000	mm	Rz	180.0000	deg.

- R_x must be the input rotation angle around X'_F of flange coordinates.



X	0.000	mm	Rx	0.0000	deg.
Y	0.000	mm	Ry	90.0000	deg.
Z	0.000	mm	Rz	180.0000	deg.

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.



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.



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

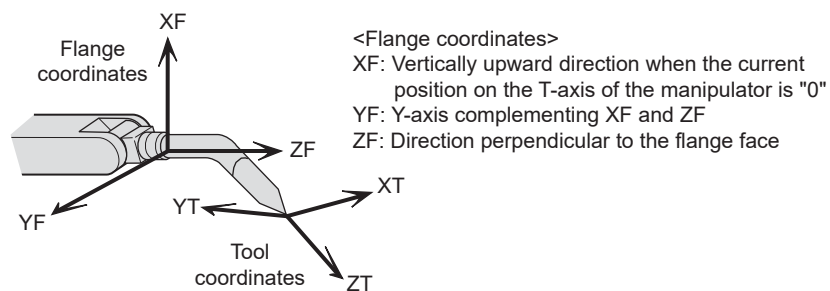
8.3.2 Tool Calibration

8.3.2.1 Tool Calibration

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

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

What is registered in tool calibration is the coordinates of the TCP and the tool posture data in the flange coordinates.



8.3.2.2 Setting of Tool Calibration Method

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

S2C432: Designation of tool calibration method

0: Calibrates only the coordinates.

"Coordinates" calculated from 5 calibration teaching points is registered in the tool file.

In this case "Tool Posture Data" is all cleared to be 0.

1: Calibrates only the posture.

"Tool Posture Data" calculated from the first calibration teaching point is registered in the tool file.

In this case, "Coordinates" will not be changed. (the prior value is maintained.)

2: Calibrates the coordinates and the posture.

"Coordinates" calculated from 5 calibration teaching points and "Tool Posture Data" calculated from the first calibration teaching point are registered in the tool file.

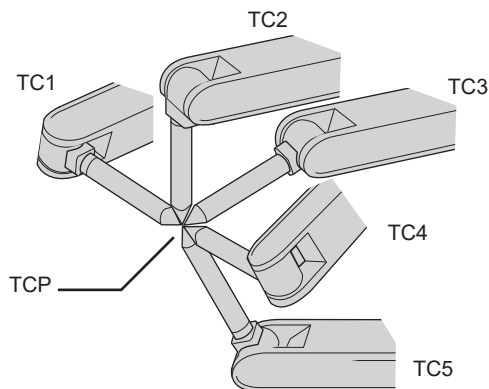


- In case of S2C432=0 (only coordinates is calibrated), tool posture data is overwritten with 0. (When the coordinates calculated from tool calibration is registered in the tool file in which the tool posture data is already registered, the tool posture data will be deleted.)
- In case of S2C432=1 (only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

8.3.2.3 Teaching of Calibration Point

■ Teaching for defining coordinates

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



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

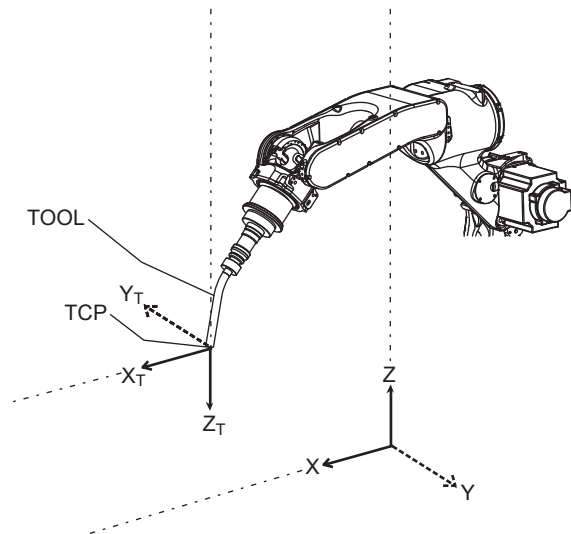
■ Teaching for defining posture

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

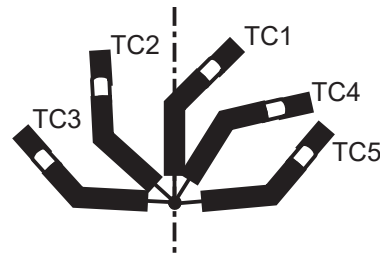
Teach TC1 with Z-axis of the desired tool coordinates downward vertically to the ground. (the Z-axis of the tool coordinates is parallel to the Z-axis of the base tool and points to the opposite direction.)

Tool posture data is automatically calculated with this TC1 posture.

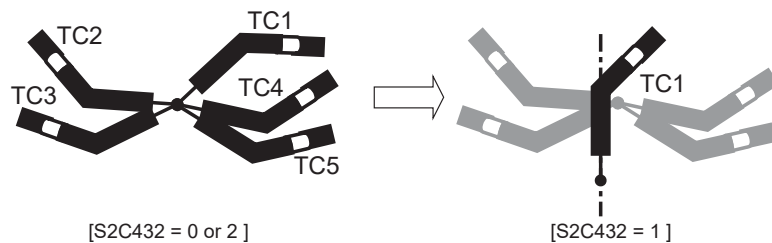
The X-axis of the tool coordinates is defined in the same direction as the X-axis of the base coordinates.



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



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



8 System Setup

8.3 Tool Data Setting



- 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.

TOOL			
TOOL NO. : 0 / 64			
NAME: TOOL1			
X	0.000 mm	Rx	0.0000 deg.
Y	0.000 mm	Ry	0.0000 deg.
Z	0.000 mm	Rz	0.0000 deg.
W	0.000 kg		
Xg	0.000 mm	Ix	0.000 kg.m2
Yg	0.000 mm	Iy	0.000 kg.m2
Zg	0.000 mm	Iz	0.000 kg.m2

Main Menu Simple Menu PAGE

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

TOOL			
TOOL NO. : 0 / 64			
NAME: TOOL1			
X	0.000 mm	Rx	0.0000 deg.
Y	0.000 mm	Ry	0.0000 deg.
Z	0.000 mm	Rz	0.0000 deg.
W	0.000 kg		
Xg	0.000 mm	Ix	0.000 kg.m2
Yg	0.000 mm	Iy	0.000 kg.m2
Zg	0.000 mm	Iz	0.000 kg.m2

Main Menu Simple Menu PAGE

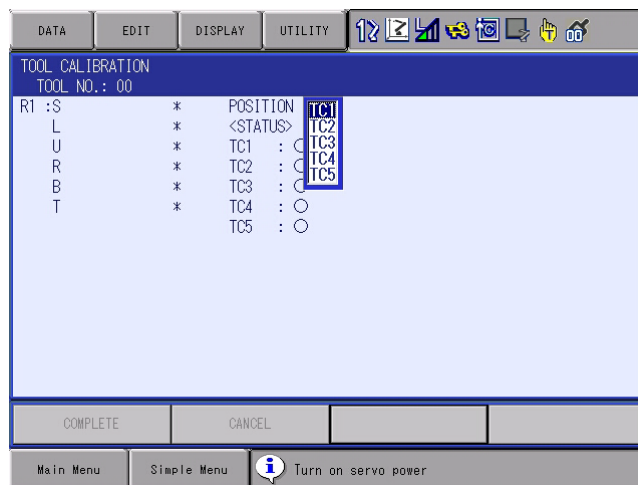
8 System Setup

8.3 Tool Data Setting

7. Select "POSITION".

- The selection dialog box is shown.

(1) Select the teaching point for calibration.



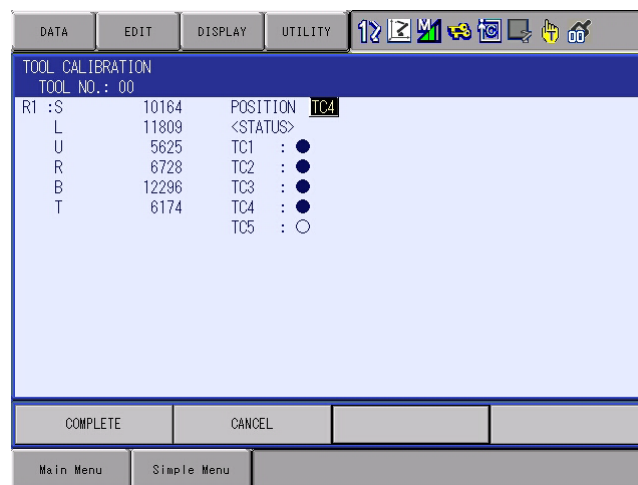
8. Move the manipulator using the axis key.

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.

8 System Setup

8.3 Tool Data Setting

10. Select "COMPLETE".

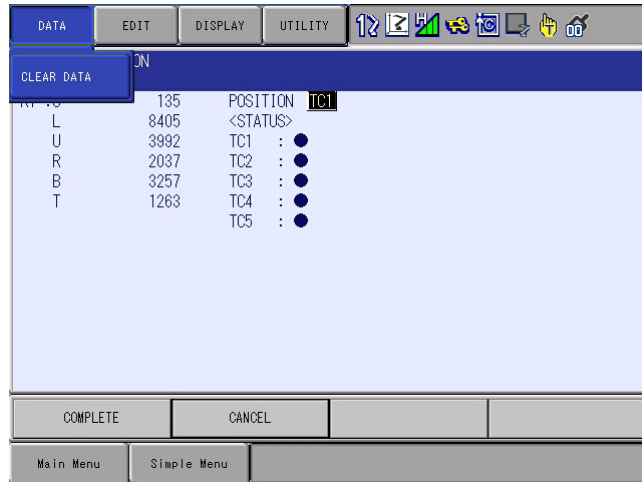
- Calibration data is registered in the tool file. Once the calibration is completed, the tool coordinate window is displayed on the screen.

DATA				EDIT				DISPLAY				UTILITY			
TOOL															
TOOL NO. : 0 / 64															
NAME TOOL1															
X	-618.211	mm	Rx	0.0000	deg.										
Y	-78.445	mm	Ry	0.0000	deg.										
Z	-186.339	mm	Rz	0.0000	deg.										
W	0.000	kg													
Xg	0.000	mm	Ix	0.000	kg.m2										
Yg	0.000	mm	Iy	0.000	kg.m2										
Zg	0.000	mm	Iz	0.000	kg.m2										
PAGE															
Main Menu Simple Menu															

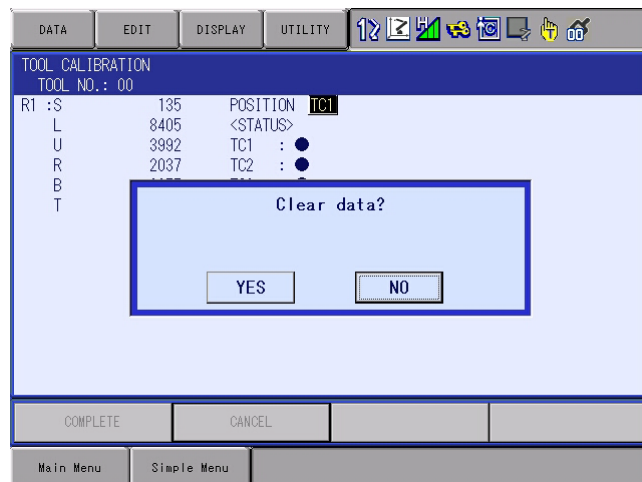
8.3.2.4 Clearing Calibration Data

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

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



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

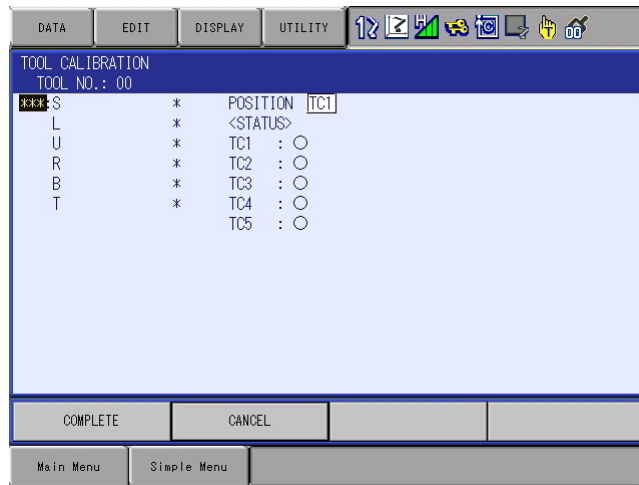


8 System Setup

8.3 Tool Data Setting

3. Select {YES}.

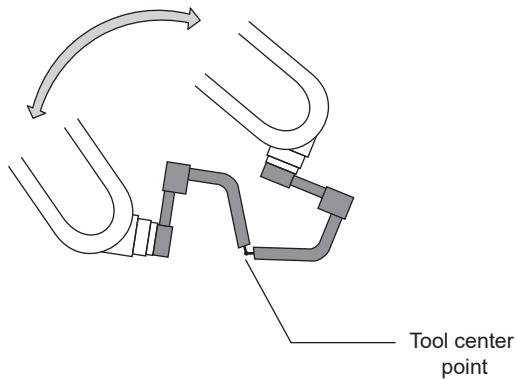
– All data is cleared.




If tool angle data is required, input the data number in the tool coordinate window. Refer to *chapter 8.3.1.3 "Registering Tool Angle"* 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].

TOOL

TOOL NO. : 0 / 64

NAME **TOOL1**

X	0.000 mm	Rx	0.0000 deg.
Y	0.000 mm	Ry	0.0000 deg.
Z	0.000 mm	Rz	0.0000 deg.
W	0.000 kg		
Xg	0.000 mm	Ix	0.000 kg.m2
Yg	0.000 mm	Iv	0.000 kg.m2
Zg	0.000 mm	Iz	0.000 kg.m2

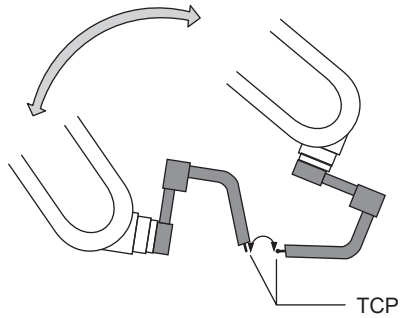
PAGE

Main Menu Simple Menu

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, see "2.8.1 Motion about TCP" in OPERATOR'S MANUAL.

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

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

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

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



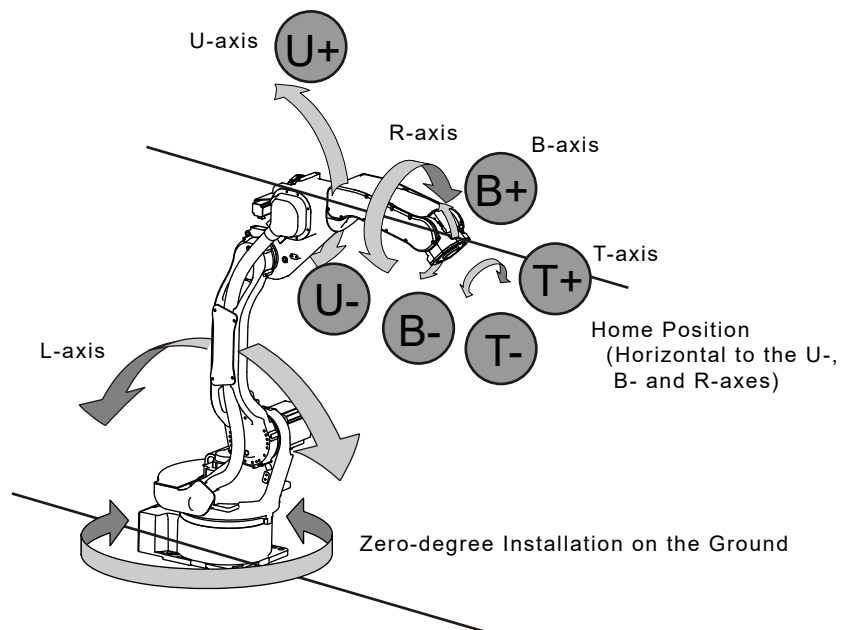
This function can be used where the manipulator is installed level on the ground.

For the conditions required for manipulator installation, refer to *chapter 8.4 "ARM Control"*.

The Automatic Measurement of the Tool Load and the Center of Gravity is not supported by some robot models, including shelf-mounted robot models, painting robot models, and palletizing robot models, due to mechanism limitations. For these models, {W.GRAV.POS MEASURE} will not be shown when {UTILITY} is selected on the menu.

8.3.3.2 Measurement of the Tool Load and the Center of Gravity

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



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

8 System Setup

8.3 Tool Data Setting

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

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

NO.	NAME
00	TOOL1
01	TOOL2
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	

TOOL			
TOOL NO. : 0 / 64			
NAME: TOOL1			
X	0.000 mm	Rx	0.0000 deg.
Y	0.000 mm	Ry	0.0000 deg.
Z	0.000 mm	Rz	0.0000 deg.
W	0.000 kg		
Xg	0.000 mm	Ix	0.000 kg.m2
Yg	0.000 mm	Iy	0.000 kg.m2
Zg	0.000 mm	Iz	0.000 kg.m2

8 System Setup

8.3 Tool Data Setting

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}.

The screenshot shows the 'TOOL' coordinate window. At the top, there are tabs: DATA, EDIT, DISPLAY, and UTILITY. The 'DISPLAY' tab is active, and a 'LIST' button is highlighted. Below the tabs, the window displays tool data for 'TOOL 1'. The data is organized into two columns. The left column contains: NAME (TOOL 1), X (0.000 mm), Y (0.000 mm), Z (0.000 mm), W (0.000 kg), Xg (0.000 mm), Yg (0.000 mm), and Zg (0.000 mm). The right column contains: Rx (0.0000 deg.), Ry (0.0000 deg.), Rz (0.0000 deg.), Ix (0.000 kg.m2), Iy (0.000 kg.m2), and Iz (0.000 kg.m2). At the bottom of the window, there is a 'PAGE' button and a 'Main Menu' button.

4. Select {UTILITY} under the menu.

The screenshot shows the 'TOOL' coordinate window with the 'UTILITY' tab selected. A 'CALIBRATION' menu is open, showing 'W.GRAV.POS MEASURE' and '0.0000 deg.'. The tool data for 'TOOL 1' is displayed in the background, including X, Y, Z, W, Xg, Yg, Zg, Rx, Ry, Rz, Ix, Iy, and Iz. At the bottom of the window, there is a 'PAGE' button and a 'Main Menu' button.



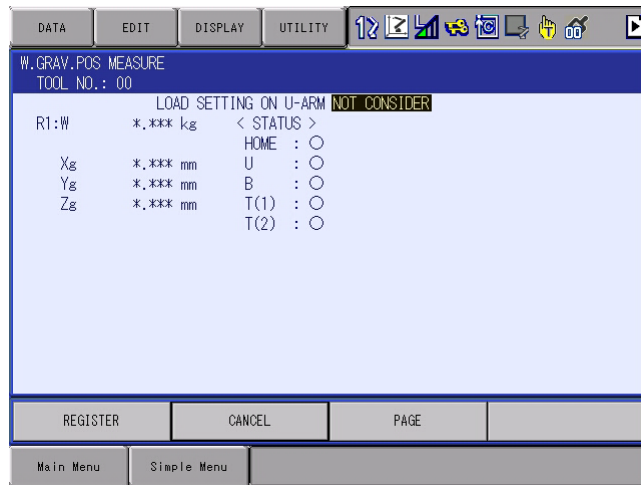
The Automatic Measurement of the Tool Load and the Center of Gravity is not supported by some robot models, including shelf-mounted robot models, painting robot models, and palletizing robot models, due to mechanism limitations. For these models, {W.GRAV.POS MEASURE} will not be shown when {UTILITY} is selected on the menu.

8 System Setup

8.3 Tool Data Setting

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

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



6. Press the [PAGE].

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

7. Press [FWD].

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

8. Press [FWD] again.

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

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

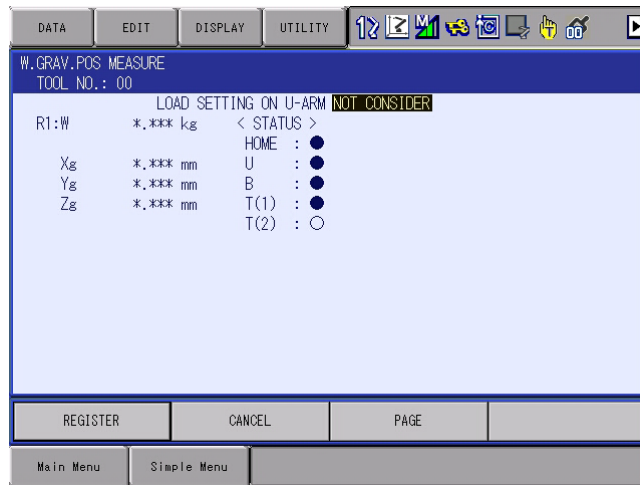


- The speed during measurement automatically changes to “Medium”.
- During the measurement, “HOME” or “U” blinks on the screen.
- During the measurement, the [FWD] button has to be kept pressed. If the button is released during the measurement or if it is released before “O” changes into “●”, the measurement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

8 System Setup

8.3 Tool Data Setting

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



9. Select “REGISTER”.

- The measured data is registered in the tool file, and the tool coordinate window appears.
- Select “CANCEL” to call up the tool list window without registering the measured data in the tool file.

8.4 ARM Control

8.4.1 ARM Control

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

The moment of inertia and the gravity moment etc. of each axis are calculated by the ARM control function, and DX200 controls robot motion according to the result. It is necessary to set the robot setup condition and the tool load information to request these accurately.

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

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

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

8.4.2 ARM CONTROL Window



CAUTION

- Correctly set the robot setup condition.

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

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

Set the robot setup condition when setting up the manipulator.

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

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

8.4.2.1 Robot Setup Condition

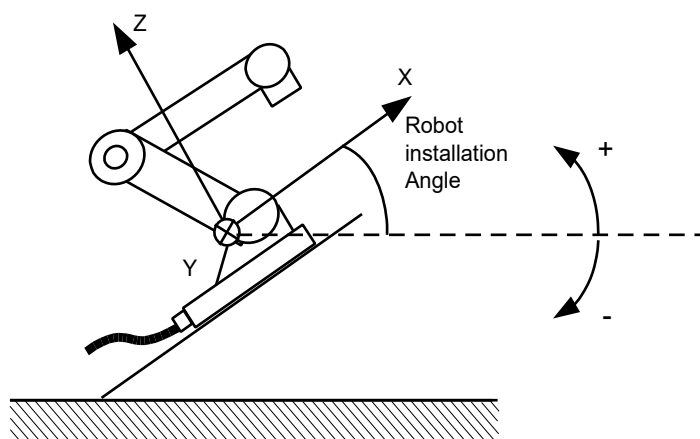
Fulfill the following robot setup condition to enable the ARM control.

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

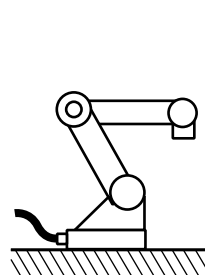
■ Robot installation angle

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

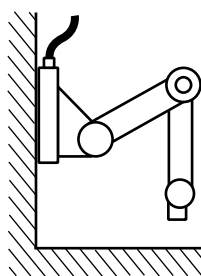
The robot installation angle sets how much X axis of the robot coordinates has inclined with the ground around Y axis of the robot coordinates. The direction of + in the U axis operation from the home position posture of the manipulator becomes direction of + of the robot installation angle. Therefore,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



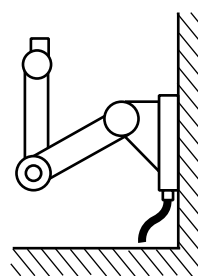
<Example>



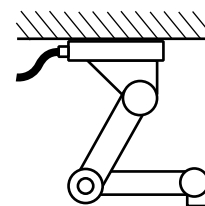
0 degrees



-90 degrees



+90 degrees



180 degrees

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



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 center of gravity position roughly when the equipment such as transformer is installed at the S-head.

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

WEIGHT (unit: kg)

The weight of the installed load is set.

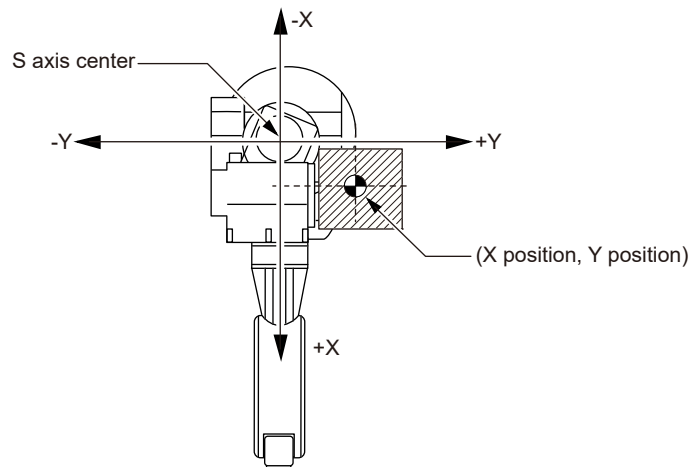
It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual load. (Round up the value with each fraction between 0.5 to 1 kg.)

X (From S-Axis), Y (From S-Axis) (unit: mm)

The center of gravity position of the installed load is set by the distance in the direction of X and the direction of Y from S axis center here. It can be set with a rough value.

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

Load on the S-head (Top View)



■ **U-arm payload**

Set the weight and the center of gravity position roughly when the equipment such as the wire supplying motors is installed on U arm.

A standard value is set when shipping from the factory.

Set the weight in “0” if there is no installing equipment on U arm.

WEIGHT (unit: kg)

The weight of the installing load is set here.

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

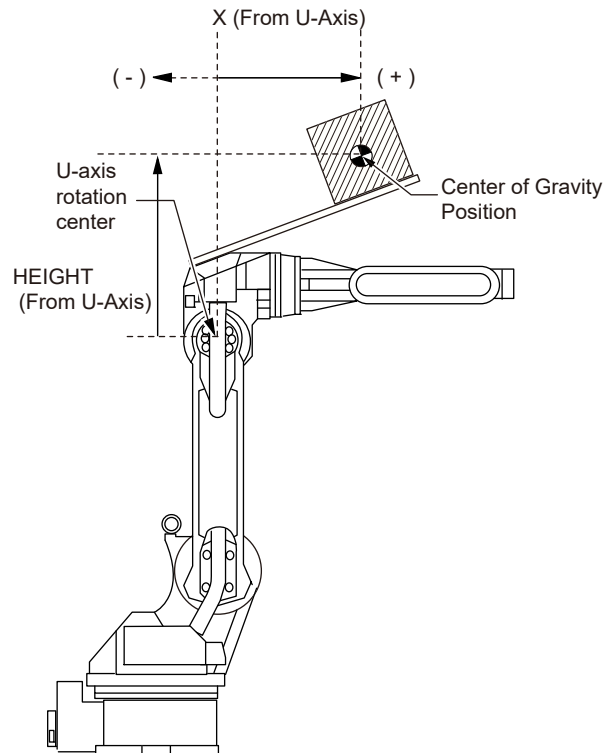
X (From U-Axis), HEIGHT (From U-Axis) (unit: mm)

The center of gravity position of the installing load is set here. It does not care by a rough value.

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

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

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

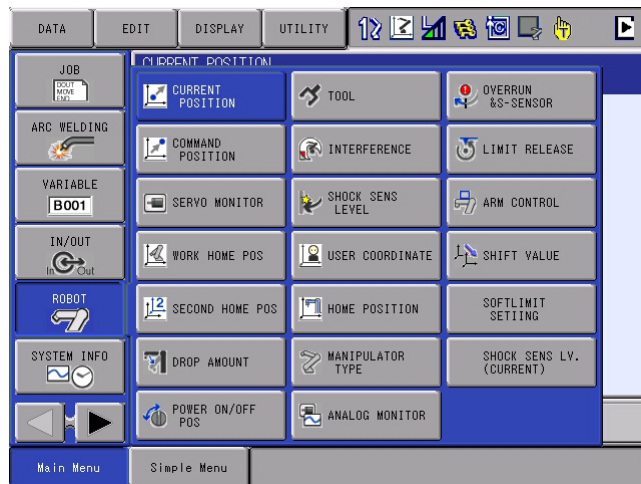


ARM CONTROL window is displayed only when the security mode is set in the management mode.

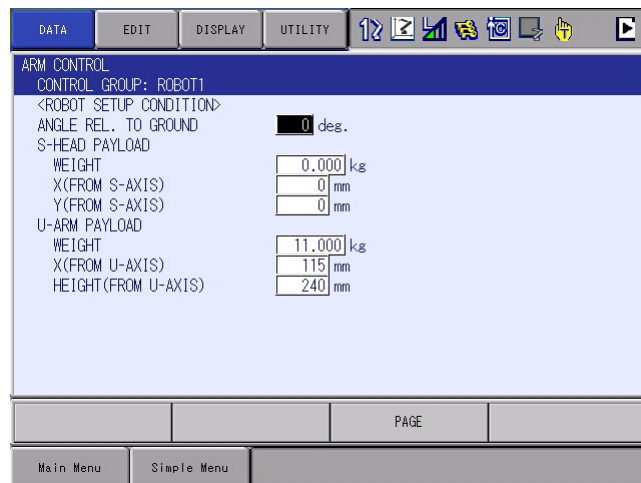
8 System Setup


8.4 ARM Control

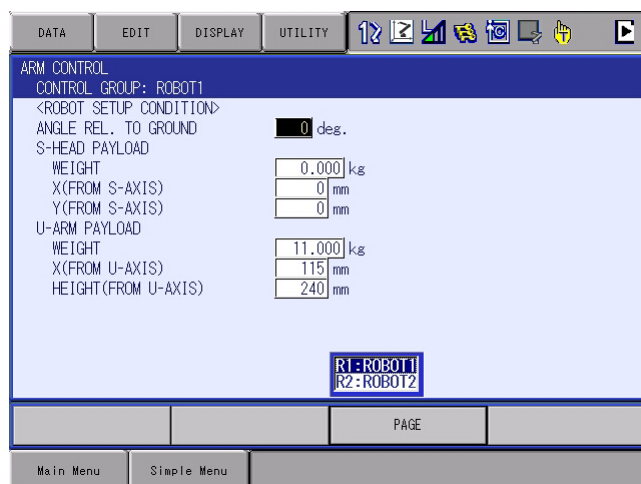
1. Select {ROBOT} under the main menu.



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



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



4. Select the desired item.
5. Input the value and press [ENTER].

8.4.3 Tool Load Information Setting



CAUTION

- Set the tool load information correctly.

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

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

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

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

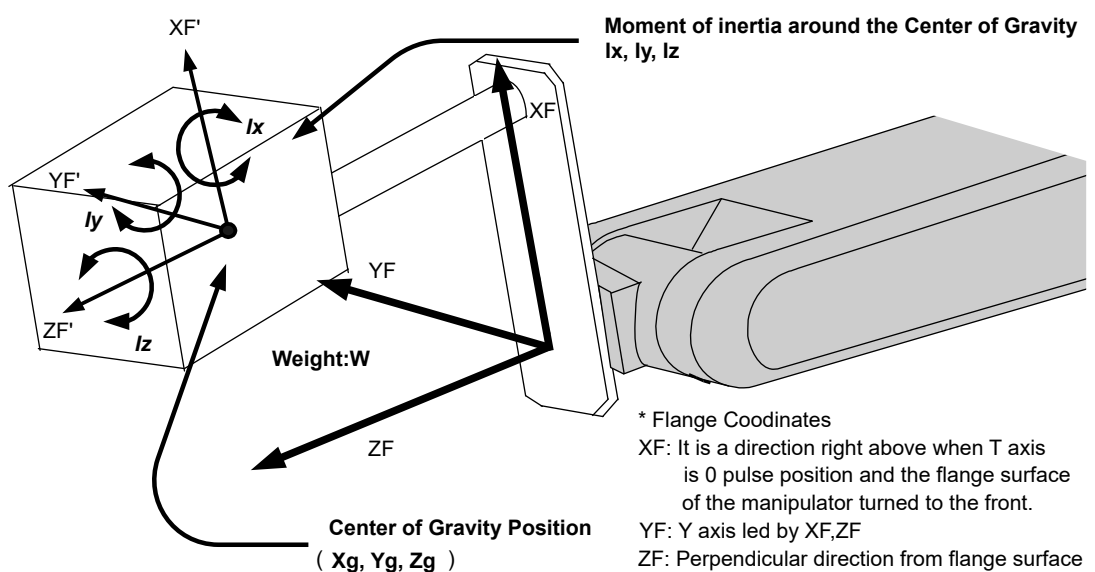
Set the tool load information before teaching the job after the tool is installed.

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

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

8.4.3.1 Tool Load Information

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



8.4.3.2 How to Calculate Tool Load Information

■ **Weight: W (Unit: kg)**

The total weight of the installing tool is set.

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

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

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

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: I_x, I_y, I_z (Unit: $\text{kg}\cdot\text{m}^2$)**

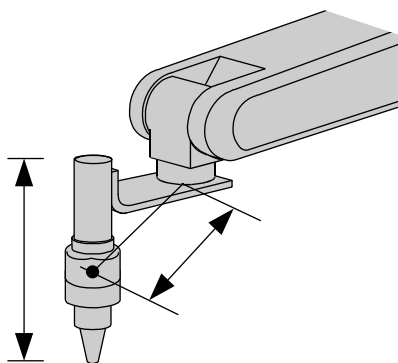
It is an moment of inertia of the tool at the center of gravity position.

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

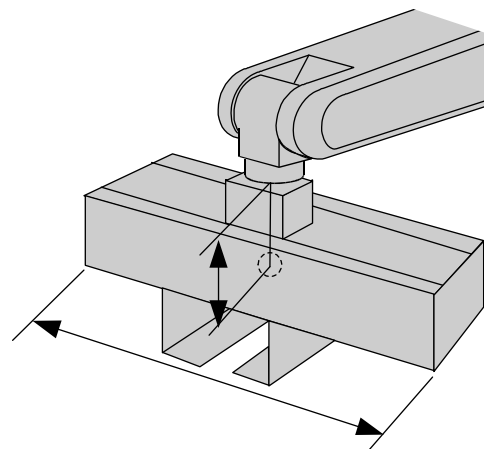
It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual value.

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

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



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



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

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

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

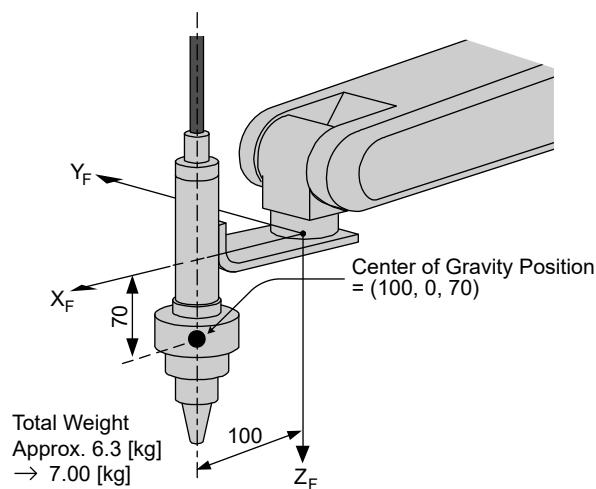
Refer to the following setting examples for details.

<Example 1>

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

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

<Setting>

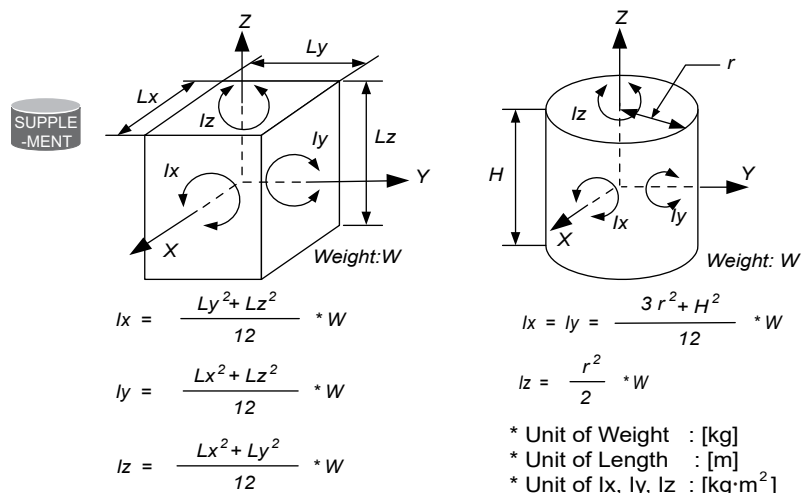


- W : 7.000 kg
- Xg : 100.000 mm
- Yg : 0.000 mm
- Zg : 70.000 mm
- Ix : 0.000 kg · m²
- Iy : 0.000 kg · m²
- Iz : 0.000 kg · m²

- The own moment of inertia calculation for hexahedron and cylinder

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

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

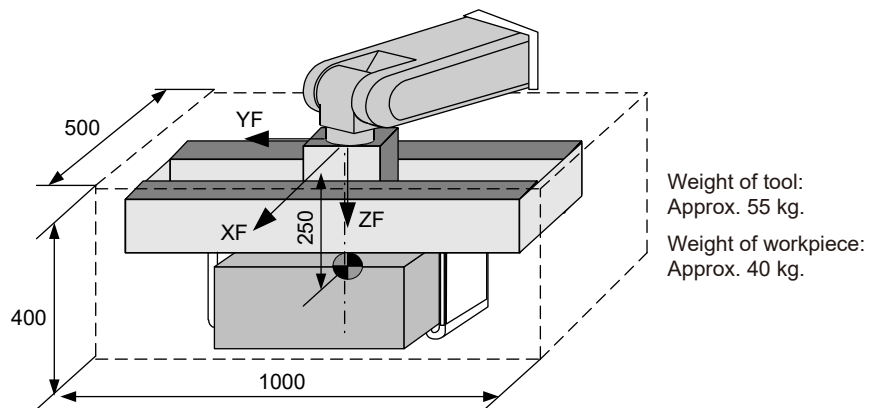


<Example 2>

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

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

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



Weight: $W = 55 + 40 = 95$
= approx. 100[kg]

Center of gravity: Position at flange right under 250mm almost
(Xg, Yg, Zg) = (0,0,250)

Moment of inertia at the center of gravity:

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

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

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

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

$$I_y = (L_x^2 + L_z^2 / 12) * W = ((0.500^2 + 0.400^2) / 12) * 100 = 3.417$$

$$= \text{approx. } 3.500$$

$$I_z = (L_x^2 + L_y^2 / 12) * W = ((0.500^2 + 1.000^2) / 12) * 100 = 10.417$$

$$= \text{approx. } 10.500$$

<Setting>

- W : 100.000 kg
- Xg : 0.000 mm
- Yg : 0.000 mm
- Zg : 250.000 mm
- Ix : 10.000 kg.m²
- Iy : 3.500 kg.m²
- Iz : 10.500 kg.m²

How to calculate "Center of gravity position" and "moment of inertia at center of gravity" for plural mass

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

1. Divide the tool into some parts as the weight and the center of gravity position can be roughly presumed. It is not necessary to divide in detail. The tool is approximated in construction of rough parts.
2. Calculate the weight and the center of gravity position of the each parts on flange coordinates. It does not care by a rough value. Calculate the own moments of inertia of the big parts. (If parts are small, it is not necessary to calculate the own moments of inertia. Refer to above-mentioned supplement: "The own moment of inertia calculation for hexahedron and cylinder" for how to calculate the own moment of inertia.)

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

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

$l_{cx_i}, l_{cy_i}, l_{cz_i}$: Own moments of inertia of the i-th parts [$\text{kg} \cdot \text{m}^2$]

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

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

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

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

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

$$I_x = \{w_1 * ((y_1 - y_g)^2 + (z_1 - z_g)^2) * 10^{-6} + l_{cx1}\} + \{w_2 * ((y_2 - y_g)^2 + (z_2 - z_g)^2) * 10^{-6} + l_{cx2}\}$$

$$\dots\dots\dots + \{w_i * ((y_i - y_g)^2 + (z_i - z_g)^2) * 10^{-6} + l_{cx_i}\}$$

$$I_y = \{w_1 * ((x_1 - x_g)^2 + (z_1 - z_g)^2) * 10^{-6} + l_{cy1}\} + \{w_2 * ((x_2 - x_g)^2 + (z_2 - z_g)^2) * 10^{-6} + l_{cy2}\}$$

$$\dots\dots\dots + \{w_i * ((x_i - x_g)^2 + (z_i - z_g)^2) * 10^{-6} + l_{cy_i}\}$$

$$I_z = \{w_1 * ((x_1 - x_g)^2 + (y_1 - y_g)^2) * 10^{-6} + l_{cz1}\} + \{w_2 * ((x_2 - x_g)^2 + (y_2 - y_g)^2) * 10^{-6} + l_{cz2}\}$$

$$\dots\dots\dots + \{w_i * ((x_i - x_g)^2 + (y_i - y_g)^2) * 10^{-6} + l_{cz_i}\}$$

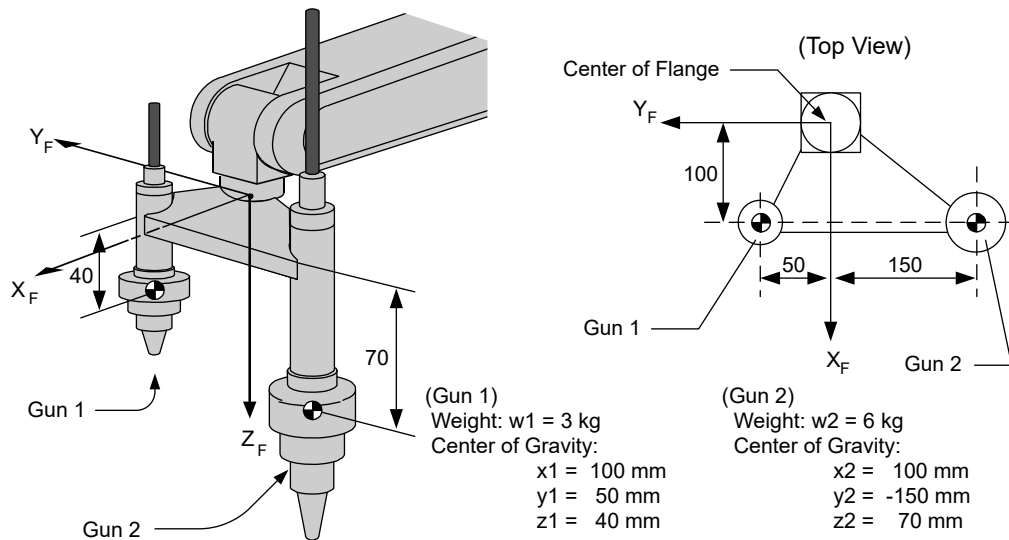


<Example 3>

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

1. Set the center of gravity position when the center of gravity position of the entire tool is roughly understood, and set the moment of inertia at the center of gravity calculated by approximating the entire tool in the shape of hexahedron or cylinder. (It is enough in this setting usually.); or
2. When weight in each mass and the center of gravity position are understood, the center of gravity position and the moment of inertia at the center of gravity of the entire tool can be calculated. (Refer to forementioned supplement column: "How to calculate "Center of gravity position" and "moment of inertia at the center of gravity" for plural mass".)

This example shows the calculation with the method 2.



Weight :

$$W = w_1 + w_2$$

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

$$\text{Center of gravity } X_g = (w_1 * x_1 + w_2 * x_2) / (w_1 + w_2)$$

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

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

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

The moment of inertia at the center of gravity position:

$$\begin{aligned} I_x &= \{w_1 * ((y_1 - Y_g)^2 + (z_1 - Z_g)^2) * 10^{-6} + I_{cx1}\} \\ &+ \{w_2 * ((y_2 - Y_g)^2 + (z_2 - Z_g)^2) * 10^{-6} + I_{cx2}\} \\ &= 3 * ((50 - (-83))^2 + (40 - 60)^2) * 10^{-6} \\ &+ 6 * (((-150) - (-83))^2 + (70 - 60)^2) * 10^{-6} \\ &= 0.082 = \text{approx. } 0.100 \end{aligned}$$

$$\begin{aligned} I_y &= 3 * ((100 - 100)^2 + (40 - 60)^2) * 10^{-6} \\ &+ 6 * ((100 - 100)^2 + (70 - 60)^2) * 10^{-6} \\ &= 0.002 = \text{approx. } 0.010 \end{aligned}$$

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

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

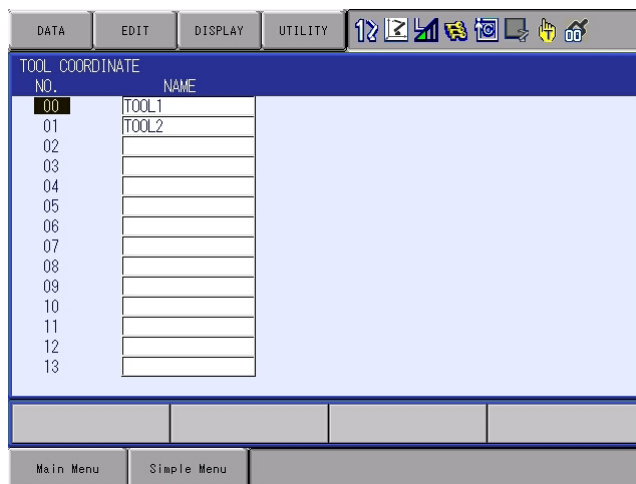
<Setting>

- W : 10.000 kg
- Xg : 100.000 mm
- Yg : -83.333 mm
- Zg : 60.000 mm
- lx : 0.100 kg.m²
- ly : 0.010 kg.m²
- lz : 0.100 kg.m²

8.4.3.3 Tool Load Information Registering

Tool load information is registered in the tool file.

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



TOOL
TOOL NO. : 0 / 64

NAME	TOOL1	
X	0.000 mm	Rx 0.0000 deg.
Y	0.000 mm	Ry 0.0000 deg.
Z	0.000 mm	Rz 0.0000 deg.
W	0.000 kg	
Xg	0.000 mm	Ix 0.000 kg.m2
Yg	0.000 mm	Iy 0.000 kg.m2
Zg	0.000 mm	Iz 0.000 kg.m2

PAGE

Main Menu Simple Menu

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.

TOOL
TOOL NO. : 0 / 64

NAME	TOOL1	
X	0.000 mm	Rx 0.0000 deg.
Y	123	Ry 0.0000 deg.
Z	0.000 mm	Rz 0.0000 deg.
W	0.000 kg	
Xg	0.000 mm	Ix 0.000 kg.m2
Yg	0.000 mm	Iy 0.000 kg.m2
Zg	0.000 mm	Iz 0.000 kg.m2

PAGE

Main Menu Simple Menu

5. Press [ENTER].
 - The input value is registered.
 - The servo power is automatically turned OFF when editing the value while the servo power is ON, followed by a message "Servo off by changing data" displayed for three seconds.

- When the data setting is not done

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

- When the weight (W) is "0".
- When the center of gravity position (Xg, Yg, Zg) are all "0".

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

Initial Setting Value:

Weight: $W = \text{Payload}$

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

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

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



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

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

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).

8.5 Work Home Position

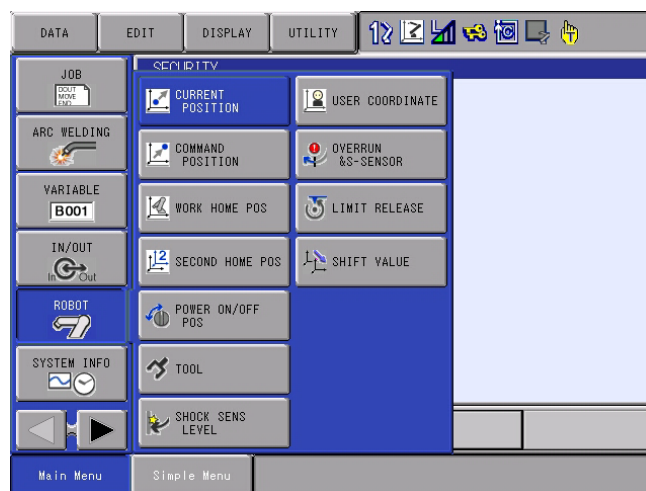
8.5.1 What is the Work Home Position?

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.

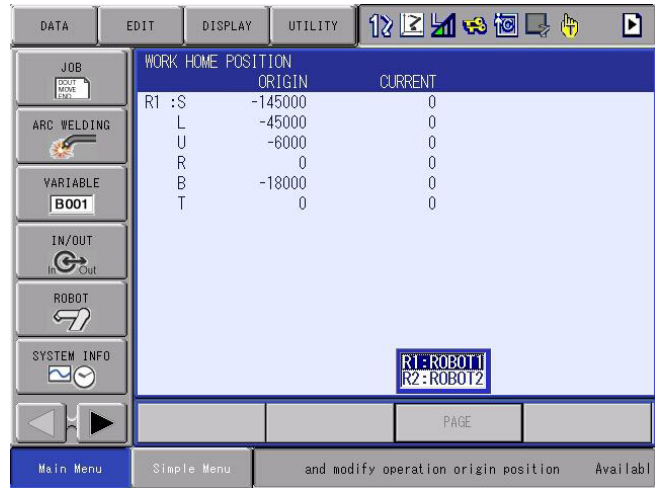


8 System Setup

8.5 Work Home Position

3. Press the [PAGE].

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



8.5.2.2 Registering/Changing the Work Home Position

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

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

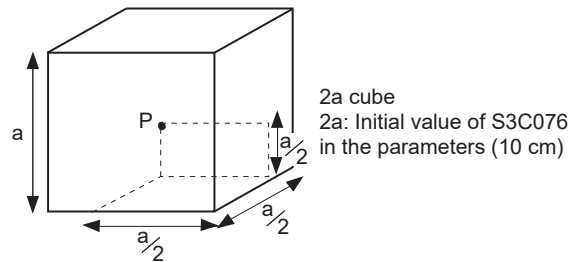
- The cube 64 is for ROBOT1
- The cube 63 is for ROBOT2
- The cube 62 is for ROBOT3
- The cube 61 is for ROBOT4
- The cube 60 is for ROBOT5
- The cube 59 is for ROBOT6
- The cube 58 is for ROBOT7
- The cube 57 is for ROBOT8



The work home position cube is a cube like the one shown in the figure below; the length of its sides is determined by a parameter setting made by the user (units: μm).

By changing this parameter setting, the size of the cube can be changed.

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



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

8.5.2.3 Returning to the Work Home Position

■ In the teach mode

1. Press [FWD] in the work home position display.

- The manipulator moves to the new work home position. The moving speed is the selected manual speed.

■ In the play mode

When the work home position return signal is input (detected at leading edge), the TCP of the manipulator is moved to the work home position. When the manipulator moves, a message "Operation origin returning" is displayed. In this case, the move interpolation is MOVJ, and the speed applied is the one set in the parameters. (S1CxG56; units: 0.01 %.)

8.5.2.4 Output of the Work Home Position Signal

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

8.6 Interference Area

8.6.1 Interference Area

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

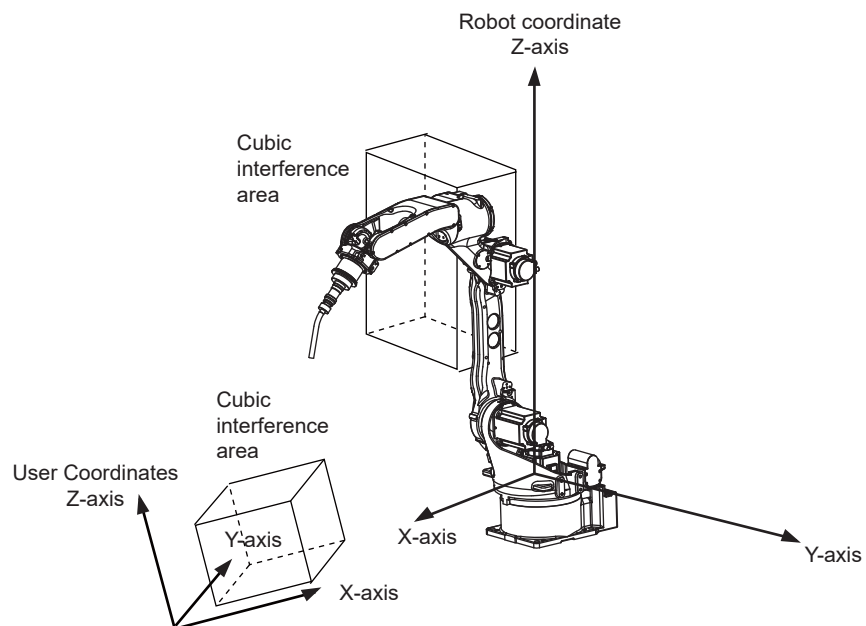
- Cubic Interference Area
- Axis Interference Area

The DX200 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

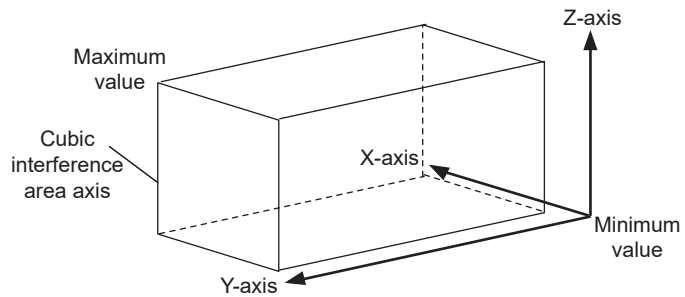
This area is a rectangular parallelepiped which is parallel to the base coordinate, robot coordinate, or user coordinate. The DX200 judges whether the current position of the manipulator's TCP is inside or outside this area, and outputs this status as a signal.



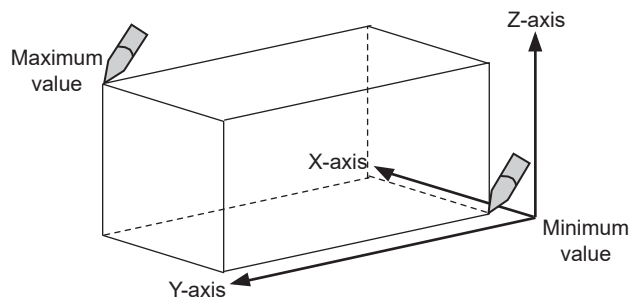
8.6.2.2 Cube Setting Method

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

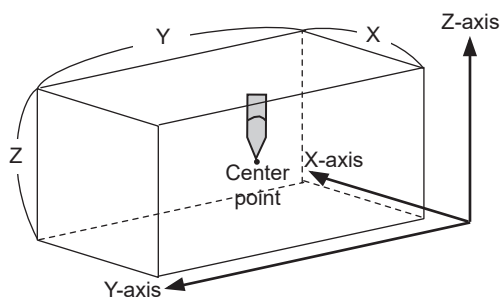
1. Enter the maximum and minimum values for the cube coordinates.



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



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

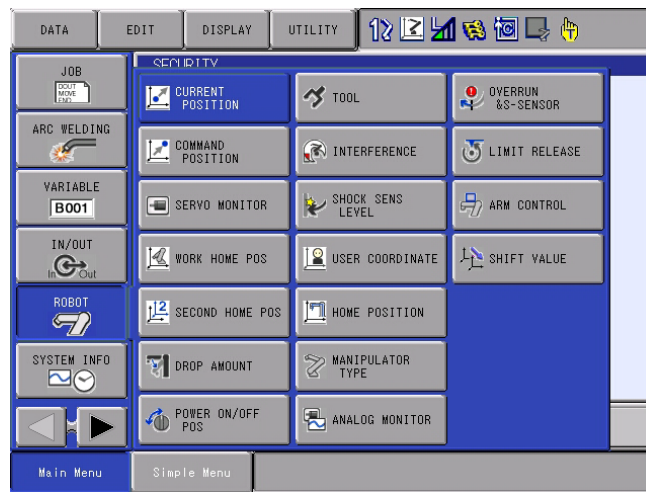


8 System Setup

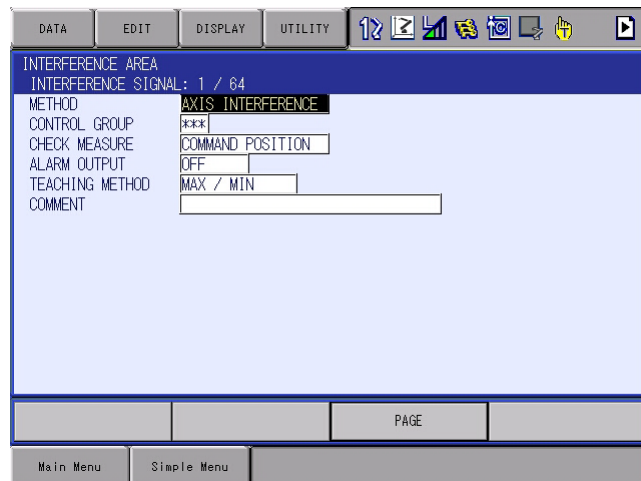
8.6 Interference Area

8.6.2.3 Setting Operation

1. Select {ROBOT} under the main menu.



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



8 System Setup

8.6 Interference Area

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.

The screenshot shows a software interface for the 'INTERFERENCE AREA'. At the top, there are tabs for 'DATA', 'EDIT', 'DISPLAY', and 'UTILITY'. Below these is a toolbar with various icons. The main display area has a title bar 'INTERFERENCE AREA' and a subtitle 'INTERFERENCE SIGNAL: 1 / 64'. The 'METHOD' field is set to 'AXIS INTERFERENCE'. Other fields include 'CONTROL GROUP' (***), 'CHECK MEASURE' (COMMAND POSITION), 'ALARM OUTPUT' (OFF), 'TEACHING METHOD' (MAX / MIN), and 'COMMENT'. At the bottom, there is a 'PAGE' button and a 'Main Menu' button.

4. Select "METHOD".

- "AXIS INTERFERENCE" and "CUBIC INTERFERENCE" are displayed alternately every time [SELECT] is pressed. If "CUBIC INTERFERENCE" is selected, the window is changed.

The screenshot shows the same software interface as the previous one, but with 'CUBIC INTERFERENCE' selected in the 'METHOD' field. The 'CONTROL GROUP' field is now '***', 'CHECK MEASURE' is 'COMMAND POSITION', 'REF COORDINATE' is 'BASE', 'ALARM OUTPUT' is 'OFF', and 'TEACHING METHOD' is 'MAX / MIN'. The 'COMMENT' field is empty. The 'PAGE' button and 'Main Menu' button are still present at the bottom.

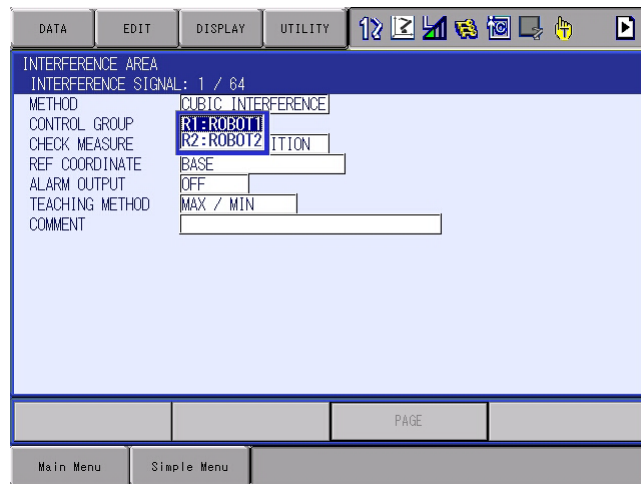
8 System Setup

8.6 Interference Area

5. Select "CONTROL GROUP".

– A selection dialog box appears.

(1) Select the desired control group.

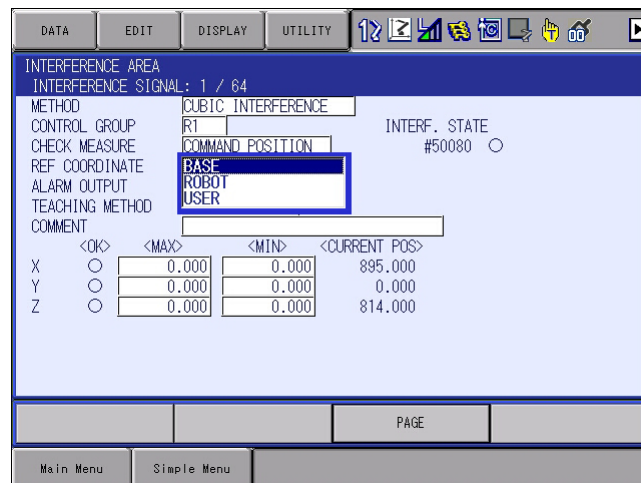


6. Select "REF COORDINATES".

– A selection box appears.

(2) Select the desired coordinate.

(3) If the user coordinates are selected, the number input line is displayed. Input the user coordinate number and press [ENTER].



8 System Setup

8.6 Interference Area

7. Select "CHECK MEASURE."

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

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD: CUBIC INTERFERENCE
CONTROL GROUP: R1
CHECK MEASURE: FEEDBACK POSITION
REF COORDINATE: BASE
ALARM OUTPUT: OFF
TEACHING METHOD: MAX / MIN
COMMENT:

INTERF. STATE: #50080 ☐

	<OK>	<MAX>	<MIN>	<CURRENT POS>
X	<input type="radio"/>	0.000	0.000	895.000
Y	<input type="radio"/>	0.000	0.000	0.000
Z	<input type="radio"/>	0.000	0.000	814.000

PAGE

Main Menu Simple Menu

- "COMMAND POSITION" : When the command position (which is displayed on the current position window) is in the interference area, the signal is turned ON.
- "FEEDBACK POSITION" : When the actual position of the manipulator is in the interference area, the signal is turned ON.



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

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

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

8 System Setup

8.6 Interference Area

8. Select "ALARM OUTPUT."

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

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD: CUBIC INTERFERENCE
CONTROL GROUP: R1
CHECK MEASURE: FEEDBACK POSITION
REF COORDINATE: BASE
ALARM OUTPUT: ON
TEACHING METHOD: MAX / MIN
COMMENT:

INTERF. STATE: #50080 ☐

	<OK>	<MAX>	<MIN>	<CURRENT POS>
X	<input type="radio"/>	0.000	0.000	895.000
Y	<input type="radio"/>	0.000	0.000	0.000
Z	<input type="radio"/>	0.000	0.000	814.000

PAGE

Main Menu Simple Menu

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".

The screenshot shows the 'INTERFERENCE AREA' screen with the 'METHOD' menu open. The menu options are: CUBIC INTERFERENCE, R1, INTERF. STATE #50080, COMMAND POSITION, BASE, ALARM OUTPUT OFF, TEACHING METHOD MAX / MIN (highlighted), and COMMENT. Below the menu, there are four columns: <OK>, <MAX>, <MIN>, and <CURRENT POS>. The X-axis values are 0.000, 0.000, 0.000, and 895.000. The Y-axis values are 0.000, 0.000, 0.000, and 0.000. The Z-axis values are 0.000, 0.000, 0.000, and 814.000. The bottom of the screen has buttons for 'Main Menu', 'Simple Menu', and 'PAGE'.

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

– The cubic interference area is set.

The screenshot shows the 'INTERFERENCE AREA' screen with the 'METHOD' menu open. The menu options are: CUBIC INTERFERENCE, R1, INTERF. STATE #50080, COMMAND POSITION, BASE, ALARM OUTPUT OFF, TEACHING METHOD MAX / MIN (highlighted), and COMMENT. Below the menu, there are four columns: <OK>, <MAX>, <MIN>, and <CURRENT POS>. The X-axis values are 100.000, 0.000, 0.000, and 895.000. The Y-axis values are 50.000, 0.000, 0.000, and 0.000. The Z-axis values are 0.000, 0.000, 0.000, and 814.000. The bottom of the screen has buttons for 'Main Menu', 'Simple Menu', and 'PAGE'.

■ Teaching Corner

1. Select "METHOD".

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

- (2) Select "MAX/MIN".

DATA EDIT DISPLAY UTILITY 12 1 1 1 1 1 1 1 1 1 1 1

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD	CUBIC INTERFERENCE		
CONTROL GROUP	R1		INTERF. STATE
CHECK MEASURE	COMMAND POSITION		#50080 ○
REF COORDINATE	BASE		
ALARM OUTPUT	OFF		
TEACHING METHOD	MAX / MIN		
COMMENT			

	<OK>	<MAX>	<MIN>	<CURRENT POS>
X	○	0.000	0.000	895.000
Y	○	0.000	0.000	0.000
Z	○	0.000	0.000	814.000

PAGE

Main Menu Simple Menu

2. Press [MODIFY].

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

DATA		EDIT		DISPLAY		UTILITY			
INTERFERENCE AREA									
INTERFERENCE SIGNAL: 1 / 64									
METHOD		CUBIC INTERFERENCE							
CONTROL GROUP		R1				INTERF. STATE			
CHECK MEASURE		COMMAND POSITION				#50080 ○			
REF COORDINATE		BASE							
ALARM OUTPUT		OFF							
TEACHING METHOD		MAX / MIN							
COMMENT									
	<OK>	<MAX>	<MIN>	<CURRENT POS>					
X	○	0.000	0.000	895.000					
Y	○	0.000	0.000	0.000					
Z	○	0.000	0.000	814.000					
				PAGE					
Main Menu		Simple Menu		Teach max./min. position					

8 System Setup

8.6 Interference Area

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.

DATA	EDIT	DISPLAY	UTILITY	12																										
INTERFERENCE AREA																														
INTERFERENCE SIGNAL: 1 / 64																														
METHOD CUBIC INTERFERENCE																														
CONTROL GROUP R1																														
CHECK MEASURE COMMAND POSITION																														
REF COORDINATE BASE																														
ALARM OUTPUT OFF																														
TEACHING METHOD MAX / MIN																														
COMMENT																														
<table border="1"> <thead> <tr> <th></th> <th><OK></th> <th><MAX></th> <th><MIN></th> <th><CURRENT POS></th> </tr> </thead> <tbody> <tr> <td>X</td> <td><input type="radio"/></td> <td>821.521</td> <td>0.000</td> <td>895.000</td> </tr> <tr> <td>Y</td> <td><input type="radio"/></td> <td>2.216</td> <td>0.000</td> <td>0.000</td> </tr> <tr> <td>Z</td> <td><input type="radio"/></td> <td>614.526</td> <td>0.000</td> <td>814.000</td> </tr> </tbody> </table>												<OK>	<MAX>	<MIN>	<CURRENT POS>	X	<input type="radio"/>	821.521	0.000	895.000	Y	<input type="radio"/>	2.216	0.000	0.000	Z	<input type="radio"/>	614.526	0.000	814.000
	<OK>	<MAX>	<MIN>	<CURRENT POS>																										
X	<input type="radio"/>	821.521	0.000	895.000																										
Y	<input type="radio"/>	2.216	0.000	0.000																										
Z	<input type="radio"/>	614.526	0.000	814.000																										
				PAGE																										
Main Menu		Simple Menu																												

■ **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".

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD	CUBIC INTERFERENCE				INTERF. STATE	#50080 ○
CONTROL GROUP	RT					
CHECK MEASURE	COMMAND POSITION					
REF COORDINATE	BASE					
ALARM OUTPUT	OFF					
TEACHING METHOD	CENTER POS					
COMMENT						

	<OK>	<MAX>	<MIN>	<LENGTH>	<CURRENT POS>
X ○		0.000	0.000	0.000	895.000
Y ○		0.000	0.000	0.000	0.000
Z ○		0.000	0.000	0.000	814.000

PAGE

Main Menu Simple Menu

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

– The length is set.

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD	CUBIC INTERFERENCE				INTERF. STATE	#50080 ○
CONTROL GROUP	RT					
CHECK MEASURE	COMMAND POSITION					
REF COORDINATE	BASE					
ALARM OUTPUT	OFF					
TEACHING METHOD	CENTER POS					
COMMENT						

	<OK>	<MAX>	<MIN>	<LENGTH>	<CURRENT POS>
X ○		0.000	0.000	0.000	894.997
Y ○		25.000	-25.000	50.000	105.755
Z ○		0.000	0.000	0.000	813.997

PAGE

Main Menu Simple Menu

8 System Setup

8.6 Interference Area

3. Press [MODIFY].

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

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD: CUBIC INTERFERENCE
CONTROL GROUP: R1
CHECK MEASURE: COMMAND POSITION
REF. COORDINATE: BASE
ALARM OUTPUT: OFF
TEACHING METHOD: CENTER POS
COMMENT:

INTERF. STATE: #50080 ○

	<OK>	<MAX>	<MIN>	<LENGTH>	<CURRENT POS>
X	○	0.000	0.000	0.000	895.000
Y	○	25.000	-25.000	50.000	98.400
Z	○	0.000	0.000	0.000	814.000

PAGE

Main Menu Simple Menu Move to center point and teach

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.

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD: CUBIC INTERFERENCE
CONTROL GROUP: R1
CHECK MEASURE: COMMAND POSITION
REF. COORDINATE: BASE
ALARM OUTPUT: OFF
TEACHING METHOD: CENTER POS
COMMENT:

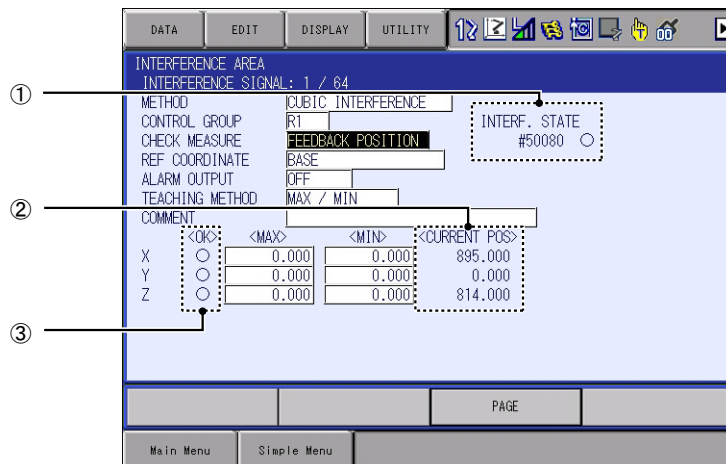
INTERF. STATE: #50080 ○

	<OK>	<MAX>	<MIN>	<LENGTH>	<CURRENT POS>
X	○	862.197	862.197	0.000	895.000
Y	○	-8.801	-8.801	0.000	0.000
Z	○	813.999	813.999	0.000	814.000

PAGE

Main Menu Simple Menu

■ 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

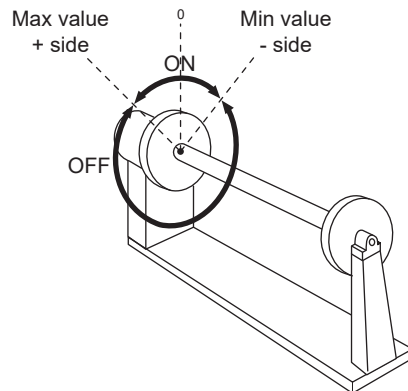
"○": within the range, "●": out of the range, which is between "MAX" and "MIN" displayed the current value of the axis.

8.6.3 Axis Interference Area

8.6.3.1 Axis Interference Area

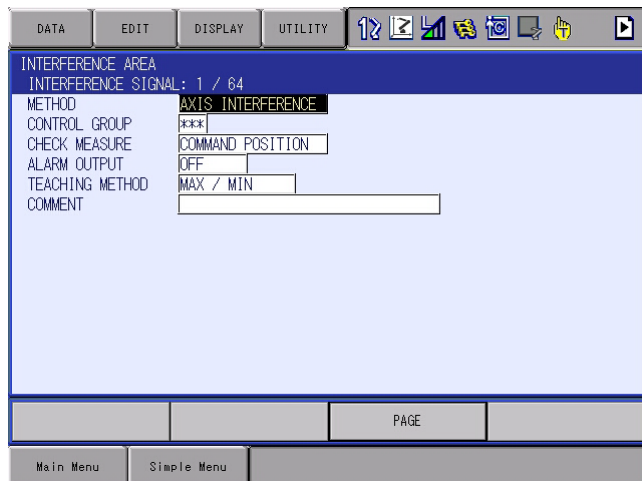
The axis interference area is a function that judges the current position of the each axis and outputs a signal. Once the maximum and minimum values have been set at the plus and minus sides of the axis to define the working range, a signal indicating whether the current position of the axis is inside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

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



8.6.3.2 Setting Operation

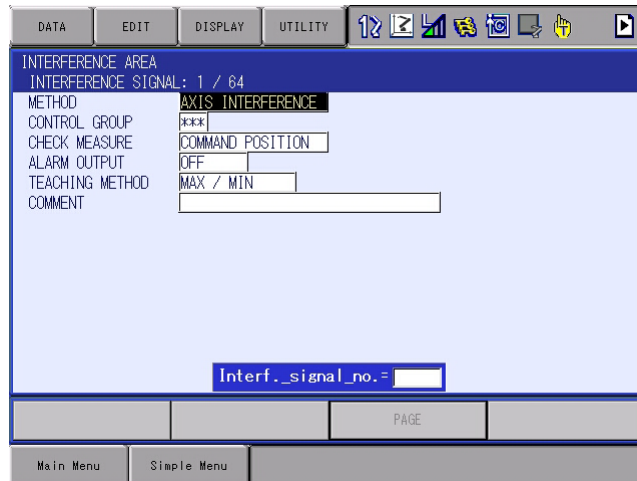
1. Select {ROBOT} under the main menu.
 2. Select {INTERFERENCE}.
- The INTERFERENCE AREA window appears.



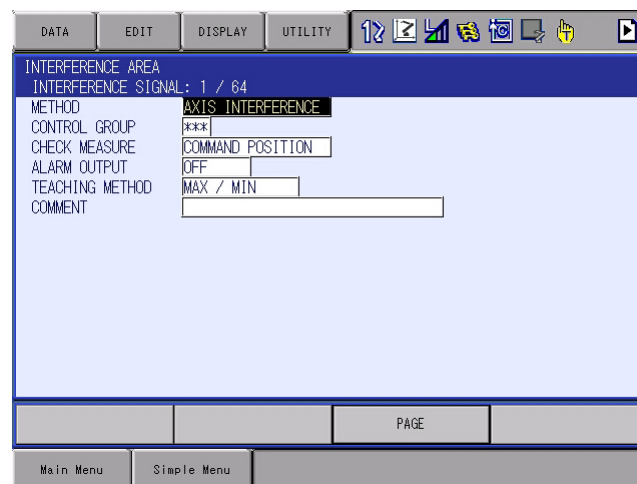
8 System Setup

8.6 Interference Area

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



8 System Setup

8.6 Interference Area

5. Select “CONTROL GROUP”.

- A selection box appears. Select the desired control group.

The screenshot shows the 'INTERFERENCE AREA' menu with 'INTERFERENCE SIGNAL: 1 / 64'. The 'CONTROL GROUP' option is highlighted with a blue selection box. Other options include METHOD, CHECK MEASURE, ALARM OUTPUT, TEACHING METHOD, and COMMENT. The right side of the screen shows fields for 'R1:ROBOT1', 'R2:ROBOT2', 'ITTON', 'OFF', and 'MAX / MIN'. The bottom of the screen has 'Main Menu' and 'Simple Menu' buttons.

6. Select “CHECK MEASURE”.

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

The screenshot shows the 'INTERFERENCE AREA' menu with 'INTERFERENCE SIGNAL: 1 / 64'. The 'CHECK MEASURE' option is highlighted with a black selection box. The right side of the screen shows 'INTERF. STATE #50080' and a radio button. Below the menu, there is a table with columns for '<OK>', '<MAX>', '<MIN>', and '<CURRENT POS>'. The table lists positions for R1:S, L, U, R, B, and T. The bottom of the screen has 'Main Menu' and 'Simple Menu' buttons.

	<OK>	<MAX>	<MIN>	<CURRENT POS>
R1 :S	<input type="radio"/>	0	0	13792
L	<input type="radio"/>	0	0	-309
U	<input type="radio"/>	0	0	-1604
R	<input type="radio"/>	0	0	1000
B	<input type="radio"/>	0	0	1233
T	<input type="radio"/>	0	0	990

8 System Setup

8.6 Interference Area

7. Select "ALARM OUTPUT".

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

DATA EDIT DISPLAY UTILITY

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD:

CONTROL GROUP: INTERF. STATE: #50080 ☐

CHECK MEASURE:

ALARM OUTPUT:

TEACHING METHOD:

COMMENT:

	<OK>	<MAX>	<MIN>	<CURRENT POS>
R1 : S	<input type="radio"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	13792
L	<input type="radio"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	-309
U	<input type="radio"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	-1604
R	<input type="radio"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	1000
B	<input type="radio"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	1233
T	<input type="radio"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	990

PAGE

Main Menu Simple Menu

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.

The screenshot shows the 'INTERFERENCE AREA' screen with the 'METHOD' menu open. The menu options are: METHOD (AXIS INTERFERENCE), CONTROL GROUP (R1), CHECK MEASURE (FEEDBACK POSITION), ALARM OUTPUT (ON), TEACHING METHOD (MAX / MIN), and COMMENT. The 'MAX / MIN' option is highlighted. Below the menu, there is a table with columns: <OK>, <MAX>, <MIN>, and <CURRENT POS>. The table contains data for axes R1, S, L, U, R, B, and T. The 'MAX / MIN' option is also highlighted in the bottom right corner of the screen.

	<OK>	<MAX>	<MIN>	<CURRENT POS>
R1 :S	<input type="radio"/>	0	0	13792
L	<input type="radio"/>	0	0	-309
U	<input type="radio"/>	0	0	-1604
R	<input type="radio"/>	0	0	1000
B	<input type="radio"/>	0	0	1233
T	<input type="radio"/>	0	0	990

(2) Select "MAX/MIN".

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

– The axis interference area is set.

The screenshot shows the 'INTERFERENCE AREA' screen with the 'MAX / MIN' menu open. The menu options are: METHOD (AXIS INTERFERENCE), CONTROL GROUP (R1), CHECK MEASURE (FEEDBACK POSITION), ALARM OUTPUT (ON), TEACHING METHOD (MAX / MIN), and COMMENT. The 'MAX / MIN' option is highlighted. Below the menu, there is a table with columns: <OK>, <MAX>, <MIN>, and <CURRENT POS>. The table contains data for axes R1, S, L, U, R, B, and T. The 'MAX / MIN' option is also highlighted in the bottom right corner of the screen.

	<OK>	<MAX>	<MIN>	<CURRENT POS>
R1 :S	<input type="radio"/>	100	0	13792
L	<input type="radio"/>	50	0	-309
U	<input type="radio"/>	0	0	-1604
R	<input type="radio"/>	0	0	1000
B	<input type="radio"/>	0	0	1233
T	<input type="radio"/>	0	0	990

■ Teaching Corner

1. Select "METHOD".

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

(2) Select "MAX/MIN".

The screenshot shows the 'INTERFERENCE AREA' screen with the 'METHOD' menu open. The menu options are: METHOD (AXIS INTERFERENCE), CONTROL GROUP (R1), CHECK MEASURE (COMMAND POSITION), ALARM OUTPUT (ON), TEACHING METHOD (MAX / MIN), and COMMENT. The 'MAX / MIN' option is highlighted. Below the menu, there is a table with columns: <OK>, <MAX>, <MIN>, and <CURRENT POS>. The table contains data for axes R1, S, L, U, R, B, and T.

	<OK>	<MAX>	<MIN>	<CURRENT POS>
R1 :S	<input type="radio"/>	100	0	13792
L	<input type="radio"/>	50	0	-309
U	<input type="radio"/>	0	0	-1604
R	<input type="radio"/>	0	0	1000
B	<input type="radio"/>	0	0	1233
T	<input type="radio"/>	0	0	990

2. Press [MODIFY].

– A message "Teach max./min. position" appears.

The screenshot shows the 'INTERFERENCE AREA' screen with the 'METHOD' menu open. The menu options are: METHOD (AXIS INTERFERENCE), CONTROL GROUP (R1), CHECK MEASURE (COMMAND POSITION), ALARM OUTPUT (ON), TEACHING METHOD (MAX / MIN), and COMMENT. The 'MAX / MIN' option is highlighted. Below the menu, there is a table with columns: <OK>, <MAX>, <MIN>, and <CURRENT POS>. The table contains data for axes R1, S, L, U, R, B, and T. At the bottom of the screen, a message box displays "Teach max./min. position".

	<OK>	<MAX>	<MIN>	<CURRENT POS>
R1 :S	<input type="radio"/>	100	0	13792
L	<input type="radio"/>	50	0	-309
U	<input type="radio"/>	0	0	-1604
R	<input type="radio"/>	0	0	1000
B	<input type="radio"/>	0	0	1233
T	<input type="radio"/>	0	0	990

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.

8 System Setup

8.6 Interference Area

5. Press [ENTER].

- The cubic interference area is registered.

		<OK>	<MAX>	<MIN>	<CURRENT POS>
R1 :S	●		13792	0	13792
L	●		-309	0	-309
U	●		-1604	0	-1604
R	●		1000	0	1000
B	●		1233	0	1233
T	●		990	0	990

■ **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".

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD: AXIS INTERFERENCE
CONTROL GROUP: R1
CHECK MEASURE: COMMAND POSITION
ALARM OUTPUT: ON
TEACHING METHOD: CENTER POS
COMMENT:

INTERF. STATE: #50080

	<OK>	<MAX>	<MIN>	<WIDTH>	<CURRENT POS>
R1 : S	<input type="radio"/>	6896	6896	0	13792
L	<input type="radio"/>	-154	-154	0	-309
U	<input type="radio"/>	-802	-802	0	-1604
R	<input type="radio"/>	500	500	0	1000
B	<input type="radio"/>	616	616	0	1233
T	<input type="radio"/>	495	495	0	990

PAGE

Main Menu Simple Menu

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

– "WIDTH" is set.

INTERFERENCE AREA
INTERFERENCE SIGNAL: 1 / 64

METHOD: AXIS INTERFERENCE
CONTROL GROUP: R1
CHECK MEASURE: COMMAND POSITION
ALARM OUTPUT: ON
TEACHING METHOD: CENTER POS
COMMENT:

INTERF. STATE: #50080

	<OK>	<MAX>	<MIN>	<WIDTH>	<CURRENT POS>
R1 : S	<input type="radio"/>	6946	6846	100	13792
L	<input type="radio"/>	-129	-179	50	-309
U	<input type="radio"/>	-802	-802	0	-1604
R	<input type="radio"/>	500	500	0	1000
B	<input type="radio"/>	616	616	0	1233
T	<input type="radio"/>	495	495	0	990

PAGE

Main Menu Simple Menu

8 System Setup

8.6 Interference Area

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.

	<OK>	<MAX>	<MIN>	<WIDTH>	<CURRENT POS>
R1 :S	<input type="radio"/>	6946	6846	100	13792
L	<input type="radio"/>	-129	-179	50	-309
U	<input type="radio"/>	-802	-802	0	-1604
R	<input type="radio"/>	500	500	0	1000
B	<input type="radio"/>	616	616	0	1233
T	<input type="radio"/>	495	495	0	990

4. Move the manipulator using the axis keys.

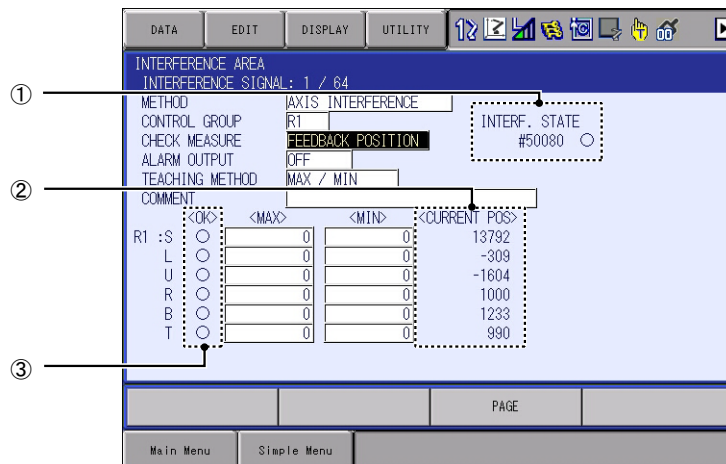
- Move the manipulator to the center position of the cube using the axis keys.

5. Press [ENTER].

- The center position of the cube is registered.

	<OK>	<MAX>	<MIN>	<WIDTH>	<CURRENT POS>
R1 :S	<input checked="" type="radio"/>	13842	13742	100	13792
L	<input checked="" type="radio"/>	-284	-334	50	-309
U	<input checked="" type="radio"/>	-1604	-1604	0	-1604
R	<input checked="" type="radio"/>	1000	1000	0	1000
B	<input checked="" type="radio"/>	1233	1233	0	1233
T	<input checked="" type="radio"/>	990	990	0	990

■ 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.

	<OK>	<MAX>	<MIN>	<WIDTH>	<CURRENT POS>
R1 :S	●	13842	13742	100	13792
L	●	-284	-334	50	-309
U	●	-1604	-1604	0	-1604
R	●	1000	1000	0	1000
B	●	1233	1233	0	1233
T	●	990	990	0	990

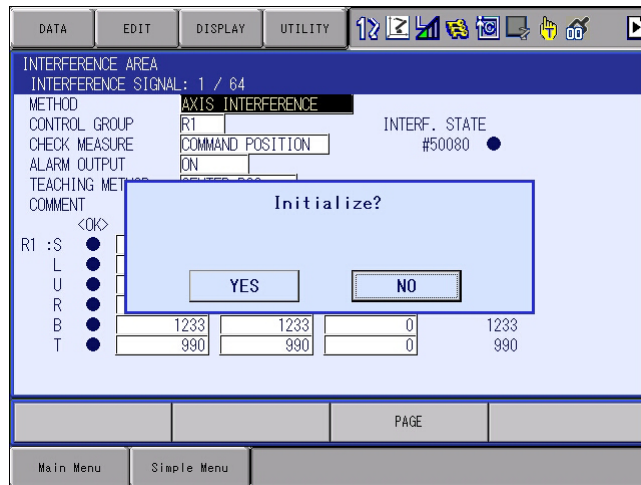
3. Select interference signal to be cleared.
- Select the desired interference signal number to be cleared using the [PAGE] or by number input.
- When selecting the desired interference signal number by number input, select [PAGE] to input the desired signal number.
4. Select {DATA} in the pull-down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

	<OK>	<MAX>	<MIN>	<WIDTH>	<CURRENT POS>
R1 :S	●	13842	13742	100	13792
L	●	-284	-334	50	-309
U	●	-1604	-1604	0	-1604
R	●	1000	1000	0	1000
B	●	1233	1233	0	1233
T	●	990	990	0	990

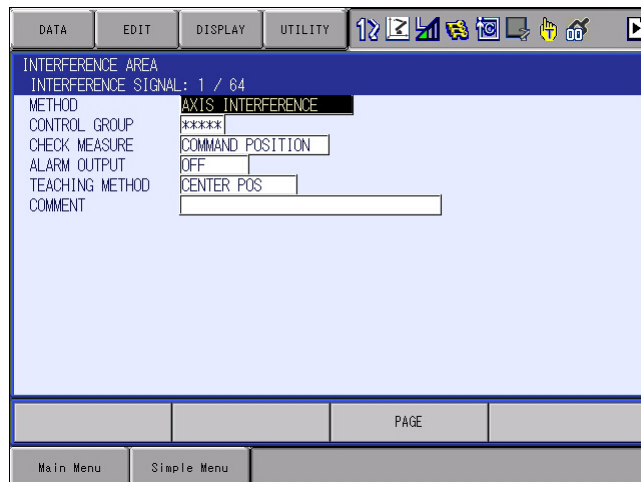
8 System Setup

8.6 Interference Area

5. Select {CLEAR DATA}.
- The confirmation dialog box appears.



6. Select {YES}.
- All the data of the interference signal number are cleared.



8.7 Shock Detection Function

8.7.1 Shock Detection Function

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

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



WARNING

This function does not completely avoid damage to the peripheral devices; moreover, it does not guarantee the user's safety. Make sure to prepare the safety measures such as the safeguarding etc. Refer to *chapter 1 "Safety"* to *chapter 6 "Test of Program Operation"* for the safety measures in details.

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



CAUTION

For robot models other than models for press handling and YASKAWA standard models, the shock detection function may be set to "INVALID". When "INVALID", the EACH AXIS LEVEL window will not appear after selecting {ROBOT} on the main menu and then {SHOCK SENS LEVEL}.

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.

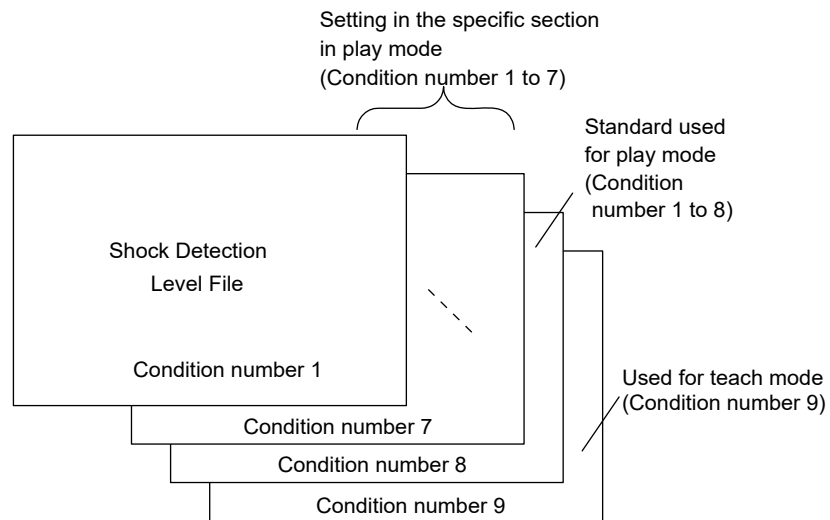
The shock detection level set file are nine condition files as following figure.

- 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.



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



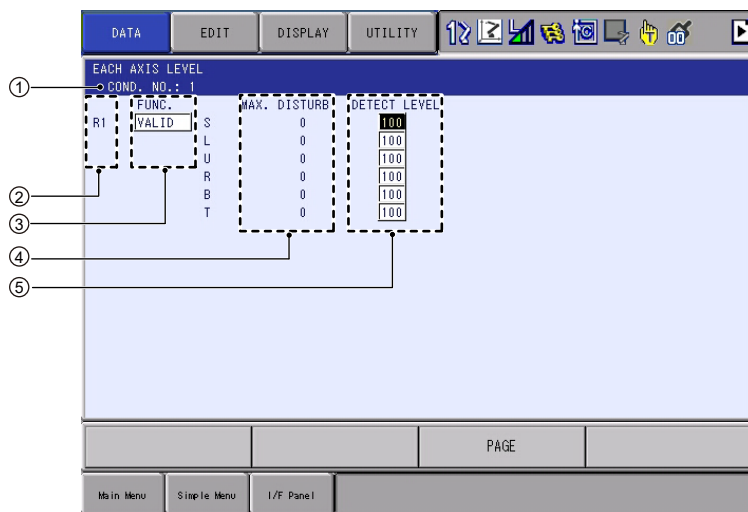
Teach Mode Each Axis Setting Function

Usually, the detection level setting of teach mode is set for each group.

By using this function, the detection level can be set for each axis.

S2C869: Teach Mode Each Axis Setting Function

(1: VALID, 0: INVALID)



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.

Refer to this value when inputting the detection level value in ⑤.

The maximum disturbance force can be cleared by selecting {DATA} → {CLEAR MAX VALUE} in the menu.

⑤ Detection Level (Level range: 1 to 500)

Specifies the shock detection level. Set a value larger than the maximum disturbance force.

The value set by default (the level 100) enables the function without false detection even if the manipulator is operated at the maximum speed.

To change DETECT LEVEL, move the cursor to the subject manipulator, and press [SELECT] to display the numeric input status; input the value with a numeric key and press [ENTER]. To increase the detection sensitivity, set the level to small value, and to decrease the sensitivity, set the level to large value.

■ **Method of Shock Detection Level File Setting**

1. Select {ROBOT} under the main menu.
2. Select {SHOCK SENS LEVEL}.
 - The EACH AXIS LEVEL window appears.
 - Perform either of the following operations to display the page of desired condition number:
 - (1) Press [PAGE] in the window. Enter the desired condition number using numeric keys and press [ENTER]. Then the page of the condition number appears.
 - (2) Press the [PAGE] to change the condition number.
3. Level setting for the condition numbers 1 to 8.

Level setting values can be set for each axis on the EACH AXIS LEVEL window.

Perform the following “Disturbance force measurement”, then perform “Setting all levels at once”.

■ **Disturbance force measurement**

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

■ **Setting all levels at once**

- ① Open the SHOCK DETECT LEVEL window.
- ② Select {DATA}, then {CHANGE EVERY LEVEL}.
- ③ Enter 120 in the coefficient (%) by which the max. disturbance force is multiplied.

The following calculated value A or B, whichever is larger, is set to the DETECT LEVEL.

A: (Max. disturbance force) x (coefficient = 120%)
B: (Max. disturbance force) + 15

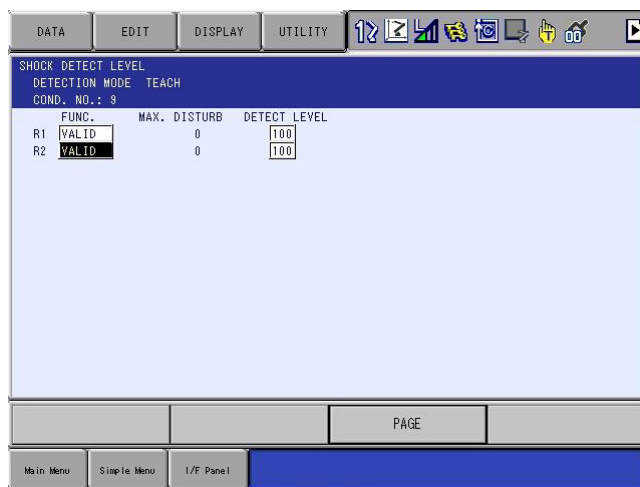
<Example>
When the max. disturbance force is 80, the DETECT LEVEL is 96.
When the max. disturbance force is 10, the DETECT LEVEL is 25.



CAUTION

For robot models other than models for press handling and YASKAWA standard models, the shock detection function may be set to "INVALID". When "INVALID", the EACH AXIS LEVEL window will not appear after selecting {ROBOT} on the main menu and then {SHOCK SENS LEVEL}.

4. Level setting for the condition number 9.
The level setting for the condition number 9 is for the teach mode.
This setting is made for each group.
Refer to the max. disturbance force to set the DETECT LEVEL.



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

To avoid false detection during manipulator operation, set the following calculated value A or B, whichever is larger, to the DETECT LEVEL. An emergency stop of the manipulator due to the false detection may become a factor to damage the speed reducers and tools.



A: (Max. disturbance force) x (coefficient = 120%)
B: (Max. disturbance force) + 15

<Example>

When the max. disturbance force is 80, set the DETECT LEVEL to 96 or more.

When the max. disturbance force is 10, set the DETECT LEVEL to 25 or more.



To adjust to the change in the grease viscosity at a cold start, the offset value is automatically added to DETECT LEVEL until the robot has operated for a certain period of time.

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.

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 varies depending on the manipulator type.



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.

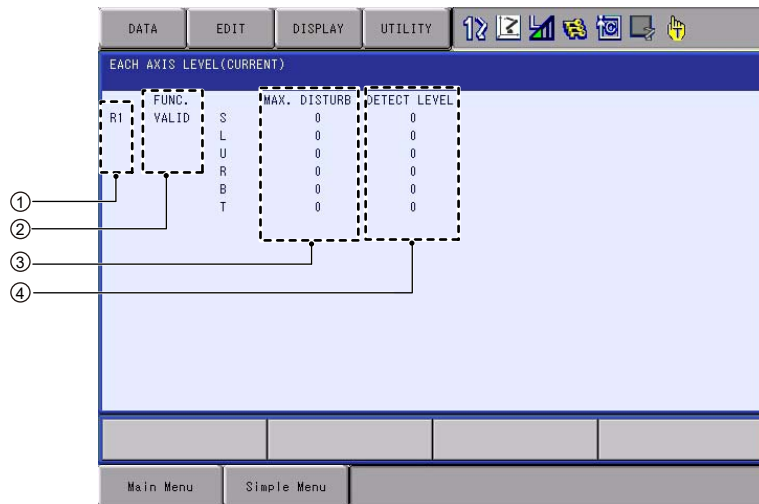
For the EACH AXIS LEVEL (CURRENT) Window, refer to *chapter 8.7.2.2 "EACH AXIS LEVEL (CURRENT) Window"*.



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

8.7.2.2 EACH AXIS LEVEL (CURRENT) Window

Able to confirm the current detection level.



① Robot Select

Select the manipulator to display the detection level.

② Function Select

Displays the valid/invalid status of the shock detection function.

③ Max. Disturbance Force

Indicates the maximum disturbance force to the manipulator when the manipulator is moved in play back operation or axis operation.

The maximum disturbance force can be cleared by selecting {DATA} → {CLEAR MAX VALUE} in the menu.

④ Detection Level

Displays the shock detection level.

When the maximum disturbance force exceeds this set value, the shock is detected.



To adjust to the change in the grease viscosity at a cold start, the offset value is automatically added to DETECT LEVEL until the robot has operated for a certain period of time.

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.

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

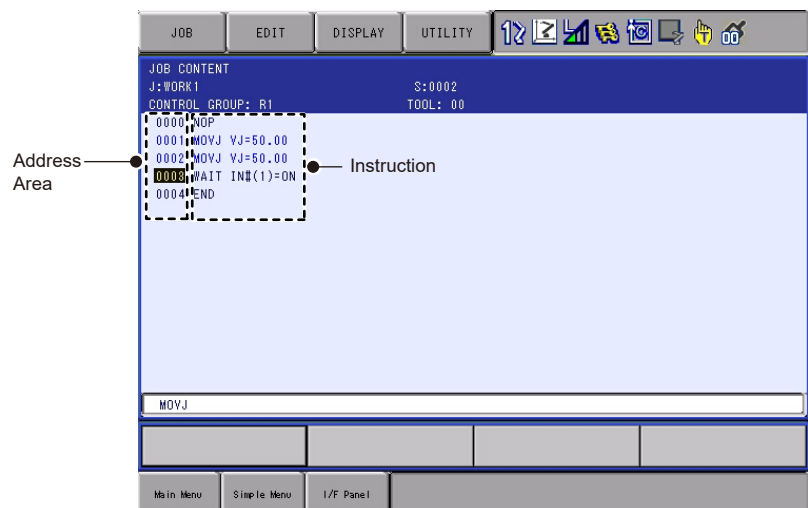
① **Robot Setting**

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

■ **Instruction Registration**

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

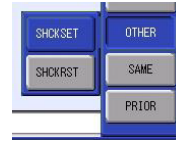
1. Select {JOB} under the main menu.



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

■ **SHCKSET**

1. Move the cursor to the immediately preceding line where the SHCKSET instruction is to be registered.
2. Press [INFORM LIST].
 - The inform list dialog box is shown.



3. Select SHCKSET instruction.

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



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

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

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

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

- < When adding or changing the additional item >

• **When changing the shock detection level**

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



• **When the value is input with the numeric key**

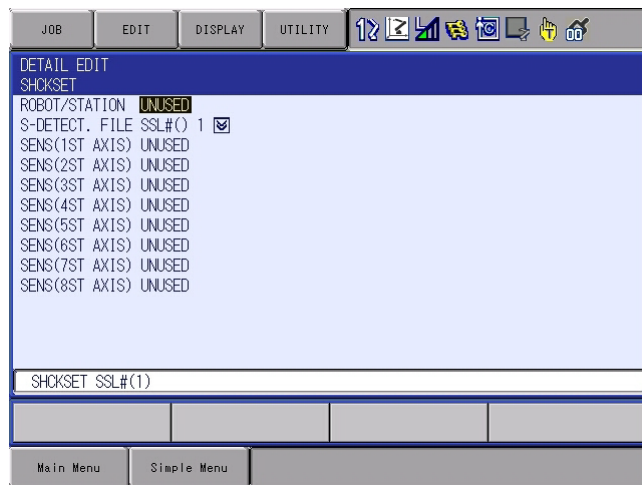
- (1) When the value is input with the numeric key, press [SELECT] to display the input buffer line.



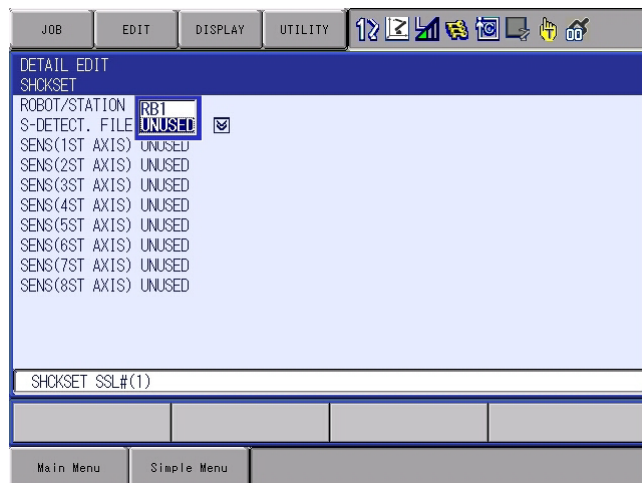
- (2) Press [ENTER] to change the number in the input buffer line.

• 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.



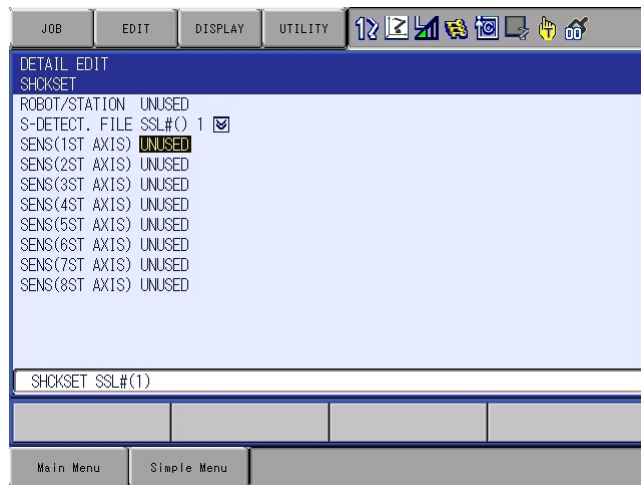
- (2) Move the cursor to "UNUSED" of "ROBOT/STATION", and press [SELECT].
(3) The selection box appears.
(4) Point the cursor to the robot/station to be added and press [SELECT].



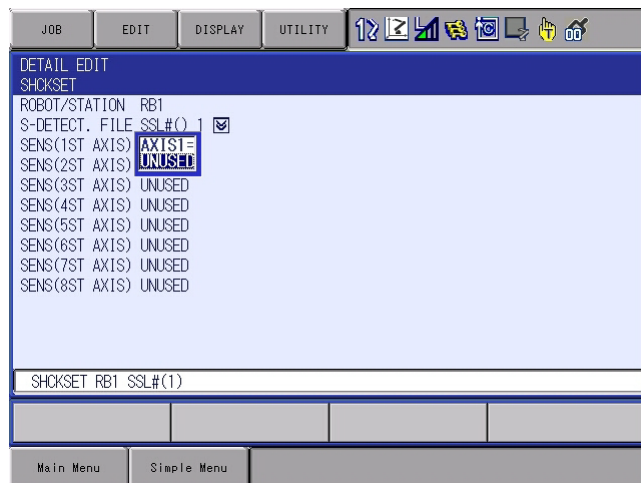
- (5) When the addition of robot/station is completed, press [ENTER].
(6) The DETAIL window closes and the JOB CONTENT window appears.

- 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.



SHOCKSET SSL#(1) AXIS1= 100 AXIS2= 100 AXIS3= 100 AXIS4= 100 AXIS5= 100 AXIS6

• 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.



1st Axis Sens(%)= SHOCKSET RB1 SSL#(1) AXIS1= 100 IS2= 100 AXIS3= 100 AXIS4= 100 AXIS5= 100 A

- (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.

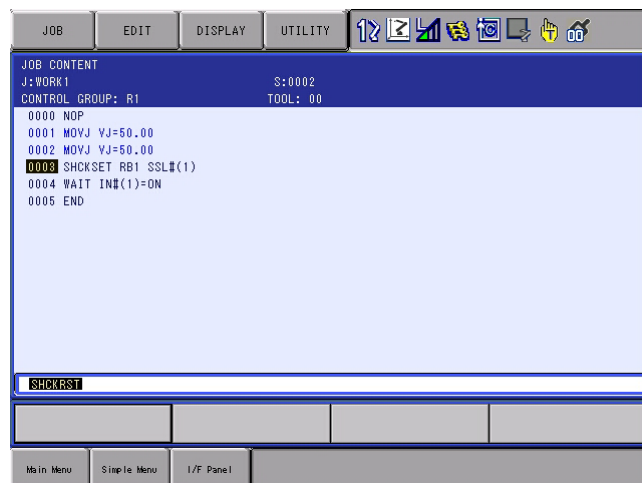
■ SHCKRST

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.



JOB CONTENT S:0002
J:WORK1 TOOL: 00
CONTROL GROUP: R1
0000 NOP
0001 MOVJ VJ=50.00
0002 MOVJ VJ=50.00
0003 SHCKSET RB1 SSL#(1)
0004 WAIT IN#(1)=ON
0005 END
SHCKRST

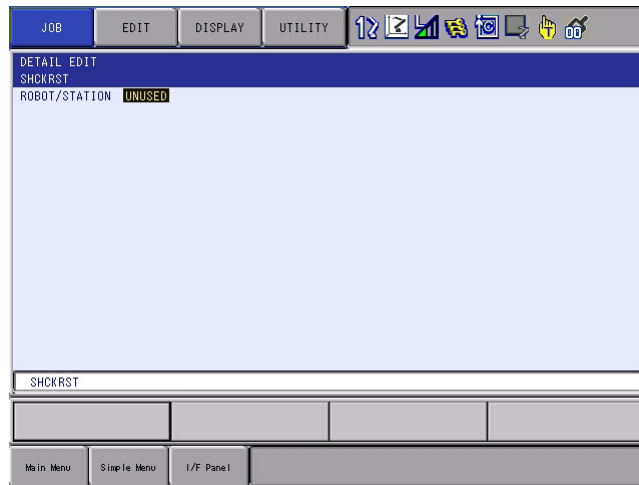
4. Change the value of the additional item.

- < 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 >

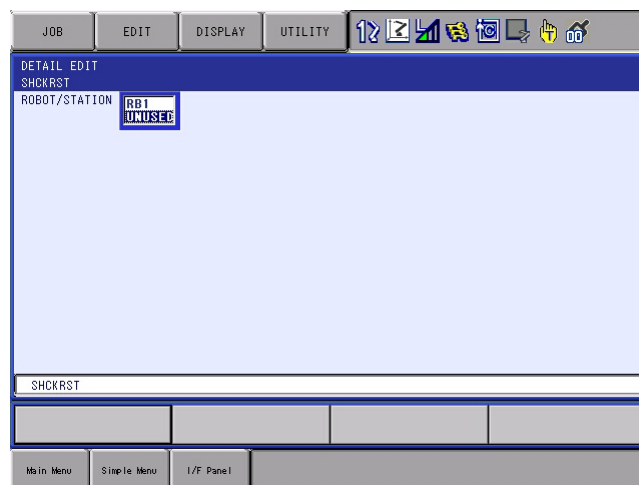
8 System Setup

8.7 Shock Detection Function

- (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.



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

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

8.7.3 High-Sensitivity Shock Detection Function (For Arc Welding Application Only)

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

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

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

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



WARNING

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

Make sure to prepare safety measures such as safeguarding etc.

Refer to *chapter 1 "Safety"* to *chapter 6 "Test of Program Operation"* for the safety measures in details.

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

8.7.3.1 Manipulator Type for High-Sensitivity Shock Detection Function

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

Types for high-sensitivity shock detection function

8.7.3.2 Setting for High-Sensitivity Shock Detection Function

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

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

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

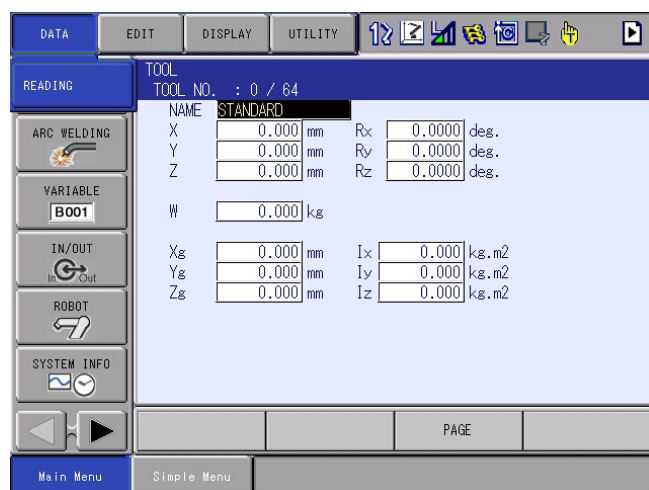
② Setting the U-arm payload

To perform shock detection more accurately, set the U-arm payload referring to *chapter 8.4.2 “ARM CONTROL Window”*.

The U-arm payload prepared by YASKAWA can be read on the MAKER INITIAL VALUE window. Read the same data as the actual U-arm payload on the MAKER INITIAL VALUE window.

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

1. Change the “SECURITY MODE” to the “MANAGEMENT MODE”, then select {ROBOT} under the main menu.
2. Select {TOOL}.
 - The TOOL window appears.
3. Select the desired tool number.
4. Select {DATA} under the menu.
 - The pull-down menu appears.

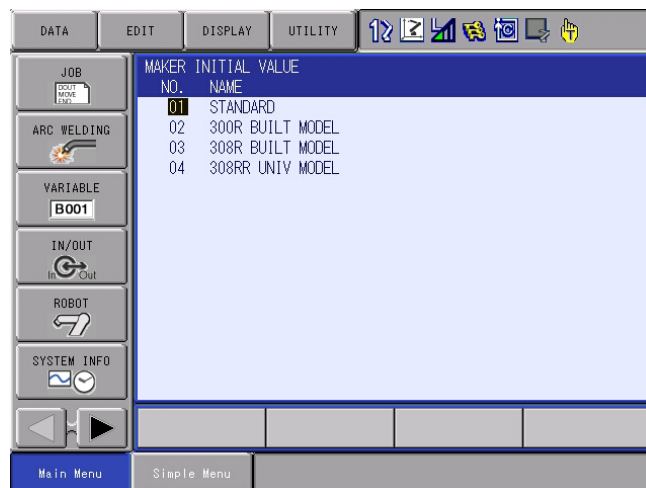


5. Select {READING}.

8 System Setup

8.7 Shock Detection Function

- The MAKER INITIAL VALUE window appears.



6. Select the number of the maker initial value to be read.
 - A confirmation dialog box appears.
 - Select a maker initial value other than the “STANDARD” to enable the high-sensitivity shock detection function.



8 System Setup

8.7 Shock Detection Function

7. Select {YES}.

- The tool load information is read into the tool file, and the TOOL window appears.

When “NO” is selected, the tool load information is NOT read into the tool file, and the TOOL window appears.

TOOL			
TOOL NO. : 0 / 64			
NAME 800R BUILT MODEL			
X	0.000 mm	Rx	0.0000 deg.
Y	0.000 mm	Ry	0.0000 deg.
Z	0.000 mm	Rz	0.0000 deg.
W		1.100 kg	
Xg	0.000 mm	Ix	0.001 kg.m2
Yg	0.000 mm	Iy	0.001 kg.m2
Zg	100.000 mm	Iz	0.001 kg.m2



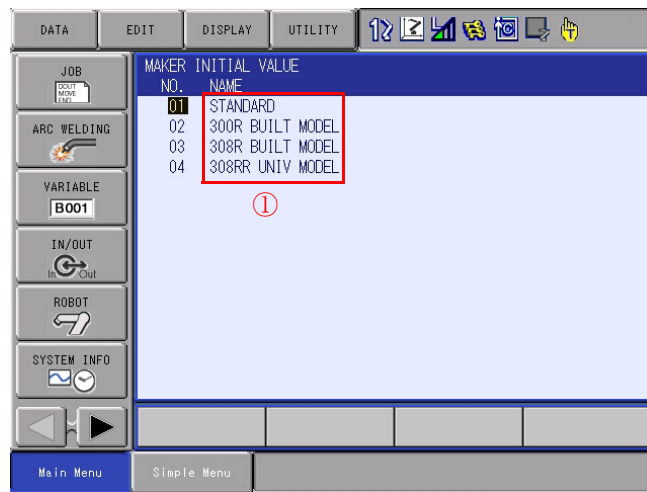
The high-sensitivity shock detection function is enabled when a maker initial value other than the “STANDARD” is selected. The read tool load information cannot be changed because it is used for the high-sensitivity shock detection function. When the standard torch is read, the function is disabled and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



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

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

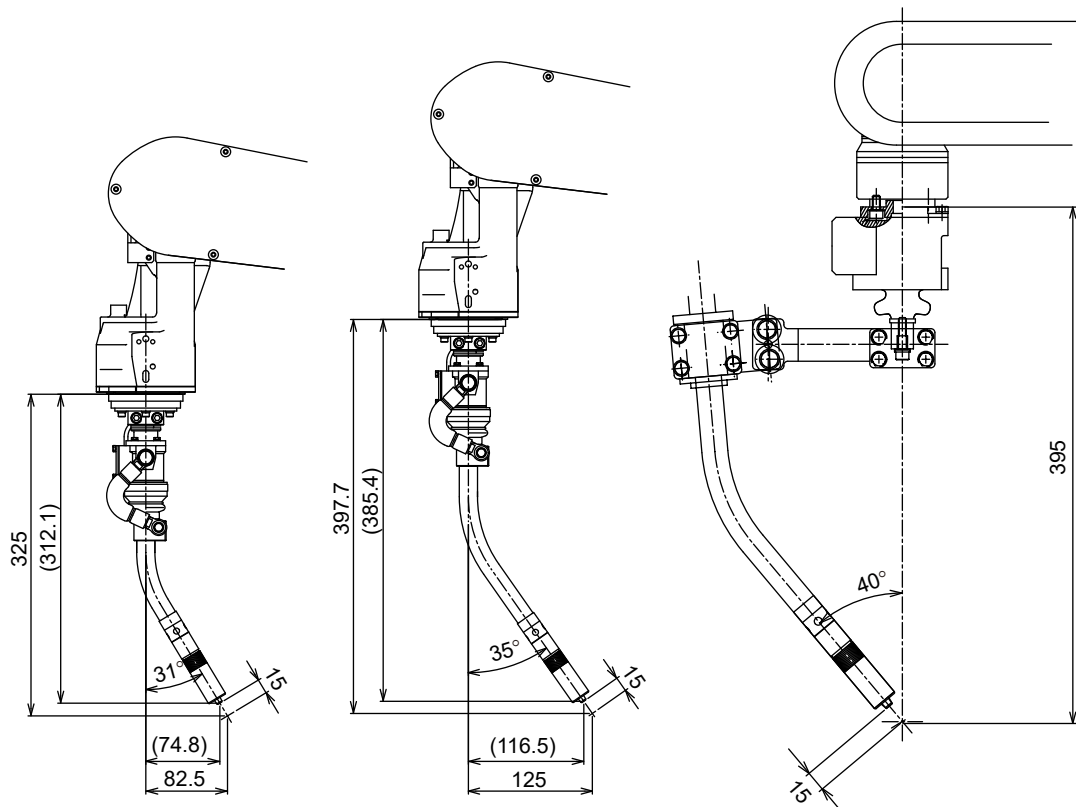
8.7.3.4 Explanation of Maker Initial Value



① NAME

The name of tool load information prepared by YASKAWA is indicated. When using the tool in the following figure, select 300R BUILT MODEL, 308R BUILT MODEL, or 308RR UNIV MODEL.

Fig. 8-4: Tool for High-Sensitivity Shock Detection



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

To perform shock detection more accurately, read the tool load which is the same as the actual load on the MAKER INITIAL VALUE window.

8 System Setup

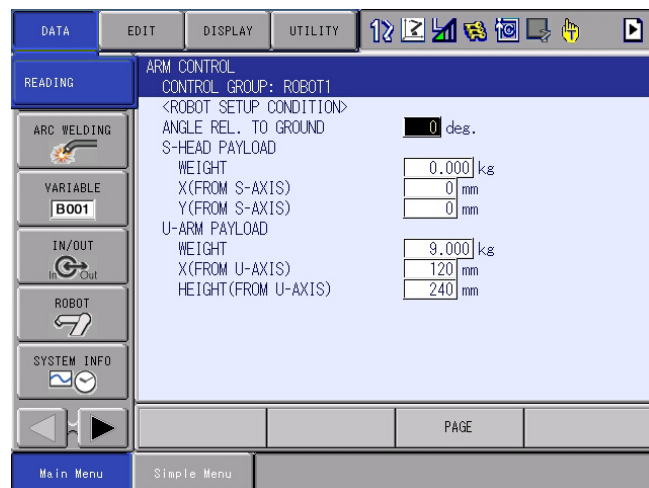
8.7 Shock Detection Function

8.7.3.5 Reading the U-Arm Payload

1. Change the "SECURITY MODE" to the "MANAGEMENT MODE".
2. Select {ARM CONTROL}.
 - The ARM CONTROL window appears.



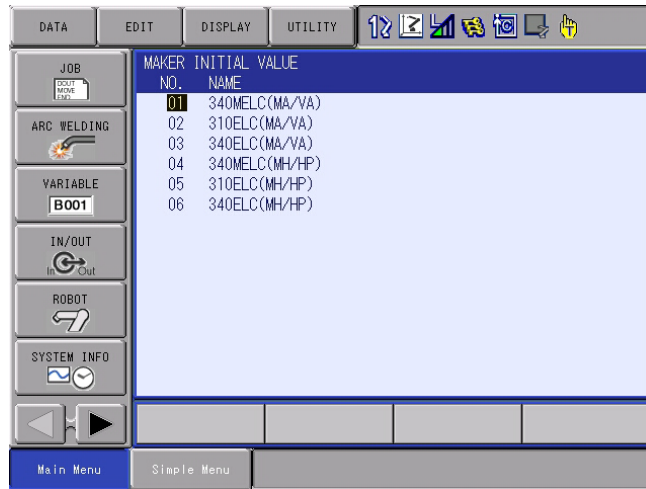
3. Select {DATA} under the menu.
 - The pull-down menu appears.



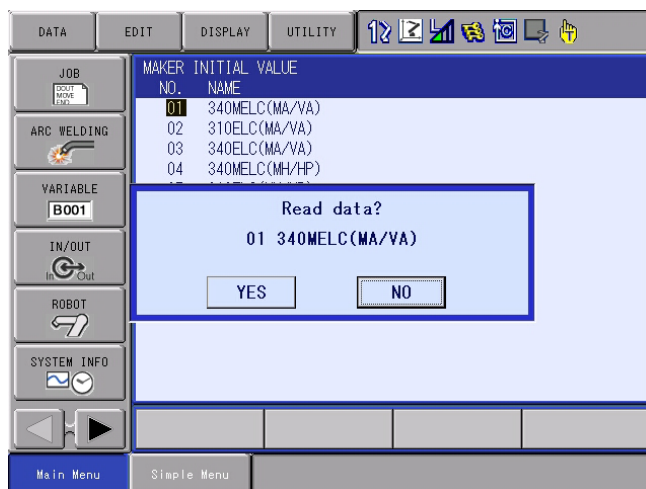
8 System Setup

8.7 Shock Detection Function

4. Select {READING}.
- The MAKER INITIAL VALUE window appears.



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



8 System Setup

8.7 Shock Detection Function

6. Select {YES}.

- The U-arm payload is read into the ARM CONTROL window, and the ARM CONTROL window appears.

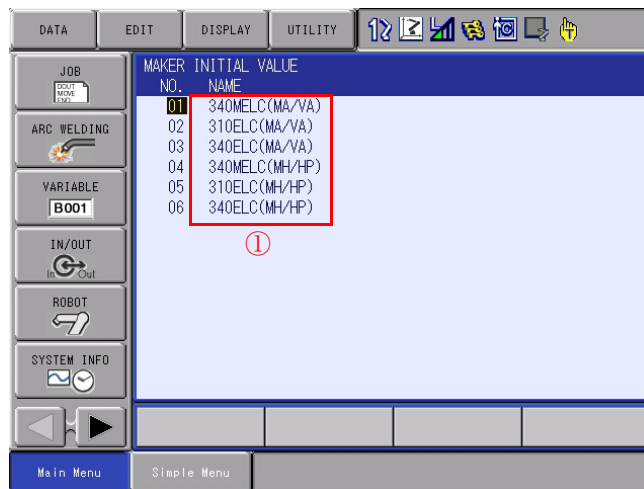
When {NO} is selected, the ARM CONTROL window appears without the U-arm payload being read into the ARM CONTROL window.

The screenshot displays the 'ARM CONTROL' window for 'ROBOT1'. The left sidebar contains buttons for JOB, ARC WELDING, VARIABLE (set to B001), IN/OUT, ROBOT, and SYSTEM INFO. The main area shows the following data:

ARM CONTROL	
CONTROL GROUP: ROBOT1	
<ROBOT SETUP CONDITION>	
ANGLE REL. TO GROUND	0 deg.
S-HEAD PAYLOAD	
WEIGHT	0.000 kg
X(FROM S-AXIS)	0 mm
Y(FROM S-AXIS)	0 mm
U-ARM PAYLOAD	
WEIGHT	5.000 kg
X(FROM U-AXIS)	-60 mm
HEIGHT(FROM U-AXIS)	200 mm

A red box highlights the U-ARM PAYLOAD section, and a red label 'U-arm payload information' points to it. The bottom of the window has 'Main Menu' and 'Simple Menu' buttons, and a 'PAGE' indicator.

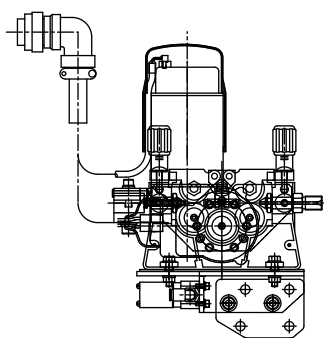
8.7.3.6 Explanation of Maker Initial Value



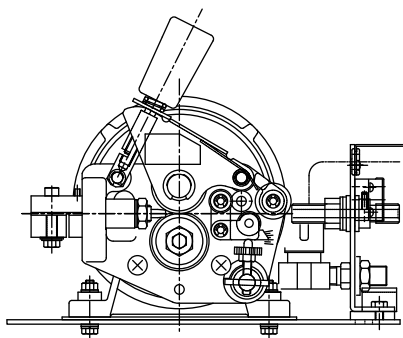
① NAME

The name of U-arm payload information prepared by YASKAWA is indicated.

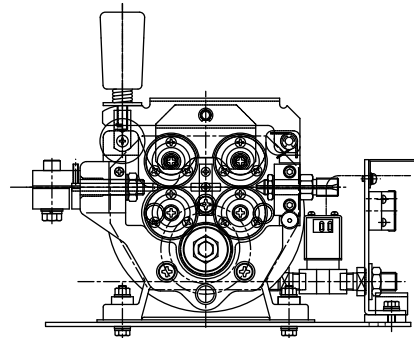
When using the U-arm payload in the following figure, select from the MAKER INITIAL VALUE window.



340MELC



310ELC



340ELC



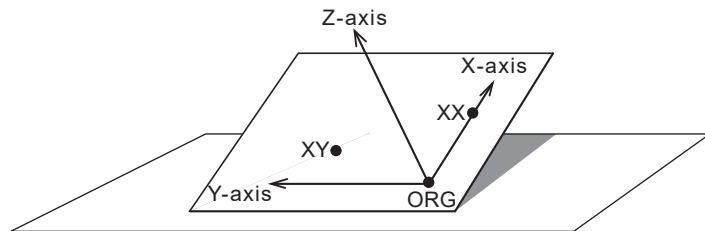
To perform shock detection more accurately, even when the U-arm payload information prepared by YASKAWA and the actual payload are the same, DO NOT read the payload information if the robot types are different.

8.8 User Coordinate Setting

8.8.1 User Coordinates

8.8.1.1 Definition of the User Coordinates

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



User coordinate definition point

ORG: Home position

XX: Point on the X-axis

XY: Point on the Y-axis

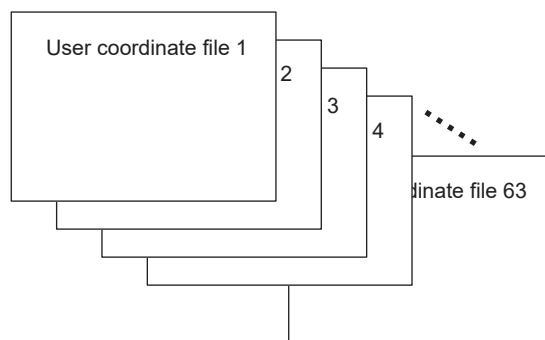
ORG is the home position, and XX is a point on the X-axis. XY is a point on the Y-axis side of the user coordinates that has been taught, and the directions of Y- and Z-axes are determined by point XY.



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

8.8.1.2 User Coordinate Files

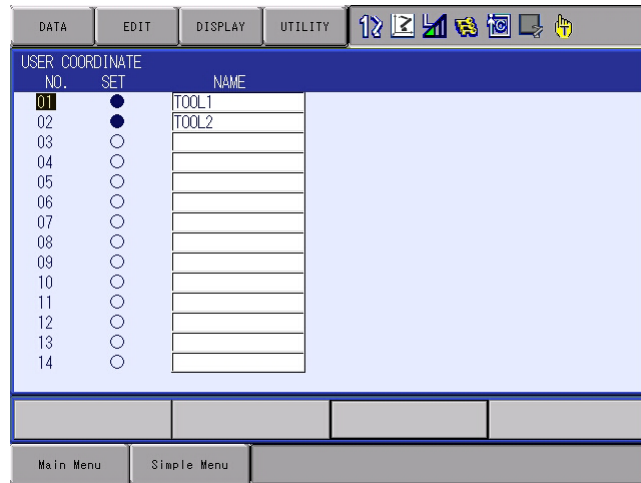
Up to 63 kinds of user coordinates can be registered. Each coordinate has a user coordinate No. and is called a user coordinate file.



8.8.2 User Coordinate Setting

8.8.2.1 Selecting the User Coordinate File

1. Select {ROBOT} under the main menu.
2. Select {USER COORDINATE}.
3. Select the user coordinate number.
 - (1) The USER COORDINATE window appears.



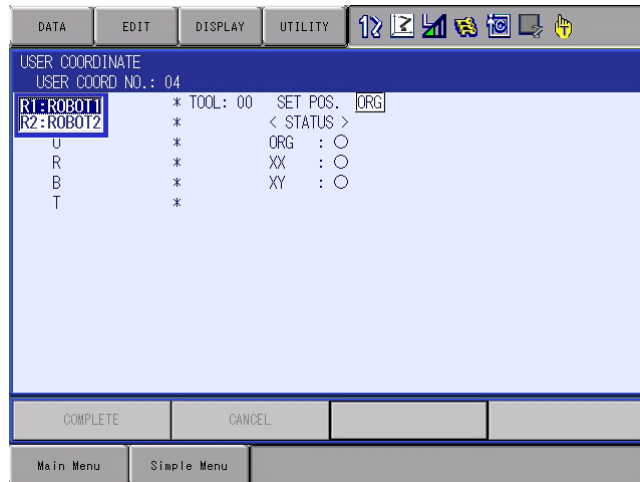
- (2) The "●" mark indicates that the user coordinates is completed to set and the "○" mark indicates that it is not completed.
- (3) To check the position of the user coordinates select {DISPLAY} → {COORDINATE DATA}.
- (4) The following window appears.



8.8.2.2 Teaching the User Coordinates

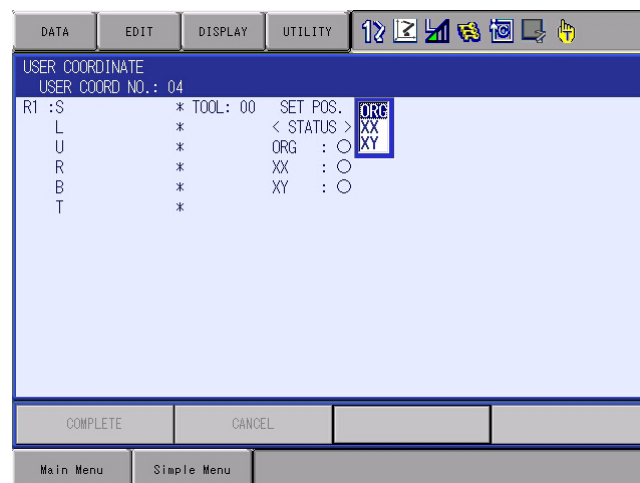
1. Select the robot.

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



2. Select "SET POS".

- Select the teaching point.



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

8 System Setup

8.8 User Coordinate Setting

4. Press [MODIFY] then [ENTER].

- Taught position is registered.
- Repeat the steps 2 to 4 to teach ORG, XX and XY.
- “●” indicates that teaching is completed and “○” indicates that it is not completed.

USER COORDINATE			
USER COORD NO.: 04			
R1	:S	0	TOOL: 00
L		14487	SET POS. XY
U		29777	< STATUS >
R		0	ORG : ●
B		-8070	XX : ●
T		0	XY : ●

Buttons: COMPLETE, CANCEL, Main Menu, Simple Menu

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

USER COORDINATE		
NO.	SET	NAME
01	●	TOOL1
02	●	TOOL2
03	○	
04	●	TOOL3
05	○	
06	○	
07	○	
08	○	
09	○	
10	○	
11	○	
12	○	
13	○	
14	○	

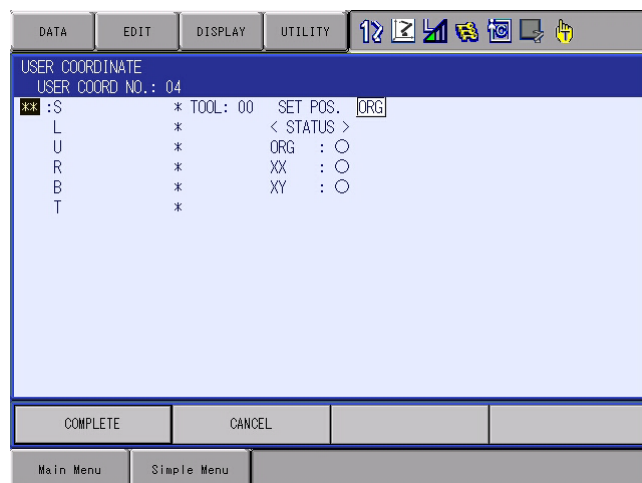
Buttons: Main Menu, Simple Menu

8.8.2.3 Clearing the User Coordinates

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



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



8.9 Overrun/Tool Shock Sensor Releasing



CAUTION

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

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

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



3. Select “RELEASE”.

- The control group in which overrun or shock sensor is detected is indicated with “●”.
- If “RELEASE” is selected, overrun or tool shock sensor is released and “CANCEL” indication will be displayed.



4. Select “ALM RST”.

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



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.



- The taught data cannot be registered when the soft limit is being released.
- The setting of "SOFT LIMIT RELEASE" becomes "INVALID" when the mode is changed to the play mode.

8.11 All Limit Release Function



CAUTION

To operate the manipulator with all limits released, pay extra attention to ensure the safety of the surrounding operation environment.

Failure to observe this caution may result in injury or damage to equipment due to the unexpected manipulator motion exceeding its range of motion.

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

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



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

8 System Setup

8.11 All Limit Release Function

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



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



8.12 Instruction Level Setting

8.12.1 Setting Contents

8.12.1.1 Instruction Set

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

Subset Instruction Set

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

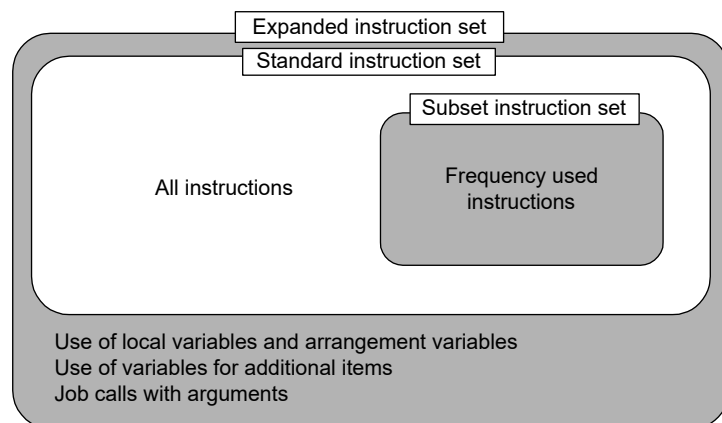
Standard Instruction Set / Expanded Instruction Set

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

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

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

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



Instruction set

8 System Setup

8.12 Instruction Level Setting

8.12.1.2 Learning Function

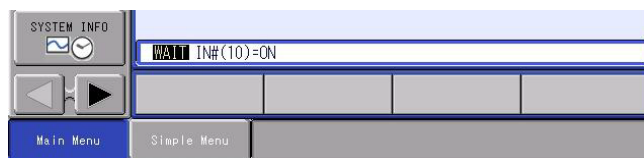
When an instruction is entered from the instruction list, the additional items that were entered last time are also shown. This function can simplify instruction input.

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

1. An instructions are registered.

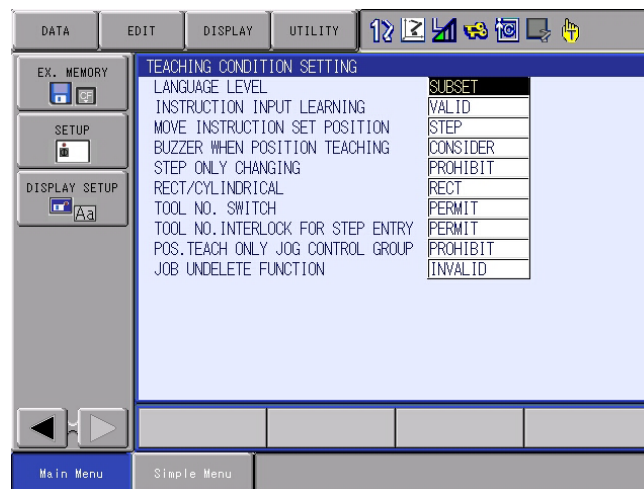
```
0002 MOVJ P000 VJ=50.00  
0003 WAIT INH(10)=ON  
0004 END
```

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.

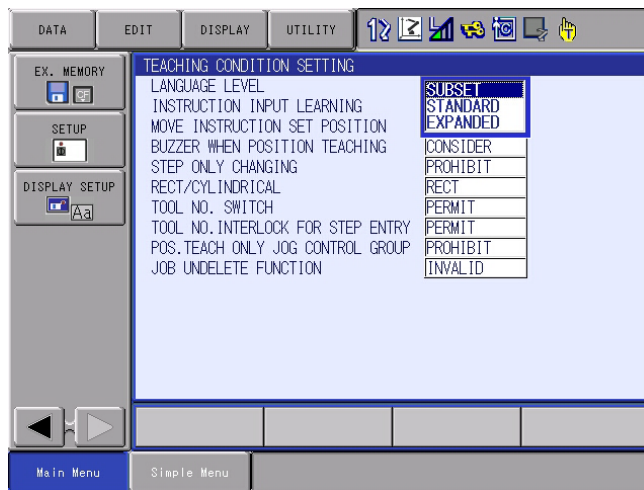


8 System Setup

8.12 Instruction Level Setting

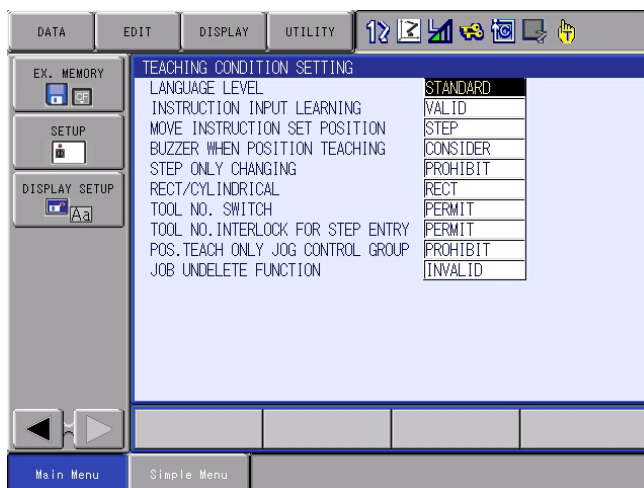
3. Select "LANGUAGE LEVEL".

- The selection list appears.



4. Select desired language level.

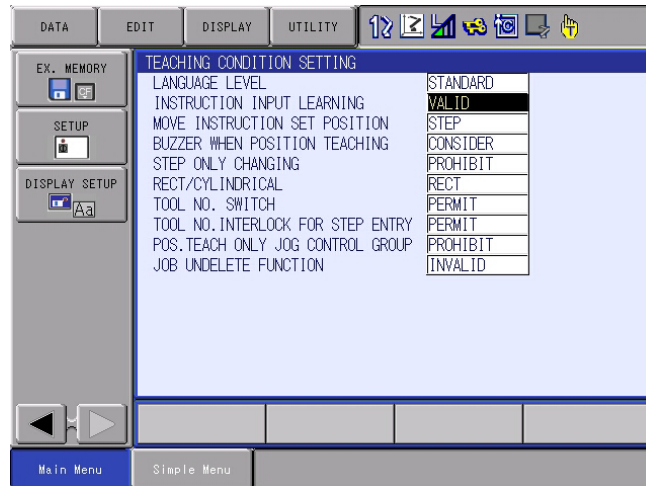
- Language level is set.



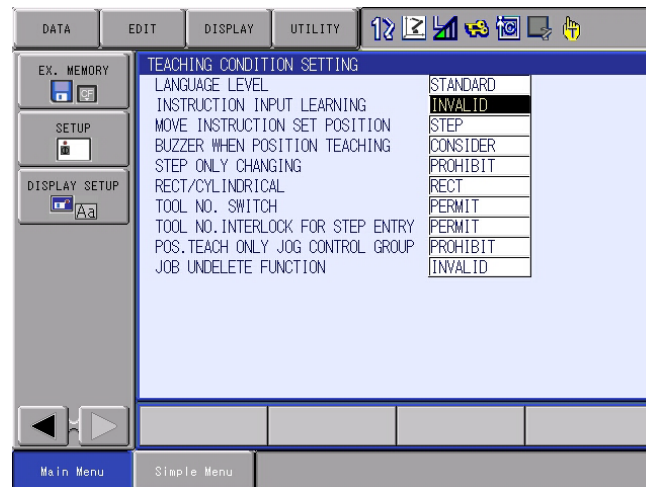
8.12.3 Setting the Learning Function

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.



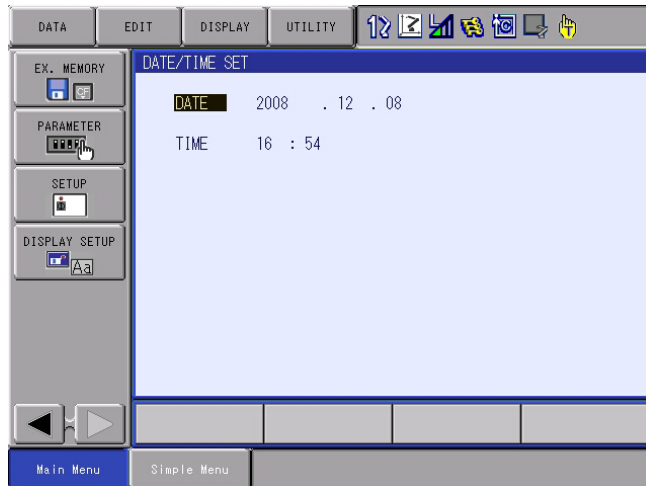
3. Select "INSTRUCTION INPUT LEARNING".
- "VALID" and "INVALID" are displayed alternately every time [SELECT] is pressed.



8.13 Setting the Controller Clock

The clock inside the DX200 controller can be set as follows.

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

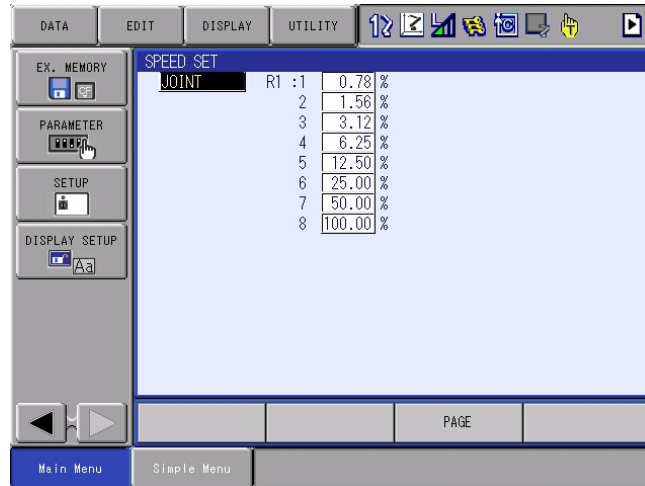


3. Select "DATE" or "TIME".
 - The input buffer line appears.
4. Input the new date/time.
 - For instance, to set the date to August 1, 2008, input "2008.8.1". To set the time at twelve o'clock, enter "12.00".
5. Press [ENTER].
 - The date/time is changed.

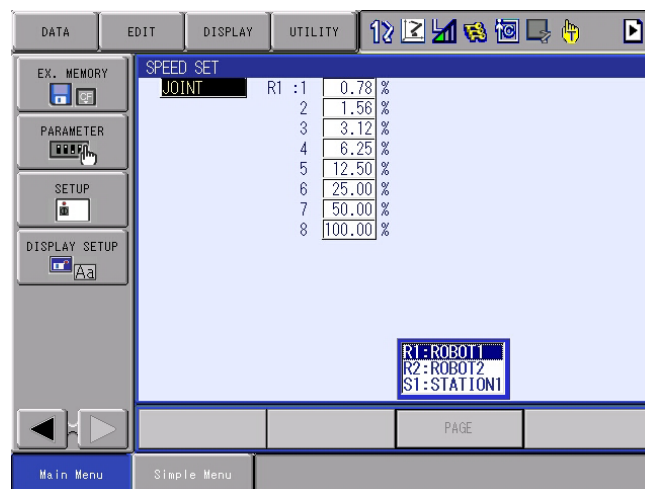


8.14 Setting the Play Speed

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



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



8 System Setup

8.14 Setting the Play Speed

4. Select “JOINT” or “LNR/CIR”.

- The type of speed alternately changes from “JOINT” to “LNR/CIR”.



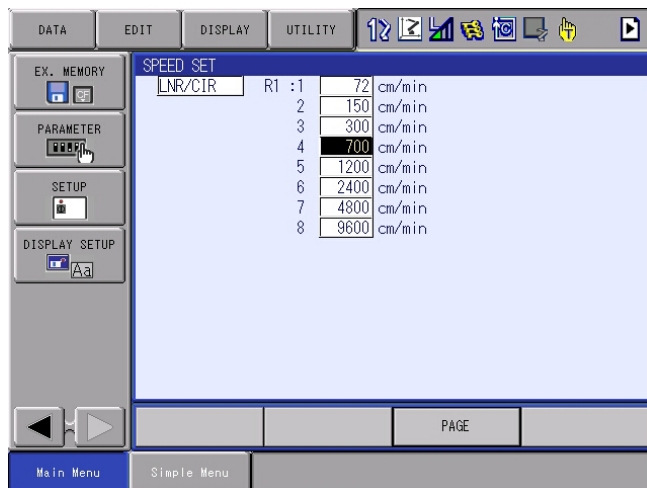
5. Select the speed to modify.

- The input buffer line appears.

6. Input the speed value.

7. Press [ENTER].

- The speed is modified.



8.15 Numeric Key Customize Function

8.15.1 What is the Numeric Key Customize Function?

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

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



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

8.15.2 Allocatable Functions

There are two allocation methods as follows:

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

8.15.2.1 Key Allocation (EACH)

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

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

8.15.2.2 Key Allocation (SIM)

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

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

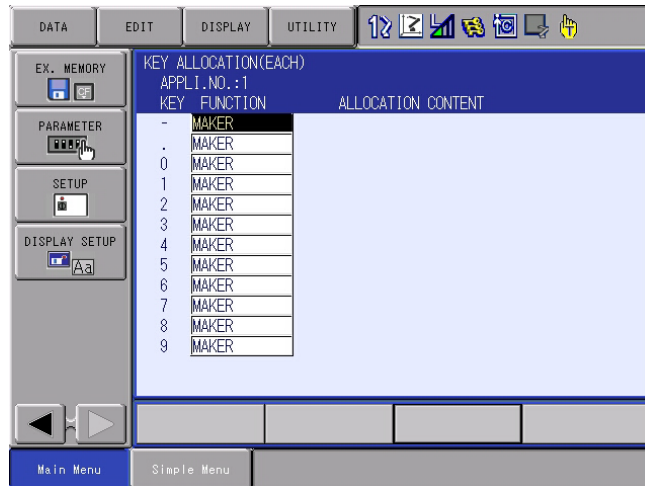


In a system for multiple applications, a numeric key can be allocated for each application.

8.15.3 Allocating 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}.

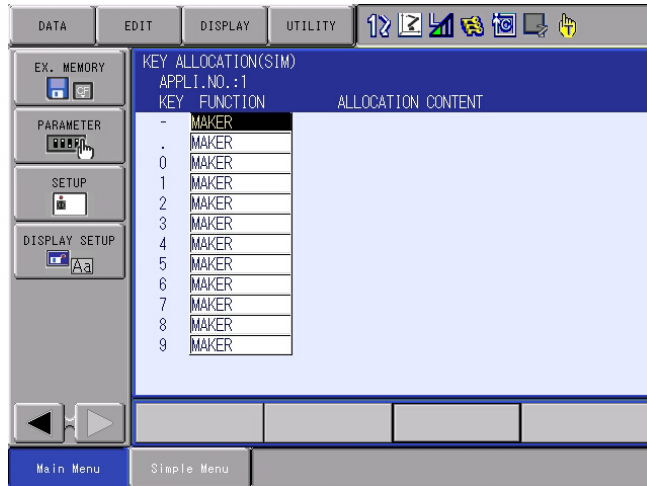


8 System Setup

8.15 Numeric Key Customize Function

4. Select {ALLOCATE SIM. KEY}.

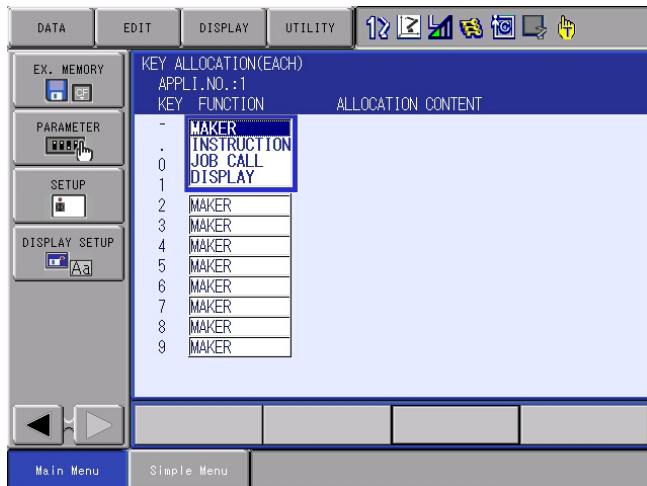
- The KEY ALLOCATION (SIM) window appears.
- In a system multiple applications, press the [PAGE] to change the window to the allocation window for each application, or click on [PAGE] to select the desired application number.



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".

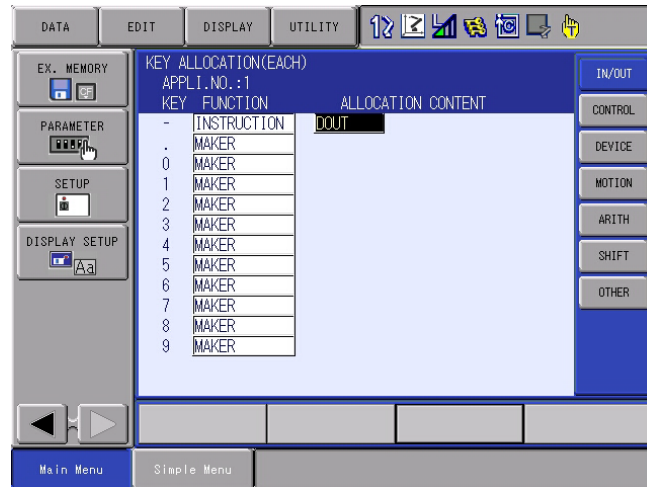
- The instruction is shown in the "ALLOCATION CONTENT".



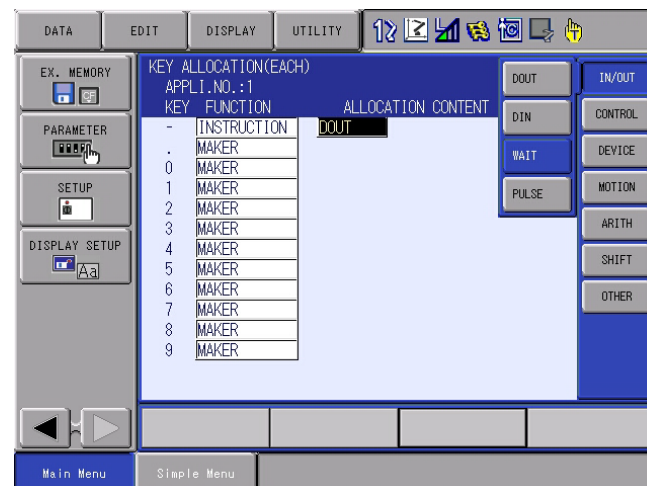
8 System Setup

8.15 Numeric Key Customize Function

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



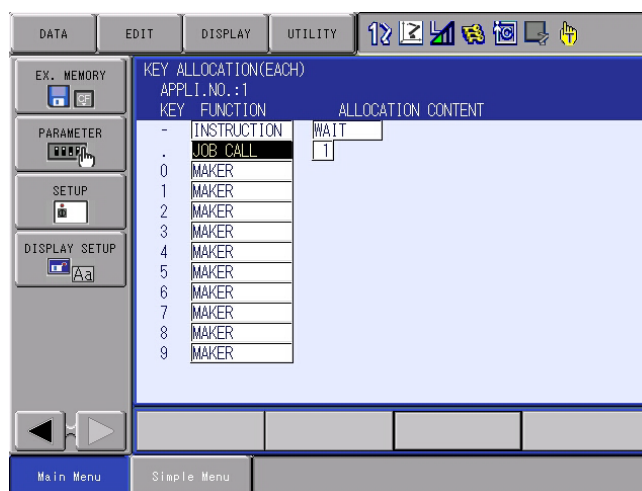
- (2) Select the group which contains the instruction to modify.
- (3) When the instruction list dialog box is shown, select the instruction to be changed.



8.15.3.3 Job Call Allocation

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

1. Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT].
 - A selection list appears.
2. Select "JOB CALL".
 - The reserved job registration No. is shown in the "ALLOCATION CONTENT" (reserved job registration No.: 1 to 10).

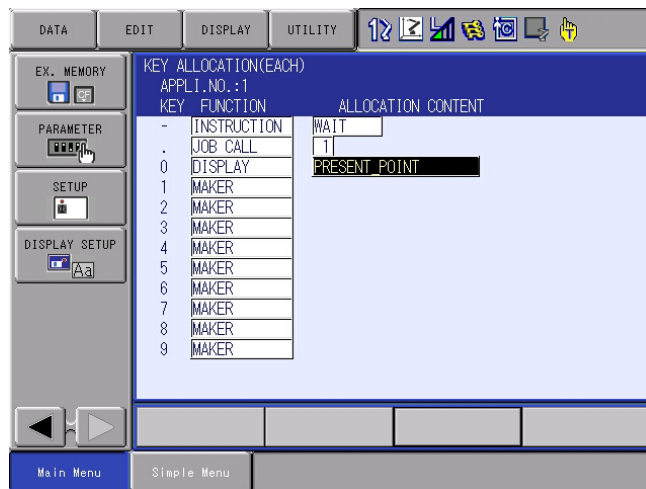


- (1) To change the reserved job registration No. move the cursor to the No. and press [SELECT]. Then input buffer line appears.
- (2) Input the number to be changed, and press [ENTER].

8.15.3.4 Display Allocation

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

1. Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT].
 - Selection list appears.
2. Select [DISPLAY].
3. Move the cursor to "ALLOCATION CONTENT" and press [SELECT].
 - Character input is available.
4. Input the name of the reserved window and press [ENTER].
 - The reserved name input to the "ALLOCATION CONTENT" is shown.

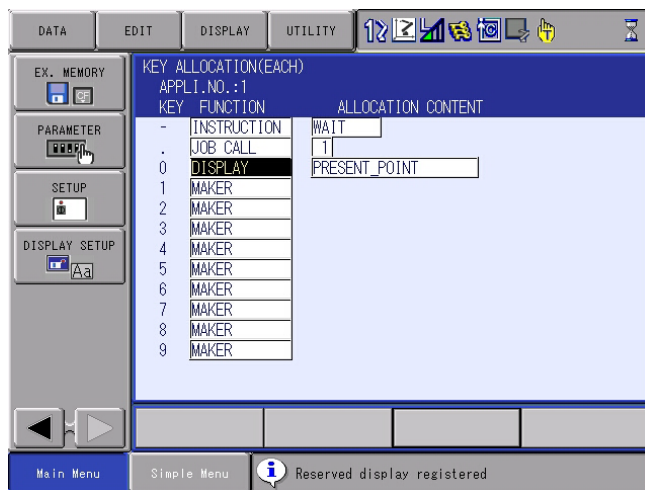


5. Open the window for allocation.

8 System Setup

8.15 Numeric Key Customize Function

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.



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 System Setup

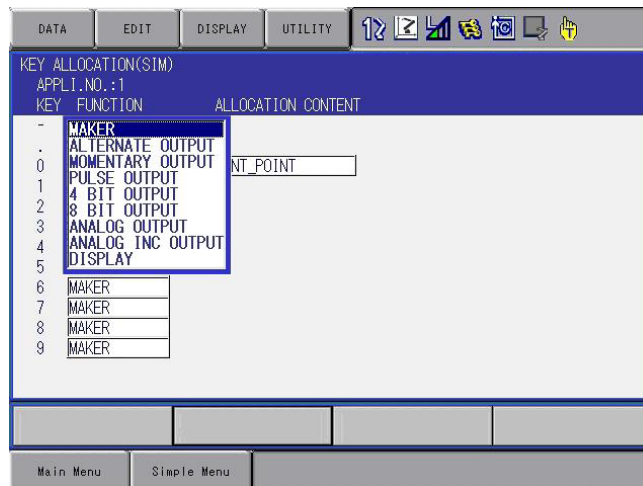
8.15 Numeric Key Customize Function

8.15.3.5 Alternate Output Allocation

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

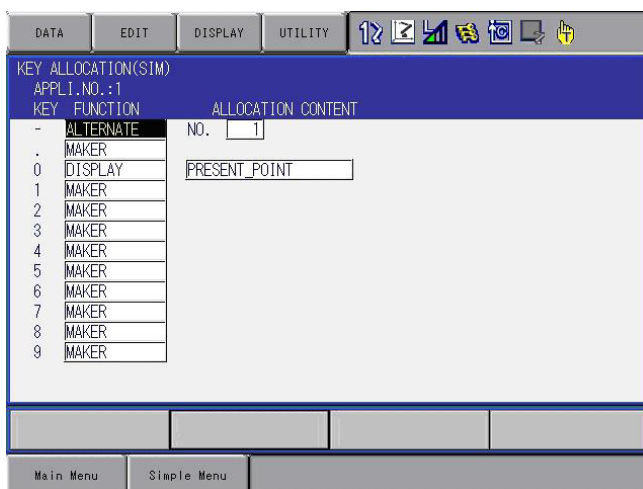
1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].

– Selection list appears.



2. Select “ALTERNATE OUTPUT”.

– The output No. is displayed in the “ALLOCATION CONTENT”.

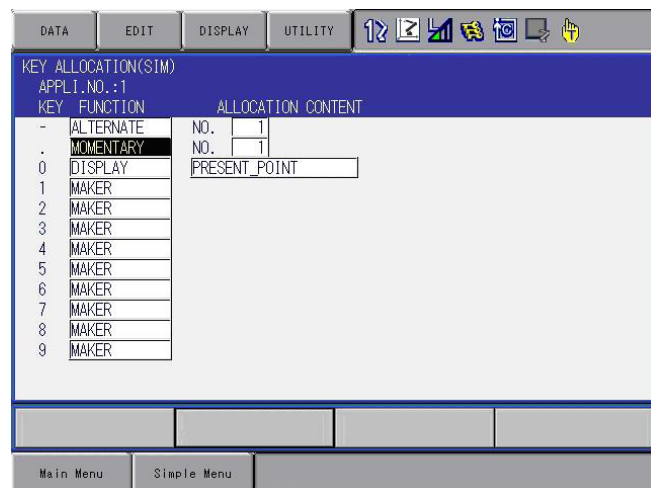


- (1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.
- (2) Input the number to be changed, and press [ENTER].

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].

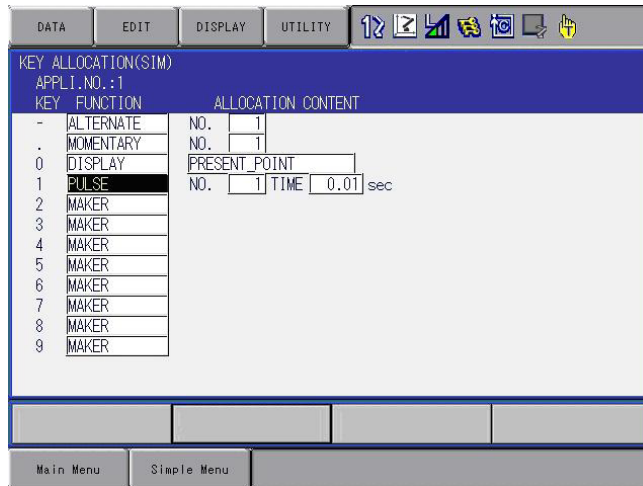
8 System Setup

8.15 Numeric Key Customize Function

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].

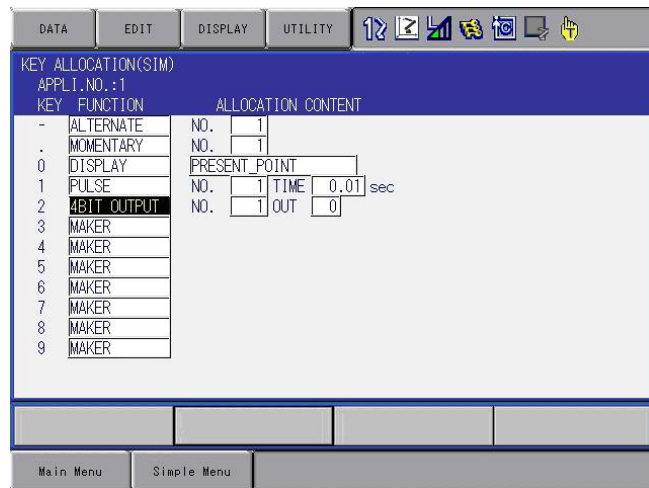
8 System Setup

8.15 Numeric Key Customize Function

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.

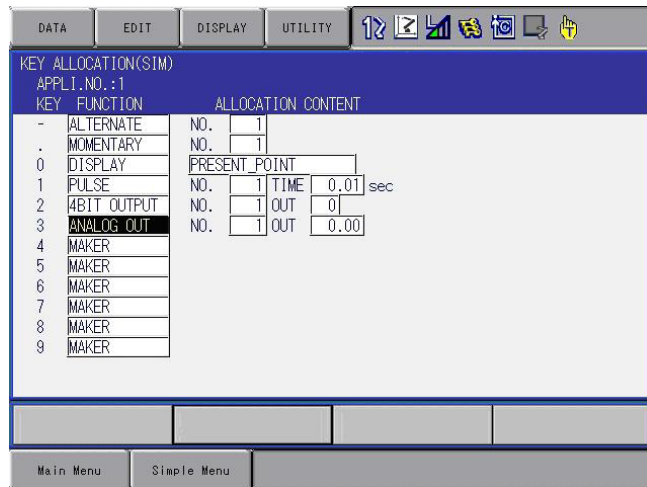
1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
 - A selection list appears.

8 System Setup

8.15 Numeric Key Customize Function

2. Select "ANALOG OUTPUT".

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

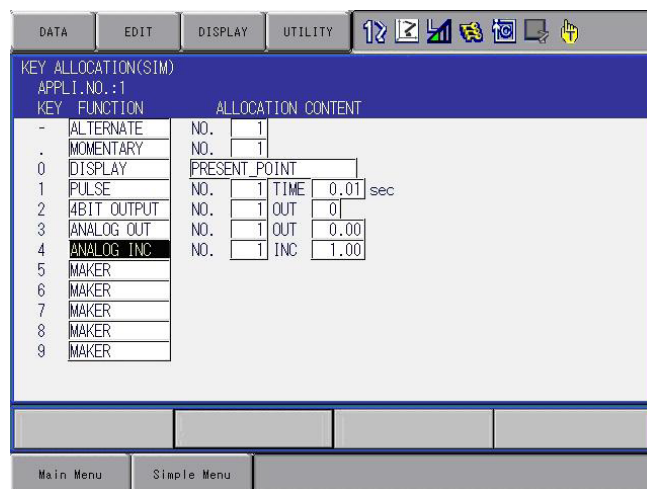


- (1) To change the output port No. or output voltage value, move the cursor to the No. or voltage value and press [SELECT]. Then numeric value can be entered.
- (2) Input the number or voltage value to be changed, and press [ENTER]

8.15.3.10 Analog Incremental Output Allocation

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

1. Move the cursor to the "FUNCTION" of the key to be allocated and press [SELECT].
 - A selection list appears.
2. Select "ANALOG INC OUTPUT".
 - The output port No. and incremental value are displayed in the "ALLOCATION CONTENT".



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

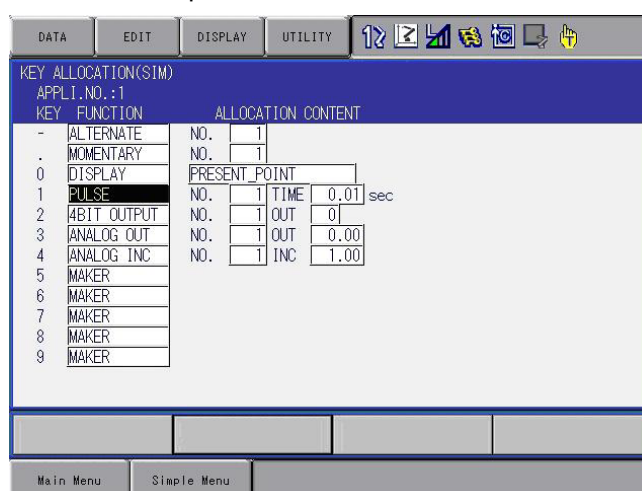
8.15.4 Allocation of I/O Control Instructions

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

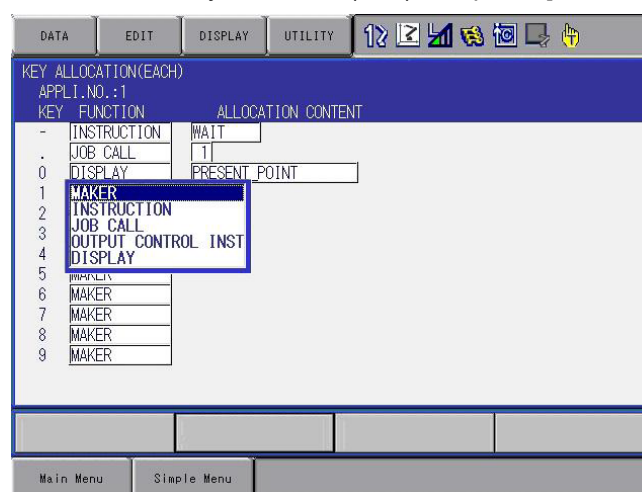
Function	Output Control Instruction allowed to be Allocated
Alternate output allocation	DOUT OT# (No.) ON
Momentary output allocation	
Pulse output allocation	PULSE OT# (No.) T = output time
Group output allocation (4-bit)	DOUT OGH (No.) output value
Group output allocation (8-bit)	DOUT OG# (No.) output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

1. Allocation of I/O control instruction.

- Allocate the I/O control instruction with key allocation (SIM) following the forementioned procedure.



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



- Selection list appears.

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8.15 Numeric Key Customize Function

3. Select "OUTPUT CONTROL INST".

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

The screenshot shows a software interface for key allocation. At the top, there are tabs: DATA, EDIT, DISPLAY, and UTILITY. Below these is a title bar with several icons. The main window is titled "KEY ALLOCATION(EACH)" and contains the following text:

APPLI.NO.:1

KEY	FUNCTION	ALLOCATION CONTENT
-	INSTRUCTION	WAIT
.	JOB CALL	T
0	DISPLAY	PRESENT_POINT
1	INSTRUCTION	PULSE
2	MAKER	
3	MAKER	
4	MAKER	
5	MAKER	
6	MAKER	
7	MAKER	
8	MAKER	
9	MAKER	

At the bottom of the window, there are two buttons: "Main Menu" and "Simple Menu".

- 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.



INW(T)=ON

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



CALL JOB: ARCON

8.15.5.2 Executing the Job Call Allocation

1. Press the key allocated for the job call allocation.
 - The CALL instruction is displayed in the input buffer line.
2. Press [INSERT] then [ENTER].
 - The CALL instruction shown in the input buffer line is registered.

8.15.5.3 Executing the Display Allocation

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

8.15.5.4 Executing the I/O Control Allocation

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

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

8.16 Changing the Output Status

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

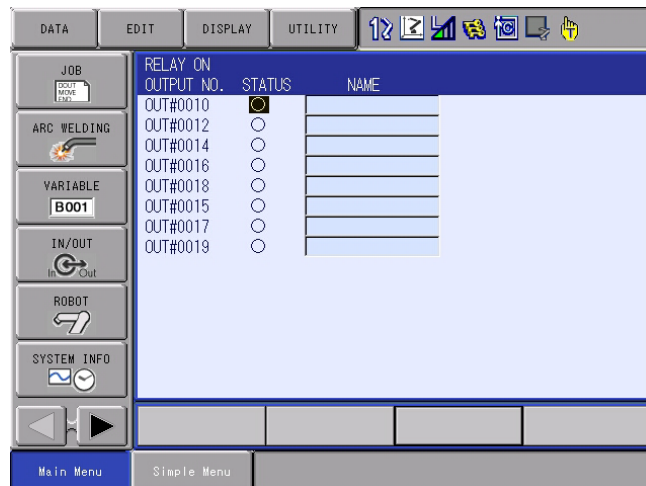
- On the user output status window
- On the RELAY ON window

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



A maximum of 64 output signals can be shown on the RELAY ON window and they must be set in advance to parameters S4C327 to S4C390. If they are not set, the sub menu in the RELAY ON window will not be displayed.

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



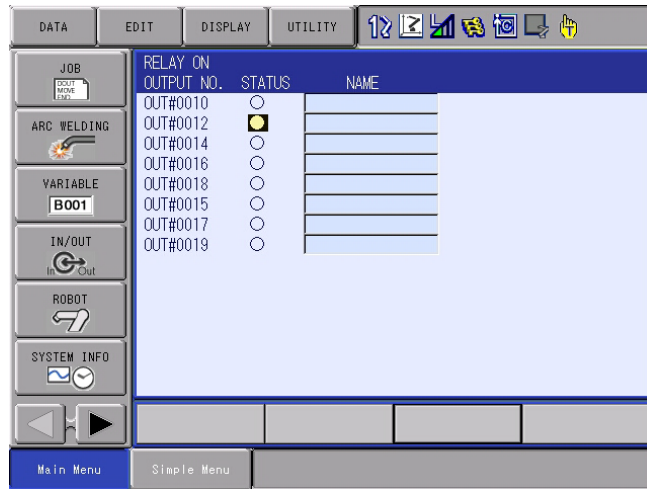
3. Select the desired signal to change the output status.
- Select the status (● or ○) of the desired signal.

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8.16 Changing the Output Status

4. Press [INTERLOCK] +[SELECT].

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

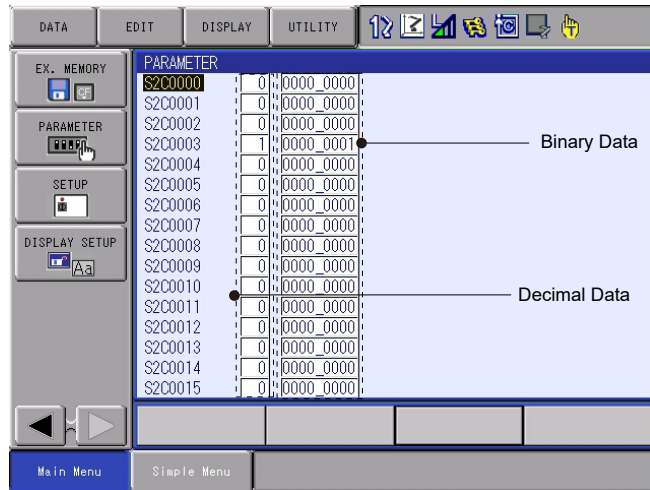


It is also possible to turn the relevant external output signal on only for the duration that [INTERLOCK]+[SELECT] are pressed. This selection is made in advance by setting the parameters (S4C391 to 454) to "1".

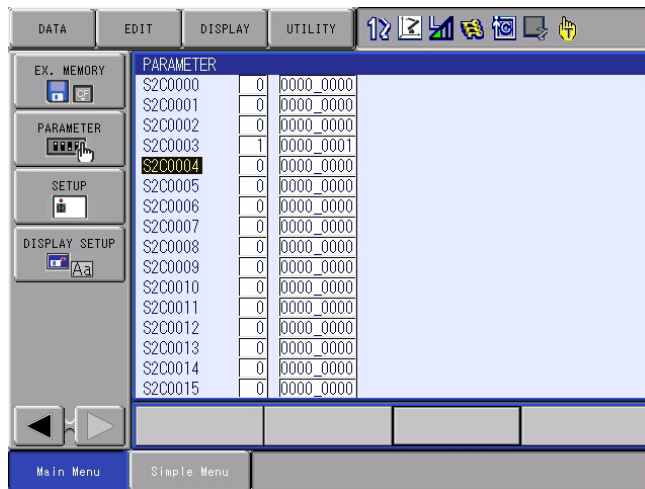
8.17 Changing the Parameter Setting

The parameter settings can be changed only by the operator who has the correct user ID number for the management mode.

1. Select {PARAMETER} under the main menu.
2. Select the parameter type.
 - The PARAMETER window appears. Select the desired parameter.



3. Move the cursor to the desired parameter number.

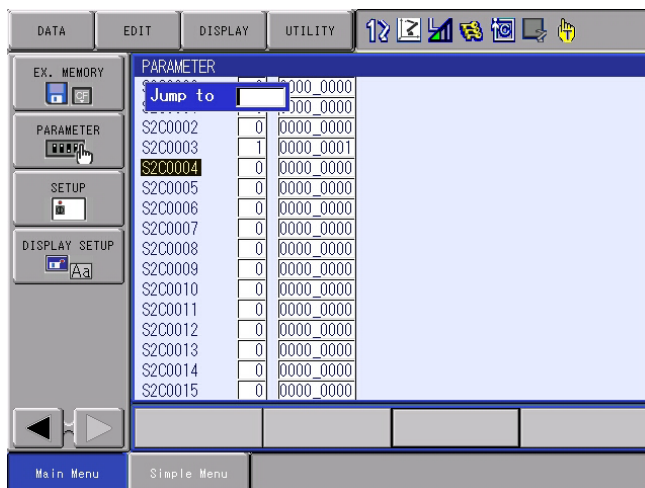


- When the desired parameter number is not in the current window, move the cursor in the following way:

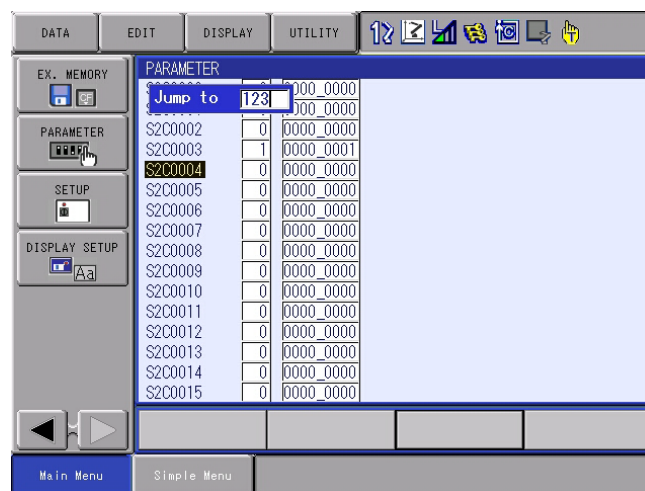
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8.17 Changing the Parameter Setting

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

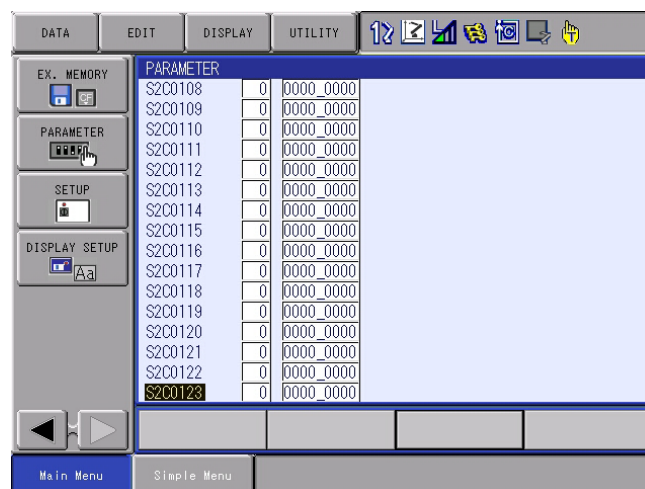


- (2) Enter the desired parameter number with the numeric keys.



- (3) Press [ENTER].

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

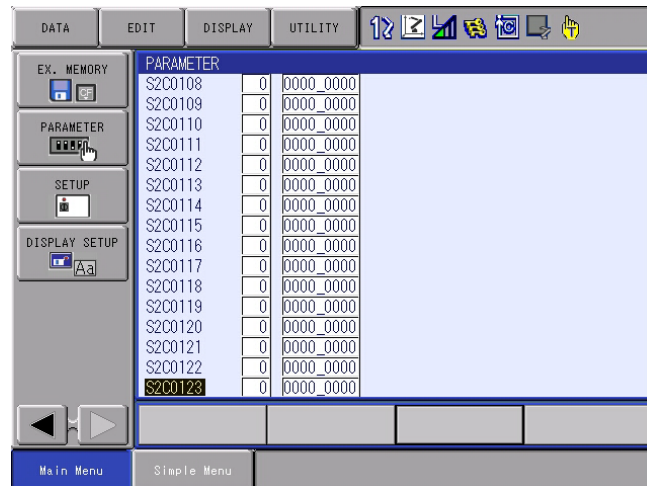


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8.17 Changing the Parameter Setting

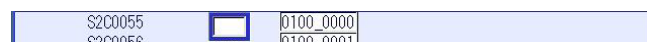
Set the parameters in the following manner.

1. Select the parameter data to be set.
 - (1) Move the cursor to the parameter number data (decimal or binary) in the PARAMETER window, and press [SELECT].
 - (2) To enter a decimal setting, select the decimal figure.
 - (3) To enter a binary setting, select the binary figure.



2. Enter the value.

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

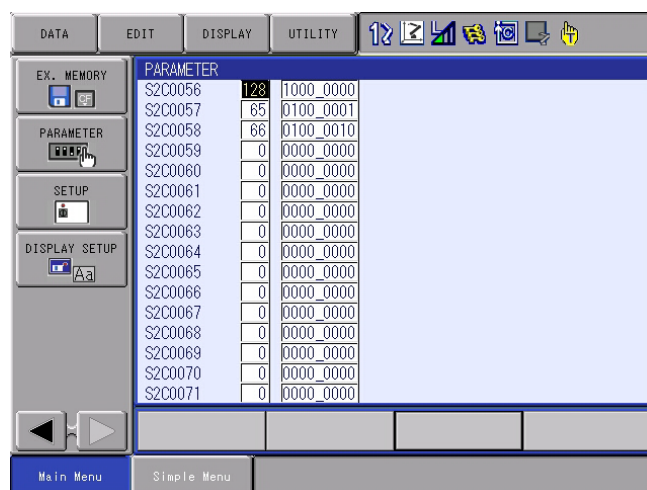


- If a binary figure is selected, move the cursor to the binary figure data in the input buffer line, and press [SELECT].
- Each time [SELECT] is pressed, “0” and “1” alternate in the window.
- “0” or “1” can also be entered with the numeric keys.



3. Press [ENTER].

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



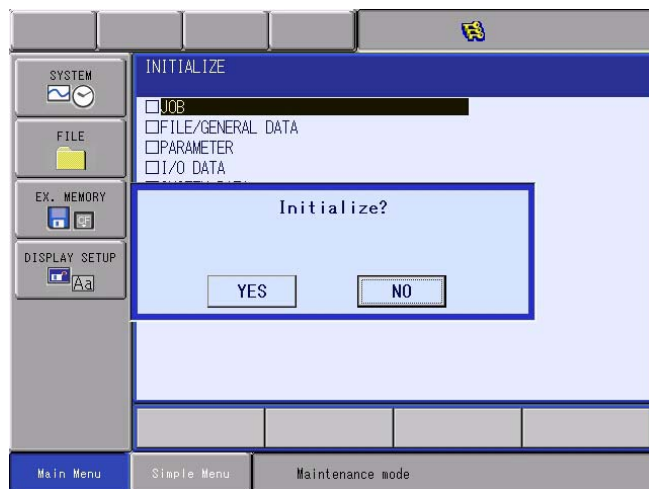
8.18 File Initialization

8.18.1 Initializing Job File

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



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



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



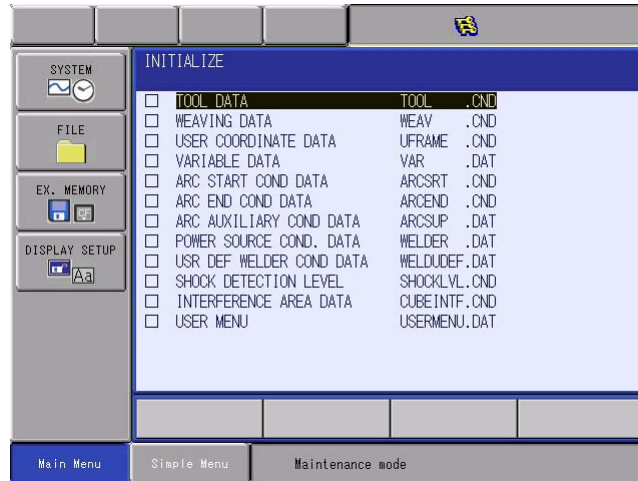
When JOB is initialized, the following files are reset at the same time.

Be careful when initializing JOB.

- User coordinates
- Memo play file
- Spot monitor data
- Variable data
- System definition parameter (S4D)
- Robot calibration data
- Conveyor calibration data
- Laser Welding Pos

8.18.2 Initializing Data File

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



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

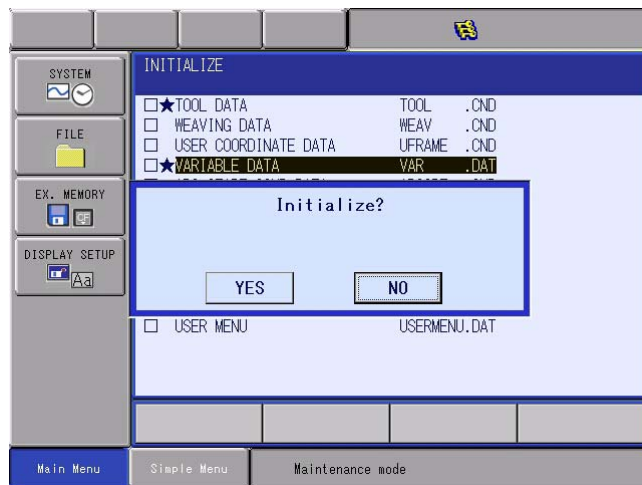


8 System Setup

8.18 File Initialization

7. Press [ENTER].

- A confirmation dialog box appears.



8. Select {YES}.

- The selected data file/general data are initialized.

8.18.3 Initializing Parameter File

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



6. Select the parameter to be initialized.
- The selected parameter is marked with "★".
- The parameters marked with "■" cannot be selected.

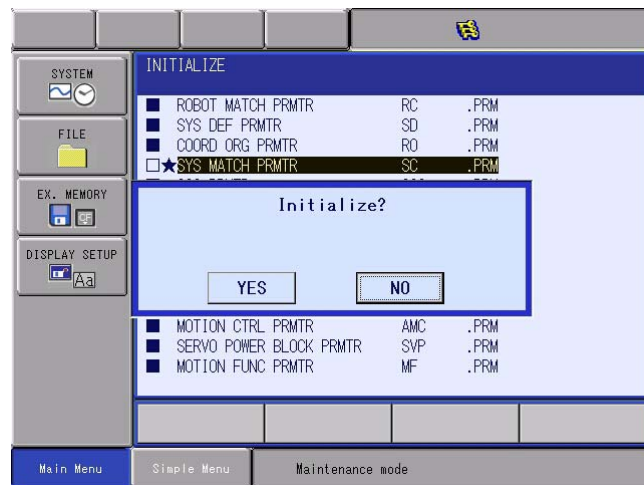


8 System Setup

8.18 File Initialization

7. Press [ENTER].

- A confirmation dialog box appears.

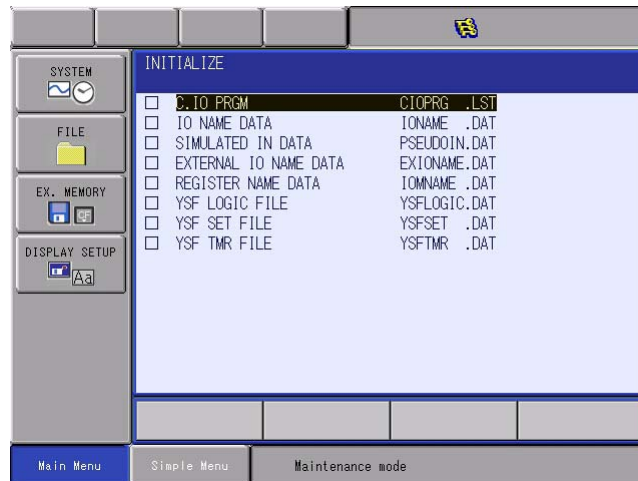


8. Select {YES}.

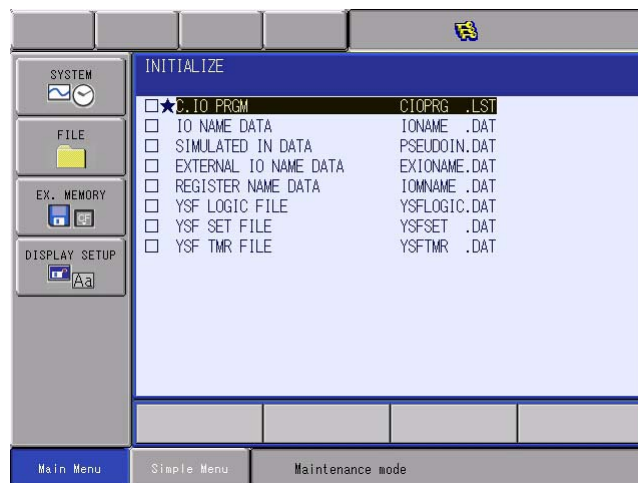
- The selected parameter is initialized.

8.18.4 Initializing I/O Data

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



6. Select data to be initialized.
 - The selected data is marked with “★”.
 - The I/O data marked with "■" cannot be selected.

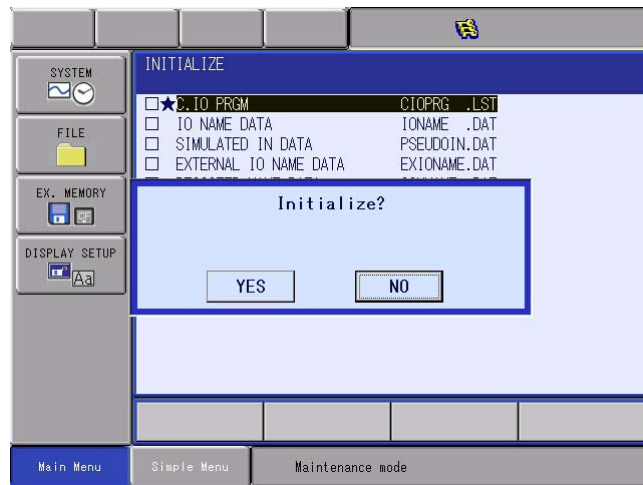


8 System Setup

8.18 File Initialization

7. Press [ENTER].

- A confirmation dialog box appears.



8. Select {YES}.

- The selected data is initialized.

8.18.5 Initializing System Data

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



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

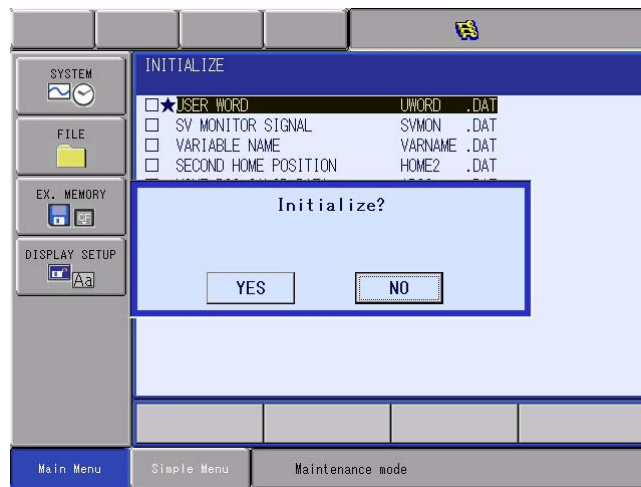


8 System Setup

8.18 File Initialization

7. Press [ENTER].

- A confirmation dialog box appears.



8. Select {YES}.

- The selected data is initialized.

8.19 Display Setting Function

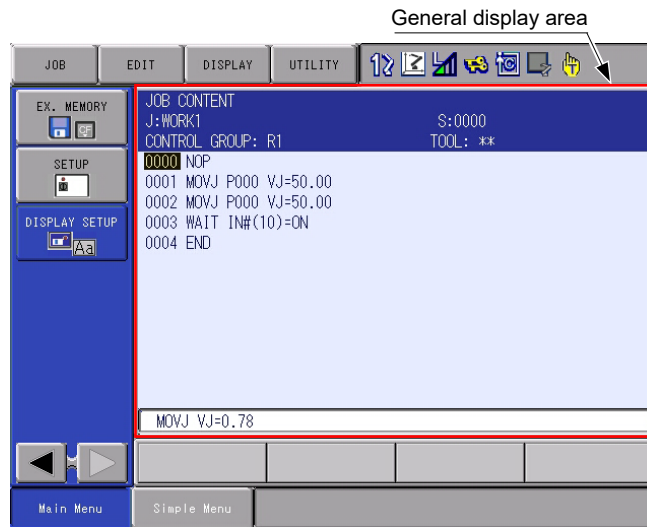
8.19.1 Font Size Setting

DX200 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

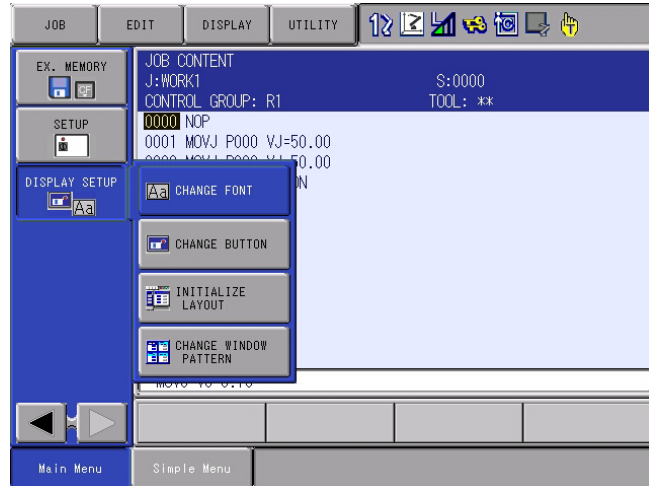
The following eight patterns of fonts are available in setting the size of fonts displayed on the screen.

	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

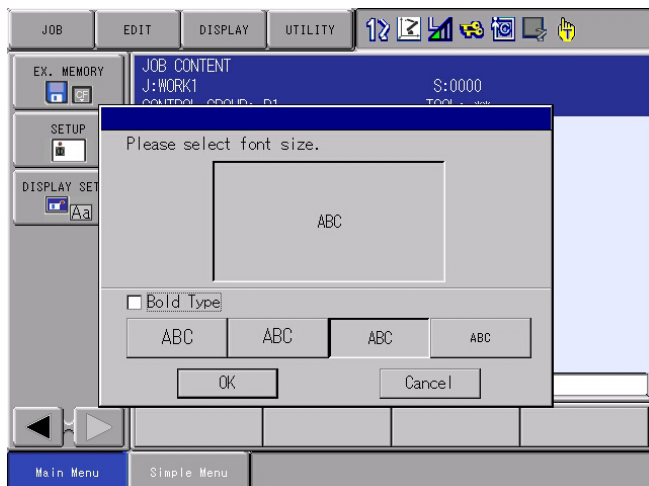
8.19.1.3 Setting the Font Size

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.

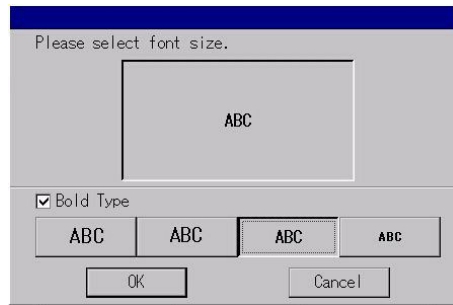


2. The font size setting dialog box appears on the center of the current window.

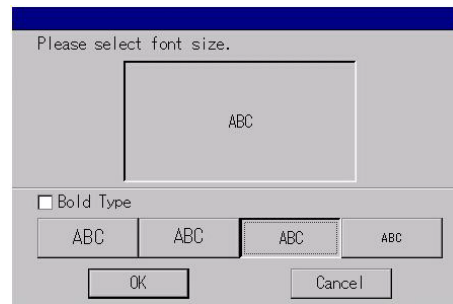


■ To set the font size in the font size setting dialog box, follow the procedure below.

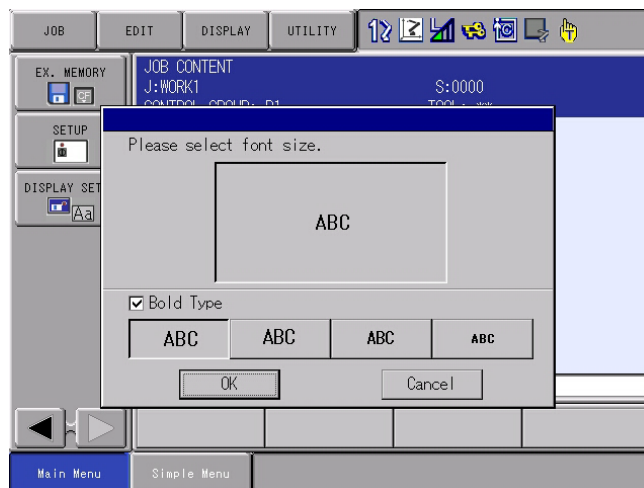
1. Specify the font style.
 - The {Bold Type} check box can be checked or unchecked alternately each time the check box is selected.
 - Check the {Bold Type} check box as follows to set the font to the bold style.



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



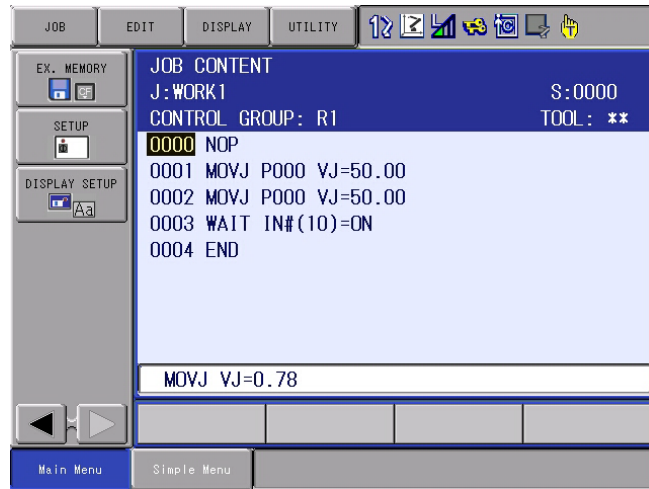
2. Specify the font size.
 - Select a button from the four buttons in the dialog box.



8 System Setup

8.19 Display Setting Function

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

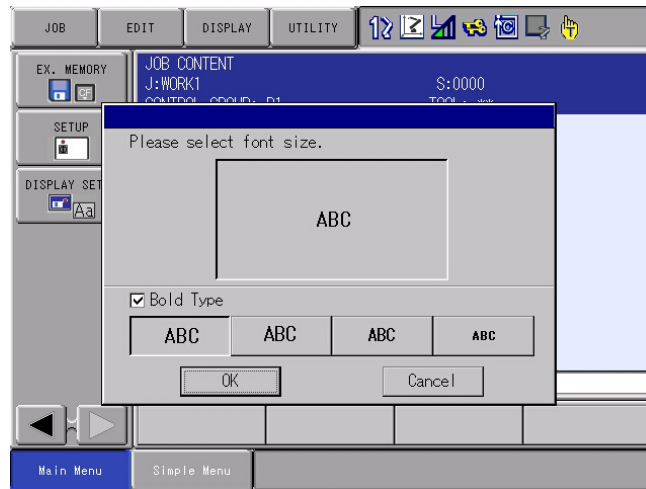


8 System Setup

8.19 Display Setting Function

■ 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.



Do not turn OFF the DX200 power supply when the font size is being changed (when the font size setting dialog box is on the screen).

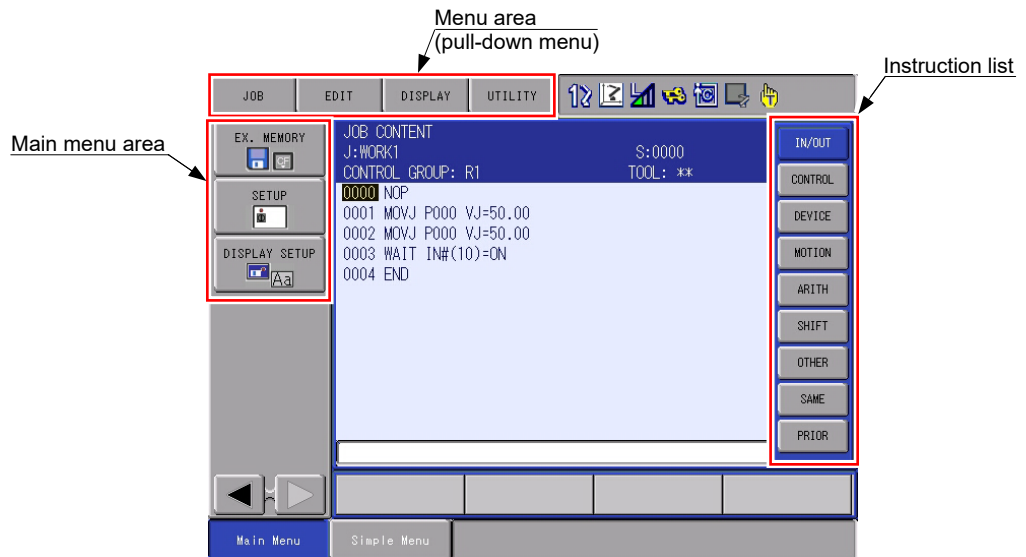
8.19.2 Operation Button Size Setting

DX200 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

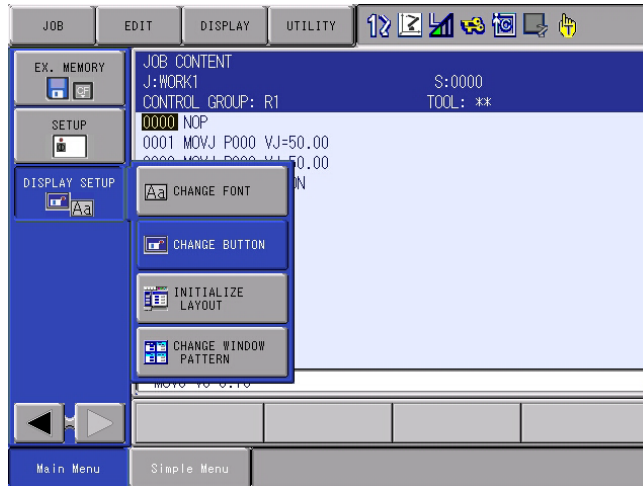
8 System Setup

8.19 Display Setting Function

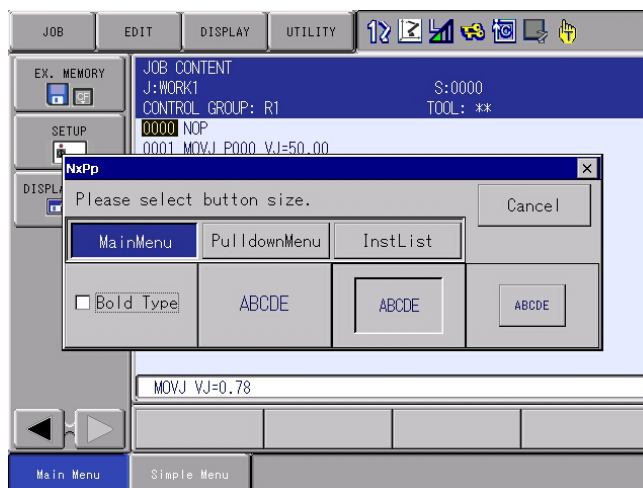
8.19.2.3 Setting the Button Size

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.

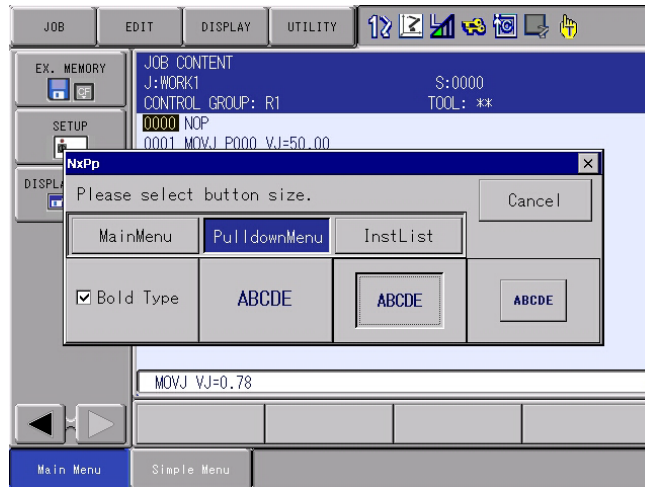


8 System Setup

8.19 Display Setting Function

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.)

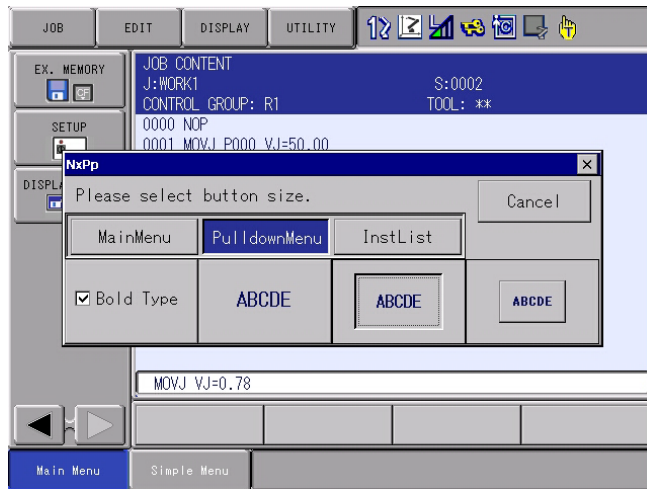


8 System Setup

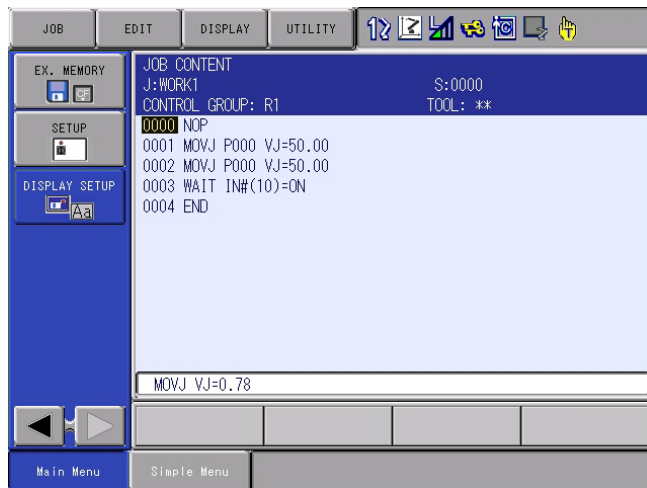
8.19 Display Setting Function

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

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



- The dialog box closes without changing the button size.



Do not turn OFF the DX200 power supply when the button size is being changed (when the button size setting dialog box is on the screen, or when an hourglass is indicated in the middle of the screen).

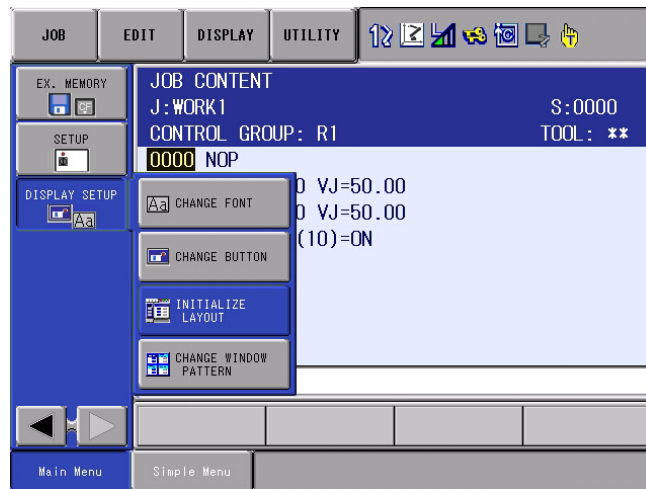
8.19.3 Initialization of Screen Layout

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

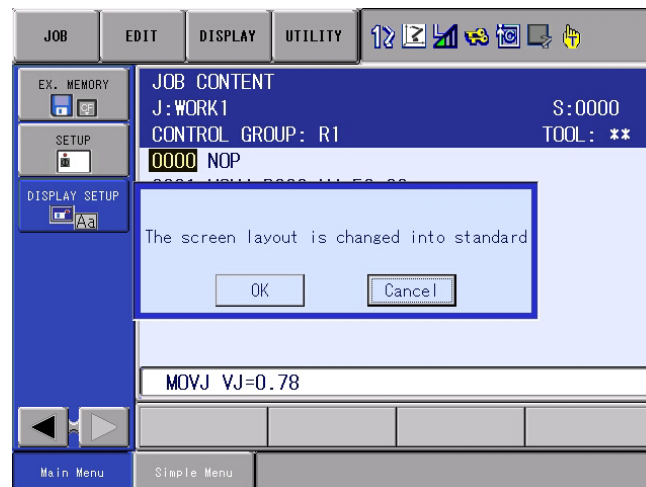
8.19.3.1 Initializing the Screen Layout

To initialize the screen layout, follow the procedure below.

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

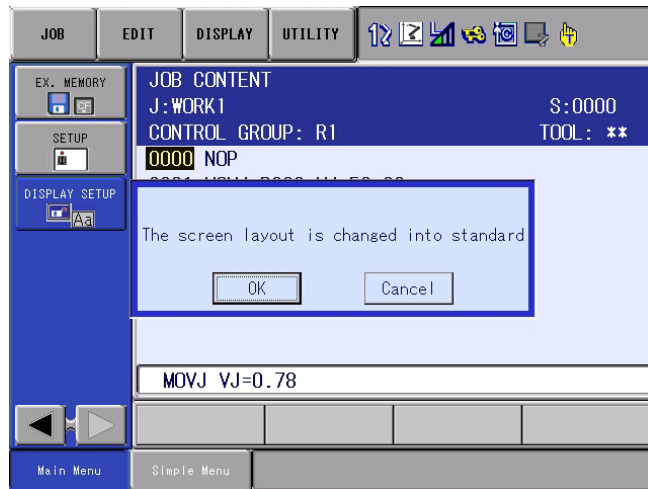


- A confirmation dialog box appears on the center of the current window.



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

1. select {OK}.

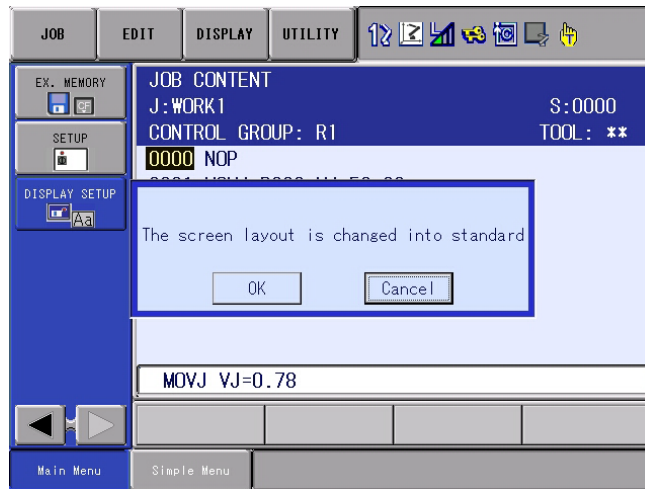


- The dialog box is closed, and the font/button sizes are collectively changed to the regular size.



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

1. Select {CANCEL}.



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



Do not turn OFF the DX200 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

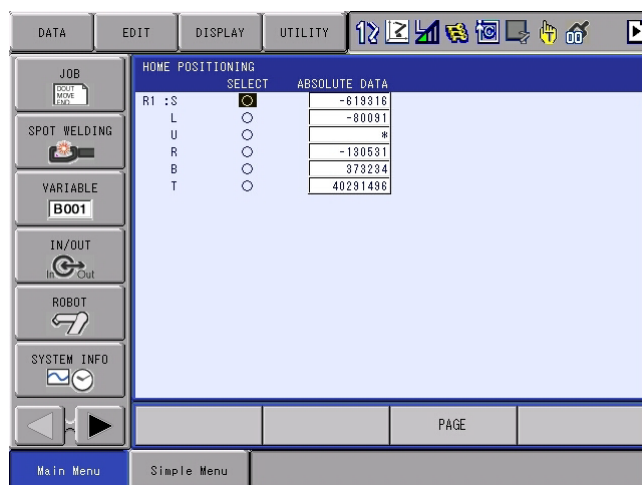
8.20.1 About Encoder Back-up Error Recovery Function

A motor of the robot, the travel axis or the rotation station which is controlled by the DX200 is connected with the back-up battery in order to keep the position information even though the control power is disconnected. This battery consumes battery power through time, and the alarm “4312 ENCODER BATTERY ERROR” occurs when the voltage becomes lower than 2.8V. If the battery is not replaced and keep consuming more battery power, it will cause the lost of the position information. In addition, the alarm “4311 ENCODER BACK-UP ERROR” occurs. Meanwhile, there would be a gap between the manipulator position and the position of the absolute encoder.

This function allows to recover the absolute data by moving the axis operation to the home position from the position information where the axis is lost.

8.20.2 Encoder Back-up Error Recovery Function Operation

1. Press {SELECT}.
 - When select the “RESET” in the alarm display, the alarm is reset. The manipulator can be move by the axis operation key.
2. Adjust the alarm occurring axis to the home position mark of the each manipulator axis by the axis operation key.
3. Change the security mode to the management mode.
 - Refer to *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 POSITIONING}.
 - The home positioning display appears. The absolute data of the axis which is occurring the encoder back-up error appears with the “*” which indicates the undefined state.

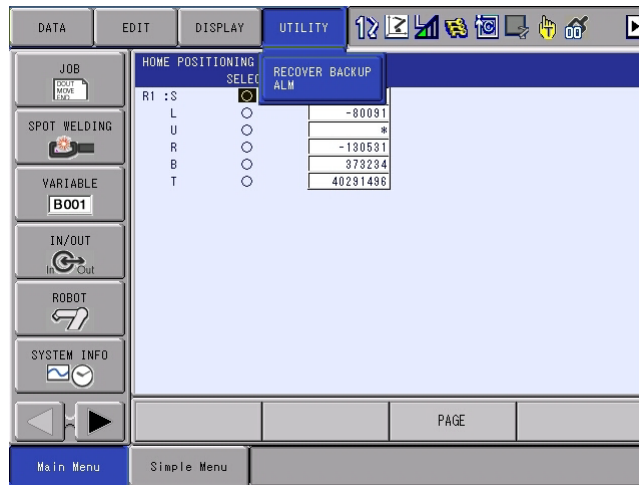


6. Select the control group.

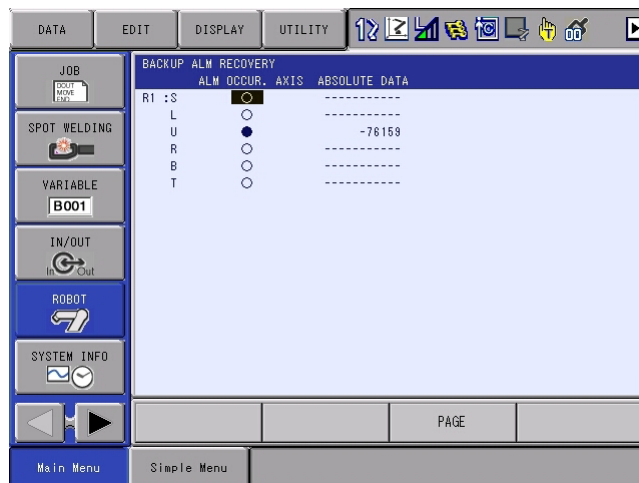
8 System Setup

8.20 Encoder Back-up Error Recovery Function

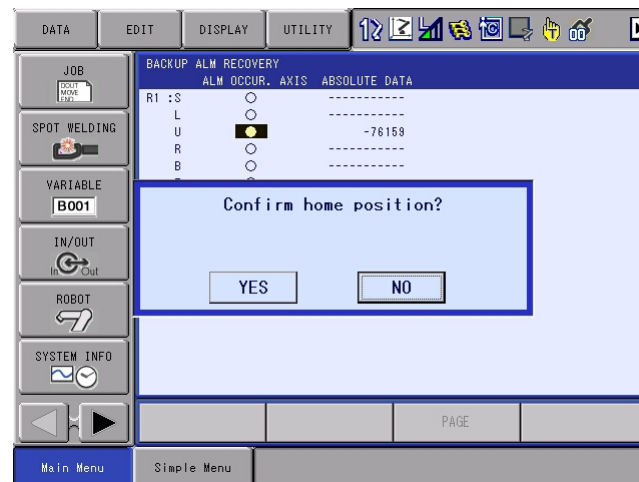
7. Select {UTILITY} in the menu.
 - The pull-down menu appears.



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



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



10. Select {YES}.

- The absolute data of the selected axis is recovered.
- Select {NO} to cancel the operation.

11. Select the current position.

- To display the current position window, refer to DX200
MAINTENANCE MANUAL *Chap 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 DX200
INSTRUCTION *chapter 8.1.2 "Calibrating Operation"*.

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
- Gas pressure check function

8.21.2 Preventive Maintenance Function for the Speed Reducer

Diagnoses the duration of life for the speed reducer by using the both methods of the lifetime calculation and the torque average value. The diagnosis is executed by operating the job in the play mode. It is unnecessary to prepare the job for this diagnosis.



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

8.21.2.1 Diagnose by the Lifetime Calculation

■ Outline

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

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

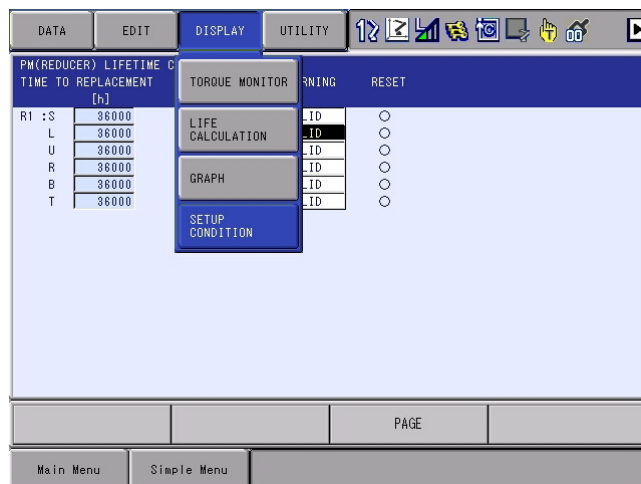


This function is only available for the robot axes. As for the external axes, this function is not available.

■ Set the Replacement Signal

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

1. Change the security mode to the management mode.
 2. Select {=PM} in the main menu.
 3. Select {=RM(REDUCER)}.
 4. Select {Display} in the menu.
- {=SETUP CONDITION} appears under the pull down menu.



8 System Setup

8.21 Preventive Maintenance Function

5. Select {=SETUP CONDITION}.

- The condition setup window is appears.

TORQUE VARIATION	ACCEPT RATE	ALARM OUTPUT
HIGH	50 %	OT# *
MID	40 %	OT# *
LOW	20 %	OT# *

CONSECUTIVE DAYS(ACCEPT NG) 3 DAYS

MOVING AVERAGE

CALCULATION DAYS 30 DAYS

ELAPSED DAYS FROM CALC. START 60 DAYS

LATEST MEASURED DAYS 5 DAYS

ERROR DELETE FILTER 200 %

GRAPH NAME

REPLACEMENT SIGNAL OT#

Main Menu Simple Menu

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

- Able to enter the values.

TORQUE VARIATION	ACCEPT RATE	ALARM OUTPUT
HIGH	50 %	OT# *
MID	40 %	OT# *
LOW	20 %	OT# *

CONSECUTIVE DAYS(ACCEPT NG) 3 DAYS

MOVING AVERAGE

CALCULATION DAYS 30 DAYS

ELAPSED DAYS FROM CALC. START 60 DAYS

LATEST MEASURED DAYS 5 DAYS

ERROR DELETE FILTER 200 %

GRAPH NAME

REPLACEMENT SIGNAL OT#

Main Menu Simple Menu

7. Enter the universal output signal.

■ Lifetime Calculation Window

1. Select {=RM} in the main menu.
2. Select {=RM(REDUCER)}.
- The lifetime calculation window appears. In the case of the another window appears, select {Display}, and select the {=LIFE CALCULATION} in the pull down menu to display the lifetime calculation window.

	TIME TO REPLACEMENT [h]	NOTICE TIME [h]	WARNING	RESET
R1 :S	36000	1000	VALID	<input type="radio"/>
L	36000	1000	VALID	<input type="radio"/>
U	36000	1000	VALID	<input type="radio"/>
R	36000	1000	VALID	<input type="radio"/>
B	36000	1000	VALID	<input type="radio"/>
T	36000	1000	VALID	<input type="radio"/>

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

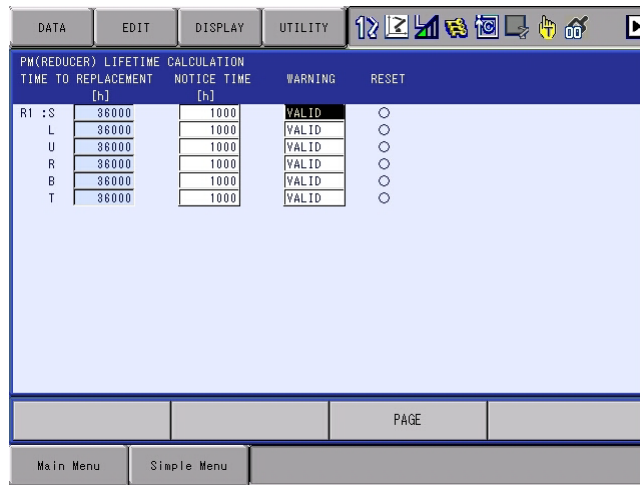
Select this item to invalidate the notification signal and displaying the message. [Invalid] and [Valid] will alternate each time when pressing the [Select].

④ =RESET

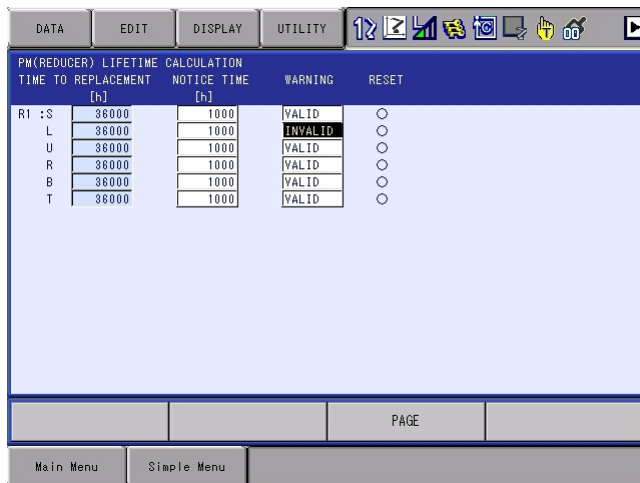
Select this item after replacing the speed reducer.

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 {=RM} in the main menu.
 3. Select {=RM(REDUCER)}.
 - The lifetime calculation window appears. In the case of the another window appears, select {Display}, and select the {=LIFE CALCULATION} in the pull down menu to display the lifetime calculation window.



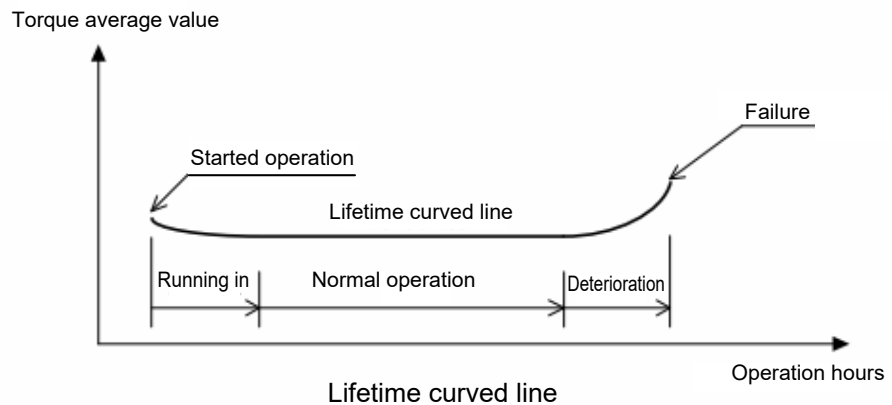
4. Move the cursor over the “=WARNING” to invalidate the desired axis, and select [Select]. [Invalid] and [Valid] will alternate each time when press the [Select].



8.21.2.2 Diagnose by the Torque Average Value

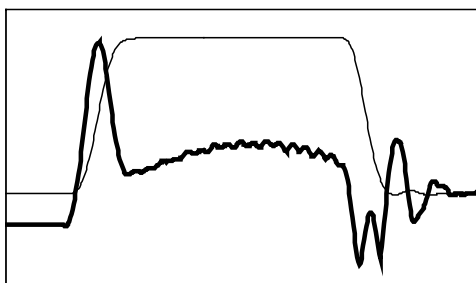
■ **Diagnosis Element**

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

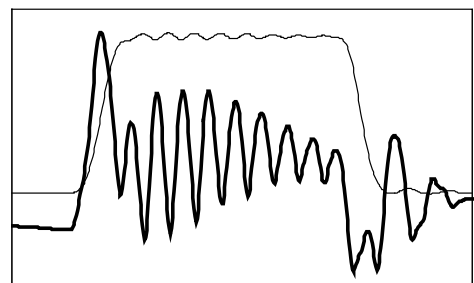


As the condition of the speed reducer is changing to “deterioration” from “normal operation”, the torque element changes to “increase” from “normal”. It is estimated that the speed reducer is in the deterioration period as the number of the torque element is increasing by the deterioration of the speed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

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



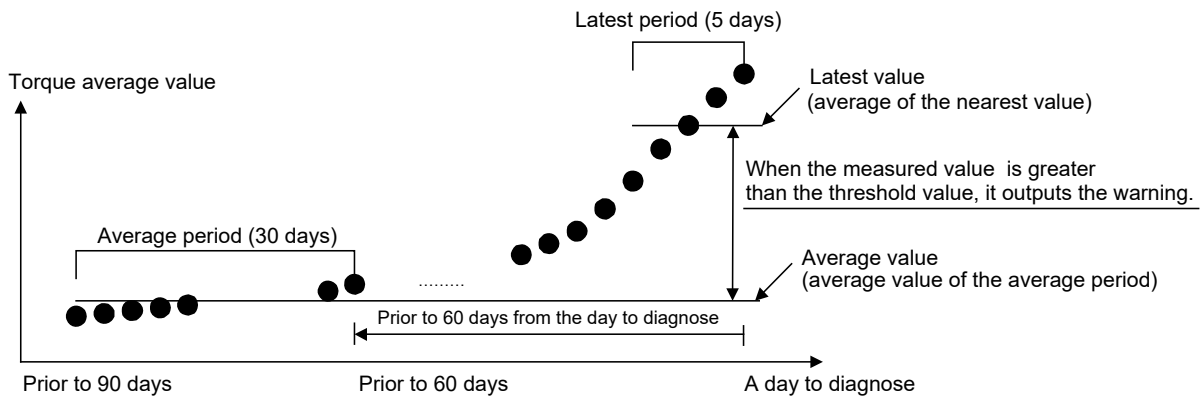
Torque and speed at the normal operation period



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 {=RM} in the main menu.
3. Select {=RM(REDUCER)}.

– The lifetime calculation window appears.

	TIME TO REPLACEMENT [h]	NOTICE TIME [h]	WARNING	RESET
R1 : S	36000	1000	VALID	<input type="radio"/>
L	36000	1000	INVALID	<input type="radio"/>
U	36000	1000	INVALID	<input type="radio"/>
R	36000	1000	INVALID	<input type="radio"/>
B	36000	1000	INVALID	<input type="radio"/>
T	36000	1000	INVALID	<input type="radio"/>

4. Select {Display} in the menu.

– The {=SETUP CONDITION} appears in the pull down menu.

	TIME TO REPLACEMENT [h]	NOTICE TIME [h]	WARNING	RESET
R1 : S	36000	1000	VALID	<input type="radio"/>
L	36000	1000	INVALID	<input type="radio"/>
U	36000	1000	INVALID	<input type="radio"/>
R	36000	1000	INVALID	<input type="radio"/>
B	36000	1000	INVALID	<input type="radio"/>
T	36000	1000	INVALID	<input type="radio"/>

8 System Setup

8.21 Preventive Maintenance Function

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 ALERT OUTPUT

• =ACCEPT RATE HIGH

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

• =ACCEPT RATE MID, LOW

The universal output signal, which is set by "=ACCEPT RATE MID" and "=ACCEPT RATE LOW", is turned ON when it is determined as follows.

The latest value - the average value > "=ACCEPT RATE MID".

The latest value - the average value > "=ACCEPT RATE LOW".

If unnecessary to output the signal, set the item "0". The initial value of this item is "0".

③ =CONSECUTIVE DAYS (ACCEPT NG)

It is determined as the speed reducer is almost failure, when the number of the day, which is determined as tolerance NG (the latest value - the average value > "=ACCEPT RATE HIGH"), is more than the number of this item. The initial value of this item is "3" (days).

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 $\times 100 >$ filter setting value

The any measurement value of the average period / the average from the previous day $\times 100 >$ filter setting value

- The average from the previous day does not exist.

The latest value / any measurement value of the average period $\times 100 >$ filter setting value

The any measurement value of the average period / the latest value $\times 100 >$ filter setting value

The initial value of this item is "200" (%).

⑧ =GRAPH NAME

Able to register the name of the graph.

⑨ =REPLACEMENT SIGNAL

Use this item to calculate the lifetime. Refer to "*Set the Replacement Signal*".



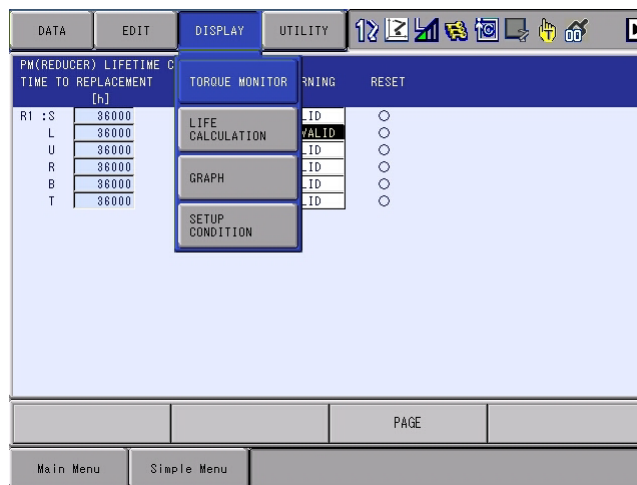
Even though the initial value is set, the accuracy of the life diagnosis is not guaranteed performance.

■ Data Confirmation

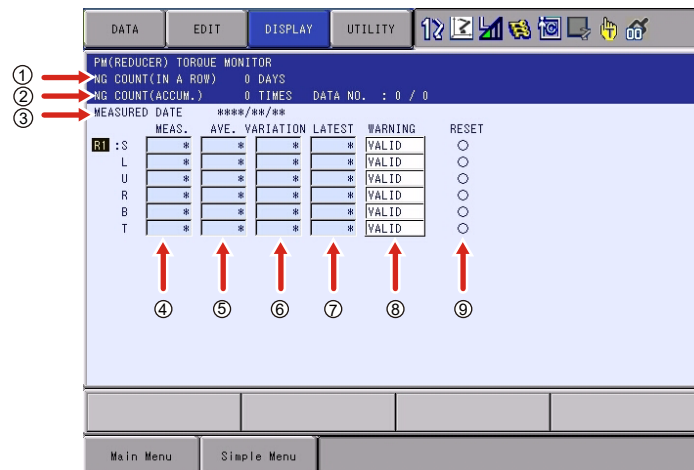
By operating a job in the play mode, a data (the torque element arising from the deterioration of the speed reducer) for each axis is recorded automatically on a daily basis, and the data is accumulated. It is unnecessary to prepare the job for this diagnosis.

Able to refer the data by following procedures.

1. Select [=RM] in the main menu.
 2. Select [=RM(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 the data of a date corresponding to the number by pressing the [PAGE] key. Modify the number as necessary.



Unable to measure the torque average value because the axis of the measured value indicating “*” is not operating, or the motion speed is less than the reference speed.

Each item on the screen represents the following description.

① =NG COUNT (IN A ROW)

Shows the number of the variation days, which is higher than the value of the torque variation "HIGH". The warning output signal, which is set by "=ACCEPT RATE HIGH", is turned ON when the number of the day above is more than the number of the consecutive accept NG days.

② =NG COUNT (ACCUM.)

Shows the total number of the variation days, which is higher than the value of the torque variation "HIGH". The number of "=NG COUNT (IN A ROW)" is reset as "0", when a day does not exceed the torque variation. However, this "=NG COUNT (ACCM.)" will not be reset.

③ =MEASURED DATE

Shows the date of the measurement or the updated speed reducer diagnosis database.

④ =MEAS.

Shows the measured torque average.

⑤ =AVE.

Shows the arithmetic mean of the average period (certain number of the days, which is calculated in the past, based on the MEASURED DATE). However, the measured values excepted in the =ERROR DELETE FILTER are not included.

⑥ =VARIATION (The Determining Value)

Shows the difference value between the latest value and the average value. When this value exceeds the value, which is set at the torque variation, it is determined as accept NG.

⑦ =LATEST

Shows the arithmetic mean of the latest period (certain number of the days included the measured day).

⑧ =WARNING

Select this item to invalidate the warning output signal. [Invalid] and [Valid] will alternate each time when press the [Select].

⑨ =RESET

Select this item after replacement of the speed reducer. The warning output signal will be turned OFF, and the old data will not be used for the lifetime diagnosis.

■ **Invalidate the Warning Output Signal**

Able to invalidate for each axis. Invalidate the warning output signal by the following procedures, in the case of the speed reducer seems to operate normally even though the warning output signal is turned ON.

1. Select {=RM} in the main menu.
 - The sub menu appears.
2. Select {=RM(REDCER)}.
- The lifetime calculation window appears.
3. Select {Display}.
- The pull down menu appears.
4. Select {=TORQUE MONITOR}.
- The torque monitor window appears.

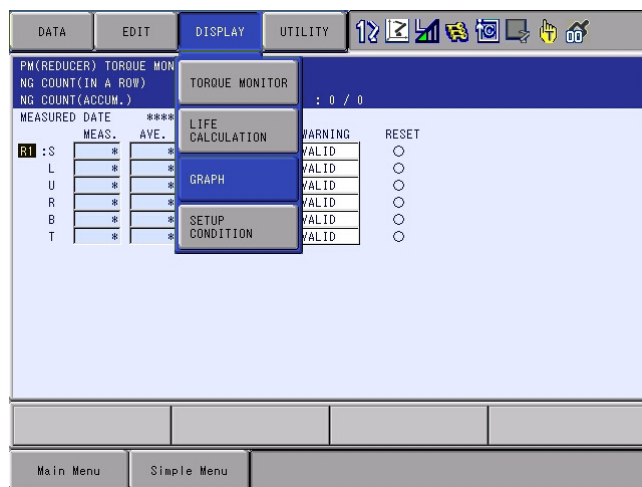
Move the cursor over the “=WARNING” of the desired axis to invalidate, and press [Select]. [Invalid] and [Valid] will alternate each time when pressing the [Select].

■ Graph Display

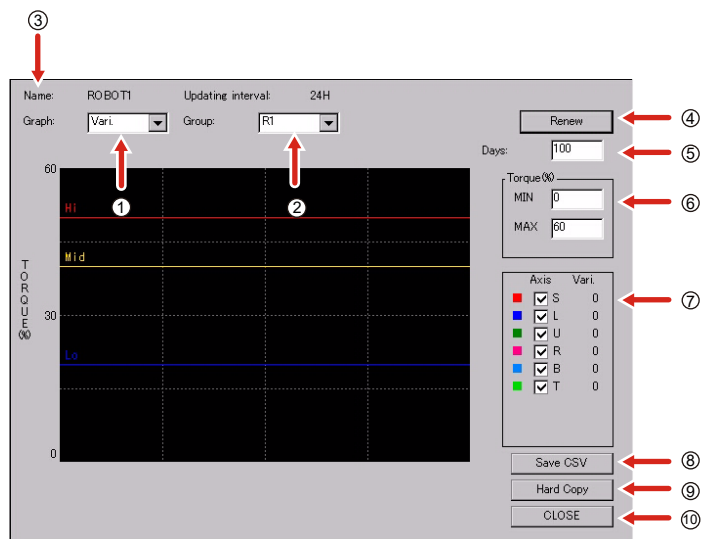
Able to confirm the variation by a graph after the measurement. The graph is updated every 24 hours automatically. The measured value and changes of the variation can be displayed on the programming pendant. Thus, able to confirm the changes of the torque visually. Use the graph display as the one of the methods to determine the duration of life for the speed reducer.

The graph can be displayed by the following procedures.

1. Select {=RM} in the main menu.
2. Select {=RM(REDUCER)}.
3. Select {Display}.
 - The pull down menu appears.



4. Select {=GRAPH}.
 - The graph appears.



5. Select {CLOSE}.
 - Return to the lifetime calculation window.

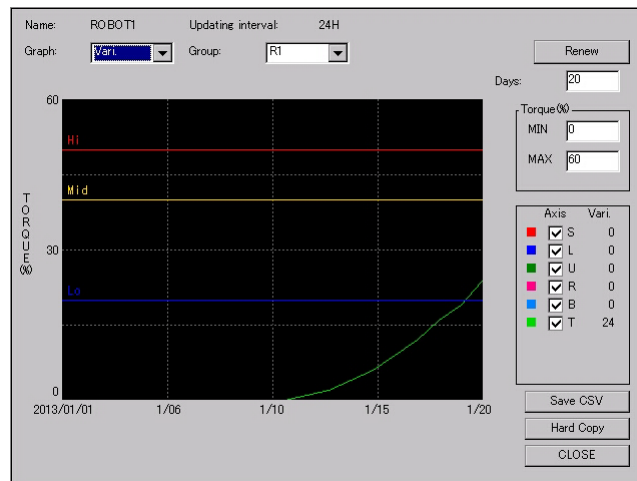
Each item on the screen represents the following description.

① =Graph

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

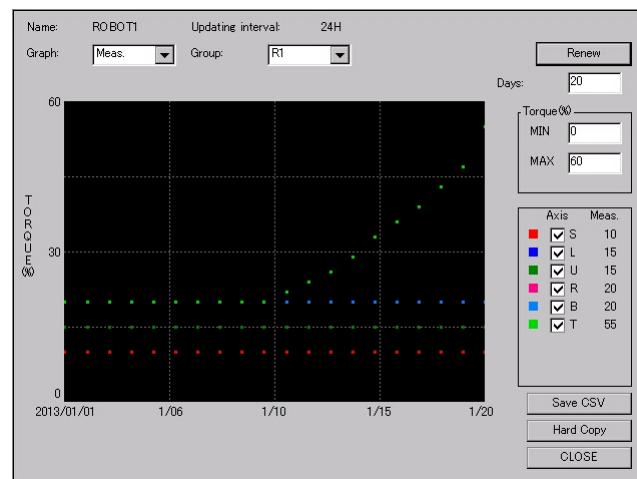
- When selecting “=Vari.”,
the variation (=latest value - average value) appears on the graph.
The line of each “Hi”, “Mid” and “Lo” appears.
“Hi” means “the torque variation accept high”.
“Mid” means “the torque variation accept medium”.
“Lo” means “the torque variation accept low”.

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.

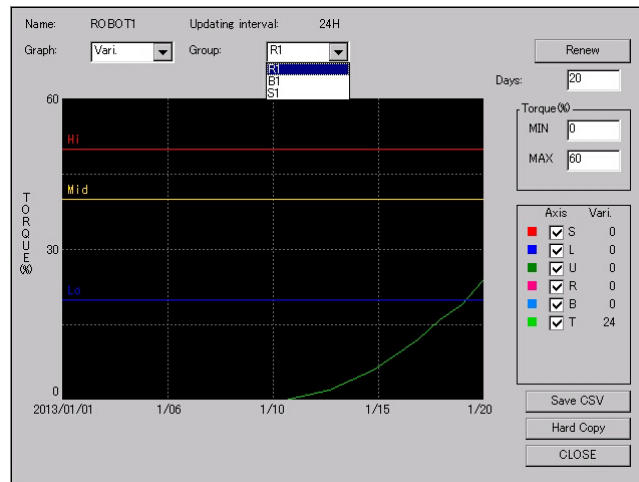


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8.21 Preventive Maintenance Function

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 CF card and USB, but the data is priory save into the CF card. The followings are the name for a file and a folder to be saved.

File name: "the name which is set in the each setting window" + "year/month/day" + "hour/minute/second". CSV

Folder name: "SR LIFE DIAGNOSIS"

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8.21 Preventive Maintenance Function

⑨ =Hard COPY

Pressing the “=Hard COPY” button saves the hard copy of the screen as JPG format into the CF card.

The following is a name for the file.

File name: “year/month/day” + “hour/minute/second”. JPG

⑩ =CLOSE

Pressing “=CLOSE” button closes the graph window.

8.21.2.3 After Replacement of the Speed Reducer

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

Perform the following procedures after replacement of the speed reducer.

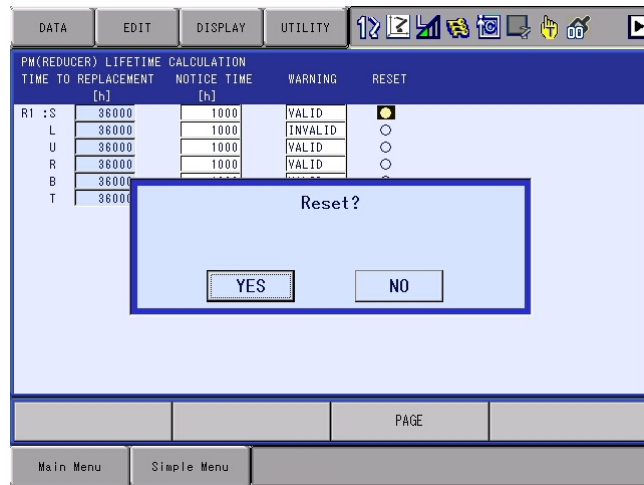
1. Change the security mode to the management mode.
2. Select {=RM} in the main menu.
3. Select {=RM(REDCER)}.
4. Select {Display}, select the {=LIFE CALCULATION} or {=TORQUE MONITOR} in the pull down menu.
 - The lifetime calculation window or the torque monitor window appears.

	TIME TO REPLACEMENT [h]	NOTICE TIME [h]	WARNING	RESET
RI : S	36000	1000	VALID	○
L	36000	1000	VALID	○
U	36000	1000	VALID	○
R	36000	1000	VALID	○
B	36000	1000	VALID	○
T	36000	1000	VALID	○

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8.21 Preventive Maintenance Function

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 cancelled 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.

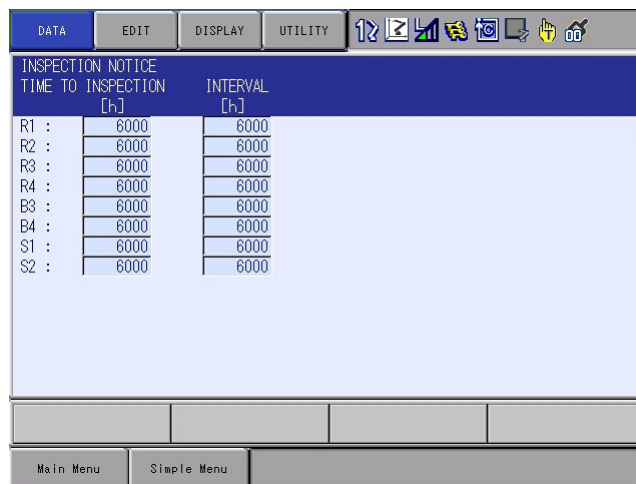
8 System Setup

8.21 Preventive Maintenance Function

8.21.3.1 Inspection Signal

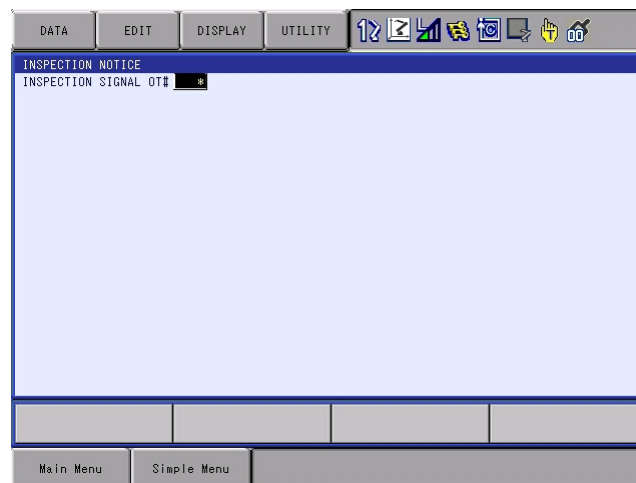
Set the universal output signal for the inspection time as the following procedures.

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



INSPECTION NOTICE	
TIME TO INSPECTION [h]	INTERVAL [h]
R1 :	6000
R2 :	6000
R3 :	6000
R4 :	6000
B3 :	6000
B4 :	6000
S1 :	6000
S2 :	6000

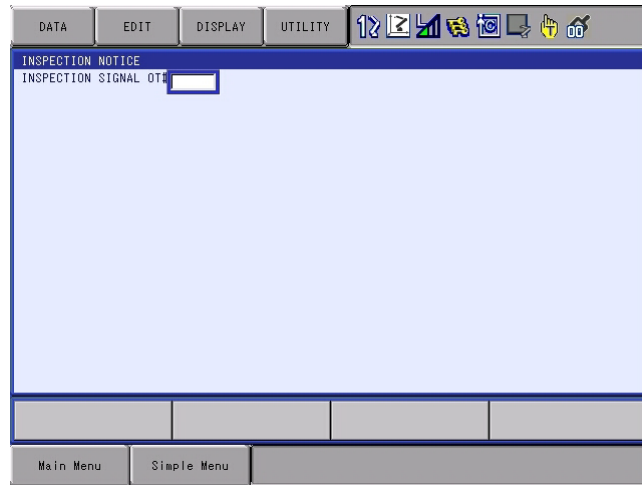
4. Select {Display} in the main menu.
 - {=SETUP CONDITION} is displayed in the pull down menu.
5. Select {=SETUP CONDITION}.
 - {=SETUP CONDITION} window appears.



DATA	EDIT	DISPLAY	UTILITY
INSPECTION NOTICE			
INSPECTION SIGNAL OT#			

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8.21 Preventive Maintenance Function

6. Move the cursor over the “=INSPECTION SIGNAL”, and select.
– It becomes the numeric value input status.



7. Enter the universal output number.

8.21.3.2 The Inspection Notice Window

1. Select {=RM} in the main menu.
 2. Select {=INSPECTION NOTICE}.
- The inspection notice window appears.

	TIME TO INSPECTION [h]	INTERVAL [h]
R1 :	6000	6000
R2 :	6000	6000
R3 :	6000	6000
R4 :	6000	6000
B3 :	6000	6000
B4 :	6000	6000
S1 :	6000	6000
S2 :	6000	6000

Each item on the screen represents the following description.

① =TIME TO INSPECTION

The rest of the time to inspection is displayed. When the servo power is turned ON, it calculates the subtraction automatically. When this item become “0”, the inspection notice signal is turned ON, and the message is displayed.

② =INTERVAL

The inspection interval is displayed.



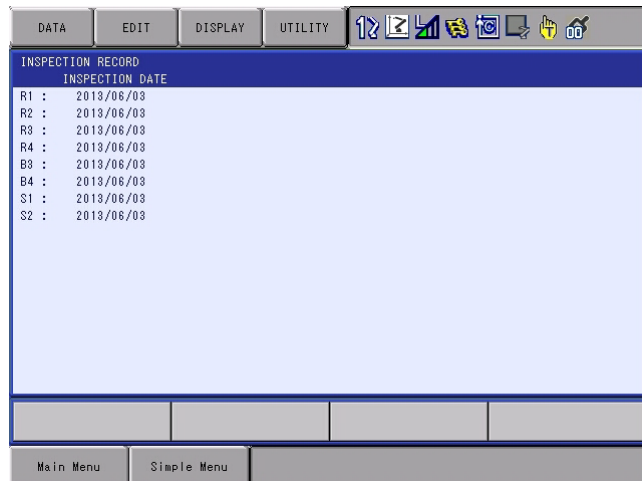
When the inspection signal is turned ON or the message is displayed, perform the inspection by an authorized personnel or your YASKAWA representative. The message is displayed continuously until the DX200 is inspected.

8.21.4 Record of the Inspection Day • the Replacement Day

Able to confirm the inspection day and the replacement day by following procedures.

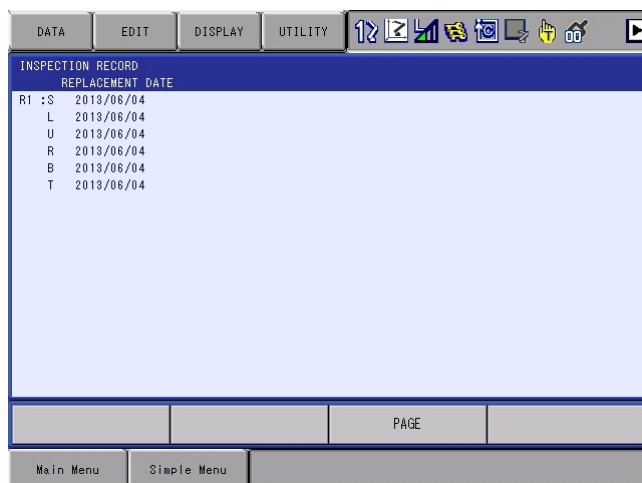
1. Select {=RM} in the main menu.
2. Select {=INSPECTION RECORD}.
3. Select {Display}, and select {=INSPECTION DATE} in the pull down menu.

– Able to confirm the inspection day.



4. Select {Display}, and select {=REPLACEMENT DATE} in the pull down menu.

– Able to confirm the replacement day.

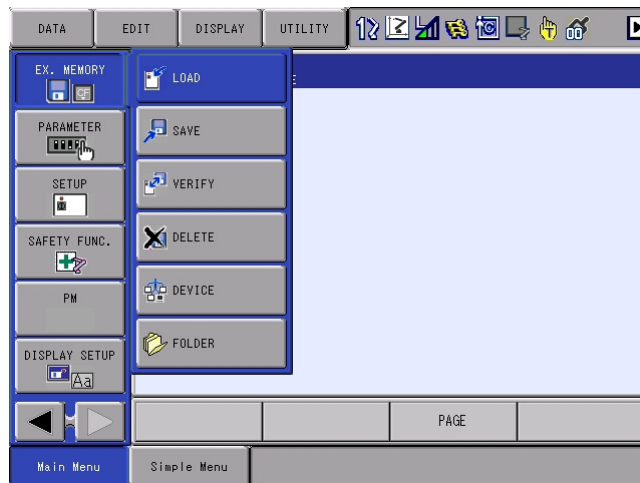


8.21.5 Management of the Data

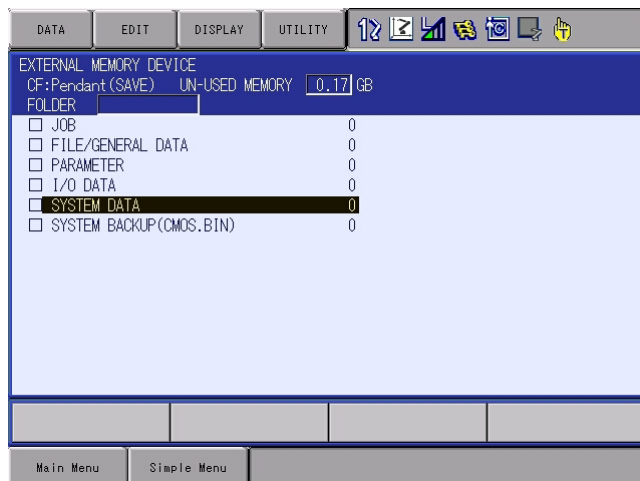
According to the torque average value, such as the speed reducer preventive maintenance data base, the preventive maintenance elements, the record of the inspection and replacement, can be loaded/saved by the external memory device.

As for the external device menu, refer to Chapter 7 External Memory Devices of “DX200 OPERATOR’S MANUAL” for more details.

1. Select {External memory} in the main menu.
 - The external memory menu window appears.



2. Select {Load} or {Save}.
 - The load window or the save window appears.

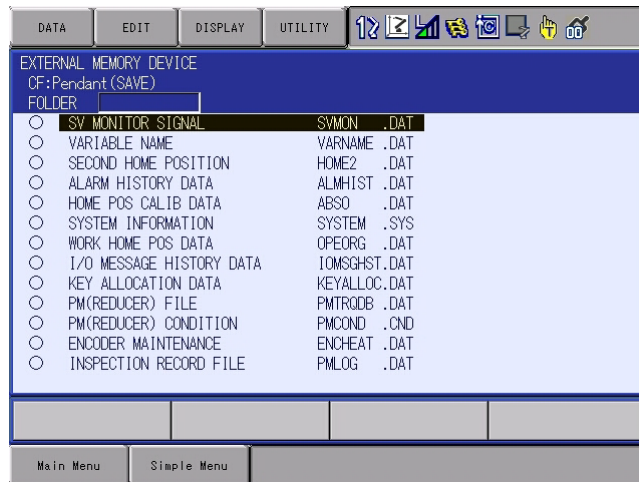


8 System Setup

8.21 Preventive Maintenance Function

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 general signals to be the reference for the replacement time.

The function overview is described below.

8.21.6.1 Target Components for Diagnosis

Regarding the following, calculations of the consumed amount and outputs of the general signals to be the reference for the replacement time are performed.

- Cooling fan*
- Capacitor
- Amplifier IGBT
- Contactor
- Motor (numbers of revolution and reverse revolution are displayed)

*Even though a fan is 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 judgement from A to D is displayed, and it can be used as the reference for the replacement time.

Judgement 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 general output which is set as "Alarm signal" of the file.

However, only one signal for this general signal can be output for one controller.

■ **Mask of Signal Output**

The general output signals can be masked for each component.

If any of the components is judged as D, ON signal is output from the general output which is set as "Alarm signal" of the file. This signal is output continuously, so the signal to inform the replacement time of the component cannot output newly. Therefore, the signal of the replacement time for other components can be output by masking the signal output of the component which is already judged as D and turning OFF the general output signal temporarily.

Even if the masking is performed, D remains to be displayed for the component judged that it should be replaced.

8.21.6.3 Replacement of Component

■ **Record of Replacement Date of Component**

When the component is replaced, the replacement date (year, month, day) can be recorded. It can be used for the reference for the next replacement time or for the estimation of the failure mode by the failure time.

■ **Life Span Setting at Replacement of Component**

A new component or an used one, whichever it is replaced with, the life span setting can be performed.

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

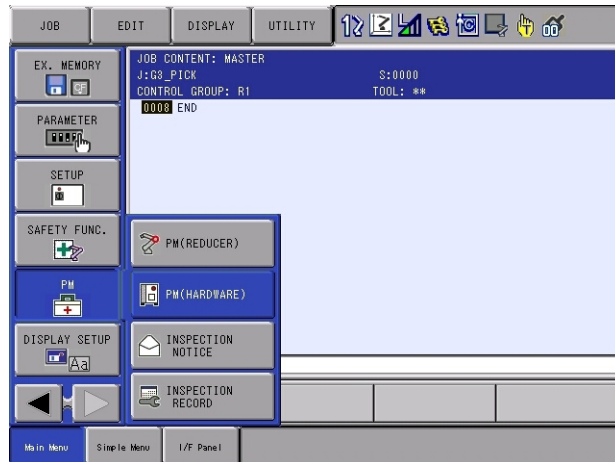
■ **Display of the Numbers of Motor Revolution and Reverse Revolution**

The accumulated values are displayed regarding the number of each motor revolution and the number of reverse revolution of positive and negative revolution. They can be used as the reference for the replacement time of the speed reducer or motor.

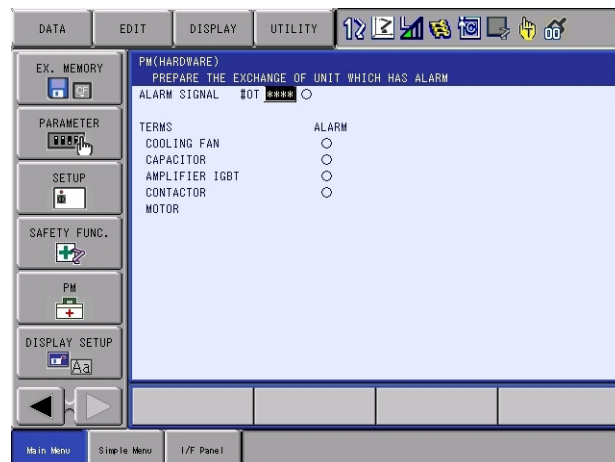
8.21.7 Setting of Preventive Maintenance for the Hardware

8.21.7.1 Setting of Replacement Time Display

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



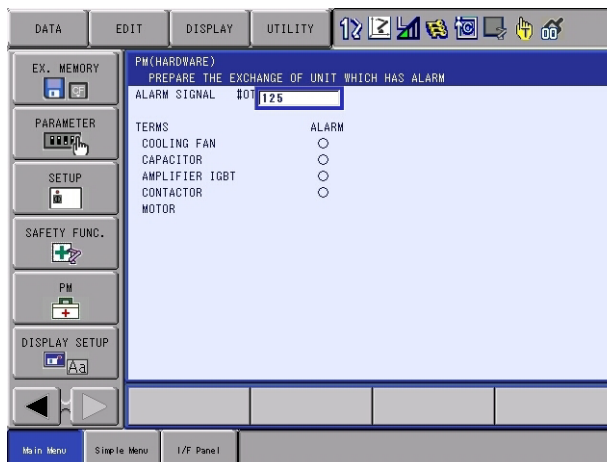
- * The operation icons on the main menu vary depending on the system usage.
2. Select {PM (HARDWARE)}.
- Alarm signal setting and unit selection window appears.



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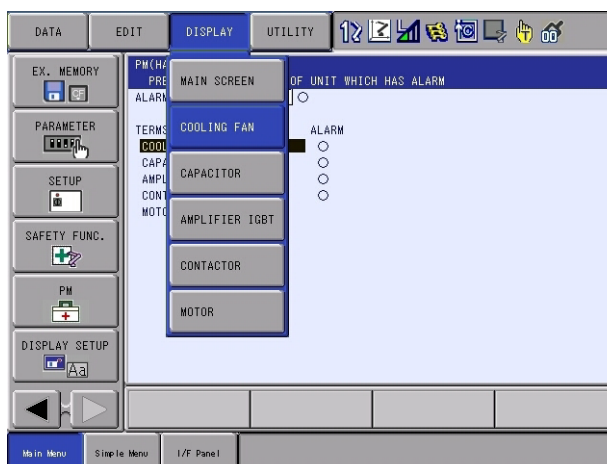
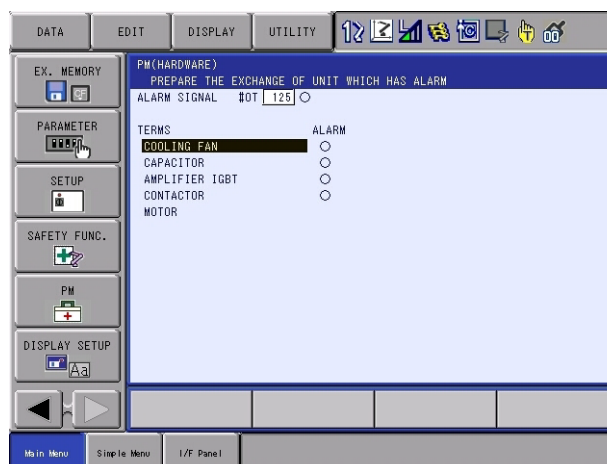
8.21 Preventive Maintenance Function

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



– * For example, 125 is input.

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



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

8 System Setup

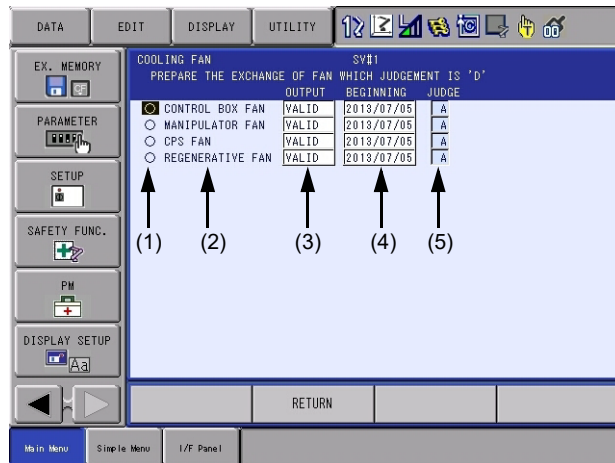
8.21 Preventive Maintenance Function

5. The following information is displayed:

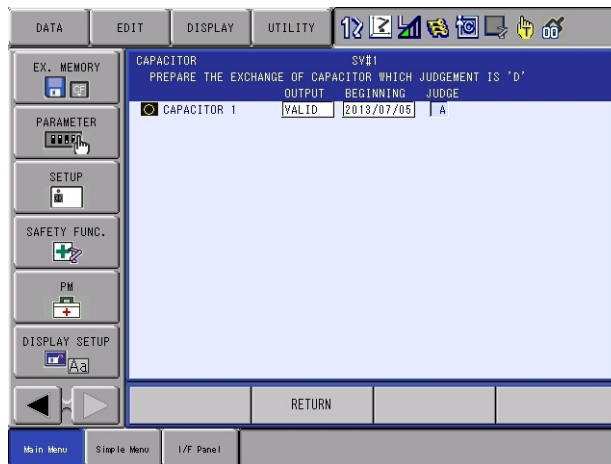
Starting from the left,

- (1) “●” is displayed when the replacement time is judged as D.
- (2) Component name
- (3) General output signal valid/invalid
- (4) The first day of use
- (5) Leftover life judgement

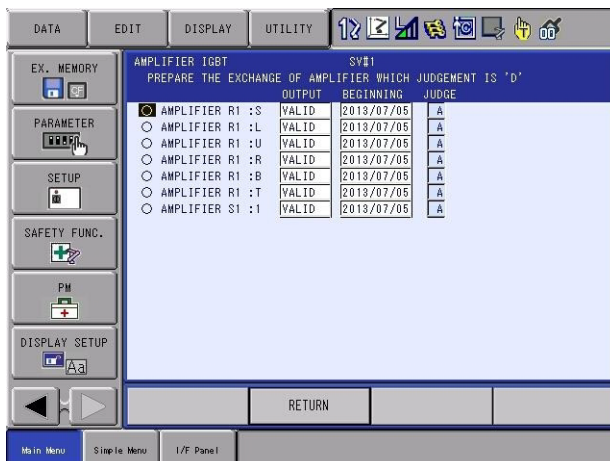
– When {COOLING FAN} is selected:



– When {CAPACITOR} is selected:



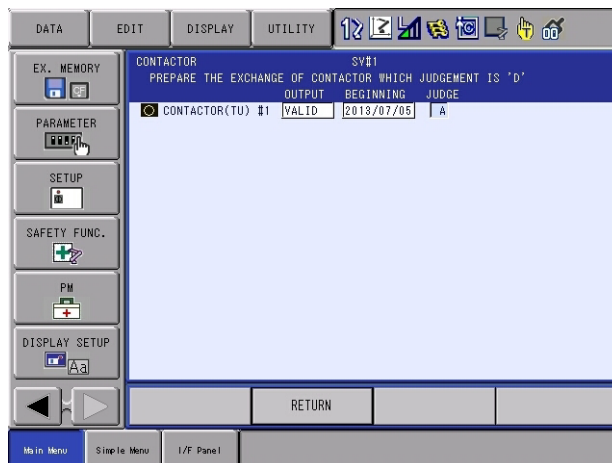
– When {AMPLIFIER IGBT} is selected:



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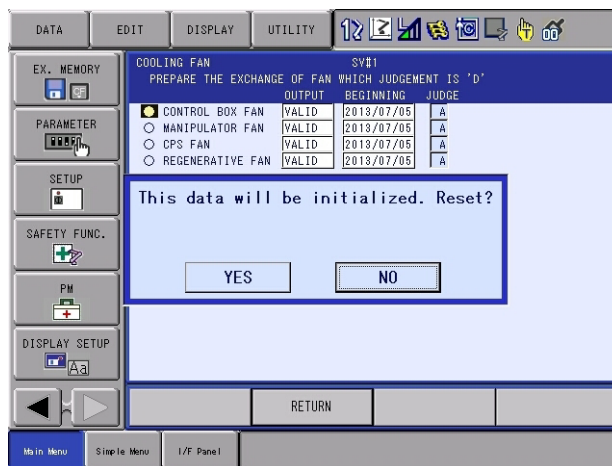
8.21 Preventive Maintenance Function

- 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}.

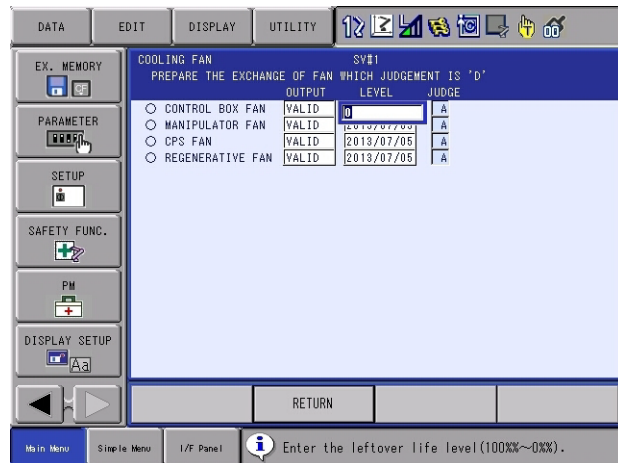
- A window to input the numerical value appears. Input the replacement date using half-width characters like {2009.3.14}. After that, a following confirmation dialog box appears. When replaced with an used component, select "YES".



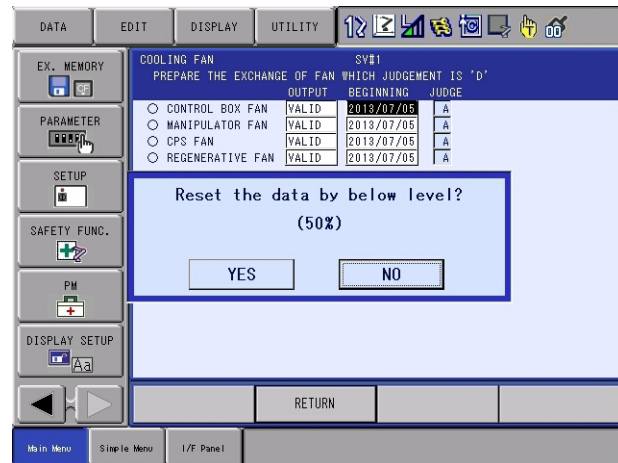
8 System Setup

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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”.



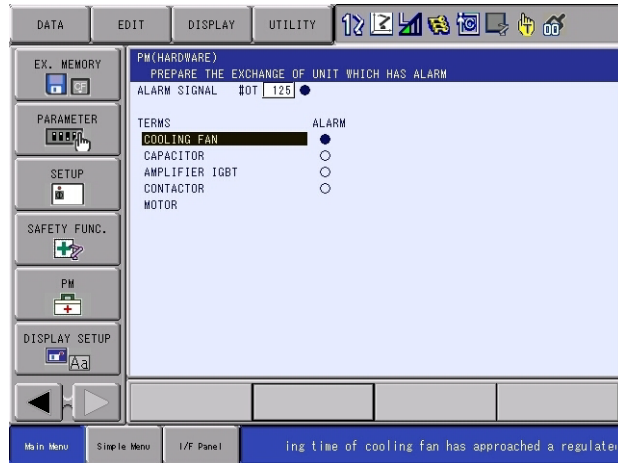
8 System Setup

8.21 Preventive Maintenance Function

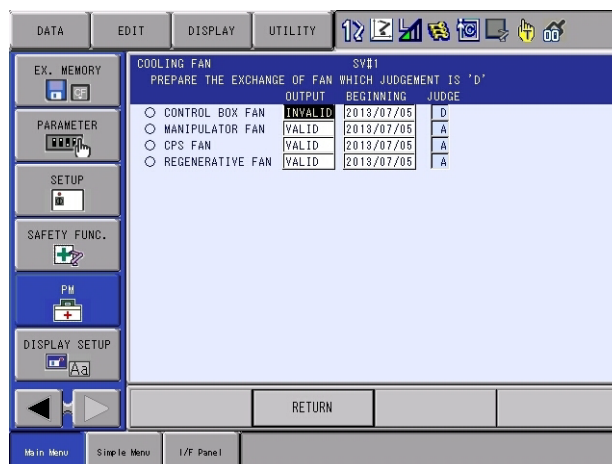
8.21.7.2 Mask of Replacement Time Display (Signal Display)

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.



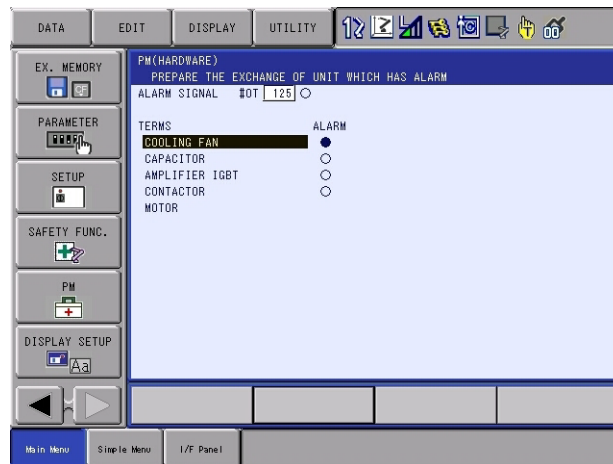
2. The message is also displayed per component.
Invalidate the output.
 - After checking the components, invalidate the output.



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8.21 Preventive Maintenance Function

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



- * Before the replacement, perform the above operation in order to detect the multiple components because only one general output of life diagnosis can be output for one controller. That is, "Replacement time of component → Turn ON the general output → Check the component and invalidate the output → Turn OFF the general output → Replacement time of other component → Turn ON the general output".

8.21.8 Display of the Numbers of Motor Revolution and Reverse Revolution

8.21.8.1 Display of the Numbers of Revolution and Reverse Revolution

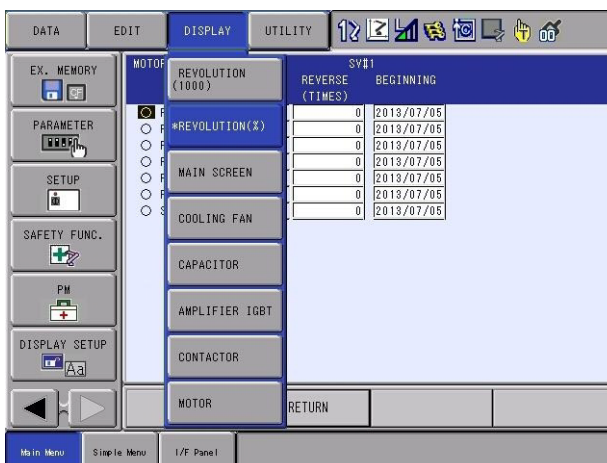
1. Select {PM} in Main Menu → {PM(HARDWARE)} → {MOTOR}.



8.21.8.2 Percent Display of the Number of Motor Revolution

At the motor rated number of revolution, it displays how many percent it has operated with 100% representing the case it operates 20000 hours.

1. After select {PM} in Main Menu → {PM(HARDWARE)} → {MOTOR}, select {DISPLAY} on the menu → {REVOLUTION(%)}.



8 System Setup

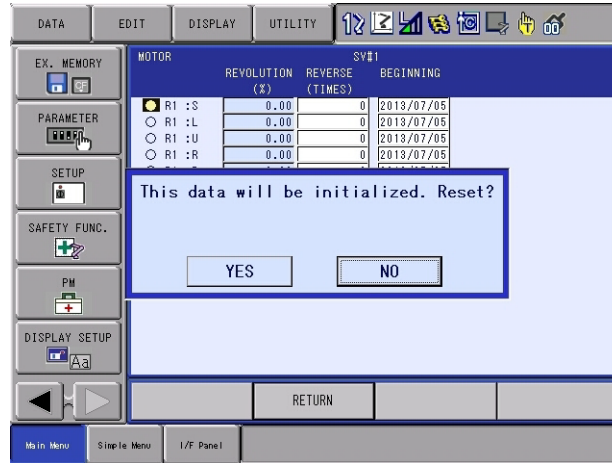
8.21 Preventive Maintenance Function

8.21.8.3 Resetting the Number of Revolution

Used when the motor replaced with a new one.

1. Select "O" of the axis to be reset by moving the cursor to it, and then select "YES" on the dialog box.

The day of the first use (BEGINNING) is automatically changed.



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8.21 Preventive Maintenance Function

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.

MOTOR	SV#1	REVOLUTION (1000TIMES)	REVERSE (TIMES)	BEGINNING
<input type="radio"/> R1 : S		5000	0	2013/07/05
<input type="radio"/> R1 : L		0	0	2013/07/05
<input type="radio"/> R1 : U		0	0	2013/07/05
<input type="radio"/> R1 : R		0	0	2013/07/05
<input type="radio"/> R1 : B		0	0	2013/07/05
<input type="radio"/> R1 : T		0	0	2013/07/05
<input type="radio"/> S1 : 1		0	0	2013/07/05
<input type="radio"/> S2 : 1		0	0	2013/07/05
<input type="radio"/> S3 : 1		0	0	****/**/**
<input type="radio"/> S4 : 1		0	0	2013/07/05
<input type="radio"/> S5 : 1		0	0	****/**/**

– * When changing the number of revolution.

MOTOR	SV#1	REVOLUTION (1000TIMES)	REVERSE (TIMES)	BEGINNING
<input type="radio"/> R1 : S		5000	5000	2013/07/05
<input type="radio"/> R1 : L		0	0	2013/07/05
<input type="radio"/> R1 : U		0	0	2013/07/05
<input type="radio"/> R1 : R		0	0	2013/07/05
<input type="radio"/> R1 : B		0	0	2013/07/05
<input type="radio"/> R1 : T		0	0	2013/07/05
<input type="radio"/> S1 : 1		0	0	2013/07/05

– * When changing the number of reverse revolution.

8.21.9 Gas Pressure Check Function

This function detects low gas pressure in the gas balancer. Applicable models that use a gas balancer ship with this function enabled by default. This function can be used by configuring the default settings. When the pressure drops in the gas balancer, the torque generated by the gas balancer decreases, and the torque generated by the motor increases to compensate for that lost torque. If the manipulator is operated with low gas pressure in the gas balancer, unexpected alarms, malfunction, or damage may occur. When low gas pressure in the gas balancer is detected by using this function, check the gas pressure. For how to check the gas pressure, refer to the maintenance manual of the manipulator. If the result of checking the gas pressure is the gas pressure is within the normal range, continue using the manipulator. If the gas pressure has decreased, make a plan to fill the gas balancer with gas. This function is available in DN3.14-00 or later.



Even when conducting gas pressure checks by using this function, refer to the maintenance manual for the manipulator and check the gas pressure in the gas balancer every 6000 hours.

8.21.9.1 Gas Pressure Check Window

Select {PM} → {GAS PRESS CHECK} in the main menu to display the Gas Press Check window.

Label	Field	Value
1	Robot Number	R1
2	Setting	NOT DONE
3	Ambient Temp.	20.0 C
4	Run En. Signal	INH
5	Err Detect Cnt	1 TIMES
6	Err Cnt Latest	10 TIMES
7, 8	Position	S, L, U, R, B, T
9	Tool No.	*
10, 11	Criteria	DATE/TIME, JUDGE

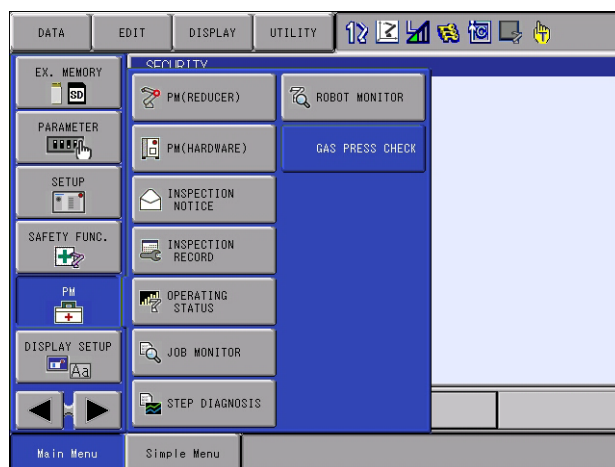
1. Robot Number
Indicates the number of the robot to use.
If there are two or more robots, select the number with [PAGE].
2. Setting
Displays whether the criteria values have been registered. For details, refer to *chapter 8.21.9.2 "Registering Criteria Values"*.
3. Ambient Temperature
Register the ambient temperature when the criteria values are registered. For details, refer to *chapter 8.21.9.2*.

4. Run Enable Signal
Set the run enable signal for the gas pressure check. The gas pressure check is executed when this general-purpose input is turned ON.
5. Error Detection Count
Set the number of consecutive errors.
6. Error Count
Displays the number of consecutive times an error value was detected. If an error value was detected consecutively for the number of times in "ERR DETECT CNT" or more, the specific output signals "LOW GAS PRESSURE ALARM SIGNAL" (#51280 to #51287) are turned ON.
7. Criteria Values (Positions and Tool Number)
Displays the criteria positions and tool number that were registered. For details, refer to *chapter 8.21.9.2 "Registering Criteria Values"*.
8. Latest Values (Positions and Tool Number)
Displays the criteria positions and tool number when the criteria registration operation was executed. For details, refer to *chapter 8.21.9.2*.
9. Measurement Date/Time (Criteria Values)
Displays the date and time when the criteria values were registered.
10. Measurement Date/Time (Latest Values)
Displays the date and time when the last gas pressure check was executed.
11. Judgment (Latest Values)
Displays the result when the last gas pressure check was executed.

■ **Clear Data**

Use this procedure to reset the gas pressure check data. {CLEAR DATA} does not appear if the security is less than management mode, when the mode is not teach mode, and when there is an alarm.

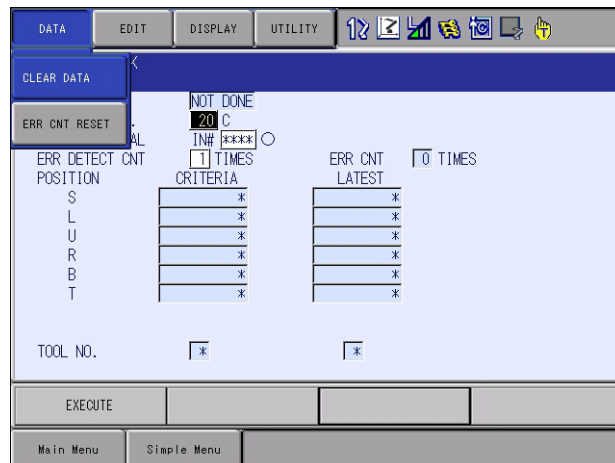
1. Select {PM} under the main menu.
2. Select {GAS PRESS CHECK}.



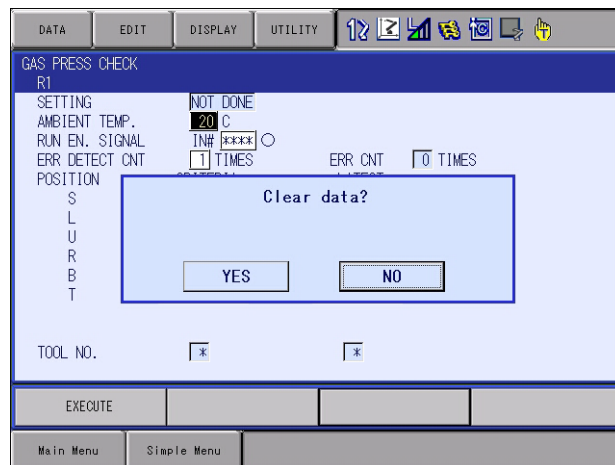
– The Gas Pressure Check window appears.

3. Select the robot number with [PAGE].

4. Select {DATA} and {CLEAR DATA}.



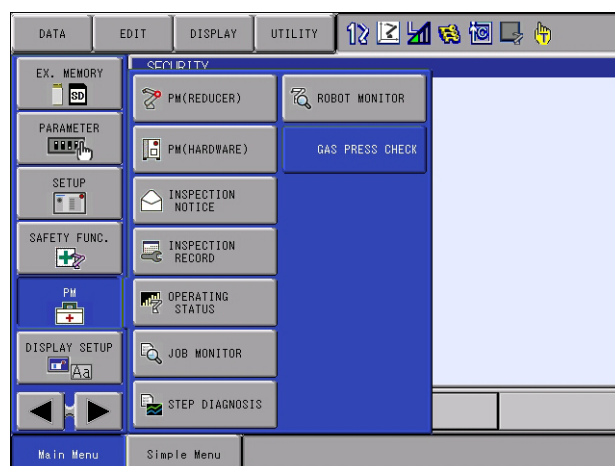
5. Select "YES".



■ Error Count Reset

Use this procedure to reset the number of times low gas pressure was detected. {CLEAR DATA} does not appear if the security is less than management mode, when the mode is not teach mode, and when there is an alarm.

1. Select {PM} under the {Main Menu}.
2. Select {GAS PRESS CHECK}.

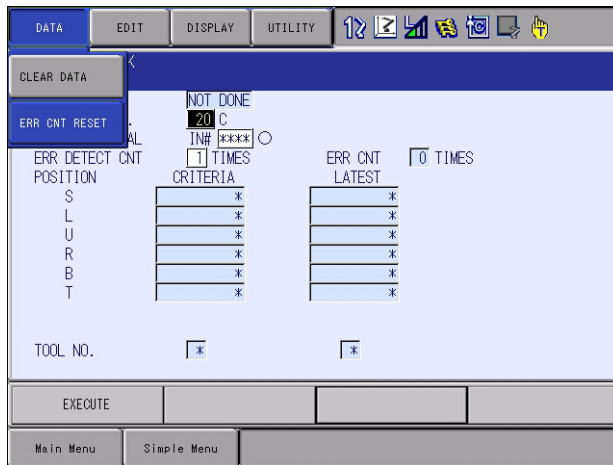


– The Gas Pressure Check window appears.

8 System Setup

8.21 Preventive Maintenance Function

3. Select the robot number with [PAGE].
4. Select {DATA} and {ERR CNT RESET}.



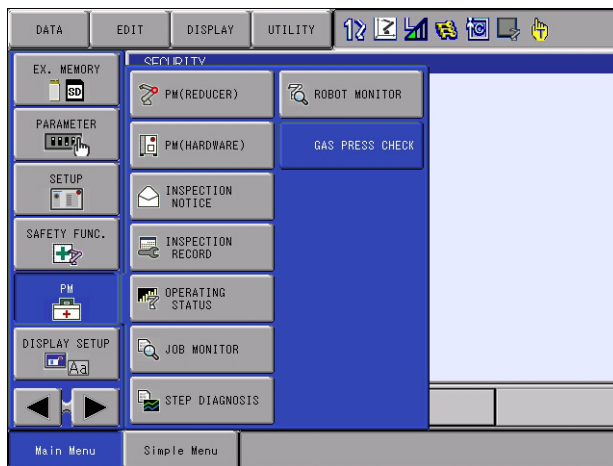
5. Select "YES".

8.21.9.2 Registering Criteria Values

Register the criteria values before using the gas pressure check function. Before registering the criteria values, check the gas pressure in the gas balancer and confirm the pressure is normal.

■ Operation Procedure

1. Select {PM} under the {Main Menu}.
2. Select {GAS PRESS CHECK}.



– The Gas Pressure Check window appears.

3. Select the robot number with [PAGE].
4. Select the "AMBIENT TEMP." item.

8 System Setup

8.21 Preventive Maintenance Function

- Enter the ambient temperature at the time and press [ENTER].

The screenshot shows the 'GAS PRESS CHECK' screen with the following fields and values:

SETTING	VALUE
AMBIENT TEMP.	20 C
RUN EN. SIGNAL	IN# [****] ○
ERR DETECT CNT	[] TIMES
ERR CNT LATEST	[0] TIMES
POSITION	
S	*
L	*
U	*
R	*
B	*
T	*
TOOL NO.	[*] [*]

Buttons at the bottom: EXECUTE, Main Menu, Simple Menu.

- Set the mode key to play mode.
- Press [SERVO ON READY] to turn ON the servo power supply.
- Select "EXECUTE".

The screenshot shows the same 'GAS PRESS CHECK' screen as before, but with a confirmation dialog box overlaid:

Do you perform gas pressure check?
Do not turn off servo during operation.

Buttons: YES, NO



Before selecting "EXECUTE", move the robot to the position to register as "CRITERIA (POSITION)". Register the standby position of the robot for "CRITERIA (POSITION)". For "CRITERIA (TOOL NO.)", register the tool number when the robot is at the standby position, and use the tool when the tool to mount is at the standby position.

※The criteria values cannot be registered in energy saving mode. Register the criteria values when energy saving mode is disabled.



The standby position means the position the robot evacuates to when work is completed or the position where the robot stops when finished operating for the day. Registering the standby position of the robot for "CRITERIA (POSITION)" is recommended. However, a posture with the L-axis angle between -30° and 0° cannot be registered for "CRITERIA (POSITION)". If the standby position is a position where the L-axis angle is between -30° and 0° , change the standby position or register a different standby position.

9. Select "YES".

- The gas pressure check operation is executed and the values are stored as the latest values.

GAS PRESS CHECK
R1

SETTING NOT DONE
AMBIENT TEMP. 20 C
RUN EN. SIGNAL IN# [***] ○
ERR DETECT CNT [1] TIMES
POSITION CRITERIA ERR CNT LATEST [0] TIMES

S	*	0
L	*	10000
U	*	0
R	*	0
B	*	0
T	*	0

TOOL NO. [0]

COMPLETE CANCEL

Main Menu Simple Menu

10. Set the mode key to teach mode.

11. Select "COMPLETE".

GAS PRESS CHECK
R1

SETTING DONE
AMBIENT TEMP. 20 C
RUN EN. SIGNAL IN# [***] ○
ERR DETECT CNT [1] TIMES
POSITION CRITERIA ERR CNT LATEST [0] TIMES

S	0	*
L	10000	*
U	0	*
R	0	*
B	0	*
T	0	*

TOOL NO. [0]

EXECUTE

Main Menu Simple Menu

- "SETTING" changes from "NOT DONE" to "DONE" and the criteria value registration is completed.

12. Select "RUN EN. SIGNAL".

13. Enter the general-purpose input signal number to set, and press [ENTER].

8.21.9.3 Execute the Gas Pressure Check

The gas pressure check is automatically executed when the following conditions are satisfied.

- "RUN ENABLE SIGNAL" is turned ON.
- The robot stays at the position in "CRITERIA (POSITION)" for 60 seconds or longer after "RUN ENABLE SIGNAL" is turned ON.
- The tool number matches "CRITERIA (TOOL NO.)".
- The specific output signals "GAS PRESSURE CHECK RUN DISABLE SIGNAL" (#50260 to #50267) are turned OFF.

When the gas pressure check is executed, the specific output signals "GAS PRESSURE CHECK RUN DISABLE SIGNAL" are turned ON. "GAS PRESSURE CHECK RUN DISABLE SIGNAL" is turned OFF when either of the following conditions is satisfied.

- "RUN ENABLE SIGNAL" changes from OFF to ON.
- 24 hours elapses after "GAS PRESSURE CHECK RUN DISABLE SIGNAL" was turned ON.

If "RUN ENABLE SIGNAL" remains ON, "GAS PRESSURE CHECK RUN DISABLE SIGNAL" is turned OFF 24 hours after the gas pressure check is executed. If "RUN ENABLE SIGNAL" is turned OFF, "GAS PRESSURE CHECK RUN DISABLE SIGNAL" is turned OFF when "RUN ENABLE SIGNAL" is turned ON again. To automatically execute the gas pressure check every 24 hours, leave "RUN ENABLE SIGNAL" turned ON. To execute the gas pressure check at an arbitrary time, change "RUN ENABLE SIGNAL" from OFF to ON.

8.21.9.4 When Low Gas Pressure Is Detected

If the gas pressure check is executed and low gas pressure is detected consecutively for the number of times in "ERR DETECT CNT" or more, the specific output signals "LOW GAS PRESSURE ALARM SIGNAL" are turned ON. The following message also appears for the applicable robot.

Gas pressure is low.

When low gas pressure is detected by using this function, check the gas pressure. For how to check the gas pressure, refer to the maintenance manual of the manipulator. If the result of checking the gas pressure is the gas pressure is within the normal range, continue using the manipulator. If the gas pressure has decreased, make a plan to fill the gas balancer with gas.

After the gas balancer is filled with gas, follow the procedure in *chapter 8.21.9.2 "Registering Criteria Values"* to register the criteria values again.



When registering the criteria values again after filling the gas balancer with gas, clear the criteria value data. For the procedure to clear the criteria value data, refer to *chapter 8.21.9.1 "Clear Data"*.

8.21.9.5 Alarm

Alarm No.	Alarm Name	Description	Sub Code	Sub Code Description	Cause	Action
6039	GAS PRESS CHECK ERROR	An error occurred when registering gas pressure check criteria values.			Software (Setting error)	Do not perform the following during registration of gas pressure check criteria values. • Job execution
					Software (Operation error)	Reset the alarm and register the gas pressure check criteria values again.
					Other	If the alarm occurs again even after taking the other actions, save CMOS.BIN and inform your YASKAWA representative of the conditions when the alarm occurs (e.g., operating procedure).

8.22 Break Line Ground Judgement Function

8.22.1 About the break Line Ground Judgement Function

If the current flowing through the break line exceeds the capacity of the control power supply unit, the DC 24V power supply will be disconnected by the protective circuit of the control power supply unit; then an alarm "1683 DC24V POWER SUPPLY FAILURE(SV)" occurs.

This function identifies the position where the ground fault occurred after arising the alarm "1683 DC24V POWER SUPPLY FAILURE(SV)". It is able to identify which axis break line does the ground fault occur by inspecting the each axis from the programming pendant.

Identify the ground fault of the break line by the following methods.

- (1) Turn the servo ON the group which the ground fault occurs.
- (2) Discharge the any axis break, and then confirm if the DC 24V power supply will be disconnected.

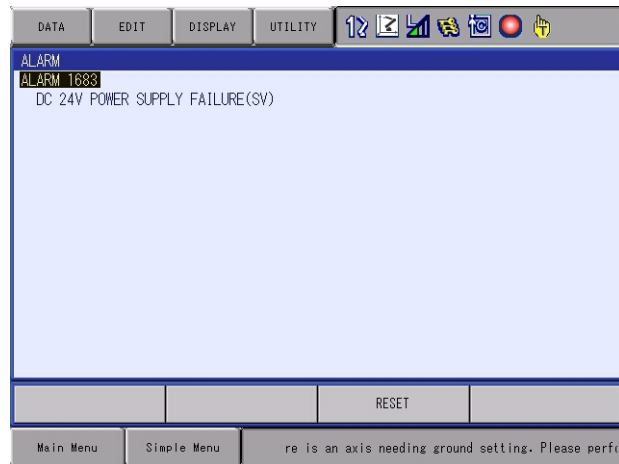
8.22.2 Operating Condition

1. Condition of the controller
The controller has restarted normally by restarting the controller after arising the alarm "1683 DC24V POWER SUPPLY FAILURE(SV)".
2. Mode
Only teach mode
3. Security
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)
 - The servo power is not disconnected by the servo power supply individual control function.

8.22.3 Operation

8.22.3.1 Arising the DC 24V Power Supply Failure (SERVO)

- When detecting either the ground fault or the short circuit of the break line, the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)” occurs.
- Restart the control power, and perform the break line ground check.

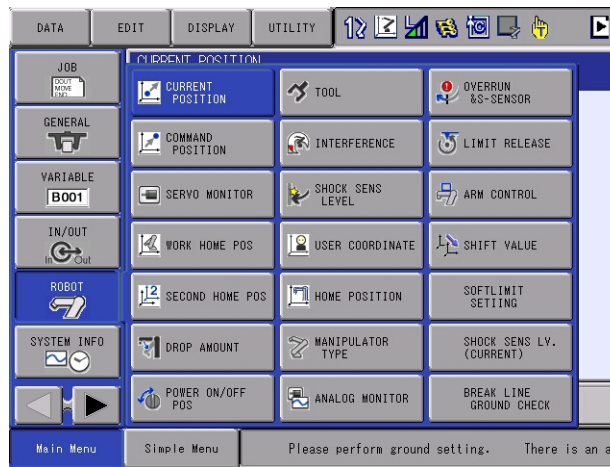


8 System Setup

8.22 Break Line Ground Judgement Function

8.22.3.2 Break Line Ground Check

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



2. Press "YES".
 - The confirmation dialog appears due to prevent the mis-operation.
 - Select "YES", then the break line ground check appears.
 - Select "NO", the window returns to the previous window.

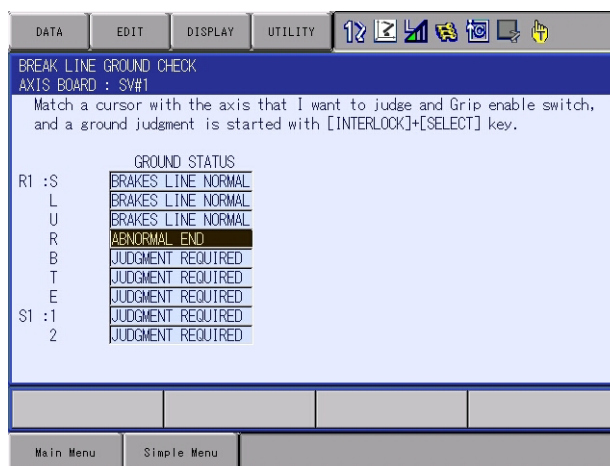


3. Move the cursor over the axis to perform the brake line ground check.



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 break line ground check, and press [SERVO ON READY]. Grip the enable switch and long press [SELECT] while pressing down the [INTER LOCK] to perform the break line ground check.
- Perform the break line ground check to the every single axis displayed on the screen.
- The break line ground check is cancelled in the case of following conditions.
 - [SELECT] is detached.
 - The emergency button of the programming pendant, controller or external signal is pressed.
 - The servo power is disconnected by the servo power supply individual control function.
 - The servo alarm occurs.



JUDGEMENT REQUIRED: The ground check is not performed

BREAKS LINE NORMAL: The break line is normal.

DETECTED GROUND: The ground fault or short circuit of the break line

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

8 System Setup

8.22 Break Line Ground Judgement Function

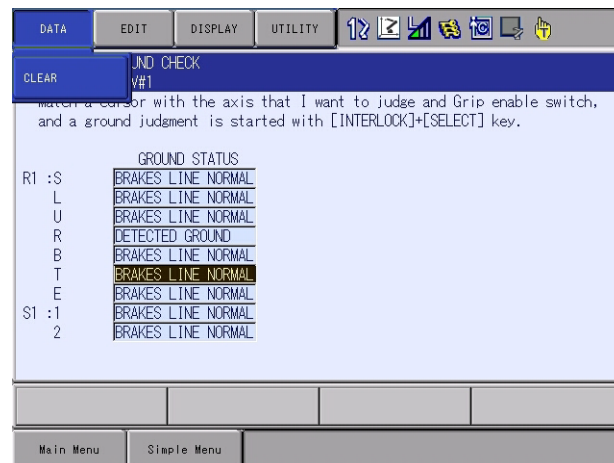
4. Detecting the Break Line Ground Fault

- When the break line ground fault or the short circuit is detected, the alarm “1694 GROUND FAULT (BRAKE LINE)” occurs.
- Inspect the break line of the axis which raised the alarm.
- Restart the control power, and perform the break line ground check to the rest of the axes.



8.22.3.3 Initializing the Related Information

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

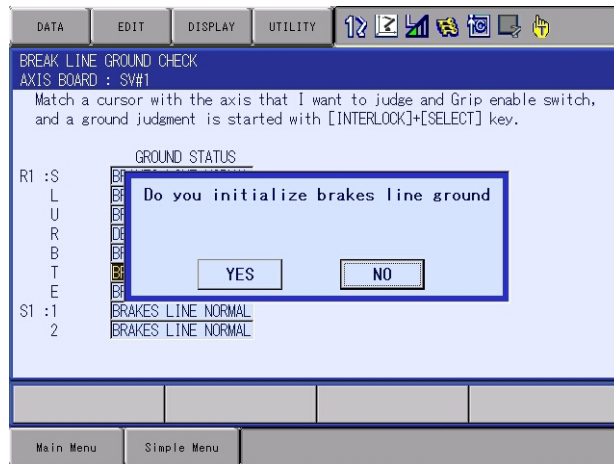


8 System Setup

8.22 Break Line Ground Judgement Function

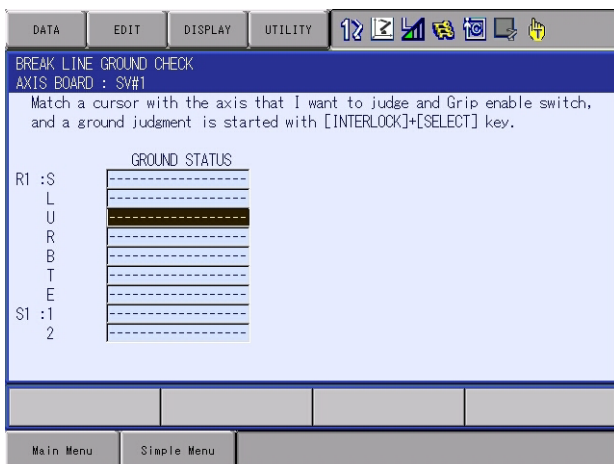
3. Select {CLEAR}.

- The confirmation dialog appears.



4. Press "YES".

- The related information of the break line ground check is initialized.
- {BREAK LINE GROUND CHECK} does not appear in the {Main Menu} until the alarm "1683 DC24V POWER SUPPLY FAILURE(SV)" occurs.



8.23 Safety Logic Circuit

8.23.1 Outline

The safety logic circuit is a function to create the safety logic circuit on the programming pendant. It enables to set up the logical operations, such as stopping the manipulator and outputting the servo ON signal.

The followings are the contents of this function.

- (1) Executes the safety logic circuit by the machine safety logic circuit board (type:YSF21-E) corresponded to the secure authentication.
- (2) The safety logic circuit is composed by two inputs and one output circuit or one input and one output circuit, and can be set up to 128 lines.
- (3) The safety logic circuit with 128 lines is operated in every 4ms cycle.
- (4) The safety logic circuit is referred by the all modes regardless the security mode, and it can be edit only when the security mode is higher than "SAFETY MODE" plus under the teach mode and the servo is OFF.
- (5) In the safety logic circuit expansion function, by using the optional safety PLC and the safety logic circuit, the safety PLC can also control the function that has been attained by the hard-wired signal. This enables less wiring.

The safety logic circuit expansion function is applicable from software version DN1.80-00. To use the safety logic circuit expansion function, refer to *chapter 8.23.4 "The Safety Logic Circuit Expansion Function"*.

8.23.2 Set up the Safety Logic Circuit

In order to set up the safety logic circuit, the security mode needs to be changed to safety mode. Before creating the safety logic circuit, the following procedures need to be set in the window as shown below.

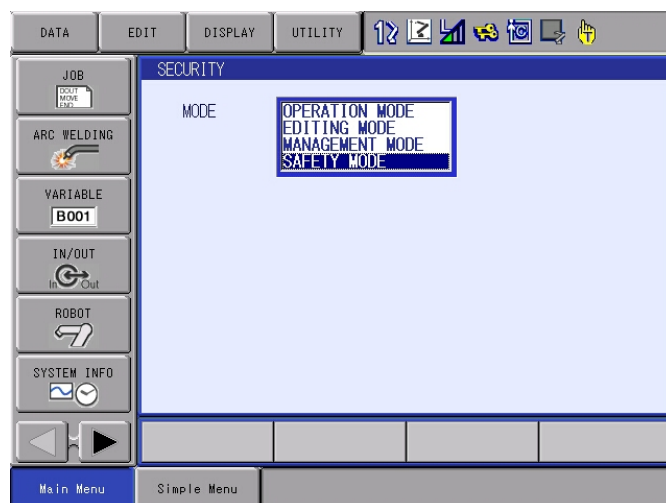
- M-SAFETY SIGNAL ALLOC
- SAFETY SIG. BOARD ALLOC
(displayed when the optional safety field bus function is valid)
- TIMER DELAY SET
(need to be set when using the timer delay)

These items above are displayed by selecting the {SAFETY FUNC.} in the main menu. The setup information is written in the file.



8.23.2.1 Changing the Security Mode

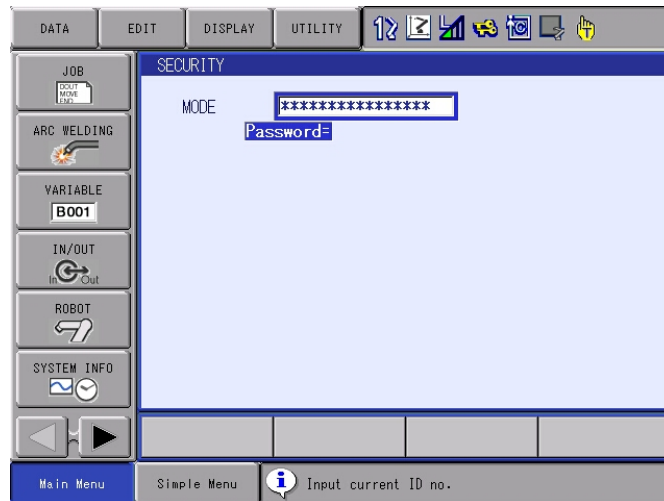
1. Displaying the window.
 - Select {SECURITY} from {SYSTEM INFO} in the main menu.
2. Change to the safety mode.
 - Select {SAFETY MODE}.




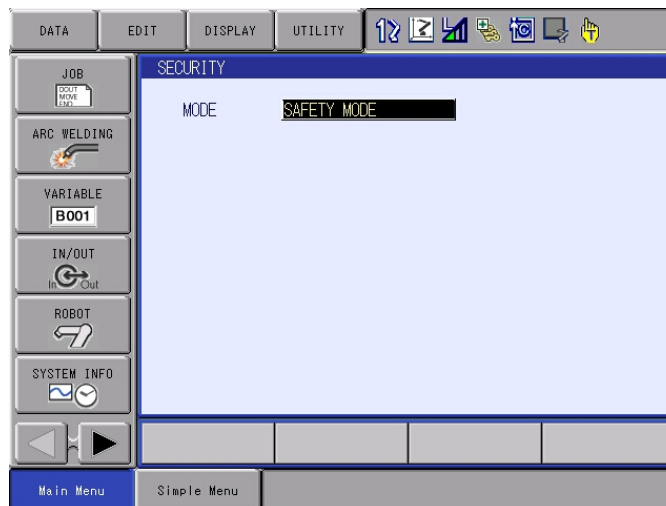
8 System Setup

8.23 Safety Logic Circuit

- Enter the password for the safety mode, and then press [ENTER].



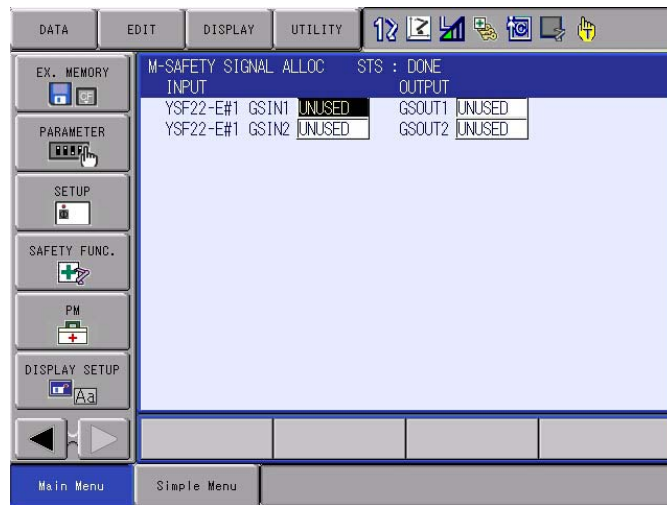
- When the entered password is correct, the mode is changed to {SAFETY MODE}. After changing to the safety mode, the icon  is displayed on the status area.



8.23.2.2 Allocating the Machine Safety Signal

1. Displaying the window.

- Select {M-SAFETY SIGNAL ALLOC} from {SAFETY FUNC.} in the main menu.



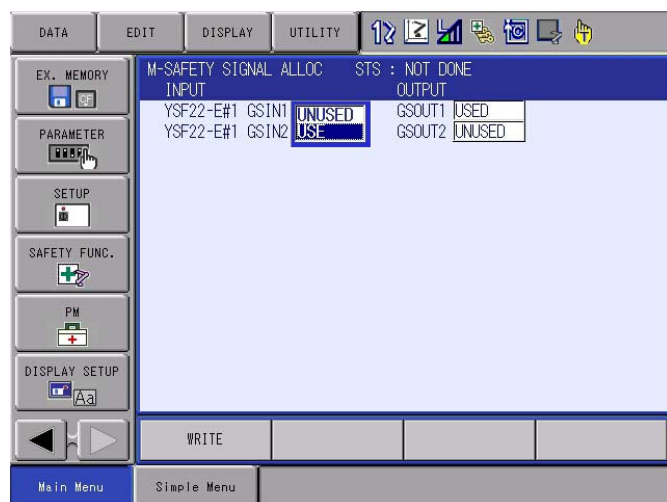
2. Set up the universal safety signal.

- In the DX200, the two points of the universal safety input signal and the two points of the universal safety output signal are present from I/O board (type:YSF22 □ -E), and these signals can be used at the safety logic circuit.

Set the "USE" for the input and output signal(s) to use.

After the setting, the status changes from "DONE" to "NOT DONE".

The "WRITE" button is displayed on the left down corner of the screen.

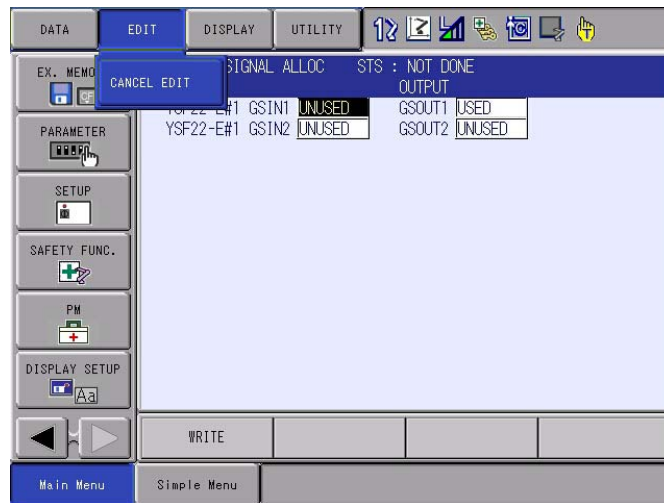


8 System Setup

8.23 Safety Logic Circuit

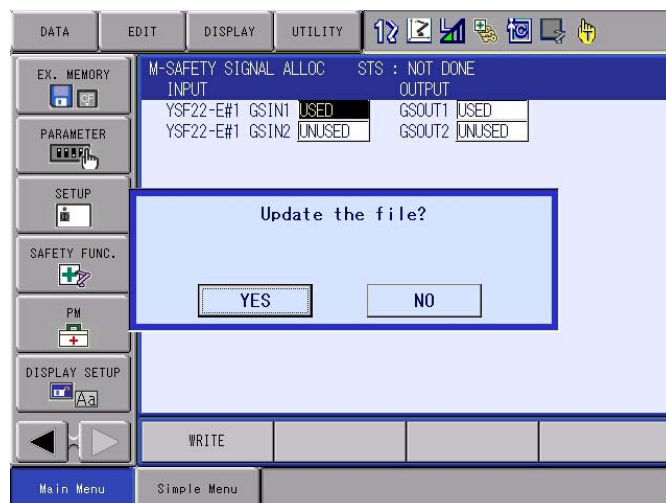
3. Canceling the edit

- To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.

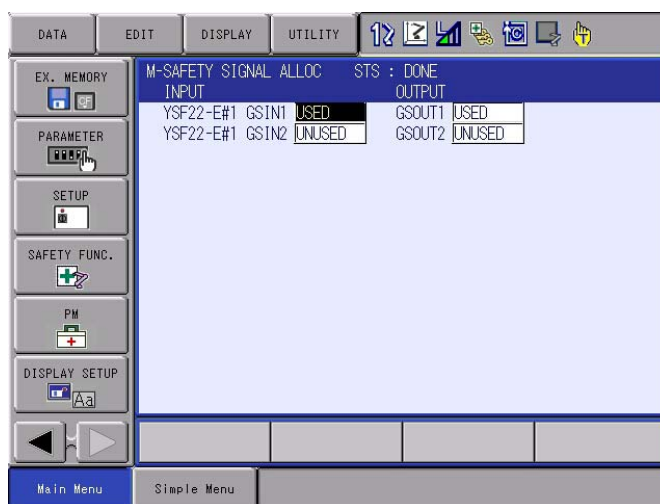


4. Transferring or updating the file

- After editing, select {WRITE} button.
The file is transferred to the machine safety circuit board (type:YSF21-E). When the file transfer is done correctly, the confirmation dialog "Update the file?" appears.



- Press “YES”, and then the file is updated.
The file transferred to the machine safety circuit board (type:YSF21-E) is written in the FLASH ROM.
The status becomes “DONE” from “NOT DONE”.



If press “NO”, the file will not be updated. The status remains “NOT DONE”.



If press “YES” on the confirmation dialog, the all window information, such as {M-SAFETY SIGNAL ALLOC}, {SAFETY SIG. BOARD ALLOC}, {TIMER DELAY SET}, and {SAFETY LOGIC CIRCUIT} are updated. The written file in the FLASH ROM of the machine safety circuit board is also updated.



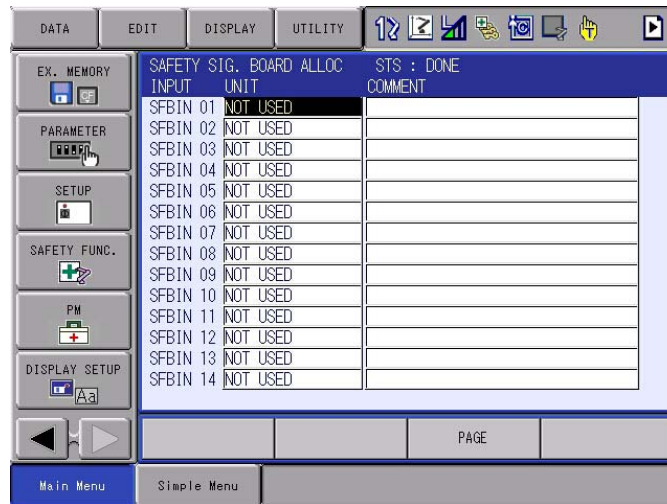
When performing {WRITE}, the universal safety and the safety field bus output signals, which are sent from the machine safety circuit board, are turned OFF till the writing processing is finished.

8.23.2.3 Allocating the Safety Signal Board

This window is displayed when the optional safety field bus is valid.

1. Displaying the window.

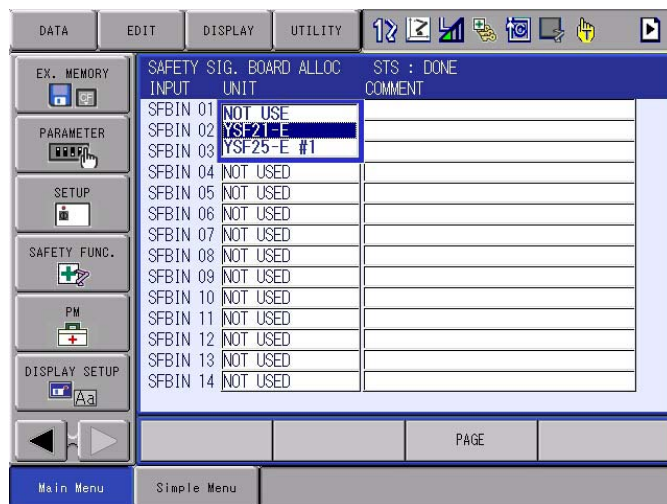
- Select {SAFETY SIG. BOARD ALLOC} from {SAFETY FUNC.} in the main menu.



2. Set up the safety field bus signal.

- In the DX200, the 64 points of the safety input signal and the 64 points of the safety output signal are present from the safety PLC, and these signals can be used at the safety logic circuit. Set the “USE” for the input and output signal(s) to use. After the setting, the status changes from “DONE” to “NOT DONE”. The “WRITE” button is displayed on the left down corner of the screen.

<Input signal window>



<Output signal window>

OUTPUT	UNIT	COMMENT
SFBOUT01	NOT USE	
SFBOUT02	YSF21-E	
SFBOUT03	YSF25-E #1	
SFBOUT04	NOT USED	
SFBOUT05	NOT USED	
SFBOUT06	NOT USED	
SFBOUT07	NOT USED	
SFBOUT08	NOT USED	
SFBOUT09	NOT USED	
SFBOUT10	NOT USED	
SFBOUT11	NOT USED	
SFBOUT12	NOT USED	
SFBOUT13	NOT USED	
SFBOUT14	NOT USED	

3. Canceling the edit

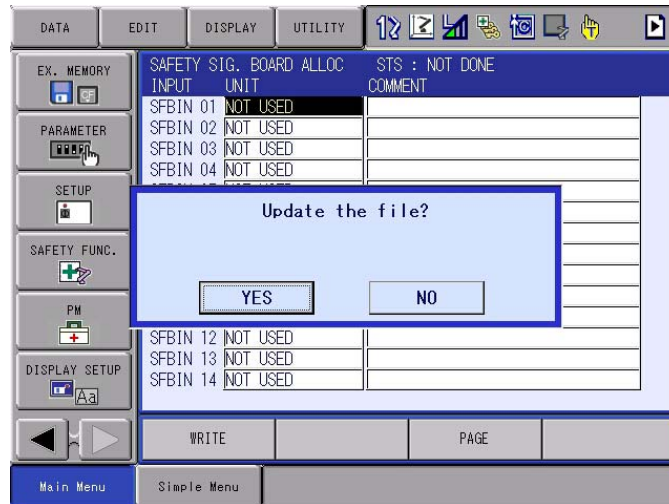
- To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.

OUTPUT	UNIT	COMMENT
SFBIN 02	NOT USED	
SFBIN 03	NOT USED	
SFBIN 04	NOT USED	
SFBIN 05	NOT USED	
SFBIN 06	NOT USED	
SFBIN 07	NOT USED	
SFBIN 08	NOT USED	
SFBIN 09	NOT USED	
SFBIN 10	NOT USED	
SFBIN 11	NOT USED	
SFBIN 12	NOT USED	
SFBIN 13	NOT USED	
SFBIN 14	NOT USED	

4. Transferring or updating the file

- After editing, select {WRITE} button.

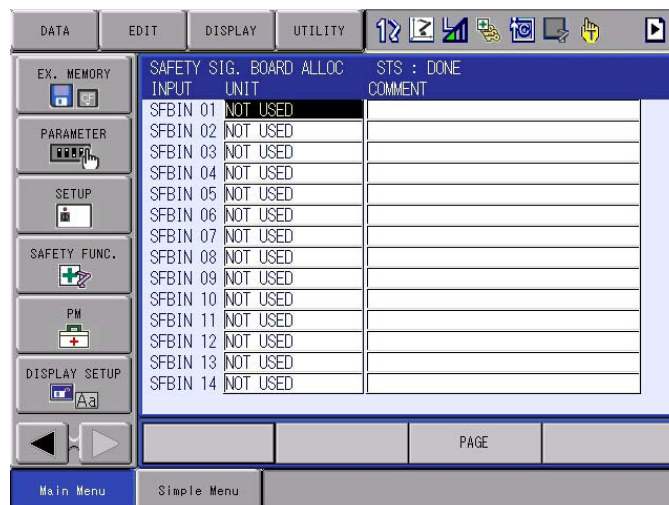
The file is transferred to the machine safety circuit board (type:YSF21-E). When the file transfer is done correctly, the confirmation dialog “Update the file?” appears.



- Press “YES”, and then the file is updated.

The file transferred to the machine safety circuit board (type:YSF21-E) is written in the FLASH ROM.

The status becomes “DONE” from “NOT DONE”.



If press “NO”, the file will not be updated. The status remains “NOT DONE”.



If press “YES” on the confirmation dialog, the all window information, such as {M-SAFETY SIGNAL ALLOC}, {SAFETY SIG. BOARD ALLOC}, {TIMER DELAY SET}, and {SAFETY LOGIC CIRCUIT} are updated. The written file in the FLASH ROM of the machine safety circuit board is also updated.



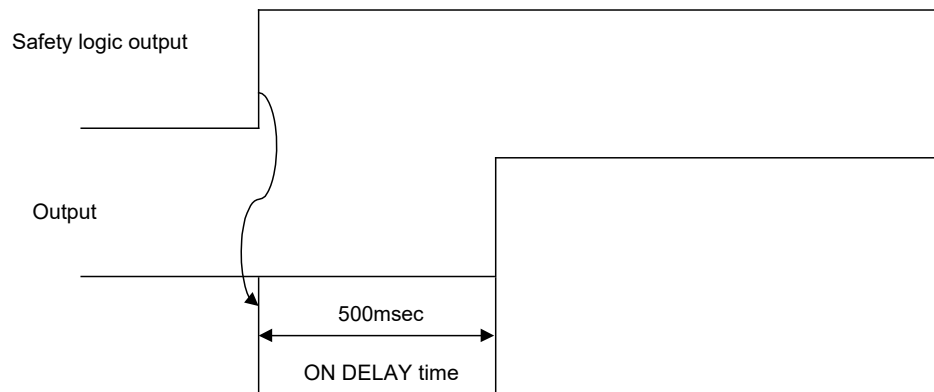
When performing {WRITE}, the universal safety and the safety field bus output signals, which are sent from the machine safety circuit board, are turned OFF till the writing processing is finished.

8.23.2.4 Timer Delay

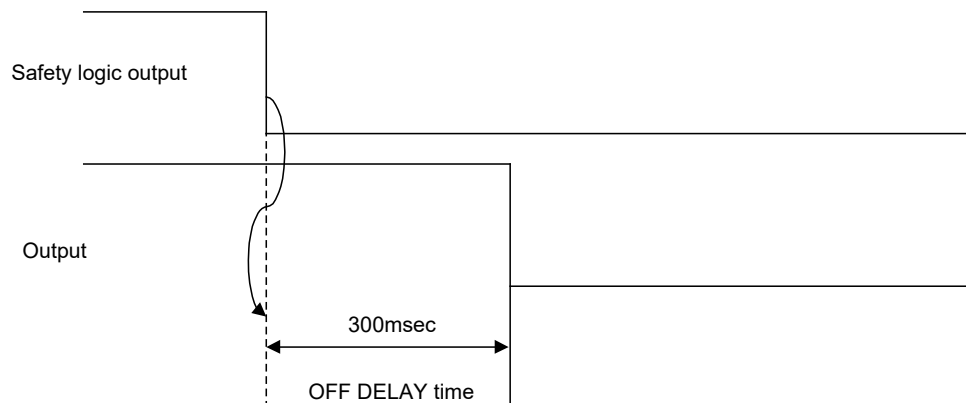
Set up the delay time of the output signal to use by the safety logic circuit.

In the TIMER DELAY, there are “ON DELAY TIME” to delay the ON output and “OFF DELAY TIME” to delay the OFF output . It can be four timer settings.

When setting the 500msec to ON DELAY TIME,



When setting the 300msec to OFF DELAY TIME,



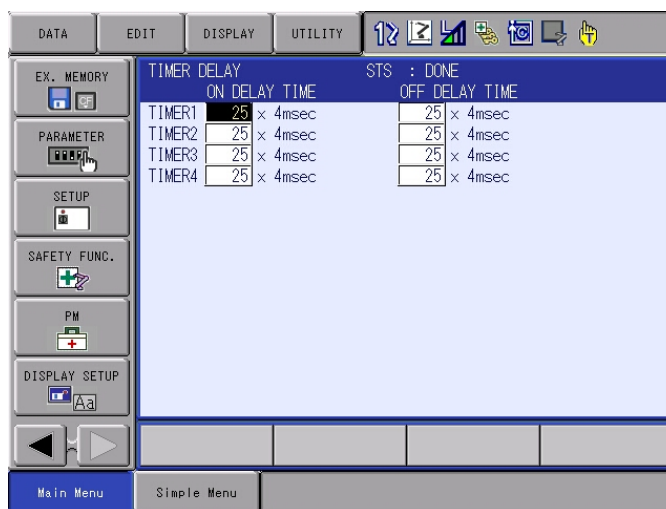
The initial value is $100(25 \times 2)$ [msec]. It is able to set every 4msec up to 399,996 ($99,999 \times 4$)[msec].

8 System Setup

8.23 Safety Logic Circuit

1. Displaying the window.

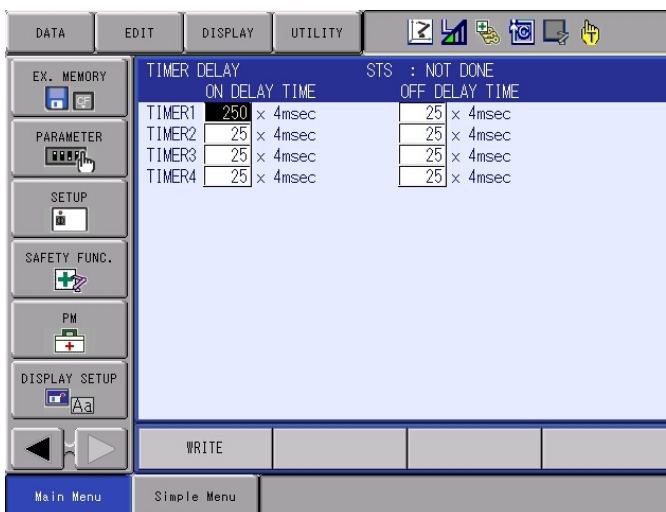
- Select {TIMER DELAY} from {SAFETY FUNC.} in the main menu.



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”.
The “WRITE” button is displayed on the left down corner of the screen.

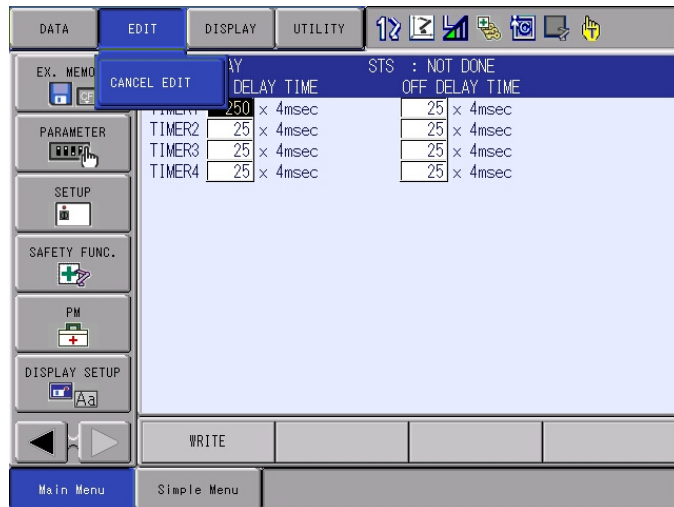


8 System Setup

8.23 Safety Logic Circuit

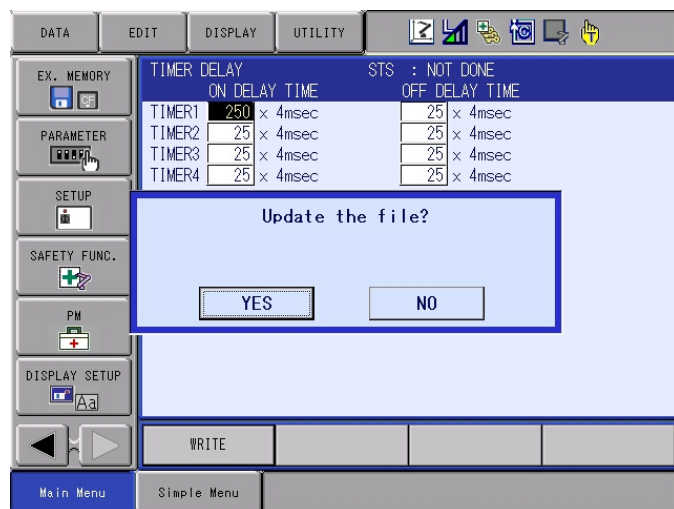
3. Canceling the edit

- To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.



4. Transferring or updating the file

- After editing, select {WRITE} button.
The file is transferred to the machine safety circuit board (type:YSF21-E). When the file transfer is done correctly, the confirmation dialog "Update the file?" appears.



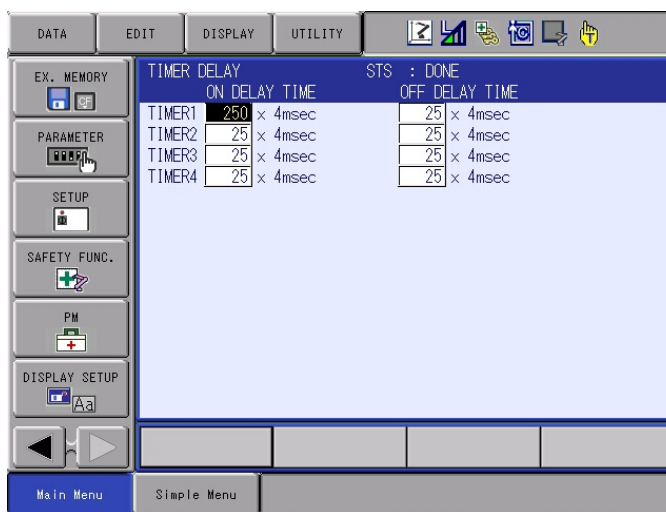
8 System Setup

8.23 Safety Logic Circuit

- Press “YES”, and then the file is updated.

The file transferred to the machine safety circuit board (type:YSF21-E) is written in the FLASH ROM.

The status becomes “DONE” from “NOT DONE”.



If press “NO”, the file will not be updated. The status remains “NOT DONE”.



If press “YES” on the confirmation dialog, the all window information, such as {M-SAFETY SIGNAL ALLOC}, {SAFETY SIG. BOARD ALLOC}, {TIMER DELAY SET}, and {SAFETY LOGIC CIRCUIT} are updated. The written file in the FLASH ROM of the machine safety circuit board is also updated.

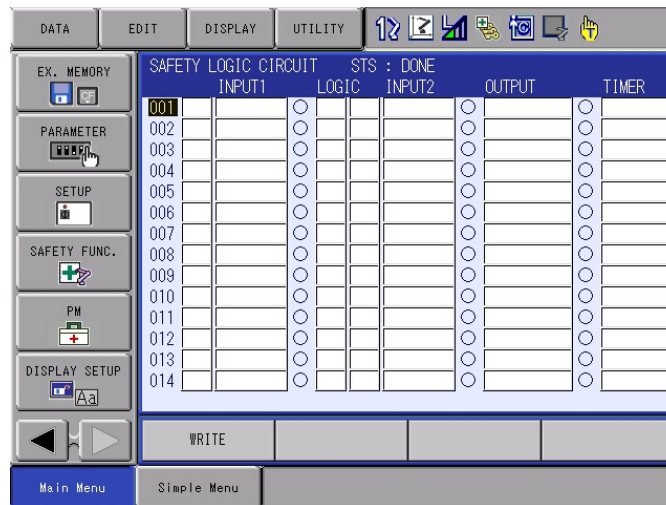


When performing {WRITE}, the universal safety and the safety field bus output signals, which are sent from the machine safety circuit board, are turned OFF till the writing processing is finished.

8.23.2.5 Safety Logic Circuit

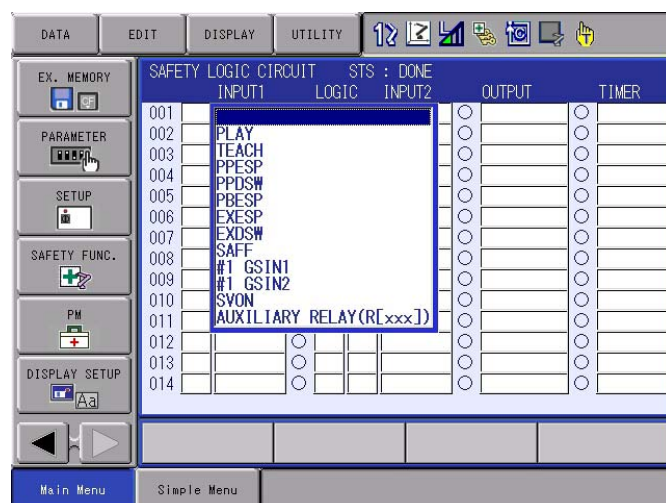
1. Displaying the window.

- Select {SAFETY LOGIC CIRCUIT} from {SAFETY FUNC.} in the main menu.

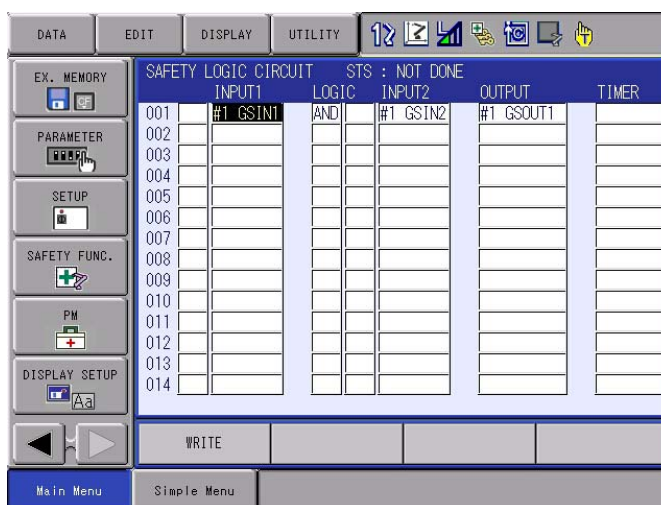


2. Set up the safety logic circuit

- Create the safety logic circuit. The setting items are “INPUT1”, “LOGIC”, “INPUT2”, “OUTPUT” and “TIMER”.
- The SIGNAL1 and SIGNAL2 must be set.
- When setting the signal 1 or the signal 2, LOGIC also must to be set.
- OUTPUT also must be set. The same output signal cannot be set to the multiple logic circuit.

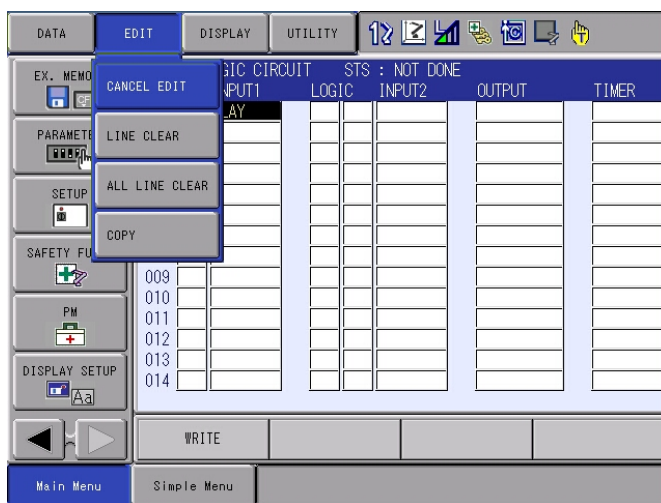


After the setting, the status changes from “DONE” to “NOT DONE”. The “WRITE” button is displayed on the left down corner of the screen.



3. Canceling the edit

- To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.

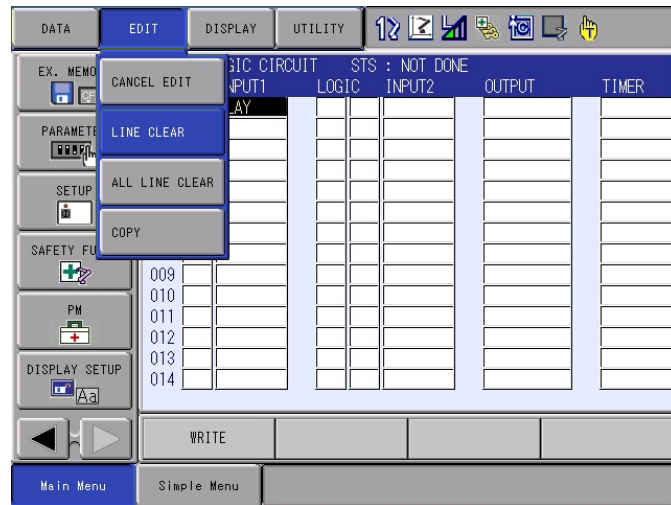


8 System Setup

8.23 Safety Logic Circuit

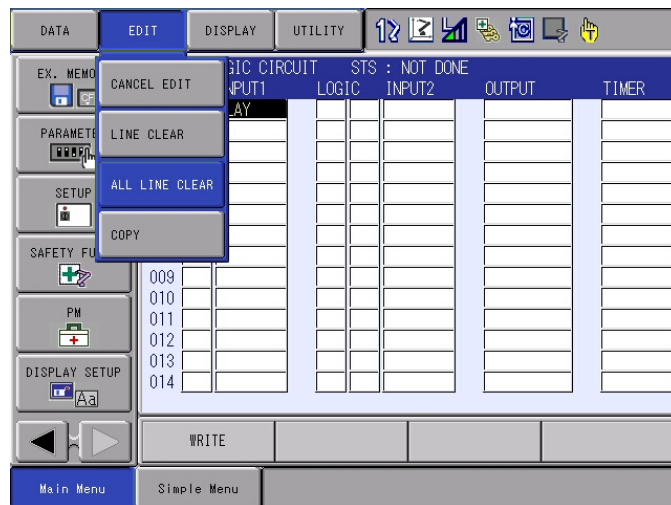
4. Line clear

- To clear the one line, select {LINE CLEAR} from {EDIT} in the pull-down menu.



5. All line clear

- To clear the all line, select {ALL LINE CLEAR} from {EDIT} in the pull-down menu.

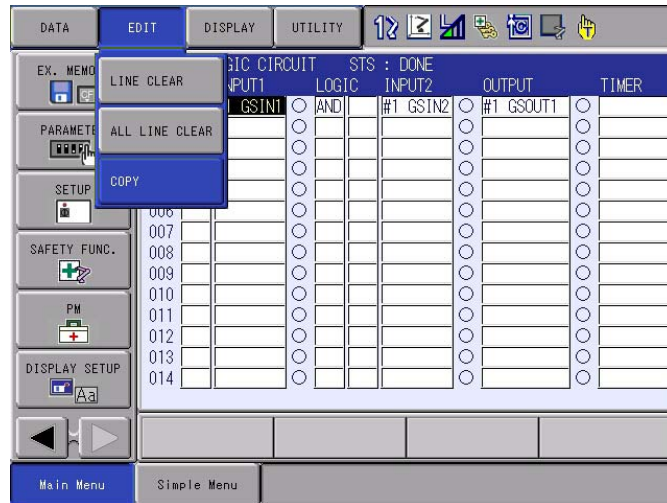


8 System Setup

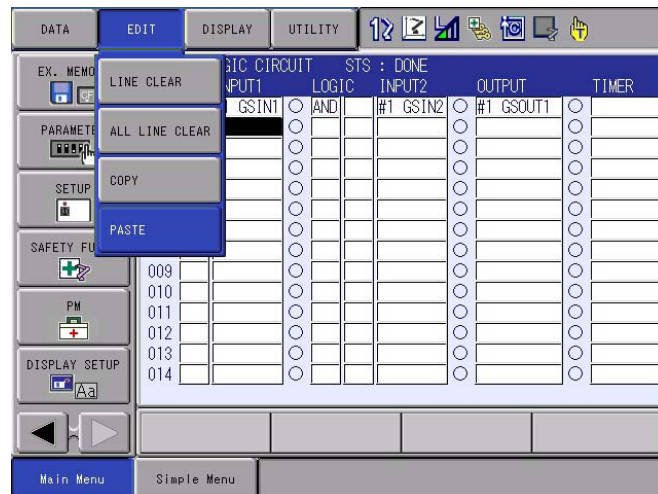
8.23 Safety Logic Circuit

6. Copy

- Choose the desired area to make a copy, and select {COPY} from {EDIT} in the pull-down menu.



- Go to the area to paste, select {PASTE} from {EDIT} in the main menu to paste.

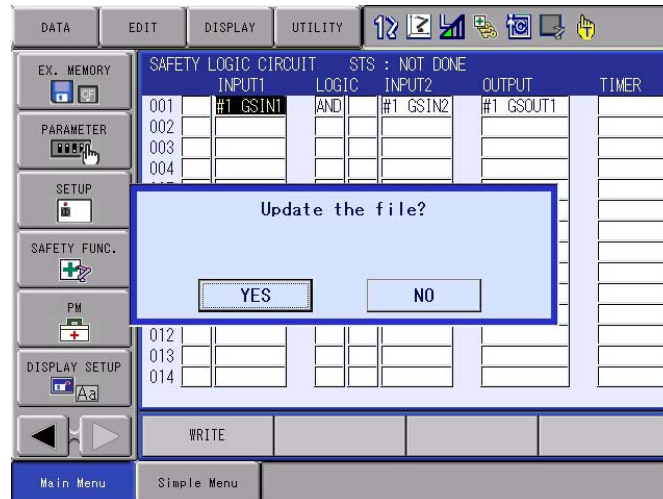


7. Transferring or updating the file

- After editing, select {WRITE} button.

If there is a blank line in the safety logic board, it will be filled automatically.

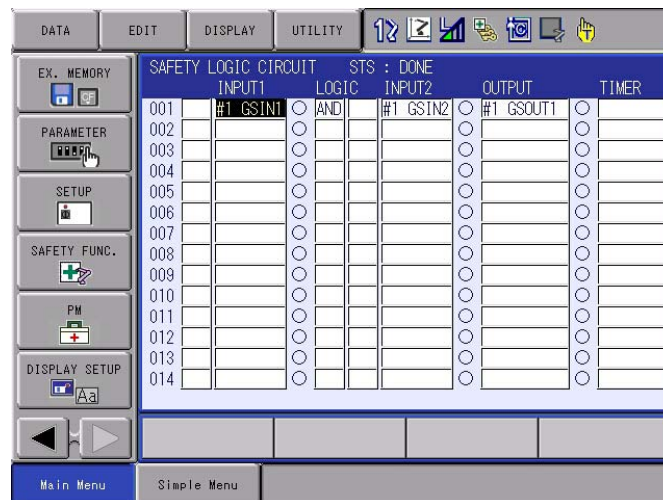
The file is transferred to the machine safety circuit board (type:YSF21-E). When the file transfer is done correctly, the confirmation dialog “Update the file?” appears.



- Press “YES”, and then the file is updated.

The file transferred to the machine safety circuit board (type:YSF21-E) is written in the FLASH ROM.

The status becomes “DONE” from “NOT DONE”.



If press “NO”, the file will not be updated. The status remains “NOT DONE”.



If press “YES” on the confirmation dialog, the all window information, such as {M-SAFETY SIGNAL ALLOC}, {SAFETY SIG. BOARD ALLOC}, {TIMER DELAY SET}, and {SAFETY LOGIC CIRCUIT} are updated. The written file in the FLASH ROM of the machine safety circuit board is also updated.



When performing {WRITE}, the universal safety and the safety field bus output signals, which are sent from the machine safety circuit board, are turned OFF till the writing processing is finished.

■ **Setup the Signal1 and Signal2**

The signal 1 and signal 2 are the signals to be used by the safety logic circuit. The following table shows the usable input signals. When add “NOT” in the beginning of the signal name, it becomes a negative logic of the input signal.

○/● shows the status of the input signal during the safety logic circuit operation.

No.	Signal Name	Abbreviation	Logic		Note
			OFF(0) ○	ON (1) ●	
1	Play mode	PLAY	Not play mode	Play mode	-
2	Teach mode	TEACH	Not teach mode	Teach mode	-
3	Programming pendant emergency stop	PPEST	Not under emergency stop [Short circuit]	Under emergency stop (Emergency stop button is pressed) [Release]	-
4	Programming pendant enable switch	PPDSW	Grip [Short circuit]	Released [Release]	-
5	Controller emergency stop	PBESP	Not under emergency stop [Short circuit]	Under emergency stop (Emergency stop button is pressed) [Release]	-
6	External emergency stop	EXESP	Not under emergency stop [Short circuit]	Under emergency stop (Emergency stop button is pressed) [Release]	-
7	External enable switch	EXDSW	Grip [Short circuit]	Released [Release]	-
8	Safeguarding	SAFF	Close [Short circuit]	Open [Release]	-
9	Servo ON status	SVON	Servo OFF	Servo ON	-
10	Universal safety input signal 1,2	GSIN1, GSIN2	OFF [Short circuit]	ON [Release]	Two points of the input signal are present for each YSF22□-E circuit board. YSF22□-E circuit board can be connected up to eight boards.
11	Safety field bus input 1 to 64	SFBIN1 to SFBIN64	OFF	ON	Can be used when the optional safety field bus function is valid.
12	Auxiliary relay	R1 to R128	OFF	ON	Can be used as the work area.
13	Safety data monitoring Monitoring result of the safety-related parameter	CSCFG01	Abnormal monitoring (Parameter changed.)	Normal monitoring (Parameter not changed.)	Compare the holding CRC for the safety-related parameter and the current CRC for the safety-related parameter, and show whether there is any change in the data.

No.	Signal Name	Abbreviation	Logic		Note
			OFF(0) ○	ON (1) ●	
14	Safety data monitoring Monitoring result of the machine safety data file	CSCFG02	Abnormal monitoring (Data file changed.)	Normal monitoring (Data file not changed.)	Compare the holding CRC for the machine safety data file and the current CRC for the machine safety data file, and show whether there is any change in the data.
15	Safety data monitoring Monitoring result of the functional safety data file	CSCFG03	Abnormal monitoring (Data file changed.)	Normal monitoring (Data file not changed.)	Compare the holding CRC for the functional safety data file and the current CRC for the functional safety data file, and show whether there is any change in the data. When the functional safety function is disabled, it is always "ON" (Normal monitoring).
16	Safety data monitoring All monitoring results	CSCFG04	Abnormal monitoring (Either of the parameter or the data file changed.)	Normal monitoring (Parameter and the data file not changed.)	Compare the holding CRCs for the safety-related parameter and the data files of the machine safety and the functional safety and the current CRCs for the parameter and the data file. Show whether there is any change in the data. (Equivalent to AND of CSCFG01, CSCFG02, and CSCFG03)



In the case of teach mode, the manipulator stops immediately as the DX200 system when the one of the following signals, PPEST, PPDSW, PBESP, or EXDSW is inputted.



The signal for the safety data monitoring can be used with system software version "DN2.70.00A (□) -00" or later.

■ Logic

The usable logical signals are shown below.

No.	Signal Name	Abbreviation	Note
1	Logic OR	OR	
2	Logic AND	AND	

■ **Output Signal**

The usable output signals are shown below.

No.	Signal Name	Abbreviation	Logic		Note
			OFF(0) ○	ON (1) ●	
1	Universal safety input signal 1,2	GSIN1, GSIN2	OFF	ON	Two points of the input signal are present for each YSF22□-E circuit board. YSF22 □-E circuit board can be connected up to eight boards.
2	Manipulator stop immediately	SVOFF CAT0	OFF	ON	-
3	Manipulator deceleration to a stop	SVOFF CAT1	OFF	ON	-
4	Safety field bus input 1 to 64	SFBIN1 to SFBIN64	OFF	ON	Can be used when the optional safety field bus function is valid.
5	Auxiliary relay	R1 to R128	OFF	ON	Can be used as the work area.
6	Safety data monitoring Holding CRC updating trigger	SICFGTRG	OFF	ON	When this signal falls (ON to OFF), each CRC of the safety-related parameter, the machine safety data file, and the functional safety data file is held. The safety data can be monitored by using the holding CRC. (For the monitoring result, refer to CSCFG01, CSCFG02, CSCFG03, CSCFG04.)

SIGNAL1: Teach mode (TEACH)

SIGNAL2: Programming pendant enable switch (PPDSW)

LOGIC: AND



OUTPUT: Manipulator deceleration to a stop
(SVOFF CAT1)

If create the safety logic circuit shown above, the manipulator will stop immediately as the DX200 system.
(Manipulator does not decelerate.)

When using the GSOUT signal, output the pulse width signal for 20 ms or longer to execute the confirmation of the machine safety internal diagnosis function and the verification of wiring.



The confirmation of the machine safety internal diagnosis function and the verification of wiring is always executed. Confirm that the pulse width of the signal to be used is 20 ms or longer prior to performing the automatic operation. When the pulse width is less than 20 ms, the following alarm may be detected wrongly.

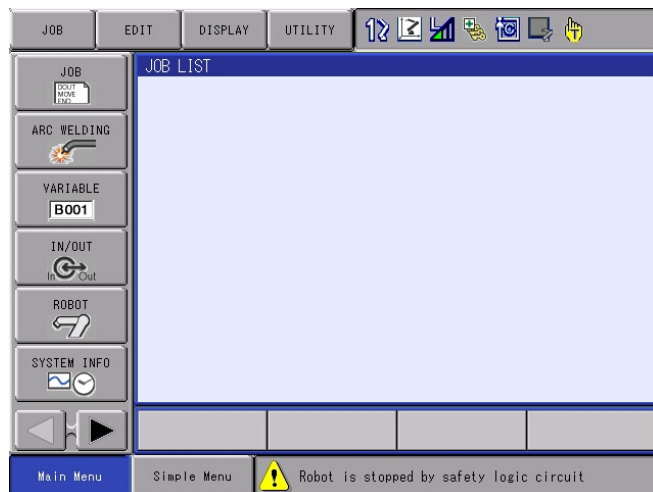
Alarm 4771 M-SAF GENERAL OUTPUT DIAG. ERROR

Alarm 4767 M-SAF GENERAL OUT FB DIAG. ERROR

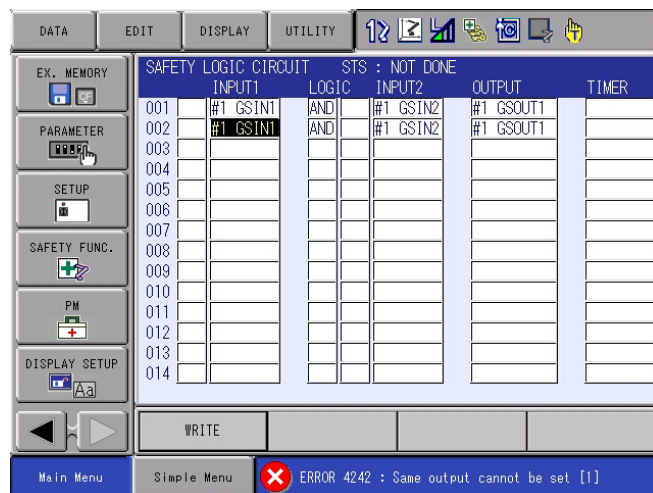
Alarm 4926 M-SAF GENERAL OUTPUT UNMATCH

8 System Setup

8.23 Safety Logic Circuit



When the manipulator is stopped by the safety logic circuit signal, the message “Robot is stopped by safety logic circuit” appears on the message area of the programming pendant. Also, the control status signal “#80343” is turned ON.



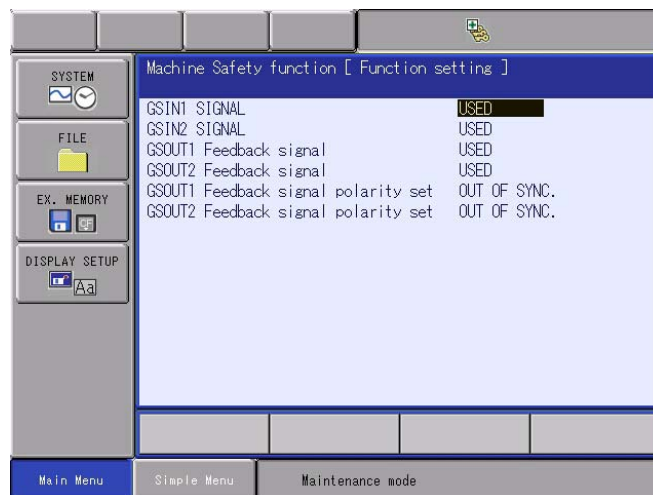
The same output signal cannot be used.

■ **Timer**

No.	Signal Name	Abbreviation	Note
1	ON delay timer1 to ON delay timer4	TIM1 ON DELAY ~ TIM4 ON DELAY	The value set in the timer delay.
2	OFF delay timer1 to OFF delay timer4	TIM1 OFF DELAY ~ TIM4 OFF DELAY	

■ **Feedback Signal (Signal Name: GSEDM1, 2) of Universal Output Signal**

The setting of whether to use or not to use the signal and the polarity setting of the feedback signal (signal name: GSEDM1, 2) of the universal output signal can be set in the following window.

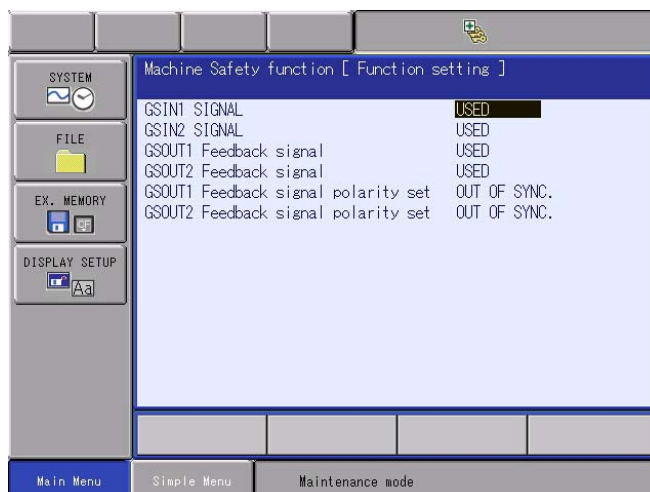


1. Turn ON the power of DX200 while pressing “Main Menu” key of the programming pendant.
2. Select {SYSTEM} - {SECURITY} and change the security mode to the safety mode.
3. Select {SYSTEM} - {SETTING} - {OPTION FUNCTION} - {Machine Safety function}. Then the following window appears and the setting change becomes possible.

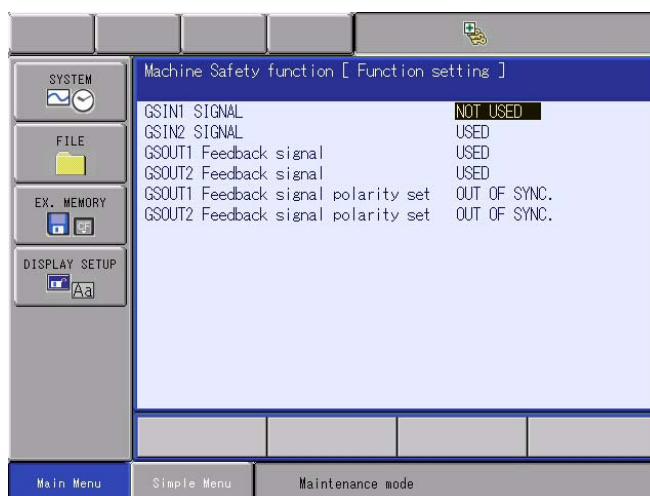
Whether the universal input signals (signal name: GSIN1, 2) are used, whether the universal output signals (signal name: GSOUT1, 2) are used, and the polarity of the universal output signals can be set.

1. Select {DETAIL} of Machine Safety.

- The DETAIL settings window of the machine safety function appears. If the two or more YSF22 boards exist in the robot coordinated specifications, press [PAGE] on the pendant and perform the settings of the second pages and the later.



It is possible to change the content of the setting each time the [SELECT] is pressed.

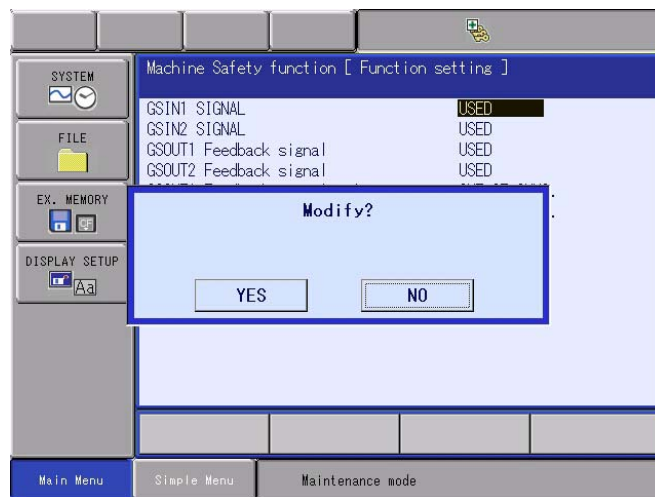


The relation of the polarity of universal output signals (signal name: GSOUT1, 2) and the universal output signals is as follows:

Polarity of GSOUT Feedback signal	Output of GSOUT signal	Feedback signal from external devices
Synchronization is performed (SYNC.)	0	0
	1	1
Synchronization is not performed (OUT OF SYNC.)	0	1
	1	0

2. Press [ENTER].

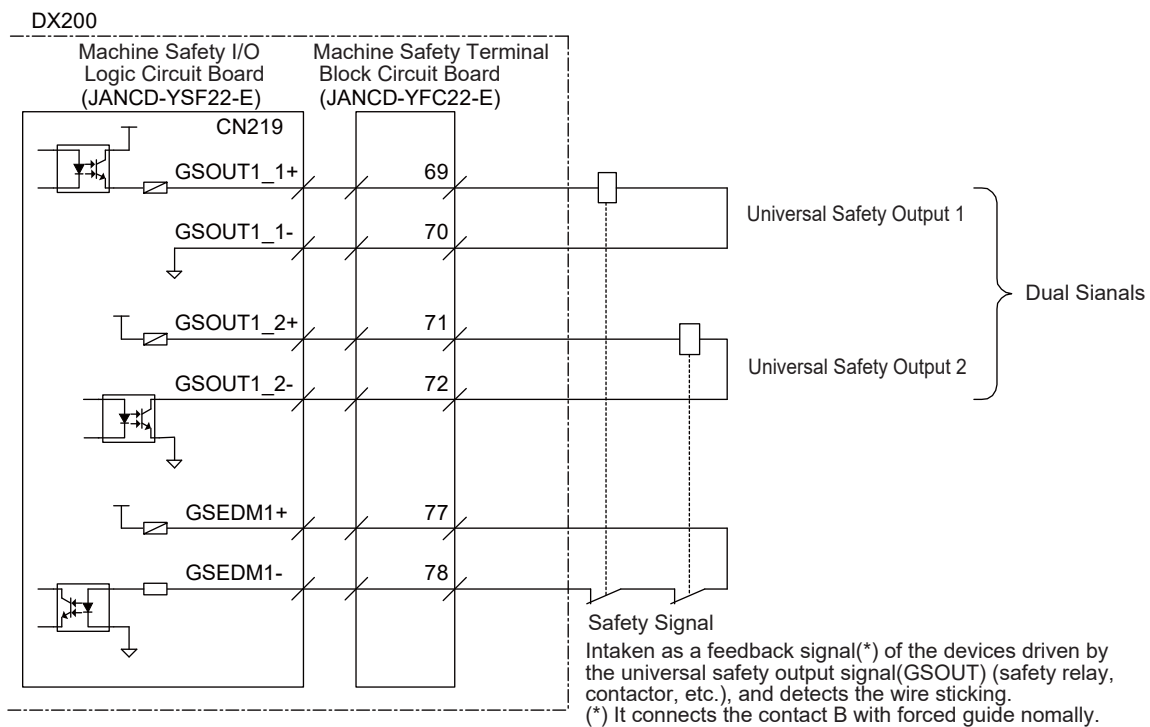
- The confirmation dialog box of parameter change appears.



3. Select {YES}.
 - If {YES} is selected, the system parameter is set automatically, and then the OPTION FUNCTION window appears.

■ Feedback Signal

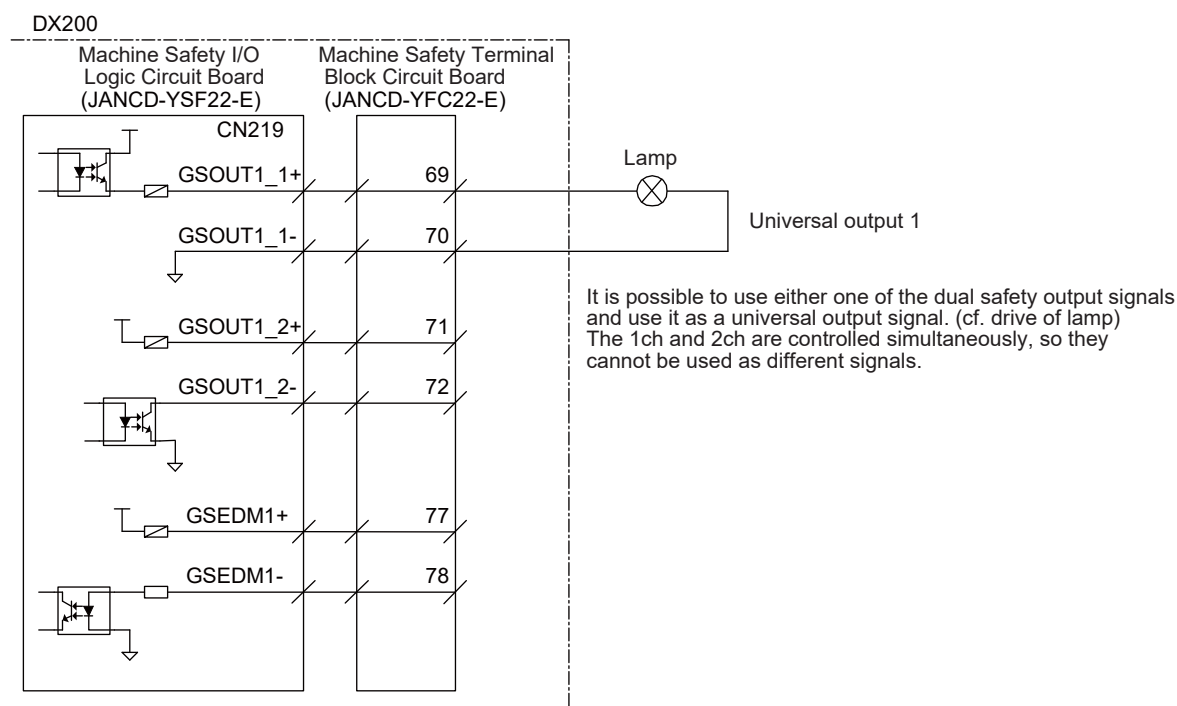
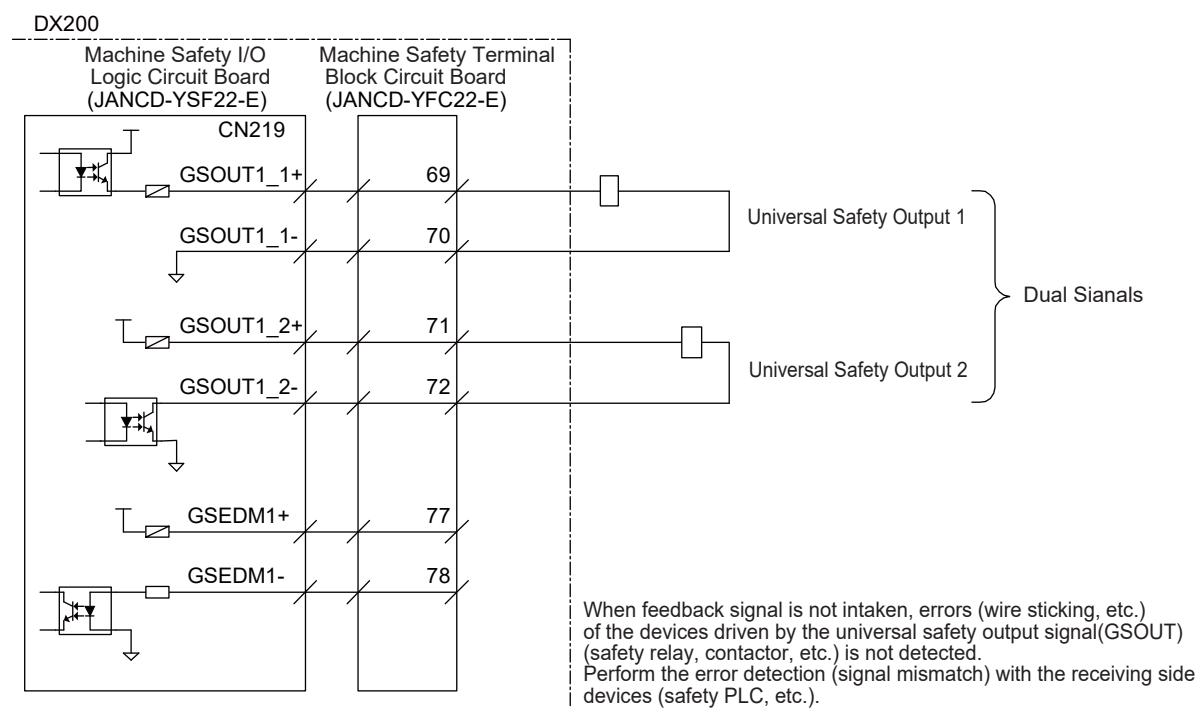
(1) With feedback signal connection



8 System Setup

8.23 Safety Logic Circuit

(2) Without feedback signal connection



■ **Safety data monitoring**

By using the signals for the safety data monitoring (CSCFG01, CSCFG02, CSCFG03, CSCFG04, SICFGTRG), the safety data (the safety-related parameter, the machine safety data file, and the functional safety data file) can be monitored whether to have been changed.

Monitoring is performed by comparing the CRC of the safety data, and if changed, that can be notified by the safety output.



The signal for the safety data monitoring can be used with system software version “DN2.70.00A (□) -00” or later.

When GSIN01 is the holding CRC updating trigger, the example of the monitoring results output to MS-OUT01 - 04 is shown below.

1. Editing the safety logic circuit

- Correspond GSIN01 to the updating trigger SICFGTRG, and MS-OUT01 - 04 to CSCFG01 - 04.

DATA		EDIT		DISPLAY		UTILITY	
SAFETY LOGIC CIRCUIT		STS : NOT DONE					
	INPUT1	LOGIC	INPUT2	OUTPUT	TIMER	COMMEN	
001	CSCFG01			MS-OUT01			
002	CSCFG02			MS-OUT02			
003	CSCFG03			MS-OUT03			
004	CSCFG04			MS-OUT04			
005	#1 GSIN1			SICFGTRG			
006							
007							
008							
009							
010							
011							
012							
013							
014							

WRITE

Main Menu Simple Menu

8 System Setup

8.23 Safety Logic Circuit

2. Transferring or updating the file

- After editing, select {WRITE}.
- When the transfer is done correctly, the confirmation dialog appears. Then select {YES}.

SAFETY LOGIC CIRCUIT				STS : DONE	
INPUT1	LOGIC	INPUT2	OUTPUT	TIMER	COMMENT
001	CSCFG01		MS-OUT01		
002	CSCFG02		MS-OUT02		
003	CSCFG03		MS-OUT03		
004	CSCFG04		MS-OUT04		
005	#1 GSIN1		SICFGTRG		
006					
007					
008					
009					
010					
011					
012					
013					
014					

Main Menu Simple Menu



Since the safety data monitoring compares the CRC held by falling the holding CRC updating trigger (signal name: SICFGTRG) and the current CRC to monitor, the monitoring result is turned OFF (○: abnormal monitoring) until the CRC is held by the holding CRC updating trigger.

3. Input of the holding CRC updating trigger


















































- When the holding CRC updating trigger (signal name: SICFGTRG GSIN01 is set this time) is turned ON (●) to OFF (○), the holding CRC is updated.
- When the holding CRC is updated, the monitoring result is turned ON (●: normal monitoring) until the safety data is changed.
- The monitoring result (signal name: CSCFG01 - 04) can be output to any signal by using the safety logic circuit. The monitoring result can be output to the external device by using the safety output.

SAFETY LOGIC CIRCUIT				STS : DONE	
INPUT1	LOGIC	INPUT2	OUTPUT	TIMER	COMMENT
001	CSCFG01		MS-OUT01		
002	CSCFG02		MS-OUT02		
003	CSCFG03		MS-OUT03		
004	CSCFG04		MS-OUT04		
005	#1 GSIN1		SICFGTRG		
006					
007					
008					
009					
010					
011					
012					
013					
014					

Main Menu Simple Menu

4. Monitoring the safety data change

- When any functional safety data file is changed, the following status appears.
- Both CSCGF03 shown the monitoring result of the functional safety data file and CSCFG04 shown the monitoring result of changing either safety data (if any) will be turned OFF (○ : abnormal monitoring).

DATA				EDIT				DISPLAY				UTILITY																							
																																			
SAFETY LOGIC CIRCUIT												STS : DONE																							
INPUT1						LOGIC						INPUT2						OUTPUT						TIMER						COMMENT					
001	CSCFG01													MS-OUT01																					
002	CSCFG02													MS-OUT02																					
003	CSCFG03													MS-OUT03																					
004	CSCFG04													MS-OUT04																					
005	#1 GSIN1													SICFGTRG																					
006																																			
007																																			
008																																			
009																																			
010																																			
011																																			
012																																			
013																																			
014																																			
Main Menu												Simple Menu																							

SAFETY LOGIC CIRCUIT STS : DONE									
	INPUT1	LOGIC	INPUT2	OUTPUT	TIMER	COMMEN			
001	CSCFG01	●		○ MS-OUT01	●				
002	CSCFG02	●		○ MS-OUT02	●				
003	CSCFG03	●		○ MS-OUT03	●				
004	CSCFG04	●		○ MS-OUT04	●				
005	#1 GSIN1	○		○ SICFGTRG	○				
006		○		○	○				
007		○		○	○				
008		○		○	○				
009		○		○	○				
010		○		○	○				
011		○		○	○				
012		○		○	○				
013		○		○	○				
014		○		○	○				

Main Menu Simple Menu

The safety parameter and the data file for monitoring are shown below.

(1) Safety-related parameter for monitoring

- Robot alignment parameter (RC.PRM)
- Coordinate origin parameter (RO.PRM)
- Servo parameter (SV.PRM)
- Servo motor parameter (SVM.PRM)
- System definition parameter (SD.PRM)
- Motion function parameter (MF.PRM)
- Functional definition parameter (FD.PRM)
- Robot control extension parameter (RE.PRM)
- Safety function parameter (FMS.PRM)

(2) Machine safety data file for monitoring

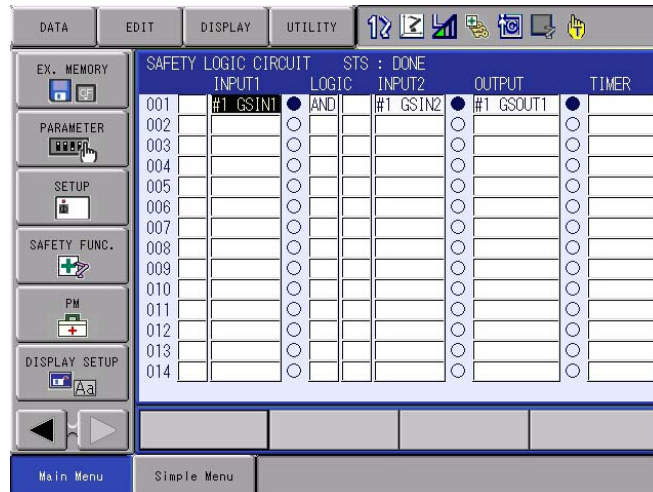
- Safety logic circuit related file (YSFLOGIC.DAT)

(3) Functional safety data file for monitoring

- Each axis motion range limited file (AXRNGLMT.DAT)
- Each axis speed monitoring file (AXSPDMON.DAT)
- Speed limited file (SPDLMT.DAT)
- Robot motion range limited file (RBRNGLMT.DAT)
- Tool angle monitoring setting file (TLANGMON.DAT)
- Tool change monitor/Tool number selection file (TLCHGMON.DAT)
- Home positioning file (ABSO.DAT)
- Tool file (TOOL.CND)
- Tool interference file (TOOLINTF.CND)

8.23.3 Performing the Safety Logic Circuit

The safety logic circuit is always performed except updating the file.
Confirm that the status is "DONE". When setting signal is turned ON, the mark "●" is displayed, and when setting signal is turned OFF, the mark "○" is displayed.



8.23.4 The Safety Logic Circuit Expansion Function

8.23.4.1 Setting for the Safety Logic Circuit Expansion Function

When using the safety logic circuit expansion function, start the maintenance mode and perform the following settings.

1. Start the maintenance mode.
 - While pressing the main menu key on the programming pendant, turn ON the DX200. The maintenance window is displayed.



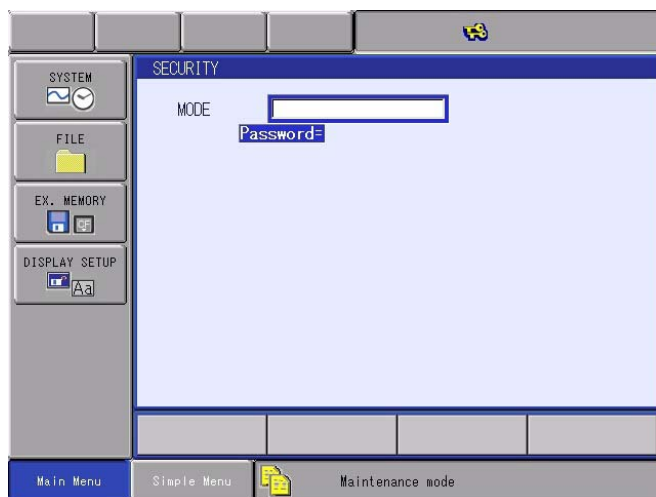
2. Change the security.


- Select {SYSTEM}-{SECURITY}-{SAFETY MODE}.

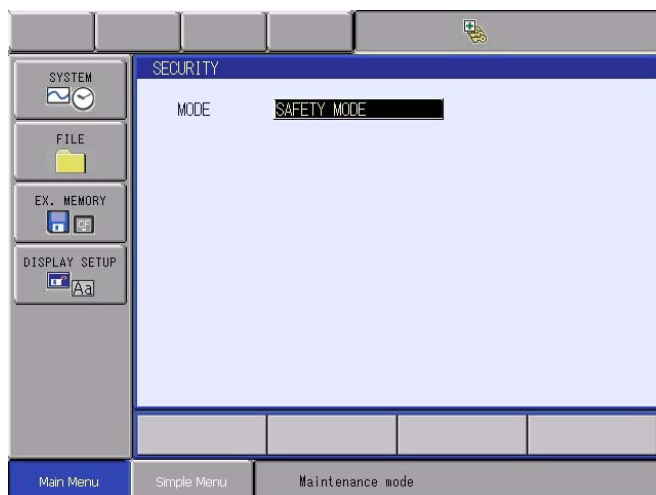


3. Change to the safety mode.

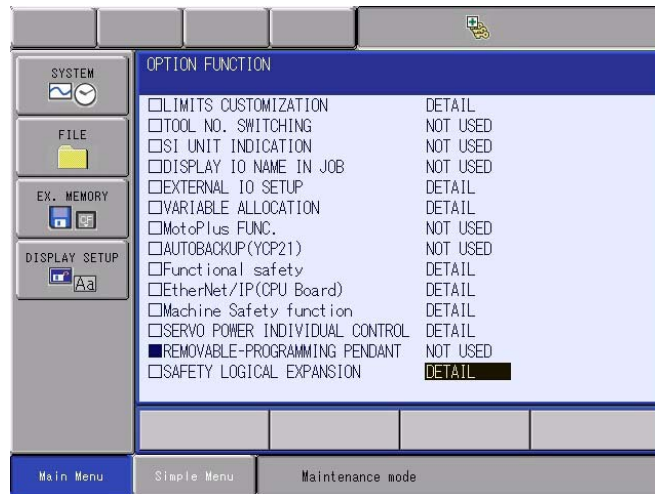
- Enter the password for the safety mode and press [ENTER] on the programming pendant.



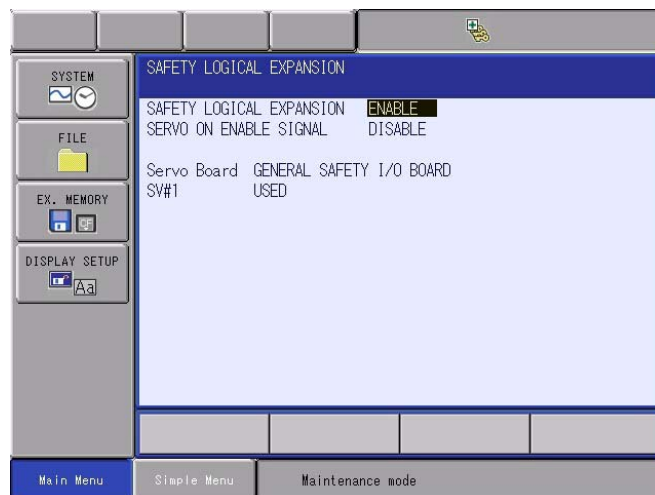
4. When the entered password is correct, the mode is changed to {SAFETY MODE}. After changing to the safety mode, the icon  is displayed on the status area.



5. After changing to the safety mode, select {SYSTEM}-{SETTING}-{OPTION FUNCTION}-{SAFETY LOGICAL EXPANSION}.



6. Press the select key on the programming pendant to enable {SAFETY LOGICAL EXPANSION}. If the general safety I/O board (type: YSF24-E) is connected to the DX200, select "USED".



<Setting for SAFETY LOGICAL EXPANSION>

ENABLE : The safety logic circuit expansion function is available.

DISABLE: The safety logic circuit expansion function is not available.

<Setting for SERVO ON ENABLE SIGNAL>

ENABLE : S-SVON_EN signal is available in the safety logic circuit expansion function. For details on this function, refer to *chapter 8.23.4.7*.

DISABLE: S-SVON_EN signal is not available in the safety logic circuit expansion function. When this signal is disabled, the signal name is not displayed on the safety logic circuit.

<Setting for GENERAL SAFETY I/O BOARD (type: YSF24-E)>

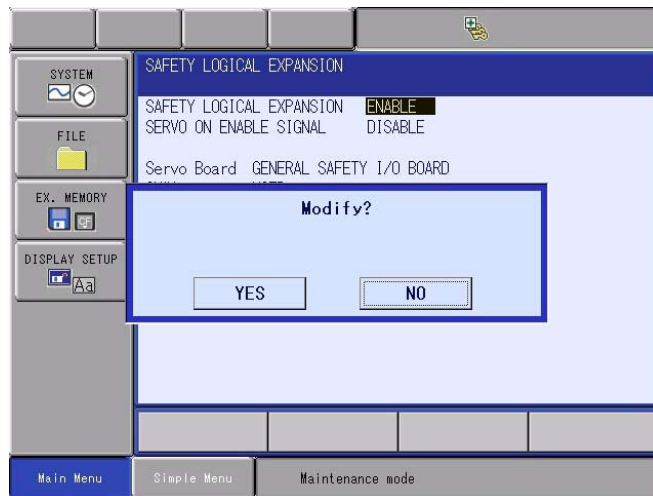
USED : Input and output signals of the general safety I/O board (type: YSF24-E board) is available both on the functional safety board and in the safety logic circuit expansion function. For details on this function, refer to *chapter 8.23.4.10*.

NOT USED: Input and output signals of the general safety I/O board (type: YSF24-E board) is available only on the functional safety board.

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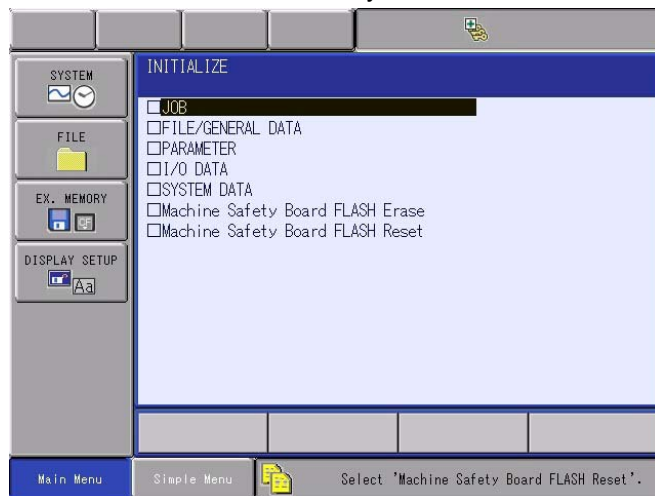
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7. Press [Enter] on the programming pendant and select “YES” to update the data.

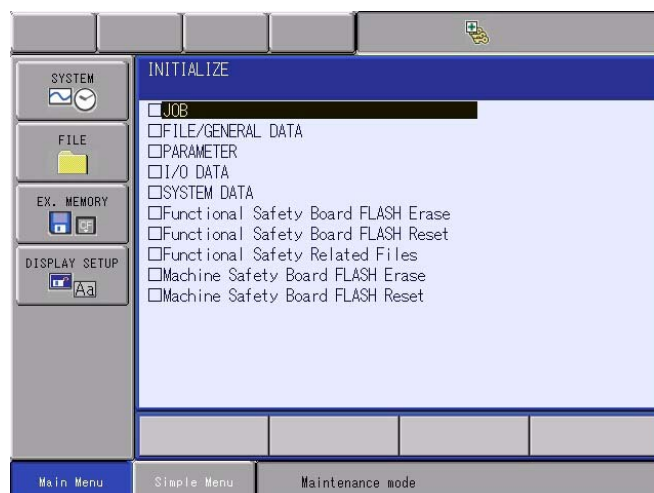


8. After the update, select {FILE}-{INITIALIZE}-{Machine Safety Board FLASH Reset}. The initialization is completed when a bleep sounds. Also, the message on the programming pendant disappears. If the message, “Select 'Machine Safety Board FLASH Reset'.” appears in the message area on the programming pendant, reset the FLASH data of the functional safety board.

<The window when the functional safety function is disabled>



<The window when the functional safety function is enabled>



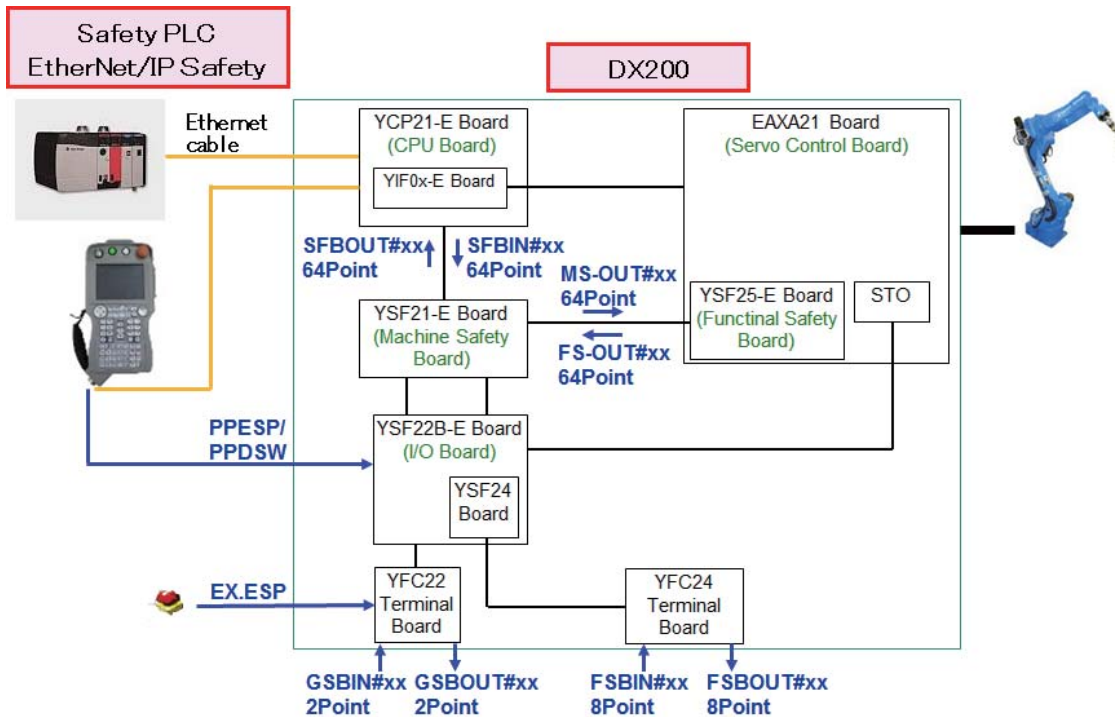
9. Turn OFF/ON the DX200.

8.23.4.2 Outline of the Safety Logic Circuit Expansion Function

In the safety logic circuit expansion function, input and output signals and logic (instructions) available in the logic circuit are expanded. Also, the signal that has been attained by the hardware can be also attained by the safety PLC (optional function). The machine safety board monitors the hard-wired signal at all times. Therefore the safety function to turn OFF the servo power supply to the manipulator when an error is detected is still maintained.

Also, by using MS-OUT signal (the output data from the machine safety board) and FS-OUT signal (the output data from the functional safety board), the data can be transferred between the machine safety board and the functional safety board (optional).

The following is the signal flow in the safety logic circuit expansion function.



When using the safety PLC, enable the optional safety field bus function.



WARNING

- Compared to the hard-wired signal, the output signal from the safety PLC (optional) requires time to be transmitted to the machine safety board (type: YSF21-E) to stop the manipulator. Therefore, to start detecting the signal on the machine safety board is a little delayed. When stopping the manipulator by the output signal from the safety PLC, consider the delayed time and perform enough risk assessment for the robot system.

8.23.4.3 Setting the Comment

Comments (up to 32 characters) can be input in the following windows.

- Select {SAFETY FUNC.}-{SAFETY LOGIC CIRCUIT} to display the safety logic circuit window on the programming pendant.

	INPUT1	LOGIC	INPUT2	OUTPUT	TIMER	COMMENT
001						
002						
003						
004						
005						
006						
007						
008						
009						
010						
011						
012						
013						
014						

- Select {SAFETY FUNC.}-{SAFETY SIG. BOARD ALLOC} to display the safety signal board allocation window on the programming pendant. The sub menu of {SAFETY SIG. BOARD ALLOC} is displayed only when the optional safety field bus is enabled.

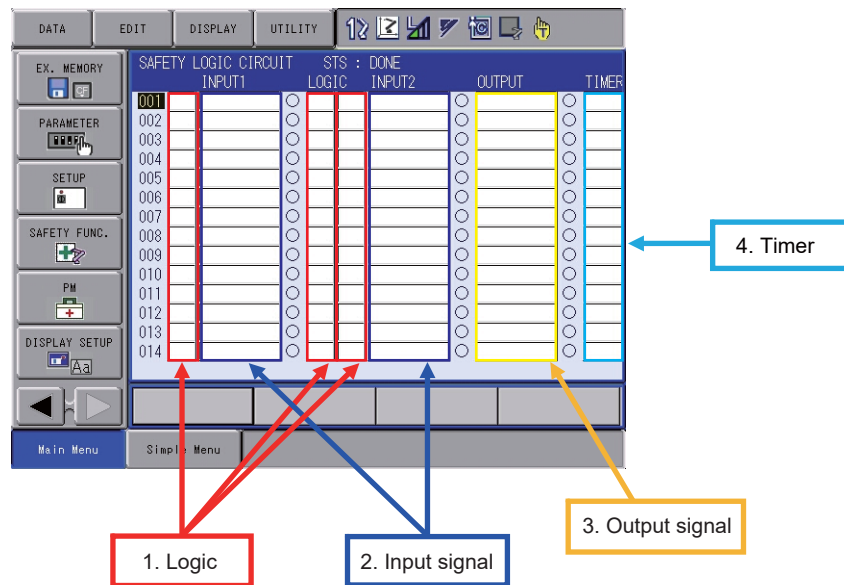
OUTPUT	UNIT	COMMENT
SFBOUT01	NOT USED	
SFBOUT02	NOT USED	
SFBOUT03	NOT USED	
SFBOUT04	NOT USED	
SFBOUT05	NOT USED	
SFBOUT06	NOT USED	
SFBOUT07	NOT USED	
SFBOUT08	NOT USED	
SFBOUT09	NOT USED	
SFBOUT10	NOT USED	
SFBOUT11	NOT USED	
SFBOUT12	NOT USED	
SFBOUT13	NOT USED	
SFBOUT14	NOT USED	

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8.23.4.4 Adding Input and Output Signals and Instructions in Safety Logic Circuit Expansion Function

The following is the explanation of the expanded input and output signals and logic (instructions) available in the safety logic circuit.



1. Logic

No.	Display	Contents	Standard	Expansion Function		Note
				Safety Field Bus Disabled	Safety Field Bus Enabled	
1	NOT	Negative	○	○	○	
2	DSU	Detection of signal rising edge	-	●	●	
3	DSD	Detection of signal falling edge	-	●	●	
4	AND	Logic AND	○	○	○	
5	OR	Logic OR	○	○	○	

○ : Already supported in the standard function ● : Additional instruction

2. Input signal 1/ Input signal 2

No.	Display	Contents	Standard	Expansion Function		Note
				Safety Field Bus Disabled	Safety Field Bus Enabled	
1	EXDSW	External enable switch signal (●: Servo OFF [release]/ ○ : Servo ON available [short circuit])	○	○	○	
2	EXESP	External emergency stop input signal (●:Under emergency stop [release]/ ○ :Not under emergency stop [short circuit])	○	○	○	
3	#n FSBIN[x]	Functional safety universal input 8 points (YSF24-E) (●:OFF [release]/ ○ :ON [short circuit])	-	●	●	
4	#n FSBOUT[x]	Functional safety universal output 8 points (YSF24-E) (●:ON status/ ○ :OFF status)	-	●	●	
5	FS-OUT[x]	Functional safety output in the safety logic circuit 64 point (●:ON status/ ○ :OFF status)	-	●	●	
6	FST	Full speed mode (●: Full speed mode/ ○ : Safety speed)	-	●	●	
7	#n GSIN[x]	Machine safety universal input 2 points (YSF22B-E) (●:OFF [release]/ ○ :ON [short circuit])	○	○	○	
8	#n GSOUT[x]	Machine safety universal output 2 points (YSF22B-E) (●:ON output/ ○ :OFF output)	-	●	●	
9	HOLD	Hold (●:OFF (Hold signal is not input.)/ ○ :ON (Hold signal is being input.))	-	●	●	
10	MS-OUT[x]	Machine safety output used in the safety logic circuit (64 points) (●:ON status/ ○ :OFF status)	-	●	●	
11	#n ONEN[x]	Servo power supply individual control input status (●:Individual servo OFF status/ ○ :Normal status)	-	●	●	
12	PBESP	Controller emergency stop signal (●: Under emergency stop [release]/ ○ :Not under emergency stop [short circuit])	○	○	○	
13	PLAY	Play mode (●:Play mode/ ○ :Not play mode)	○	○	○	
14	PPDSW	PP enable switch signal (●:Released [release]/ ○ :Grip [short circuit])	○	○	○	
15	PPESP	PP emergency stop signal (●:Under emergency stop [release]/ ○ :Not under emergency stop [short circuit])	○	○	○	
16	PROFISafe	PROFISafe communication status (●:Normal communication/ ○ :Abnormal communication)	-	-	●	Appears only when the optional PROFISafe is enabled.

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17	R[x]	Workpiece area 128 points (●:ON status/ ○ :OFF status)	○	○	○	
18	REMOTE	Remote mode (●:Remote mode/ ○ :Not remote mode)	-	●	●	
19	S-EXDSW	External enable switch signal (●:ON (servo ON enabled)/ ○ :OFF (servo OFF status))	-	-	●	
20	S-EXESP	External emergency stop signal (●:Release/ ○ :Press (emergency stop status))	-	-	●	
21	S-FST	Full speed mode in the safety logic circuit (●: Full speed mode/ ○ : Safety speed)	-	-	●	
22	S-SAFF	Safeguarding signal (●:Close/ ○ :Open (servo OFF status))	-	-	●	
23	#n S-ONEN[x]	Servo power supply individual control input in the safety logic circuit 4 points (●:Individual servo OFF status/ ○ :Normal status)	-	-	●	
24	S-SVON_EN	Servo ON enable signal (●:Servo ON enabled status/ ○ :Servo OFF)	-	●	●	
25	SAFF	Safeguarding signal (●:Open/ ○ :Close)	○	○	○	
26	SFBIN[x]	Safety field bus input signal 64 points (●:ON status/ ○ :OFF status)	○	○	○	
27	SFBOUT[x]	Safety field bus output signal 64 points (●:ON status/ ○ :OFF status)	-	-	●	
28	#n SFRON[x]	Servo ON/OFF status of valid contactor signal (●:Servo ON/ ○ :Servo OFF)	-	●	●	
29	SPIN[x]	Specific input 32 points (●:ON status/ ○ :OFF status)	-	●	●	
30	SVON	Servo ON/OFF status (●:Servo ON/ ○ :Servo OFF)	○	○	○	
31	SVONRDY0	Servo ON ready (●:Servo ON available status/ ○ : Servo OFF)	-	●	●	
32	TEACH	Teach mode (●:Teach mode/ ○ :Not teach mode)	○	○	○	

○ : Already supported in the standard function ● : Additional instruction
n: Number of machine safety I/O board (type: YSF22-E) (up to eight boards)

3. Output signal

No.	Display	Contents	Standard	Expansion Function		Note
				Safety Field Bus Disabled	Safety Field Bus Enabled	
1	#n GSOUT[x]	Machine safety universal output 2 points (YSF22B-E) (●:ON output/ ○:OFF output)	○	○	○	
2	MS-OUT[x]	Machine safety output in the safety logic circuit 64 points (●:ON output/ ○:OFF output)	-	●	●	
3	R[x]	Workpiece area 128 point (●:ON output/ ○:OFF output)	○	○	○	
4	S-EXDSW	External enable switch signal (●:ON (servo ON enabled)/ ○:OFF (servo OFF status))	-	-	●	
5	S-EXESP	External emergency stop signal (●:Release/ ○:Press (emergency stop status))	-	-	●	
6	S-FST	Full speed mode in the safety logic circuit (●: Full speed mode/ ○: Safety speed)	-	-	●	
7	#n S-ONEN[x]	Servo power supply individual control input in the safety logic circuit 4 points (●:Individual servo OFF status/ ○:Normal status)	-	-	●	
8	S-SAFF	Safeguarding signal (●:Close/ ○:Open (servo OFF status))	-	-	●	
9	S-SVON_EN	Servo ON enable signal (●:Servo ON enabled status/ ○:Servo OFF)	-	●	●	
10	SFBOUT[x]	Safety field bus output signal 64 points (●:ON output/ ○:OFF output)	○	-	○	
11	SVOFF CAT0	Turns OFF the power supply to the manipulator. (Cat0 stopped) (●:Request stop/ ○:Not request stop)	○	○	○	
12	SVOFF CAT1	Turns OFF the power supply to the manipulator. (Cat1 stopped) (●:Request stop/ ○:Not request stop)	○	○	○	

○ : Already supported in the standard function ● : Additional instruction
n: Number of machine safety I/O board (type: YSF22-E) (up to eight boards)



When using the S-FSY signal in the safety logic circuit, the hard-wired FST signal input in the YSF22 board is ignored. When using the hard-wired FST signal, delete the S-FST signal used in the safety logic circuit.



When using the GSOUT signal and the XOUT signal, output the pulse width signal for 20 ms or longer to execute the confirmation of the machine safety internal diagnosis function and the verification of wiring.

The confirmation of the machine safety internal diagnosis function and the verification of wiring is always executed. Confirm that the pulse width of the signal to be used is 20 ms or longer prior to performing the automatic operation. When the pulse width is less than 20 ms, the following alarm may be detected wrongly.

Alarm 4771 M-SAF GENERAL OUTPUT DIAG. ERROR
Alarm 4767 M-SAF GENERAL OUT FB DIAG. ERROR
Alarm 4926 M-SAF GENERAL OUTPUT UNMATCH
Alarm 4772 YSF24 GENERAL OUTPUT DIAG. ERROR
Alarm 4768 YSF24 GENERAL OUT FB DIAG. ERROR
Alarm 4927 YSF24 GENERAL OUTPUT UNMATCH

4. Timer

No.	Display	Contents	Standard	Expansion Function		Note
				Safety Field Bus Disabled	Safety Field Bus Enabled	
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	○	○	○	

○ : Already supported in the standard function ● : Additional instruction



WARNING

- If there is an error in the safety I/O signal connection, the safety function is damaged and a serious accident may happen. When setting or changing the safety I/O signal connection, be sure to confirm it operates correctly.

8.23.4.5 Output Signal

The following is the explanation of the output signals expanded in the safety logic circuit function.

Expanded signal name	Hard-wired signal name	Explanation
S-EXDSW	EXDSW	<ul style="list-style-type: 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 machine safety board regards this as the short-circuit status. • The machine safety board monitors the hard-wired EXDSW signal at all times only in the teach mode. When one of the EXDSW signal, the S-EXDSW signal and the enable switch on the programming pendant is OFF, the servo power supply is turned OFF. • The control status signal #80036 is turned ON/OFF.
S-EXESP	EXESP	<ul style="list-style-type: none"> • This is the external emergency stop input signal. • When the S-EXDSW signal is turned OFF, the signal performs the similar control to the EXESP signal when it is turned OFF. • When the S-EXESP signal is not used in the safety logic circuit, the machine safety board regards this as the short-circuit status. • The hard-wired EXESP signal is always monitored. When either the EXESP signal or the S-EXESP signal is OFF, the servo power supply is turned OFF. • The control status signal #80025 is turned ON/OFF.
S-FST	FST	<ul style="list-style-type: none"> • This is the full speed signal and functions only in the teach mode. • When this signal is ON in the teach mode, the manipulator operation speed can be switched to 100% output. The machine safety board does not check the status of the hard-wired FST signal if the S-FST signal is used in the safety logic circuit. • The control status signal #80047 is turned ON/OFF.
#n S-ONEN[x]	ON ENABLE[x]	<ul style="list-style-type: none"> • This signal controls the servo power supply in units of control groups. (n shows the number of the YSF22 board and x shows the available point number. Four points can be controlled with a YSF22 board.) • When The S-ONEN signal is turned ON, the signal performs the similar control to the ON ENABLE signal. Therefore, the servo power of the connected control group can be individually turned ON/OFF. • When the S-ONEN signal is not used in the safety logic circuit, the machine safety board regards this as the short-circuit status. • The control status signal #80061 is turned ON/OFF.
S-SAFF	SAFF	<ul style="list-style-type: none"> • This is the safeguarding signal and functions only in the play mode. • When The ONS-SAFF signal is turned OFF, the signal performs the similar control to the SAFF signal. The hard-wired SAFF signal is monitored at all times only in the play mode. When either the SAFF signal or the S-SAFF signal is OFF, the servo power supply is turned OFF. • When the S-EXESP signal is not used in the safety logic circuit, the machine safety board regards this as the short-circuit status. • The control status signal #80023 is turned ON/OFF.
S-SVON_EN	(None)	For details, refer to <i>chapter 8.23.4.7</i> .
MS-OUT	(None)	This is the data area to transfer the data created in the safety logic circuit to the machine safety board.

8.23.4.6 Message of Output Signals

The signals input by the hard-wired and the safety logic circuit display the following messages on the programming pendant.

Signal name	Message on the programming pendant
FST	Full-speed test mode.
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)
EXDSW	EXDSW signal is OFF.
S-EXDSW	EXDSW signal is OFF.(Safety Logical Circuit)
SAFF	Safety guard is open.
S-SAFF	Safety guard is open. (Safety Logical Circuit)
#x ONENn	Servo on enable signal (ON-EN) is OFF.
#x S-ONENn	Servo on enable signal (ON-EN) is OFF. (Safety Logical Circuit)
(None)	(The hard-wired signal does not have this function.)
S-SVON_EN	SERVO ON ENABLE signal is OFF. (Safety Logical Circuit)

(Note) The upper line: the message by the hard-wired signal
The lower line: the message by the safety logic circuit

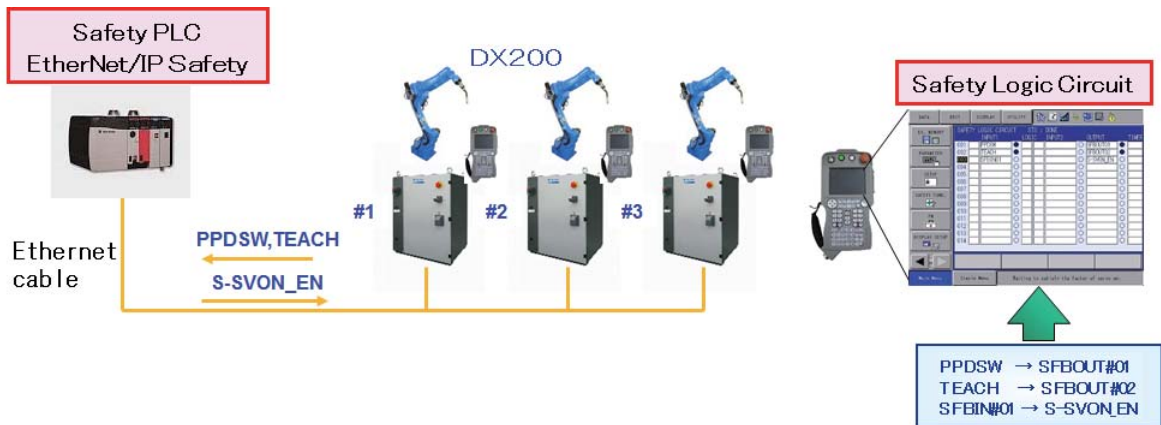
8.23.4.7 Enable Switch Link Function

This function is enabled only in the teach mode.

Normally in the teach mode, the servo power is turned ON when the enable switch is gripped while the servo ON LED on the programming pendant is flashing. However in this function, when the S-SVON_EN signal is enabled, the servo power is not turned ON unless the enable switch is gripped and the S-SVON_EN signal is turned ON.

The following is an example of using the optional safety PLC.

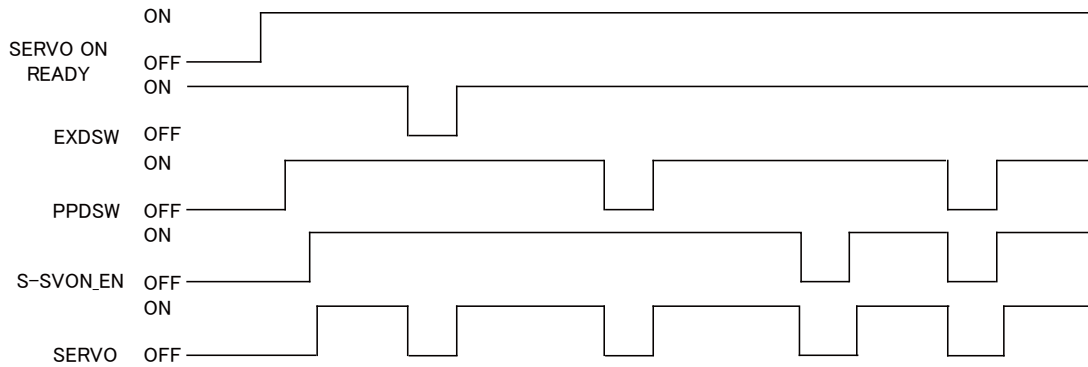
1. The enable switch signal on the programming pendant and the teach mode information are output to the safety PLC by the safety logic circuit. The value output from the safety PLC is input in the S-SVON_EN signal of the safety logic circuit.
2. When the S-SVON_EN signal is turned ON, the servo power is ON and when the enable switch is released, the signal is OFF.



The Servo ON/OFF Status When the Servo On Enable (S-SVON_EN) Signal is Enabled.

MODE	EXDSW	PPDSW	S-EXDSW	S-SVON_EN	Servo ON/OFF Status
TEACH	ON	ON	ON	ON	Servo ON
TEACH	ON	ON	Not Used	ON	Servo ON
TEACH	ON	ON	Not Used	OFF	Servo OFF
TEACH	ON	OFF	Not Used	ON	Servo OFF

*Note: Not Used means no circuit is configured in the safety logic circuit.



The Timing Chart When the Servo On Enable (S-SVON_EN) Signal is Enabled.



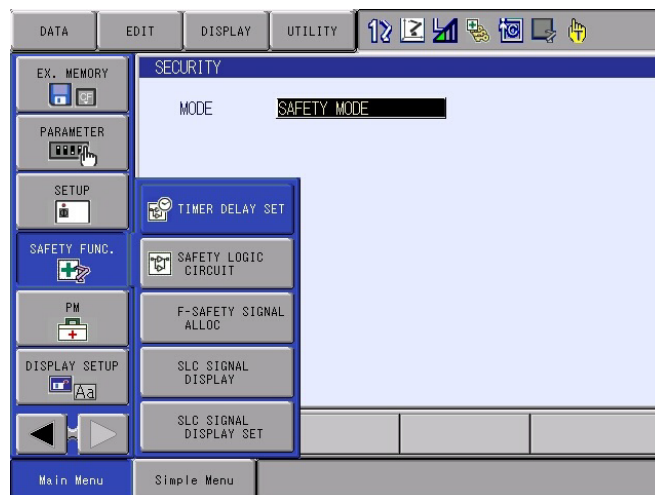
WARNING

- Configure the optional safety PLC circuit so that the servo ON enable (S-SVON_EN) signal is turned OFF by releasing the enable switch on the programming pendant when this function is enabled.

8.23.4.8 Signal List Window

The ON/OFF status list of signals used in the safety logic circuit is displayed.

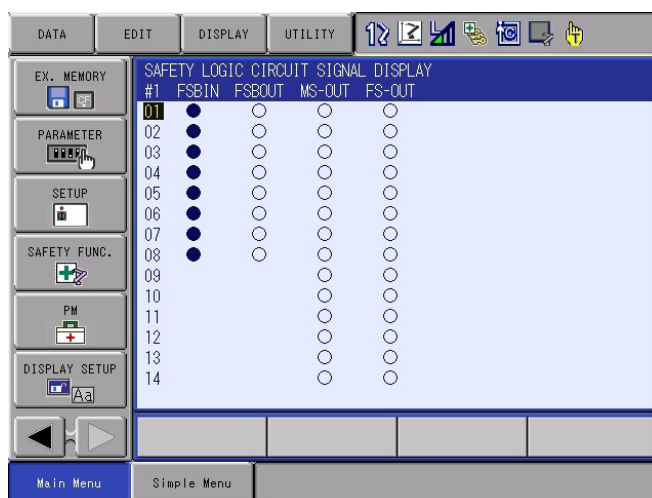
1. Select {SAFETY FUNC.}-{SLC SIGNAL DISPLAY}.



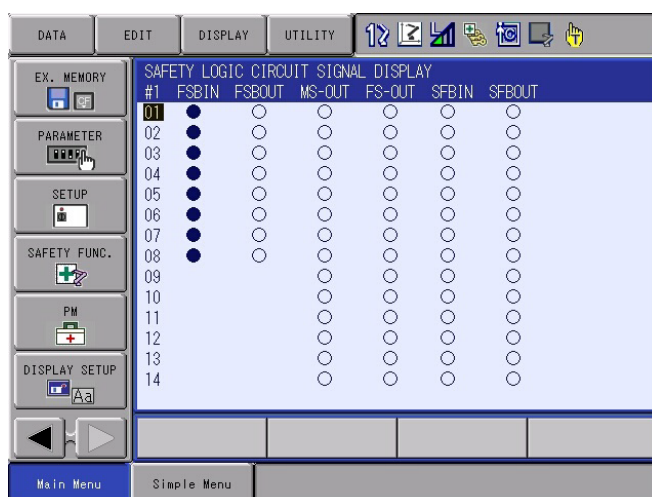
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- The signals used in the safety logic circuit are displayed. When the optional field bus function is enabled, its signals are also displayed.



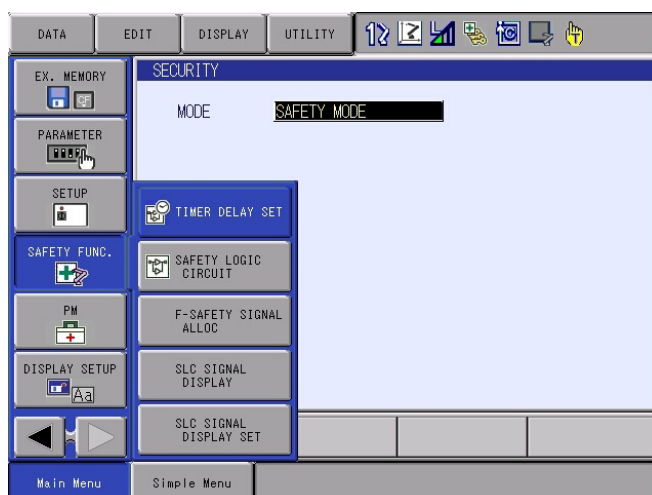
<The signal list when the field bus function (optional) is enabled>



8.23.4.9 Setting ON/OFF to the Input Signals

The ON/OFF status of input signals used in the safety logic circuit can be switched.

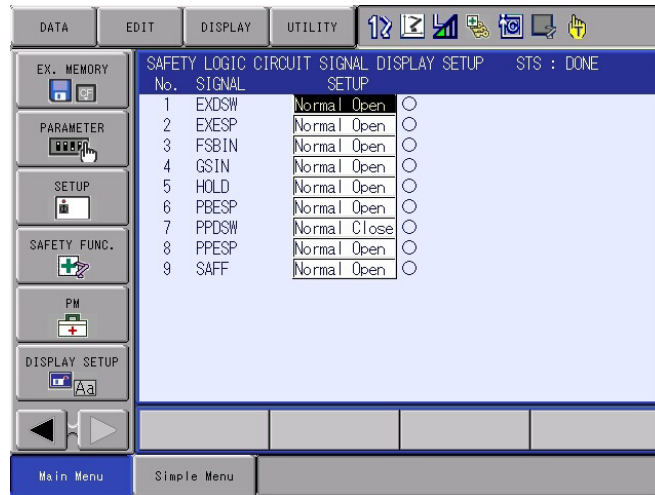
- Select {SAFETY FUNC.}-[SLC SIGNAL DISPLAY SET].



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2. The ON/OFF status of input signals used in the safety logic circuit can be switched by pressing the select key on the programming pendant .

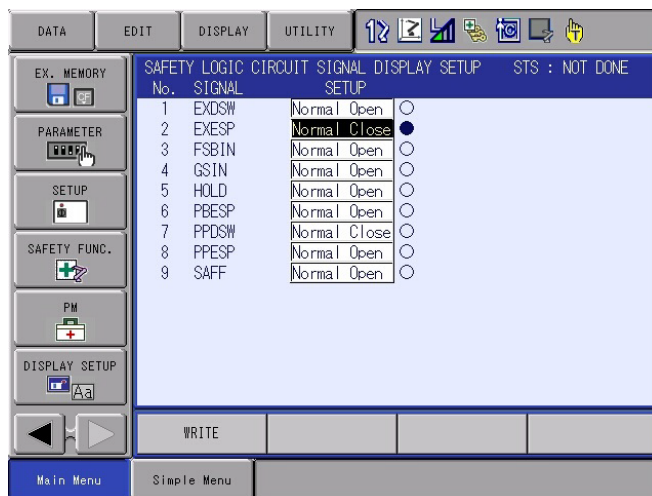


No.	Signal Name	Normal Open	Normal Close
1	EXDSW	External enable switch signal (●:Servo OFF/ ○ :Servo ON enabled)	External enable switch signal (●:Servo ON enabled/ ○ :Servo OFF)
2	EXESP	External emergency stop input signal (●:Under emergency stop/ ○ :Normal)	External emergency stop input signal (●:Normal/ ○ :Under emergency stop)
3	FSBIN	Universal safety input signal (YSF24B-E) (●:OFF [release]/ ○ :ON [short circuit])	Universal safety input signal (YSF24B-E) (●:ON [short circuit]/ ○ :OFF [release])
4	GSIN	Machine safety universal safety input signal (YSF22B-E) (●:OFF [release]/ ○ :ON [short circuit])	Machine safety universal safety input signal (YSF22B-E) (●:ON [short circuit]/ ○ :OFF [release])
5	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.))
6	PBESP	Controller emergency stop signal (●:Under emergency stop/ ○ :Normal)	Controller emergency stop signal (●:Normal/ ○ :Under emergency stop)
7	PPDSW	Programming pendant enable switch signal (●:Grip/ ○ :Not grip (servo OFF))	Programming pendant enable switch signal (●:Not grip (servo OFF)/ ○ :Grip)
8	PPESP	Programming pendant emergency stop signal (●:Under emergency stop/ ○ :Normal)	Programming pendant emergency stop signal (●:Normal/ ○ :Under emergency stop)
9	SAFF	Safeguarding signal (●: Open (safeguarding opened)/ ○ :Close)	Safeguarding signal (●:Close/ ○ :Open (safeguarding opened))

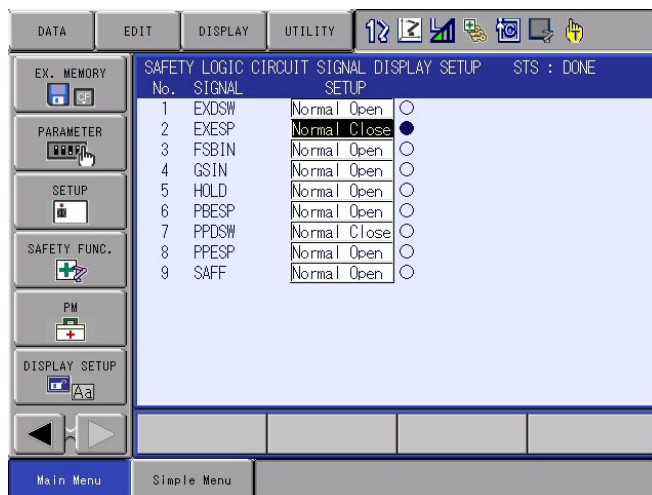
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3. For example, when the EXESP signal is changed from “Normal Open” to “Normal Close”, the mark “●” indicates the external emergency stop signal is in the normal state (Normal Close) and the mark “○” indicates the external emergency stop signal is being input (Normal Open).



4. Select “WRITE” and then “CONFIRM” to enable the changed settings. When the data is updated correctly, the status on the title line is changed from NOT DONE to DONE.

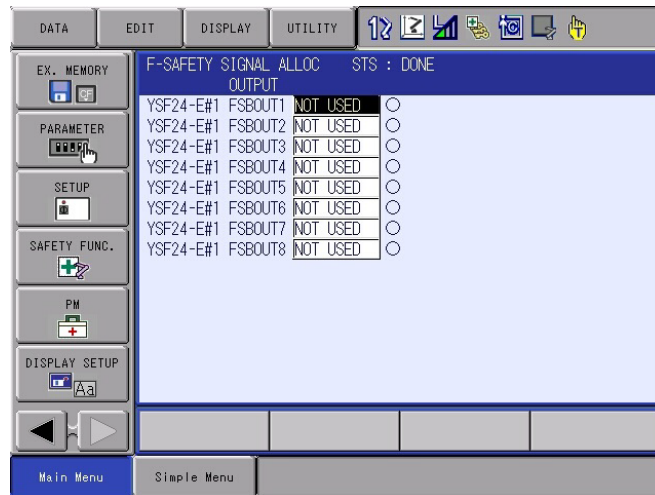


When the ON/OFF settings of the input signals are changed, outputting the signals that have been output normally may fail. This may lead to a serious accident. After changing the ON/OFF settings of the input signals, be sure to confirm the safety logic circuit operates normally.

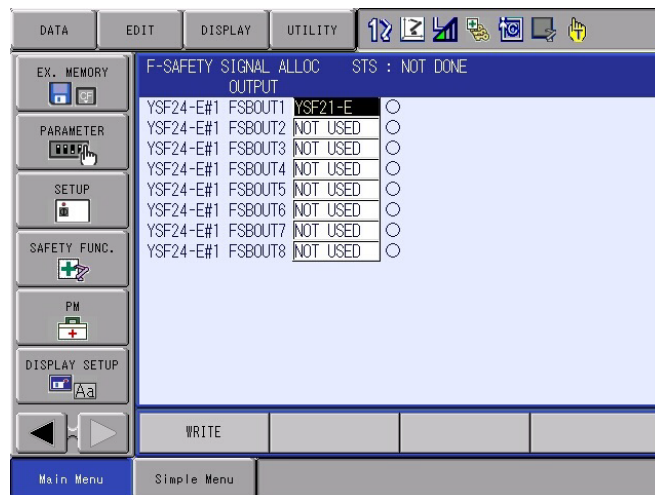
8.23.4.10 Setting for the Universal Safety Output Signals

The general safety output signals (type: YSF24-E) that have been used only on the optional functional safety board can be also used in the safety logic circuit.

1. Select {SAFETY FUNC.}->{F-SAFETY SIGNAL ALLOC} to display the following window. The marks at the right end indicates OFF/ON status. The mark “○” means OFF and the mark “●” means ON.



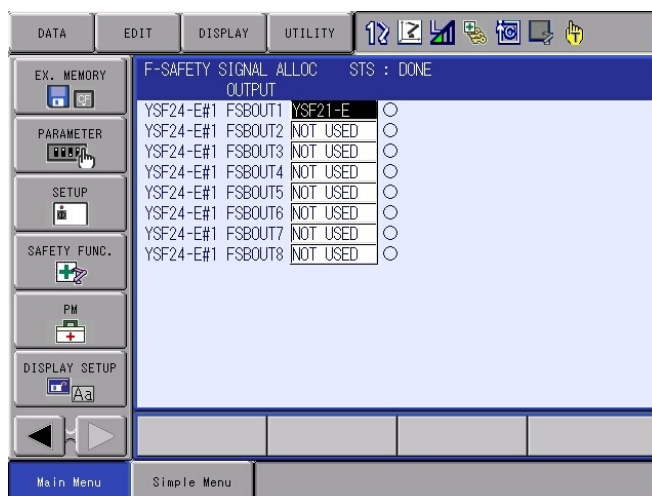
2. To use the universal safety output signals in the safety logic circuit, press the select key on the programming pendant and set “YSF21-E”. The universal safety output signals allocated to “YSF21-E” are available in the safety logic circuit. However, if the setting is “NOT USED”, the signals are available only on the functional safety board as usual.



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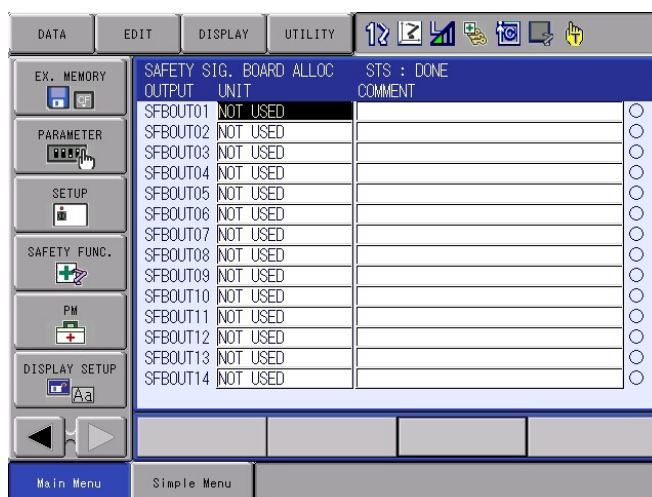
3. Select “WRITE” and then “CONFIRM” to enable the changed settings. When the data is updated correctly, the status on the title line is changed from NOT DONE to DONE.



8.23.4.11 Setting for the Safety Signal Allocation Board

This window is displayed only when the optional safety field bus function is enabled.

1. Select {SAFETY FUNC.}-{SAFETY SIG. BOADR ALLOCATION}. The marks at the right end indicates OFF/ON status. The mark “○” means OFF and the mark “●” means ON. Also, comments (up to 32 characters) can be input.

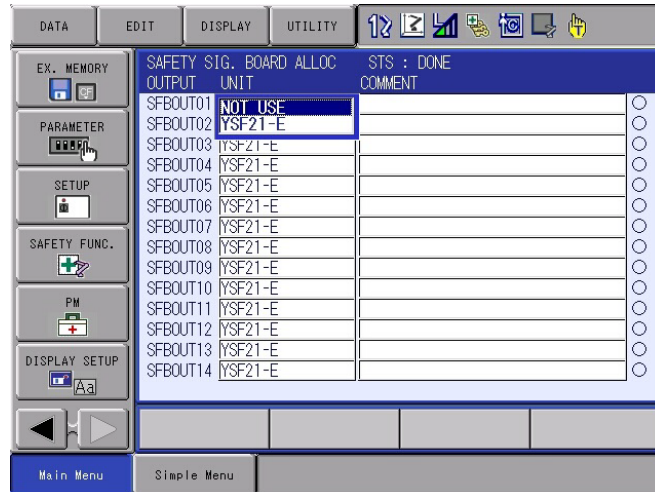


8 System Setup

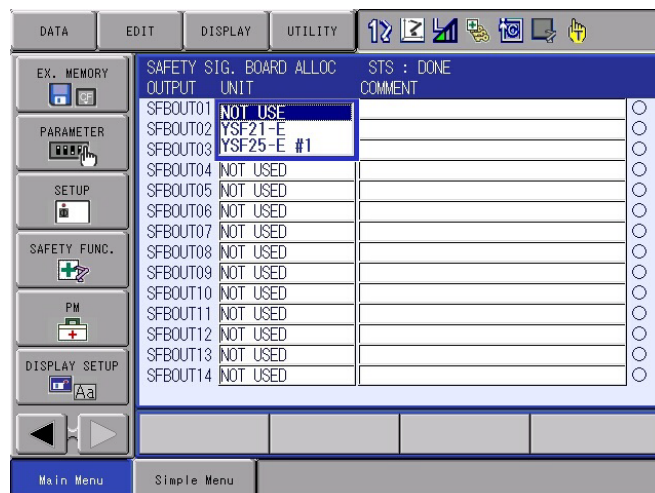
8.23 Safety Logic Circuit

2. The default setting is “NOT USED”. Press the select key on the programming pendant and select one of “NOT USED”, “YSF21-E” and “YSF25-E #n”. When the functional safety board (optional) is disabled, “YSF25-E #n” is not displayed.

<When the functional safety board is disabled>



<When the functional safety board is enabled>



NOT USED : Not available in the safety logic circuit and on the functional safety board.

YSF21-E : Available in the safety logic circuit.

YSF25-E #n: Available on the optional functional safety board.

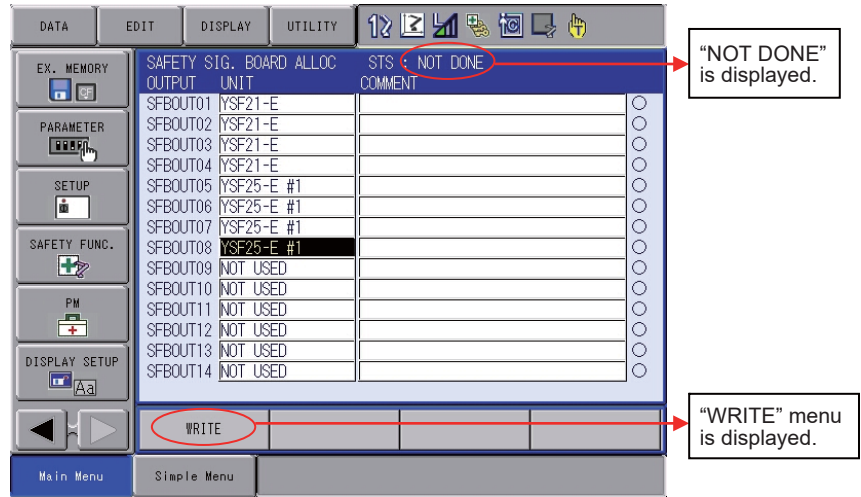
Up to eight functional safety boards can be connected in the DX200. When using a functional safety board, specify its board number.

YSF25-E #1 means the first functional safety board to be used.

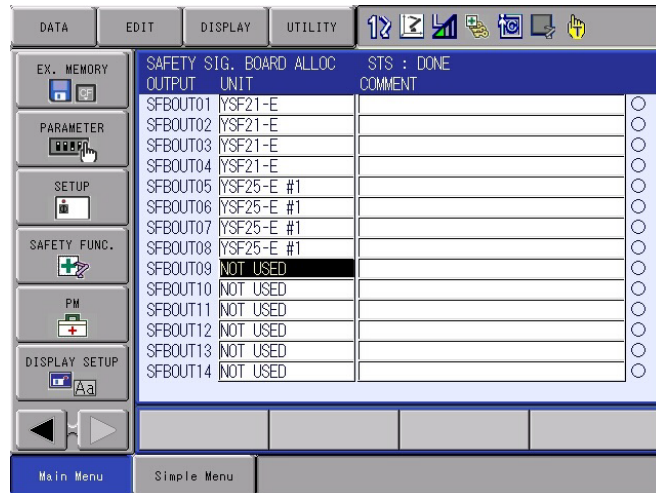
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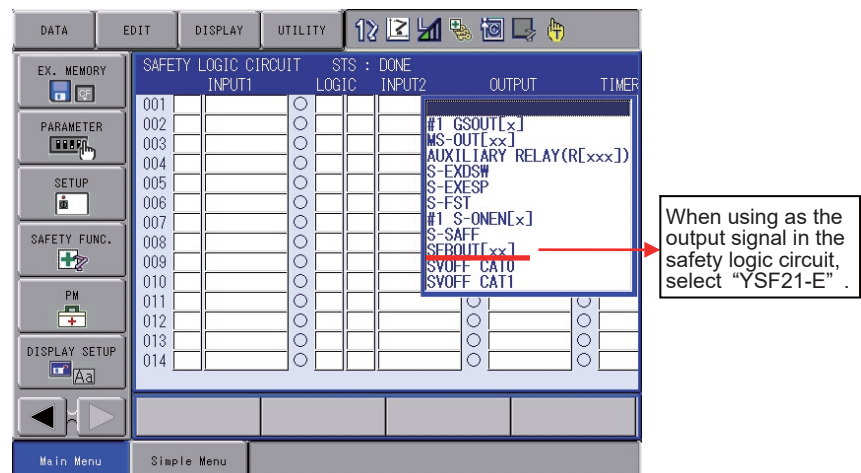
- In the following setting, SFBOUT01 to SFBOUT04 are available in the safety logic circuit and SFBOUT05 to SFBOUT08 are available on the functional safety board as the first board. After changing the setting, the status in the title line becomes "NOT DONE" and "WRITE" menu is displayed. Update the data.



- When the data update is completed, the status in the title line becomes "DONE" and the "WRITE" menu disappears.



- When either "NOT USED" or "YSF25-E #n" is set, the output signal in the safety logic circuit is not available.





While the safety logic circuit is edited, all the output signals are OFF.



When updating any of the followings, 1. to 5. are also update.

1. "SAFETY LOGIC CIRCUIT"
2. "SAFETY LOGIC CIRCUIT EXT. SIGNAL ALLOC"
3. "TIMER DELAY SET"
4. "M-SAFETY SIGNAL ALLOC" (Displayed only when the safety field bus function is enabled.)
5. "F-SAFETY SIGNAL ALLOC" (Displayed only when the functional safety function is enabled.)

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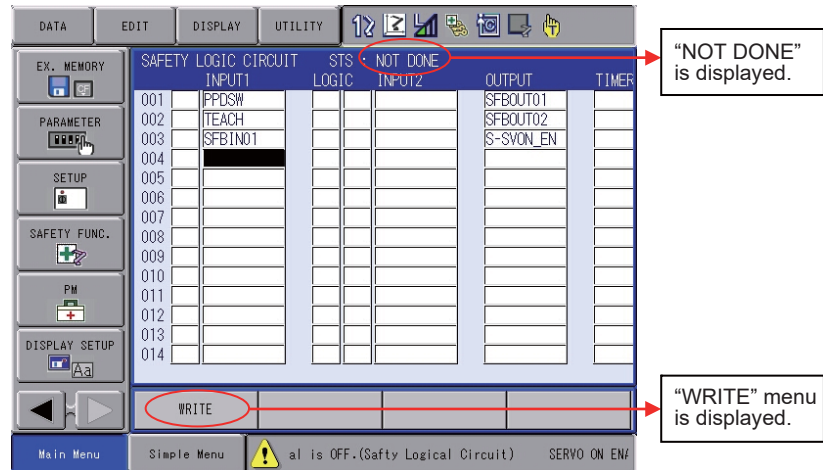
8.23 Safety Logic Circuit

8.23.4.12 Update and Execution of the Safety Logic Circuit

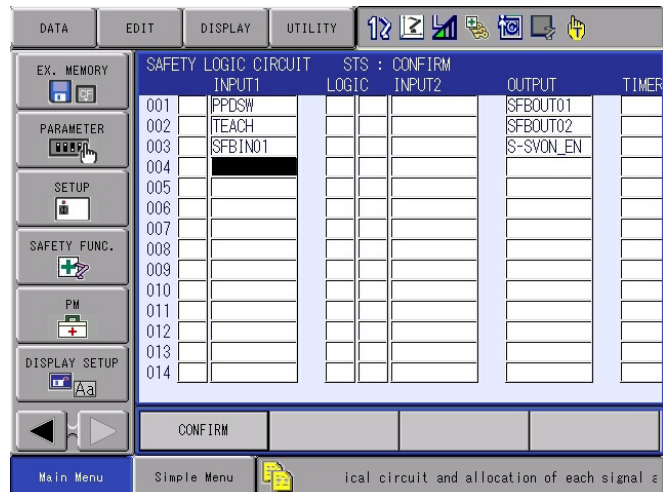
1. Select {SAFETY FUNC.}-{SAFETY LOGIC CIRCUIT}. The safety logic circuit can be created or edited.

The following is an example to create the safety logic circuit. After the setting is changed, the status in the title line becomes “NOT DONE” and “WRITE” menu is displayed.

001 PPDSW SFBOUT01
002 TEACH SFBOUT02
003 SFBIN01 S-SVON_EN



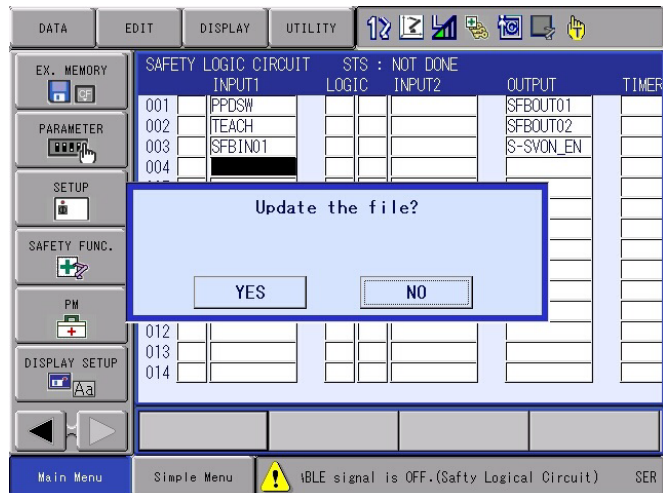
2. After creating the safety logic circuit is completed, press “WRITE” to display “CONFIRM” as shown below.



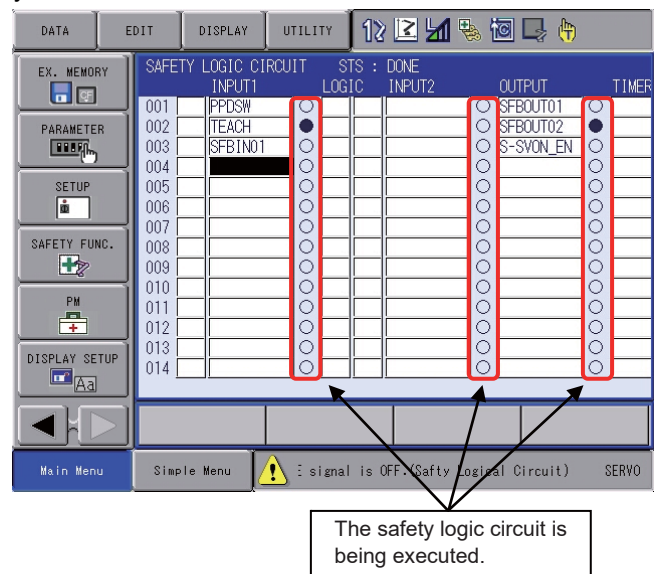
8 System Setup

8.23 Safety Logic Circuit

- After “CONFIRM” menu is displayed, press “CONFIRM” to display the following dialog. Then select “YES”. If “No” is selected, the window returns to the status in the 1. procedure.



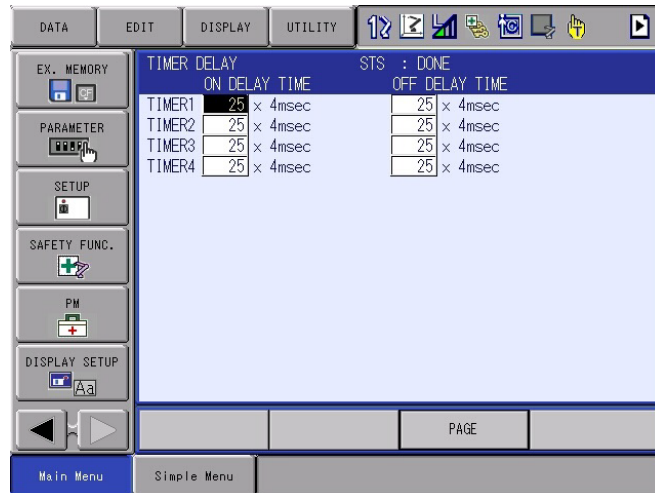
- When the file update is completed, the status in the title line is changed to “DONE” and the safety logic circuit is executed. While the safety logic circuit is executed, the signal status (“○” or “●”) is displayed.



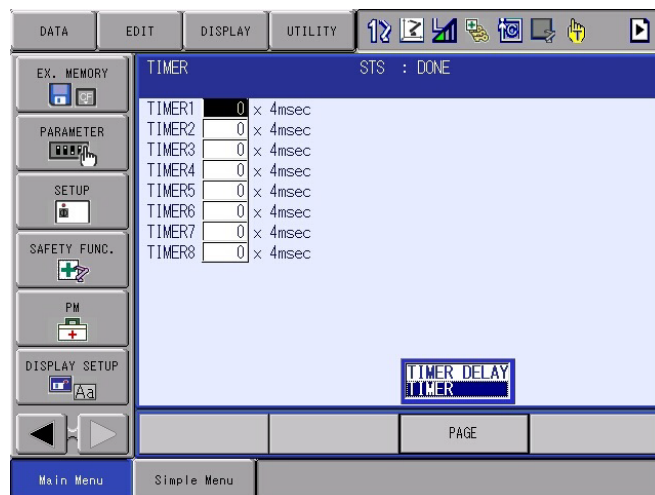
8.23.4.13 Sample of the Safety Logic Circuit Expansion Function

a. Create the one-second one-shot output signal in the safety logic circuit. Create the safety logic circuit in which the machine safety universal safety output (#1 GSOUT1) signal is ON for one second.)

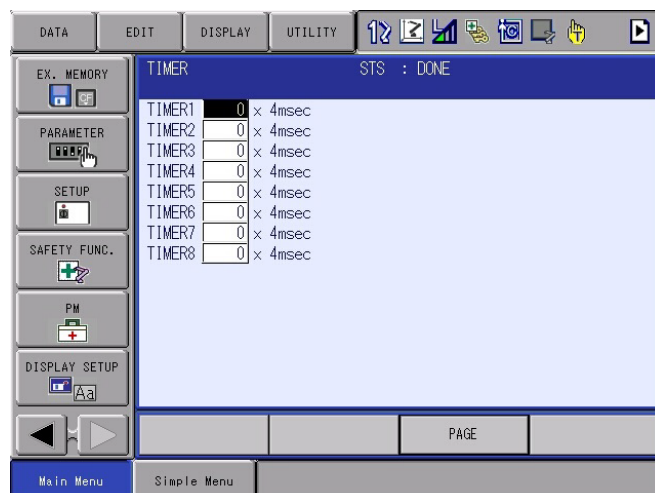
1. Select {SAFETY FUNC.}-{TIMER DELAY}.



2. Select {PAGE}-{TIMER}.



3. Input "250" at TIMER1.



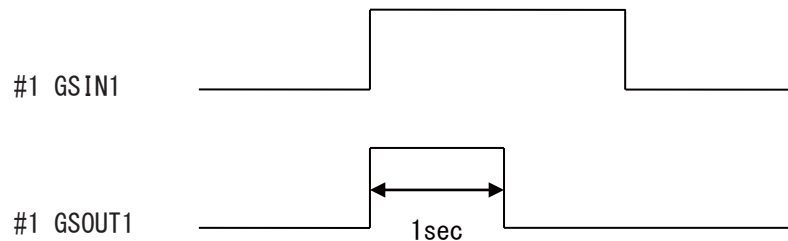
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8.23 Safety Logic Circuit

4. Create the following safety logic circuit.
001 DSU #1GSIN1 #1 GSOUT1 TMR1

DATA		EDIT		DISPLAY		UTILITY	
SAFETY LOGIC CIRCUIT STS : NOT DONE							
	INPUT1	LOGIC	INPUT2	OUTPUT	TIMER	COMMENT	
001	DSU #1 GSIN1			#1 GSOUT1	TMR1		
002							
003							
004							
005							
006							
007							
008							
009							
010							
011							
012							
013							
014							
WRITE							
Main Menu		Simple Menu					

When #1 GSIN1 signal is ON, #1 GSOUT1 is ON for one second.



5. To enable the changed settings, press “WRITE” and then “CONFIRM”. When the data is updated correctly, the status in the title line is changed from “NOT DONE” to “DONE”.

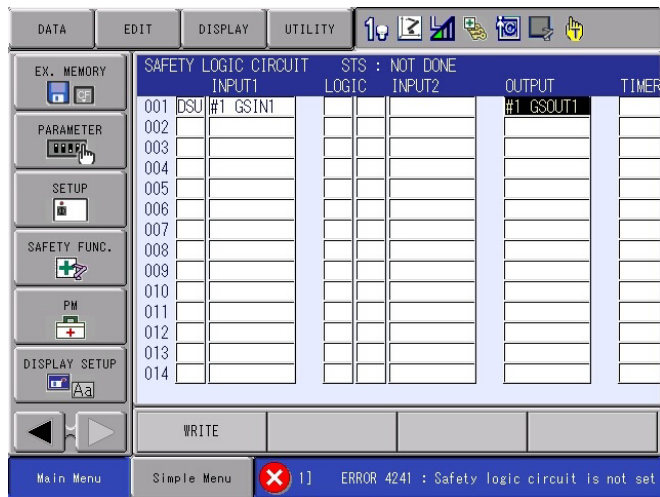
DATA		EDIT		DISPLAY		UTILITY	
SAFETY LOGIC CIRCUIT STS : DONE							
	INPUT1	LOGIC	INPUT2	OUTPUT	TIMER	COMMENT	
001	DSU #1 GSIN1			#1 GSOUT1	TMR1		
002							
003							
004							
005							
006							
007							
008							
009							
010							
011							
012							
013							
014							
Main Menu		Simple Menu					



When using the DSU or DSD instruction, be sure to set TMR to TIMER for the output signal. If “WRITE” is pressed without setting TMR to TIMER for the output signal, “ERROR 4241: Safety logic circuit is not set” is displayed on the programming pendant as shown in the following window.

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8.23 Safety Logic Circuit



WARNING

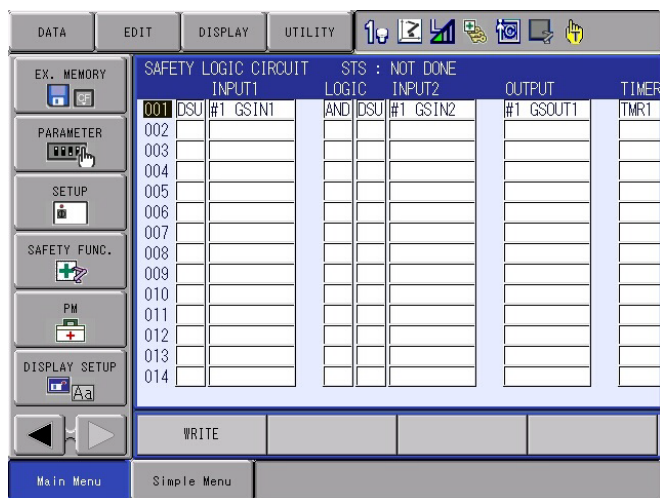
When the DSU or DSD instruction is used, the signal status only in 4ms where the condition is established is changed to “●”. However, the changed status cannot be seen because it appears for a short time.

By displaying two windows of *chapter 8.23.4.8 “Signal List Window”* and the safety logic circuit window, confirm the ON/OFF status of input signals.

b. Create the one-second one-shot output signal in the safety logic circuit for when two signals are turned ON simultaneously.

1. Create the following safety logic circuit.

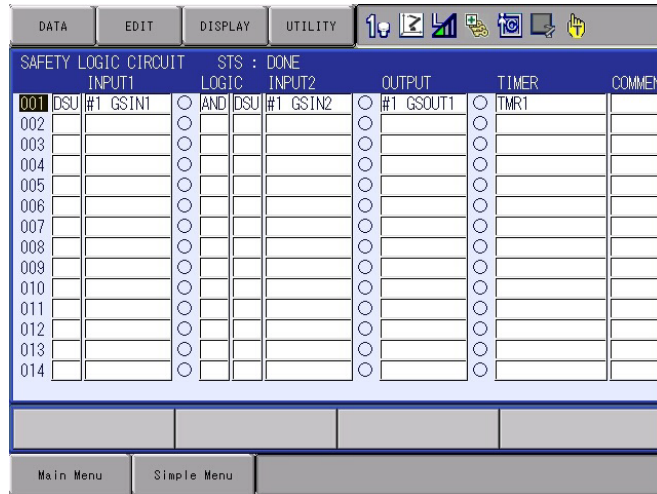
001 DSU #1 GSIN1 AND DSU #1 GSIN2 #1 GSOUT1 TMR1



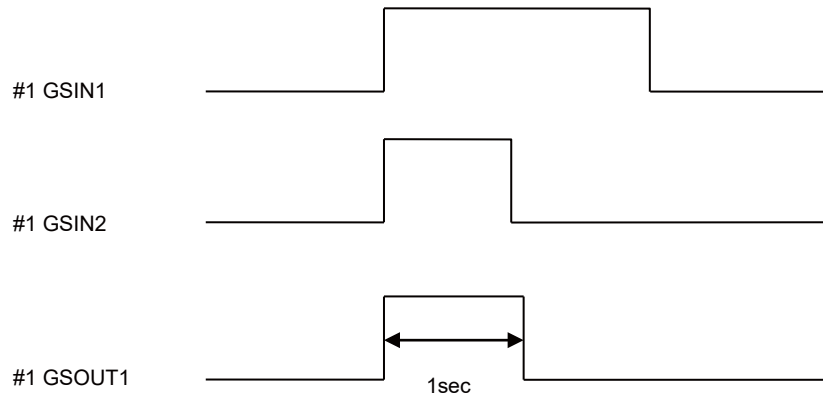
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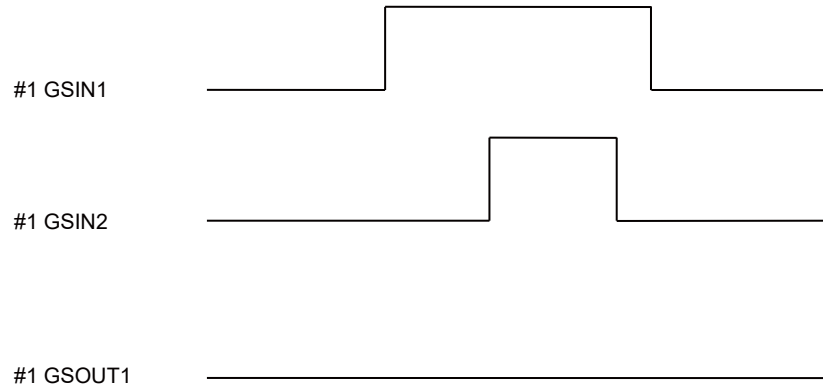
- To enable the changed setting, select "WRITE" and then "CONFIRM". When the data is updated correctly, the status on the title line is changed from NOT DONE to DONE.



- When #1 GSIN1 signal and #1 GSIN2 are simultaneously turned ON, #1 GSOUT1 is ON for one second.



- When #1 GSIN1 signal and #1 GSIN2 are not simultaneously turned ON, #1 GSOUT1 remains OFF.

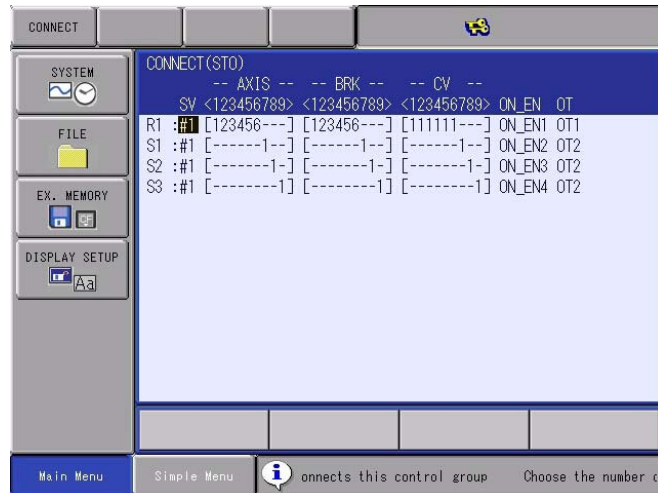


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c. Servo power individual control function by the safety PLC (optional)

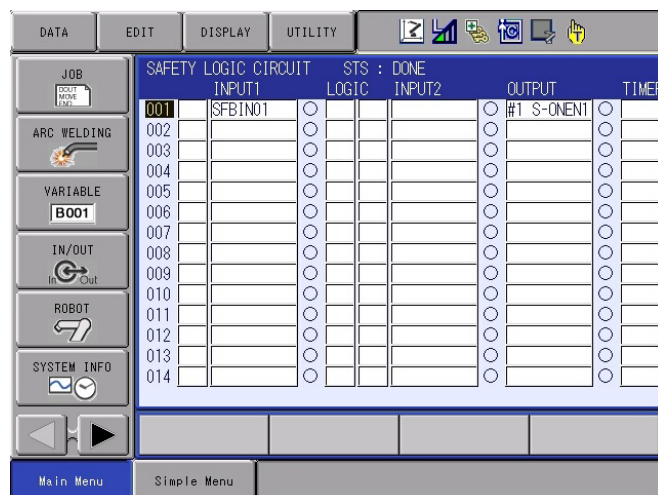
1. While pressing the main menu key on the programming pendant, start the maintenance mode.
2. Select {SYSTEM}-{SETTING}-{CONTROL GROUP}. Then confirm which ON ENABLE signal each control group is allocated to.



In the above example, the allocation of the control groups is as follows.

The control group R1 is allocated to ON ENABLE1 signal (ON_EN1).
The control group S1 is allocated to ON ENABLE2 signal (ON_EN2).
The control group S2 is allocated to ON ENABLE3 signal (ON_EN3).
The control group S3 is allocated to ON ENABLE4 signal (ON_EN4).

3. Output the input1 (SFBIN01) from the safety PLC (optional) to S-ONEN1. At this time, short-circuit the hard-wired ON_ENABLE1 signal.
4. Create the safety logic circuit as follows.
01 SFBIN01 #1 S-ONEN1



5. When #1 S-ONEN1 is turned ON, the servo power of R1 is turned OFF. Also, the message “SERVO ON ENABLE signal is OFF. (Safety Logical Circuit)” is displayed on the programming pendant.



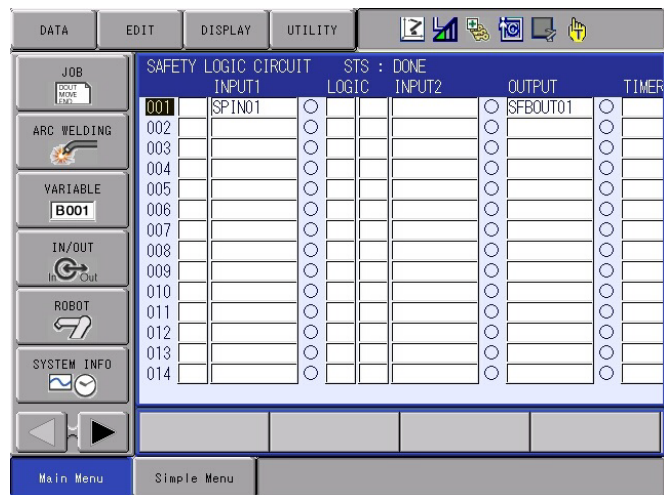
In case of using both the hard-wired ON_ENABLE signal and #x S-ONENx signal of the safety logic circuit, the servo power is turned ON only when both signals are ON. When either signal is OFF or both signals are OFF, the servo power of the control group allocated to the ON_ENABLE signal is not turned ON.



For details on the servo power supply individual control function, refer to chapter 8 “Servo Power Supply Individual Control Function” of the DX200 Options Instructions for independent/coordinated control function (RE-CKI-A462).

d. Output of the specific input signal to the safety PLC (optional)
Create the logic circuit in which the specific input1 (#40780) signal is output to the safety PLC.

1. Press {SAFETY FUNC.}-[M-SAFETY SIGNAL ALLOC] and set YSF21-E to SFBOUT01.
2. Create the safety logic circuit.
01 SPIN01 SFBOUT01



3. When #40780 is turned OFF, SFBOUT01 is turned OFF. Also, when #40780 is turned ON, SFBOUT01 is turned ON.

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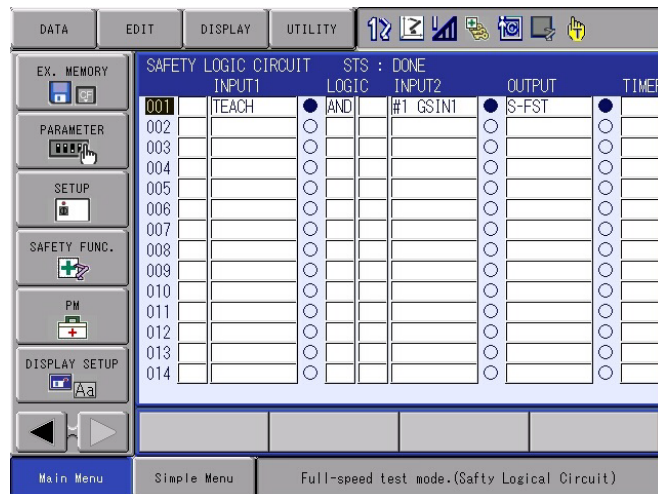
8.23 Safety Logic Circuit

e. Input of full speed test (S-FST) signal

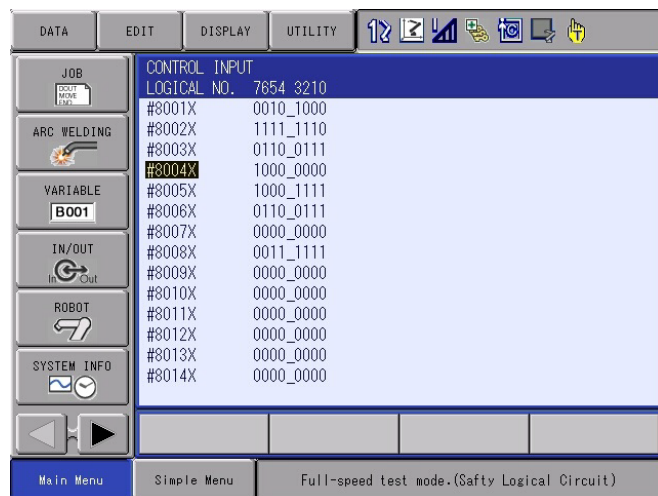
Set the safety logic circuit in which the full speed test output is turned ON after the machine safety universal safety signal (GSIN1) is ON in the teach mode.

1. Create the following safety logic circuit.

01 TEACH AND GSIN1 S-FST



2. When GSIN1 signal is turned ON, S-FST signal is turned ON.
3. When S-FST signal is turned ON, the message "Full-speed test mode. (Safety Logical Circuit)" appears on the programming pendant. Also the control status signal #80047 is turned ON.



S-FST signal is enabled only in the teach mode.

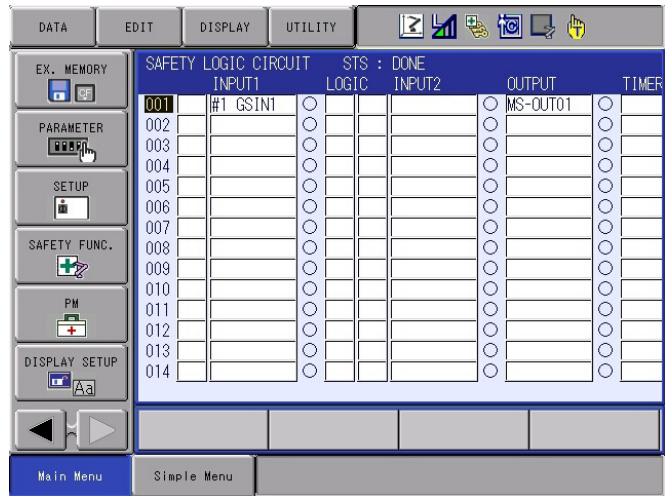
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8.23 Safety Logic Circuit

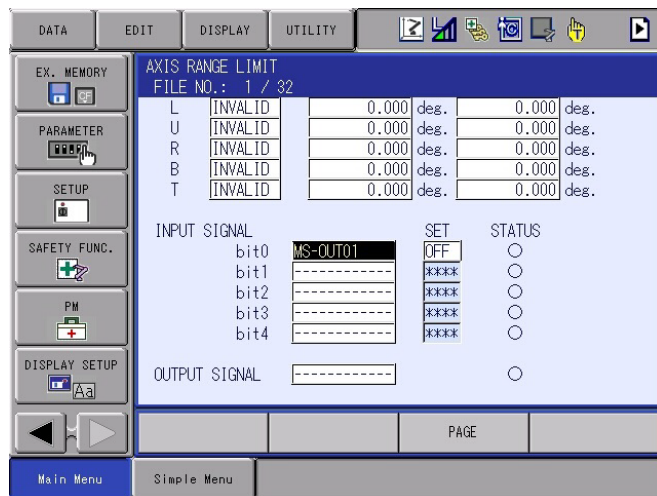
f. How to use MS-OUT signal

The following is the explanation to use MS-OUT signal.

1. Create the following safety logic circuit.
01 #1 GSIN1 MS-OUT01



2. When GSIN1 signal is turned ON, MS-OUT01 signal is turned ON.
3. The MS-OUT01 signal created in the safety logic circuit can be used as a input signal, etc. to set each axis motion range in the functional safety (optional function).



8.23.4.14 Saving or Loading the File

Refer to *chapter 8.23.5* .

8.23.4.15 Alarm List of the Safety Logic Circuit

Refer to *chapter 8.23.8* .

8.23.4.16 Specific Input Signals allocated to SPIN[xx]

32 signals input in the SPIN[xx] are allocated to specific input signals #40780 to #40817.

The signals input in the SPIN[xx] are available in the safety logic circuit.

40787	40786	40785	40784	40783	40782	40781	40780
Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit
Specific input 8 SPIN08	Specific input 7 SPIN07	Specific input 6 SPIN06	Specific input 5 SPIN05	Specific input 4 SPIN04	Specific input 3 SPIN03	Specific input 2 SPIN02	Specific input 1 SPIN01

40797	40796	40795	40794	40793	40792	40791	40790
Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit
Specific input 16 SPIN16	Specific input 15 SPIN15	Specific input 14 SPIN14	Specific input 13 SPIN13	Specific input 12 SPIN12	Specific input 11 SPIN11	Specific input 10 SPIN10	Specific input 9 SPIN09

40807	40806	40805	40804	40803	40802	40801	40800
Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit
Specific input 24 SPIN24	Specific input 23 SPIN23	Specific input 22 SPIN22	Specific input 21 SPIN21	Specific input 20 SPIN20	Specific input 19 SPIN19	Specific input 18 SPIN18	Specific input 17 SPIN17

40817	40816	40815	40814	40813	40812	40811	40810
Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit	Safety logic circuit
Specific input 32 SPIN32	Specific input 31 SPIN31	Specific input 30 SPIN30	Specific input 29 SPIN29	Specific input 28 SPIN28	Specific input 27 SPIN27	Specific input 26 SPIN26	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.

8.23.4.17 Output to the Control Status Signal

The following signals used in the safety logic circuit can be confirmed in the control status signals.

- (1) SFBIN[64]
- (2) SFBOUT[64]
- (3) MS-OUT[64]
- (4) FS-OUT[64]
- (5) #n FSBIN[8]
- (6) #n SFBOUT[8]

80527	80526	80525	80524	80523	80522	80521	80520
Safety Field bus SFBIN8	Safety Field bus SFBIN7	Safety Field bus SFBIN6	Safety Field bus SFBIN5	Safety Field bus SFBIN4	Safety Field bus SFBIN3	Safety Field bus SFBIN2	Safety Field bus SFBIN1

80537	80536	80535	80534	80533	80532	80531	80530
Safety Field bus SFBIN16	Safety Field bus SFBIN15	Safety Field bus SFBIN14	Safety Field bus SFBIN13	Safety Field bus SFBIN12	Safety Field bus SFBIN11	Safety Field bus SFBIN10	Safety Field bus SFBIN9

80547	80546	80545	80544	80543	80542	80541	80540
Safety Field bus SFBIN24	Safety Field bus SFBIN23	Safety Field bus SFBIN22	Safety Field bus SFBIN21	Safety Field bus SFBIN20	Safety Field bus SFBIN19	Safety Field bus SFBIN18	Safety Field bus SFBIN17

80557	80556	80555	80554	80553	80552	80551	80550
Safety Field bus SFBIN32	Safety Field bus SFBIN31	Safety Field bus SFBIN30	Safety Field bus SFBIN29	Safety Field bus SFBIN28	Safety Field bus SFBIN27	Safety Field bus SFBIN26	Safety Field bus SFBIN25

80567	80566	80565	80564	80563	80562	80561	80560
Safety Field bus SFBIN40	Safety Field bus SFBIN39	Safety Field bus SFBIN38	Safety Field bus SFBIN37	Safety Field bus SFBIN36	Safety Field bus SFBIN35	Safety Field bus SFBIN34	Safety Field bus SFBIN33

80577	80576	80575	80574	80573	80572	80571	80570
Safety Field bus SFBIN48	Safety Field bus SFBIN47	Safety Field bus SFBIN46	Safety Field bus SFBIN45	Safety Field bus SFBIN44	Safety Field bus SFBIN43	Safety Field bus SFBIN42	Safety Field bus SFBIN41

80587	80586	80585	80584	80583	80582	80581	80580
Safety Field bus SFBIN56	Safety Field bus SFBIN55	Safety Field bus SFBIN54	Safety Field bus SFBIN53	Safety Field bus SFBIN52	Safety Field bus SFBIN51	Safety Field bus SFBIN50	Safety Field bus SFBIN49

80597	80596	80595	80594	80593	80592	80591	80590
Safety Field bus SFBIN64	Safety Field bus SFBIN63	Safety Field bus SFBIN62	Safety Field bus SFBIN61	Safety Field bus SFBIN60	Safety Field bus SFBIN59	Safety Field bus SFBIN58	Safety Field bus SFBIN57

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80607	80606	80605	80604	80603	80602	80601	80600
Safety Field bus SFBOUT8	Safety Field bus SFBOUT7	Safety Field bus SFBOUT6	Safety Field bus SFBOUT5	Safety Field bus SFBOUT4	Safety Field bus SFBOUT3	Safety Field bus SFBOUT2	Safety Field bus SFBOUT1

80617	80616	80615	80614	80613	80612	80611	80610
Safety Field bus SFBOUT16	Safety Field bus SFBOUT15	Safety Field bus SFBOUT14	Safety Field bus SFBOUT13	Safety Field bus SFBOUT12	Safety Field bus SFBOUT11	Safety Field bus SFBOUT10	Safety Field bus SFBOUT9

80627	80626	80625	80624	80623	80622	80621	80620
Safety Field bus SFBOUT24	Safety Field bus SFBOUT23	Safety Field bus SFBOUT22	Safety Field bus SFBOUT21	Safety Field bus SFBOUT20	Safety Field bus SFBOUT19	Safety Field bus SFBOUT18	Safety Field bus SFBOUT17

80637	80636	80635	80634	80633	80632	80631	80630
Safety Field bus SFBOUT32	Safety Field bus SFBOUT31	Safety Field bus SFBOUT30	Safety Field bus SFBOUT29	Safety Field bus SFBOUT28	Safety Field bus SFBOUT27	Safety Field bus SFBOUT26	Safety Field bus SFBOUT25

80647	80646	80645	80644	80643	80642	80641	80640
Safety Field bus SFBOUT40	Safety Field bus SFBOUT39	Safety Field bus SFBOUT38	Safety Field bus SFBOUT37	Safety Field bus SFBOUT36	Safety Field bus SFBOUT35	Safety Field bus SFBOUT34	Safety Field bus SFBOUT33

80657	80656	80655	80654	80653	80652	80651	80650
Safety Field bus SFBOUT48	Safety Field bus SFBOUT47	Safety Field bus SFBOUT46	Safety Field bus SFBOUT45	Safety Field bus SFBOUT44	Safety Field bus SFBOUT43	Safety Field bus SFBOUT42	Safety Field bus SFBOUT41

80667	80666	80665	80664	80663	80662	80661	80660
Safety Field bus SFBOUT56	Safety Field bus SFBOUT55	Safety Field bus SFBOUT54	Safety Field bus SFBOUT53	Safety Field bus SFBOUT52	Safety Field bus SFBOUT51	Safety Field bus SFBOUT50	Safety Field bus SFBOUT49

80677	80676	80675	80674	80673	80672	80671	80670
Safety Field bus SFBOUT64	Safety Field bus SFBOUT63	Safety Field bus SFBOUT62	Safety Field bus SFBOUT61	Safety Field bus SFBOUT60	Safety Field bus SFBOUT59	Safety Field bus SFBOUT58	Safety Field bus SFBOUT57

80687	80686	80685	80684	80683	80682	80681	80680
Functional safety FSBIN8 YSF24#1	Functional safety FSBIN7 YSF24#1	Functional safety FSBIN6 YSF24#1	Functional safety FSBIN5 YSF24#1	Functional safety FSBIN4 YSF24#1	Functional safety FSBIN3 YSF24#1	Functional safety FSBIN2 YSF24#1	Functional safety FSBIN1 YSF24#1

80697	80696	80695	80694	80693	80692	80691	80690
Functional safety FSBOUT8 YSF24#1	Functional safety FSBOUT7 YSF24#1	Functional safety FSBOUT6 YSF24#1	Functional safety FSBOUT5 YSF24#1	Functional safety FSBOUT4 YSF24#1	Functional safety FSBOUT3 YSF24#1	Functional safety FSBOUT2 YSF24#1	Functional safety FSBOUT1 YSF24#1

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80707	80706	80705	80704	80703	80702	80701	80700
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
YSF24#2	YSF24#2	YSF24#2	YSF24#2	YSF24#2	YSF24#2	YSF24#2	YSF24#2

80717	80716	80715	80714	80713	80712	80711	80710
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
YSF24#2	YSF24#2	YSF24#2	YSF24#2	YSF24#2	YSF24#2	YSF24#2	YSF24#2

80727	80726	80725	80724	80723	80722	80721	80720
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
YSF24#3	YSF24#3	YSF24#3	YSF24#3	YSF24#3	YSF24#3	YSF24#3	YSF24#3

80737	80736	80735	80734	80733	80732	80731	80730
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
YSF24#3	YSF24#3	YSF24#3	YSF24#3	YSF24#3	YSF24#3	YSF24#3	YSF24#3

80747	80746	80745	80744	80743	80742	80741	80740
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
YSF24#4	YSF24#4	YSF24#4	YSF24#4	YSF24#4	YSF24#4	YSF24#4	YSF24#4

80757	80756	80755	80754	80753	80752	80751	80750
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
YSF24#4	YSF24#4	YSF24#4	YSF24#4	YSF24#4	YSF24#4	YSF24#4	YSF24#4

80767	80766	80765	80764	80763	80762	80761	80760
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
YSF24#5	YSF24#5	YSF24#5	YSF24#5	YSF24#5	YSF24#5	YSF24#5	YSF24#5

80777	80776	80775	80774	80773	80772	80771	80770
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
YSF24#5	YSF24#5	YSF24#5	YSF24#5	YSF24#5	YSF24#5	YSF24#5	YSF24#5

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80787	80786	80785	80784	80783	80782	80781	80780
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
YSF24#6	YSF24#6	YSF24#6	YSF24#6	YSF24#6	YSF24#6	YSF24#6	YSF24#6

80797	80796	80795	80794	80793	80792	80791	80790
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
YSF24#6	YSF24#6	YSF24#6	YSF24#6	YSF24#6	YSF24#6	YSF24#6	YSF24#6

80807	80806	80805	80804	80803	80802	80801	80800
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
YSF24#7	YSF24#7	YSF24#7	YSF24#7	YSF24#7	YSF24#7	YSF24#7	YSF24#7

80817	80816	80815	80814	80813	80812	80811	80810
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
YSF24#7	YSF24#7	YSF24#7	YSF24#7	YSF24#7	YSF24#7	YSF24#7	YSF24#7

80827	80826	80825	80824	80823	80822	80821	80820
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
YSF24#8	YSF24#8	YSF24#8	YSF24#8	YSF24#8	YSF24#8	YSF24#8	YSF24#8

80837	80836	80835	80834	80833	80832	80831	80830
Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety	Functional safety
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
YSF24#8	YSF24#8	YSF24#8	YSF24#8	YSF24#8	YSF24#8	YSF24#8	YSF24#8

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

8 System Setup

8.23 Safety Logic Circuit

81357	81356	81355	81354	81353	81352	81351	81350
Safety Logic Circuit MS-OUT32	Safety Logic Circuit MS-OUT31	Safety Logic Circuit MS-OUT30	Safety Logic Circuit MS-OUT29	Safety Logic Circuit MS-OUT28	Safety Logic Circuit MS-OUT27	Safety Logic Circuit MS-OUT26	Safety Logic Circuit 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

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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

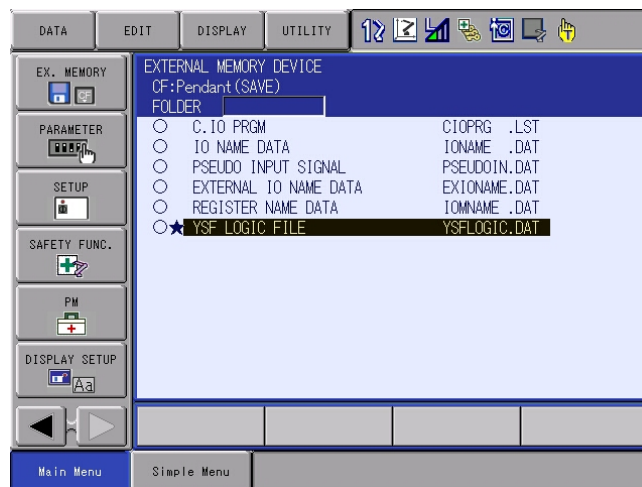
8.23.5 Saving or Loading the File

8.23.5.1 Saving the File

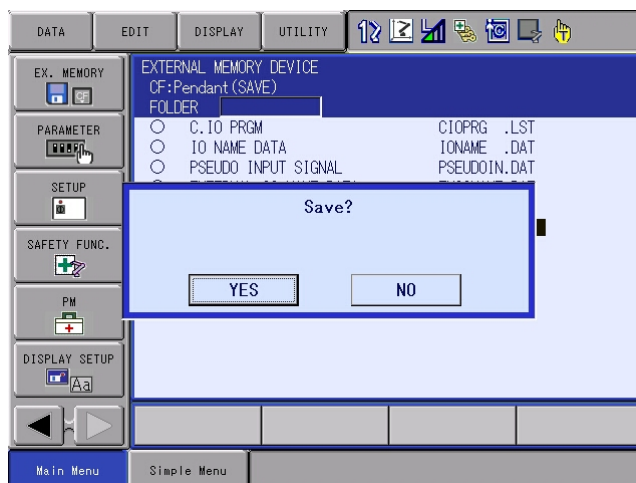
In order to save the file, which is set in the safety logic circuit, select {I/O DATA} by going to {SAVE} from {EX. MEMORY} in the main menu. Perform the saving the file after confirming the either the CompactFlash or USB memory stick is inserting to the programming pendant.

1. Displaying the window.

- Select {I/O DATA}, by going to {SAVE} from {EX. MEMORY} in the main menu.
- The signal list relative to the I/O data is displayed, and then select “YSF LOGIC FILE”.



- The confirmation dialog appears, and select “YES”.



- The safety logic circuit file (file name:YSFLOGIC.DAT) is saved in the specified device.

8.23.5.2 Loading the File

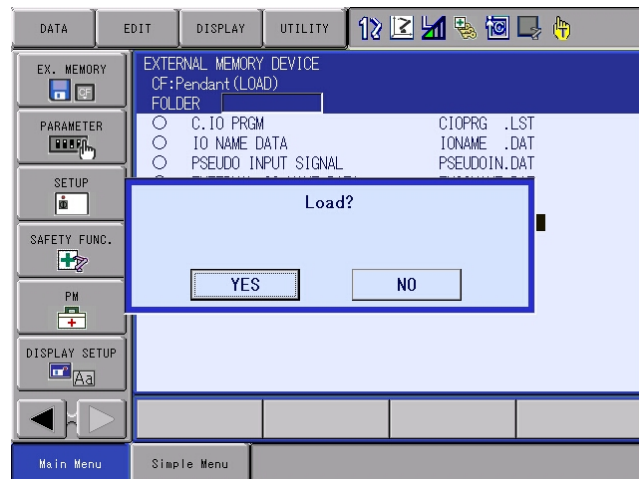
In order to load the safety logic circuit file (file name: YSFLOGIC.DAT), select {I/O DATA} by going to {LOAD} from {EX. MEMORY} in the main menu. Perform the saving the file after confirming the either the CompactFlash or USB memory stick is inserting to the programming pendant.

1. Displaying the window.

- Select {I/O DATA}, by going to {LOAD} from {EX. MEMORY} in the main menu.
- The signal list relative to the I/O data is displayed, and then select “YSF LOGIC FILE”.



- The confirmation dialog appears, and select “YES”.



- The safety logic circuit file (file name:YSFLOGIC.DAT) is loaded from the specified device.



When loading the safety logic circuit file, the file is not transferred to the machine safety circuit board (type: YSF21-E). Thus, perform {WRITE} in the one of the following windows, such as {M-SAFETY SIGNAL ALLOC}, {TIMER DELAY SET}, {SAFETY LOGIC CIRCUIT} or {SAFETY SIG. BOARD ALLOC}. The all display information above are updated, and the file written in the FLASH ROM of the machine safety circuit board is also updated.

8.23.6 Initializing the Safety Logic Circuit File

If the following alarm shown below appears when starting the DX200, it will become the management mode. The alarm occurs when the file does not match the file written in the FLASH ROM of the machine safety circuit board (type: YSF21-E). For example, if the machine safety circuit board is replaced the spared part, the alarm will occur.

When the alarm occurs, perform the following procedures to restore.

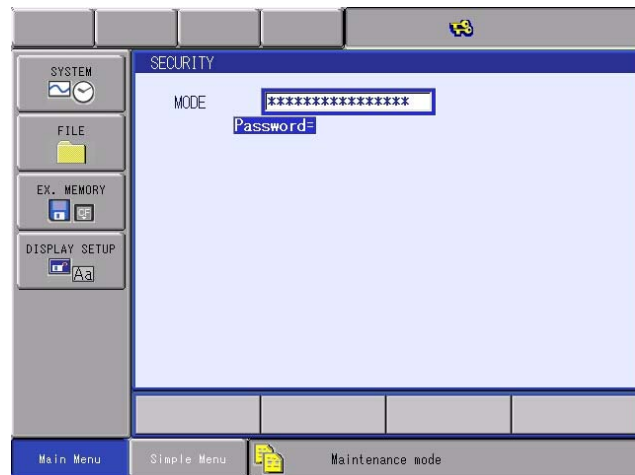


8.23.6.1 Initializing the Safety Logic Circuit File

1. Displaying the window.
 - Select {SEECURITY} from {SYSTEM} in the main menu.
2. Changing to the safety mode.
 - Select {SAFETY MODE}.




- Enter the password for the safety mode, and press {ENTER}.



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



4. Select the file to be initialized.
- Select {I/O DATA} by going to {INITIALIZE} from {FILE} in the main menu.
 - The I/O data file list is displayed, and then select “YSF LOGIC FILE”.



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8.23 Safety Logic Circuit

5. Perform the initialization.

- Select {ENTER}.
- The confirmation dialog appears.



- Select {YES}.
- The file written in the FLASH ROM of the machine safety circuit board (type: YSF21-E) is initialized.

8.23.6.2 Machine Safety Flash Data Erase or Reset

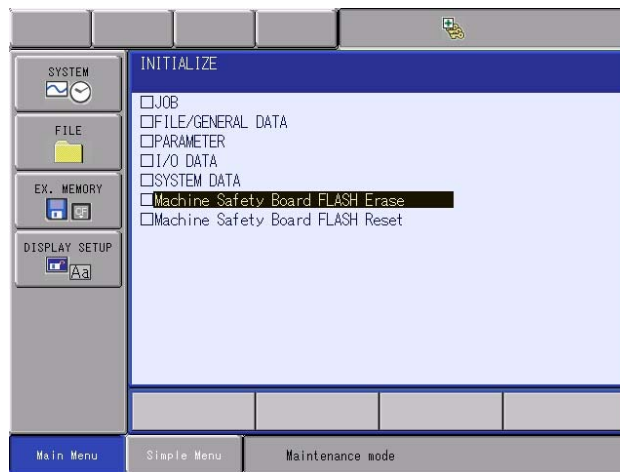
Erase the safety logic circuit file (file name: YSFLOGIC.DAT) written in the FLASH ROM of the machine safety circuit board (type: YSF21-E) by selecting “Machine Safety Board FLASH Erase”.

By selecting the “Machine Safety Board FLASH Reset”, the machine safety circuit board (type: YSF21-E) is transferred and saved in the FLASH ROM of the machine safety circuit board (type: YSF21-E).

■ Machine Safety Board FLASH Erase

1. Displaying the window.

- Select {Machine Safety Board FLASH Erase} by going to {INITIALIZE} from {FILE} in the man menu.



- The confirmation dialog appears, and select {YES}.
- The safety logic circuit file (file name: YSFLOGIC.DAT) written in the FLASH ROM of the machine safety circuit board (type: YSF21-E) is erased.

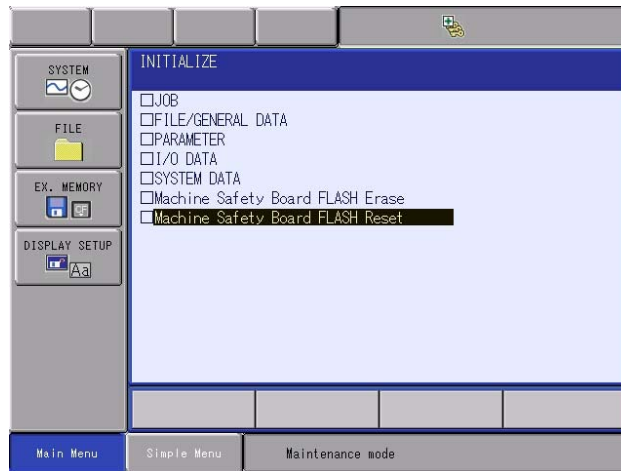


After performing the “Machine Safety Board FLASH Erase”, and turning the DX200 power supply ON/OFF. Next time when turning the power supply ON, the alarm “0300: VERIFY ERROR (SYSTEM CONFIG-DATA)” occurs. Therefore, when performing the “Machine Safety Board FLASH Erase”, the “Machine Safety FLASH Restart” needs to be performed as well.

■ **Machine Safety FLASH Reset**

1. Displaying the window.

- Select {Machine Safety Board FLASH Reset} by going to {INITIALIZE} from {FILE} in the man menu.



- The confirmation dialog appears, and select {YES}.
- The safety logic circuit file (file name: YSFLOGIC.DAT) is transferred and written in the FLASH ROM of the machine safety circuit board (type: YSF21-E).

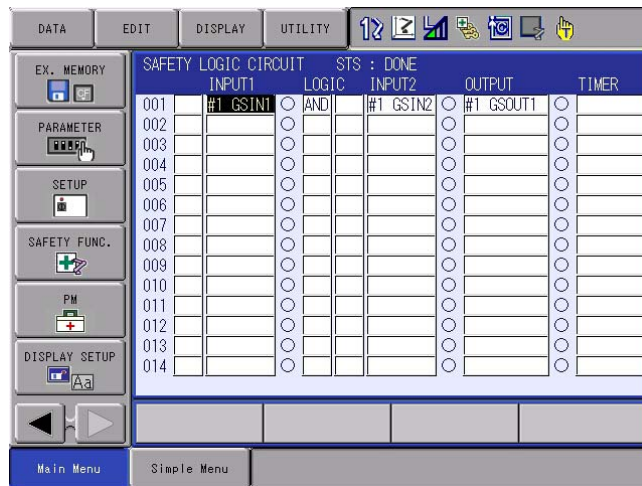
8.23.7 Example of Safety Logic Circuit

The followings are the examples of the safety logic circuit.

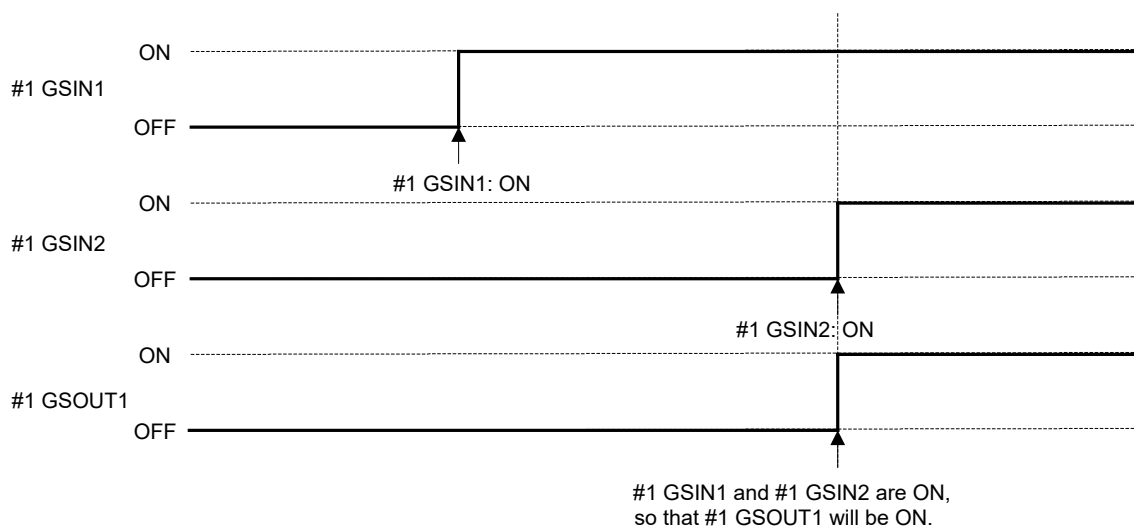
<The safety logic circuit: example 1>

1. The first universal input safety signal of the I/O circuit board (type:YSF22 □ -E) “1” is ON (#1 GSIN1), and the first universal input safety signal of the I/O circuit board (type:YSF22 □ -E) “2” is ON (#1 GSIN2). The signal is outputted from the I/O circuit board (type:YSF22 □ -E) “1” (#1 GSOUT1) of the first universal output safety signal.

- Signal 1: Universal safety input signal 1 (#1 GSIN1)
- Signal 2: Universal safety input signal 2 (#1 GSIN2)
- Logic: AND
- Output signal: Universal output signal 1 (#1 GSOUT1)



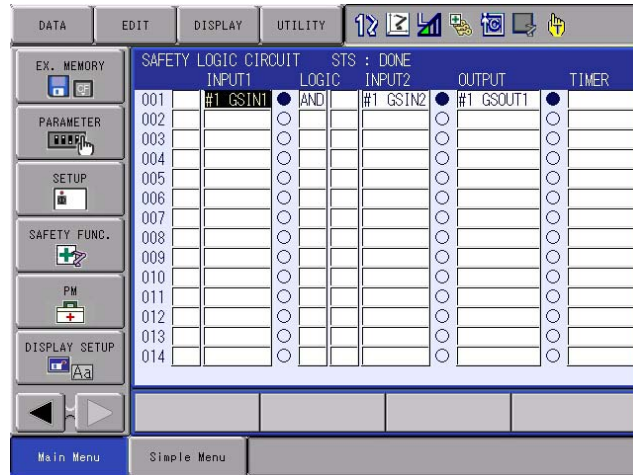
2. Displays the time chart.



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8.23 Safety Logic Circuit

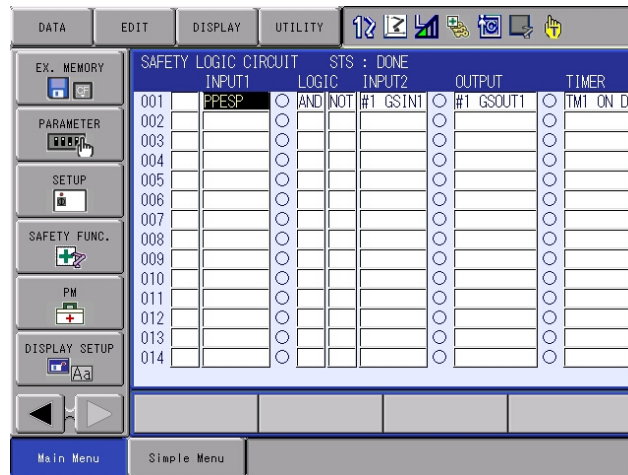
3. Verifying the safety logic circuit.
Switch ON the universal safety signal “1” and “2”.
The mark “○” becomes “●”.



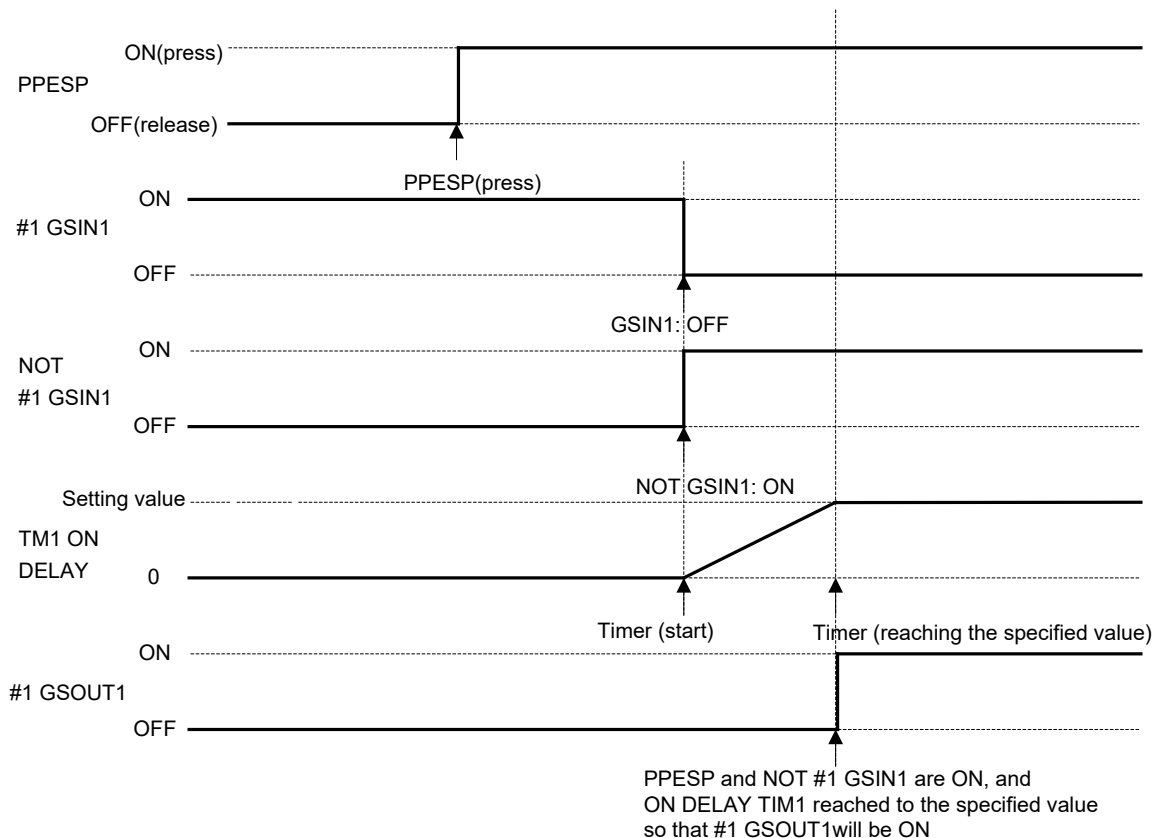
<The safety logic circuit: example 2>

1. The emergency button of the programming pendant is pressed, and the first universal input safety signal of the I/O circuit board (type:YSF22 □ -E) "1" is OFF, and the I/O circuit board (type:YSF22 □ -E) of the first universal output safety signal is ON after one second passed.

- Signal 1: Programming pendant emergency button (PPESP)
- Signal 2: NOT machine safety universal input signal 1 (#1 GSIN1)
- Logic: AND
- Output signal: Machine universal output signal 0 (#1 GSOUT0)
- Delay timer: ON delay timer1 (TM1 ON DELAY) 1 second



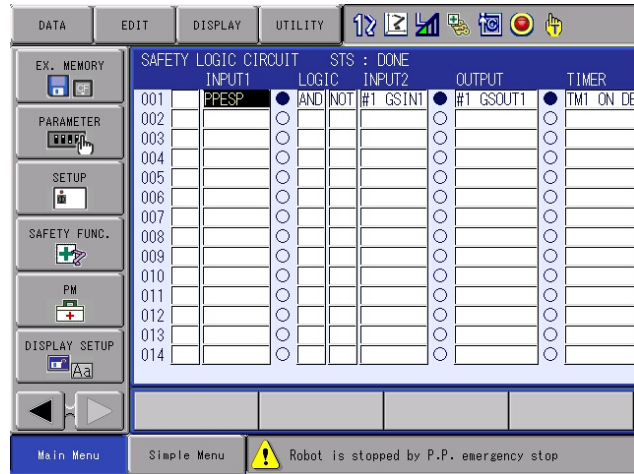
2. Displays the time chart.



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8.23 Safety Logic Circuit

3. Verifying the safety logic circuit.
Confirm that the mark “○” becomes “●” when pressing the programming pendant and switching the universal safety signal ON.
The mark “○” of the universal safety output signal 1 becomes “●” after one second passed.



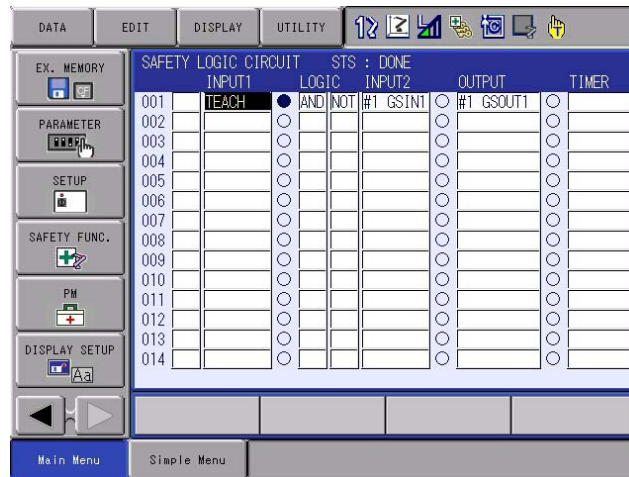
8 System Setup

8.23 Safety Logic Circuit

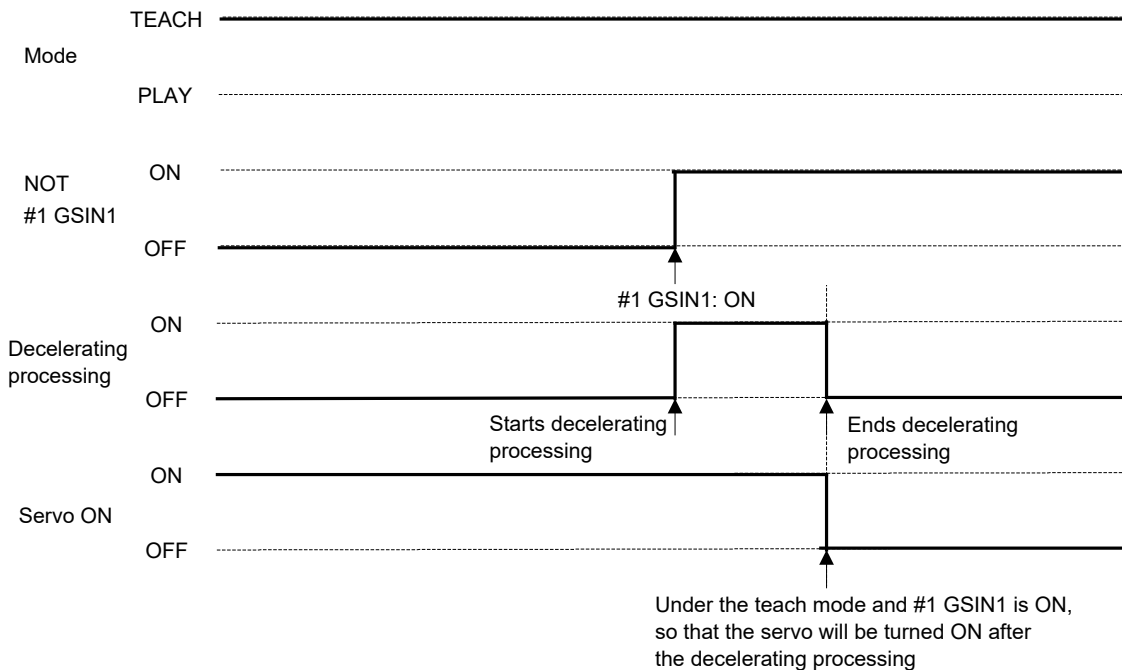
<The safety logic circuit: example 3>

1. When the first universal input safety signal of the I/O circuit board (type:YSF22□-E) “1” is ON (#1 GSIN1) and under the teaching mode, the manipulator will decelerate and stop.

- Signal 1: Teach mode (TEACH)
- Signal 2: Universal safety input signal 1 (#1 GSIN1)
- Logic: AND
- Output signal: Manipulator deceleration to a stop (SVOFF CAT1)



2. Displays the time chart.

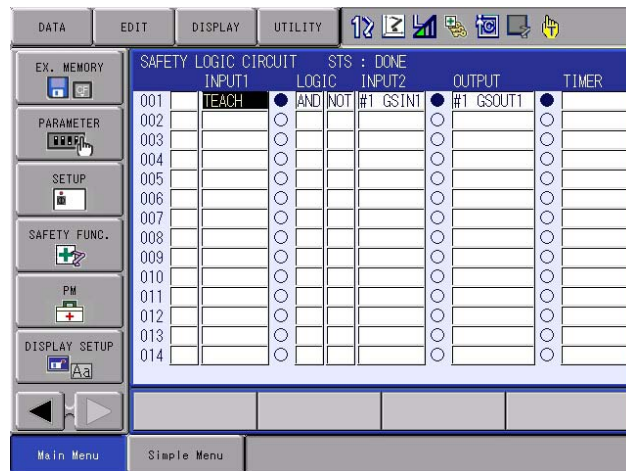


8 System Setup

8.23 Safety Logic Circuit

3. Verifying the safety logic circuit.

Set up the teach mode, and turn the servo ON. When switching the universal safety signal ON, the mark “○” of the universal safety output signal 1 becomes “●”.



SIGNAL1: Teach mode (TEACH)

SIGNAL2: Programming pendant enable switch (PPDSW)

LOGIC: AND



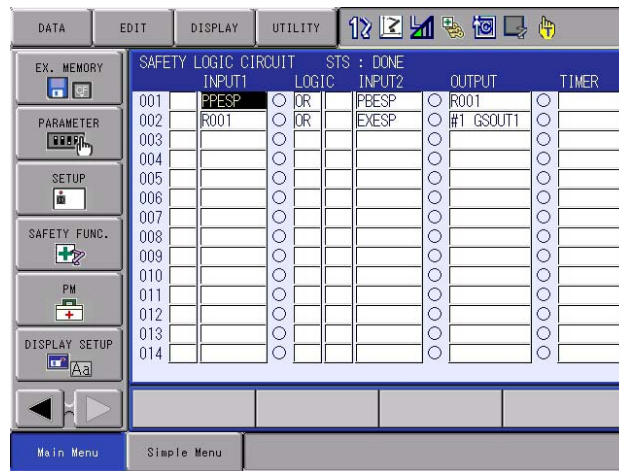
OUTPUT: Manipulator deceleration to a stop
(SVOFF CAT1)

If create the safety logic circuit shown above, the manipulator will stop immediately as the DX200 system.
(Manipulator does not decelerate.)

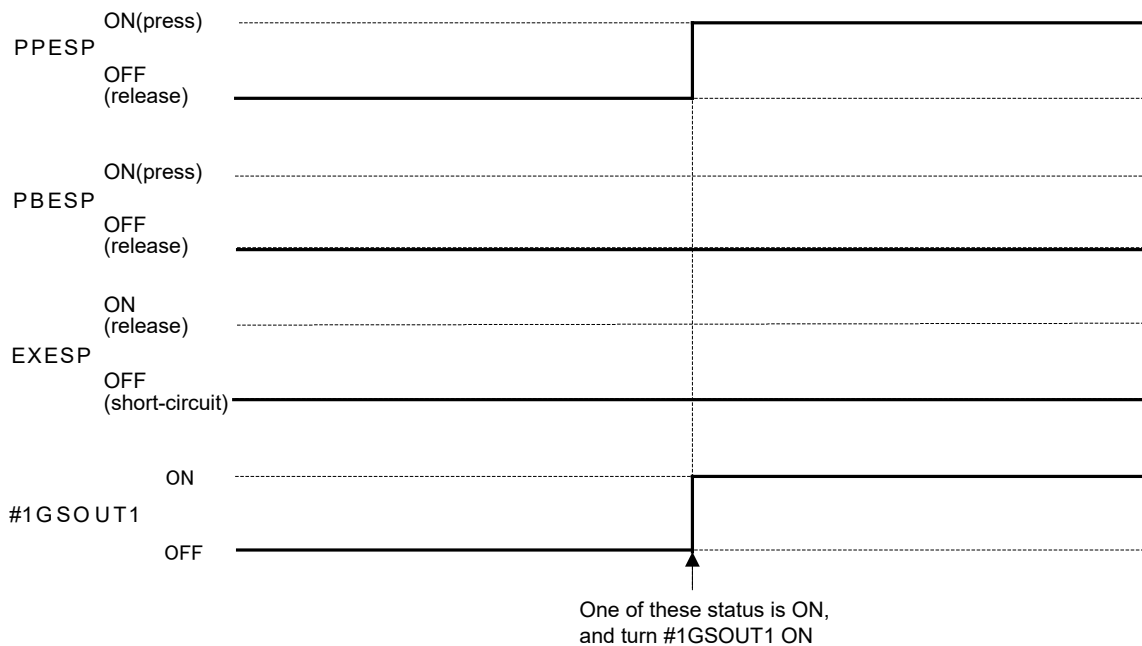
<The safety logic circuit: example 4>

1. The setting example by using the auxiliary relay is described below.
When the any one of the status of the programming pendant emergency stop, controller emergency stop or external emergency stop is stopped, the first universal output safety signal "1" of the I/O circuit board (type:YSF22 □ -E) is ON.

- Signal 1: Programming pendant emergency stop (PPESP)
- Signal 2: Controller emergency stop (PBESP)
- Signal 3: External emergency stop (EXESP)
- Logic: AND
- Output signal: Universal safety output signal(#1 GSOUT1)
The display "#1 GSOUT1" indicates the "#1 GSOUT1" of the first I/O circuit board (type:YSF22 □ -E).



2. Displays the time chart.

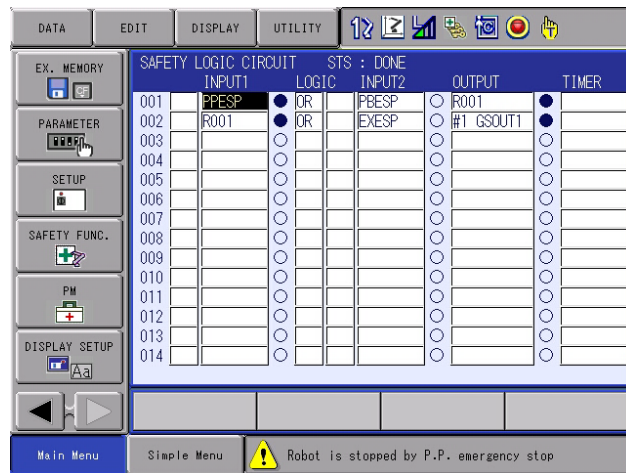


8 System Setup

8.23 Safety Logic Circuit

3. Verifying the safety logic circuit.

When the one of the programming pendant emergency stop, controller emergency stop or the external emergency stop is inputted, the mark “○” of the universal safety output signal 1 becomes “●”.



8.23.8 Alarm List of the Safety Logic Circuit

Alarm Number	Sub-code	Message	Remedy
300	VERIFY ERROR (SYSTEM CONFIG-DATA)		
	20	Machine Safety board save data error	The safety logic circuit files in the file written in the Main CPU circuit board (type: YCP21-E) and the machine safety circuit board (type: YSF21-E) does not match. Refer to <i>chapter 8.23.6.2 "Machine Safety Flash Data Erase or Reset"</i> for more details to restore.
4776	M-SAFETY YSF LOGIC FILE SIGNAL ERR		
	0	Start-up, in reading information from the FlashROM of YSF21 board, YSF21 board has detected an undefined signal.	The error of the safety logic circuit is detected when startup. Check the safety logic circuit because an invalid I/O signal is used by the safety logic signal.
	1	In the receiving information on safe logic circuit information, YSF21 board has detected an undefined signal.	The error is detected when updating the file. Check the safety logic circuit because an invalid I/O signal is used by the safety logic signal.
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 machine safety circuit board (type:YSF21-E). 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 machine safety circuit board (type:YSF21-E). 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 machine safety circuit board (type:YSF21-E). 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 machine safety circuit board (type:YSF21-E). Reset the alarm, and re-send the safety logic circuit file.
	253	M-safety command reception time out was detected.	No response from the machine safety circuit board (type:YSF21-E) while transferring the safety logic circuit file. Reset the alarm, and re-send (perform the writing) the safety logic circuit file. If the alarm occurs again, replace the machine safety circuit board (type: YSF21-E).
	254	Safe logic circuit write error was detected.	Failure to transfer the safety logic circuit file to the machine safety circuit board (type:YSF21-E). Please re-send the safety logic circuit file. If the alarm occurs again, refer to <i>chapter 8.23.6.2</i> 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 machine safety circuit board (type:YSF21-E). Please re-send the safety logic circuit file. If the alarm occurs again, refer to <i>chapter 8.23.6.2</i> for more details.

8.24 Robot Stop Factor Monitor Function

8.24.1 Outline

The robot stop factor monitor function is a function to detect a robot stop, which is caused by the servo OFF or the hold and so on. The factors, which caused to stop the robot, are stored in chronological order and displayed on the screen.

8.24.1.1 The Robot Stop Factor

This function detects the servo OFF status caused by the machine safety circuit board instructions or the main CPU instructions and the hold status caused by programing 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 CALIBRATION	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 Machine 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
PANEL BOX EMERGENCY STOP		Controller emergency stop
EXTERNAL EMERGENCY STOP		External emergency stop
EXTERNAL ENABLE SWITCH		External enable switch
SAFETY FENCE		Safety guard
EXTERNAL SERVO ON		External servo ON It is displayed only when the level (S1D271=0) is specified
RDY0 OFF		RDY0OFF Servo OFF request from the main CPU
CATEGORY1 REQUEST		Category 1 stop request from the main CPU
M3 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 machine safety
CATEGORY1 SAFETY LOGIC CIRCUIT		Category 1 stop request from the safety logic circuit
CATEGORY1 FUNCTION SAFETY		Category 1 stop request from the machine safety
YSF21 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	Circuit board No. SV#1 to SV#8	Servo OFF by the over travel signal 1
OVER TRAVEL2	Circuit board No. SV#1 to SV#8	Servo OFF by the over travel signal 2
OVER TRAVEL3	Circuit board No. SV#1 to SV#8	Servo OFF by the over travel signal 3
OVER TRAVEL4	Circuit board No. SV#1 to SV#8	Servo OFF by the over travel signal 4
CONTACTOR OR STO OFF1	Circuit board No. SV#1 to SV#8	Servo OFF of the contactor 1 or STO1 from the main CPU

Table 8-2: The List of the Servo OFF Factors by Machine Safety Circuit Board Instructions

Displayed Item	Secondary Indication	Description of the Signal
CONTACTOR OR STO OFF2	Circuit board No. SV#1 to SV#8	Servo OFF of the contactor 2 or STO2 from the main CPU
CONTACTOR OR STO OFF3	Circuit board No. SV#1 to SV#8	Servo OFF of the contactor 3 or STO3 from the main CPU
CONTACTOR OR STO OFF4	Circuit board No. SV#1 to SV#8	Servo OFF of the contactor 4 or STO4 from the main CPU
ON ENABLE1	Circuit board No. SV#1 to SV#8	Servo OFF of the control group connected to ON_ENABLE1
ON ENABLE2	Circuit board No. SV#1 to SV#8	Servo OFF of the control group connected to ON_ENABLE2
ON ENABLE3	Circuit board No. SV#1 to SV#8	Servo OFF of the control group connected to ON_ENABLE3
ON ENABLE4	Circuit board No. SV#1 to SV#8	Servo OFF of the control group connected to ON_ENABLE4
CATEGORY ON ENABLE1	Circuit board No. SV#1 to SV#8	The time of the category 0 is up after inputting the ON_ENABLE1 signal, then switch OFF the servo of the machine safety.
CATEGORY ON ENABLE2	Circuit board No. SV#1 to SV#8	The time of the category 0 is up after inputting the ON_ENABLE2 signal, then switch OFF the servo of the machine safety.
CATEGORY ON ENABLE3	Circuit board No. SV#1 to SV#8	The time of the category 0 is up after inputting the ON_ENABLE3 signal, then switch OFF the servo of the machine safety.
CATEGORY ON ENABLE4	Circuit board No. SV#1 to SV#8	The time of the category 0 is up after inputting the ON_ENABLE4 signal, then switch OFF the servo of the machine safety.
2ND CONTACTOR1	Circuit board No. SV#1 to SV#8	2NDSF1 The time of an auxiliary contactor 1 in the secondary contactor is up, and switch OFF the servo of the machine safety.
2ND CONTACTOR2	Circuit board No. SV#1 to SV#8	2NDSF2 The time of an auxiliary contactor 2 in the secondary contactor is up, and switch OFF the servo of the machine safety.
2ND CONTACTOR3	Circuit board No. SV#1 to SV#8	2NDSF3 The time of an auxiliary contactor 3 in the secondary contactor is up, and switch OFF the servo of the machine safety.
2ND CONTACTOR4	Circuit board No. SV#1 to SV#8	2NDSF4 The time of an auxiliary contactor 4 in the secondary contactor is up, and switch OFF the servo of the machine safety.

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
EX.HOLD (SPECIFIC. IN SIGNAL)	None
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

8.24.1.2 The Robot Stop Factor Record Number

- One screen: maximum 37 factors
- History number: 20 histories

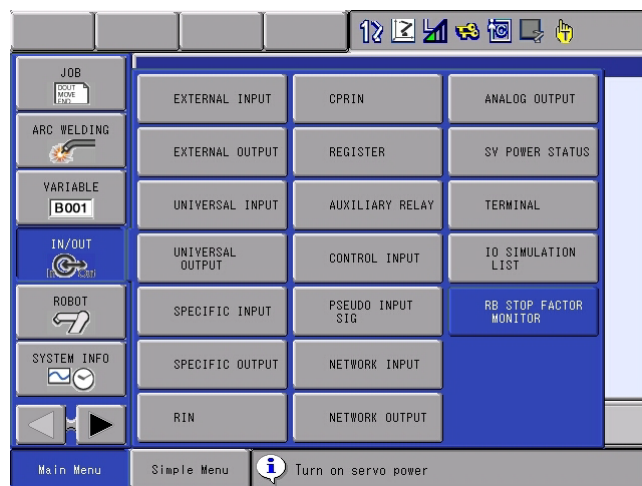
If exceeds the number above, the old data will be deleted, and the new data will be recorded.

8.24.2 Operation

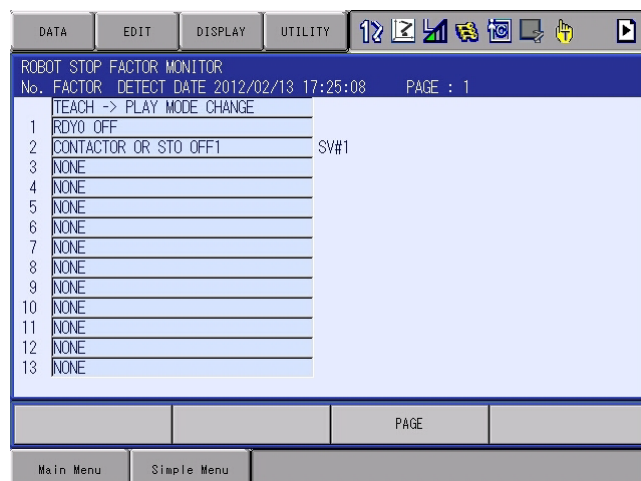
8.24.2.1 Displaying the Robot Stop Factor Monitor

The RB STOP FACTOR MONITOR can be referred by following procedures.

1. Select {ROB STOP FACTOR 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.

```
ROBOT STOP FACTOR MONITOR
No. FACTOR DETECT DATE 2012/02/13 17:25:08 PAGE : 1
```

- The factor detected by the main CPU is displayed on the first line.

```
ROBOT STOP FACTOR MONITOR
No. FACTOR DETECT DATE 2012/02/13 17:25:08 PAGE : 1
1 |TEACH -> PLAY MODE CHANGE|
2 |RDYO OFF| SV#1
3 |CONTACTOR OR STO OFF1|
  |NONE|
```

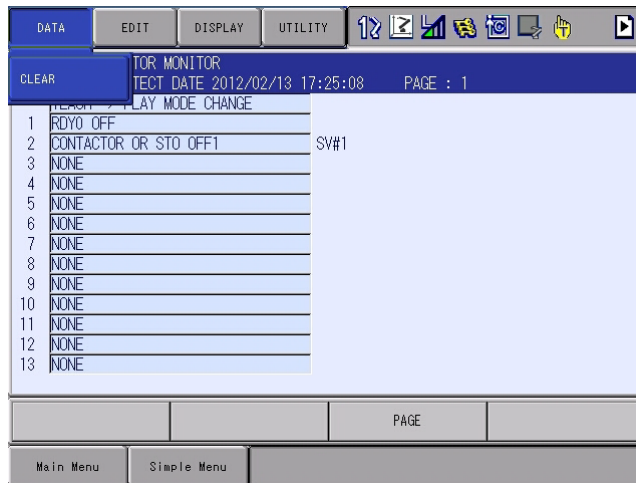
- The factor(s) detected by the machine safety is(are) displayed from the second line on the screen.

```
ROBOT STOP FACTOR MONITOR
No. FACTOR DETECT DATE 2012/02/13 17:25:08 PAGE : 1
1 |TEACH -> PLAY MODE CHANGE|
2 |RDYO OFF| SV#1
3 |CONTACTOR OR STO OFF1|
  |NONE|
```

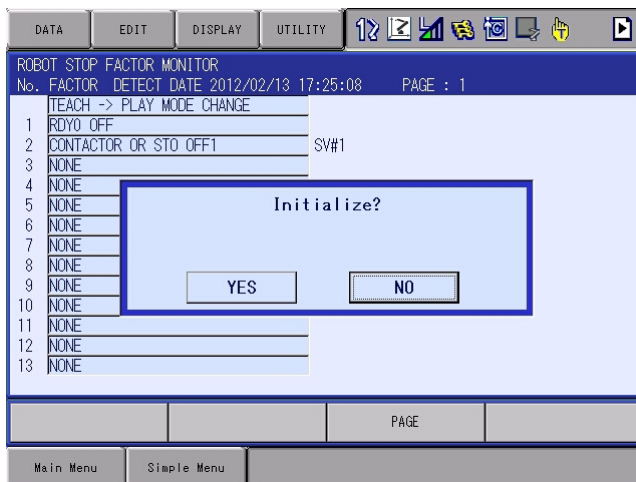
- The data on the first page is the latest one, and the page 20 is the oldest data.

8.24.2.2 Clear the Robot Stop Factor Information

1. Select {DATA} from the pull-down menu on the RB STOP FACTOR MONITOR window when the security mode is the management or higher mode. {CLEAR} is displayed.



2. Select {CLEAR}, and the confirmation dialog "Initialize?" appears. Press "YES", and the all information of the robot stop factor is cleared.



The robot stop factor information is not saved when turning the power supply OFF. Therefore, it will be initialized when turning the power supply ON again. If it is necessary to save the data, please store the data into the external memory devices before turning the power supply OFF.

8.25 Robot Detachment Function

8.25.1 Setting Maintenance Mode

This mode is used for setting up and maintenance of the robot system.

1. Turn the power ON while pressing {MAIN MENU} button.
 - Maintenance mode screen starts up.



2. Select {SYSTEM} under the main menu.
 - Sub menu is shown.

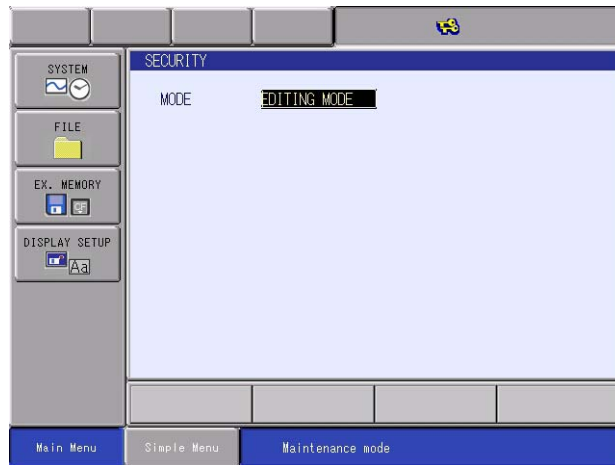


8 System Setup

8.25 Robot Detachment Function

3. Select {SECURITY}.

- Mode selection screen is shown.



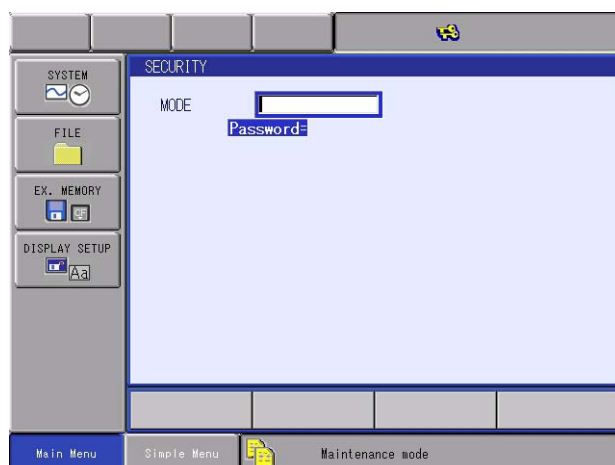
4. Press [SELECT] to select the mode.

- Mode selection list is shown.



5. Move the cursor to {SAFETY MODE} and select.

- Password input box is shown.



8 System Setup

8.25 Robot Detachment Function

6. Input the password for safety mode and press [ENTER].
 - When the correct password is input, security mode is changed.

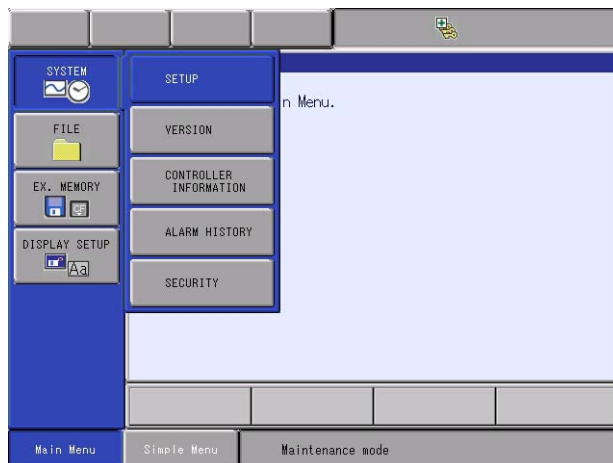


8.25.2 Setting Robot Detachment Function

Operator can set or modify the setting items for robot detachment function in detail setting screen.

The specified parameters are to be set automatically according to the setting contents in detail setting screen.

1. Select {SYSTEM} under main menu.
 - Sub menu is shown.

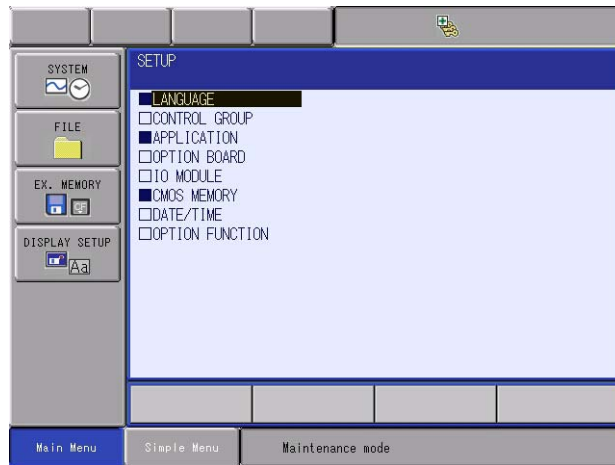


8 System Setup

8.25 Robot Detachment Function

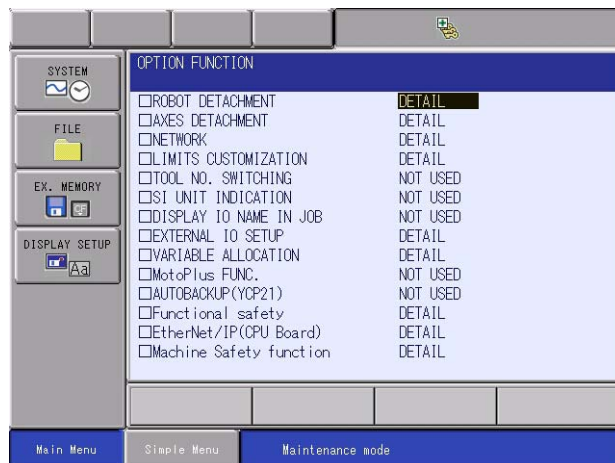
2. Select {SETUP}.

– “SETUP” screen is shown.



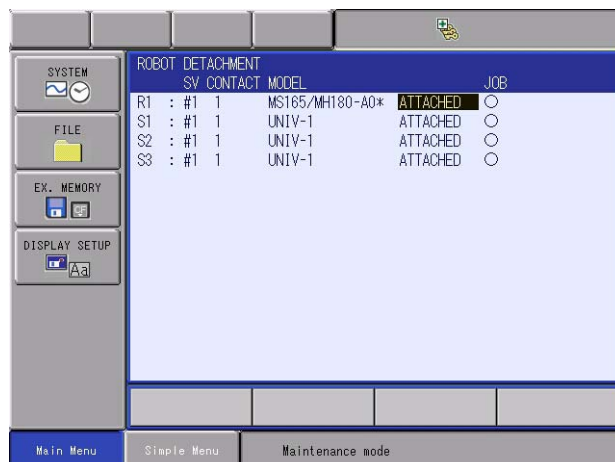
3. Move the cursor to {OPTION FUNCTION} and select.

– “OPTION FUNCTION” screen is shown.



4. Move the cursor to {ROBOT DETACHMENT} and select.

– Detail setting screen for robot detachment function is shown.

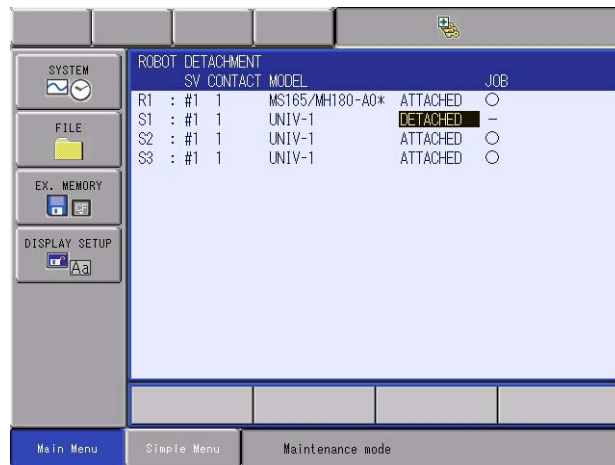


8 System Setup

8.25 Robot Detachment Function

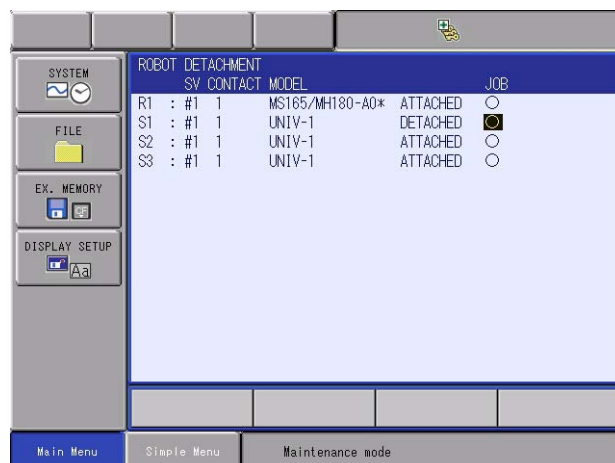
5. Change the setting contents.

- 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.

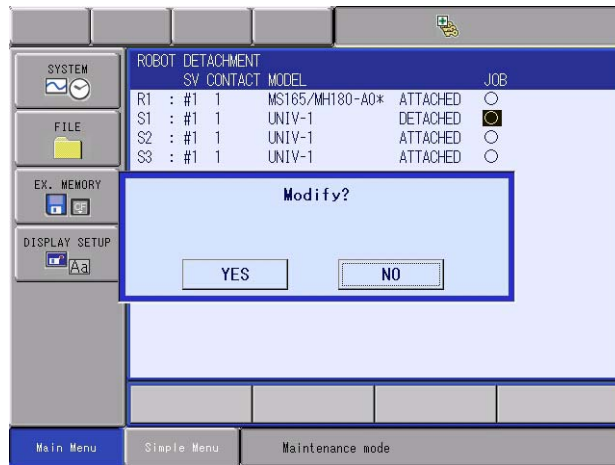
When “○” is selected: The JOB including detached group can be started up. However, the detached axes cannot be operated.

8 System Setup

8.25 Robot Detachment Function

7. Press [ENTER].

- Confirmation message for parameter change is shown.



8. Select "YES" to confirm the change.

- System parameters are to be set automatically, then the screen returns to the option function screen.

8.26 Axes Detachment Function

8.26.1 Outline

The axes detachment function is to invalid the connection of specific axes by setting in maintenance mode. When the axes detachment function is set, the system can be started without any alarm even if some axes are not connected physically during setup or motor exchange.

8.26.2 Setting Maintenance Mode

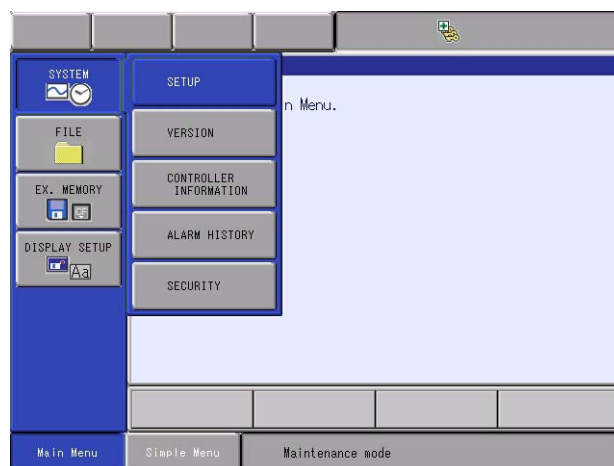
Start the maintenance mode and set the security mode to the safety mode. (Refer to *chapter 8.25.1* .)

8.26.3 Setting Axes Detachment Function

Operator can set or modify the setting items for axes detachment function in detail setting screen.

The specified parameters are to be set automatically according to the setting contents in detail setting screen.

1. Select {SYSTEM} under the main menu.
 - Sub menu is shown.

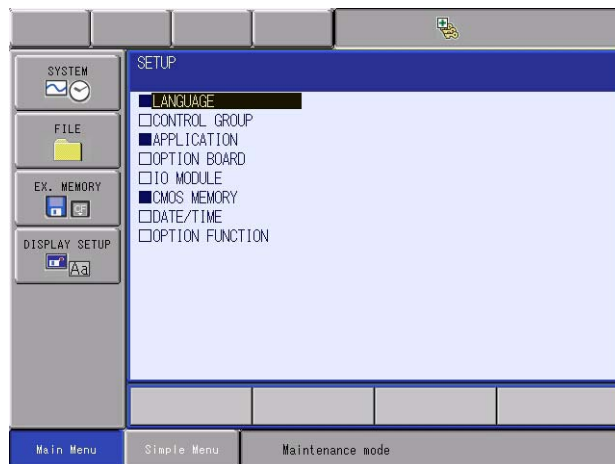


8 System Setup

8.26 Axes Detachment Function

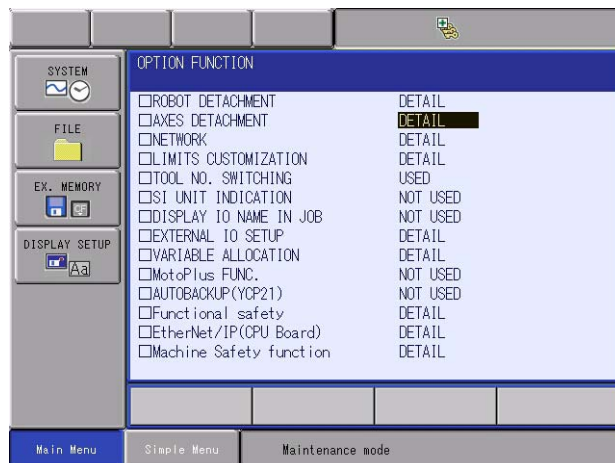
2. Select {SETUP}.

– Setting selection screen is shown.



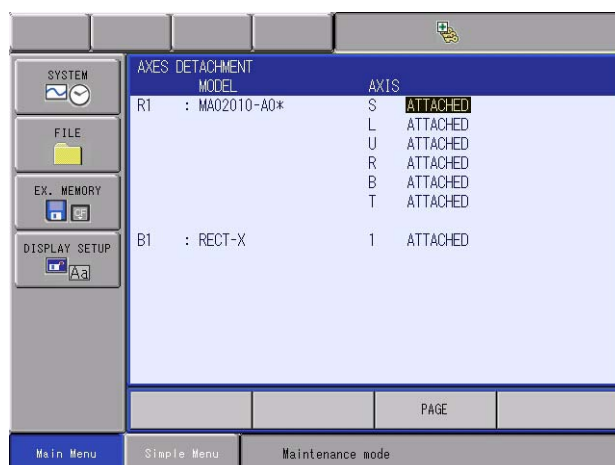
3. Move the cursor to {OPTION FUNCTION} and select.

– “OPTION FUNCTION” screen is shown.



4. Move the cursor to {AXES DETACHMENT} and select.

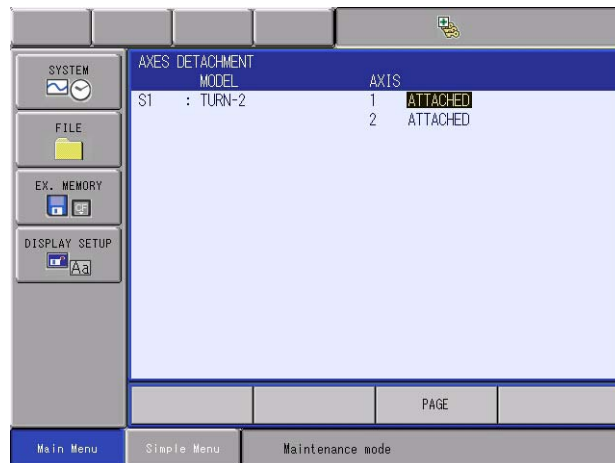
– Detail setting screen for axes detachment function is shown.



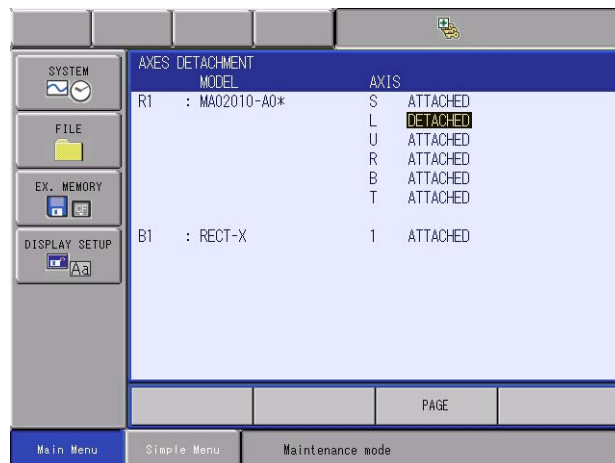
8 System Setup

8.26 Axes Detachment Function

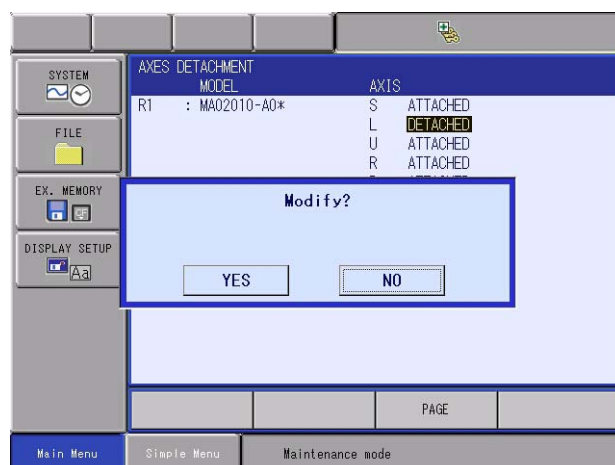
5. By pressing [PAGE], the target group for setting is switched.



6. Change the setting contents.
- Move the cursor to the target axis and select to change the setting.
 - Select “ATTACHED” or “DETACHED”.



7. Press [ENTER].
- Confirmation message for parameter change is shown.



8. Select "YES" to confirm the change.
- System parameters are to be set automatically, then the screen returns to the option function screen.

8.26.4 Specific Output and Messages

When the system is started in online mode and any axes (at least one axis) are detached, the following specific output and message are output all the time.

○ Specific output #50913 "AXES DETACHMENT"

○ Message is displayed

The following message is output in the bottom right message area on the window of the programming pendant.

"Axes deatchment has been set[sub code]"

The control group including the detached axis is shown in [sub code].

8.26.5 Restrictions

1. Operation with restrictions

When the axes detachment function is set, the following operations are restricted. If these operations are tried to be performed, an error or an alarm occurs.

Playback

Test run

Job registration (insert/modify/delete jobs in the target control group)

Variable registration

Second home position registration

Home position registration

Work home position registration



Use the robot detachment function (*chapter 8.25*) when performing the playback operation in the state that the specific manipulator, the base, or the station is detached.

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."

2. Operation without restrictions



CAUTION

- While the axes detachment function is set, even if try to move the manipulator to the taught position, the manipulator may not be moved to the right position or operated in the right posture because the specific axes don't operate. When performing the operations mentioned below while the axes detachment function is set, be very careful to the manipulator's motion and the interference between the manipulator and the peripheral devices.

The axes detachment function doesn't restrict the following operations, though be careful when performing.

Jog operation (link, cartesian, user, tool, cylindrical, and I/O jog)

Next/Back operation

Variable movement

Second home position movement

Work home position return

3. Restriction in using with other function

Before using the following function, be sure to release the axes detachment function.

○ Functional safety function

If there is any detached axis, safety monitoring cannot be performed.

8.27 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.

VARIABLE NAME	ADJUST	NUMBER	RANGE
BYTE	++ / --	100	(0 - 2000)
INTEGER	++ / --	100	(0 - 2000)
DOUBLE	++ / --	100	(0 - 2000)
REAL	++ / --	100	(0 - 2000)
STRING	++ / --	100	(0 - 1365)
POSITION(ROBOT)	++ / --	128	(0 - 1611)
POSITION(BASE)	++ / --	128	(0 - 1611)
POSITION(STATION)	++ / --	128	(0 - 1611)

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.

VARIABLE NAME	ADJUST	NUMBER	RANGE
BYTE	++ / --	50	(0 - 2000)
INTEGER	++ / --	100	(0 - 2000)
DOUBLE	++ / --	100	(0 - 2000)
REAL	++ / --	100	(0 - 2000)
STRING	++ / --	100	(0 - 1367)
POSITION(ROBOT)	++ / --	128	(0 - 1611)
POSITION(BASE)	++ / --	128	(0 - 1611)
POSITION(STATION)	++ / --	128	(0 - 1611)

8 System Setup

8.27 Variable Allocation

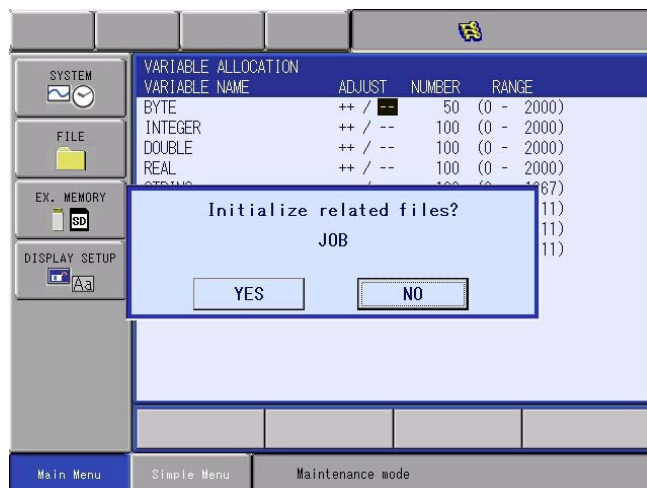
7. Press [ENTER].

- The confirmation dialog of the parameter change shows up.



8. Select {YES}.

- Select {YES} for the confirmation dialog.
When a file needs to be initialized due to the change of the variable allocation, the confirmation dialog of initialization shows up.
Select {YES} for all the confirmation dialog of initialization.





9. After the initialization of file is completed, the option function window is shown.



When the position variable allocation is changed, not only the data of variable/variable name but also the following files are cleared. Be sure to handle the data properly.

- User coordinate
- Memory play file
- Spot monitor data
- Robot calibration data
- Conveyor calibration data



The Compact Flash data saved in the main CPU board is updated by performing the procedures above. Do not turn OFF the controller power supply until the update operation is complete. If the controller power supply is turned OFF while updating the data, the data in the Compact Flash may be damaged and the system may not start correctly or be operated.

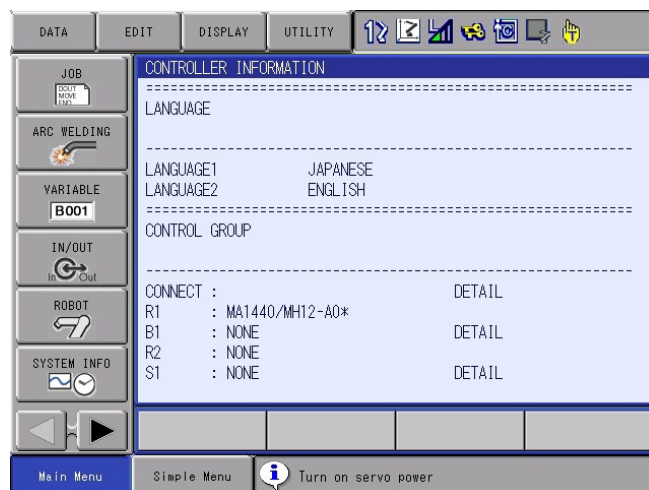
8.28 Controller Information Display Function

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.



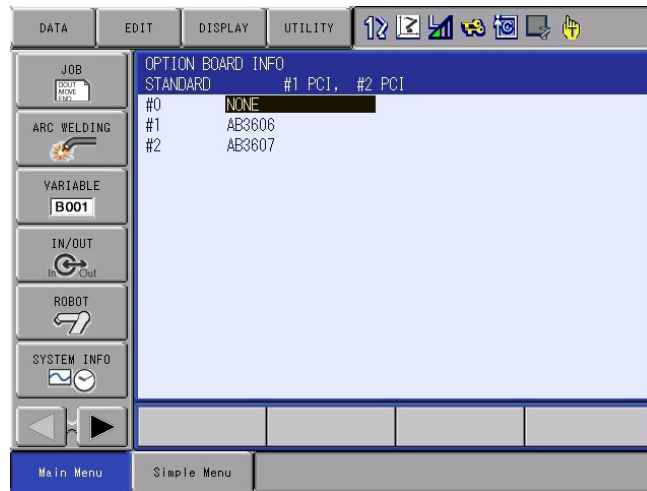
3. Select {DISPLAY}.



8 System Setup

8.28 Controller Information Display Function

4. Select {OPTION BOARD INFO}.
 - The OPTION BOARD INFO window is shown. Move the cursor to the option board to show the details.



5. Press [SELECT].
 - The setting contents of the option board information is shown.



While the CONTROLLER INFORMATION window is shown, the following display is shown by performing the bilingual operation ({SHIFT} and {AREA} on the programming pendant are pressed).
Select {CONTROLLER INFORMATION} from {SYSTEM INFO} once again.

NOTE



9	System Backup
9.1	System Backup with DX200

9 System Backup

For the DX200, the system data can be collectively backed up in advance so that the data can be immediately loaded and restored in case of an unexpected trouble such as data loss.

9.1 System Backup with DX200

For the DX200, two types of collective backup are available: CMOS.BIN and CMOSBK.BIN.

9.1.1 Function Types of Data

9.1.1.1 CMOS.BIN

For the normal backup, use this data.

Save: Perform in the normal or maintenance mode.

Load: Perform in the maintenance mode.
(the management mode or higher mode)

The loading/saving procedures in the maintenance mode, refer to *chapter 9.2 "Backup by CMOS.BIN"*.
As for saving in the normal mode, refer to *DX200 OPERATOR'S MANUAL chapter 7.3.0.2 "Saving Data"*.

Target Area: All areas of the internally stored data.
(Note that the monitoring time is not loaded.)

9.1.1.2 CMOSBK.BIN

This data is used in the automatic backup function.

Save: Saves with the preset conditions in the normal mode.

Load: Perform for the system restoration in the maintenance mode
(the management mode or higher mode)

For details, refer to *chapter 9.3 "Automatic Backup Function"*.

Target Area: All areas of the internally stored data.
(Note that the monitoring time is not loaded.)

9.1.2 Device

For the backup of the DX200 system, the CompactFlash or the USB memory is used. (The USB slot of the programming pendant is not available in the automatic backup function.)

The following tables show the recommended CompactFlash and USB memory.

<Recommended CompactFlash>

No.	Manufacturer	Model	Remarks
1	Hagiwara Solutions	MCF10P-256MS-YE	256MB
2	Hagiwara Solutions	MCF10P-512MS	512MB
3	Hagiwara Solutions	MCF10P-A01GS	1GB
4	Hagiwara Solutions	MCF10P-A02GS	2GB

9 System Backup
9.1 System Backup with DX200

< 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. 26 MByte

Note that the free space for one working file is needed in addition to the free space for the stored files when using the automatic backup function.

Also, it is recommended to store the backup data in two or more media cards to minimize problems if the media is damaged.

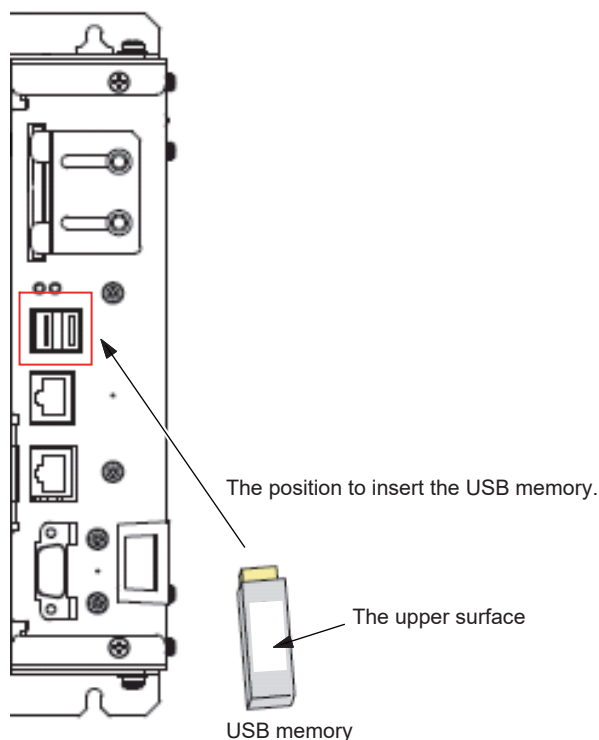


The water-proof function of the Pendant is not effective while the USB memory is connected.

If USB memory is connected constantly, there is a risk it drops off.

Use CompactFlash if there is no measures to maintain water-proof function or to prevent USB memory from dropping off.

When using the USB memory, insert it in the USB slot of the CPU circuit board. Be careful about the insertion direction of the connector: The USB memory should be inserted slowly with the upper surface right. Forcible insertion may cause the damage of the USB memory and the USB connector.



* There are two USB connectors.

The left side is for USB1 and the right side is for USB2.

9.2 Backup by CMOS.BIN

Perform the backup by CMOS.BIN in the normal or maintenance mode.

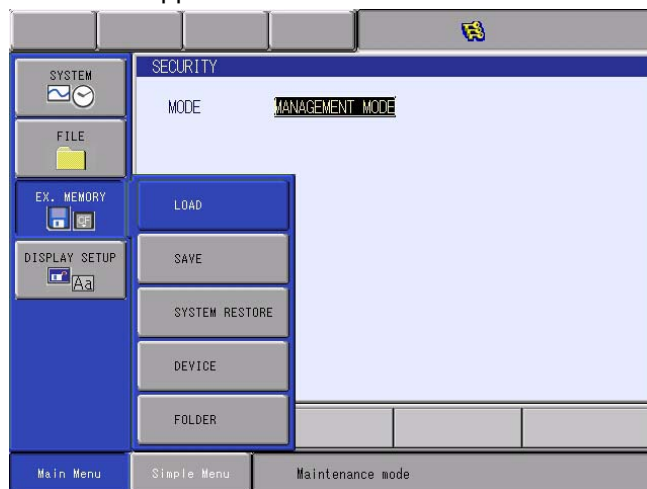
The chart below shows the availability of CMOS save/CMOS load in each security mode in the maintenance mode.

Security	CMOS Save	CMOS Load
Operation Mode	○	X
Editing Mode	○	X
Management Mode	○	○
Safety Mode	○	○

9.2.1 CMOS.BIN Save

Follow the procedures below to save CMOS.BIN in the maintenance mode.

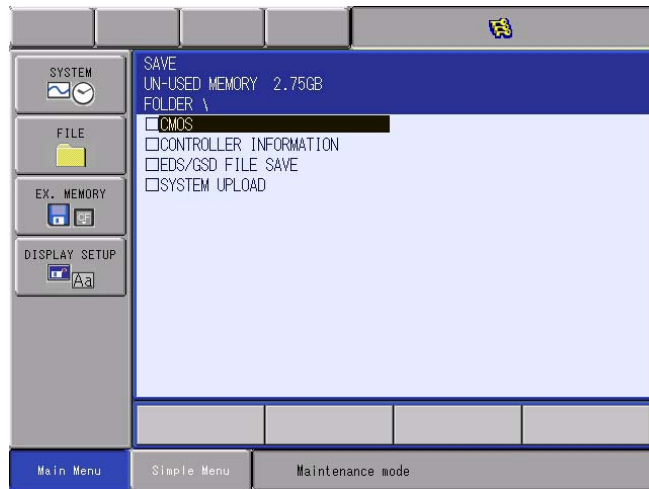
1. Turn ON the DX200 power supply while pressing [MAIN MENU].
2. Insert a CompactFlash into the CompactFlash slot on the programming pendant.
 - when USB memory is used instead of CompactFlash, mount USB memory and select one among “USB: PENDANT”, “USB1: CONTROLLER” and “USB2: CONTROLLER” in the {DEVICE}.
3. Select {FD/PC CARD} under the main menu.
 - The sub menu appears.



9 System Backup
9.2 Backup by CMOS.BIN

4. Select {SAVE}.

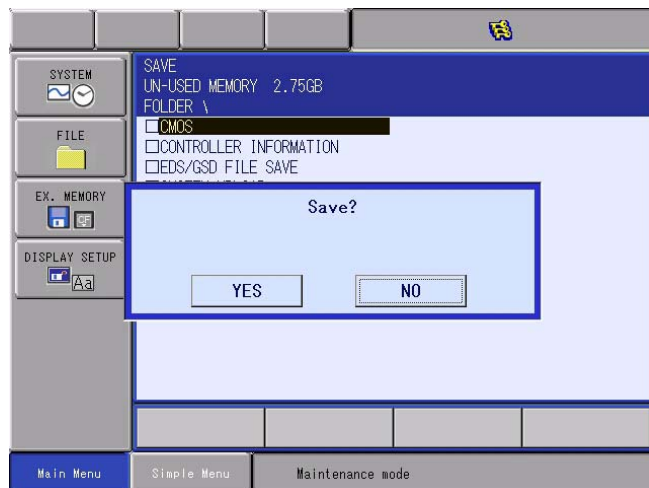
- The save display appears.



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

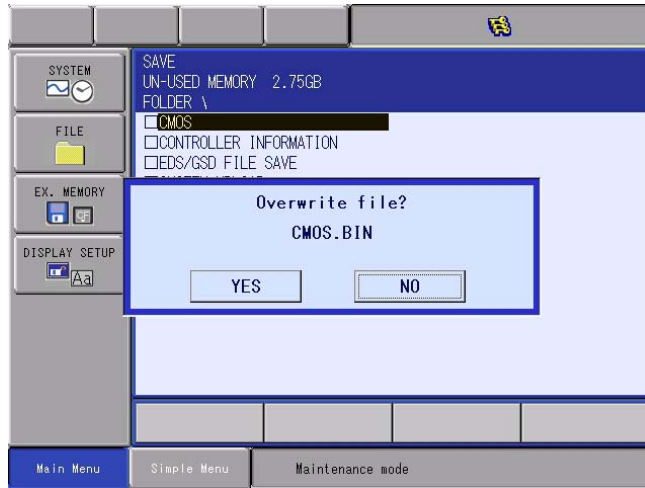
5. Select {CMOS}.

- The confirmation dialog box appears.



9 System Backup
9.2 Backup by CMOS.BIN

6. Select {YES}.
- Select {YES} to save the CMOS data into the CompactFlash.
 - When saving the file, if the CMOS.BIN file already exists in the CompactFlash, the following confirmation dialog box appears.

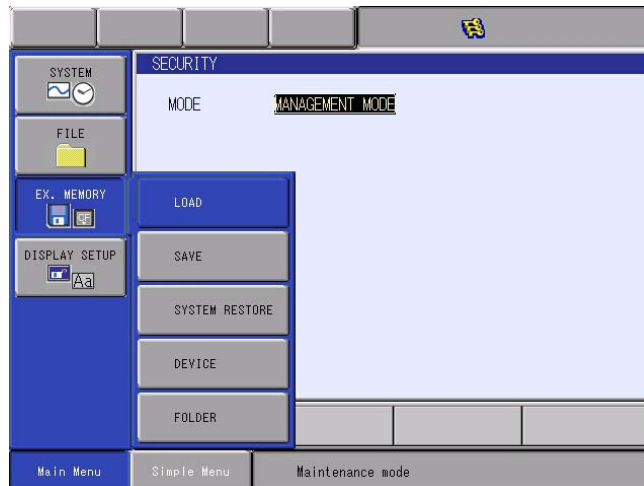


7. Select {YES}.
- The CMOS.BIN file is overwritten in the CompactFlash.

9.2.2 CMOS.BIN Load

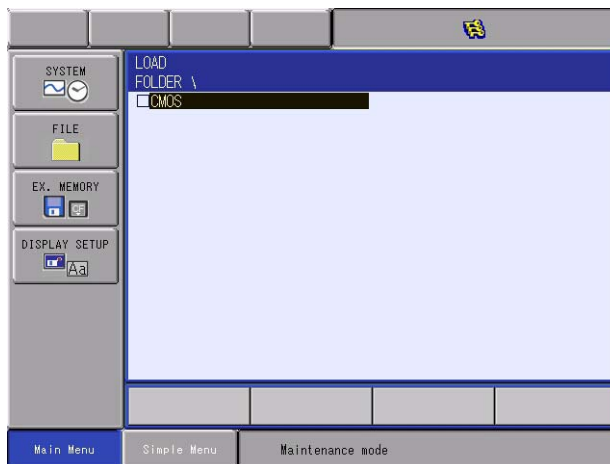
Follow the procedures below to load CMOS.BIN.

1. Turn ON the DX200 power supply while pressing [MAIN MENU].
2. Change the security mode to the maintenance mode or higher mode.
3. Insert a CompactFlash into the CompactFlash on the programming pendant.
 - When USB memory is used instead of CompactFlash, mount USB memory and select one among "USB: PENDANT", "USB1: CONTROLLER" and "USB2: CONTROLLER" in the {DEVICE}.
4. Select {FD/PC CARD} under the main menu.
 - The sub menu appears.

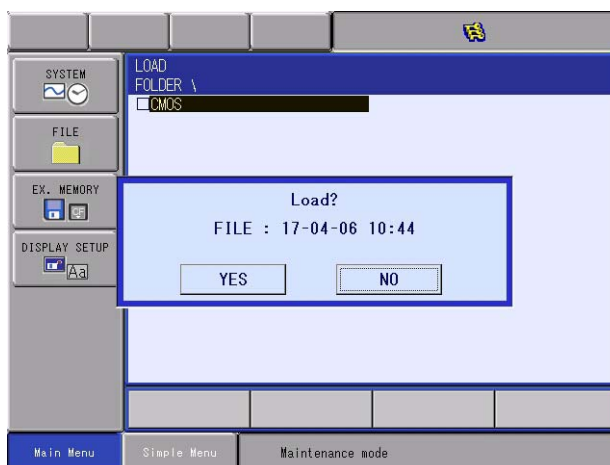


9 System Backup
9.2 Backup by CMOS.BIN

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.



CAUTION

When the “CMOS load” is performed, the current CMOS data is replaced with the CMOS data (the contents of "CMOS.BIN") in the CompactFlash. Therefore, before performing the load, make sure to perform the “CMOS Save” of the CMOS data to be loaded.

9.3 Automatic Backup Function

9.3.1 Automatic Backup Function

9.3.1.1 Objective

With the automatic backup function, the data saved in the DX200 such as system setting or operational condition are collectively backed up in the CompactFlash, which is stored in the programming pendant, or the selected device at the automatic backup window.

- speed ethernet server function is effective.)

DN1.50-00 or higher: The automatic backup function is expanded. In order to use the automatic backup extension function, set the following parameter.

For the setting of the automatic backup extension function, refer to *chapter 9.3.2.8 "AUTO BACKUP EXTENSION FUNCTION SET Window"*.

Parameter	Content	Initial Value
S2C737	Automatic backup extension function	1

Able to back up to the following devices.

- The CompactFlash inserted in the programming pendant
- USB Memory connected to the YCP21 board
- The CompactFlash of the YCP21 board
- The RAM AREA of the YCP21 board (It will display, when the high speed ethernet server function is effective.)



The automatic backup function is enabled only while the DX200 power supply is ON whereas it isn't while in the maintenance mode or the power supply is OFF.

9.3.1.2 Outline

The automatic backup function saves the internally stored data in a single file in advance for the smooth restoration from unexpected troubles of the DX200.

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 DX200 and when inputting signals are also available for some specific versions.

9 System Backup
9.3 Automatic Backup Function

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	<u>Cyclic backup</u> In the teach mode, the data in memory is backed up in a specified cycle from a specified starting time.	This function backs up as much of the latest data as possible during editing. The backup data saved in the CompactFlash can be loaded to the DX200 in case of data loss so that the damage can be minimized.
2	<u>Backup when switching modes</u> 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	<u>Backup when start-up</u> When the DX200 is start-up, the data in memory is backed up.	When the DX200 starts up, the data in memory is backed up. Since the editing/playback operation is usually completed when the DX200 power is turned OFF, the latest data is automatically backed up with this mode.
4	<u>Backup when inputting specified signals</u> 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	<u>Backup while robot program is stopped</u> 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	<u>Backup and retry at low priority</u> 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	<u>Backup in binary</u> The data is saved as binary data.	Backup in binary allows the system to be easily and speedily restored.
8	<u>Setting of items</u> Parameters can limit the settings of the backup condition.	Unnecessary settings can be avoided with this setting.

9.3.2 Settings for Automatic Backup

To set the automatic backup function, set each item at the automatic backup display.



Four ways to perform the automatic backup are available: "Cyclic backup", "Backup when switching modes", "Backup when start-up", and "Backup when inputting specified signals".

The automatic backup can be performed only when the robot is not during playback, and the robot is stopped.

Automatic backup function can be set from the command of the optional high speed ethernet server function.

9.3.2.1 The CompactFlash inserted in the Programming Pendant

To use the automatic backup function, insert CompactFlash in the CompactFlash slot on the programming pendant.

When the data could not be saved in CompactFlash during an automatic backup due to the absence or insufficient capacity of the CompactFlash, the "Check the media insertion" error occurs. At the same time, the signal "occurrence of error" is output, but the robot program will not be stopped. Check if CompactFlash is inserted and if it has enough capacity, and take the necessary actions.

YASKAWA recommends that the data be saved in two or more CompactFlash to minimize problems if the CompactFlash should be damaged.

Regarding the Compact Flash for auto backup, refer to "Recommended CompactFlash" in *chapter 9.1.2 "Device"*.

Storage capacities needed for CompactFlash are as follows:

(The number of stored files + 1) X approx. 26MByte

The number of storable files is automatically calculated and the MAX value is shown when AUTO BACKUP SET display appears.

9.3.2.2 The USB memory connected to the YCP21 board

A USB memory connected to the YCP21 board can also be used as a backup device for the automatic backup function. The USB memory connected to the YCP21 board can be used in the same manner as the CompactFlash inserted in the programming pendant.

For the USB memory for automatic backups, refer to "Recommended CompactFlash" in *chapter 9.1.2 "Device"*.

9.3.2.3 The CompactFlash of the YCP21 Board

Set the following procedures in advance to back up to the CompactFlash of the YCP21 board. If the following procedures are not done, "CF: Controller" would not be shown on the device list of the auto backup set display.

1. Turn ON the Power supply while pressing the {MAIN MENU} on the programming pendant.
2. After starting maintenance mode, change the security mode to the management or higher mode.
3. Select {SYSTEM} in the main menu.
 - When the sub menu will appear, select {SETTING}-{OPTION FUNCTION}. The list of the optional function will appear.
4. Select {Automatic backup (YCP21)}, and change the "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 CompactFlash of the YCP21. During allocating, the message of do not turn the power off appears.
 - The message of the maintenance mode will appear, when finished allocating.
5. Turn ON the power supply again.
6. The online window appears on the programming pendant.
7. Change the security mode to the management mode.
8. Select {SETUP}-{AUTO BACKUP SET}.
9. If the device is set to "CF: 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 "CF: Controller".



Backup setting to the CompactFlash of the YCP21 board should be done while the robot is not operating.

When access to CompactFlash of the YCP21 by using other than the auto backup function, the auto backup function and the exclusive process would be run. Therefore, the save time of the auto backup will extend.

(Normally, it takes about three minutes to finish backing-up. However, duplication access to the CompactFlash of the YCP21 board takes three to ten minutes.)

9.3.2.4 RAMDISK on the YCP21 Board

RAMDISK will be shown when the high speed ethernet server function is effective. Refer to the instruction of the DX200 HIGH-SPEED ETHERNET SERVER FUNCTION for more details.

9.3.2.5 DX200 Status and Automatic Backup

Backup Timing	DX200 Status		Automatic Backup	
			Compact Flash ready to save the data	Absence or insufficient capacity of the CompactFlash
From a specified starting time	Teach mode	Editing (Accessing to the memory)	Retry	Retry
		When editing is interrupted	Backup	Error
	Play mode Remote mode	Executing jobs	Disabled	Disabled
		When stopped	Backup	Error
When a specified signal (#40560) is input	Teach mode	Editing (Accessing to the memory)	Error	Error
		When editing is interrupted	Backup	Error
	Play mode Remote mode	Executing jobs	Disabled	Disabled
		When stopped	Backup	Error
When switching the mode from the teach mode to the play mode	-		Backup	Error
When the DX200 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 DX200 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 DX200 starts up**

Since the automatic backup process is added to the DX200 start-up process, a few extra seconds are needed to start up the DX200.

■ **Backup when Specific Signal is Input**

While the DX200 memory is edited such as overwriting, the backup operation becomes an error even if there is an input to a specific signal (#40560). To start the specific input backup, perform it while the robot program is stopped and a job or file is not being modified.

Also, since the signal input is executed at rising detection, turn the signal to "0" if it is already "1", then return to "1" again.

Execute the job after three second since starting the back-up.

■ **Overwriting Limit in CompactFlash**

The number of times that the CompactFlash can be overwritten is limited to approx. 100,000 times. Because frequent backup operations may shorten the life of CompactFlash, the number of backup times should be minimized as much as possible.

9.3.2.6 Setting Examples

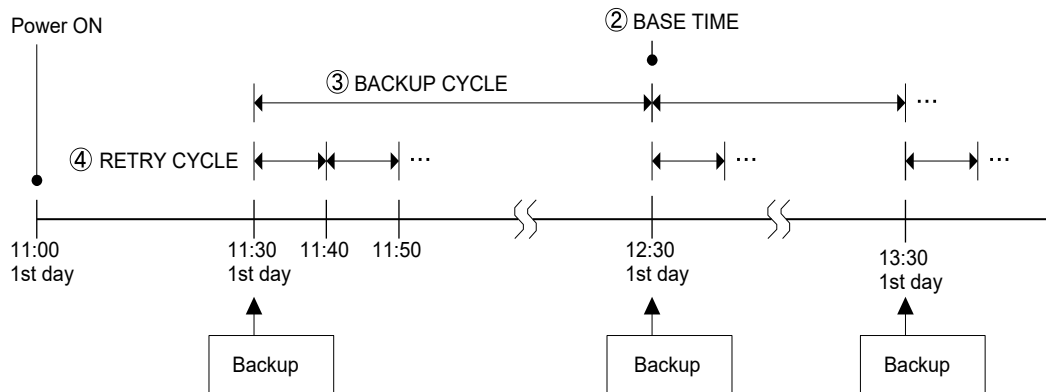
■ **Setting Example 1**

The following diagram shows a setting example with the following conditions:

BASE TIME: 12:30

BACKUP CYCLE: 60 (minutes)

RETRY CYCLE: 10 (minutes)



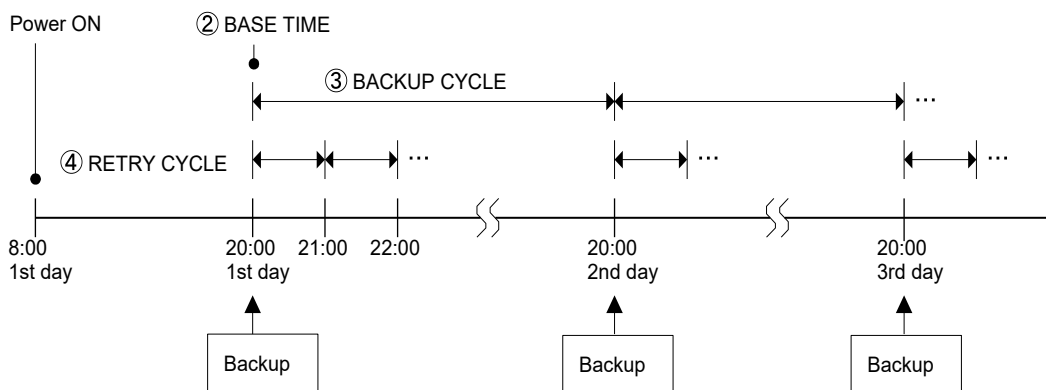
■ **Setting Example 2**

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)



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

9.3.2.7 AUTO BACKUP SET Display

■ Settings

Select the following items on the AUTO BACKUP SET display and set values for the automatic backup.

- RESERVE TIME BACKUP (VALID/INVALID of the cyclic backup)
- BASE TIME
- BACKUP CYCLE
- RETRY CYCLE
- MODE CHANGE BACKUP (VALID/INVALID of the backup when switching the mode from teach mode to play mode)
- STARTUP AUTO BACKUP (VALID/INVALID of the backup when the DX200 is started up)
- SPECIFIC INPUT BACKUP (VALID/INVALID of the backup when inputting specified signals)
- UNIV.OUT NO. ON ERROR
- DISPLAY AT EMERGENCY
- DURING ALARM OCCURENCE
- DEVICE
(Setting of the device to store the automatic backup file)
- STORED FILE SETTING
(Can be set when "CF: Pendant", "USB1: Controller", or "USB2: Controller" is set in {DEVICE}.)



When the "CF: Pendant", "USB1: Controller", "USB2: Controller", or "CF: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. When "CF: Pendant", "USB1: Controller", or "USB2: Controller" is selected, an error will occur if the specified media is not inserted.

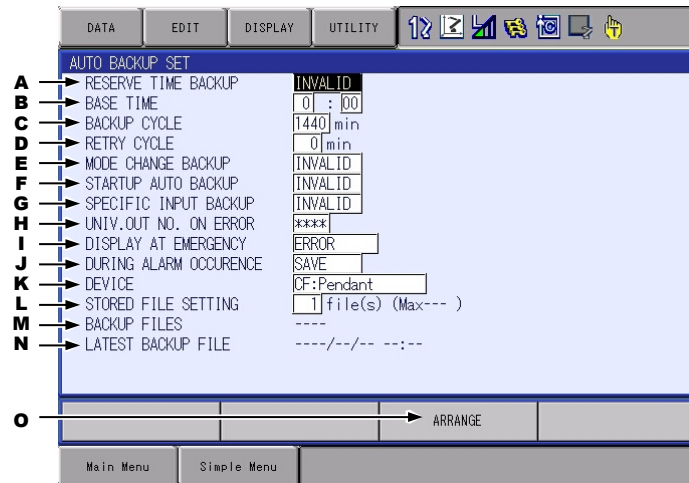
When executing "ARRANGE", the files "CMOSBK.BIN" and "CMOSBK??.BIN" (?? denotes figures) in the Compact-Flash card or USB memory are changed in name or deleted. If a certain file of this type is needed to be saved before changed in name or deleted, evacuate it into a PC, etc. beforehand.

While an error occurring, the setting of the each item on the auto backup set display cannot be changed.

9 System Backup

9.3 Automatic Backup Function

1. Turn ON the DX200.
 - Insert the CompactFlash to the programming pendant, when the backup is set on the CompactFlash inserted in the programming pendant. If the DX200 is set to make backups to the USB memory connected to the YCP21 board, connect the USB memory to the YCP21 board.
2. Change the security mode to the management or higher mode.
3. Select {SETUP} under the main menu.
4. Select {AUTO BACKUP SET}.
 - The AUTO BACKUP SET display appears.



A. RESERVE TIME BACKUP

Set the backup function to valid or invalid in a specified cycle from a specified starting time.

Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

The reserve time can be set by inputting values in B,C and D in the display.

Every time values are set to these three items, reset the RESERVE TIME BACKUP to VALID.

If these settings are incorrect, the RESERVE TIME BACKUP cannot be reset to VALID.

If so, check and then change the values to the correct settings.

B. BASE TIME

Specify the reference time to start reserve time backup.

The time elapsed from the reference time for a BACKUP CYCLE period is recognized as the BACKUP TIME.

The first automatic backup is performed at the first BACKUP TIME after the power of the DX200 is turned ON.

The automatic backup after the first time, is performed at the interval of BACKUP CYCLES.

The reference time ranges from 0:00 to 23:59.

C. BACKUP CYCLE

Specify the length of time for a cycle to back up. After the first backup, the next backup is performed automatically in the time specified in the BACKUP CYCLE.

Set the backup cycle in units of minutes. The cycle setting ranges from 10 to 9999 minutes, and is longer than the RETRY CYCLE.

D. RETRY CYCLE

Specify the length of time for a cycle to retry backing up when the backup operation is suspended.

After being suspended, the backup is retried in the time specified in the RETRY CYCLE.

Set the retry cycle in units of minutes. The cycle setting ranges from 0 to 255, and is shorter than the BACKUP CYCLE.

When it is set to 0, retry will not be performed.

E. MODE CHANGE BACKUP

Set the automatic backup function to be valid or invalid when the mode is switched from teach mode to play mode.

Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

F. STARTUP AUTO BACKUP

Set the backup function to be valid or invalid when the power of the DX200 is turned ON.

Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

G. SPECIFIC INPUT BACKUP

Set the backup function to be valid or invalid when specific input signal (# 40560) is input (rising edge from 0 to 1).

Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

H. UNIV.OUT NO. ON ERROR

Set "1" to the specified user output signal which was specified in this chapter when the automatic backup error occurs.

The term "automatic backup error" here means that the backup is not performed successfully before the next backup (including retry operation) starts.

I. DISPLAY AT EMERGENCY

Set the method of notification of the automatic backup error to "ERROR" or "MESSAGE."

Each time [SELECT] is pressed, "ERROR" and "MESSAGE" are displayed alternately.

J. DURING ALARM OCCURENCE

Set the backup function to be valid or invalid when an alarm occurs.

Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

K.DEVICE

Press {SELECT} to display the device list.

The Device Name in Display	Explanation
CF: Pendant	Set the backup to the CompactFlash inserted in the programming pendant.
CF: Controller	Set the backup to the CompactFlash of the YCP21 board. When the "CF: controller" of the device name is not shown, refer to 9.3.2.2 the CompactFlash of the YCP21.
RAMDISK	It will be shown when the optional function of High Speed Ethernet Server function is effective. It can back up by the DX200 high speed ethernet server function command. Refer to the [DX200 Instruction HIGH-SPEED ETHERNET SERVER FUNCTION].
USB1: Controller	Set the backup to the USB memory connected to the YCP21 board (USB1 connector).
USB2: Controller	Set the backup to the USB memory connected to the YCP21 board (USB2 connector).

L. STORED FILE SETTING

Set the number of files to be stored by the automatic backup function. The number mentioned on the right side of this item with "(Max)" indication is the maximum number of files that can be stored in the CompactFlash inserted in the Programming Pendant or USB memory connected to the YCP21 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 CompactFlash inserted in the Programming Pendant or USB memory connected to the YCP21 board when this window is displayed.

N. LATEST BACKUP FILE

Indicates the date of the latest file in the CompactFlash inserted in the Programming Pendant or USB memory connected to the YCP21 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.

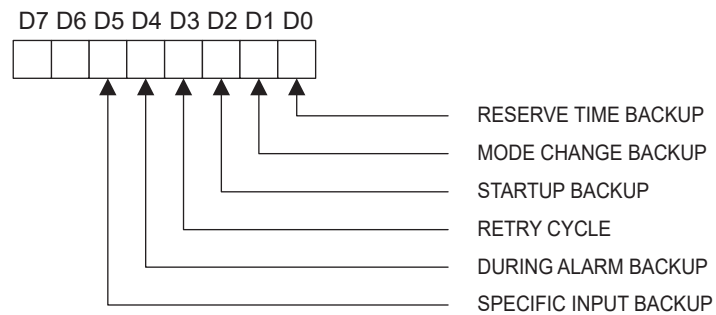
To reduce the number of files that are already backed up, change "STORED FILE SETTING" to the desired number of files and then select "ARRANGE".

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 CompactFlash after creating the backup data. Do not remove the CompactFlash from the programming pendant during this period.

9.3.2.8 AUTO BACKUP EXTENSION FUNCTION SET Window

■ Settings

Automatic backup setting is performed by setting the following items on the AUTO BACKUP SET window:

- RESERVE TIME BACKUP
(Setting for performing the backup on what day of the week, every day, or in a specific cycle)
- BASE TIME
- BACKUP CYCLE
- RETRY CYCLE
- MODE CHANGE BACKUP
(VALID/INVALID of the backup when switching the mode from the teach mode to the play mode)
- STARTUP AUTO BACKUP
(VALID/INVALID of the backup when the DX200 is started up)
- SPECIFIC INPUT BACKUP
(VALID/INVALID of the backup when inputting specified signals)
- UNIV.OUT NO. ON ERROR
- DISPLAY AT EMERGENCY
- DURING ALARM OCCURENCE
- DEVICE
(Setting of the device to store the automatic backup file)
- STORED FILE SETTING
(Can be set when "CF: Pendant", "USB1: Controller", or "USB2: Controller" is set in {DEVICE}.)



When the "CF: Pendant", "USB1: Controller", "USB2: Controller", or "CF: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. When "CF: Pendant", "USB1: Controller", or "USB2: Controller" is selected, an error will occur if the specified media is not inserted.

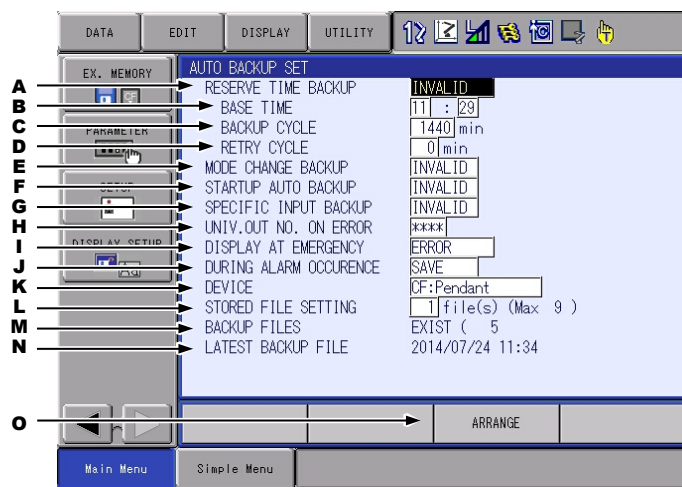
When executing "ARRANGE", the files "CMOSBK.BIN" and "CMOSBK??.BIN" (?? denotes figures) in the Compact-Flash card or USB memory are changed in name or deleted. If a certain file of this type is needed to be saved before changed in name or deleted, evacuate it into a PC, etc. beforehand.

While an error occurring, the setting of the each item on the auto backup set display cannot be changed.

9 System Backup

9.3 Automatic Backup Function

1. Turn ON the DX200.
 - Insert the CompactFlash to the programming pendant, when the backup is set on the CompactFlash inserted in the programming pendant. If the DX200 is set to make backups to the USB memory connected to the YCP21 board, connect the USB memory to the YCP21 board.
2. Change the security mode to the management or higher mode.
3. Select {PARAMETER} in the main menu.
4. Select {S2C}.
- The parameter setting window appears. Set the value of S2C737 to "1".
5. Select {SETUP} under the main menu.
6. Select {AUTO BACKUP SET}.
- The AUTO BACKUP SET display appears.

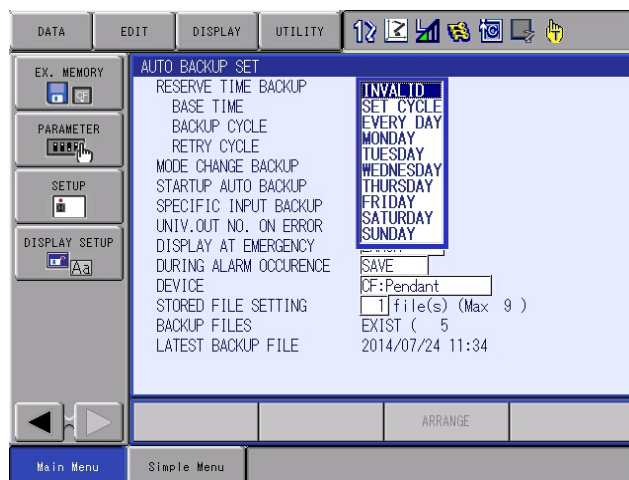


A. RESERVE TIME BACKUP

Pressing [SELECT] displays the following list. Select the item from "SET CYCLE", "EVERY DAY", or the day of the week ("MONDAY" to "SUNDAY").

Please note that after setting the base time, the backup cycle, and the retry cycle, select the item from "SET CYCLE", "EVERY DAY", or the day of the week ("MONDAY" to "SUNDAY").

If "SET CYCLE", "EVERY DAY", or the day of the week ("MONDAY" to "SUNDAY") is set before setting one of the base time, the backup cycle, and the retry cycle, "INVALID" is selected for RESERVE TIME BACKUP.



9 System Backup

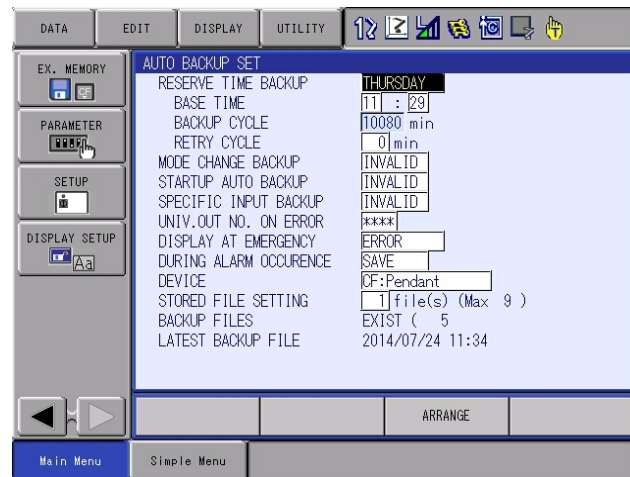
9.3 Automatic Backup Function

- "INVALID" : RESERVE TIME BACKUP is not performed.
- "SET CYCLE" : The automatic backup is performed every BACKUP CYCLE based on the specified BASE TIME.
- "EVERY DAY" : The automatic backup is performed at the specified BASE TIME every day.
- "MONDAY" to "SUNDAY" : The automatic backup is performed at the specified BASE TIME every week.

– Setting example for the automatic backup at 11:29 every day



– Setting example for the automatic backup at 11:29 on every Thursday



B. BASE TIME

Specify the reference time to start the automatic backup.

The reference time ranges from 0:00 to 23:59.

C. BACKUP CYCLE

Specify the backup cycle to perform the cyclic back up.

Set the backup cycle in units of minutes. The cycle setting ranges from 10 to 9999 minutes. After the first backup, the following backups are performed automatically in every BACKUP CYCLE.

When "EVERY DAY" or the day of the week ("MONDAY" to "SUNDAY") for RESERVE TIME BACKUP is selected, BACKUP CYCLE cannot be input.

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 DX200 is turned ON.

Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

G. SPECIFIC INPUT BACKUP

Set the backup function to be valid or invalid when specific input signal (# 40560) is input (rising edge from 0 to 1).

Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

H. UNIV.OUT NO. ON ERROR

Set "1" to the specified user output signal which was specified in this chapter when the automatic backup error occurs.

The term "automatic backup error" here means that the backup is not performed successfully before the next backup (including retry operation) starts.

I. DISPLAY AT EMERGENCY

Set the method of notification of the automatic backup error to "ERROR" or "MESSAGE."

Each time [SELECT] is pressed, "ERROR" and "MESSAGE" are displayed alternately.

J. DURING ALARM OCCURENCE

Set the backup function to be valid or invalid when an alarm occurs.

Each time [SELECT] is pressed, "INVALID" and "VALID" are displayed alternately.

K.DEVICE

Press {SELECT} to display the device list.

The Device Name in Display	Explanation
CF: Pendant	Set the backup to the CompactFlash inserted in the programming pendant.
CF: Controller	Set the backup to the CompactFlash of the YCP21 board. When the "CF: controller" of the device name is not shown, refer to 9.3.2.2 the CompactFlash of the YCP21.
RAMDISK	It will be shown when the optional function of High Speed Ethernet Server function is effective. It can back up by the DX200 high speed ethernet server function command. Refer to the [DX200 Instruction HIGH-SPEED ETHERNET SERVER FUNCTION].
USB1: Controller	Set the backup to the USB memory connected to the YCP21 board (USB1 connector).
USB2: Controller	Set the backup to the USB memory connected to the YCP21 board (USB2 connector).

L. STORED FILE SETTING

Set the number of files to be stored by the automatic backup function. The number mentioned on the right side of this item with "(Max)" indication is the maximum number of files that can be stored in the CompactFlash inserted in the Programming Pendant or USB memory connected to the YCP21 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 CompactFlash inserted in the Programming Pendant or USB memory connected to the YCP21 board when this window is displayed.

N. LATEST BACKUP FILE

Indicates the date of the latest file in the CompactFlash inserted in the Programming Pendant or USB memory connected to the YCP21 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.

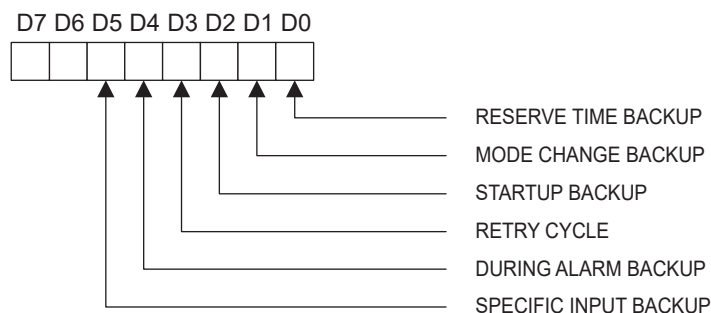
To reduce the number of files that are already backed up, change "STORED FILE SETTING" to the desired number of files and then select "ARRANGE".

7. 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 CompactFlash after creating the backup data. Do not remove the CompactFlash from the programming pendant during this period.



When the value of the parameter S2C737 is changed from "0" to "1" or "1" to "0", the setting details of RESERVE TIME BACKUP are not taken over, but the others are.

9.3.3 Limiting the Automatic Backup File Creation

9.3.3.1 Setting to Limit the Automatic Backup File Creation

It is applicable from version DN1.60-00 to limit the backup file creation executed by the automatic backup function to once a day.

To limit the backup file creation to once a day, set the following parameter.

Parameter number	Contents	Setting value
S0C682	Limits the backup file creation executed by the automatic backup function to once a day.	0 (Invalid) 1 (Valid)



When the automatic backup function is requested to start in the state of limiting the automatic backup file to once a day, an error occurs to notify that the backup has not been processed.

To avoid the above error, set DISPLAY AT EMERGENCY to "message".

For the setting of DISPLAY AT EMERGENCY, refer to *chapter 9.3.2.7 "AUTO BACKUP SET Display"* and *chapter 9.3.2.8 "AUTO BACKUP EXTENSION FUNCTION SET Window"*.

9.4 Loading the Backup Data from the CompactFlash

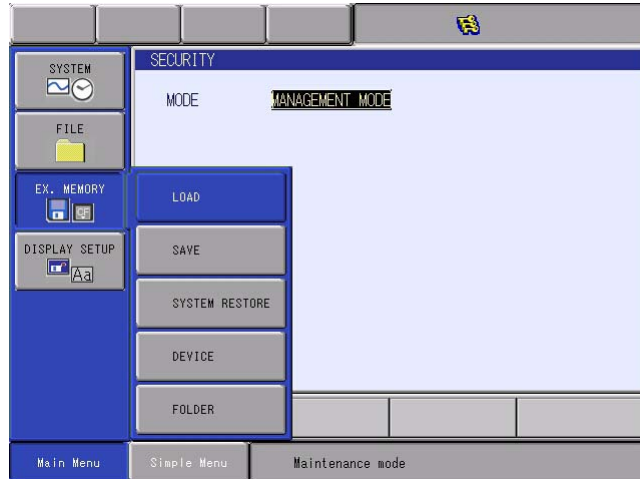
To restore the backup memory in the auto backup function is done in the maintenance mode. Otherwise, restore from the CompactFlash of the programming pendant or USB memory when backup is done at the optional high speed ethernet server function command. Prepare either of the CompactFlash or the USB memory to make copies.

9.4.1 Loading Procedure

To restore from the CompactFlash of the programming pendant, perform the following procedures No.1 to 8. To restore from the CompactFlash on the YCP21 board, perform the following procedures from No.9.

For the USB memory, select one among the "USB: pendant", "USB1: controller" and "USB2: controller" in the {EX. MEMORY} -{DEVICE} to restore.

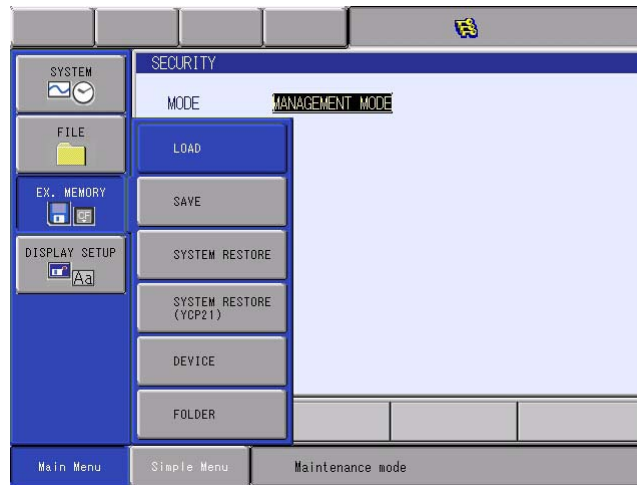
1. Insert the CompactFlash with the backup data in the CompactFlash slot on the programming pendant.
(When selecting "USB1: controller" or "USB2: controller", insert it in the YCP21 board.)
 - The backup data is stored under the file name "CMOSBK.BIN" or "CMOSBK???.BIN" (?? denotes figures.)
2. Turn ON the DX200 power supply while pressing [MAIN MENU].
3. Change the security mode to the management or higher mode.
4. Select {EX. MEMORY} under the main menu.
 - The sub menu appears.



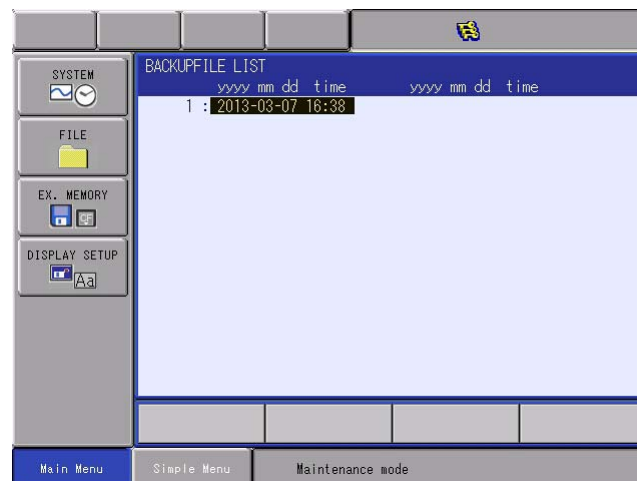
9 System Backup

9.4 Loading the Backup Data from the CompactFlash

- When set the {SYSTEM}- {SETUP}- {OPTIONAL FUNCTION}- {AUTO BACKUP (YCP21)} as “USE”, the following sub menu appears.



5. Select {SYSTEM RESTORE}.
- The BACKUP FILE LIST display appears.



9 System Backup
9.4 Loading the Backup Data from the CompactFlash

6. Select the file to be loaded.

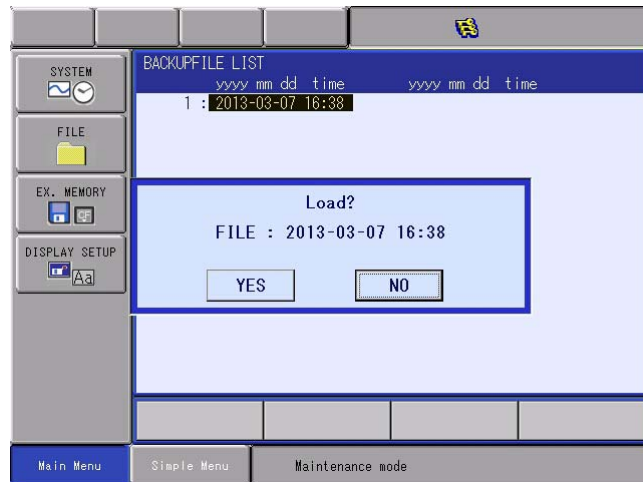
- The dialog box appears for the YIF/YCP21 board replacement confirmation.



- Select {YES} if the YIF/YCP21 board has been replaced, or select {NO} if it has not been replaced.
- Selecting {YES} initializes the system monitoring time. Selecting {NO} continues the counting of the current system's monitoring time.

7. Select from the confirmation dialog box.

- The dialog box appears for the loading confirmation.

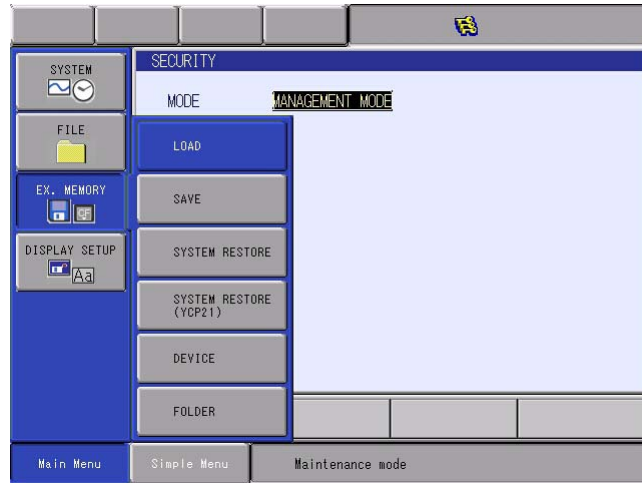


- Select {YES} in the loading confirmation dialog box to start loading the contents of "CMOSBK.BIN" or "CMOSBK???.BIN" (?? denotes figures) from the CompactFlash to the DX200 CMOS.

8. Select {YES}.

9 System Backup
9.4 Loading the Backup Data from the CompactFlash

9. Turn the power on, while pressing the [MAIN MENU].
10. Change the security mode to the management or higher mode.
11. Select {External memory} in the main menu.
 - The sub menu will appear. .



12. Select {SYSTEM RESTORE (YCP21)}.
- The backup-file list display will appear.



9 System Backup
9.4 Loading the Backup Data from the CompactFlash

13. Select desired date file.

- The YIF/YCP21 board dialog will appear.



- Select [YES] when exchanged the YIF/YCP21 board. If not, select [NO].
- When select [YES], cumulative time display will be initialized. For selecting [NO], cumulative time display will continue.

14. Select from the confirmation dialog box.

- The dialog box appears for the loading confirmation.



- Selecting [YES] in the confirmation dialog starts loading the content of [CMOSBK.BIN] to CMOS of the YCP21 board.

15. Select [YES].



CAUTION

Note that executing "SYSTEM RESTORE" or "SYSTEM RESTORE (YCP21)" replaces the current CMOS data with the data of the file "CMOSBK.BIN" or "CMOSBK???.BIN" (?? denotes figures) in the CompactFlash.

After "CMOSBK.BIN" has been loaded, check if the new data is the same as the previously saved data in the CMOS, and call the master job to confirm that the current manipulator position is correct and safe. Then, start moving the manipulator.

9.5 Error List

9.5.1 Error Contents

Error No.	Data	Message	Cause
0770	*	The robot or the station is in motion.	The automatic backup would not work when the robot or a manipulator is in motion.
3390		File not found	The file to be loaded no longer exists.
3430	*	I/O error on the drive	The capacity of the CompactFlash is 128MB. Change the CompactFlash to 256MB.
3460	*	Cannot backup the media	
	1		Insufficient capacity on backup media (e.g., CompactFlash).
	2		Cannot access backup media (e.g., CompactFlash).
3501	*	Check the media insertion	Cannot access backup media (e.g., CompactFlash).
3550	*	The automatic backup is executed. Try it later.	The automatic backup window cannot be called to display while the automatic backup is being processed.
3551	*	The automatic backup is executed. Arrange the file after it is finished.	The file arrangement cannot be operated during the automatic backup operation.
3560	*	Failed to re-arrange the backup file.	Failed to re-arrange the backup file for another reason than the access to backup media (e.g., CompactFlash).
3580	*	Accessing to backup file. Try it later.	To display another window and then display the automatic backup window again after "ARRANGE" operation, "ARRANGE" process should be completely finished.
3581	*	Accessing to backup file. Try "ARRANGE" operation later.	The previous "ARRANGE" process should be completely finished to perform the next "ARRANGE" operation.

10 Upgrade Function

10.1 Functional Overview

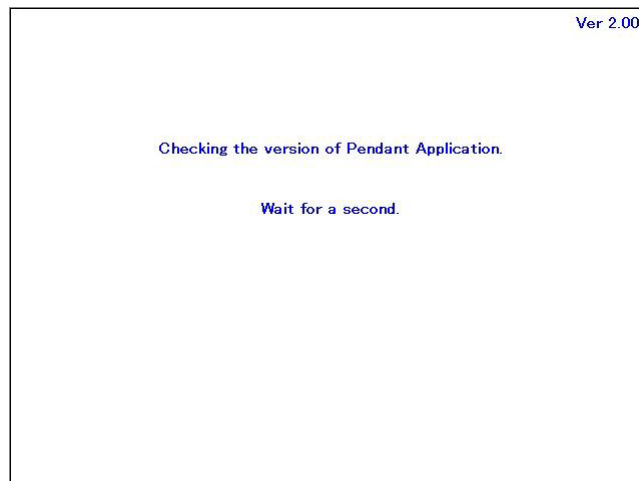
DX200 applies two software for the CPU configuration: a software for YCP21 (for the main CPU board) and a software for YPP (for programming pendant). The system works only with the combination of certain versions due to a compatibility problem of each software.

Therefore, with the system version NS3.00 and the subsequent versions, DX200 can upgrade the software for YPP if the combination of the software for YCP21 and YPP is invalid.

10.2 Upgrade Procedure

10.2.1 Confirmation of Software Version

The compatibility of the versions of YCP21 and YPP are automatically checked in 20 seconds after the DX200 power supply is turned on.



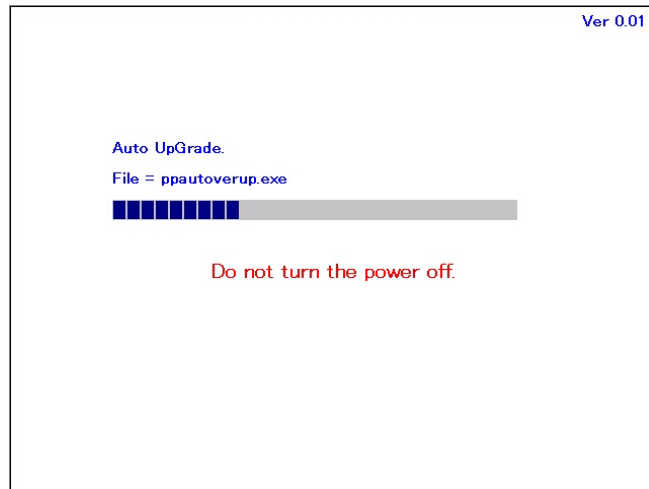
- In case the versions of YCP21 and YPP matches.

1. Automatic upgrade process completes and the communication process between YCP21 and YPP is restarted.
2. Initial window appears approx. 45 seconds later.



10.2.2 Automatic Upgrade of YPP

In case that the pendant application version of YPP is older than the one of YCP21 or the pendant application version of YPP is not compatible to the one of YCP21, the YPP is automatically upgraded.



1. After the automatic upgrade process is completed, the communication process between YCP21 and YPP is restarted.
 - Some upgraded software require restart.
In this case restart is done automatically and the communication process between YPP and YCP21 starts again.
2. Initial window appears approx. 45 seconds later.



If start the DX200 without the auto upgrade process, press all of the [Interlock]+[5]+[Select] keys at the same time to start.

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

In case the main power supply is turned off, exercise the following process.

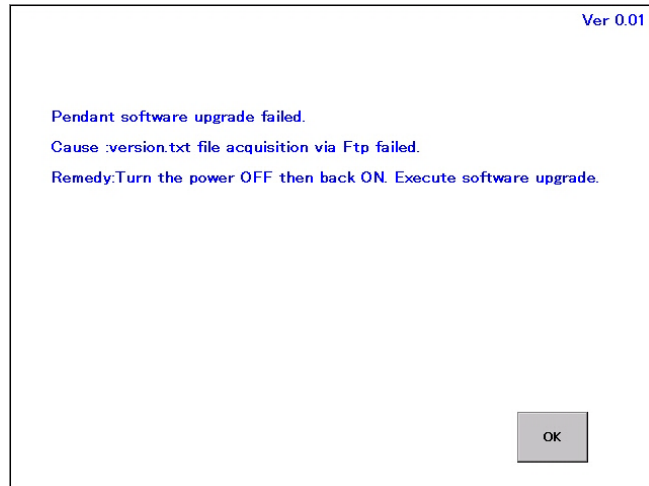
- Turn on the main power supply of DX200.
 - Automatic upgrade might be exercised again.
- In case error occurs during automatic upgrade process.



- (1) Prepare CF for upgrading or USB memory.
 - (2) Press [2], [8] and [HIGH SPEED] at the same time.
 - Upgrade of the OS of Programming Pendant
 - (3) Press [INTERLOCK], [8] and [SELECT] at the same time.
 - (4) Exercise manual upgrading.
 - Refer to “DX200 Upgrade Procedure” (HW1481995).
- If no recovery is made with all the procedure above, replace the pendant.

10.3 Error Message

If Error occurs while automatic upgrading, exercise the following procedure.



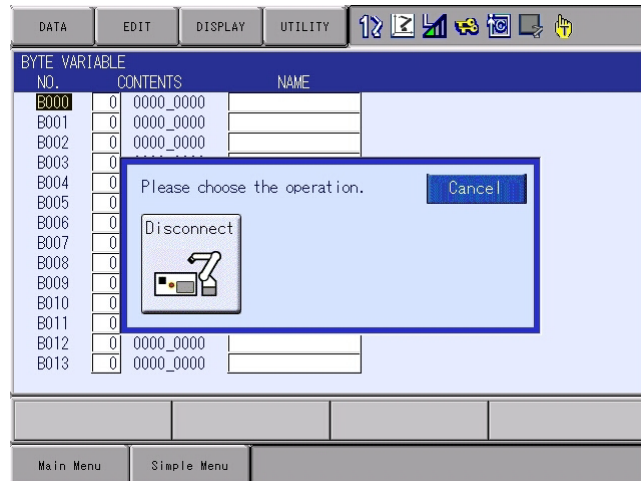
- Turn on the main power supply of DX200.
 - Automatic upgrade might be exercised again.
- In case error occurs during automatic upgrade process.
 - (1) Prepare CF for upgrading or USB memory.
 - (2) Press [2], [8] and [HIGH SPEED] at the same time.
 - Upgrade of the OS of Programming Pendant
 - (3) Press [INTERLOCK], [8] and [SELECT] at the same time.
 - (4) Exercise manual upgrading.
 - Refer to “DX200 Upgrade Procedure” (HW1481995) for detail.

11 Programming Pendant

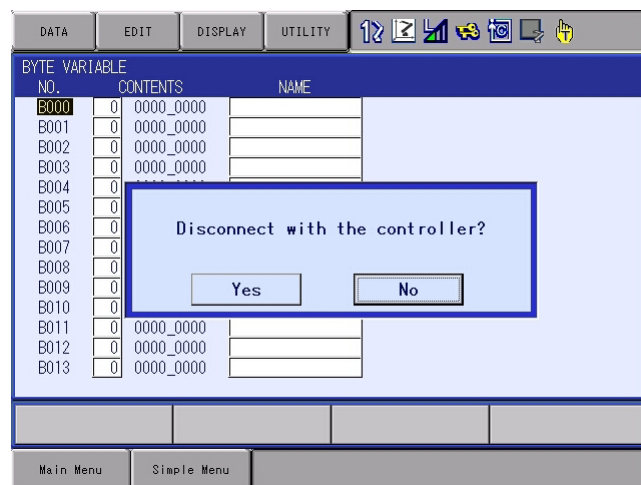
11.1 Disconnection Function

Disconnection function enables to cut off the communication between the programming pendant and the controller.

1. Long press [Simple Menu] key to show the pop-up menu.



2. Select "Disconnect" button, and the confirmation dialog appears.



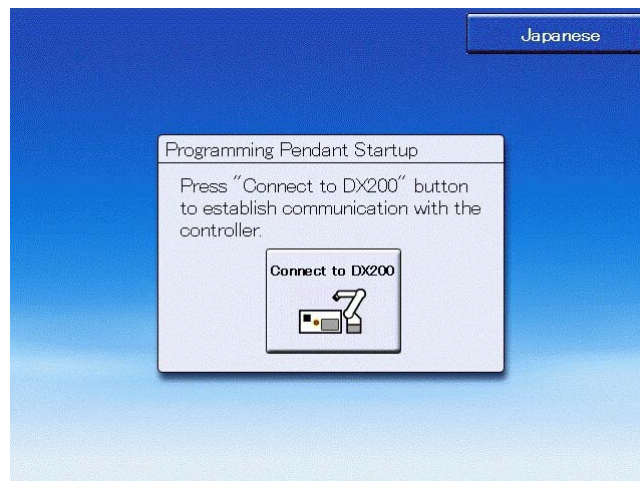
11 Programming Pendant
11.1 Disconnection Function

3. Select "YES" to disconnect the communication between the controller and the programming pendant. After disconnecting the communication, the message is displayed.



4. Press "OK" on the message dialog, otherwise the window is closed automatically after 10 seconds since the window appears on the screen, and then the programming pendant startup window is displayed.

When connecting the controller and the programming pendant again, press "Connect to DX200" button.



11.2 Reset Function

Reset function enables to restart only the programming pendant while the main power supply of the controller is ON.

If unable to operate the robot by the programming pendant causing from the communications error of the programming pendant, recover the programming pendant by following procedures.

5. Confirmation of the LED (DS1) display on the JANCD-YIF01- □ E
 - Check the LED display on the JANCD-YIF01- □ E.



- Check that an alphabet letter or a number is displayed on the LED display.
- Check that a dot is displayed at the lower right of the LED. If it is, check that the dot is blinking or lighted.
- If the displayed alphabet or the number is continuously changing, write down them in order.

6. Reset the programming pendant
 - Open the CF slot cover on the programming pendant.
 - There is a small hole below the CF insertion slot. Insert a spit to press inside the hole.
 - The programming pendant is rebooted and it starts connecting to the controller again.

11.3 Touch Panel Invalidate Function

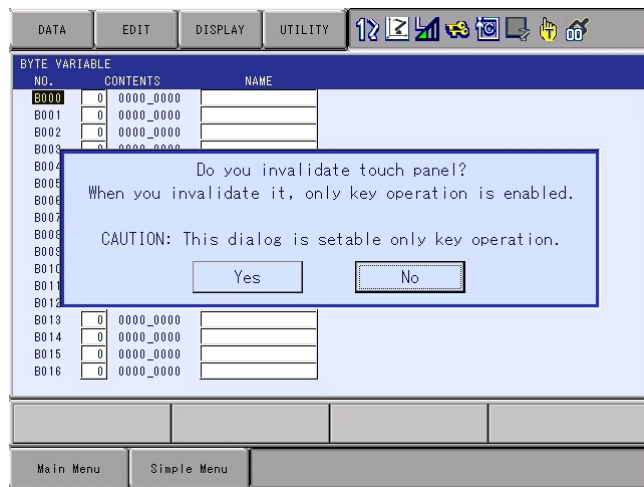
The touch panel invalidate function enables to invalidate the touch panel operation of the programming pendant (key operation is still valid).

Even if the touch panel is failure, it is able to prevent the mis-operation by using this function.

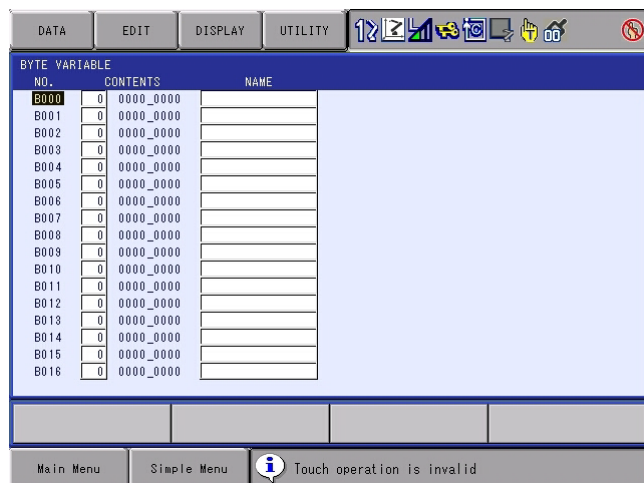
Operate the following procedures to valid/invalid the touch panel.

■ Invalidate the Touch Panel

1. Push down the [INTER LOCK]+[AUX] keys at the same time.
The confirmation dialog to invalidate the touch panel appears.

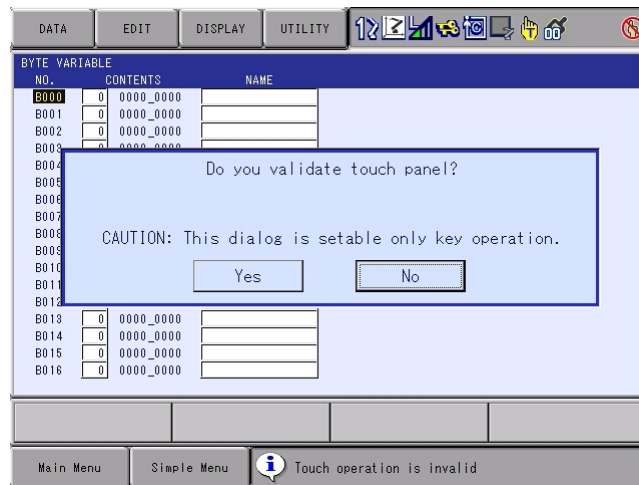


2. Move the focus area over the "YES" on the confirmation dialog by using [←] key.
3. Press [Select] key. The touch panel becomes invalid.
When the touch panel is invalid, an icon, which shows the invalidating the touch panel, is displayed on the status area, and the message "Touch operation is invalid" 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.



- In the case of invalidating the touch panel, the touch panel invalidating status continues even though the power supply is turned ON/OFF.
- To validate the touch panel again, push down the [INTER LOCK]+[AUX] keys at the same time, and then validate the touch panel on the confirmation dialog.

12 Modification of System Configuration

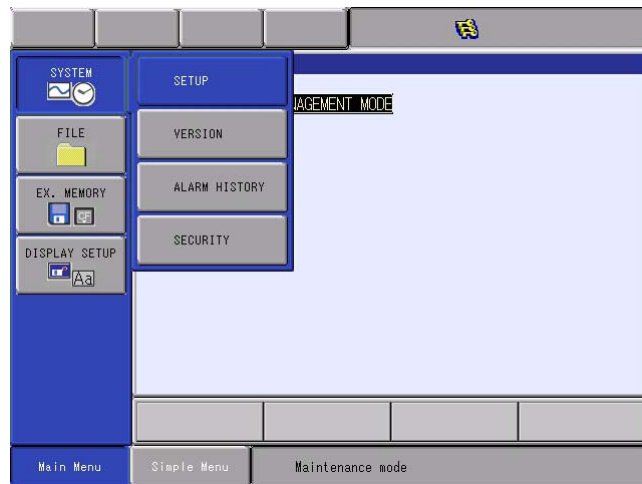
12.1 Addition of I/O Modules

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



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

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



4. Select {SETUP}.
 - The SETUP window appears.
 - The items marked with "■" cannot be selected.



12 Modification of System Configuration

12.1 Addition of I/O Modules

5. Select [IO MODULE].

- The current status of the mounted I/O module is shown.

ST#	DI	DO	AI	AO	BOARD
00	0040	0040	-	-	YSF21
01	-	-	-	-	NONE
02	-	-	-	-	NONE
03	-	-	-	-	NONE
04	-	-	-	-	NONE
05	-	-	-	-	NONE
06	-	-	-	-	NONE
07	-	-	-	-	NONE
08	-	-	-	-	NONE
09	-	-	-	-	NONE
10	-	-	-	-	NONE
11	-	-	-	-	NONE
12	-	-	-	-	NONE
13	-	-	-	-	NONE

6. Confirm the status of mounted I/O module.

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

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

- 1) A hyphen, -, indicates that the corresponding I/O section is not mounted.
- 2) If the system cannot recognize the circuit board type, a row of stars (****) are shown. No problem will occur as long as the values displayed in DI, DO, AI, and AO are correct.

7. Press [ENTER].

- Confirm the statuses of the mounted I/O modules for the other stations.

ST#	DI	DO	AI	AO	BOARD
06	-	-	-	-	NONE
07	-	-	-	-	NONE
08	-	-	-	-	NONE
09	-	-	-	-	NONE
10	-	-	-	-	NONE
11	-	-	-	-	NONE
12	-	-	-	-	NONE
13	-	-	-	-	NONE
14	-	-	-	-	NONE
15	-	-	-	-	NONE
16	-	-	-	-	NONE
17	-	-	-	-	NONE
18	-	-	-	-	NONE
19	-	-	-	-	NONE

12 Modification of System Configuration

12.1 Addition of I/O Modules

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.



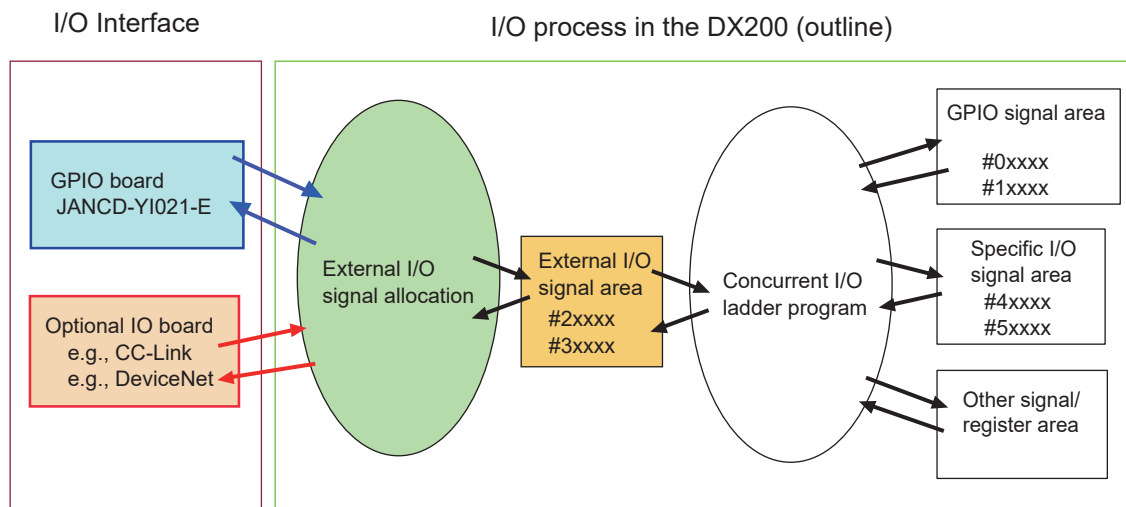
If there is a difference between the displayed contents and the actual mounted status, confirm the status again. If the status is correct, the I/O module may be defective: in such a case, contact your YASKAWA representative.

12.2 Allocating External I/O Signal

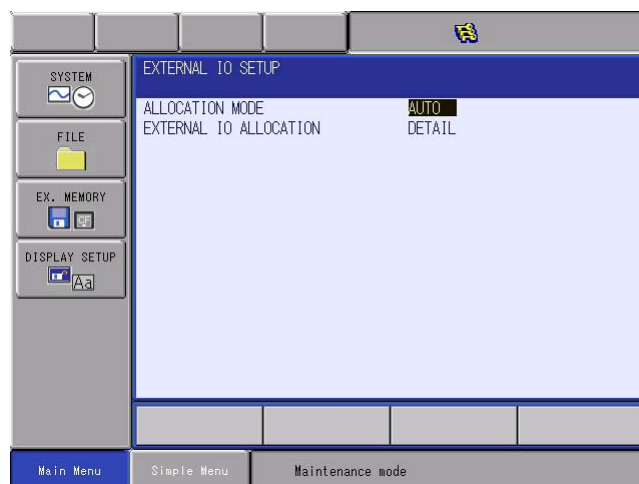
■ Allocation of the external I/O signal

The DX200 exchanges I/O data with the I/O interface by using external I/O signal area (#2xxxxm #3xxxx). The allocation of the external-I/O signal area and I/O interface used to be unchangeable since they have been allocated to the signals from lower to higher numbers in bytes (8 points unit) by system software.

With the function of allocating the external-I/O signal, the change is possible and a user can specify the signals in byte (8 points unit) to allocate.



1. The EXTERNAL IO SETUP window appears.



2. Select "AUTO" or "MANUAL" under the ALLOCATION MODE.

12 Modification of System Configuration

12.2 Allocating External I/O Signal

- The selected menu appears.



When the allocation mode is changed from “MANUAL” to “AUTO”, the set allocation data is discarded, and re-allocation in the Auto mode takes place.
If it is necessary to save the set allocation data, save it using the external memory menu in advance.

12 Modification of System Configuration

12.2 Allocating External I/O Signal

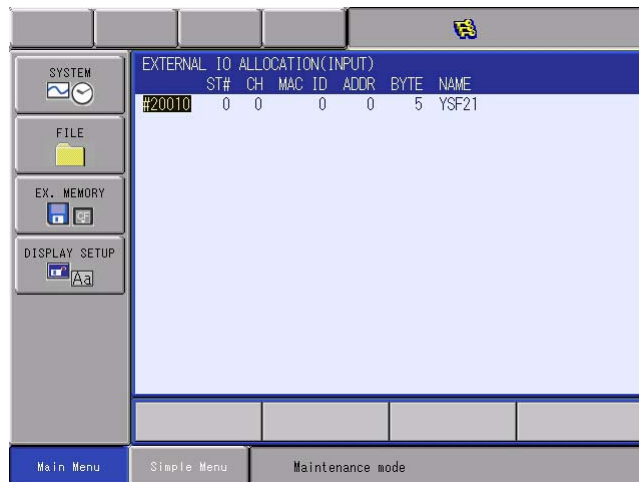
3. Select the allocation mode to set.

- To operate the I/O signal allocation automatically, select the allocation mode “AUTO”.
- To operate the I/O signal allocation manually, select the allocation mode “MANUAL”.
- Selected allocation mode appears.



4. Select “DETAIL” under the “EXTERNAL IO ALLOCATION”.

- The External Input Signals Allocation window appears.
- When select the “AUTO”, skip the following procedures from No. 5 to No. 7. Operate from the procedure No. 8.
- S for the allocation mode “MANUAL”, operate the following procedures.



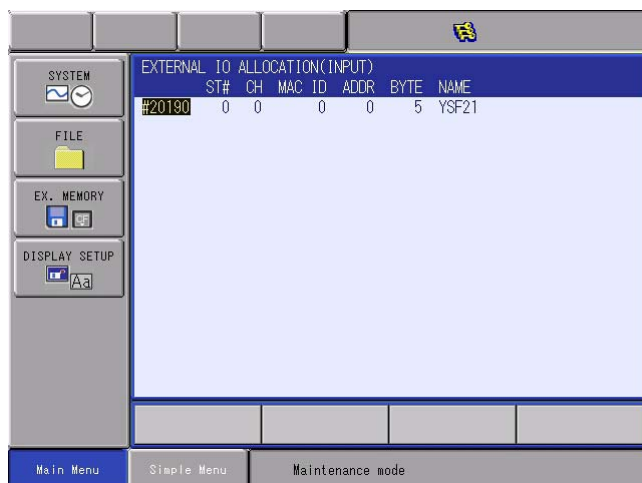
12 Modification of System Configuration

12.2 Allocating External I/O Signal

5. Select the external input signal number (at the change source) to be changed. (In the setting example, select “#20010”.)
 - The select menu appears.



6. Select “MODIFY”, and input the external input signal number (at the change destination) to be changed. (In the setting example, enter ‘20190’.)
 - The external I/O signal is changed.



7. Likewise, select/modify the number of the external input signal.
 - Repeat select/modify until it becomes the desired allocation.

12 Modification of System Configuration

12.2 Allocating External I/O Signal

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.

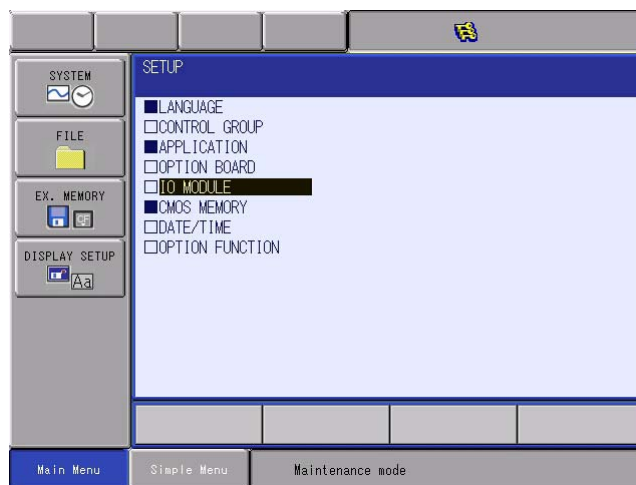
10. Press [ENTER].

- The confirmation dialog box appears.



11. Select {YES}.

- The settings are confirmed, and the SETUP window reappears.



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.

EXTERNAL IO ALLOCATION(INPUT)						
	ST#	CH	MAC ID	ADDR	BYTE	NAME
#20010	14	0	0	0	5	YSF21
#20060	16	0	254	0	1	DN4-PCU-1
#20070	16	0	1	1	5	DN4-PCU-1
#20120	16	0	2	6	4	DN4-PCU-1
#20160	16	0	3	10	3	DN4-PCU-1
#20190	17	0	254	0	1	CCS-PCU
#20200	17	0	0	1	6	CCS-PCU

① External I/O signal numbers

Indicates the beginning number of the external I/O signals allocated to each I/O area. On the allocation window, the set values of these items are used and displayed in ascending order. The following contents are displayed.

#20010 to #25120: The number of the signal allocated to the beginning of each I/O area, in the input signals

#30010 to #35120: The number of the signal allocated to the beginning of each I/O area, in the output signals

#---- : Unallocated I/O area

② ST#

Indicates the DX200 station number allocated to each I/O board. The displayed contents include the following:

0 : General I/O board (JANCD-YIO21)

1 to 13: Optional I/O board which is connected to the JANCD-YSF21 using a serial communication cable (The serial communication station number is determined by the rotary switch setting on each board.)

16 : The first field bus board
(Normally, optional board inserted into CN1 of the riser card in the CPU rack.)

17 : The second field bus board
(Normally, optional board inserted into CN2 of the riser card in the CPU rack.)

③ CH

Indicates the channel number (network communication system) on the board. The following contents are displayed.

0: I/O area for channel 1

1: I/O area for channel 2

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 board (PCU-ETHIO)
- 1 to 251 : Network communication station number '1' to '251'
Adapter station of EtherNet/IP board (PCU-ETHIO)
(Scanner allocation number sequence)
- 252 : Unallocated I/O area of channel 1
- 253 : Unallocated I/O area of channel 2
- 254 : Communication status area of channel 1
- 255 : Communication status area of channel 2

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.

■ Allocation example of external I/O signal

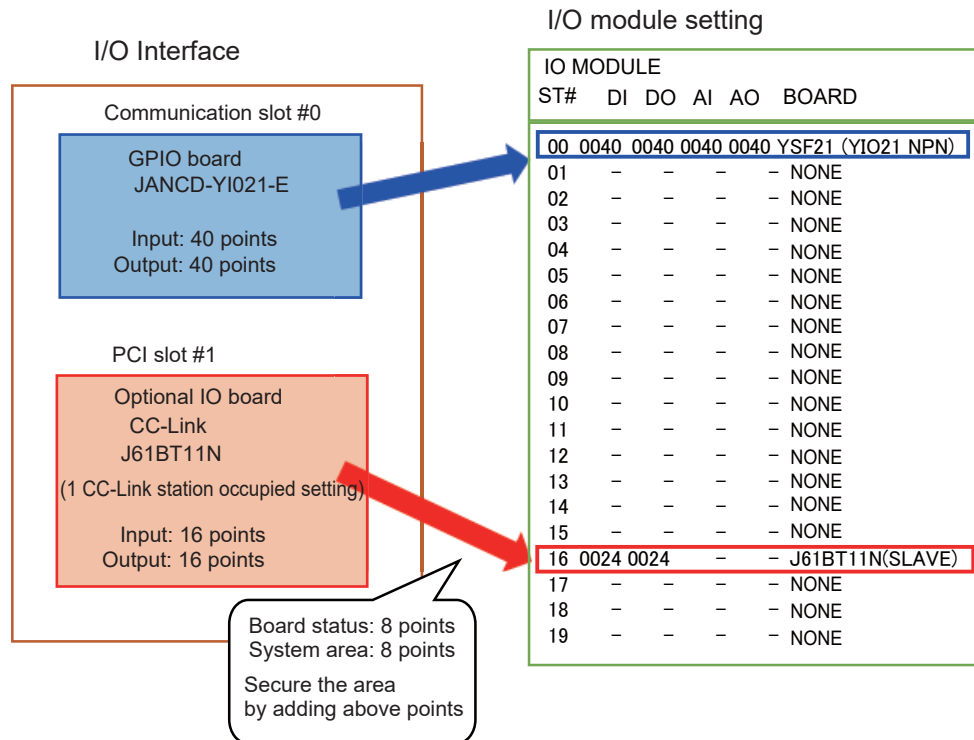
<Example System>

The following shows a system of setting example.

I/O interface must be recognized in the I/O module setting window.

The communication slots #0 to #15 are recognized as ST#00 to ST#15 of I/O module.

PCI slot #1 and #2 are recognized as ST#16 and ST#17 of I/O module.

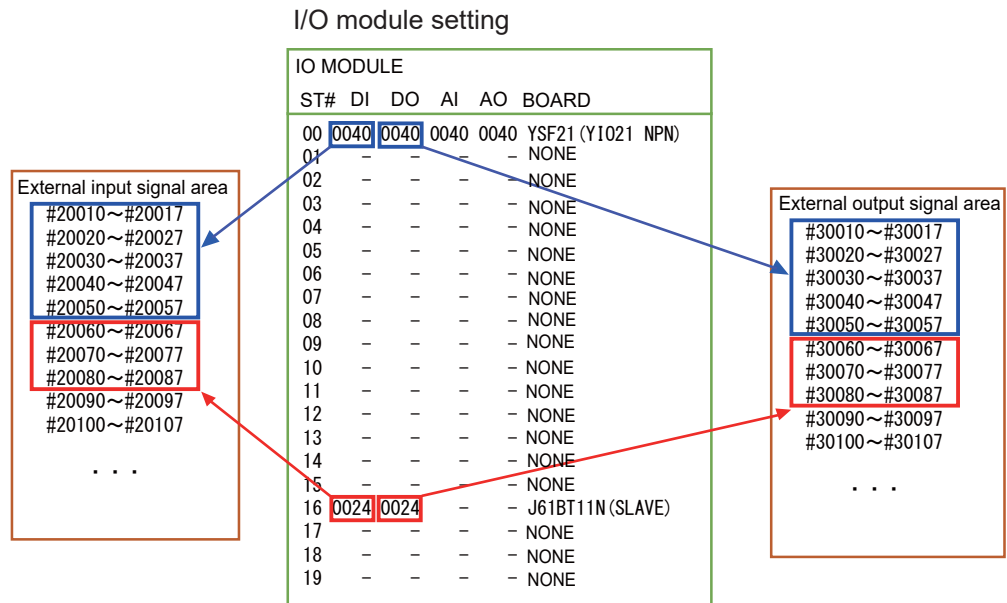


12 Modification of System Configuration

12.2 Allocating External I/O Signal

< Setting example: Automatic setting >

When the automatic setting is performed by external IO allocation, IO data is allocated to the external IO signals from lower to higher numbers.



In this case, the following contents are shown in the external IO setting window.

External IO allocation setting

EXTERNAL IO ALLOCATION (INPUT)					
ST#	CH	MAC ID	ADDR	BYTE	NAME
#20010	0	0	0	5	YSF21
#20060	16	0	254	0	J61BT11N
#20070	16	0	0	1	J61BT11N

GP input data (40 points)
Board status (8 points)
Input data (16 points)

EXTERNAL IO ALLOCATION (OUTPUT)					
ST#	CH	MAC ID	ADDR	BYTE	NAME
#30010	0	0	0	5	YSF21
#30060	16	0	254	0	J61BT11N
#30070	16	0	0	1	J61BT11N

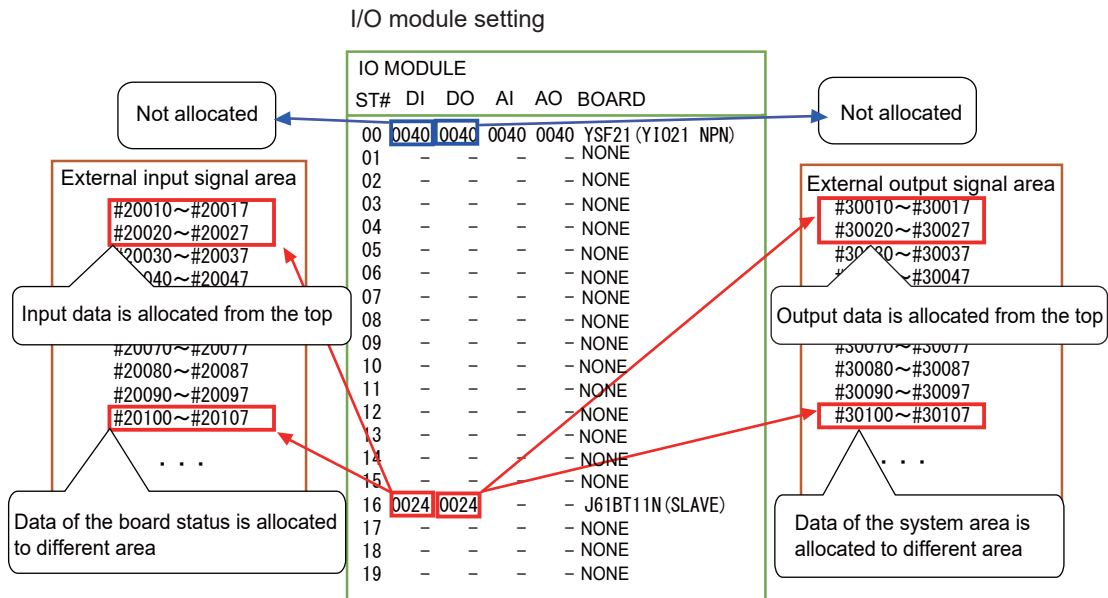
GP output data (40 points)
System area (8 points)
Output data (16 points)

12 Modification of System Configuration

12.2 Allocating External I/O Signal

< Setting example: Allocating the CC-Link board data only by manual setting >

IO data of the CC-Link can be allocated from the top while data of the board status/system area allocated to different area.



In this case, the following contents are shown in the external IO setting window.

External IO allocation setting

EXTERNAL IO ALLOCATION (INPUT)						
ST#	CH	MAC ID	ADDR	BYTE	NAME	
#20010	16	0	0	1	2	J61BT11N ← Input data (16 points)
#20100	16	0	254	0	1	J61BT11N ← Board status (8 points)

EXTERNAL IO ALLOCATION (OUTPUT)						
ST#	CH	MAC ID	ADDR	BYTE	NAME	
#30010	16	0	0	1	2	J61BT11N ← Output data (16 points)
#30100	16	0	254	0	1	J61BT11N ← System area (8 points)

12.3 Addition of Base and Station Axes

To add the base and station axes, mount all hardware correctly and then execute maintenance mode.



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

When adding a base and a station axis, set the following items:

- TYPE

Select one in the type list.

- In case of base axis (B1,B2,B3...B8)

Select one of RECT-X, -Y, -Z, -XY, -XZ, -YZ or -XYZ.

- In case of station axis (S1,S2,S3,S4,S5... S24)

Select UNIV-* ("*" represents the number of axes) when using a mechanism other than the registered type as a station axis.

- CONNECTION

In the CONNECTION window, specify the SERVOPACK which is connected with each axis group, the contactor which is used for the SERVOPACK, and the overrun signal (OT).

- AXIS TYPE

Select from the axis type list.

- In case of TURN-* type

No need to select (The axis type is set as TURN type.)

- In case of RECT-* type

Select BALL-SCREW type or RACK & PINION type.

- In case of UNIV-* type

Select BALL-SCREW type, RACK & PINION type or TURN type.

- MECHANICAL SPECIFICATION

- If axis type is ball-screw type, set the following items:

- MOTION RANGE (+) [mm]

- MOTION RANGE (-) [mm]

- REDUCTION RATIO (numerator)

- REDUCTION RATIO (denominator)

- BALL-SCREW PITCH [mm/r]

- If axis type is rack & pinion type, set the following items.

- MOTION RANGE (+) [mm]

- MOTION RANGE (-) [mm]

- REDUCTION RATIO (numerator)

- REDUCTION RATIO (denominator)

- PINION DIAMETER [mm]

12 Modification of System Configuration
12.3 Addition of Base and Station Axes

- 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

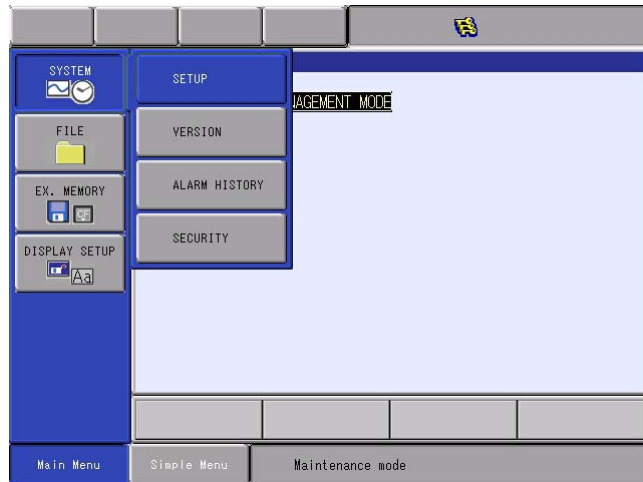
* Select MOTOR, AMPLIFIER and CONVERTER from each type list on the display.

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 MODE" to the "MANAGEMENT MODE".
3. Select {SYSTEM} under the main menu.
 - The system window appears.



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

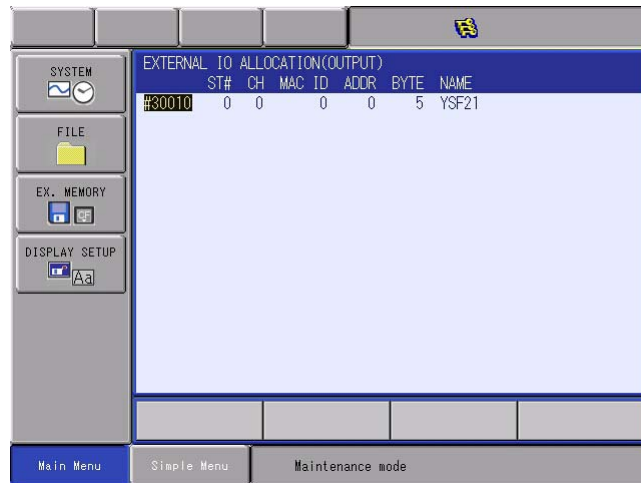


12 Modification of System Configuration

12.3 Addition of Base and Station Axes

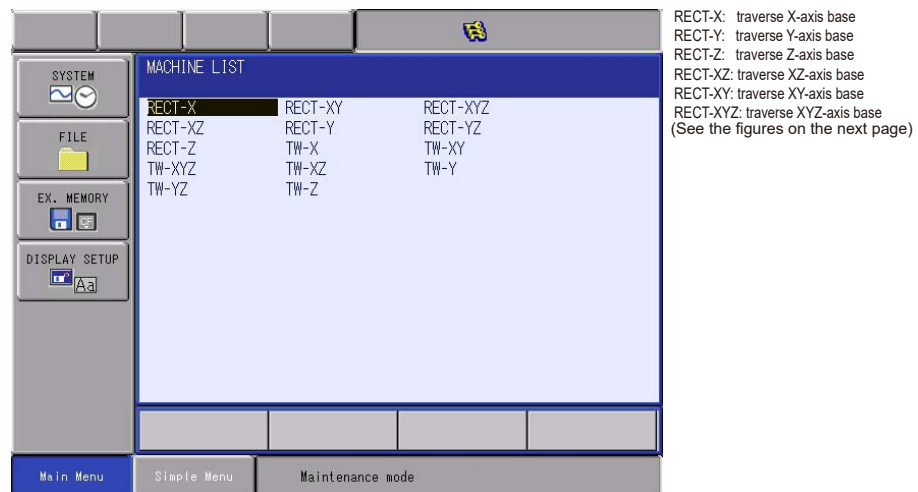
5. Select {CONTROL GROUP}.

- The current control group type is displayed.



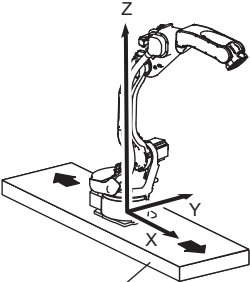
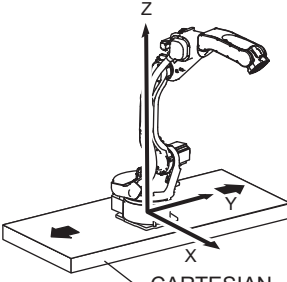
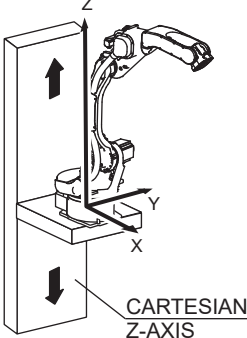
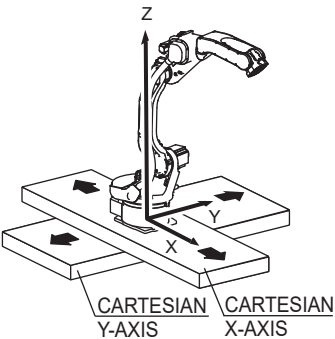
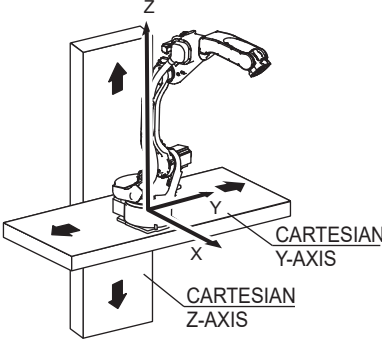
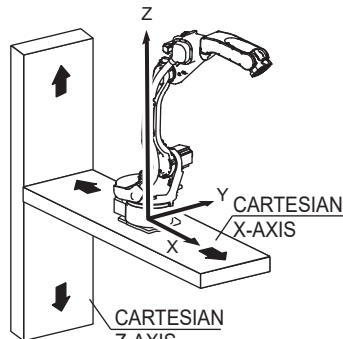
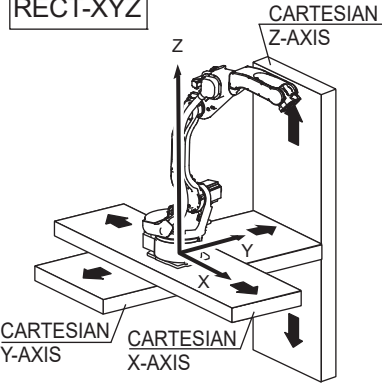
6. Move the cursor to the type of control group to be modified, and press [SELECT].

- The MACHINE LIST window is displayed.



7. Select one in the type list.

- After the type selection, the window returns to the CONNECT window.

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

12 Modification of System Configuration

12.3 Addition of Base and Station Axes

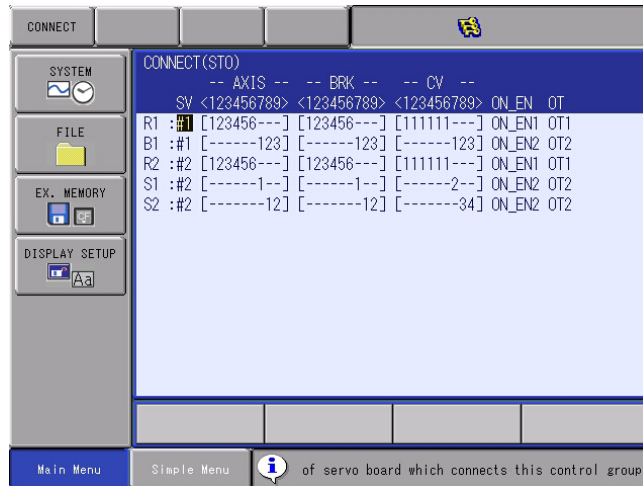
12.3.1.2 Connection Setting

In the CONNECT window, it is specified that each axis of each control group is connected to which connector of the SERVO board, which break of the contactor unit, which converter, and which overrun signal.

1. Confirm the type of each control group in the CONNECT window.

– The connection status of each control group is displayed.

[CONNECT(STO) window]



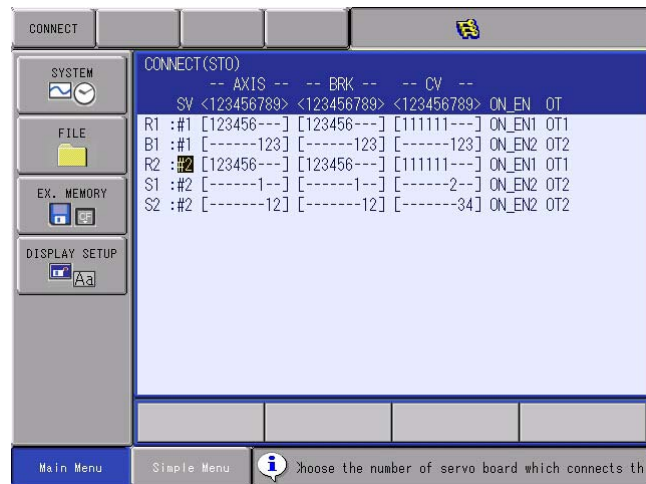
[CONNECT (CONTACTOR) window]



2. Select the connection item of a desired control group.

- The settable items are displayed.
- Select an item to change the setting. Select {Cancel} to return to the CONNECT window.

[CONNECT (STO) window]

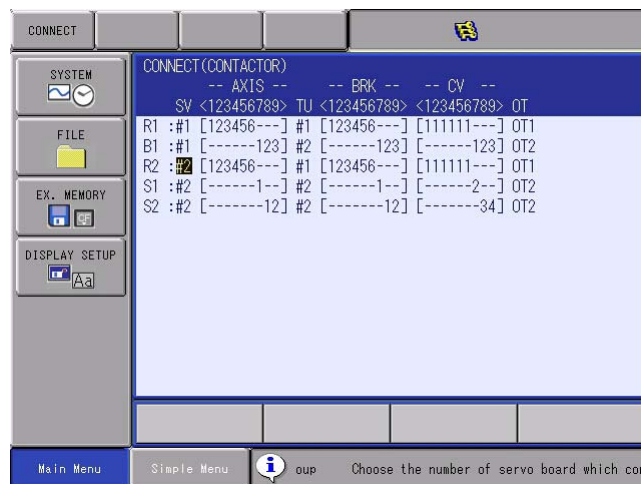


- Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [] represent axis numbers, and indicate which axis is connected to which connector.
- Specify which break (BRK) of the each control group is connected to.
The numbers in [] represent the axis numbers, and indicate which axis is connected to which break.
- Specify which converter (CV) each axis of each control group is connected to.
The numbers in [] represent the converter numbers, and indicate which axis is connected to which converter.
- Specify which on enable signal (ON_EN) each control group is connected to.
- Specify which overrun signal (OT) each control group is connected to.

12 Modification of System Configuration

12.3 Addition of Base and Station Axes

[CONNECT (CONTACTOR) window]



- Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [] represent axis numbers, and indicate which axis is connected to which connector.
- Specify which break (BRK) of the contactor unit each axis of each control group is connected to.
The numbers in [] represent the axis numbers, and indicate which axis is connected to which break.
- Specify which converter (CV) each axis of each control group is connected to.
The numbers in [] represent the converter numbers, and indicate which axis is connected to which converter.
- Specify which overrun signal (OT) each control group is connected to.
- In this example, B1 (Base) is connected in the following manner:

1st axis	→	SERVO Board (SV #2),	Connector (7CN),
		Contactor Unit (TU #1),	break Connector (BRK7),
		Converter (CV #1)	
2nd axis	→	SERVO Board (SV #2),	Connector (8CN)
		Contactor Unit (TU #1),	break Connector (BRK8)
		Converter (CV #2)	
3rd axis	→	SERVO Board (SV #2),	Connector (9CN)
		Contactor Unit (TU #1),	break Connector (BRK9)
		Converter (CV #3)	
Overrun	→	(OT2)	

3. Therefore, when an overrun alarm occurs, the subcode is indicated by the control group.
However, select "NOT CONNECT" if an overrun switch is not installed to the control group or the allocation of the external axis overrun signal is not needed.
Regarding the connection of the external axis overrun signal, refer to *chapter 14.7 "Universal I/O Circuit Board (JANCD-YIO21-E)"*.
4. Select a desired item.
5. Press [ENTER] in the CONNECT window.
 - The setting in the CONNECT window is completed and the window moves to the AXES CONFIG window.



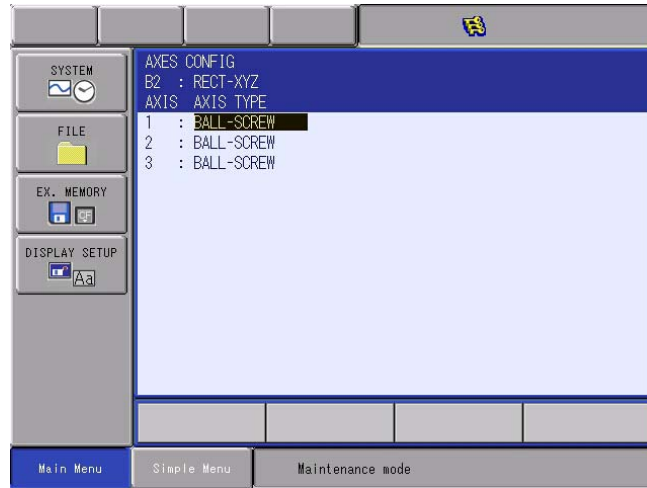
An error message Error 8217 "Cannot change setting. Check the setting of spot high speed spec." may appear when press [ENTER] in the CONNECT window.

When the error message appears, invalid SPOT HIGH SPEED SPEC or review the configuration of the control group by referring to chapter 9.12 "High Speed Spot Welding Function" at DX200 OPERATOR'S MANUAL FOR SPOT WELDING USING MOTOR GUN.

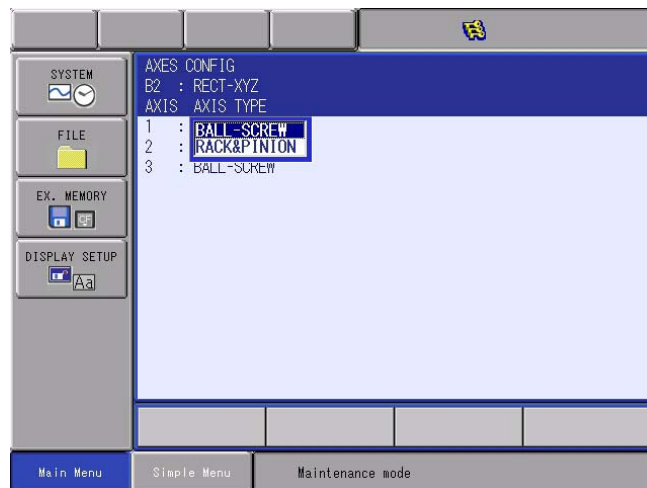
12.3.1.3 Axis Configuration Setting

The axis type is specified in the AXES CONFIG window.

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



2. Select the axis type to be modified.
 - (1) The settable axis type is displayed.



- (2) Select "BALL-SCREW" when the servo track is ball-screw type, and "RACK&PINION" when the servo track is rack & pinion type. After the selection, the window returns to the AXES CONFIG window.
 - (3) Select the axis type.
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.

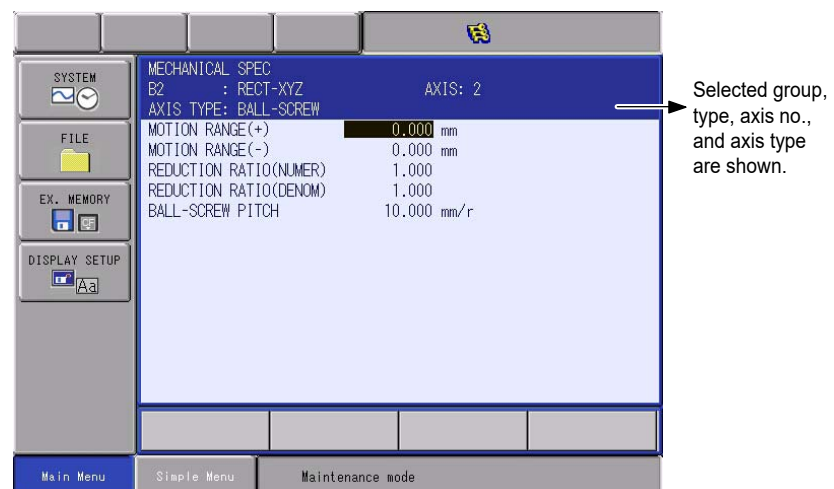
- The mechanical specification of axis is shown.

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)

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- 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

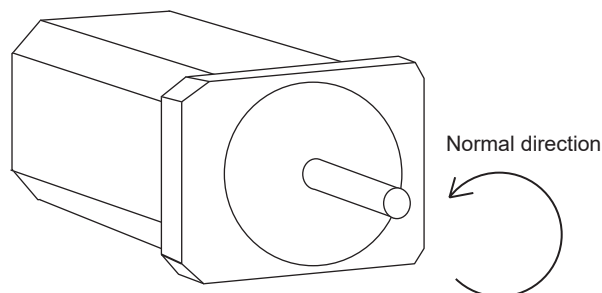
The motor data is specified in the MOTOR SPEC window.

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)
- ACCELERATION TIME: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
- INERTIA RATIO: The initial value is set at 300 in case of servo track; 0 in case of rotation axis.
However, if the following phenomenon occurs in motion, deal with the followed procedure.
- <Phenomenon1>
During motion, the axis moves unsteady on advance direction.
→ Confirm the motion with increasing this ratio in each 100.
- <Phenomenon2>
During pause, the motor makes a lot of noise.
→ Confirm the motion with decreasing this ratio in each 100.

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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.

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.

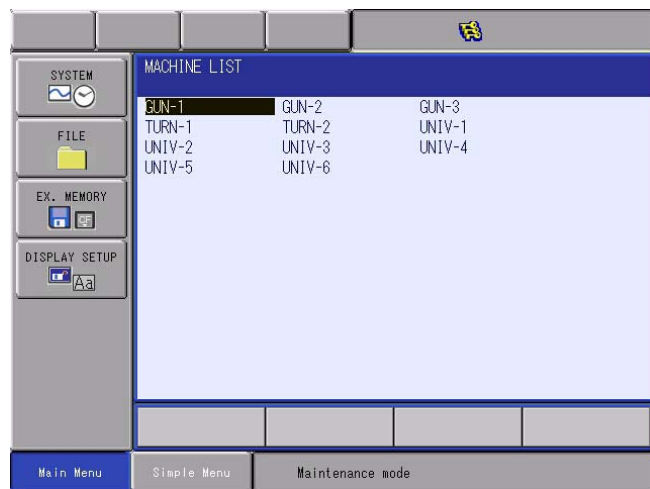
1. Confirm the type of control group in CONTROL GROUP window.

– The CONTROL GROUP window appears.



2. Select the type of control group to be modified.

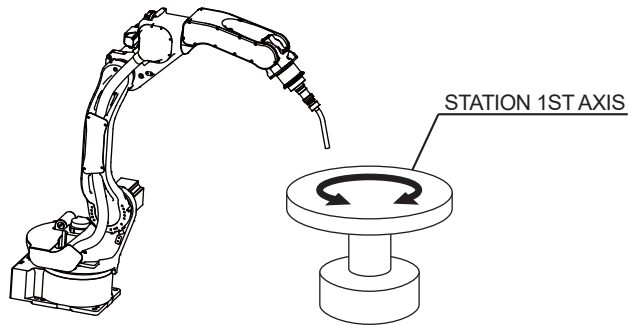
– The MACHINE LIST window appears.



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.

TURN-1



12.3.2.2 Connection Setting

In the CONNECT window, it is specified that each axis of each control group is connected to which connector of the SERVO board, which break of the contactor unit, which converter, and which overrun signal.

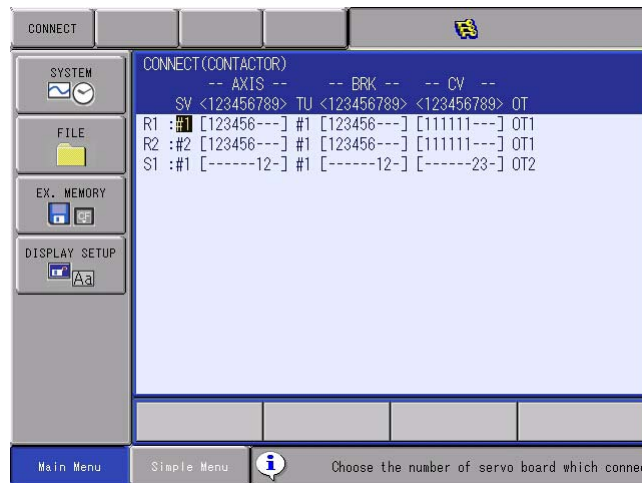
1. Confirm the type of each control group in the CONNECT window.
2. Connection status of each control group is displayed. Select the connection item of desired control group.
 - The settable items are displayed.
 - Select an item to change the setting. Select {Cancel} to return to the CONNECT window.

[CONNECT (STO) window]



- Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [] represent axis numbers, and indicate which axis is connected to which connector.
- Specify which break (BRK) of the each control group is connected to.
The numbers in [] represent the axis numbers, and indicate which axis is connected to which break.
- Specify which converter (CV) each axis of each control group is connected to.
The numbers in [] represent the converter numbers, and indicate which axis is connected to which converter.
- Specify which on enable signal (ON_EN) each control group is connected to.
- Specify which overrun signal (OT) each control group is connected to.

[CONNECT (CONTACTOR) window]



- Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [] represent axis numbers, and indicate which axis is connected to which connector.
- Specify which break (BRK) of the contactor unit each axis of each control group is connected to.
The numbers in [] represent the axis numbers, and indicate which axis is connected to which break.
- Specify which converter (CV) each axis of each control group is connected to.
The numbers in [] represent the converter numbers, and indicate which axis is connected to which converter.
- Specify which overrun signal (OT) each control group is connected to.
- In this example, S1 (Station) is connected in the following manner:

1st axis	→	SERVO Board (SV #1),	Connector (7CN),
		Contactor Unit (TU #1),	break Connector (BRK7),
		Converter (CV #2)	
2nd axis	→	SERVO Board (SV #1),	Connector (8CN),
		Contactor Unit (TU #1),	break Connector (BRK8),
		Converter (CV #3)	
Overrun	→	(OT2)	

3. An overrun signal is allocated to a control group. Therefore, when an overrun alarm occurs, the subcode is indicated by the control group. However, select "NOT CONNECT" if an overrun switch is not installed to the control group or the allocation of the external axis overrun signal is not needed.
Regarding the connection of the external axis overrun signal, refer to *chapter 14.7.1 "Universal I/O Circuit Board (JANCD-YIO21-E)"*.
4. Select a desired item.
5. Press [ENTER] in the CONNECT window.
 - The setting in the CONNECT window is completed and the window moves to the AXES CONFIG window.

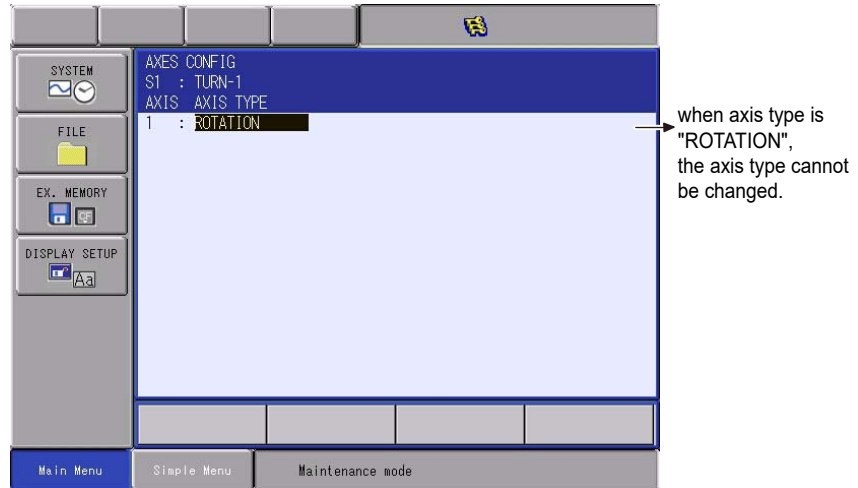
12.3.2.3 Axis Configuration Setting

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

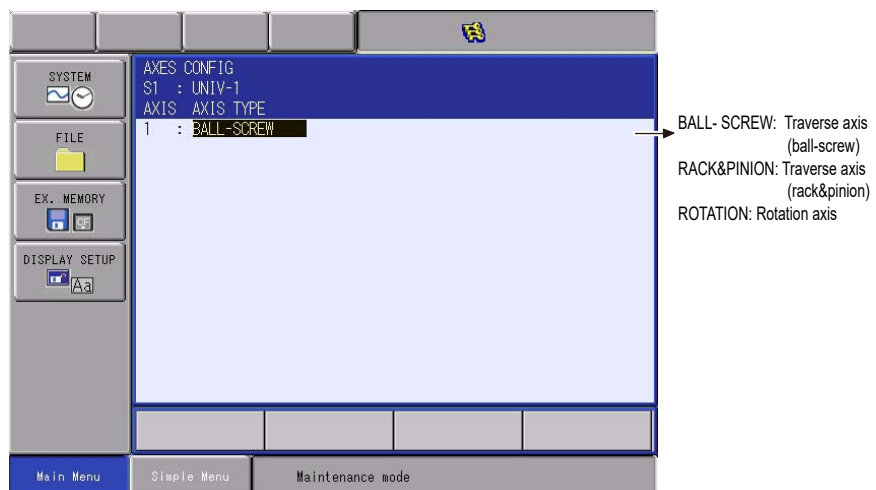
1. Confirm axis type of each axis in the AXES CONFIG window.

– The axis type of each axis is displayed.

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

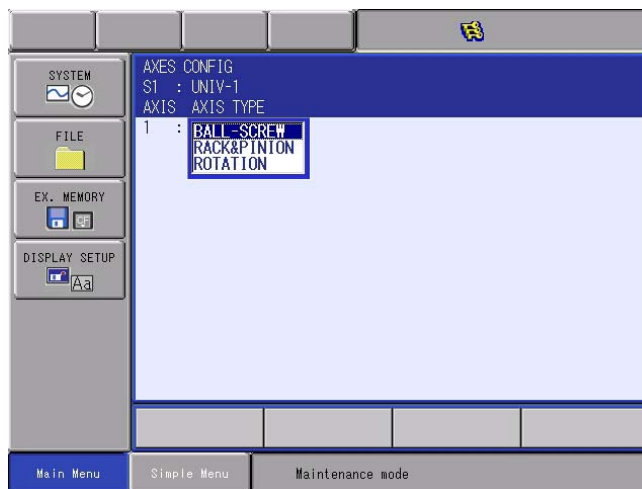


- The AXES CONFIG window (in case of the UNIVERSAL type)



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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.

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12.3.2.4 Mechanical Specification Setting

The mechanical data is specified in the MECHANICAL SPEC window.

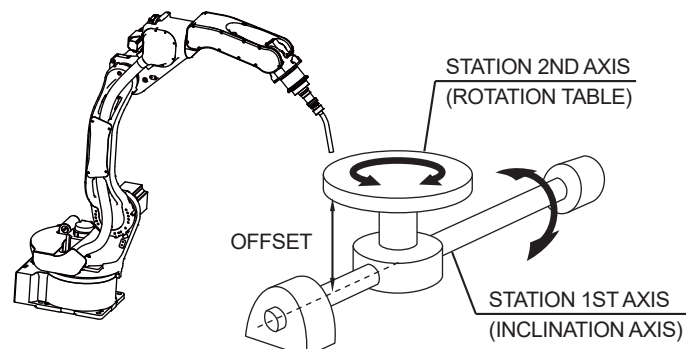
1. Confirm specification of each axis in the MECHANICAL SPEC window.

– 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)

TURN-2



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12.3 Addition of Base and Station Axes

- The MECHANICAL SPEC window (In case of the BALL-SCREW type)

The screenshot shows the 'MECHANICAL SPEC' window for 'AXIS: 1'. The window has a left sidebar with buttons: SYSTEM, FILE, EX. MEMORY, and DISPLAY SETUP. The main area displays the following data:

MECHANICAL SPEC	
S1 : UNIV-1	AXIS: 1
AXIS TYPE: BALL-SCREW	
MOTION RANGE(+)	0.000 mm
MOTION RANGE(-)	0.000 mm
REDUCTION RATIO(NUMER)	1.000
REDUCTION RATIO(DENOM)	1.000
BALL-SCREW PITCH	10.000 mm/r

At the bottom, there are three buttons: Main Menu, Simple Menu, and Maintenance mode. An arrow points to the header area with the text: 'Selected group, type, axis no. and axis type are shown.'

- 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)

The screenshot shows the 'MECHANICAL SPEC' window for 'AXIS: 1'. The window has a left sidebar with buttons: SYSTEM, FILE, EX. MEMORY, and DISPLAY SETUP. The main area displays the following data:

MECHANICAL SPEC	
S1 : UNIV-1	AXIS: 1
AXIS TYPE: RACK&PINION	
MOTION RANGE(+)	0.000 mm
MOTION RANGE(-)	0.000 mm
REDUCTION RATIO(NUMER)	1.000
REDUCTION RATIO(DENOM)	1.000
PINION DIAMETER	10.000 mm

At the bottom, there are three buttons: Main Menu, Simple Menu, and Maintenance mode. An arrow points to the header area with the text: 'Selected group, type, axis no. and axis type are shown.'

- MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)
- REDUCTION RATIO: Input the numerator and the denominator.
<e.g.>If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.
- PINION DIAMETER : Input the diameter of a pinion. (Unit: mm)

12 Modification of System Configuration

12.3 Addition of Base and Station Axes

- The MECHANICAL SPEC window (In case of the ROTATION type)

The screenshot shows a terminal window titled 'MECHANICAL SPEC'. The header bar is blue and contains the text 'S1 : TURN-1' and 'AXIS: 1'. Below the header, the text 'AXIS TYPE: ROTATION' is displayed. The main area of the window is light blue and contains the following settings:

MOTION RANGE(+)	0.000 deg
MOTION RANGE(-)	0.000 deg
REDUCTION RATIO(NUMER)	1.000
REDUCTION RATIO(DENOM)	1.000

At the bottom of the window, there are three buttons: 'Main Menu', 'Simple Menu', and 'Maintenance mode'. An arrow points to the header bar with the text: 'Selected group, type, axis no. and axis type are shown.'

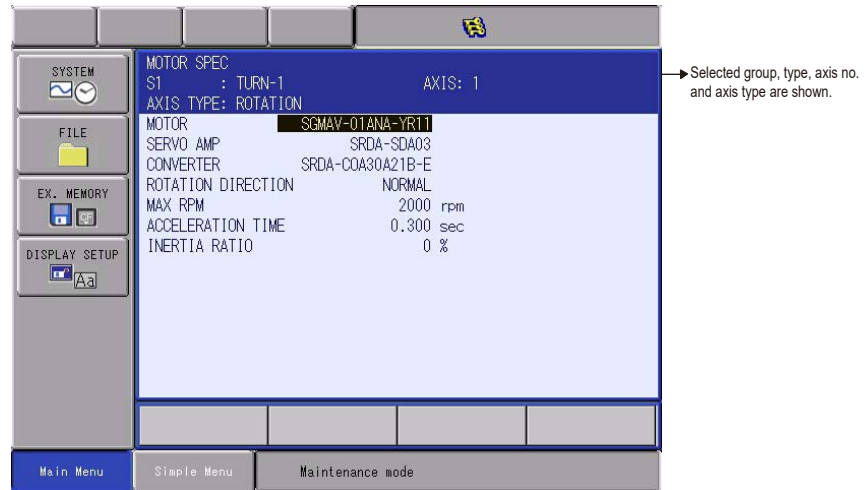
- MOTION RANGE: Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: deg)
 - REDUCTION RATIO: Input the numerator and the denominator.
<e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.
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.

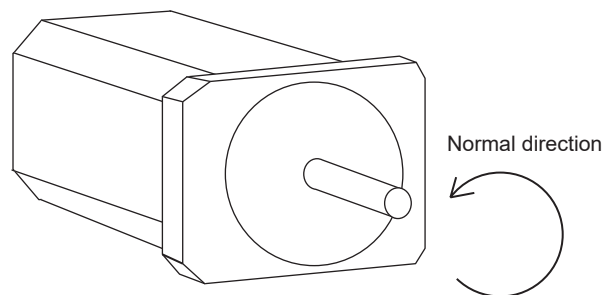
– The motor specification of each axis is displayed.



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)
- ACCELERATION SPEED: Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
- INERTIA RATIO: The initial value is set at 300 in case of servo track; 0 in case of rotation axis.
However, if the following phenomenon occurs in motion, deal with the followed procedure.

12 Modification of System Configuration
12.3 Addition of Base and Station Axes

- <Phenomenon1> During motion, the axis moves unsteady on advance direction.
→ Confirm the motion with increasing this ratio in each 100.
 - <Phenomenon2> During pause, the motor makes a lot of noise.
→ Confirm the motion with decreasing this ratio in each 100.
3. Modify the settings.



CAUTION

- If the control axis configuration is changed by addition of a base axis or station axis, the internal data of the job file are also changed so that the job file data should be initialized.
Initialize the job file data with procedure “File Initialize” in this manual after changing the construction.
- When the data, motion range for example, should be changed after the addition of a base axis or station axis, the change can be done in the same procedure as shown above.
In this case, the control axis configuration is not changed so the job file data should not be initialized.

13 DX200 Specification



WARNING

Make sure that there is no one within the P-point maximum envelope of the manipulator and that you are in a safe place before turning ON the DX200 power.

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

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

Improper or unintentional manipulator operation can result in injury.

- Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop buttons on the right of the front door of the DX200 and the programming pendant are pressed.

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

The emergency stop buttons are located on the right of the front door of the DX200 and the programming pendant.



CAUTION

- Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.
 - Check for problems in manipulator movement.
 - Check for damage to the insulation and sheathing of external wires.
- Always return the programming pendant to its specified position after use.

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator operation may result in injury.

Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.

13.1 Specification List

	Controller	Dust/Splash-proof Construction	IP54 (The back fan is IP2X.)
		Dimensions	Refer to the following table
		Cooling System	Indirect cooling
		Power Supply	3-phase, 200 V/220 V AC (+10% to -15%) at 60 Hz(±2%) 200 V AC (+10% to -15%) at 50 Hz(±2%)
		Grounding	Grounding resistance: 100 Ω or less Exclusive grounding
		Noise Level	Less than 62 dB
		Digital I/O	Specific signal (hardware) 28 inputs and 7 outputs General signals (standard, max.) 40 inputs and 40 outputs (Transistor: 32 outputs, Relay: 8 outputs)
		Positioning System	By serial communication (absolute encoder)
		Drive Unit	SERVOPACK for AC servomotors
		Memory Capacity	200,000 steps, 10,000 instructions
Ambient Conditions	Ambient Temperature		0°C to + 45°C (During operation) -10°C to + 60°C (During transit and storage)
	Relative Humidity		10% to 90%RH (non-condensing)
	Vibration Acceleration		0.5G or less
	Others		Free from corrosive gas or liquid, or explosive gas Free from exposure to water, oil, or dust Free from excessive electrical noise (plasma)

Type	Dimension
Small capacity	600(W) × 730(H) × 520(D) mm
Medium and Large capacity	600(W) × 730(H) × 520(D) mm

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	CF card slot, USB port (USB1.1) (At Programming Pendant)
	Application	Arc welding, Spot welding, Handling, General, Others
Safety Feature	Essential Measures	JIS (Japanese Industrial Standard)
	Running Speed Limit	User definable
	Enable Switch	3 position type. Servo power can be turned on at the middle position only. (Located on programming pendant)
	Collision proof Frames	S-axis frame (doughnut-sector), Cubic frame (user coordinate)
	Self-Diagnosis	Classifies error and two types of alarms (major and minor) and displays the data
	User Alarm Display	Possible to display alarm messages for peripheral device
	Machine Lock	Test-run of peripheral devices without robot motion
	Door Interlock	A door can be opened only when a circuit breaker is OFF.
Maintenance Function	Operation Time Display	Control power-on time, Servo power-on time, Playback time, Operation time, Work time
	Alarm Display	Alarm message, troubleshooting, previous alarm records
	I/O Diagnosis	Simulated enabled/disabled output possible
	T.C.P. Calibration	Automatically calibrates parameters for end effectors using a master positioner

Programing Functions	Programming	Interactive programming
	Language	Robot language: INFORM II
	Robot Motion Control	Joint coordinates, Linear/Circular interpolations, Tool coordinates
	Speed Setting	Percentage for joint coordinates, 0.1mm/s units for interpolations, Angular velocity for T.C.P. fixed motion
	Program Control Instructions	Jumps, Calls, Timer, Robot stop, Execution of some instructions during manipulator motion
	Operation Instructions	Preparing the operation instructions for each application Arc (ON), Arc (OFF), etc.
	Variable	Global variable, Local variable
	Variable Type	Byte type, Integer-type, Double precision-type, Real type, Position type, 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	169(W) × 314.5(H) × 50(D) mm (excluding protrusions)
Displayed Units	TFT Color liquid crystal display, VGA (640 × 480)
	Touch panel
Operated Units	Three-position enable switch, start switch, hold switch, 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.
Others	Provided with CF (Compact Flash) card slot USB port (USB1.1) X 1

13.4 Equipment Configuration

The DX200 is comprised of individual units and modules (circuit boards). Malfunctioning components can generally be easily repaired after a failure by replacing a unit or a module.

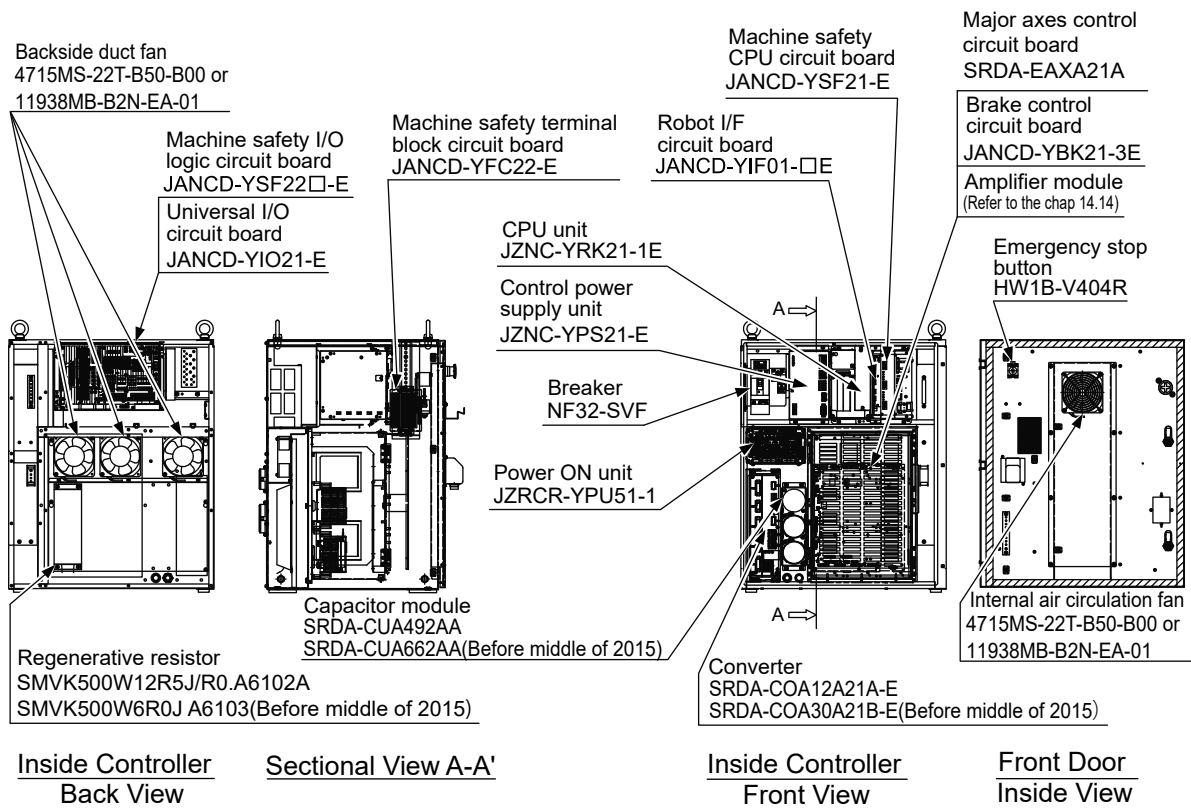
This section explains the configuration of the DX200 equipment.

13.4.1 Arrangement of Units and Circuit Boards

The arrangements of units and circuit boards in small-capacity, medium-capacity, and large-capacity DX200s are shown.

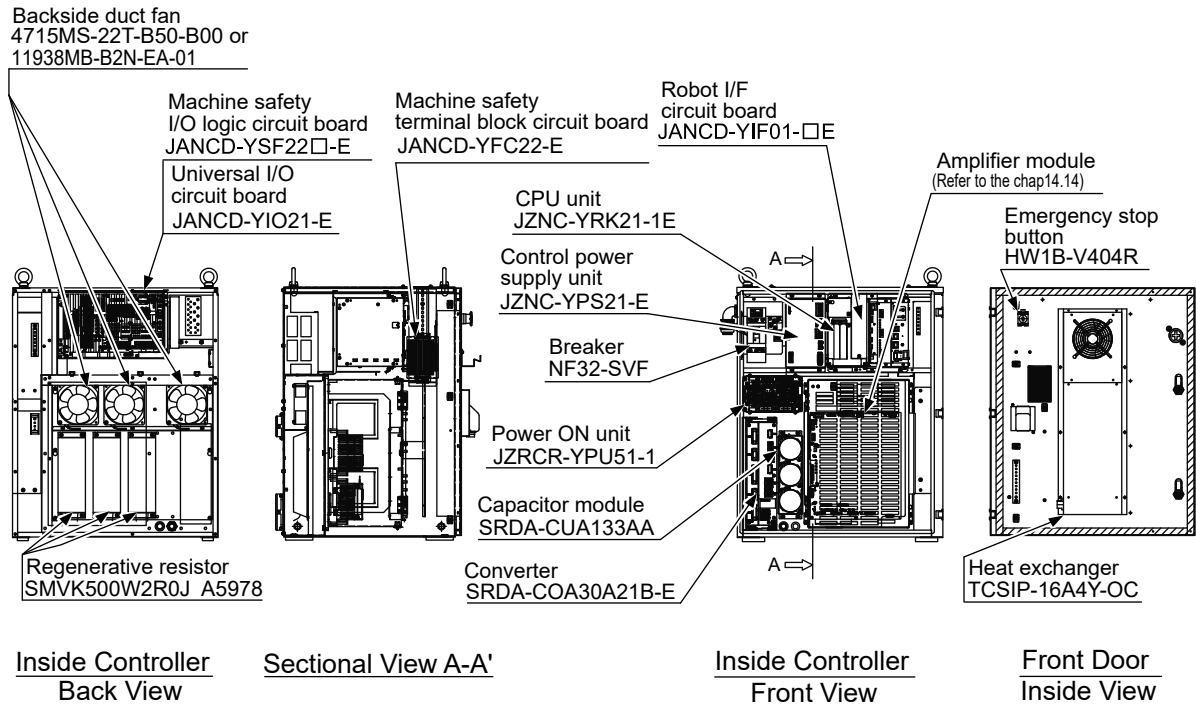
■ Small Capacity

Fig. 13-1: Configuration for Small-Capacity



■ **Medium and Large Capacity**

Fig. 13-2: Configuration for Medium and Large Capacity



13.4.2 Cooling System of the Controller Interior

The backside duct fan draws in air from the air intake and expels it from the air outlet to cool the SERVOPACK. The fan mounted inside the door circulates the air to keep temperature even throughout the interior of the DX200. Make sure the door of the DX200 is closed when it's used to keep this cooling system effective.

Fig. 13-3: .Cooling System for Small Capacity

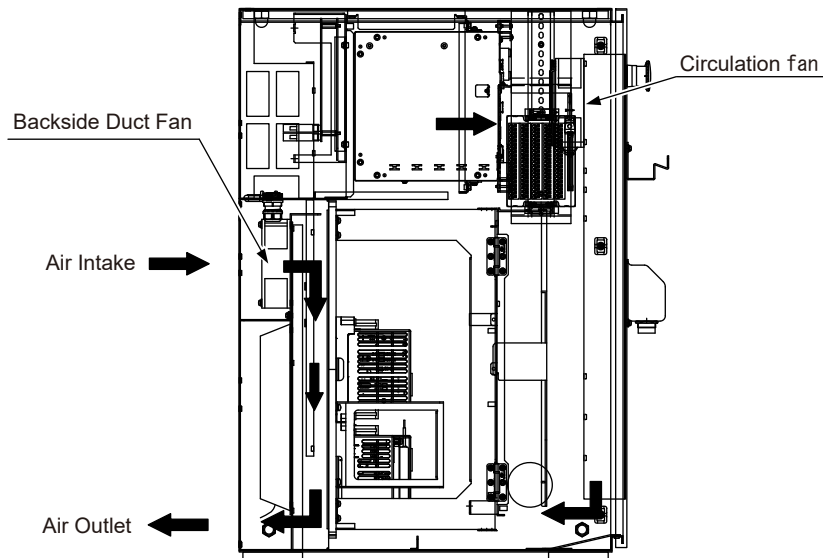
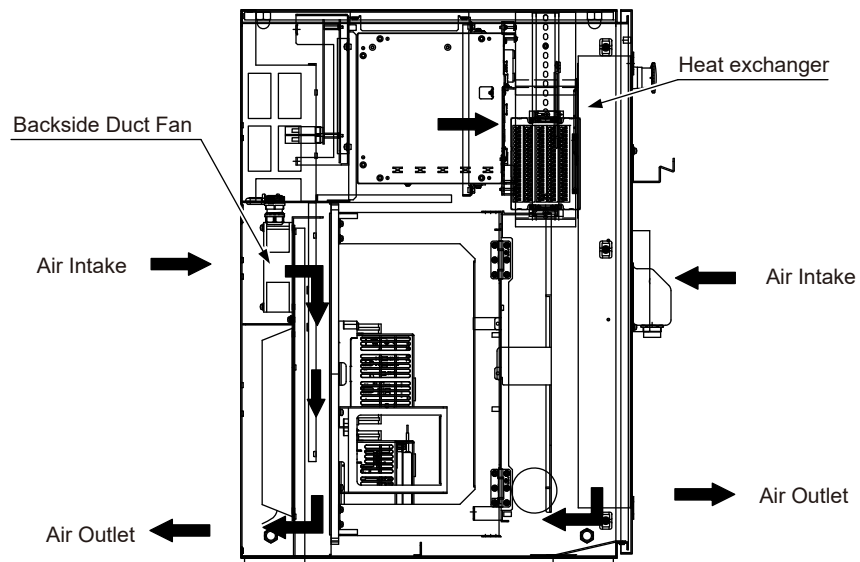


Fig. 13-4: Cooling System for Medium and Large Capacity



14 Description of Units and Circuit Boards



WARNING

- Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop buttons on the right of the front door of DX200 and the programming pendant are pressed.

Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency. The emergency stop buttons are located on the right of the front door of DX200 and the programming pendant.

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

Improper or unintentional manipulator operation can result in injury.

- When turning ON the power to DX200, be sure that there is no one within the P-point maximum envelope of the manipulator, and that you are in a safe place.

Injury may result from collision with the manipulator to anyone entering the P-point maximum envelope of the manipulator. Always press the emergency stop button immediately if there are problems.



CAUTION

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

- Check for problems in manipulator movement.
- Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to its specified position after use.

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the angularities of the floor may activate the Enable Switch, and the servo power could be turned ON as a consequence. Also, when the manipulator starts its operation, the manipulator or a tool could collide with the inadvertently left programming pendant during manipulator movement, possibly causing injury or equipment damage.

- Make sure that a system manager stores the key of the mode select switch on the programming pendant.
After operation, the key should be removed and stored by the system manager.

Improper or unintended manipulator operation may result in injury.

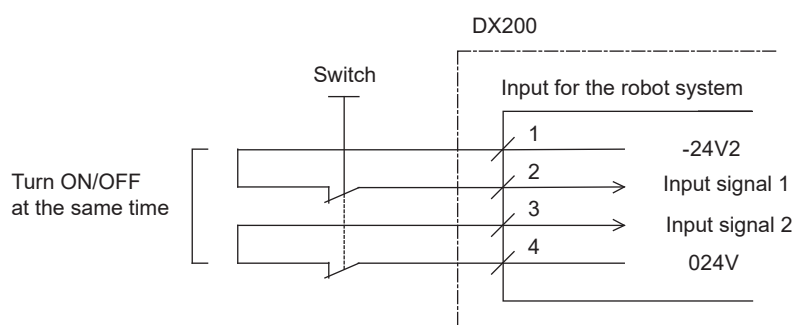
Also, the key or the mode select switch may be damaged if the programming pendant is dropped with the key inserted.

■ Cautions for Connection of Dual Input Signals



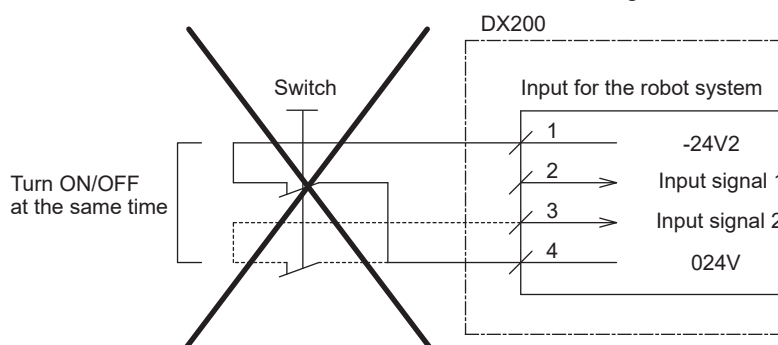
CAUTION

- Connect the switch (contact) that turns the dual signals ON and OFF simultaneously.
- If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs. Refer to the figure below.
- If one of the signals becomes abnormal, an alarm occurs.



CAUTION

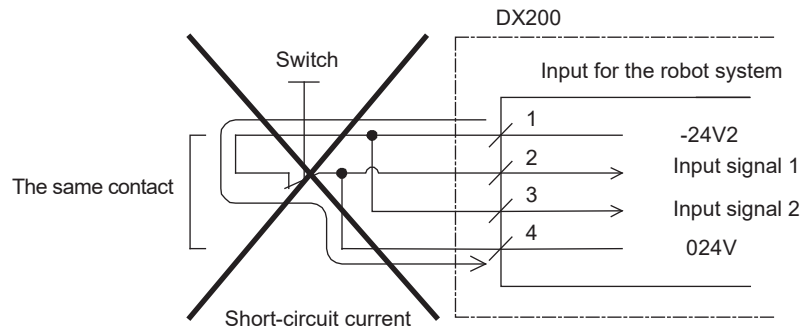
- For the dual input signals, connect input 1 and 2 for input signal 1, and connect input 3 and 4 for input signal 2. Incorrect connections may damage the board. Incorrect wiring, such as wiring shown below, may cause the 24 V and 0 V of the I/O power supply to short-circuit via elements of the board and an electric current to flow from input 1 to input 4. This may cause the elements of the board to become heated and damage the board.





CAUTION

- Do not connect two signals to the same contact point.
(Prepare two individual contact points)
- Since the power supply for each signal is reversed, it will short-circuit and may cause breakdown of DX200 Unit if the signals are connected to the same contact point.

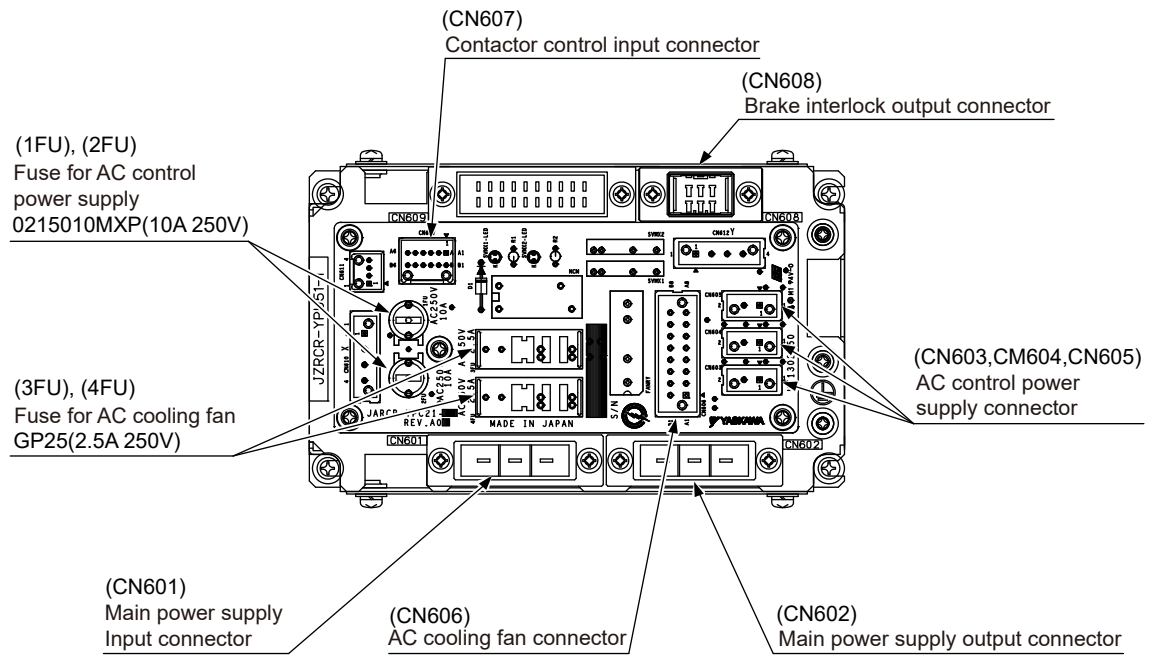


14.1 Power ON Unit (JZRCCR-YPU51-□)

The power ON unit consists of the power ON control circuit board (JARCCR-YPC21-1) and the main circuit contactor and the line filter. It turns the main circuit control contactor ON and OFF using the signal for the servo power control from the machine safety I/O logic circuit board, and supplies power(3-phase AC200/220V) to the converter.

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

Fig. 14-1: Power ON unit Configuration (JZRCCR-YPU51-□)



14.2 Axes Control Circuit Board

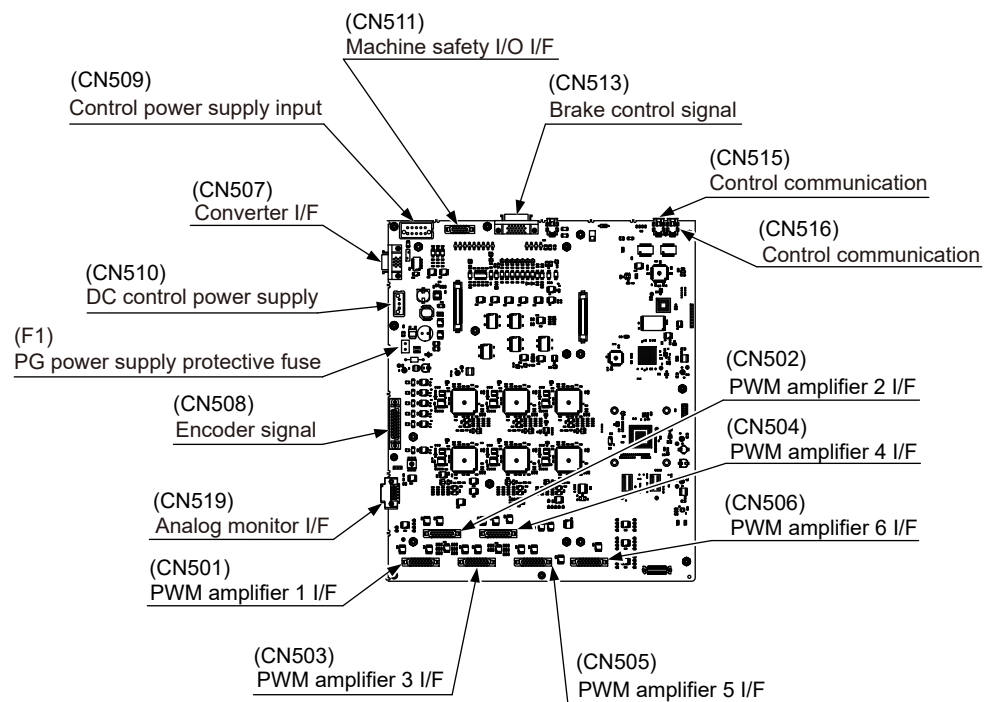
14.2.1 Major Axes Control Circuit Board (SRDA-EAXA21A)

The major axes control circuit board controls the servomotors of the manipulator's six axes. It also controls the converter and the PWM amplifiers. Mounting an external axes control circuit board of an option (SRDA-EAXB21A) makes it possible to control the servomotor of nine axes, including the robot axes.

The major axes control circuit board (SRDA-EAXA21A) also has the following functions.

- break power supply control circuit
- Shock sensor (shock) input circuit
- Direct-in circuit

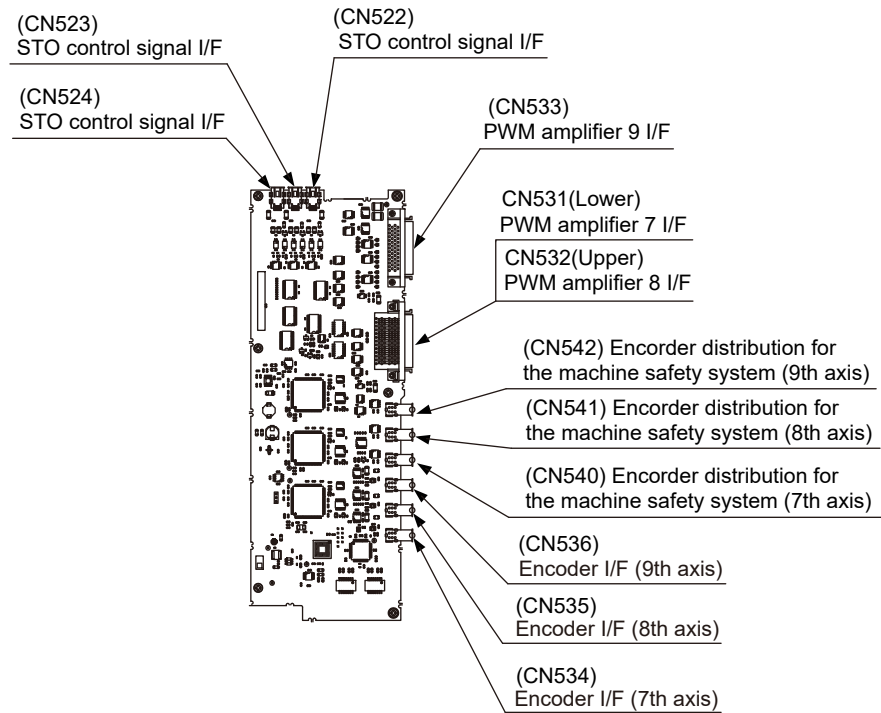
Fig. 14-2: Major Axes Control Circuit Board (SRDA-EAXA21A)



14.2.2 External Axes Control Circuit Board (SRDA-EAXB21A)

An external axes control circuit board (SRDA-EAXB21A) is an optional, and it can control the additional three axes. It can be mounted on the external axes control circuit board.

Fig. 14-3: External Axes Control Circuit Board (SRDA-EAXB21A)

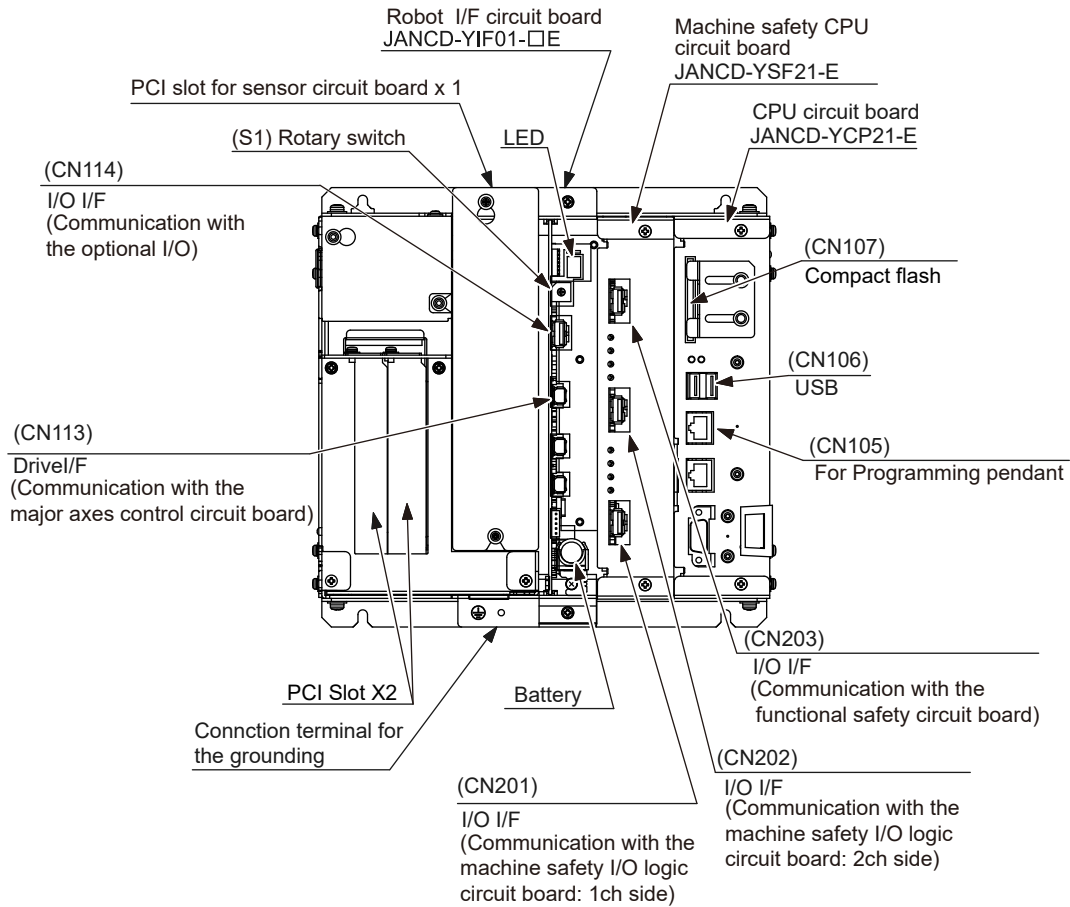


14.3 CPU Unit (JZNC-YRK21-1E)

14.3.1 CPU Unit Configuration

CPU unit consists of circuit board racks (frame, back circuit board, PCI riser circuit board), CPU circuit board, robot I/F circuit board and the machine safety CPU circuit board. The JZNC-YRK21-1E CPU unit contains only circuit board racks and CPU circuit boards. Be sure that it does not contain robot I/F circuit board and the machine safety CPU circuit board.

Fig. 14-4: CPU Unit Configuration (JZNC- YRK21-1E)



14.3.2 Unit and Circuit Board in the CPU Unit

14.3.2.1 CPU Circuit Board (JANCD-YCP21-E)

This circuit board (JANCD-YCP21-E) performs to control the entire system, display to the programming pendant, control the operating keys, control operation and calculate interpolation.

14.3.2.2 Robot I/F Circuit Board (JANCD-YIF01- □ E)

The robot I/F circuit board (JANCD-YIF01- □ E) controls the entire robotic system. It is connected to the CPU circuit board (JANCD-YCP21-E) with a PCI bus interface on the back circuit board, and to the major axes control circuit board (SRDA-EAXA21A) with high-speed serial transmissions.



Please do not change the factory setting of S1.
(Factory setting is [0])

14.3.2.3 Machine Safety CPU Circuit Board

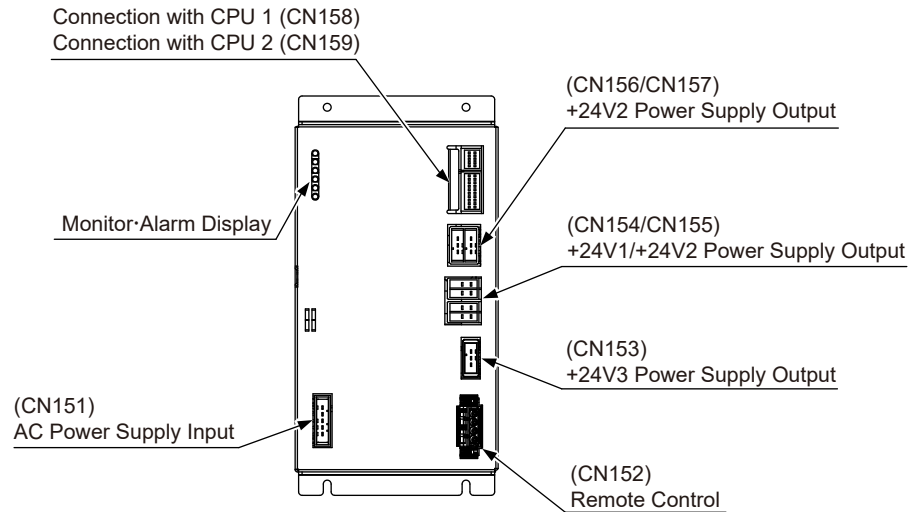
This circuit board (JANCD-YSF21-E) performs I/O processing or diagnosis processing for the safety sequence, and it is connected with the CPU circuit board (JANCD-YCP21-E) by the PCI Express bus I/F in the back circuit board.

It is also connected with the machine safety I/O logic circuit board by the high speed serial communications (two lines).

14.4 Control Power Supply Unit (JZNC-YPS21-E)

This unit (JZNC-YPS21-E) supplies the DC power (DC5V, DC24V) for control (system, I/O, break). It is also equipped with the input function for turning the control power supply ON and OFF.

Fig. 14-5: Control Power Supply Unit JZNC-YPS21-E



14 Description of Units and Circuit Boards
14.4 Control Power Supply Unit (JZNC-YPS21-E)

Items	Specifications																					
Input	Rating Input Voltage: 200/220VAC Voltage Fluctuation Range: +10% to -15% (170 to 242VAC) Frequency: 50/60Hz ± 2Hz (48 to 62Hz)																					
Output Voltage	DC + 5V DC +24V (24V1: System, 24V2: I/O, 24V3: break)																					
Indicator	<table><tr><th>DISPLAY</th><th>Color</th><th>Status</th></tr><tr><td>SOURCE</td><td>Green</td><td>Lights with power supply input. Lights out when internal live part completes discharge. (Power supply status: being input)</td></tr><tr><td>POWER ON</td><td>Green</td><td>Lights when PWR_OK output signal is ON. (Power supply status: being output)</td></tr><tr><td>+5V</td><td>Red</td><td>Lights with +5V over-current (ON when abnormal)</td></tr><tr><td>+24V</td><td>Red</td><td>Lights with +24V over-current (ON when abnormal)</td></tr><tr><td>FAN</td><td>Red</td><td>Lights when FAN error occurs.</td></tr><tr><td>OHT</td><td>Red</td><td>Lights when unit interior overheats</td></tr></table>	DISPLAY	Color	Status	SOURCE	Green	Lights with power supply input. Lights out when internal live part completes discharge. (Power supply status: being input)	POWER ON	Green	Lights when PWR_OK output signal is ON. (Power supply status: being output)	+5V	Red	Lights with +5V over-current (ON when abnormal)	+24V	Red	Lights with +24V over-current (ON when abnormal)	FAN	Red	Lights when FAN error occurs.	OHT	Red	Lights when unit interior overheats
DISPLAY	Color	Status																				
SOURCE	Green	Lights with power supply input. Lights out when internal live part completes discharge. (Power supply status: being input)																				
POWER ON	Green	Lights when PWR_OK output signal is ON. (Power supply status: being output)																				
+5V	Red	Lights with +5V over-current (ON when abnormal)																				
+24V	Red	Lights with +24V over-current (ON when abnormal)																				
FAN	Red	Lights when FAN error occurs.																				
OHT	Red	Lights when unit interior overheats																				
Control Power ON/OFF	<p>To turn ON the DX200 controller power, turn ON the non-fuse breaker of the controller so that the control power supply is turned ON. If the controller is not located at the workplace, the control power supply can be turned ON/OFF by an external device, etc. after the non-fuse breaker of the controller is turned ON. It is operated by the external switch connected with CN152 of the Control power supply unit as shown in the following figure. (CN152-1 and CN152-2 are short-circuited when shipment)</p> <p><i>Fig. 14-6: Connection to Control Power Supply Unit</i></p> <p>See chapter 14.8 “break Control Circuit Board (JANCD-YBK21-3E)” for wiring of CN152 connector.</p>																					

14.5 Machine Safety I/O Logic Circuit Board (JANCD-YSF22 □-E)

14.5.1 Machine Safety I/O Logic Circuit Board (JANCD-YSF22 □ -E)

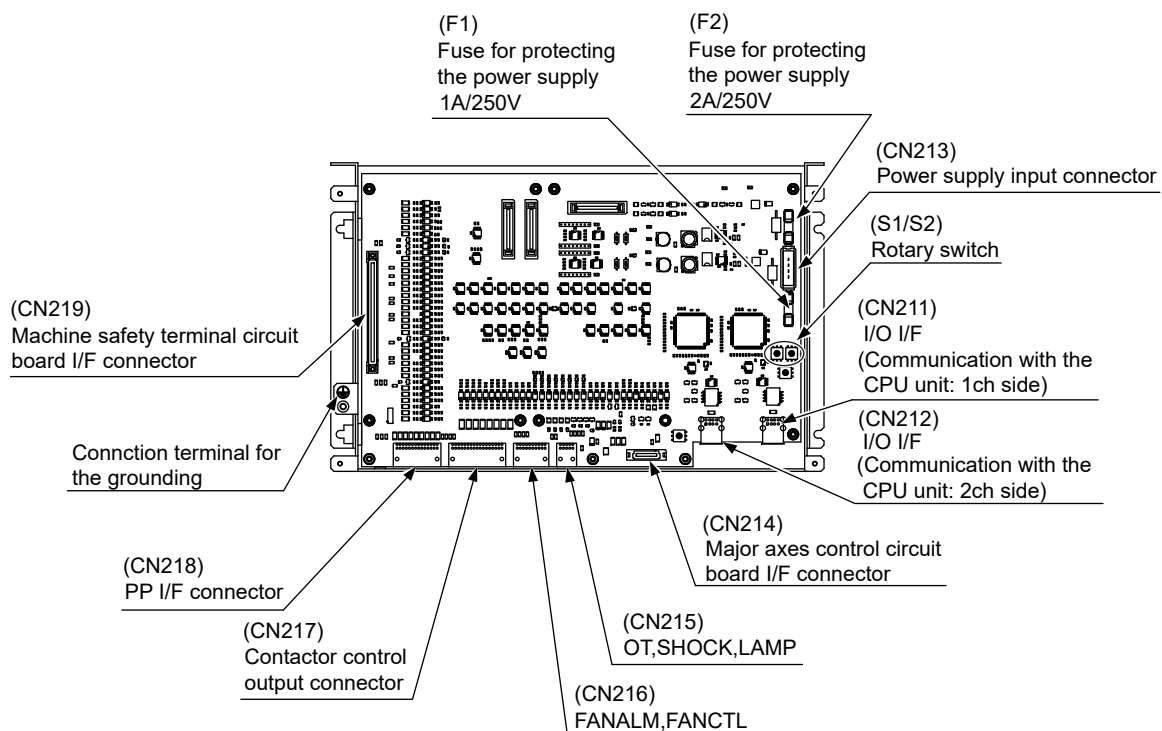
This circuit board contains dual processing circuits for safety signal and the I/O circuit for the un-safety signal.

It processes external safety signals with the dual processing circuits and control ON/OFF of the main circuit control contactor of the power ON unit according to conditions.

Followings are the main functions of Machine Safety I/O Logic Unit.

- System safety input circuit (dual circuits)
- User safety input circuit (dual circuits)
- User safety output circuit (dual circuits)
- Emergency stop signal input circuit (dual circuits)
- Servo power control signal output circuit (dual circuits)
- Anti-safety I/O circuit for the robot system
- Machine safety terminal block circuit board I/F

Fig. 14-7: Machine Safety I/O Logic Board (JANCD-YSF22 □ -E)



NOTE

If the F1 fuse becomes blown, it will cause a damage on the inner circuit of the board. Replace the board instead of replacing the fuse.
(There is no attached spare of the fuse.)

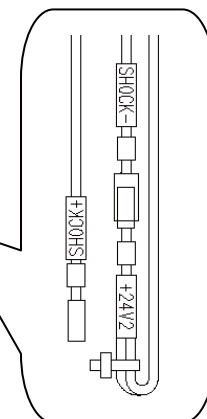
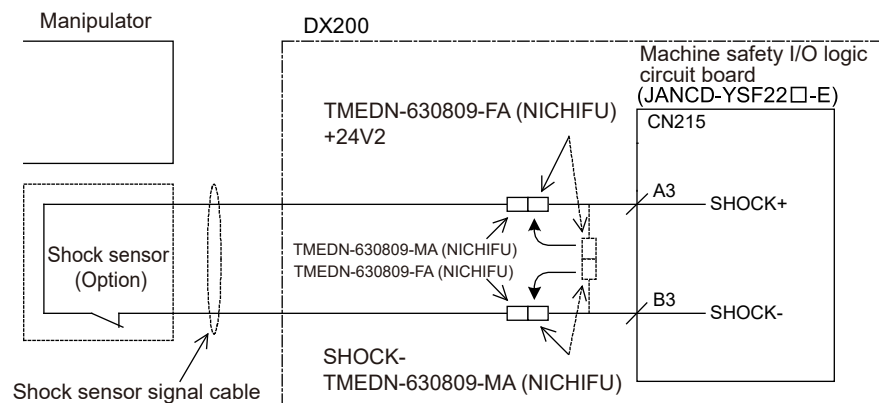
14.5.2 Connection for Tool Shock Sensor (SHOCK)

14.5.2.1 To Connect the Tool Shock Sensor Directly to the Tool Shock Sensor Signal Line

1. Disconnect the minus SHOCK (-) and +24V2 pin terminal from the DINAMIC connector, the machine safety I/O logic circuit board (YSF22 □ -CN215). The pin terminal for the shock sensor is attached on the right side of the controller.
2. Connect the minus SHOCK (-) and +24V2 pin terminals to the signal line of the tool shock sensor. Use the following pin terminals for preparing the end of the signal line.

Pin Terminal Name	Pin Terminal Model	Signal Line Terminal Model
SHOCK-	TMEDN-630809-MA	TMEDN-630809-FA (manufactured by NICHIFU Co., Ltd.)
+24V2	TMEDN-630809-FA	TMEDN-630809-MA (manufactured by NICHIFU Co., Ltd.)

Fig. 14-8: Direct Connection to Tool Shock Sensor Signal Line



The pin terminal for the shock sensor is attached on the right side of the controller.

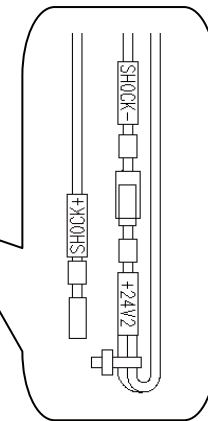
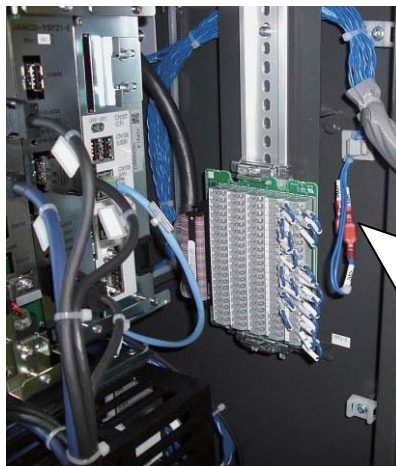
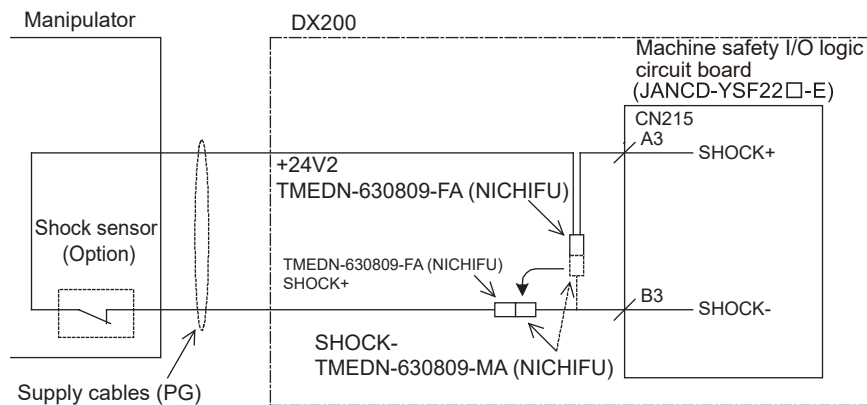
14.5.2.2 To Connect the Tool Shock Sensor with the Cable that is Built into the Manipulator

1. Disconnect the minus SHOCK (-) and +24V2 pin terminal from the DINAMIC connector, the machine safety I/O logic circuit board (YSF22 □ -CN215). The pin terminal for the shock sensor is attached on the right side of the controller.
2. Connect the minus SHOCK (-) pin terminal to the plus SHOCK(+) pin terminal of the manipulator.

NOTE

Cable that is built into the manipulator is not connected to shocks sensor because the tool shock sensor is a option. For connecting the tool shock sensor, refer to the wiring diagrams in the INSTRUCTIONS for the manipulator.

Fig. 14-9: Connection with Manipulator Cable



The pin terminal for the shock sensor is attached on the right side of the controller.



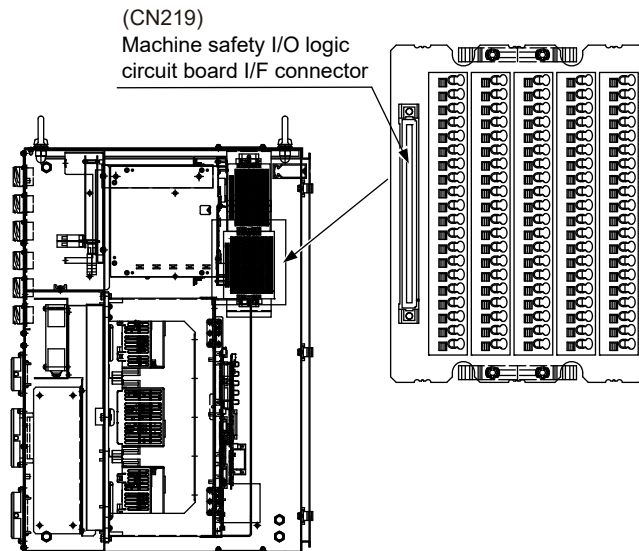
When the tool shock sensor input signal is used, the stopping method of the robot can be specified. The stopping methods are hold stop and servo power supply OFF. Selection of the stopping method is set in the display of the programming pendant. Refer to explanations in *chapter 8 "System Setup"* for details.

14.6 Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)

The machine safety terminal block circuit board (JANCD-YFC22-E) is for the system external signal to connect with the safety I/O signals.

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

Fig. 14-10: Machine Safety Terminal Block



14 Description of Units and Circuit Boards
14.6 Machine Safety Terminal Block Circuit Board (JANCD-YFC22-E)

Table 14-1(a): JANCD-YFC22-E Details for the Connection Terminal

Signal Name	Connection No. (MXT)	Dual input	Function	Factory Setting
SAFF1+ SAFF1-	-1 -2	Applicable	Safety Plug	Short-circuit with a jumper cable
SAFF2+ SAFF2-	-3 -4		Used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is input, the servo power turns OFF. While the signal is turned ON. The servo power cannot be turned ON. Note that these signals are disabled in teach mode.	
EXESP1+ EXESP1-	-5 -6		External Emergency Stop	
EXESP2+ EXESP2-	-7 -8		Used to connect the emergency stop switch of an external device. If the signal is input, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON.	
EXDSW1+ EXDSW1-	-9 -10	Applicable	External Enable Switch	Short-circuit with a jumper cable
EXDSW2+ EXDSW2-	-11 -12		Used to connect a Enable switch other than the one on the programming pendant when two people are teaching.	
FST1+ FST1-	-13 -14	Applicable	Full-speed Test	Open
FST2+ FST2-	-15 -16		Used to reset the slow speed limit for the test run in the teach mode. If this signal input circuit is short-circuited, the speed of the test run becomes the speed of the playback (taught speed). If this signal's circuit is open, the status SSP input signal determines the safety speed: The first slow speed (16%) or second slow speed (2%).	
SSP+ SSP-	-17 -18	-	Slow Speed Mode Selection	Short-circuit with a jumper cable
			Used to determine the speed of the test run when the FST (full-speed test) signal input circuit is open. Open: Second slow speed (2%) Short-circuit: First slow speed (16%)	
EXHOLD+ EXHOLD-	-19 -20	-	External Hold	Short-circuit with a jumper cable
			Used to connect the temporary stop switch of an external device. If the signal is input, the job is stopped. While the signal is input, starting and axis operations are disabled.	
EXSVON+ EXSVON-	-21 -22	-	External Servo ON	Open
			Use to connect the servo ON switch of an external operation device. If the signal is input, the servo power supply is turned ON.	
SYSRUN+ SYSRUN-	-23 -24	-	SYSRUN signal	Open
			Use to determine the normal/abnormal condition of the DX200 controller by SYSRUN signal.	

Table 14-1(b): JANCD-YFC22-E Details for the Connection Terminal

Signal Name	Connection No. (MXT)	Dual input	Function	Factory Setting
ONEN11+ ONEN11-	-25 -26	Applicable	Servo ON Enable	Short-circuit with a jumper cable
ONEN12+ ONEN12-	-27 -28		Connected to use a function which distributes the robot system to the multiple servo areas, and turns the servo power ON/OFF.	
ONEN21+ ONEN21-	-29 -30	Applicable		
ONEN22+ ONEN22-	-31 -32			
ONEN31+ ONEN31-	-33 -34	Applicable		
ONEN32+ ONEN32-	-35 -36			
ONEN41+ ONEN41-	-37 -38	Applicable		
ONEN42+ ONEN42-	-39 -40			
OT21+ OT21-	-41 -42	-	External Axes Overrun	Open
OT22+ OT22-	-43 -44		Used to input the overrun in the external axes other than the main body of the manipulator.	
OT31+ OT31-	-45 -46	-		
OT32+ OT32-	-47 -48			
OT41+ OT41-	-49 -50	-		
OT42+ OT42-	-51 -52			
PPESP3+ PPESP3-	-53 -54	-	Emergency Stop Button Contact Output	Open
PPESP4+ PPESP4-	-55 -56		Used to output a contact point of the emergency stop button on the programing pendant.	
PBESP3+ PBESP3-	-57 -58	-	Used to output a contact point of the emergency stop button on the front door of the DX200 Control panel.	
PBESP4+ PBESP4-	-59 -60			

Table 14-1(c): JANCD-YFC22-E Details for the Connection Terminal

Signal Name	Connection No. (MXT)	Dual input	Function	Factory Setting
GSIN11+ GSIN11-	-61 -62	Applicable	Universal Safety Input	Open
GSIN12+ GSIN12-	-63 -64		The universal safety input signal is used in the safety logical circuit function.	
GSIN21+ GSIN21-	-65 -66			
GSIN22+ GSIN22-	-67 -68			
GSOUT11+ GSOUT11-	-69 -70	-	Universal Safety Output	Open
GSOUT12+ GSOUT12-	-71 -72	The universal safety output signal is used in the safety logical circuit function. Also, inputs and uses the driven connection device status as the monitoring signal by the output signal.		
GSOUT21+ GSOUT21-	-73 -74			
GSOUT22+ GSOUT22-	-75 -76			
GSEDM1+ GSEDM1-	-77 -78			
GSEDM2+ GSEDM2-	-79 -80			
+24V2U3	-81 -82 -92 -93	-	DC +24V2 output terminal	
			-	
024V2	-83 -84 -94 -95	-	DC024V2 output terminal	Open
			-	
AXDIN_COM AXDIN1 AXDIN2 AXDIN3 AXDIN4 AXDIN5 AXDIN6	-85 -86 -87 -88 -89 -90 -91	-	Direct -in (Servo)	Open
			Used to input the quick responding signals in the search function etc.	
AIN_COM AXIN1 AXIN2	-96 -97 -98	-	Universal input (Servo)	Open
			Used to input the universal signal from the external device.	
AXOUT1 AXOUT2	-99 -100	-	Universal output (Servo)	Open
			Used to output the universal signal to the external device.	

■ **Wiring Procedure of the Terminal Block**

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

1. Tool: Screwdriver

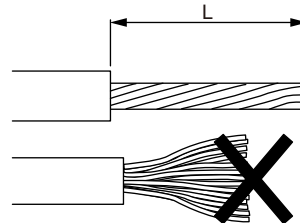
- For the connection, be sure to use a screwdriver of an applicable size and configuration.

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



2. Applicable Wires

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

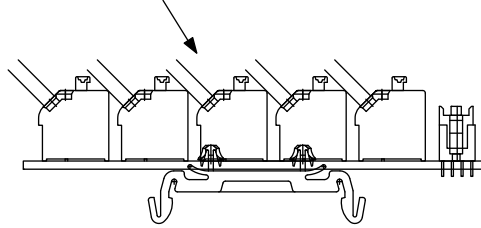


- * The length of the exposed conductor set for the terminal block (L)
WAGO series 250 (with 5.0 mm pitch): 9-10 mm
- * Applicable max cable outside diameter: 3.1 mm dia.

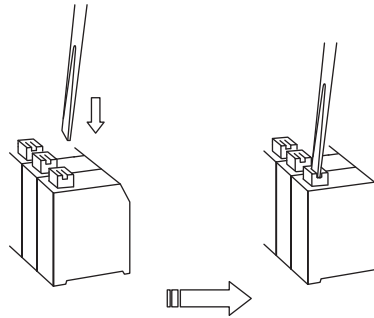
- (2) In case that the conductor is bent or feazed, make it straight as illustrated in the figure above.

3. Wire Connection

Terminal block: screwless clamp
terminal WAGO series 250

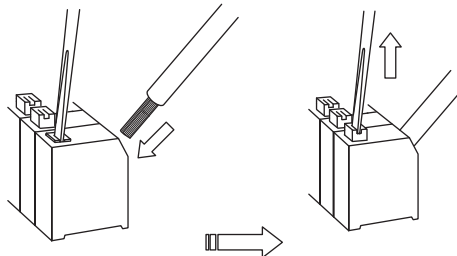


- (1) Place the screwdriver on the lever upright as shown in the figure below and push straight down.



- (2) Insert the wire into the connection hole slowly until its leading end touches the end of the hole.

For thin wires, never insert the wire with force, or the wire jacket may get caught in.



- (3) Pull out the screwdriver to clamp the conductor with a spring.
(4) Check if the wire is connected firmly by pulling the wire softly.

14.6.1 Safety Plug

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



CAUTION

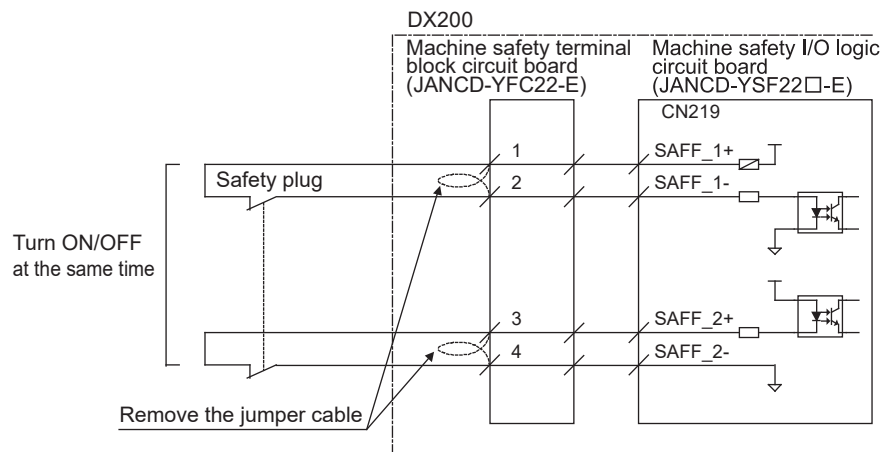
- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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



Because of its dual circuit signal to input, the alarm occurs if the signal does not match. However, in the teach mode, even though the signal does not match, the alarm is not detected. The alarm is detected only in the play mode.

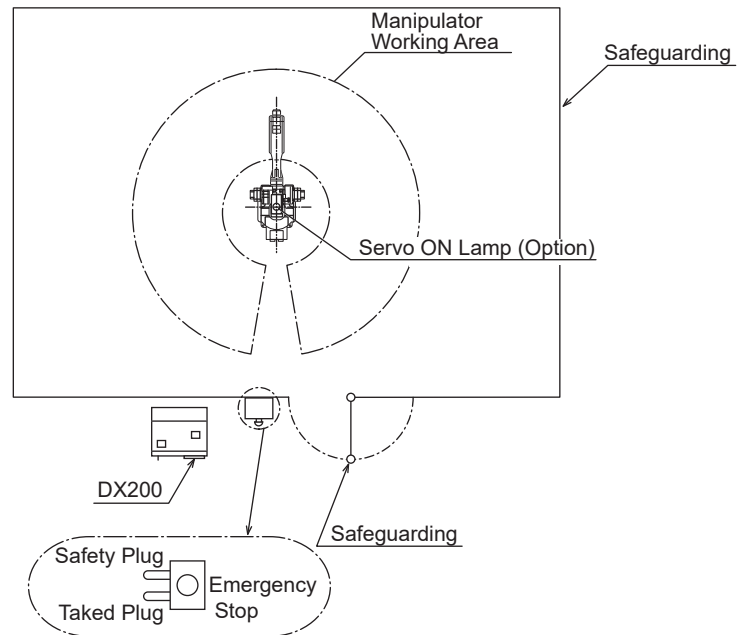
Fig. 14-11: Connection for Safety Plug



■ **Installation of Safety Plug**

The manipulator must be surrounded by a safeguarding and a door protected by an interlock function. The door must be opened by the technician to enter and the interlock function stops the robot operation when the door is open. The safety plug input signal is connected to the interlock signal from the gate.

Fig. 14-12: Installation of Safety Plug



If the servo power is ON when the interlock signal is input, the servo power turns OFF. The servo power cannot be turned ON while the interlock signal is input. However, the servo power does not turn OFF when the door is opened only during the teach mode. In this case, the servo power can be turned ON while the interlock signal is input.

14.6.2 External Emergency Stop

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

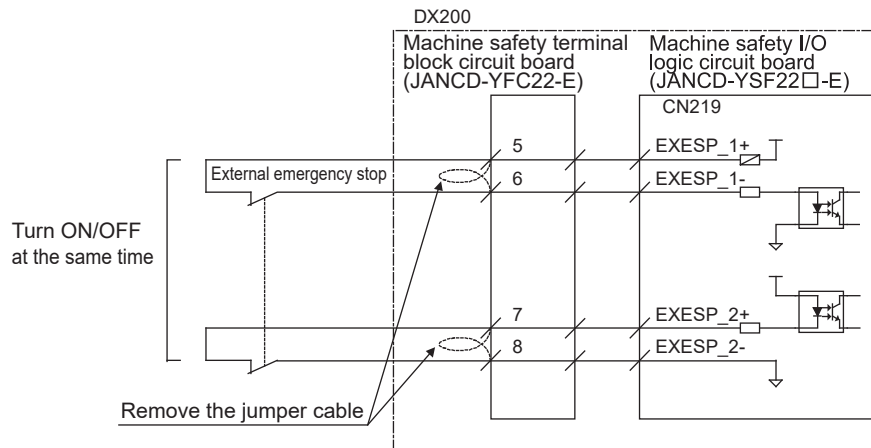


CAUTION

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

Fig. 14-13: Connection for External Emergency Stop



14.6.3 External Enable Switch

This signal is used to connect Enable switch other than the one on the programming pendant when two people are teaching. In the condition of the external enable switch ON, when turn the enable switch ON/OFF by the programming pendant, the servo power is also turned ON/OFF. However, when turn the external enable switch ON after turning the enable switch ON by the programming pendant, the servo power is not turned ON.

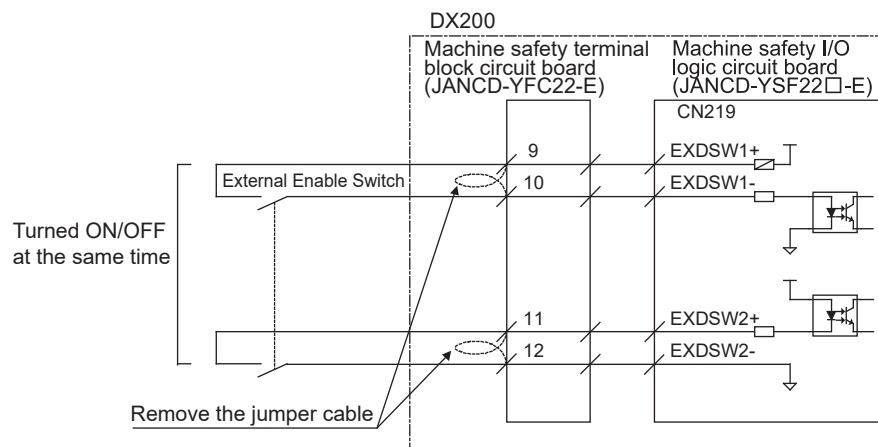


CAUTION

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

Fig. 14-14: Connection for External Enable Switch



14.6.4 Full-speed Test

This signal is used to reset the slow speed limit for the test run in the teach mode.

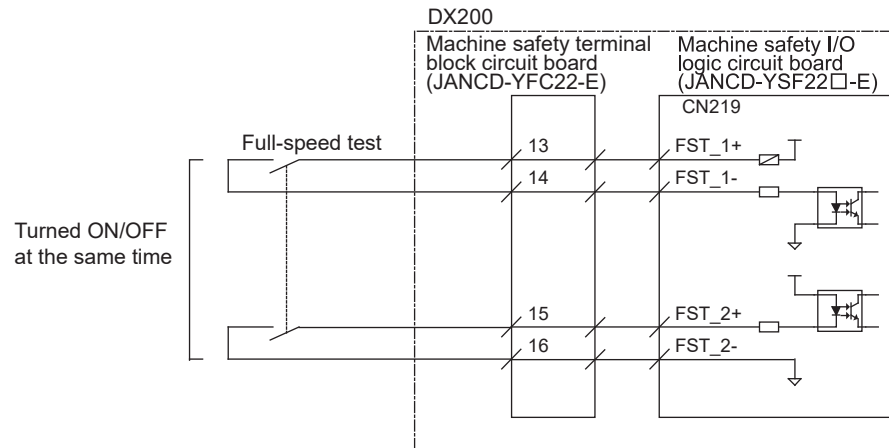
If this signal input circuit is short-circuited, the speed of the test run becomes the speed of the playback (taught speed).

If this signal's circuit is open, the status SSP input signal determines the slow speed: The first slow speed (16%) or second slow speed (2%).

- Setting Method

1. Short-circuit terminal numbers 13 and 14 of the machine safety terminal block circuit board(JANCD-YFC22-E), and 15 and 16 as well. (Normally, each terminal is unwired.)

Fig. 14-15: Connection for Full-speed Test



2. The message "Full-speed test mode" is displayed as follows when the setting is finished.



• Operation Speed

When the full-speed test mode is set, operation speed is set depending on the setting of manual speed as follows.

At the time of setting the full-speed test mode, the servo power is turned OFF once, the setting of manual speed shifts to Inching automatically. If the enable switch is released in the full-speed mode, the setting of manual speed also shifts to Inching automatically.

When changing the setting of manual speed, make sure that there is no person around the manipulator and pay great attention to perform the operation.

Manual speed	Limit of operation speed (default value)	Parameter (Unit: 0.01%)
Inching	20%	S1CxG60 (default value: 2000)
Slow	50%	S1CxG61 (default value: 5000)
Medium	75%	S1CxG62 (default value: 7500)
Fast	100% (fixed value)	-



- The limit values of operation speed described in the table above are the ratio against the manipulator's maximum speed, not against the taught speed. The values are for restraining the operation speed not to exceed the limit values of operation speed against the manipulator's maximum speed during the test run or FWD/BWD operation.
- Manual full-speed function allows the manipulator to perform the test run or FWD/BWD operation at the taught speed by a job during the teach mode. Perform the operation outside the motion range.
- If the full-speed test mode is set or released while a servo power is ON, the servo power turns OFF.

14.6.5 Slow Speed Mode Selection

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

Open: Second slow speed (2%)

Short-circuit: First slow speed (16%)

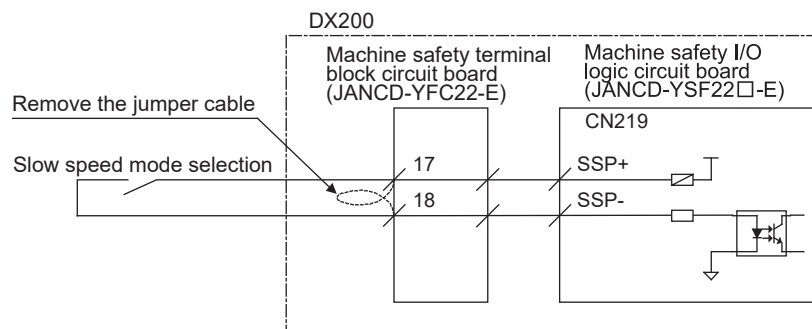


CAUTION

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

Fig. 14-16: Connection for Slow Speed Mode Selection



14.6.6 External Hold

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

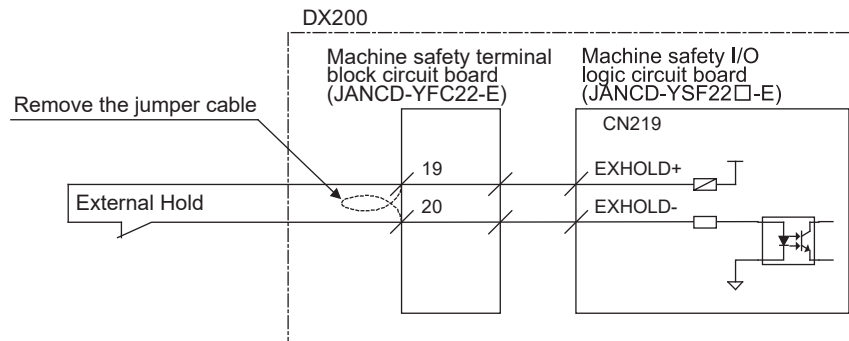


CAUTION

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

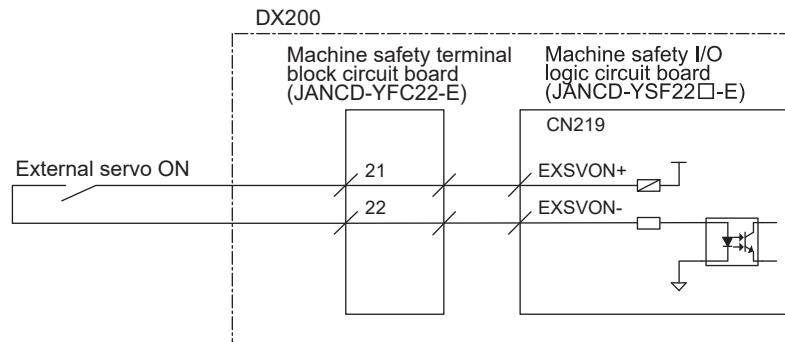
Fig. 14-17: Connection for External Hold



14.6.7 External Servo ON

This signal is used to connect the servo ON switch of an external operation device. If the signal is input, the servo power supply is turned ON.

Fig. 14-18: Connection for External Servo ON



14.6.8 SYSRUN Signal Output

This signal is used to check whether the DX200's status is normal or abnormal.

This signal is output on the following conditions.

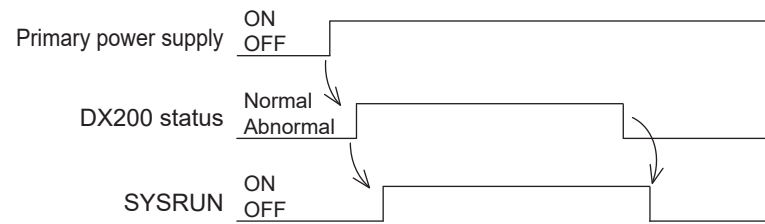
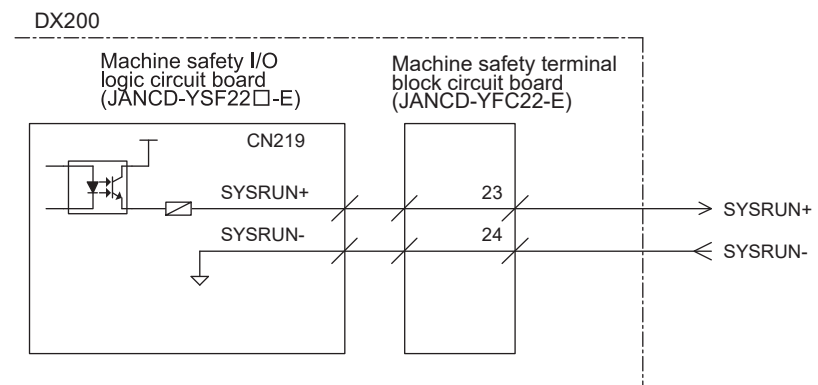


Fig. 14-19: Connection for SYSRUN Signal Output



Because the pulse signal is outputted from the specific output signal (#50911) to the external device for each 100ms, it is also able to check whether the DX200's control circuit board is normal or abnormal.

Refer to “Chapter 4.12 Specific Output Signals” of DX200 OPTIONS INSTRUCTIONS FOR CONCURRENT I/O (RE-CKI-A465) for more details.

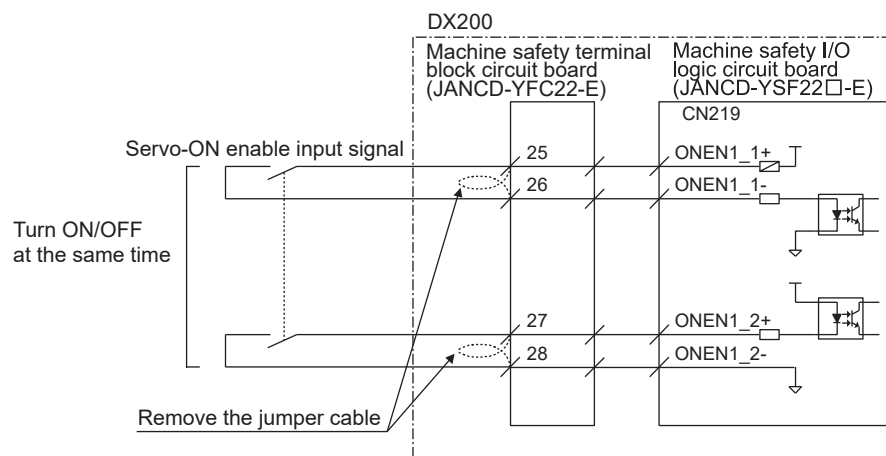
14.6.9 Connection for Servo-ON Enable Input

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

For safety reasons, dual circuits are used for the Servo-ON Enable input signals. Connect the signal so that both input signals are turned ON or OFF at the same time. If only one signal is turned ON, an alarm occurs.

Refer to “8 Servo Power Supply Individual Control Function” of “Independent/Coordinated Function Instructions Manual” for the usage of the Servo-ON Enable signals.

Fig. 14-20: Connection for Servo-ON Enable Input



14.6.10 External Axes Overrun

With a unit of standard specifications without an external axis, the external axis overrun input signal is not used. In this case, a jumper cable is connected as shown in the following figure.

If an overrun input signal for an axis other than manipulator axes, for example the external axis, is required, connect the signal input circuit in the following manner.

For safe reason, a dual circuits are used for the external axis overrun signal input. Connect the external axis overrun signal so that both input signals are turned ON or OFF at the same time.

If only one signal is turned ON, the machine safety signal error occurs.

For the setting of the external axis overrun, refer to *chapter 12.3.1.2 "Connection Setting"*.

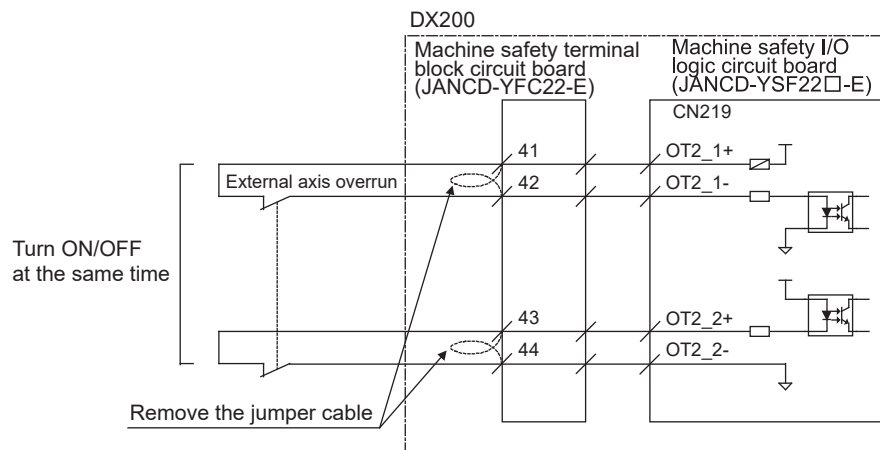


CAUTION

- Jumper cables are installed at the factory. Be sure to remove the jumper cables before using.

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

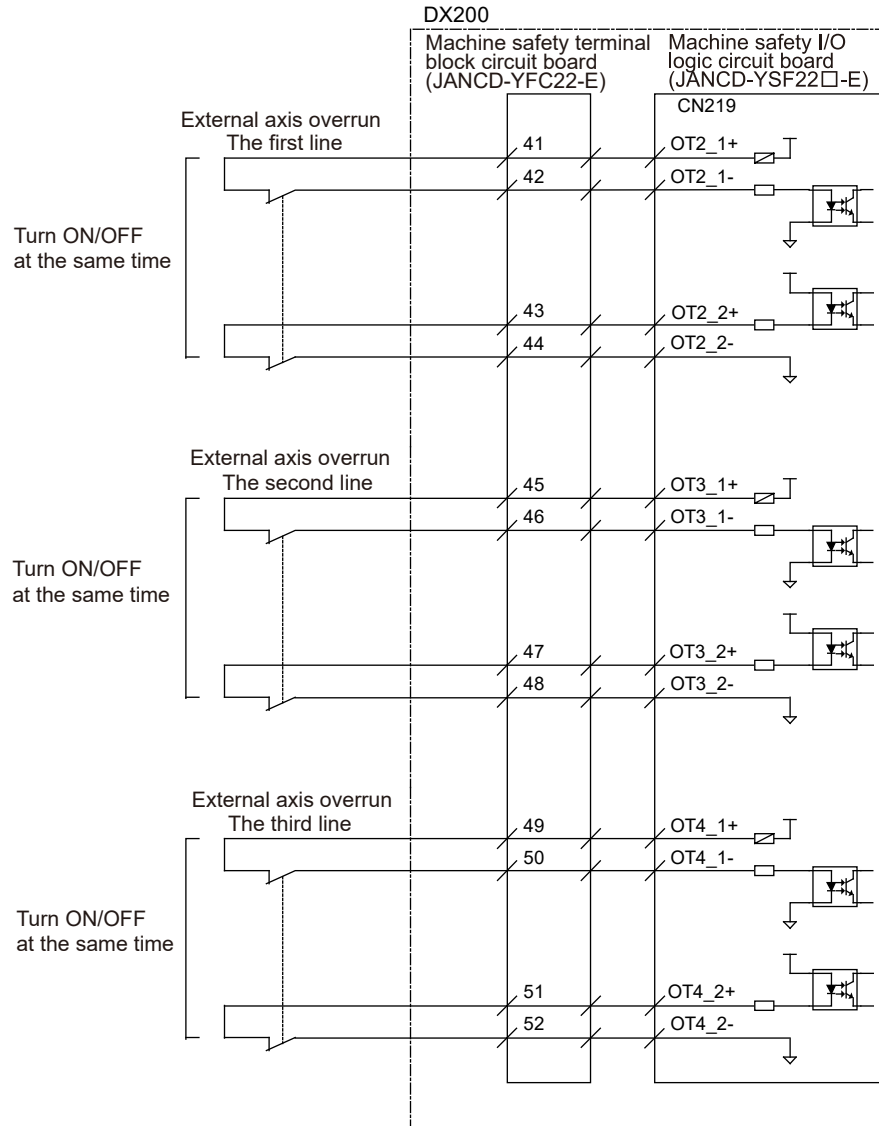
Fig. 14-21: Connection for External Axis Overrun



The following figure shows the external axis overrun wiring of the factory default setting when the external axes are connected to the DX200.

Please refer to the following figure to connect the external axes overrun signal to wire in the another route. On that occasion, confirm the external axes overrun setting to connect. (Refer to *chapter 12.3.1.2 “Connection Setting”* .)

Fig. 14-22: Connection for External Axis Overrun (Multiple Lines)



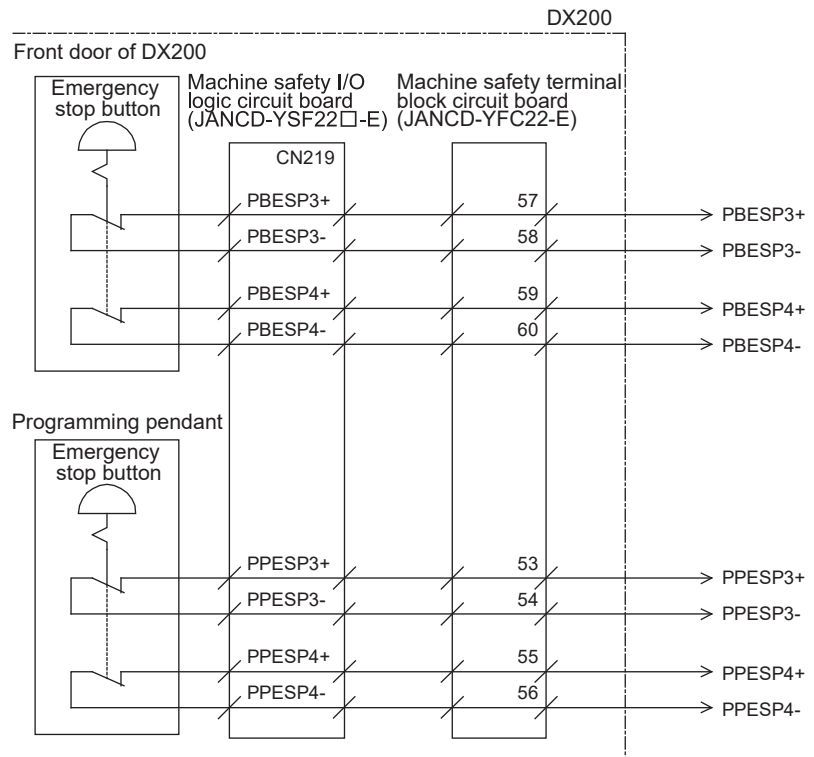
14.6.11 Emergency Stop Output

Outputs the contact output terminals for both emergency stop buttons on the programming pendant and on the front door.

These contact outputs are always valid regardless of the DX200 main power supply status ON or OFF. (Status output signal: normally closed contact)

 CAUTION
<ul style="list-style-type: none"> Do not use the emergency stop button with 24 VAC, 0.5 A or more. Failure to observe this instruction may result in damage to equipment.

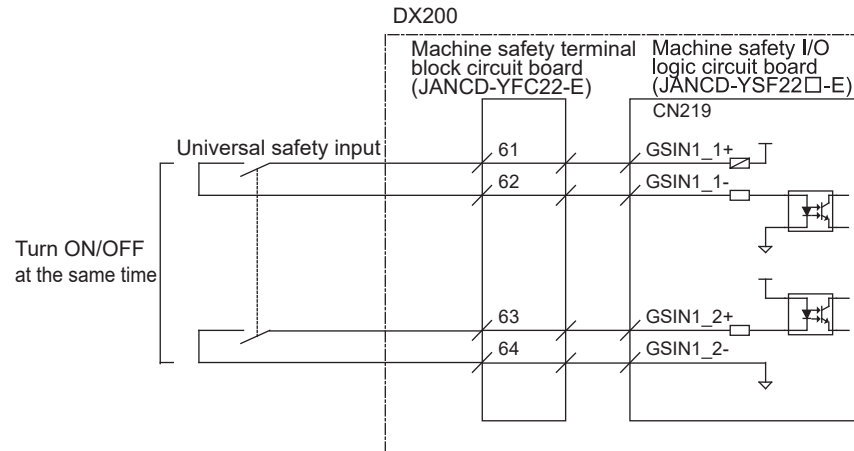
Fig. 14-23: Output of Emergency Button



14.6.12 Universal Safety Input

The universal safety input signal is used in the safety logic circuit function.

Fig. 14-24: Universal Safety Input



14.6.13 Universal Safety Output

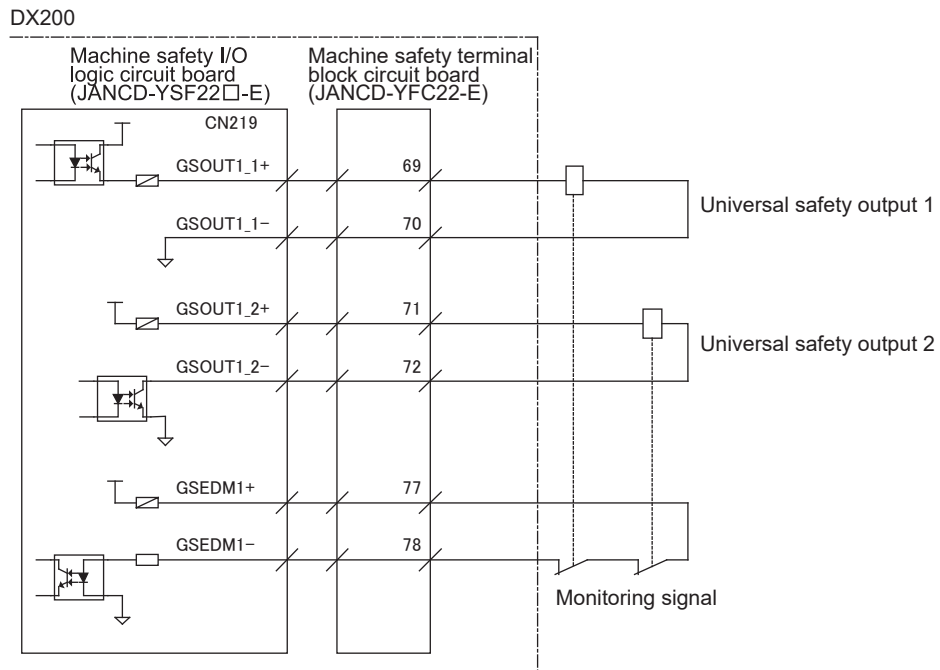
The universal safety output signal is used in the safety logic circuit function.

For example, composing the circuit to output the status signal, such as the servo ON signal or the emergency stop button by the safety logic circuit function enables to output the signals to the external device.

The signal is outputted as the dual signals, and inputs the status of the driven devices by the output signal as the monitoring signal.

For the example of use of the universal safety output signal, refer to chapter 8.23 "Safety Logic Circuit".

Fig. 14-25: Example of Use of Universal Safety Output Signal





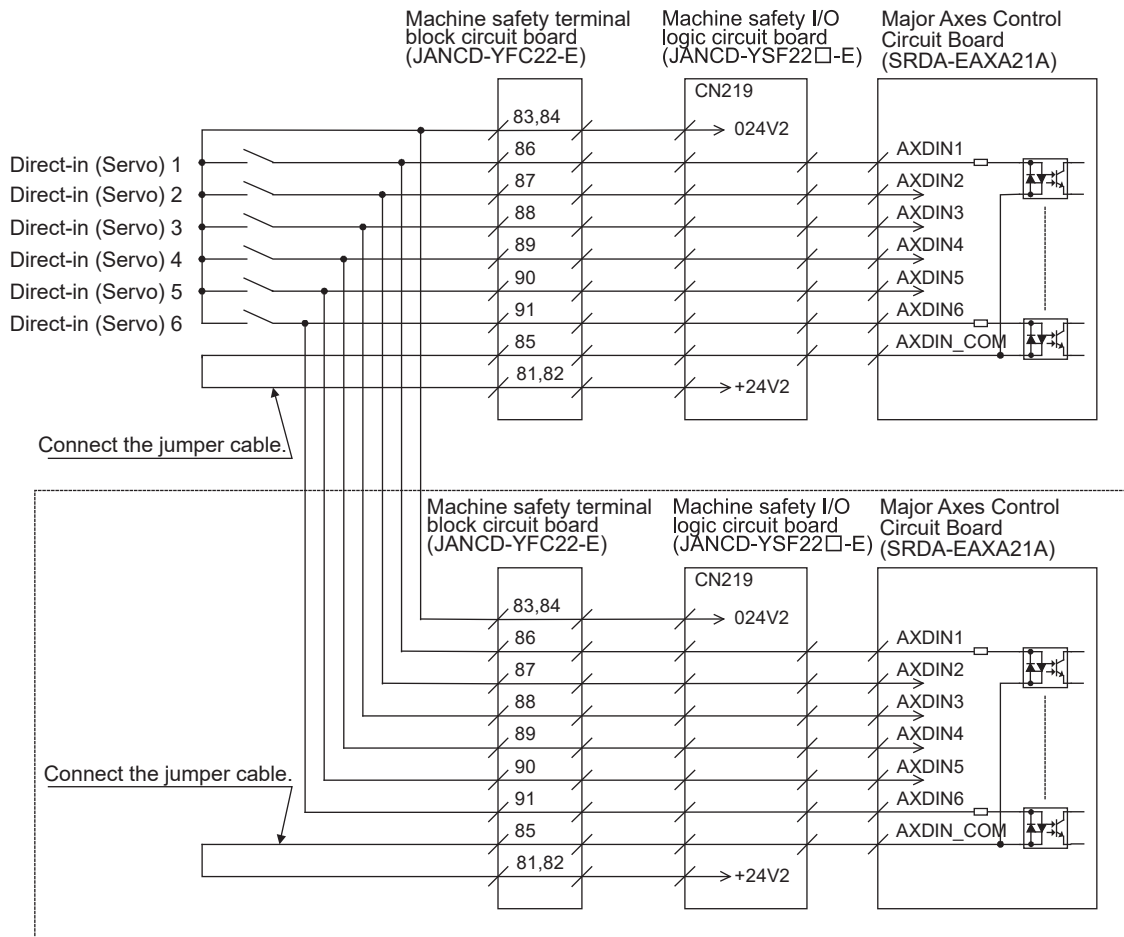
- Rated output value is DC24V and less than 50mA. Avoid excessive load when connect.
- When connect the inductive load, such as the safety relay, with the output circuit, use of the built-in protective circuit for the surge suppressor or connect the flyback diode in parallel to the inductive load to suppress the surge voltage.
It may cause the damage on the output circuit.
- The feedback signal must be inputted to the DX200 when use the universal safety output signal.

14.6.14 Connection for Direct-in

■ Direct-in (Servo) 1 to 6

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

Fig. 14-26: Connection for Direct-in (Servo) 1 to 6

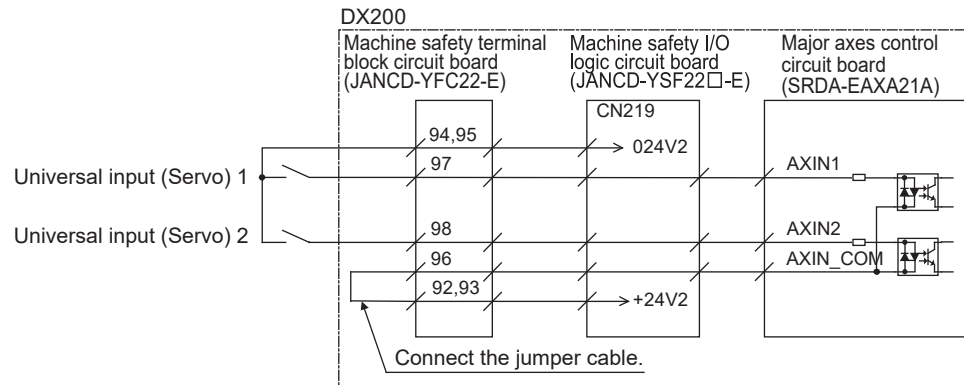


The [] part of wiring is that if there is a slave for the coordinated control side major axes control circuit board (SRDA-EAXA21A).

14.6.15 Universal Input (Servo)

Connect when use the universal signal.

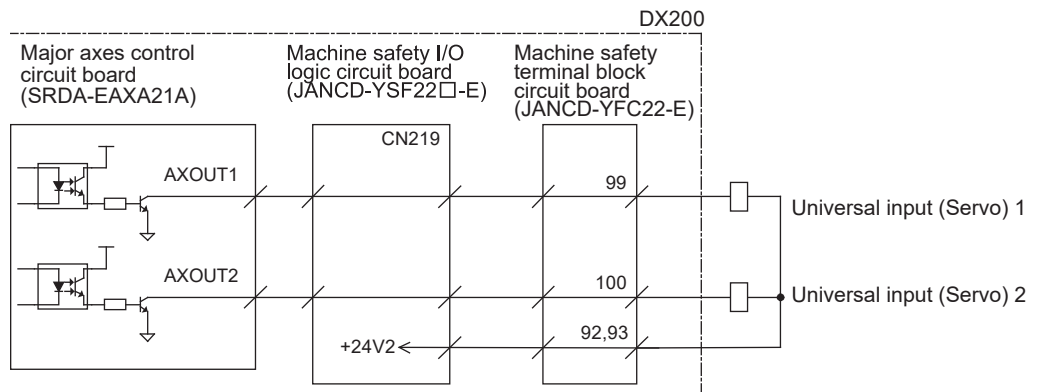
Fig. 14-27: Universal Input (Servo)



14.6.16 Universal Output (Servo)

Connect when use the universal signal.

Fig. 14-28: Universal Output (Servo)



14.7 Universal I/O Circuit Board (JANCD-YIO21-E)

14.7.1 Universal I/O Circuit Board (JANCD-YIO21-E)

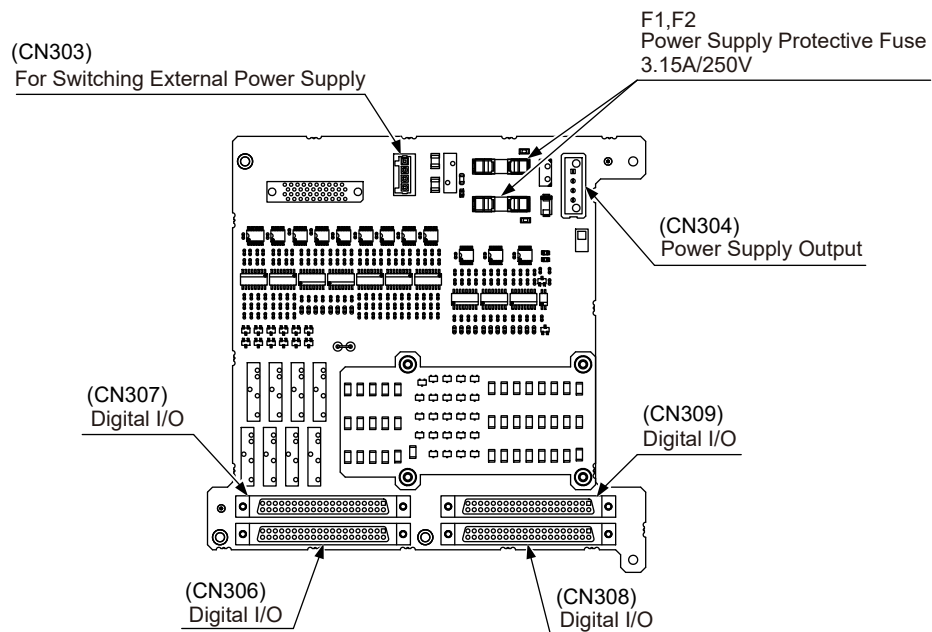
Four digital I/O connectors for the robot universal I/O are provided:
40 inputs and 40 outputs.

The I/Os are divided into two types: universal I/O and specific I/O.
The I/O assignment differs depending on the application. Specific I/O is a signal in which the part is decided in advance. Specific I/O is used when the external operation equipment such as positioner controller and centralized controller control the manipulator and related equipment as a system. Universal I/O are mainly used as timing signals for the manipulator and peripheral devices in jobs that require robot motion.

Refer to *chapter 14.13 “Universal I/O Signal Assignment”* for more details on signal allocation.

For the connection of the robot's universal I/O signal connectors, and the I/O signal related to start and stop, refer to *“Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)”* and *“Specific I/O Signal Related to Start and Stop”*.

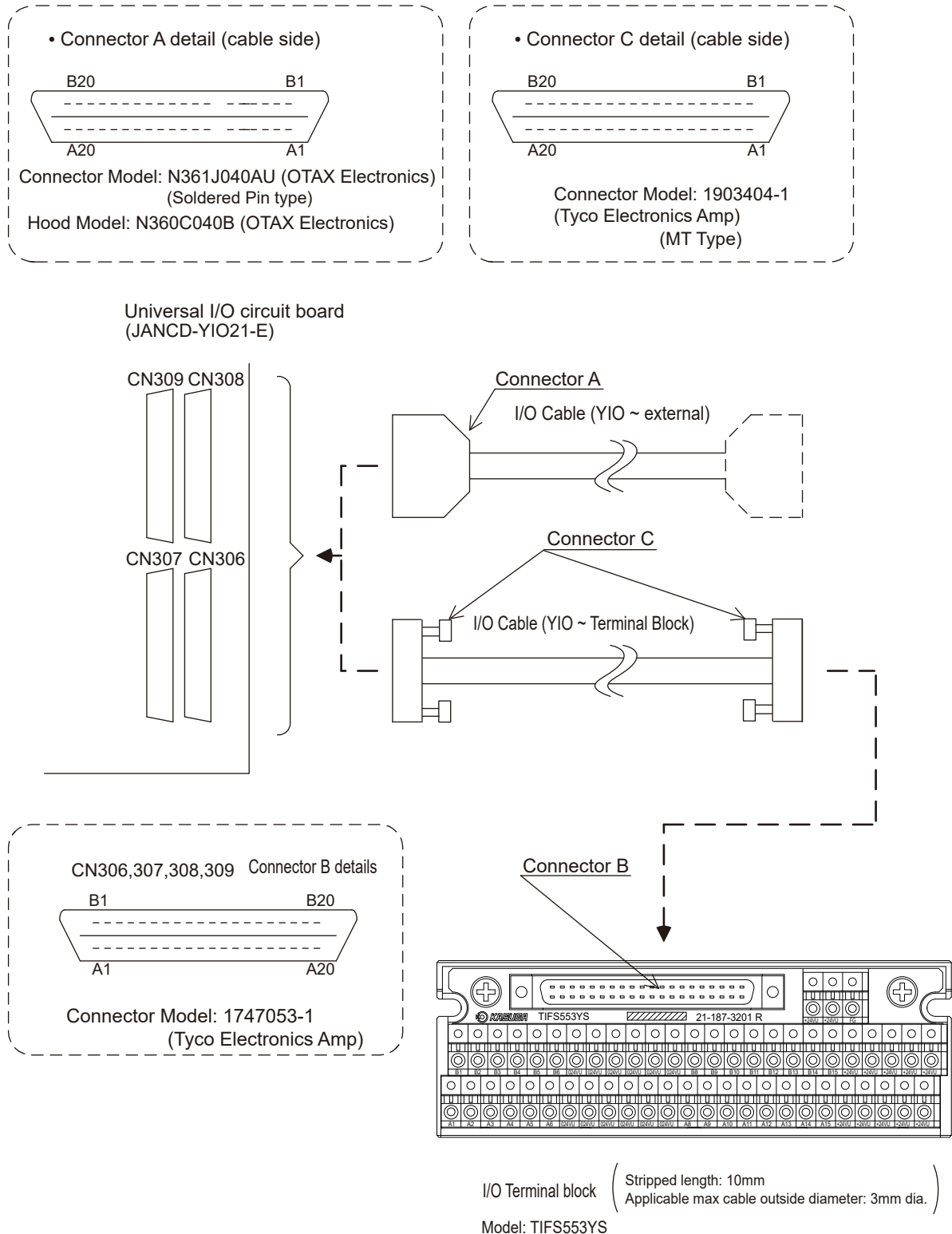
Fig. 14-29: Universal I/O Circuit Board (JANCD-YIO21-E)



■ **Connection wire with Robot Universal I/O Connector (CN306, 307, 308, 309)**

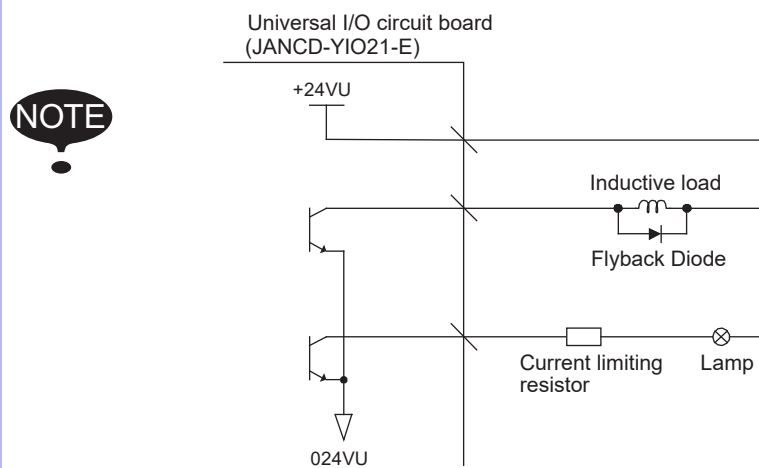
Please refer to the figure below when you manufacture the cable connecting with robot universal I/O connector (CN306, 307, 308, 309) of robot universal I/O circuit board (JANCD-YIO21-E). Unshielded twisted pair cable must be used. (The cable side connector and the I/O terminal block are the options)

Fig. 14-30: Robot Universal I/O Connector (CN306, 307, 308, 309) Connection



When connecting an inductive load to the output circuit, connect a flyback (snubber) diode in parallel to the inductive load to suppress the surge voltage. Not using the flyback (snubber) diode may damage the output circuit.

When connecting the load with a large inrush current such as the lamp, connect the current limiting resistor in series to the load, so that the output current does not exceed its maximum value. Exceeding the maximum output current value may damage the output circuit.



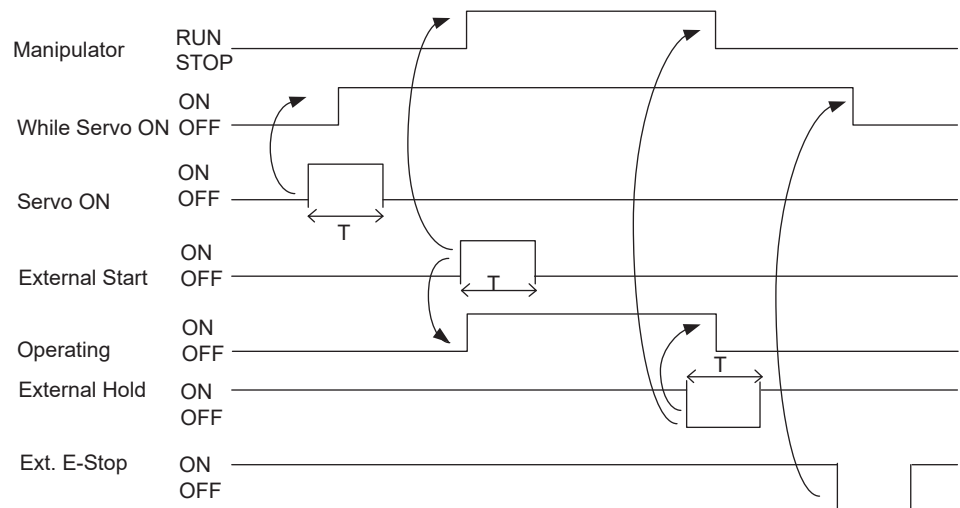
Refer to *chapter 14.13 "Universal I/O Signal Assignment"* about the maximum current of the transistor and the relay output circuits.

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

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

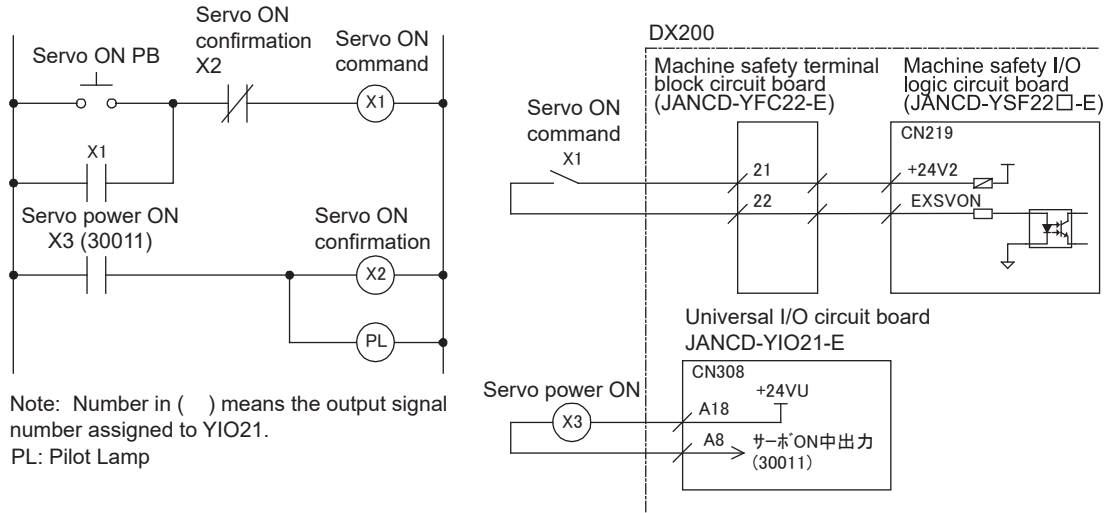
- Servo ON (depending on application: JANCD-YIO21-E)
- External Servo ON (common to all application: JANCD-YFC22-E)
- External Start (depending on application: JANCD-YIO21-E)
- Operating (depending on application: JANCD-YIO21-E)
- External Hold (common to all application: JANCD-YFC22-E)
- External Emergency Stop (common to all application: JANCD-YFC22-E)

<Timing Chart>



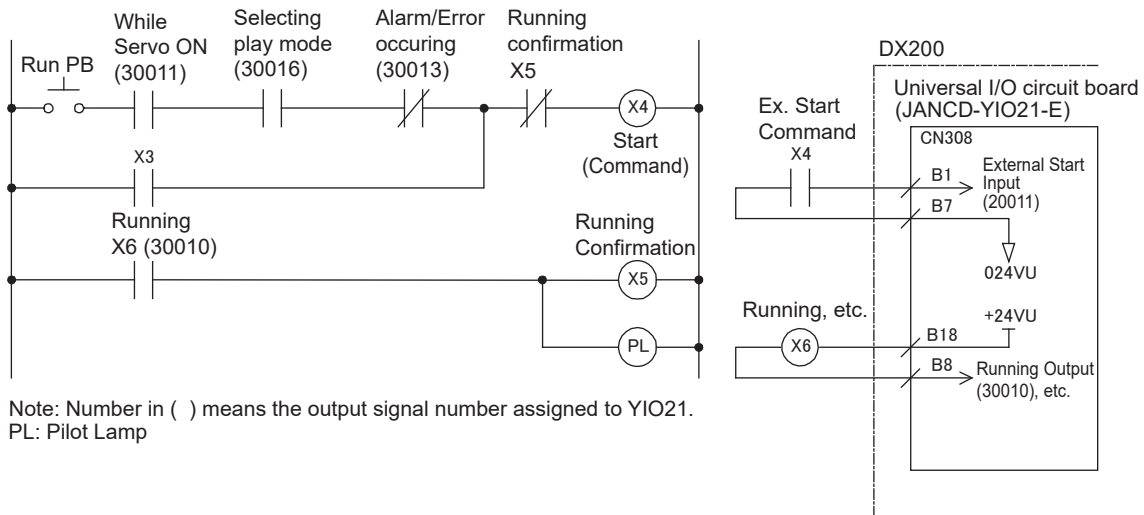
- **Example of Servo ON Sequence Circuit from External Device**
Only the rising edge of the servo ON signal is valid. This signal turns ON the manipulator servo power supply. The set and reset timings are shown in the following.

Fig. 14-31: Example of the Servo ON Sequence Circuit from the External Device



- **Example of Start Sequence Circuit from External Device**
Only the rising edge of the external start signal is valid. This signal starts the manipulator. Reset this signal with the interlock configuration that determines if operation can start and with the playback (RUNNING) signal confirming that the manipulator has actually started moving.

Fig. 14-32: Example of Start Sequence Circuit from the External Device



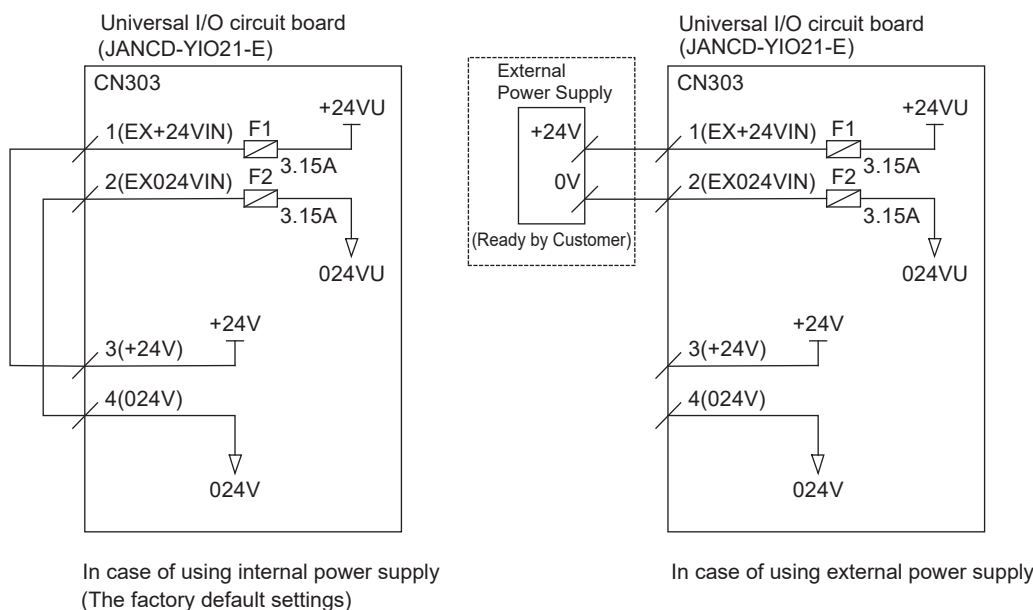
■ Connection of External Power Supply for I/O

At factory setting, the internal power supply for I/O is used. If the external power supply for I/O is used, connect it with following procedure.

1. Remove the wire connected between CN303-1 to -3 and CN303-2 to -4 of the universal I/O circuit board.
2. Connect +24V of the external power supply to CN303-1 and 0V to CN303-2 of the robot I/O unit.

For the connection of the CN303 connector, refer to *chapter 14.12 "WAGO Connector"*.

Fig. 14-33: Connection of External Power Supply for I/O



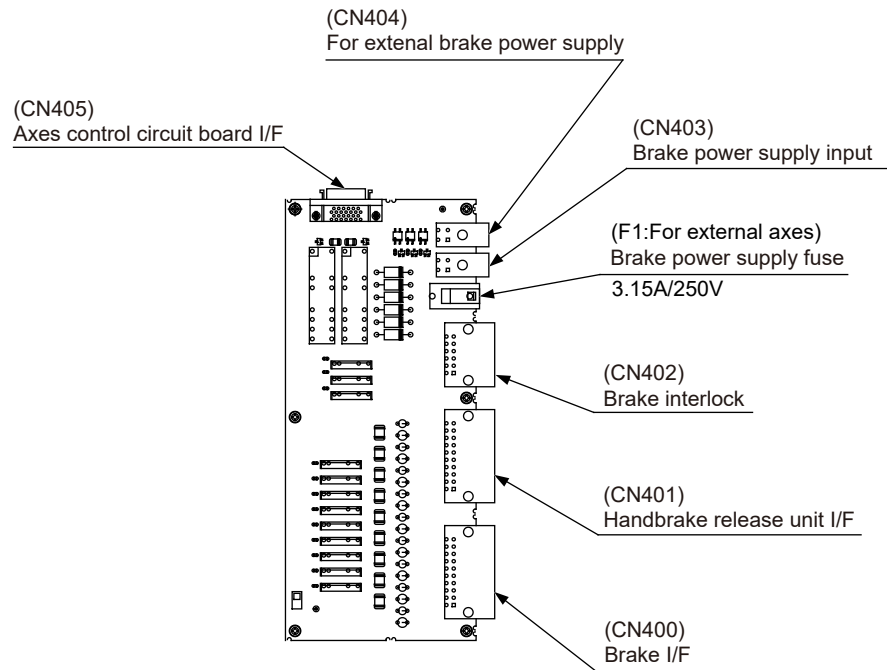
- The internal power supply of 24V of about 1.5A of DX200 can be used for I/O. Use external 24V power supply for higher currents and to isolate the circuit inside and outside the DX200.
- Power supply circuit for I/O (+24 VU, 024 VU) has 3.15A fuses (F1, F2).
- Install the external power supply outside the DX200 to avoid electric noise problems.
- If the internal power supply is selected and the external power supply is connected to CN303-1 to -3 and CN303-2 to -4, do not connect the line of the external power supply to the +24VU and 0VU terminals. The unit may malfunction if the external power supply is also connected.

14.8 break Control Circuit Board (JANCD-YBK21-3E)

14.8.1 break Control Circuit Board (JANCD-YBK21-3E)

The break control circuit board controls ON/OFF of the breaks of total nine axes (Robot + external axes) according to the command signal from the major axes control circuit board (SRDA-EAXA21A).

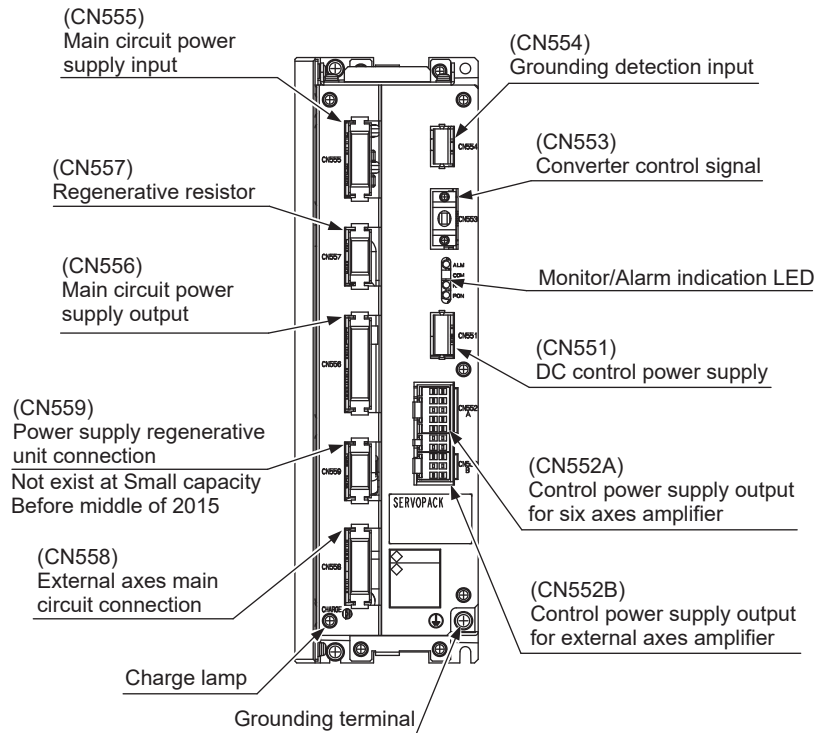
Fig. 14-34: break Control Circuit Board (JANCD-YBK21-3E)



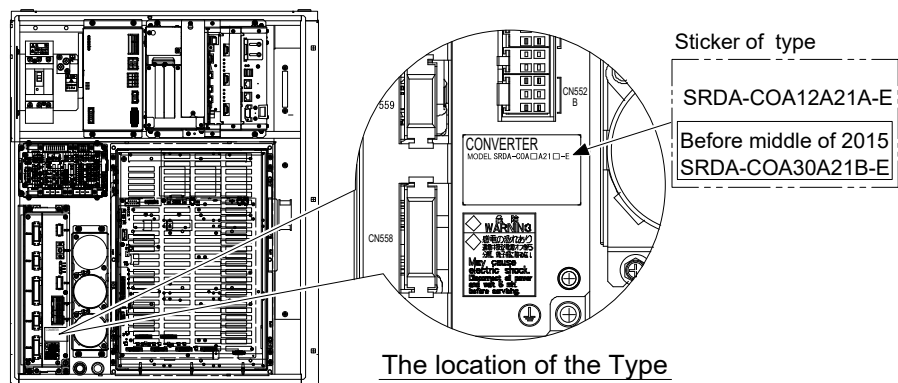
14.9 Converter (SRDA-COA □ A21 □ -E)

The converter (SRDA-COA □ A21 □ -E) exchanges the power supply (3-phase: AC200/220V) supplied by the power ON unit for DC power supply and supplies the power to the amplifier module (PWM amplifiers).

Fig. 14-35: Converter (SRDA-COA □ A21 □ -E)



The Type of the converter is different before middle of 2015. Please check it by a Type sticker of the following figure.



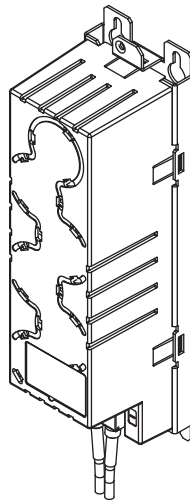
14.10 Capacitor Module (SRDA-CUA □ AA)

The capacitor module smooth the DC voltage (PN voltage) created in the converter and also save the electric energy.

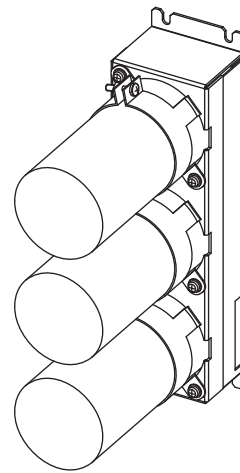
There are two type of the capacitors shown below.

- Small capacity: SRDA-CUA492AA
SRDA-CUA662AA(Before middle of 2015)
- Medium / Large capacity: SRDA-CUA133AA

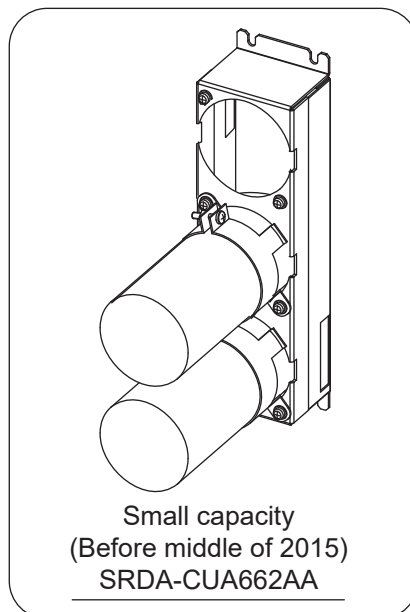
Fig. 14-36: Capacitor Module (SRDA-CUA □ AA)



Small capacity
SRDA-CUA492AA



Large capacity
SRDA-CUA133AA



Small capacity
(Before middle of 2015)
SRDA-CUA662AA

14.11 Amplifier Module (SRDA-SDA □ A01A-E)

The amplifier module exchanges the DC power supply supplied by a converter for a 3-phase motor power source and outputs to each servo motor.

Fig. 14-37(a): Amplifier Module

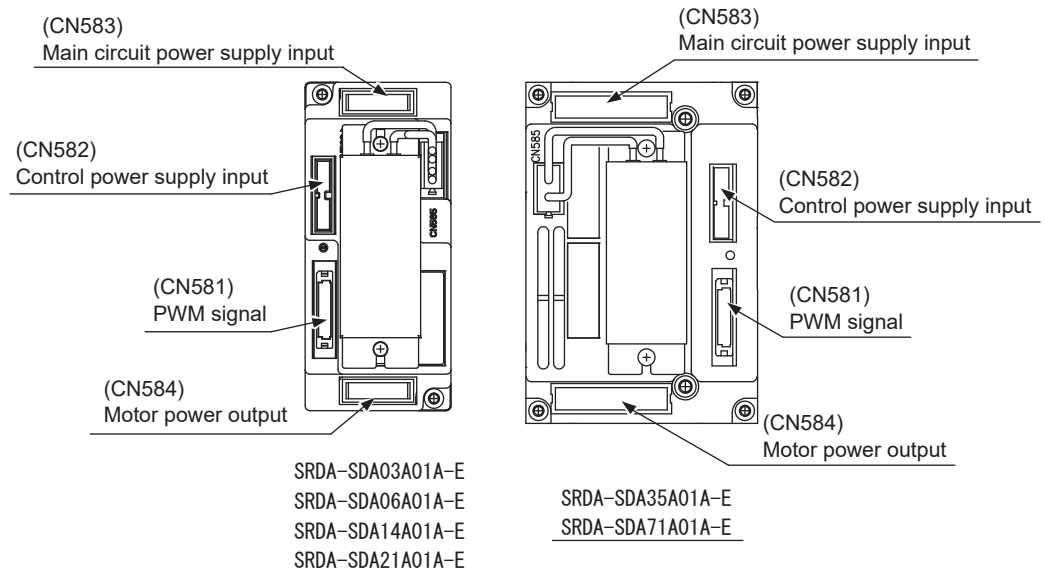
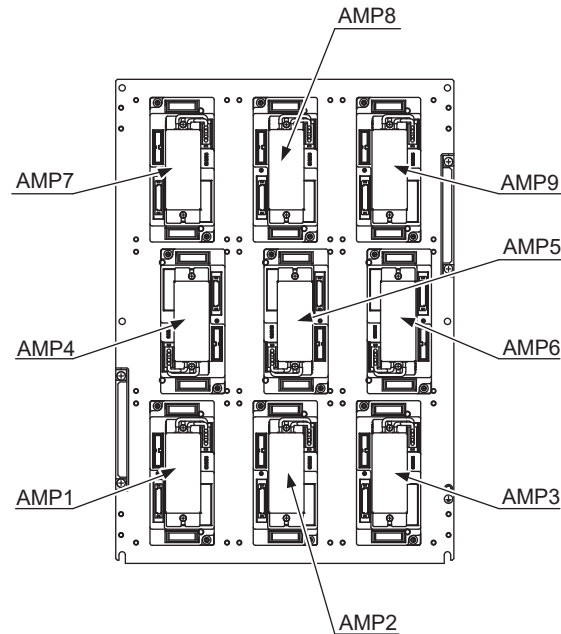


Fig. 14-37(b): Amplifier Module Arrangement Example



14.12 WAGO Connector

The control power supply unit: CN152 on (JZNC-YPS21-E), and CN303 on the universal I/O circuit board (JANCD-YIO21-E) are equipped with a connector made by WAGO.

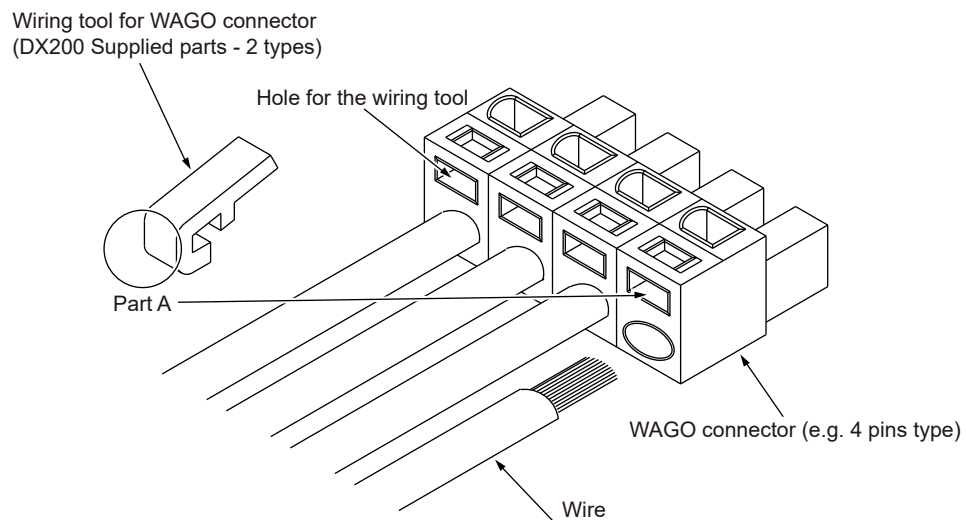
The “wiring tool for the WAGO connector” is necessary to wire the WAGO connector.

The tools (total 3, 2 types) are supplied with the DX200.

Use them with the appropriate sizes of connectors.

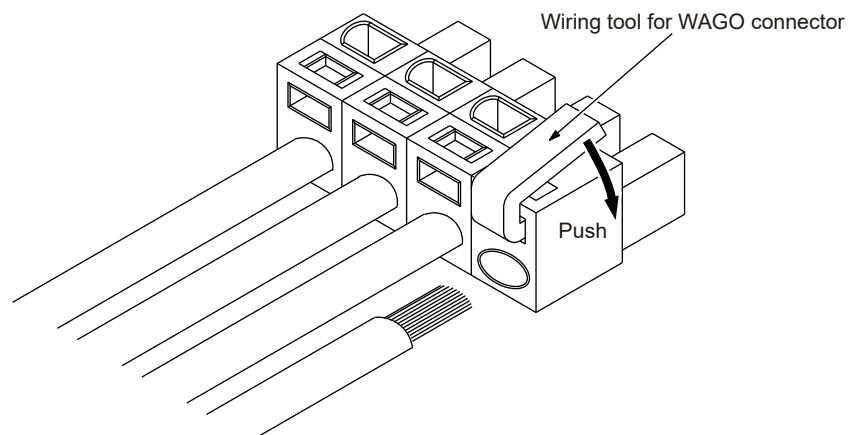
The wiring procedure is described as follows:

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



Connector to be applied	Specification
Control power supply unit: (JANC-YPS21-E) CN152	Max cable outside diameter: 4.1mm dia. Stripped length: 8-9mm
Universal I/O unit: (JANCD-YIO21-E) CN303	Max cable outside diameter: 3.4mm dia. Stripped length: 7mm

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



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

14.13 Universal I/O Signal Assignment

14.13.1 Arc Welding

Fig. 14-38: JANCD-YIO21-E (CN308 (8TX) Connector) I/O Allocation and Connection Diagram (For Arc Welding)

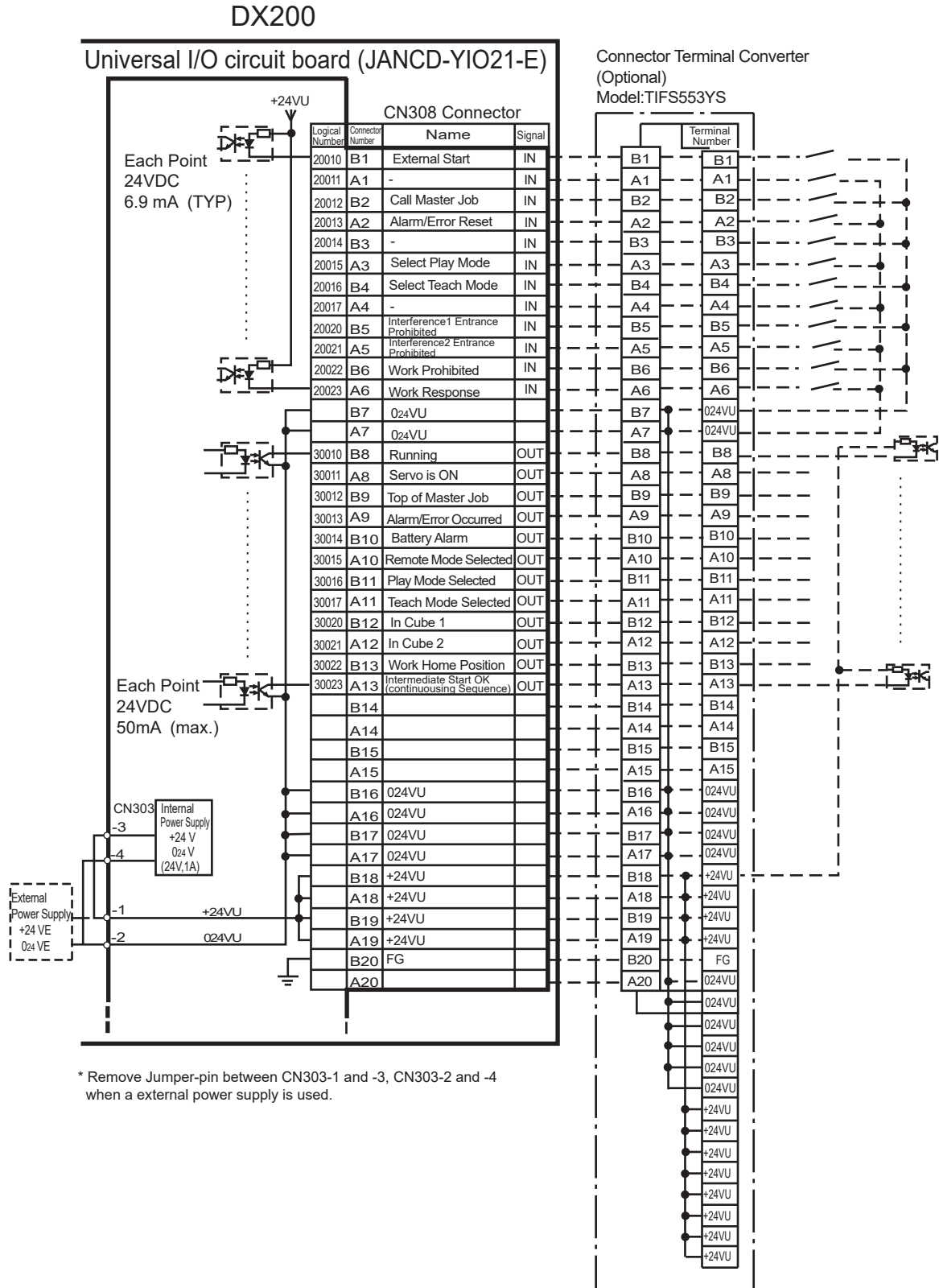
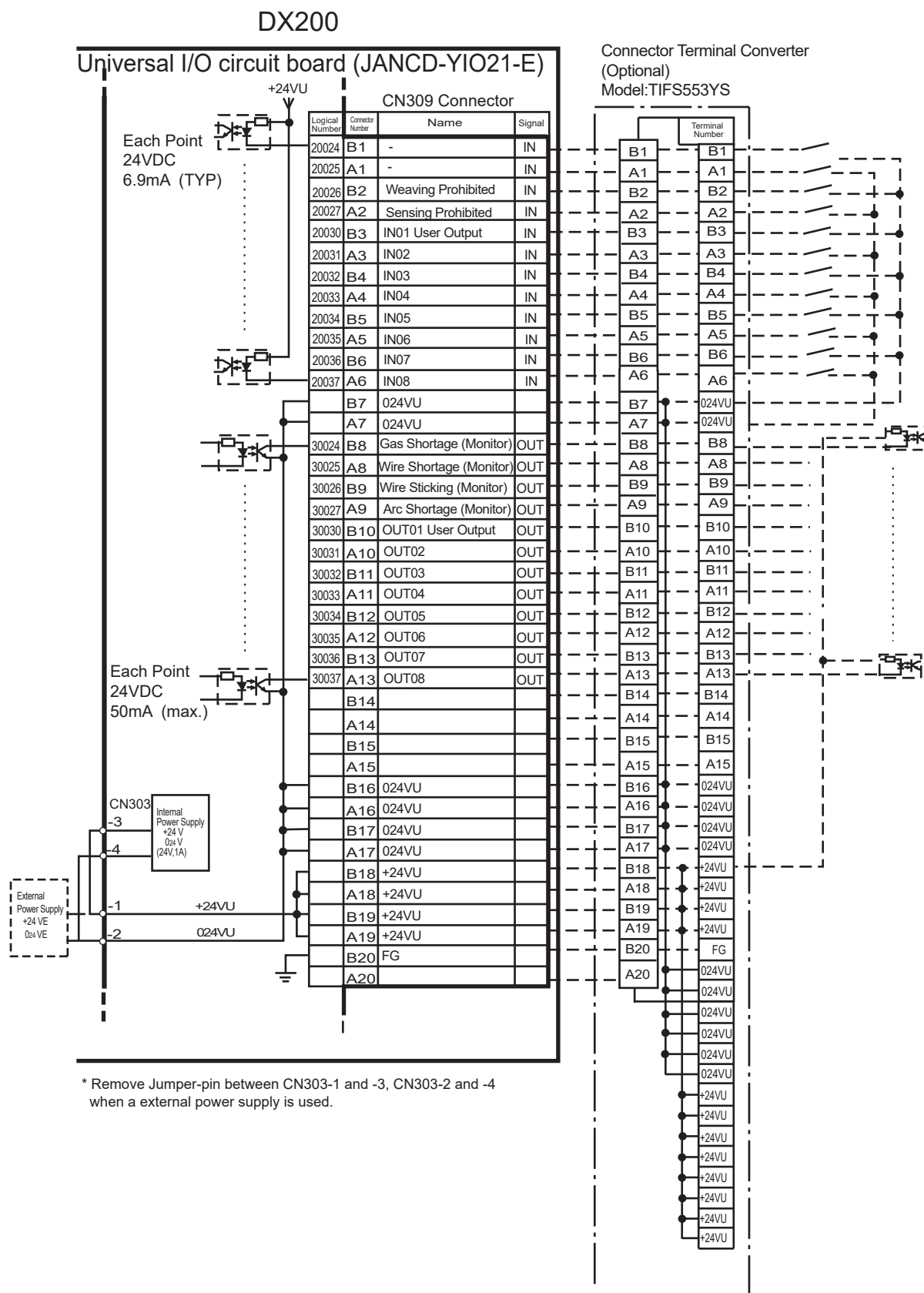
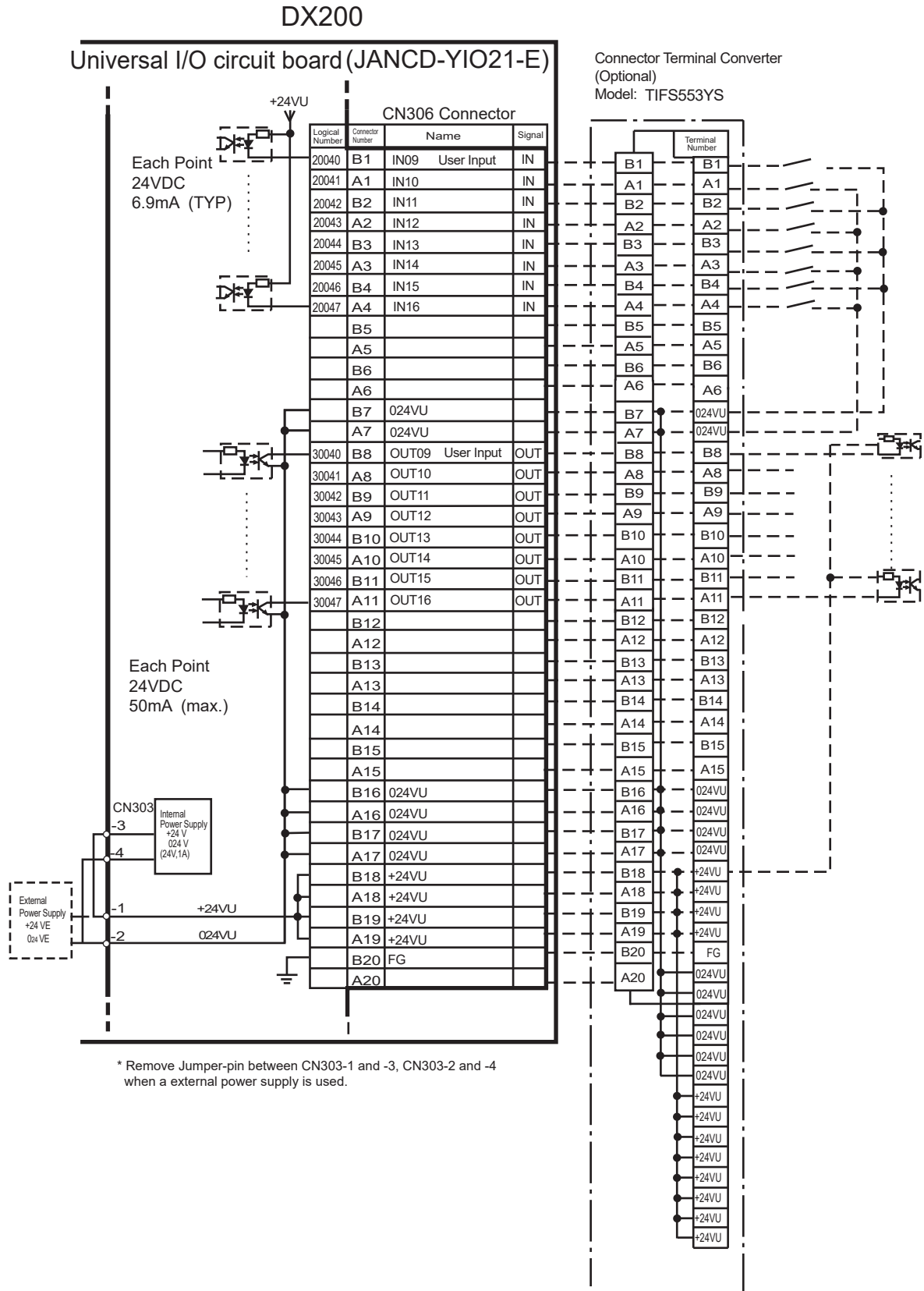


Fig. 14-39: JANCD-YIO21-E (CN309 (9TX) Connector) I/O Allocation and Connection Diagram (For Arc Welding)



14 Description of Units and Circuit Boards
 14.13 Universal I/O Signal Assignment

Fig. 14-40: JANCD-YIO21-E (CN306 (6TX) Connector) I/O Allocation and Connection Diagram (For Arc Welding)



14 Description of Units and Circuit Boards
14.13 Universal I/O Signal Assignment

Fig. 14-41: JANCD-YIO21-E (CN307 (7TX) Connector) I/O Allocation and Connection Diagram (For Arc Welding)

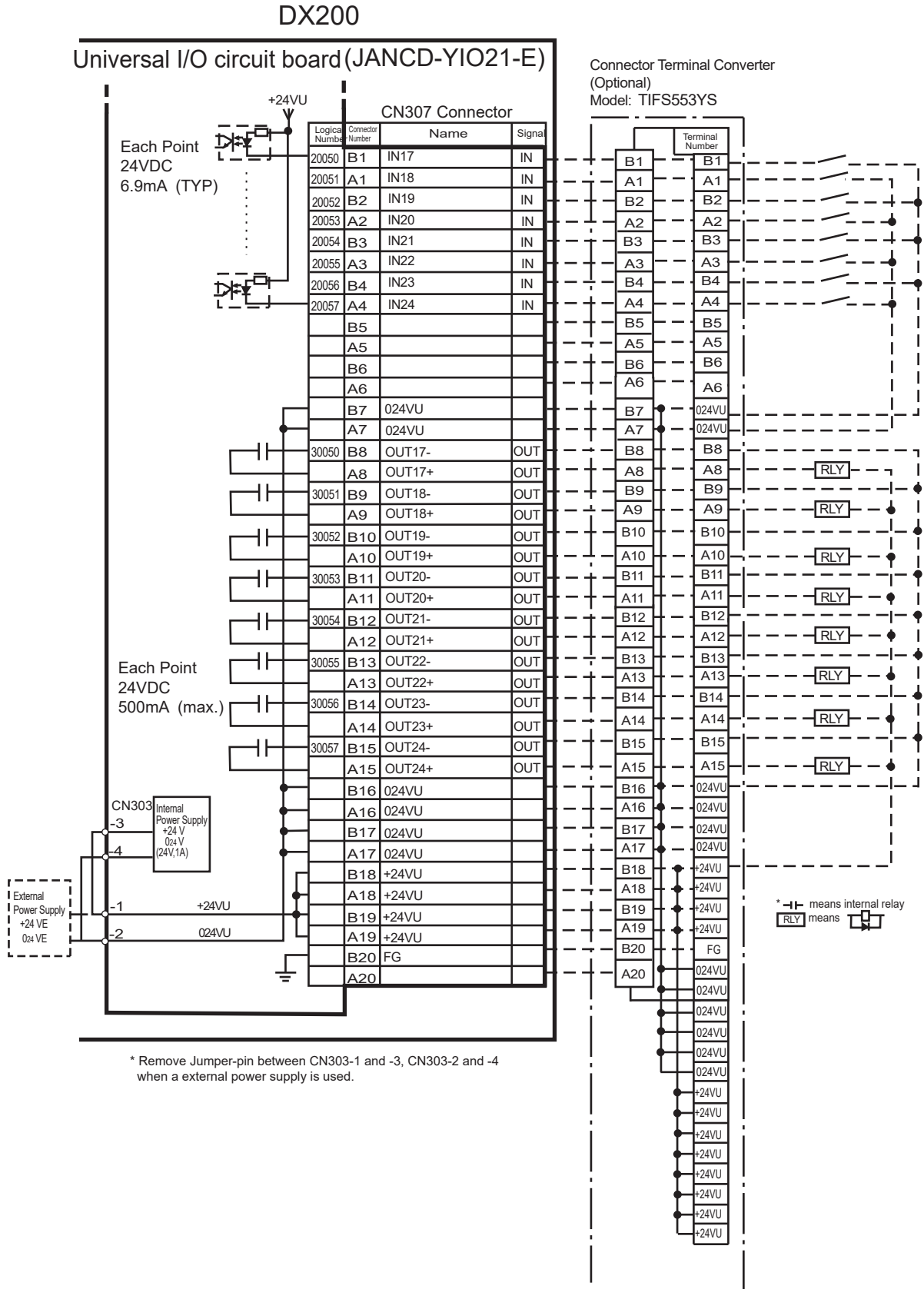


Table 14-2: Specific Input (Arc Welding)

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

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

2 See chapter 8.6 "Interference Area".

14 Description of Units and Circuit Boards
14.13 Universal I/O Signal Assignment

Table 14-3: Specific Output (Arc Welding)

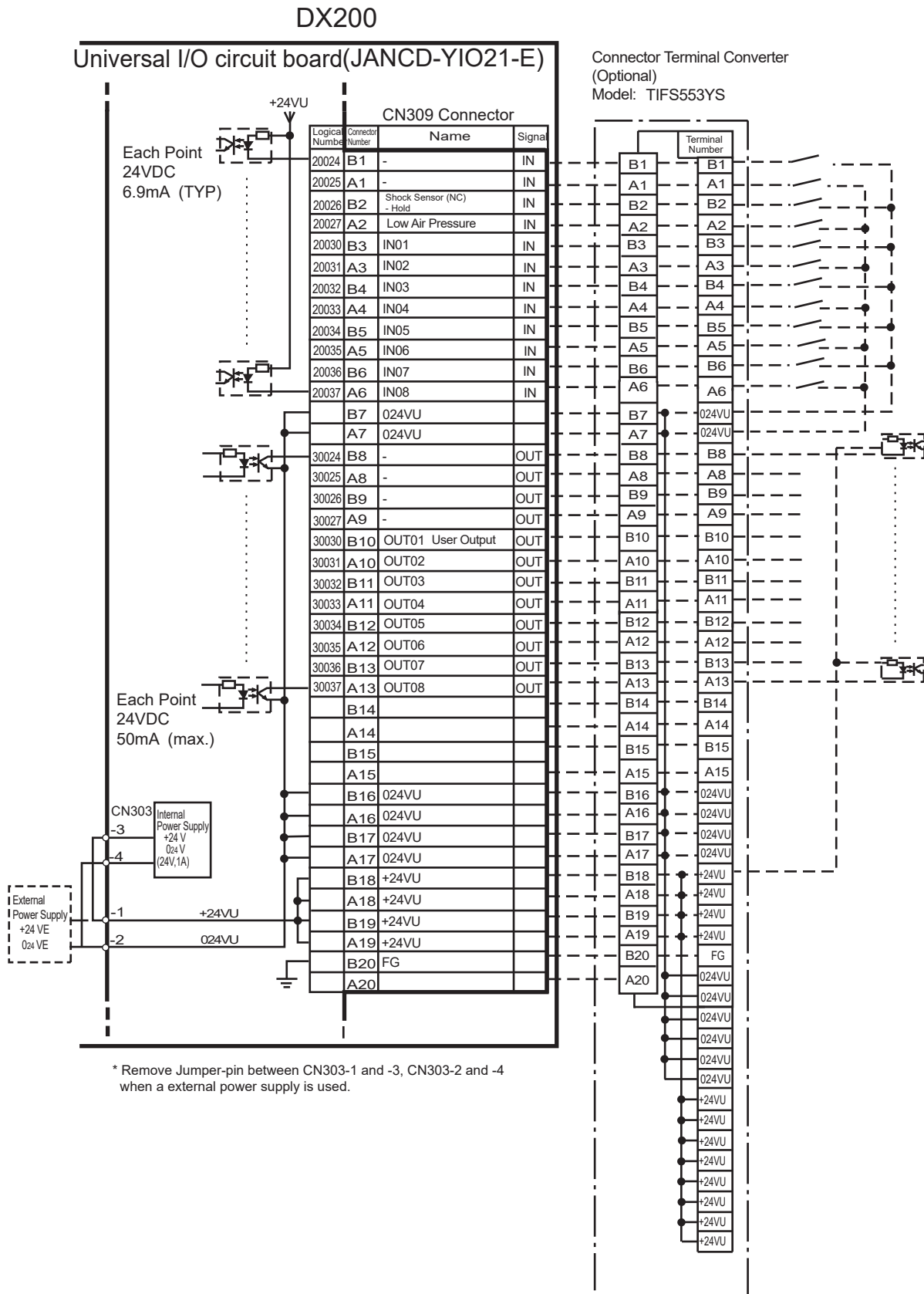
Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX200 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called. ¹⁾
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 64)²⁾ This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.
30023	INTERMEDIATE START OK This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.
30024	GAS SHORTAGE (MONITOR) This signal stays ON while the gas shortage signal from the welding power supply is ON.
30025	WIRE SHORTAGE (MONITOR) This signal status ON while the wire shortage signal from the welding power supply is ON.
30026	WIRE STICKING (MONITOR) The wire sticking check is conducted automatically when the arc turns OFF. If wire sticking is detected, this signal remains ON until the wire sticking is released.
30027	ARC SHORTAGE (MONITOR) This signal stays ON while the arc shortage signal from the welding power supply is ON.

1 This signal is not output during operation.

2 The work home position cube and Cube 64 are the same.

14 Description of Units and Circuit Boards 14.13 Universal I/O Signal Assignment

Fig. 14-43: JANCD-YIO21-E (CN309 (9TX) Connector) I/O Allocation and Connection Diagram (For Handling)



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 14.13 Universal I/O Signal Assignment

Fig. 14-44: JANCD-YIO21-E (CN306 (6TX) Connector) I/O Allocation and Connection Diagram (For Handling)

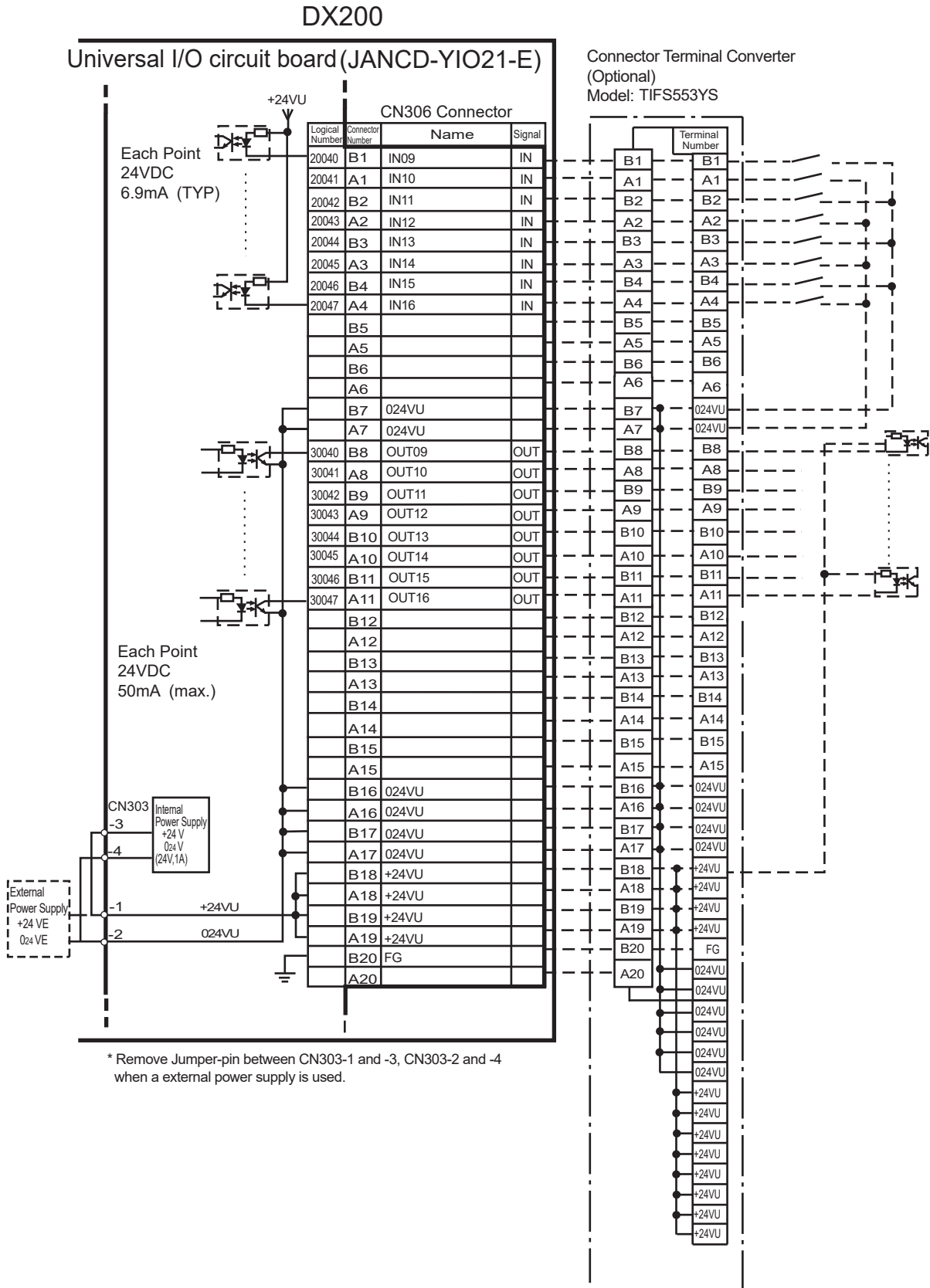


Fig. 14-45: JANCD-YIO21-E (CN307 (7TX) Connector) I/O Allocation and Connection Diagram (For Handling)

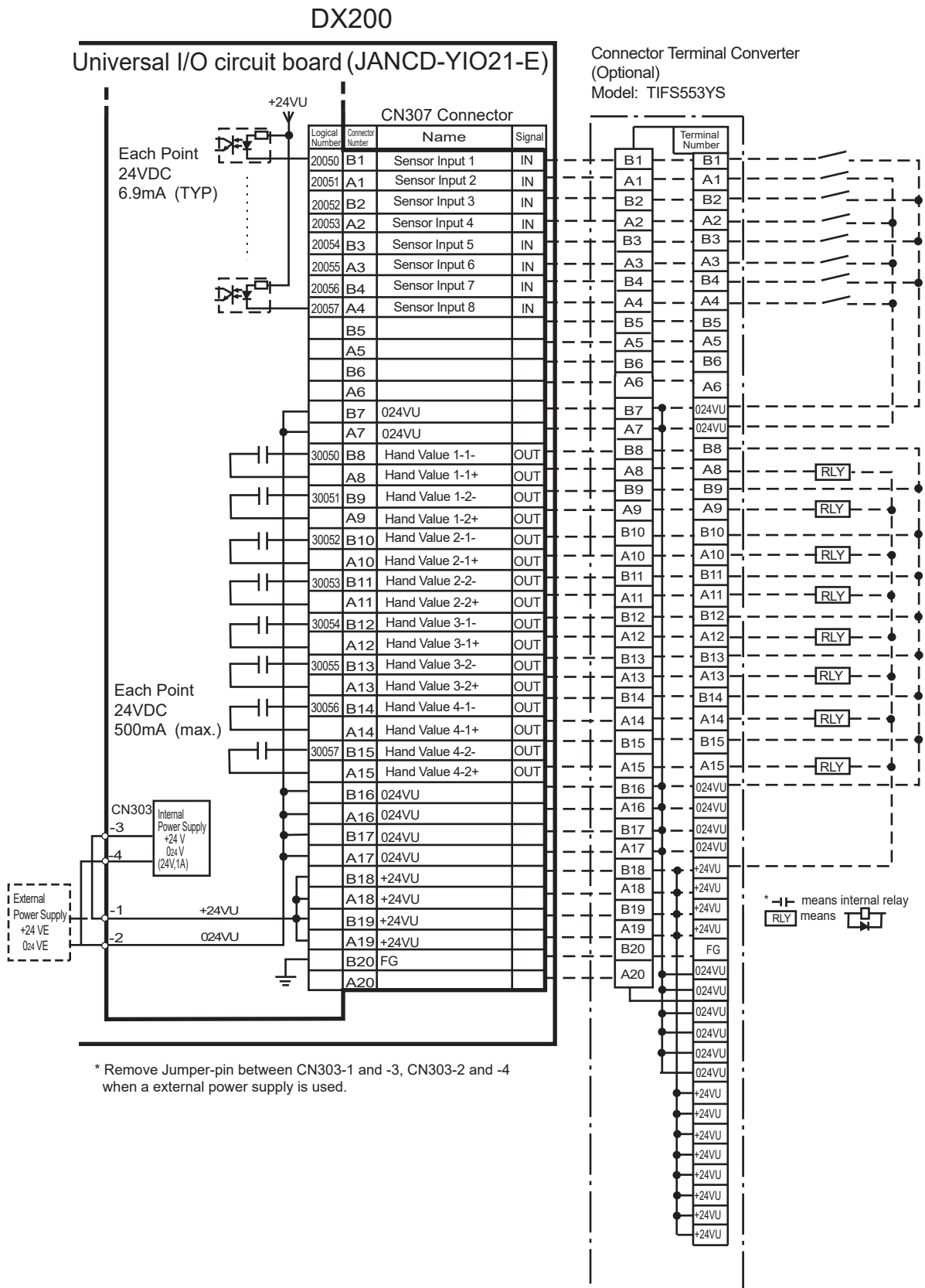


Table 14-4: Specific Input (Handling)

Logical Number	Input Name / Function
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job ¹⁾ . This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at "REMOTE". Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at "REMOTE". The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
20020	INTERFERENCE 1 ENTRANCE PROHIBITED If the manipulator attempts to enter the cube 1 ²⁾ area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.
20021	INTERFERENCE 2 ENTRANCE PROHIBITED If the manipulator attempts to enter the cube 2 ²⁾ area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.
20026	TOOL SHOCK SENSOR This is normally ON (NC) signal input. When it turns OFF, an DX200 displays a message "HAND TOOL SHOCK SENSOR OPERATING" and a HOLD is applied. The releasing in teach mode is done on the handling application diagnostic display. Set tool shock sensor function "NOT USE" on the handling applications diagnostic display if this signal is not be used.
20027	LOW AIR PRESSURE This signal is normally OFF (NO). When it turns ON, DX200 displays user alarm in the PLAY mode or displays user message in the teach mode.
20050 to 20057	SENSOR INPUT 1 - 8 Inputs 1 to 8 are monitored with the HSEN handling specific instructions. Sensor inputs 1 to 8 correspond to HSEN 1 to 8.

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

2 See chapter 8.6 "Interference Area".

Table 14-5: Specific Output (Handling)

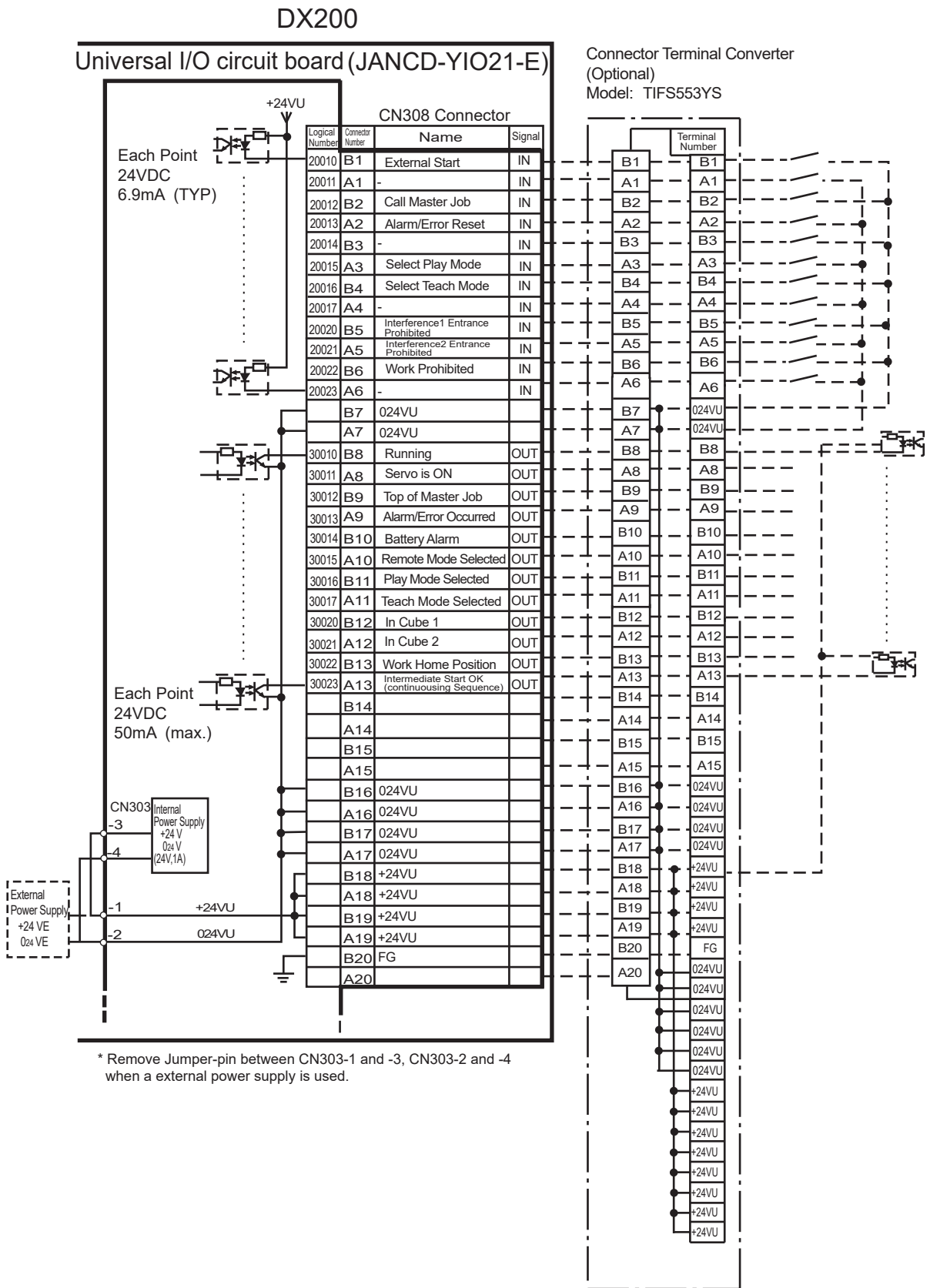
Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX200 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called. ¹⁾
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 64)²⁾ This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.
30023	INTERMEDIATE START OK This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.
30050 to 30057	HAND VALVE 1-4 These outputs are controlled by the HAND handling specific instructions. Hand valves 1 to 4 correspond to HAND 1 to 4.

1 This signal is not output during operation.

2 The work home position cube and Cube 64 are the same.

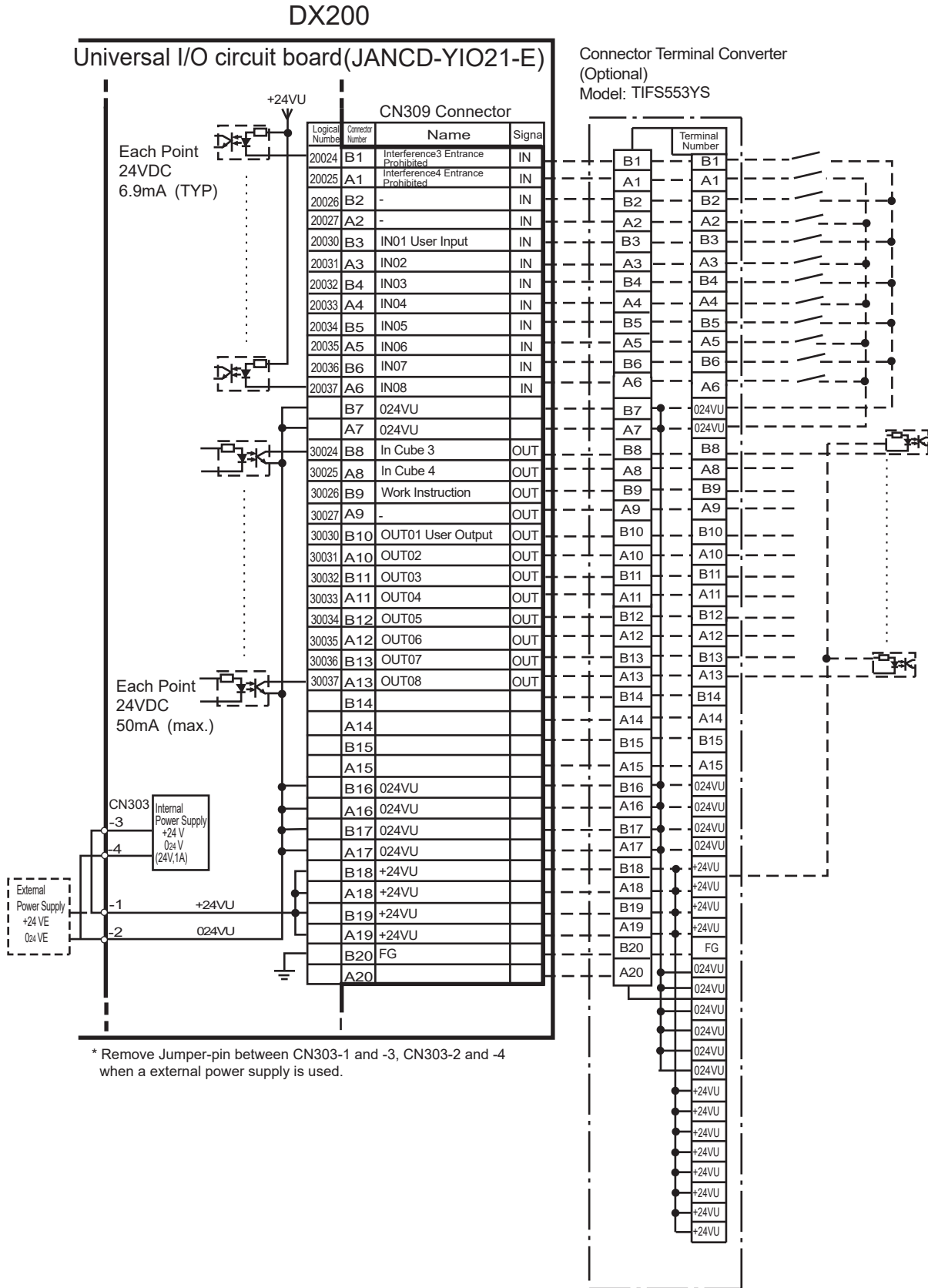
14.13.3 General Application

Fig. 14-46: JANCD-YIO21-E (CN308 (8TX) Connector) I/O Allocation and Connection Diagram (For General Application)



14 Description of Units and Circuit Boards
14.13 Universal I/O Signal Assignment

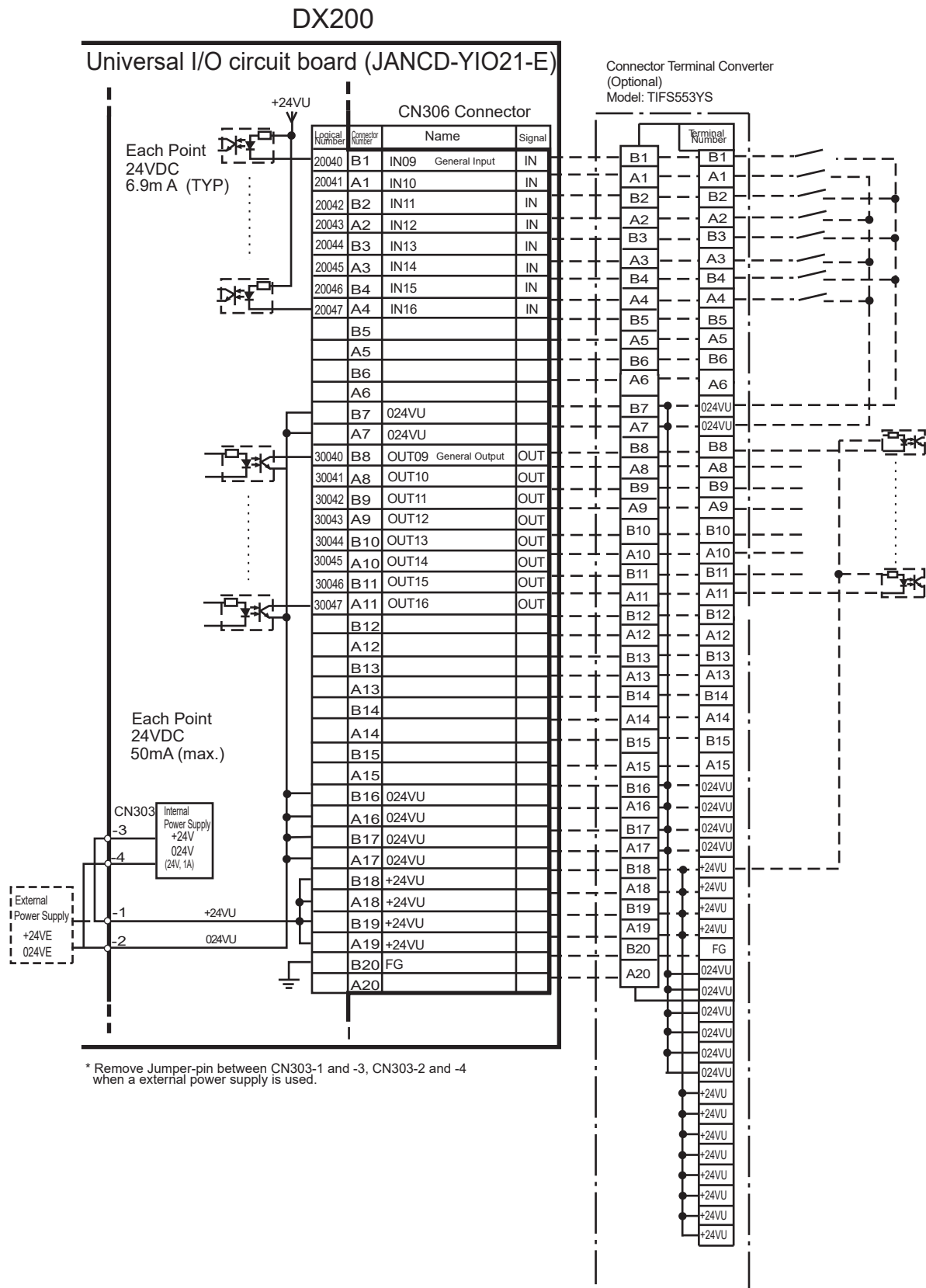
Fig. 14-47: JANCD-YIO21-E (CN309 (9TX) Connector) I/O Allocation and Connection Diagram (For General Application)



14 Description of Units and Circuit Boards

14.13 Universal I/O Signal Assignment

Fig. 14-48: JANCD-YIO21-E (CN306 (6TX) Connector) I/O Allocation and Connection Diagram (General Application)



14 Description of Units and Circuit Boards
14.13 Universal I/O Signal Assignment

Fig. 14-49: JANCD-YIO21-E (CN307 (7TX) Connector) I/O Allocation and Connection Diagram (For General Application)

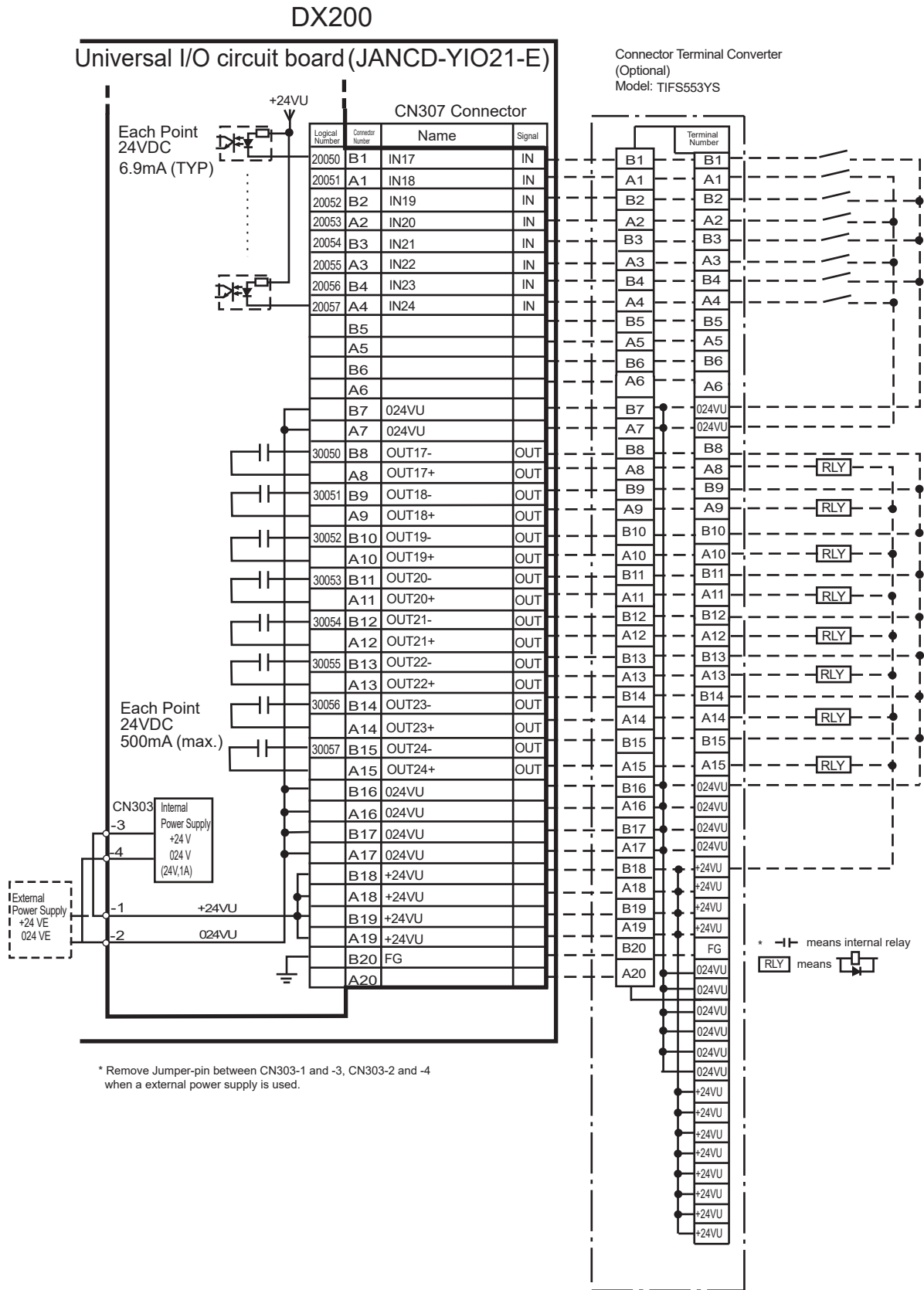


Table 14-6: Specific Input (General Application)

Logical Number	Input Name / Function
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job ¹⁾ . This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at "REMOTE". Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at "REMOTE". The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
20020	INTERFERENCE 1 ENTRANCE PROHIBITED If the manipulator attempts to enter the cube 1 ²⁾ area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.
20021	INTERFERENCE 2 ENTRANCE PROHIBITED If the manipulator attempts to enter the cube 2 ²⁾ area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.
20022	WORK PROHIBITED (Tool ON Prohibited) Even if TOOLON instruction is executed, DX200 doesn't output to external while this signal is ON.
20024	INTERFERENCE 3 ENTRANCE PROHIBITED If the manipulator attempts to enter the cube 3 ²⁾ area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.
20025	INTERFERENCE 4 ENTRANCE PROHIBITED If the manipulator attempts to enter the cube 4 ²⁾ area while this signal is ON, the manipulator goes to wait status (with servo power ON). During wait status, the manipulator operation restarts if this signal turns OFF.

1 A master job is a job (program) which can be called by CALL MASTER JOB.

Other functions are the same as for normal jobs. Normally, the parent job, which manages the child jobs called up immediately after the power is turned ON, is set as the master job.

2 See chapter 8.6 "Interference Area".

Table 14-7: Specific Output (General Application)

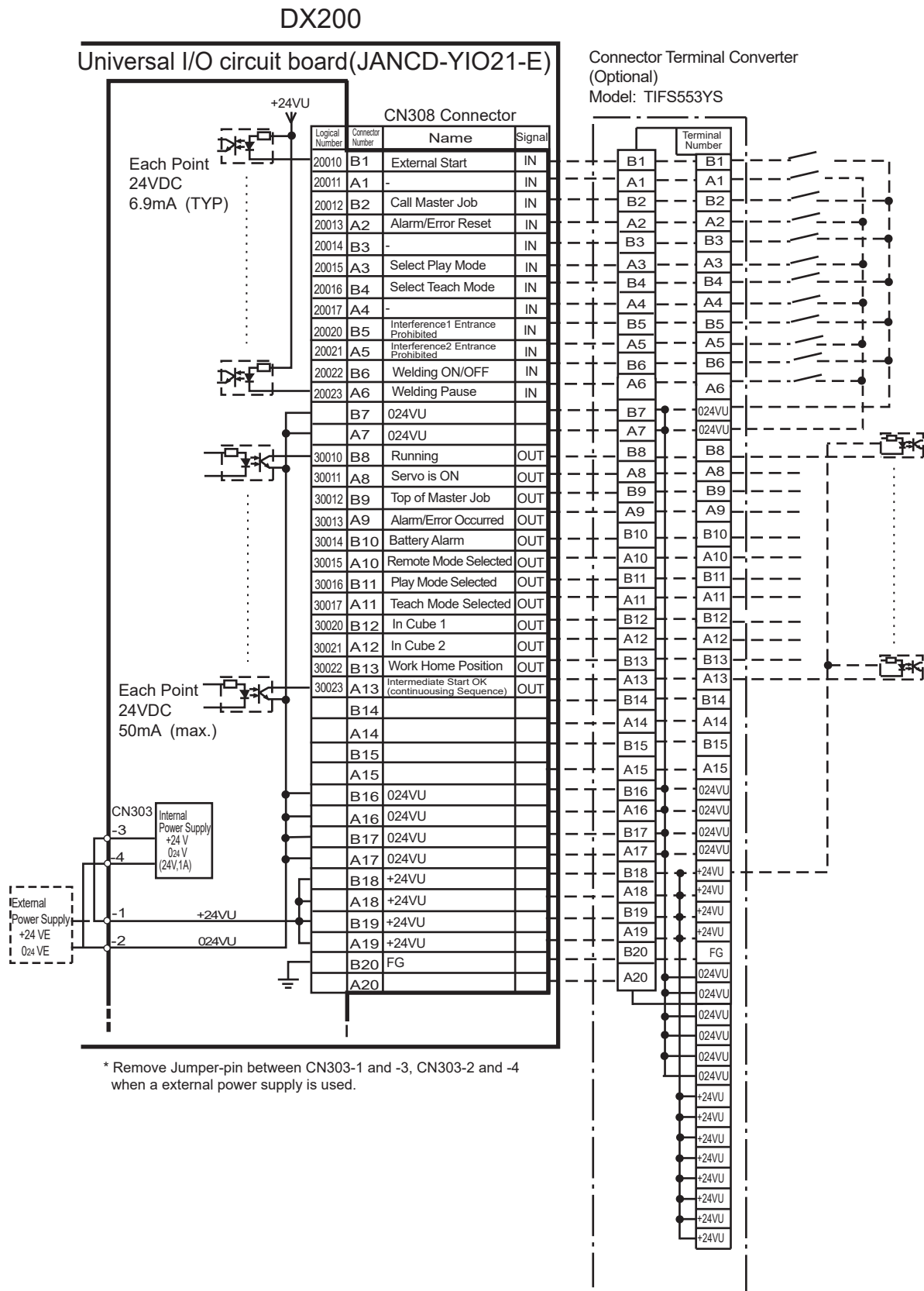
Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX200 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called. ^{1)*1}
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 64)²⁾ This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the robot is in the start position.
30023	INTERMEDIATE START OK This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.
30024	IN CUBE 3 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other manipulators and positioners.
30025	IN CUBE 4 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other manipulators and positioners.
30026	WORK COMMAND This signal provides the command for the general tool to operate. TOOL ON instruction execution or the [TOOL ON] key in the programming pendant turns this signal ON and TOOL OFF instruction execution or the [TOOL OFF] key in the programming pendant turns it OFF. However, it remains OFF while the WORK PROHIBITED signal (2022) is input or while the robot is stopped.

1 This signal is not output during operation.

2 The work home position cube and Cube 64 are the same.

14.13.4 Spot Welding

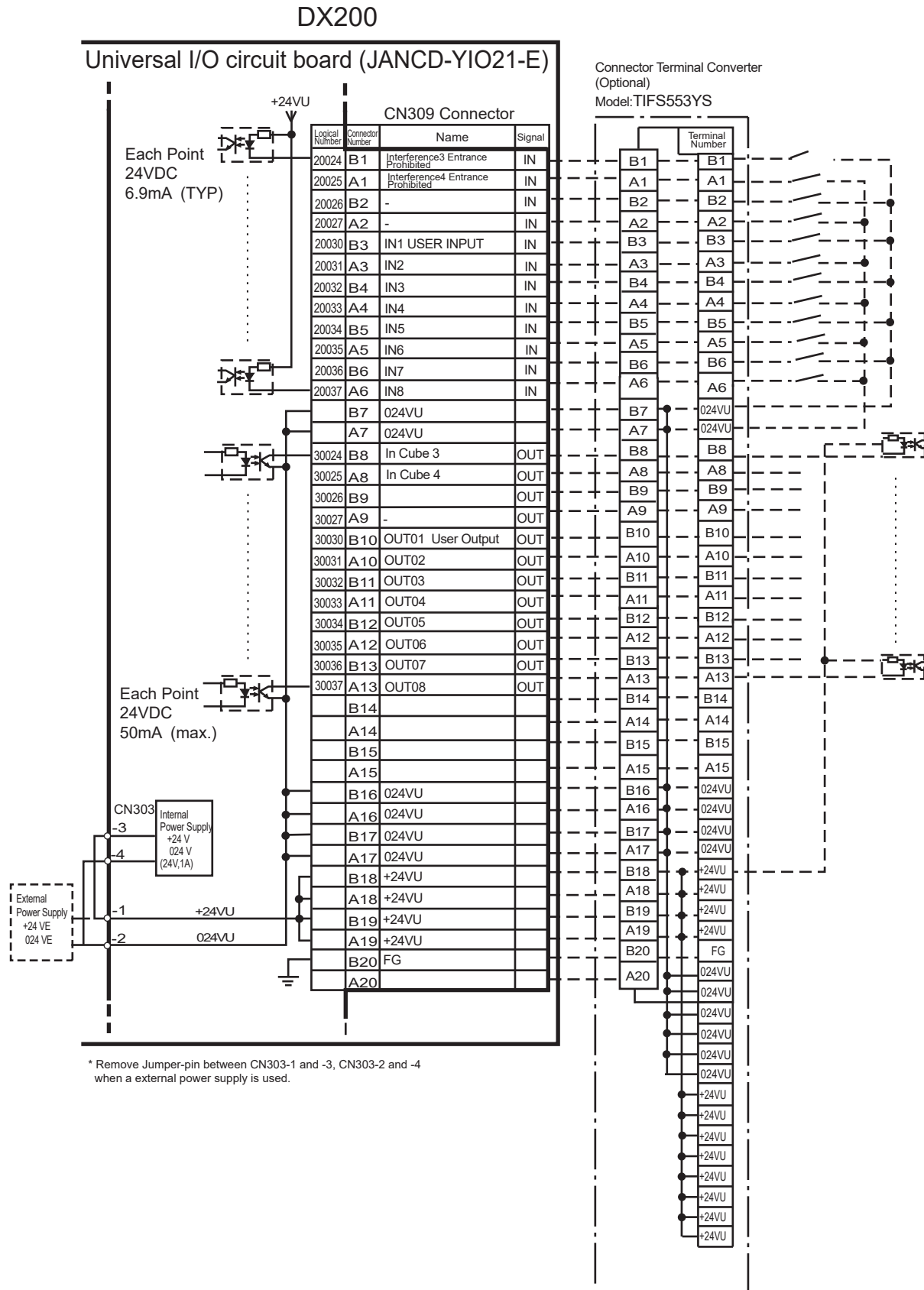
Fig. 14-50: JANCD-YIO21-E (CN308 (8TX) Connector) I/O Allocation and Connection Diagram (For Spot Welding)



14 Description of Units and Circuit Boards

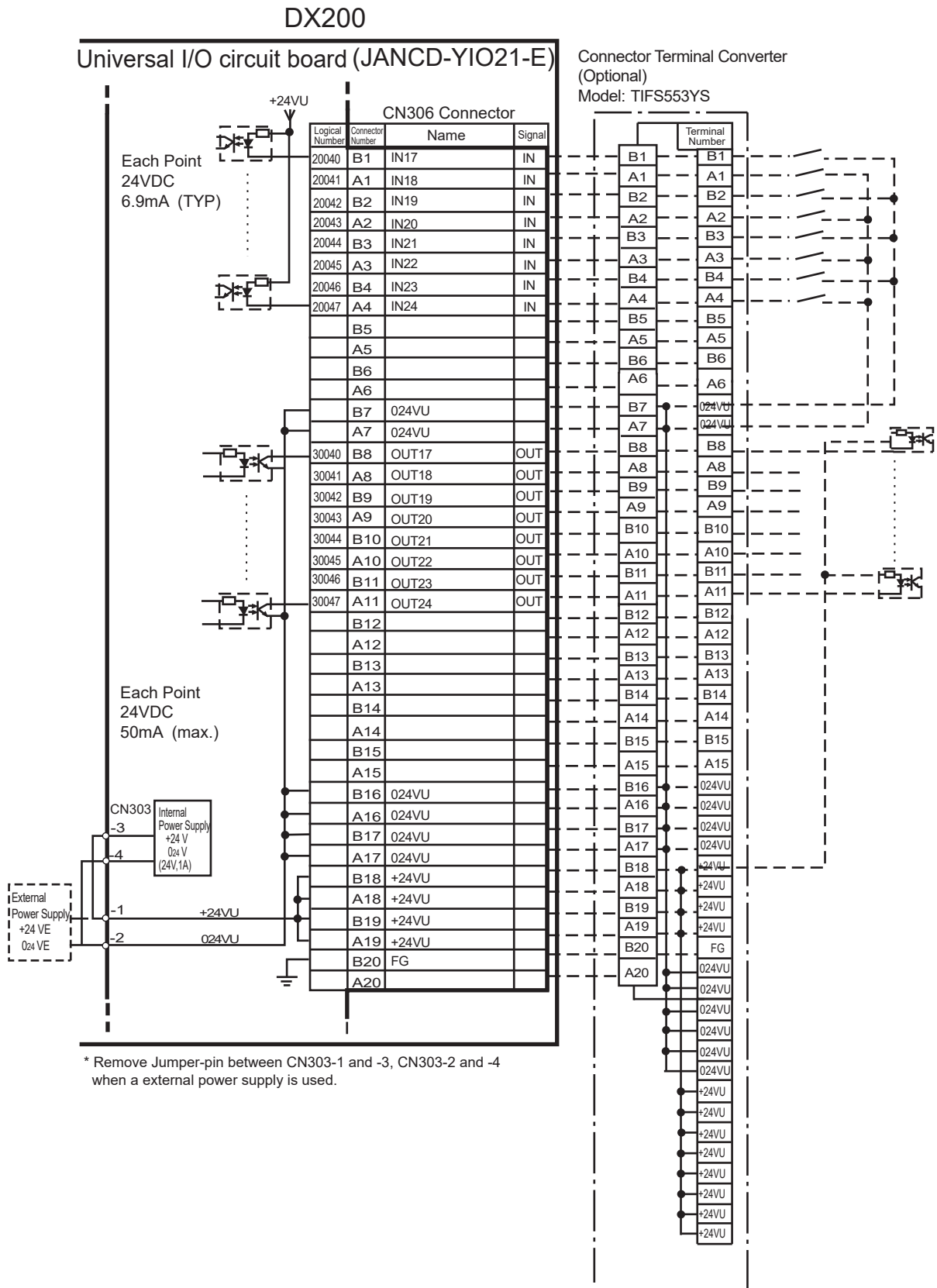
14.13 Universal I/O Signal Assignment

Fig. 14-51: JANCD-YIO21-E (CN309 (9TX) Connector) I/O Allocation and Connection Diagram (For Spot Welding)



14 Description of Units and Circuit Boards
 14.13 Universal I/O Signal Assignment

Fig. 14-52: JANCD-YIO21-E (CN306 (6TX) Connector) I/O Allocation and Connection Diagram (For Spot Welding)



14 Description of Units and Circuit Boards

14.13 Universal I/O Signal Assignment

Fig. 14-53: JANCD-YIO21-E (CN307 (7TX) Connector) I/O Allocation and Connection Diagram (For Spot Welding)

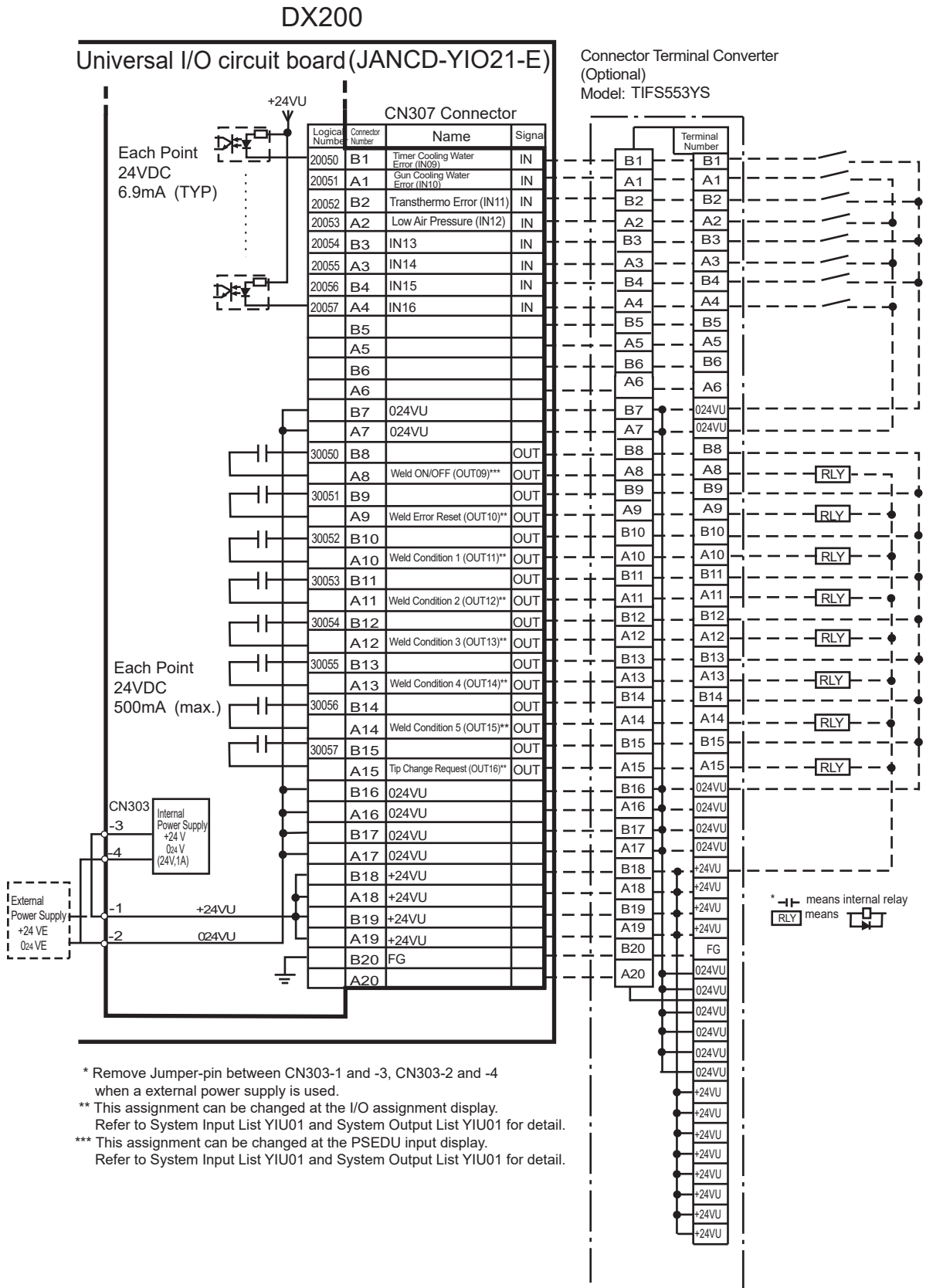


Table 14-8: Specific Input (Spot Welding) (Sheet 1 of 2)

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

Table 14-8: Specific Input (Spot Welding) (Sheet 2 of 2)

Logical Number	Input Name / Function
20052 3)	TRANSTHERMO ERROR Error signal is sent from the transformer in the gun to the robot. This signal is ON normally (NC) and an alarm occurs when the signal is OFF. The servo power supply remains ON.
20053 3)	LOW AIR PRESSURE When air pressure is reduced and this input is turned ON, an alarm occurs. The servo power supply remains ON.
4)	WELD COMPLETION This signal indicates that the Power Source completed welding without error. This signal is used as a confirmation signal for welding instruction execution and manual spot welding. After this signal is input, the welding sequence is completed and the next step is executed when confirmation limit switch is not provided.
4)	WELDING ERROR This signal indicates an abnormal welding result or Power Source's error. Alarm occurs and the manipulator stops if this signal is input during welding.
4)	STICK DETECTION This signal indicates an abnormal welding result or Power Source's error. Alarm occurs and the manipulator stops if this signal is input during welding.
4)	GUN FULL OPEN DETECTION This signal indicates that the stroke of the double stroke gun is full open.
4)	GUN SHORT OPEN DETECTION This signal is connected with a single gun open verification limit switch or a double stroke gun short open verification limit switch to verify the gun open.
4)	GUN PRESSURE DETECTION This signal indicates that a gun is in pressing status.
4)	TIP REPLACE COMPLETION When this signal is input after tip replacement, the TIP REPLACE REQUEST signal turns OFF, and the stored number of welding is cleared.

- 1 A master job is a job (program) which can be called by CALL MASTER JOB. Other functions are the same as for normal jobs. Normally, the parent job, which manages the child jobs called up immediately after the power is turned ON, is set as the master job.
- 2 See chapter 8.6 "Interference Area".
- 3 This signal can be set as "USE" or "NOT USE" by pseudo input signal "8702x". If "NOT USE" is selected, this signal can be used as the universal I/O signal described in parentheses.
- 4 This signal can be allocated to any universal I/O signal at the I/O allocation display in operation condition.

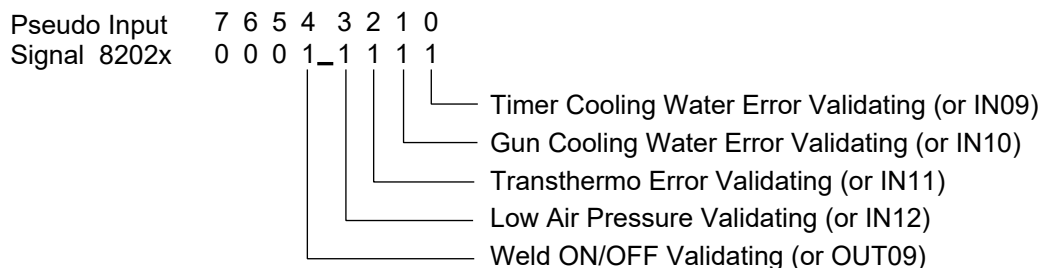


Table 14-9: Specific Output (Spot Welding) (Sheet 1 of 2)

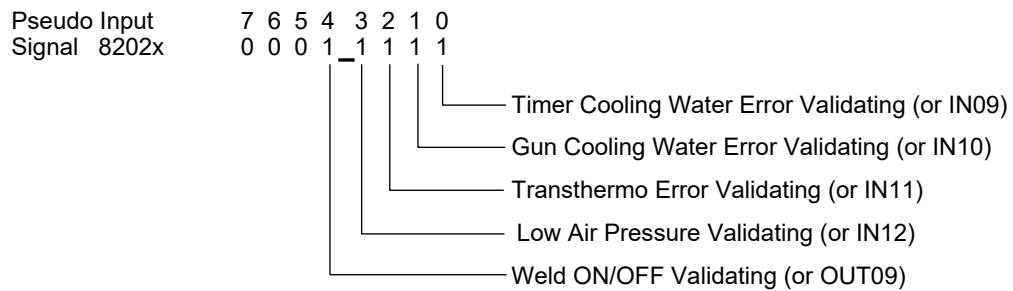
Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for DX200 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called. ¹⁾
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 64)²⁾ This signal turns ON when the current TCP lies inside a the work home position area. Use this signal to evaluate whether the robot is in the start position.
30057	TIP REPLACE REQUEST This signal is output when the stored number of welding reaches the number of welding set for the tip replacement.
30023	INTERMEDIATE START OK This signal turns ON when the manipulator operates. It turns OFF when the currently executed line is moved with the cursor or when editing operation is carried out after HOLD is applied during operation. Therefore, this signal can be used as a restart interlock after a HOLD is applied. However, it also turns ON in the teach mode and TEACH MODE SELECTED signal must be referred together.
30024	IN CUBE 3 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 3). Use this signal to prevent interference with other manipulators and positioners.
30025	IN CUBE 4 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 4). Use this signal to prevent interference with other manipulators and positioners.
30050 ³⁾	WELD ON/OFF Outputs a signal input from the interlock panel, etc. considering the robot status.

14 Description of Units and Circuit Boards
14.13 Universal I/O Signal Assignment

Table 14-9: Specific Output (Spot Welding) (Sheet 2 of 2)

Logical Number	Output Name / Function
30051 4)	WELD ERROR RESET This signal commands the reset error status of the Power Source. This is operated with the programing pendant operation.
30052 to 30056 4)	WELD CONDITION (Level signals) 1(1), 2(2), 4(3), 8(4), 16(5), 32(6), 64(7), 128(8) Sets the welding conditions for the Power Source. The output format can be selected as binary or discrete (bit number). It can handle up to 255 conditions. Most-significant bit is the parity bit (when specified).
4)	WELDING COMMAND This signal outputs execution command signal to the Power Source. This signal is not necessary for a Power Source which is executed using the WELDING CONDITION signal.
4)	STROKE CHANGE1 SINGLE SOLENOID DOUBLE SOLENOID This is a signal, when a double stroke gun is used, to change the open stroke of the welding gun.
4)	GUN PRESS COMMAND This outputs gun press command.

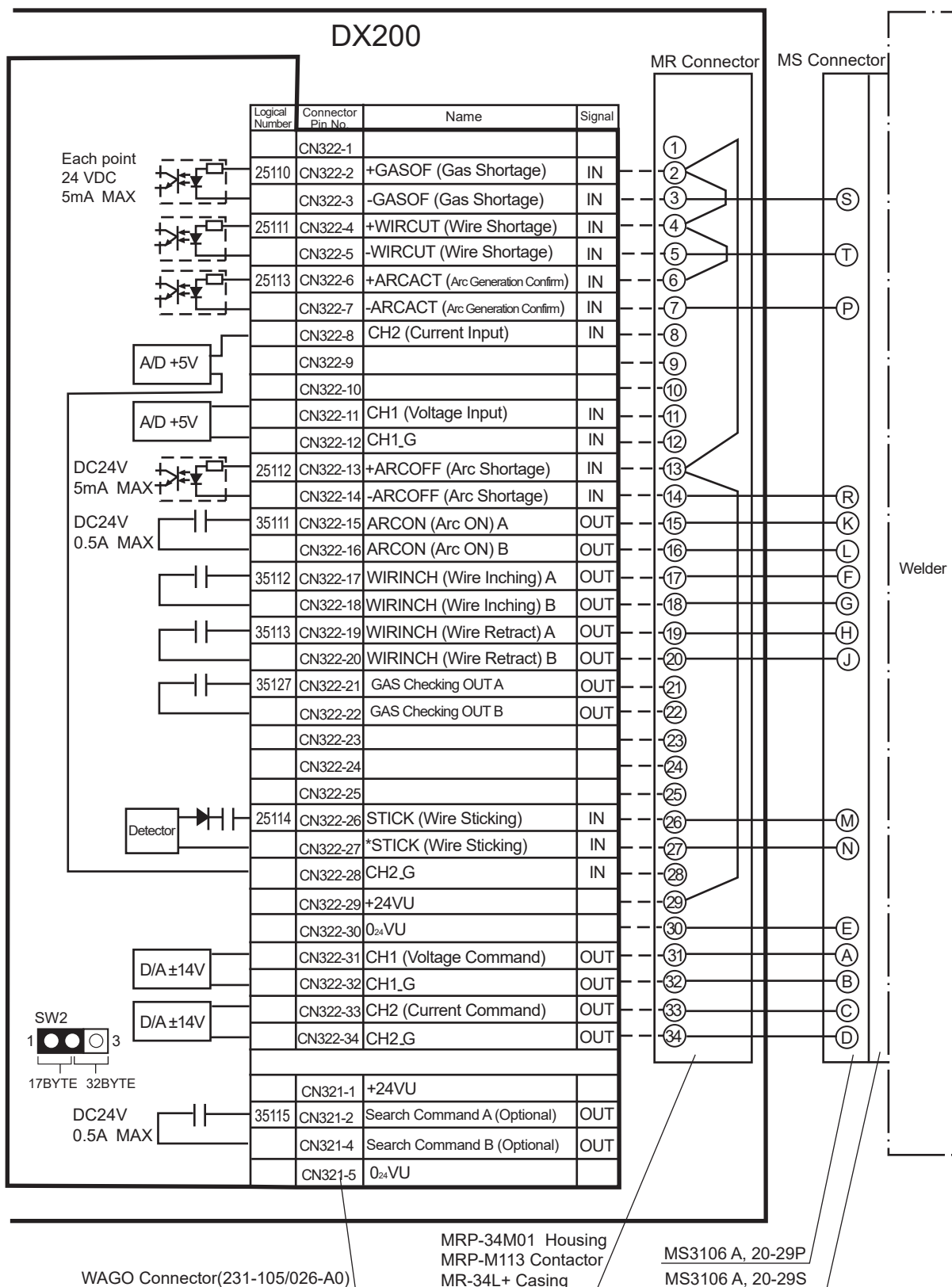
- 1 This signal is not output during operation.
- 2 The work home position cube and Cube 64 are the same.
- 3 This signal can be select "USE" or "NOT USE" by pseudo input signal "8702x". If "NOT USE" is selected, this signal can be used as the universal I/O signal described in parentheses.
- 4 This signal can be allocated to any universal I/O signal at the I/O allocation display in operation condition.



14.13.5 JANCD-YEW01-E Circuit Board (Option)

14.13.5.1 Arc Welding

This circuit board is a welder I/F circuit board for the welding, and it is an optional for the DX200. It is necessary to use this circuit board when operating the instructions by the analog instruction to the welder.



14.14 The List of the Equipment Configuration by Model



For the models which are not in *table 14-10*, *table 14-11(a)* and *table 14-11(b)*, refer to “DX200 INSTRUCTIONS SUPPLEMENT FOR Controller Specification List: Japan/Asia Specification” (HW1482743).

Table 14-10: Small Capacity Model

Model			MA1440/MH12
Type			ERER-MA1440/MH12-A00
Dimension(W) x (H) x (D)			600mm×730mm×520mm
Breaker			NF32-SVF 3P 15A
Control power supply unit			JZNC-YPS21-E
CPU unit			JZNC-YRK21-1E
			CPU circuit board JANCD-YCP21-E
			Back circuit board JANCD-YBB21-E
			PCI raiser Circuitboard JANCD-YBB22-E
Robot I/F circuit board			JANCD-YIF01- □ E
Machine safety CPU circuit board			JANCD-YSF21-E
Machine safety I/O logic circuit board			JANCD-YSF22 □ -E
Machine safety terminal block circuit board			JANCD-YFC22-E
Universal I/O circuit board			JANCD-YIO21-E
Power ON unit			JZRCR-YPU51-1
Major axes control circuit board			SRDA-EAXA21A
Break control circuit board			JANCD-YBK21-3E
Converter			SRDA-COA12A21A-E SRDA-COA30A21B-E (Before middle of 2015)
Capacitor module			SRDA-CUA492AA SRDA-CUA662AA (Before middle of 2015)
Amplifier module	AMP1	S	SRDA-SDA14A01A-E
	AMP2	L	SRDA-SDA21A01A-E
	AMP3	U	SRDA-SDA14A01A-E
	AMP4	R	SRDA-SDA06A01A-E
	AMP5	B	SRDA-SDA06A01A-E
	AMP6	T	SRDA-SDA06A01A-E
Regenerative resistor	Type		SMVK500W12R5J/R0.A6102A SMVK500W6R0J A6103(Before middle of 2015)
	Rated value		500W
	Resister value		12.5Ω 6Ω(Before middle of 2015)
Circulation fan			4715MS-22T-B50-B00 or 11938MB-B2N-EA-01
Cooling fan			4715MS-22T-B50-B00 x3 or 11938MB-B2N-EA-01 x3

Table 14-11(a): Medium/Large Capacity Robot

Model			MS210/MH225
Type			ERER-MS210/MH225-A00
Dimension(W) x (H) x (D)			600mm×730mm×520mm
Breaker			NF32-SVF 3P 30A
Control power supply unit			JZNC-YPS21-E
CPU unit			JZNC-YRK21-1E
	CPU circuit board		JANCD-YCP21-E
	Back circuit board		JANCD-YBB21-E
	PCI raiser circuit board		JANCD-YBB22-E
Robot I/F circuit board			JANCD-YIF01- □ E
Machine safety CPU circuit board			JANCD-YSF21-E
Machine safety I/O logic circuit board			JANCD-YSF22 □ -E
Machine safety terminal block			JANCD-YFC22-E
Universal I/O circuit board			JANCD-YIO21-E
Power ON unit			JZRCR-YPU51-1
Major axes control circuit board			SRDA-EAXA21A
Break control circuit board			JANCD-YBK21-3E
Converter			SRDA-COA30A21B-E
Capacitor module			SRDA-CUA133AA
Amplifier module	AMP1	S	SRDA-SDA71A01A-E
	AMP2	L	SRDA-SDA71A01A-E
	AMP3	U	SRDA-SDA71A01A-E
	AMP4	R	SRDA-SDA35A01A-E
	AMP5	B	SRDA-SDA35A01A-E
	AMP6	T	SRDA-SDA35A01A-E
Regenerative resistor	Type		SMVK500W2R0J A5978 x3
	Rated value		1500W
	Resister value		6Ω
Heat exchanger			TCSIP-16A4Y-0C
Cooling fan			4715MS-22T-B50-B00 x3 or 11938MB-B2N-EA-01 x3

14 Description of Units and Circuit Boards
14.14 The List of the Equipment Configuration by Model

Table 14-11(b): Medium/Large Capacity Robot

Model			MS165/MH180
Type			ERER-MS165/MH180-A00
Dimension(W) x (H) x (D)			600mm×730mm×520mm
Breaker			NF32-SVF 3P 30A
Control power supply unit			JZNC-YPS21-E
CPU unit			JZNC-YRK21-1E
		CPU circuit board	JANCD-YCP21-E
		Back circuit board	JANCD-YBB21-E
		PCI raiser circuit board	JANCD-YBB22-E
Robot I/F circuit board			JANCD-YIF01- □ E
Machine safety CPU circuit board			JANCD-YSF21-E
Machine safety I/O logic circuit board			JANCD-YSF22 □ -E
Machine safety terminal block			JANCD-YFC22-E
Universal I/O circuit board			JANCD-YIO21-E
Power ON unit			JZRRCR-YPU51-1
Major axes control circuit board			SRDA-EAXA21A
Break control circuit board			JANCD-YBK21-3E
Converter			SRDA-COA30A21B-E
Capacitor module			SRDA-CUA133AA
Amplifier module	AMP1	S	SRDA-SDA71A01A-E
	AMP2	L	SRDA-SDA71A01A-E
	AMP3	U	SRDA-SDA71A01A-E
	AMP4	R	SRDA-SDA35A01A-E
	AMP5	B	SRDA-SDA35A01A-E
	AMP6	T	SRDA-SDA35A01A-E
Regenerative resistor	Type	SMVK500W2R0J A5978 x3	
	Rated value	1500W	
	Resister value	6Ω	
Heat exchanger			TCSIP-16A4Y-0C
Cooling fan			4715MS-22T-B50-B00 x3 or 11938MB-B2N-EA-01 x3

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