The Americas YASKAWA Representative

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

YASKAWA

YRC1000
INSTRUCTIONS

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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
YRC1000 INSTRUCTIONS
YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

Have the following information available when contacting the YASKAWA Representative:

- System
- Primary Application
- Software Version *(Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version})*
- Warranty ID *(Located on Robot Controller)*
- Robot Serial Number *(Located on Manipulator data plate)*
- Robot Sales Order Number *(Located on Robot controller data plate)*

Part Number: 178642-1CD
Revision: 35

MANUAL NO. RE-CTO-A221 ◈35

DANGER

- This manual describes setup, diagnosis, maintenance, hardware, etc. of the YRC1000 system. Read this manual carefully and be sure to understand its contents before handling the YRC1000. Any matter, including operation, usage, measures, and an item to use, not described in this manual must be regarded as “prohibited” or “improper”.
- General information related to safety are described in “Chapter 1. Safety” of “YRC1000 INSTRUCTIONS”. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of “YRC1000 INSTRUCTIONS”.

CAUTION

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

NOTICE

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. Be sure to tell the representative the manual number listed on the front cover.

Notes for Safe Operation

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

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



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



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



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



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

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

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



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

DANGER

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

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

Fig. : Emergency Stop Button



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

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

Fig. : Release of Emergency Stop



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

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

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

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

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

WARNING

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

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

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
YRC1000 Controller	YRC1000
YRC1000 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. (The switch names are denoted as symbols)
	Button	The three buttons on the upper side of the programming pendant are denoted as follows: START, HOLD, or EMERGENCY STOP. (The button names are denoted as symbols)
	Displays	The menu displayed in the programming pendant is denoted with { }. e.g. {JOB}



Description of the Operation Procedure

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

Registered Trademark

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

Explanation of Warning Labels

The following warning labels are attached to the manipulator and YRC1000.

Fully comply with the precautions on the warning labels.

DANGER

- The label described below is attached to the manipulator.

Observe the precautions on the warning labels.

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

Refer to the manipulator manual for the warning label location.

Collision hazard label



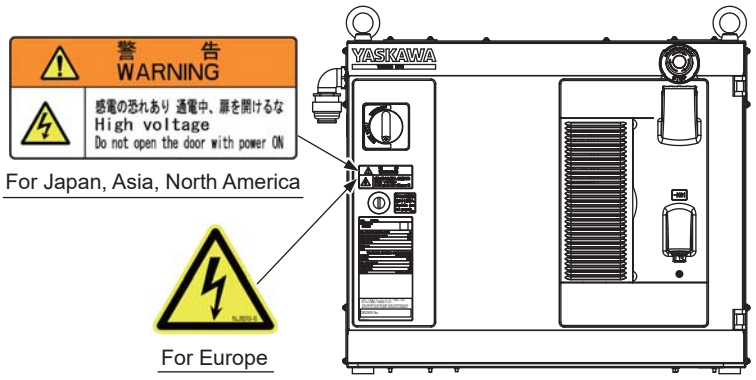
Crush hazard label



- The following warning labels are attached to YRC1000.

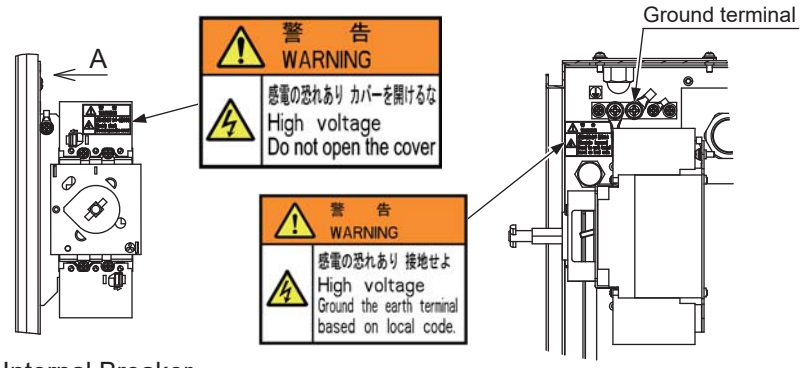
Observe the precautions on the warning labels.

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



For Japan, Asia, North America

For Europe



Internal Breaker

View A: Ground terminal

Contents

1 Safety 1-1

1.1 For Your Safety 1-1

1.2 Special Training 1-2

1.3 MOTOMAN Manual List 1-2

1.4 Personnel Safety 1-3

1.5 MOTOMAN Safety 1-5

1.5.1 Installation and Wiring Safety 1-6

1.5.2 Work Area Safety 1-10

1.5.3 Operation Safety 1-11

1.6 Notes for Moving and Transferring the MOTOMAN 1-14

1.7 Notes on MOTOMAN Disposal 1-15

2 Product Confirmation 2-1

2.1 Contents Confirmation 2-1

2.2 Order Number Confirmation 2-2

3 Installation 3-1

3.1 Handling Procedure 3-1

3.1.1 Using a Crane to Move the Controller 3-1

3.1.2 Using a Forklift to Move the Controller 3-2

3.2 Place of Installation 3-3

3.3 Location 3-4

3.4 Mounting the Controller 3-5

3.5 Procedure of Stacking the Controllers 3-6

4 Connection 4-1

4.1 Notes on Cable Junctions 4-3

4.2 Power Supply 4-4

4.2.1 Three-Phase Power Supply 4-4

4.2.2 Noise Filter Installation 4-6

4.2.3 Leakage Breaker Installation 4-6

4.2.4 Primary Power Supply Breaker Installation 4-7

4.3 Connection Methods 4-10

4.3.1 Connecting the Primary Power Supply 4-10

4.3.2 Connecting the Manipulator Cable 4-15

4.3.3 Connecting the Programming Pendant 4-17
4.3.4 User I/O Cable Connection 4-18

5 Turning ON and OFF the Power Supply 5-1
5.1 Turning ON the Main Power Supply 5-1
5.1.1 Initial Diagnosis 5-2
5.1.2 When Initial Diagnosis Are Complete 5-2
5.2 Turning ON the Servo Power 5-3
5.2.1 During Play Mode 5-3
5.2.2 Play Mode Enable Function 5-3
5.2.2.1 Preparation of Switch 5-3
5.2.2.2 Settings 5-5
5.2.2.3 Procedures for Operation Mode Change 5-5
5.2.3 During Teach Mode 5-7
5.3 Turning OFF the Power Supply 5-9
5.3.1 Turning OFF the Servo Power (Emergency Stop) 5-9
5.3.2 Turning OFF the Main Power 5-9
5.3.3 The Method of Stopping Manipulator Operation 5-10

6 Test of Program Operation 6-1
6.1 Movement of the Axes 6-3
6.2 Manual Brake Release Function 6-4

7 Security System 7-1
7.1 Protection through Security Mode Settings 7-1
7.1.1 Security Mode 7-1
7.1.1.1 Changing the Security Mode 7-6
7.1.2 User ID 7-9
7.1.2.1 Changing User ID 7-9
7.1.3 Main CPU SD Card ID 7-11

8 System Setup 8-1
8.1 Home Position Calibration 8-2
8.1.1 Home Position Calibration 8-4
8.1.2 Calibrating Operation 8-7
8.1.2.1 Registering All Axes at One Time 8-7
8.1.2.2 Registering Individual Axes 8-10
8.1.2.3 Changing the Absolute Data 8-11
8.1.2.4 Clearing Absolute Data 8-12

8.1.3 Home Position Posture of Manipulator 8-14
8.2 Setting the Second Home Position 8-15
8.2.1 Purpose of Position Check Operation 8-17
8.2.2 Procedure for the Second Home Position Setting (Check Point) 8-19
8.2.3 Procedure after the Alarm 8-21
8.3 Tool Data Setting 8-23
8.3.1 Registering Tool Files 8-23
8.3.1.1 Number of Tool Files 8-23
8.3.1.2 Registering Coordinate Data 8-23
8.3.1.3 Registering Tool Posture Data 8-26
8.3.1.4 Setting the Tool Load Information 8-27
8.3.2 Tool Calibration 8-29
8.3.2.1 Tool Calibration 8-29
8.3.2.2 Setting of Tool Calibration Method 8-29
8.3.2.3 Teaching of Calibration Point 8-32
8.3.2.4 Clearing Calibration Data 8-38
8.3.2.5 Checking the TCP 8-39
8.3.3 Automatic Measurement of the Tool Load and the Center of Gravity 8-41
8.3.3.1 What is the Automatic Measurement of the Tool Load and the Center of Gravity? 8-41
8.3.3.2 Measurement of the Tool Load and the Center of Gravity 8-41
8.3.3.3 Measurement of the Moment of Inertia at the Center of Gravity 8-46
8.4 ARM Control 8-50
8.4.1 ARM Control 8-50
8.4.2 ARM CONTROL Window 8-50
8.4.2.1 Robot Setup Condition 8-51
8.4.3 Tool Load Information Setting 8-55
8.4.3.1 Tool Load Information 8-56
8.4.3.2 How to Calculate Tool Load Information 8-56
8.4.3.3 Tool Load Information Registering 8-62
8.4.3.4 Tool File Overload Check Function 8-65
8.5 Work Home Position 8-66
8.5.1 What is the Work Home Position? 8-66
8.5.2 Setting Work Home Position 8-66
8.5.2.1 Work Home Position Window 8-66
8.5.2.2 Registering/Changing the Work Home Position 8-68
8.5.2.3 Returning to the Work Home Position 8-69
8.5.2.4 Output of the Work Home Position Signal 8-69
8.6 Interference Area 8-70
8.6.1 Interference Area 8-70
8.6.2 Cubic Interference Area 8-70

8.6.2.1 Cubic Interference Area 8-70
8.6.2.2 Cube Setting Method 8-72
8.6.2.3 Setting Operation 8-73
8.6.3 Axis Interference Area 8-84
8.6.3.1 Axis Interference Area 8-84
8.6.3.2 Setting Operation 8-84
8.6.4 Clearing the Interference Area Data 8-94
8.7 Shock Detection Function 8-96
8.7.1 Shock Detection Function 8-96
8.7.2 Shock Detection Function Setting 8-96
8.7.2.1 Shock Detection Level Setting 8-96
8.7.2.2 EACH AXIS LEVEL (CURRENT) Window 8-102
8.7.2.3 Tool Load Information Setting 8-103
8.7.2.4 U-Arm Payload Setting 8-103
8.7.2.5 Instruction of Shock Detection Function 8-103
8.7.2.6 Resetting the Shock Detected 8-110
8.7.3 High-Sensitivity Shock Detection Function (for Arc Welding Application Only) 8-111
8.7.3.1 Manipulator Type for High-Sensitivity Shock Detection Function 8-111
8.7.3.2 Setting for High-Sensitivity Shock Detection Function 8-111
8.7.3.3 Reading the Tool Load Information on the MAKER INITIAL VALUE Window 8-112
8.7.3.4 Explanation of Maker Initial Value 8-115
8.7.3.5 Reading the U-Arm Payload 8-120
8.7.3.6 Explanation of Maker Initial Value 8-123
8.8 User Coordinates Setting 8-124
8.8.1 User Coordinates 8-124
8.8.1.1 Methods for User Coordinates Setting 8-124
8.8.1.2 User Coordinates Files 8-125
8.8.2 User Coordinate Setting 8-126
8.8.3 Clearing the User Coordinates 8-134
8.9 Overrun/Tool Shock Sensor Releasing 8-135
8.10 Soft Limit Release Function 8-137
8.11 All Limit Release Function 8-139
8.12 Instruction Level Setting 8-141
8.12.1 Setting Contents 8-141
8.12.1.1 Instruction Set 8-141
8.12.1.2 Learning Function 8-142
8.12.2 Setting the Instruction Set Level 8-143
8.12.3 Setting the Learning Function 8-145
8.13 Setting the Controller Clock 8-146

8.14 Setting the Play Speed 8-147

8.15 Numeric Key Customize Function 8-149

8.15.1 About the Numeric Key Customize Function 8-149

8.15.2 Allocatable Functions 8-149
8.15.2.1 Key Allocation (EACH) 8-149
8.15.2.2 Key Allocation (SIM) 8-150

8.15.3 Allocating Operation 8-151
8.15.3.1 Allocation Window 8-151
8.15.3.2 Instruction Allocation 8-152
8.15.3.3 Job Call Allocation 8-154
8.15.3.4 Display Allocation 8-154
8.15.3.5 Alternate Output Allocation 8-156
8.15.3.6 Momentary Output Allocation 8-157
8.15.3.7 Pulse Output Allocation 8-158
8.15.3.8 Group (4-bit/8-bit) Output Allocation 8-159
8.15.3.9 Analog Output Allocation 8-160
8.15.3.10 Analog Incremental Output Allocation 8-161

8.15.4 Allocation of I/O Control Instructions 8-162

8.15.5 Execution of Allocation 8-164
8.15.5.1 Executing the Instruction/Output Control Allocation 8-164
8.15.5.2 Executing the Job Call Allocation 8-164
8.15.5.3 Executing the Display Allocation 8-164
8.15.5.4 Executing the I/O Control Allocation 8-164

8.16 Changing the Output Status 8-165

8.17 Changing the Parameter Setting 8-167

8.18 File Initialization 8-170

8.18.1 Initializing Job File 8-170

8.18.2 Initializing Data File 8-171

8.18.3 Initializing Parameter File 8-173

8.18.4 Initializing I/O Data 8-174

8.18.5 Initializing System Data 8-176

8.18.6 Reset Safety Circuit Board FLASH Data 8-178
8.18.6.1 Saving Dual Data 8-178
8.18.6.2 FLASH Data Reset 8-179
8.18.6.3 Setting to Hide the Safety Board FLASH Erase Item 8-180

8.19 Display Setting Function 8-181

8.19.1 Font Size Setting 8-181
8.19.1.1 Applicable Range for the Font Size Change 8-181
8.19.1.2 Settable Font Size 8-181
8.19.1.3 Setting the Font Size 8-182

8.19.2 Operation Button Size Setting 8-185
8.19.2.1 Applicable Range for the Button Size Change 8-185
8.19.2.2 Settable Button Size 8-185
8.19.2.3 Setting the Button Size 8-186
8.19.3 Initialization of Screen Layout 8-190
8.19.3.1 Initializing the Screen Layout 8-190
8.19.4 Layout Storage 8-192
8.20 Encoder Back-Up Error Recovery Function 8-193
8.20.1 About Encoder Back-Up Error Recovery Function 8-193
8.20.2 Encoder Back-Up Error Recovery Function Operation 8-193
8.21 Preventive Maintenance Function 8-196
8.21.1 Preventive Maintenance Function 8-196
8.21.2 Preventive Maintenance Function for the Speed Reducer 8-196
8.21.2.1 Diagnose by the Lifetime Calculation 8-197
8.21.2.2 Diagnose by the Torque Average Value 8-203
8.21.2.3 After Replacement of the Speed Reducer 8-219
8.21.3 Inspection Notice Function 8-221
8.21.3.1 Setting Procedures 8-221
8.21.3.2 The Inspection Notice Window 8-223
8.21.4 Record of Inspection Date and Replacement Date 8-224
8.21.5 Management of the Data 8-225
8.21.6 Preventive Maintenance for the Hardware 8-227
8.21.6.1 Target Components for Diagnosis 8-227
8.21.6.2 Replacement Time Display 8-227
8.21.6.3 Replacement of Component 8-228
8.21.6.4 Display of the Numbers of Motor Revolution and Reverse Revolution 8-228
8.21.7 Setting of Preventive Maintenance for the Hardware 8-229
8.21.7.1 Setting of Replacement Time Display 8-229
8.21.7.2 Mask of Replacement Time Display (Signal Display) 8-235
8.21.8 Display of the Numbers of Motor Revolution and Reverse Revolution 8-237
8.21.8.1 Display of the Numbers of Revolution and Reverse Revolution 8-237
8.21.8.2 Percent Display of the Number of Motor Revolution 8-237
8.21.8.3 Resetting the Number of Revolution 8-238
8.21.8.4 Changing the Numbers of Revolution and Reverse Revolution 8-239
8.21.9 Gas Pressure Check Function 8-240
8.21.9.1 Gas Pressure Check Window 8-240
8.21.9.2 Registering Criteria Values 8-243
8.21.9.3 Execute the Gas Pressure Check 8-246
8.21.9.4 When Low Gas Pressure Is Detected 8-246
8.21.9.5 Alarm 8-247
8.22 Operating Status Monitor Function 8-248

8.23 Job Monitor Function 8-250
8.24 Robot Monitor Function 8-257
8.25 Brake Line Ground Judgment Function 8-260
8.25.1 About the Brake Line Ground Judgment Function 8-260
8.25.2 Operating Condition 8-260
8.25.3 Operation 8-261
8.25.3.1 Occurrence of a DC 24V Power Supply Failure (SERVO) 8-261
8.25.3.2 Brake Line Ground Check 8-262
8.25.3.3 Initializing the Related Information 8-264
8.26 Safety Logic Circuit 8-266
8.26.1 Outline 8-266
8.26.2 Changing the Security Mode 8-268
8.26.3 Available I/O Signals and Instructions in Safety Logic Circuit 8-270
8.26.3.1 Full Speed Mode 8-281
8.26.3.2 Switching Display of System and User Section 8-282
8.26.4 Safety Logic Circuit 8-284
8.26.5 Signal List Window 8-291
8.26.6 Setting ON/OFF to the Input Signals 8-292
8.26.7 Setting for the GP Safety I/O Signals 8-295
8.26.7.1 Preliminary setting for the GP Safety I/O Signal 8-295
8.26.7.2 Setting for the GP Safety Output Signals 8-298
8.26.8 Safety Signal Board Allocation 8-300
8.26.9 Timer Delay 8-303
8.26.10 Timer 8-307
8.26.11 Output Signal 8-309
8.26.12 Display of the Message on the Programming Pendant 8-310
8.26.13 Enable Switch Link Function 8-311
8.26.13.1 Setting of the Enable Switch Link Function 8-311
8.26.13.2 Example of Use of the Enable Switch Link Function 8-312
8.26.14 Specific Input Signals Allocated to SPIN[xx] 8-314
8.26.15 Output to the Control Status Signal 8-315
8.26.16 Saving or Loading the File 8-326
8.26.16.1 Saving the File 8-326
8.26.16.2 Loading the File 8-327
8.26.17 Initializing the Safety Logic Circuit File 8-328
8.26.17.1 Initializing the Safety Logic Circuit File 8-328
8.26.17.2 Safety Circuit Board FLASH ROM Data Erase and Reset 8-331
8.26.18 Example of Safety Logic Circuit 8-333

8.26.19 Alarm List of the Safety Logic Circuit 8-348
8.26.20 General-Purpose Safety Output Monitoring Signal 8-349
8.27 Robot Stop Factor Monitor Function 8-356
8.27.1 Outline 8-356
8.27.1.1 The Robot Stop Factor 8-356
8.27.1.2 The Robot Stop Factor Record Number 8-360
8.27.2 Operation 8-360
8.27.2.1 Displaying the Robot Stop Factor Monitor 8-360
8.27.2.2 Clear the Robot Stop Factor Information 8-362
8.28 Robot Detachment Function 8-363
8.28.1 Setting Maintenance Mode 8-363
8.28.2 Setting Robot Detachment Function 8-365
8.29 Axes Detachment Function 8-369
8.29.1 Outline 8-369
8.29.2 Connecting the Dummy Connector 8-369
8.29.3 Setting Maintenance Mode 8-370
8.29.4 Setting Axes Detachment Function 8-370
8.29.5 Specific Output and Messages 8-373
8.29.6 Restrictions 8-374
8.30 User Group Input and Output 8-376
8.30.1 Outline of the Function 8-376
8.30.2 User Group Input 8-377
8.30.2.1 User Group Input Setting 8-377
8.30.2.2 Display of User Group Input 8-379
8.30.3 User Group Output 8-380
8.30.3.1 User Group Output Setting 8-380
8.30.3.2 Display of User Group Output 8-382
8.30.4 Examples of Use 8-383
8.31 Variable Allocation 8-387
8.32 Controller Information Display Function 8-391
8.33 Power Supply Regeneration Monitor Function 8-394
8.33.1 Outline 8-394
8.33.2 Power Regeneration Window 8-394
8.33.3 Regeneration Monitor Window 8-396
8.33.4 Reset Time Setting 8-397
8.33.5 Resetting the Amount of Regenerated Power for Today 8-399
8.33.6 Power Regeneration Monitor Data Output Function 8-400

8.33.6.1 Output from GP Output Signals 8-401
8.33.6.2 Writing Data to Register Addresses 8-406
8.34 Step Diagnosis Function 8-409
8.35 Overload Detection Function 8-413
8.36 Overload Alarm Management Function 8-414
8.36.1 OVERLOAD ALARM MANAGEMENT Window 8-414
8.36.2 Overload Anomaly Notification 8-421
8.36.3 INSPECTION ITEM Window 8-422
9 System Backup 9-1
9.1 System Backup with YRC1000 9-1
9.1.1 Function Types of Data 9-1
9.1.1.1 CMOS.BIN 9-1
9.1.1.2 CMOSBK.BIN 9-1
9.1.2 Device 9-2
9.2 Backup by CMOS.BIN 9-4
9.2.1 CMOS.BIN Save 9-4
9.2.2 CMOS.BIN Load 9-7
9.3 Automatic Backup Function 9-9
9.3.1 Automatic Backup Function 9-9
9.3.1.1 Objective 9-9
9.3.1.2 Outline 9-9
9.3.2 Settings for Automatic Backup 9-11
9.3.2.1 The SD Card inserted in the Programming Pendant 9-11
9.3.2.2 USB Memory connected to the ACP01 Board 9-11
9.3.2.3 The SD Card of the ACP01 Board 9-12
9.3.2.4 RAMDISK on the ACP01 Board 9-12
9.3.2.5 YRC1000 Status and Automatic Backup 9-13
9.3.2.6 Setting Examples 9-15
9.3.2.7 AUTO BACKUP FUNCTION SET Window 9-16
9.3.3 Limiting the Automatic Backup File Creation 9-22
9.3.3.1 Setting to Limit the Automatic Backup File Creation 9-22
9.4 Loading the Backup Data from the SD Card 9-23
9.4.1 Loading Procedure 9-23
9.5 Error List 9-29
9.5.1 Error Contents 9-29
10 Upgrade Function 10-1
10.1 Functional Overview 10-1

10.2 Upgrade Procedure 10-1
10.2.1 Confirmation of Software Version 10-1
10.2.2 Automatic Upgrade of the Programming Pendant 10-3
10.3 Error Message 10-5

11 Programming Pendant 11-1
11.1 Disconnection Function 11-1
11.2 Reset Function 11-4
11.3 Touch Panel Invalidate Function 11-5
11.4 Reboot Robot System 11-7

12 Modification of System Configuration 12-1
12.1 Addition of I/O Modules 12-1
12.2 Allocating External I/O Signal 12-4
12.2.1 Mechanism to Exchange I/O Signals with External Devices (Standard Settings) 12-4
12.2.2 Mechanism to Exchange I/O Signals with External Devices (Example of Changing Signals with External I/O Signal Allocations) 12-6
12.2.3 Setup Procedure for the External I/O Allocation Function 12-7
12.3 Addition of Base and Station Axes 12-13
12.3.1 Base Axis Setting 12-15
12.3.1.1 Selection of Base Axis Type 12-15
12.3.1.2 Connection Setting 12-18
12.3.1.3 Axis Configuration Setting 12-22
12.3.1.4 Mechanical Specification Setting 12-23
12.3.1.5 Motor Specification Setting 12-26
12.3.2 Station Axis Setting 12-28
12.3.2.1 Selection of Station Axis Type 12-28
12.3.2.2 Connection Setting 12-30
12.3.2.3 Axis Configuration Setting 12-32
12.3.2.4 Mechanical Specification Setting 12-34
12.3.2.5 Motor Specification Setting 12-37
12.4 Encoder Connection Settings 12-39

13 YRC1000 Specification 13-1
13.1 Specification List 13-3
13.2 Function List 13-4
13.3 Programming Pendant 13-5
13.4 Equipment Configuration 13-6

13.4.1 Arrangement of Units and Circuit Boards 13-6
13.4.2 Cooling System of the Controller Interior 13-16

14 .Description of Units and Circuit Boards 14-1
14.1 Power Supply Contactor Unit (JZRCR-APU0□-1) 14-4
14.2 Control Power Supply Unit (CSRA-CPS01K□) 14-4
14.3 CPU Unit (JZNC-ARK5□-□E) 14-6
14.3.1 CPU Unit Configuration 14-6
14.3.2 Unit and Circuit Board in the CPU Unit 14-7
14.3.2.1 CPU Board (JANCD-ACP01-E) 14-7
14.3.2.2 Robot I/F Circuit Board (JANCD-AIF01-□E) 14-7
14.4 Converter (CSRA-CV□□□0□A) 14-8
14.4.1 Converter (Small-Capacity Model) 14-8
14.4.2 Converter (Medium/Large-Capacity Model) 14-9
14.5 Inverter Unit (CSRA-SDA□□H01A) 14-10
14.5.1 Inverter Unit Configuration 14-10
14.5.2 Inverter 14-11
14.5.3 Servo Control Board (CSRA-SDCA01AA) 14-13
14.6 Safety Circuit Board (JANCD-ASF01-E) 14-14
14.6.1 Safety Circuit Board (JANCD-ASF01-E) 14-14
14.6.2 Connection for Tool Shock Sensor 14-15
14.7 Safety Terminal Block Board (IM-YE250/5-80P) 14-17
14.7.1 Safety Plug 14-22
14.7.2 External Emergency Stop 14-24
14.7.3 SYSRUN Signal Output 14-25
14.7.4 Connection for Servo-ON Enable Input 14-26
14.7.5 External Axes Overrun 14-28
14.7.6 Emergency Stop Output 14-30
14.7.7 General-Purpose Safety Input 14-31
14.7.8 General-Purpose Safety Output 14-32
14.7.9 Connection for Direct-In 14-33
14.7.10 General-Purpose Input (Servo) 14-34
14.8 General-Purpose I/O Board (JANCD-AIO0□-E) 14-35
14.9 WAGO Connector Wiring 14-41
14.10 Robot General-Purpose I/O Signal Assignment 14-42

14.10.1 Arc Welding 14-42
14.10.2 Material Handling..... 14-48
14.10.3 Press Tending, Cutting, and Other Applications..... 14-54
14.10.4 Spot Welding 14-60
14.11 The List of the Equipment Configuration 14-68

1 Safety

1.1 For Your Safety

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

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

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

DANGER

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

Other related laws and regulations are:

  - Occupational Safety and Health Act in USA
  - Factory Act (Gewerbeordnung) in Germany
  - Health and Safety at Work, etc. Act in UK
  - EC Machinery Directive 2006/42/EC

- Prepare
  - SAFETY WORK REGULATIONS

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

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

by designating authorized operators and safety managers for the robot, as well as giving continuing safety education and training.

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

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

1.2 Special Training

DANGER

- Personnel engaged in operation, maintenance, or management of the robot must receive required training before using the robot.
- For more information on training, contact your YASKAWA representative.

1.3 MOTOMAN Manual List

DANGER

- For safety, make sure to have the following manuals for MOTOMAN on hand, read them thoroughly and understand the contents of them:
  - MOTOMAN-□□□ INSTRUCTIONS
  - YRC1000 INSTRUCTIONS
  - YRC1000 MAINTENANCE MANUAL
  - YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
  - YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)
- Confirm that you have all the above manuals on hand. If any of them is missing, contact your YASKAWA representative.

1.4 Personnel Safety

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

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

WARNING

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

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

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

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

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

Failure to observe this instruction may result in personal injury.

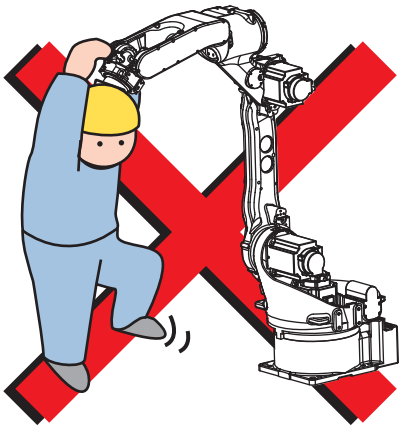
- The following must be understood and strictly observed by all personnel as rules:
  - Unauthorized personnel other than the operator must not approach the area where the MOTOMAN is installed.
  - Do not let unauthorized personnel other than the operator approach the area where the MOTOMAN is installed.

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

WARNING

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

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

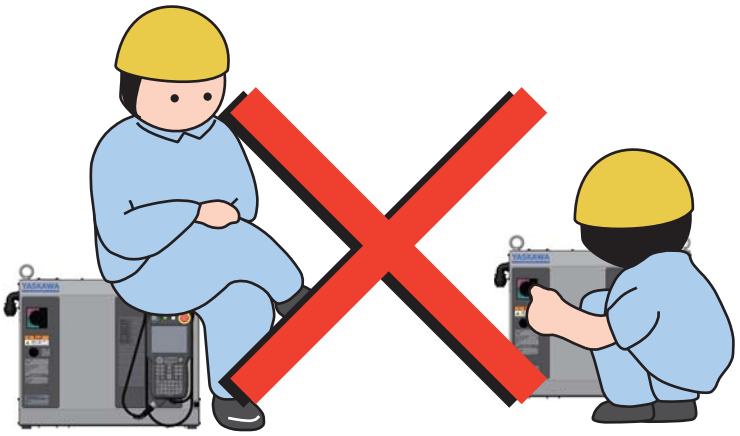


- Do not sit or lean on the YRC1000.

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

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

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



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

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

1.5 MOTOMAN Safety

The followings are safety functions of MOTOMAN/YRC1000.

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

These safety functions conform to the following safety standards.

- EN ISO 13849-1: 2023 Cat.3/PLe
- EN 62061 (IEC 61508) SIL CL3

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

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

1.5.1 Installation and Wiring Safety

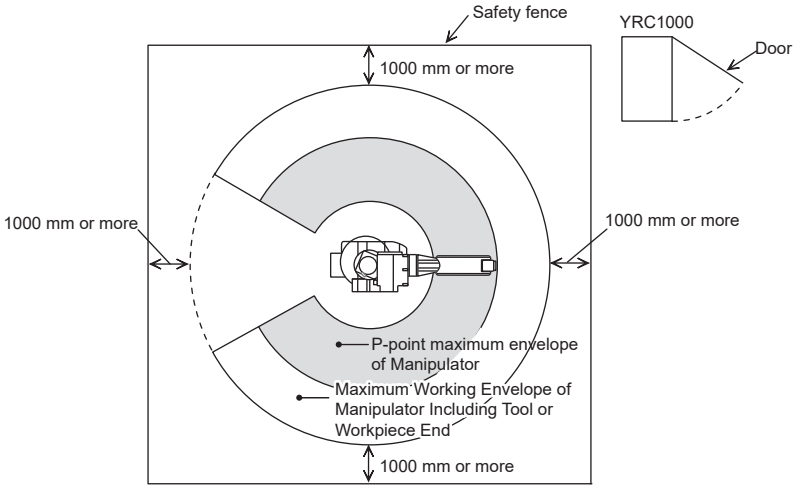
Refer to the MOTOMAN-□□□ INSTRUCTIONS and the YRC1000 INSTRUCTIONS for details on installation and wiring.

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

WARNING

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

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



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

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

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

WARNING

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

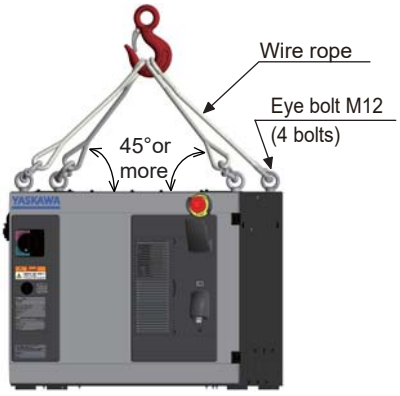
Failure to observe this instruction may result in personal injury and/or equipment damage.

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

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

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

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



YRC1000

Table 1-1: Approx. Weight of YRC1000

Models Available for YRC1000	**Specification**	**Approx. Weight [Kg]**
Small-Capacity Model	For Japan	60
	For Asia, For North America, For Europe	70
Medium/ Large-Capacity Model	For Japan	75
	For Asia, For North America, For Europe	85

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

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

WARNING

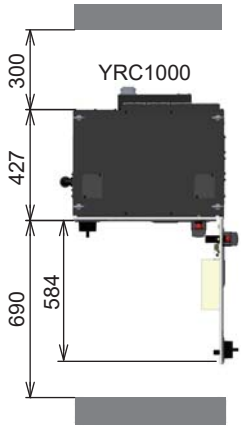
- If storing the manipulator temporarily before installation, be sure to place it on a stable and flat surface and take precautions to prevent unauthorized personnel from touching it.

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

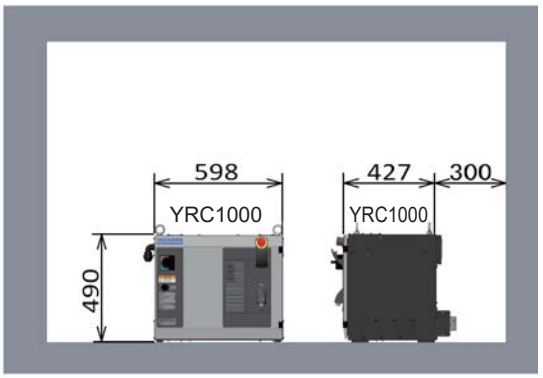
WARNING

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

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



YRC1000 Maintenance Area
(Unit: mm)



YRC1000 External Dimensions (Unit: mm)

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

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

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

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

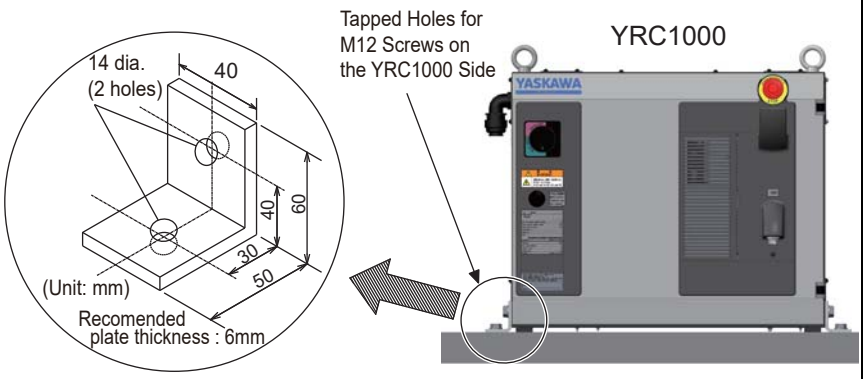
- To install the manipulator, use the bolts and screws of the types and sizes specified in the MOTOMAN-□□□ INSTRUCTIONS of the manipulator.

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

WARNING

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

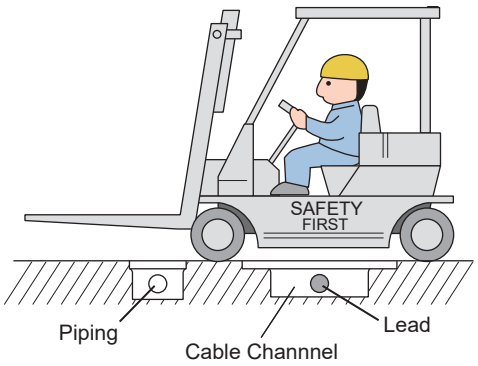
Failure to observe this instruction may cause overturning of the YRC1000, which may result in personal injury and/or equipment damage.



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

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

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



Failure to observe this instruction may cause personnel to trip over exposed piping, wiring, or a cable, which may result in personal injury.

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

1.5.2 Work Area Safety

Carelessness contributes to serious accidents in the work area.

To ensure safety, enforce the following precautions:

DANGER

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

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

CAUTION

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

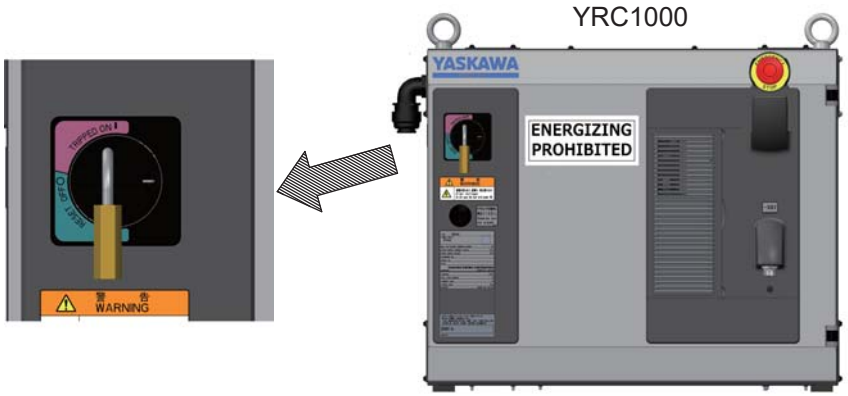
If an industrial tool, etc. is left unattended on the manipulator, on a fixture, or on the floor, etc., the manipulator may come in contact with the industrial tool left unattended, which may result in damage to the manipulator and/or the fixture.

- If the light in the operator's working space is not bright enough, provide the space with appropriate lighting.

1.5.3 Operation Safety

DANGER

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



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

- Use the MOTOMAN only within the specifications described in the manuals for MOTOMAN.

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

- Without a compelling reason, perform operations in the teach mode only when no person is present in the area enclosed by the safety fences.
- Perform operations in the teach mode from outside the manipulator's operating range whenever possible.

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

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

DANGER

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

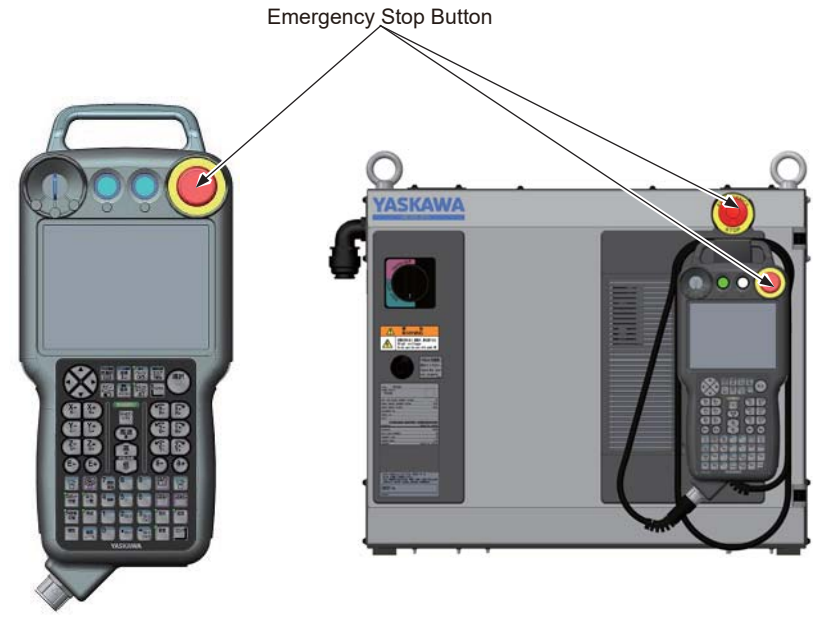
If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

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

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

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

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



DANGER

- Personnel engaged in teaching or inspection, etc. of the MOTOMAN must receive special training required by applicable laws and regulations.
  - Refer to *chapter 1.2 "Special Training"*

WARNING

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- After installing the manipulator, replacing parts, modifying the taught job, or modifying the robot system by changing the tool or a peripheral device, etc., make sure to perform the first operation of the manipulator at low speed, and confirm that there is no abnormal noise, abnormal vibration, or abnormal operation. If an error occurs, immediately turn OFF the YRC1000 power supply and inform the safety manager of the error.
- Always return the programming pendant to the hook on the YRC1000 cabinet after use

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

1.6 Notes for Moving and Transferring the MOTOMAN

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

DANGER

- When relocating, transferring, or selling the MOTOMAN, make sure that the MOTOMAN is always accompanied by its manuals so that all users have access to necessary manuals.

See *chapter 1.3 "MOTOMAN Manual List"* for a list of the manuals.

If any of them is missing, contact your YASKAWA representative.

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

Contact your YASKAWA representative if you require new warning labels.

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

If installation or wiring of a device is incorrect, personal injury and/or equipment damage may result.

1.7 Notes on MOTOMAN Disposal

DANGER

- Do not modify the manipulator or the YRC1000.

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

WARNING

- Take precautionary measures to prevent the manipulator from overturning, such as anchoring it firmly, etc., even when temporarily storing it before disposal.

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

NOTICE

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



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

2 Product Confirmation

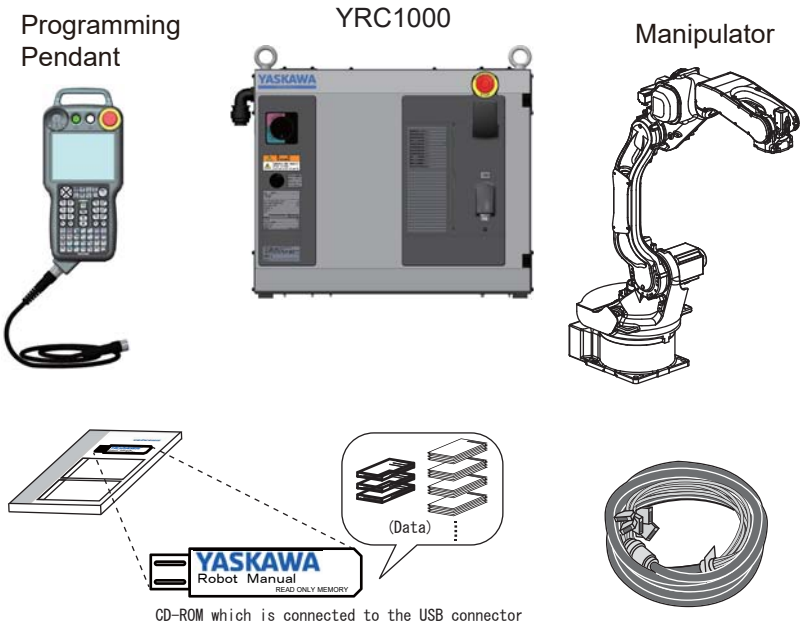
2.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

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

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

Fig. 2-1: Standard Five Items

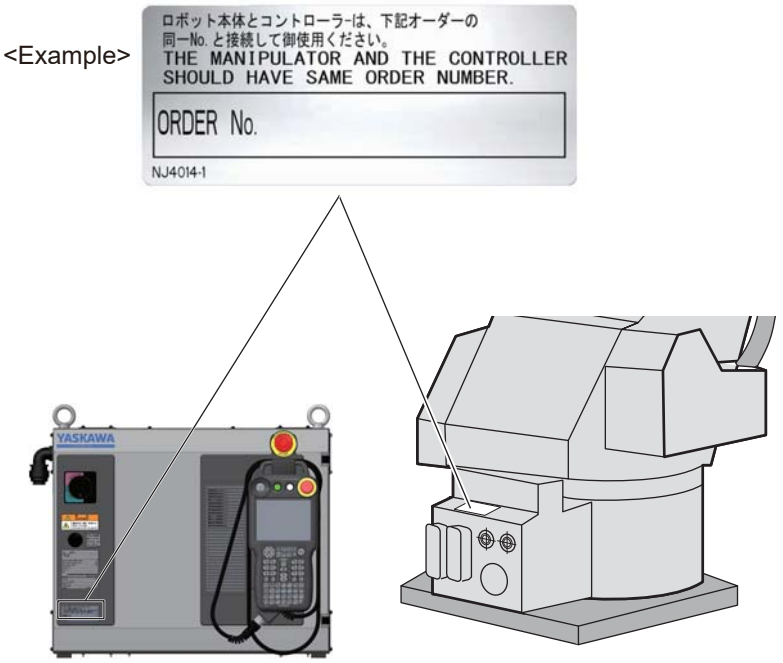


2.2 Order Number Confirmation

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

The order number plates are affixed to the figure below.

<Example>



3 Installation

3.1 Handling Procedure

WARNING

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

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

NOTICE

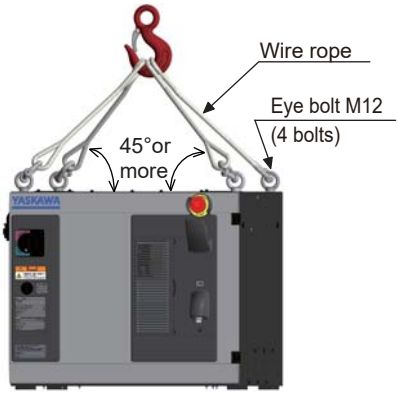
- Avoid excessive vibration or shock while transporting or moving the YRC1000.

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

3.1.1 Using a Crane to Move the Controller

Check the following before handling the YRC1000:

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



YRC1000

Table 3-1: Approx. Weight of YRC1000

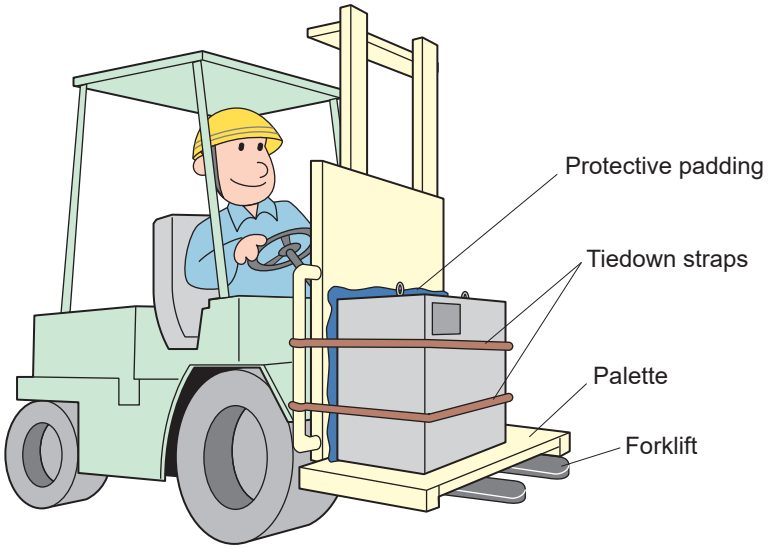
Models Available for YRC1000	Specification	Approx. Weight (Kg)
Small-Capacity Model	For Japan	60
	For Asia, For North America, For Europe	70
Medium/ Large-Capacity Model	For Japan	75
	For Asia, For North America, For Europe	85

3.1.2 Using a Forklift to Move the Controller

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

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

Fig. 3-1: Using Forklift



3.2 Place of Installation

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

- Ambient temperature must be 0 to 45° C (32 to 113°F) during operation and -10 to 60°C (14 to 140°F) during transportation and maintenance. Temperature change must be 0.3°C/min or less.
- Humidity must be low with no condensation (10~90%RH).
- Only a small amount of dirt, dust, cutting oil, organic solvent, oil fume, water or salt in the place. Especially, avoid adhesion of chemicals, cutting oil including coolant, rust preventive oil, organic solvent, etc. to the programming pendant.
- Free from flammable or corrosive liquid, gas, etc.
- Free from excessive shock, vibration, etc. (vibration: 0.5G or less)
- Free from large electrical noise. (An electrical noise source such as a TIG welding device must not be placed close to the YRC1000.)
- Free from excessive microwaves, ultraviolet rays, X-rays, or radiation.
- Altitude: 1000 m or less (To use the DX100 at the altitude over 1000 m, calculate the maximum ambient temperature by decreasing it by 1% per 100 m. The maximum allowable altitude is 2000 m. When the altitude is 2000 m, the maximum ambient temperature during operation is 40.5°C.)

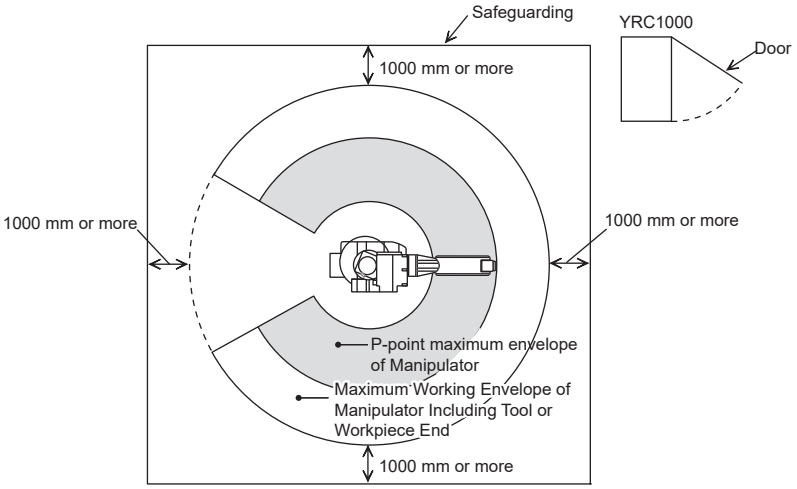
NOTE

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

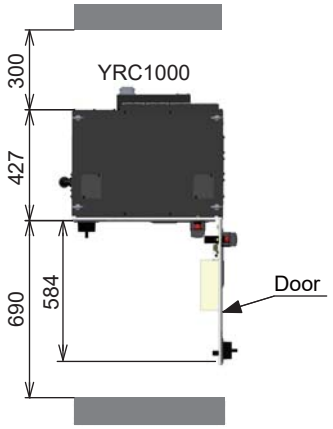
3.3 Location

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

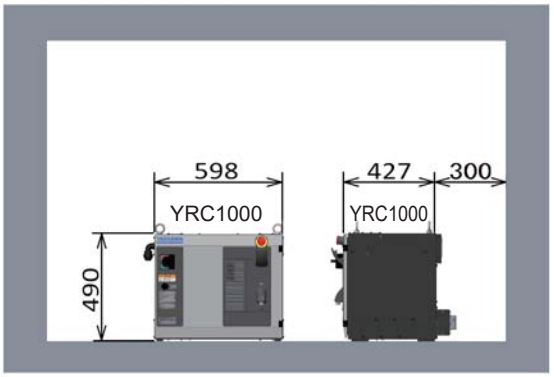
Fig. 3-2: Location of YRC1000



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



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



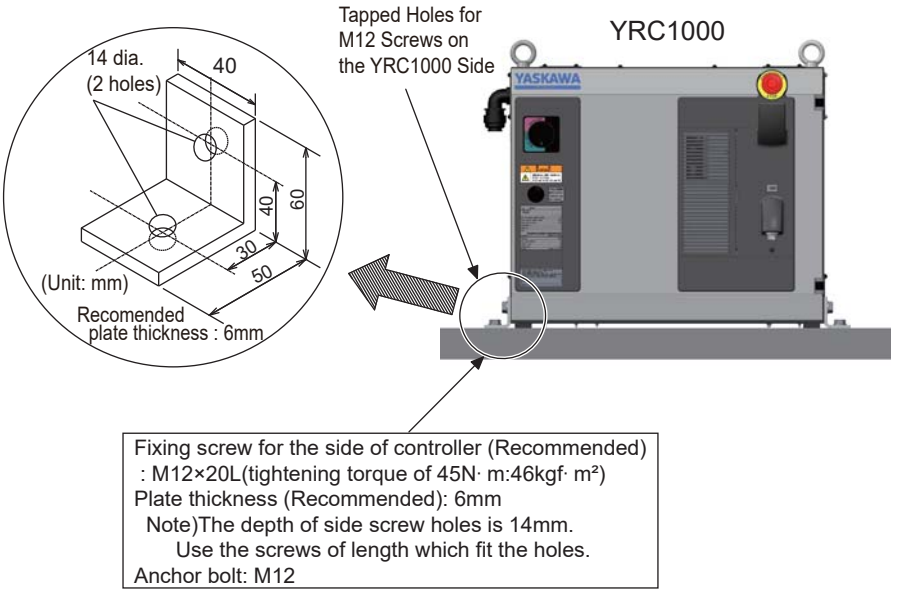
3.4 Mounting the Controller

WARNING

- Do not sit or lean on the YRC1000.

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

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



Fixing screw for the side of controller (Recommended)
: M12×20L(tightening torque of 45N· m:46kgf· m²)
Plate thickness (Recommended): 6mm
Note)The depth of side screw holes is 14mm.
Use the screws of length which fit the holes.
Anchor bolt: M12

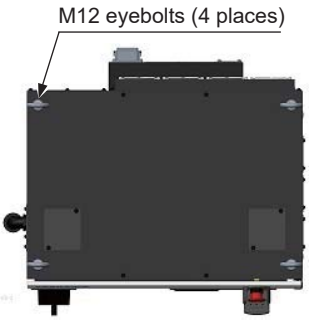
NOTE For details on installation of the manipulator, the INSTRUCTIONS for the manipulator.

3.5 Procedure of Stacking the Controllers

It is possible to stack the YRC1000 controllers.

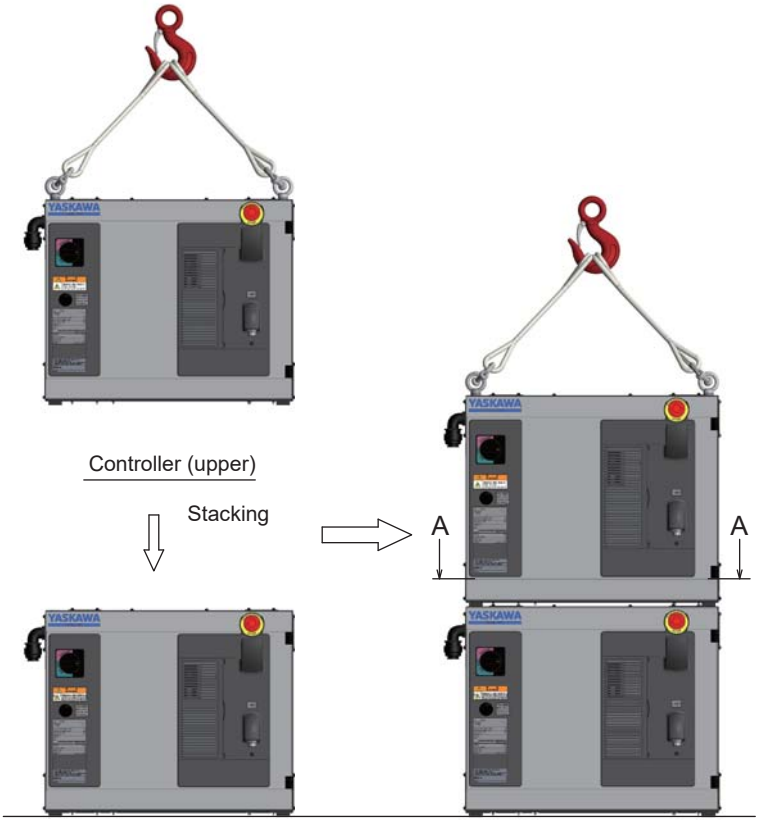
Follow the procedures below when stacking the YRC1000 controllers.

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



Top View

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

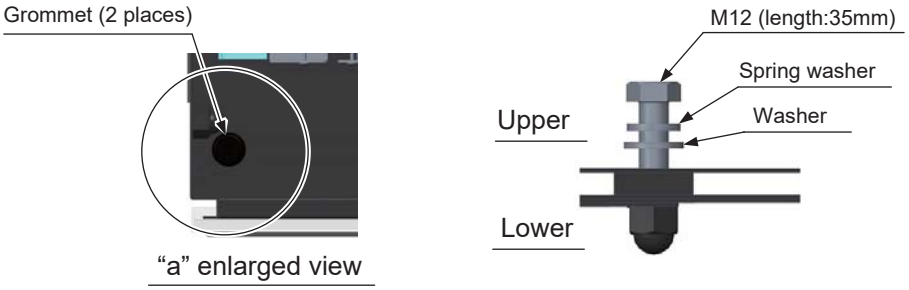


WARNING

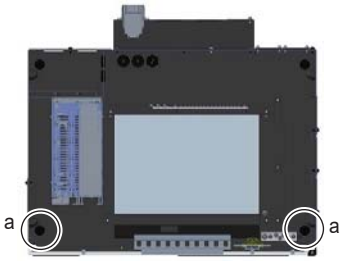
- Keep the YRC1000 lifted by the crane until the YRC1000 is stacked and fixed securely.

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

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

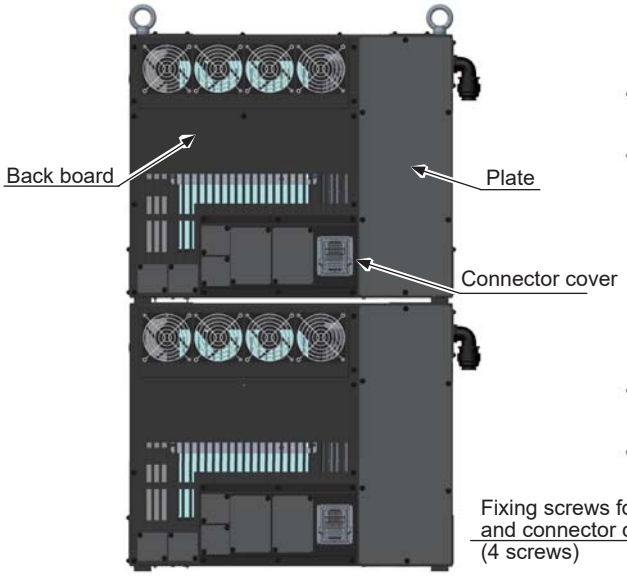


“a” enlarged view

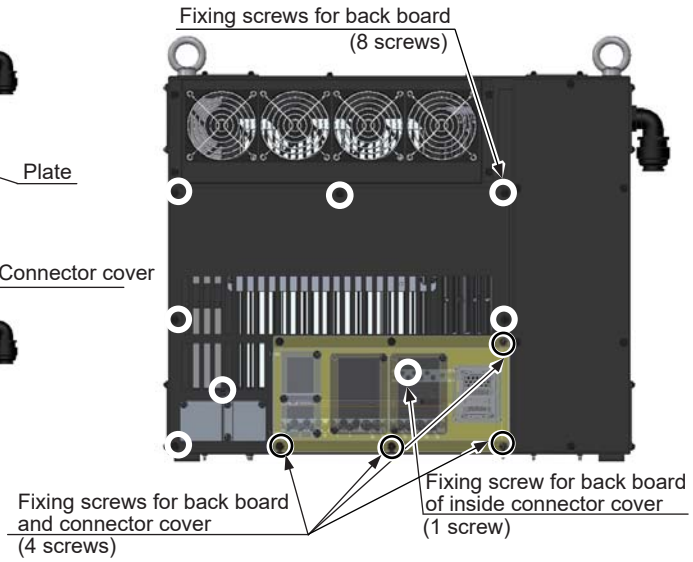


A-A Section View

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



Back View



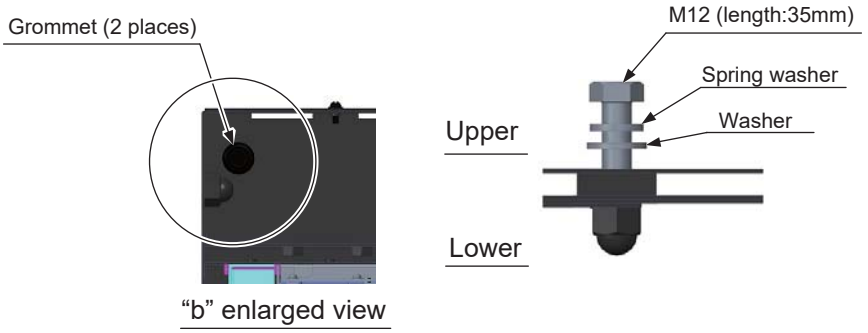
Details of fixing screws on back board

NOTICE

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

Failure to observe this instruction may result in damage to the cables.

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

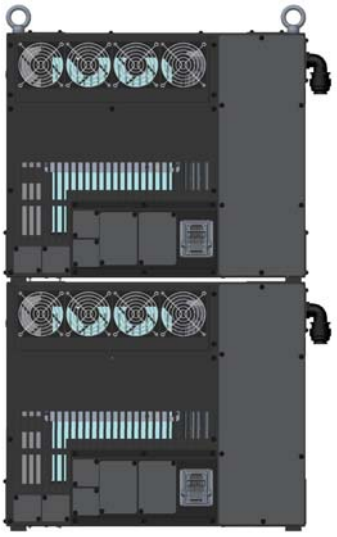


“b” enlarged view



A-A Section View

6. After confirming the stacking the controllers, tighten the temporally M12 bolts firmly. (a, b parts: tighten the 4 places)
(tightening torque: 35 N·m)
7. Reinstall the removed back board and plate at procedure No.4.
8. Remove the wire lifting the controller by the crane, and stacking is completed.



4 Connection

WARNING

- The system must be grounded.

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

- Before wiring, make sure to turn OFF the primary power supply and use tagout (e.g., “DO NOT TURN THE POWER ON”).

Failure to observe this instruction may result in electric shock and/or personal injury.

- Do not touch any part inside the YRC1000 for at least five minutes after turning OFF the power supply. In addition, confirm that the charge lamps (orange LED) on the converter and the inverter unit are turned OFF.

Failure to observe this instruction may result in electric shock and/or personal injury due to residual voltage in the capacitor.

- While the power is ON, make sure that the protective cover of the breaker is mounted and the front door of the YRC1000 is closed.

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

- Wiring of the emergency stop circuit must be performed under the responsibility of the user. Make sure to perform operation check after wiring.

Failure to observe this instruction may result in personal injury and/or mechanical failure.

- Wiring must be performed only by authorized personnel.

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

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

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

- Make sure to securely tighten the terminal screws on the main circuit and the control circuit.

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

NOTICE

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

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

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

NOTICE

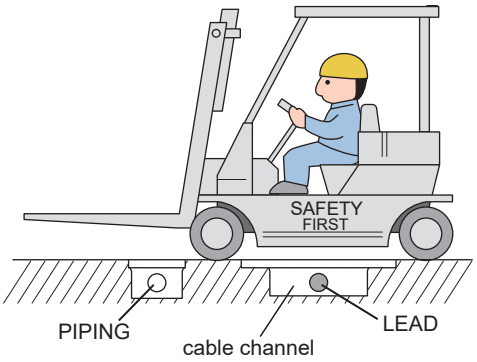
- Do not touch the circuit board directly by hand.

Failure to observe this instruction may result in malfunction of the IC due to static electricity.

4.1 Notes on Cable Junctions

- The cables that connect the controller to peripheral device are low voltage circuits. Keep controller signal cables away from the primary power circuit. High voltage power lines should not be run in parallel to controller signal cables. If running parallel cables is unavoidable, use metal ducts or conduit to isolate electrical signal interference. If cables must be crossed, run the power cables perpendicular across the signal cables.
- Confirm the connector and cable numbers to prevent mis-connection and equipment damage. One connects the manipulator and YRC1000. Another connects the YRC1000 and peripheral device. A wrong connection can cause damage to electronic equipment.
- Clear the area of all unauthorized personnel while making cable connections. Place all cables in a covered cable channel in the floor.

Fig. 4-1: YRC1000 Cable Junction Diagram



4.2 Power Supply

4.2.1 Three-Phase Power Supply

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.

Provide the three-phase power supply as follows.

Table 4-1: Power Supply Specification

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

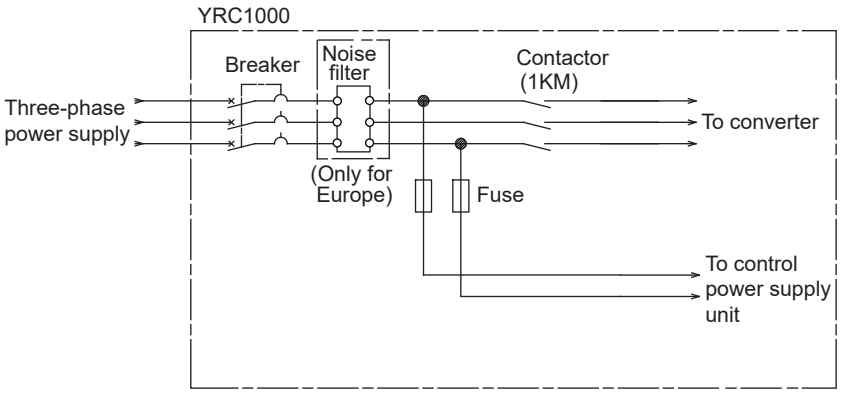
A specification of connectable power supply differs depending on the controller type. Confirm the specification of power supply corresponding to the controller's model by the rated label on the door of YRC1000.

WARNING

- For the power supply of 380 to 480 VAC, make sure to ground the neutral point of the power supply.

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

Fig. 4-2: Input Power Connection



WARNING

- The system must be grounded.

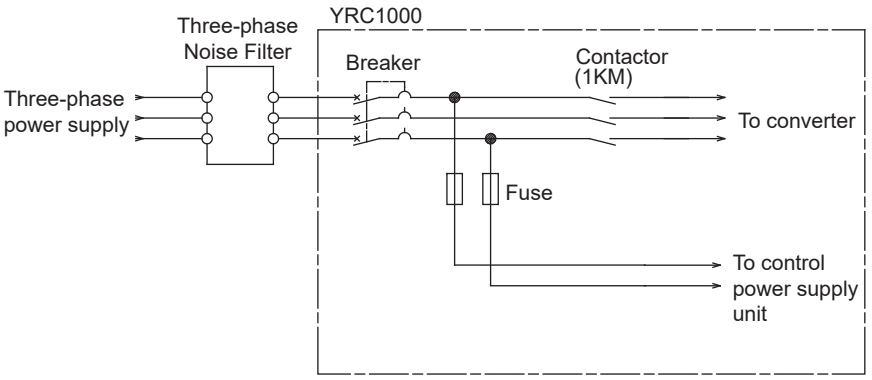
Failure to observe this instruction may result in fire and/or electric shock. Especially in the case where the YRC1000 for European standards is used in Japan, difference in conditions related to electricity such as grounding methods may cause increase in leakage current, which may result in electric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

4.2.2 Noise Filter Installation

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

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

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



4.2.3 Leakage Breaker Installation

When connecting the leakage breaker to the controller power supply wiring, use a leakage breaker which can handle high frequencies from the YRC1000 inverter. Leakage breakers which cannot handle high frequencies may malfunction.

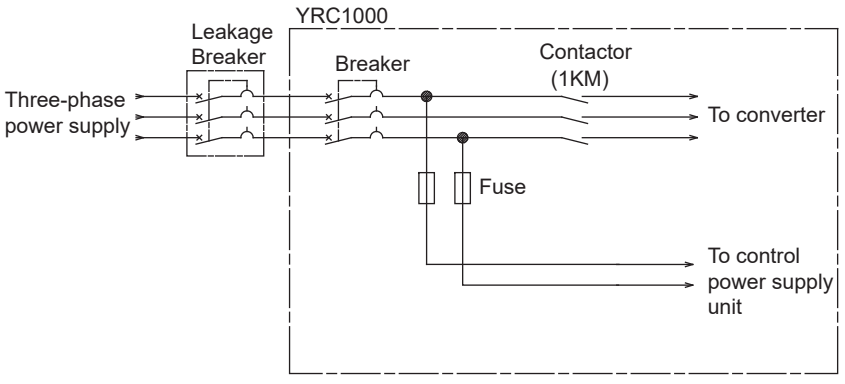
Table 4-2: Example of High Frequency Leakage Breaker

Maker	**Model**
Mitsubishi Electric Co., Ltd.	NV class (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 YRC1000 inverter. However, this current leakage presents no safety risks.

Fig. 4-4: Connection of the Leakage Breaker

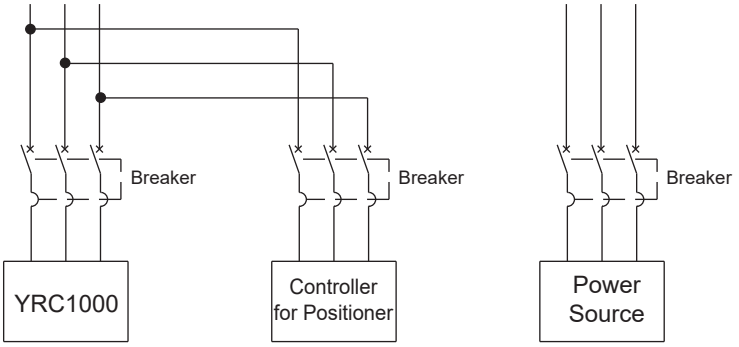


4.2.4 Primary Power Supply Breaker Installation

Install the primary power supply breaker as shown below.

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



NOTE

- The rated current value of the primary power supply breaker should be more than the breaker capacity of YRC1000.
- When an error, such as overload, or short circuit or earth fault occurs, depending on the installed breaker's capacity and cut-off characteristics, the primary power supply breaker could trip before the YRC1000 breaker.

Table 4-3: Example of YRC1000 Breaker Capacity and Cable Size (Sheet 1 of 2)

YRC1000 type	Capacity of breaker in YRC1000 (A)		Cable size (size of terminal) (In case of Cabtyre cable (three cores)) (mm^2)		Major manipulator type	Power capacity (kVA)
	For Japan:200 V	For Asia, For North America, For Europe: 400 V	For Japan, For Asia, For Europe	For North America		
ERAR-1000-06VX8-□□□	15	15	3.5 (M5)	3.5 (M8)	GP7	1.0
	15	15	3.5 (M5)	3.5 (M8)	AR900	1.0
	15	15	3.5 (M5)	3.5 (M8)	GP8	1.0
	15	15	3.5 (M5)	3.5 (M8)	AR700	1.0
ERAR-1000-06VXH25-□□□	15	15	3.5 (M5)	3.5 (M8)	GP10	1.5
	15	15	3.5 (M5)	3.5 (M8)	GP12	1.5
	15	15	3.5 (M5)	3.5 (M8)	AR1440	1.5
	15	15	3.5 (M5)	3.5 (M8)	GP25	2.0
	15	15	3.5 (M5)	3.5 (M8)	AR1730	2.0
	15	15	3.5 (M5)	3.5 (M8)	GP25-12	2.0
	15	15	3.5 (M5)	3.5 (M8)	AR2010	2.0
ERAR-1000-07VXHE6-□□□	15	15	3.5 (M5)	3.5 (M8)	AR1440E	1.5
ERAR-1000-06VXHL20-□□□	30	20	5.5 (M5)	5.5 (M8)	GP20HL	3.5
	30	20	5.5 (M5)	5.5 (M8)	AR3120	3.5

Table 4-3: Example of YRC1000 Breaker Capacity and Cable Size (Sheet 2 of 2)

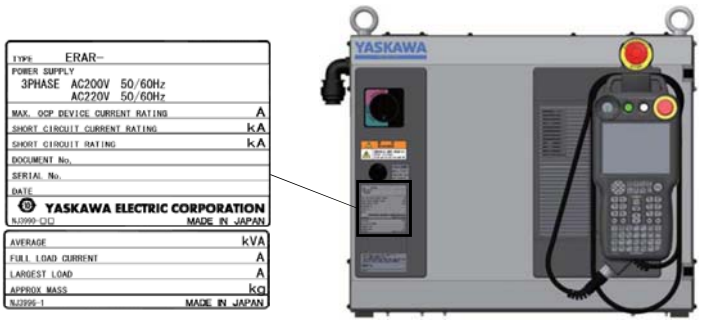
YRC1000 type	Capacity of breaker in YRC1000 (A)		Cable size (size of terminal) (In case of Cabtyre cable (three cores)) (mm^2)		Major manipulator type	Power capacity (kVA)
	For Japan:200 V	For Asia, For North America, For Europe: 400 V	For Japan, For Asia, For Europe	For North America		
ERAR-1000-06VX280-□□□	30	20	5.5 (M5)	5.5 (M8)	GP50	4.5
	30	20	5.5 (M5)	5.5 (M8)	GP35L	4.5
	30	20	5.5 (M5)	5.5 (M8)	GP88	4.0
	30	20	5.5 (M5)	5.5 (M8)	SP80	4.0
	30	20	5.5 (M5)	5.5 (M8)	GP110	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP100	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP130	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP180	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP165	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP180-120	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP165-105	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP200S	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP215	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP225	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP210	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP250	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP235	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP280	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP280L	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP165R	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP150R	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP200R	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP185R	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP110H	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP180H	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP180H-110	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP225H	5.0
	30	20	5.5 (M5)	5.5 (M8)	GP360	5.0
	30	20	5.5 (M5)	5.5 (M8)	ME1000	5.0
ERAR-1000-07VXB110-□□□	30	20	5.5 (M5)	5.5 (M8)	GP110B	5.0
	30	20	5.5 (M5)	5.5 (M8)	SP100B	5.0
ERAR-1000-06VRF130-□□□	30	20	5.5 (M5)	5.5 (M8)	PH130RF	7.5
	30	20	5.5 (M5)	5.5 (M8)	PH130F	7.5
	30	20	5.5 (M5)	5.5 (M8)	PL500	8.0
ERAR-1000-06VX600-□□□	30	20	5.5 (M5)	5.5 (M8)	GP400	7.0
	30	20	5.5 (M5)	5.5 (M8)	GP600	7.0
	30	20	5.5 (M5)	5.5 (M8)	GP400R	7.0

NOTE

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

SUPPLE-MENT

- The maximum load value (payload, operation speed, and frequency, etc.) is displayed. However, the power capacity differs depending on work conditions.
- The power supply capacity shown in *table 4-3 "Example of YRC1000 Breaker Capacity and Cable Size"* is the power capacity of the manipulator only. The power capacity varies depending on the optional specifications, such as the added external axis.
- For the YRC1000 breaker capacity and the power capacity, check the rating label on the controller.

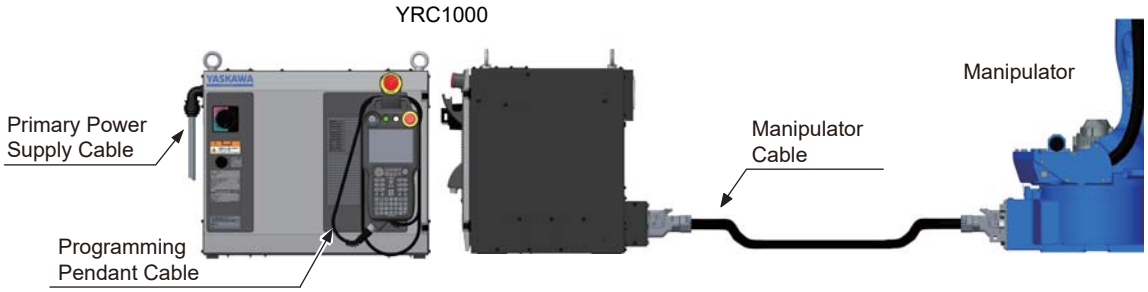


- The power capacity of the manipulator which is not shown in the table above, refer to the table 5-1 "Basic Specifications" of Chapter 5 in the INSTRUCTIONS for the manipulator.
- Short Circuit Current Rating(SCCR) shown in *table 14-10(a) "Equipment Configuration (for Small-Capacity Model 1-1)"* and *table 14-10(c) "Equipment Configuration (for Medium/Large-Capacity Model 1-1)"* .

4.3 Connection Methods

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

Fig. 4-6: Cable Connection

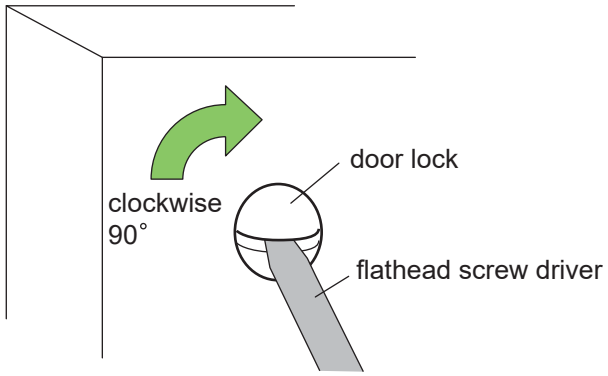


4.3.1 Connecting the Primary Power Supply

1. Open the front door of the YRC1000.

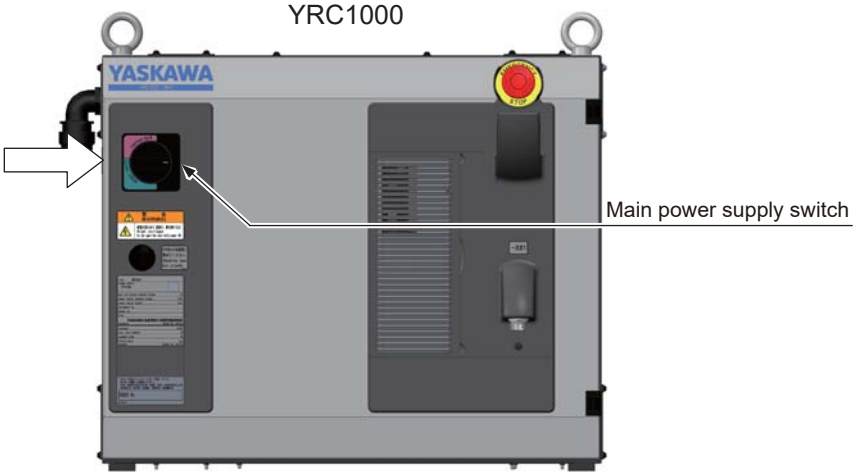
   (1) Using a flathead screwdriver, rotate the door locks on the front of the YRC1000 (one place) 90 degrees clockwise.

Fig. 4-7: Rotating the Key Clockwise



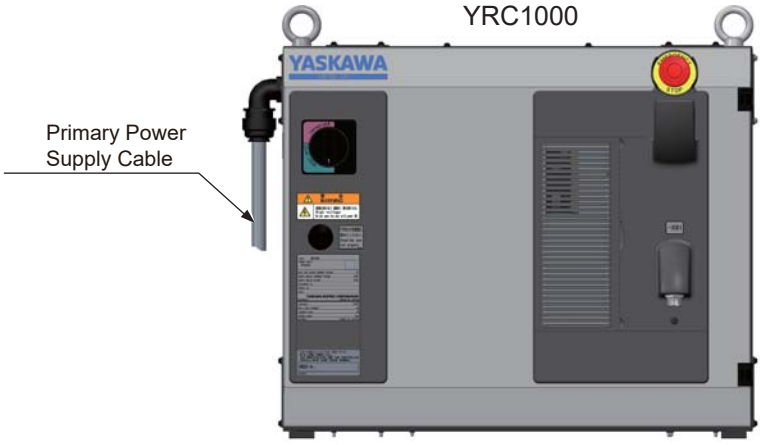
   (2) Rotate the main power supply switch to the “OFF” position and open the door gently.

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



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

Fig. 4-9: Cable Clamp



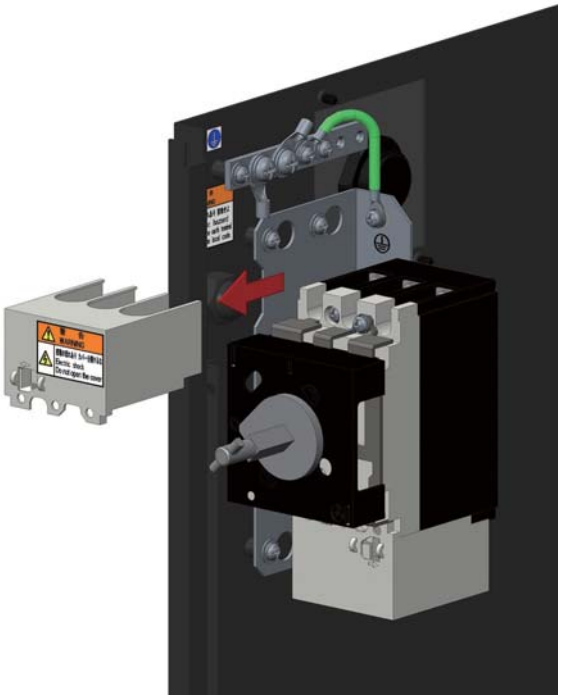
WARNING

- Before wiring the cable, make sure the primary power supply is turned OFF.
- Make sure to use a cable clamp to connect the primary power supply cable to the YRC1000.
- Make sure to tightly fasten the cable clamp to prevent the ingress of dust, dirt, or water.

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

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

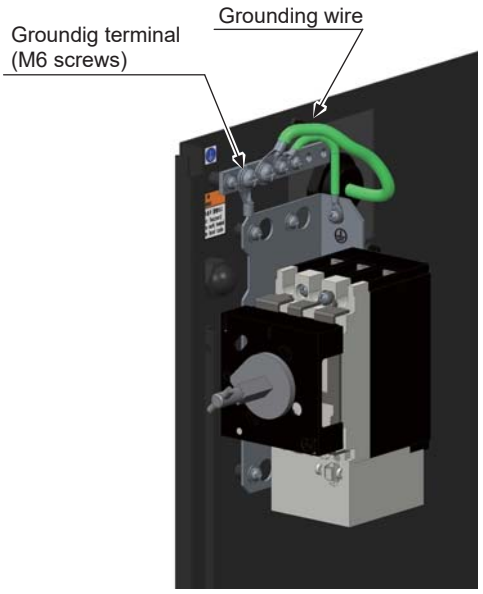
Fig. 4-10: Pulling Off the Cover



(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) which is on the upper left side of YRC1000.

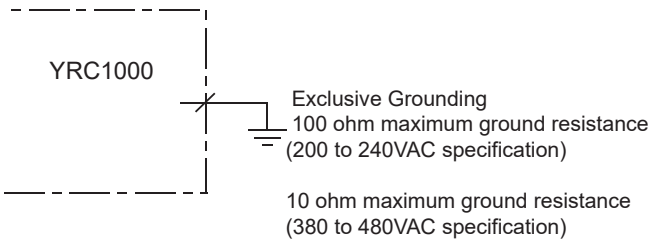
Fig. 4-11: Connection of the Ground Wire



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

NOTE The customer must prepare the ground wire.

Fig. 4-12: Exclusive Grounding



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

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

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

(3) Connect the primary power supply cable.

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



(4) Install the cover.

Fig. 4-14: Install the Cover

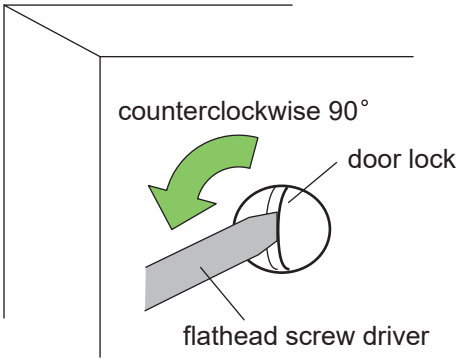


4. Close the YRC1000 door.

   (1) Close the door gently.

   (2) Rotate the door lock counterclockwise 90 degrees.

Fig. 4-15: Rotating the Key Counterclockwise



WARNING

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

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

4.3.2 Connecting the Manipulator Cable

WARNING

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

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

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

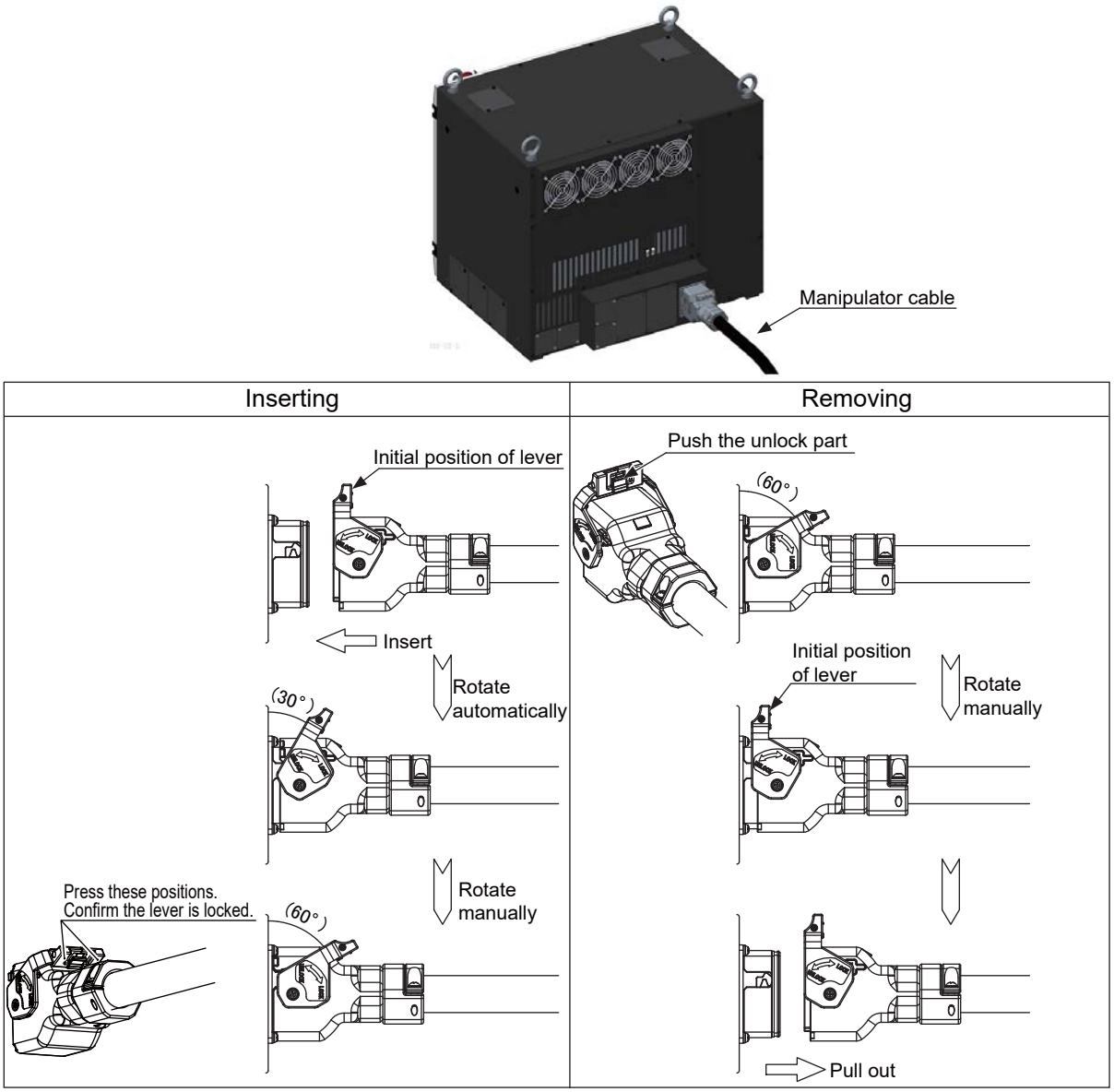
   (1) Confirm that the connector lever of manipulator cable is at the initial position. Then insert the manipulator cable straight into the connector on the back side of YRC1000.

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

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

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

Fig. 4-16: Connection of the Manipulator Cable



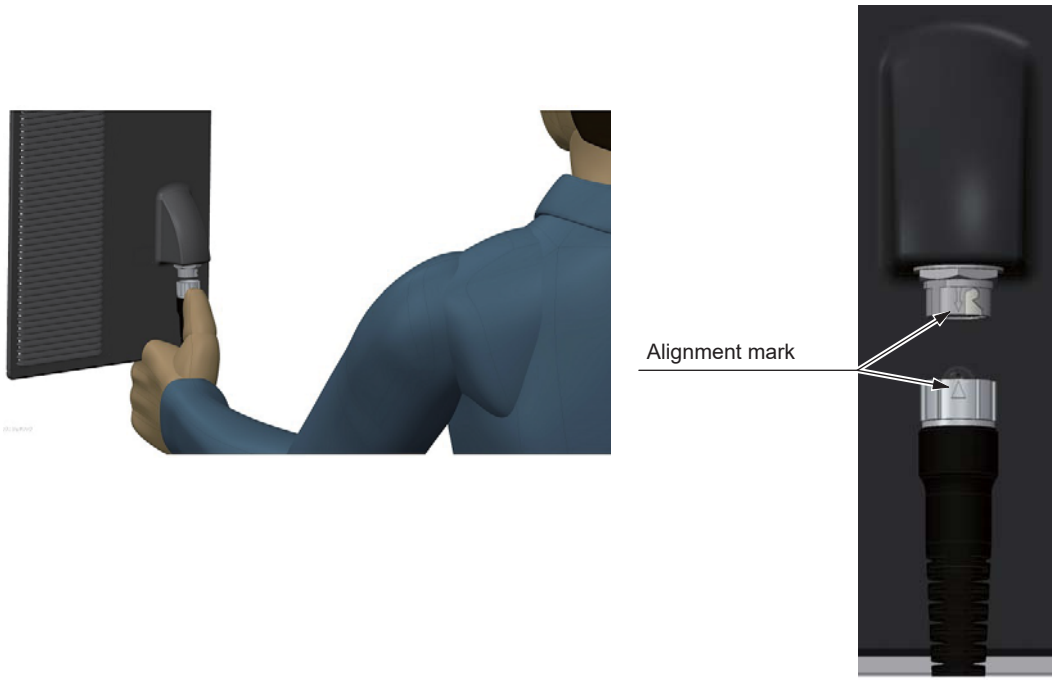
2. Connect the manipulator cable to the manipulator.

   – Confirm the connector number of manipulator cable. Push the cable connector into the manipulator side connector firmly, and tighten securely in the same procedure as step1.

4.3.3 Connecting the Programming Pendant

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

Fig. 4-17: Connecting the Programming Pendant



– The manipulator, YRC1000, and the programming pendant connections are now complete.

Table 4-4: Specifications of Programming Pendant Cable

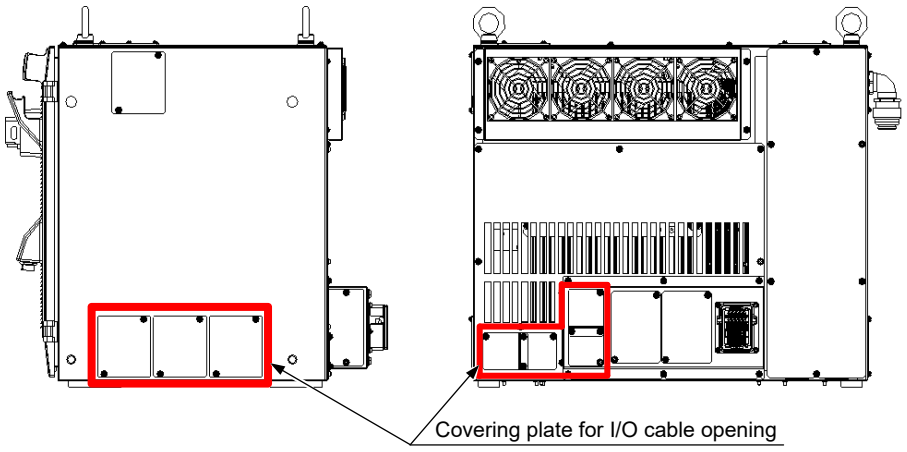
Outside diameter (mm)	Minimum bending radius (mm) (fixed part)
9.0 dia.	60

4.3.4 User I/O Cable Connection

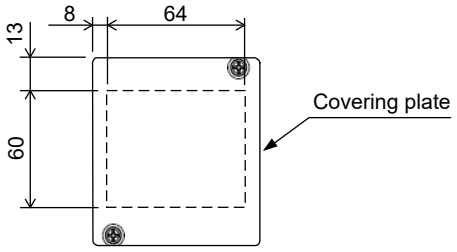
User can choose one I/O cable connection method out of following three ways.

Connect user I/O signal to I/O terminal blocks (TIFS553YS) that are connected to general-purpose I/O board (JANCD-AIO0□-E)	User connects general-purpose 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 safety terminal block board (IM-YE250/5-80P)	Connect safety plug and system external signal for external emergency stop, etc. to safety terminal block board which is mounted on the back side of the controller's front door.
Directly connect user I/O signal to general-purpose I/O board (JANCD-AIO0□-E)	User connects user I/O signal to general-purpose I/O board (JANCD-AIO0□-E) directly.

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



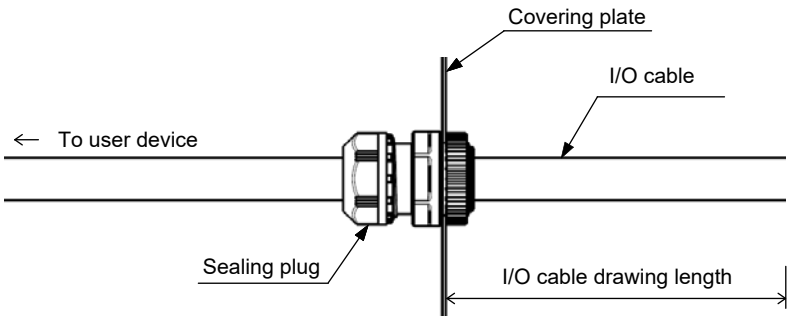
2. Make a hole on each covering plate and run the user I/O cable.
   – Cut a hole in the covering plate on the right side of the controller that is within the dimensions shown in the following figure (64 mm × 60 mm).



Hole to Cut in Right-Side Covering Plate

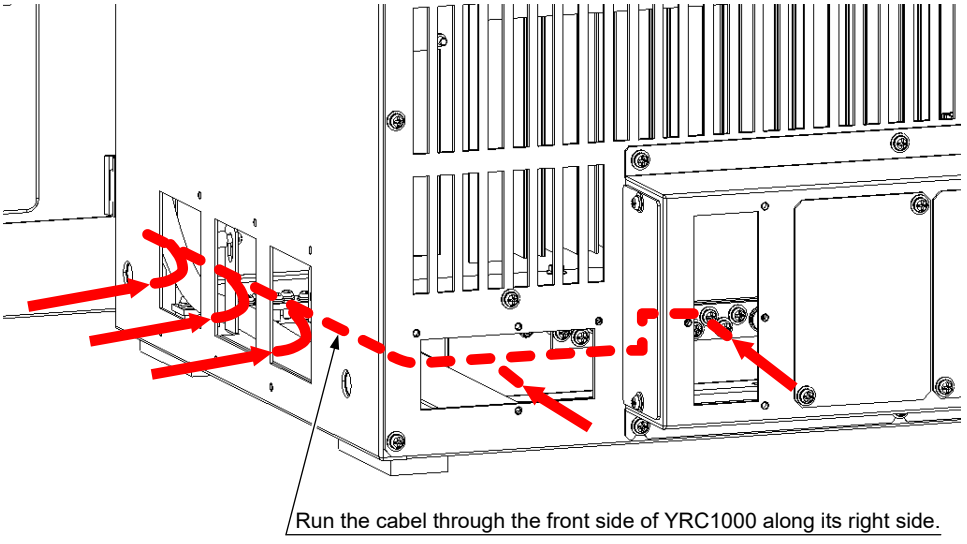
   – Use a cable gland, etc. to prevent any particles from getting inside the YRC1000.
   – For the drawing length of the cable, refer to the table in the next page since it varies depending on the connecting part.

3. After running the cable through the I/O cable opening, set the covering plate back to the original position.



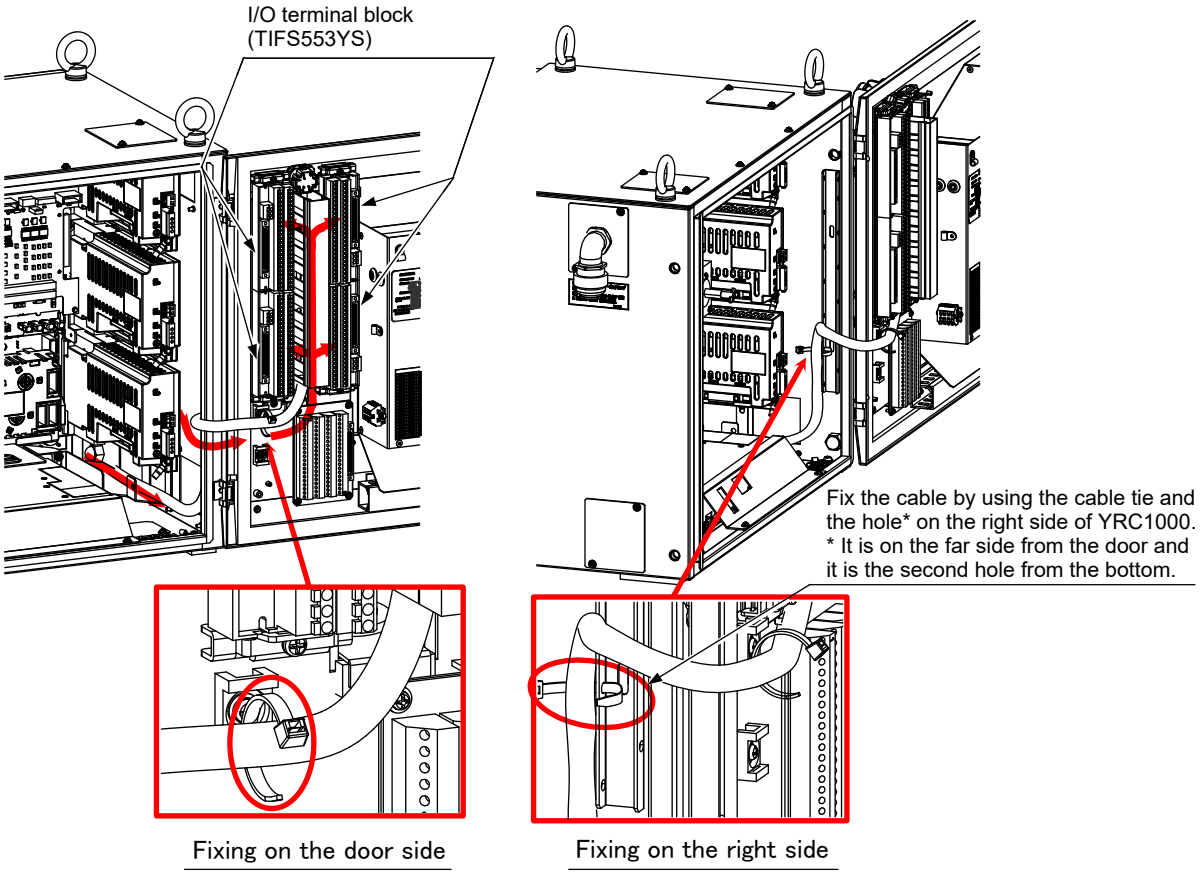
Connect user I/O signal to I/O terminal blocks (TIFS553YS) connected to general-purpose I/O board (JANCD-AIO0□-E)	Drawing length: 1.5m (Cable length for terminal processing is included)	Cable terminal process: Unshielded Refer to *"Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)"* in *chapter 14.8 "General-Purpose I/O Board (JANCD-AIO0□-E)"*.
Connect safety plug and system external signal for external emergency stop, etc. to safety terminal block board (IM-YE250/5-80P)	Drawing length: 1.3m (Cable length for terminal processing is included)	Cable terminal process: Unshielded Refer to *"Wiring Procedure of the Terminal Block"* in *chapter 14.7 "Safety Terminal Block Board (IM-YE250/5-80P)"*.
Directly connect user I/O signal to general-purpose I/O board (JANCD-AIO0□-E)	Drawing length: 1.0m (Cable length for terminal processing is included)	Cable terminal process: Connector Refer to *"Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)"* in *chapter 14.8*.

4. Draw the user system external signal cable and general-purpose I/O signal cable from the cable openings to the front part of the controller along its right side.



5. Run the general-purpose I/O signal cable through the I/O terminal block as shown by the red line in the figure below.

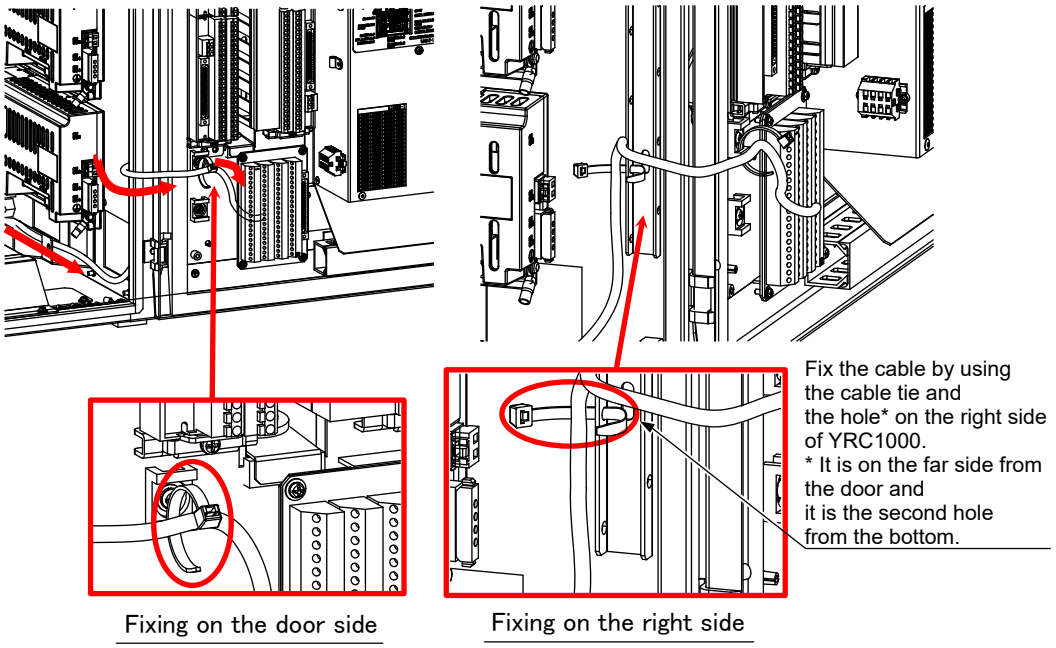
   – For the details of the connection, refer to *"Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)"* in *chapter 14.8 "General-Purpose I/O Board (JANCD-AIO0□-E)"*



Fix the cable on the door and right side by using the cable ties as the figure.
Note the following two points.
-No tension is found to the cables when the door is fully opened.
(Cable length between fixing part of the door side and the right side: approximately 150mm)
-Be careful not to get stuck the cables between the main body of the controller and its door when the door is closed.

6. Run the system external signal cables such as the safety I/O signals through the safety terminal block board (IM-YE250/5-80P) as shown by the red line in the figure below.

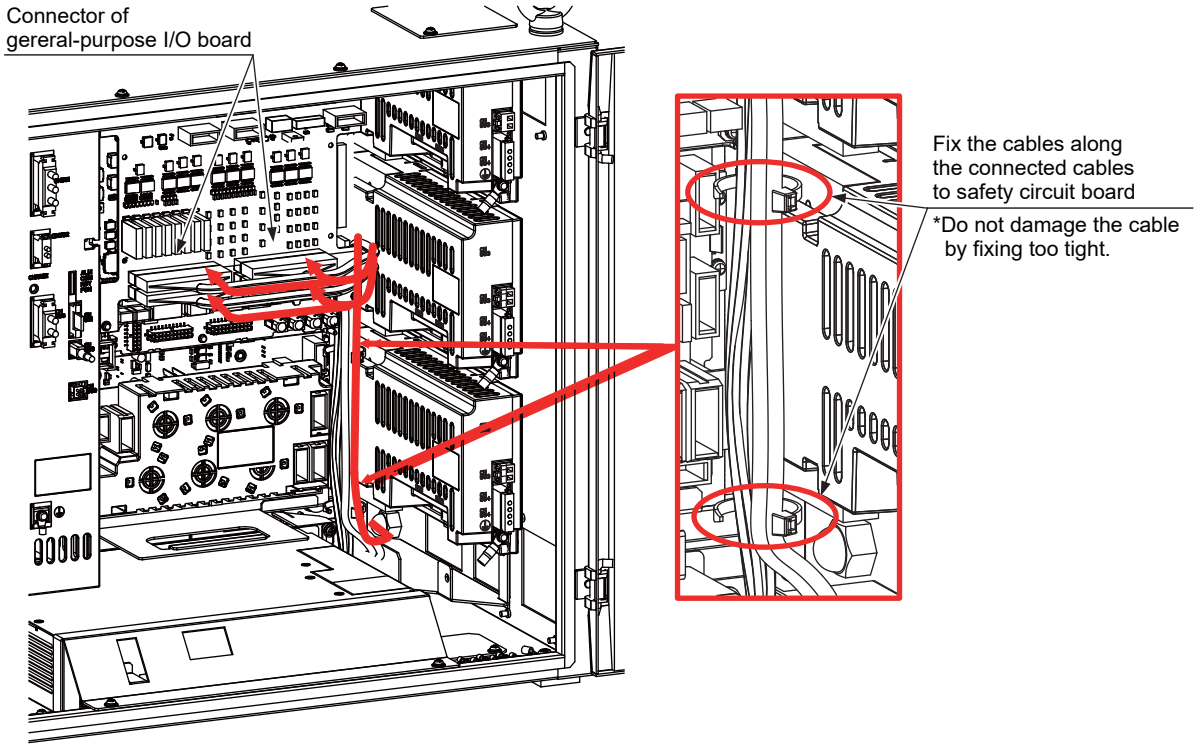
   – For the details of the connection, refer to *"Wiring Procedure of the Terminal Block"* in *chapter 14.7 "Safety Terminal Block Board (IM-YE250/5-80P)"*



Fix the cable on the door and right side by using the cable ties as the figure.
Note the following two points.
-No tension is found to the cables when the door is fully opened.
(Cable length between fixing part of the door side and the right side: approximately 150mm)
-Be careful not to get stuck the cables between the main body of the controller
and its door when the door is closed.

7. Run the general-purpose I/O signal cables through the general-purpose I/O board (JANCD-AIO0□-E) as shown by the red line in the figure below.

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



5 Turning ON and OFF the Power Supply

5.1 Turning ON the Main Power Supply

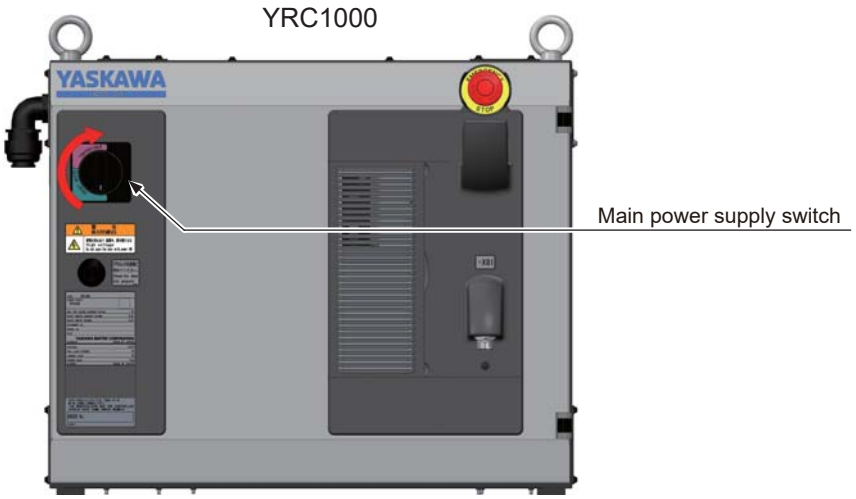
WARNING

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

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

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

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



5.1.1 Initial Diagnosis

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

Fig. 5-2: Startup Window



5.1.2 When Initial Diagnosis Are Complete

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

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

Fig. 5-3: Initial Window



WARNING

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

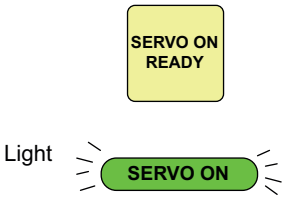
Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.

5.2 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.



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

5.2.2 Play Mode Enable Function

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

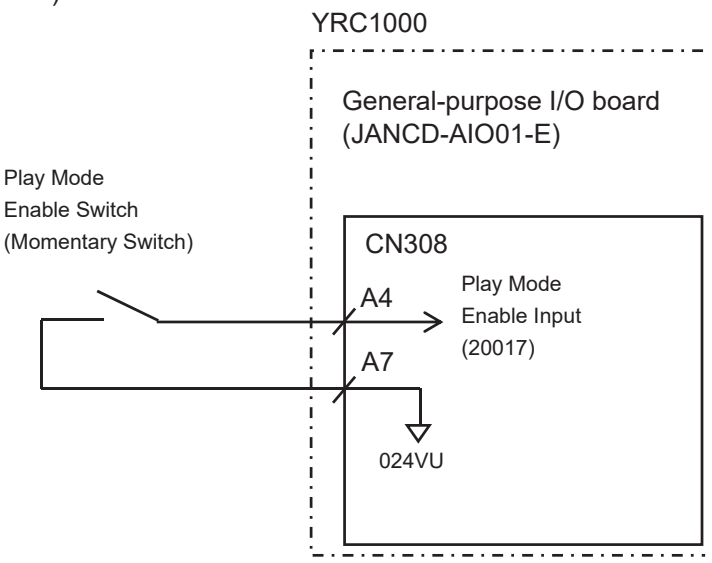
This function is available for YAS4.71.00A-00 or later.

5.2.2.1 Preparation of Switch

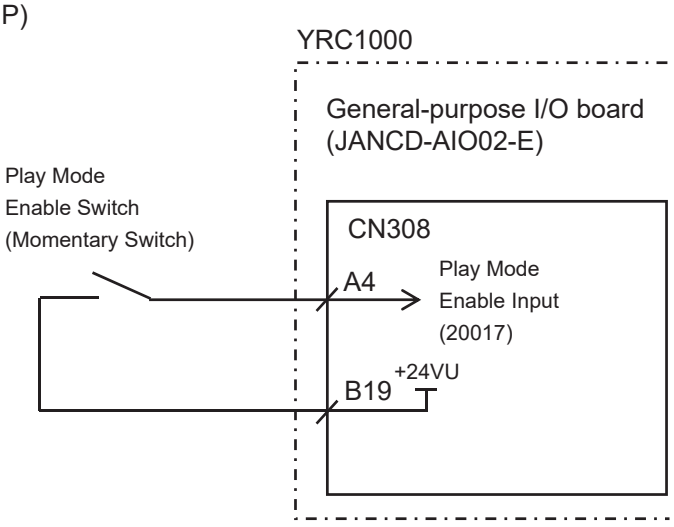
Install an external device (switch, etc.) used to input the play mode enable signal outside the safety fence and connect the device to the YRC1000 so that the operator can change the operation mode to the play mode after moving to the outside of the safety fence. Prepare the external device by the user.

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

- When using the general-purpose I/O board JANCD-AIO01-E (NPN)



- When using the general-purpose I/O board JANCD-AIO02-E (PNP)



In *table 5-4 "Play Mode Enable Switch Connection Example"*, the play mode enable signal is input to the general-purpose input signal #20017. The general-purpose signals can be set at the discretion of the user from the user's system.

NOTE

Set the concurrent I/O to turns ON the specific input signals #40053 of the play mode enable by the enable switch input.

<Concurrent I/O setting example>

STR#20017
(input signal that connects the Play Mode Enable switch)

OUT#40053
(specific input signal for Play Mode Enable)

SUPPLE -MENT

For the details on the connecting of the general-purpose I/O board (JANCD-AIO0□-E) connectors, refer to *chapter 14.8 "General-Purpose I/O Board (JANCD-AIO0□-E)"* .

5.2.2.2 Settings

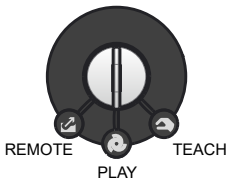
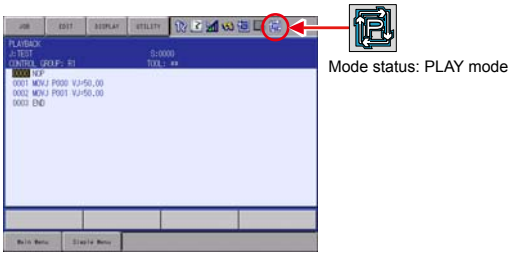
The play mode enable signal is disabled at factory setting. Set the parameter to enable the signal.

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

Set S2C1903 to "1" and restart the YRC1000 to enable the Play Mode Enable function.

5.2.2.3 Procedures for Operation Mode Change

■ **Change of Operation Mode to PLAY Mode**

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

WARNING

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

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

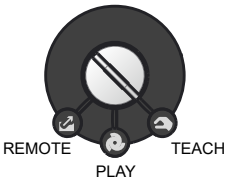
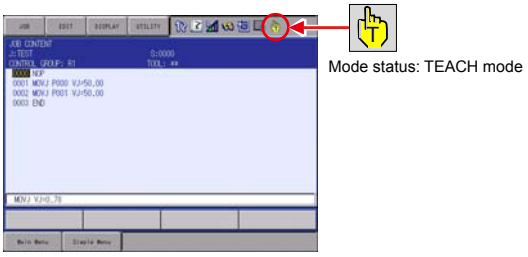
NOTE

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

NOTE

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

■ Change of Operation Mode to TEACH Mode

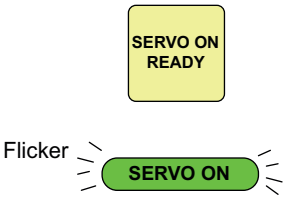
	Operation	Explanation
1	Set the mode switch on the programming pendant to “TEACH”.  	The operation mode is changed to the teach mode. The mode status icon located up right of the programming pendant screen changes to TEACH mode icon as shown below. 

NOTE

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

5.2.3 During Teach Mode

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



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



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

Servo Power ON/OFF --- Enable Switch

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



NOTE

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

How to adjust the length of the strap

To adjust the length of the strap of the programming pendant, use the Velcro section inside the strap cover.

SUPPLE -MENT



■ **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 / Safety Signal	Play Mode	Teach Mode
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
Servo Power Enable (ONEN)	Valid	Valid
Manipulator Overrun (OT)	Valid	Valid
External Axis Overrun (EXOT)	Valid	Valid
Speed Limit	Invalid	Valid

5.3 Turning OFF the Power Supply

5.3.1 Turning OFF the Servo Power (Emergency Stop)

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

- Press the emergency stop button and the servo power supply is turned off.
  The emergency stop buttons are located on the front door of the YRC1000 and on the upper right of the programming pendant.
- The brake operates once the servo power supply is turned OFF, and the manipulator can no longer operate.
  The emergency stop mode can be operated at any mode.
  (Teach mode, Play mode, Remote mode)



Programming Pendant

EMERGENCY STOP

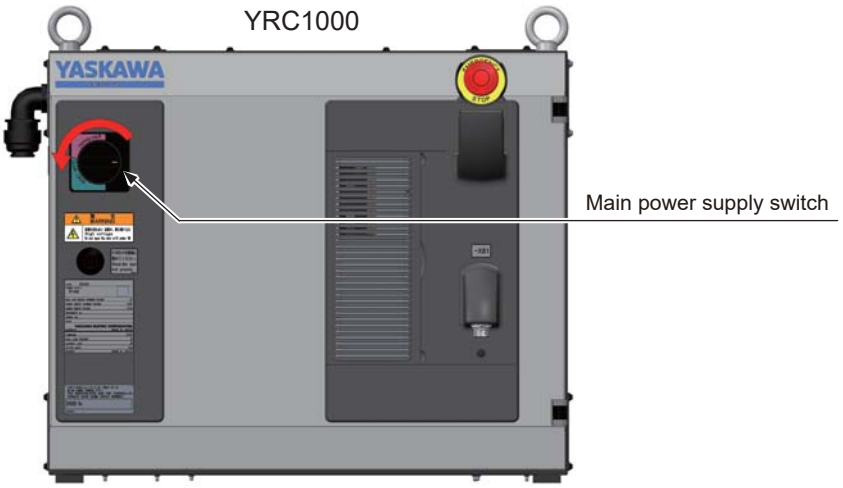


Door upper side

5.3.2 Turning OFF the Main Power

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

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



NOTE

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

If turn the YRC1000 power supply OFF during the data writing, the data may be broken. Do not turn the power supply OFF when the hour glass pointer is seen on the programming pendant.

5.3.3 The Method of Stopping Manipulator Operation

The following 3 categories are stop functions of the manipulator.

- Stop Category 0
  The immediate insulation of the motor power source to servo motor causes the stop.
  After the motor power is insulated, the manipulator and the external axis decelerate by the brake and stop.
  The manipulator and the external axis may run off the operation path (Path).
- Stop Category 1
  The manipulator and the external axis are controlled on the operation path, decelerate and then stop.
  After the stop, the manipulator and the external axis are locked by the brake and the motor power is insulated.
- Stop Category 2
  The manipulator and the external axis are controlled on the operation path, decelerate and then stop.
  After the stop, the stop position is retained in a state that the motor power is being supplied.

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

The method of stopping the manipulator by each stop signal is shown in the following table.

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		○	
Safeguarding (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.
Thus, when using the stop category 1, perform the risk assessment of the whole system by considering increased stopping distance and stopping time.

6 Test of Program Operation

DANGER

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

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

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

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

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

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

WARNING

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

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

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

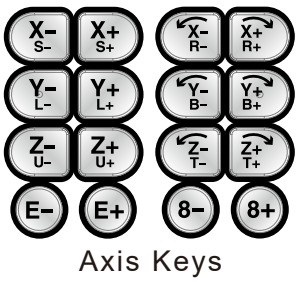
Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.

6.1 Movement of the Axes

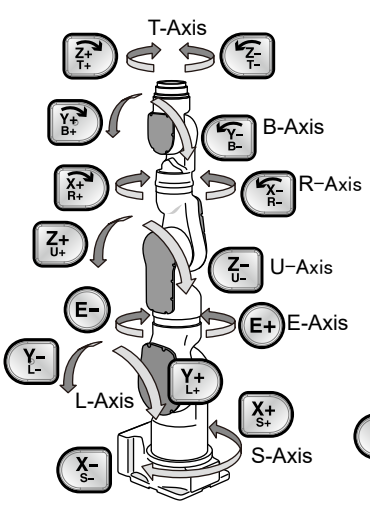
Move each axis of the manipulator by pressing the axis keys on the programming pendant.

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

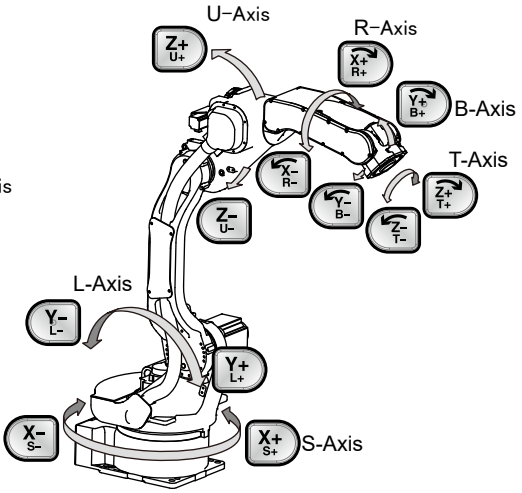
> **NOTE** Be sure to remove all items from the area before moving the manipulator.
> For details on the appropriate position of the fixture, the INSTRUCTIONS for the manipulator.



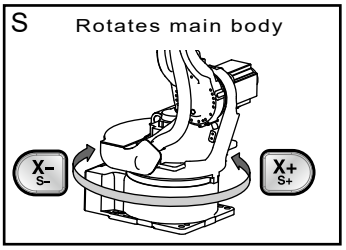
Axis Keys

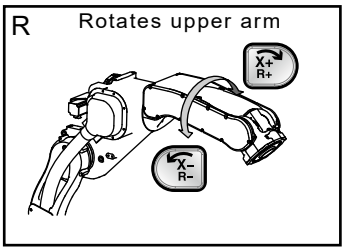


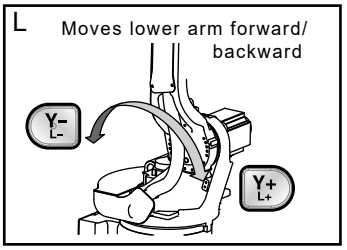
7-Axis manipulator

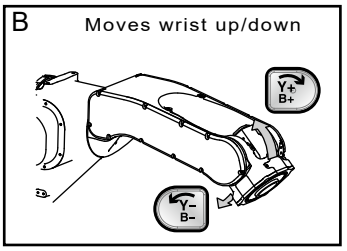


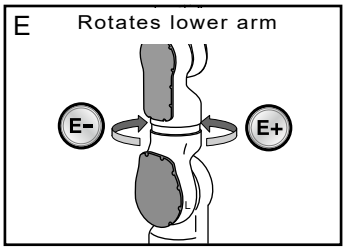
6-Axis manipulator

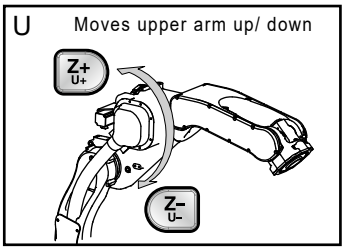


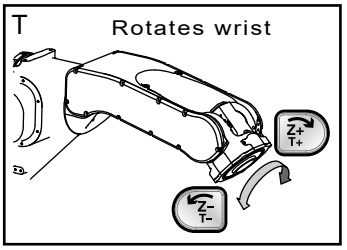








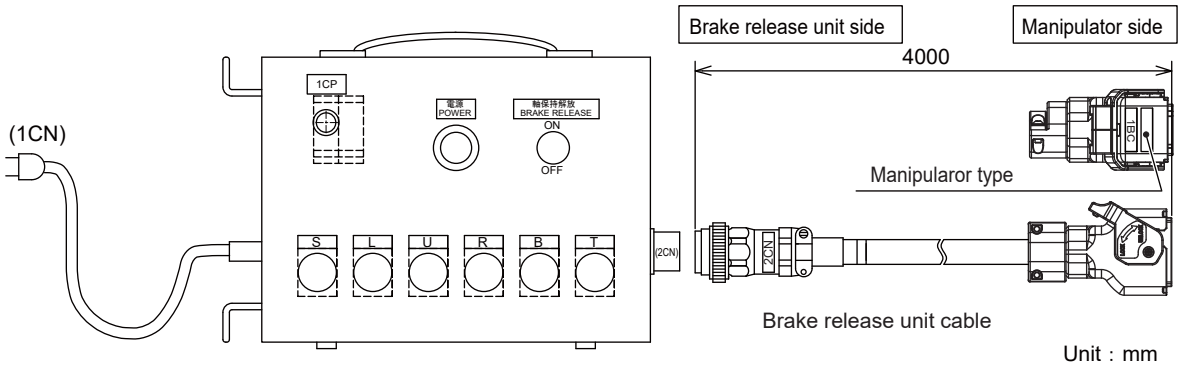




6.2 Manual Brake Release Function

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

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



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

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

Be very careful about the followings when using.

DANGER

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

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

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

If the brakes of two or more axes must be released simultaneously out of necessity, pay careful attention to ensure the safety of the surrounding operation environment because the manipulator's arm may move in an unexpected way.
Failure to observe this instruction may result in personal injury and/or equipment damage.

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

System Up

7 Security System

7.1 Protection through Security Mode Settings

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

7.1.1 Security Mode

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

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

Operating the one time manage mode requires to enter the security code, which is issued by 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 “YRC1000 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY FUNCTION (HW1483576)” for more details.
One Time Manage Mode	This mode allows to operator to maintain the mode which is higher than the management mode. The loading limitation of the batch data (CMOS.BIN), the parameter batch data (ALL.PRM) and the functional definition parameter (FD.PRM) are removed.

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

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

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

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

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

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

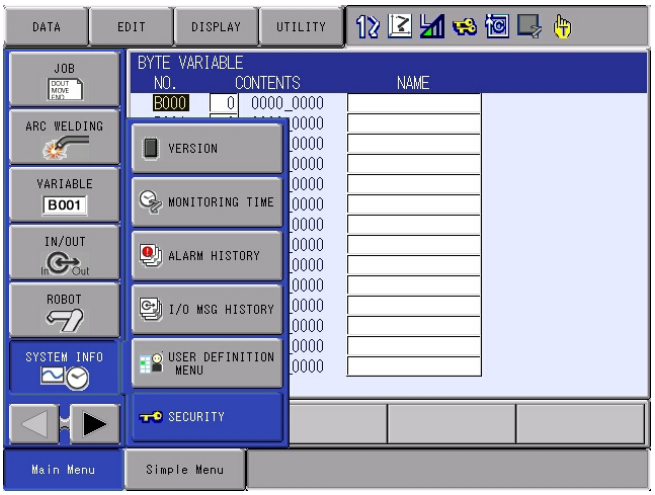
Table 7-2: Menu & Security Mode (Sheet 4 of 4)

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
	OPERATING STATUS	Operation	Edit
	JOB MONITOR	Operation	Edit
	STEP DIAGNOSIS	Operation	Edit
	ROBOT MONITOR	Operation	Edit
DISPLAY SETUP	CHANGE FONT	Operation	Operation
	CHANGE BUTTON	Operation	Operation
	INITIALIZE LAYOUT	Operation	Operation
	CHANGE WINDOW PATTERN	Operation	Operation
	TOUCH OPE. SETTING	Operation	Operation
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 SETTING	Management	Management
GENERAL	WEAVING	Operation	Edit
	GENERAL DIAG.	Operation	Edit
COMMON TO ALL APPLICATIONS	I/O VARIABLE CUSTOMIZE	Operation	Operation

1 Displayed in the teach mode only.
2 Displayed in the play mode only.
3 Displayed when the job reconstruction function is valid.
*As for the menu and the security mode when the functional safety is valid, refer to “YRC1000 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY BOARD OPERATION (HW1483576)” for more details.

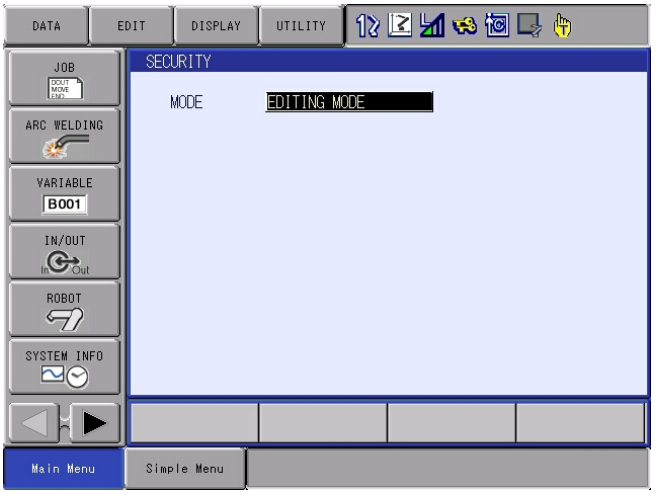
7.1.1.1 Changing the Security Mode

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

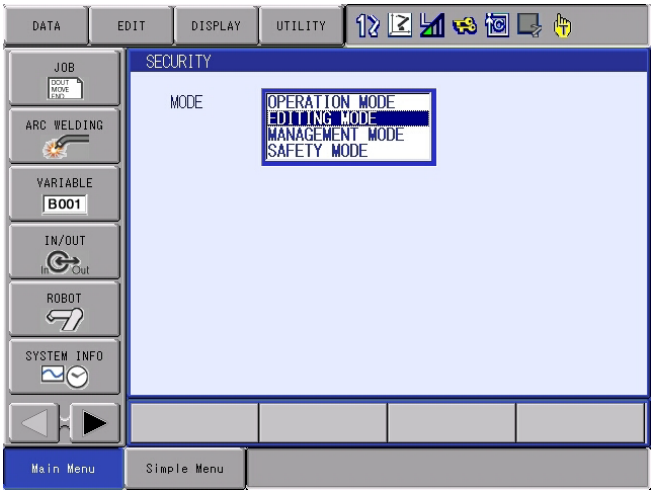


Note: Icons for the main menu, such as arc welding system, differ depending on the system being used.

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

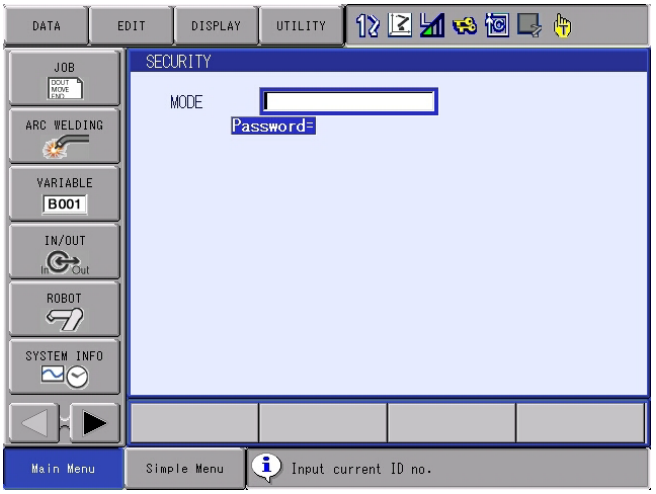


– Security mode can be selected from “OPERATION MODE”, “EDITING MODE”, “MANAGEMENT MODE” or “SAFETY MODE”.



3. Select the security mode to change.

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



4. Enter the password.

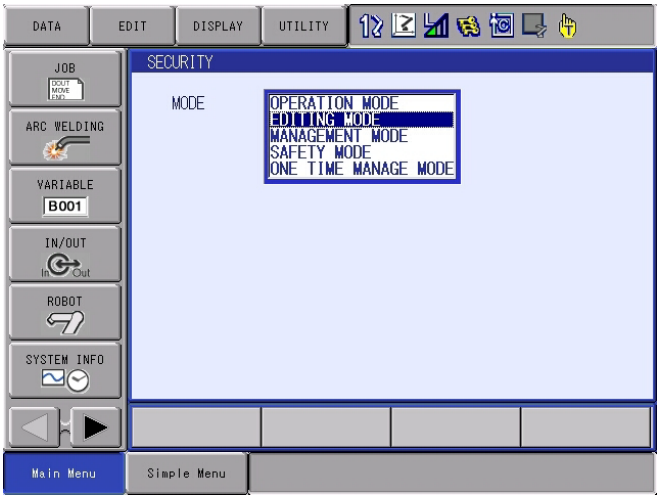
– The following user ID numbers are set as default.
Editing Mode: [0000000000000000]
Management Mode: [9999999999999999]
Safety Mode: [5555555555555555]

5. Press [ENTER].

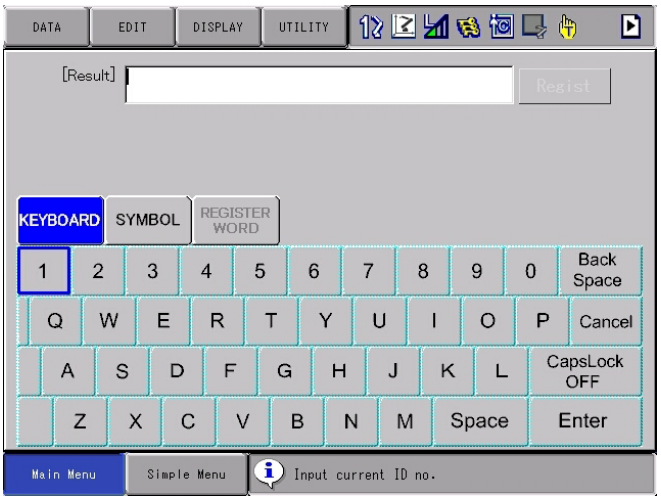
– If the password is correct, the security mode will be changed.

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

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



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



7.1.2 User ID

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

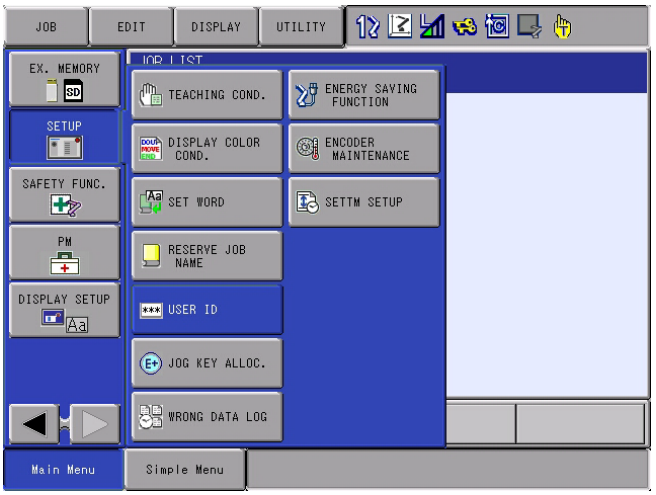
The user ID should be 4 or more and 16 or less characters with number(s) and symbol(s) for the editing mode and the management mode. As for the safety mode, it should be 9 or more and 16 or less characters with number(s) and symbol(s).

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

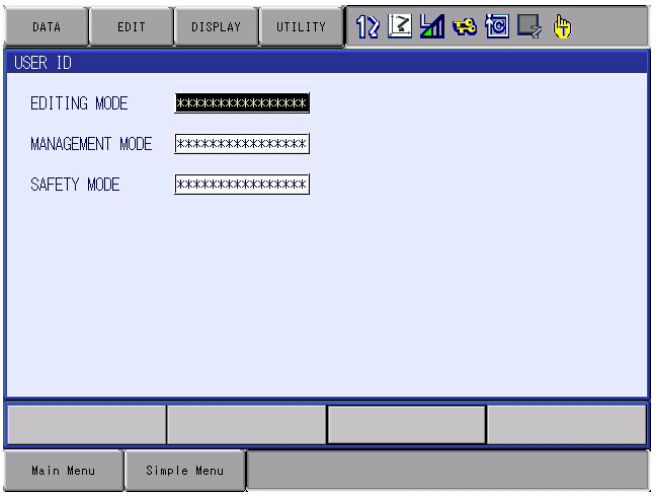
7.1.2.1 Changing User ID

In order to change the user ID, the YRC1000 must be in the editing mode, the management mode or the safety mode. Higher security modes can make changes the user ID of to lower security modes.

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

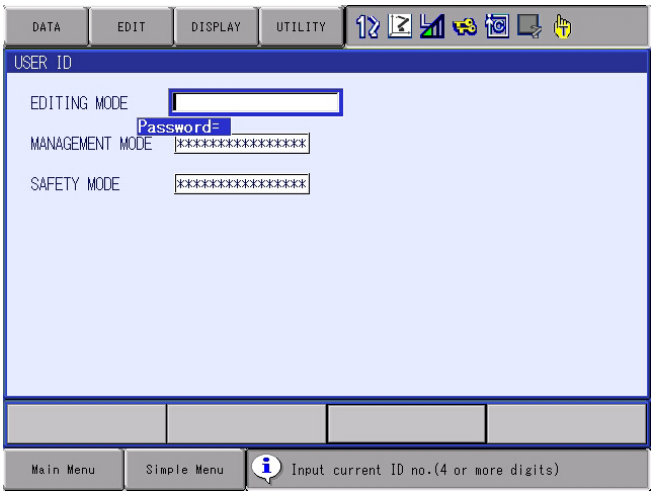


2. Select {USER ID}.
   – The USER ID window appears.



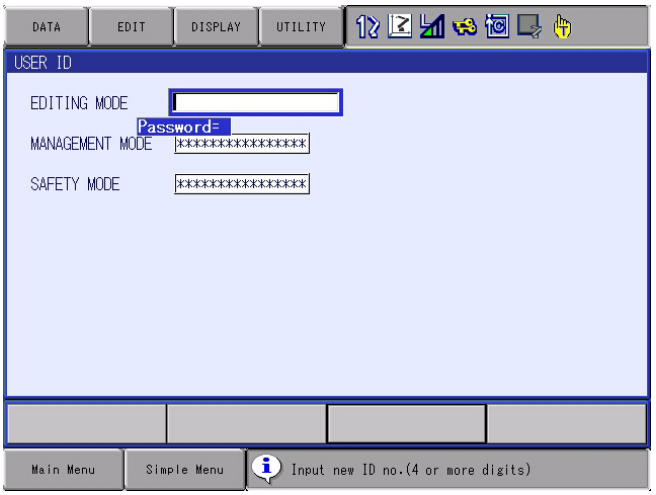
3. Select the desired ID.

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



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

– When the correct user ID is entered, a new ID is requested to be input. “Input new ID no.(4 or more digits)” appears.
(As for the safety mode, 9 or more digits)



5. Input new ID and press [ENTER].

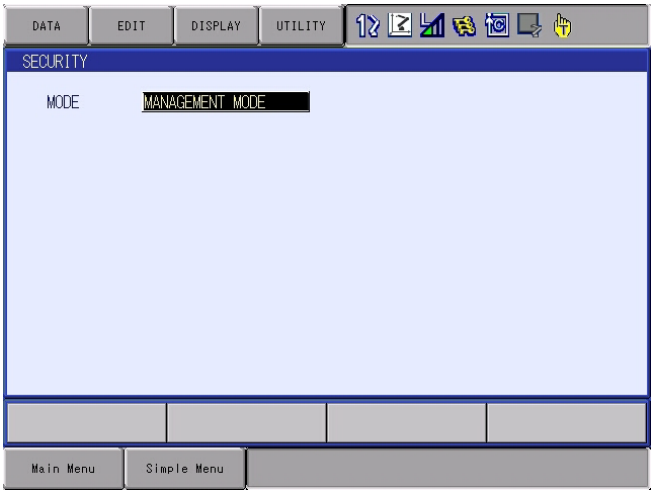
– User ID is changed.

7.1.3 Main CPU SD Card ID

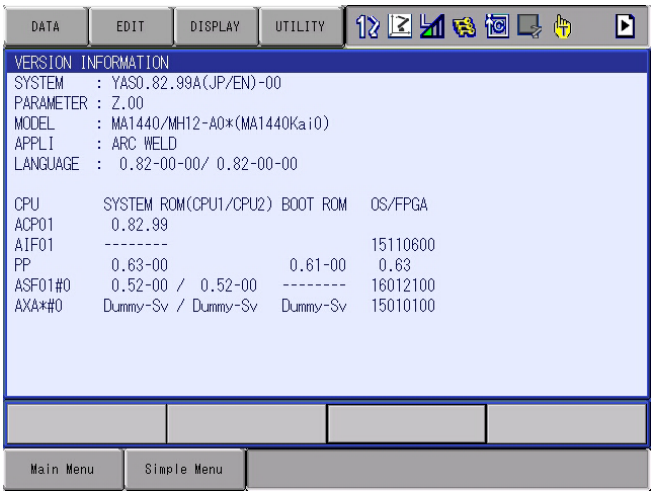
To display the Main CPU SD Card ID is described below.

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

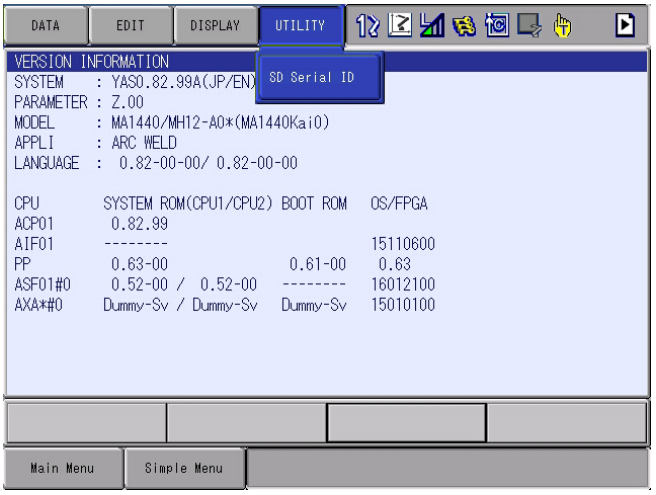
1. Change the security mode to the management mode.



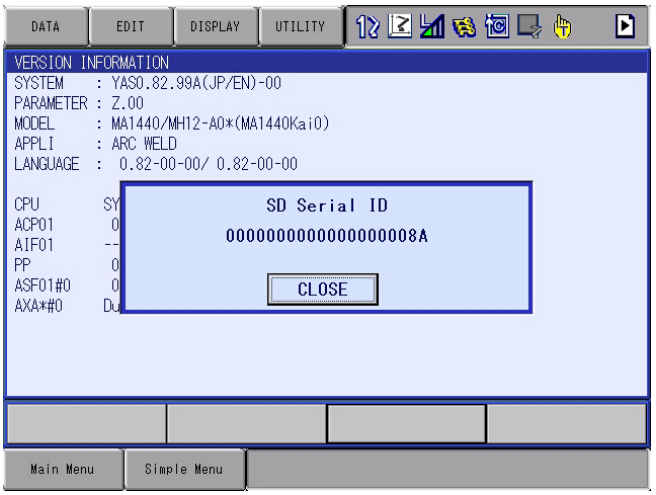
2. Select {SYSTEM INFO} in the main menu.
   – The sub menu appears.
3. Select {VERSION}.
   – VERSION window appears.



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



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



8 System Setup

WARNING

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

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

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

NOTICE

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

8.1 Home Position Calibration

DANGER

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

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

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

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

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

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

WARNING

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

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

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

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

8.1.1 Home Position Calibration

NOTE

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

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

- Change in the combination of the manipulator and YRC1000
- Replacement of the motor or absolute encoder
- Clearing stored memory (by replacement of AIF01-1E circuit board, weak battery, etc.)
- Home position deviation caused by hitting the manipulator against a workpiece, etc.

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

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

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

Home Position

SUPPLE-MENT

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

Certain axes, such as the wrist axes of the manipulator, have a configuration in which multiple axes move in an interconnected manner (a configuration in which a different axis is made to rotate when a specific axis is moved). For this reason, corrective control is performed to eliminate this interconnected motion so that each axis can operate independently.

To perform home position calibration by selecting each axis individually, the position of the interconnected axis must be taken into consideration.
The interconnected axes of each manipulator model are listed below. When home position calibration is performed for the interconnected axis, do so with the primary axis set to the home position.
If home position calibration is performed for the interconnected axis without the primary axis set to the home position, the home position is not set correctly.
Contact your YASKAWA representative for models not found in the following list.

<Example> For the GA50
Perform home position calibration for the B-axis when the R-axis is set to the home position.
Perform home position calibration for the T-axis when the R-axis and the B-axis are set to the home positions.

NOTE

Table 8-1: Interconnected Axes of Manipulator Models

Manipulator Model	**Primary Axis**	**Interconnected Axis**
AR700,AR900,AR1440,AR1440E, AR1730,AR2010,AR3120,GP4,GP7, GP8,GP8L,GP12,GP15HLB,GP20HL, GP25,GP25-12,GP25SV,GP35H, MPOS225H,PL80,SP110H,SP180H, SP180H-110,SP225H,SP225H-135	B-axis	T-axis
GA50,GP35L,GP50,GP70L,GP88, GP110,GP110B,GP165R,GP180, GP180-120,GP200R,GP200S,GP215, GP225,GP250,GP280,GP300R,GP400, GP400R,GP600,PH130F,PH130RF, PH200R,PH200RF,SP80,SP100, SP100B,SP130,SP150R,SP165, SP165-105,SP185R,SP210,SP235	R-axis	B-axis
	R- and B-axis	T-axis
PL190,PL320,PL500,PL800,HC10, HC10DT,HC10DTP,HC10DTF, HC10DTFP,HC10SDTP,HC20DT, HC20DTP,HC20SDT,HC20SDTP, HC30PL,UH100Y	Not applicable	

The manipulator’s encoders are configured with model information. Alarm 1915 "CONTROLLER TYPE MISMATCH (SERVO)" occurs in the following cases.

- If the manipulator's motor is replaced with a motor used on a different model
- If the manipulator's encoders are replaced with encoders used on a different model

The model information can be reset without alarm occurring by performing home position calibration with the following parameters.

NOTE

S2C1962: Model Information Maintenance Mode
0: Standard mode
1: Maintenance mode

The procedure for resetting the manipulator's model information is shown below.

1. Set the model information maintenance mode to maintenance mode, and reset the robot controller.
2. Perform home position calibration.
3. Set the model information maintenance mode to standard mode, and reset the robot controller.

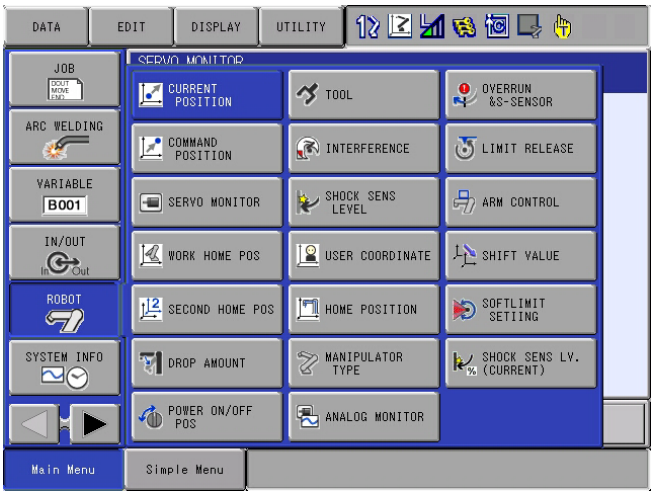
For details on the procedure to reset the manipulator's model information, contact your YASKAWA representative.

8.1.2 Calibrating Operation

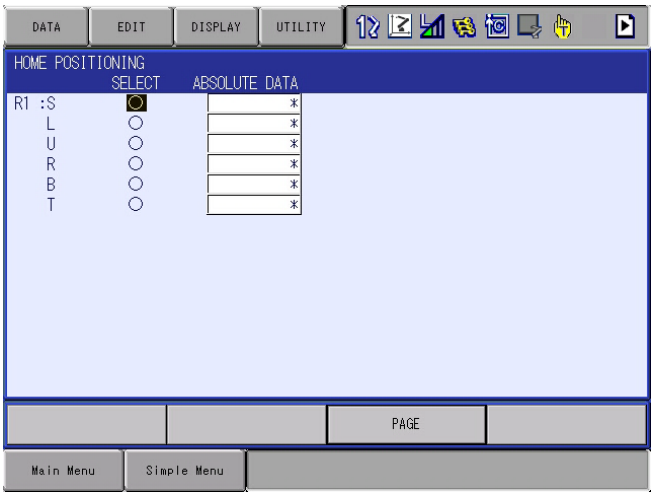
NOTE Home position calibration screen is shown only in the security mode or the management mode.

8.1.2.1 Registering All Axes at One Time

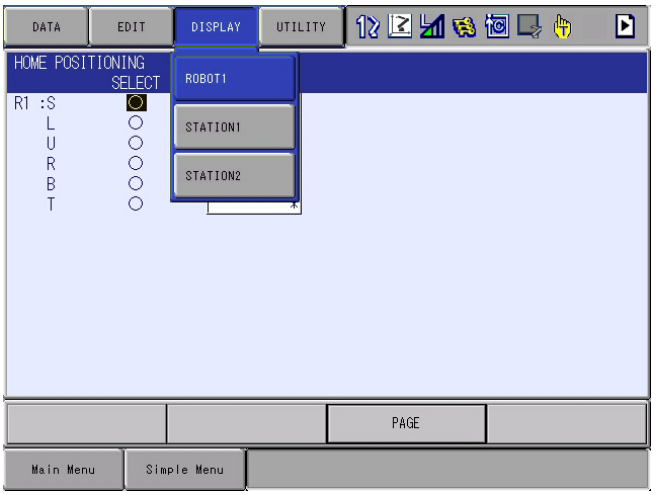
1. Select {ROBOT} under the main menu.
   – The sub menu appears



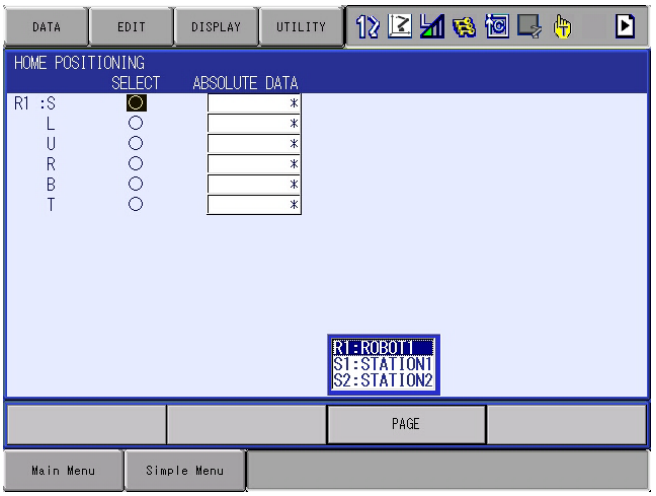
2. Select {HOME POSITION}.
   – The HOME POSITIONING window appears.



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

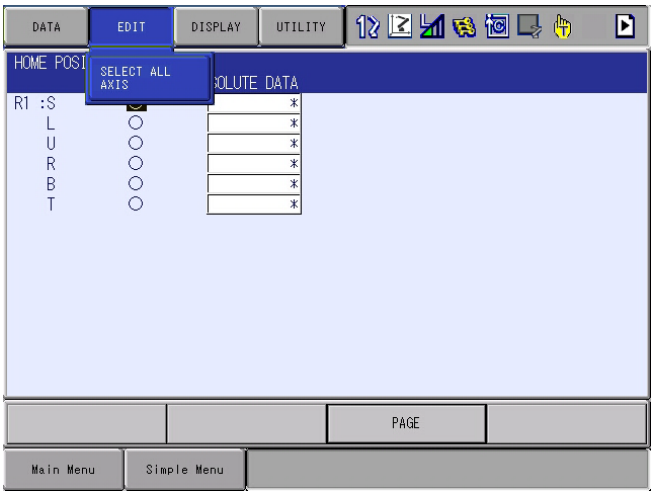


   – The same operation as the instruction 3 can also be performed by selecting [PAGE], and selection box appears.

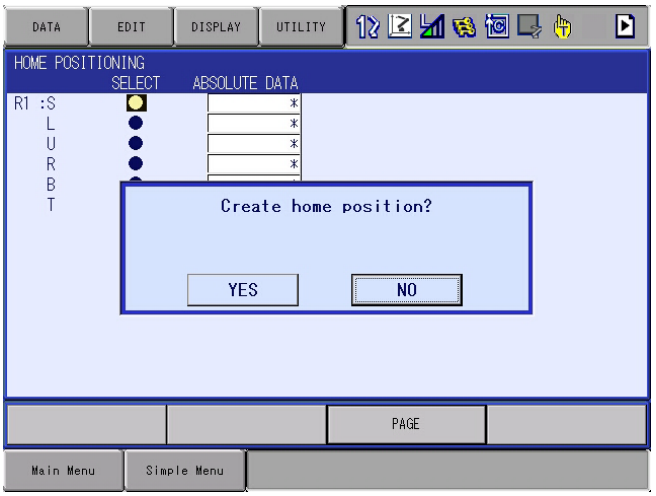


4. Select the desired control group.
   – Select the control group for HOME POSITIONING.
   – The control group can also be selected by pressing [PAGE].

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



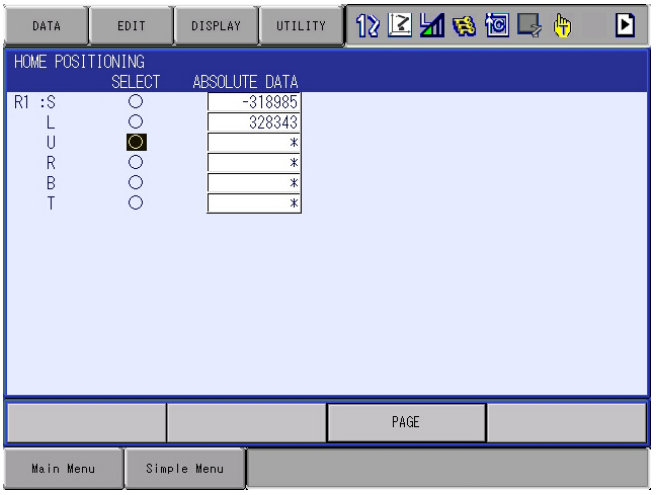
6. Select {SELECT ALL AXES}.
   – The confirmation dialog box appears.



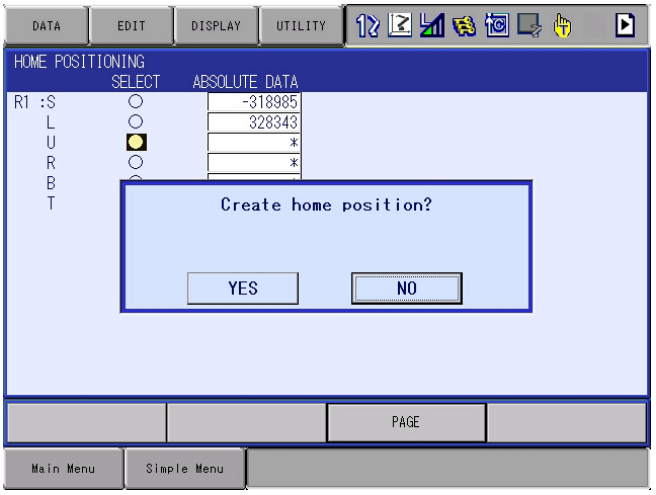
7. Select {YES}.
   – The position data of all axes which is shown are registered as home position. When {NO} is selected, the registration will be canceled.

8.1.2.2 Registering Individual Axes

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



   – A confirmation dialog box appears.

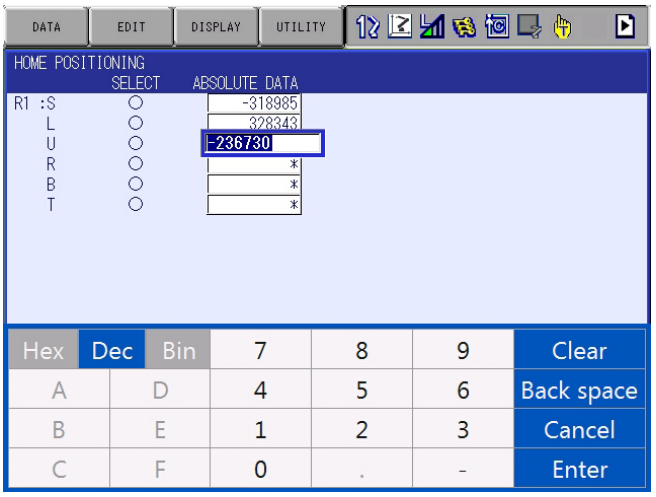


5. Select {YES}.
   – The position data of the axis which is shown is registered as home position. When {NO} is selected, the registration will be canceled.

8.1.2.3 Changing the Absolute Data

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

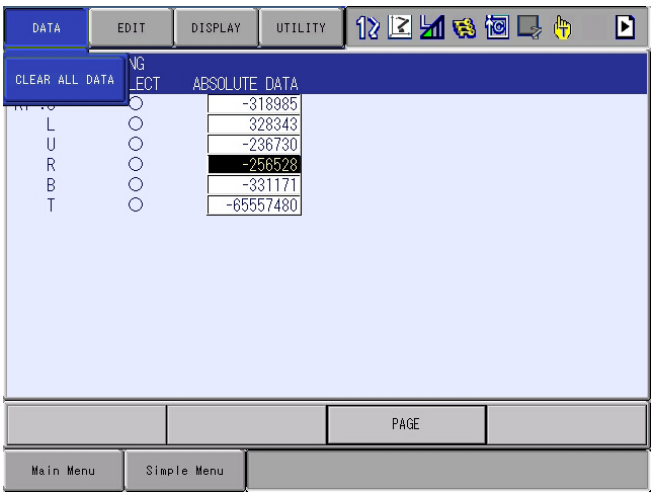
1. Select {ROBOT} under the main menu.
2. Select {HOME POSITION}.
3. Select the desired control group.
   – By performing the step 3 and 4 of the “Registering All Axes at One Time”, the HOME POSITIONING window is shown and the desired control group can be selected.
4. Select the absolute data to be registered.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



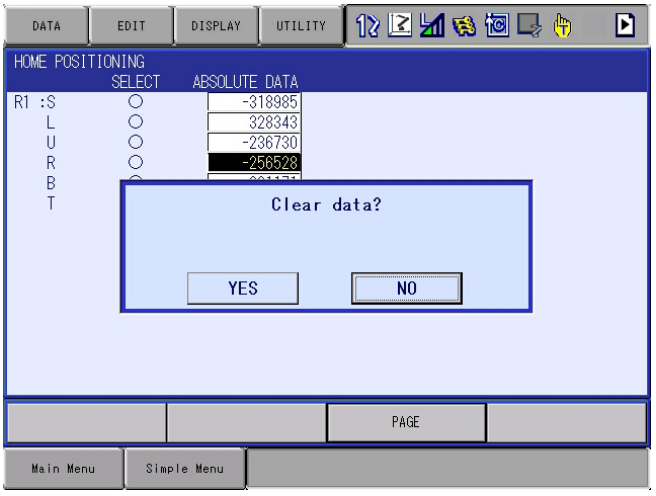
5. Enter the absolute data by using the numeric keys.
6. Press [ENTER].
   – Absolute data is modified.

8.1.2.4 Clearing Absolute Data

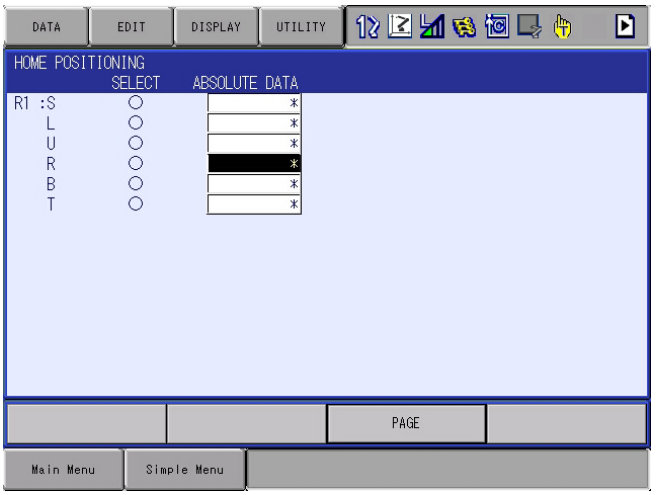
1. Select {ROBOT} under the main menu.
   – The sub menu appears
2. Select {HOME POSITION}.
   – By performing the step 2, 3 and 4 of the “Registering All Axes at One Time”, the HOME POSITIONING window is shown and the desired control group can be selected.
3. Select {DATA} under the main menu.
   – The pull-down menu appears



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



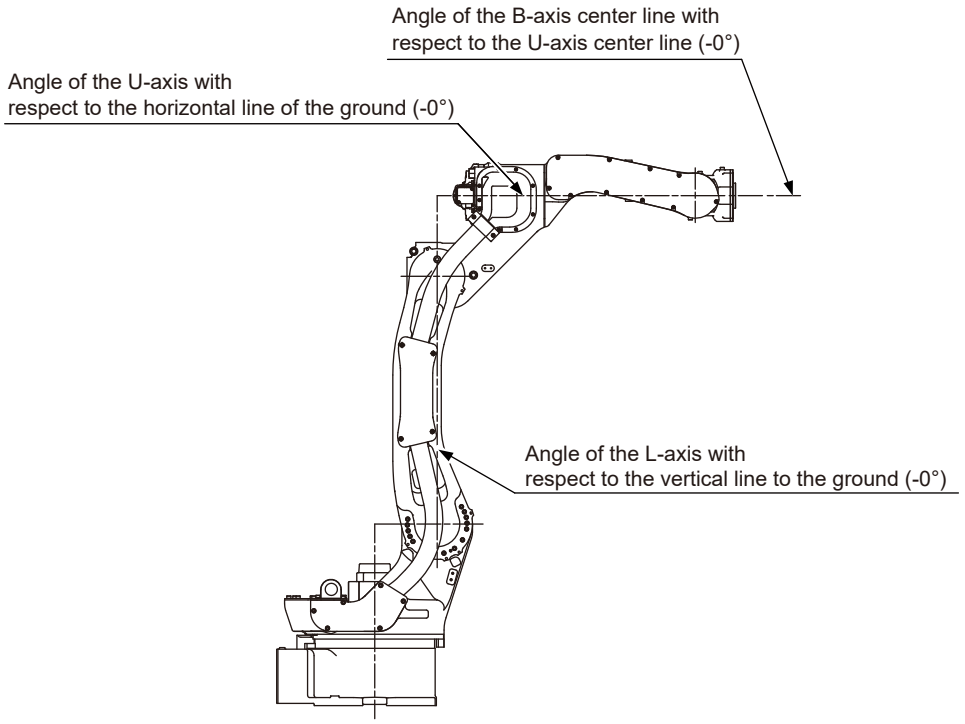
5. Select {YES}.
   – All absolute data are cleared.



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

8.1.3 Home Position Posture of Manipulator

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



NOTE The home position posture of each manipulator differs depending on its model. Refer to the INSTRUCTIONS for the manipulator corresponding to its model.

8.2 Setting the Second Home Position

DANGER

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

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

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

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

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

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

WARNING

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

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

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

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

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

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

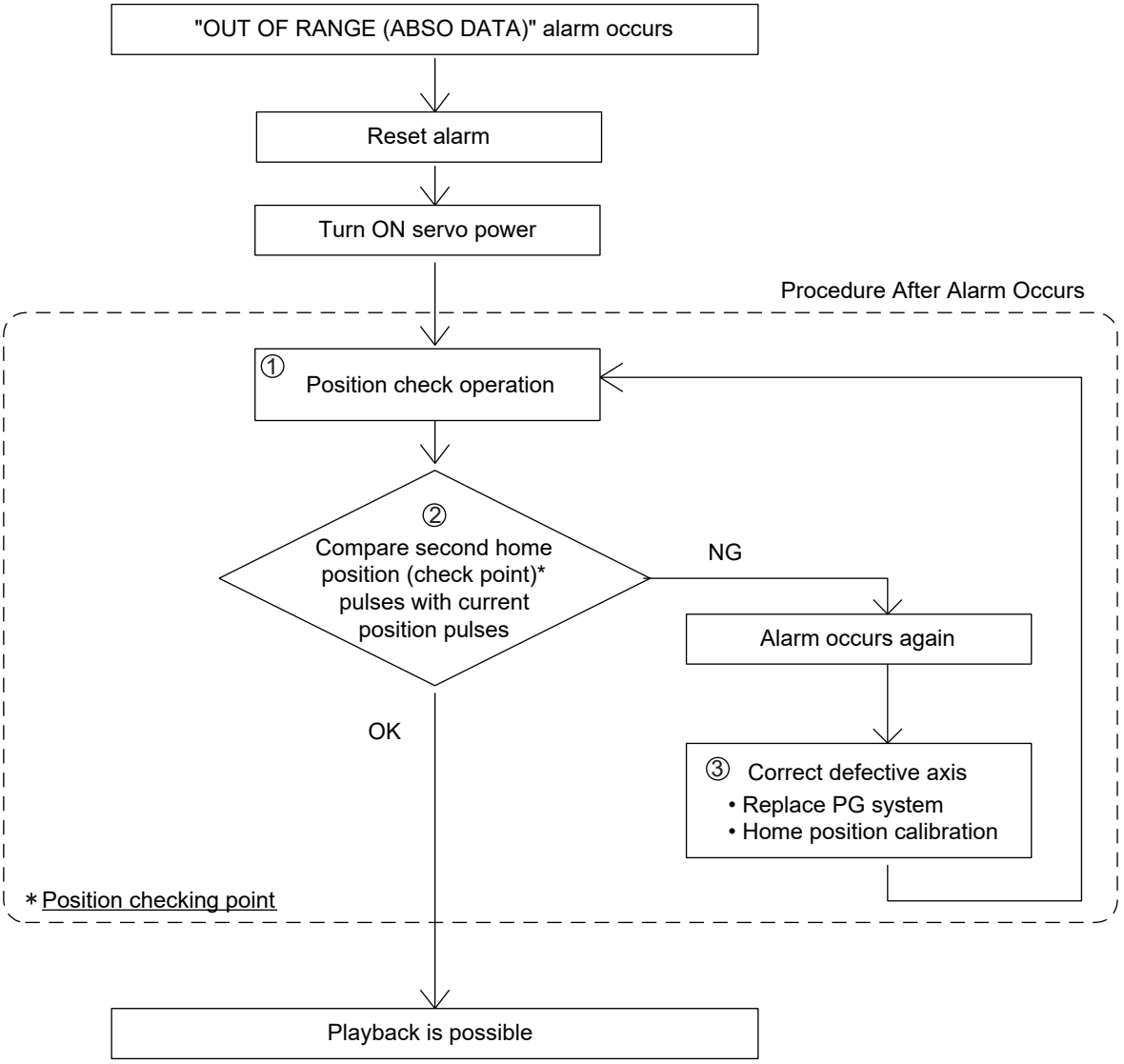
8.2.1 Purpose of Position Check Operation

If the absolute number of rotation detected at power supply ON does not match the data stored in the absolute encoder the last time the power supply was turned OFF, the alarm no. 4107 “OUT OF RANGE (ABSO DATA)” is issued when the controller power is turned ON.

There are two possible causes of this alarm:

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

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



① Position Check

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

② Pulse Difference Check

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

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

③ Alarm Occurrence

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

NOTE

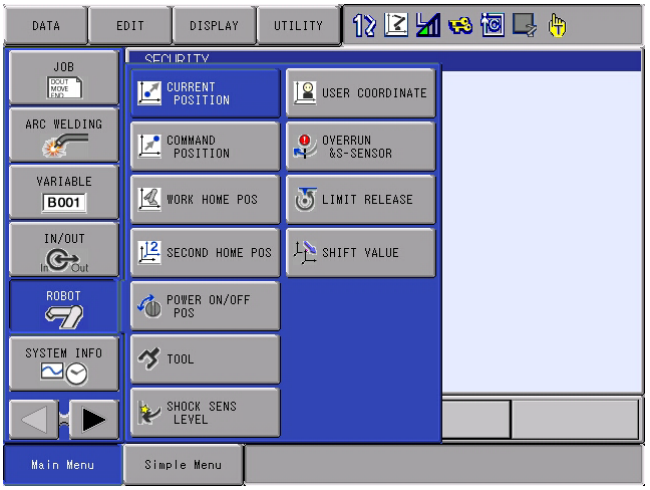
- Home position calibration of all the axes at the same time enables playback operations without having to check the position.
- Sometimes in a system with a manipulator with no brake, it is possible to enable playback without position checking after the alarm occurs. However, as a rule, always perform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

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

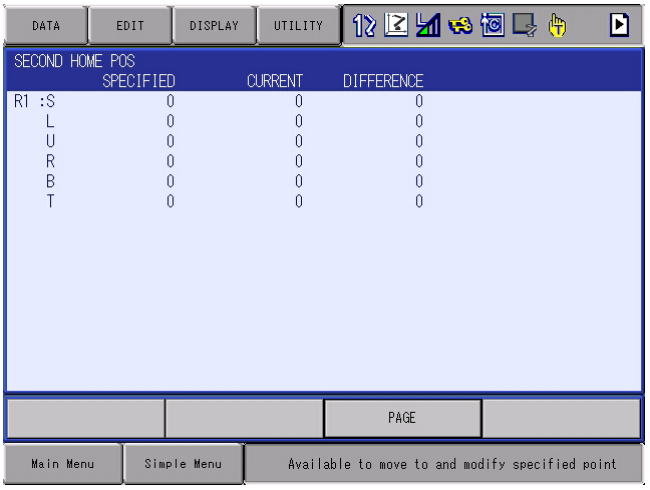
Apart from the home position of the manipulator, the second home position can be set up as a check point for absolute data. Perform the following steps to set the specified point.

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

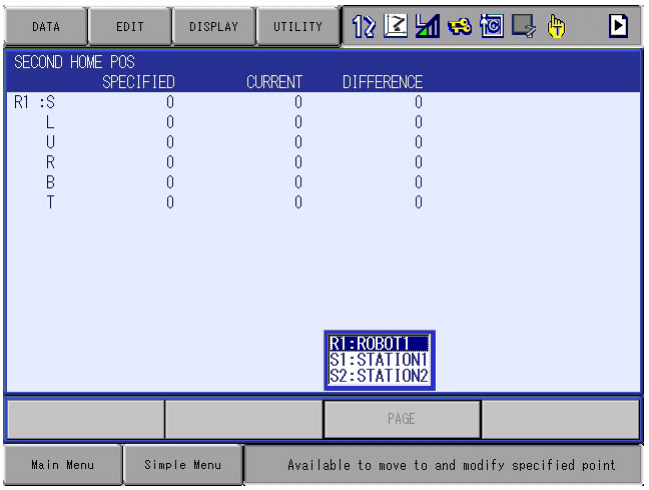
1. Select {ROBOT} under the main menu.
   – The sub menu appears.



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



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



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

8.2.3 Procedure after the Alarm

WARNING

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

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

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

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

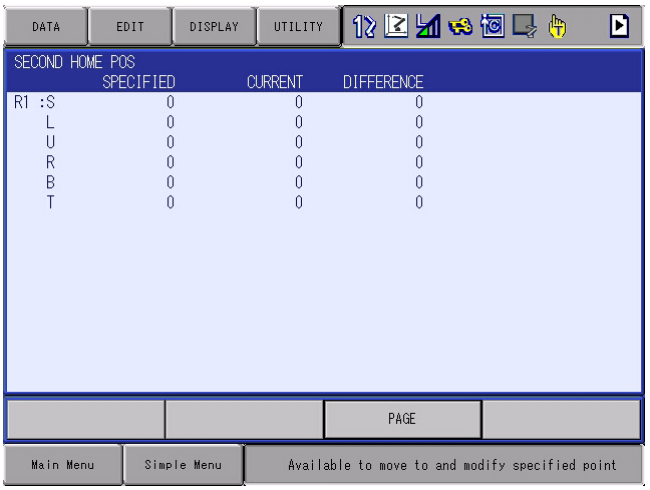
then confirm the second home position. After the confirmation, if the encoder communication related components are found to be the cause of the alarm, perform the necessary operation, such as replacing the encoder, etc.

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

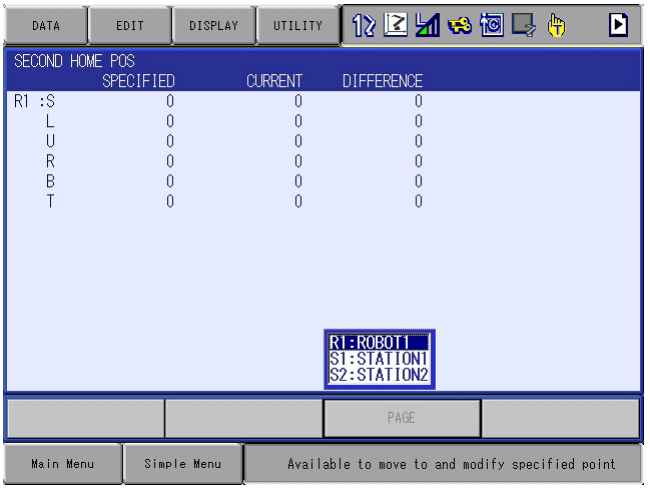
SUPPLE -MENT

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

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



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



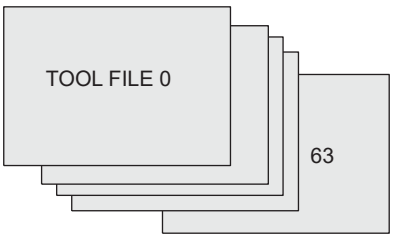
4. Press [FWD].
   – TCP moves to the second home position. The robot moving speed is set as selected manual speed.
5. Select {DATA} under the menu.
6. Select {CONFIRM POSITION}.
   – A message “Home position checked” appears.
   – Pulse data of the second home position and current pulse data are compared.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

8.3 Tool Data Setting

8.3.1 Registering Tool Files

8.3.1.1 Number of Tool Files

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

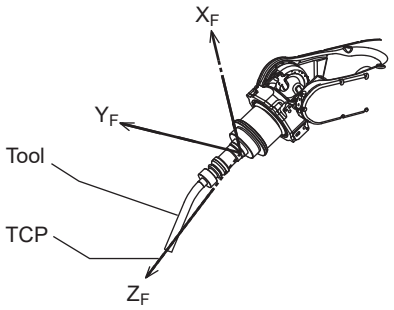


SUPPLE -MENT

Tool File Extension Function
Normally, one robot uses one kind of tool file. The tool file extension function can change many tool files to be used by one robot. Use the following parameter to set this function.
S2C333: TOOL NO. SWITCHING (1: enabled; 0: disabled)
For more details, refer to “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 8 Parameter”.

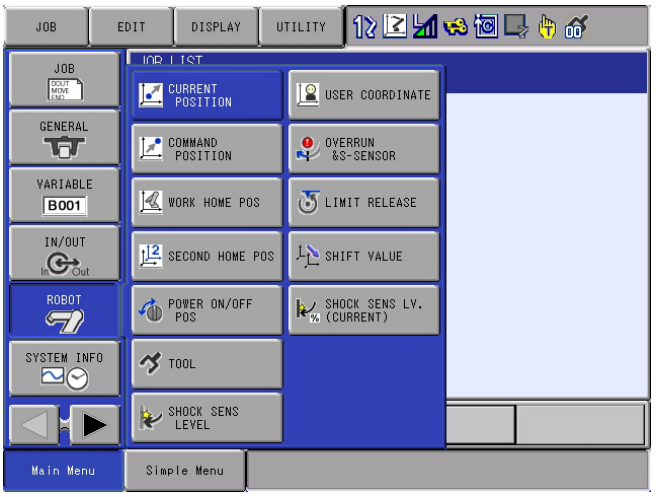
8.3.1.2 Registering Coordinate Data

When registering the tool file by number input operation, input the TCP of the tool on the flange coordinates.



1. Select {ROBOT} under the main menu.

   – The sub menu appears.

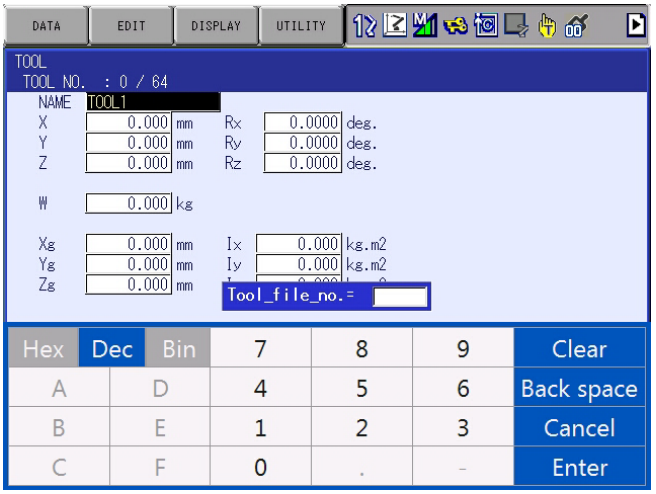


2. Select {TOOL}.

   (1) Move the cursor to the number of the desired tool, and press {SELECT} in the tool list window.

   (2) The tool coordinate window of the selected number appears.

   – In the tool coordinate window, the tool number can be changed by pressing the [PAGE] or selecting [PAGE].



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



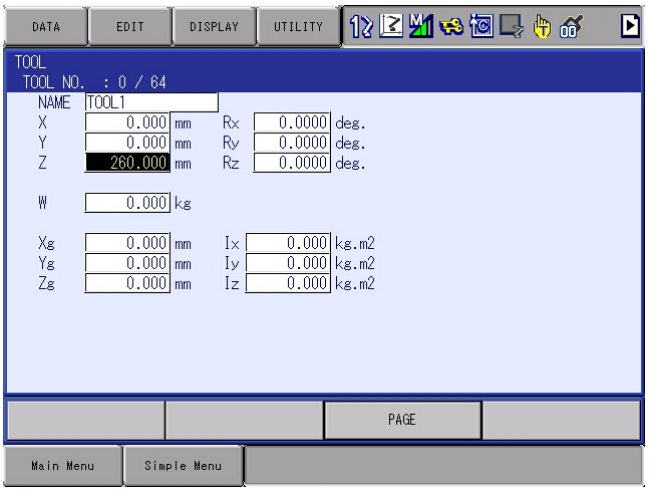
3. Select the desired tool number.

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

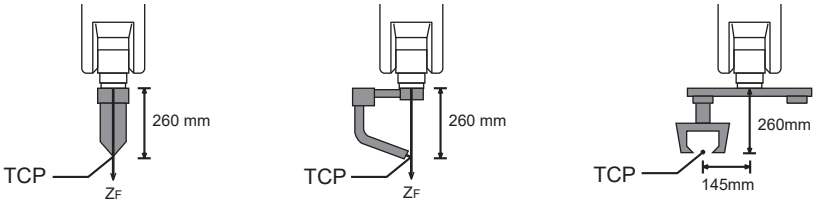
   – The number is ready to input.

5. Input the coordinate data.

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

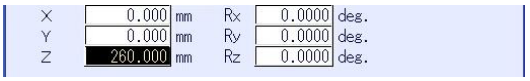


<Setting Example>

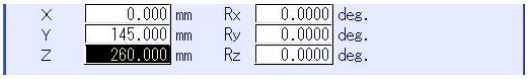


Tool A Tool B Tool C

In case of Tool A, B



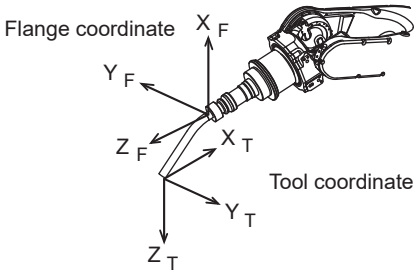
In case of Tool C



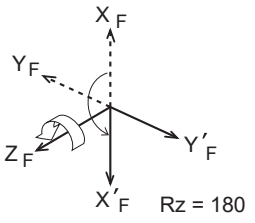
8.3.1.3 Registering Tool Posture Data

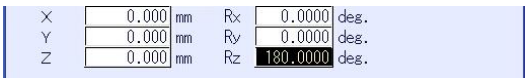
The tool posture data is an angle data which shows the relation between the flange coordinates and the tool coordinates. The angle when the flange coordinates are rotated to meet to the tool coordinates becomes an input value. Clockwise toward the arrow is the positive direction. Register in the following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

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



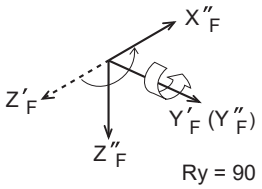
1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
3. Select the desired tool number.
   – In the same way as shown in Explanation 2, 3 in *chapter 8.3.1.2 "Registering Coordinate Data"* , open the desired tool coordinate window.
4. Select the desired coordinate axis to modify.
   – First, select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

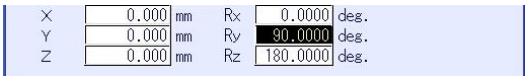




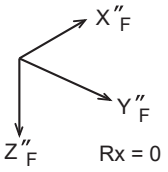
6. Press [ENTER].
   – The rotation angle of Rz is registered.

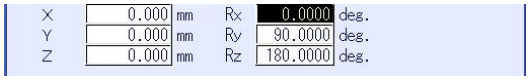
   In the same way, register the angle of Ry, Rx.
   Ry must be the input rotation angle around Y'_F of flange coordinates.





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





8.3.1.4 Setting the Tool Load Information

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

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

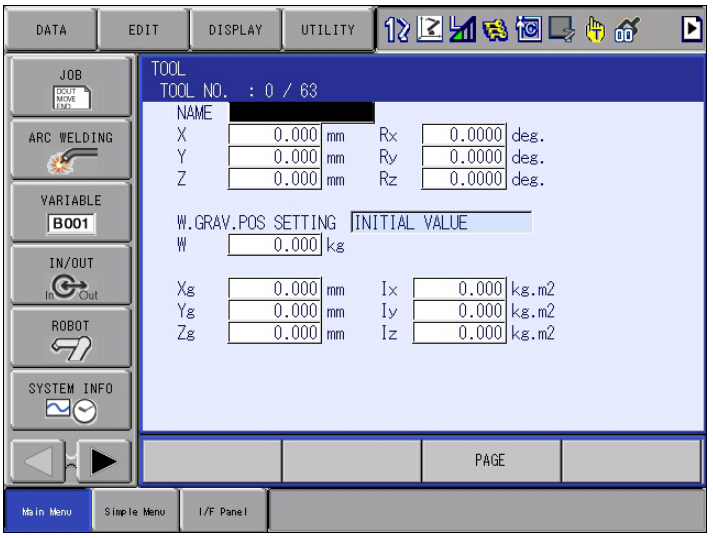
SUPPLE-MENT For more details on the tool load information, refer to *chapter 8.4.3 "Tool Load Information Setting"* .

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

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

"W.GRAV.POS SETTING" displays which method below has been used to set the weight(W) and the center of gravity(Xg, Yg, Zg).

"W.GRAV.POS SETTING" is available for YAS5.21.00A-00 or later.



NOTE

DISPLAY	CONTENT
INITIAL VALUE	Initial setting value.
MANUAL INPUT	Enter the weight(W), center of gravity(Xg, Yg, Zg) on TOOL window.
AUTO MEASURE	Result of automatic measurement of the tool load and center of gravity. About the measurement method, refer to *chapter 8.3.3 "Automatic Measurement of the Tool Load and the Center of Gravity"* .
MAKER INITIAL VALUE	Reading the tool load information on the MAKER INITIAL VALUE (for arc welding application only). About the setting method, refer to *chapter 8.7.3.3 "Reading the Tool Load Information on the MAKER INITIAL VALUE Window"* .

- "W.GRAV.POS SETTING" state does not change, when settings other than the weight(W) and the center of gravity(Xg, Yg, Zg) is changed.
- When loading tool data from an external storage, the settings of the loading source will be reflected.

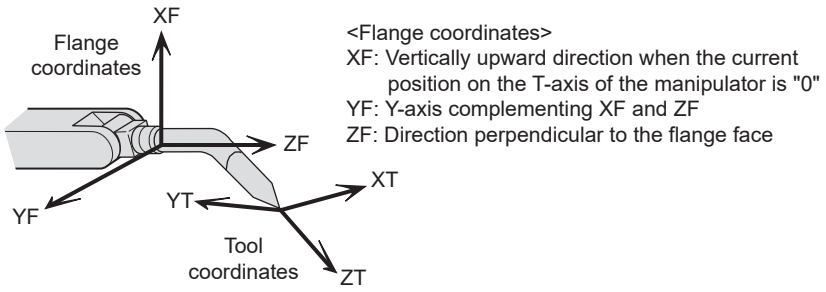
8.3.2 Tool Calibration

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 can be selected with the conversion method setting on the TOOL CALIBRATION window.

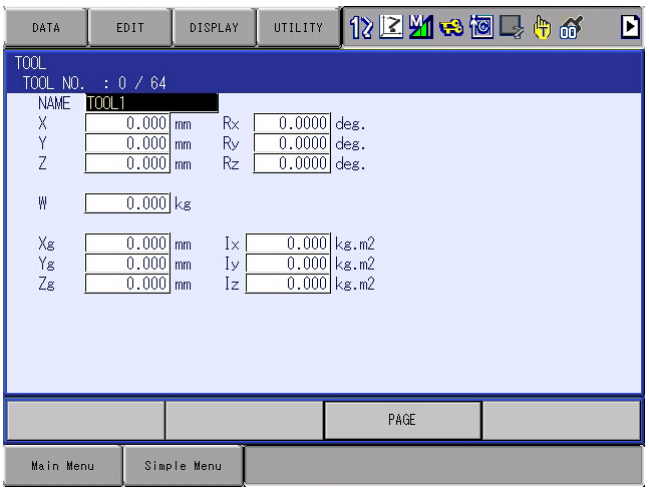
• Designation of tool calibration conversion method

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

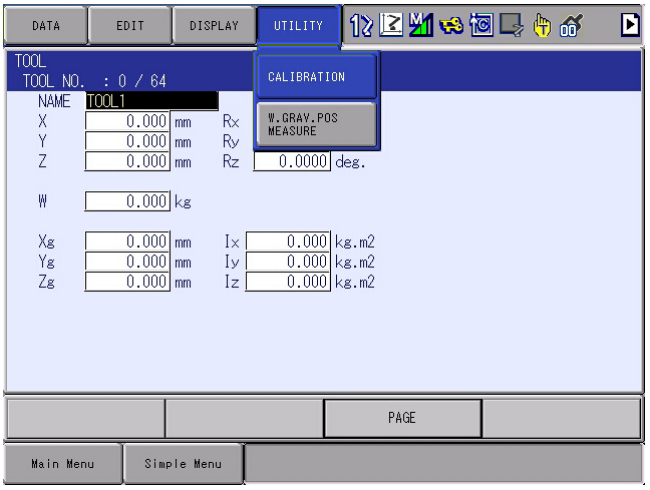
"Posture" : Calibrates only the posture.
“Tool Posture Data” calculated from the first calibration teaching point is registered in the tool file.
In this case, “Coordinates” will not be changed. (the prior value is maintained.)

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

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

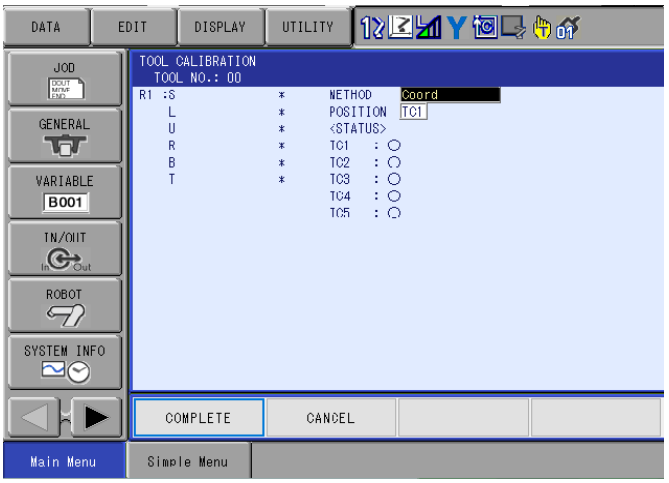


4. Select {UTILITY} under the menu.
   – The pull-down menu appears.



5. Select {CALIBRATION}.

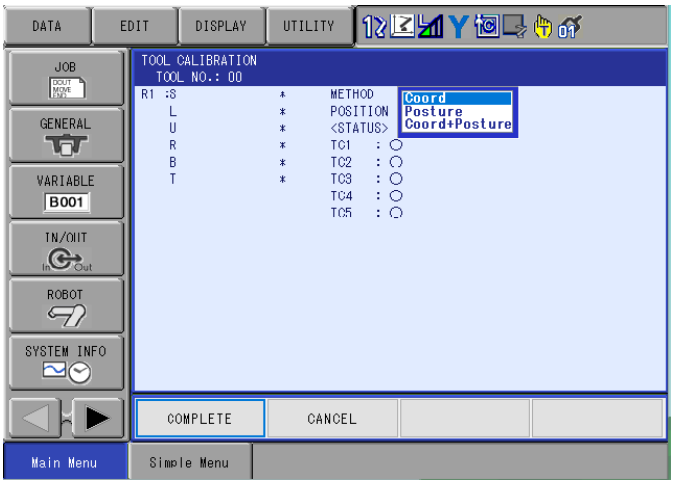
   – The TOOL CALIBRATION window is shown.



6. Select "METHOD".

   – The selection dialog box appears.

   (1) Select the conversion method.



NOTE

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

SUPPLE-MENT

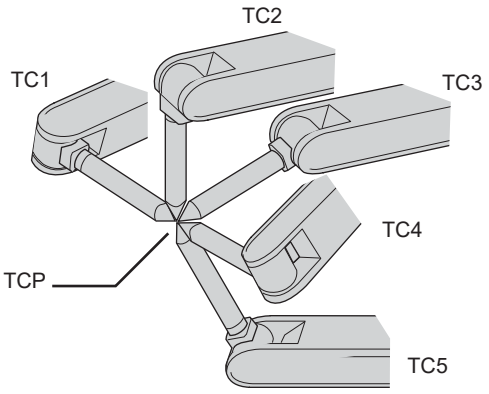
Tool calibration conversion method can also be set with a parameter. The setting on the TOOL CALIBRATION window is applied to the parameter setting.

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

8.3.2.3 Teaching of Calibration Point

■ **Teaching for defining coordinates**

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



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

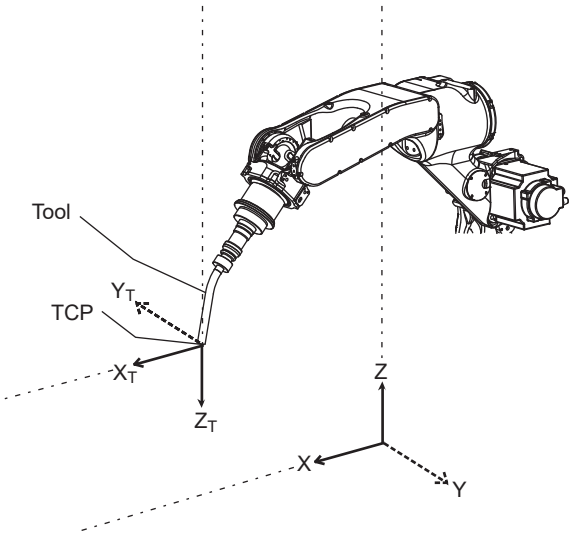
■ **Teaching for defining posture**

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

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

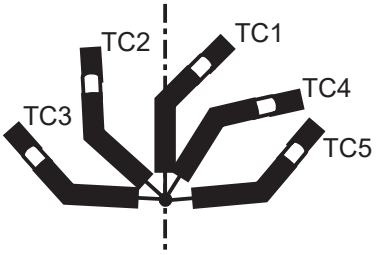
Tool posture data is automatically calculated with this TC1 posture.

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

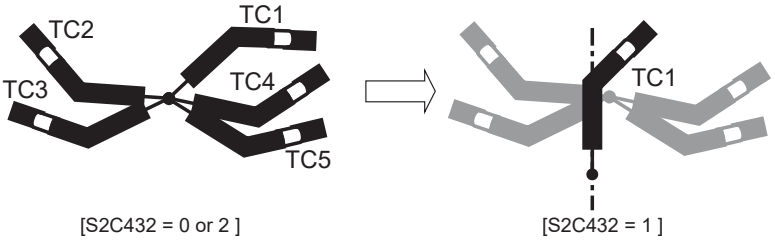


SUPPLE -MENT

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



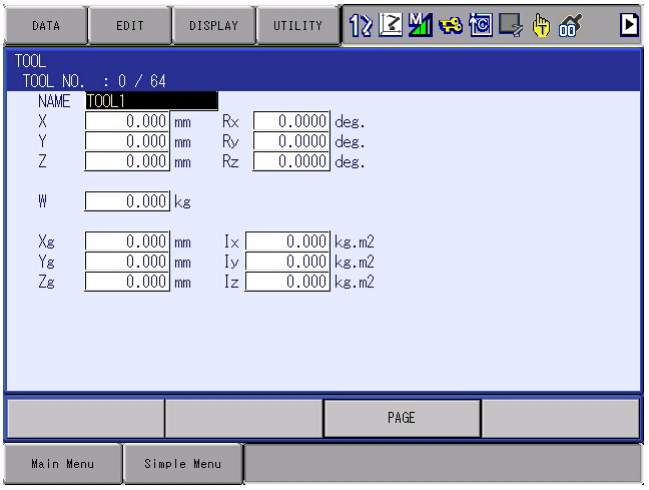
If teaching in one place as the figure above is impossible due to the interference of peripheral equipment and so on, perform calibration of coordinates with S2C432=0 or 2, and then change to S2C432=1, teach only TC1 in a different position and register the tool posture data.



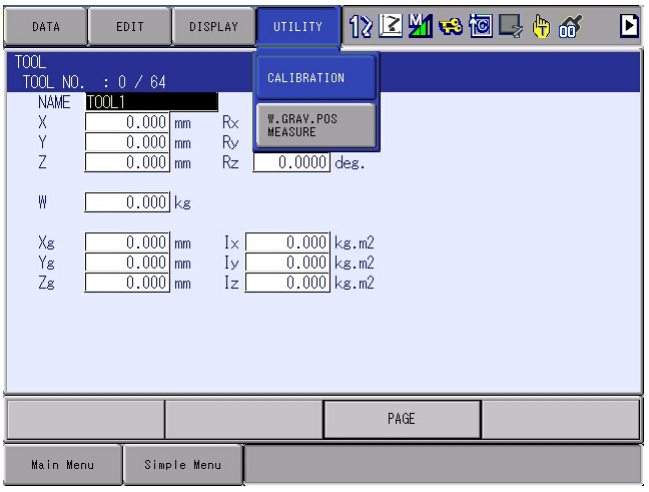
SUPPLE -MENT

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

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

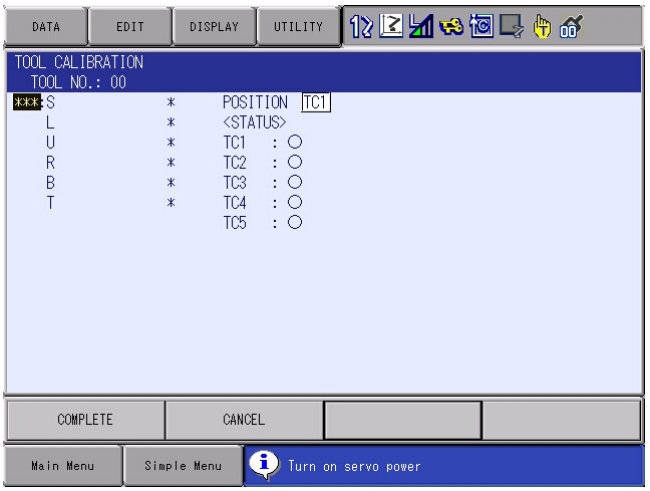


4. Select {UTILITY} under the menu.
   – The pull-down menu appears.



5. Select {CALIBRATION}.

   – The TOOL CALIBRATION window is shown.

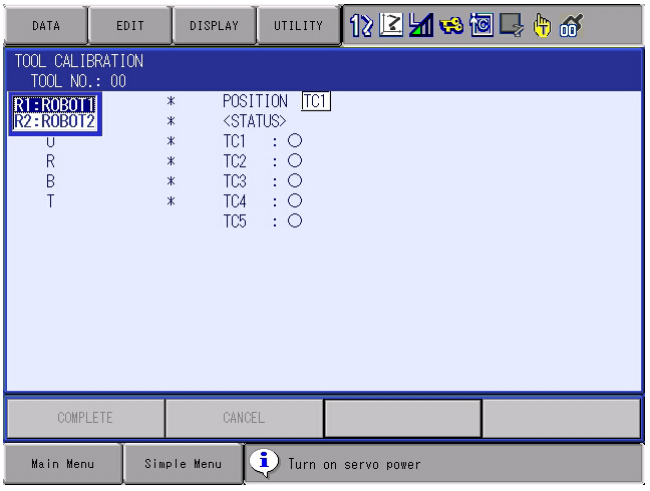


6. Select the robot.

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

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

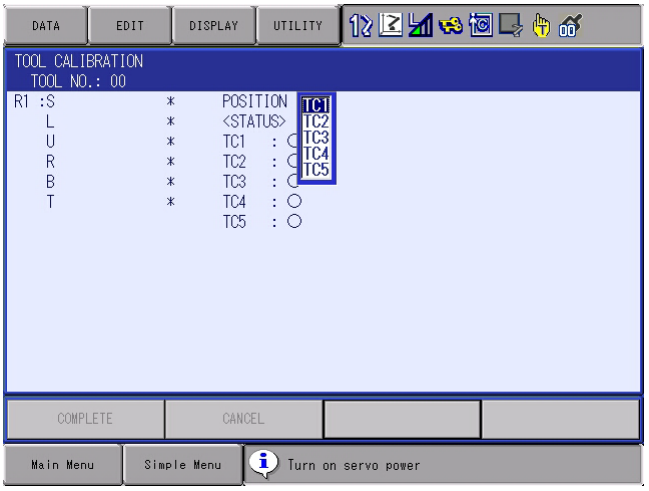
   (3) The robot is set.



7. Select “POSITION”.

   – The selection dialog box is shown.

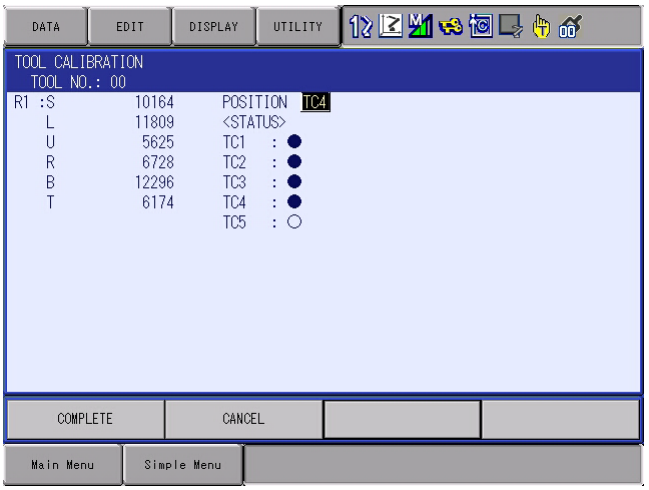
   (1) Select the teaching point for calibration.



8. Move the manipulator using the axis key.

9. Press [MODIFY] and [ENTER].

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

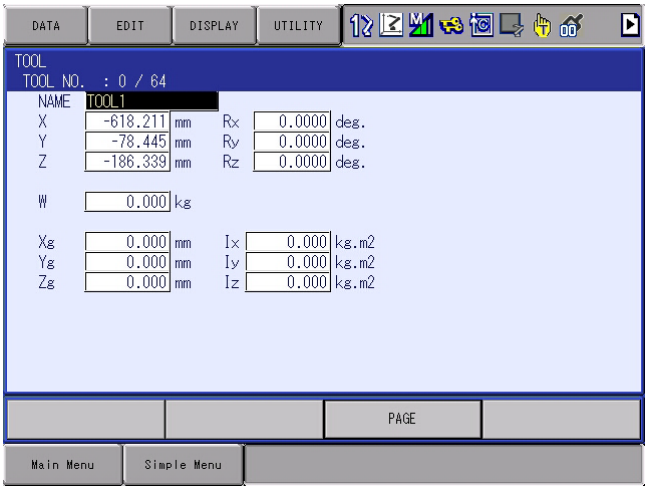


   – To check the taught positions, call up the required window among TC1 to TC5 and press [FWD]. The manipulator moves to the set position.

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

10. Select “COMPLETE”.

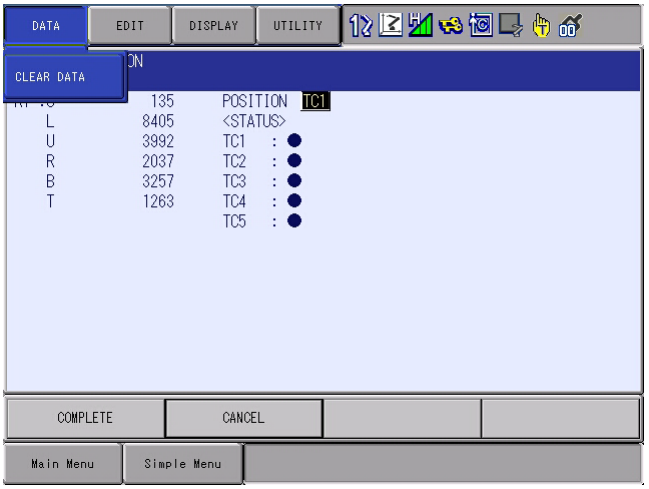
– Calibration data is registered in the tool file. Once the calibration is completed, the tool coordinate window is displayed on the screen.



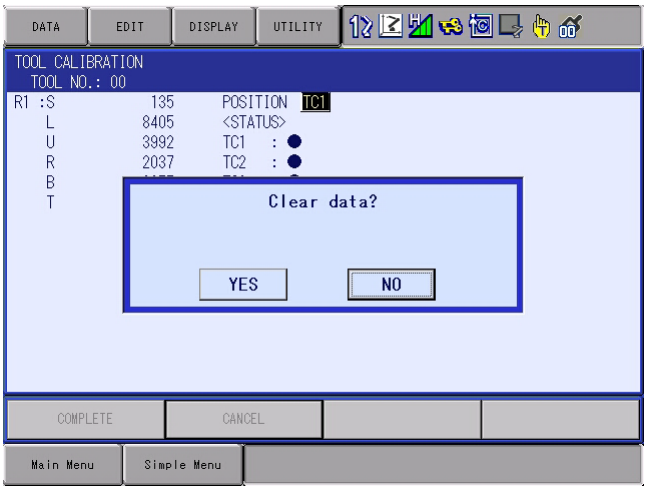
8.3.2.4 Clearing Calibration Data

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

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

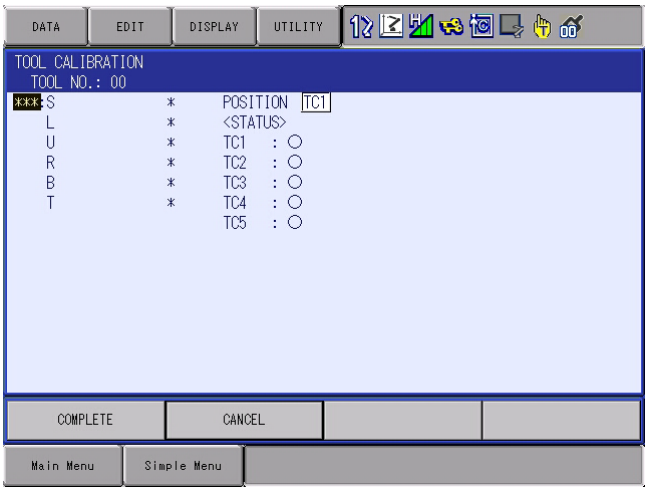


2. Select {CLEAR DATA}.
   – The confirmation dialog box is shown.



3. Select {YES}.

   – All data is cleared.

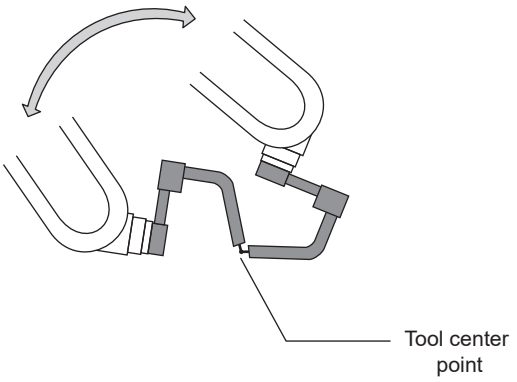


SUPPLE -MENT

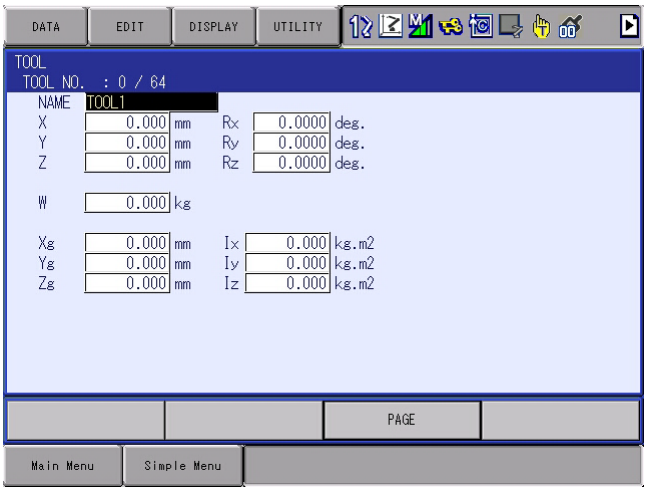
If tool angle data is required, input the data number in the tool coordinate window.
Refer to *chapter 8.3.1.3 "Registering Tool Posture Data"* for the operating instructions.

8.3.2.5 Checking the TCP

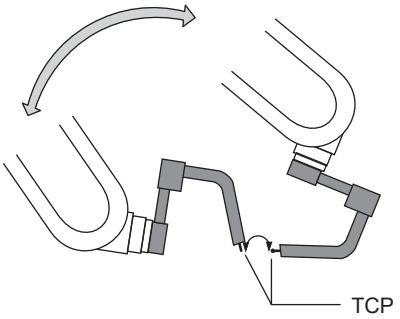
After registering the tool file, check if the TCP is correctly registered by performing a TCP fixed operation like the one shown below, in any coordinate system other than the joint.



1. Press [COORD].
   – Select any coordinate system except “ JOINT” by pressing [COORD].



2. Select desired tool number.
   – Show the tool coordinate window of the desired tool by pressing the [PAGE] or selecting it in the tool list window.
3. Move the R, B, or T axes using the axis key.
   – By pressing the axis keys for the R, B, and T axes, change the manipulator pose without changing the TCP position.
   If this operation shows a large TCP error, adjust the tool data.



SUPPLE-MENT For details on the TCP fixed operation, refer to “YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051) 2.3.7 Control Point Operation”.

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

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

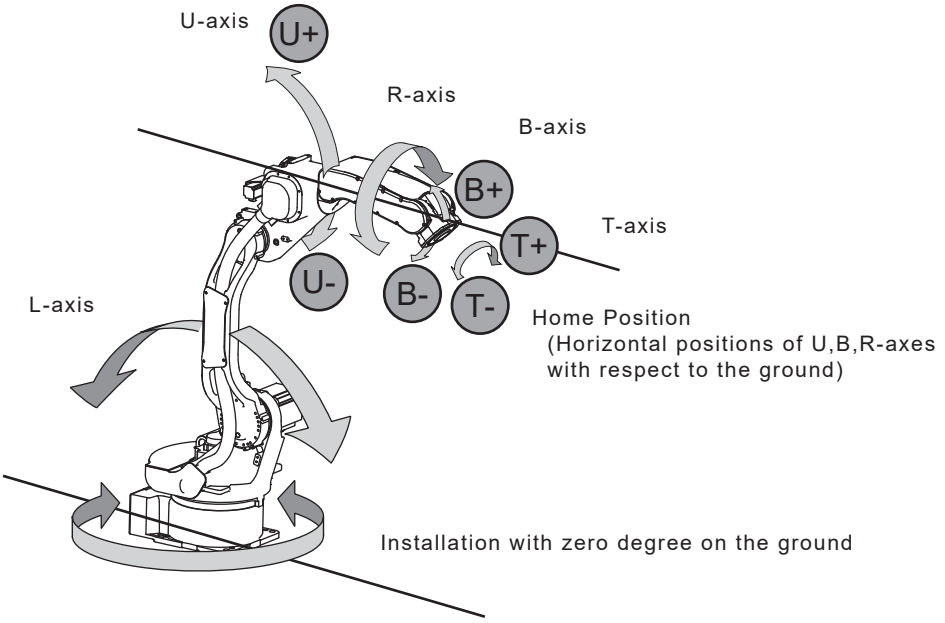
With this function, the user can register the load of tool, the position of the tools center of gravity and the moment of inertia at the center of gravity.

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

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

8.3.3.2 Measurement of the Tool Load and the Center of Gravity

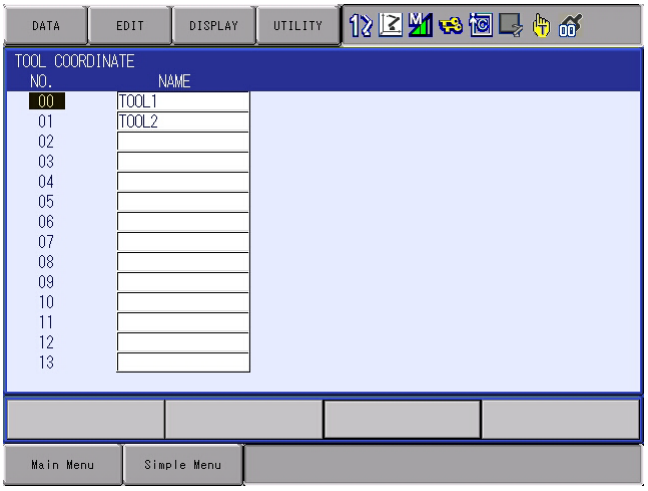
To measure the tool load and the center of gravity, move the manipulator to its home position (U-, B- and R-axes: horizontal to the ground) and operate the U-, B- and T-axes.

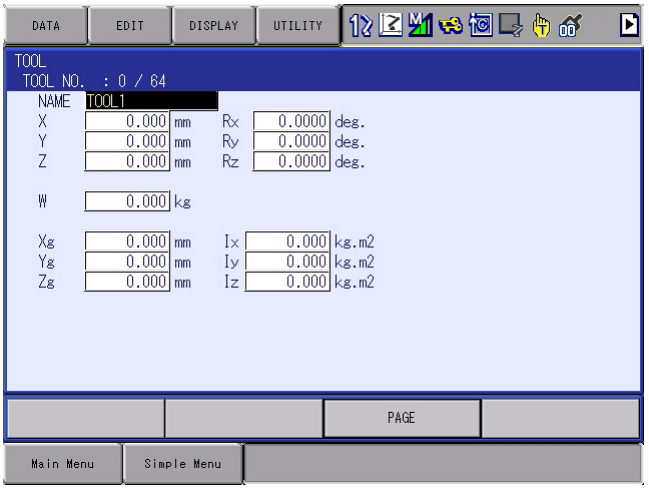


NOTE To correctly measure the tool load or the center of gravity, remove the cables or wires connected to the tool.
The measurement may not be performed properly because unnecessary loads are applied.

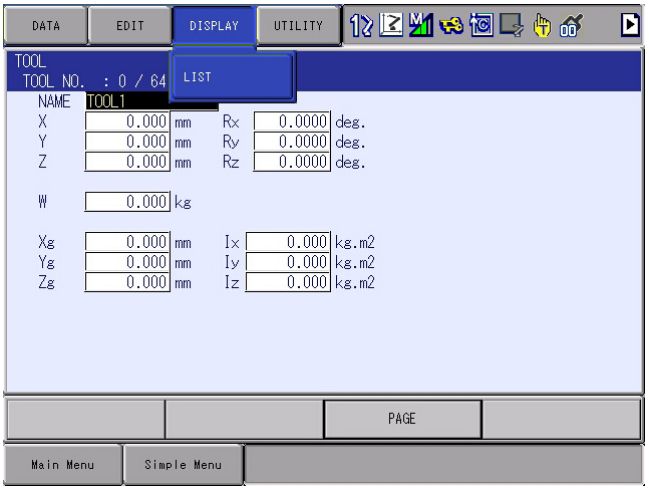
1. Select {ROBOT} under the main menu.
2. Select {TOOL}.
   – The tool list window appears.
   – The tool list window is called up only when the file extension function is valid.

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





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

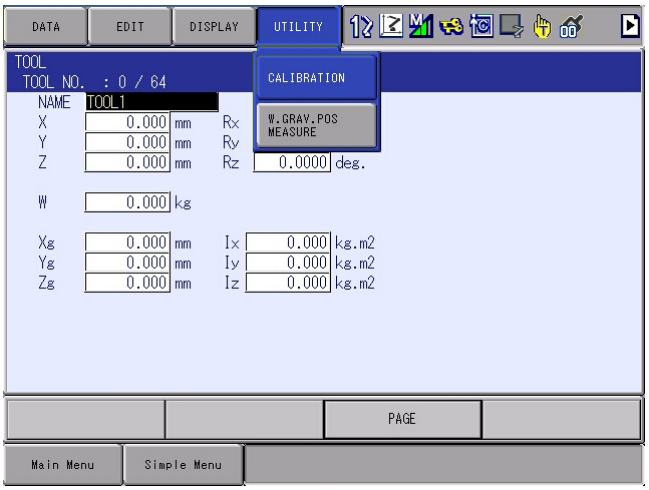


4. Write down the X, Y, and Z coordinate values, and then set them all to 0. (Restore the original values after the measurements are finished.)

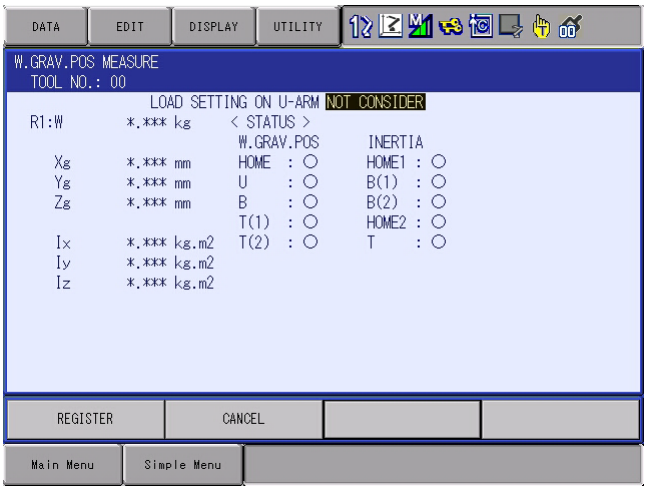
NOTE

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

5. Select {UTILITY} under the menu.



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



7. Press the [PAGE].
   – In a system with several manipulators, use the [PAGE] to change the group to be controlled.
8. Press [FWD].
   – Press [FWD] once, and the manipulator moves to the home position (U-, B- and R-axes: horizontal to the ground).
9. Press [FWD] again.
   – Press [FWD] again, and measurement starts. Keep the button pressed until measurement is completed.

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

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

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

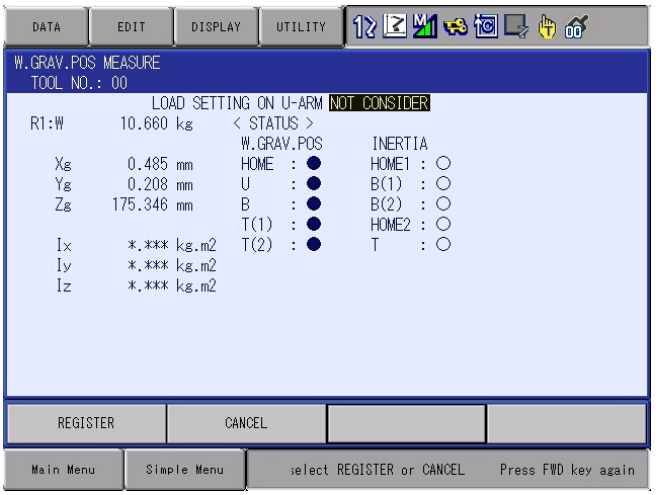
③ First measurement of the T-axis: T-axis home position +4.5 degrees → -4.5 degrees

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

SUPPLE-MENT

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

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



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

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

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

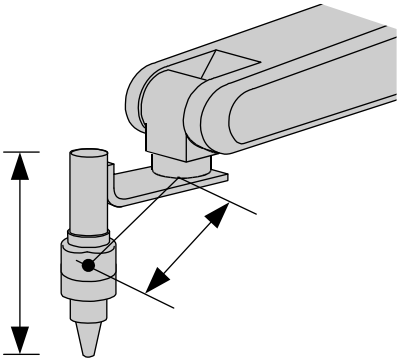
– Select “FWD” and the manipulator moves to the home position 1 and the measurement of the moment of inertia at the center of gravity starts.

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

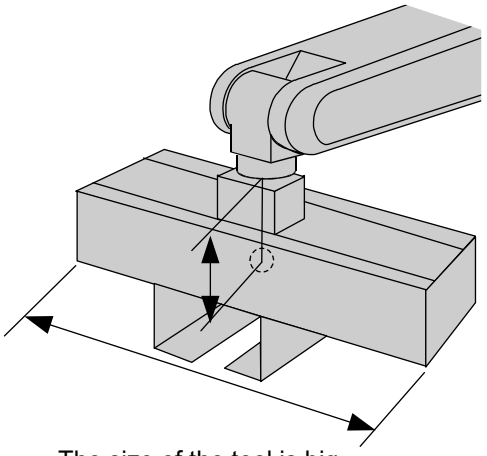
Measure the moment of inertia at the center of gravity.

SUPPLE -MENT

The moment of inertia at the center of gravity does not need to be measured when this data is small enough for the moment of inertia calculated from weight and the center of gravity position. However, the measurement is required when the moment of inertia of the tool is large (as a rough guide, the tool is considered to be large when the tool size is about more than 2-times the distance between the flange and the center of gravity).

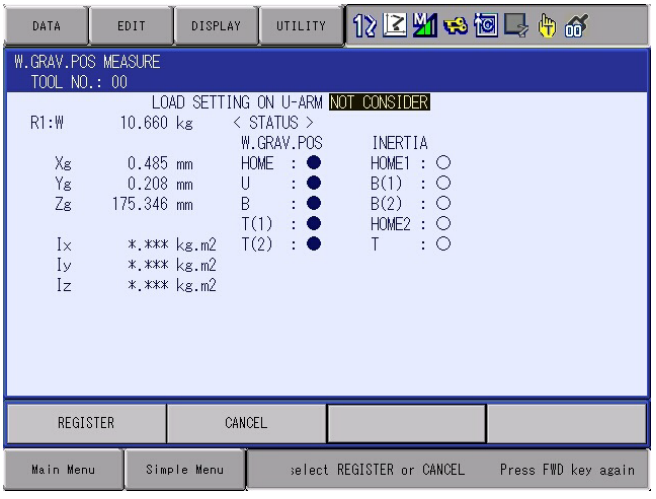


The size of the tool is not too big.
Measurement of the moment of inertia at center of gravity is not necessary.



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

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



NOTE

If the tool is interfered with during the measurement, operate the S-, L- and R-axes and move the manipulator to avoid the interference. Then move the axis to the home position 1.

2. Press [FWD] again.
   – Press [FWD] again, and measurement of B-axis 1 and B-axis 2 starts.

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

① Measurement of the B-axis 1: B-axis home position +30 degrees → -30 degrees

② Move to the measurement position of B-axis 2

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

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

CAUTION

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

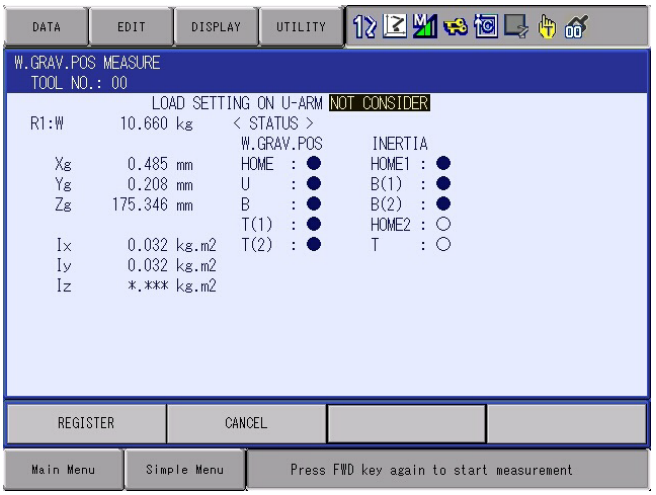
SUPPLE -MENT

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

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

NOTE

If the tool is interfered with during the measurement, operate the S-, L- and T-axes and move the manipulator to avoid the interference. Then move the axis to the home position 2.



4. Press [FWD] again.

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

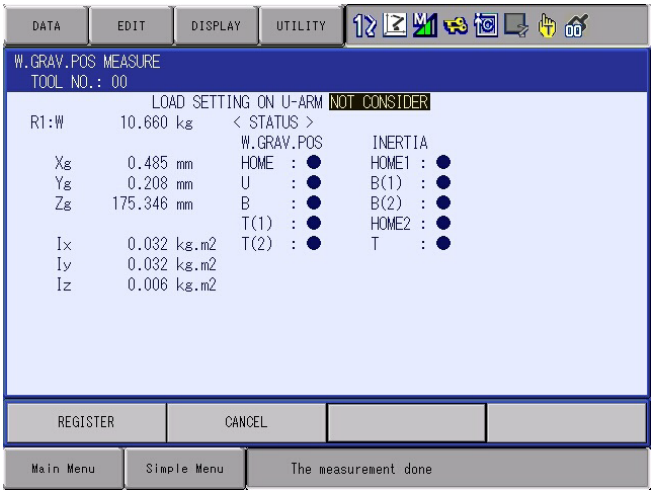
The manipulator moves in the order listed below. Once measurement is completed, "○" changes to "●".

① Measurement of the T-axis: T-axis home position +30 degrees → -30 degrees

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

SUPPLE -MENT

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



5. Select "REGISTER". (When measuring only the tool load and the center of gravity.)

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

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

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

NOTE

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

8.4 ARM Control

8.4.1 ARM Control

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

The moment of inertia and the gravity moment etc. of each axis are calculated by the ARM control function, and YRC1000 controls robot motion according to the result. It is necessary to set the robot setup condition and the tool load information to request these accurately.

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

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

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

8.4.2 ARM CONTROL Window

CAUTION

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

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

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

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

8.4.2.1 Robot Setup Condition

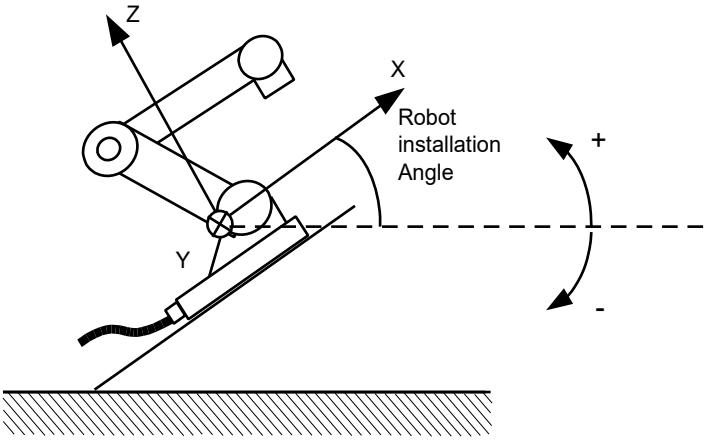
Fulfill the following robot setup condition to enable the ARM control.

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

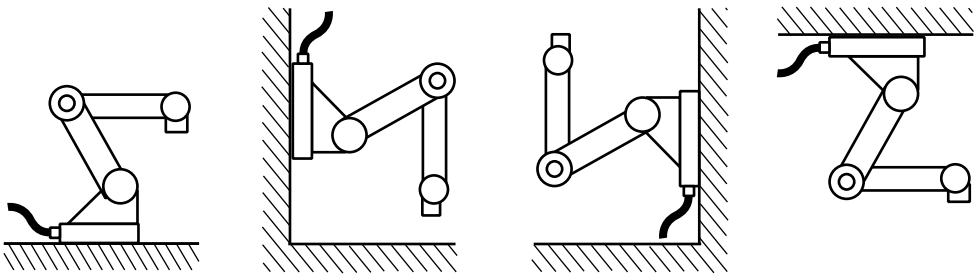
■ **Robot installation angle**

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

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



<Example>



0 degrees -90 degrees +90 degrees 180 degrees

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

NOTE

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

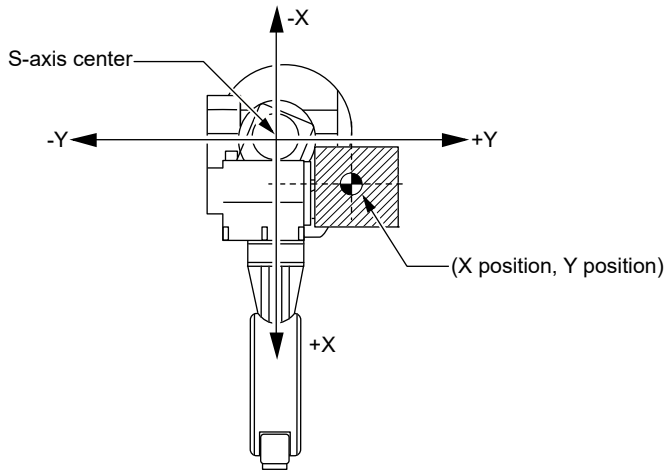
■ **S-HEAD PAYLOAD**

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

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

- WEIGHT (unit: kg)
  Set the weight of the installed load.
  It is not required to set a correct value, and it is recommended to set a value slightly larger than the actual weight. (Round up the value with each fraction between 0.5 to 1 kg.)
- X (FROM S-AXIS), Y (FROM S-AXIS) (unit: mm)
  Set the position of the gravity center of the installed load by the distance from the S-axis center in the directions of X and Y.
  It can be set with a rough value.
  The directions of X and Y conform to the robot coordinates. When the position is in the negative direction, set a negative value.

Fig. 8-1: Load on the S-Head (Top View)



■ U-ARM PAYLOAD

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

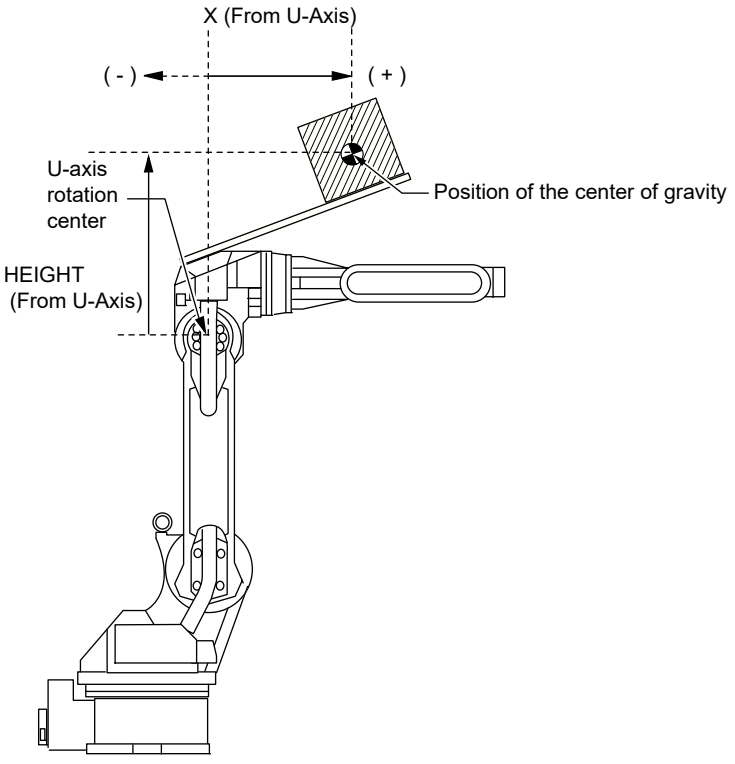
A standard value is set at the factory.

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

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

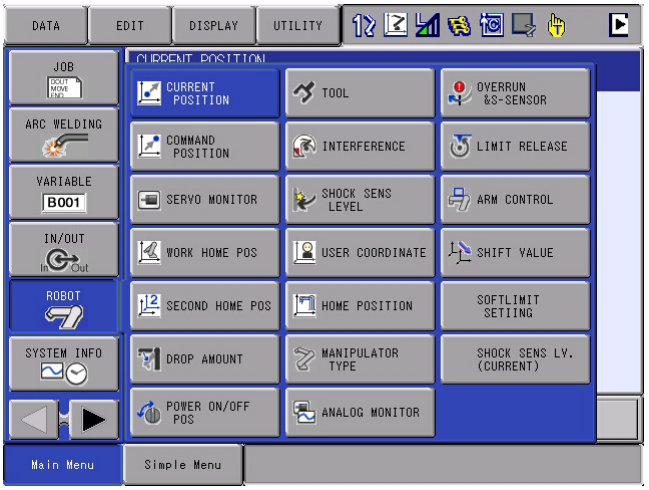
- X (FROM U-AXIS), HEIGHT (FROM U-AXIS) (unit: mm)
  Set the position of the gravity center of the installed load. It can be set with a rough value.
  X (FROM U-AXIS) is the horizontal distance from the U-axis rotation center to the position of the gravity center of the load. If the mass point is on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

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



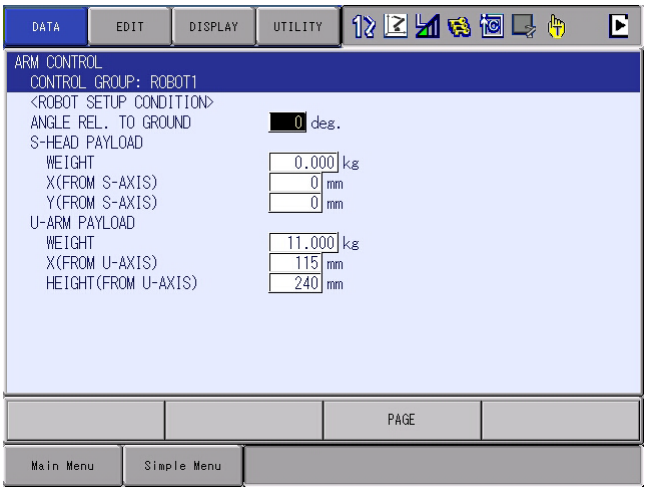
NOTE The ARM CONTROL window is displayed only when the security mode is set to the management mode.

1. Select {ROBOT} under the main menu.



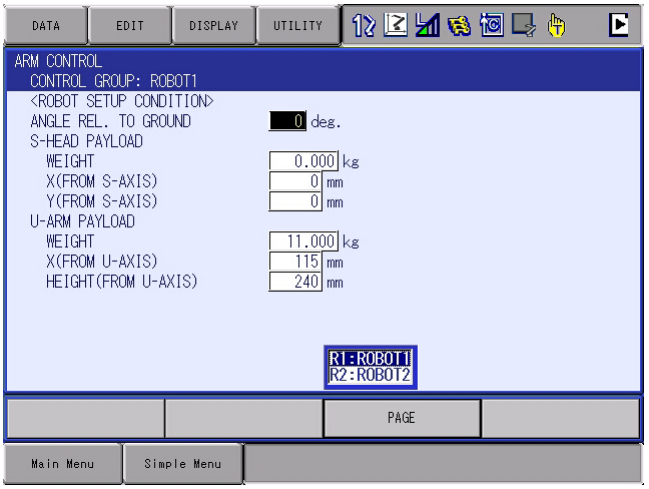
2. Select {ARM CONTROL}.

   – The ARM CONTROL window appears.



3. Press the page key , or select [PAGE].

   – Select the desired control group when there are two or more group axes.



4. Select the desired item.

5. Input the value and press [ENTER].

8.4.3 Tool Load Information Setting

WARNING

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

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

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

CAUTION

- Correctly set the tool load information.

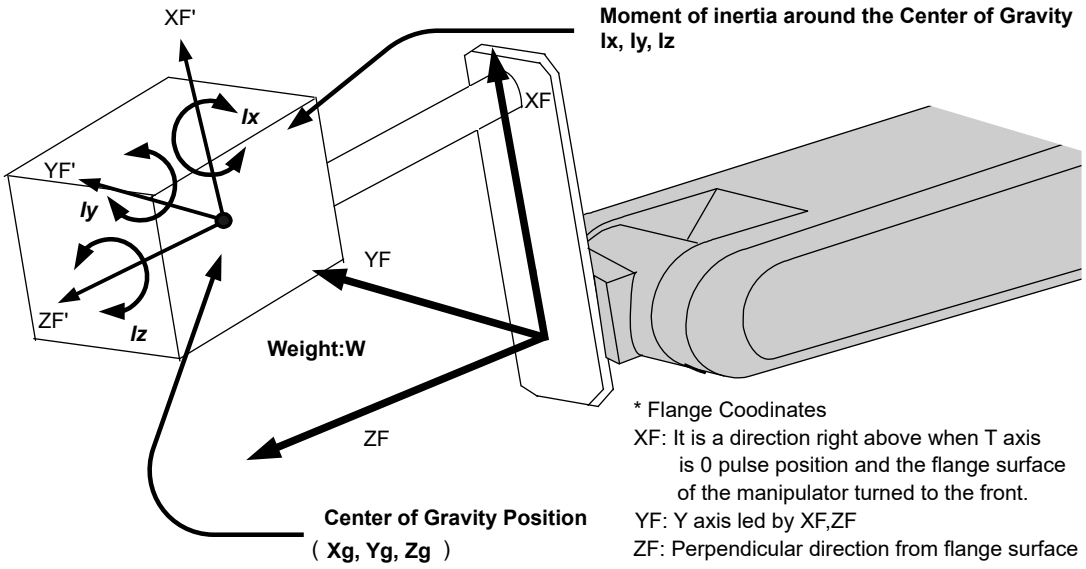
If the tool load information is not set correctly, the life of speed reducer may be shorter or the alarm may occur.

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

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

8.4.3.1 Tool Load Information

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



8.4.3.2 How to Calculate Tool Load Information

■ **Weight: W (Unit: kg)**

The total weight of the installing tool is set.

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

■ **Center of gravity position: xg, yg, zg (Unit: mm)**

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

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

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

■ **Moment of inertia at the center of gravity: Ix, Iy, Iz (Unit: kg·m^2)**

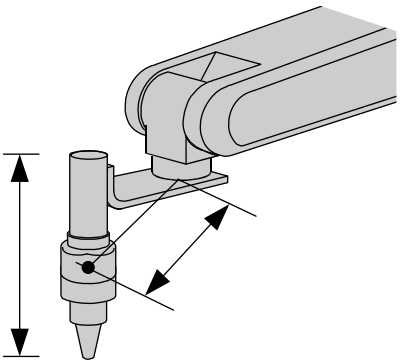
It is an moment of inertia of the tool at the center of gravity position.

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

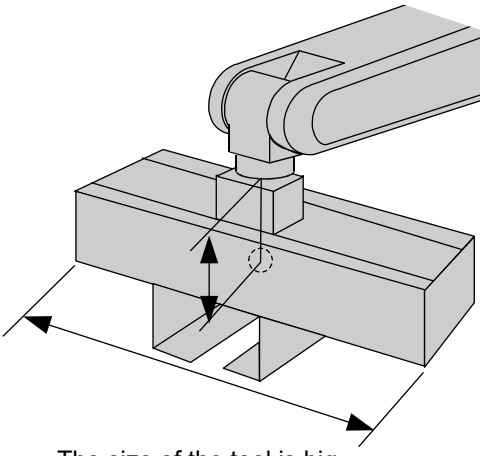
It is not required to set a correct value, however, it is recommended to set a value slightly larger than the actual value.

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

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



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



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

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

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

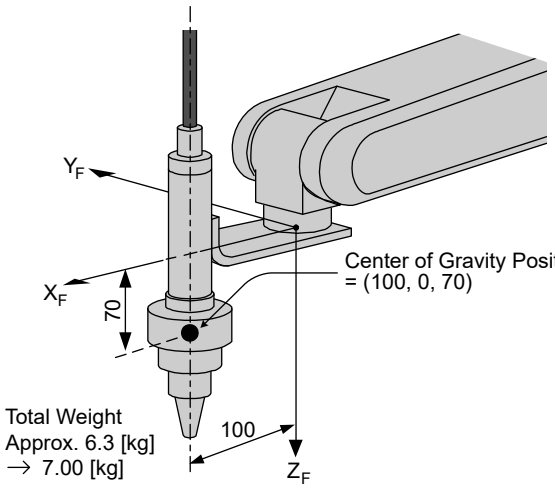
the following setting examples for details.

<Example 1>

In the example of 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>



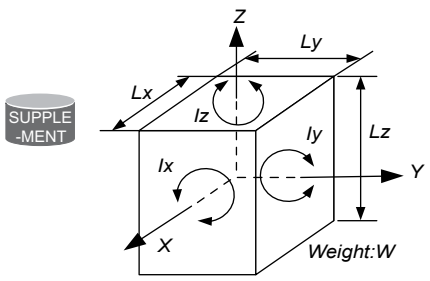
- W : 7.000 kg
- Xg : 100.000 mm
- Yg : 0.000 mm
- Zg : 70.000 mm
- Ix : 0.000 kg •m^2
- Iy : 0.000 kg •m^2
- Iz : 0.000 kg •m^2

SUPPLE -MENT

- The own moment of inertia calculation for hexahedron and cylinder

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

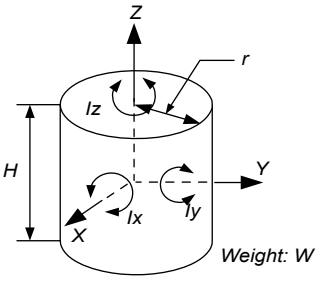
the expression when the calculation of the moment of inertia at the center of gravity.



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

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

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



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

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

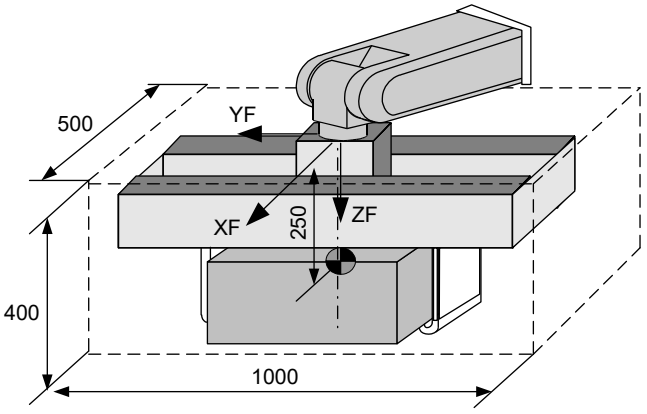
* Unit of Weight : [kg]
* Unit of Length : [m]
* Unit of Ix, Iy, Iz : [kg·m^2]

<Example 2>

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

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

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



Weight of tool: Approx. 55 kg.

Weight of workpiece: Approx. 40 kg.

Weight: W = 55 + 40 = 95

= approx. 100[kg]

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

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

Moment of inertia at the center of gravity:

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

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

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

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

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

<Setting>

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

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

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

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

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

   (xi, yi, zi) : Center of gravity position of the i- th parts (On flange coordinates) [mm]

   Icxi, Icyi, Iczi : Own moments of inertia of the i-th parts [kg*m^2]



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

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

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

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

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

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

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

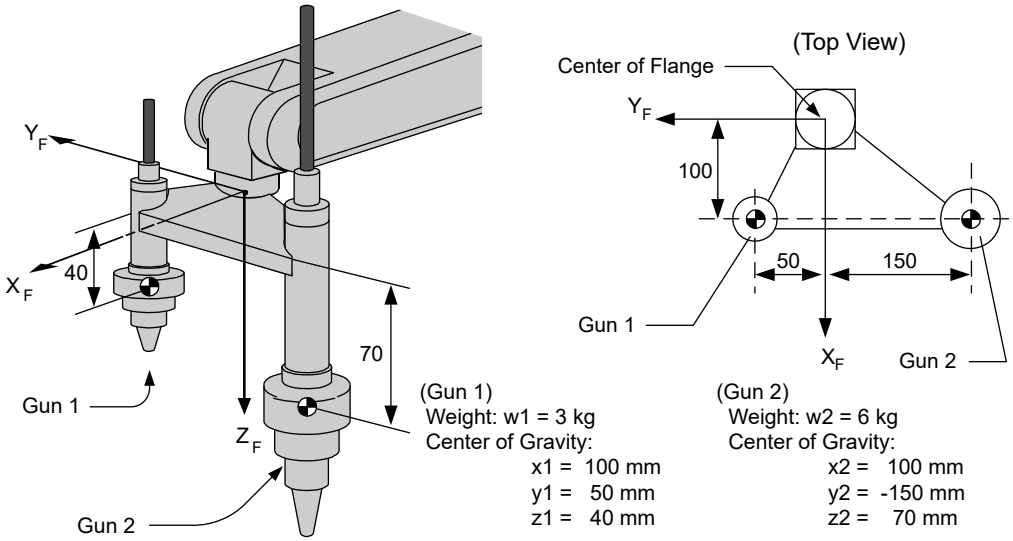
   $Iz = \{w1 * ((x1 - xg)^2 + (y1 - yg)^2) * 10^{-6} + Icz1\} + \{w2 * ((x2 - xg)^2 + (y2 - yg)^2) * 10^{-6} + Icz$
   .....
   $+ \{wi * ((xi - xg)^2 + (yi - yg)^2) * 10^{-6} + Iczi\}$

<Example 3>

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

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

This example shows the calculation with the method 2.



(Gun 1)
Weight: w1 = 3 kg
Center of Gravity:
x1 = 100 mm
y1 = 50 mm
z1 = 40 mm

(Gun 2)
Weight: w2 = 6 kg
Center of Gravity:
x2 = 100 mm
y2 = -150 mm
z2 = 70 mm

Weight : $W = w1 + w2$

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

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

$= (3 * 100 + 6 * 100) / (3+6) = 100.0 [mm]$

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

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

The moment of inertia at the center of gravity position:

$Ix = \{w1 * ((y1 - Yg)^2 + (z1 - Zg)^2) * 10^{-6} + Icx1\}$
$+ \{w2 * ((y2 - Yg)^2 + (z2 - Zg)^2) * 10^{-6} + Icx2\}$
$= 3 * ((50 - (-83))^2 + (40 - 60)^2) * 10^{-6}$
$+ 6 * (((-150) - (-83))^2 + (70 - 60)^2) * 10^{-6}$
$= 0.082 = \text{approx. } 0.100$

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

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

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

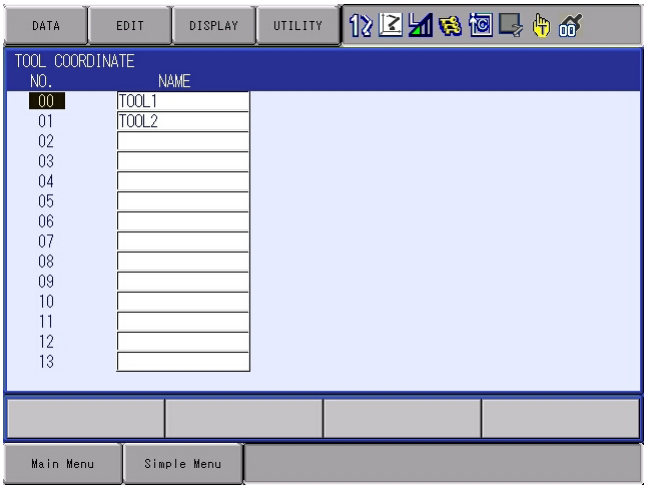
<Setting>

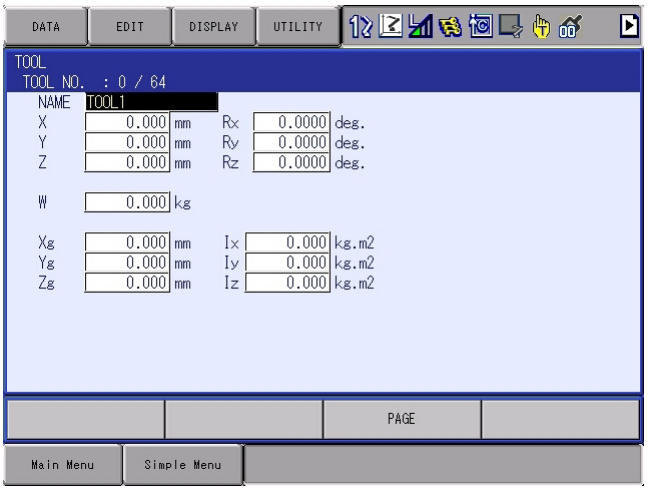
- W : 10.000 kg
- Xg : 100.000 mm
- Yg : -83.333 mm
- Zg : 60.000 mm
- Ix : 0.100 kg.m^2
- Iy : 0.010 kg.m^2
- Iz : 0.100 kg.m^2

8.4.3.3 Tool Load Information Registering

Tool load information is registered in the tool file.

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





3. Select the desired tool number.

   (1) Move the cursor to the number of the desired tool, and press [SELECT] in the tool list window.

   (2) The tool coordinate window of the selected number appears.

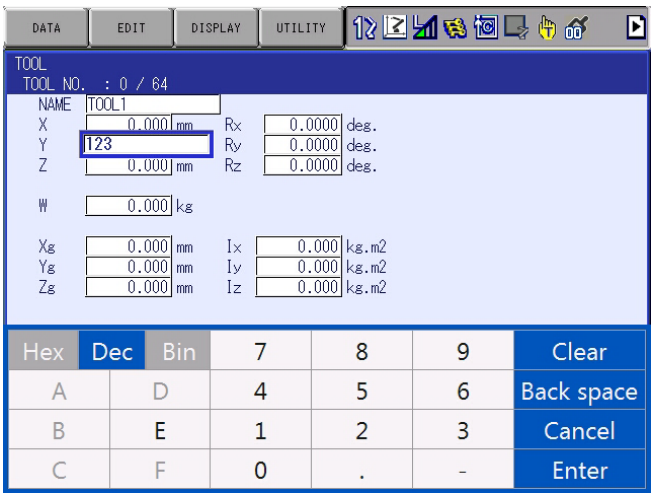
   (3) Select the desired number in the tool coordinate window by pressing the [PAGE] or clicking on the [PAGE] button.

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

4. Select the desired item to register and input the value.

   – The window can be scrolled with the cursor.

   – The menu enters the state of a numeric input if the cursor is on the desired item to register and the [SELECT] is pressed.



5. Press [ENTER].

   – The input value is registered.

   – The servo power is automatically turned OFF when editing the value while the servo power is ON, followed by a message “Servo off by changing data” displayed for three seconds.

• When the data setting is not done

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

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

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

Initial Setting Value:

Weight: W = Payload

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

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

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

NOTE

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

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

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

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

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

• Switch of the tool file

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

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

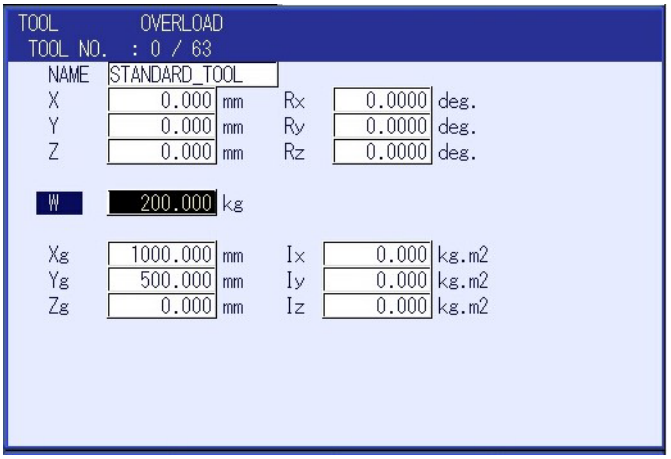
Moreover, set tool load information to the corresponding tool file respectively when total weight and the center of gravity position etc. of the tool is changed (when the system which exchange the tool by automatic tool changer).

8.4.3.4 Tool File Overload Check Function

This function provides notification of an overload when the tool information set in the tool file exceeds the permissible range.
This function is available for YAS4.37-00 or later.

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

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



NOTICE

- This function is not supported when there are multiple manipulators.

8.5 Work Home Position

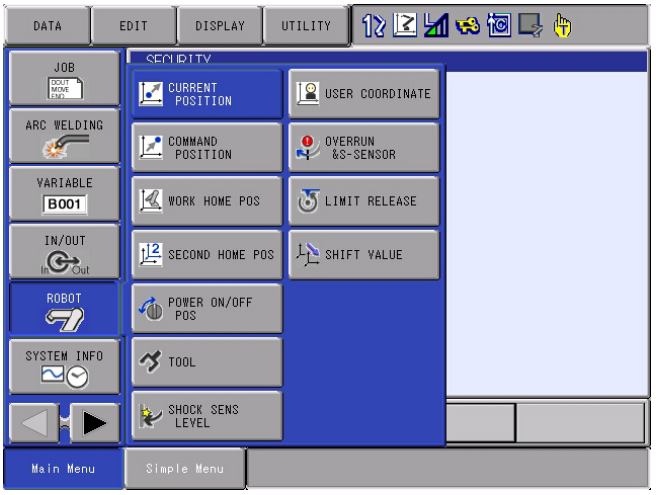
8.5.1 What is the Work Home Position?

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

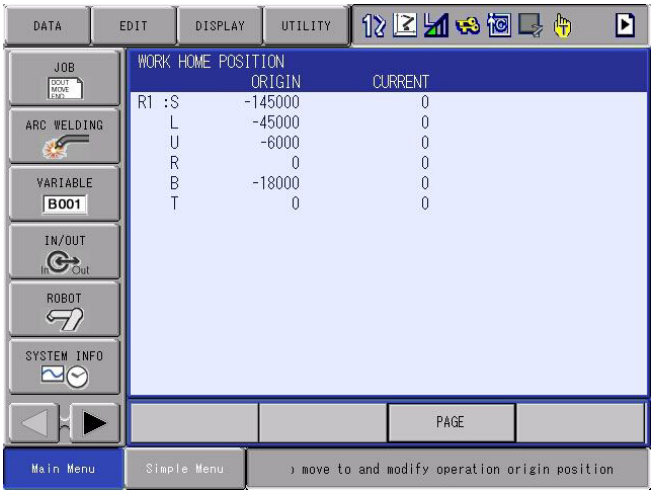
8.5.2 Setting Work Home Position

8.5.2.1 Work Home Position Window

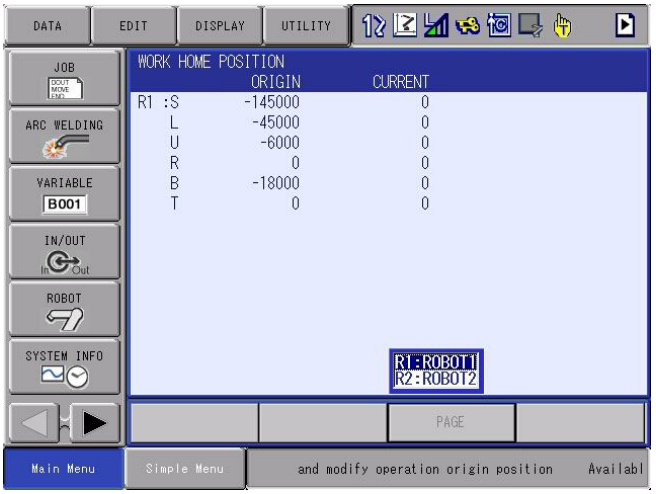
1. Select {ROBOT} under the main menu.



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



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



8.5.2.2 Registering/Changing the Work Home Position

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

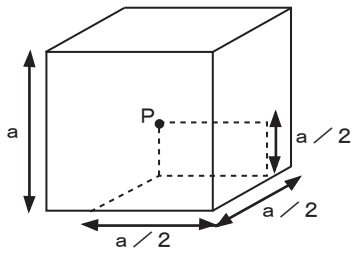
NOTE

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

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

The work home position cube is a cube as shown in *fig. 8-3 "S3C1097: The work home position cube length of its sides (μm)"* ; the length of its sides (a in fig8-3) is determined by a parameter of S3C1097 (units: μm).
By changing the contents of this parameter, the size of the cube can be changed.(The initial value is 10cm)

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



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

8.5.2.3 Returning to the Work Home Position

■ **In the teach mode**

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

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

■ **In the play mode**

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

8.5.2.4 Output of the Work Home Position Signal

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

8.6 Interference Area

8.6.1 Interference Area

The interference area is a function that prevents interference between multiple manipulators or the manipulator and peripheral device. The areas can be set up to 64 areas. Three types of methods to use each interference area are as follows:

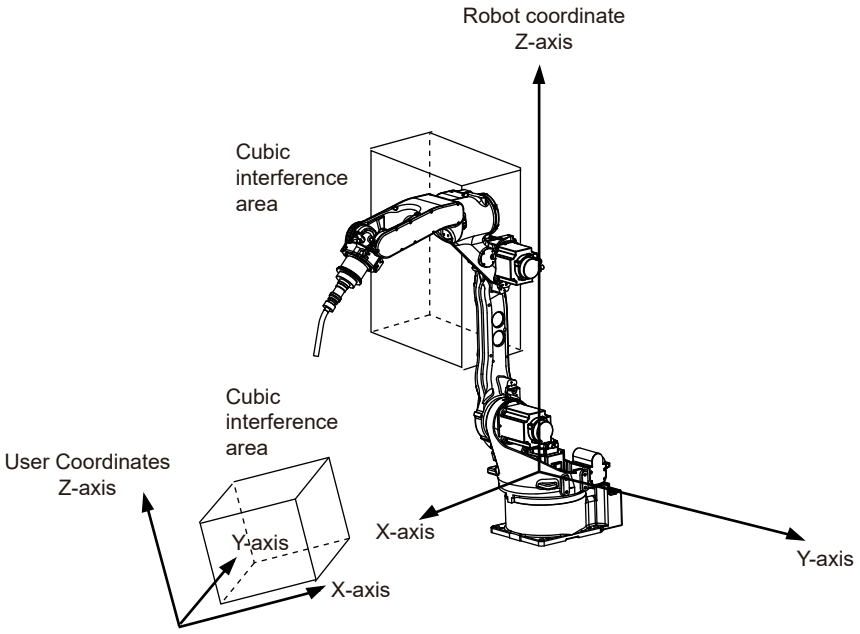
- Cubic Interference
- Outside of cubic area
- Axis Interference

The YRC1000 judges whether the TCP of the manipulator is inside or outside this area, and outputs this status as a signal.

8.6.2 Cubic Interference Area

8.6.2.1 Cubic Interference Area

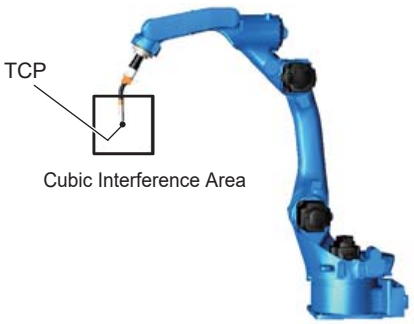
This area is a rectangular parallelepiped which is parallel to the base coordinate, robot coordinate, or user coordinate. The YRC1000 judges whether the current position of the manipulator's TCP is inside or outside this area, and outputs this status as a signal.



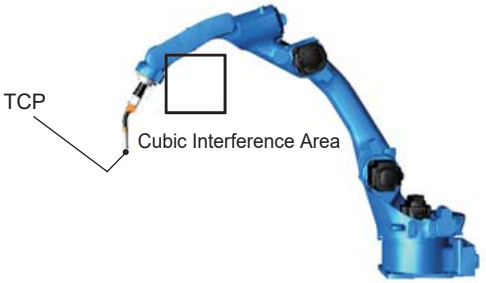
■ **Types of Cubic Interference Area**

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

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



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

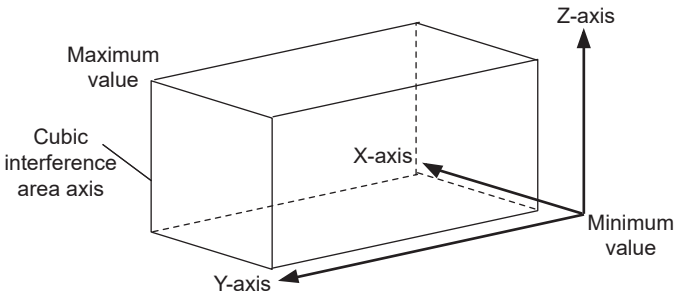


TCP is located outside the cube
- Cubic interference: Specified output signal = OFF
- Outside of cubic area: Specified output signal = ON

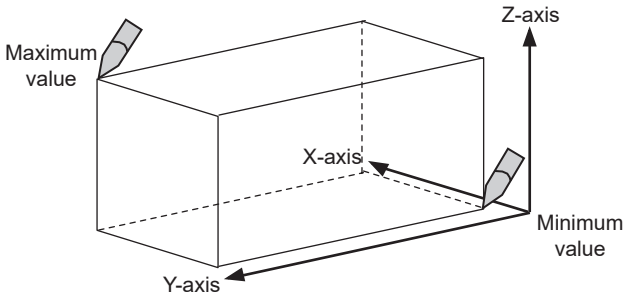
8.6.2.2 Cube Setting Method

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

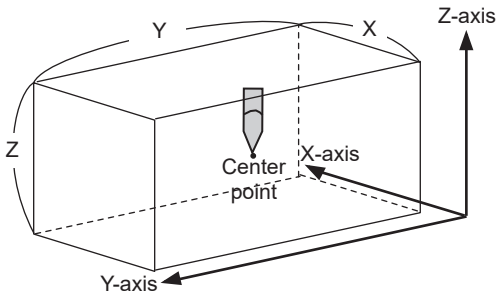
1. Enter the maximum and minimum values for the cube coordinates.



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

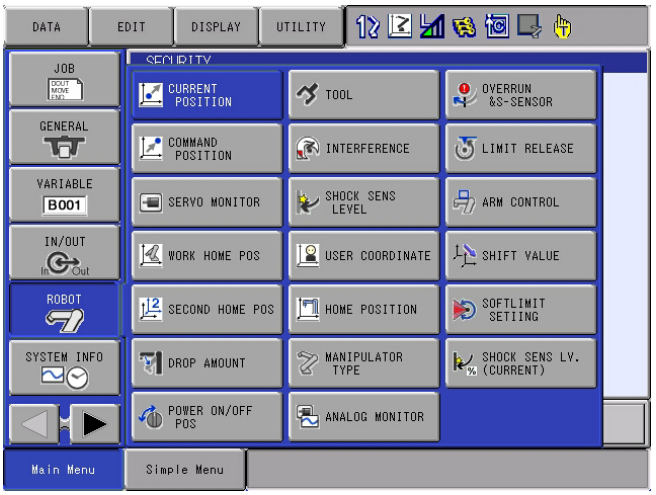


3. After entering the lengths of the three faces of the cube (axial length) using the Numeric keys, move the manipulator to the center point of the cube using the axis keys.

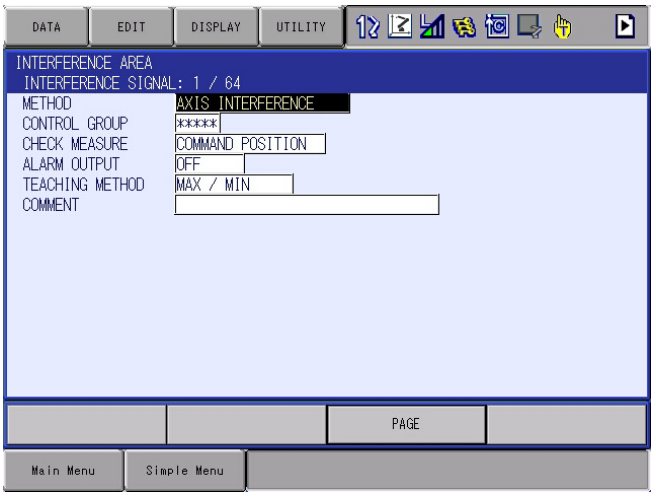


8.6.2.3 Setting Operation

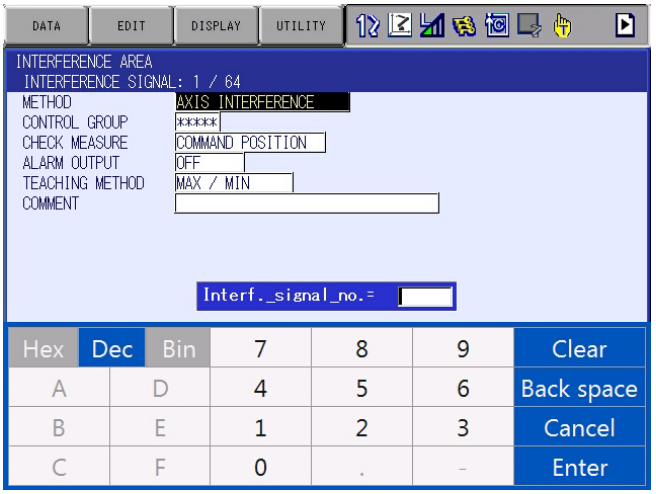
1. Select {ROBOT} under the main menu.



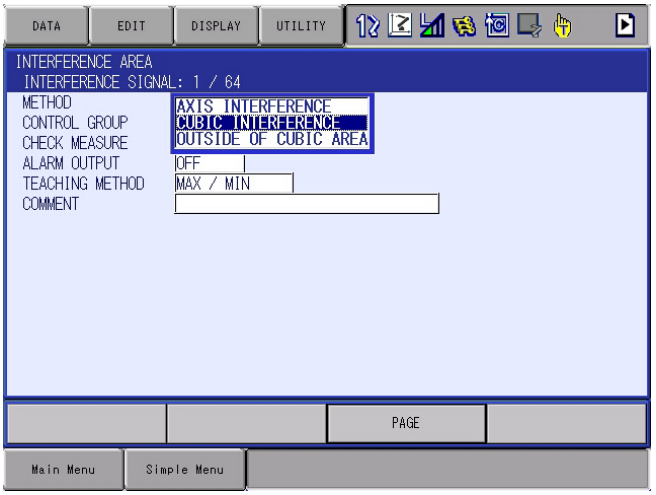
2. Select {INTERFERENCE}.
   – The INTERFERENCE AREA window is shown.



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



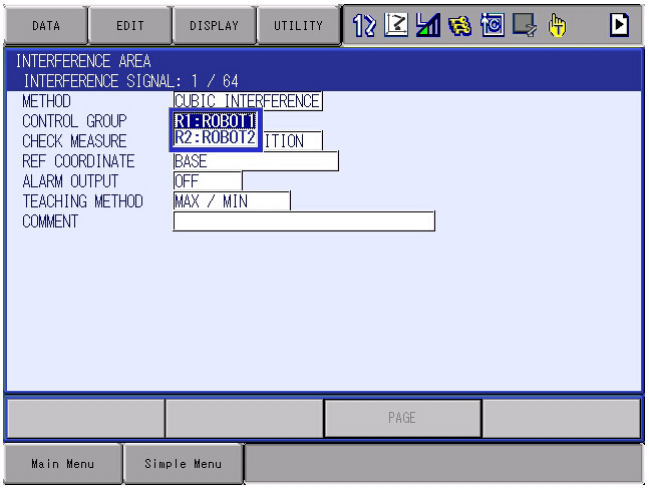
4. Select “METHOD”.
   – A selection dialog box appears.
   (1) Select “CUBIC INTERFERENCE” or “OUTSIDE OF CUBIC AREA”.



5. Select “CONTROL GROUP”.

   – A selection dialog box appears.

   (1) Select the desired control group.

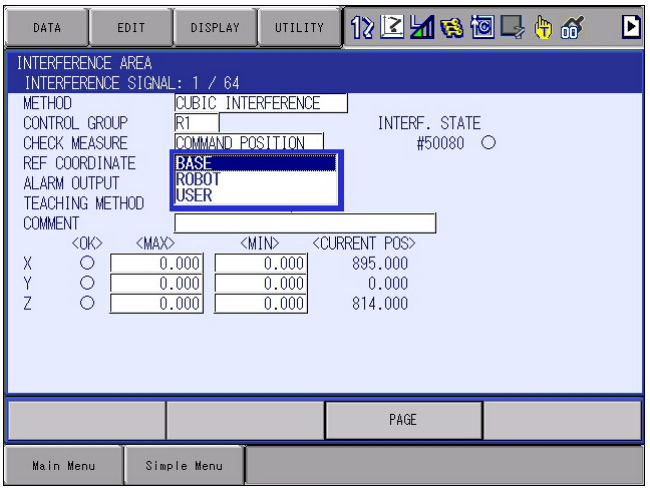


6. Select “REF COORDINATES”.

   – A selection box appears.

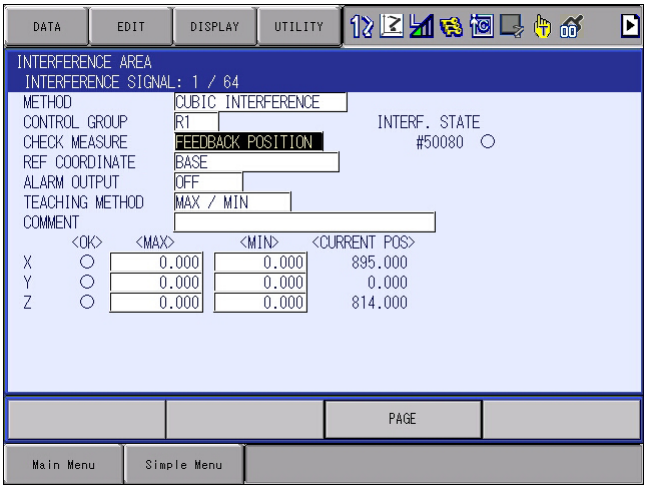
   (1) Select the desired coordinate.

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



7. Select “CHECK MEASURE”.

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



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

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

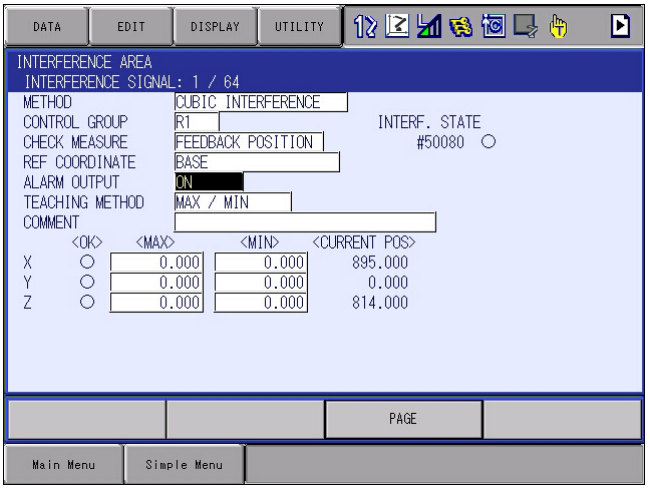
NOTE

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

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

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

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



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

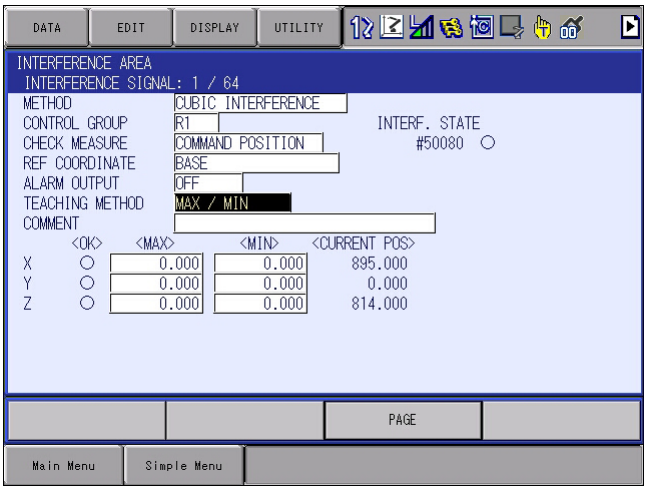
AL4902 CUBE INTERFERENCE (TCP)

■ **Number Input of the Cube Coordinates**

1. Select “METHOD”.

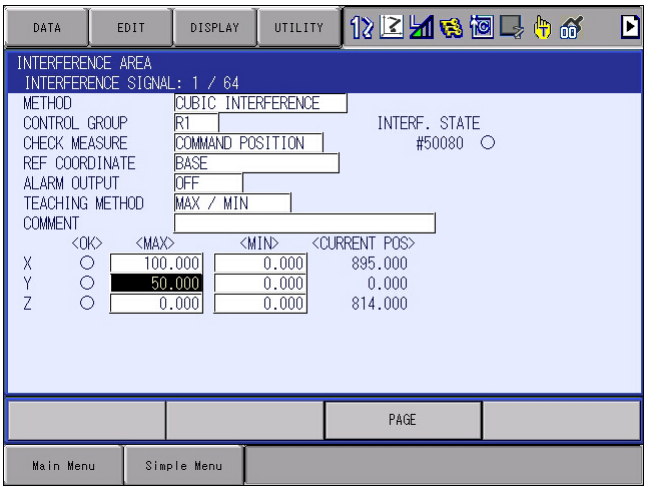
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.



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

   – The cubic interference area is set.

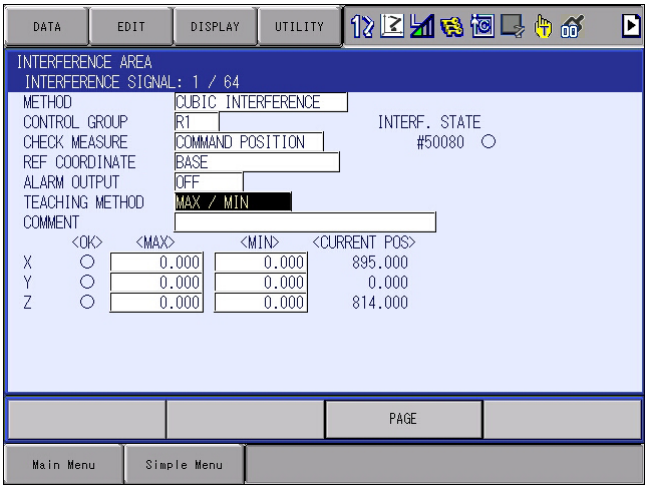


■ **Teaching Corner**

1. Select “METHOD”.

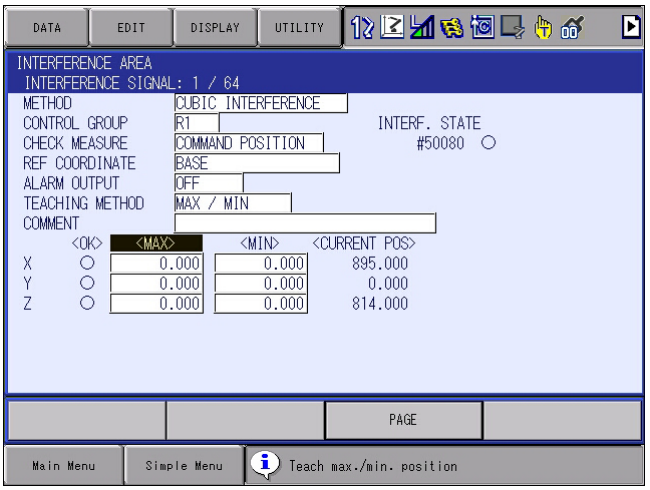
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.



2. Press [MODIFY].

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



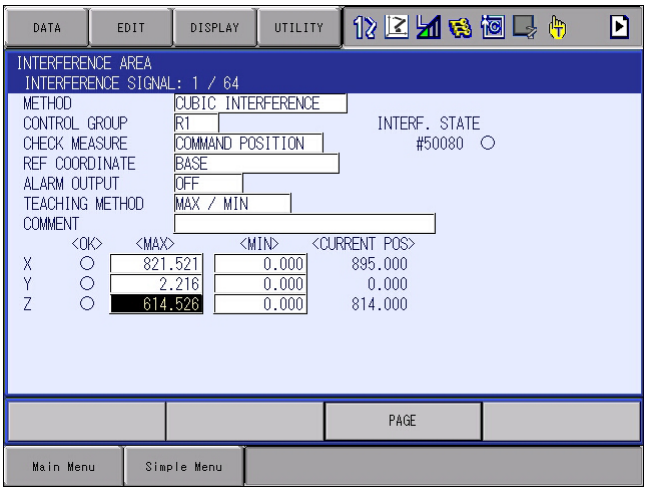
3. Move the cursor to “<MAX>” or “<MIN>.”

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

4. Move the manipulator using the axis keys.

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

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

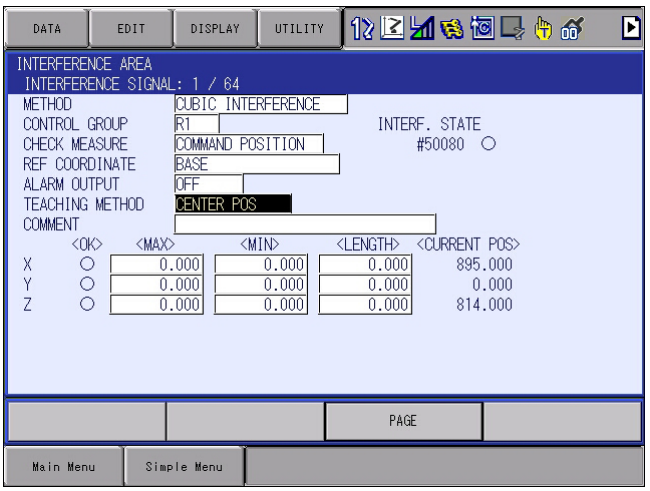


■ **Number Input of the Side of Cube and Teaching Center**

1. Select “METHOD”.

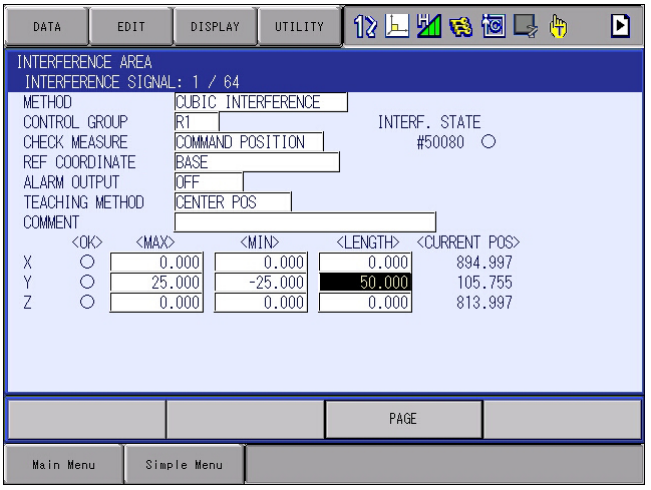
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “CENTER POS”.

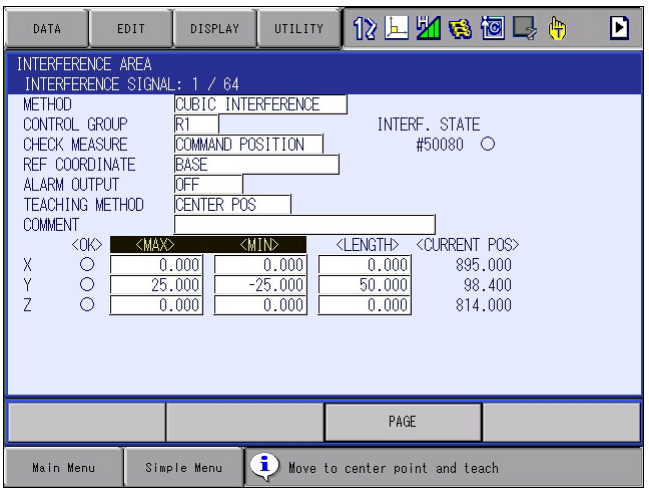


2. Input data for length of the cube, then press [ENTER].

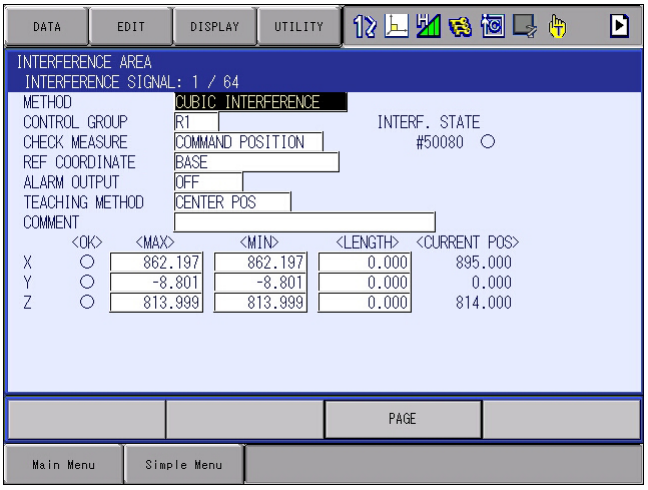
   – The length is set.



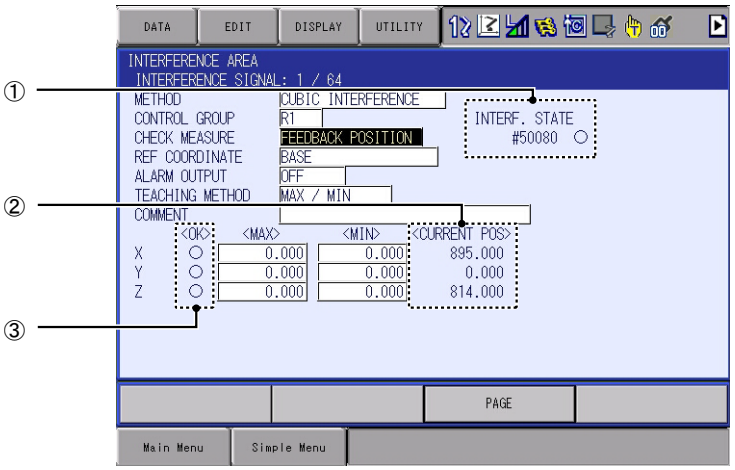
3. Press [MODIFY].
   – A message “Move to center point and teach” appears. The cursor only moves to either “<MIN>” or “<MAX>” at this time.



4. Move the manipulator using the axis keys.
   – Move the manipulator to the center point of the cube using the axis keys.
5. Press [ENTER].
   – The current position is registered as the center point of the cube.



■ Current Position and Interference Area Judgment



① INTERF. STATE

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

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

② CURRENT POS

Displays the current robot position.

③ OK

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

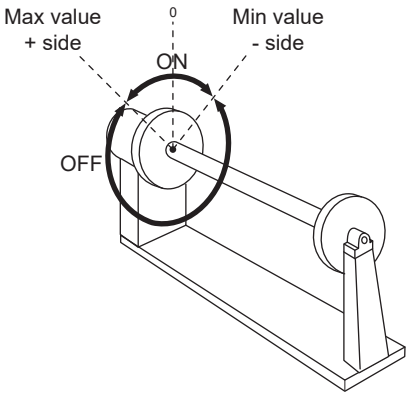
“○”: within the range, “●”: out of the range, which is between “MAX” and “MIN” displayed the current value of the axis.

8.6.3 Axis Interference Area

8.6.3.1 Axis Interference Area

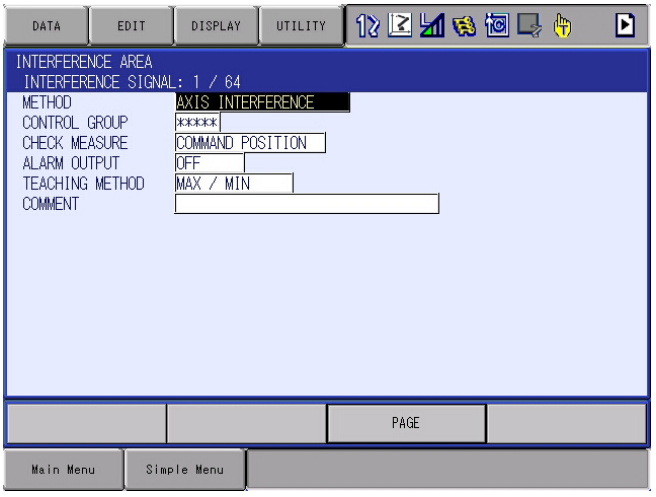
The axis interference area is a function that judges the current position of the each axis and outputs a signal. Once the maximum and minimum values have been set at the plus and minus sides of the axis to define the working range, a signal indicating whether the current position of the axis is inside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

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

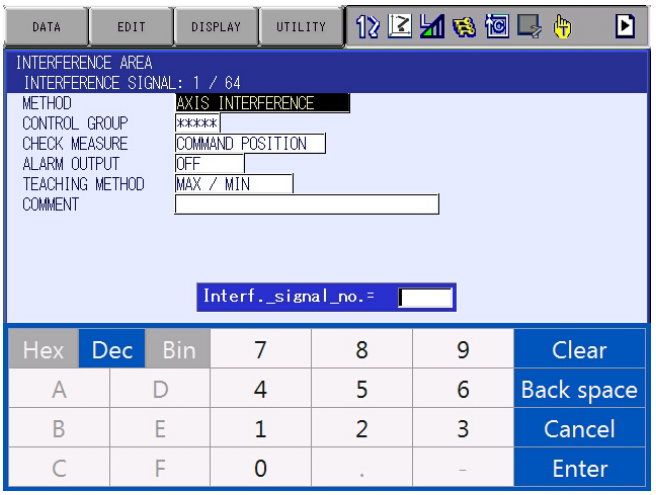


8.6.3.2 Setting Operation

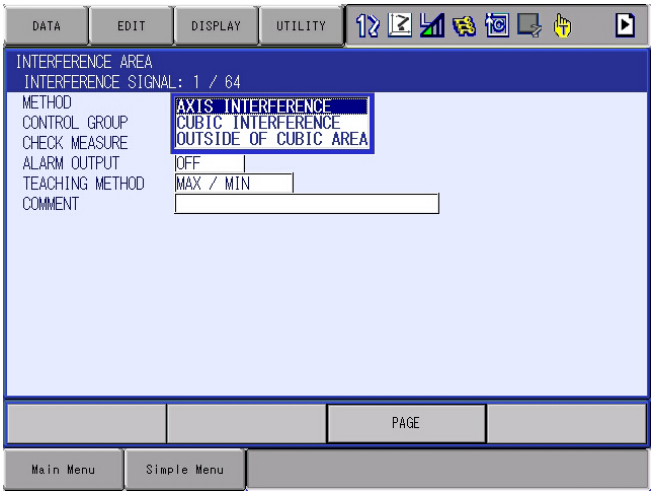
1. Select {ROBOT} under the main menu.
2. Select {INTERFERENCE}.
   – The INTERFERENCE AREA window appears.



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

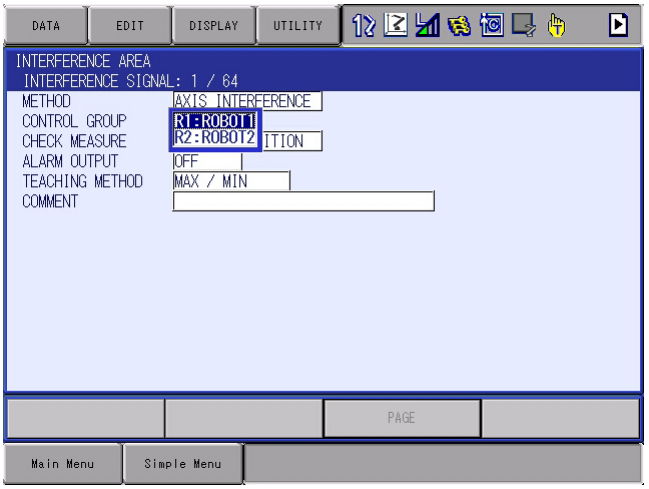


4. Select “METHOD”.
   – A selection dialog box appears.
   (1) Select “AXIS INTERFERENCE”.



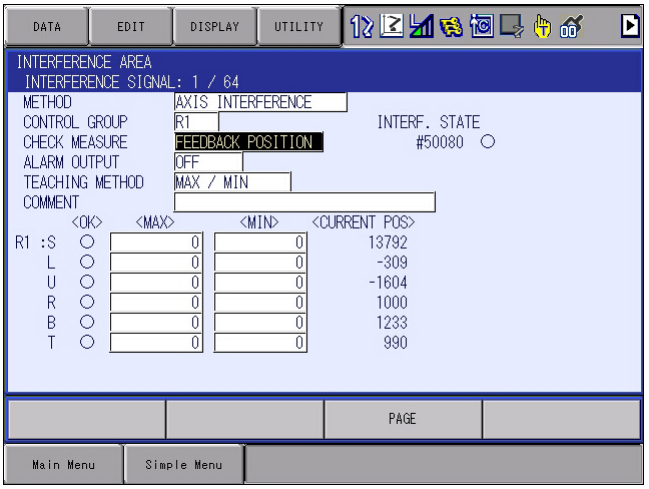
5. Select “CONTROL GROUP”.

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



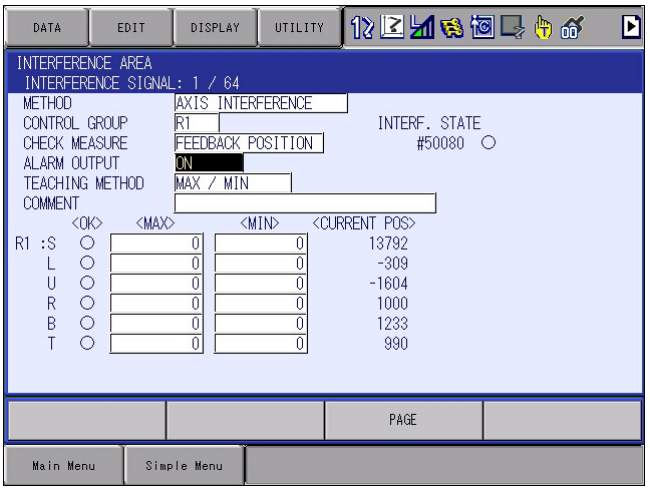
6. Select “CHECK MEASURE”.

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



7. Select “ALARM OUTPUT”.

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



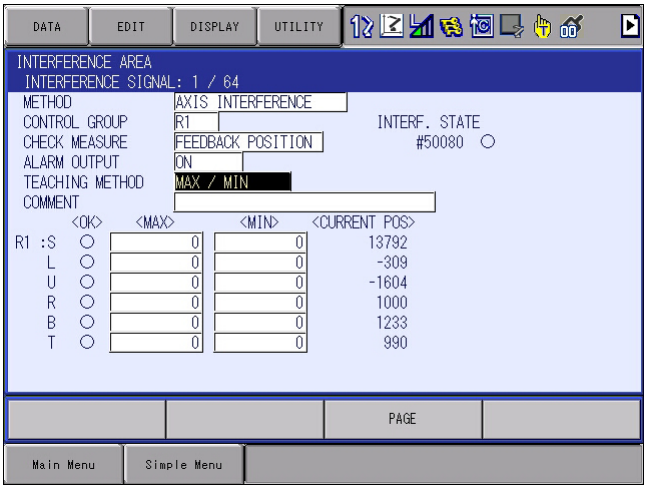
When selecting “ON” and if the manipulator’s axes approach inside the pre-defined interference area, the following alarm occurs and the manipulator stops immediately.

AL4901 AXIS INTERFERENCE

■ **Number Input of the Axis Data Coordinates**

1. Select “METHOD”.

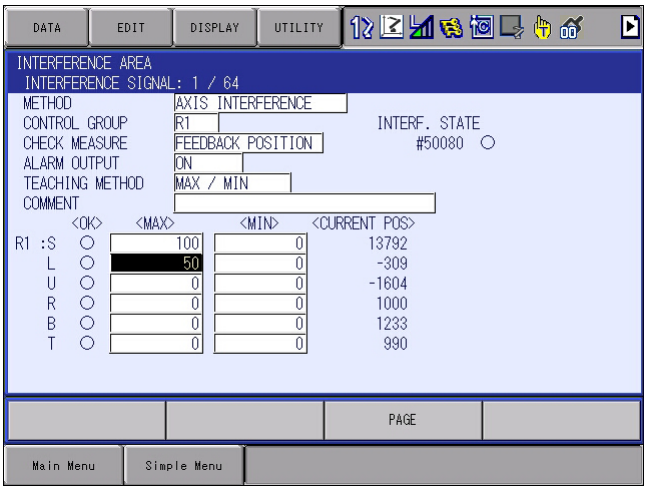
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.



   (2) Select “MAX/MIN”.

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

   – The axis interference area is set.

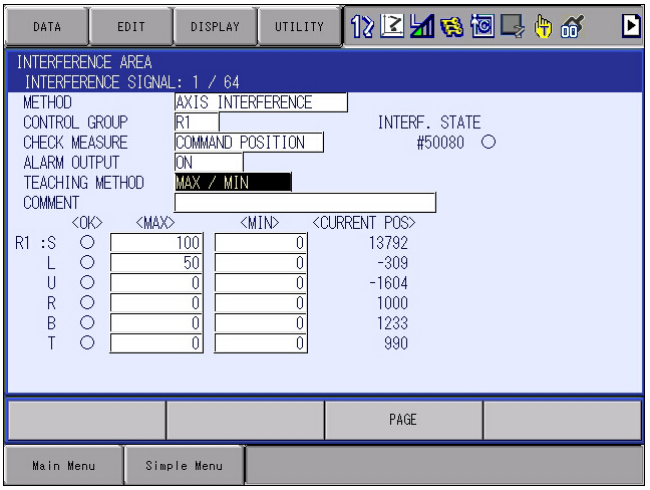


■ **Teaching Corner**

1. Select “METHOD”.

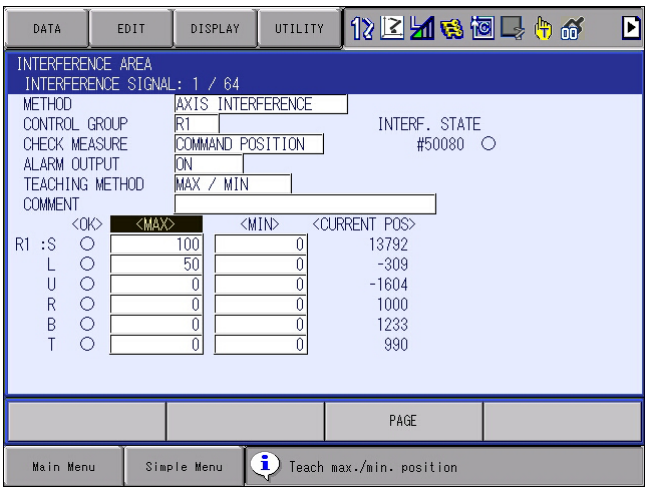
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “MAX/MIN”.



2. Press [MODIFY].

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



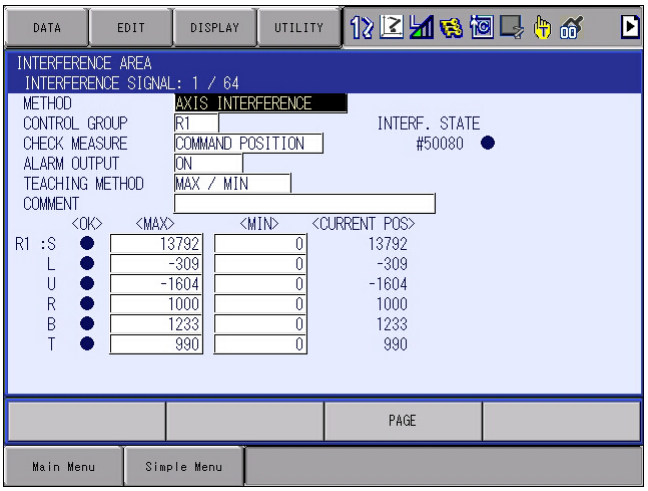
3. Move the cursor to “<MAX>” or “<MIN>”.

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

4. Move the manipulator using the axis keys.

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

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

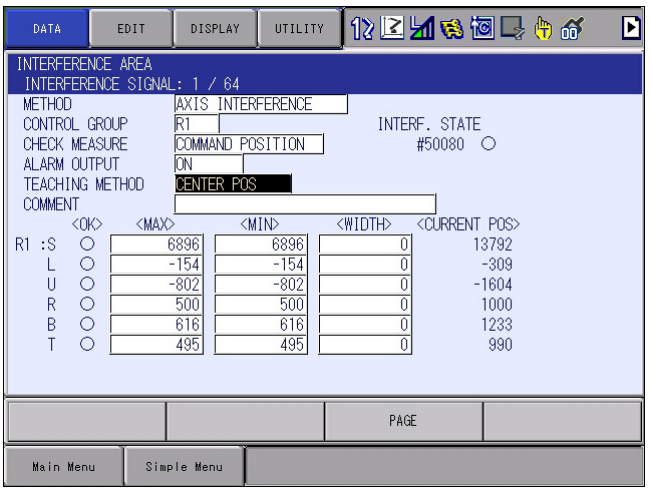


■ **Number Input of Center Position (WIDTH) and Teaching Center**

1. Select “METHOD”.

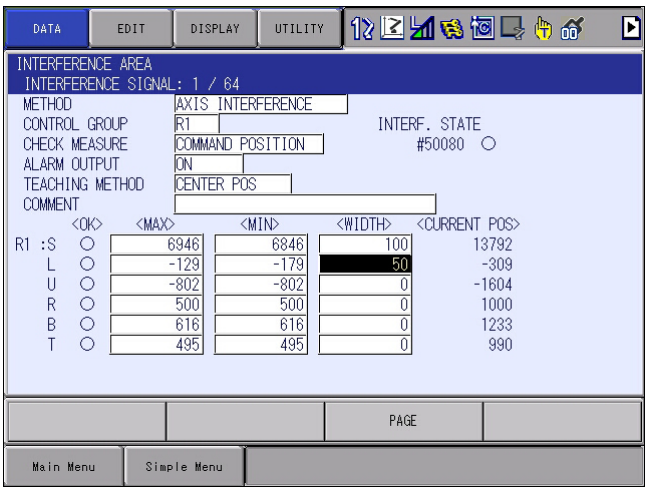
   (1) Each time [SELECT] is pressed, “MAX/MIN” and “CENTER POS” switch alternately.

   (2) Select “CENTER POS”.

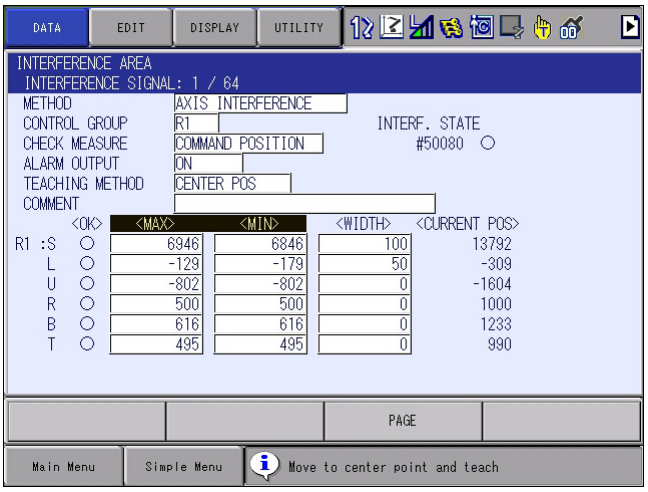


2. Input number for “WIDTH” data and press [ENTER].

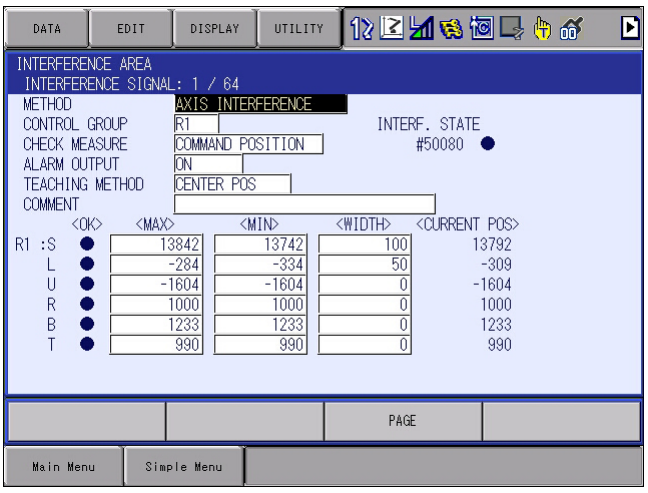
   – “WIDTH” is set.



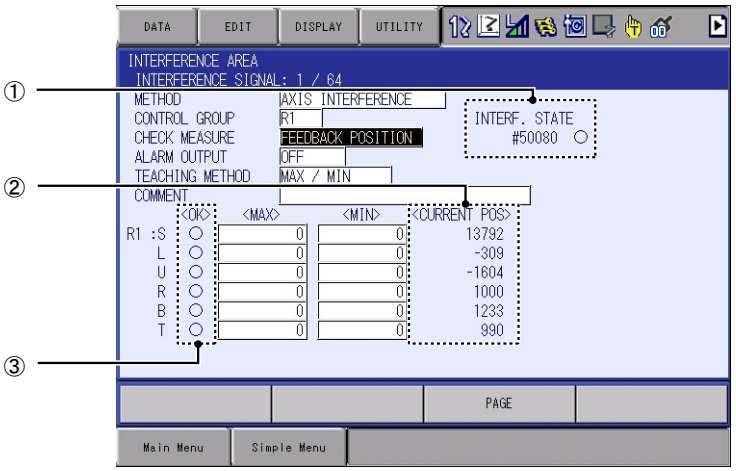
3. Press [MODIFY].
   – A message “Move to the center point and teach” appears.
   The cursor only moves to either “<MIN>” or “<MAX>” at this time.



4. Move the manipulator using the axis keys.
   – Move the manipulator to the center position of the cube using the axis keys.
5. Press [ENTER].
   – The center position of the cube is registered.



■ Current Position and Interference Area Judgment



① INTERF. STATE

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

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

② CURRENT POS

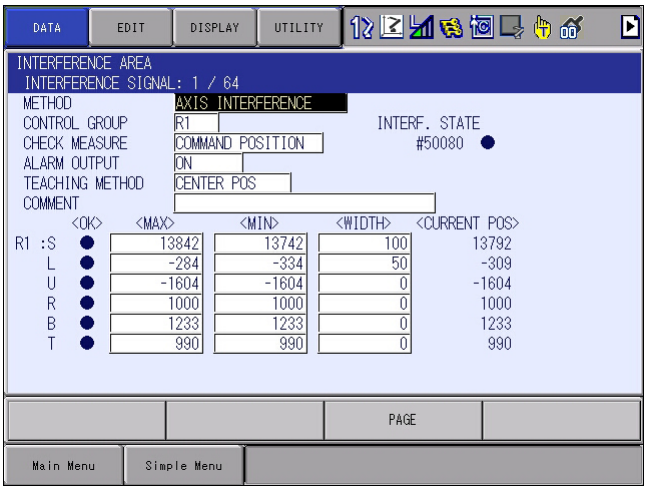
Displays the current robot position.

③ OK

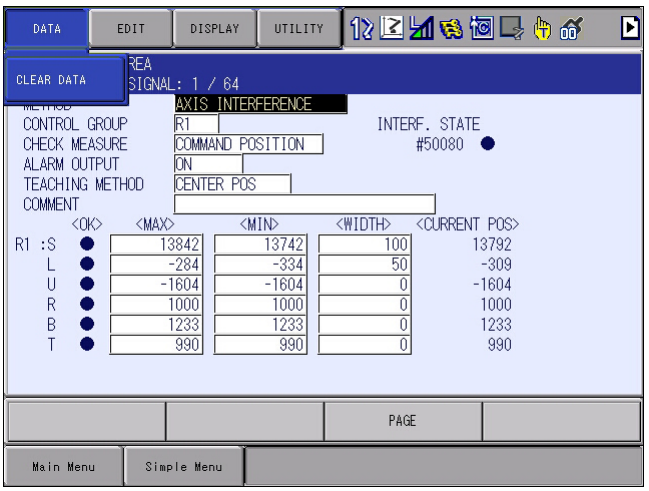
“●”: within the range, “○”: out of the range, which is between “MAX” and “MIN” displayed the current value of the axis.

8.6.4 Clearing the Interference Area Data

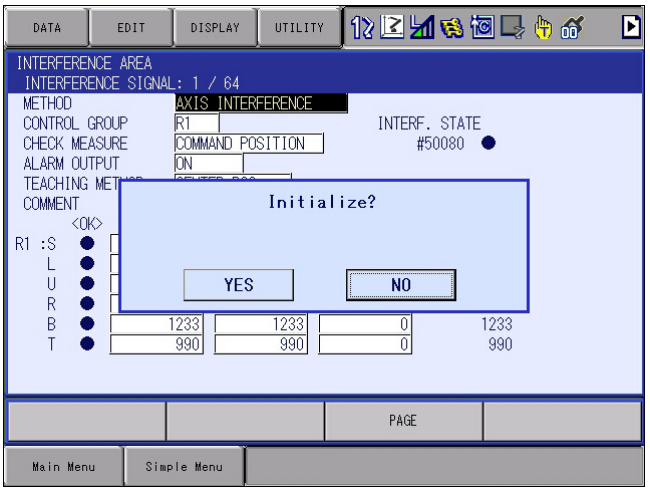
1. Select {ROBOT} under the main menu.
2. Select {INTERFERENCE}.
   – The INTERFERENCE AREA window is shown.



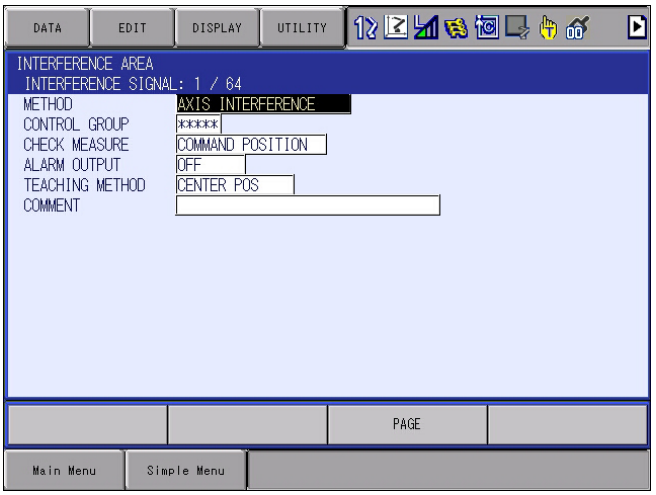
3. Select interference signal to be cleared.
   – Select the desired interference signal number to be cleared using the [PAGE] or by number input.
   – When selecting the desired interference signal number by number input, select [PAGE] to input the desired signal number.
4. Select {DATA} in the pull-down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



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



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



8.7 Shock Detection Function

8.7.1 Shock Detection Function

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

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

WARNING

The shock detection function does not completely prevent damage to the peripheral devices or guarantee human safety. Make sure to take safety measures such as installing safety fences. For details on safety measures, refer to *chapter 1 "Safety"* to *chapter 6 "Test of Program Operation"* .

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

8.7.2 Shock Detection Function Setting

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

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

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

The detection sensitivity is set by setting the detection level.

8.7.2.1 Shock Detection Level Setting

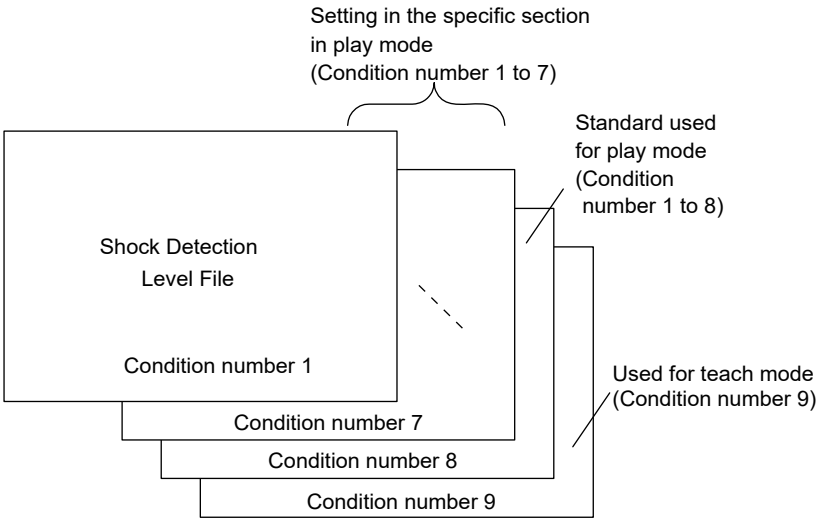
The shock detection level is set in the shock detection level set file.

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

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

The detection level is changed by a job instruction SHCKSET.

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



SUPPLE-MENT

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

SUPPLE-MENT

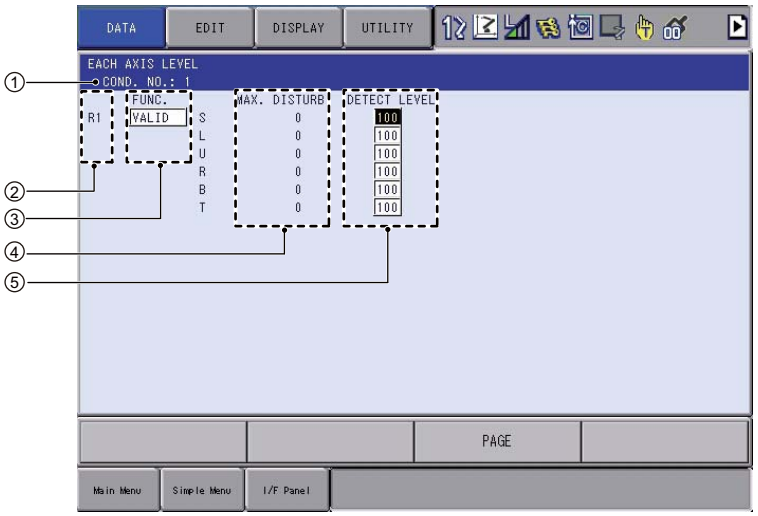
Teach Mode Each Axis Setting Function

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

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

S2C869: Teach Mode Each Axis Setting Function

(1: VALID, 0: INVALID)



① Condition Number (1 to 9)

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

② Robot Select

Select the manipulator whose detection level is to be changed.

③ Function Select

Specifies VALID/INVALID of the shock detection function. The shock detection function is specified for each manipulator.

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

④ Max. Disturbance Force

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

this value when inputting the detection level value in ⑤.

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

⑤ Detection Level (Level range: 1 to 500)

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

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

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

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

1. Select {ROBOT} under the main menu.
2. Select {SHOCK SENS LEVEL}.
   – The EACH AXIS LEVEL window appears.
   – Perform either of the following operations to display the page of desired condition number:
   (1) Press [PAGE] in the window. Enter the desired condition number using numeric keys and press [ENTER]. Then the page of the condition number appears.
   (2) Press the [PAGE] to change the condition number.
3. Level setting for the condition numbers 1 to 8.
   Level setting values can be set for each axis on the EACH AXIS LEVEL window.
   Perform the following “Disturbance force measurement”, then perform “Setting all levels at once”.

■ **Disturbance force measurement**

① Mount the tool, workpiece, external equipment, and equipment on the arm to the manipulator.

② Set the tool file correctly.
For spot welding : Set the gun load information (weight and center of gravity). To use the gun change function, while removing the gun, switch to the tool file with which the load information without a gun is set.
For material handling: Set the total load information (weight and center of gravity) of the hand and the maximum load workpiece.
For other applications: Set the load information (weight and center of gravity) of the tool.

③ Set the detection level values of all the axes to 100.
(1) Open the SHOCK DETECT LEVEL window.
(2) Select {DATA}, then {CLEAR MAX VALUE}.

④ Perform the JOB.

■ **Setting all levels at once**

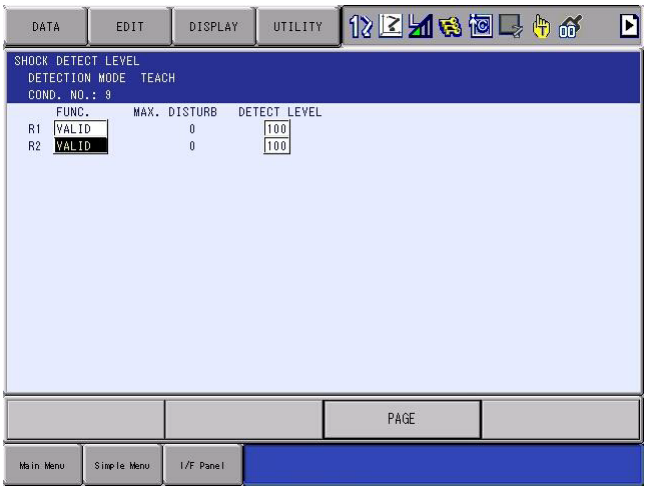
① Open the SHOCK DETECT LEVEL window.

② Select {DATA}, then {CHANGE EVERY LEVEL}.

③ Enter 120 in the coefficient (%) by which the max. disturbance force is multiplied.
The following calculated value A or B, whichever is larger, is set to the DETECT LEVEL.
A: (Max. disturbance force) x (coefficient = 120%)
B: (Max. disturbance force) + 15

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

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



NOTE

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

NOTE

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

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

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

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

A cold start refers to starting the robot without a warm-up operation after it has not been operated for a long time.

In a cold start, an disturbance force is large for a certain period of time because the grease viscosity is high. An offset value is added to DETECT LEVEL for a certain period of time to avoid a false shock detection that may be caused by the large disturbance force.

Excluding special cases, the robot is set to the cold start state and a 20% offset value is added to DETECT LEVEL when the control power supply is turned ON and when the robot has stopped continuously for 30 minutes or longer. The cold start state is canceled after 60 minutes of operation.

NOTE

Please note that at a cold start the shock detection will be performed only when the value is more than or equal to the sum of DETECT LEVEL and the offset value. Whether it is in a cold start state or not can be checked on the EACH AXIS LEVEL (CURRENT) Window.
The offset value is 20% except for special models.

During a cold start in YAS5.60.00A-00 or later, whether to add the offset value to DETECT LEVEL can be specified in the following parameter.

S1CxG228 = 0: Add the offset value to DETECT LEVEL during a cold start.

S1CxG228 = 1: Add the offset value to DETECT LEVEL during a cold start.

The "COLD START INVALID" message appears for 3 seconds when S1CxG228 is set to 1 and the servo is turned ON. The "COLD START INVALID" specific output signals (#53880 to #53887) are also turned ON while the servo is ON.

When S1CxG228 = 1, collision detection may be detected by mistake.

NOTE

The current DETECT LEVEL (when there is a cold start and S1CxG228 = 0, DETECT LEVEL + the offset value) can be confirmed under "Detection Level" on the EACH AXIS LEVEL (CURRENT) Window.

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

NOTE

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

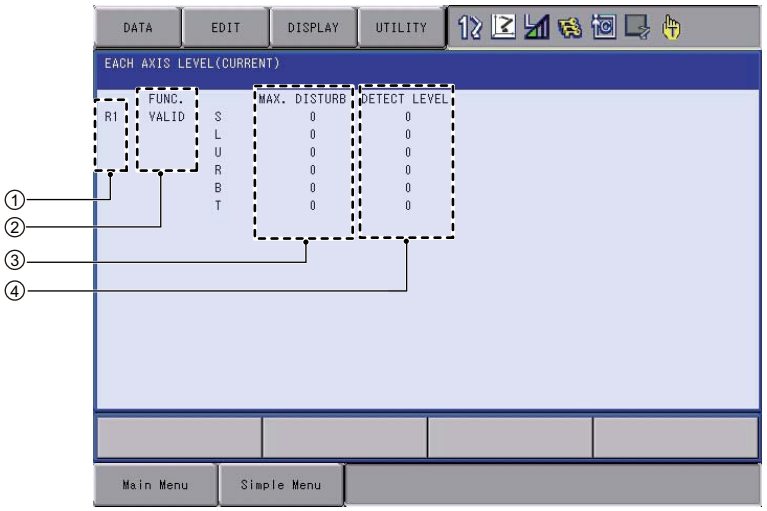
8.7.2.2 EACH AXIS LEVEL (CURRENT) Window

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

The shock detection levels change for the following reasons.

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

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



① Robot Select

Select the manipulator to display the detection level.

② Function Select

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

③ Max. Disturbance Force

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

④ Detection Level

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

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.

NOTE Except for certain models, a station does not support the shock detection function because it is difficult to accurately detect an external force.

■ **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

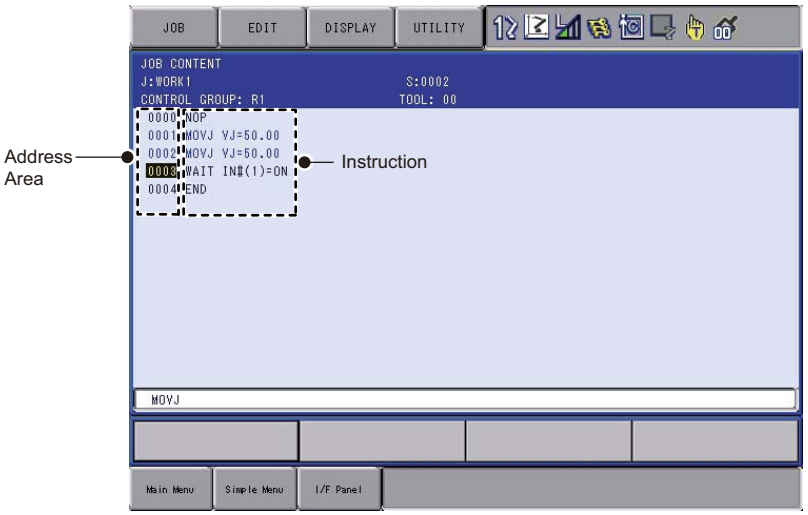
① **Robot Setting**

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.

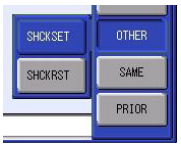
1. Select {JOB} under the main menu.



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

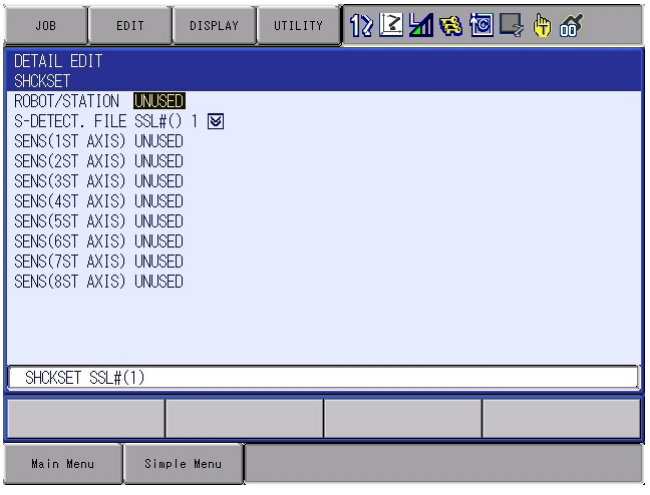
   (1) When the value is input with the numeric key, press [SELECT] to display the input buffer line.



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

   • When the robot specification is added

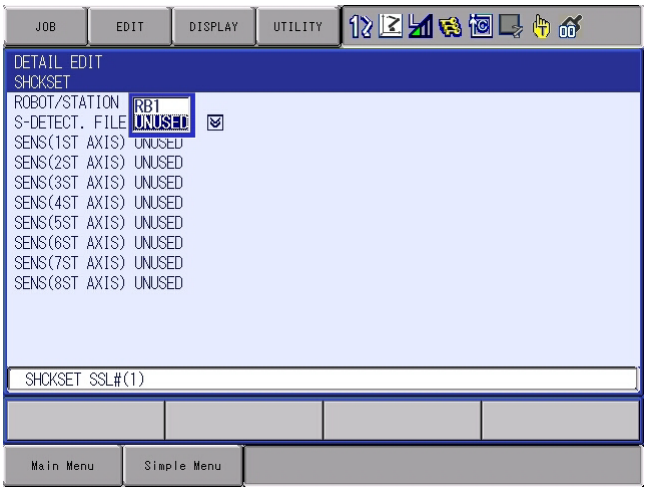
   (1) When the robot specification is added, move the cursor to the instruction in the input buffer line and press [SELECT] to display the DETAIL window.



   (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].

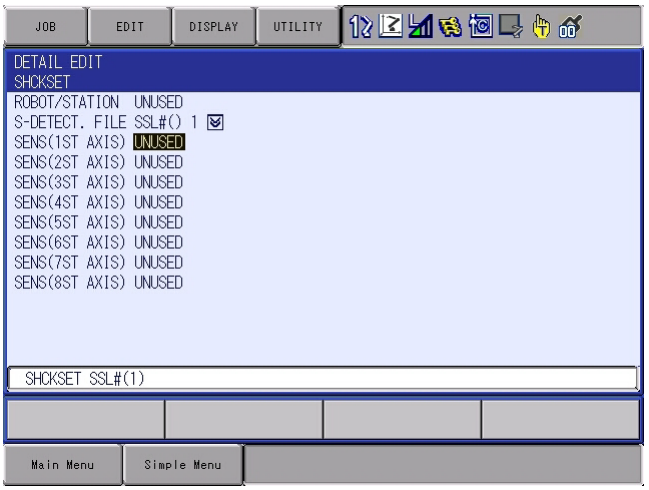


(5) When the addition of robot/station is completed, press [ENTER].

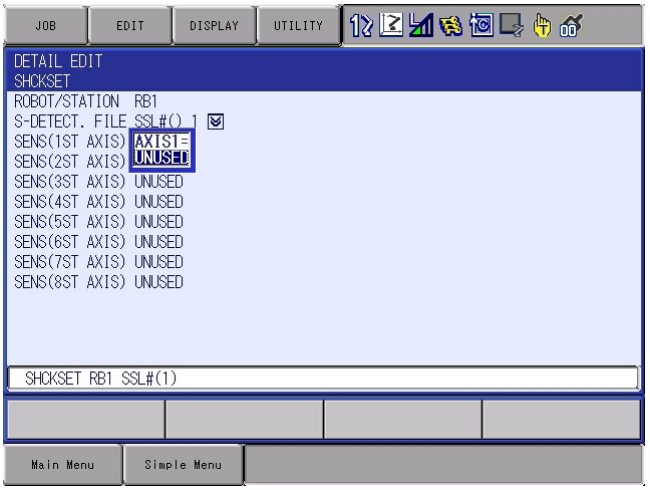
(6) The DETAIL window closes and the JOB CONTENT window appears.

• 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].



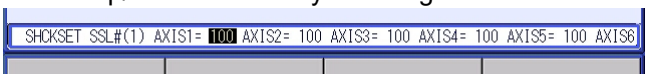
(3) The selection box appears, and select “AXIS=”.

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

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

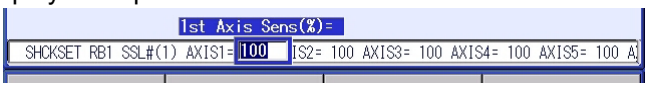
• When changing the shock detection level for the each axis

(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.



• When the value is input with the numeric key

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



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

5. Press [INSERT] then [ENTER].

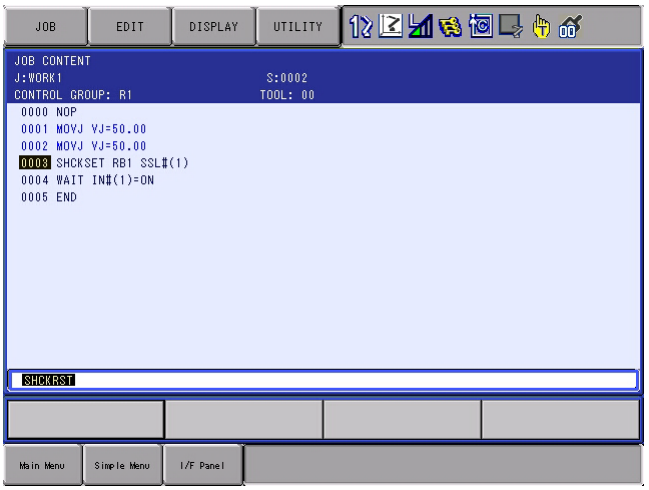
– The instruction displayed in the input buffer line is registered.

■ **SHCKRST**

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

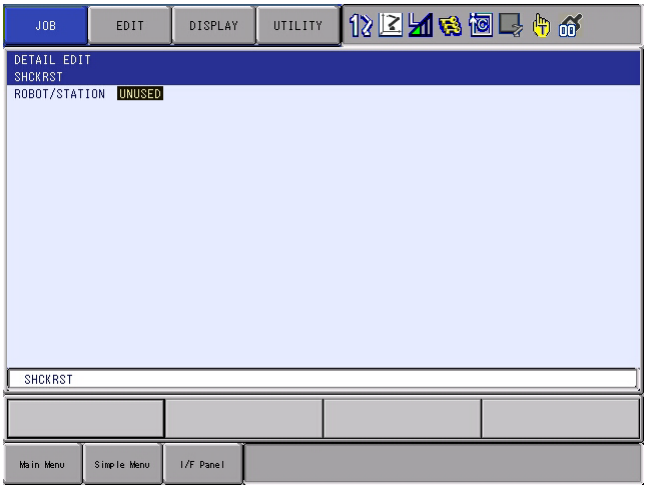


3. Select SHCKRST instruction.
   – SHCKRST instruction appears in the input buffer line.



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

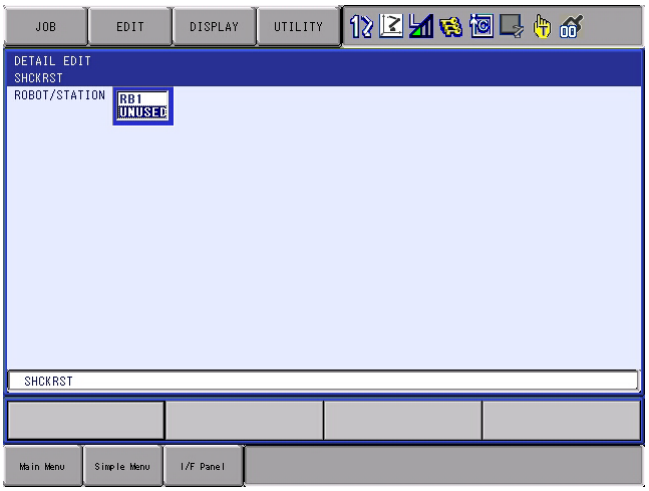
   (1) When adding the robot specification, move the cursor to instruction in the input buffer line and press [SELECT] to display the DETAIL window.



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

(3) The selection box appears.

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



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

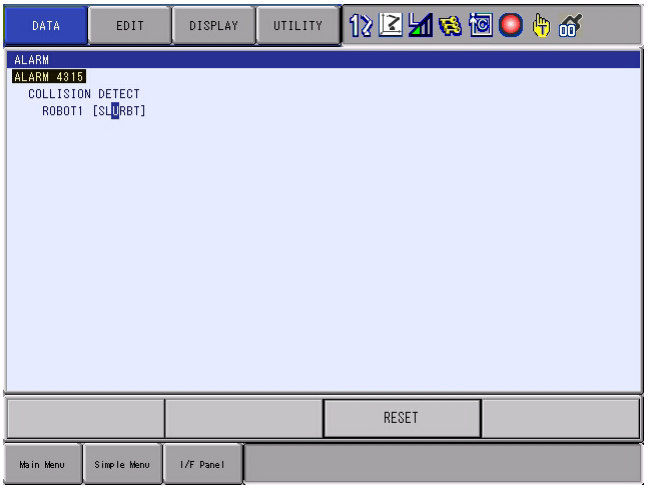
(6) The DETAIL window closes and the JOB CONTENT window appears.

5. Press [INSERT] then [ENTER].

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

8.7.2.6 Resetting the Shock Detected

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



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

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

NOTE

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

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

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

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

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

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

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

WARNING

This function does not completely prevent damage to the peripheral devices or guarantee human safety. Make sure to take safety measures such as installing safety fences. For details on safety measures, refer to *chapter 1 "Safety"* to *chapter 6 "Test of Program Operation"* .

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

8.7.3.1 Manipulator Type for High-Sensitivity Shock Detection Function

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

8.7.3.2 Setting for High-Sensitivity Shock Detection Function

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

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

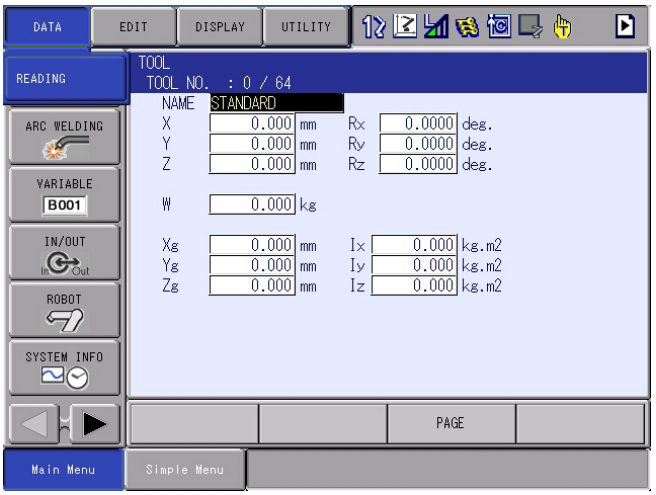
To enable the high-sensitivity shock detection function, read the tool load information prepared by YASKAWA on the MAKER INITIAL VALUE window. Since this function works on the assumption that the tool file is correctly set, read the tool load which is the same as the actual load on the MAKER INITIAL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

② Setting the U-arm payload

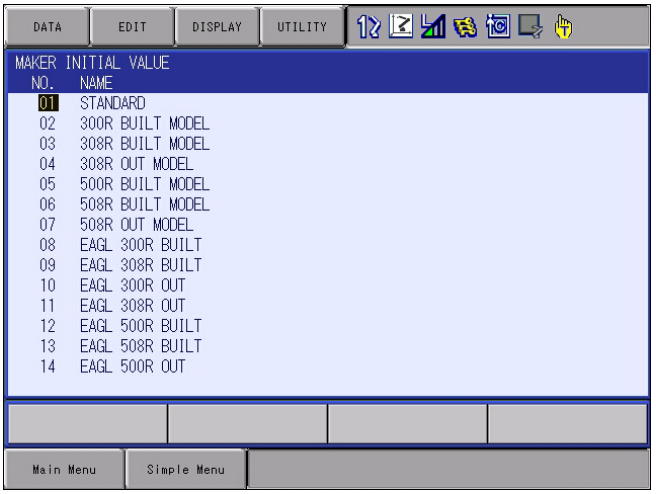
To perform shock detection more accurately, set the U-arm payload by referring to *chapter 8.4.2 "ARM CONTROL Window"* .
The U-arm payload prepared by YASKAWA can be read on the MAKER INITIAL VALUE window. Read the same data as the actual U-arm payload on the MAKER INITIAL VALUE window.

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

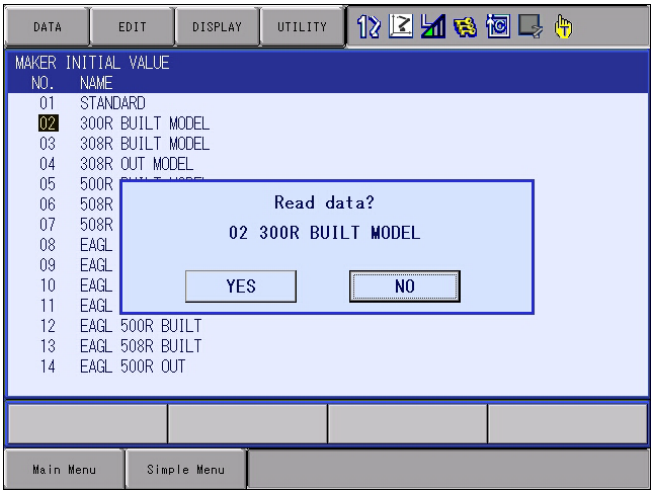
1. Change the “SECURITY MODE” to the “MANAGEMENT MODE”, then select {ROBOT} under the main menu.
2. Select {TOOL}.
   – The TOOL window appears.
3. Select the desired tool number.
4. Select {DATA} under the menu.
   – The pull-down menu appears.



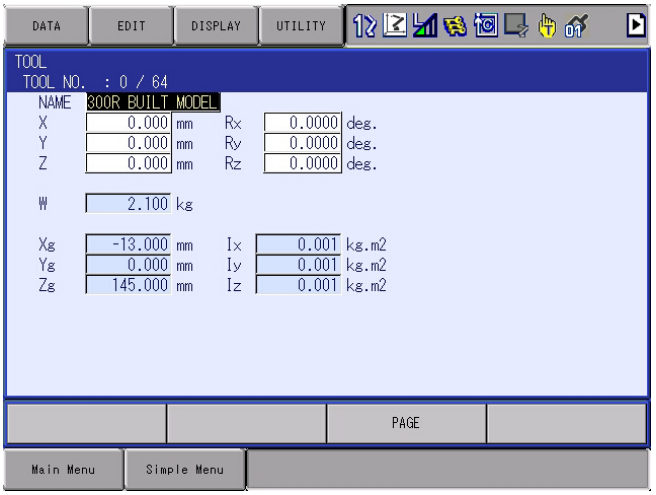
5. Select {READING}.
   – The MAKER INITIAL VALUE window appears.



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



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



NOTE

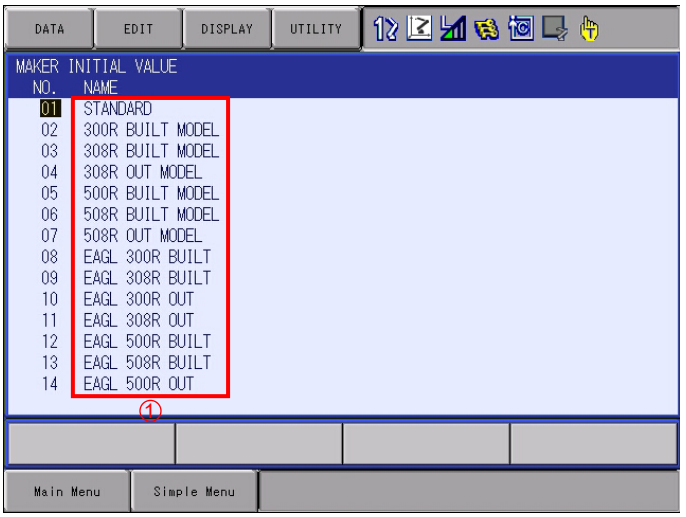
The high-sensitivity shock detection function is enabled when a maker initial value other than the “STANDARD” is selected. The read tool load information cannot be changed because it is used for the high-sensitivity shock detection function. When the standard torch is read, the function is disabled and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

NOTE

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.

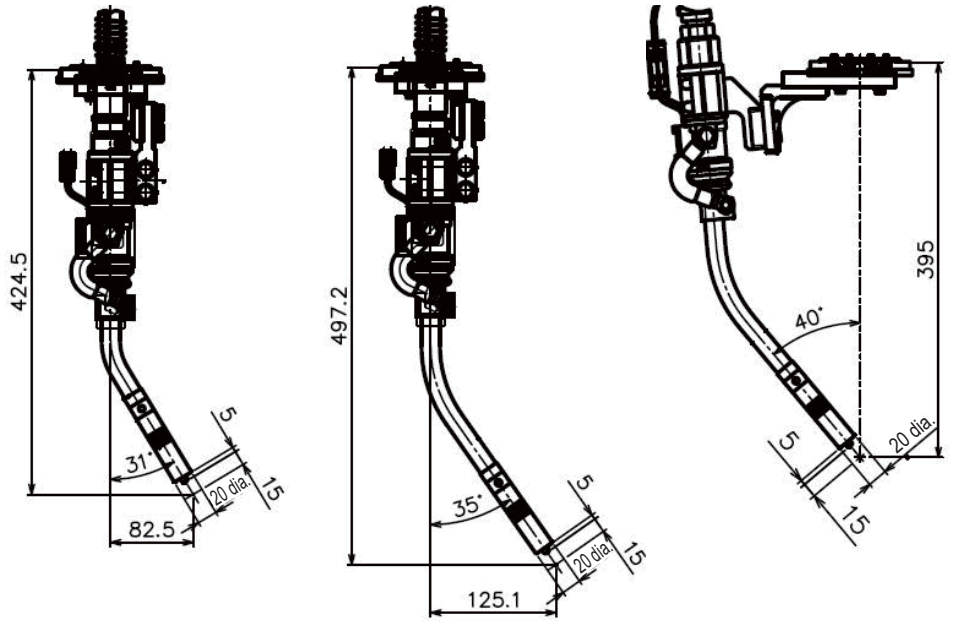
8.7.3.4 Explanation of Maker Initial Value



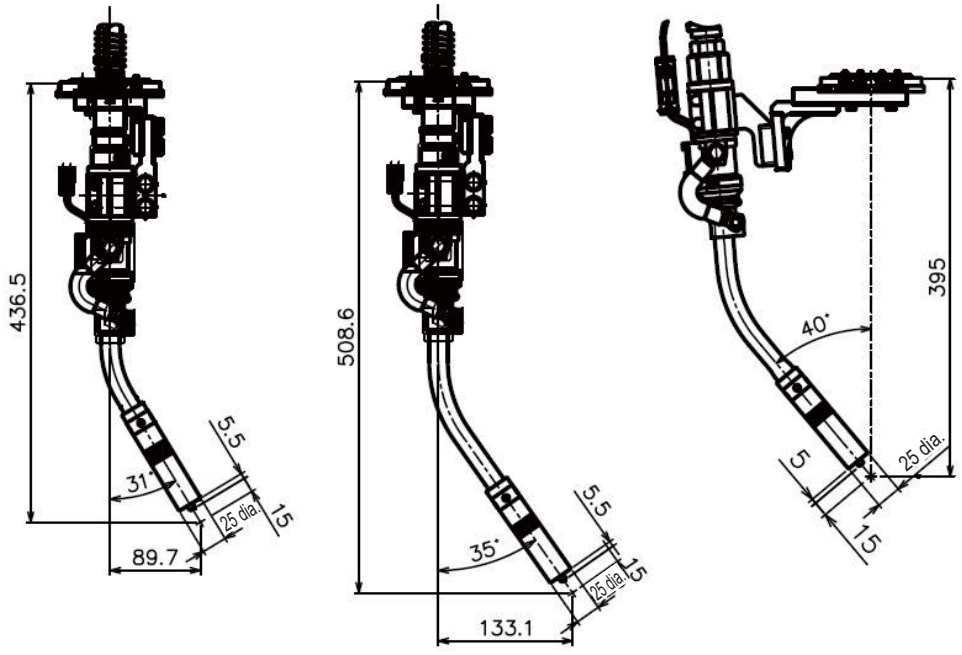
① **NAME**

The name of tool load information prepared by YASKAWA is indicated. When using one of the tools shown in the following figures, select the corresponding tool.

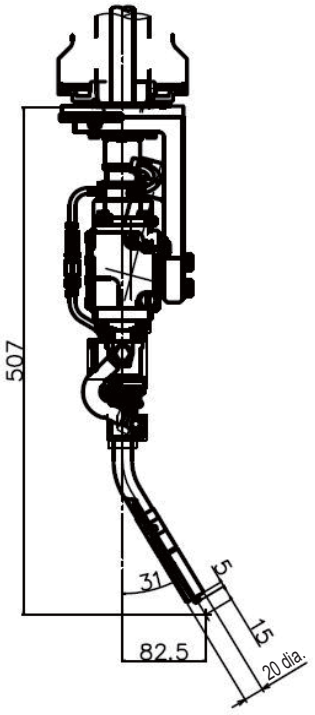
Fig. 8-5: Tool for High-Sensitivity Shock Detection



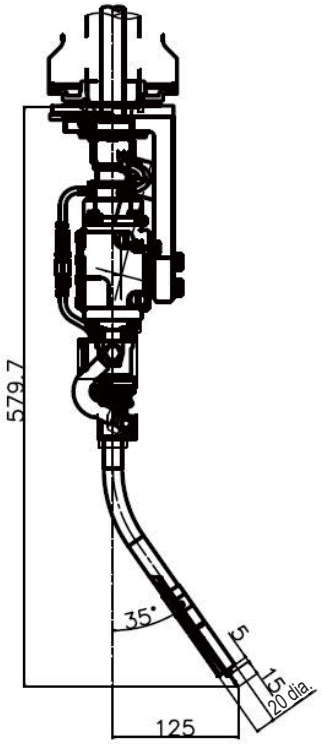
300R BUILT MODEL | 308R BUILT MODEL | 308R OUT MODEL



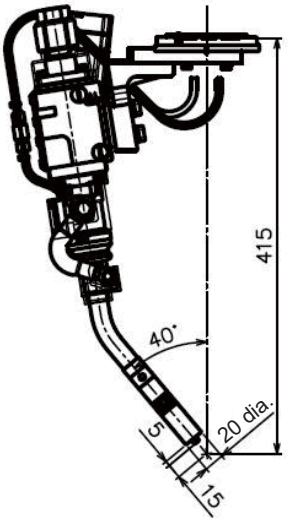
500R BUILT MODEL | 508R BUILT MODEL | 508R OUT MODEL



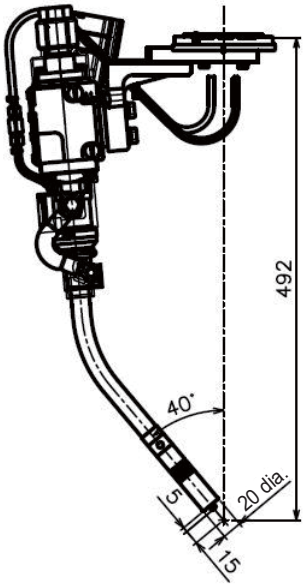
EAGL 300R BUILT



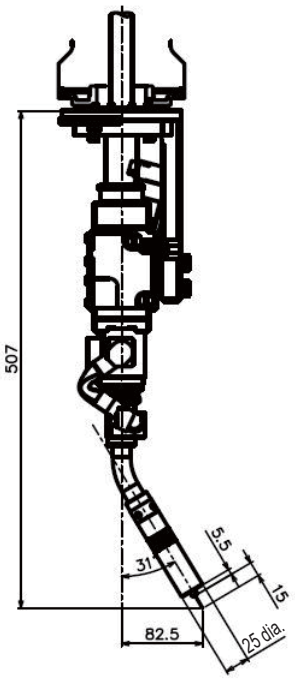
EAGL 308R BUILT



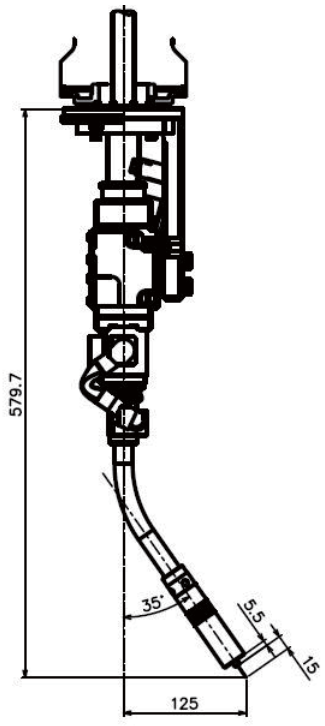
EAGL 300R OUT



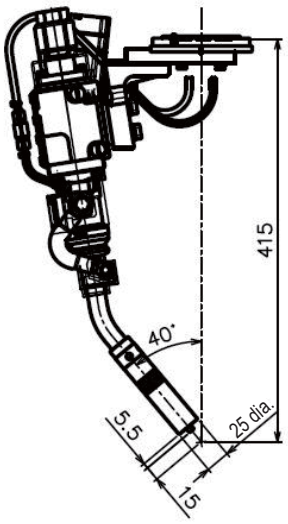
EAGL 308R OUT



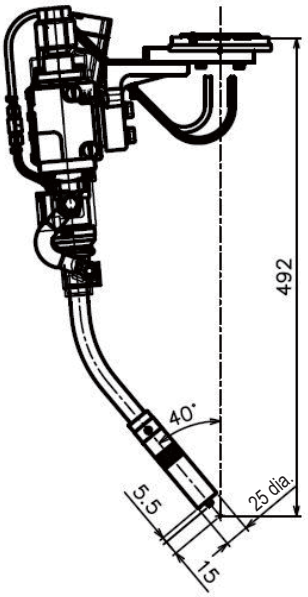
EAGL 500R BUILT



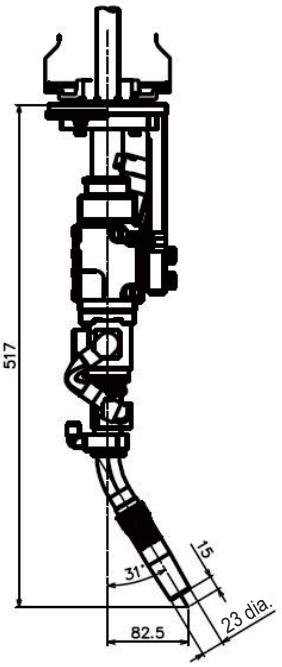
EAGL 508R BUILT



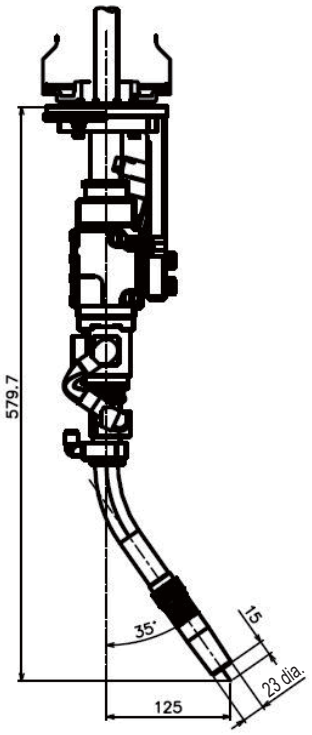
EAGL 500R OUT



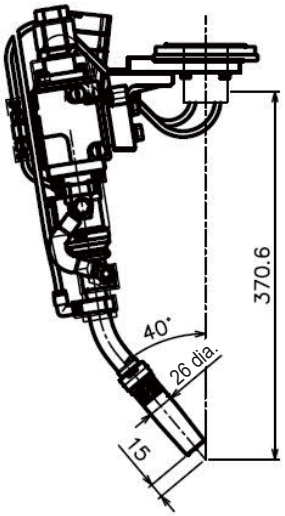
EAGL 508R OUT



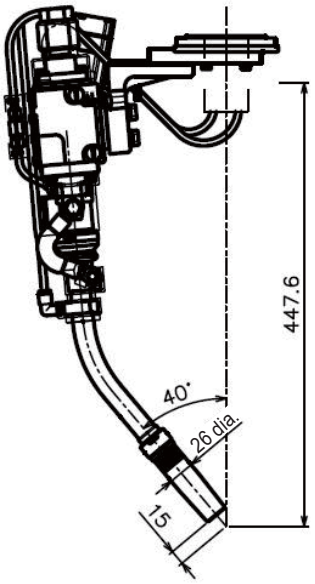
EAGL 500W BUILT



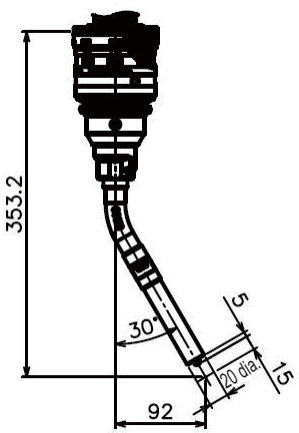
EAGL 508W BUILT



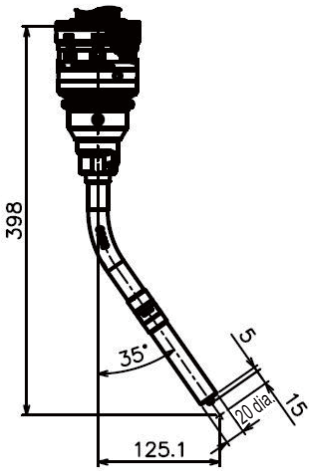
EAGL 500W OUT



EAGL 508W OUT



BINZEL 30S BUILT



BINZEL 308 BUILT

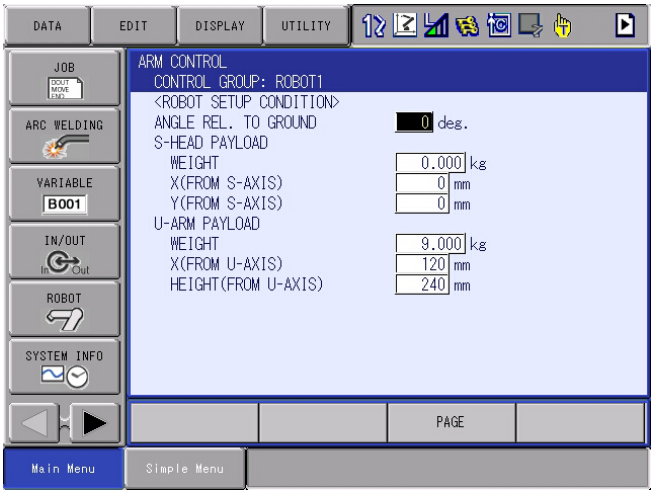
NOTE

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

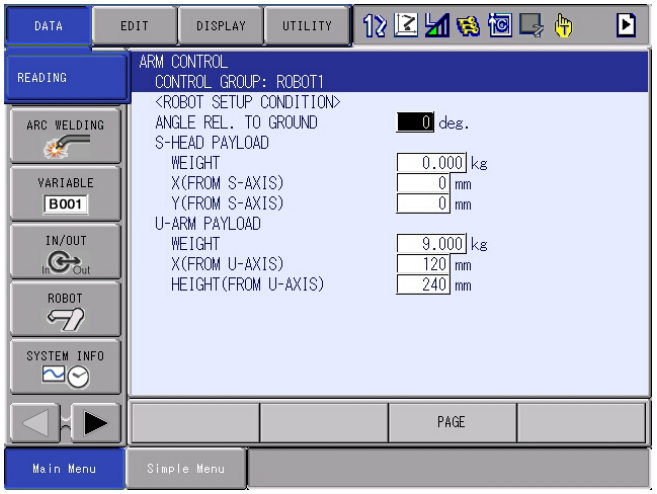
To perform shock detection more accurately, read the tool load which is the same as the actual load on the MAKER INITIAL VALUE window.

8.7.3.5 Reading the U-Arm Payload

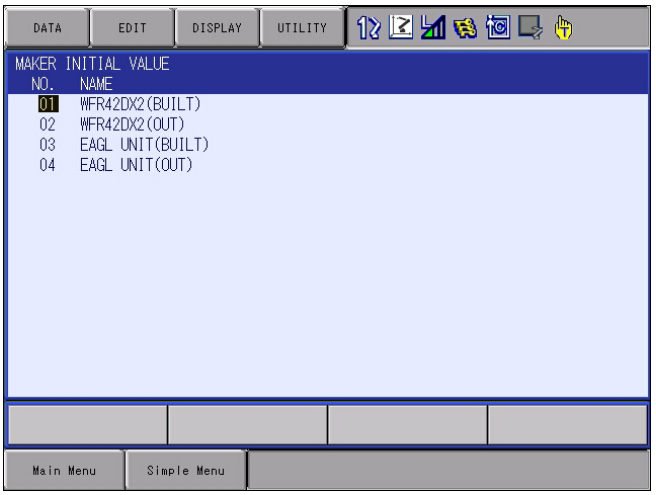
1. Change the “SECURITY MODE” to the “MANAGEMENT MODE”.
2. Select {ARM CONTROL}.
   – The ARM CONTROL window appears.



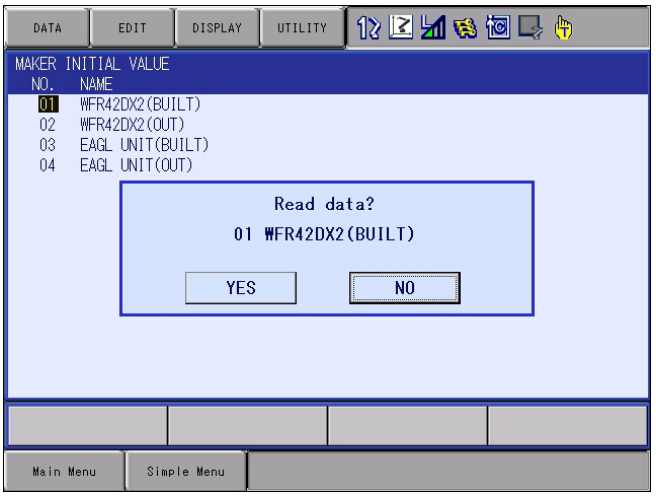
3. Select {DATA} under the menu.
   – The pull-down menu appears.



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

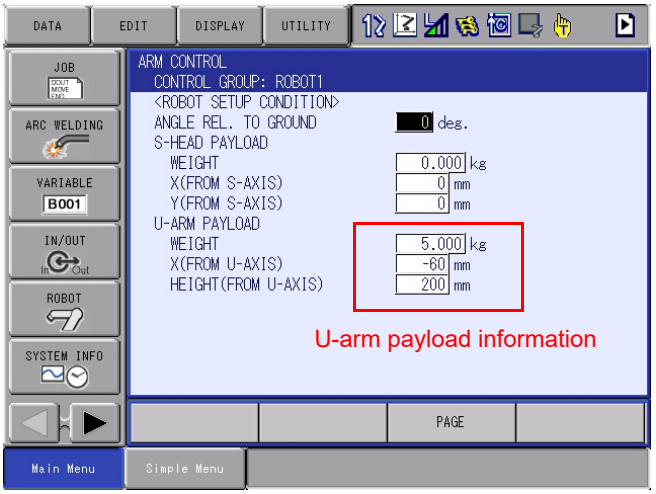


5. Select the number of the MAKER INITIAL VALUE to be read.
   – A confirmation dialog box appears.

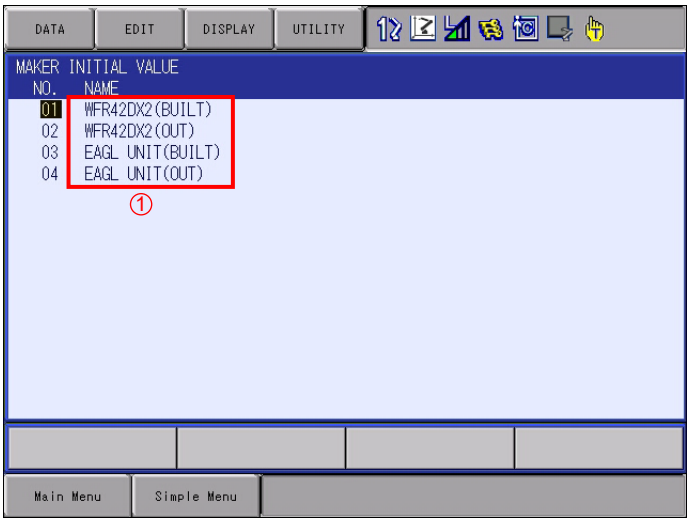


6. Select {YES}.

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

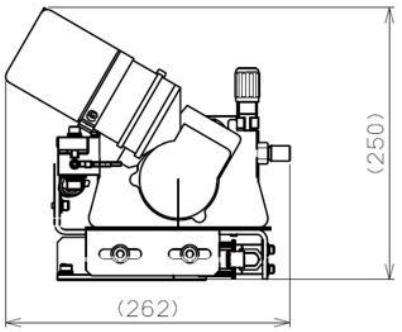


8.7.3.6 Explanation of Maker Initial Value

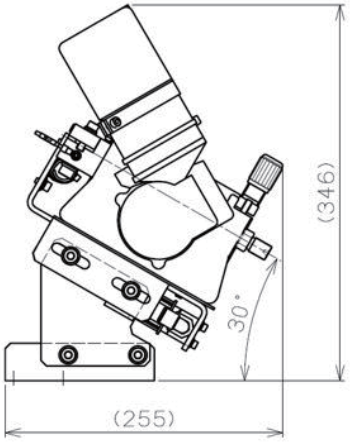


① **NAME**

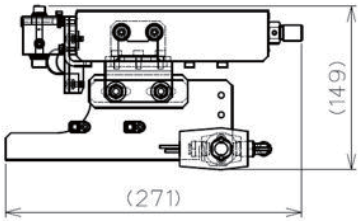
The name of U-arm payload information prepared by YASKAWA is indicated.
When using the U-arm payload in the following figure, select from the MAKER INITIAL VALUE window.



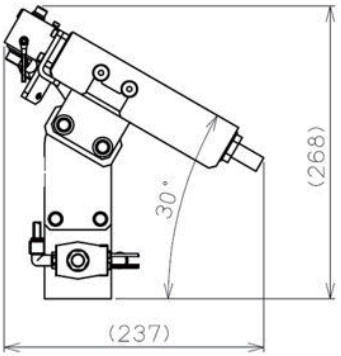
WFR42DX2 (BUILT)



WFR42DX2 (OUT)



EAGL UNIT (BUILT)



EAGL UNIT (OUT)

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

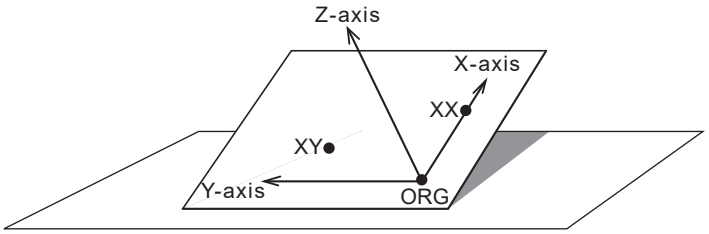
8.8 User Coordinates Setting

8.8.1 User Coordinates

8.8.1.1 Methods for User Coordinates Setting

There are two methods for user coordinates setting as following.

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

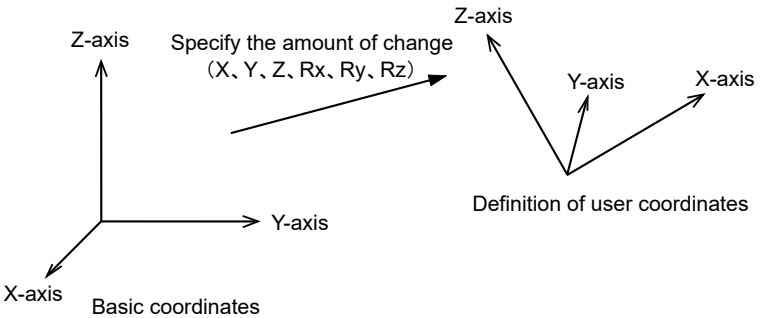


User coordinate definition point
ORG: Home position
XX: Point on the X-axis
XY: Point on the Y-axis

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

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

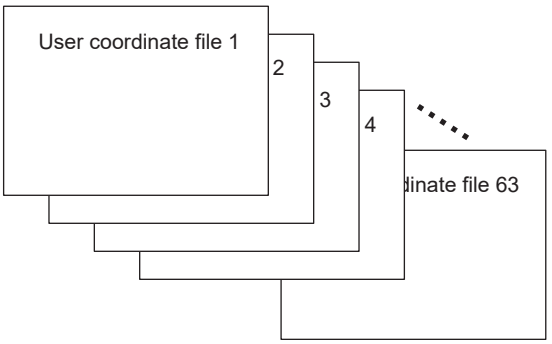
- Specify the amount of change from the basic coordinates
  User coordinates are defined by specifying the coordinates as a basic coordinates (base coordinates or user coordinates) and the amount of change of coordinate value from the basic coordinates. As shown in the following figure, the data X, Y,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



X,Y,Z are the amount of movement with respect to the basic coordinates. Rx, Ry, Rz are the rotation angle with respect to the basic coordinates.

8.8.1.2 User Coordinates Files

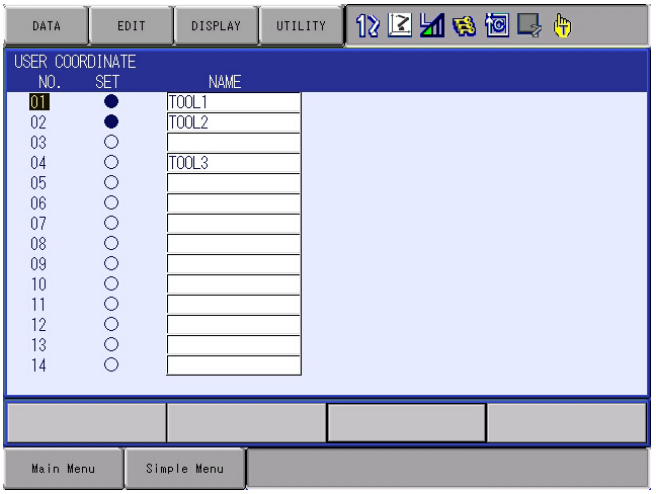
Up to 63 kinds of user coordinates can be registered. Each coordinates has a user coordinate No. and is called a user coordinate file.



8.8.2 User Coordinate Setting

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

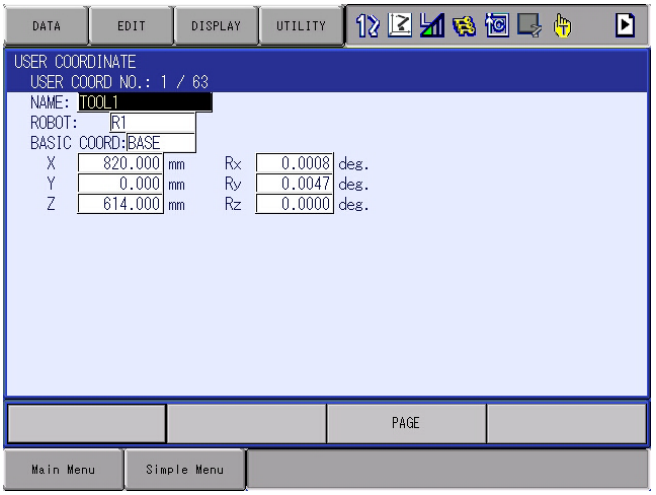
(1) The USER COORDINATE window appears.



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

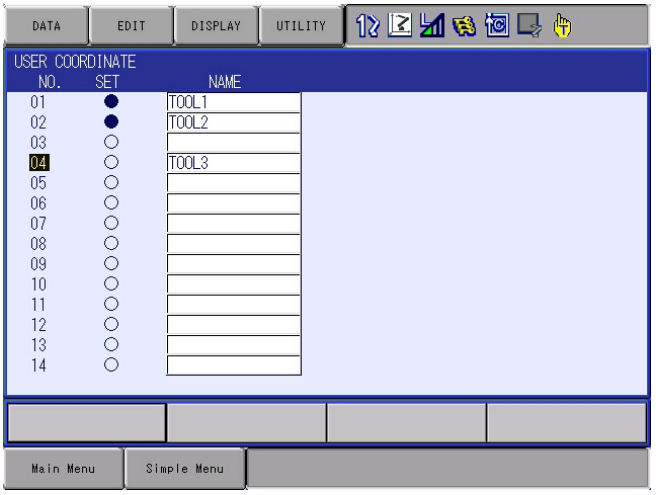
(3) To check the position of the user coordinates select {DISPLAY} → {COORDINATE DATA}.

(4) The following window appears.



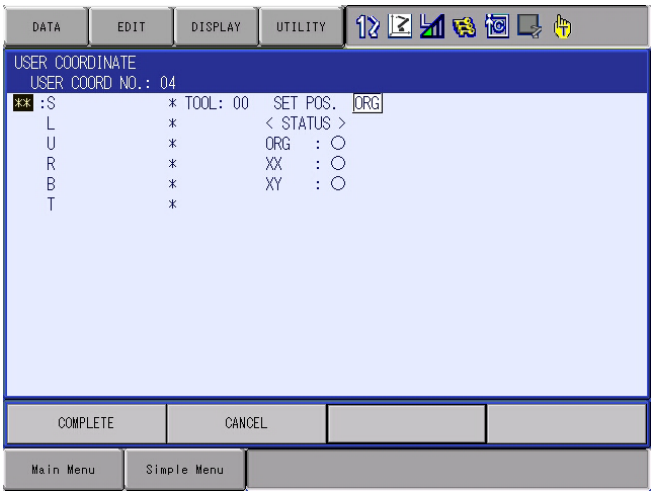
■ **Perform teaching by axis operations of the manipulator**

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



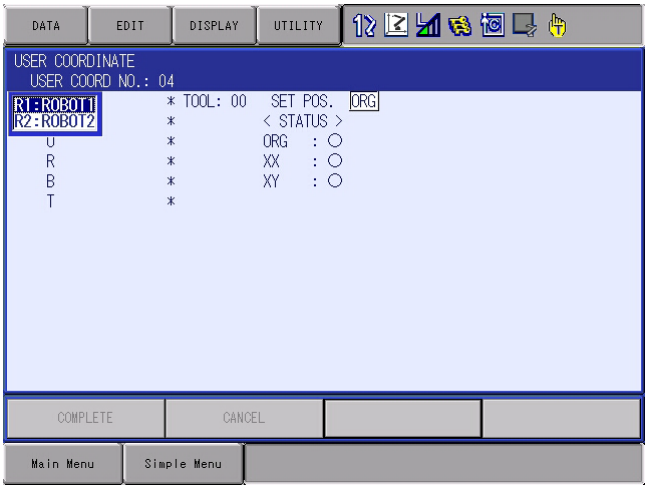
2. Press [SELECT].

   – The user coordinate setup window is shown.

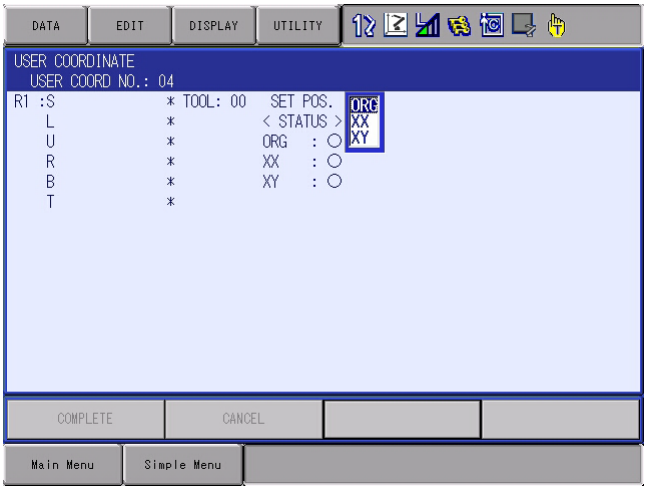


3. Select the robot.

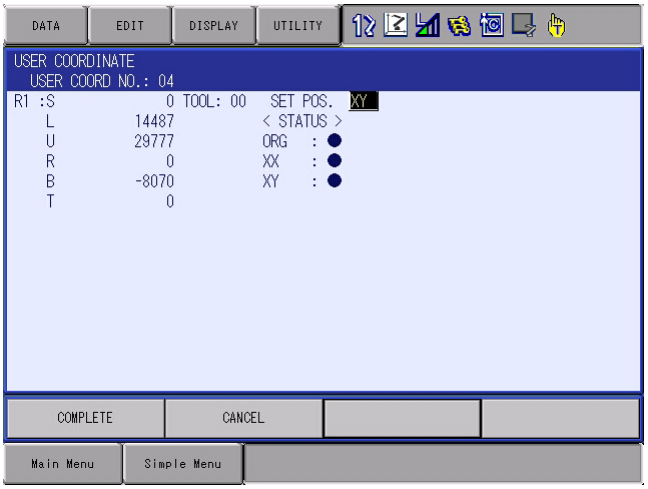
   – Select “**” on the upper left of the window to select the subject robot. (This operation can be omitted if the robot selection has already been made or if there is only one robot.)



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

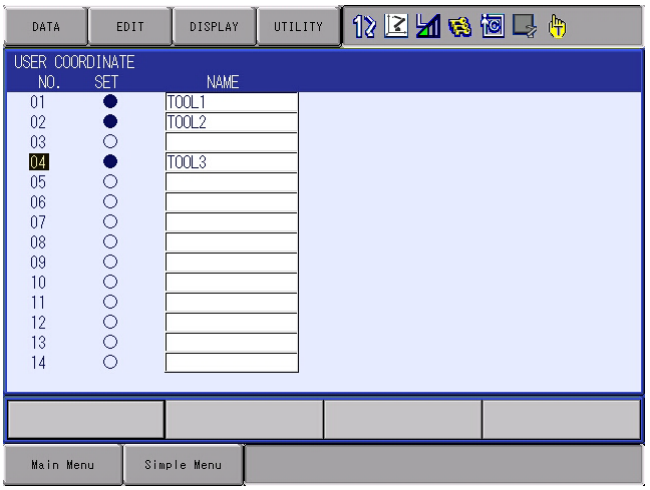


5. Move the manipulator to the desired position with the axis keys.
6. Press [MODIFY] then [ENTER].
   – Taught position is registered.
   – Repeat the steps 2 to 4 to teach ORG, XX and XY.
   – “●” indicates that teaching is completed and “○” indicates that it is not completed.



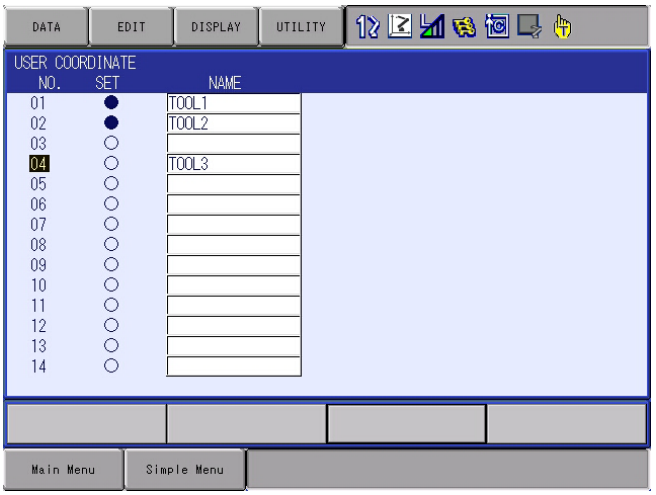
   – To check the taught positions, call up the required window among ORG to XY and press [FWD]. The manipulator moves to the set position.
   – If there is a difference between the current position of the manipulator and the displayed position data, “ORG”, “XX”, or “XY” flashes.

7. Select {COMPLETE}.
   – User coordinates are registered in the file.
   – Once the user coordinate setting is completed, the following window appears.



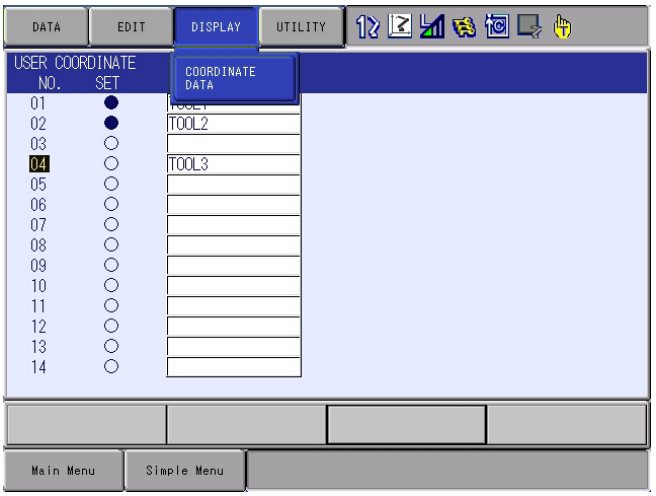
■ **Specify the amount of change from the basic coordinate**

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

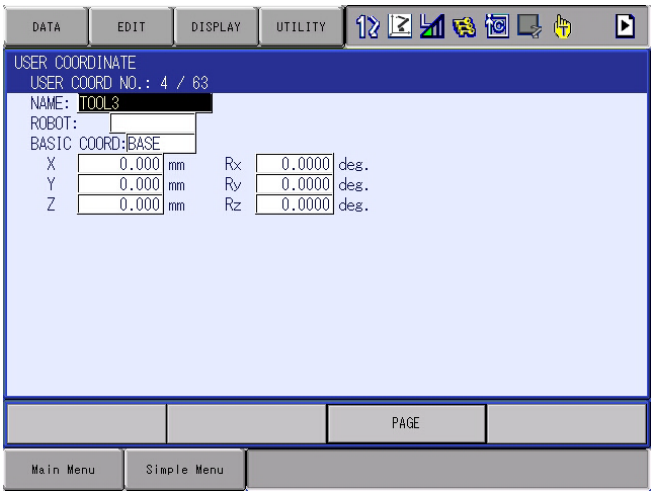


2. Select {DISPLAY} of the main menu.

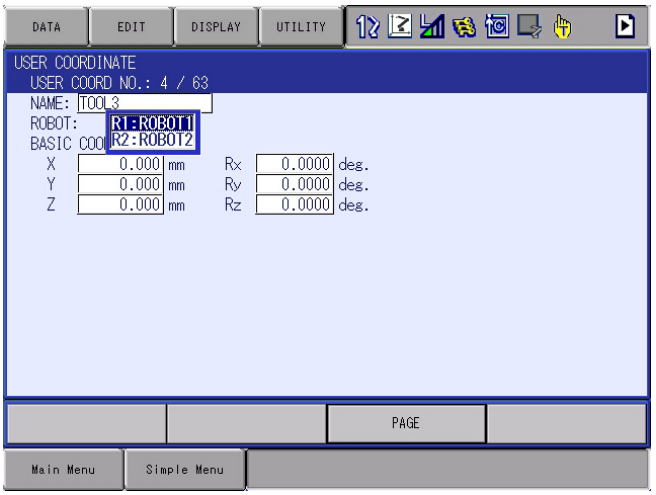
   – The pull-down menu is shown.



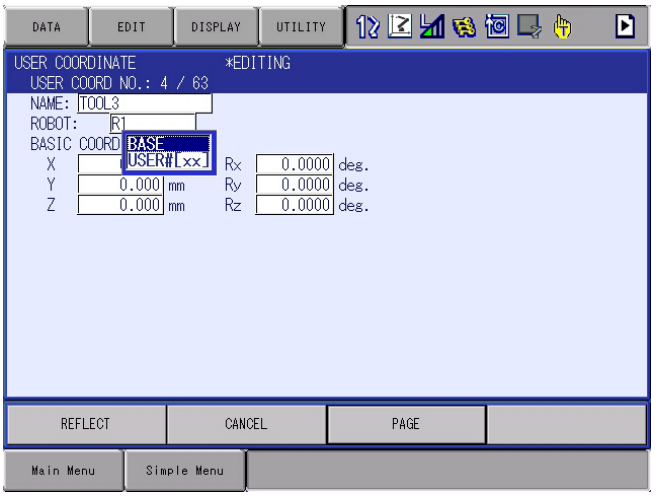
3. Select {COORDINATE VALUE}.



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



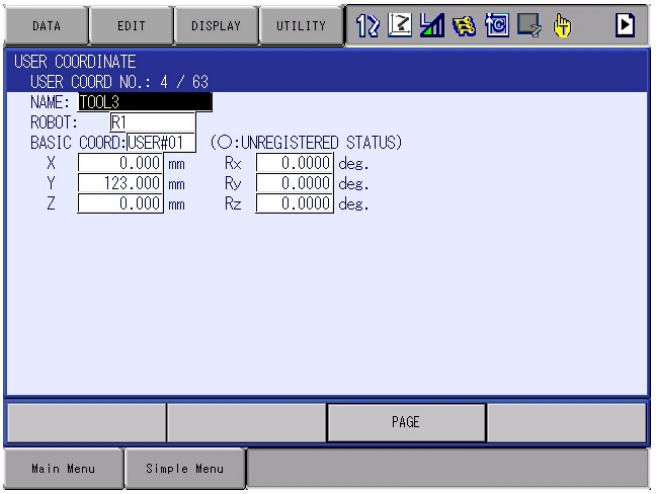
5. Select “BASIC COORDINATE”.
   – Select the base coordinate/user coordinate for the basic coordinate.



NOTE

The user coordinates number which is not yet registered or currently selected cannot be selected.
Also, the user coordinates number which uses another user coordinates as the basic coordinates cannot be selected.

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

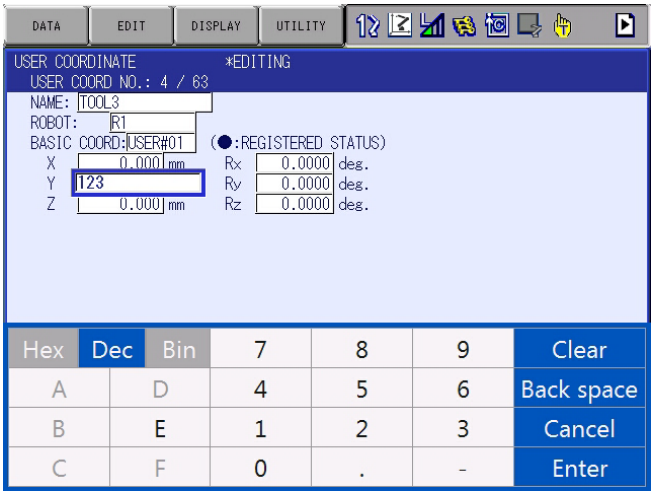


NOTE

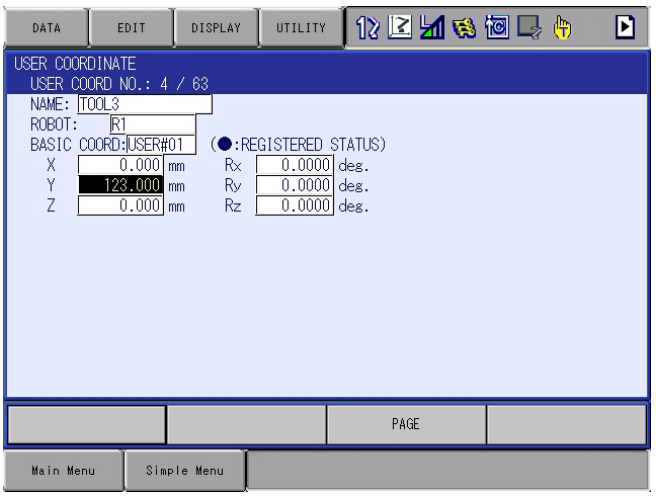
If the user coordinates which specify another user coordinates number in unregistered status as the basic coordinates are used, the alarm no.4508 "SPECIFIED ERROR(COORDINATE) [18]" occurs.
To select the user coordinates for the basic coordinates, specify the registered user coordinates number as the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

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

– Input the amount of change from the basic coordinate.

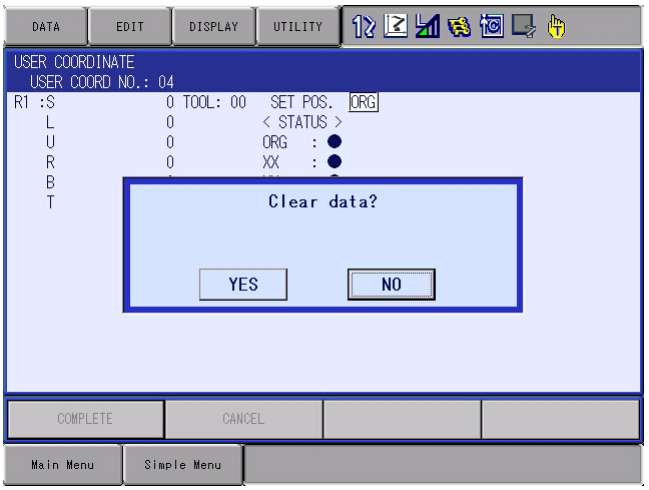


7. Select {REFLECT}.
   – The user coordinate is created and registered in the user coordinate file.

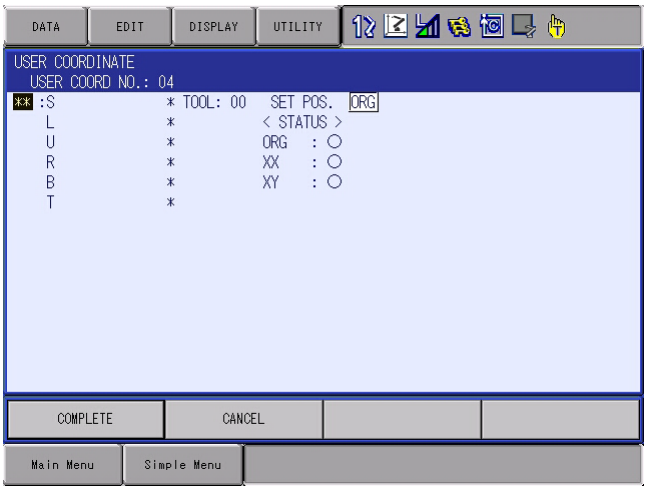


8.8.3 Clearing the User Coordinates

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



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



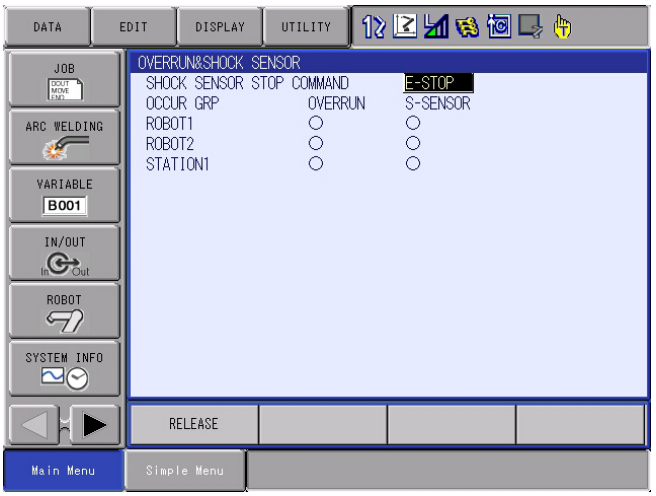
8.9 Overrun/Tool Shock Sensor Releasing

CAUTION

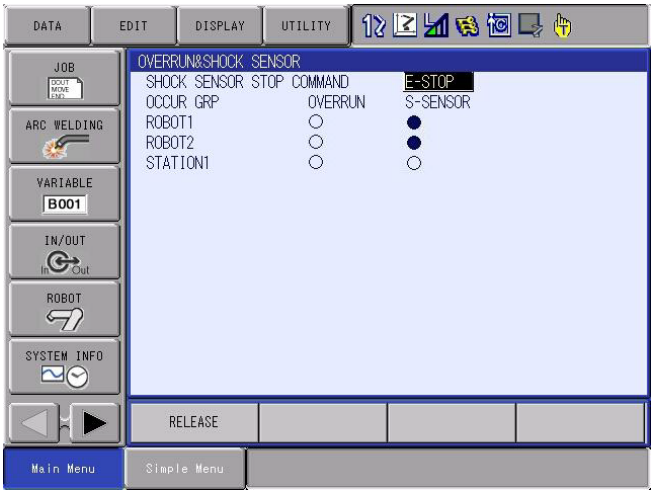
When operating the manipulator with the overrun or shock sensor released, pay careful attention to ensure the safety of the surrounding operation environment.

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

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



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



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

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

8.10 Soft Limit Release Function

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

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

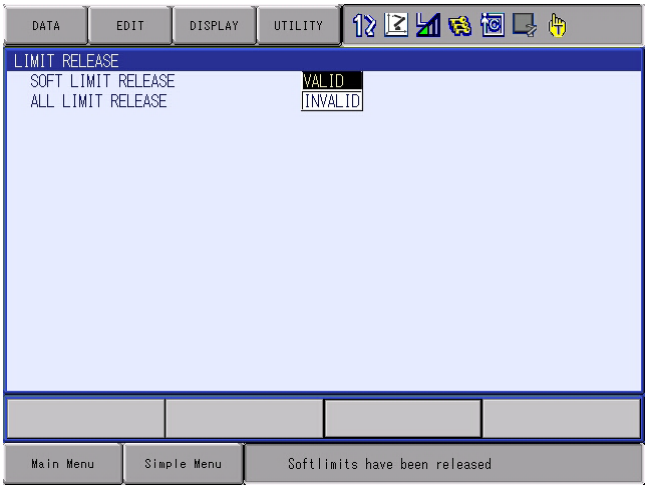
These soft limits are continually monitored by the system, and the manipulator automatically stops when the its TCP reaches a soft limit.

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

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



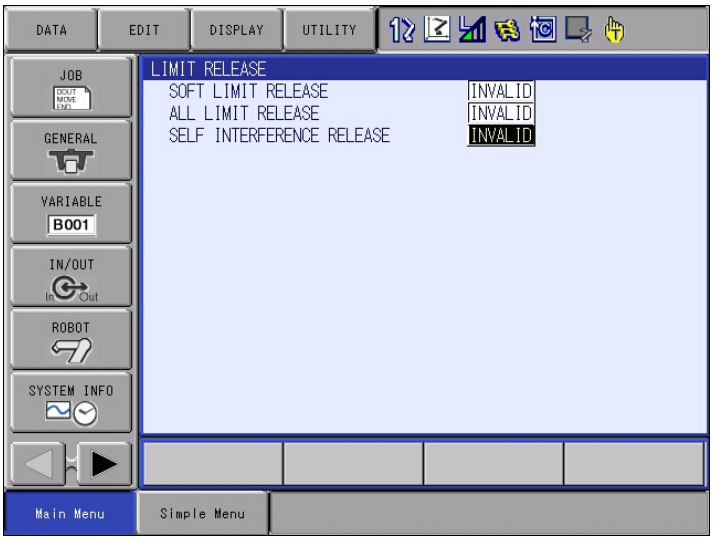
3. Select “SOFT LIMIT RELEASE”.
   – Each time [SELECT] is pressed, “VALID” and “INVALID” switch alternately.
   – When “SOFT LIMIT RELEASE” is set to “VALID”, a message “Soft limits have been released” appears.



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

NOTE

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



8.11 All Limit Release Function

CAUTION

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

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

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

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

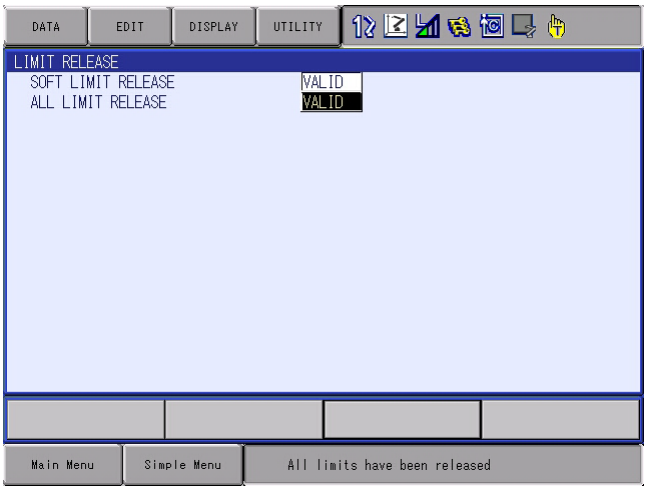
NOTE

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

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



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



8.12 Instruction Level Setting

8.12.1 Setting Contents

8.12.1.1 Instruction Set

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

Subset Instruction Set

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

Standard Instruction Set / Expanded Instruction Set

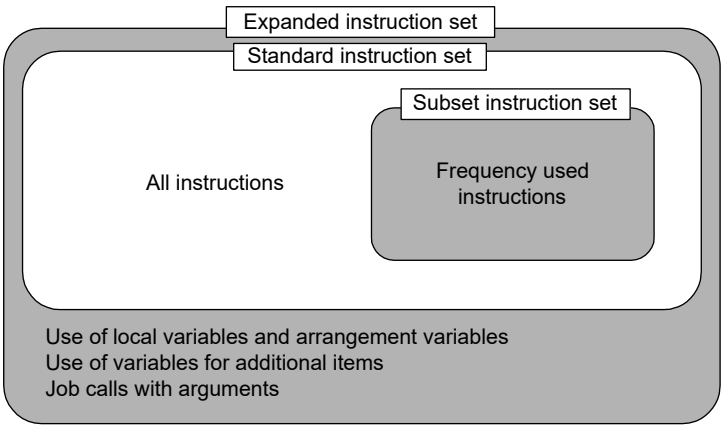
All the INFORM III instructions can be used. The number of additional items to be used in each instruction differ in the standard instruction set and expansion instruction set.

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

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

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

Fig. 8-6: Instruction Set



8.12.1.2 Learning Function

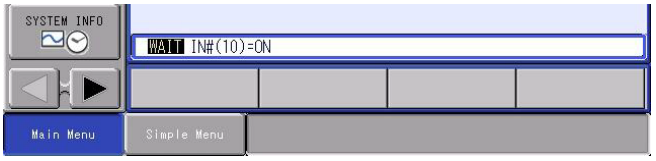
When an instruction is entered from the instruction list, the additional items that were entered last time are also shown. This function can simplify instruction input.

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

1. An instructions are registered.

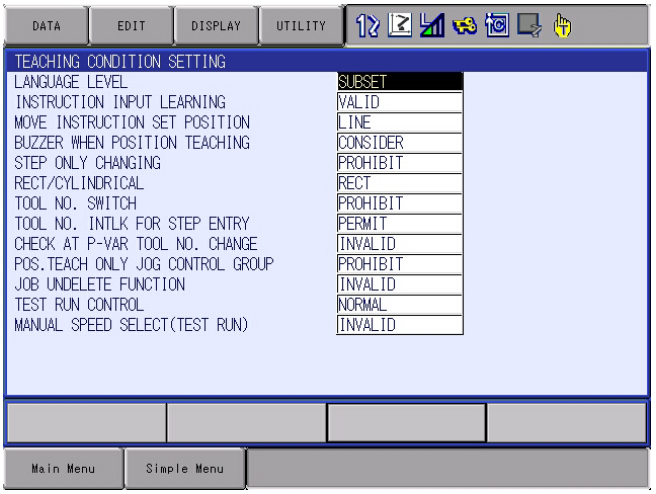


2. The next time an attempt is made to register the same instruction as in 1, the same additional items as were registered last time are also shown in the input buffer line.

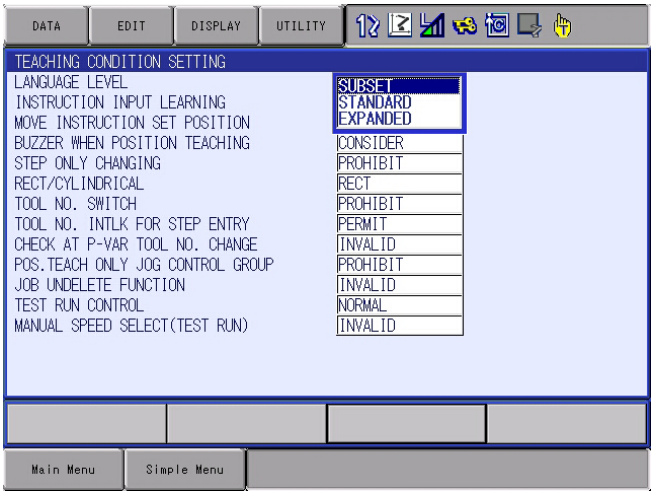


8.12.2 Setting the Instruction Set Level

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

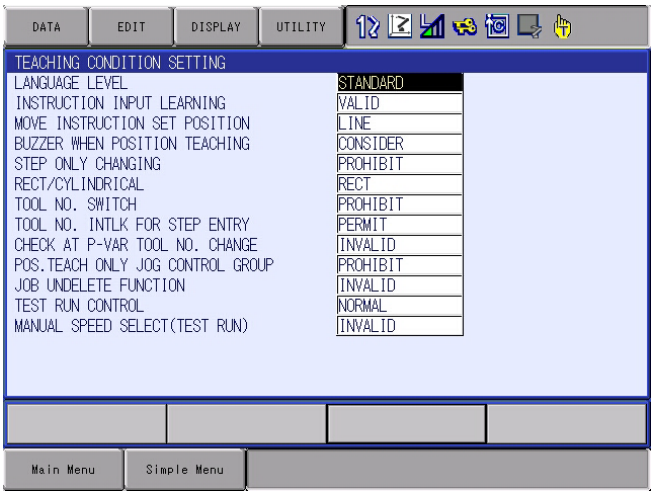


3. Select “LANGUAGE LEVEL”.
   – The selection list appears.



4. Select desired language level.

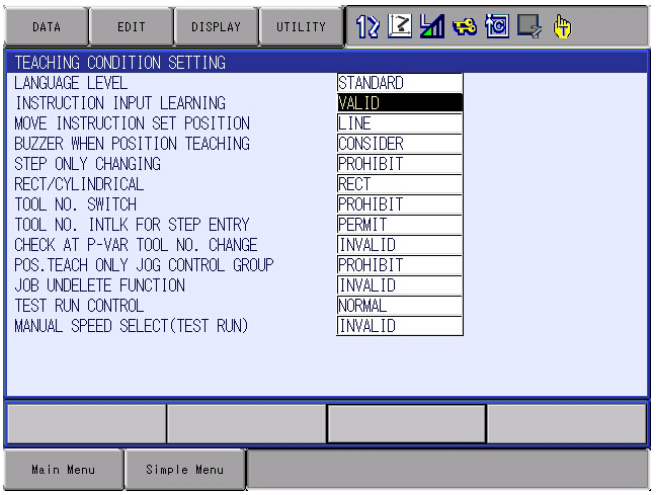
   – Language level is set.



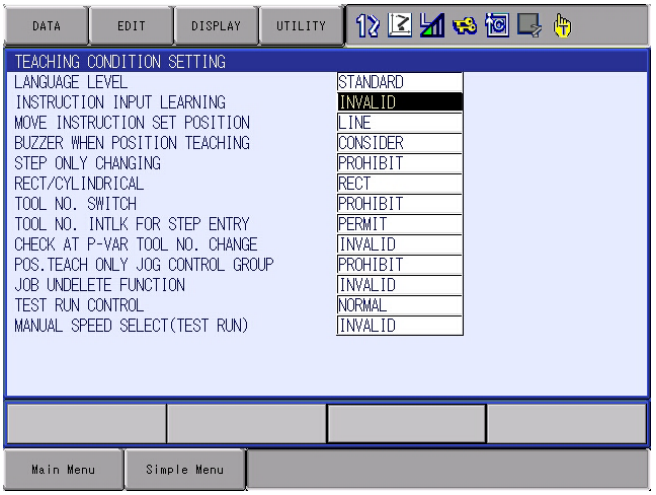
8.12.3 Setting the Learning Function

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

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



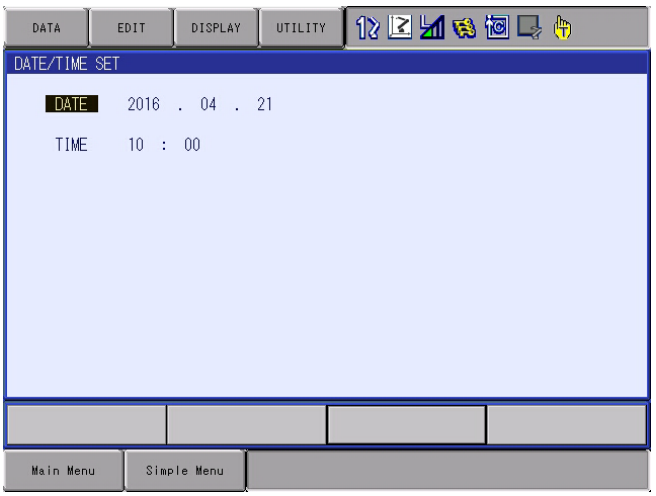
3. Select “INSTRUCTION INPUT LEARNING”.
   – “VALID” and “INVALID” are displayed alternately every time [SELECT] is pressed.



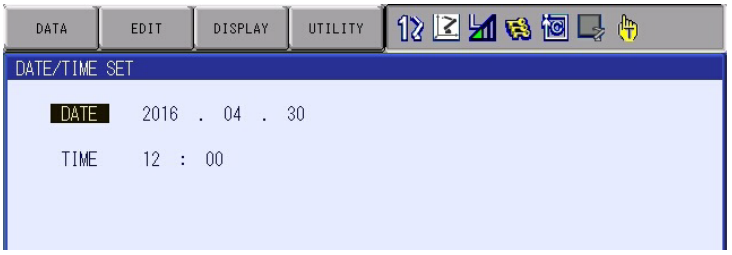
8.13 Setting the Controller Clock

The clock inside the YRC1000 controller can be set as follows.

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

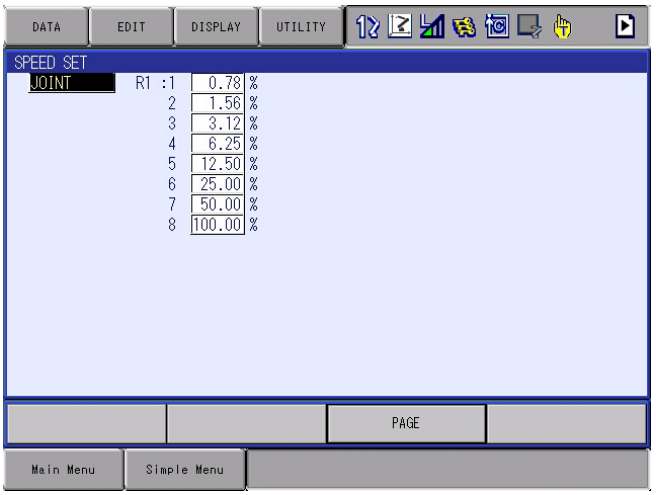


3. Select “DATE” or “TIME”.
   – The input buffer line appears.
4. Input the new date/time.
   – For instance, to set the date to April 30, 2016, input “2016.4.30”. To set the time at twelve o’clock, enter “12.00”.
5. Press [ENTER].
   – The date/time is changed.

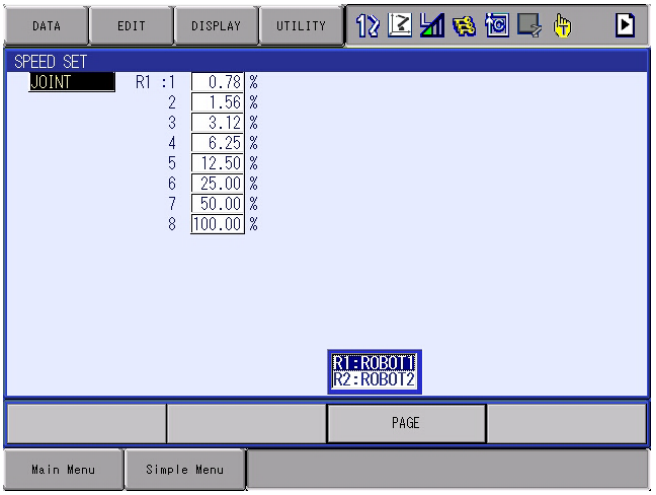


8.14 Setting the Play Speed

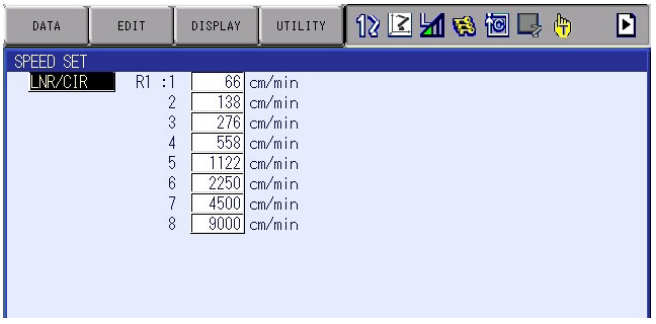
1. Select {SETUP} under the main menu.
2. Select {SET SPEED}.
   – The SPEED SET window is shown.



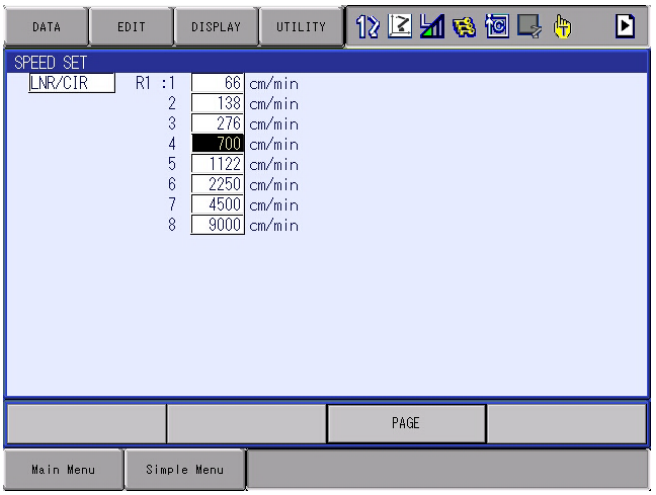
3. Press the [PAGE].
   – When two or more manipulators and stations exist in the system, use the [PAGE] to change the control group, or click on [PAGE] to select the desired control group.



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



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



8.15 Numeric Key Customize Function

8.15.1 About the Numeric Key Customize Function

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

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

8.15.2 Allocatable Functions

There are two allocation methods as follows:

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

8.15.2.1 Key Allocation (EACH)

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

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

8.15.2.2 Key Allocation (SIM)

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

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

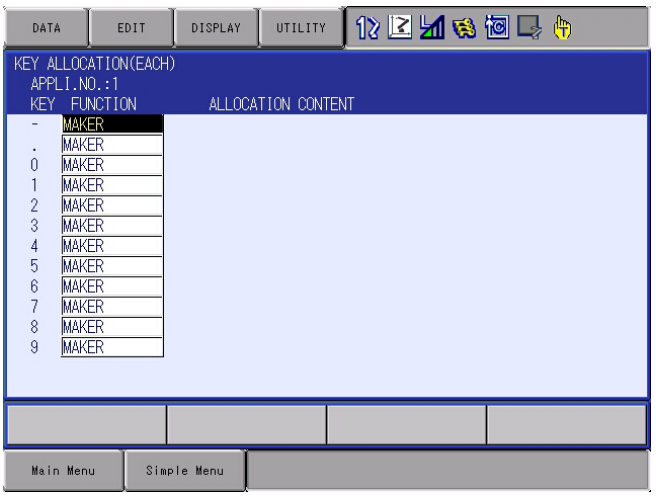


In a system for multiple applications, a numeric key can be allocated for each application.

8.15.3 Allocating Operation

8.15.3.1 Allocation Window

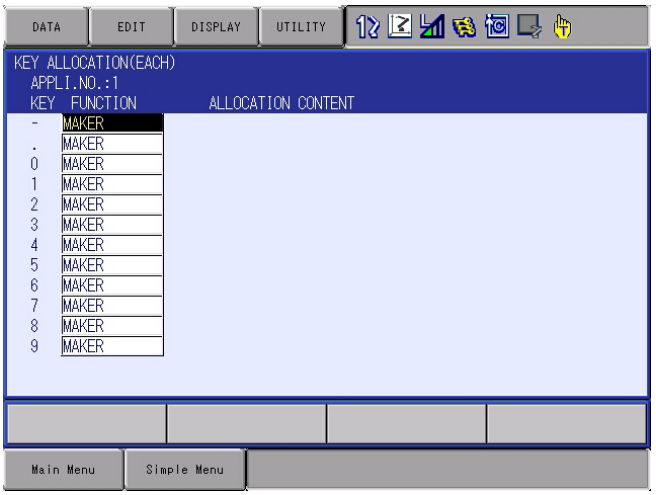
1. Select {SETUP} under the main menu.
2. Select {KEY ALLOCATION}.
   – The KEY ALLOCATION (EACH) window appears.



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

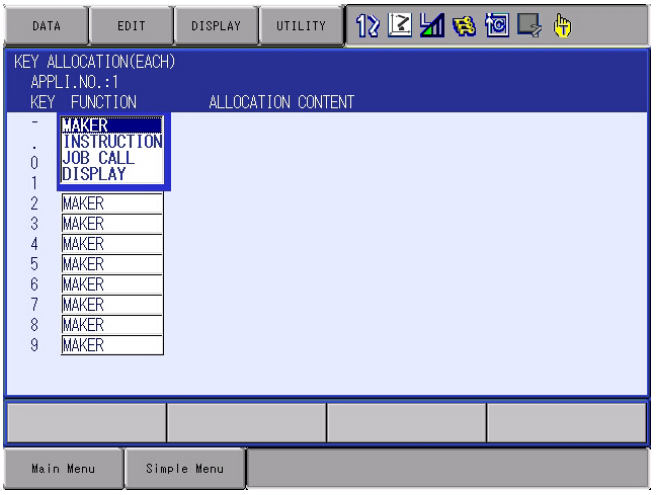


4. Select {ALLOCATE SIM. KEY}.
   – The KEY ALLOCATION (SIM) window appears.
   – In a system multiple applications, press the [PAGE] to change the window to the allocation window for each application, or click on [PAGE] to select the desired application number.



8.15.3.2 Instruction Allocation

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

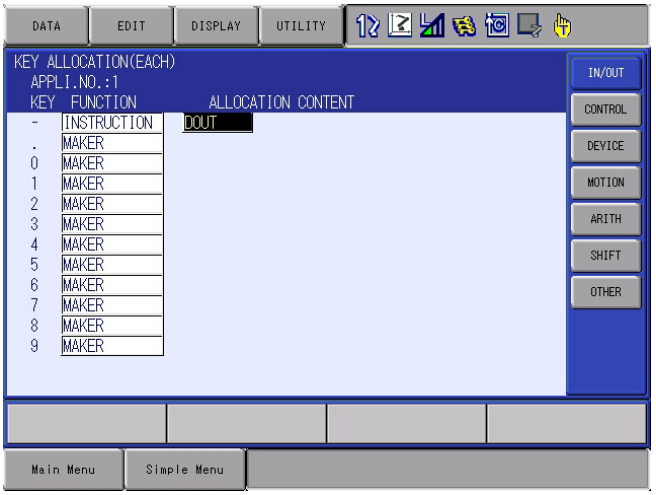


2. Select “INSTRUCTION”.

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

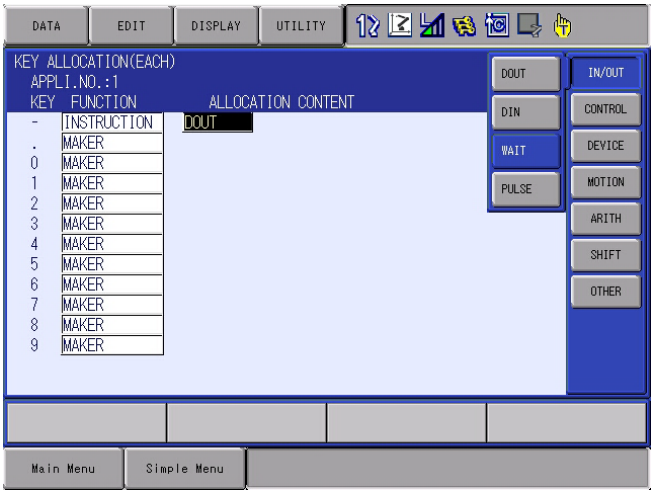


(1) To change the instruction, move the cursor to the instruction and press [SELECT]. Then the instruction group list appears.



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

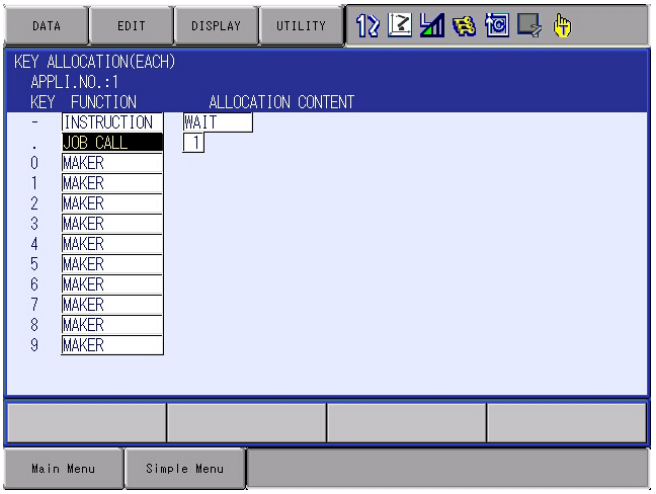
(3) When the instruction list dialog box is shown, select the instruction to be changed.



8.15.3.3 Job Call Allocation

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

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



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

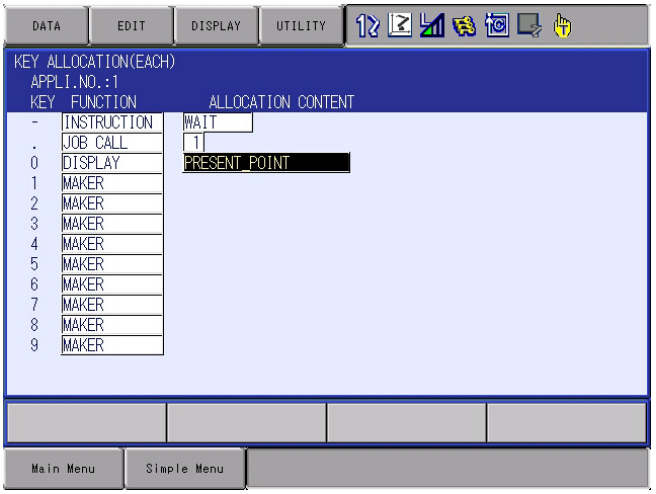
(2) Input the number to be changed, and press [ENTER].

8.15.3.4 Display Allocation

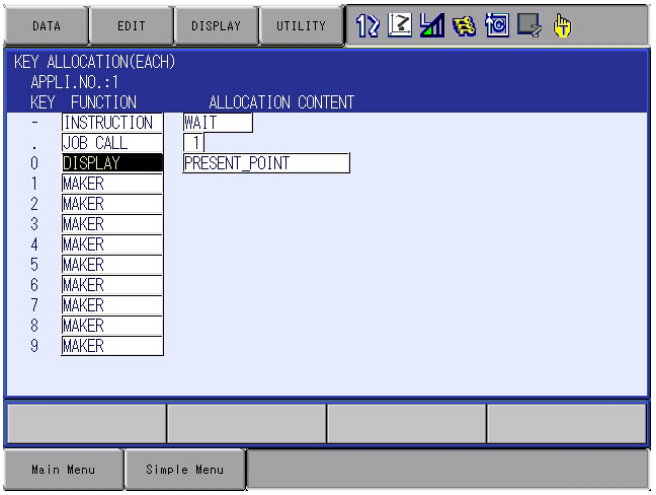
Set this function in the KEY ALLOCATION (EACH) window.

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – Selection list appears.
2. Select [DISPLAY].
3. Move the cursor to “ALLOCATION CONTENT” and press [SELECT].
   – Character input is available.

4. Input the name of the reserved window and press [ENTER].
   – The reserved name input to the “ALLOCATION CONTENT” is shown.



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



SUPPLE-MENT

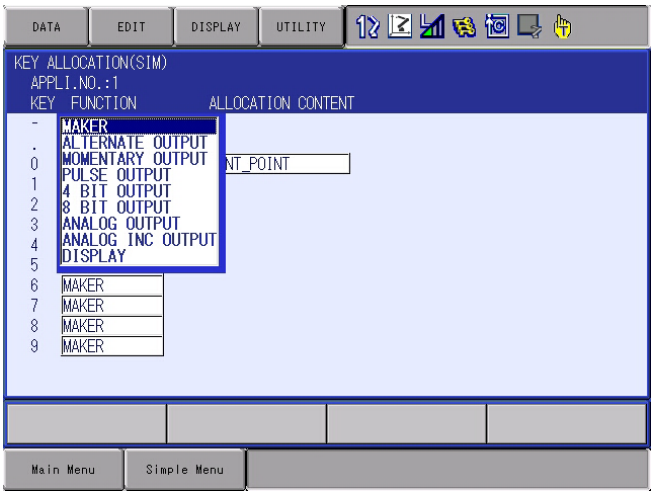
When allocate the display allocation to a key, key allocation (SIM) will be set to the display set.

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

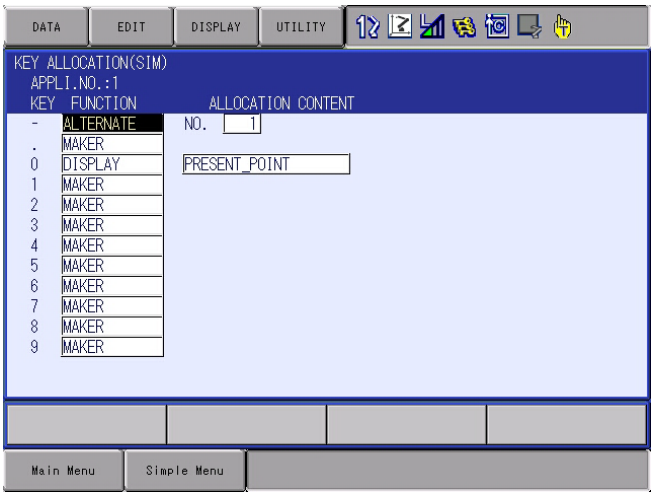
8.15.3.5 Alternate Output Allocation

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

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



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



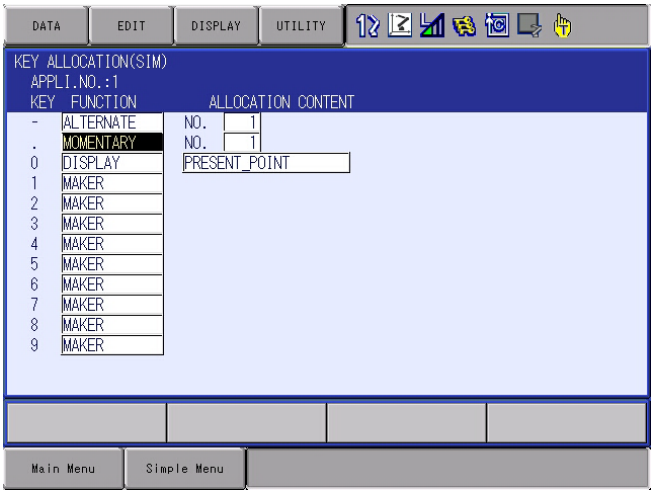
   (1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.

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

8.15.3.6 Momentary Output Allocation

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

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – A selection list appears.
2. Select “MOMENTARY OUTPUT”.
   – The output No. is displayed in the “ALLOCATION CONTENT”.



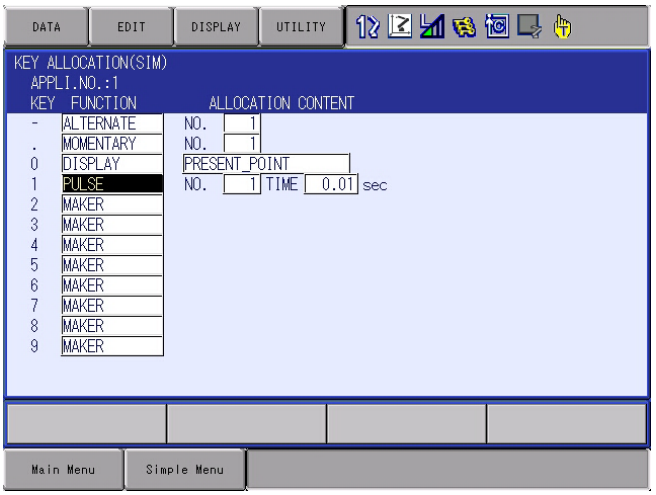
(1) To change the output No., move the cursor to the No. and press [SELECT]. Then numeric value can be entered.

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

8.15.3.7 Pulse Output Allocation

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

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



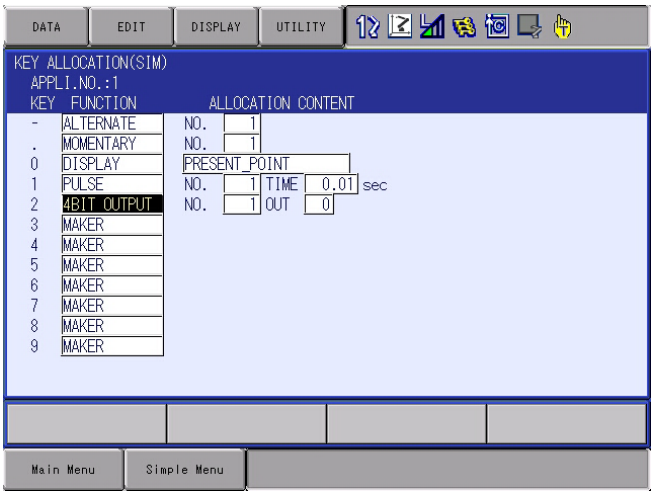
(1) To change the output No. or output time, move the cursor to the No. or time and press [SELECT]. Then numeric value can be entered.

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

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

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

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – A selection list appears.
2. Select “4 BIT OUTPUT” or “8 BIT OUTPUT”.
   – The output No. and output value are displayed in the “ALLOCATION CONTENT”.



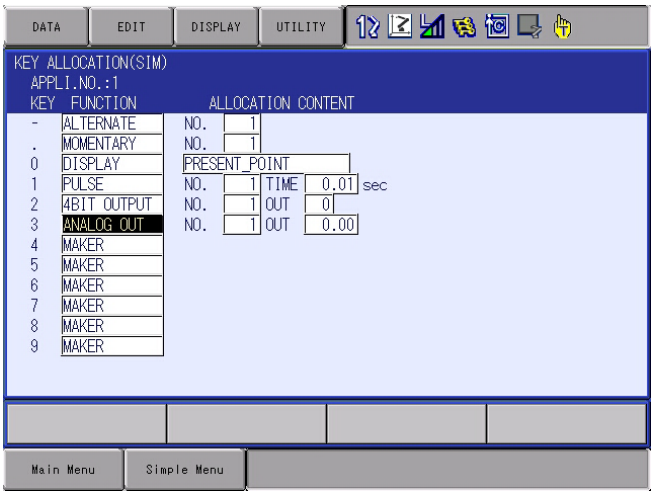
(1) To change the output No. or output value, move the cursor to the No. or value and press [SELECT]. Then numeric value can be entered.

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

8.15.3.9 Analog Output Allocation

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

1. Move the cursor to the “FUNCTION” of the key to be allocated and press [SELECT].
   – A selection list appears.
2. Select “ANALOG OUTPUT”.
   – The output port number and the output voltage value are displayed in the “ALLOCATION CONTENT”.



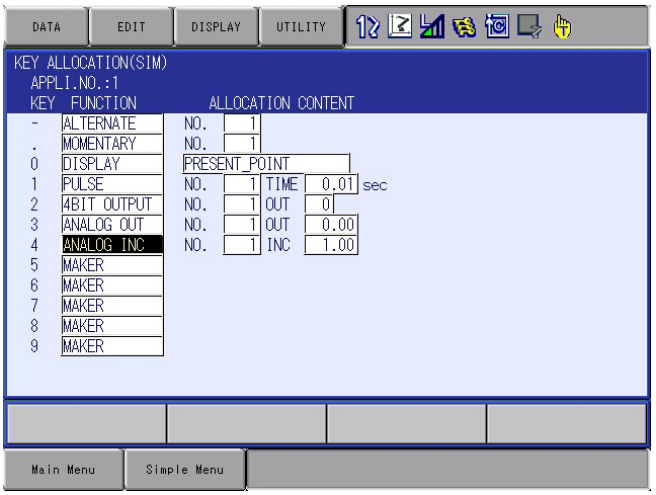
(1) To change the output port No. or output voltage value, move the cursor to the No. or voltage value and press [SELECT]. Then numeric value can be entered.

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

8.15.3.10 Analog Incremental Output Allocation

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

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



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

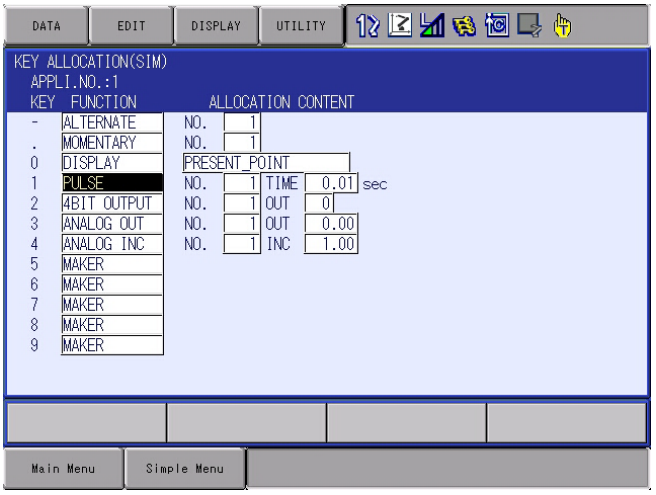
(2) Input the number or incremental value to be changed, and press [ENTER].

8.15.4 Allocation of I/O Control Instructions

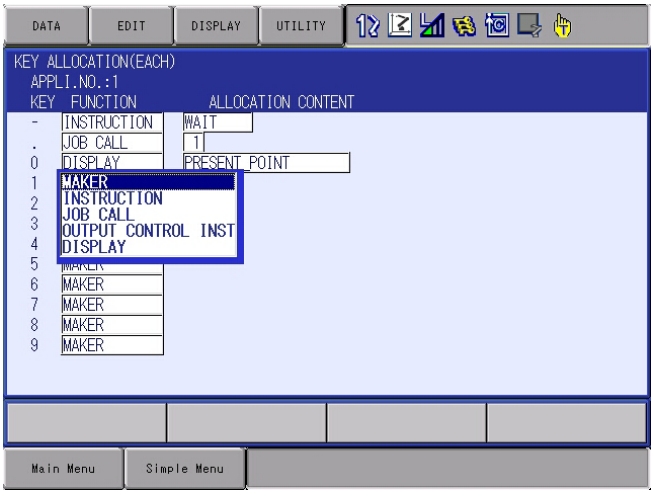
In key allocation (SIM), output control instructions can be allocated to the numeric keys that have been allocated one of the following I/O controls with key allocation (EACH).

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

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



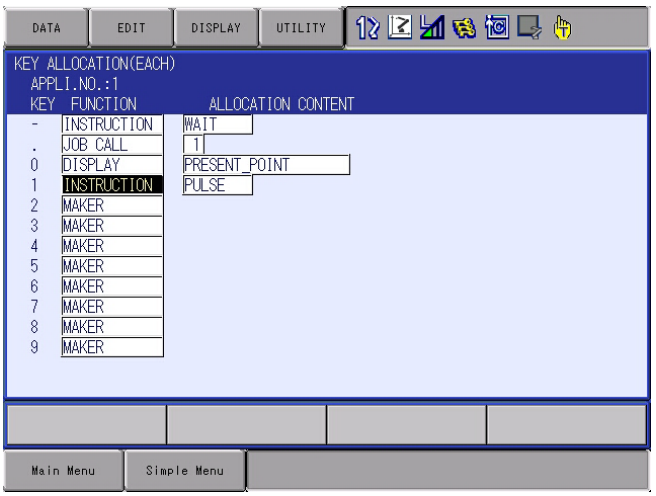
2. Move the cursor to the “FUNCTION” of the key that has been allocated with I/O control with key allocation (SIM) and press [SELECT].



   – Selection list appears.

3. Select “OUTPUT CONTROL INST”.

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



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

8.15.5 Execution of Allocation

8.15.5.1 Executing the Instruction/Output Control Allocation

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



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



8.15.5.2 Executing the Job Call Allocation

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

8.15.5.3 Executing the Display Allocation

1. Press the key allocated for the display allocation.
   – The allocated display appears.

8.15.5.4 Executing the I/O Control Allocation

Alternate output allocation, momentary output allocation, pulse output allocation, group output allocation (4-bit/8-bit), analog output allocation, analog incremental output allocation are executed by the following operation.

1. Press [INTERLOCK] and the key allocated for I/O control allocation at the same time.
   – Allocated functions are executed.

8.16 Changing the Output Status

The status of GP output signals can be changed from the programming pendant by using either of the following two methods.

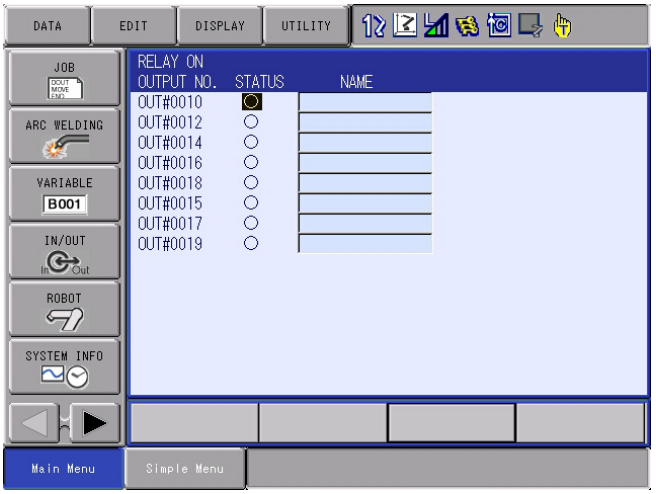
- On the GP output status window
- On the RELAY ON window

The method that uses the RELAY ON window, which is described here, simplifies the operation for changing the status of signals that are used frequently.

NOTE

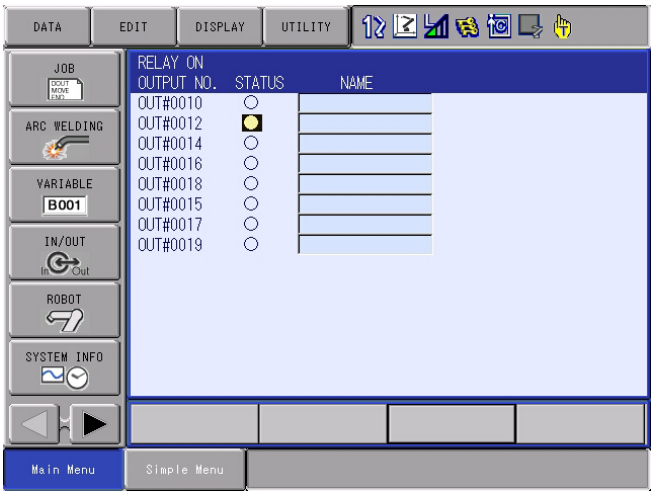
A maximum of 64 GP output signals can be shown on the RELAY ON window and the number of the signals which are shown in the parameters S4C327 to S4C390 must be set in advance. If they are not set, the sub menu in the RELAY ON window will not be displayed.

1. Select {IN/OUT} under the main menu.
2. Select {RELAY ON}.
   – The RELAY ON window appears.



3. Select the desired signal to change the output status.
   – Select the status (● or ○) of the desired signal.

4. Press [INTERLOCK] +[SELECT].
   – The output status is changed. (●: status ON; ○: status OFF.)



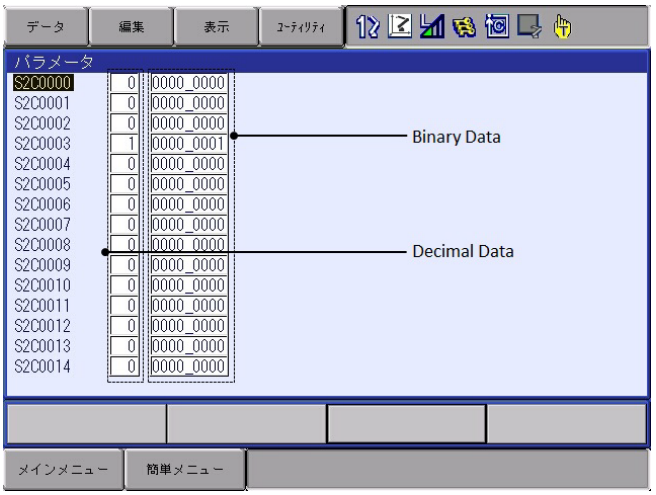
SUPPLE-MENT

It is also possible to turn the relevant GP output signal ON only for the duration that [INTERLOCK]+[SELECT] are pressed. This selection is made in advance by setting the parameters (S4C391 to 454) to “1”.

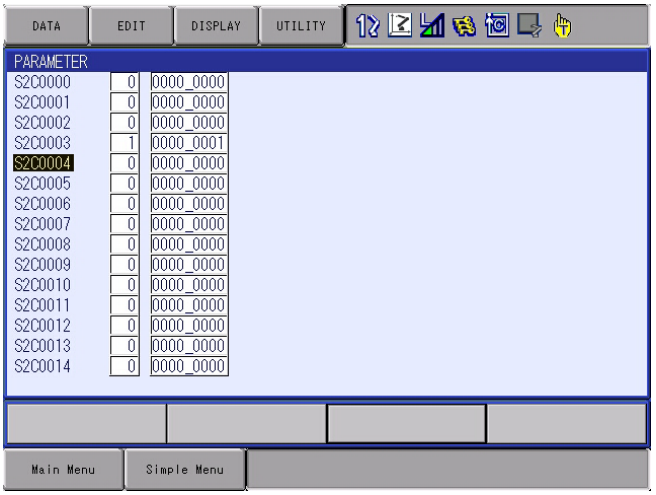
8.17 Changing the Parameter Setting

The parameters are protected not to be changed easily.
The following operations are allowed only for the operator who can set the security mode to the management mode or higher.
The operations must be performed properly.

1. Select {PARAMETER} under the main menu.
2. Select the parameter type.
   – The PARAMETER window appears. Select the desired parameter.

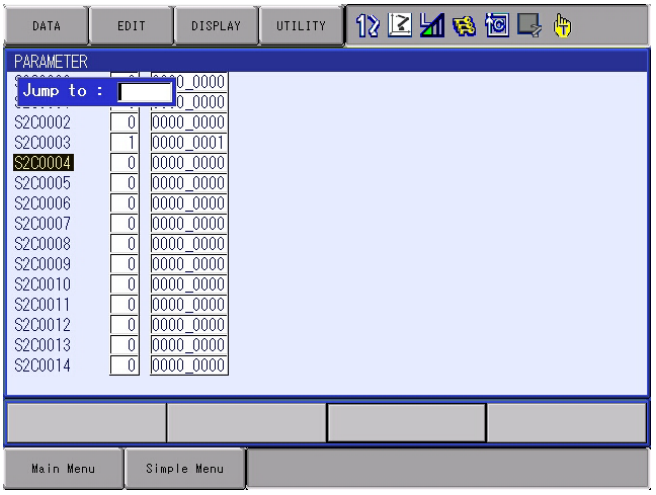


3. Move the cursor to the desired parameter number.

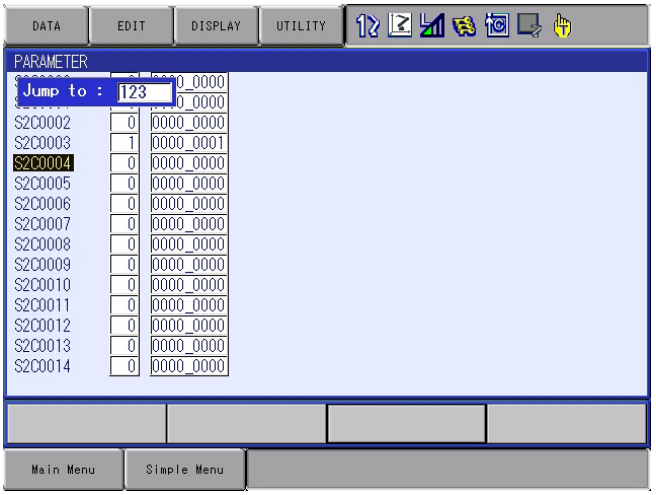


– When the desired parameter number is not in the current window, move the cursor in the following way:

(1) Move the cursor to a parameter number and press [SELECT].

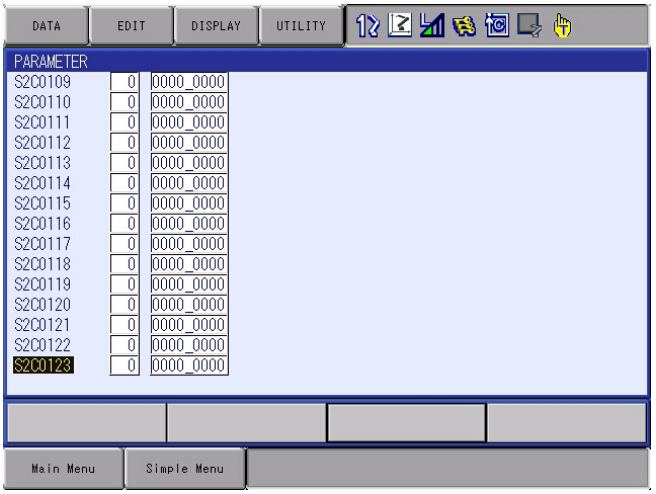


(2) Enter the desired parameter number with the numeric keys.



(3) Press [ENTER].

(4) The cursor moves to the selected parameter number.



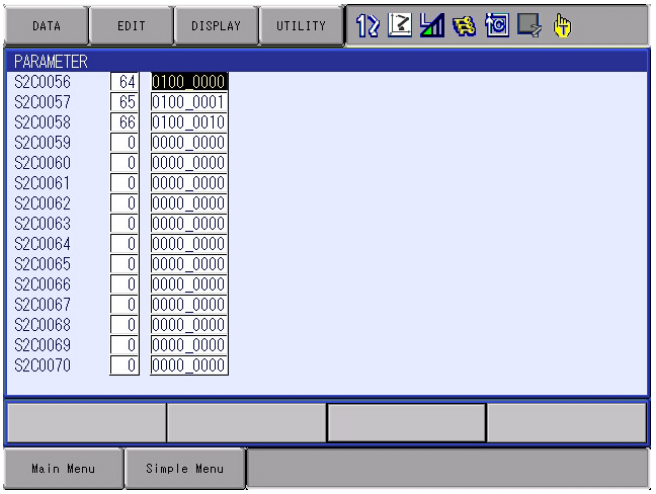
Set the parameters in the following manner.

1. Select the parameter data to be set.

   (1) Move the cursor to the parameter number data (decimal or binary) in the PARAMETER window, and press [SELECT].

   (2) To enter a decimal setting, select the decimal figure.

   (3) To enter a binary setting, select the binary figure.



2. Enter the value.

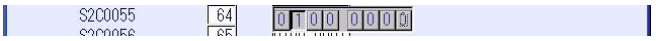
   – If a decimal figure is selected, enter a decimal value with the numeric keys.



   – If a binary figure is selected, move the cursor to the binary figure data in the input buffer line, and press [SELECT].

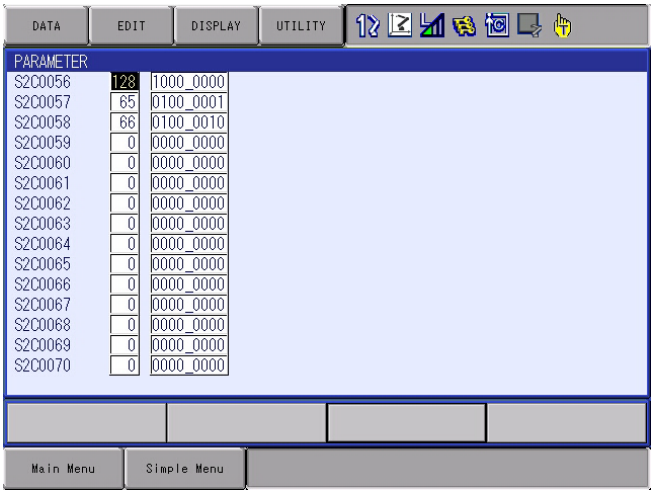
   – Each time [SELECT] is pressed, “0” and “1” alternate in the window.

   – “0” or “1” can also be entered with the numeric keys.



3. Press [ENTER].

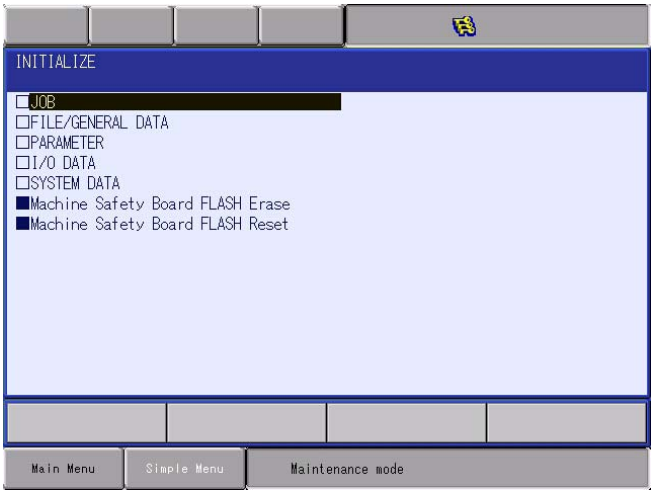
   – The new setting appears in the position where the cursor is located.



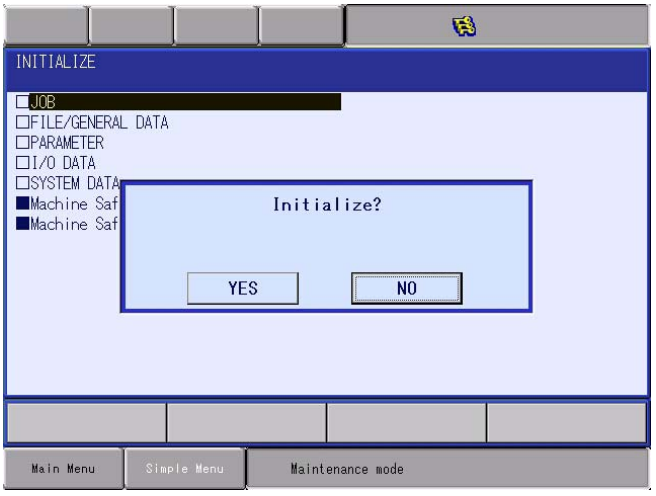
8.18 File Initialization

8.18.1 Initializing Job File

1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
   – The INITIALIZE window appears.



5. Select {JOB}.
   – A confirmation dialog box appears.



6. Select {YES}.
   – The job data is initialized.

NOTE

When JOB is initialized, the following files are reset at the same time.
Be careful when initializing JOB.

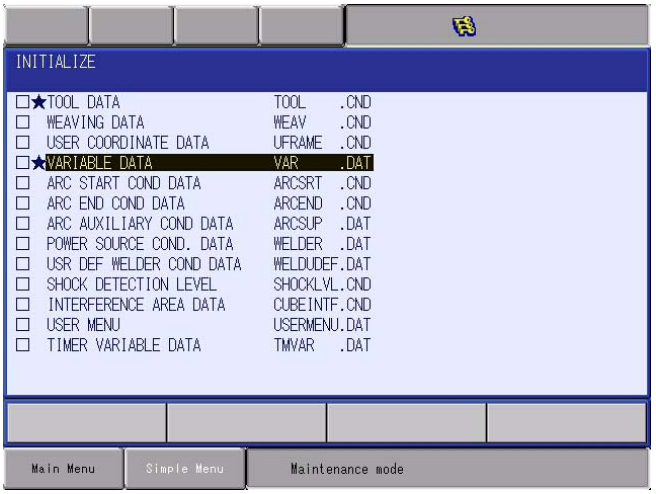
- User coordinates
- Memo play file
- Spot monitor data
- Variable data
- Robot calibration data
- Conveyor calibration data
- Laser Welding Pos

8.18.2 Initializing Data File

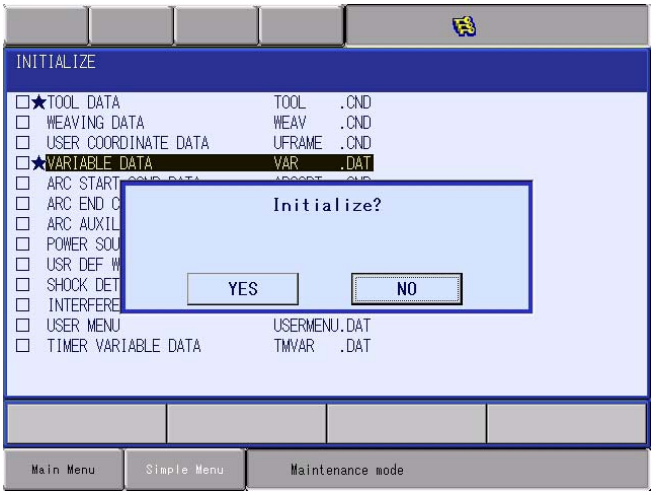
1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {FILE/GENERAL DATA}.
   – The INITIALIZE window appears.



6. Select the data file to be initialized.
   – The selected data file/general data are marked with "★".
   – The parameters marked with "■" cannot be selected.



7. Press [ENTER].
   – A confirmation dialog box appears.



8. Select {YES}.
   – The selected data file/general data are initialized.

8.18.3 Initializing Parameter File

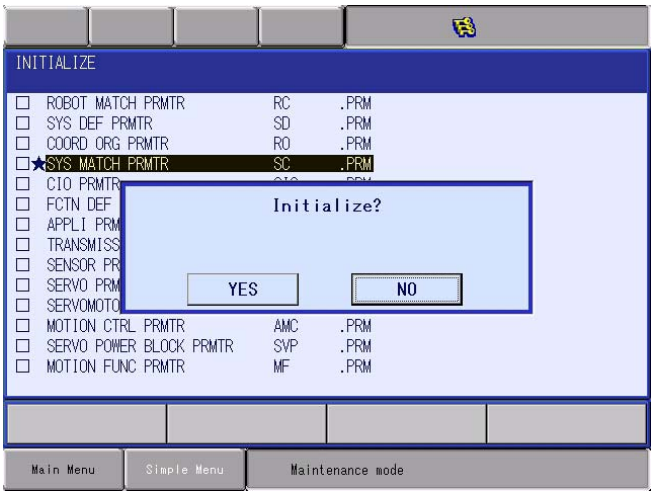
1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {PARAMETER}.
   – The parameter selection window appears.



6. Select the parameter to be initialized.
   – The selected parameter is marked with "★".
   – The parameters marked with "■" cannot be selected.



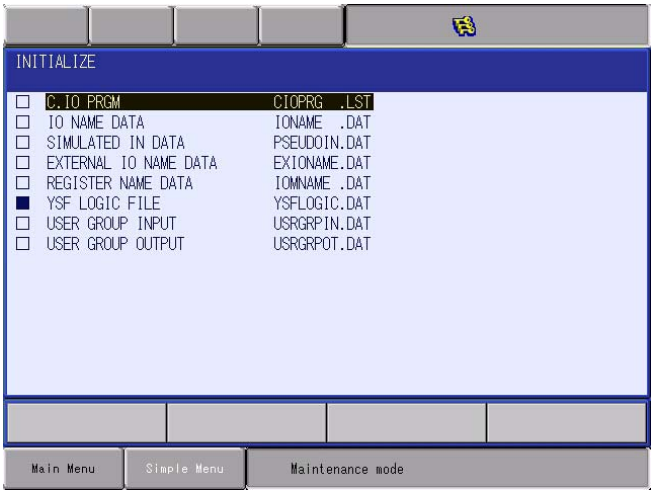
7. Press [ENTER].
   – A confirmation dialog box appears.



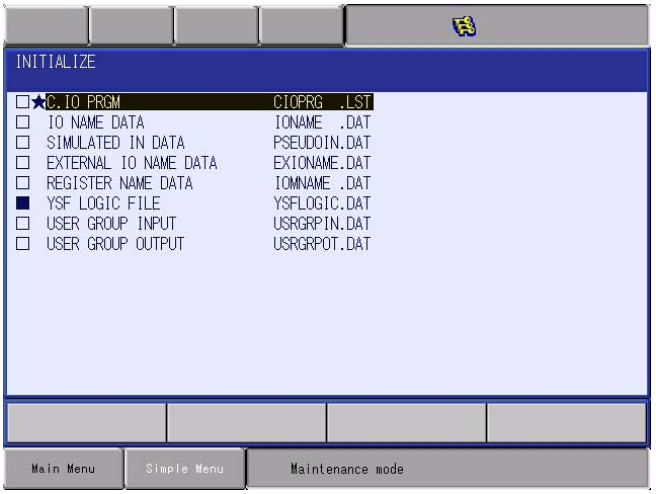
8. Select {YES}.
   – The selected parameter is initialized.

8.18.4 Initializing I/O Data

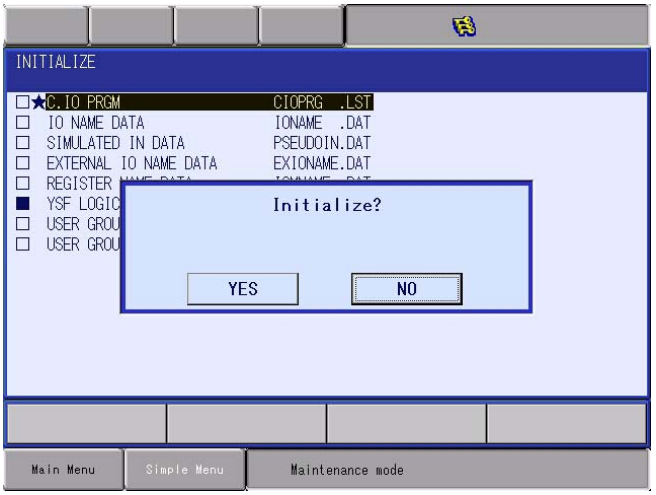
1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {I/O DATA}.
   – The I/O data selection window appears.



6. Select data to be initialized.
   – The selected data is marked with "★".
   – The I/O data marked with "n" cannot be selected.



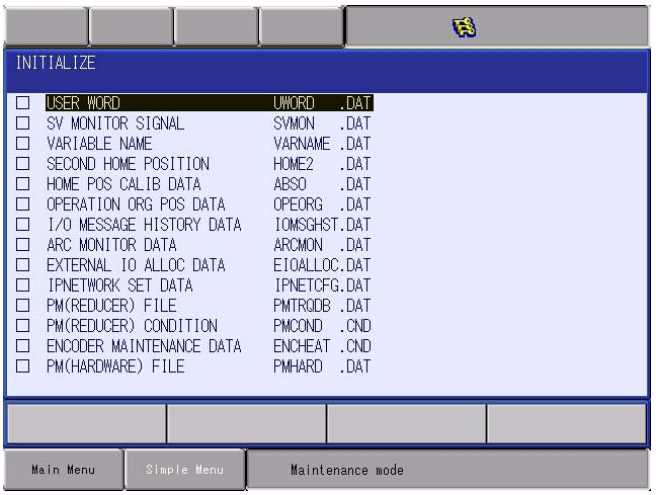
7. Press [ENTER].
   – A confirmation dialog box appears.



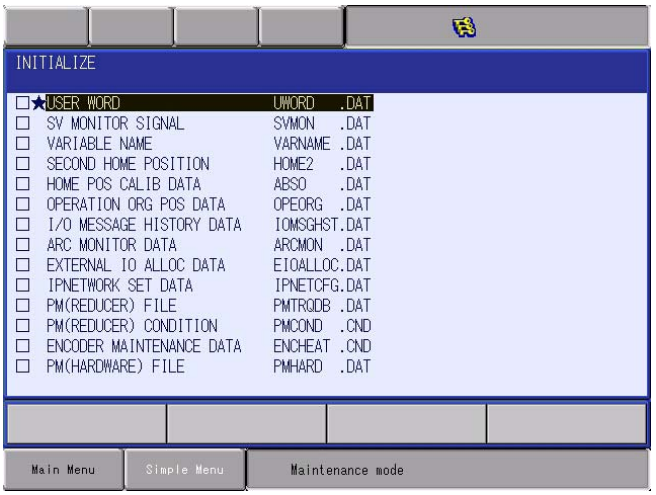
8. Select {YES}.
   – The selected data is initialized.

8.18.5 Initializing System Data

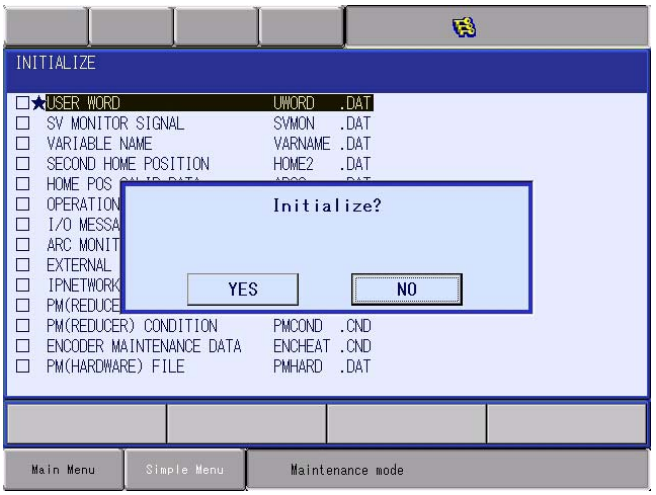
1. Turn ON the power supply again while pressing [MAIN MENU] on the programming pendant simultaneously.
2. Change the security mode to the management mode.
3. Select {FILE} under the main menu.
4. Select {INITIALIZE}.
5. Select {SYSTEM DATA}.
   – The system data selection window appears.



6. Select the parameter to be initialized.
   – The selected data is marked with "★".
   – The system data marked with "■" cannot be selected



7. Press [ENTER].
   – A confirmation dialog box appears.



8. Select {YES}.
   – The selected data is initialized.

8.18.6 Reset Safety Circuit Board FLASH Data

8.18.6.1 Saving Dual Data

The data related to the safety function is saved in the safety circuit board memory in a duplicated manner for safety.

When the control power is turned ON, check is performed to see that dual data sets are the same.

If they are different when the control power is turned ON, the following alarm occurs.

Alarm 0300: “VERIFY ERROR(SYSTEM CONFIG-DATA)[10]”

In the system with the functional safety function, a message “Select ‘Safety Board FLASH Reset’ in the maintenance mode” is displayed after the following operations.

Turning ON or OFF causes error in verification.

- The data related to the safety function is loaded from an external storage.
- A parameter related to the safety function is rewrote by setting operations in maintenance mode.
- The zeroing function is performed.
- Encoder is reset

In case one of the above mentioned operations is performed, re-set the data following the procedures shown in *chapter 8.18.6.2 “FLASH Data Reset”* .

In the maintenance mode, there are cases when parameters related to the safety function are rewrote by several setting operations.
For this reason, the message “Select ‘Safety Board FLASH Reset’” may be displayed.
Perform the safety board FLASH reset operation by following the procedure shown in *chapter 8.18.6.2* .

8.18.6.2 FLASH Data Reset

If the following alarm occurs when the control power supply is turned ON,

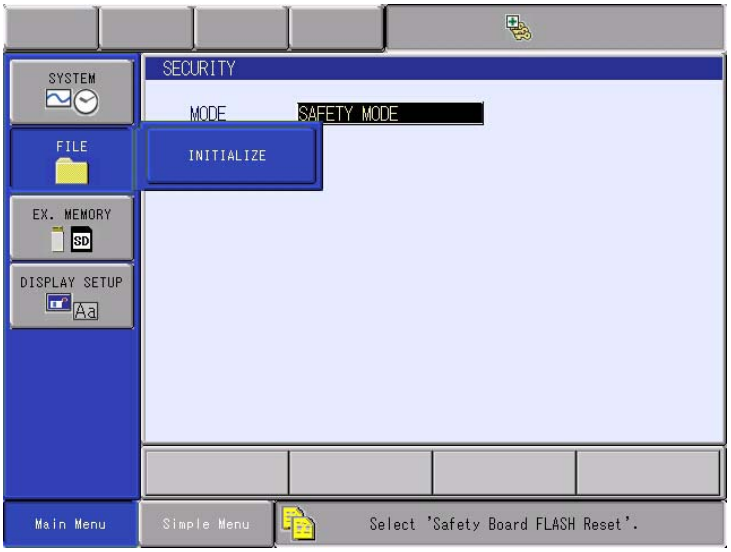
Alarm 0300: “VERIFY ERROR(SYSTEM CONFIG-DATA)[10]”

perform the following operations to re-set the data of the function safety board.

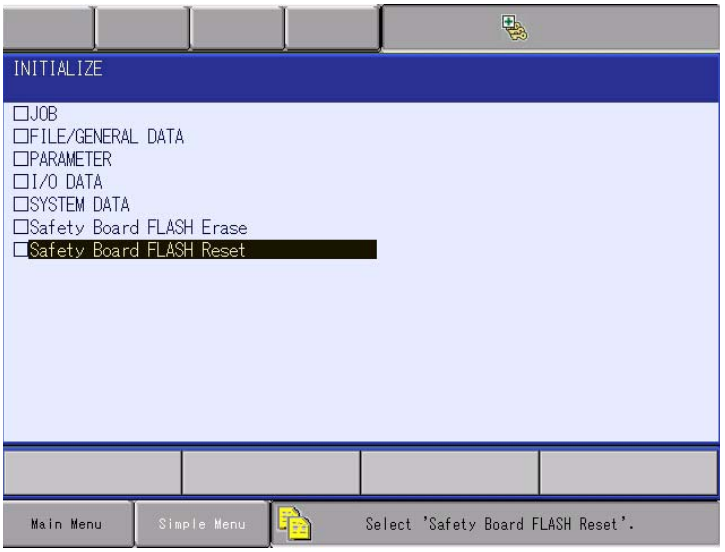
1. When the controller power is turned ON,
   Alarm 0300: “VERIFY ERROR(SYSTEM CONFIG-DATA)[10]” occurs and the maintenance mode is started up.
2. Select {SYSTEM} under the main menu. Then, press {SECURITY} to change the security mode to the safety mode.



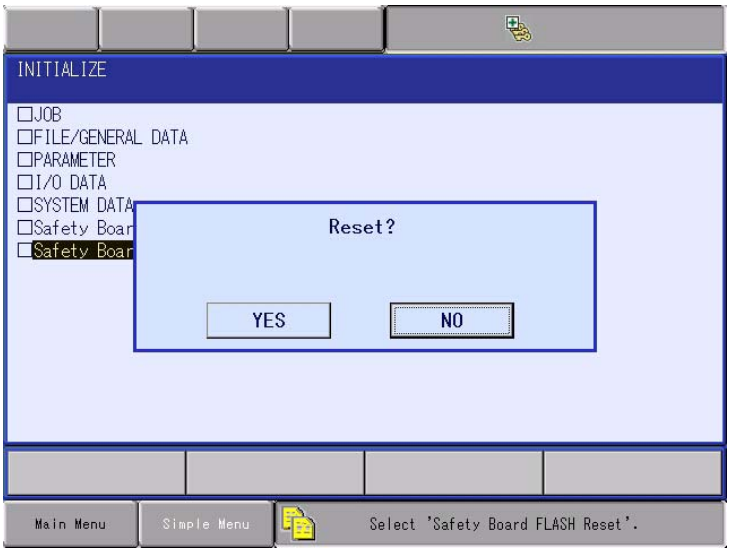
3. Select {FILE} under the main menu. Then, select {INITIALIZE} under the sub menu.
   – INITIALIZE window appears.



4. Move the cursor to {Safety Board FLASH Reset} and press [ENTER].



5. The dialog box “Reset?” is displayed. Select [YES].
   – The data of the safety circuit board is re-set. A few seconds later, the buzzer sounds and the data setting is completed.



6. When the data reset is completed, turn the control power OFF and then turn the power ON again.

8.18.6.3 Setting to Hide the Safety Board FLASH Erase Item

The safety board FLASH erase item can be hidden with the following parameter setting in system software YAS5.26.00A-00 or later.

If the PFL (Power and Force Limiting) function (option) is enabled, the PFL board FLASH erase item is also hidden.

Parameter No.	Description	Set Values
S2C1435	This parameter can hide the safety board FLASH erase item.	0 (show) 1 (hide)

8.19 Display Setting Function

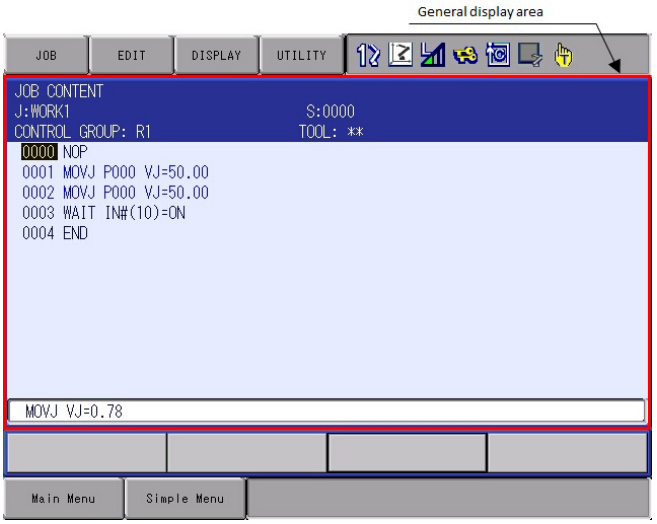
8.19.1 Font Size Setting

YRC1000 enables changing the font size displayed on the screen.

The fonts displayed on the screen can be selected from eight patterns of fonts in the font size setting dialog box.

8.19.1.1 Applicable Range for the Font Size Change

Changing the font size is allowed in the general display area indicated in the following figure:



8.19.1.2 Settable Font Size

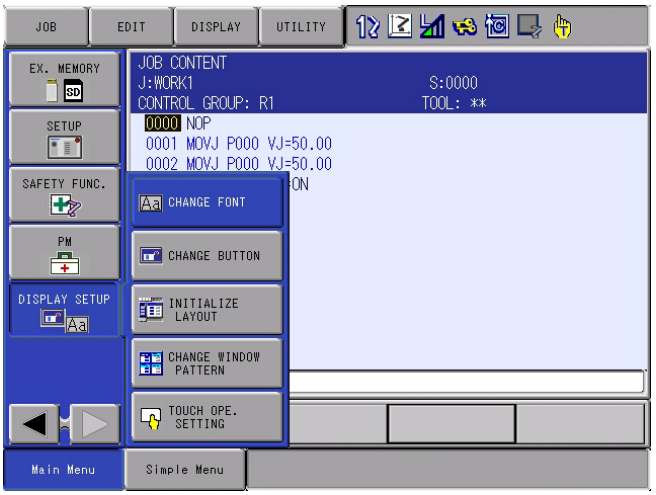
The following eight patterns of fonts are available in setting the size of fonts displayed on the screen.

	Font Size	Font Style
1	Small	Regular
2	Small	Bold
3	Regular	Regular
4	Regular	Bold
5	Large	Regular
6	Large	Bold
7	Extra large	Regular
8	Extra large	Bold

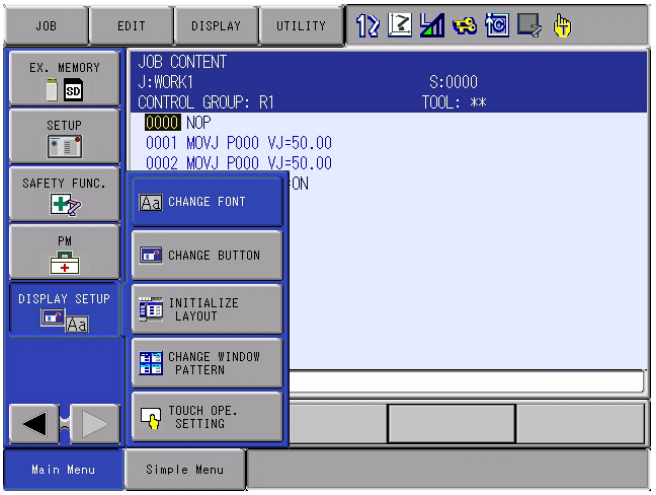
8.19.1.3 Setting the Font Size

To set the font size, first off display the font size setting dialog box as follows.

1. Select {DISPLAY SETUP} then {CHANGE FONT} under the main menu.



2. The font size setting dialog box appears on the center of the current window.

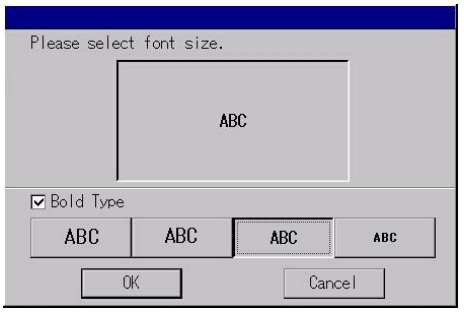


■ **To set the font size in the font size setting dialog box, follow the procedure below.**

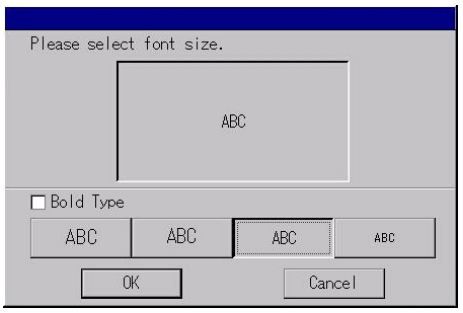
1. Specify the font style.

   – The {Bold Type} check box can be checked or unchecked alternately each time the check box is selected.

   • Check the {Bold Type} check box as follows to set the font to the bold style.

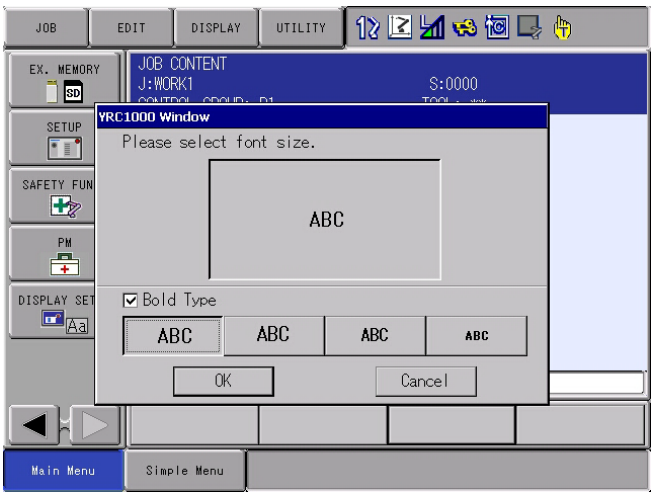


   • Clear the {Bold Type} check box as follows to set the font to the regular style.

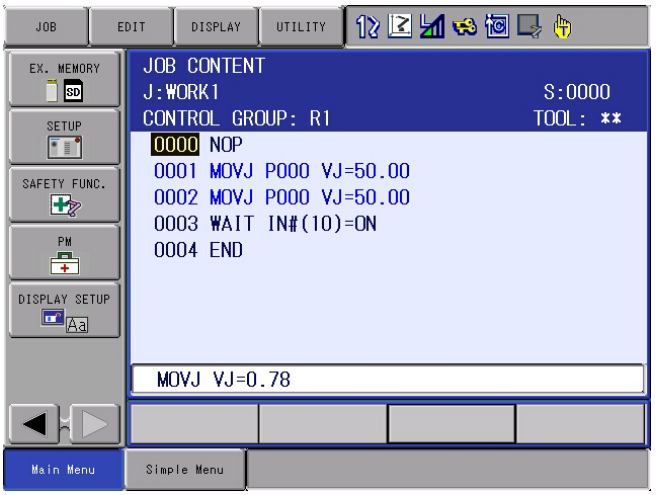


2. Specify the font size.

   – Select a button from the four buttons in the dialog box.

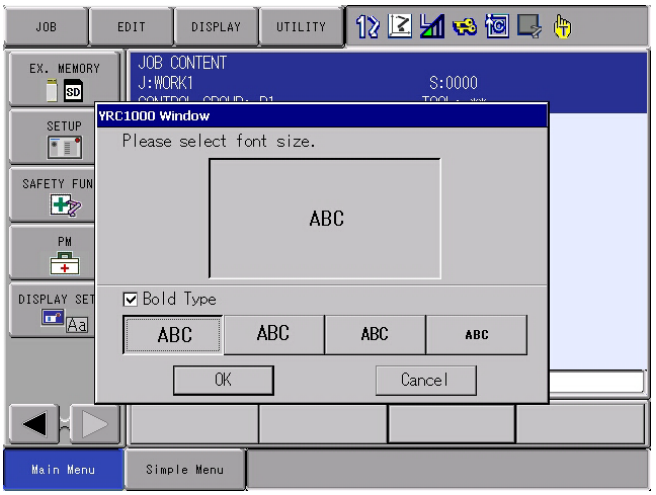


3. The font size setting dialog box is closed, and the screen displays the font specified in the dialog box.

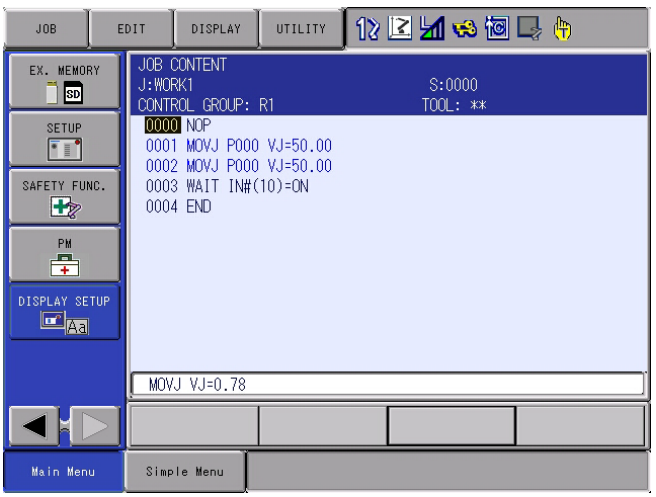


■ **To cancel the setting of the font size, follow the procedure below.**

1. Select {Cancel} in the font size setting dialog box.



2. The dialog box closes without changing the font size.



NOTE Do not turn OFF the YRC1000 power supply when the font size is being changed (when the font size setting dialog box is on the screen).

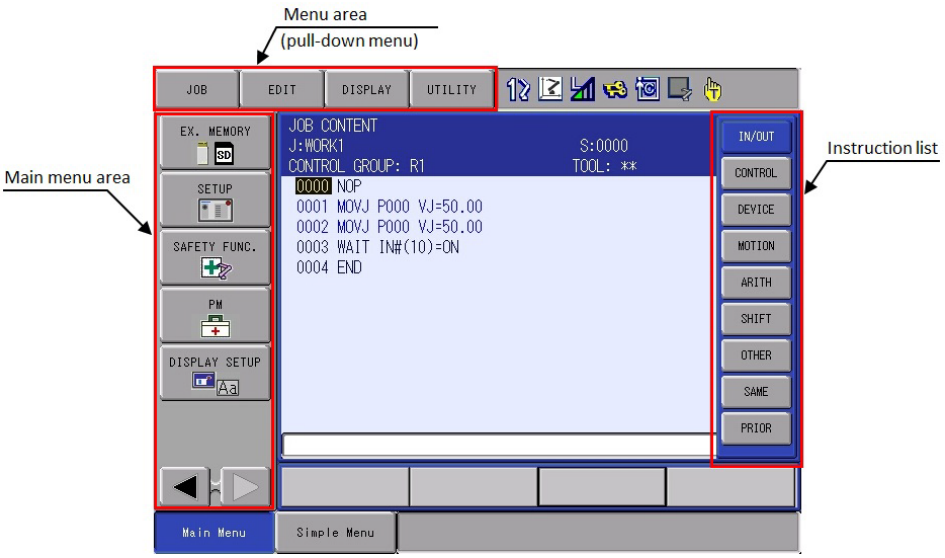
8.19.2 Operation Button Size Setting

YRC1000 enables changing the size of operation buttons.

The button size in the main menu area, menu area, and instruction list can be respectively selected from three sizes.

8.19.2.1 Applicable Range for the Button Size Change

Changing the button size is allowed in the main menu, menu (pull-down menu), and instruction list indicated in the following figure:



8.19.2.2 Settable Button Size

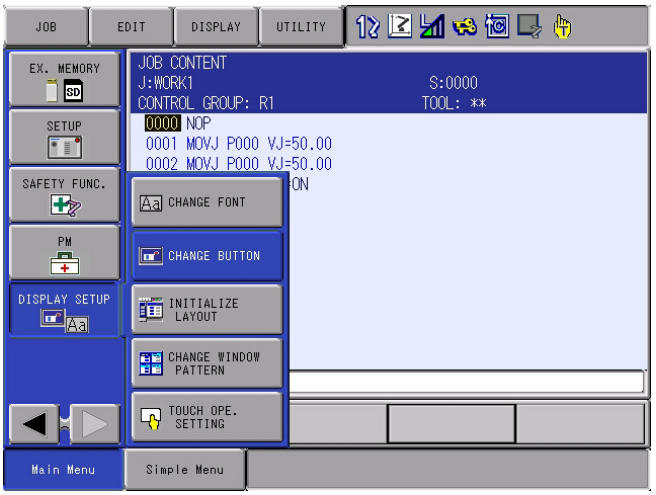
The following three sizes of buttons are available in setting the size of each operation button; the font style of the character string on buttons can also be specified.

	Button Size	Font Style
1	Small	Regular
		Bold
2	Regular	Regular
		Bold
3	Large	Regular
		Bold

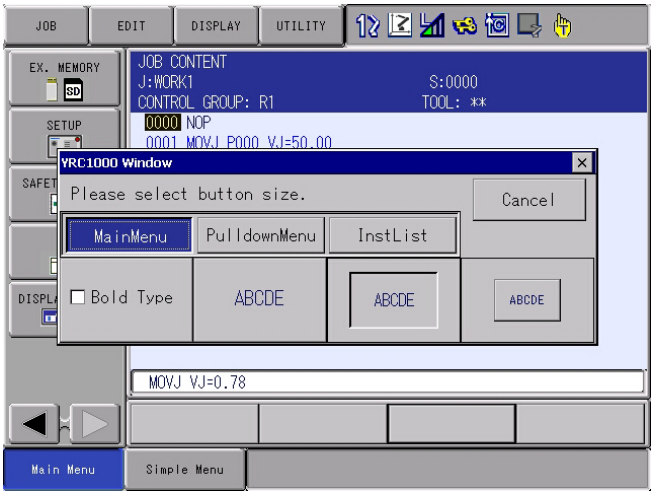
8.19.2.3 Setting the Button Size

To set the button size, first off display the button size setting dialog box as follows.

1. Select {DISPLAY SETUP} then {CHANGE BUTTON} under the main menu.

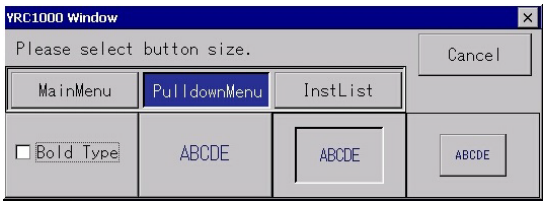


– The font size setting dialog box appears on the center of the current window.



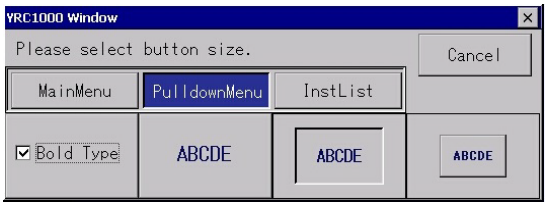
■ **To set the button size in the button size setting dialog box, follow the procedure below.**

1. Specify the area to set the button size.
   (1) Select the desired area from the area setting buttons.
   (2) The buttons in the selected area is subject to size setting.
   (3) Note that only the last-selected button determines the area subject to size setting, even if settings are performed several times before then.

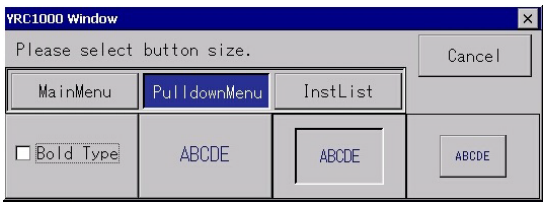


2. Specify the font style.
   – The {Bold Type} check box can be checked or unchecked alternately each time the check box is selected.

   • Check the {Bold Type} check box as follows to set the font to the bold style.

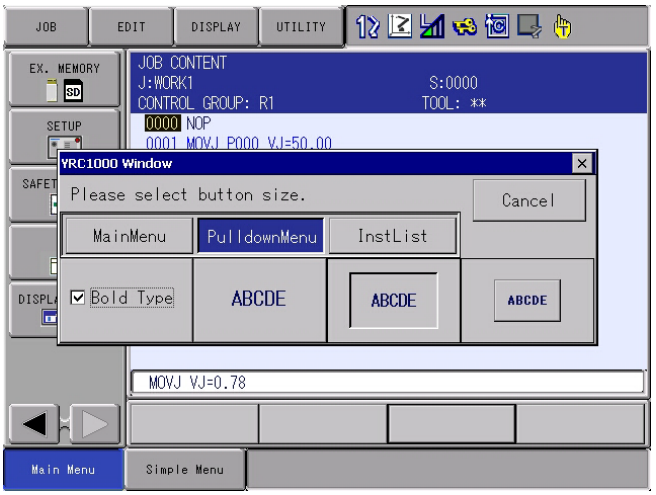


   • Clear the {Bold Type} check box as follows to set the font to the regular style.



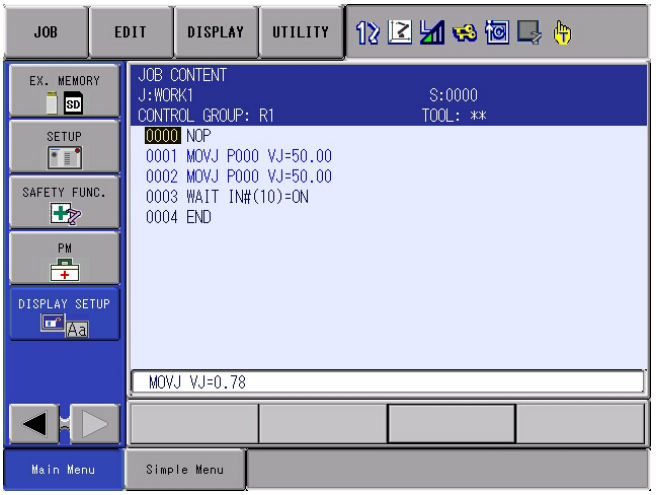
3. Specify the button size.

   – Select a button from the three buttons in the dialog box.



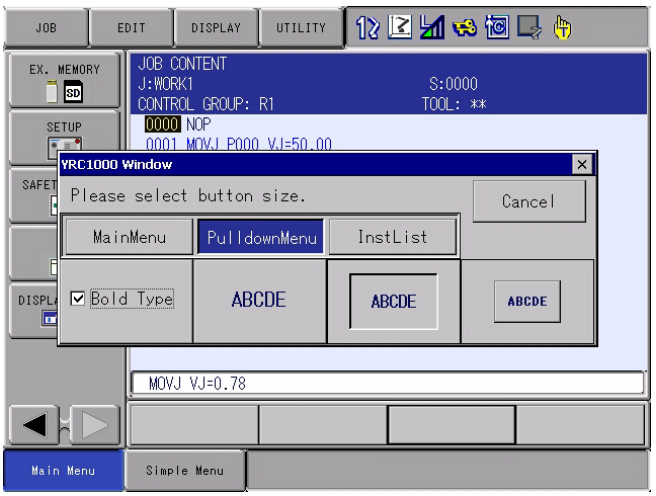
4. The font size setting dialog box is closed, and the screen displays the buttons specified in the dialog box.

   – The modification is applied only to the buttons in the area selected with the area setting button. (In this example, the change is applied only to the pull-down menu buttons in the menu area.)

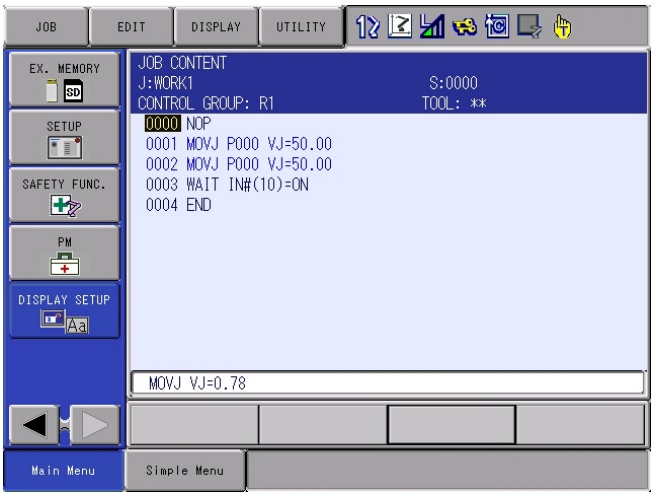


■ **To cancel the setting of the button size, follow the procedure below.**

1. Select {Cancel} in the button size setting dialog box.



– The dialog box closes without changing the button size.



NOTE Do not turn OFF the YRC1000 power supply when the button size is being changed (when the button size setting dialog box is on the screen, or when an hourglass is indicated in the middle of the screen).

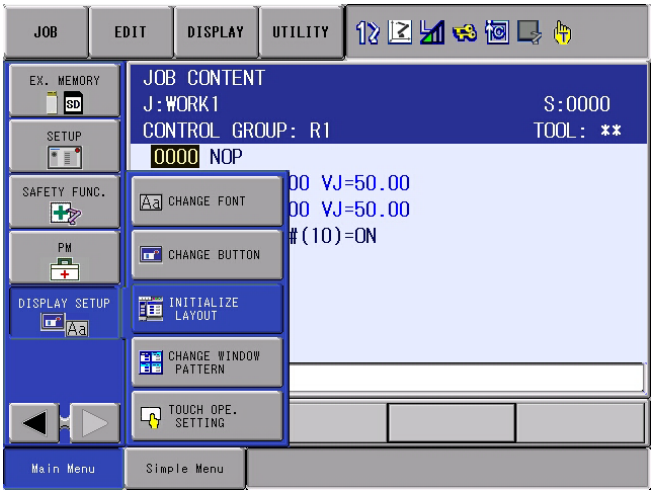
8.19.3 Initialization of Screen Layout

The font/button size changed with the font/button size setting function can be collectively changed back to the regular size.

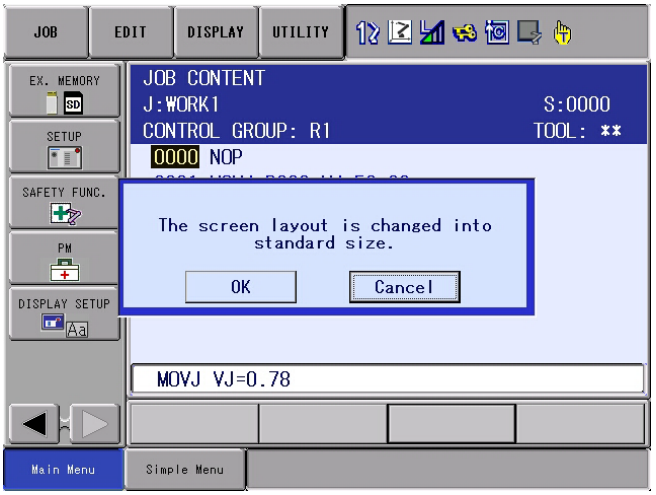
8.19.3.1 Initializing the Screen Layout

To initialize the screen layout, follow the procedure below.

1. Select {DISPLAY SETUP} then {INITIALIZE LAYOUT} under the main menu.

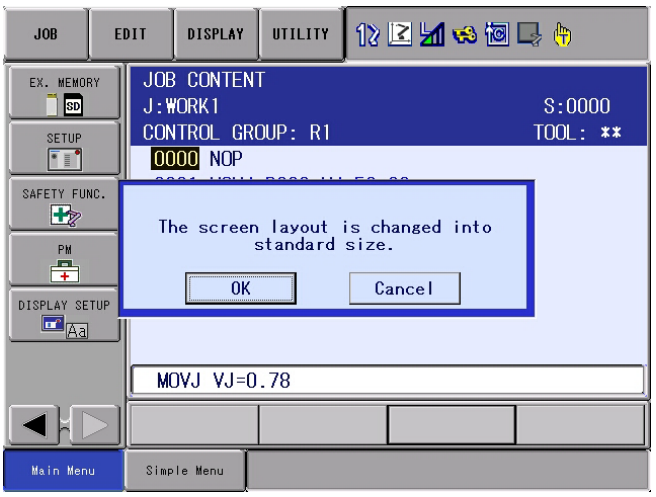


– A confirmation dialog box appears on the center of the current window.

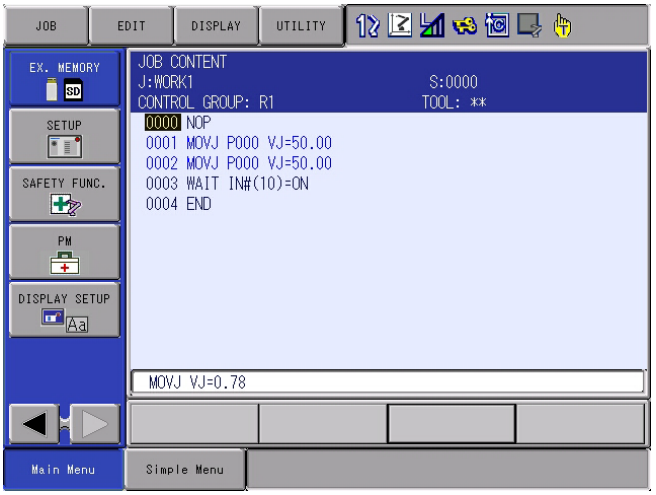


■ **To Initialize the screen layout, follow the procedure below.**

1. select {OK}.

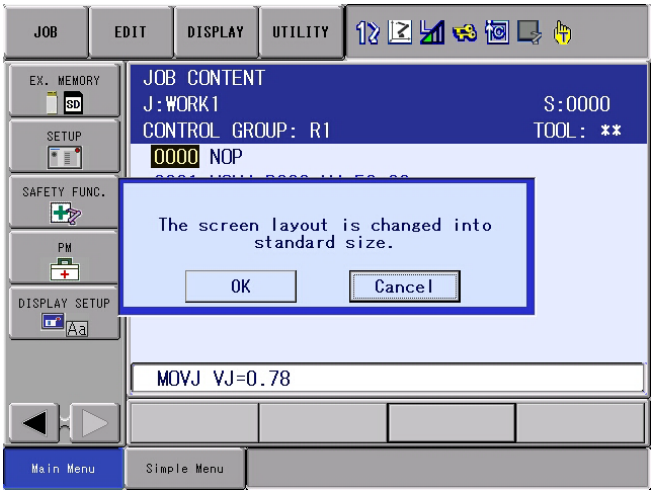


– The dialog box is closed, and the font/button sizes are collectively changed to the regular size.

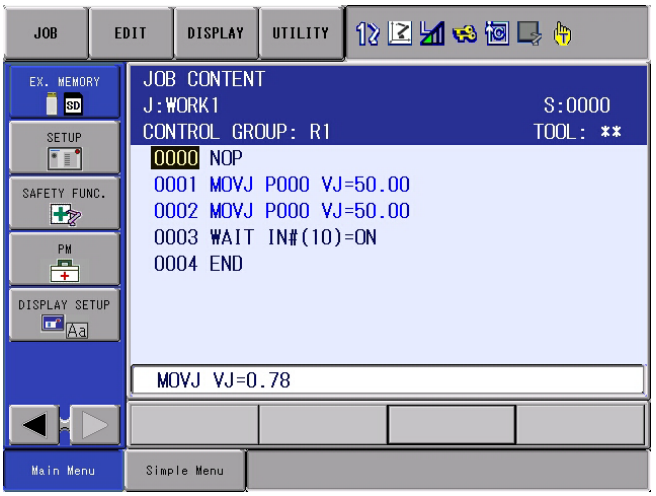


■ **To cancel the Initialized screen layout, follow the procedure below.**

1. Select {CANCEL}.



– The dialog box closes without changing the current screen layout.



NOTE Do not turn OFF the YRC1000 power supply when the screen layout is being initialized (when the confirmation dialog box is on the screen, or when an hourglass is indicated in the middle of the screen).

8.19.4 Layout Storage

The settings of the font or button sizes are saved in the programming pendant. The screen displays the font/button size specified last time with the current programming pendant.

8.20 Encoder Back-Up Error Recovery Function

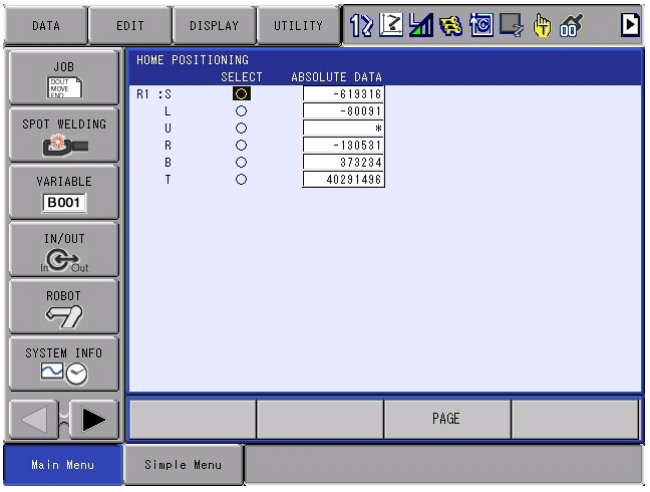
8.20.1 About Encoder Back-Up Error Recovery Function

A motor of the robot, the travel axis or the rotation station which is controlled by the YRC1000 is connected with the back-up buttery in order to keep the position information even though the control power is disconnected. This buttery consumes buttery power through time, and the alarm “4312 ENCODER BATTERY ERROR” occurs when the voltage becomes lower than 2.8V. If the battery is not replaced and keep consuming more battery power, it will cause the lost of the position information. In addition, the alarm “4311 ENCODER BACK-UP ERROR” occurs. Meanwhile, there would be a gap between the manipulator position and the position of the absolute encoder.

This function is used to recover the absolute data by moving the axis whose position information is lost to a position close to the home position by axis operation.

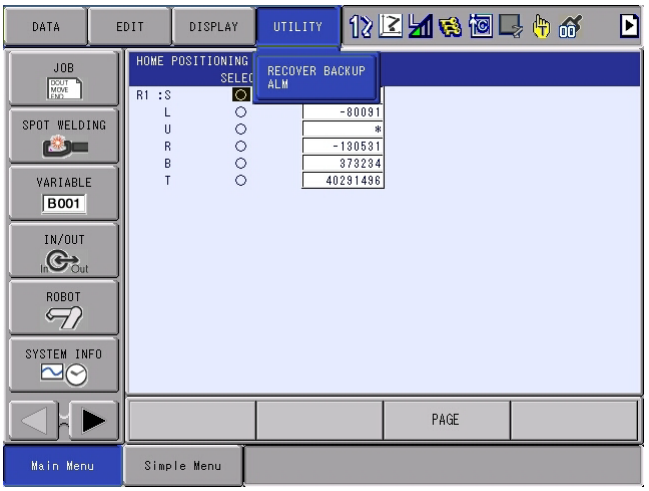
8.20.2 Encoder Back-Up Error Recovery Function Operation

1. Press {SELECT}.
   – When select the “RESET” in the alarm display, the alarm is reset. The manipulator can be move by the axis operation key.
2. Adjust the alarm occurring axis to the home position mark of the each manipulator axis by the axis operation key.
3. Change the security mode to the management mode.
   – Refer to *chapter 7.1.1.1 “Changing the Security Mode”* for the operation of the changing the security mode.
4. Select {ROBOT} in the main menu.
5. Select {HOME POSITIONNING}.
   – The home positioning display appears. The absolute data of the axis which is occurring the encoder back-up error appears with the “ * ” which indicates the undefined state.

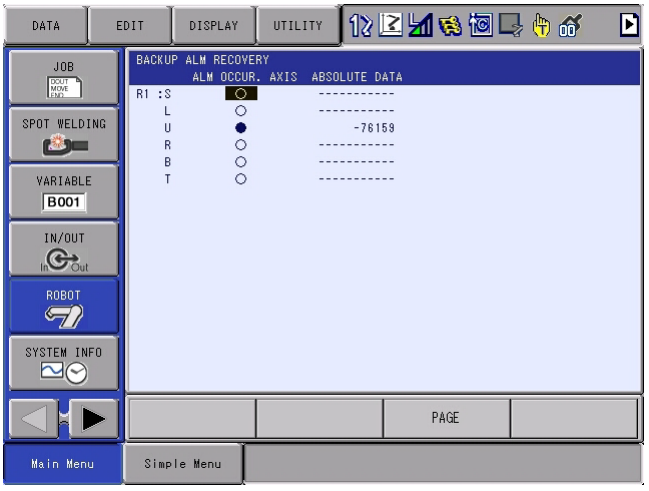


6. Select the control group.

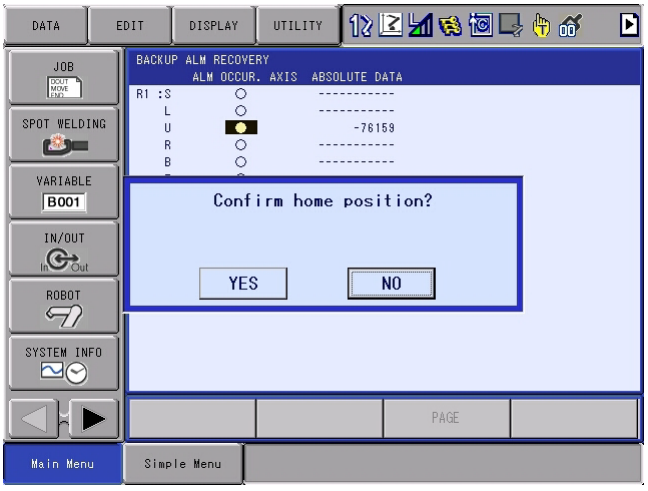
7. Select {UTILITY} in the menu.
   – The pull-down menu appears.



8. Select {BACKUP ALM RECOVERY} in the menu.
   – The back-up alarm recovery display appears.



9. Select the axis to be fixed.
   – Move the cursor over the axis to fix, and select it. The confirmation dialog appears.



10. Select {YES}.
    – The absolute data of the selected axis is recovered.
    – Select {NO} to cancel the operation.
11. Select the current position.
    – To display the current position window, refer to “YRC1000 MAINTENANCE MANUAL (R-CHO-A114) 7.8.1 Current Position Window”.
12. Confirm the current position.
    – Confirm the recovered current position, and modify the followings depending on its values.

    (1) The pulse number is approximately “0”.

    • Recovered normally.

    (2) The pulse number is approximately “4096”.

    • Move the recovered axis to the 4096 pulse position, and register the individual axis to calibrate the home position.

    (3) The pulse number is approximately “-4096”.

    • Move the recovered axis to the -4096 pulse position, and register the individual axis to calibrate the home position.
    As for the registering the individual axis, refer to *chapter 8.1.2.2 “Registering Individual Axes”* .

8.21 Preventive Maintenance Function

8.21.1 Preventive Maintenance Function

The preventive maintenance function contains the function which provides the information of diagnosis the duration of life for the speed reducer and the function which informs the inspection time of the robot. Furthermore, it contains the function which provides the information of the life span of the controller components. Use these functions for the preventive maintenance for the robot.

The followings are the features.

- Preventive maintenance function for the speed reducer
- Inspection notice function
- Preventive maintenance function for the hardware
- 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.

NOTE

- The accuracy of the performance of the life diagnosis is not guaranteed. Use this function as the one of the methods to determine the duration of life for the speed reducer.
- If the periodic grease replenishment and grease replacement are not performed, or the excessive pressure is applied to the speed reducer, such as the mechanical interference etc, it will be failed before reaching to the diagnosis period.
- The diagnosis is performed by executing the job in the play mode. When operating the robot in the teach mode (operation by the axis key, FWD operation and test operation), the life diagnosis function is not performed.

8.21.2.1 Diagnose by the Lifetime Calculation

■ **Outline**

This function calculates the torque and the speed of the each axis during the job operation, and diagnoses the time to replace the speed reducer by the lifetime calculation. The replacement time is informed by displaying the message and turning the replacement signal ON.

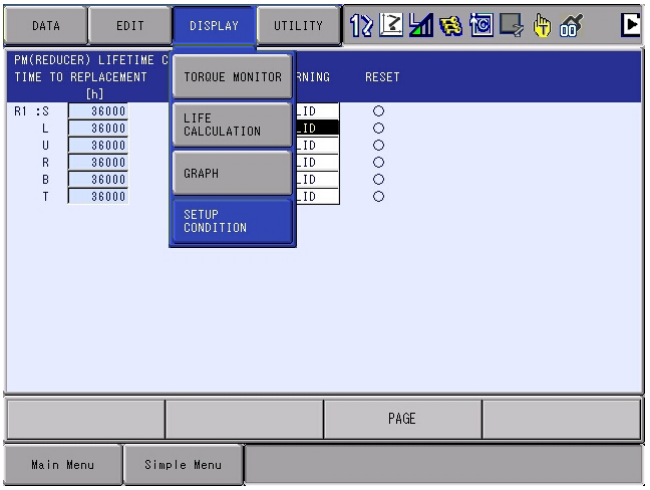
Operating the job in the play mode performs the diagnosis automatically.

NOTE This function is only available for the robot axes. As for the external axes, this function is not available.

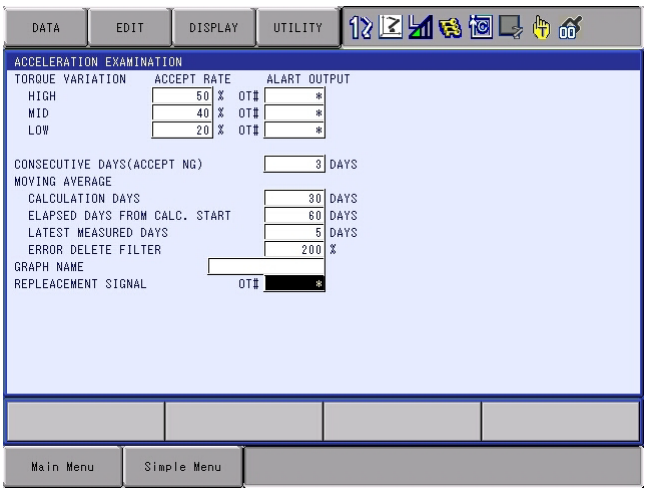
■ **Set the Replacement Signal**

Set the GP output signal to notify the replacement time by following procedures.

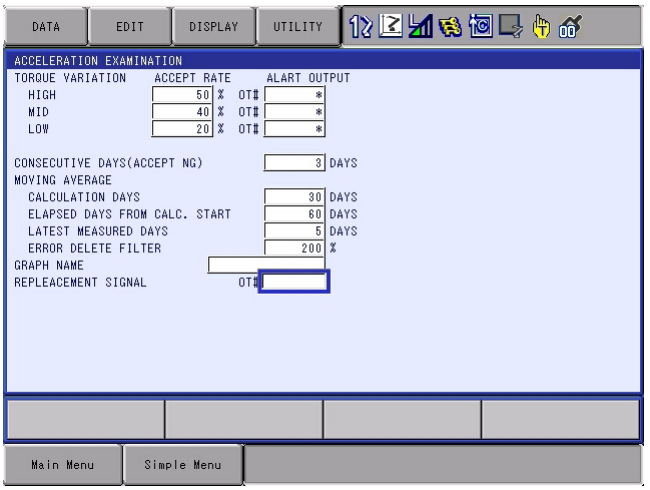
1. Change the security mode to the management mode.
2. Select {PM} in the main menu.
3. Select {PM(REDUCER)}.
4. Select {DISPLAY} in the menu.
   – {=SETUP CONDITION} appears under the pull down menu.



5. Select {=SETUP CONDITION}.
   – The condition setup window is appears.



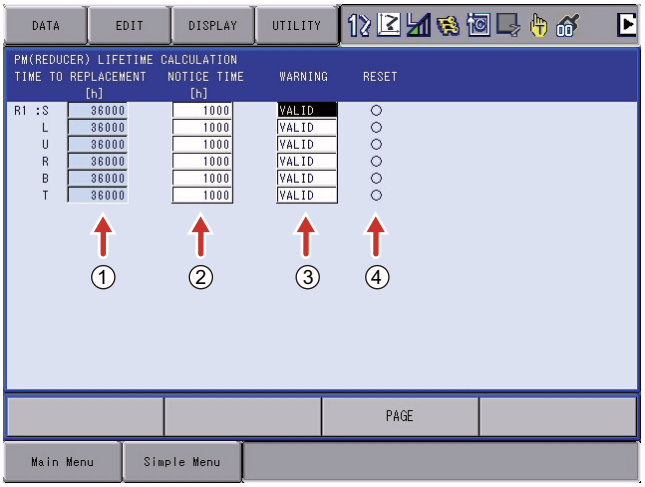
6. Move the cursor to over the {=REPLACEMENT SIGNAL}, and select.
   – Able to enter the values.



7. Enter the GP output signal.

■ Lifetime Calculation Window

1. Select {PM} in the main menu.
2. Select {PM(REDUCER)}.
   – The lifetime calculation window appears. In the case of the another window appears, select {DISPLAY}, and select the {=LIFE CALCULATION} in the pull down menu to display the lifetime calculation window.



Each item on the screen represents the following description.

① =TIME TO REPLACEMENT

Displays the rest of the lifetime to replace the speed reducer. The calculation of the subtraction of the number is operated automatically by performing the job in the play mode.

② =NOTICE TIME

By setting the time in this item, the replacement time is informed by displaying the message and turning the replacement signal ON before the “TIME TO REPLACEMENT” becomes “0”.

For example, when setting with “100”, the message will be displayed 100 hours before the “TIME TO REPLACEMENT” becomes “0”, and the replacement signal will be turned ON as well.

For example, when setting with “-100”, the message will be displayed 100 hours after the “TIME TO REPLACEMENT” became “0”, and the replacement signal will be turned ON as well.

③ =WARNING

Select this item to invalidate the notification signal and displaying the message. [Invalid] and [Valid] will alternate each time when pressing the [Select].

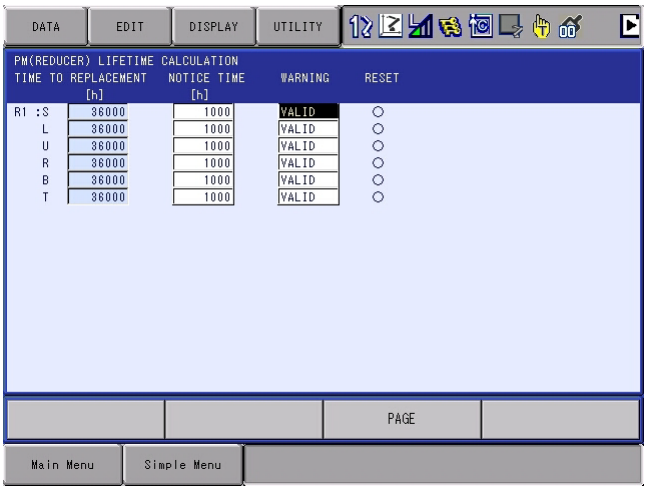
④ =RESET

Select this item after replacing the speed reducer.
Addition to the message is deleted, and the replacement signal is OFF, “TIME TO REPLACEMENT” is reset.

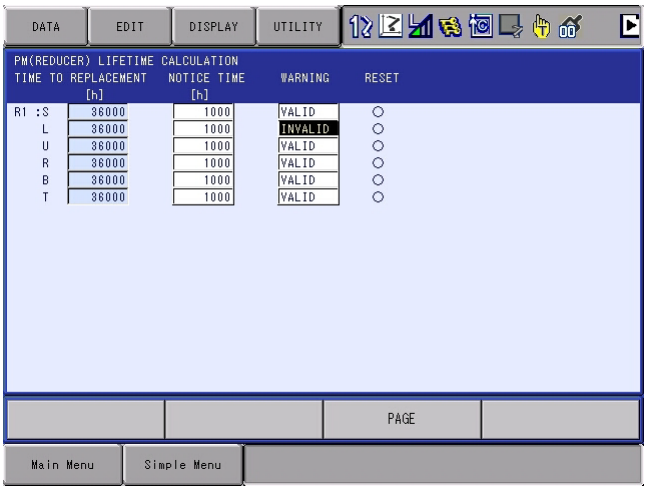
■ **Invalidate the Replacement Signal and the Message Display**

Able to invalidate the replacement signal and the message display in each axis. Invalidate the replacement signal and the message display by the following procedures, in the case of the speed reducer seems to operate normally even though the replacement signal is turned ON.

1. Change the security mode to the management mode.
2. Select {=PM} in the main menu.
3. Select {=PM(REDUCER)}.
   – The lifetime calculation window appears. In the case of the another window appears, select {DISPLAY}, and select the {=LIFE CALCULATION} in the pull down menu to display the lifetime calculation window.



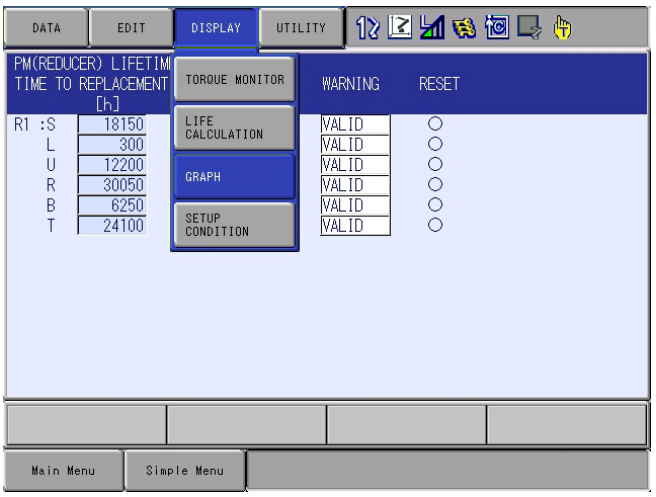
4. Move the cursor over the “=WARNING” to invalidate the desired axis, and select [Select]. [Invalid] and [Valid] will alternate each time when press the [Select].



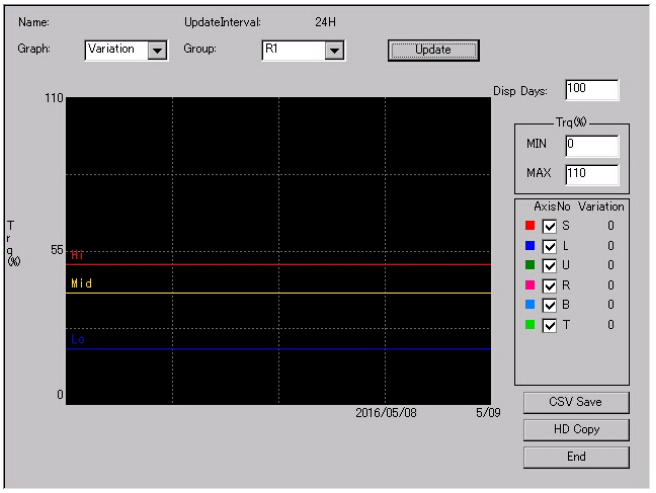
■ **Graph Display**

The lifetime calculation can be checked in the graph. The shift of lifetime calculation is shown on the programming pendant, so that it is possible to check visually how the lifetime decreases. Use this function as a method to judge the lifetime of the speed reducer. The graph is shown by the following procedures.

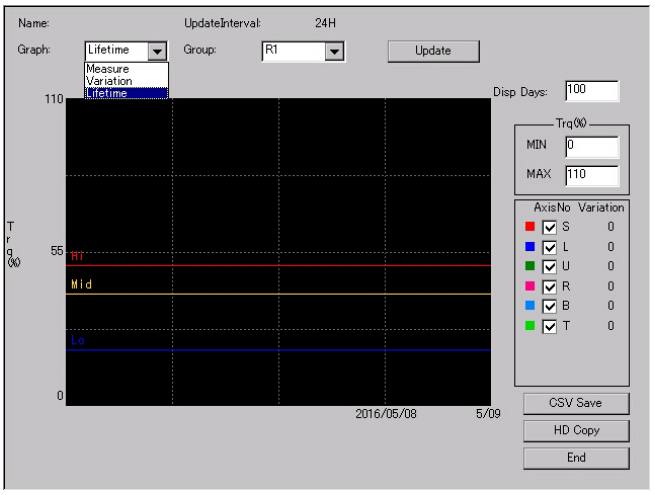
1. Select {PM} of main menu.
2. Select {PM(REDUCER)}.
3. Select {DISPLAY}.
   – The pull down menu is shown.



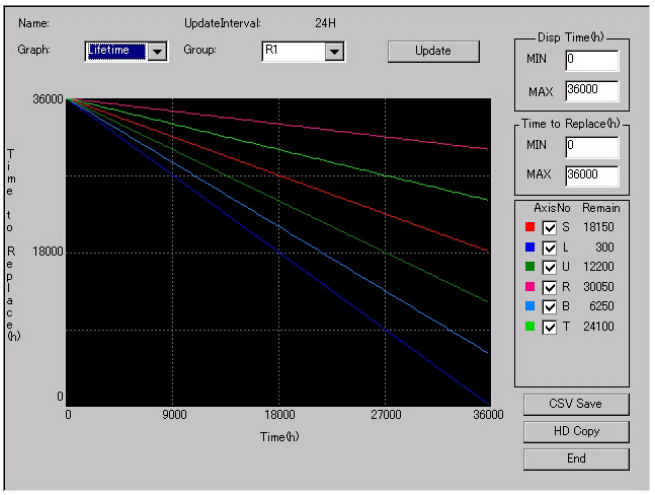
4. Select {GRAPH}.
   – The graph is shown.



5. Select {GRAPH}.
   – The pull down menu is shown.



6. Select {Lifetime}
   – The calculation result is shown as a graph.

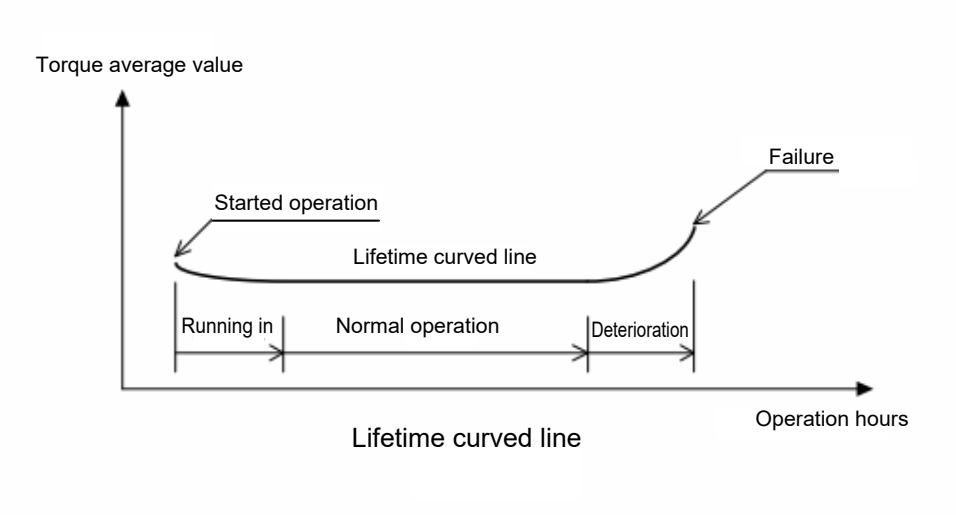


The vertical axis of the graph indicates the time to replace. The horizontal axis indicates the operation time.
To change the display range of the horizontal axis, modify the MIN and MAX values of display time.
To change the display range of the vertical axis, modify the MIN and MAX values of time to replace.
By pressing {CSV Save}, the lifetime calculation data can be saved as a CSV format into the external memory device.
For the other operations, refer to *chapter 8.21.2.2 “Diagnose by the Torque Average Value”* .

8.21.2.2 Diagnose by the Torque Average Value

■ **Diagnosis Element**

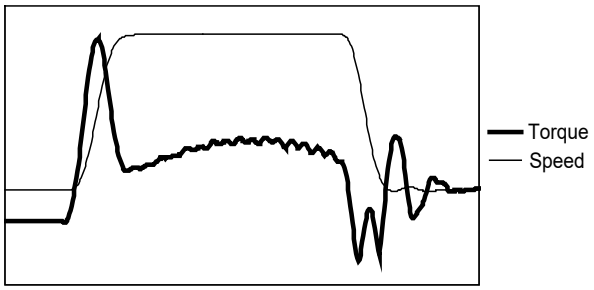
Monitors the torque waveform during the job operation, and calculates the average value of the vibration amplitude by extracting the waveform from the torque arising from the speed reducer. This data is called the torque average value, and it is the basis data to diagnose the lifetime. The following chart shows the lifetime curved line according to the torque average value and the operation hours.



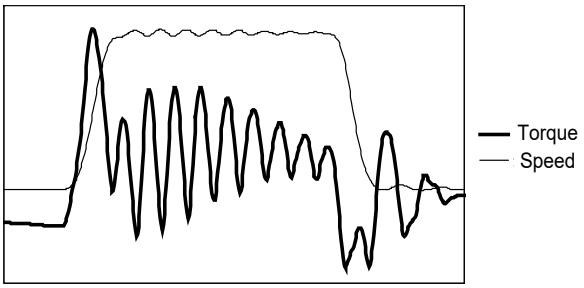
Lifetime curved line

As the condition of the speed reducer is changing to “deterioration” from “normal operation”, the torque element changes to “increase” from “normal”. It is estimated that the speed reducer is in the deterioration period as the number of the torque element is increasing by the deterioration of the speed reducer.

This function records the torque element arising from the deterioration of the speed reducer on a daily basis, and diagnoses the lifetime of the speed reducer by monitoring the change of the torque element.



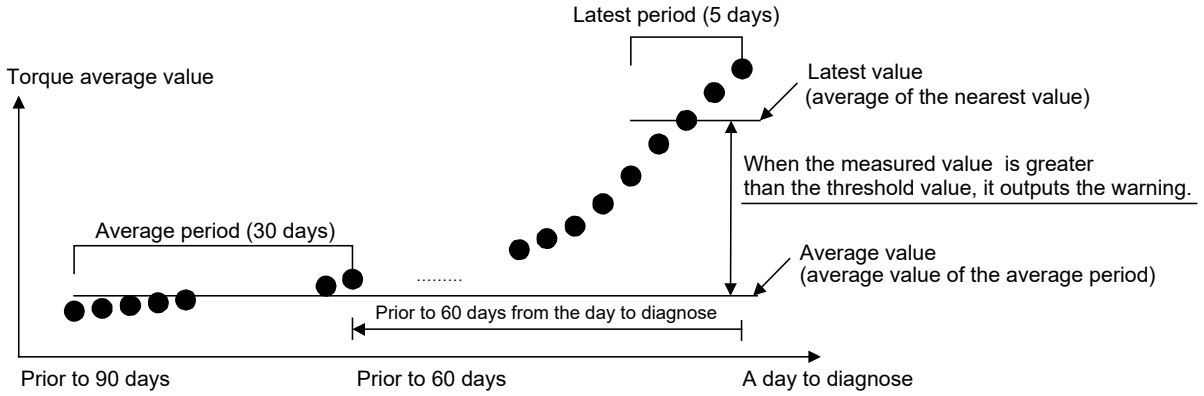
Torque and speed at the normal operation period



Torque and speed at the deterioration period

By operating a job in the play mode, a data (the torque element arising from the deterioration of the speed reducer) for each axis is recorded automatically on a daily basis, and the data is accumulated.

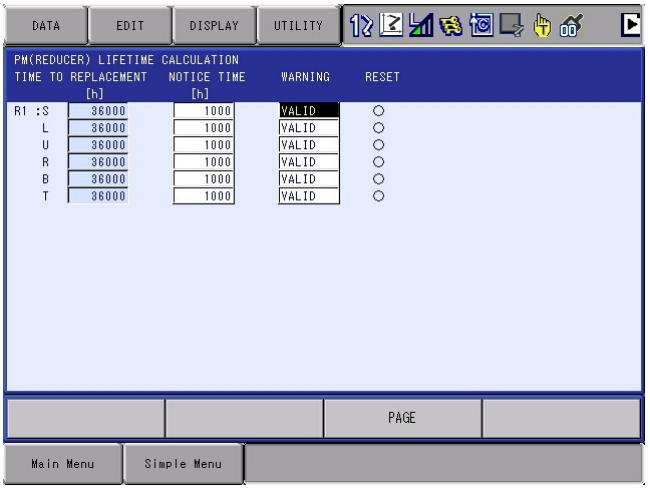
When the difference value between the latest value “the average value from the measured result of the five days (the initial value) including the day to diagnose” and the average value “the average of 30 days (the initial value) between prior to 60 days from the day to diagnose and prior to 90 days from the day to diagnose” becomes the threshold value or more, it determines the speed reducer is almost failure, and outputs the warning. The average value is indicated with%, and 100% indicates the standard torque.



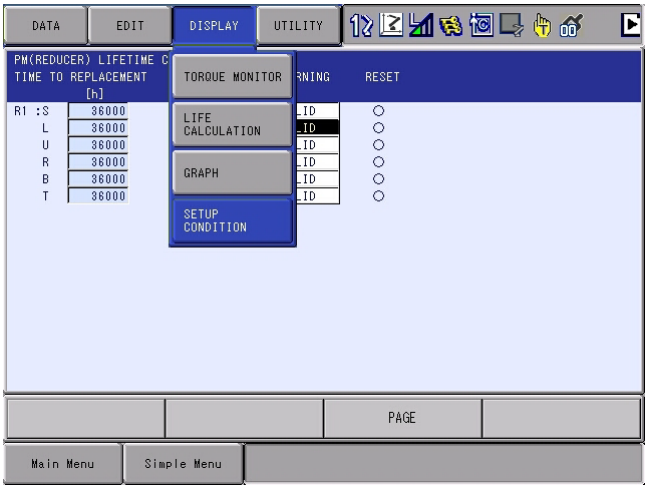
■ **Setting Procedures**

The setting procedures are described as follows.

1. Change the security mode to the management mode.
2. Select {=PM} in the main menu.
3. Select {=PM(REDUCER)}.
   – The lifetime calculation window appears.



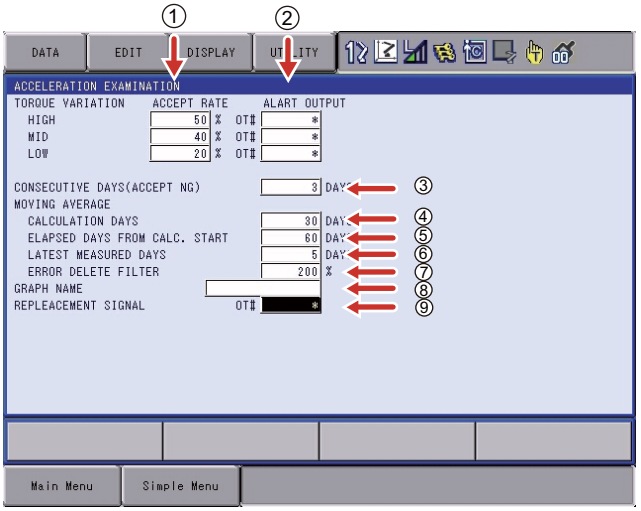
4. Select {DISPLAY} in the menu.
   – The {=SETUP CONDITION} appears in the pull down menu.



5. Select {=SETUP CONDITION}.

   – The setup window appears.

   – Modify the condition as necessary.



6. Select {End} button.

Each item on the screen represents the following description.

① =TORQUE VARIATION ACCEPT RATE

It is determined as accept OK when the measured value (the latest value - the average value) is smaller than the set value or the equal value. It is determined as accept NG when the measured value is greater than the set value. The torque variation accept rate can be set as “High”, “Medium” or “Low”. The initial value of each item is 50%, 40% and 20%.

② =TORQUE VARIATION ALART OUTPUT

- =ACCEPT RATE HIGH
  The warning output signal is turned ON when the number of the day, which is determined as accept NG (the latest value - the average value > “=ACCEPT RATE HIGH”), is more than the number of the consecutive days. If unnecessary to output the signal, set the item “0”. The initial value of this item is “0”.

- =ACCEPT RATE MID, LOW
  The GP output signal, which is set by “=ACCEPT RATE MID” and “=ACCEPT RATE LOW”, is turned ON when it is determined as follows.
  The latest value - the average value > “=ACCEPT RATE MID”.
  The latest value - the average value > “=ACCEPT RATE LOW”.
  If unnecessary to output the signal, set the item “0”. The initial value of this item is “0”.
  Alart signal can be output for each control group by setting parameters. *“Alart Output Control Group Setting”* below.

③ =CONSECUTIVE DAYS (ACCEPT NG)

It is determined as the speed reducer is almost failure, when the number of the day, which is determined as tolerance NG (the latest value - the average value > “=ACCEPT RATE HIGH”), is more than the number of this item. The initial value of this item is “3” (days).

④ =CALCULATION DAYS

Set the period to calculate the average value. The initial value of this item is “30” (days).

⑤ =ELAPSED DAYS FROM CALC. START

Set the period to calculate the average value from the day to diagnose. The initial value of this item is “60” (days).

⑥ =LATEST MEASURED DAYS

Set the period to calculate the latest value. The initial value of this item is “5” (days).

⑦ =ERROR DELETE FILTER

Use to delete the error when calculate the average value. The following values (torque average) are excepted from the calculation of the average value.

- The average from the previous day exists.

  The average from the previous day / any measurement value of the average period×100 > filter setting value

  The any measurement value of the average period / the average from the previous day×100 > filter setting value

- The average from the previous day does not exist.

  The latest value / any measurement value of the average period×100 > filter setting value

  The any measurement value of the average period / the latest value×100 > filter setting value

The initial value of this item is “200” (%).

⑧ =GRAPH NAME

The name of the graph can be registered.

⑨ =REPLACEMENT SIGNAL

Use this item to calculate the lifetime. Refer to *"Set the Replacement Signal"* .

NOTE Even though the initial value is set, the accuracy of the life diagnosis is not guaranteed performance.

■ Alart Output Control Group Setting

NOTE This function is available in system software version YAS5.10.00A-00 or later.

The alart output is divided by control group by setting the following parameters. This makes it possible to determine in which control group the alart output has occurred.

Parameter	Content	Value	
S2C1371	Preventive Maintenance Function Alart Output	0: Common to control group (1 signal output)	
		1: Separate by control group (offset)	①
		2: Separate by control group (sequential number)	②

■ Parameter Description

① S2C1371=1: Separate by control group (offset)

Set the alart output for each control group with an offset.
The input range of the alart output on window is 0 to 128.
(0 mean no alart output)

<When the total number of control groups (robots and stations) is 8 or less>
For ALART OUTPUT OT#x is setting, R1 alart output is OT#(x), the alart output of the next control group is set to OT#(x+256), OT#(x+256*2), etc. as shown below. (offset: 256)

(Example) If the control group is 4 robots and 4 stations:
Depending on the ALART OUTPUT setting, the alart output for each control group is as follows.

If R2 exceeds the allowable range, OT#257 is turned ON when ALART OUTPUT OT#1 is set.

ALART OUTPUT	R1	R2	R3	R4	S1	S2	S3	S4
1	OT#1 (#10010)	OT#257 (#10330)	OT#513 (#10650)	OT#769 (#10970)	OT#1025 (#11290)	OT#1281 (#11610)	OT#1537 (#11930)	OT#1793 (#12250)
2	OT#2 (#10011)	OT#258 (#10331)	OT#514 (#10651)	OT#770 (#10971)	OT#1026 (#11291)	OT#1282 (#11611)	OT#1538 (#11931)	OT#1794 (#12251)
:	:	:	:	:	:	:	:	:
128	OT#128 (#10167)	OT#384 (#10487)	OT#640 (#10807)	OT#896 (#11127)	OT#1152 (#11447)	OT#1408 (#11767)	OT#1664 (#12087)	OT#1920 (#12407)
X	x	x+256	x+256*2	x+256*3	x+256*4	x+256*5	x+256*6	x+256*7

<When the number of control groups is 5 or more robots, or 5 or more stations>

For ALART OUTPUT OT#x is setting, R1 alart output is OT#(x), the alart output of the next control group is set to OT#(x+128), OT#(x+128*2), etc. as shown below. (offset: 128)

(Example) If the control group is 8 robots and 24 stations:
Depending on the ALART OUTPUT setting, the alart output for each control group is as follows.

If R2 exceeds the allowable range, OT#129 is turned ON when ALART OUTPUT OT#1 is set.

ALART OUTPUT	R1	R2	…	R8	S1	S2	…	S24
1	OT#1 (#10010)	OT#129 (#10170)	…	OT#897 (#11130)	OT#1025 (#11290)	OT#1153 (#11450)	…	OT#3969 (#14650)
2	OT#2 (#10011)	OT#130 (#10171)	…	OT#898 (#11131)	OT#1026 (#11291)	OT#1154 (#11451)	…	OT#3970 (#14651)
:	:	:	…	:	:	:	…	:
128	OT#128 (#10167)	OT#256 (#10327)	…	OT#1024 (#11287)	OT#1152 (#11447)	OT#1280 (#11607)	…	OT#4096 (#15127)
X	x	x+128	…	x+128*7	x+128*8	x+128*9	…	x+128*31

② S2C1371=2: Separate by control group (sequential number)

Set the alart output for each control group in sequential numbers.

<When the total number of control groups (robots and stations) is 8 or less>

For ALART OUTPUT OT#x is setting, R1 alart output is OT#(x), the alart output of the next control group is set to OT#(x+1), OT#(x+2),・・・OT#(x+7) as shown below.

(Example) If the control group is 4 robots and 4 stations:
Depending on the ALART OUTPUT setting, the alart output for each control group is as follows.

If R2 exceeds the allowable range, OT#2 is turned ON when ALART OUTPUT OT#1 is set.

ALART OUTPUT	R1	R2	R3	R4	S1	S2	S3	S4
1	OT#1 (#10010)	OT#2 (#10011)	OT#3 (#10012)	OT#4 (#10013)	OT#5 (#10014)	OT#6 (#10015)	OT#7 (#10016)	OT#8 (#10017)
2	OT#2 (#10011)	OT#3 (#10012)	OT#4 (#10013)	OT#5 (#10014)	OT#6 (#10015)	OT#7 (#10016)	OT#8 (#10017)	OT#9 (#10020)
:	:	:	:	:	:	:	:	:
4089	OT#4089 (#15120)	OT#4090 (#15121)	OT#4091 (#15122)	OT#4092 (#15123)	OT#4093 (#15124)	OT#4094 (#15125)	OT#4095 (#15126)	OT#4096 (#15127)
X	x	x+1	x+2	x+3	x+4	x+5	x+6	x+7

<When the number of control groups is 5 or more robots, or 5 or more stations>
For ALART OUTPUT OT#x is setting, R1 alart output is OT#(x), the alart output of the next control group is set to OT#(x+1), OT#(x+2),･･･OT#(x+31) as shown below.

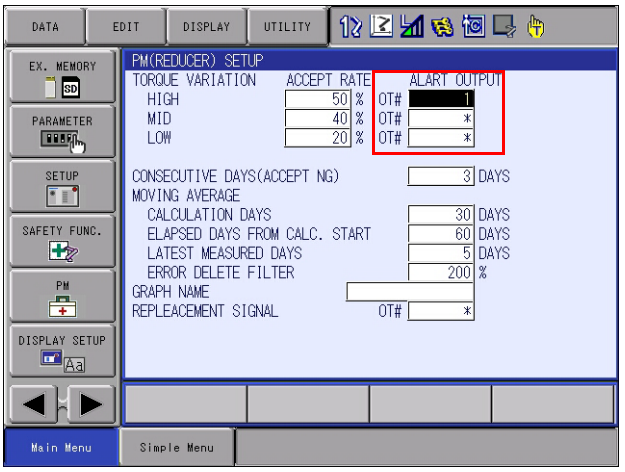
(Example) If the control group is 8 robots and 24 stations:
Depending on the ALART OUTPUT setting, the alart output for each control group is as follows.

If R2 exceeds the allowable range, OT#2 is turned ON when ALART OUTPUT OT#1 is set.

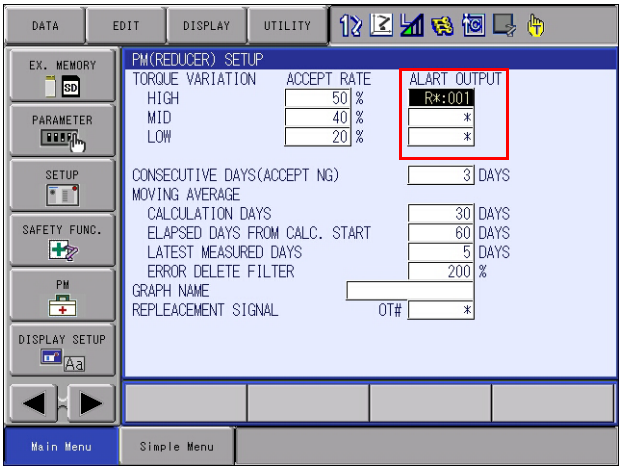
ALART OUTPUT	**R1**	**R2**	**･･･**	**R8**	**S1**	**･･･**	**S24**
1	OT#1 (#10010)	OT#2 (#10011)	･･･	OT#8 (#10017)	OT#9 (#10020)	･･･	OT#32 (#10047)
2	OT#2 (#10011)	OT#3 (#10012)	･･･	OT#9 (#10020)	OT#10 (#10021)	･･･	OT#33 (#10050)
:	:	:	･･･	:	:	･･･	:
4065	OT#4065 (#15090)	OT#4066 (#15091)	･･･	OT#4072 (#15097)	OT#4073 (#15100)	･･･	OT#4096 (#15127)
X	x	x+1	･･･	x+7	x+8	･･･	x+31

Depending on the S2C1371 setting, the “ALART OUTPUT” input field on window changes as shown bellows.

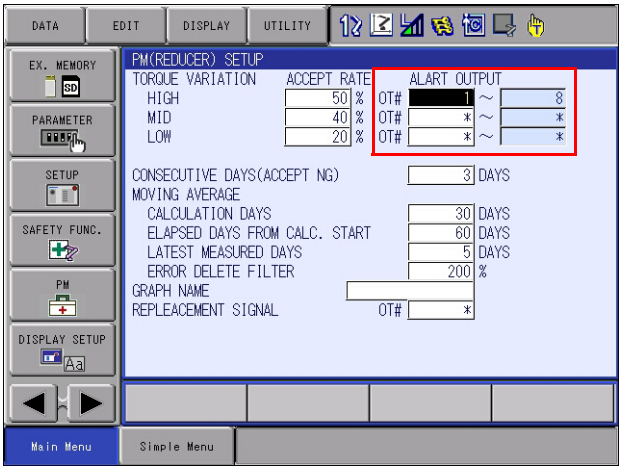
[S2C1371=0]



[S2C1371=1]



[S2C1371=2]



■ Alart Output Reset

NOTE This function is available in system software version YAS5.10.00A-00 or later.

The alart output can be reset with special input signal(#40014) by setting the following parameters.

Parameter	Content	Value
S2C1372	Preventive Maintenance Function Alart Output Reset	0: Cancel operation from the window
		1: Special input signal(#40014)

The alart output is turned OFF by special input signal(#40014: alarm reset) when S2C1372=1.

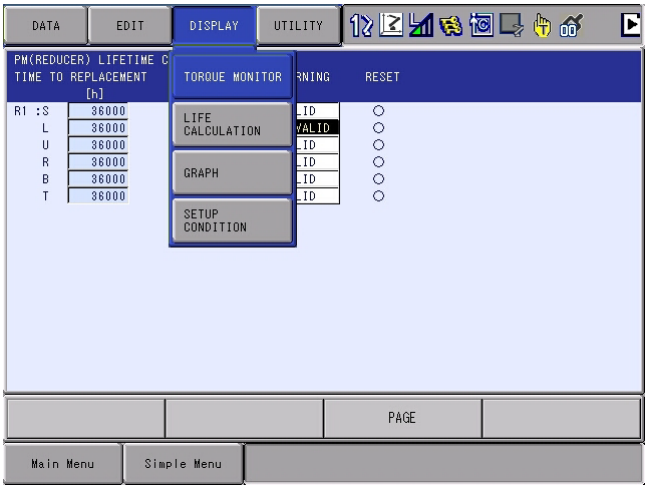
This is an alternative to reset from “PM(REDUCER) TORQUE MONITOR” window.

■ Data Confirmation

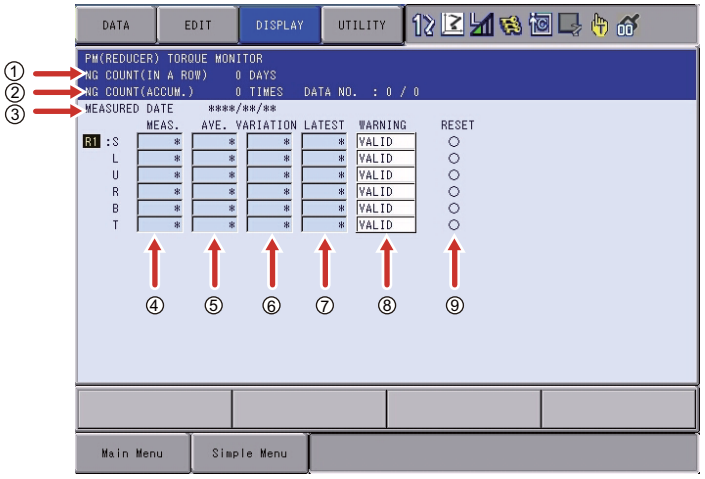
By operating a job in the play mode, a data (the torque element arising from the deterioration of the speed reducer) for each axis is recorded automatically on a daily basis, and the data is accumulated. It is unnecessary to prepare the job for this diagnosis.

Able to refer to the data by following procedures.

1. Select {=PM} in the main menu.
2. Select {=PM(REDUCER)}.
3. Select {DISPLAY}.
   – The pull down menu appears.



4. Select {=TORQUE MONITOR}.
   – The torque monitor window appears.



5. Press [PAGE] key.
   – Able to refer to the data of a date corresponding to the number by pressing the [PAGE] key. Modify the number as necessary.

SUPPLE -MENT

Unable to measure the torque average value because the axis of the measured value indicating “*” is not operating, or the motion speed is less than the reference speed.

Each item on the screen represents the following description.

① =NG COUNT (IN A ROW)

Shows the number of the variation days, which is higher than the value of the torque variation “HIGH”. The warning output signal, which is set by “=ACCEPT RATE HIGH”, is turned ON when the number of the day above is more than the number of the consecutive accept NG days.

② =NG COUNT (ACCUM.)

Shows the total number of the variation days, which is higher than the value of the torque variation “HIGH”. The number of “=NG COUNT (IN A ROW)” is reset as “0”, when a day does not exceed the torque variation. However, this “=NG COUNT (ACCM.)” will not be reset.

③ =MEASURED DATE

Shows the date of the measurement or the updated speed reducer diagnosis database.

④ =MEAS.

Shows the measured torque average.

⑤ =AVE.

Shows the arithmetic mean of the average period (certain number of the days, which is calculated in the past, based on the MEASURED DATE). However, the measured values excepted in the =ERROR DELETE FILTER are not included.

⑥ =VARIATION (The Determining Value)

Shows the difference value between the latest value and the average value. When this value exceeds the value, which is set at the torque variation, it is determined as accept NG.

⑦ =LATEST

Shows the arithmetic mean of the latest period (certain number of the days included the measured day).

⑧ =WARNING

Select this item to invalidate the warning output signal. [Invalid] and [Valid] will alternate each time when press the [Select].

⑨ =RESET

Select this item after replacement of the speed reducer. The warning output signal will be turned OFF, and the old data will not be used for the lifetime diagnosis.

■ **Invalidate the Warning Output Signal**

Able to invalidate for each axis. Invalidate the warning output signal by the following procedures, in the case of the speed reducer seems to operate normally even though the warning output signal is turned ON.

1. Select {=PM} in the main menu.
   – The sub menu appears.
2. Select {=PM(REDUCER)}.
   – The lifetime calculation window appears.
3. Select {DISPLAY}.
   – The pull down menu appears.
4. Select {=TORQUE MONITOR}.
   – The torque monitor window appears.

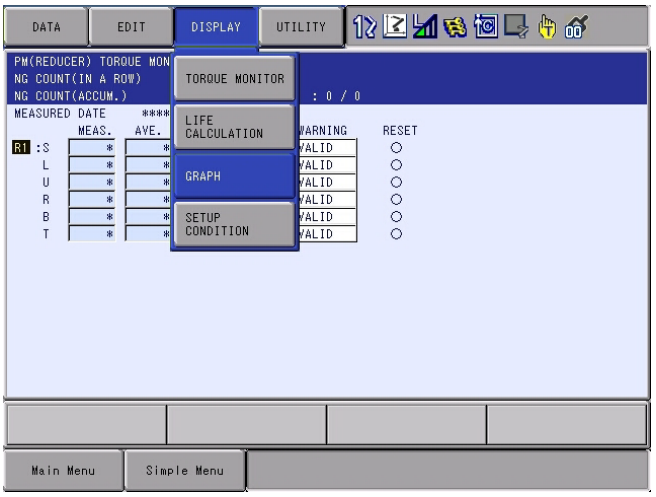
Move the cursor over the “=WARNING” of the desired axis to invalidate, and press [Select]. [Invalid] and [Valid] will alternate each time when pressing the [Select].

■ Graph Display

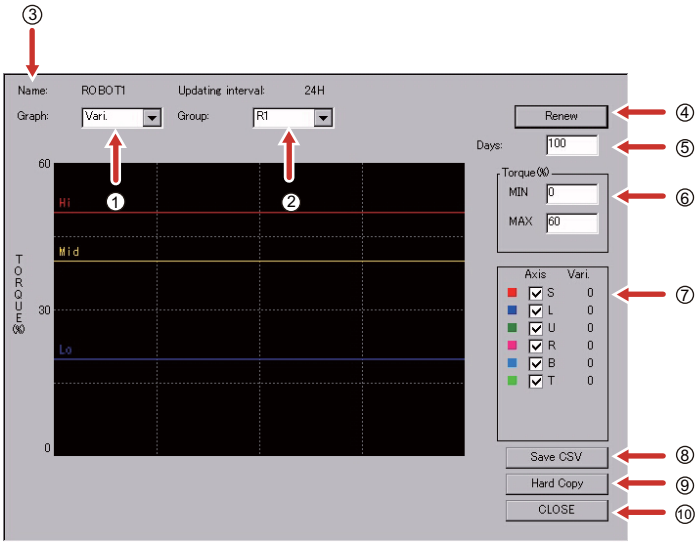
After the measurement, the variation can be checked by a graph.
The graph is updated every 24 hours automatically. The measured value and changes of the variation can be displayed on the programming pendant. Thus, the changes of the torque can be checked visually.
Use the graph display as the one of the methods to judge the lifetime of the speed reducer.

The graph can be shown by the following procedures.

1. Select {=PM} in the main menu.
2. Select {=PM(REDUCER)}.
3. Select {DISPLAY}.
   – The pull down menu appears.



4. Select {=GRAPH}.
   – The graph appears.



5. Select {CLOSE}.
   – Return to the lifetime calculation window.

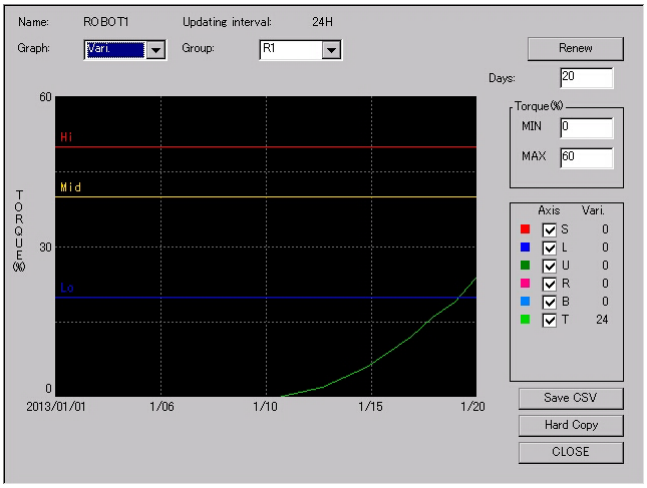
Each item on the screen represents the following description.

① =Graph

Select the {Graph}, and the pull down menu appears. Either “=Vari.” or “=Meas.” can be selected.

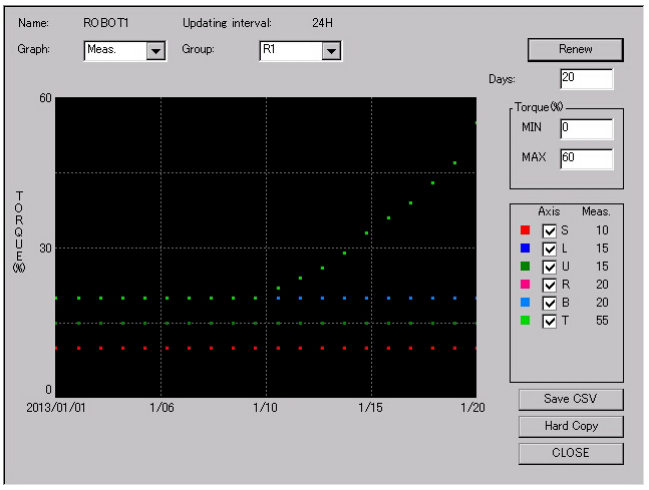
- When selecting “=Vari.”,
  the variation (=latest value - average value) appears on the graph.
  The line of each “Hi”, “Mid” and “Lo” appears.
  “Hi” means “the torque variation accept high”.
  “Mid” means “the torque variation accept medium”.
  “Lo” means “the torque variation accept low”.

  When changing “the torque variation accept high”, “the torque variation accept medium” or “the torque variation accept low” on the each setting window, the lines for “Hi”, “Mid” and “Lo” on the graph also correspond to the setting values.



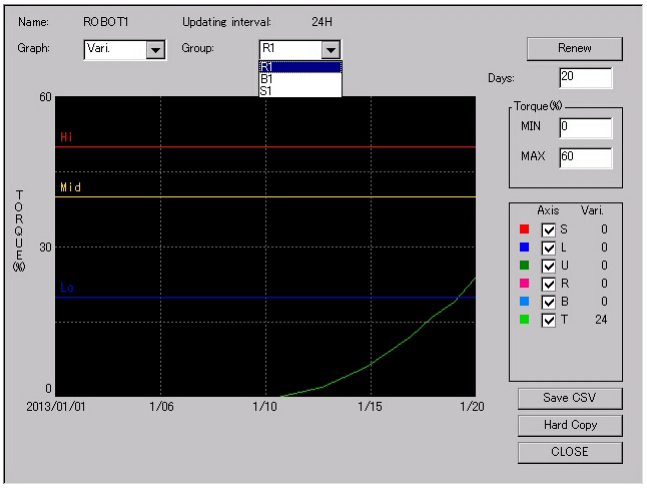
In the case of the graph above, it shows a “variation” > “Lo” of the T-axis, and the warning output signal, which is set by “torque variation low”, is ON.

- When selecting “=Meas.”,
  the measured value is displayed on the graph.



② =Group

Select {=Group}, and the pull down menu appears. Select the group to display.



③ =Name

The names set in the each setting window are displayed.

④ =Renew

Pressing the “=Renew” button updates the latest data.

⑤ =Days

Set the number of the days between 5 and 150 days to be displayed. The latest data is displayed on the right side of the graph, and the old data set by “=Days” is displayed on the left side of the graph.

⑥ =Torque

The minimum value and the maximum value of the vertical axis can be set. “MIN” is the minimum value, and “MAX” is the maximum value.

⑦ =Axis

Removing the tick in the box hides the axis on the screen.

⑧ =Save CSV

Pressing the “CSV” button saves the variation and measured value into the external memory device as CSV format. As for the external device, it can be saved into both SD card and USB, but the data is priory save into the SD card. The followings are the name for a file and a folder to be saved.

File name: “the name which is set in the each setting window” + “year/ month/day” + “hour/minute/second”. CSV

Folder name: “SR LIFE DIAGNOSIS”

⑨ =Hard COPY

Pressing the “=Hard COPY” button saves the hard copy of the screen as JPG format into the USB memory stick.

The following is a name for the file.

File name: “year/month/day” + “hour/minute/second”. JPG

⑩ =CLOSE

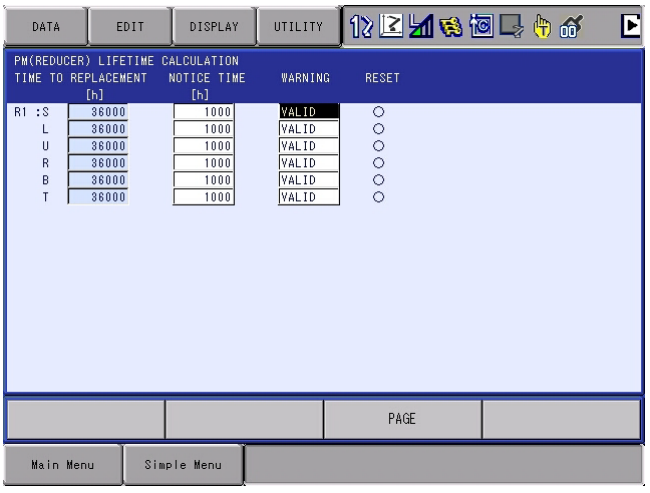
Pressing “=CLOSE” button closes the graph window.

8.21.2.3 After Replacement of the Speed Reducer

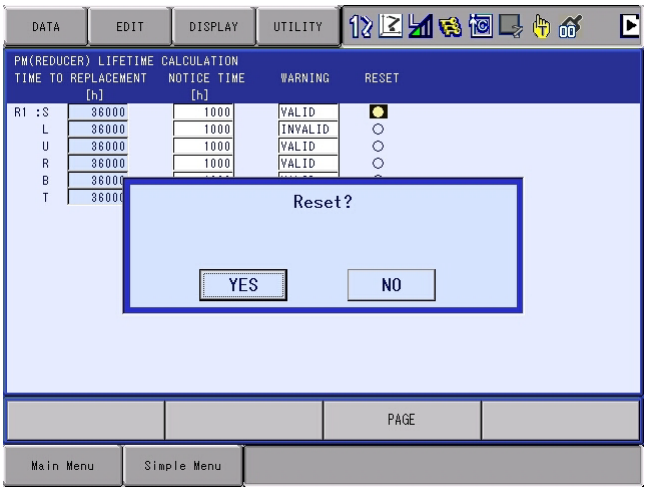
The lifetime diagnosis does not perform correctly if use the old data after replacement of the speed reducer. Thus, reset the data for the lifetime diagnosis, and prevent using the data before replacement day.

Perform the following procedures after replacement of the speed reducer.

1. Change the security mode to the management mode.
2. Select {=PM} in the main menu.
3. Select {=PM(REDUCER)}.
4. Select {DISPLAY}, select the {=LIFE CALCULATION} or {=TORQUE MONITOR] in the pull down menu.
   – The lifetime calculation window or the torque monitor window appears.



5. Move the cursor over the “Reset” on the axis window of which speed reducer is replaced, and press {Select}.
   – The confirmation dialog appears.



6. Select “Yes”.
   – The data of its axis is reset, and the replacement day is recorded into the “=INSPECTION RECORD” window.
   – The operation is canceled when select “No”.

The procedures above can be performed in the lifetime window or the torque monitor window.

The replacement day is recorded into the “INSPECTION RECORD” window by performing the procedures above.

8.21.3 Inspection Notice Function

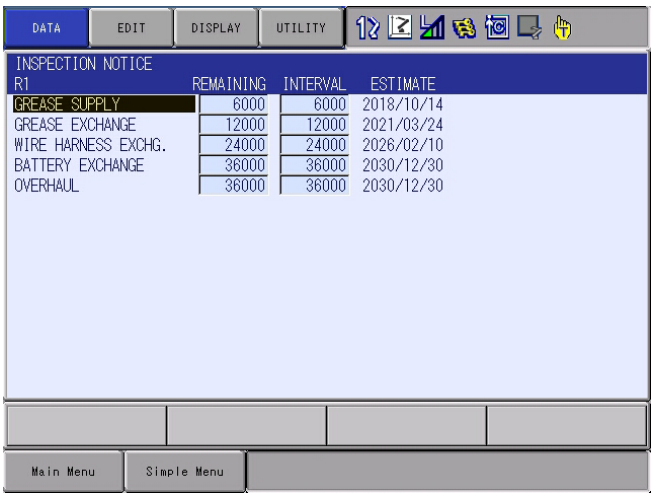
The inspection notice function turns the notice signal ON and displays the message when the inspection time has come.

Perform the inspection by the authorized personnel or your YASKAWA representative when the notice signal is turned ON.

8.21.3.1 Setting Procedures

.Perform the setting procedures as follows.

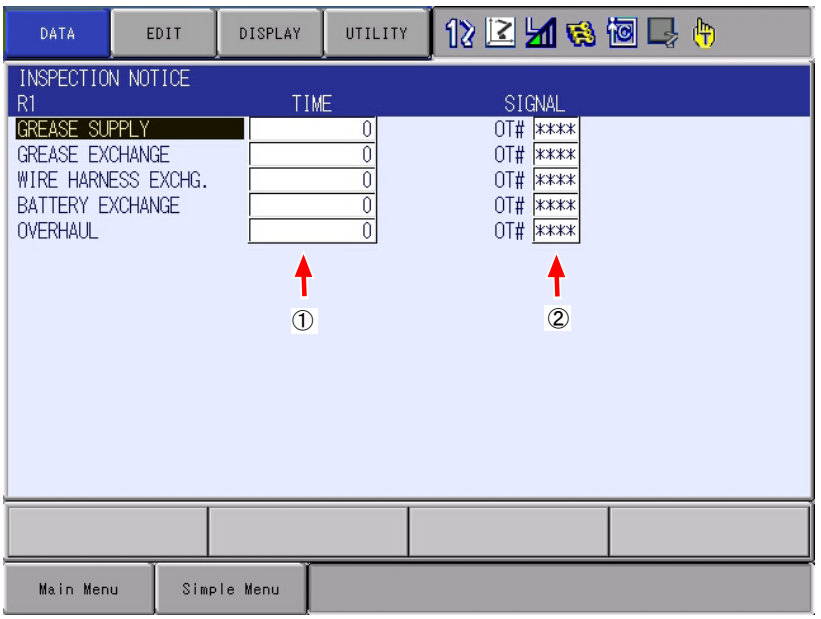
1. Change the security mode to the management mode.
2. Select {=PM} in the main menu.
3. Select {=INSPECTION NOTICE}.
   – The inspection notice window appears.



4. Select {DISPLAY} in the main menu.
   – {=SETUP CONDITION} is displayed in the pull down menu.

5. Select {=SETUP CONDITION}.

   – {=SETUP CONDITION} window appears.
   Modify each items if necessary.



Each item on the screen represents the following description.

①TIME

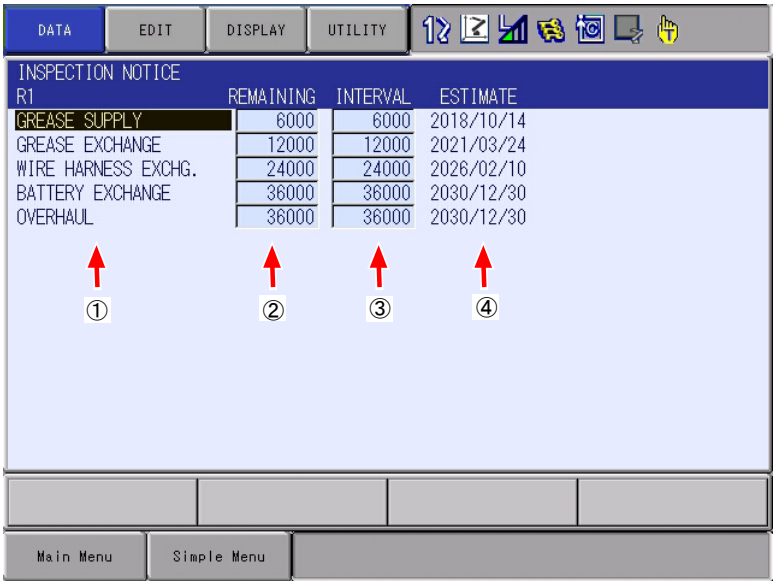
Before the remaining time to the inspection is “0”, the message is shown and the inspection signal is ON at the time which is set in this item. For example, if “100” is set, the message is shown and the signal is ON 100 hours before the remaining time to the inspection is “0”.
The time can be set in the management mode.

②SIGNAL

Set the GP output number which notifies the inspection time.

8.21.3.2 The Inspection Notice Window

1. Select {=PM} in the main menu.
2. Select {=INSPECTION NOTICE}.
   – The inspection notice window appears.



Each item on the screen represents the following description.

①Inspection items

The contents of the inspection are shown. The contents differ depending on the model of manipulators. For details of the contents, refer to the manipulator's instruction manual corresponding to the model.

②REMAINING

The remaining time to the inspection is shown. When the servo power is ON, the measurement automatically starts and the numeric value is reduced. When the value is “0” in this item, the inspection signal is turned ON and the message is shown.

③INTERVAL

The time interval of the inspection is shown.

④ESTIMATE

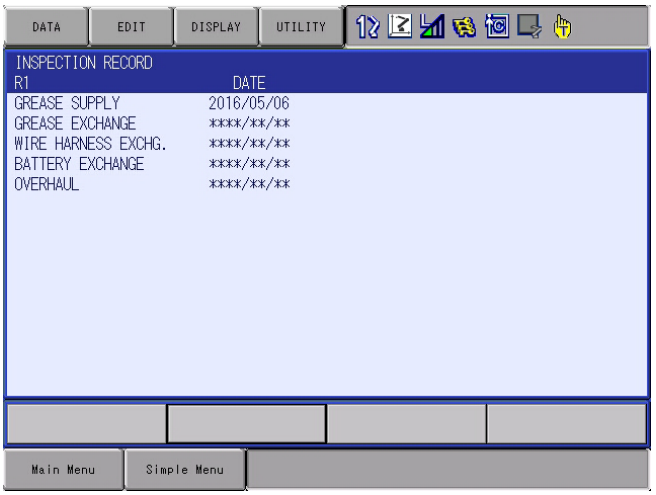
The estimated date for the inspection is shown.

NOTE When the inspection signal is turned ON or the message is displayed, perform the inspection by an authorized personnel or your YASKAWA representative. The message is displayed continuously until the YRC1000 is inspected.

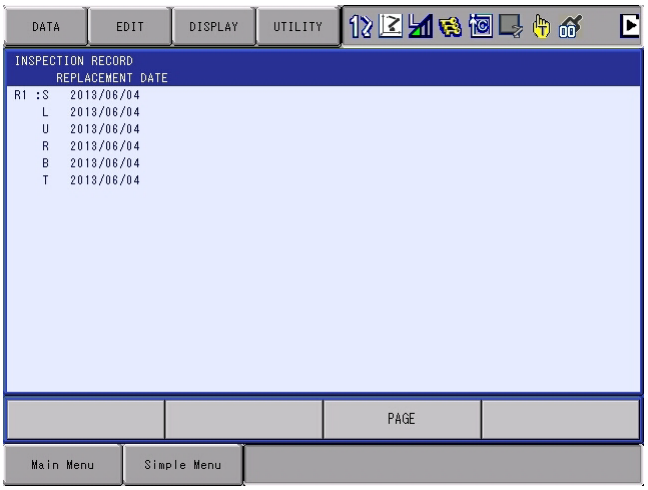
8.21.4 Record of Inspection Date and Replacement Date

The dates when the inspection or the replacement was done can be checked by following procedures.

1. Select {=PM} in the main menu.
2. Select {=INSPECTION RECORD}.
3. Select {DISPLAY}, and select {=INSPECTION DATE} in the pull down menu.
   – The inspection date can be checked.



4. Select {DISPLAY}, and select {=REPLACEMENT DATE} in the pull down menu.
   – The replacement date can be checked.

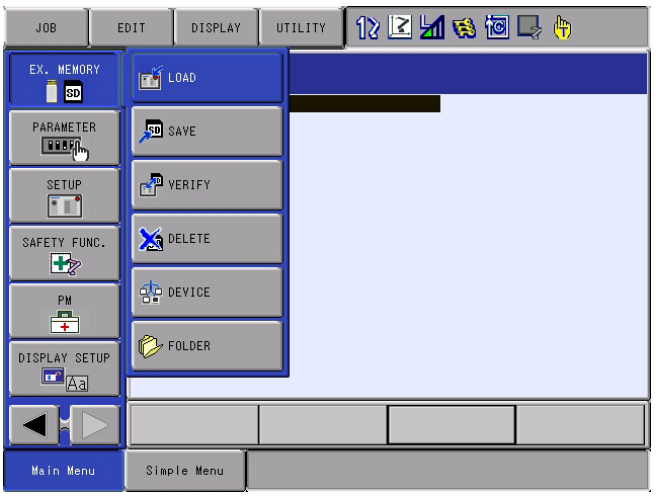


8.21.5 Management of the Data

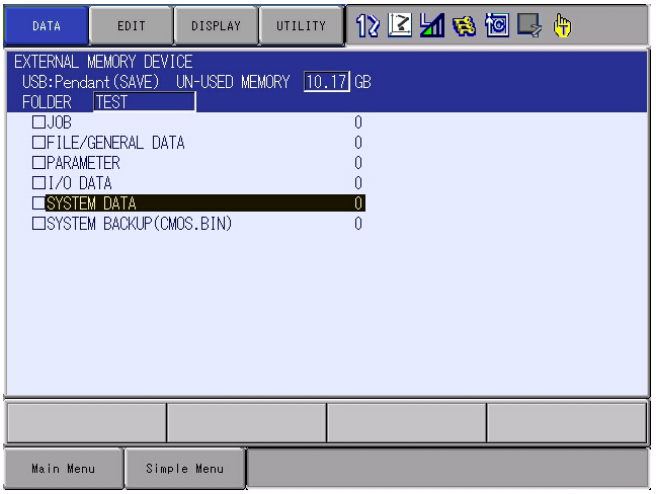
According to the torque average value, such as the speed reducer preventive maintenance data base, the preventive maintenance elements, the record of the inspection and replacement, can be loaded/saved into the external memory device.

As for the external device menu, refer to “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 7. External Memory Devices” for more details.

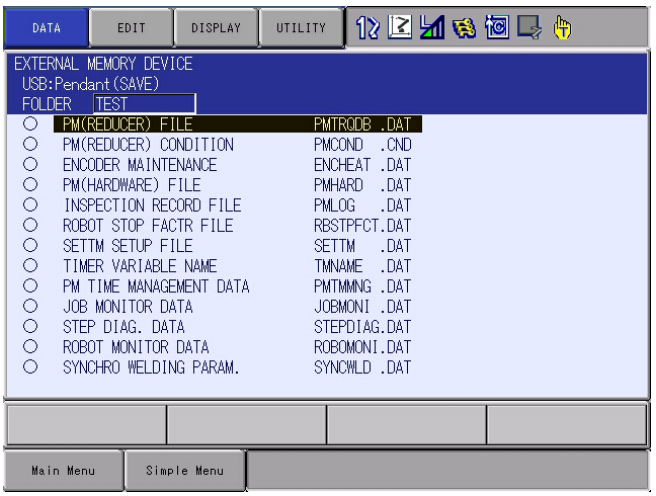
1. Select {EX.MEMORY} in the main menu.
   – The external memory menu window appears.



2. Select {LOAD} or {SAVE}.
   – The load window or the save window appears.



3. Select the “SYSTEM DATA”.
   – The system data selection window appears.
   (The following is an example of a window.)



4. Select the system data to load or save.
   – For the speed reducer preventive maintenance data base, select “={PM(REDUCER)FILE}”.
   – For the speed reducer preventive maintenance condition, select “={PM(REDUCER)CONDITION}”.
   – For the record of the inspection and replacement date, select”= {INSPECTION RECORD FILE}”.

   The selected system data is displayed with “ ★ ”.

5. Press [Enter].
   – The confirmation dialog appears.

6. Select [Yes].
   – The selected system data is saved.

8.21.6 Preventive Maintenance for the Hardware

This function estimates the life span of the controller components by calculating the consumed amount with considering the usage environment and the load, and outputs GP signals to be the reference for the replacement time.

The function overview is described below.

8.21.6.1 Target Components for Diagnosis

Regarding the following, calculations of the consumed amount and outputs of the GP signals to be the reference for the replacement time are performed.

- Cooling fan*
- Capacitor
- Amplifier IGBT
- Contactor
- Motor (numbers of revolution and reverse revolution are displayed)
- Motor brake

*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.

*Motor brake information is displayed only for applicable models.

8.21.6.2 Replacement Time Display

■ **Stepwise Display of Replacement Time**

For each component, a judgment from A to D is displayed, and it can be used as the reference for the replacement time.

Judgment display	Status
A	New - Used about half of its life span
B	Used about half of its life span
C	Used about half of its life span - Time to replace (reference)
D	Time to replace (reference)

■ **Signal Output of Replacement Time**

If any of the components is judged as D, ON signal is output from the GP output which is set as “Alarm signal” of the file.

However, only one signal for this GP signal can be output for one controller.

■ **Mask of Signal Output**
The GP output signals can be masked for each component.

If any of the components is judged as D, ON signal is output from the GP output which is set as "Alarm signal" of the file. This signal is output continuously, so the signal to inform the replacement time of the component cannot output newly. Therefore, the signal of the replacement time for other components can be output by masking the signal output of the component which is already judged as D and turning OFF the GP output signal temporarily.
Even if the masking is performed, D remains to be displayed for the component judged that it should be replaced.

8.21.6.3 Replacement of Component

■ **Record of Replacement Date of Component**
When the component is replaced, the replacement date (year, month, day) can be recorded. It can be used for the reference for the next replacement time or for the estimation of the failure mode by the failure time.

■ **Life Span Setting at Replacement of Component**
A new component or an used one, whichever it is replaced with, the life span setting can be performed.

For the used component, after recording the replacement date, the value 1 - 100% can be set as the leftover life.

Since the usage status of parts already in use cannot be determined, the leftover life setting serves as a rough guideline. Calculate the setting by subtracting the number of years the part has been used from 10 to obtain the number of years remaining and express that value as a percentage of 10. For example, the leftover life of a part that has been used for 4 years would be 60% since the number of years remaining is 6.

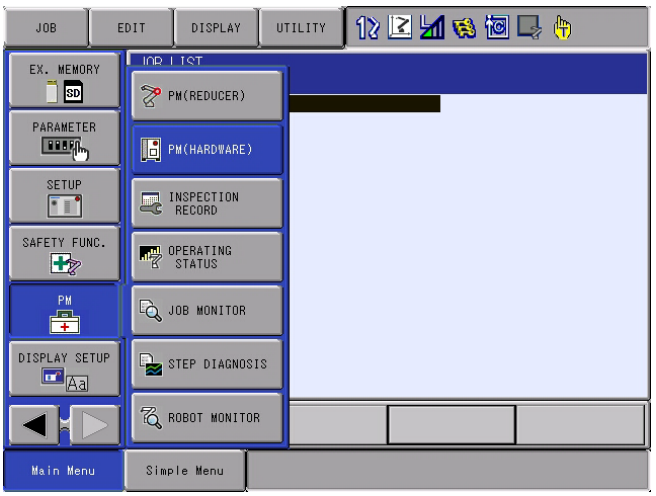
8.21.6.4 Display of the Numbers of Motor Revolution and Reverse Revolution

The accumulated values are displayed regarding the number of each motor revolution and the number of reverse revolution of positive and negative revolution. They can be used as the reference for the replacement time of the speed reducer or motor.

8.21.7 Setting of Preventive Maintenance for the Hardware

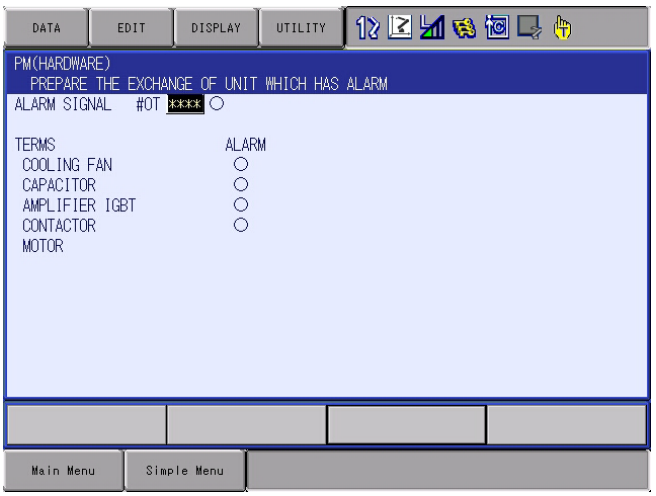
8.21.7.1 Setting of Replacement Time Display

1. Select {=PM} in the main menu.
   – The sub menu appears.

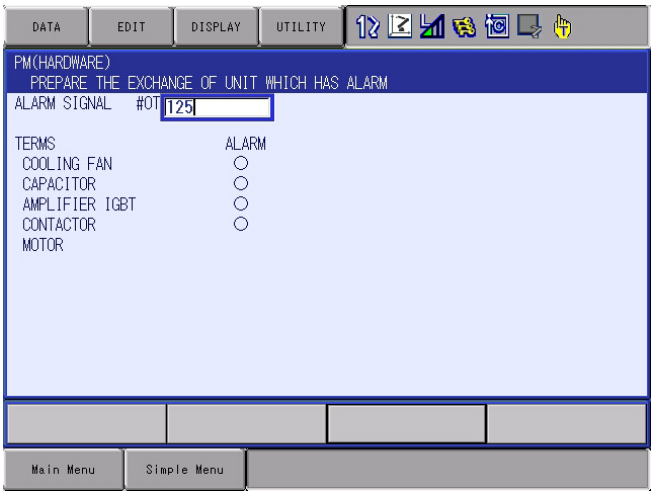


   – * The operation icons on the main menu vary depending on the system usage.

2. Select {PM (HARDWARE)}.
   – Alarm signal setting and unit selection window appears.

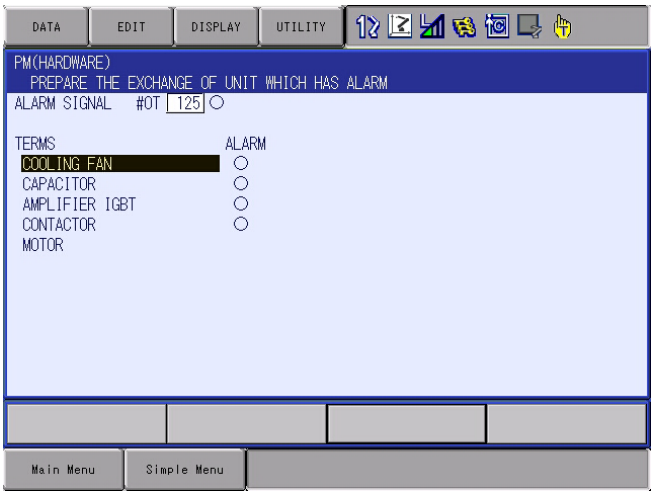


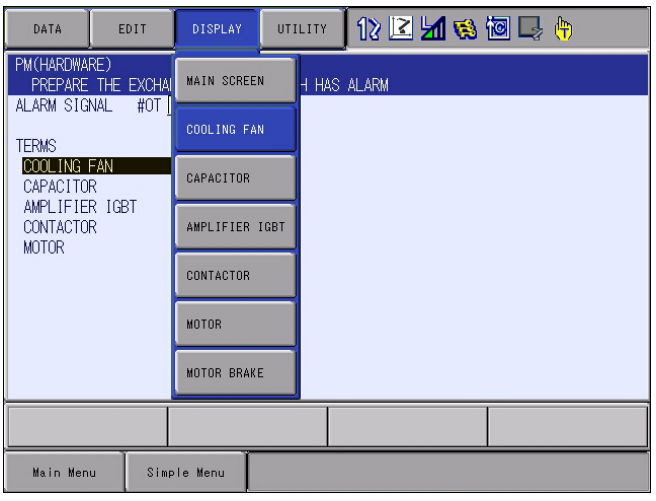
3. Input the numerical value of the alarm signal.
   When any of components in this controller comes to the replacement time, the GP output signal which is already set turns ON.



– * For example, 125 is input.

4. Select the unit.
   Or select the unit from {DISPLAY} in the menu.

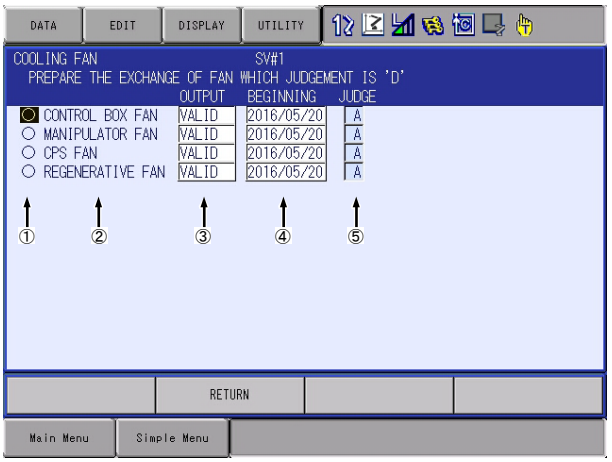




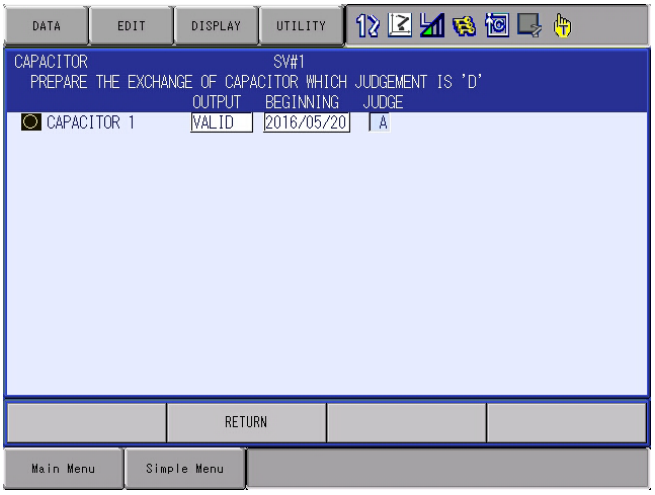
– * For example, {COOLING FAN} is selected.

5. The following information is displayed:
   Starting from the left,
   (1) " ● " is displayed when the replacement time is judged as D.
   (2) Component name
   (3) GP output signal valid/invalid
   (4) The first date of use
   (5) Leftover life judgment

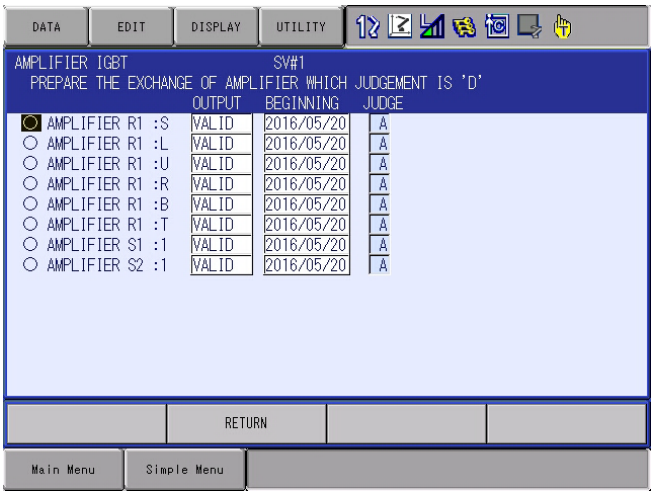
   – When {COOLING FAN} is selected:



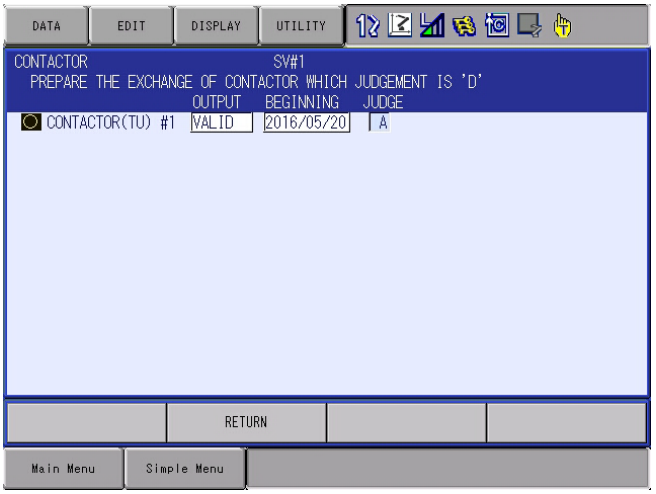
   – When {CAPACITOR} is selected:



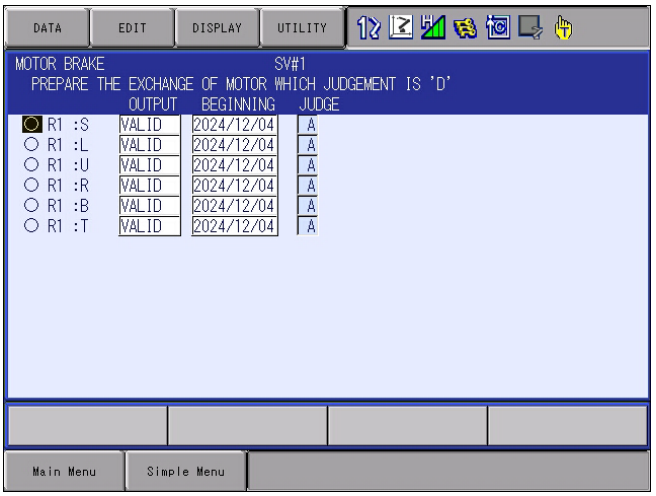
   – When {AMPLIFIER IGBT} is selected:



– When {CONTACTOR} is selected:

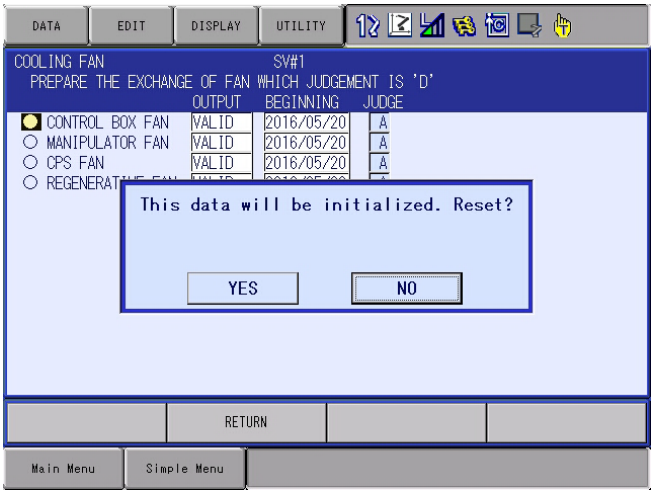


– When {MOTOR BRAKE} is selected:

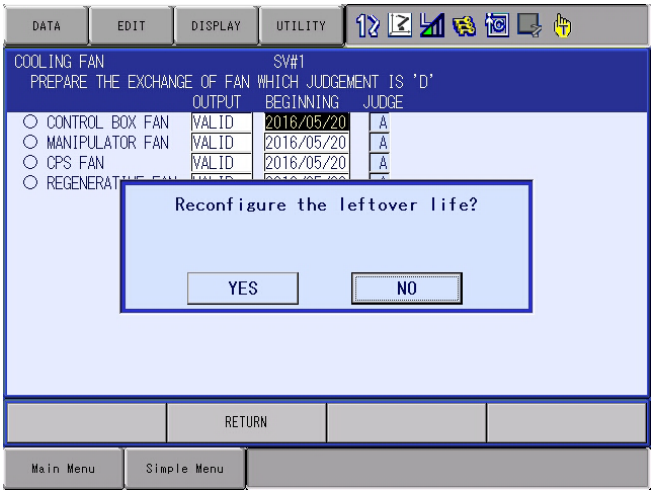


6. When replaced with a new component, select “O”.

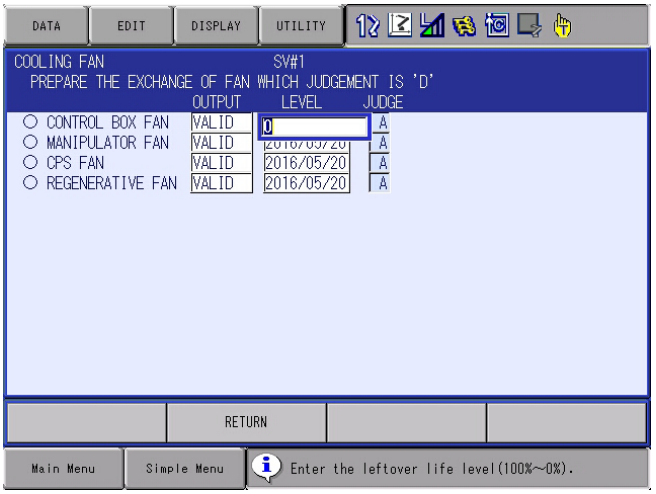
– A confirmation dialog box appears. When replaced with a new component, select “YES”.



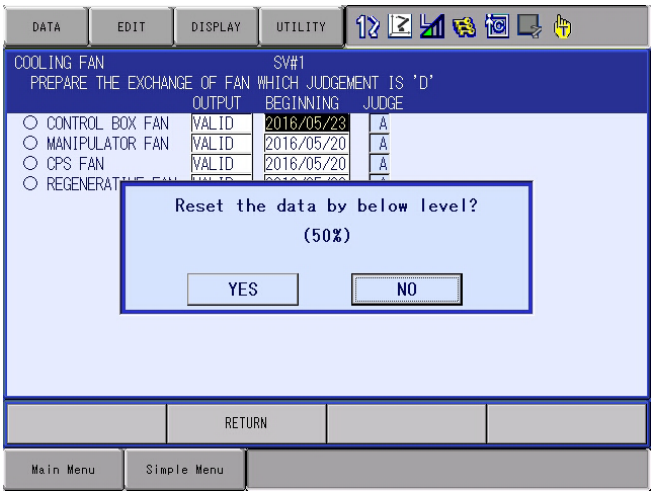
7. When replaced with an used component, select {BEGINNING}.
   – A window to input the numerical value appears. Input the replacement date using half-width characters like {2009.3.14}. After that, a following confirmation dialog box appears. When replaced with an used component, select “YES”.



8. When manually setting the approximate value to the leftover life, input the numerical value “0 - 100%”.
   – Since the usage status of parts already in use cannot be determined, the leftover life setting serves as a rough guideline. Calculate the setting by subtracting the number of years the part has been used from 10 to obtain the number of years remaining and express that value as a percentage of 10. For example, the leftover life of a part that has been used for 4 years would be 60% since the number of years remaining is 6.



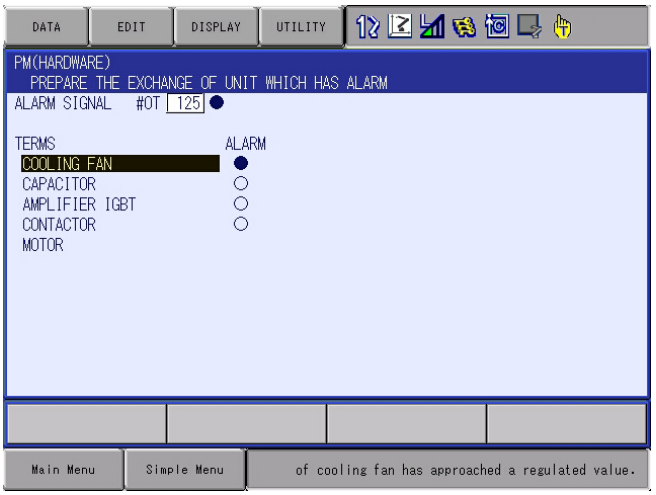
9. When the numerical value displayed in the confirmation dialog box is correct, select “YES”.



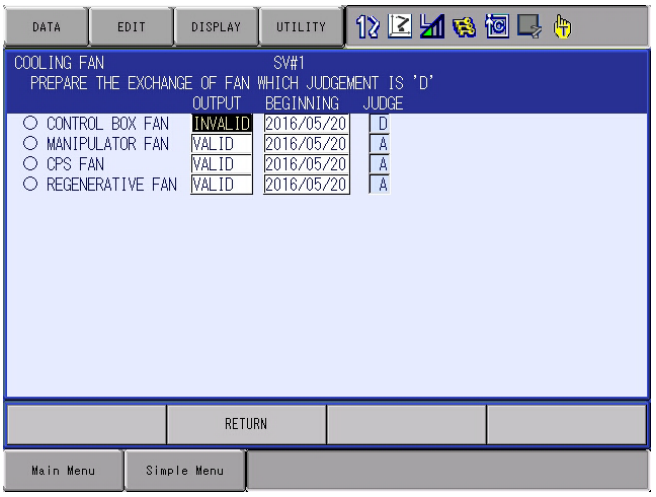
8.21.7.2 Mask of Replacement Time Display (Signal Display)

Perform the masking of the replacement time display according to the following procedures:

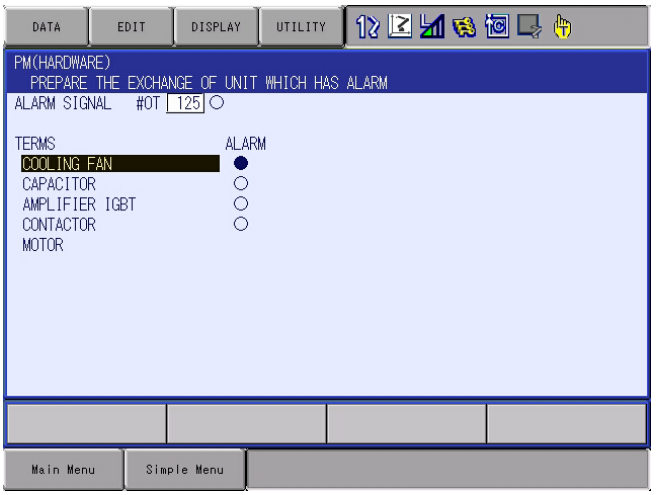
1. When any of the components comes to the replacement time, the message is displayed per unit.



2. The message is also displayed per component.
   Invalidate the output.
   – After checking the components, invalidate the output.



3. The GP output signal is turned OFF. And the message turns to be hidden.However, the stepwise display remains D.

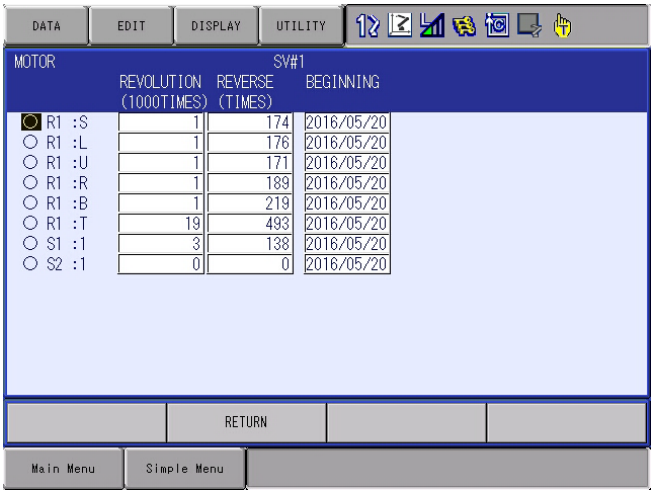


– * Before the replacement, perform the above operation in order to detect the multiple components because only one GP output of life diagnosis can be output for one controller.
The masking cycle is as follows:
Replacement time of a component, GP output ON, Checking the component and turning OFF the output of the component, GP output OFF, Replacement time of another component, GP output ON.

8.21.8 Display of the Numbers of Motor Revolution and Reverse Revolution

8.21.8.1 Display of the Numbers of Revolution and Reverse Revolution

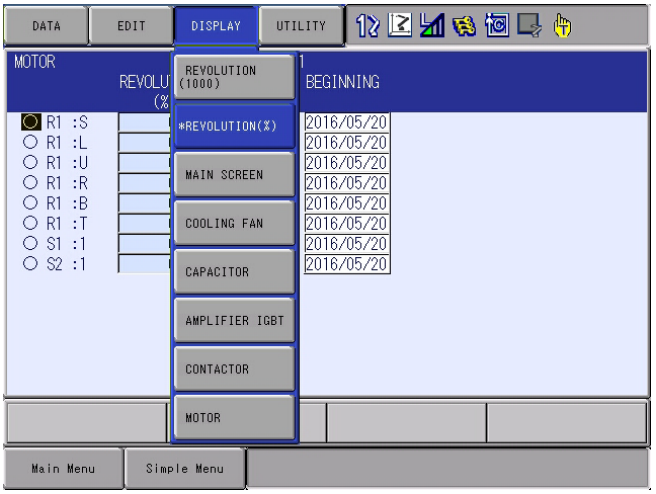
1. Select each menu in the following order. {=PM} in the main menu, {PM(HARDWARE)}, {MOTOR}.



8.21.8.2 Percent Display of the Number of Motor Revolution

At the motor rated number of revolution, it displays how many percent it has operated with 100% representing the case it operates 20000 hours.

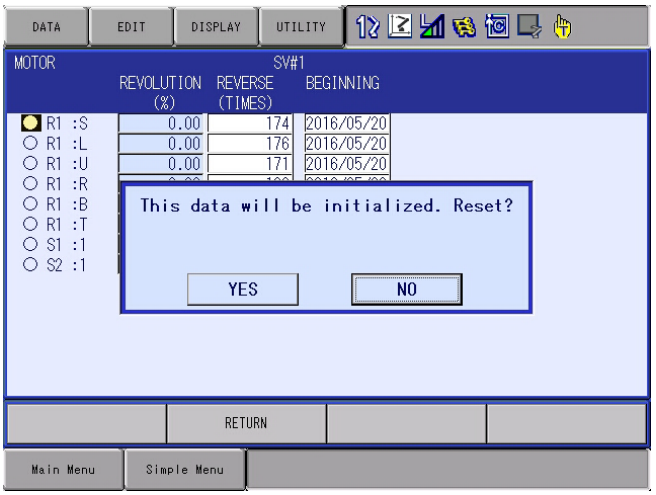
1. Select each menu in the following order. {PM} in the main menu, {PM(HARDWARE)}, {MOTOR}. And then select {DISPLAY} on the menu to select {REVOLUTION(%)}.



8.21.8.3 Resetting the Number of Revolution

Used when the motor replaced with a new one.

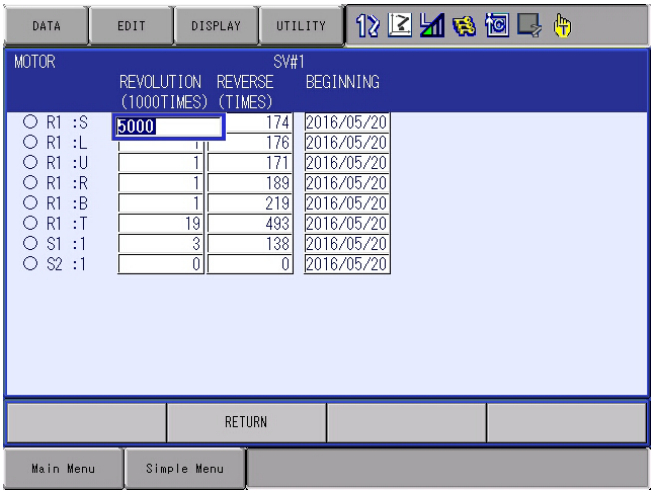
1. Select “O” of the axis to be reset by moving the cursor to it, and then select “YES” on the dialog box.
   The day of the first use (BEGINNING) is automatically changed.



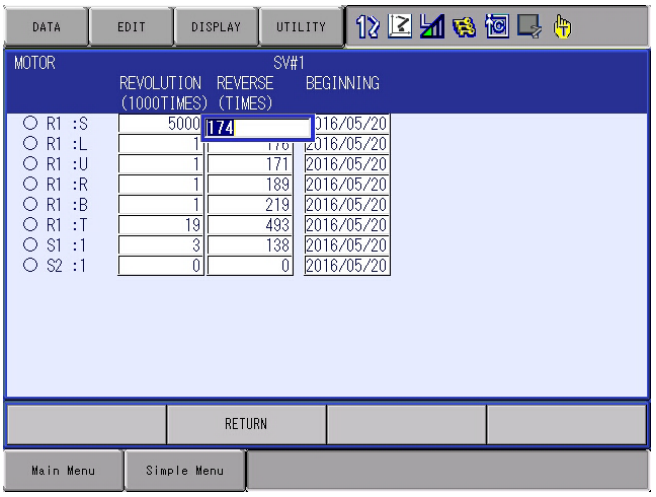
8.21.8.4 Changing the Numbers of Revolution and Reverse Revolution

Used when the motor replaced with an used one.

1. Select the number of the axis to be reset by moving the cursor to it, and then set the number.
   To set the day of the first use (BEGINNING), select the date of the axis to be reset by moving the cursor to it, and then set the date.



– * When changing the number of revolution.



– * When changing the number of reverse revolution.

8.21.9 Gas Pressure Check Function

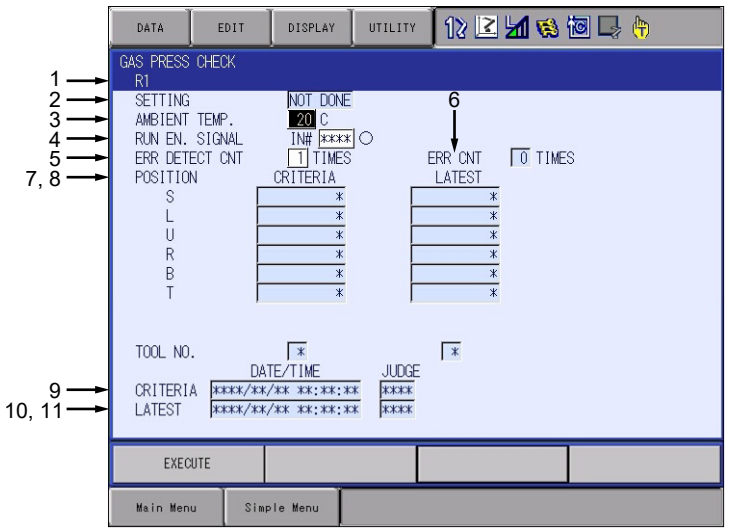
This function detects low gas pressure in the gas balancer. Applicable models that use a gas balancer ship with this function enabled by default. This function can be used by configuring the default settings. When the pressure drops in the gas balancer, the torque generated by the gas balancer decreases, 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 for YAS4.25-00 or later.

NOTE

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.



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" (#53530 to #53537) 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.

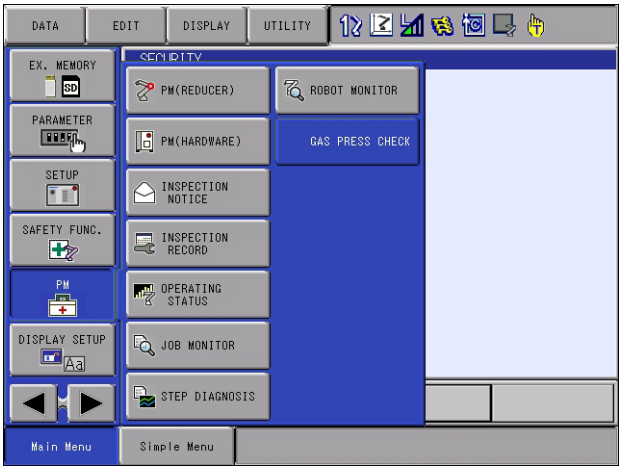
11. Judgment (Latest Values)
    Displays the result when the last gas pressure check was executed.

■ **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.

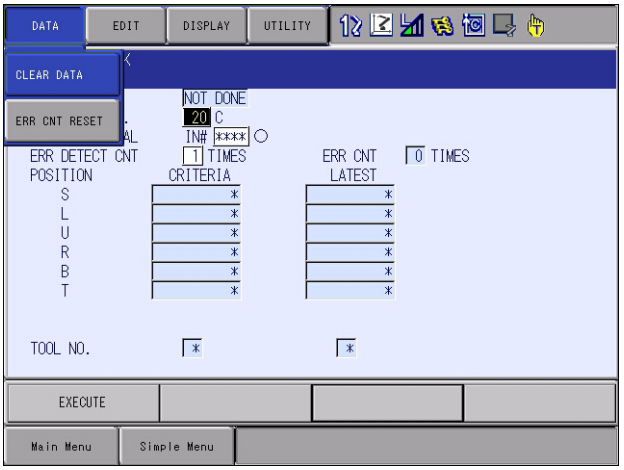
2. Select {GAS PRESS CHECK}.



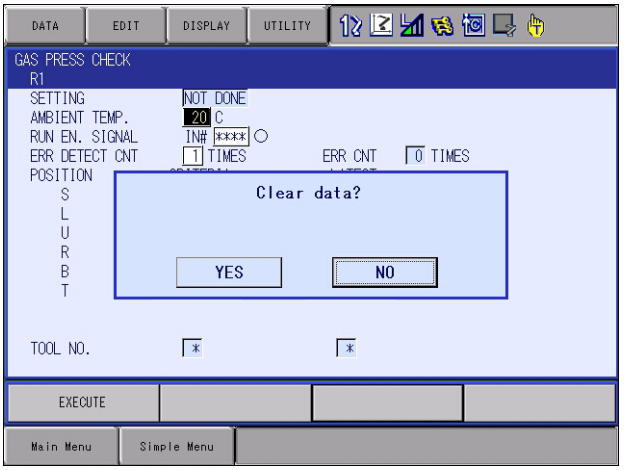
– The Gas Pressure Check window appears.

3. Select the robot number with [PAGE].

4. Select {DATA} and {CLEAR DATA}.



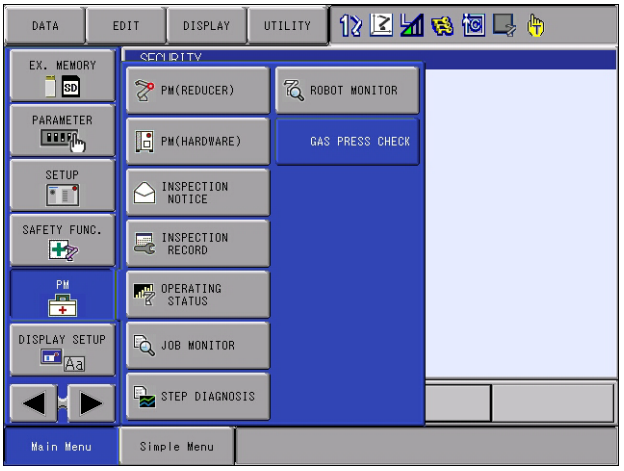
5. Select "YES".



■ Error Count Reset

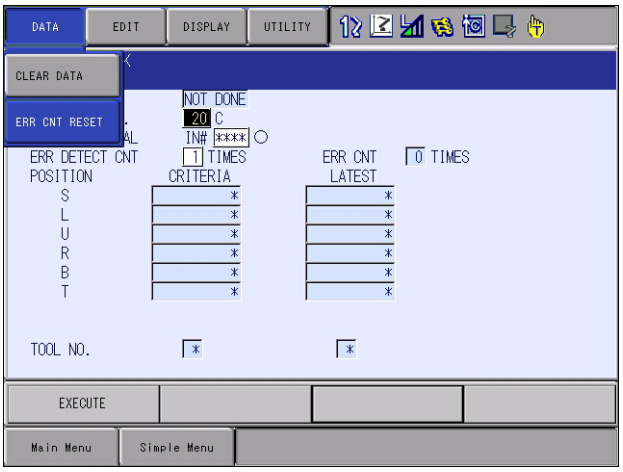
Use this procedure to reset the number of times low gas pressure was detected. {CLEAR DATA} does not appear if the security is less than management mode, when the mode is not teach mode, and when there is an alarm.

1. Select {PM} under the {Main Menu}.
2. Select {GAS PRESS CHECK}.



– The Gas Pressure Check window appears.

3. Select the robot number with [PAGE].
4. Select {DATA} and {ERR CNT RESET}.



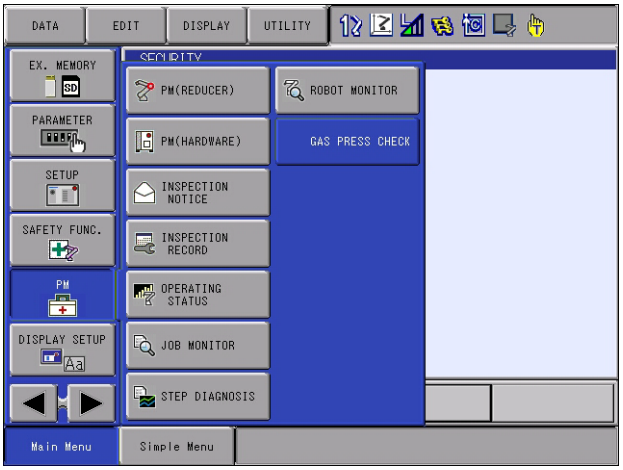
5. Select "YES".

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**

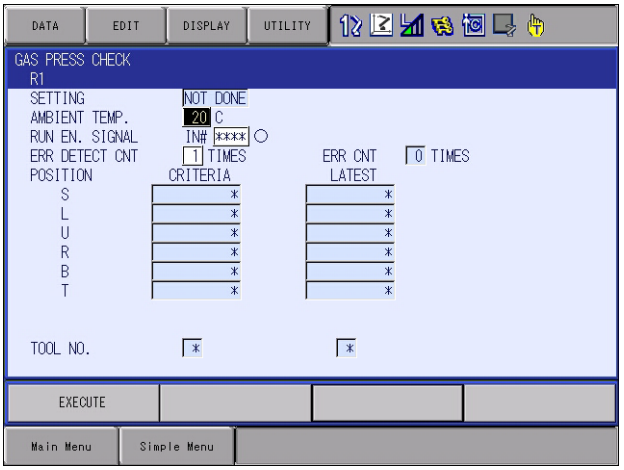
1. Select {PM} under the {Main Menu}.
2. Select {GAS PRESS CHECK}.



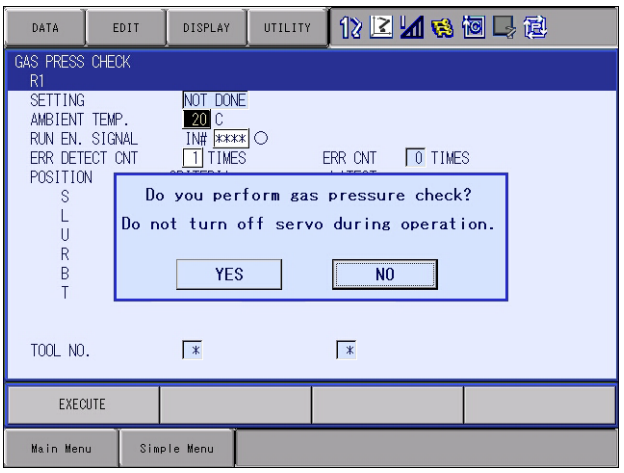
– The Gas Pressure Check window appears.

3. Select the robot number with [PAGE].
4. Select the "AMBIENT TEMP." item.

5. Enter the ambient temperature at the time and press [ENTER].



6. Set the mode key to play mode.
7. Press [SERVO ON READY] to turn ON the servo power supply.
8. Select "EXECUTE".



NOTE

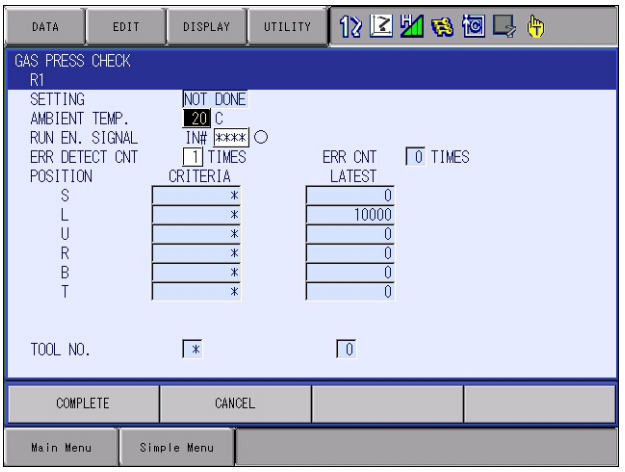
Before selecting "EXECUTE", move the robot to the position to register as "CRITERIA (POSITION)". Register the standby position of the robot for "CRITERIA (POSITION)". For "CRITERIA (TOOL NO.)", register the tool number when the robot is at the standby position, and use the tool when the tool to mount 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.

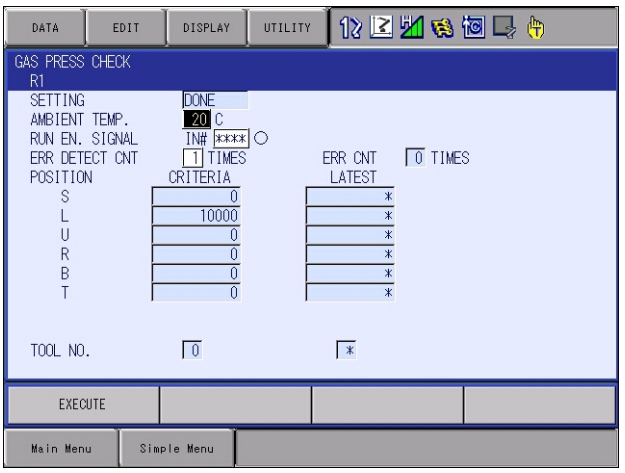
SUPPLE-MENT

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.



10. Set the mode key to teach mode.
11. Select "COMPLETE".



   – "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" (#53520 to #53527) 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).

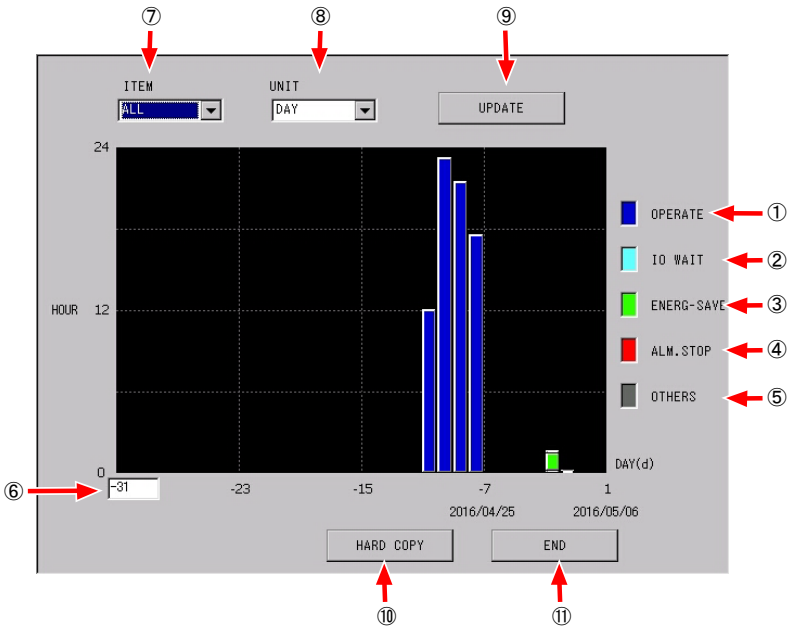
8.22 Operating Status Monitor Function

With this function, the operating status of the manipulator (Operation time, IO waiting time, energy saving time, time for stopping by the alarm) can be checked. The status can be checked consecutively for 5 days if measured by the hour, for 100 days if measured by the day, for 60 months if measured by the month.

■ Graph of the Operating Status

The graph of the operating status is shown by the following steps.

1. Select {PM} in the main menu.
2. Select {OPERATING STATUS}.
   – The operating status window is shown.



3. Select {END}.
   – The initial window is shown again.

Each item on the screen represents the following description.

①OPERATE

Indicates the cumulative time for executing the move instruction.

②IO WAIT

Indicates the cumulative time for which the manipulator's operation is stopped by the WAIT instruction or etc.

③ENERG-SAVE

Indicates the cumulative time for which the servo power is OFF by the energy saving function.

④ALM.STOP

Indicates the cumulative time until the next start after the occurrence of the alarm.

⑤OTHERS

Indicates the time other than above items no.① to no.④.

⑥Set the range of horizontal axis of the graph

The range of horizontal axis can be changed by setting the numeric value.

⑦ITEM

Select {ITEM} and the pull down menu is shown.
“ALL”, “OPERATE”, “IO WAIT”, “ALM.STOP” or “OTHERS” are selectable.

- “ALL” is selected.
  OPERATE, IO WAIT, ALM.STOP and OTHERS are shown.
- “OPERATE” is selected.
  OPERATE only is shown.
- “IO WAIT” is selected.
  IO WAIT only is shown.
- “ALM.STOP” is selected.
  ALM.STOP only is shown.
- “OTHERS” is selected.
  OTHERS only is shown.

⑧UNIT

Select {UNIT} and the pull down menu is shown.
“HOUR”, “DAY”, or “MONTH” are selectable.

- “HOUR” is selected.
  The unit of the horizontal axis of the graph is the hour.
  For the item no.⑥, the value can be set in the range from -96 to 0.
- “DAY” is selected.
  The unit of the horizontal axis of the graph is the day.
  For the item no.⑥, the value can be set in the range from -100 to -3.
- “MONTH” is selected.
  The unit of the horizontal axis of the graph is the month.
  For the item no.⑥, the value can be set in the range from -60 to -3.

⑨UPDATE

By pressing "UPDATE", the data can be updated.

⑩HARD COPY

By pressing “HARD COPY”, the hard copy on the window can be save into the USB memory stick as a JPG format. The file name to be saved is the following.

File name: “year/month/date”_ “hour/minute/second”.JPG

⑪END

By pressing “END”, the graph window is closed.

8.23 Job Monitor Function

With this function, the following items are shown. The number of job execution, the playback time, the moving time, the IO stop time, the energy saving time, the load ratio of each axis for each job.

NOTE

One of the job monitor function items to be displayed for each axis is a function that shows the lifetime of the speed reducer.

This function is only available for robot axes that have a speed reducer and is not available for external axes.

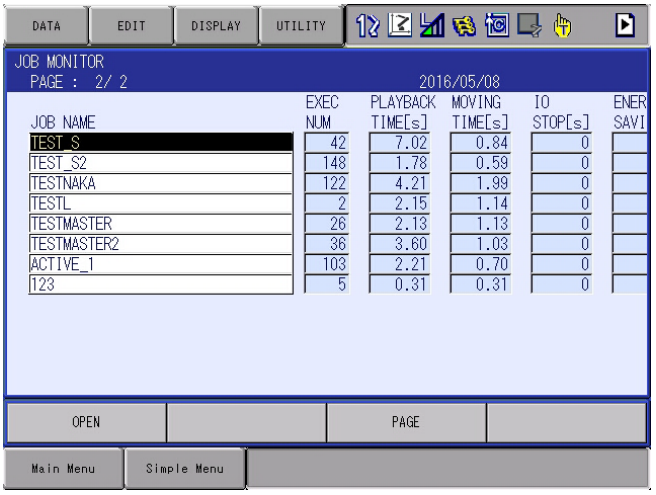
“0” is displayed for axes that are not supported.

Other job monitor function items are available for all axes, including external axes.

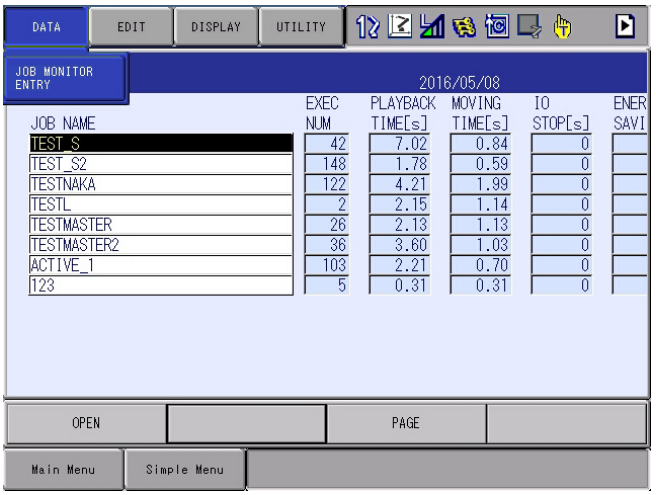
■ **Job Registration**

For the job registered on the JOB MONITOR ENTRY window, the measurement is performed. A job is registered by the following steps. The maximum 10 jobs can be registered.

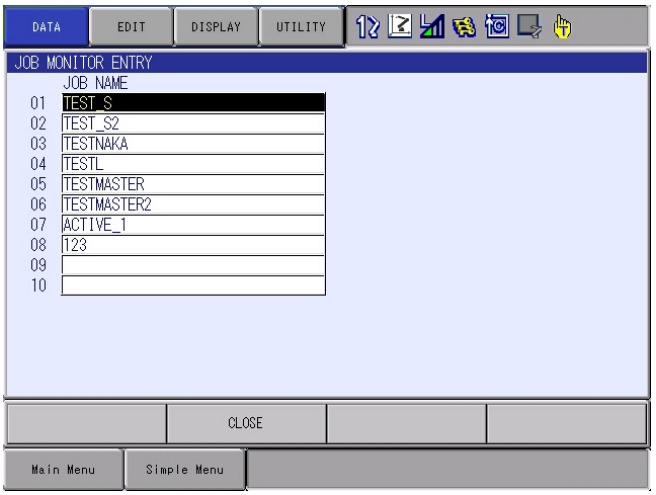
1. Select {=PM} in the main menu.
2. Select {JOB MONITOR}.
   – The JOB MONITOR window is shown.



3. Select {DATA}.
   – The pull down menu is shown.

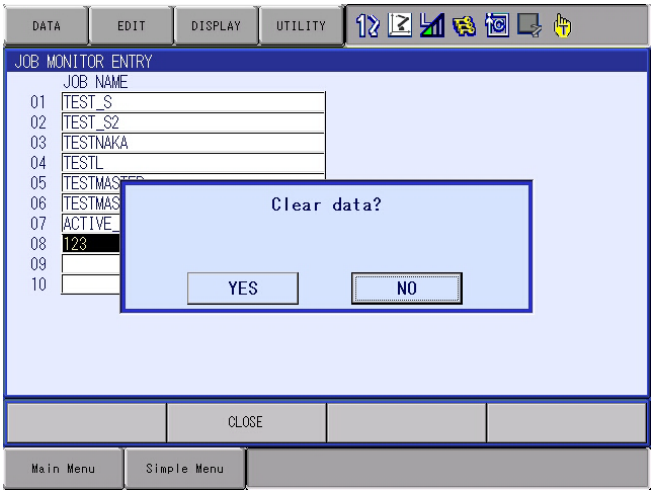


4. Select {JOB MONITOR ENTRY}.
   – The JOB MONITOR ENTRY window is shown.

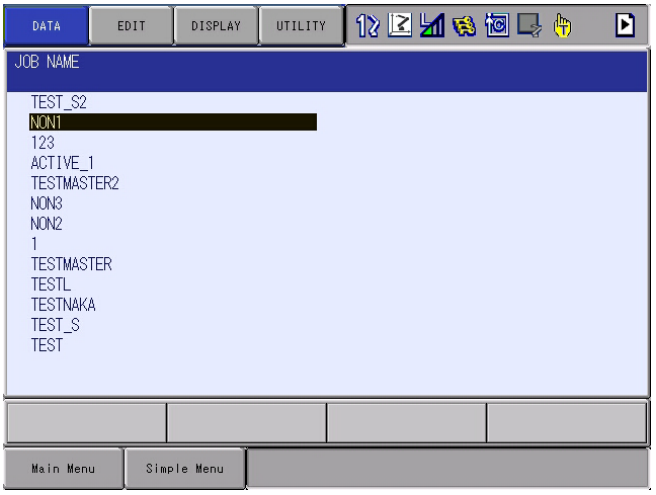


5. Job registration

(1) The maximum 10 jobs can be registered. Move the cursor to the desired number and press [SELECT]. The job name window is shown. (If the number in which the job has already registered is selected, the dialog “Clear data?” shows up. Select {YES}.)



(2) Move to the desired job and press [SELECT].
The job is registered in the JOB MONITOR ENTRY window.



■ **Measurement of Data**

When the playback is performed for the job registered in the JOB MONITOR ENTRY window, measurement automatically starts.
The data is automatically updated every time the playback is performed.
Measurement is performed for the section from NOP to END or RET of the registered job. And if the hold, the emergency stop or the alarm occurs during measurement, the measurement ends.
Also, if 600 seconds pass after starting the measurement and the conditions mentioned above are not satisfied, the measurement ends.

Following examples show the timing when measurement ends and the data is updated.

<Example 1> No RET in the section

TEST1.JBI

NOP→ measurement starts

MOVJ

MOVJ

:

:

END→ measurement ends

<Example 2> RET in the section

TEST2.JBI

NOP→ measurement starts

MOVJ

:

RET→ measurement ends

:

END

<Example 3>The hold, the emergency stop or the alarm stop occurs during measurement.

TEST1.JBI

NOP→ measurement starts

MOVJ

MOVJ→ measurement ends
(The hold, the emergency stop or the alarm stop occurs)

:

END

<Example 4>The registered job (TEST1.JBI) calls another registered job (TEST2.JBI)by CALL instruction or etc.

TEST1.JBI

NOP→ measurement starts

MOVJ

MOVJ

CALL JOB: TEST2

:

END→ measurement starts

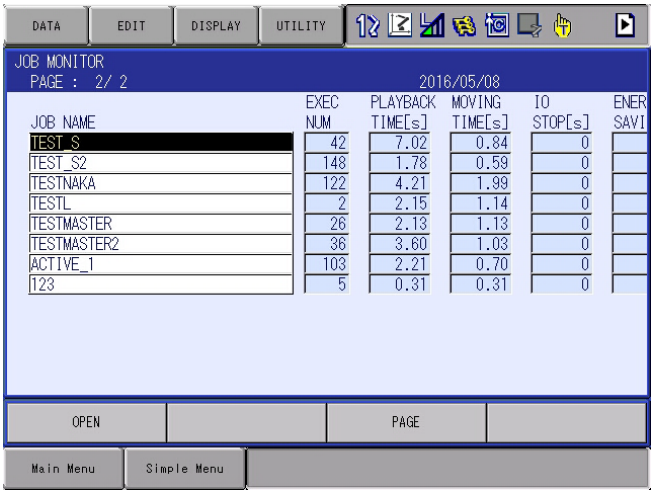
In this case, the job monitor data of TEST2 is not updated.

■ **Data Check**

The number of job execution, playback time, moving time, IO stop time, energy saving time are shown. Also, the lifetime of the speed reducer, the load ratio, the maximum speed, the average speed, the maximum torque and the average torque of each axes are shown.

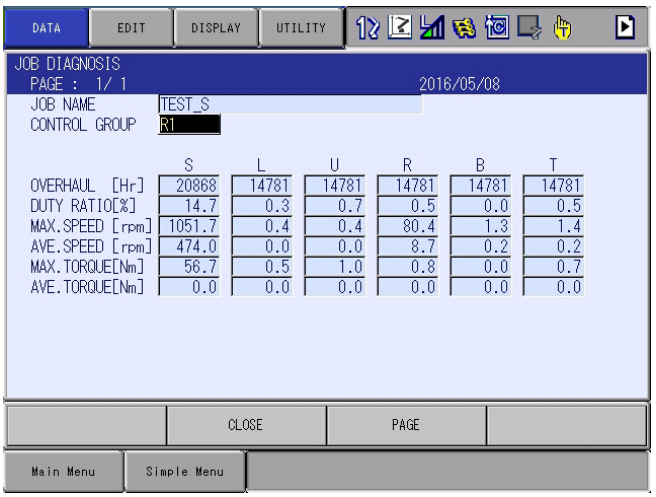
The data can be checked by following steps.

1. Select {=PM} in the main menu.
2. Select {JOB MONITOR}.
   – The JOB MONITOR window is shown.

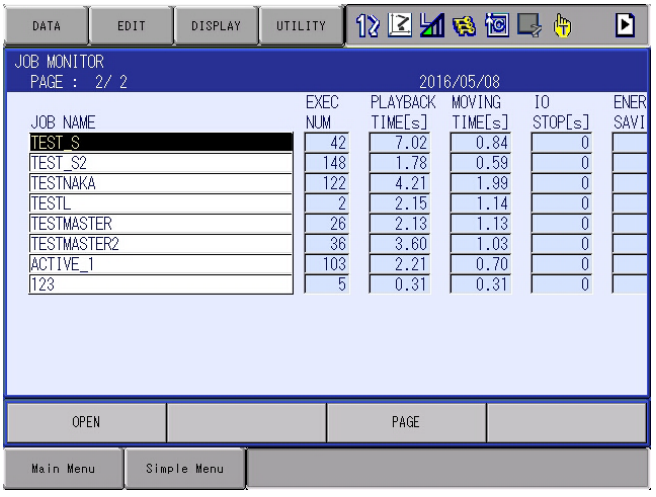


3. Press {PAGE}.
   – It is possible to check the data of the date whose number corresponds to the number of pressing {PAGE}. Modify if necessary. The data of the current day is updated with the latest data every time a job is executed. For the previous data, the average values of the day are shown. The data of the maximum 50 days can be checked.

4. Move the cursor to the desired job name and press {OPEN}.
   – The JOB DIAGNOSIS window is shown. The lifetime of the speed reducer, the load ratio (*), the maximum speed, the average speed, the maximum torque and the average torque of each axes are shown.
     * The load ratio is the mean square value of the torque value in the section where the job was executed. A load ratio of 100% indicates the standard torque.
   – It is possible to check the data of the date whose number corresponds to the number of pressing {PAGE}. Modify if necessary. The data of the current day is updated with the latest data every time a job is executed. For the previous data, the average values of the day are shown. The data of the maximum 50 days can be checked.



5. Press {CLOSE}.
   – The JOB MONITOR window is shown again.



■ **Management of Data**

The job monitor data can be saved by the external memory menu.
For details of the external memory menu, refer to “YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051) 7. External Memory Devices”.

1. Select {EX.MEMORY} in the main menu.
2. Select {SAVE}.
3. Select “SYSTEM DATA”.
4. Select “JOB MONITOR DATA”.
   The selected system data is displayed with “ ★ ”.
5. Press [ENTER].
6. Select [YES].
   – “JOB MONITOR DATA” is saved.

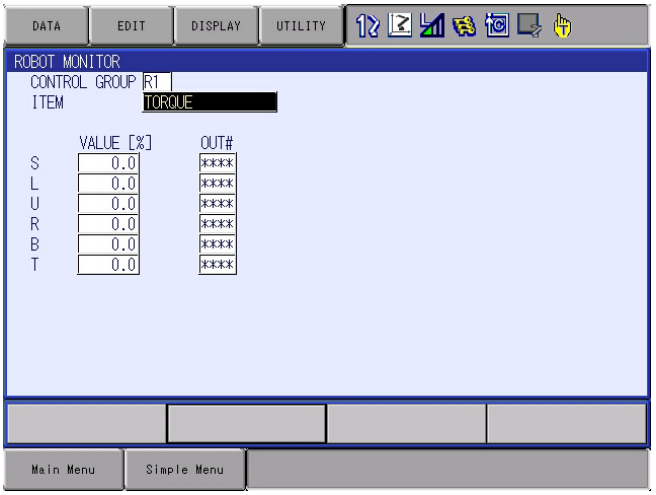
8.24 Robot Monitor Function

With this function, the threshold values are set for the following items. TORQUE, DISTURB, SPEED FEEDBACK, and ERROR PULSE. When the values is equal to the threshold values or more, the GP output signal is turned ON.

■ Setting the threshold value and GP output signal

Perform the setting of the threshold value and GP output signal in accordance with the following procedure.The data can be checked by following steps.

1. Select {=PM} in the main menu.
2. Select {ROBOT MONITOR}.
   – The ROBOT MONITOR window is shown



3. Set the “CONTROL GROUP”.
   – Select the control group in the pull down menu.
4. Set the “ITEM”.
   – Select the item (TORQUE, DISTURB, SPEED FEEDBACK, ERROR PULSE) in the pull down menu.

SUPPLE-MENT

TORQUE [%]:
Torque command for each axis. The rated torque of the motor is 100%.

DISTURB:
This is the external force applied to each axis during play-back or axis operation. If this value exceeds the level setting on the EACH AXIS LEVEL (CURRENT) Window, "Alarm 4315: COLLISION DETECT" will occur. For details, refer to *chapter 8.7 “Shock Detection Function”* .

SPEED FEEDBACK [rpm]:
Motor speed for each axis.

ERROR PULSE [pulse]:
Error between the motor command and the motor position for each axis.

5. Set the threshold value.

– Move the cursor to “VALUE” of the desired axis and input the threshold value.

6. Set the GP output number.

– Move the cursor to “OUT#” of the desired axis and input the GP output number.

■ **Setting example**

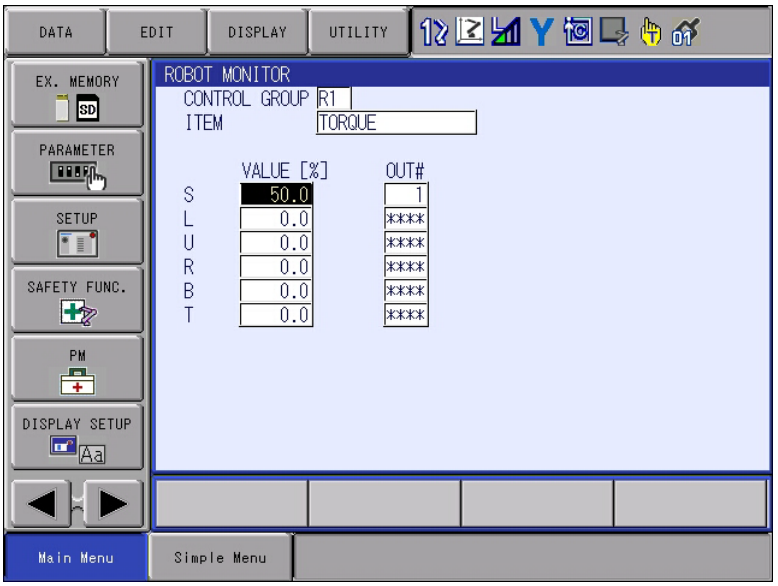
To turn ON GP output signal OUT#1 when the motor torque of the S-axis exceeds 50%, configure the following settings.

CONTROL GROUP: R1

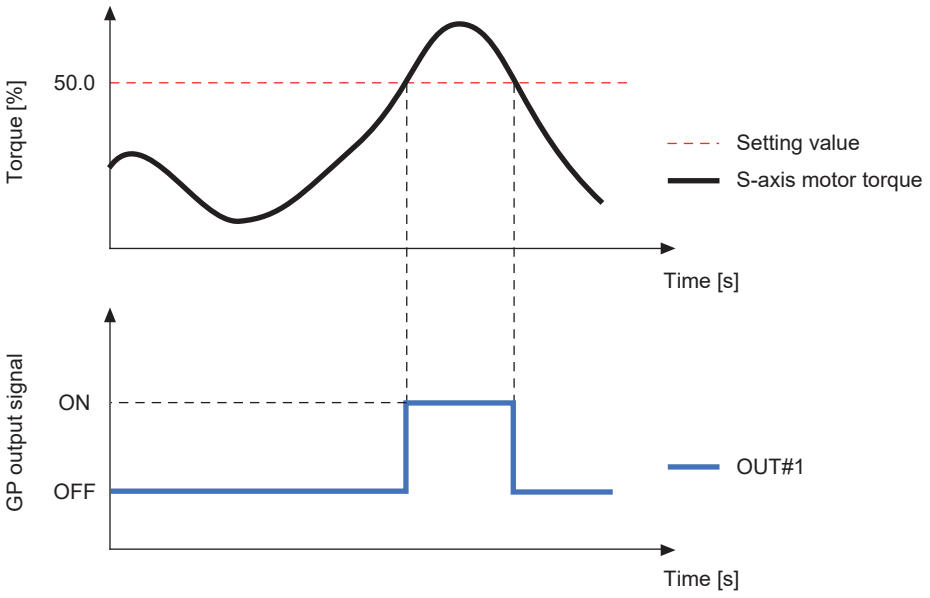
ITEM: Torque

S-Axis Setting Value: 50.0

OUT#: 1



As shown in the diagram below, when the S-axis motor torque reaches or exceeds the setting value, GP output signal OUT#1 will turn ON.



■ **Management of Data**

The robot monitor data can be saved by the external memory menu.
For details of the external memory menu, refer to “YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051) 7. External Memory Devices”.

1. Select {EX.MEMORY} in the main menu.
2. Select {LOAD} or {SAVE}.
   – The LOAD or SAVE window is shown.
3. Select “SYSTEM DATA”.
4. Select “ROBOT MONITOR DATA”.
   The selected system data is displayed with “ ★ ”.
5. Press [ENTER].
6. Select [YES].
   – “ROBOT MONITOR DATA” is saved.

8.25 Brake Line Ground Judgment Function

8.25.1 About the Brake Line Ground Judgment Function

If the current flowing through the brake line exceeds the capacity of the control power supply unit, the DC 24V power supply will be disconnected by the protective circuit of the control power supply unit; then an alarm “1683 DC24V POWER SUPPLY FAILURE(SV)” occurs.

This function identifies the position where the ground fault occurred after arising the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)”. It is able to identify which axis brake line does the ground fault occur by inspecting the each axis from the programming pendant.

Identify the ground fault of the brake line by the following methods.

(1) Turn the servo ON the group which the ground fault occurs.

(2) Discharge the any axis brake, and then confirm if the DC 24V power supply will be disconnected.

8.25.2 Operating Condition

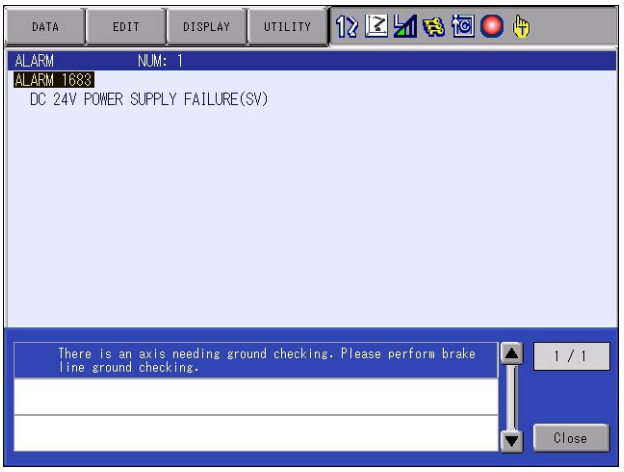
1. Condition of the controller
   The controller has restarted normally by restarting the controller after arising the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)”.
2. Mode
   Only teach mode
3. Security
   Management/Safety, Authority equal to or higher than the management mode is required.
4. Others
   - 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.

8.25.3 Operation

8.25.3.1 Occurrence of a DC 24V Power Supply Failure (SERVO)

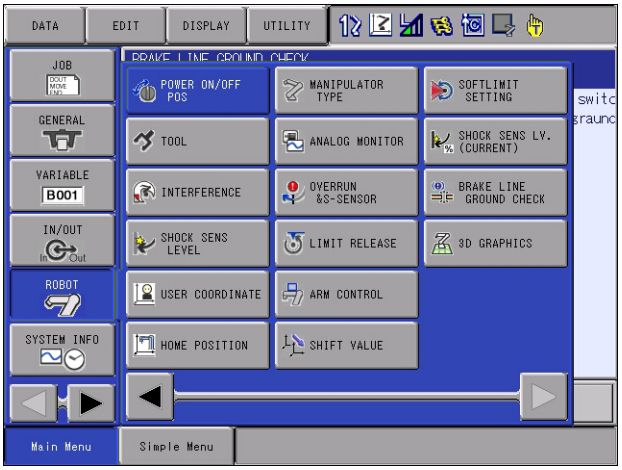
– When detecting either the ground fault or the short circuit of the brake line, the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)” occurs.

– Restart the control power, and perform the brake line ground check.

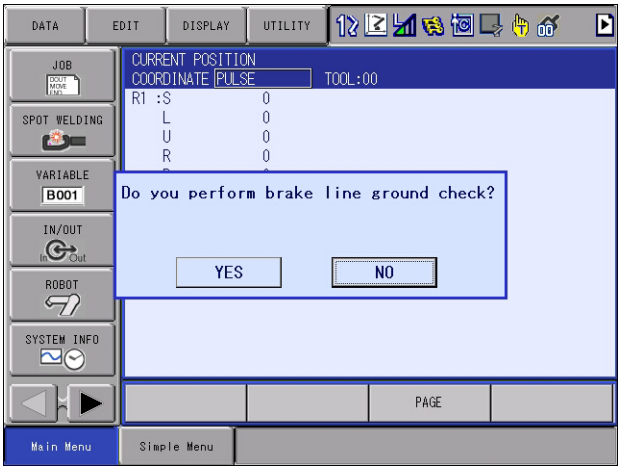


8.25.3.2 Brake Line Ground Check

1. Select {BRAKE LINE GROUND CHECK} in the sub-menu from {ROBOT} in the main menu.



2. Press “YES”.
   – The confirmation dialog appears due to prevent the mis-operation.
   – Select “YES”, then the brake line ground check appears.
   – Select “NO”, the window returns to the previous window.



3. Move the cursor over the axis to perform the brake line ground check.

NOTE On the brake line ground check window, the servo power cannot be turned ON with the standard operating procedure. If [SERVO ON READY] is pressed and the enable switch is turned ON, the message "Cannot carry out servo ON in Brake line ground check screen." will appear. This message does not affect the brake line ground check operation. Press [SELECT] while pressing down the [INTER LOCK] to perform the brake line ground check.

– Move the cursor over the axis to perform the brake line ground check, and press [SERVO ON READY]. Grip the enable switch and long press [SELECT] while pressing down the [INTER LOCK] to perform the brake line ground check.

– Perform the brake line ground check to the every single axis displayed on the screen.

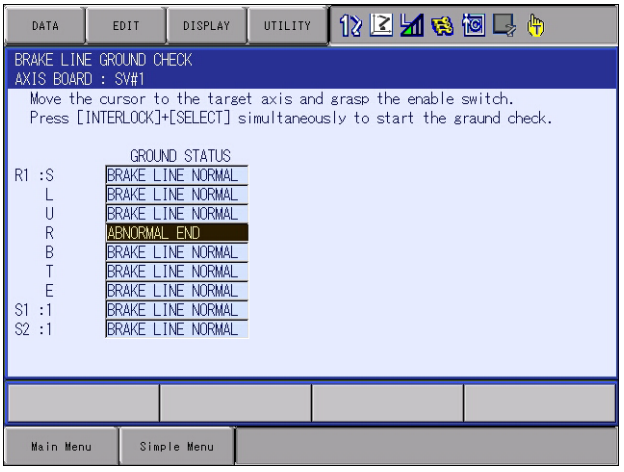
– The brake line ground check is canceled in the case of following conditions.

• [SELECT] 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.



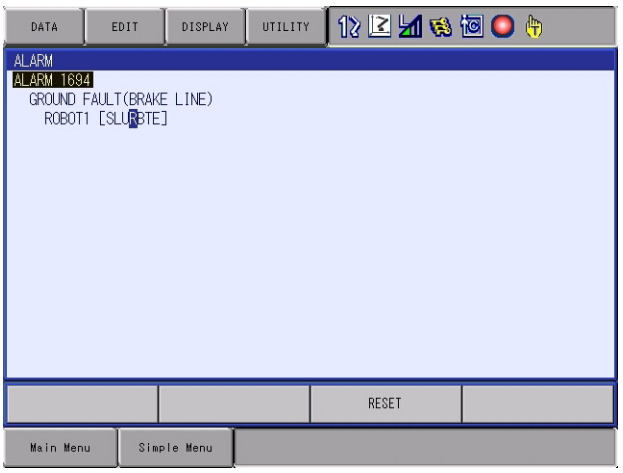
JUDGEMENT REQUIRED: The ground check is not performed

BRAKE LINE NORMAL: The brake line is normal.

DETECTED GROUND: The ground fault or short circuit of the brake line

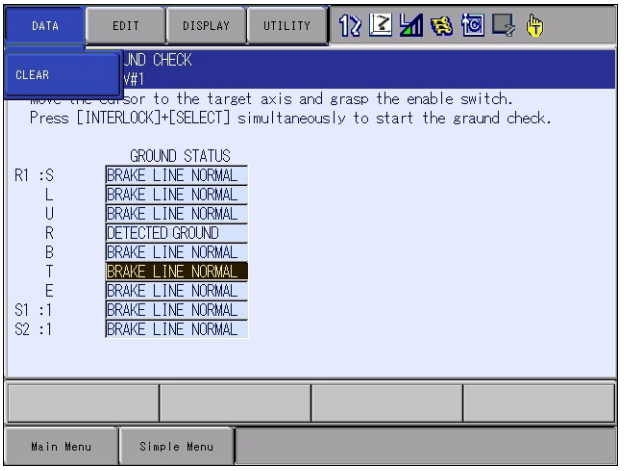
ABNORMAL END: The ground check is canceled.
(i.e. the dislocation of the axis is detected, and so on)

4. Detecting the Brake Line Ground Fault
   – When the brake line ground fault or the short circuit is detected, the alarm “1694 GROUND FAULT (BRAKE LINE)” occurs.
   – Inspect the brake line of the axis which raised the alarm.
   – Restart the control power, and perform the brake line ground check to the rest of the axes.

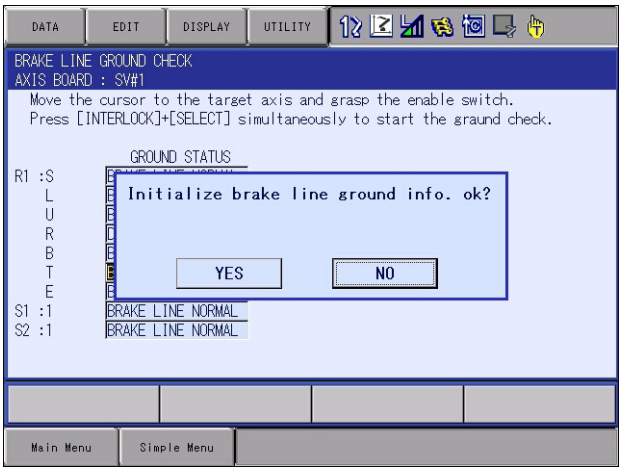


8.25.3.3 Initializing the Related Information

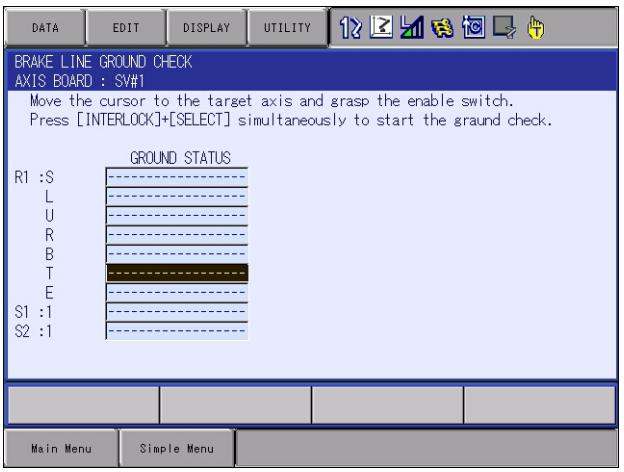
1. The sub menu {BRAKE LINE GROUND CHECK} appears after selecting the {ROBOT} in the main menu.
2. Select {DATA} in the menu.
   – The pull-down menu appears.



3. Select {CLEAR}.
   – The confirmation dialog appears.



4. Press “YES”.
   – The related information of the brake line ground check is initialized.
   – {BRAKE LINE GROUND CHECK} does not appear in the main menu until the alarm “1683 DC24V POWER SUPPLY FAILURE(SV)” occurs.



8.26 Safety Logic Circuit

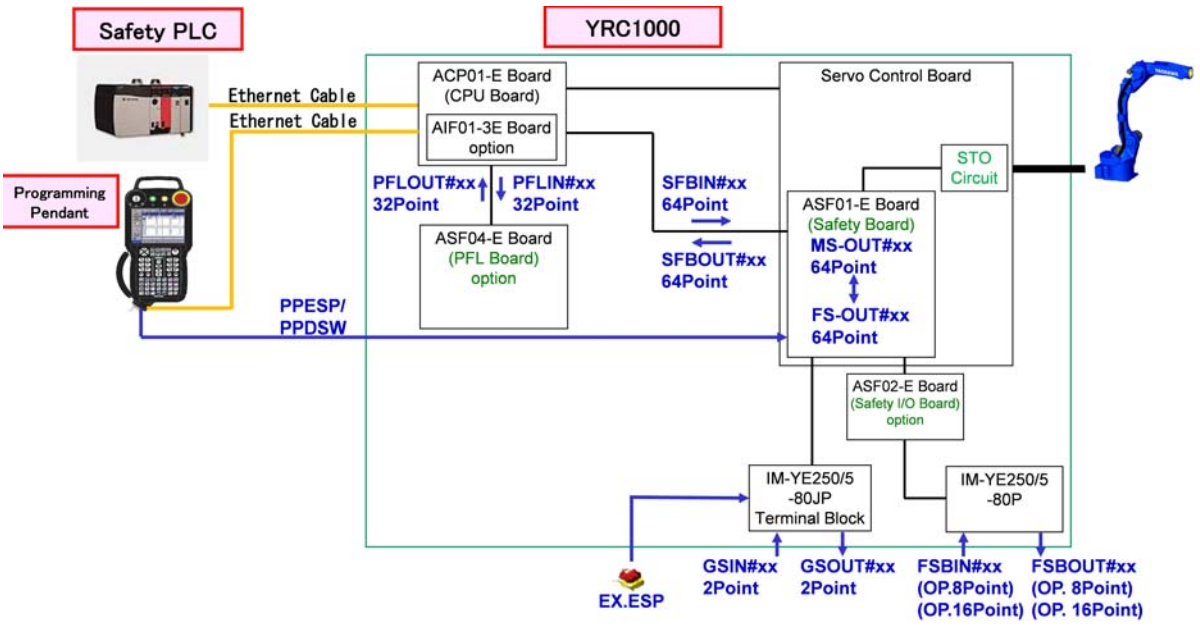
8.26.1 Outline

The safety logic circuit is a function to create the safety logic circuit on the programming pendant. It enables to set up the logical operations, such as stopping the manipulator and outputting the servo ON signal.

The followings are the contents of this function.

- Executes the safety logic circuit by the safety circuit board corresponded to the secure authentication.
- The safety logic circuit consists of the system section and the user section.
- The system section of the safety logic circuit is the specific circuit of YASKAWA, so that the safety logic circuit cannot be edited. Meanwhile, for the user part, it is possible to edit.
- Both system and user section of the safety logic circuit consist of a circuit with 2 inputs and 1 output or a circuit with 1 input and 1 output.
- Both system and user section of the safety logic circuit consist of 128 lines.
- Both system and user section of the safety logic circuit are operated in every 2ms cycle.
- Both system and user section of the safety logic circuit can be referred by the all modes regardless the security mode, however the user section can be edit only when the security mode is “SAFETY MODE” plus under the teach mode and the servo is OFF.
- Conventionally, some functions were performed only by using hard-wired signals. With the YRC1000, by using an optional safety PLC and an optional safety logic circuit, these functions can be controlled from the safety PLC. This enables less wiring.
  Meanwhile, the signals which has been controlled by a hardware are also always monitored. Thus, the safety function, which turns OFF the servo power supply when the error is detected, is maintained

The following is the example of configuration with the safety PLC.



NOTE

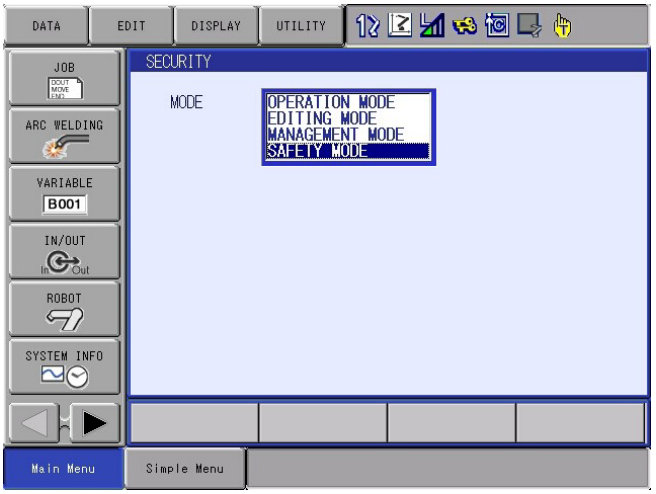
For the connection of the GP safety I/O board (optional), either the JANCD-ASF02-E (8 points available) board or the JZNC-ASU03-E (16 points available) unit can be connected to each safety circuit board (JANCD-ASF01-E).

JANCD-ASF02-E: For both input and output, 8 points of GP safety I/O signal can be used.
JZNC-ASU03-E: For both input and output, 16 points of GP safety I/O signal can be used.

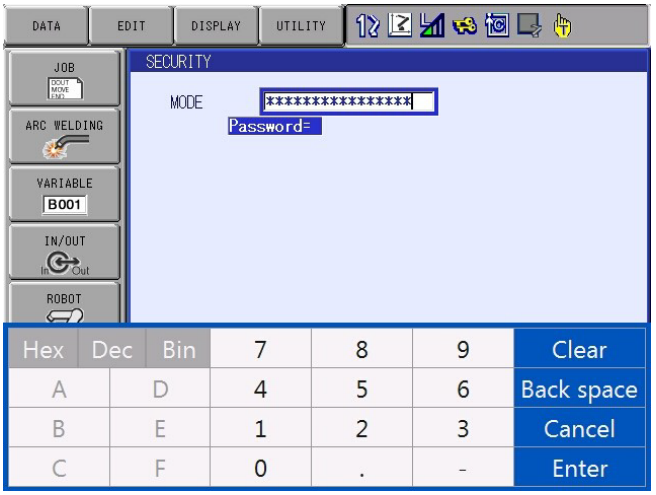
8.26.2 Changing the Security Mode

To create/edit the safety logic circuit, change the security mode to the safety mode.

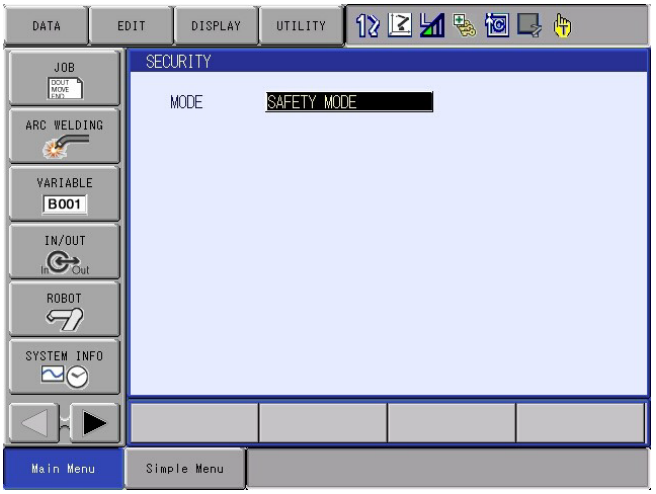
1. Display of the window.
   – Select {SECURITY} from {SYSTEM INFO} in the main menu.
2. Change to the safety mode.
   – Select {SAFETY MODE}.



   – Enter the password for the safety mode, and then press [ENTER].



– When the entered password is correct, the mode is changed to {SAFETY MODE}. After changing to the safety mode, the icon on the status area is changed to .

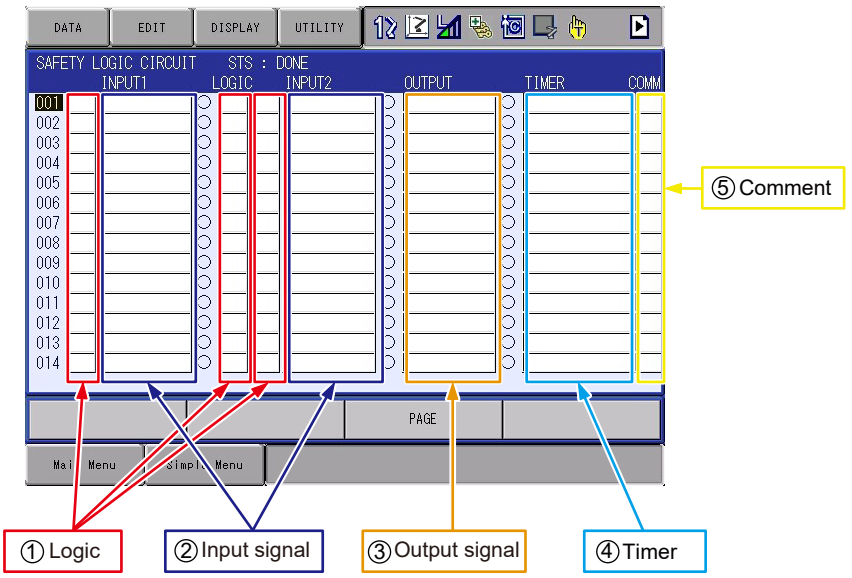


NOTE

For the key pad of the numerical input, display (available) and hide (non-available) can be switched by selecting the “SETTING OF WINDOW” in the main menu shown on the programming pendant.
At factory setting, the key pad is set as display (available).

8.26.3 Available I/O Signals and Instructions in Safety Logic Circuit

The following is the explanation of the input and output signals and logic (instructions) available in the safety logic circuit.



①. Logic

No.	Display	Contents	Note
1	NOT	Negative (reverse of signal)	
2	DSU	Detection of signal rising edge	
3	DSD	Detection of signal falling edge	
4	AND	Logic AND	
5	OR	Logic OR	

②. Input signal 1/ Input signal 2 (Signal1/Signal2)

No.	Display	Contents	Note
1	EXESP	External emergency stop input signal (●: Under emergency stop [release]/○: Not under emergency stop [short circuit])	
2	#n FSBIN[x]	GP safety input signal (8 or 16 points) (●: OFF [release]/ ○ : ON [short circuit])	This signal is shown when the optional GP safety I/O board is connected.
3	#n FSBOUT[x]	GP safety output signal (8 or 16 points) (●: ON status/ ○ : OFF status)	This signal is shown when the GP safety I/O board (option) is connected.

No.	Display	Contents	Note
4	FS-OUT[x]	Functional safety output in the safety logic circuit 64 points (●: ON status/ ○ : OFF status)	This signal is shown when the functional safety function (option) is enabled.
5	#n GSIN[x]	GP safety input signal 2 points (●: OFF [release]/ ○ : ON [short circuit])	
6	#n GSOUT[x]	GP output signal 2 points (●: ON output/ ○ : OFF output)	
7	HOLD	Hold (●: OFF (Hold signal is not input.)/○: ON (Hold signal is being input.))	
8	MS-OUT[x]	Machine safety output used in the safety logic circuit (64 points) (●: ON status/ ○ : OFF status)	
9	#n ONEN[x]	Servo power supply individual control input signal 4 points (●: Individual servo OFF status/ ○ : Normal status)	
10	PBESP	Controller emergency stop signal (●: Under emergency stop [release]/○: Not under emergency stop [short circuit])	
11	#n PFLIN[x]	Output signal to PFL board (ASF04-E) 32 points (●: ON status/ ○ : OFF status)	This signal is shown when the optional PFL board(ASF04-E) is connected.
12	#n PFLOUT[x]	Input signal from PFL board (ASF04-E) 32 points (●: ON status/ ○ : OFF status)	This signal is shown when the optional PFL board(ASF04-E) is connected.
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 (●: Communication OK/ ○ : Error communication)	Appears only when the optional PROFISafe is enabled.
17	R[x]	Work area 128 points (auxiliary relay) (●: ON status/ ○ : OFF status)	
18	REMOTE	Remote mode (●: Remote mode/ ○ : Not remote mode)	
19	S-EXDSW	External enable switch signal in the safety logic circuit (●: ON (servo ON enabled)/ ○ : OFF (servo OFF status)	
20	S-EXESP	External emergency stop signal in the safety logic circuit (●: Release/ ○ : Press (emergency stop status)	
21	S-FST	Full speed mode in the safety logic circuit (●: Full speed mode/ ○ : Safety speed)	Refer to *chapter 8.26.3.1 "Full Speed Mode"* .
22	S-SAFF	Safety fence signal in the safety logic circuit (●: Close/ ○ : Open (servo OFF status))	

No.	Display	Contents	Note
23	#n S-ONEN[x]	Servo power supply individual control input signal in the safety logic circuit 4 points (●: Individual control group servo OFF status/ ○ : Servo ON status/servo ON enabled status)	
24	S-SVON_EN	Servo ON enable signal in the safety logic circuit (●: Servo ON enabled status/ ○ : Servo OFF)	This signal is shown only when the enable switch link function is enabled. For details, refer to *chapter 8.26.13 "Enable Switch Link Function"* .
25	SAFF	Safety fence signal (●: Open/ ○ : Close)	
26	SFBIN[x]	Safety field bus input signal 64 points (●: ON status/ ○ : OFF status)	This signal is shown when the optional safety field bus function is enabled.
27	SFBOUT[x]	Safety field bus output signal 64 points (●: ON status/ ○ : OFF status)	This signal is shown when the optional safety field bus function is enabled.
28	#n SFRON[x]	Servo ON/OFF signal 4 points (●: Servo ON/ ○ : Servo OFF)	
29	SPIN[x]	Specific input signal 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)	
33	CSCFG01	Safety data monitoring Monitoring result of the safety-related parameter ● : Normal monitoring (Data file not changed.) ○ : Abnormal monitoring (Parameter 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.	Display	Contents	Note
34	CSCFG02	Safety data monitoring Monitoring result of the machine safety data file ● : Normal monitoring (Data file not changed.) ○ : Abnormal monitoring (Parameter 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.
35	CSCFG03	Safety data monitoring Monitoring result of the functional safety data file ● : Normal monitoring (Data file not changed.) ○ : Abnormal monitoring (Parameter 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).
36	CSCFG04	Safety data monitoring All monitoring results ● : Normal monitoring (Parameter and the data file not changed.) ○ : Abnormal monitoring (Either of the parameter or the data file 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)

n: The number of the safety circuit board (Maximum 8)



The signal for the safety data monitoring will be shown when the functional safety function (option) is enabled. And it can be used with system software version “YAS2.80.00A (□) -00” or later.

③. Output signal

No.	Display	Contents	Note
1	#n FSBOUT[x]	GP safety output signal (8 or 16 points) (●: ON status/ ○ : OFF status)	This signal is shown when the optional GP safety circuit board is connected. For details, refer to *chapter 8.26.7 "Setting for the GP Safety I/O Signals"*.
2	#n GSOUT[x]	GP output 2 points (●: ON output/ ○ : OFF output)	
3	MS-OUT[x]	Machine safety signal output signal in the safety logic circuit 64 points (●: ON output/ ○ : OFF output)	
4	#n PFLIN[x]	Output signal to PFL board (ASF04-E) 32 points (●: ON status/ ○ : OFF status)	This signal is shown when the optional PFL board(ASF04-E) is connected.
5	R[x]	Work area 128 point (auxiliary relay) (●: ON output/ ○ : OFF output)	
6	S-EXDSW	External enable switch signal in the safety logic circuit (●: ON (servo ON enabled)/ ○ : OFF (servo OFF status)	
7	S-EXESP	External emergency stop signal in the safety logic circuit (●: Release/ ○ : Press (emergency stop status)	
8	S-FST	Full speed test signal in the safety logic circuit (●: Full speed test/ ○ : Safety speed)	Refer to *chapter 8.26.3.1 "Full Speed Mode"*.
9	#n S-ONEN[x]	Servo power supply individual control input signal in the safety logic circuit 4 points (●: Individual control group servo OFF status/ ○ : Servo ON status/servo ON enabled status)	
10	S-SAFF	Safety fence signal in the safety logic circuit (●: Close/ ○ : Open (servo OFF status))	
11	S-SVON_EN	Servo ON enable signal in the safety logic circuit (●: Servo ON enabled status/ ○ : Servo OFF)	This signal is shown only when the enable switch link function is enabled. For details, refer to *chapter 8.26.13 "Enable Switch Link Function"*.
12	SFBOUT[x]	Safety field bus output signal 64 points (●: ON output/ ○ : OFF output)	This signal is shown when the optional safety field bus function is enabled.

No.	Display	Contents	Note
13	SVOFF CAT0	Turns OFF the servo power supply to the robot. (Category0 stopped) (●: Robot stop request/ ○ : Not robot stop request)	
14	SVOFF CAT1	Turns OFF the servo power supply to the robot. (Category1 stopped) (●: Robot stop request/ ○ : Not robot stop request)	
15	SICFGTRG	Safety data monitoring Holding CRC updating trigger	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.)

n: The number of the safety circuit board (Maximum 8)

NOTE

The signal for the safety data monitoring will be shown when the functional safety function (option) is enabled. And it can be used with system software version “YAS2.82.00A (□) -00” or later.

NOTE

When using the GSOUT signal and the FSBOUT 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

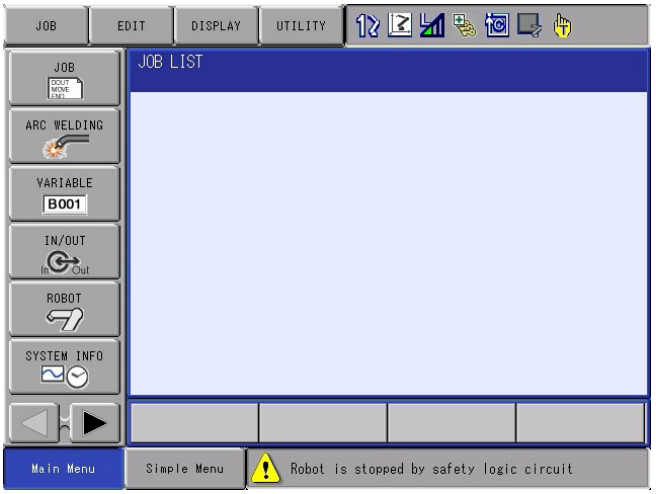
Alarm 4767 M-SAF GENERAL OUT FB DIAG. ERROR

Alarm 4926 M-SAF GENERAL OUTPUT UNMATCH

Alarm 4772 M-SAF GENERAL OUTPUT DIAG. ERROR2

Alarm 4768 M-SAF GENERAL OUTPUT FB DIAG. ERROR2

Alarm 4927 M-SAF GENERAL OUTPUT UNMATCH2



NOTE When the robot is stopped by request stop from the safety logic circuit signal, the message “Robot is stopped by safety logic circuit” is shown on the message area of the programming pendant. And the control status signal #80343(servo OFF status by safety logic circuit) is turned ON

④. Timer

No.	Display	Contents	Note
1	TMR[8]	One shot pulse width timer 8 timer	
2	TM[4] OFF DELAY	OFF Delay timer 4 timer	
3	TM[4] ON DELAY	ON Delay timer 4 timer	

⑤.Comment

It is possible to input up to 32 characters in one-byte (16 characters in two-byte).

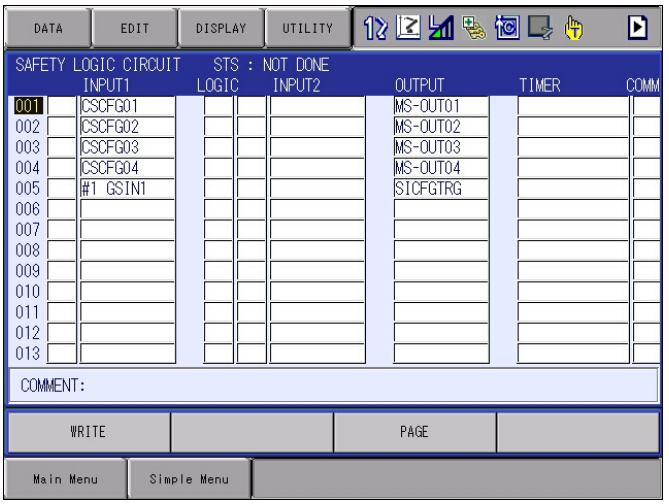
■ **Safety data monitoring**

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.

When GSIN01 is the holding CRC updating trigger, the example of the monitoring results output to MS-OUT01 - 04 is shown below.

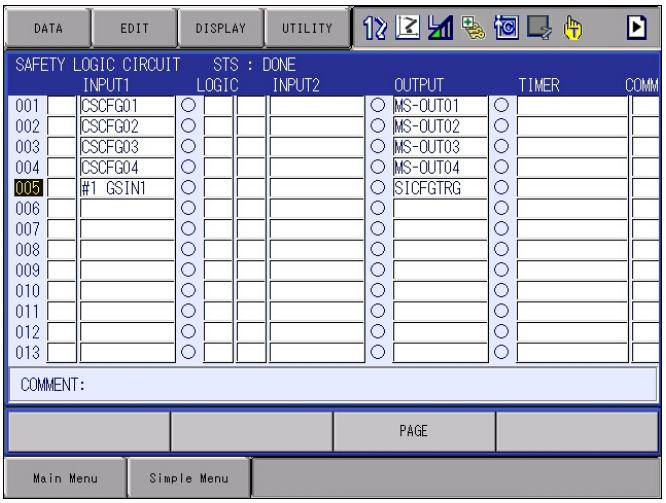
1. Editing the safety logic circuit
   – Correspond GSIN01 to the updating trigger SICFGTRG, and MS-OUT01 - 04 to CSCFG01 - 04.



2. Transferring or updating the file

   – After editing, select {WRITE}.

   – When the transfer is done correctly, the confirmation dialog appears. Then select {YES}.



NOTE

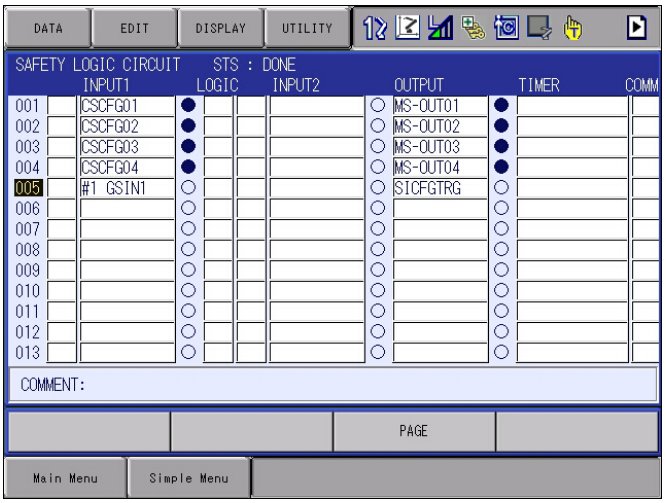
Since the safety data monitoring compares the CRC held by falling the holding CRC updating trigger (signal name: SICFGTRG) and the current CRC to monitor, the monitoring result is turned OFF (○: abnormal monitoring) until the CRC is held by the holding CRC updating trigger.

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.

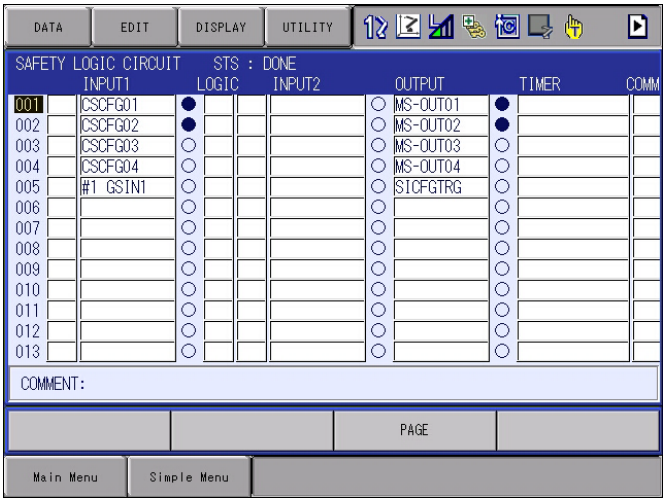
   – The monitoring result (signal name: CSCFG01 - 04) can be output to any signal by using the safety logic circuit.
   The monitoring result can be output to the external device by using the safety output.



4. Monitoring the safety data change

   – When any functional safety data file is changed, the following status appears.

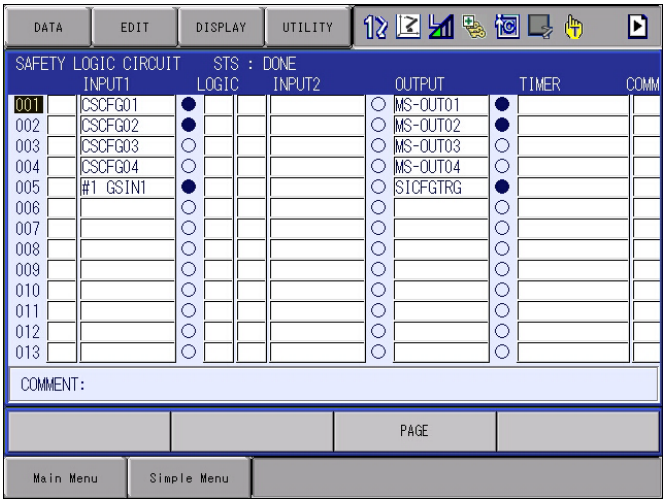
   – Both CSCGF03 shown the monitoring result of the functional safety data file and CSCFG04 shown the monitoring result of changing either safety data (if any) will be turned OFF (○ : abnormal monitoring).

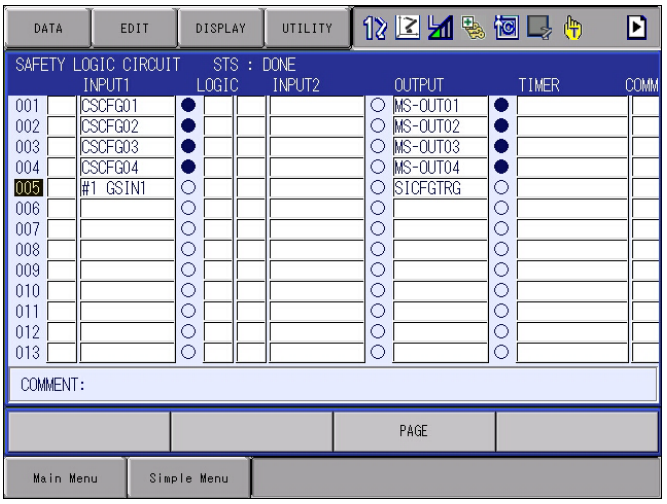


   – Also when any safety related parameter is changed, both CSCFG01 and CSCFG04 will be turned OFF (○ : abnormal monitoring).

   – Also when any machine safety data file is changed, both CSCFG02 and CSCFG04 will be turned OFF (○ : abnormal monitoring).

   – When the CRC updating trigger (signal name: SICFGTRG GSIN01 is set this time) is turned ON (●) to OFF(○) again, the holding CRC is updated and the monitoring result is turned ON (●: normal monitoring).





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)
- System alignment parameter (SC.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)

8.26.3.1 Full Speed Mode

The full speed mode is the mode to perform a test run or a forward/ backward operation of the job at the taught speed during the teach mode.

When the S-FST signal is turned ON during the teach mode, the full speed mode is activated.

When the full speed mode is selected, the servo power is turned OFF, and then the manual speed setting is automatically switched to the inching mode. In the same way, when the Enable Switch is released in the full speed mode, the manual speed setting is automatically switched to the inching mode.

The operation speed while the mode is set to the full-speed test mode is specified as follows according to the manual speed setting.

Manual speed operation speed limit (initial value)		**Parameter (unit: 0.01%)**	
Inching	20%	S1CxG60 (initial value: 2000)	Limited to 250 mm/s
Low	50%	S1CxG61 (initial value: 5000)	
Mid	75%	S1CxG62 (initial value: 7500)	
High	100% (fixed value)	-	

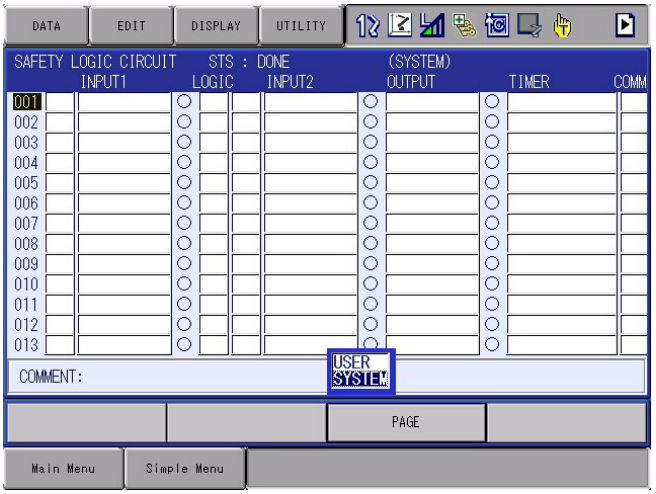
Note that the operation speed limit values in the above table are the percentages with respect to the manipulator's maximum speed, not with respect to the taught speed. These are specified in order to control the operation speed so that it does not exceed the manipulator's maximum speed during a test run or a forward/backward operation.

DANGER

- When using the full-speed test function, the manipulator moves at a high speed. Thus, make sure to secure a place where the operator can visually check the manipulator's movement in the area outside the manipulator's operating range, and perform operations by using the programming pendant from that place.

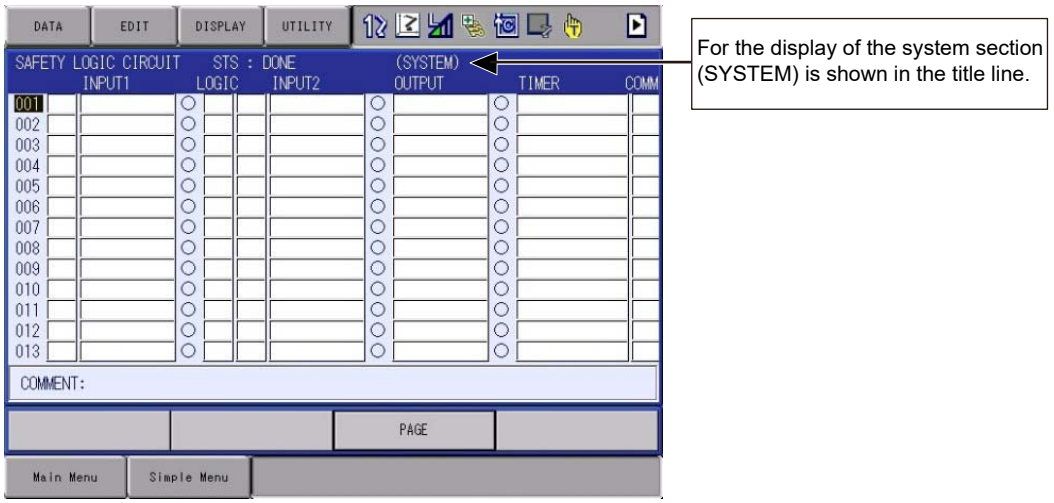
8.26.3.2 Switching Display of System and User Section

1. Operation for switching display.
   By pressing [PAGE] shown on the programming pendant and selecting the USER or SYSTEM, the display of the system and user section of the safety logic circuit can be switched.

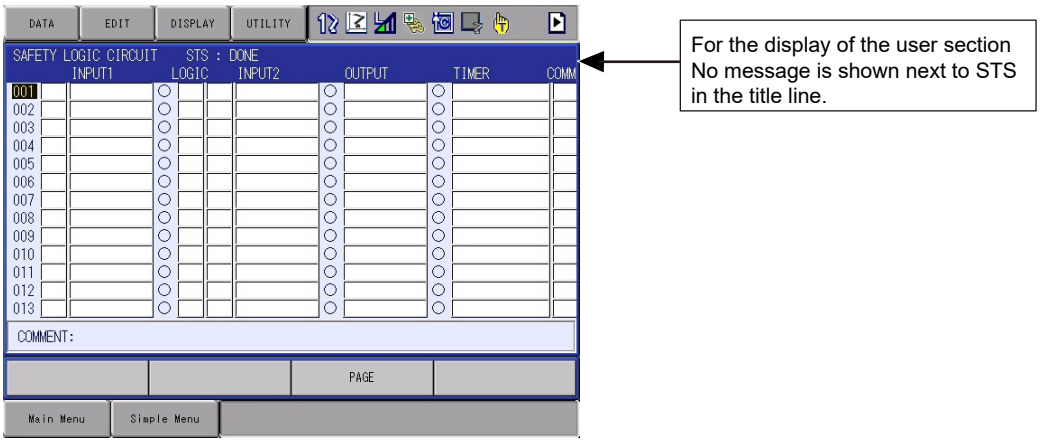


   SYSTEM: The system section of the safety logic circuit is shown.
   USER: The user section of the safety logic circuit is shown.

2. Display of the system section.
   (SYSTEM) is shown in the title line while the system section is shown.



3. Display of the user section.
   There is no message next to STS in the title line while the user section is shown.

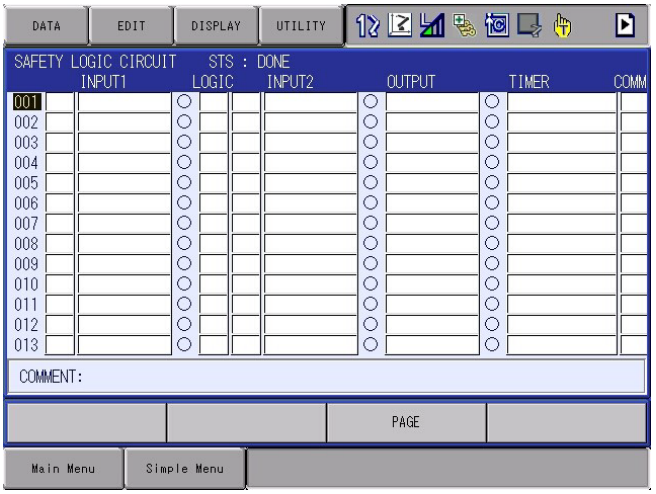


SUPPLE -MENT

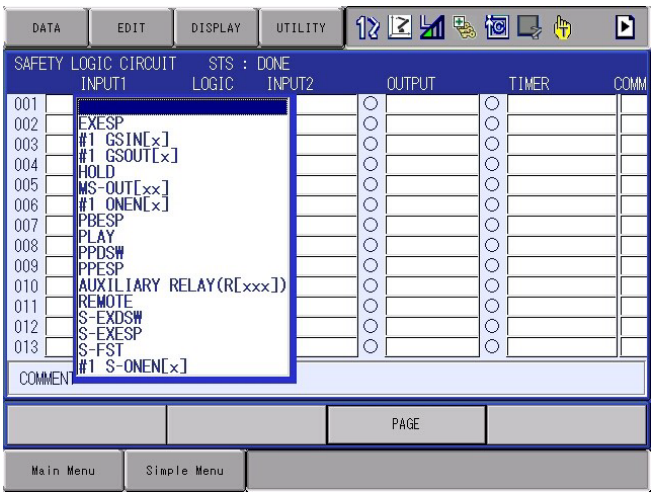
There is a case that the system section of the safety logic circuit is not defined at factory setting.

8.26.4 Safety Logic Circuit

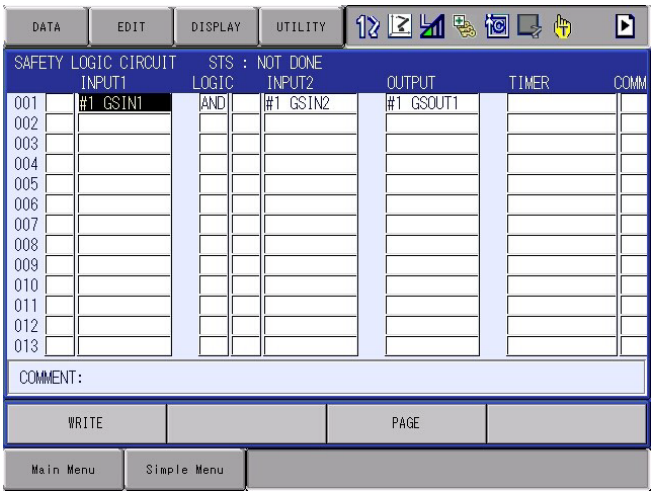
1. Display of the window.
   – Select {SAFETY LOGIC CIRCUIT} from {SAFETY FUNC.} in the main menu.



2. Create the safety logic circuit
   – Create the safety logic circuit. The setting items are “INPUT1”, “LOGIC”, “INPUT2” and “OUTPUT”.
   Set “TIMER” and “COMMENT” if necessary.
   – The INPUT1 and INPUT2 must be set.
   – When setting the input 1 or 2, LOGIC is also must to be set.
   – OUTPUT is also must be set. The same output signal cannot be set to the multiple logic circuit.

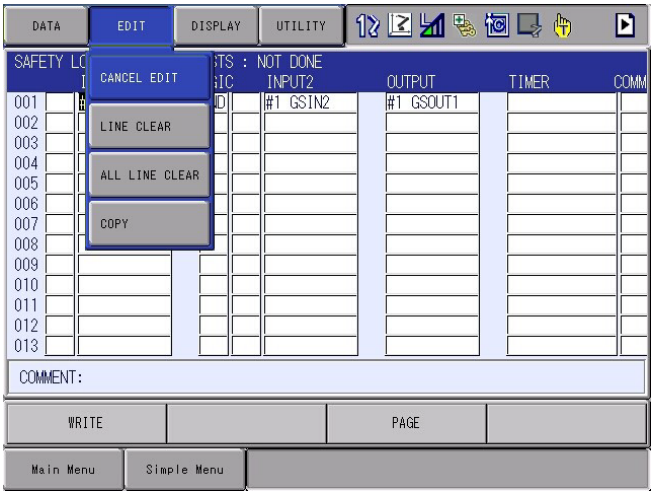


After creating the safety logic circuit, the status changes from “DONE” to “NOT DONE”. The “WRITE” button is shown on the left down corner of the screen.



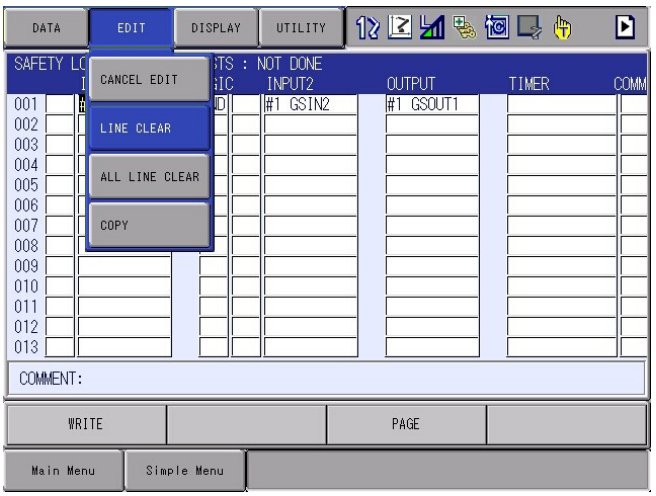
3. Canceling the edit

   – To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.



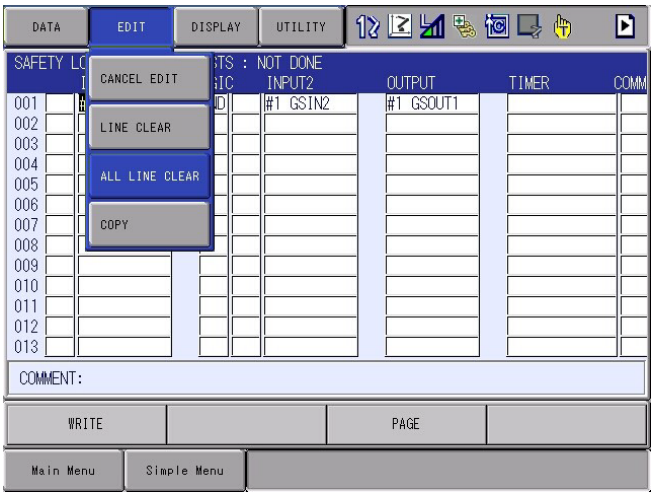
4. Line clear

   – To clear the one line, select {LINE CLEAR} from {EDIT} in the pull-down menu.



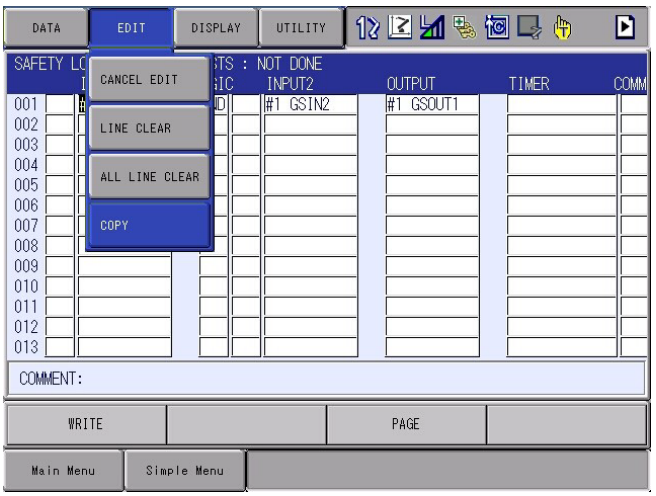
5. All line clear

   – To clear the all line, select {ALL LINE CLEAR} from {EDIT} in the pull-down menu.

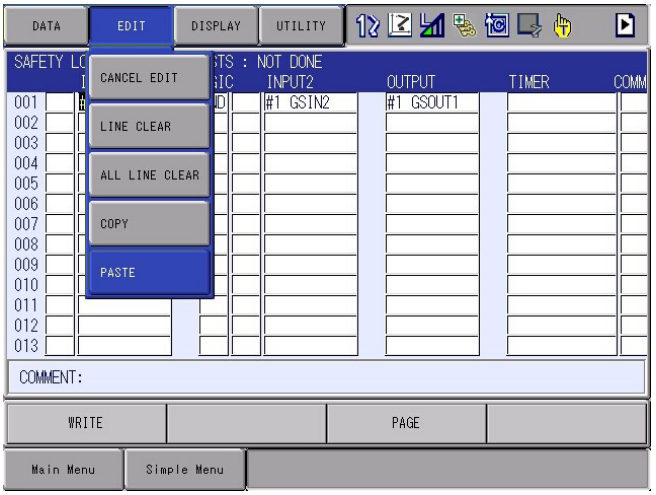


6. Copy

– Choose the desired area to make a copy, and select {COPY} from {EDIT} in the pull-down menu.



– Go to the area to paste, select {PASTE} from {EDIT} in the main menu to paste.

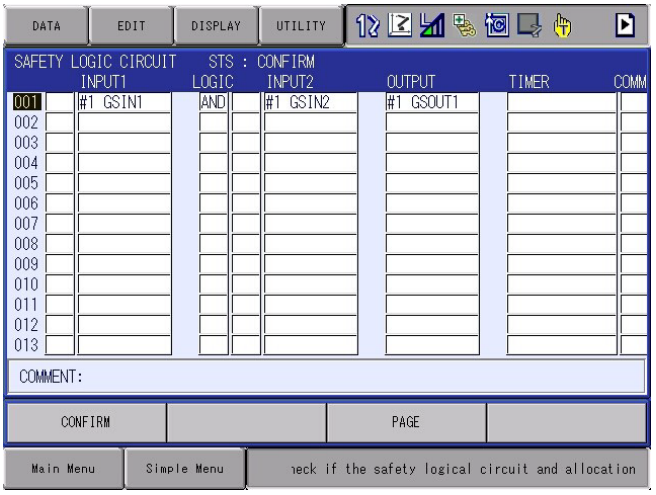


7. Transferring and updating the safety logic circuit file

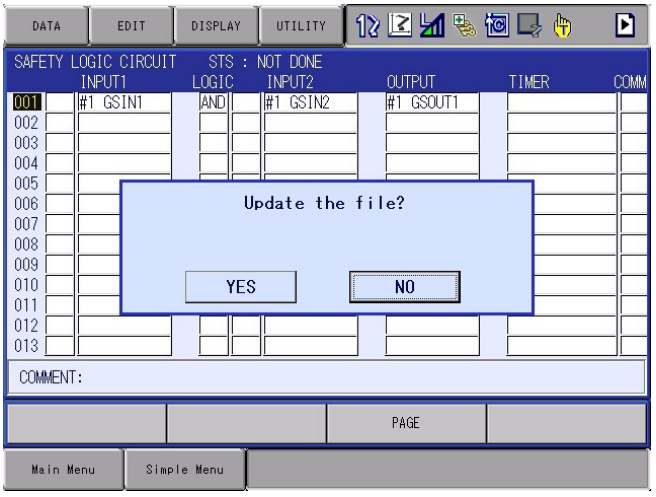
(1) After creating the safety logic circuit, select {WRITE}.

– The safety logic circuit file is transferred to the safety circuit board. If there is a blank line in the safety logic board, it will be filled automatically.

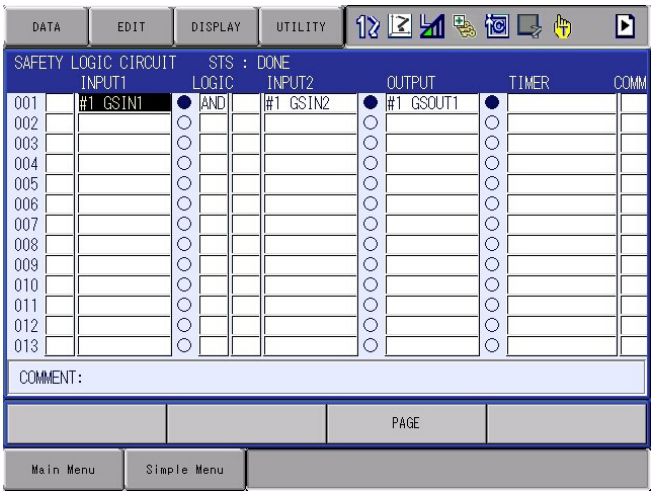
– When the transfer of the safety logic circuit file is successfully performed, the following window is shown.



(2) When {CONFIRM} shown on the programming pendant is selected, the confirmation dialog of “Update the file?” is shown.



(3) Press “YES”, and then the file transferred to the safety circuit board is written in the FLASH ROM. The status becomes “DONE” from “NOT DONE”.



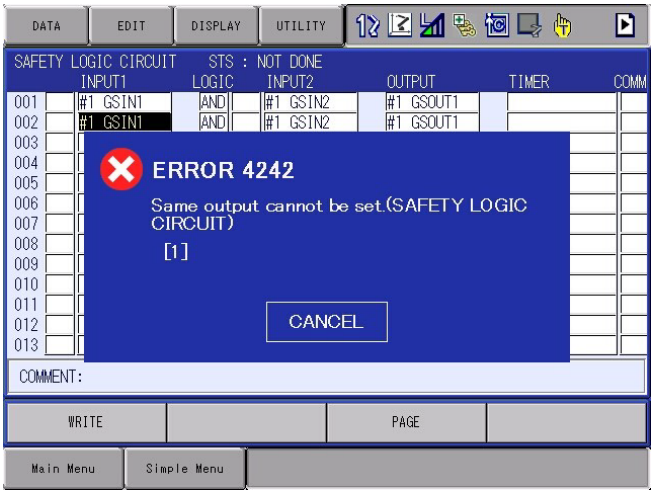
If press “NO”, the file will not be updated. The status remains “NOT DONE”.

NOTE

- If press “YES” on the confirmation dialog, the all information related to the safety logic circuit is transferred to the safety circuit board as the safety logic circuit file and written in the FLASH ROM of the safety circuit board.
- If select {WRITE}, the all output signals output from the safety circuit board are turned OFF until the writing process is completed.

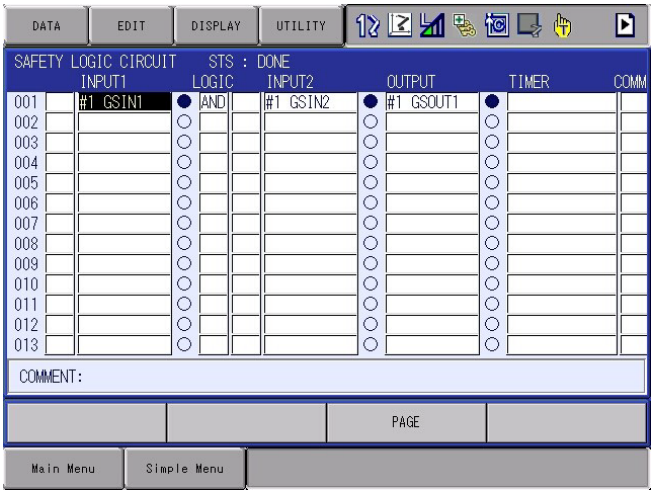
NOTE

When {WRITE} is selected, if the same output signals are set for two or more sections, the following error message shows up. So that, correct the safety logic circuit.



8. Execution of the safety logic circuit

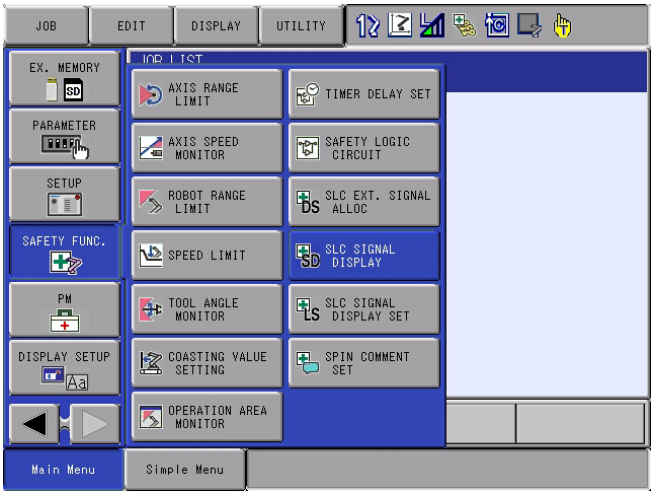
– When the write operation is completed, the safety logic circuit is executed. If the set signal is ON, " ● " is shown. If the set signal is OFF, " ◯ "is shown. The safety logic circuit is always executed except the write operation.



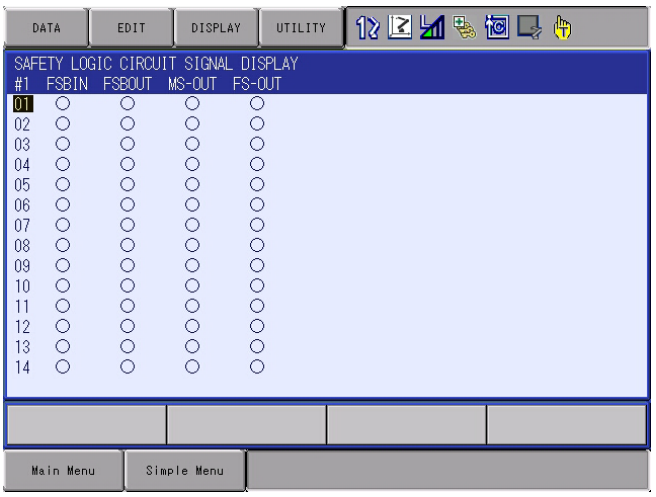
8.26.5 Signal List Window

The ON/OFF status list of the signals used in the safety logic circuit is shown.

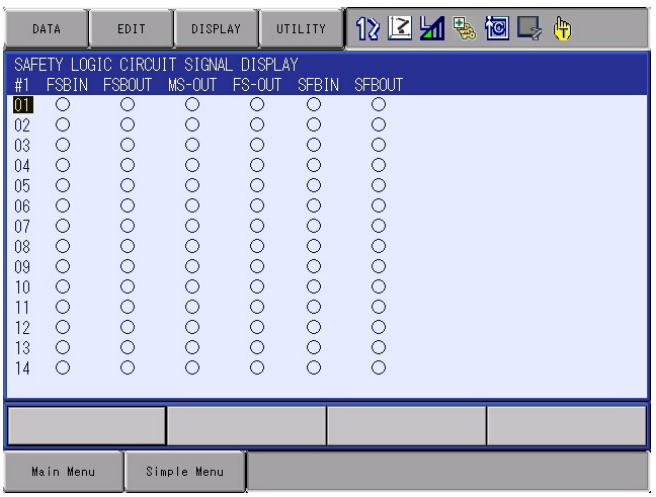
1. Select {SAFETY FUNC.}-{SLC SIGNAL DISPLAY}



2. The signals used in the safety logic circuit is shown.
   – If the optional safety field bus function is enabled, its signals are also shown.



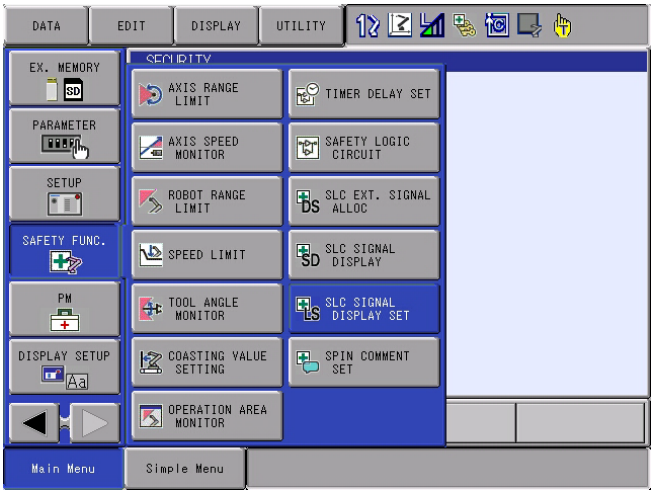
<The signal list when the safety field bus function (option) is enabled>



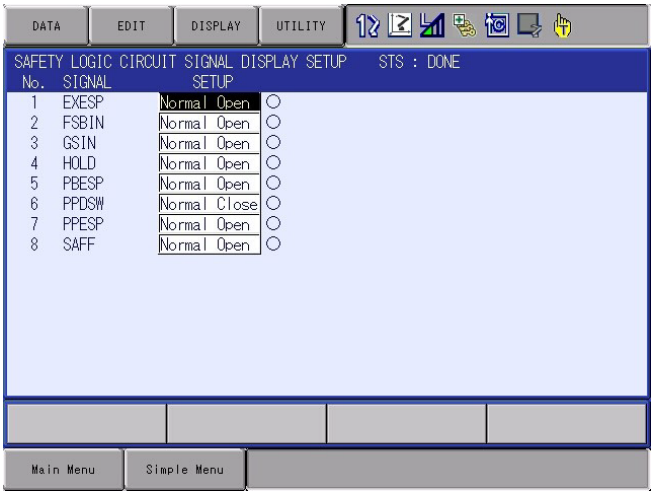
8.26.6 Setting ON/OFF to the Input Signals

The display of the ON/OFF status of input signals used in the safety logic circuit can be switched.

1. Select {SAFETY FUNC.}-{SLC SIGNAL DISPLAY SET}.

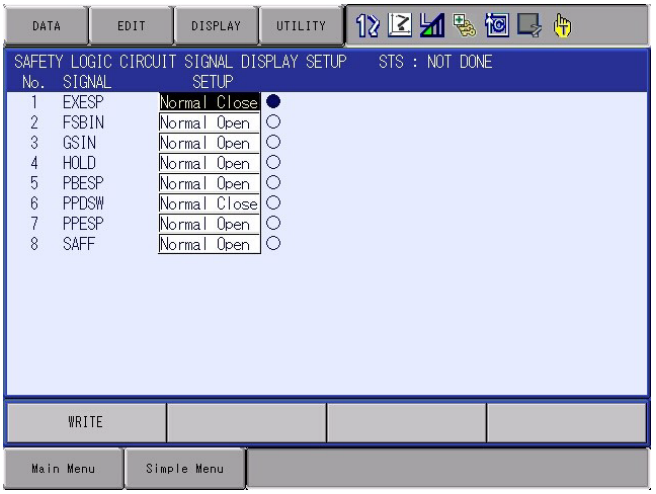


2. The ON/OFF status of input signals used in the safety logic circuit can be switched by pressing [SELECT] on the programming pendant

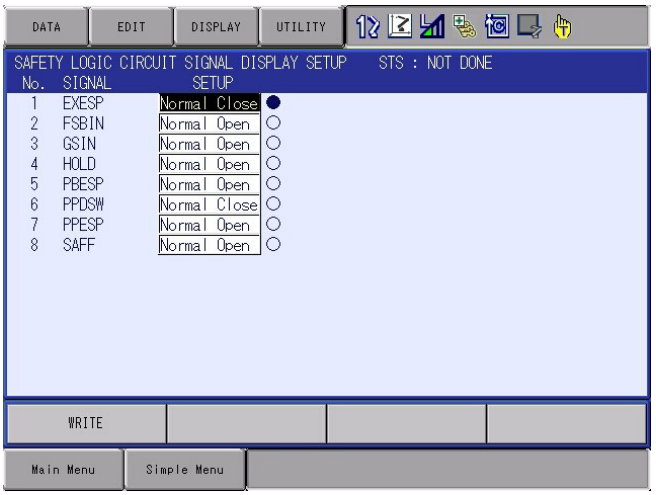


No.	Signal Name	Normal Open	Normal Close
1	EXESP	External emergency stop input signal (●: Under emergency stop/ ○ : Normal)	External emergency stop input signal (●: Normal/ ○ : Under emergency stop)
2	FSBIN	GP safety input signal (ASF02 or ASU03) (●: OFF [release]/ ○ : ON [short circuit])	GP safety input signal (ASF02 or ASU03) (●: ON [short circuit]/ ○ : OFF [release])
3	GSIN	GP safety input signal (ASF01) (●: OFF [release]/ ○ : ON [short circuit])	GP safety input signal (ASF01) (●: ON [short circuit]/ ○ : OFF [release])
4	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.))
5	PBESP	Controller emergency stop signal (●: Under emergency stop/ ○ : Normal)	Controller emergency stop signal (●: Normal/ ○ : Under emergency stop)
6	PPDSW	Programming pendant enable switch signal (●: Grip/ ○ : Not grip (servo OFF))	Programming pendant enable switch signal (●: Not grip (servo OFF)/ ○ : Grip)
7	PPESP	Programming pendant emergency stop signal (●: Under emergency stop/ ○ : Normal)	Programming pendant emergency stop signal (●: Normal/ ○ : Under emergency stop)
8	SAFF	Safety fence signal (●: Open (safeguarding opened)/ ○ : Close)	Safety fence signal (●: Close/ ○ : Open (safeguarding opened))

3. For example, when the EXESP signal is changed from “Normal Open” to “Normal Close”, the mark “●” indicates the external emergency stop signal is in the normal state (Normal Close) and the mark “○” indicates the external emergency stop signal is being input (Normal Open).



4. Select {WRITE} and then {CONFIRM} to enable the changed settings. When the data is updated correctly, the status on the title line is changed from “NOT DONE” to “DONE”.



NOTE

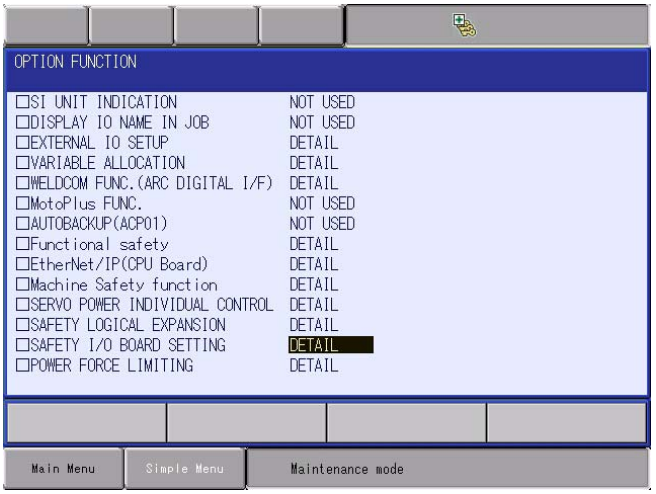
When the ON/OFF settings of the input signals are changed, outputting the signals that have been output normally may fail. This may lead to a serious accident. After changing the ON/OFF settings of the input signals, be sure to confirm the safety logic circuit operates normally.

8.26.7 Setting for the GP Safety I/O Signals

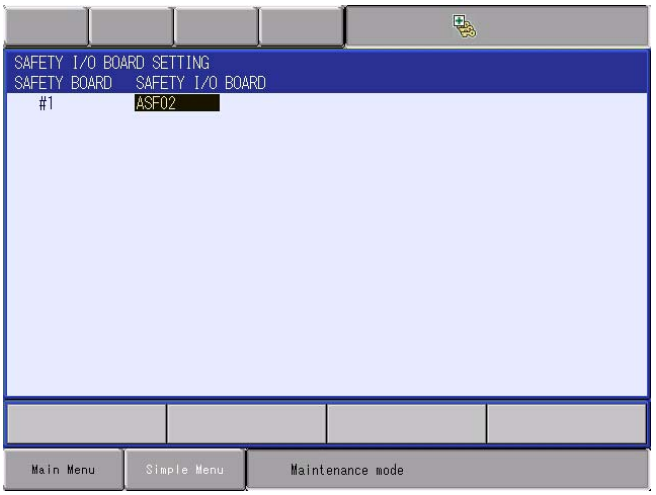
8.26.7.1 Preliminary setting for the GP Safety I/O Signal

When using the GP safety I/O signal (type: ASF02 board/ASU03 unit), start up the maintenance mode and perform the following operations.

1. Display of the window
   – Turn the power ON while pressing [MAIN MENU] on the programming pendant.
2. Change the security
   – When the maintenance mode is started, Select {SECURITY} from {SYSTEM}.
3. Change to the safety mode.
   (1) Select {SAFETY MODE}.
   (2) Input the password for the safety mode and press [ENTER].
4. When the correct password is input, the mode is changed to {SAFETY MODE}.
   – After changing to the safety mode, the icon shown on the status area is changed to .
5. After changing the security, select each menu in the following order. {SYSTEM},{SETUP},{OPTION FUNCTION},{SAFETY I/O BOARD SETTING}.



6. Press [SELECT] on the programming pendant and set the GP safety I/O board ASF02 or ASU03.



NOT USED: GP safety I/O board is not used.

JANCD-ASF02-E: The I/O 8 points of GP safety I/O signal are available.

JZNC-ASU03-E: The I/O 16 points of GP safety I/O signal are available.

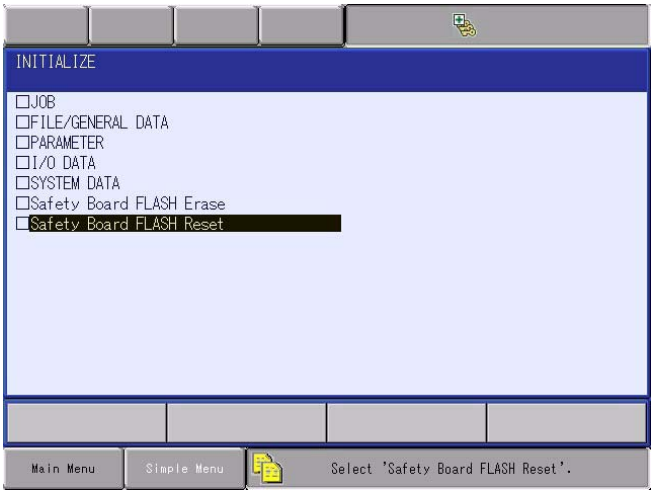
NOTICE

- When starting up the robot system, confirm the function and wiring of the general-purpose safety I/O signals.

7. Press [ENTER] on the programming pendant and select {YES}. The data is updated.



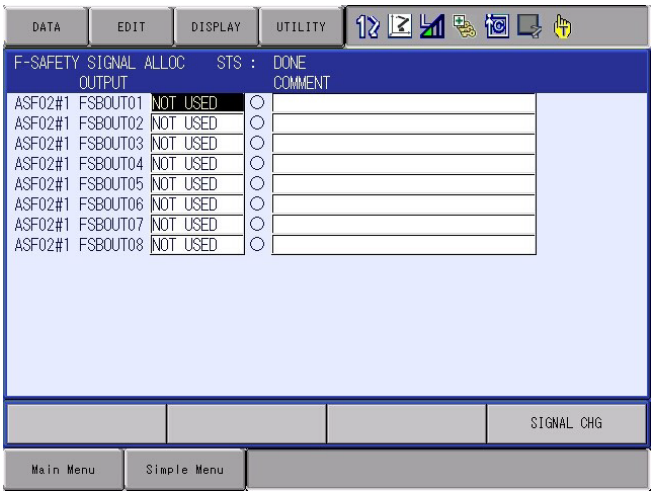
8. After updating the data, select in the following order.
   {FILE}, {INITIALIZE}, “Safety Board FLASH Reset”.
   – When “bleep” sounds, the initialization is completed and the message on the programming pendant disappears. Also, if the message “Select ‘Safety Board FLASH reset’” is shown on the message area of the programming pendant, perform “Safety Board FLASH reset”.



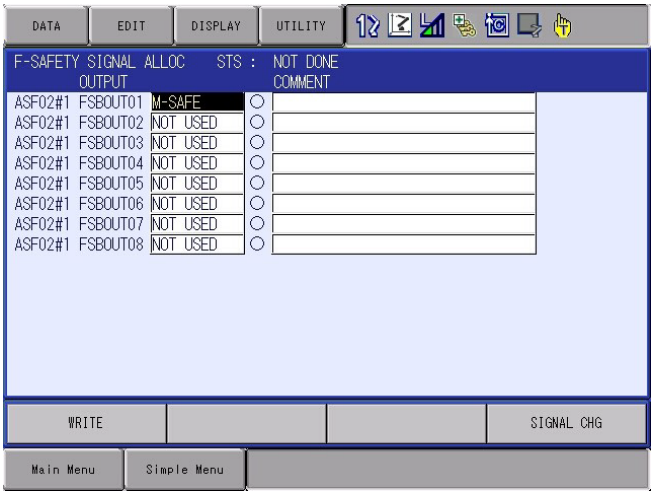
9. Turn OFF/ON the YRC1000.

8.26.7.2 Setting for the GP Safety Output Signals

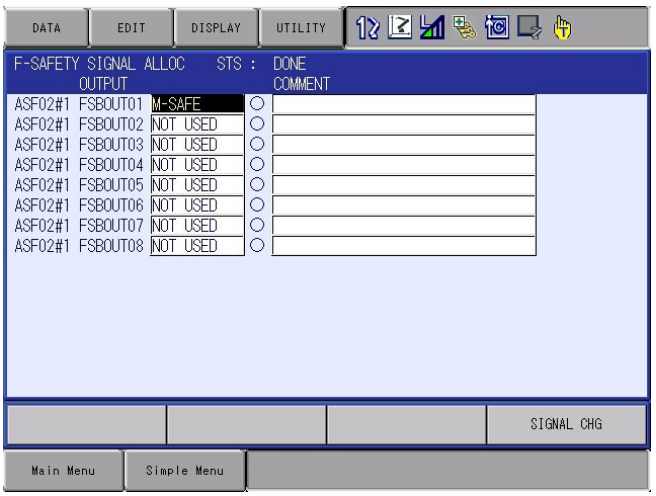
1. Select {SAFETY FUNC.}-{F-SAFETY SIGNAL ALLOC}.
   – The following window is shown. The mark at the center of the window indicates ON/OFF status. "◯" means OFF and "●" means ON.



2. To use the GP safety output signals in the safety logic circuit, press [SELECT] on the programming pendant and set "ASF01-E".
   – The GP safety output signals allocated to "ASF01-E" are available in the safety logic circuit. However, if the setting is "NOT USED", the signals are available only on the functional safety circuit board.



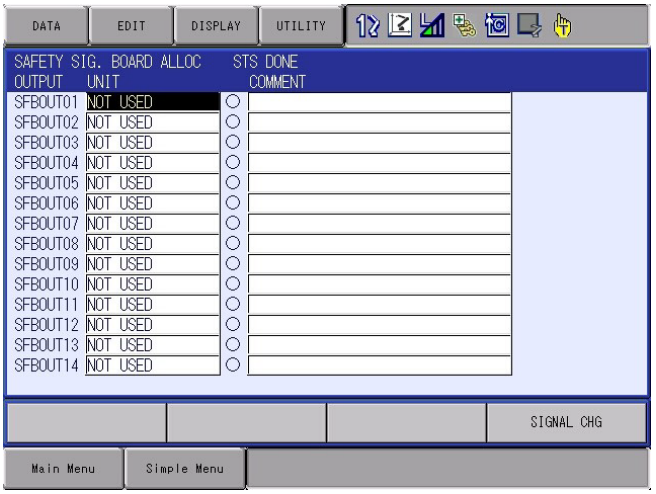
3. Select {WRITE} and then {CONFIRM} to enable the changed settings.
   – When the data is updated correctly, the status on the title line is changed from “NOT DONE” to “DONE”.



8.26.8 Safety Signal Board Allocation

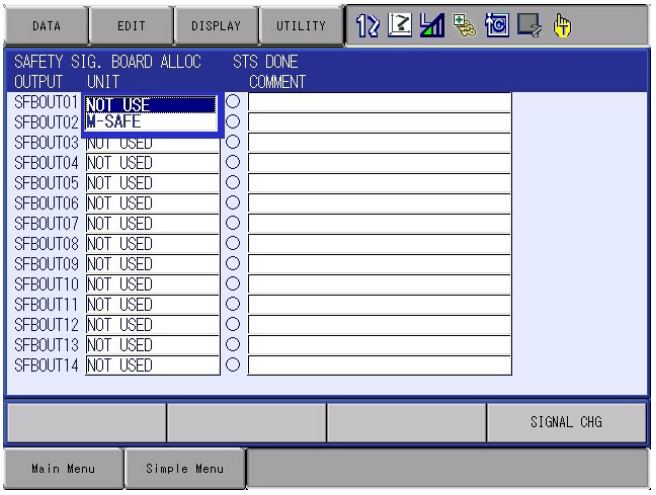
This window is shown only when the optional safety field bus function is enabled.

1. Select {SAFETY FUNC.}-{SAFETY SIG. BOADR ALLOCATION}.
   – The marks at the center of the window indicates OFF/ON status. "◯" means OFF and the mark "●" means ON. Also, comments (up to 32 characters in one-byte, 16 characters in two-byte) can be input.

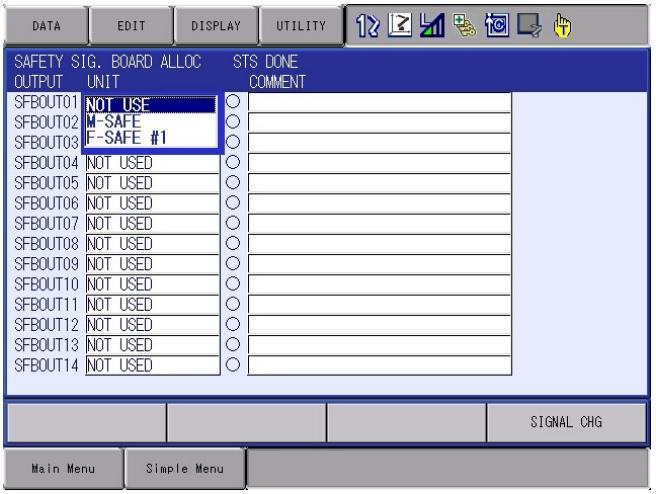


2. The initial status is set as "NOT USED". Press [SELECT] on the programming pendant and select one of "NOT USED", "SAFETY LOGIC CIRCUIT" or "FUNCTIONAL SAFETY".
   – When the functional safety (optional) is disabled, the menu of "FUNCTIONAL SAFETY" is not shown.

   <When the functional safety circuit board is disabled>



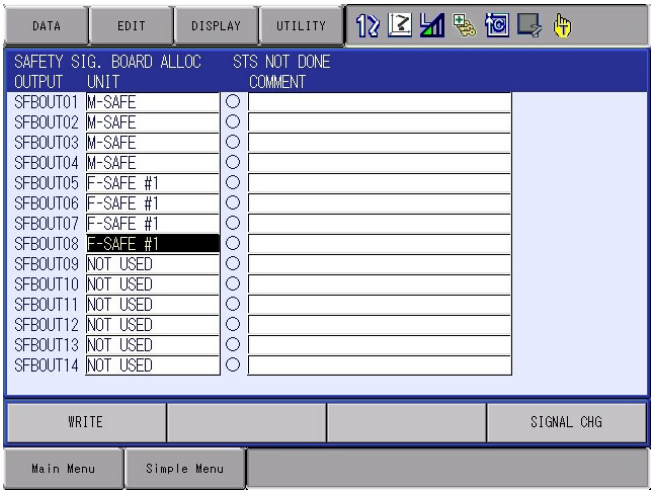
<When the functional safety circuit board is enabled>



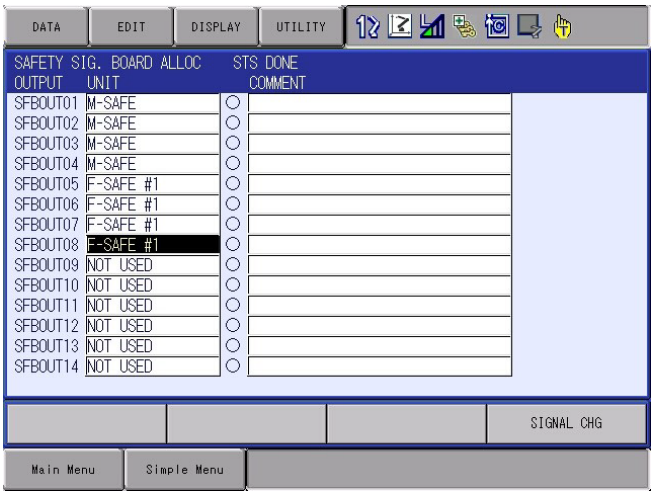
NOT USED : Not available in the safety logic circuit and on the functional safety.
SAFETY LOGIC CIRCUIT : Available in the safety logic circuit.
FUNCTIONLAL SAFETY : Available on the optional functional safety. Up to eight safety circuit boards can be connected in the YRC1000. When using a safety circuit board, specify its board number.

3. In the following setting, SFBOUT01 to SFBOUT04 are available in the safety logic circuit and SFBOUT05 to SFBOUT08 are available in the functional safety function.

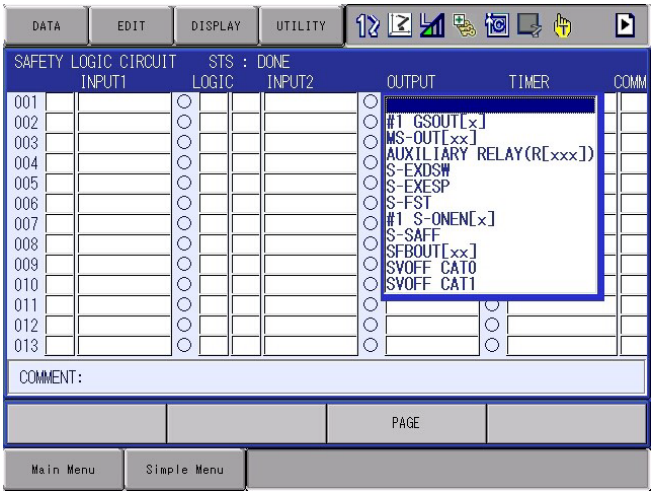
   – After changing the setting, the status in the title line becomes “NOT DONE” and {WRITE} menu is shown. Update the data.



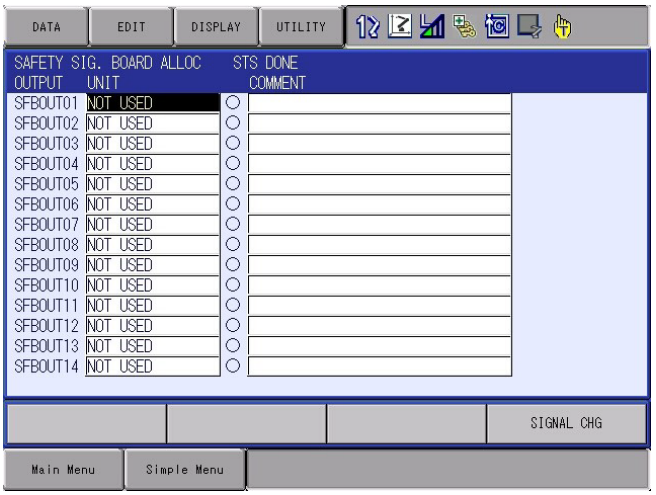
4. When the data update is completed, the status in the title line becomes “DONE” and the {WRITE} menu disappears.



5. When either “NOT USED” or “FUNCTIONAL SAFETY” is set, the output signal in the safety logic circuit is not available.



6. The display of input and output signal used in the safety field bust function can be switched by {SIGNAL CHG}.

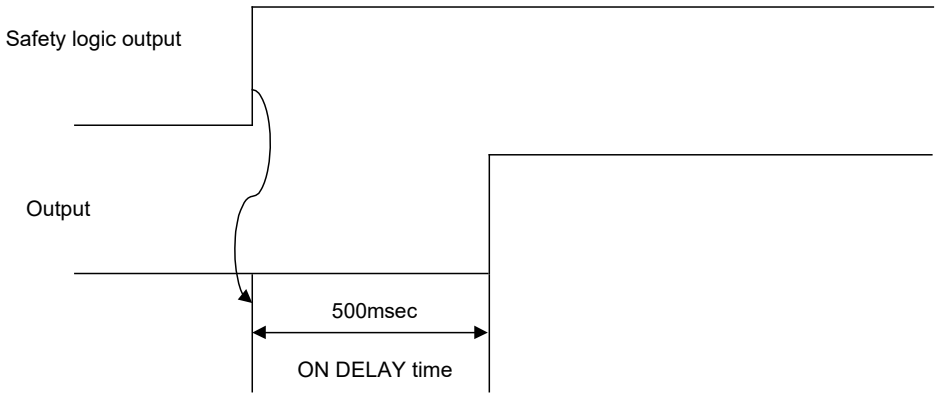


8.26.9 Timer Delay

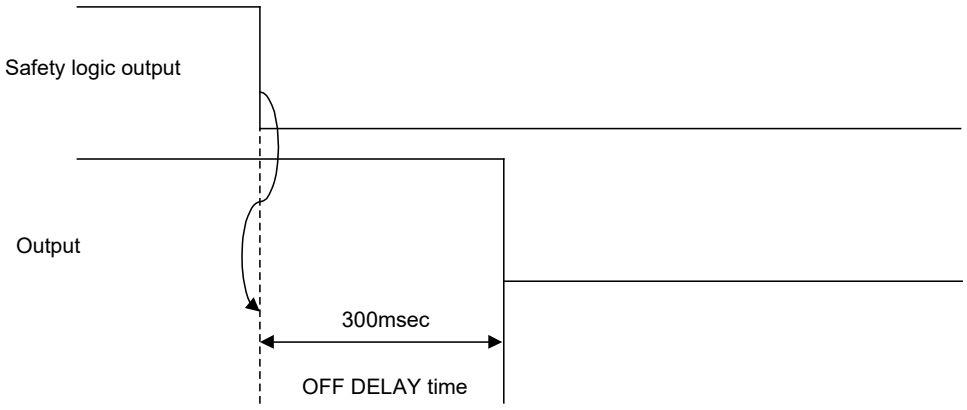
Set up the delay time of the output signal to use by the safety logic circuit.

In the TIMER DELAY, there are “ON DELAY TIME” to delay the ON output and “OFF DELAY TIME” to delay the OFF output . It can be four timer settings.

When setting the 500msec to ON DELAY TIME,



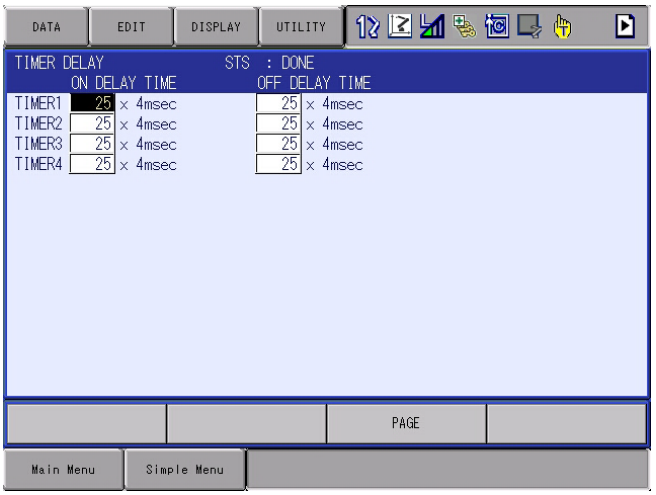
When setting the 300msec to OFF DELAY TIME,



The initial value is 100(25 × 4)[msec]. It is able to set every 4msec up to 399,996 (99,999 × 4)[msec].

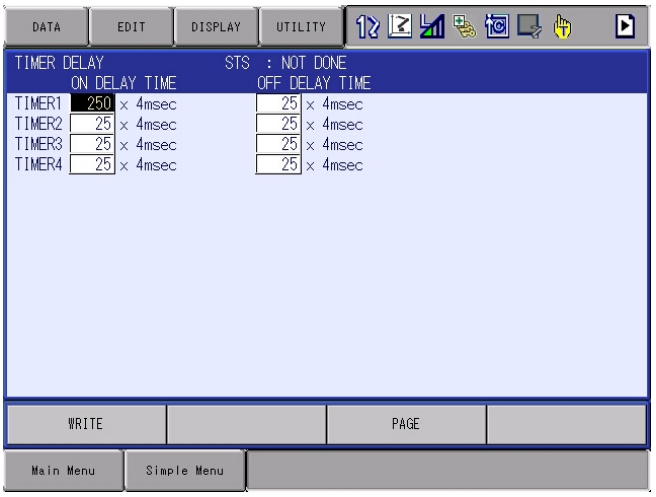
1. Displaying the window.

   – Select {TIMER DELAY} from {SAFETY FUNC.} in the main menu.



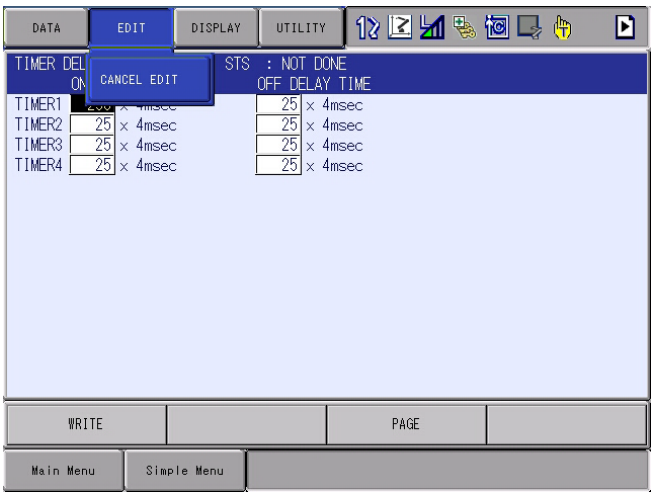
2. Set up the delay time.

   – Set the value of the delay timer to use.
   After the setting, the status changes from “DONE” to “NOT DONE”.
   {WRITE} is shown on the left down corner of the screen.



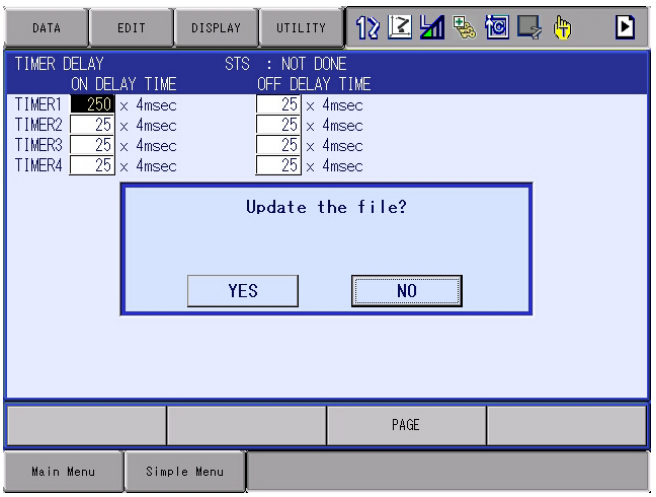
3. Canceling the edit

   – To start over the editing, select {CANCEL EDIT} from {EDIT} in the pull-down menu.

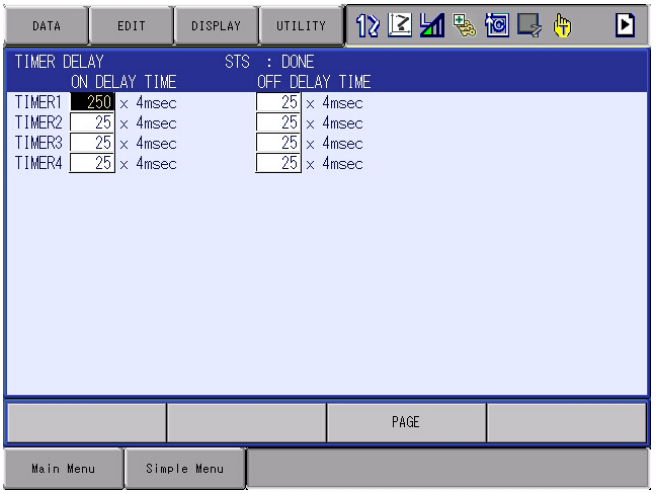


4. Transferring or updating the file

   – After editing, select {WRITE}.
   The file is transferred to the safety circuit board. When the file transfer is done correctly, the confirmation dialog “Update the file?” appears.



– Press {YES}, and then the file is updated.
The safety logic circuit file which has been transferred to the safety circuit board is written in the FLASH ROM.
The status becomes “DONE” from “NOT DONE”.

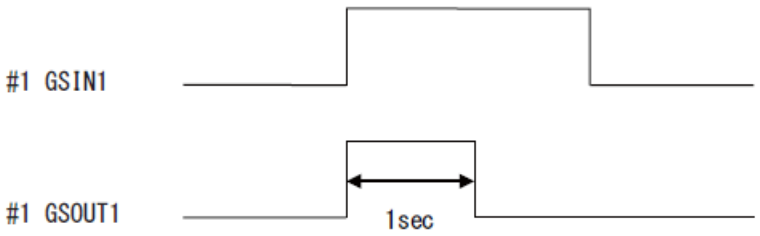


NOTE

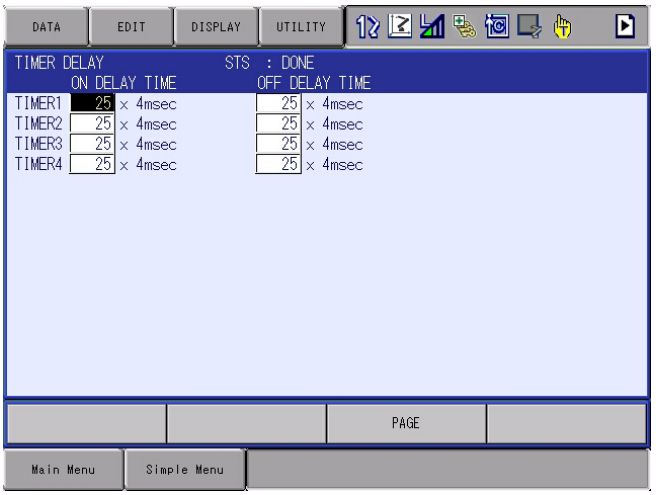
- If press “YES” on the confirmation dialog, the all information related to the safety logic circuit is transferred as the safety logic circuit file to the safety circuit board and written in the FLASH ROM of the safety circuit board.
- If select {WRITE}, the all output signals output from the safety circuit board are turned OFF until the writing process is completed.

8.26.10 Timer

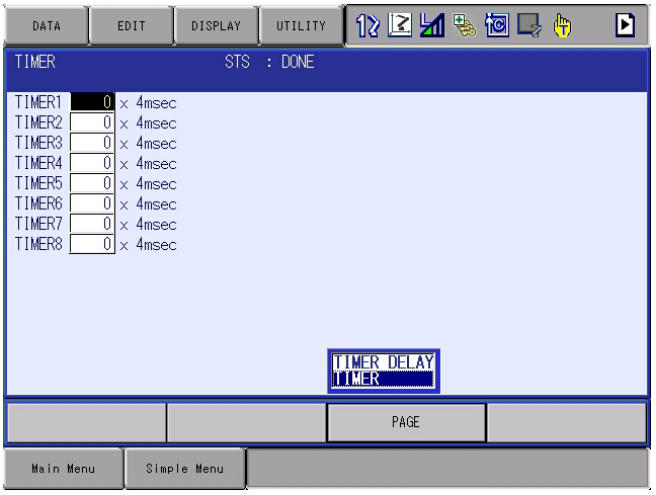
Set the width of the pulse output from the safety logic circuit by TIMER. When the GP safety input signal is ON, one-second one-shot signal is output from the GP safety output signal.



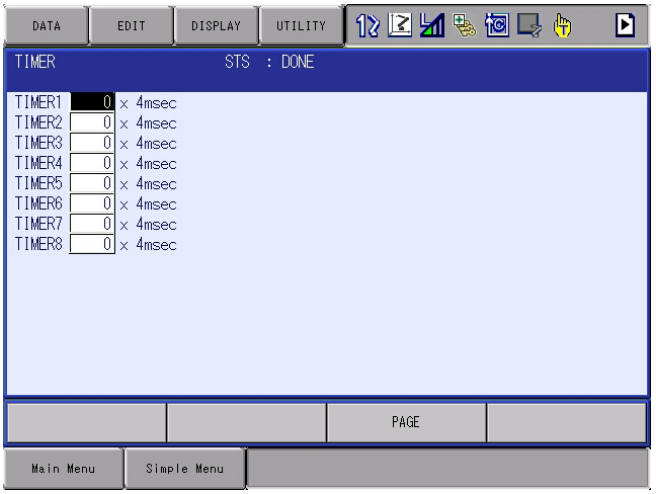
1. Select {SAFETY FUNC.}-{TIMER DELAY}.



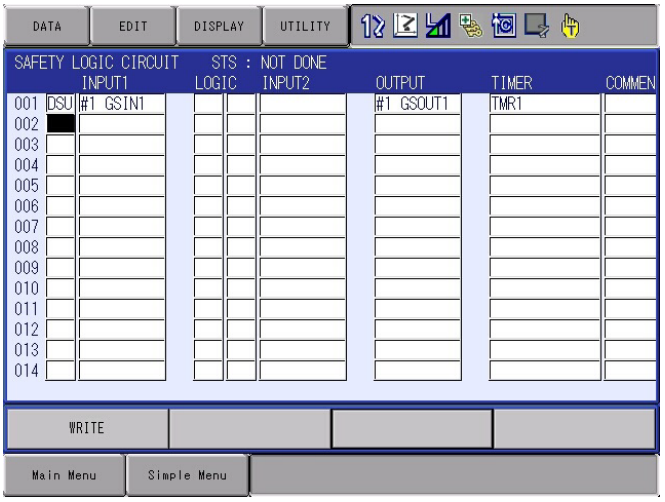
2. Select {PAGE}-{TIMER}.



3. Input “250” at TIMER1.



4. Create the following safety logic circuit.
   001 DSU #1GSIN1 #1 GSOUT1 TMR1



5. When the edit is done, select {WRITE}.

   – The safety logic circuit file is transferred to the safety circuit board.

6. If the transfer is correctly done, the confirmation dialog “Update the file?” shows up. Select {YES}.

   – The safety logic circuit file is updated.

   – The safety logic circuit file which has been transferred to the safety circuit board is written in the FLASH ROM. The status becomes “DONE” from “NOT DONE”.

NOTE

- If press “YES” on the confirmation dialog, the all information related to the safety logic circuit is transferred as the safety logic circuit file to the safety circuit board and written in the FLASH ROM of the safety circuit board.
- If select {WRITE}, the all output signals output from the safety circuit board are turned OFF until the writing process is completed.

8.26.11 Output Signal

The following signals can either be hard-wired or be controlled by the safety logic circuit.

Expanded signal name	Hard-wired signal name	Explanation
S-EXDSW	None	• This is the external enable switch signal and functions only in the teach mode. • When both the S-EXDSW signal and the enable switch on the programming pendant are ON, the servo power can be turned ON. • When the S-EXDSW signal is not used in the safety logic circuit, the safety circuit board regards this as the short-circuit status.
S-EXESP	EXESP	• This is the external emergency stop input signal. • When the S-EXDSW signal is turned OFF, the signal performs the same control as the EXESP signal is turned OFF. • The hard-wired EXESP signal is always monitored. When either the EXESP signal or the S-EXESP signal is OFF, the servo power supply is turned OFF. • When the S-EXESP signal is not used in the safety logic circuit, the safety circuit board regards this as the short-circuit status.
S-FST	None	• This is the full speed mode signal. Refer to *chapter 8.26.3.1 "Full Speed Mode"* .
#n S-ONEN[x]	ON ENABLE[x]	This signal controls the servo power supply for each control group. (n indicates the number of the ASF01 board and x is 1 to 4. 4 points are available for one ASF01 board.) When the S-ONEN signal is input, the signal performs the same control as ON ENABLE signal. When the hard-wired signal (ON ENABLE) is input, the servo power supply for the appropriate control group is turned OFF. When the signal is turned ON, the servo ON is enabled.
S-SAFF	SAFF	• This is the safeguarding signal and functions only in the play mode. • When the S-SAFF signal is turned OFF, the signal performs the same control as the SAFF signal. The hard-wired SAFF signal is always monitored. When either the SAFF signal or the S-SAFF signal is OFF, the servo power supply is turned OFF.
S-SVON_EN	None	For details, refer to *chapter 8.26.13 "Enable Switch Link Function"* .
MS-OUT	None	This is the data to transfer the data created in the safety logic circuit to the functional safety function (optional).



The signals which has been controlled by a hardware are also always monitored. Thus, the safety function, which turns OFF the servo power supply when the error is detected, is maintained.

8.26.12 Display of the Message on the Programming Pendant

When the signals input by hard-wired or the request stop from the safety logic circuit stop the manipulator's operation, the messages on the programming pendant are changed as in the following table to recognize which signal stops the manipulator.

Signal name	Message on the programming pendant
None S-FST	- Full-speed test mode. (Safety Logical Circuit)
EXESP S-EXESP	Robot is stopped by external emergency stop. Robot is stopped by external emergency stop. (Safety Logical Circuit)
None S-EXDSW	- EXDSW signal is OFF.(Safety Logical Circuit)
SAFF S-SAFF	Safety guard is open. Safety guard is open. (Safety Logical Circuit)
#x ONENn #x S-ONENn	Servo ON enable signal (ON-EN) is OFF. Servo ON enable signal (ON-EN) is OFF. (Safety Logical Circuit)
None S-SVON_EN	- Servo ON enable signal is OFF. (Safety Logical Circuit)

(Note) The upper line: the message when the manipulator is stopped by the input of the hard-wired signal.

The lower line: the message when the manipulator is stopped by the signals input from the safety logic circuit.

None: The appropriate signals do not exist.

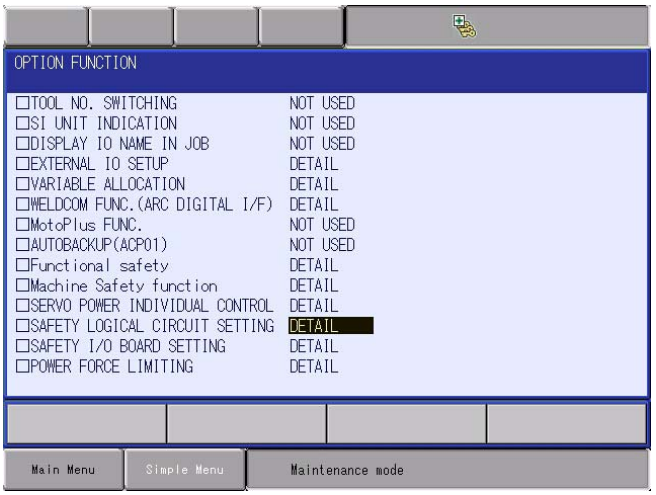
8.26.13 Enable Switch Link Function

This function is enabled only in the teach mode.
Normally in the teach mode, the servo power is turned ON when the enable switch is gripped while the servo ON LED on the programming pendant is flashing. However in this function, when the S-SVON_EN signal is enabled, the servo power is not turned ON unless the enable switch is gripped and the S-SVON_EN signal is turned ON.

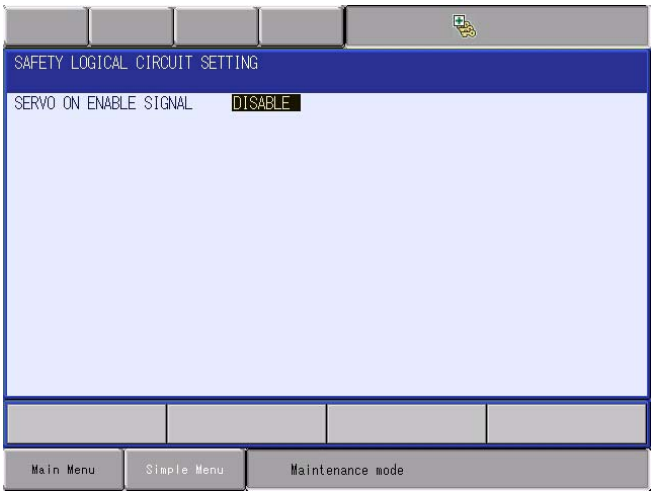
8.26.13.1 Setting of the Enable Switch Link Function

When using the enable switch link function, start up the maintenance and perform the following operations.

1. Display of the window
   – Turn the power ON while pressing [MAIN MENU] on the programming pendant.
2. Change the security
   – When the maintenance mode is started, Select {SECURITY} from {SYSTEM}.
3. Change to the safety mode.
   (1) Select {SAFETY MODE}.
   (2) Input the password for the safety mode and press [ENTER].
4. When the correct password is input, the mode is changed to {SAFETY MODE}.
   – After changing to the safety mode, the icon shown on the status area is changed to .
5. After changing the security, select each menu in the following order. {SYSTEM}, {SETUP}, {OPTION FUNCTION}, {SAFETY LOGICAL CIRCUIT SETTING}.



6. Press [SELECT] on the programming pendant and enable {SERVO ON ENABLE SIGNAL}.



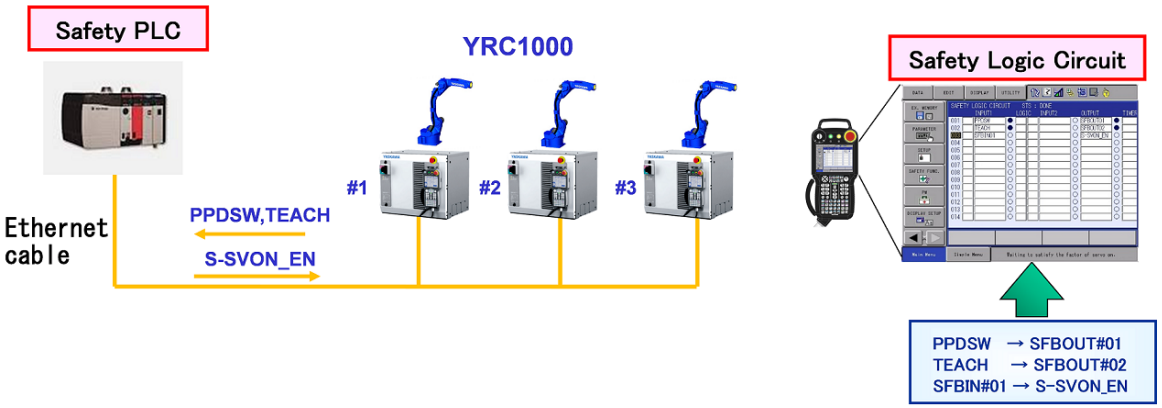
<Setting enable/disable of the servo ON enable signal>

- Enabled
  S-SVON_EN signal is available in the safety logic circuit function. For details, refer to *chapter 8.26.5 "Signal List Window"* .
- Disabled
  S-SVON_EN signal is not available in the safety logic circuit function. In this case, the signal name is not shown in the safety logic circuit.

8.26.13.2 Example of Use of the Enable Switch Link Function

The following is an example of using the optional safety PLC.

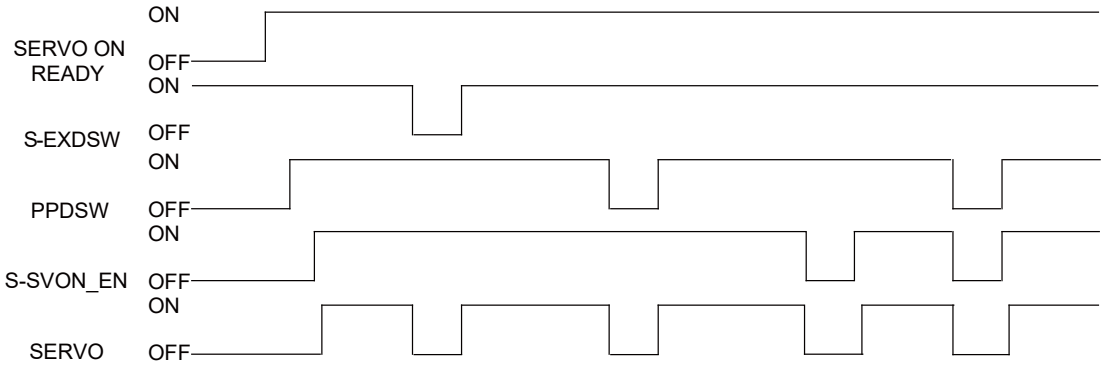
1. The enable switch signal on the programming pendant and the teach mode information are output to the safety PLC by the safety logic circuit. The value output from the safety PLC is input in the S-SVON_EN signal of the safety logic circuit.
2. When the S-SVON_EN signal is turned ON, the servo power is ON and when the enable switch is released, the signal is OFF.



The Servo ON/OFF Status When the Servo On Enable (S-SVON_EN) Signal is Enabled.

MODE	PPDSW	S-EXDSW	S-SVON_EN	Servo ON/OFF Status
TEACH	ON	ON	ON	Servo ON
TEACH	ON	Not Used	ON	Servo ON
TEACH	ON	Not Used	OFF	Servo OFF
TEACH	OFF	Not Used	ON	Servo OFF

*Note: Not Used means the S-EXDSW signal is not used as the output signal of the safety logic circuit.



The Timing Chart When the Servo On Enable (S-SVON_EN) Signal is Enabled.

NOTICE

- When this function is enabled, configure the circuit of the safety PLC (optional) to turn OFF the servo ON enable signal (S-SVON_EN) by releasing the Enable Switch of the programming pendant.

NOTE

If the S-EXDSW signal is used as the output signal of the safety logic circuit while the servo ON enable (S-SVON_EN) signal is disabled,

- If the Enable switch on the programming pendant is turned ON after the S-EXDSW signal is turned ON, the servo power is supplied to the manipulator.
- If the S-EXDSW signal is turned ON after the Enable switch on the programming pendant is turned ON, the servo power is not supplied to the manipulator.

8.26.14 Specific Input Signals Allocated to SPIN[xx]

32 signals input in the SPIN[xx] are allocated to specific input signals #40780 to #40817.
The signals input in the SPIN[xx] are available in the safety logic circuit.

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	Specific input 7	Specific input 6	Specific input 5	Specific input 4	Specific input 3	Specific input 2	Specific input 1
SPIN08	SPIN07	SPIN06	SPIN05	SPIN04	SPIN03	SPIN02	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	Specific input 15	Specific input 14	Specific input 13	Specific input 12	Specific input 11	Specific input 10	Specific input 9
SPIN16	SPIN15	SPIN14	SPIN13	SPIN12	SPIN11	SPIN10	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	Specific input 23	Specific input 22	Specific input 21	Specific input 20	Specific input 19	Specific input 18	Specific input 17
SPIN24	SPIN23	SPIN22	SPIN21	SPIN20	SPIN19	SPIN18	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	Specific input 31	Specific input 30	Specific input 29	Specific input 28	Specific input 27	Specific input 26	Specific input 25
SPIN32	SPIN31	SPIN30	SPIN29	SPIN28	SPIN27	SPIN26	SPIN25

WARNING

- SPIN is non-safety data. If a logic (AND, OR, etc.) is performed by using SPIN and another safety signal, the output result will be non-safety data. If SPIN is used for an application in which safety is required, the safety function will not be maintained. Thus, make sure to properly perform a risk evaluation of the robot system before using SPIN.

8.26.15 Output to the Control Status Signal

The following signals used in the safety logic circuit can be confirmed in the control status signals.

(1) #n GSIN [2]

(2) #n GSOUT [2]

(3) SFBIN[64]

(4) SFBOUT[64]

(5) MS-OUT[64]

(6) FS-OUT[64]

(7) #n FSBIN[8] / #n FSBIN[16]

(8) #n FSBOUT[8] / #n FSBOUT[16]

(9) #n PFLIN[32]

(10) #n PFLOUT[32]

80407	**80406**	**80405**	**80404**	**80403**	**80402**	**80401**	**80400**
GP safety Output signal	GP safety Output signal	GP safety Input signal	GP safety Input signal	GP safety Output signal	GP safety Output signal	GP safety Input signal	GP safety Input signal
GSOUT#2	GSOUT#1	GSIN#2	GSIN#1	GSOUT#2	GSOUT#1	GSIN#2	GSIN#1
ASF01#2	ASF01#2	ASF01#2	ASF01#2	ASF01#1	ASF01#1	ASF01#1	ASF01#1

80417	**80416**	**80415**	**80414**	**80413**	**80412**	**80411**	**80410**
GP safety Output signal	GP safety Output signal	GP safety Input signal	GP safety Input signal	GP safety Output signal	GP safety Output signal	GP safety Input signal	GP safety Input signal
GSOUT#2	GSOUT#1	GSIN#2	GSIN#1	GSOUT#2	GSOUT#1	GSIN#2	GSIN#1
ASF01#4	ASF01#4	ASF01#4	ASF01#4	ASF01#3	ASF01#3	ASF01#3	ASF01#3

80427	**80426**	**80425**	**80424**	**80423**	**80422**	**80421**	**80420**
GP safety Output signal	GP safety Output signal	GP safety Input signal	GP safety Input signal	GP safety Output signal	GP safety Output signal	GP safety Input signal	GP safety Input signal
GSOUT#2	GSOUT#1	GSIN#2	GSIN#1	GSOUT#2	GSOUT#1	GSIN#2	GSIN#1
ASF01#6	ASF01#6	ASF01#6	ASF01#6	ASF01#5	ASF01#5	ASF01#5	ASF01#5

80437	**80436**	**80435**	**80434**	**80433**	**80432**	**80431**	**80430**
GP safety Output signal	GP safety Output signal	GP safety Input signal	GP safety Input signal	GP safety Output signal	GP safety Output signal	GP safety Input signal	GP safety Input signal
GSOUT#2	GSOUT#1	GSIN#2	GSIN#1	GSOUT#2	GSOUT#1	GSIN#2	GSIN#1
ASF01#8	ASF01#8	ASF01#8	ASF01#8	ASF01#7	ASF01#7	ASF01#7	ASF01#7

80527	**80526**	**80525**	**80524**	**80523**	**80522**	**80521**	**80520**
Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus
SFBIN8	SFBIN7	SFBIN6	SFBIN5	SFBIN4	SFBIN3	SFBIN2	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

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	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus
SFBOUT32	SFBOUT31	SFBOUT30	SFBOUT29	SFBOUT28	SFBOUT27	SFBOUT26	SFBOUT25

80647	80646	80645	80644	80643	80642	80641	80640
Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus
SFBOUT40	SFBOUT39	SFBOUT38	SFBOUT37	SFBOUT36	SFBOUT35	SFBOUT34	SFBOUT33

80657	80656	80655	80654	80653	80652	80651	80650
Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus
SFBOUT48	SFBOUT47	SFBOUT46	SFBOUT45	SFBOUT44	SFBOUT43	SFBOUT42	SFBOUT41

80667	80666	80665	80664	80663	80662	80661	80660
Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus
SFBOUT56	SFBOUT55	SFBOUT54	SFBOUT53	SFBOUT52	SFBOUT51	SFBOUT50	SFBOUT49

80677	80676	80675	80674	80673	80672	80671	80670
Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus	Safety Field bus
SFBOUT64	SFBOUT63	SFBOUT62	SFBOUT61	SFBOUT60	SFBOUT59	SFBOUT58	SFBOUT57

80687	80686	80685	80684	80683	80682	80681	80680
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1

80697	80696	80695	80694	80693	80692	80691	80690
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1	ASF02#1/ ASU03#1

80707	80706	80705	80704	80703	80702	80701	80700
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2

80717	80716	80715	80714	80713	80712	80711	80710
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2	ASF02#2/ ASU03#2

80727	80726	80725	80724	80723	80722	80721	80720
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3

80737	80736	80735	80734	80733	80732	80731	80730
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3	ASF02#3/ ASU03#3

80747	80746	80745	80744	80743	80742	80741	80740
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4

80757	80756	80755	80754	80753	80752	80751	80750
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4	ASF02#4/ ASU03#4

80767	80766	80765	80764	80763	80762	80761	80760
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5

80777	80776	80775	80774	80773	80772	80771	80770
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5	ASF02#5/ ASU03#5

80787	80786	80785	80784	80783	80782	80781	80780
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6

80797	80796	80795	80794	80793	80792	80791	80790
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6	ASF02#6/ ASU03#6

80807	80806	80805	80804	80803	80802	80801	80800
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7

80817	80816	80815	80814	80813	80812	80811	80810
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7	ASF02#7/ ASU03#7

80827	80826	80825	80824	80823	80822	80821	80820
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN8	FSBIN7	FSBIN6	FSBIN5	FSBIN4	FSBIN3	FSBIN2	FSBIN1
ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8

80837	80836	80835	80834	80833	80832	80831	80830
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT8	FSBOUT7	FSBOUT6	FSBOUT5	FSBOUT4	FSBOUT3	FSBOUT2	FSBOUT1
ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#8	ASF02#8/ ASU03#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 MS-OUT16	Safety Logic Circuit MS-OUT15	Safety Logic Circuit MS-OUT14	Safety Logic Circuit MS-OUT13	Safety Logic Circuit MS-OUT12	Safety Logic Circuit MS-OUT11	Safety Logic Circuit MS-OUT10	Safety Logic Circuit MS-OUT9

81347	81346	81345	81344	81343	81342	81341	81340
Safety Logic Circuit MS-OUT24	Safety Logic Circuit MS-OUT23	Safety Logic Circuit MS-OUT22	Safety Logic Circuit MS-OUT21	Safety Logic Circuit MS-OUT20	Safety Logic Circuit MS-OUT19	Safety Logic Circuit MS-OUT18	Safety Logic Circuit MS-OUT17

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

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
81487	**81486**	**81485**	**81484**	**81483**	**81482**	**81481**	**81480**
GP safety Input signal FSBIN16 ASU03#1	GP safety Input signal FSBIN15 ASU03#1	GP safety Input signal FSBIN14 ASU03#1	GP safety Input signal FSBIN13 ASU03#1	GP safety Input signal FSBIN12 ASU03#1	GP safety Input signal FSBIN11 ASU03#1	GP safety Input signal FSBIN10 ASU03#1	GP safety Input signal FSBIN9 ASU03#1

81497	81496	81495	81494	81493	81492	81491	81490
GP safety Output signal FSBOUT16 ASU03#1	GP safety Output signal FSBOUT15 ASU03#1	GP safety Output signal FSBOUT14 ASU03#1	GP safety Output signal FSBOUT13 ASU03#1	GP safety Output signal FSBOUT12 ASU03#1	GP safety Output signal FSBOUT11 ASU03#1	GP safety Output signal FSBOUT10 ASU03#1	GP safety Output signal FSBOUT9 ASU03#1

81507	81506	81505	81504	81503	81502	81501	81500
GP safety Input signal FSBIN16 ASU03#2	GP safety Input signal FSBIN15 ASU03#2	GP safety Input signal FSBIN14 ASU03#2	GP safety Input signal FSBIN13 ASU03#2	GP safety Input signal FSBIN12 ASU03#2	GP safety Input signal FSBIN11 ASU03#2	GP safety Input signal FSBIN10 ASU03#2	GP safety Input signal FSBIN9 ASU03#2

81517	81516	81515	81514	81513	81512	81511	81510
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT16	FSBOUT15	FSBOUT14	FSBOUT13	FSBOUT12	FSBOUT11	FSBOUT10	FSBOUT9
ASU03#2	ASU03#2	ASU03#2	ASU03#2	ASU03#2	ASU03#2	ASU03#2	ASU03#2

81527	81526	81525	81524	81523	81522	81521	81520
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN16	FSBIN15	FSBIN14	FSBIN13	FSBIN12	FSBIN11	FSBIN10	FSBIN9
ASU03#3	ASU03#3	ASU03#3	ASU03#3	ASU03#3	ASU03#3	ASU03#3	ASU03#3

81537	81536	81535	81534	81533	81532	81531	81530
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT16	FSBOUT15	FSBOUT14	FSBOUT13	FSBOUT12	FSBOUT11	FSBOUT10	FSBOUT9
ASU03#3	ASU03#3	ASU03#3	ASU03#3	ASU03#3	ASU03#3	ASU03#3	ASU03#3

81547	81546	81545	81544	81543	81542	81541	81540
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN16	FSBIN15	FSBIN14	FSBIN13	FSBIN12	FSBIN11	FSBIN10	FSBIN9
ASU03#4	ASU03#4	ASU03#4	ASU03#4	ASU03#4	ASU03#4	ASU03#4	ASU03#4

81557	81556	81555	81554	81553	81552	81551	81550
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT16	FSBOUT15	FSBOUT14	FSBOUT13	FSBOUT12	FSBOUT11	FSBOUT10	FSBOUT9
ASU03#4	ASU03#4	ASU03#4	ASU03#4	ASU03#4	ASU03#4	ASU03#4	ASU03#4

81567	81566	81565	81564	81563	81562	81561	81560
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN16	FSBIN15	FSBIN14	FSBIN13	FSBIN12	FSBIN11	FSBIN10	FSBIN9
ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5

81577	81576	81575	81574	81573	81572	81571	81570
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT16	FSBOUT15	FSBOUT14	FSBOUT13	FSBOUT12	FSBOUT11	FSBOUT10	FSBOUT9
ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5

81587	81586	51585	81584	81583	81582	81581	81580
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN16	FSBIN15	FSBIN14	FSBIN13	FSBIN12	FSBIN11	FSBIN10	FSBIN9
ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6

81577	81576	81575	81574	81573	81572	81571	81570
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT16	FSBOUT15	FSBOUT14	FSBOUT13	FSBOUT12	FSBOUT11	FSBOUT10	FSBOUT9
ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5	ASU03#5

81587	81586	51585	81584	81583	81582	81581	81580
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN16	FSBIN15	FSBIN14	FSBIN13	FSBIN12	FSBIN11	FSBIN10	FSBIN9
ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6

81597	81596	81595	81594	81593	81592	81591	81590
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT16	FSBOUT15	FSBOUT14	FSBOUT13	FSBOUT12	FSBOUT11	FSBOUT10	FSBOUT9
ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6	ASU03#6

81607	81606	81605	81604	81603	81602	81601	81600
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN16	FSBIN15	FSBIN14	FSBIN13	FSBIN12	FSBIN11	FSBIN10	FSBIN9
ASU03#7	ASU03#7	ASU03#7	ASU03#7	ASU03#7	ASU03#7	ASU03#7	ASU03#7

81617	81616	81615	81614	81613	81612	81611	81610
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT16	FSBOUT15	FSBOUT14	FSBOUT13	FSBOUT12	FSBOUT11	FSBOUT10	FSBOUT9
ASU03#7	ASU03#7	ASU03#7	ASU03#7	ASU03#7	ASU03#7	ASU03#7	ASU03#7

81627	81626	81625	81624	81623	81622	81621	81620
GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal	GP safety Input signal
FSBIN16	FSBIN15	FSBIN14	FSBIN13	FSBIN12	FSBIN11	FSBIN10	FSBIN9
ASU03#8	ASU03#8	ASU03#8	ASU03#8	ASU03#8	ASU03#8	ASU03#8	ASU03#8

81637	81636	81635	81634	81633	81632	81631	81630
GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal	GP safety Output signal
FSBOUT16	FSBOUT15	FSBOUT14	FSBOUT13	FSBOUT12	FSBOUT11	FSBOUT10	FSBOUT9
ASU03#8	ASU03#8	ASU03#8	ASU03#8	ASU03#8	ASU03#8	ASU03#8	ASU03#8

81647	81646	81645	81644	81643	81642	81641	81640
PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal
PFLIN8	PFLIN7	PFLIN6	PFLIN5	PFLIN4	PFLIN3	PFLIN2	PFLIN1
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81657	81656	81655	81654	81653	81652	81651	81650
PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal
PFLIN16	PFLIN15	PFLIN14	PFLIN13	PFLIN12	PFLIN11	PFLIN10	PFLIN9
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81667	81666	81665	81664	81663	81662	81661	81660
PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal
PFLIN24	PFLIN23	PFLIN22	PFLIN21	PFLIN20	PFLIN19	PFLIN18	PFLIN17
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81677	81676	81675	81674	81673	81672	81671	81670
PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal
PFLIN32	PFLIN31	PFLIN30	PFLIN29	PFLIN28	PFLIN27	PFLIN26	PFLIN25
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81687	81686	81685	81684	81683	81682	81681	81680
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT8	PFLOUT7	PFLOUT6	PFLOUT5	PFLOUT4	PFLOUT3	PFLOUT2	PFLOUT1
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81697	81696	81695	81694	81693	81692	81691	81690
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT16	PFLOUT15	PFLOUT14	PFLOUT13	PFLOUT12	PFLOUT11	PFLOUT10	PFLOUT9
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81707	81706	81705	81704	81703	81702	81701	81700
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT24	PFLOUT23	PFLOUT22	PFLOUT21	PFLOUT20	PFLOUT19	PFLOUT18	PFLOUT17
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81717	81716	81715	81714	81713	81712	81711	81710
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT32	PFLOUT31	PFLOUT30	PFLOUT29	PFLOUT28	PFLOUT27	PFLOUT26	PFLOUT25
ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1	ASF04#1

81727	81726	81725	81724	81723	81722	81721	81720
PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal
PFLIN8	PFLIN7	PFLIN6	PFLIN5	PFLIN4	PFLIN3	PFLIN2	PFLIN1
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

81737	81736	81735	81734	81733	81732	81731	81730
PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal
PFLIN16	PFLIN15	PFLIN14	PFLIN13	PFLIN12	PFLIN11	PFLIN10	PFLIN9
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

81747	81746	81745	81744	81743	81742	81741	81740
PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal
PFLIN24	PFLIN23	PFLIN22	PFLIN21	PFLIN20	PFLIN19	PFLIN18	PFLIN17
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

81757	81756	81755	81754	81753	81752	81751	81750
PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal	PFL function Input signal
PFLIN32	PFLIN31	PFLIN30	PFLIN29	PFLIN28	PFLIN27	PFLIN26	PFLIN25
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

81767	81766	81765	81764	81763	81762	81761	81760
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT8	PFLOUT7	PFLOUT6	PFLOUT5	PFLOUT4	PFLOUT3	PFLOUT2	PFLOUT1
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

81777	81776	81775	81774	81773	81772	81771	81770
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT16	PFLOUT15	PFLOUT14	PFLOUT13	PFLOUT12	PFLOUT11	PFLOUT10	PFLOUT9
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

81787	81786	81785	81784	81783	81782	81781	81780
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT24	PFLOUT23	PFLOUT22	PFLOUT21	PFLOUT20	PFLOUT19	PFLOUT18	PFLOUT17
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

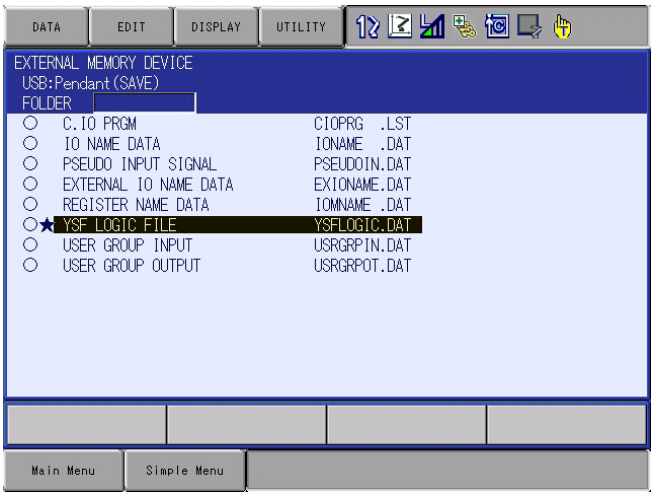
81797	81796	81795	81794	81793	81792	81791	81790
PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal	PFL function Output signal
PFLOUT32	PFLOUT31	PFLOUT30	PFLOUT29	PFLOUT28	PFLOUT27	PFLOUT26	PFLOUT25
ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2	ASF04#2

8.26.16 Saving or Loading the File

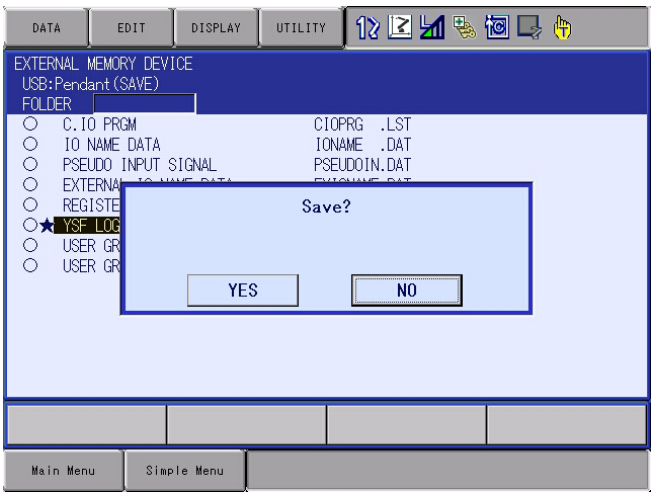
8.26.16.1 Saving the File

The safety logic circuit file can be saved into the SD card/USB memory stick of the programming pendant or the USB memory stick of the CPU board. Make sure the medium is inserted into the device of the save destination. Perform the following operations.

1. Display of the window.
   – Select each menu in the following order.
   {EX. MEMORY}, {SAVE}, {I/O DATA}.
2. The signal list relative to the I/O data is displayed, and then select “YSF LOGIC FILE”.



3. The confirmation dialog appears, and select “YES”.

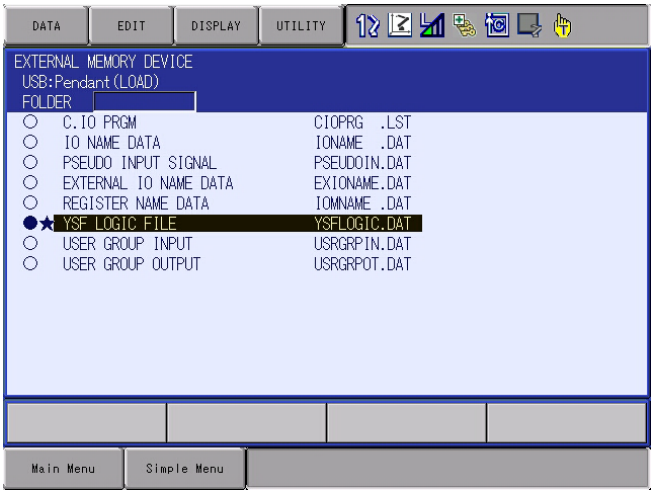


4. The safety logic circuit file (file name:YSFLOGIC.DAT) is saved in the specified device.

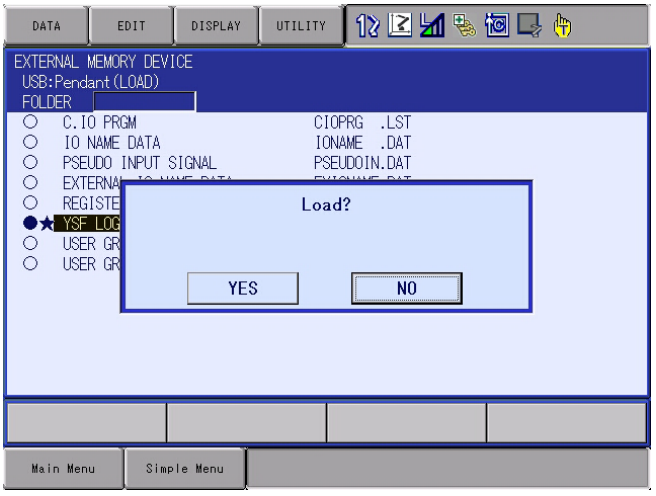
8.26.16.2 Loading the File

The safety logic circuit file can be loaded from the SD card/USB memory stick of the programming pendant or the USB memory stick of the CPU board. Make sure the medium is inserted into the device of the load destination. Perform the following operations.

1. Display of the window.
   – Select each menu in the following order.
   {EX. MEMORY}, {LOAD}, {I/O DATA}.
2. The signal list relative to the I/O data is displayed, and then select “YSF LOGIC FILE”.



3. The confirmation dialog appears, and select “YES”.



4. The safety logic circuit file (file name:YSFLOGIC.DAT) is loaded from the specified device.

NOTE

When the safety logic circuit file is loaded, the file is not transferred to the safety circuit board. Select {WRITE} on the safety logic circuit window, and the file is written in the FLASH ROM of the safety circuit board.
After the writing, the file is executed.

8.26.17 Initializing the Safety Logic Circuit File

If the following alarm is shown when starting the YRC1000, the mode is changed to the management mode. The alarm occurs when the file does not match the file written in the FLASH ROM of the safety circuit board. For example, if the safety circuit board is replaced with the spared part, the following alarm will occur.

When the alarm occurs, perform the following procedures to restore.

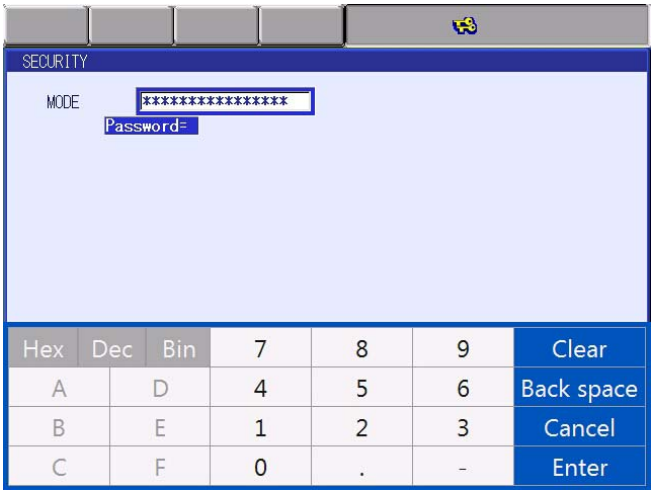


8.26.17.1 Initializing the Safety Logic Circuit File

1. Display the window.
   – Select {SEECURITY} from {SYSTEM} in the main menu.
2. Change the security.
   (1) Select {SAFETY MODE}.



(2) Enter the password for the safety mode, and press {ENTER}.



3. When the entered password is correct, the mode is changed to {SAFETY MODE}.

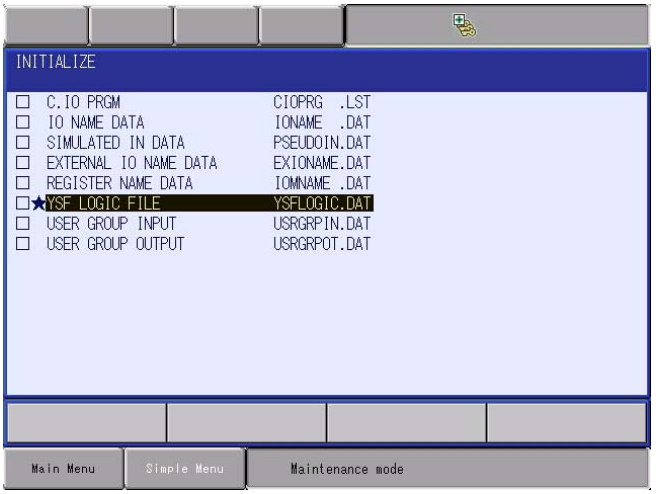
– After changing to the safety mode, the icon shown on the status area becomes .



4. Select the file to be initialized.

   (1) Select each menu in the following order.
   {FILE}, {INITIALIZE}, {I/O DATA}.

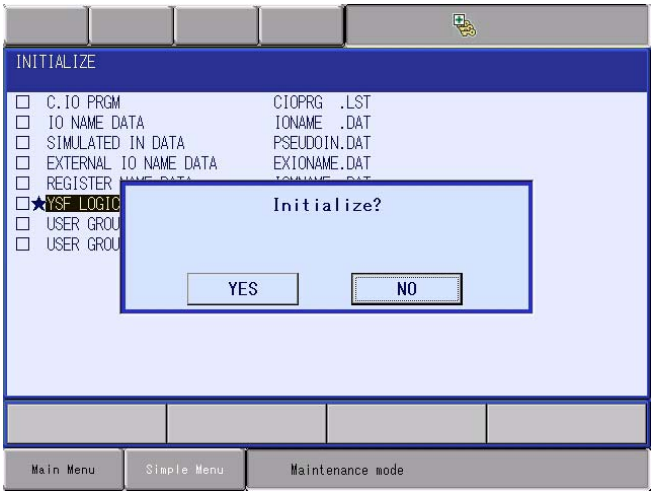
   (2) The I/O data file list is shown, and then select “YSF LOGIC FILE”.



5. Perform the initialization.

   (1) Select {ENTER}.

   – The confirmation dialog appears.



   (2) Select {YES}.

   – The file written in the FLASH ROM of the safety circuit board is initialized.

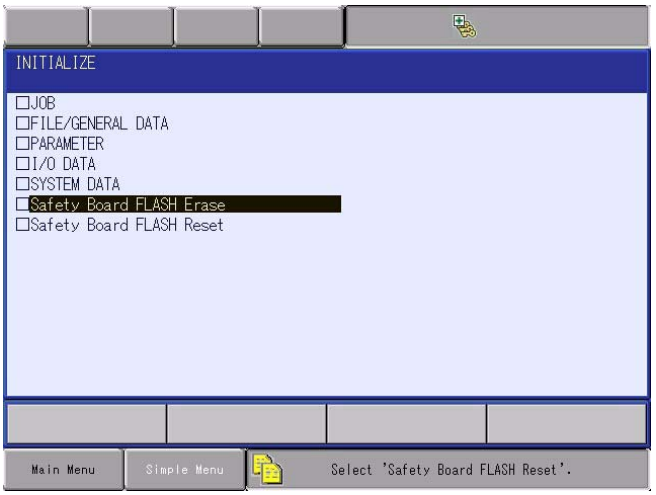
8.26.17.2 Safety Circuit Board FLASH ROM Data Erase and Reset

A safety logic circuit file written in the FLASH ROM of the safety circuit board can be cleared. After erasing, a safety logic circuit file can be transferred to the safety circuit board and written in the FLASH ROM. These clear/reset operations are explained in the following.

■ **Safety Circuit Board FLASH ROM Data Erase**

1. Display of the window.

(1) Select each menu in the following order.
{FILE}, {INITIALIZE}, {Safety Circuit Board FLASH Erase}.



(2) The confirmation dialog appears, and select {YES}.

– The safety logic circuit file written in the FLASH ROM of the safety circuit board is cleared.

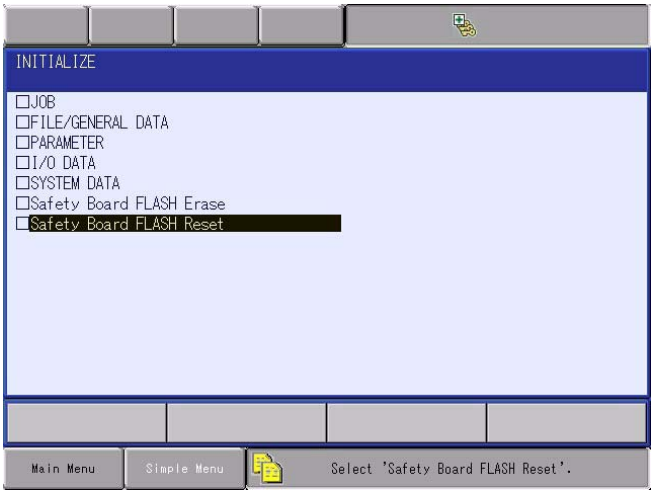
NOTE

After performing the “Safety Circuit Board FLASH Erase”, and turning the YRC1000 power supply ON/OFF. Next time when turning the power supply ON, the alarm “0300: VERIFY ERROR (SYSTEM CONFIG-DATA) [10]” occurs. Therefore, when performing the “Safety Circuit Board FLASH Erase”, the “Safety FLASH Restart” needs to be performed as well.

■ **Safety FLASH Reset**

1. Displaying the window.

(1) Select each menu in the following order.
{FILE}, {INITIALIZE}, {Safety Circuit Board FLASH Reset}



(2) The confirmation dialog appears, and select {YES}.

– The safety logic circuit file is transferred and written in the FLASH ROM of the safety circuit board.

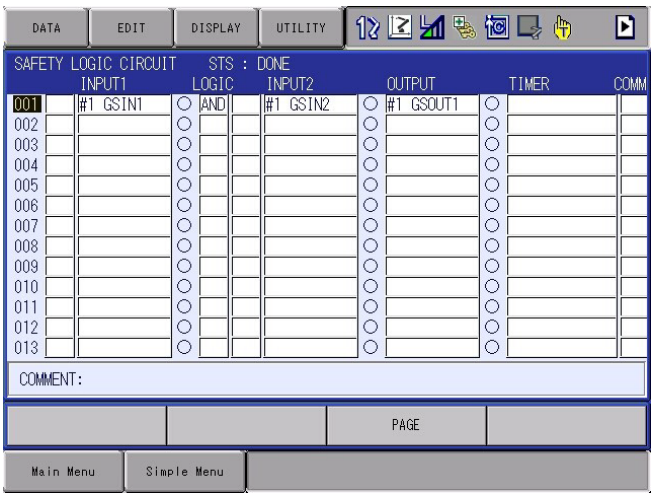
8.26.18 Example of Safety Logic Circuit

The followings are the examples of the safety logic circuit.

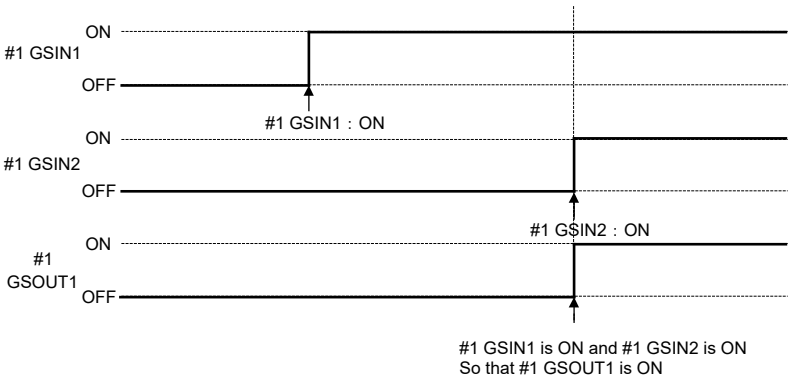
<The safety logic circuit: example 1>

This is the example of the setting to output from the GP safety output signal1(#1 GSOUT1) while the GP safety input signal1(#1 GSIN1)and 2(#2 GSIN2) are ON.

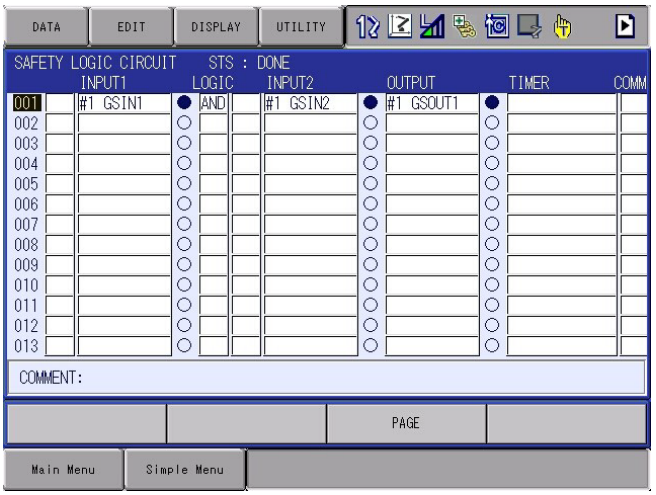
1. The following safety logic circuit is created.
   - Signal1 : GP safety input signal1(#1 GSIN1)
   - Signal2 : GP safety input signal2(#2 GSIN2)
   - Logic : AND
   - Output signal : GP safety output signal1(#1 GSOUT1)



2. The time chart is shown.



3. Verifying the safety logic circuit.
   Switch ON the GP safety signal “1” and “2”.
   The mark “◯” becomes “ ● “.



<The safety logic circuit: example 2>

In the following example, one second after the emergency button of the programming pendant (PPESP) is pressed and the GP safety input signal1 is OFF, the GP safety output signal1(#1 GSOUT1) is turned ON.

1. The following safety logic circuit is created.

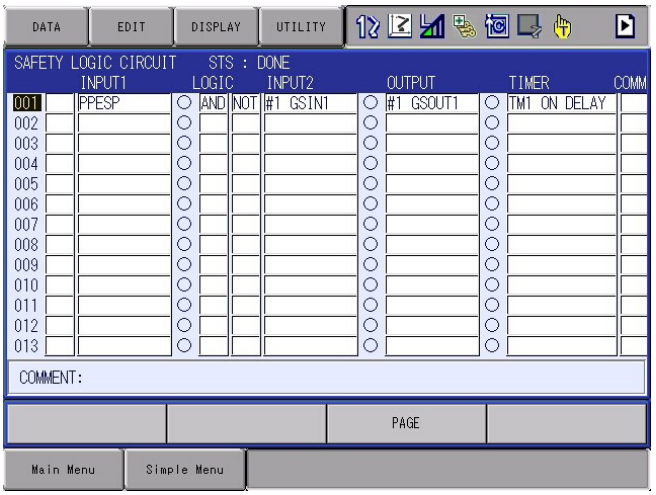
   • Signal 1 : Programming pendant emergency stop (PPESP)

   • Signal 2 : NOT GP safety input signal 1 (#1 GSIN1)

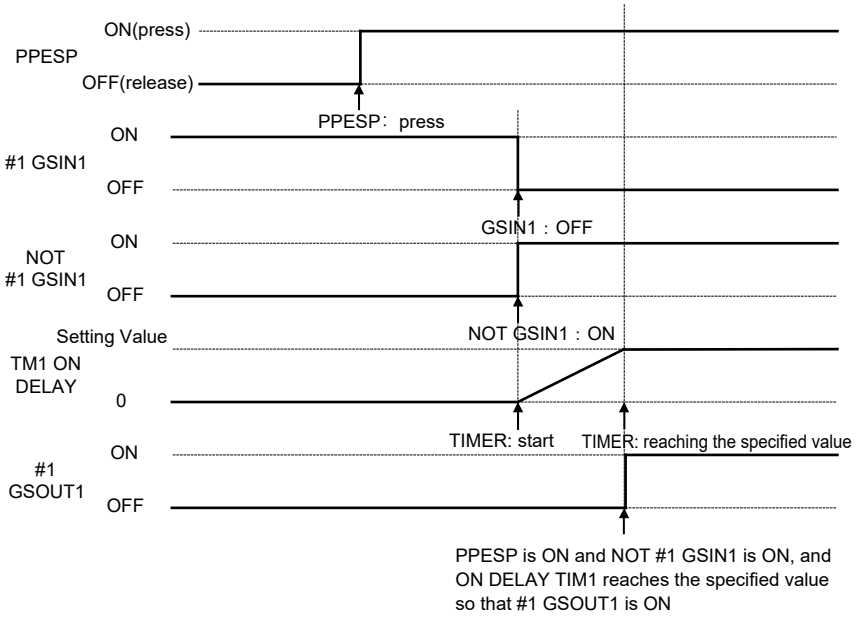
   • Logic : AND

   • Output signal : GP safety output signal 0 (#1 GSOUT0)

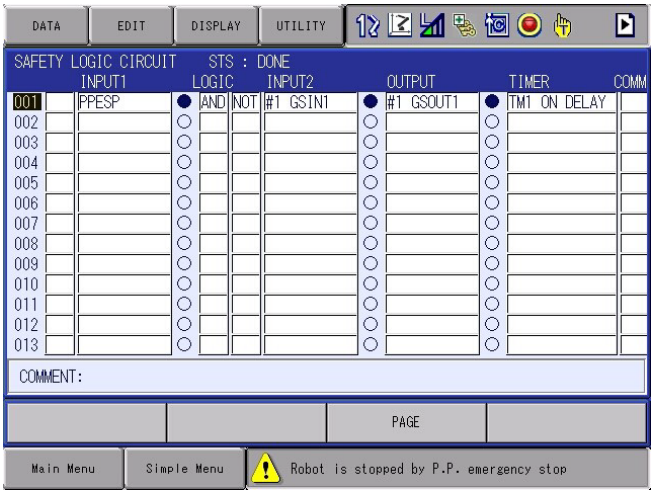
   • Timer : ON delay timer1 (TM1 ON DELAY) 1 second



2. The time chart is shown.



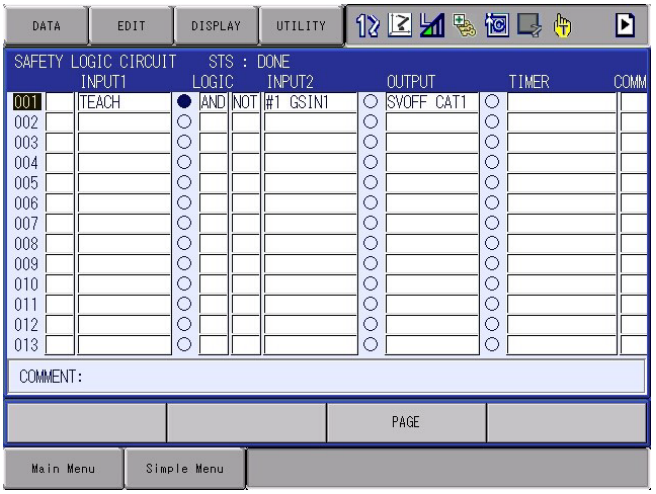
3. Verifying the safety logic circuit.
   Confirm that the mark "◯" becomes "●" when pressing the programming pendant and switching the GP safety signal ON. The mark "◯" of the GP safety output signal 1 becomes "●" after one second passed.



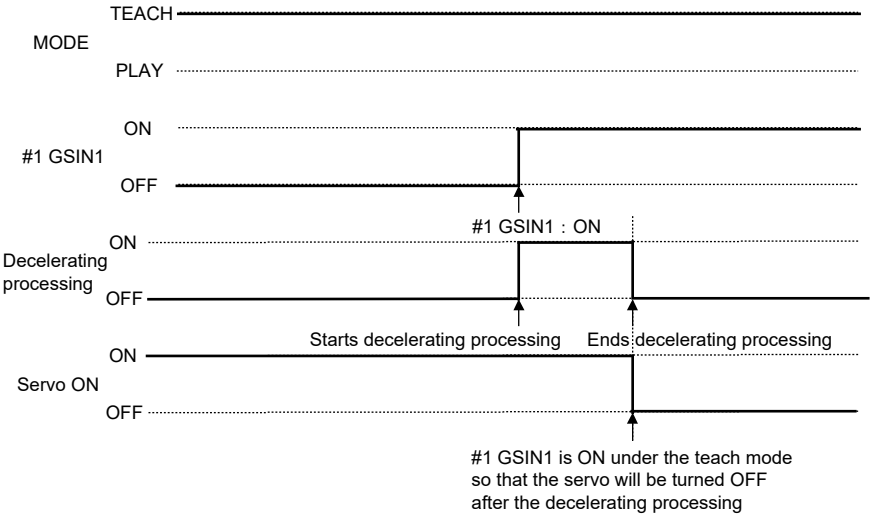
<The safety logic circuit: example 3>

In the following example, when the GP safety input signal1 (#1 GSIN1)is ON under the teaching mode, the manipulator decelerates and stops its operation.

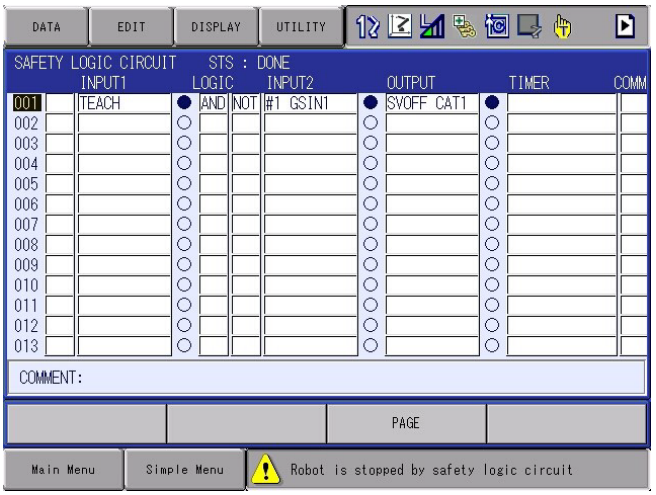
1. The following safety logic circuit is created.
   - Signal 1 : Teach mode (TEACH)
   - Signal 2 : GP safety input signal 1 (#1 GSIN1)
   - Logic : AND
   - Output signal : Manipulator deceleration to a stop (SVOFF CAT1)



2. The time chart is shown.

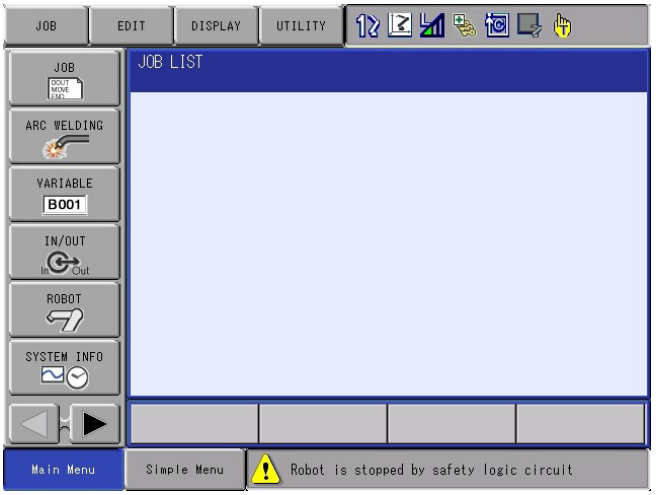


3. Verifying the safety logic circuit.
   Set up the teach mode, and turn the servo ON. After that, when the GP safety signal 1 is turned ON, the mark "◯" becomes "●"and the manipulator decelerates and stops its operation. If the manipulator stops its operation by the safety logic circuit, the message "Robot is stopped by safety logic circuit" is shown on the message area of the programming pendant.



NOTE

For the safety logic circuit of the YRC1000, even if the manipulator deceleration to a stop (SVOFF CAT1) is turned ON, the manipulator stops its operation instantly without decelerating. Under the play mode, if the manipulator deceleration to a stop (SVOFF CAT1) is turned ON, the manipulator decelerates and stops its operation.



NOTE

When the manipulator is stopped by the safety logic circuit signal, "Robot is stopped by safety logic circuit" is shown on the message area of the programming pendant.
The control status signal #80343(Robot stopped by safety logic circuit) is turned ON.

<The safety logic circuit: example 4>

The setting example by using the auxiliary relay is described below. While either status of the programming pendant emergency stop (PPESP), controller emergency stop (PBESP) or external emergency stop (EXESP) is stopped, the GP safety output signal 1 (#1 GSOUT1) is turned ON.

1. The following safety logic circuit is created

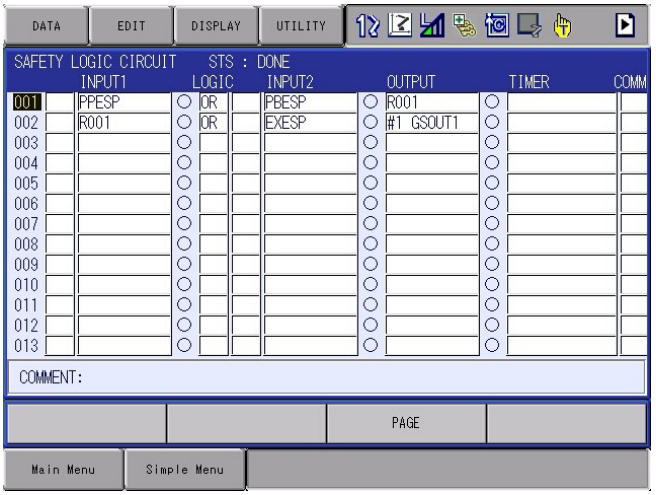
   • Signal 1 : Programming pendant emergency stop (PPESP)

   • Signal 2 : Controller emergency stop (PPESP)

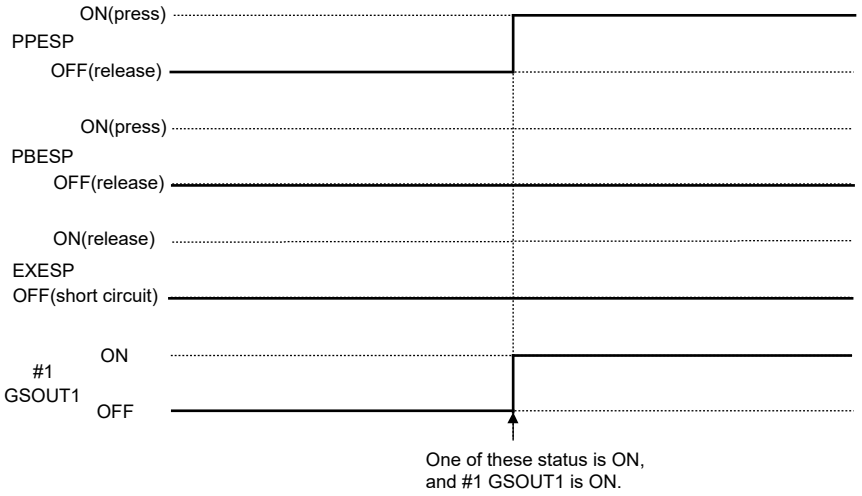
   • Signal 3 : External emergency stop (EXESP)

   • Logic : OR

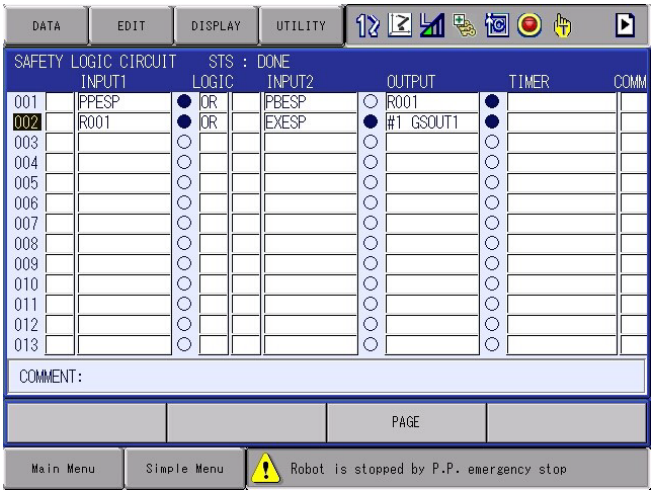
   • Output signal : GP safety output signal 1 (#1 GSOUT1) The display of “#1 GSOUT1” indicates “GSOUT1” of the first safety circuit board.



2. The time chart is shown.



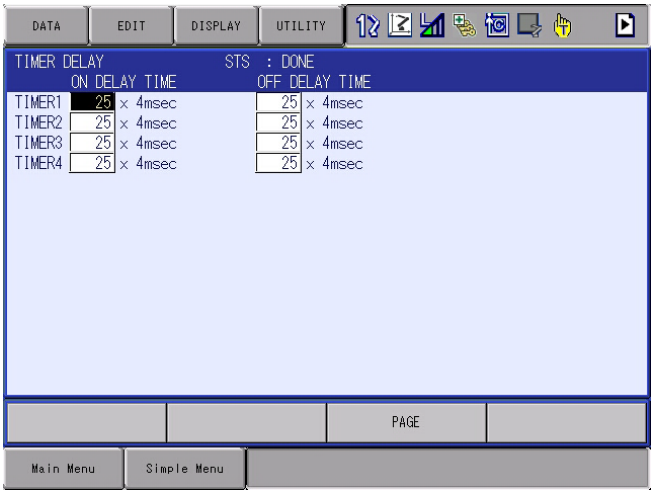
3. Verifying the safety logic circuit.
   When either the programming pendant emergency stop, controller emergency stop or the external emergency stop is input, the mark “O” of the GP safety output signal 1 becomes “ ● ”.



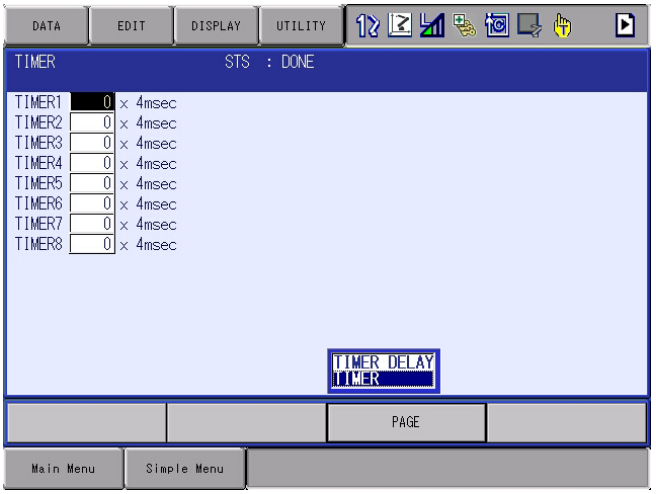
<The safety logic circuit: example 5>

The one-second one-shot output signal is created by the safety logic circuit. In the following example, the GP safety output signal (#1 GSOUT1) is ON for one second.

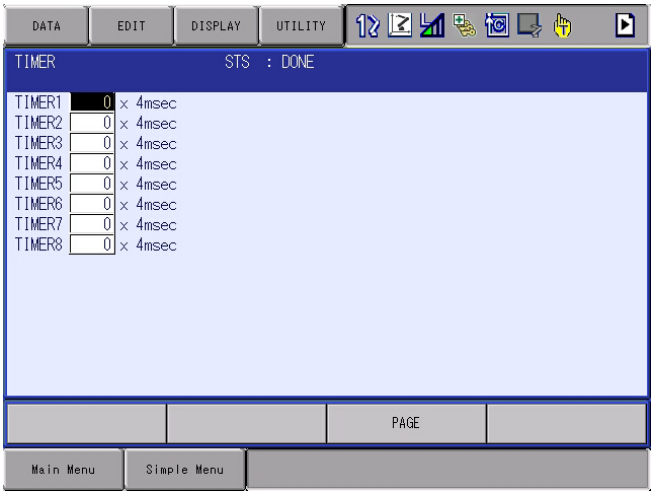
1. Select {SAFETY FUNC.} - {TIMER DELAY}.



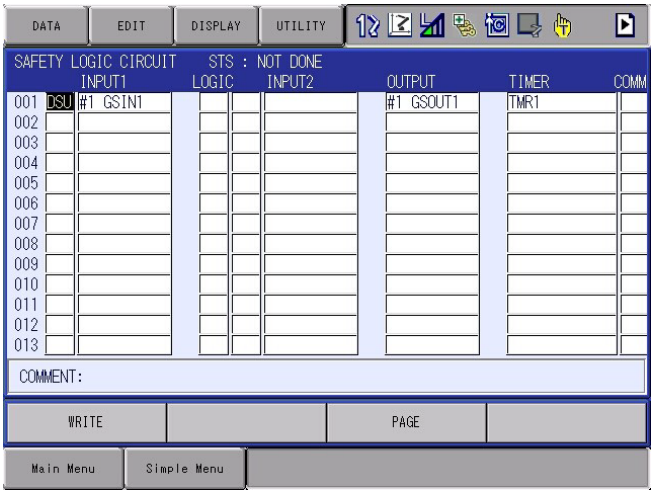
2. Select {PAGE} - {TIMER}.



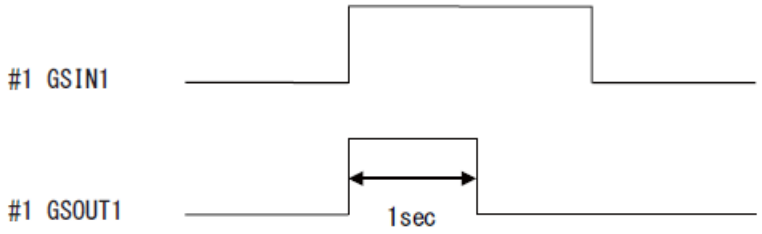
3. Input “250” at TIMER1.



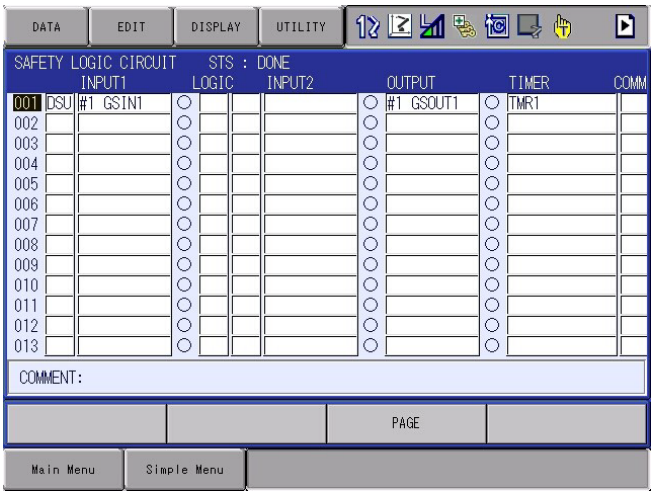
4. Create the following safety logic circuit.
   001 DSU #1GSIN1 #1 GSOUT1 TMR1



– When #1 GSIN 1 signal is turned ON, #1 GSOUT 1 is ON for one second.



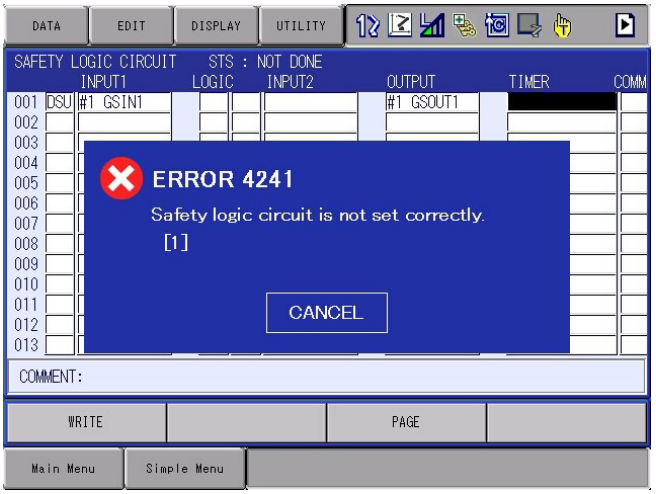
5. Select {WRITE} and then {CONFIRM} to enable the changed settings.



– When the data is updated correctly, the status on the title line is changed from “NOT DONE” to “DONE”.

NOTE

When using the DSU/DSD instruction, the timer (TMR) must be set to the output signal. If {WRITE} is press without setting the timer (TMR) to the output signal, the error message “ERROR 4241: Safety logic circuit is not set correctly” is shown on the message area of the programming pendant.



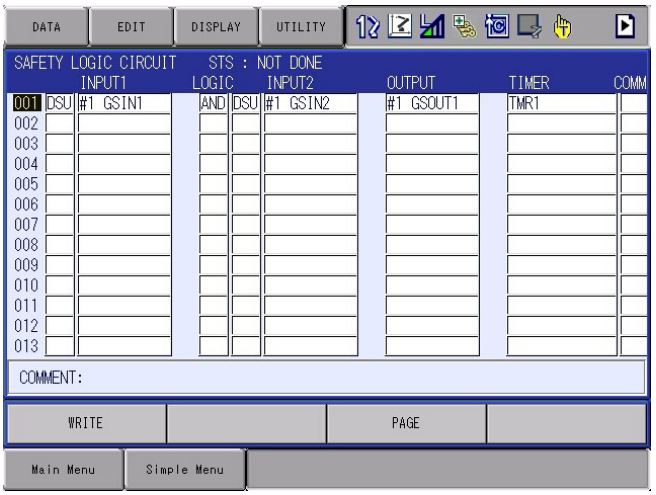
NOTICE

- When using the DSU or DSD instruction, the signal status turns to "●"only for 4 ms while the conditions are satisfied, but it is too short for visual check. Thus, display *chapter 8.26.5 "Signal List Window"* and the SAFETY LOGIC CIRCUIT window together to check the ON/OFF status of the input signal.

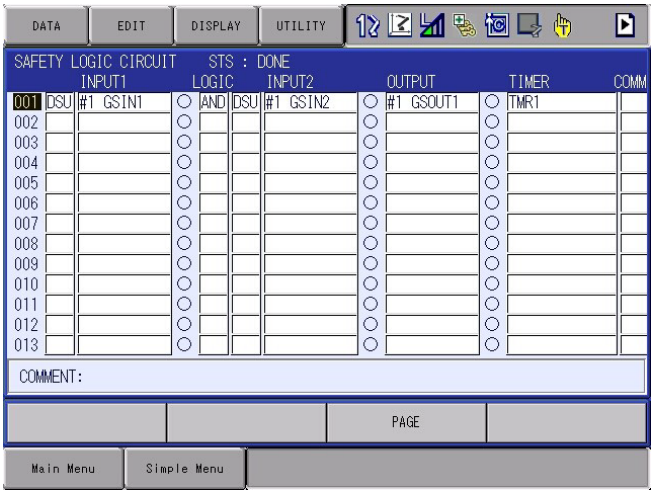
<The safety logic circuit: example 6>

The following is the setting example of the one-second one-shot output signal when two signals are turned ON at the same time.

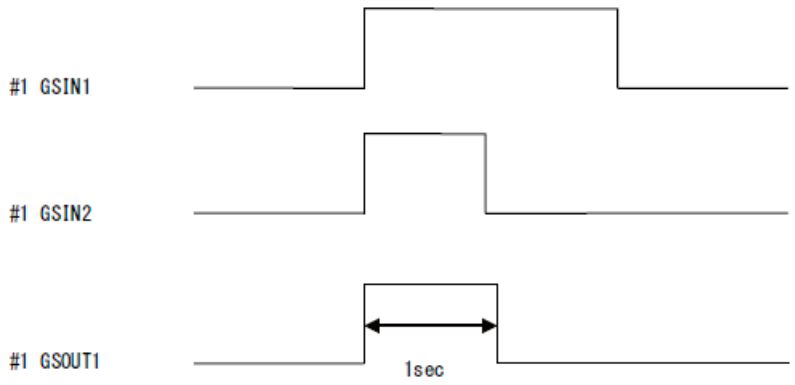
1. The following safety logic circuit is created.
   001 DSU #1 GSIN1 AND DSU #1 GSIN2 #1 GSOUT1 TMR1



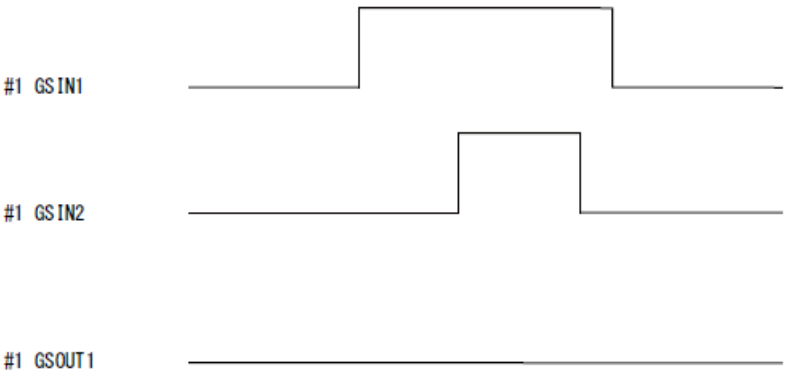
2. Select {WRITE} and then {CONFIRM} to enable the changed settings. When the data is updated correctly, the status on the title line is changed from "NOT DONE" to "DONE".



• When #1 GSIN 1 signal and #1 GSIN 2 signal are turned ON at the same time, #1GSOUT1 signal is ON for one second.



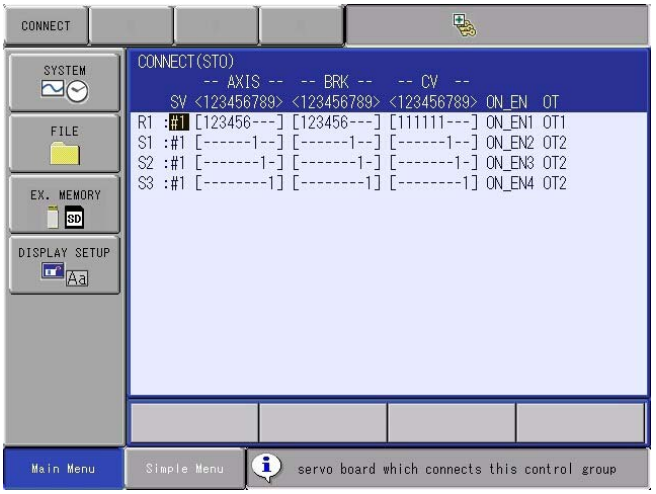
• When #1 GSIN 1 signal and #1 GSIN 2 signal are not turned ON at the same time, #1GSOUT1 signal remains OFF.



<The safety logic circuit: example 7>

In the following example, the servo power individual control function is set by the safety PLC (optional).

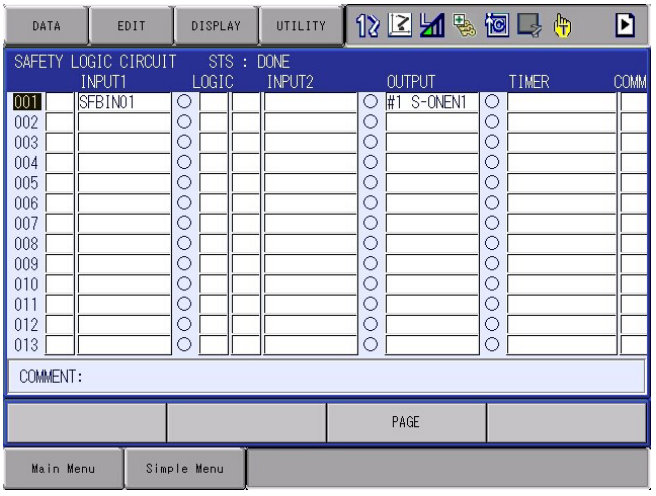
1. By pressing [MAIN MENU] on the programming pendant, start up the maintenance mode.
2. Select each menu in the following order.
   {SYSTEM}, {SETTING}, {CONTROL GROUP}. Check each control group is allocated to which ON ENABLE signal.



   – For the above example, the allocation of control group and ON ENABLE signal is the following.

     Control group R1 is allocated to ON ENABLE 1 signal (ON_EN1).
     Control group S1 is allocated to ON ENABLE 2 signal (ON_EN2).
     Control group S2 is allocated to ON ENABLE 3 signal (ON_EN3).
     Control group S3 is allocated to ON ENABLE 4 signal (ON_EN4).

3. Output the input1(SFBIN01)from the safety PLC (optional) to the S-ONEN 1. In this case, the hard-wired ON_ENABLE1 signal must short circuit.
4. The following safety logic circuit is created.
   01 SFBIN01 #1 S-ONEN1



5. When #1 S-ONEN1 is turned ON, the servo power of R1 is turned OFF.
   – The message “Servo ON enable signal (ON-EN) is OFF (Safety logic circuit)” is shown on the message area of the programming pendant.

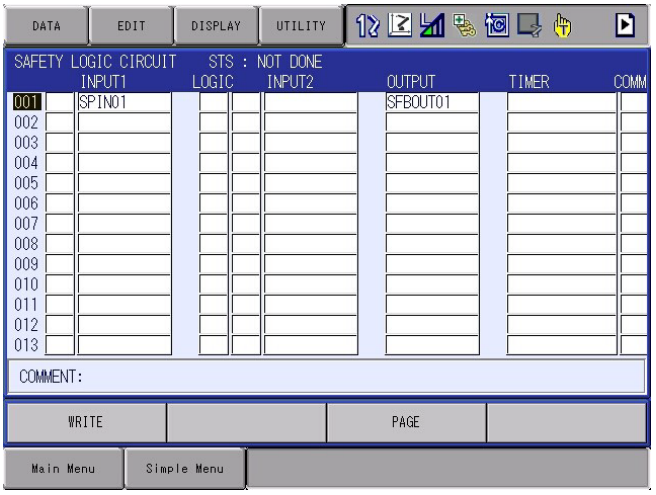
NOTE

- If the hard-wired ON_ENABLE signal and #n S-ONEN[x] signal of the safety logic circuit are used, the servo is turned ON only when the status of both signals is not the servo OFF. When the status of either signal or both signals is the servo OFF, the servo is not turned ON for the control group allocated to the ON_ENABLE signal.
- For details of the servo power individual control function, refer to “YRC1000 OPTIONS INSTRUCTIONS FOR INDEPENDENT/COORDINATED CONTROL FUNCTION (HW1484042) 8. Servo Power Individual Control Function”.

<The safety logic circuit: example 8>

In the following example, the specific input signal is output to the safety PLC (optional). The logic circuit to output the specific input1(#40780) to the safety PLC is created.

1. Select {SAFETY SIGNAL ALLOC} from {SAFETY FUNC.}.
   Set ASF01-E to SFBOUT01.
2. The following safety logic circuit is created.
   01 SPIN01 SFBOUT1

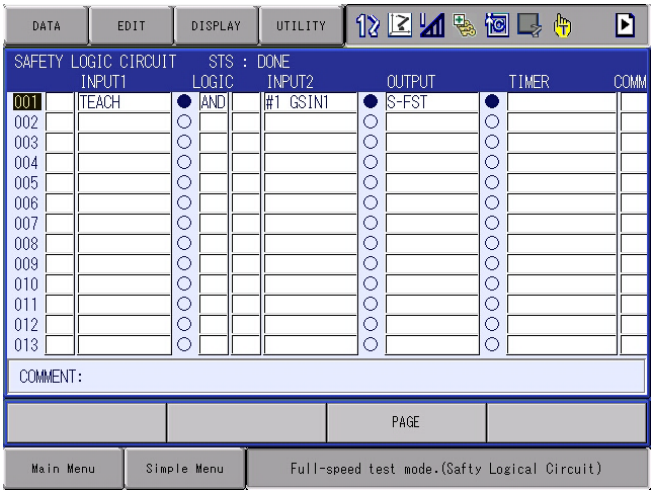


3. When #40780 is turned OFF, SFBOUT01 is also turned OFF.
   When #40780 is turned ON, SFBOUT01 is turned ON.

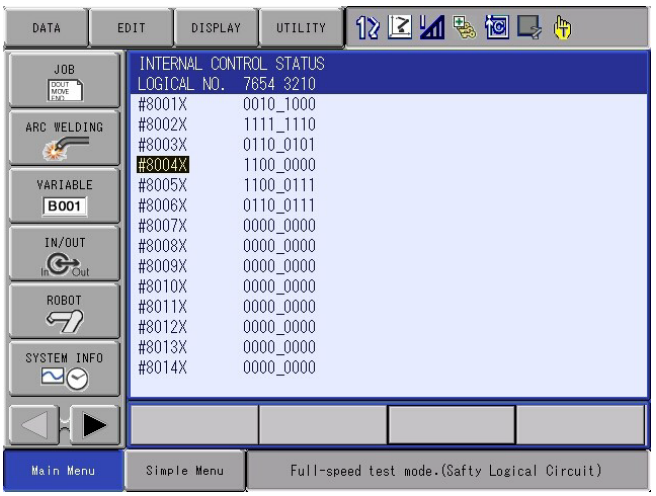
<The safety logic circuit: example 9>

The input of the full speed test (S-FST) signal is set in the following example. After turning ON the GP safety input signal (GSIN1) under the teach mode, the safety logic circuit, in which the full speed test output is turned ON, is set.

1. The following safety logic circuit is created.
   01 TEACH AND GSIN1 S-F



2. When GSIN1 signal is turned ON, S-FST signal is turned ON.
3. When S-FST signal is turned ON, “Full-speed test mode (Safety logic circuit)” is shown on the message area of the programming pendant. Also, the control status signal #80047 is turned ON.

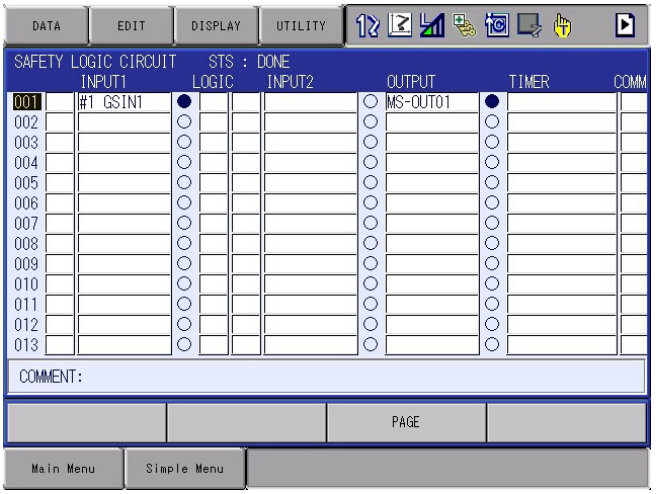


NOTE S-FST signal is enabled only in the teach mode.

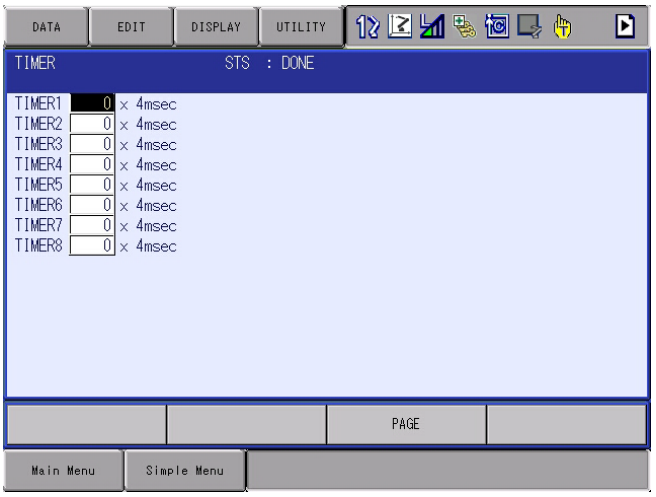
<The safety logic circuit: example 10>

The method to use MS-OUT signal is explained in the following.

1. The following safety logic circuit is created.
   01 #1 GSIN1 MS-OUT01



2. When GSIN1 signal is turned ON, MS-OUT01 signal is turned ON.
3. The MS-OUT01 signal created by the safety logic circuit can be used as the input signal of AXIS RANGE LIMIT of the functional safety (optional), etc.



8.26.19 Alarm List of the Safety Logic Circuit

Alarm Number	Sub-code	Message	Remedy
300		VERIFY ERROR (SYSTEM CONFIG-DATA)	
	10	Safety circuit board save data error	The safety logic circuit files in the file written in the Main CPU circuit board and the safety circuit board do not match. Refer to *chapter 8.26.17.2 "Safety Circuit Board FLASH ROM Data Erase and Reset"* for more details to restore.
4776		M-SAFETY YSF LOGIC FILE SIGNAL ERR	
	0	Start-up, in reading information from the FlashROM of ASF01 board, ASF01 board has detected an undefined signal.	The error of the safety logic circuit is detected when startup. Check the safety logic circuit because an invalid I/O signal is used by the safety logic signal.
	1	In the receiving information on safe logic circuit information, ASF01 board has detected an undefined signal.	The error is detected when updating the file. Check the safety logic circuit because an invalid I/O signal is used by the safety logic signal.
4777		TRANSMISSION ERROR (M-SAF FILE)	
	1	Safe logic circuit information transmission error was detected.	An alarm occurred while transferring the safety logic circuit file to the safety circuit board. Reset the alarm, and re-send the safety logic circuit file.
	2	Timer delay information transmission error was detected.	An alarm occurred while transferring the safety logic circuit file to the safety circuit board. Reset the alarm, and re-send the safety logic circuit file.
	3	M-safety signal alloc information transmission error was detected.	An alarm occurred while transferring the safety logic circuit file to the safety circuit board. Reset the alarm, and re-send the safety logic circuit file.
	4	Safety signal board alloc information transmission error was detected.	An alarm occurred while transferring the safety logic circuit file to the safety circuit board. Reset the alarm, and re-send the safety logic circuit file.
	253	M-safety command reception time out was detected.	No response from the safety circuit board while transferring the safety logic circuit file. Reset the alarm, and re-send (perform the writing) the safety logic circuit file. If the alarm occurs again, replace the safety circuit board.
	254	Safe logic circuit write error was detected.	Failure to transfer the safety logic circuit file to the safety circuit board. Please re-send the safety logic circuit file. If the alarm occurs again, refer to *chapter 8.26.17.2 "Safety Circuit Board FLASH ROM Data Erase and Reset"* for more details.
	255	Safe logic circuit cancel error was detected.	Failure to sending the cancel command while transferring the safety logic circuit file to the safety circuit board. Please re-send the safety logic circuit file. If the alarm occurs again, refer to *chapter 8.26.17.2 "Safety Circuit Board FLASH ROM Data Erase and Reset"* for more details.

8.26.20 General-Purpose Safety Output Monitoring Signal

The DX200 or an earlier version of the controller had the dedicated connection terminal for the monitoring signal. However, for downsizing, the YRC1000 supports the monitoring signal by using the safety logic circuit instead of the dedicated connection terminal.

SUPPLE -MENT

If the values of the functional safety general-purpose output signal and the general-purpose safety output monitoring signal are judged as NG for 500 ms or more, the following alarm occurs:

- When the GSOUT signal is NG
  Alarm 4767: M-SAF GENERAL OUT FB DIAG. ERROR
- When the FSBOUT signal is NG
  Alarm 4768: M-SAF GENERAL OUT FB DIAG. ERROR2

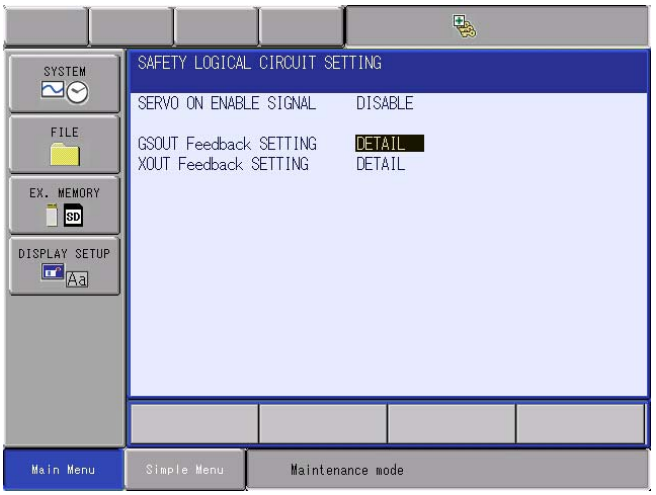
SUPPLE -MENT

For monitoring of the contact point B, the judgment is made as follows.

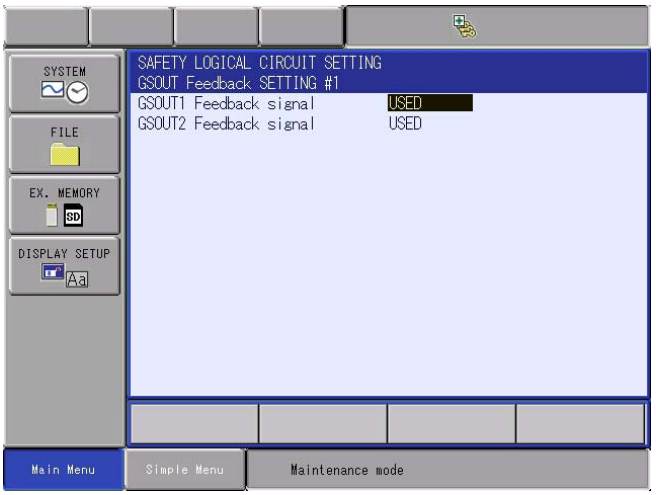
Output value of the general-purpose safety output signal (GSOUT, FSBOUT)	**Input value of the general-purpose safety output monitoring signal (GSEDM, XEDM)**	**Judgment**
OFF	Close	OK
OFF	Open	NG
ON	Close	NG
ON	Open	OK

Specify whether to enable or disable the monitoring signal of the general-purpose safety output signal on the following window:

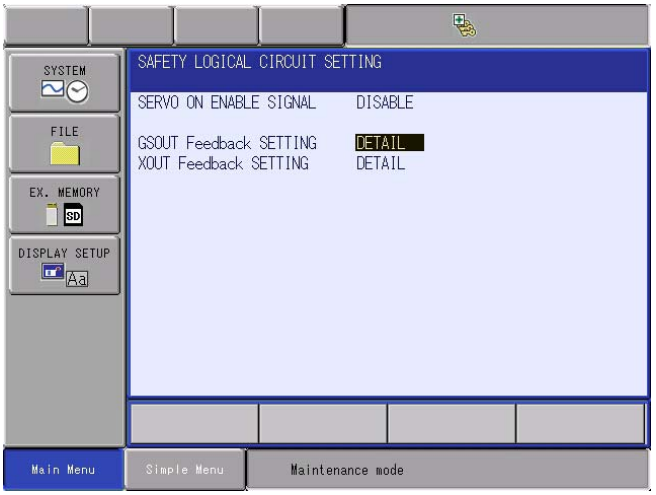
1. Turn ON the YRC1000 power while pressing [MAIN MENU] of the programming pendant.
2. Select {SYSTEM} - {SECURITY}, and then change the security mode to the safety mode.
3. Select {SYSTEM} - {SETUP} - “OPTION FUNCTION” - “SAFETY LOGICAL CIRCUIT SETTING”.
   – The following window appears.



4. Select “DETAIL” of GSOUT Feedback SETTING. The following window appears and the setting can be performed.



– The setting can be switched by pressing [SELECT].
If there are two or more ASF01 boards for the robot coordination system, press [PAGE] of the programming pendant and perform settings on the second page and after.
After completing the setting, press [ENTER] of the programming pendant. The window returns to the following state.



<Setting of the safety monitoring signal>

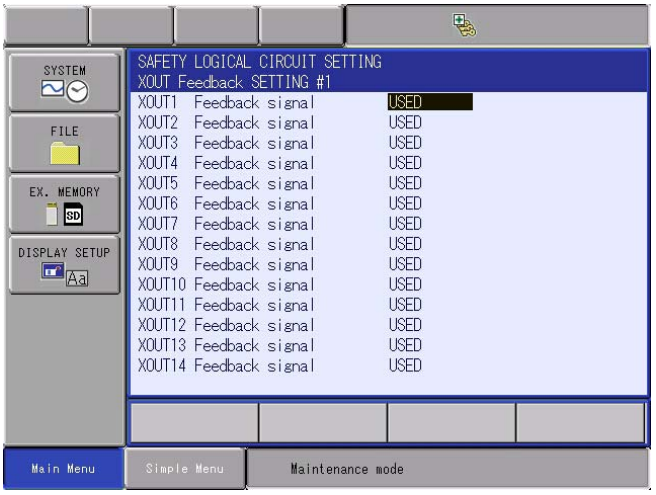
USED : The monitoring signal is used for the general-purpose safety output signal.

UNUSED : The monitoring signal is not used for the general-purpose safety output signal.

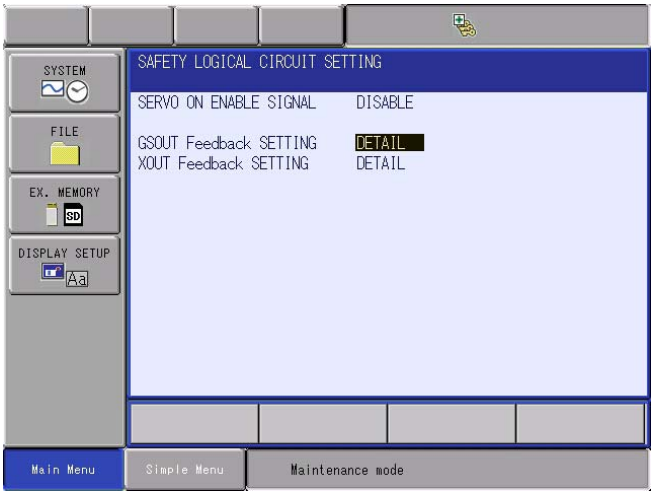
NOTE When the monitoring signal is set to “UNUSED”, the monitoring of the safety general-purpose output monitoring signal is disabled.

5. Select “DETAIL” of XOUT Feedback SETTING. The following window appears and the setting can be performed.

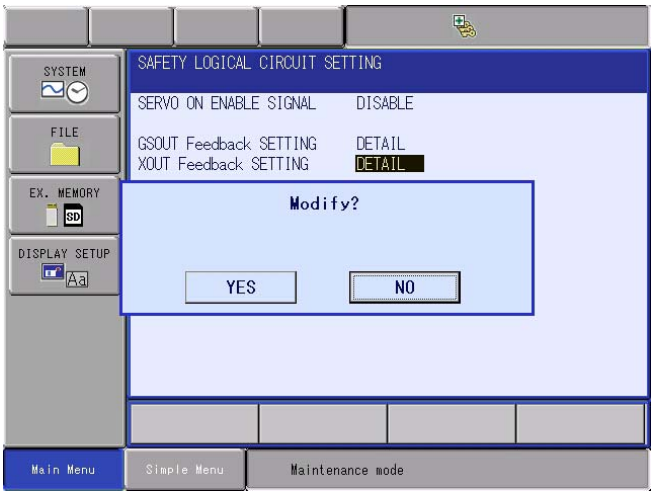
NOTE Perform this step 5 only in the system where the safety I/O expansion board (optional) is enabled.



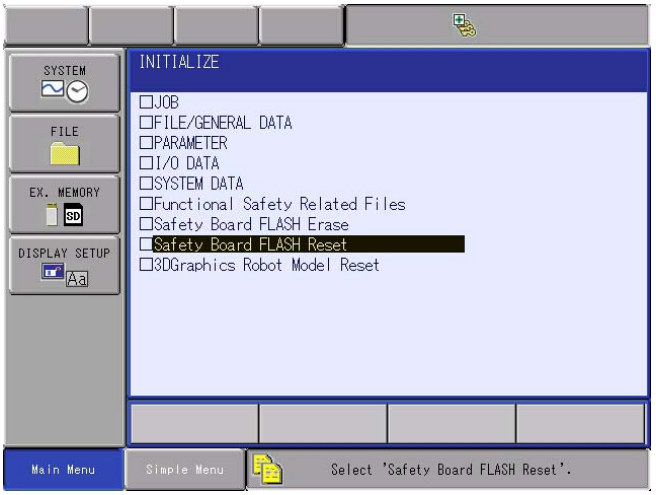
– The setting can be switched by pressing [SELECT].
After completing the setting, press [ENTER] of the programming pendant. The window returns to the following state.



6. Press [ENTER] of the programming pendant again, and select {YES}. The data is updated.

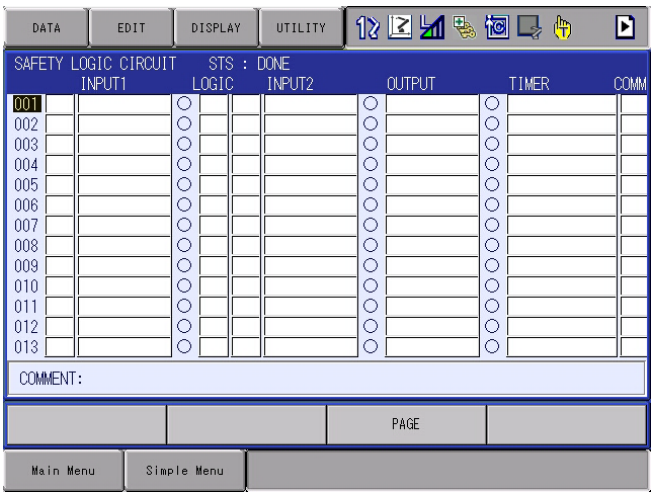


7. After updating the data, select {FILE} - {INITIALIZE} - “Safety Board FLASH Reset”, and select {YES}.
   At the sound of the beep, the re-setting is completed and the message on the programming pendant disappears.



8. Turn the YRC1000 power OFF and then ON again.
9. Select {SYSTEM} - {SECURITY}, and change the security mode to the safety mode.

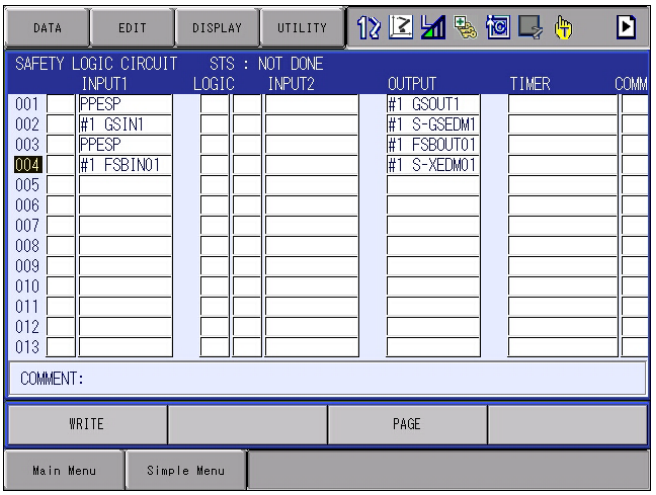
10. Select {SAFETY FUNC.} - {SAFETY LOGIC CIRCUIT}.
    – The following window appears, and the setting of the safety logic circuit can be performed.



11. Perform the setting for the connected device to be monitored. Specify the monitoring signal corresponding to the used general-purpose safety output signal.

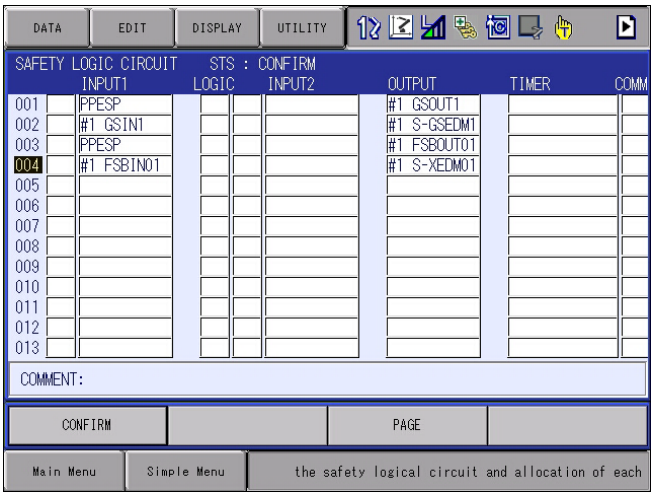
General-purpose safety output signal	**Feedback signal (monitoring signal)**
GSOUT1	GSEDM1
GSOUT2	GSEDM2
The following signals can be specified only in the system where the safety I/O expansion board (optional) is enabled.	
FSBOUT1 (XOUT1)	XEDM1
FSBOUT1 (XOUT2)	XEDM2
FSBOUT1 (XOUT3)	XEDM3
FSBOUT1 (XOUT4)	XEDM4
FSBOUT1 (XOUT5)	XEDM5
FSBOUT1 (XOUT6)	XEDM6
FSBOUT1 (XOUT7)	XEDM7
FSBOUT1 (XOUT8)	XEDM8
FSBOUT1 (XOUT9)	XEDM9
FSBOUT1 (XOUT10)	XEDM10
FSBOUT1 (XOUT11)	XEDM11
FSBOUT1 (XOUT12)	XEDM12
FSBOUT1 (XOUT13)	XEDM13
FSBOUT1 (XOUT14)	XEDM14
FSBOUT1 (XOUT15)	XEDM15
FSBOUT1 (XOUT16)	XEDM16

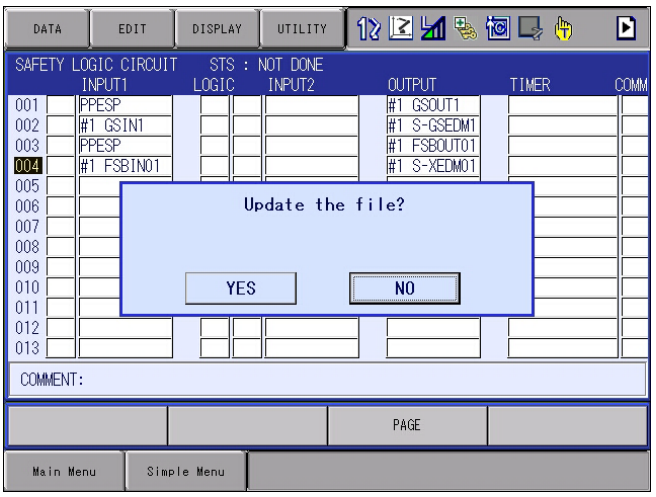
– <When monitoring the connected device to which GSOUT1 and FSBOUT1 are connected>



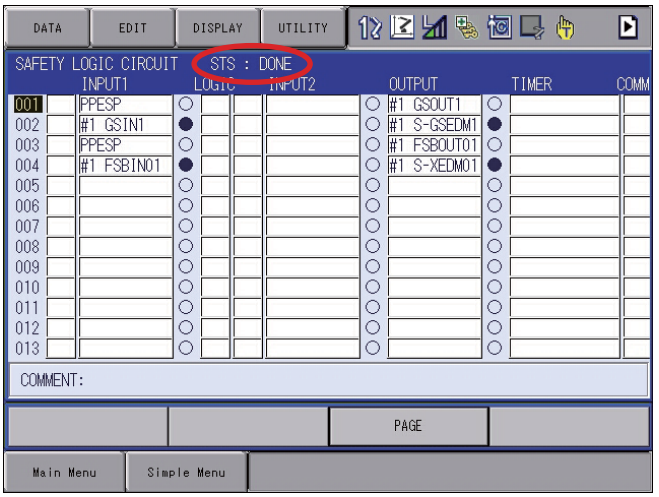
– After completing the setting, press {WRITE}.

12. After completing the writing, press {CONFIRM} and then {YES}.





13. The setting is completed when the status of the safety logic circuit turns to “DONE”.



8.27 Robot Stop Factor Monitor Function

8.27.1 Outline

The robot stop factor monitor function is a function to detect a robot stop, which is caused by the servo OFF or the hold and so on. The factors, which caused to stop the robot, are stored in chronological order and displayed on the screen.

8.27.1.1 The Robot Stop Factor

This function detects the servo OFF status caused by the safety circuit board instructions or the main CPU instructions and the hold status caused by programing pendant operations or signals. The detection items are described as follows.

Table 8-2: The List of the Servo OFF Factors by Main CPU Instructions

Displayed Item	Secondary Indication
EX.SERVO OFF1 (HOLD STOP)	System input signal number (#40065)
EX.SERVO OFF2 (CATEGORY0 STOP)	System input signal number (#40066)
EX.SERVO OFF3 (CATEGORY1 STOP)	System input signal number (#40064)
TEACH -> PLAY MODE CHANGE	None
PLAY -> TEACH MODE CHANGE	None
MAIN CPU ALARM	None
PARAMETER CHANGE	None
INST SVOFF	None
COMMAND SVON	None
HOME POSITIONING CHANGE	None
DATA FALSE RESTORE	None
TOOL FILE CHANGE	None
TOOL CALIBLATION	None
ENCODER RESET	None
ROBOT DETACHMENT	None
GROUND FAULT (BRAKE LINE)	None
MANUAL FULL SPEED	None
SERVO OFF QUE	None
SERVO ON ERROR	None
SERVO OFF ERROR	None

Table 8-3: The List of the Servo OFF Factors by Safety Circuit Board Instructions

Displayed Item	Secondary Indication	Description of the Signal
PP EMERGENCY STOP		Programming Pendant emergency stop
PP ENABLE SWITCH		Programming Pendant enable switch
PANEL BOX EMERGENCY STOP		Controller emergency stop
EXTERNAL EMERGENCY STOP		External emergency stop
SAFETY FENCE		Safety fence
RDY0 OFF		RDY0 OFF Servo OFF request from the main CPU
CATEGORY1 REQUEST		Category 1 stop request from the main CPU
SERVO COMMUNICATION ERROR		Servo OFF by M3 communication error of the main CPU or among the servo control boards
CATEGORY0 SAFETY LOGIC CIRCUIT		Category 0 stop request from the safety logic circuit
CATEGORY0 FUNCTION SAFETY		Category 0 stop request from the functional safety
CATEGORY1 SAFETY LOGIC CIRCUIT		Category 1 stop request from the safety logic circuit
CATEGORY1 FUNCTION SAFETY		Category 1 stop request from the functional safety
ASF01 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	Safety circuit board No. #1 to #8	Servo OFF by the over travel signal 1
OVER TRAVEL2	Safety circuit board No. #1 to #8	Servo OFF by the over travel signal 2
OVER TRAVEL3	Safety circuit board No. #1 to #8	Servo OFF by the over travel signal 3
OVER TRAVEL4	Safety circuit board No. #1 to #8	Servo OFF by the over travel signal 4
CONTACTOR OR STO OFF1	Safety circuit board No. #1 to #8	Servo OFF of the contactor 1 or STO1 from the main CPU
CONTACTOR OR STO OFF2	Safety circuit board No. #1 to #8	Servo OFF of the contactor 2 or STO2 from the main CPU
CONTACTOR OR STO OFF3	Safety circuit board No. #1 to #8	Servo OFF of the contactor 3 or STO3 from the main CPU
CONTACTOR OR STO OFF4	Safety circuit board No. #1 to #8	Servo OFF of the contactor 4 or STO4 from the main CPU

Table 8-3: The List of the Servo OFF Factors by Safety Circuit Board Instructions

Displayed Item	Secondary Indication	Description of the Signal
ON ENABLE1	Safety circuit board No. #1 to #8	Servo OFF of the control group connected to ON_ENABLE1
ON ENABLE2	Safety circuit board No. #1 to #8	Servo OFF of the control group connected to ON_ENABLE2
ON ENABLE3	Safety circuit board No. #1 to #8	Servo OFF of the control group connected to ON_ENABLE3
ON ENABLE4	Safety circuit board No. #1 to #8	Servo OFF of the control group connected to ON_ENABLE4
CATEGORY ON ENABLE1	Safety circuit board No. #1 to #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	Safety circuit board No. #1 to #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	Safety circuit board No. #1 to #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	Safety circuit board No. #1 to #8	The time of the category 0 is up after inputting the ON_ENABLE4 signal, then switch OFF the servo of the machine safety.

Table 8-4: The List of the Holding Factors

Displayed Item	Secondary Indication
HOLD	None
EX.HOLD (SPECIFIC INPUT SIGNAL)	System input signal number #40067
INDIVIDUAL HOLD	System input signal number #40270 to #40287 TASK#0 to TASK#15
HOLD (SHOCK SENSOR)	None
HOLD (DATA TRANSMISSION)	None
HOLD (API CTL)	None
HOLD (API)	None
HOLD (HIGH SPEED ES)	None
SKIP WAIT INST (STOP PLAYBACK)	Task number TASK#0 to TASK#15
GUN TEACH SIG. OFF (STOP PLAYBACK)	System input signal number #41231
GUN TEACH STEPOVER (STOP PLAYBACK)	None
ALARM STOP QUE	None

8.27.1.2 The Robot Stop Factor Record Number

- One screen: maximum 37 factors
- History number: 20 histories

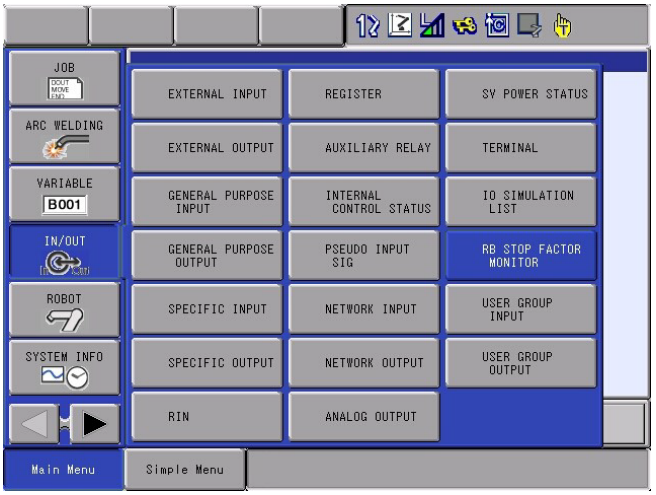
If exceeds the number above, the old data will be deleted, and the new data will be recorded.

8.27.2 Operation

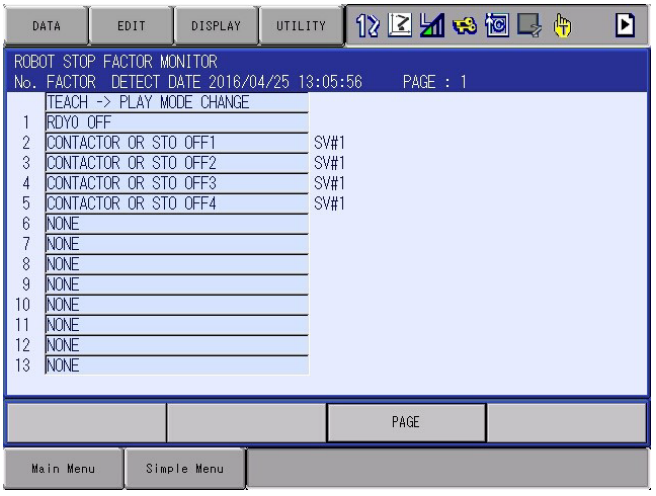
8.27.2.1 Displaying the Robot Stop Factor Monitor

The RB STOP FACTOP MONITOR can be referred by following procedures.

1. Select {ROB STOP FACTOR MMONITOR} under the {IN/OUT} in the main menu.



– The RB STOP FACTOR MONITOR window appears.

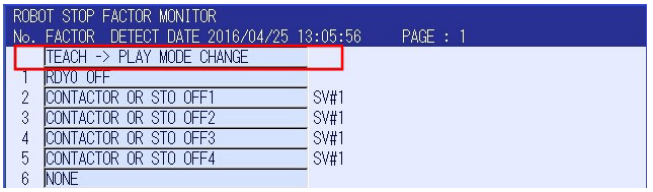


– The following items are displayed on the RB STOP FACTOR MONITOR window.

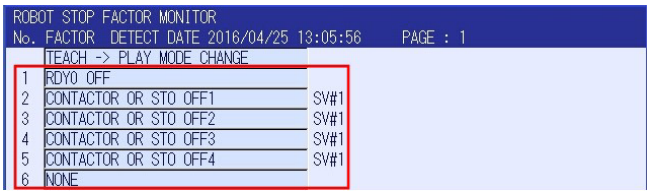
• DETECT TIME: Shows the time when the robot stop factor was detected.



• The factor detected by the main CPU is displayed on the first line.



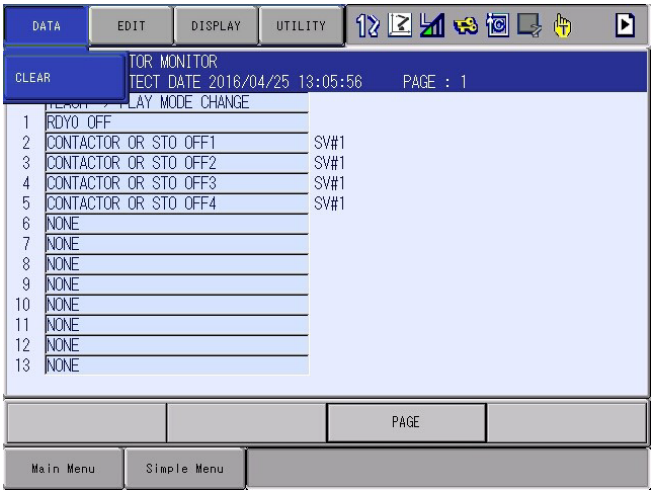
• The factor(s) detected by the safety circuit board is (are) displayed from the second line on the screen.



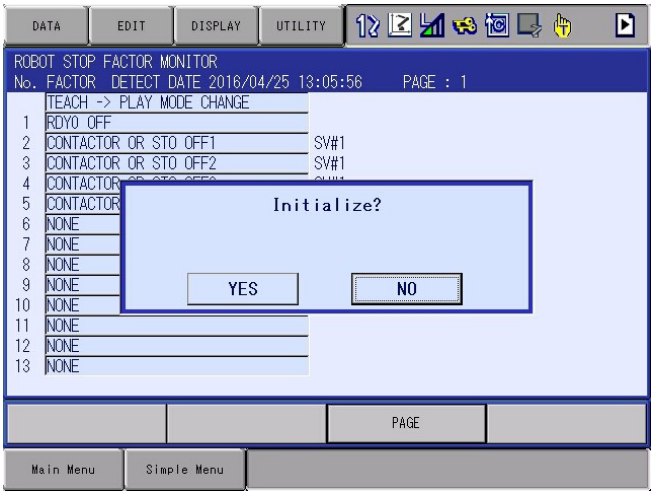
– The data on the first page is the latest one, and the page 20 is the oldest data.

8.27.2.2 Clear the Robot Stop Factor Information

1. Select {DATA} from the pull-down menu on the RB STOP FACTOR MONITOR window when the security mode is the management or higher mode. {CLEAR} is displayed.



2. Select {CLEAR}, and the confirmation dialog “Initialize?” appears. Press “YES”, and the all information of the robot stop factor is cleared.



NOTE

The robot stop factor information is not saved when turning the power supply OFF. Therefore, it will be initialized when turning the power supply ON again. If it is necessary to save the data, please store the data into the external memory devices before turning the power supply OFF.

8.28 Robot Detachment Function

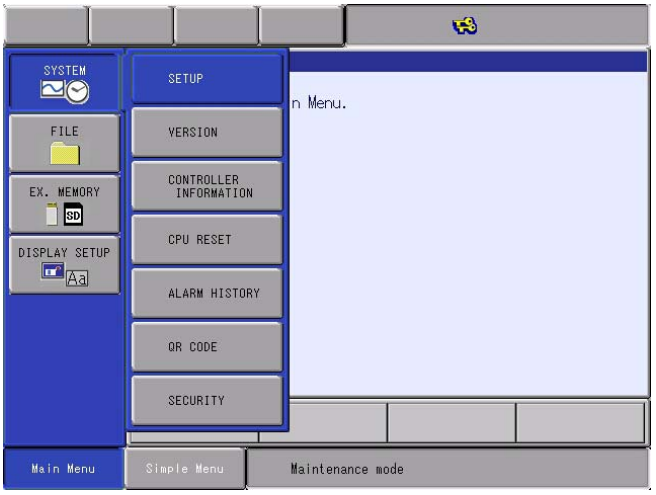
8.28.1 Setting Maintenance Mode

This mode is used for setting up and maintenance of the robot system.

1. Turn the power ON while pressing [MAIN MENU] on the programming pendant.
   – Maintenance mode screen starts up.



2. Select {SYSTEM} under the main menu.
   – Sub menu is shown.



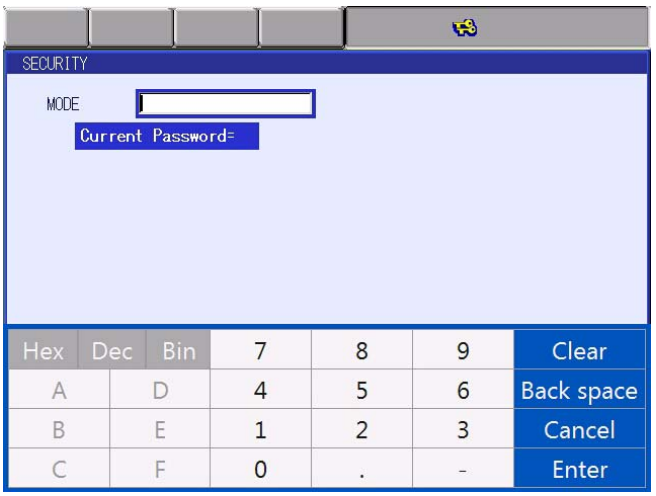
3. Select {SECURITY}.
   – Mode selection screen is shown.



4. Press [SELECT] to select the mode.
   – Mode selection list is shown.



5. Move the cursor to {SAFETY MODE} and select.
   – Password input box is shown.



6. Input the password for safety mode and press [ENTER].
   – When the correct password is input, security mode is changed.

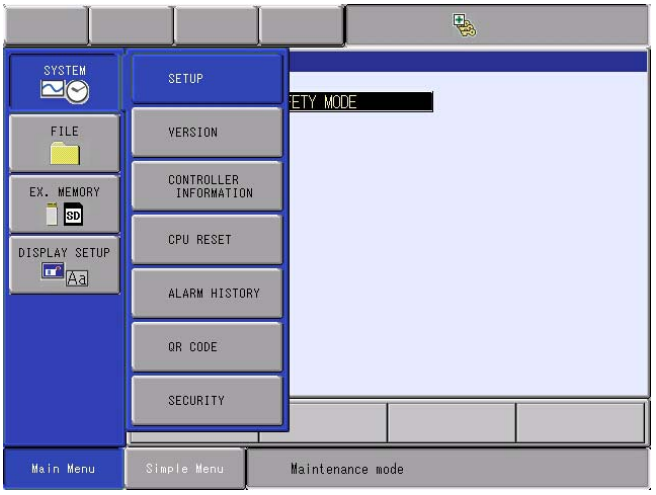


8.28.2 Setting Robot Detachment Function

Operator can set or modify the setting items for robot detachment function in detail setting screen.

The specified parameters are to be set automatically according to the setting contents in detail setting screen.

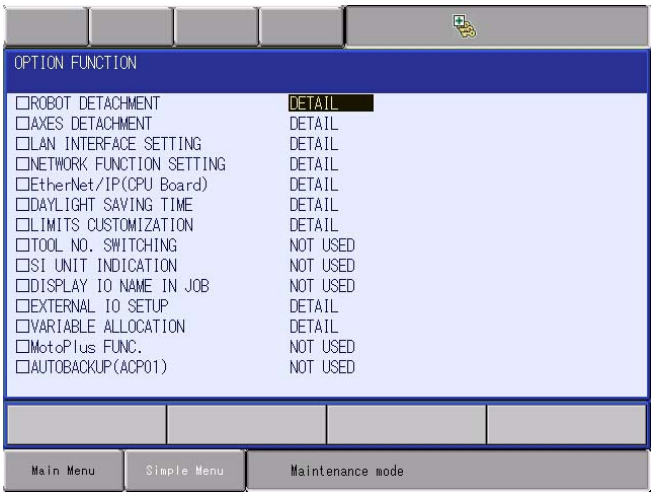
1. Select {SYSTEM} under the main menu.
   – Sub menu is shown.



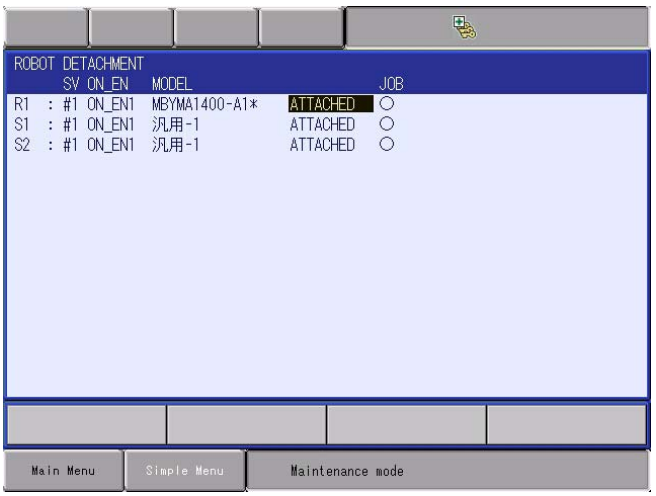
2. Select {SETUP}.
   – “SETUP” screen is shown.



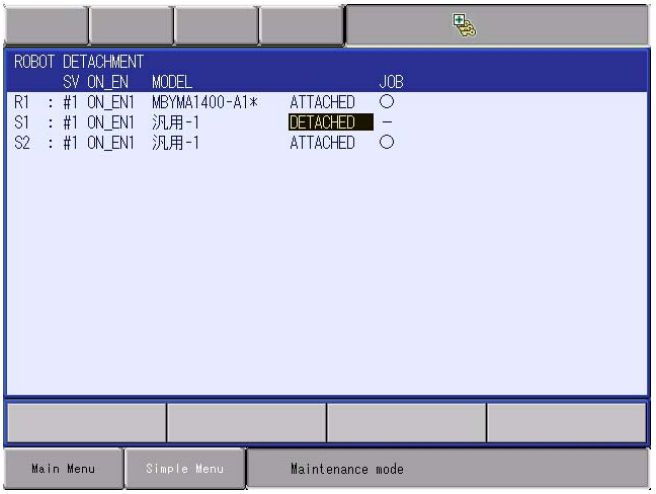
3. Move the cursor to {OPTION FUNCTION} and select.
   – “OPTION FUNCTION” screen is shown.



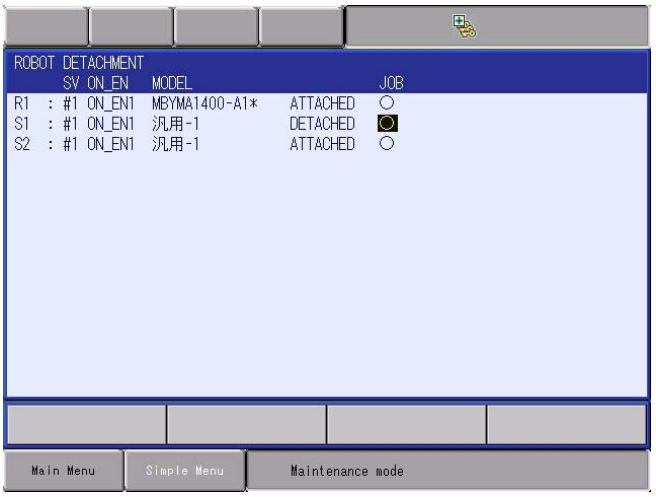
4. Move the cursor to {ROBOT DETACHMENT} and select.
   – Detail setting screen for robot detachment function is shown.



5. Change the setting contents.
   – Move the cursor to the target group and select to change the setting.
   – Select “ATTACHED” or “DETACHED”.



6. Change the setting item on JOB.
   – Move the cursor to the JOB setting item and select.
   Every pressing the [SELECT] switches the indication between “ ○ ” and “ - ”.

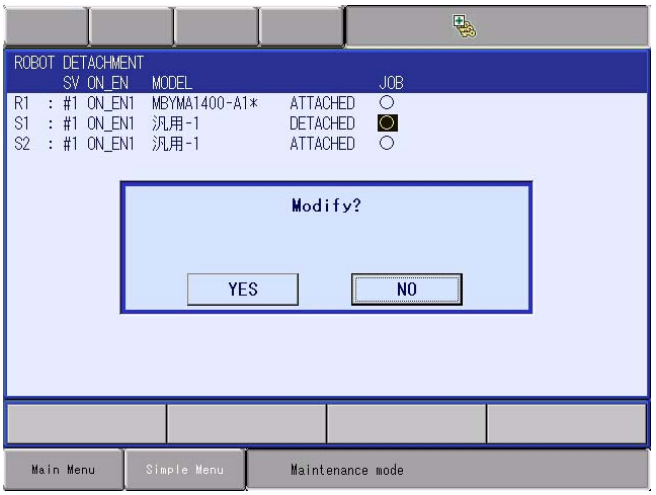


   – Description for the setting items on JOB

When “ - ” is selected: The JOB including detached group cannot be started up.

When “ ○ ” is selected: The JOB including detached group can be started up. However, the detached axes cannot be operated.

7. Press [ENTER].
   – Confirmation message for parameter change is shown.



8. Select “YES” to confirm the change.
   – System parameters are to be set automatically, then the screen returns to the option function screen.
9. If the message "Select 'Safety Board FLASH Reset'" is shown on the message area of the programming pendant, perform a data reset with the procedure in *chapter 8.18.6.2 “FLASH Data Reset”* .

8.29 Axes Detachment Function

8.29.1 Outline

With the axes detachment function, the connection of a specific axis can be disabled under the maintenance mode. In the case of setup or motor replacement where no axis is physically connected, by connecting the dummy connector (HW1471285-A) and enabling the axes detachment, the system can be started without any alarm from the specified axes.

8.29.2 Connecting the Dummy Connector

By referring to the INSTRUCTIONS of each manipulator, disconnect the encoder connector of the desired axis from the multi-port connector in the manipulator, and connect the dummy connector to the multi-port connector.

DANGER

- Always set the teach lock before starting teaching.
- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

If the dummy connector is connected to a wrong port, or if the axes detachment is performed without connecting the dummy connector, the following alarm normally occurs when the control power supply is turned ON. In this case, immediately turn OFF the control power supply and connect the dummy connector to the correct port.

AL1380: ENCODER ADDRESS VERIFY ERROR

The dummy connector is necessary only for the encoders of the manipulator.

8.29.3 Setting Maintenance Mode

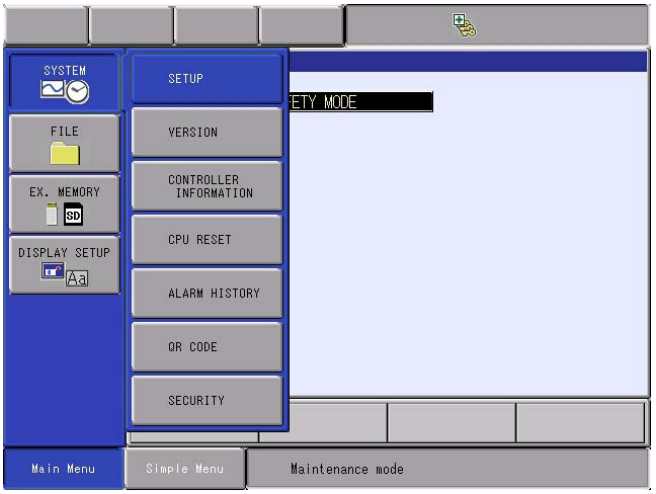
Start the maintenance mode and set the security mode to the safety mode. (Refer to *chapter 8.28.1 “Setting Maintenance Mode”* .)

8.29.4 Setting Axes Detachment Function

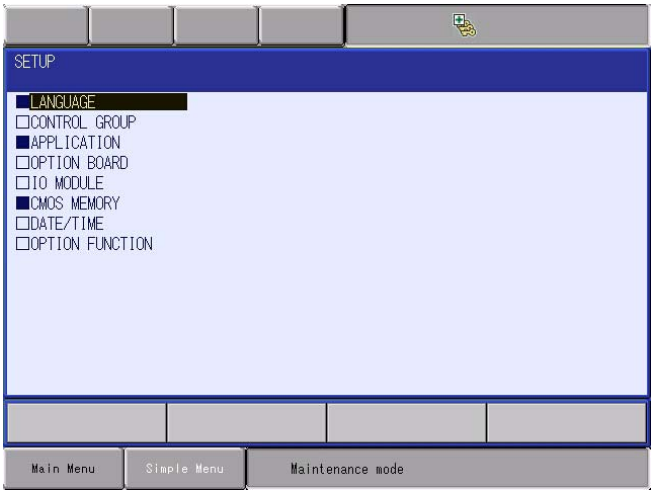
Operator can set or modify the setting items for axes detachment function in detail setting screen.

The specified parameters are to be set automatically according to the setting contents in detail setting screen.

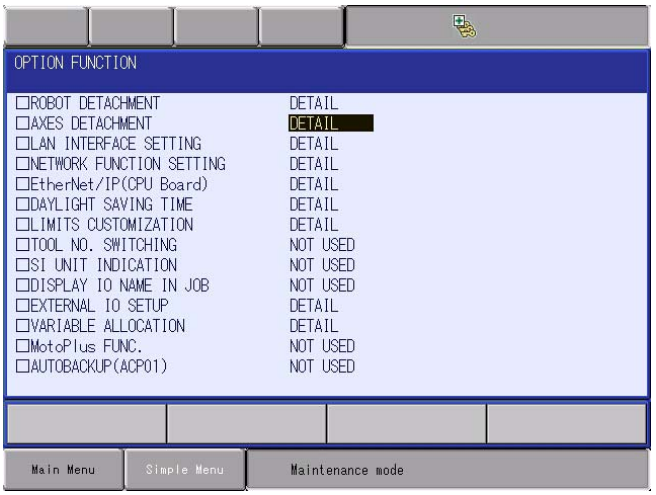
1. Select {SYSTEM} under the main menu.
   – Sub menu is shown.



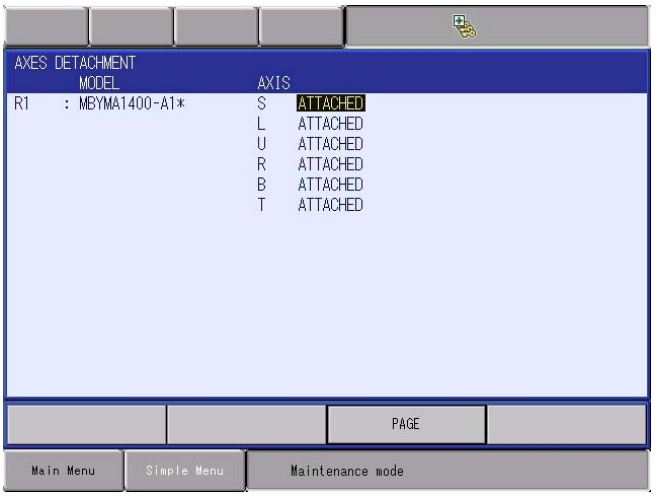
2. Select {SETUP}.
   – Setting selection screen is shown.



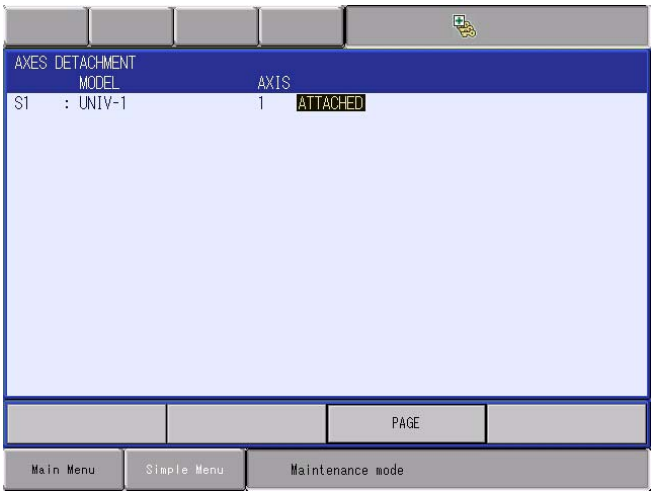
3. Move the cursor to {OPTION FUNCTION} and select.
   – “OPTION FUNCTION” screen is shown.



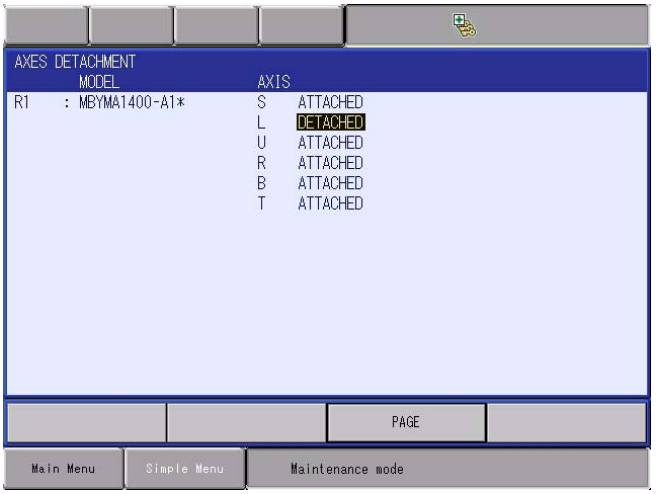
4. Move the cursor to {AXES DETACHMENT} and select.
   – Detail setting screen for axes detachment function is shown.



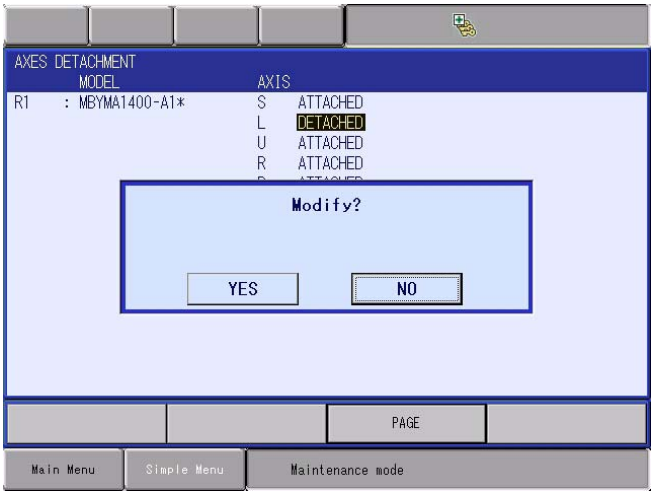
5. By pressing [PAGE], the target group for setting is switched.



6. Change the setting contents.
   – Move the cursor to the target axis and select to change the setting.
   – Select “ATTACHED” or “DETACHED”.



7. Press [ENTER].
   – Confirmation message for parameter change is shown.



8. Select “YES” to confirm the change.
   – System parameters are to be set automatically, then the screen returns to the option function screen.
9. If the message "Select 'Safety Board FLASH Reset'" is shown on the message area of the programming pendant, perform a data reset with the procedure in *chapter 8.18.6.2 “FLASH Data Reset”* .

8.29.5 Specific Output and Messages

When the system is started in online mode and any axes (at least one axis) are detached, the following specific output and message are output all the time.

- Specific output #50913 “AXES DETACHMENT”
- Message is displayed

The following message is output in the bottom right message area on the window of the programming pendant.

“Axes detachment has been set [sub code]”

The control group including the detached axis is shown in [sub code].

8.29.6 Restrictions

- Operation with restrictions
  When the axes detachment function is set, the following operations are restricted. If these operations are tried to be performed, an error or an alarm occurs.
  - Playback
  - Test run
  - Job registration (insert/modify/delete jobs in the target control group)
  - Variable registration
  - Second home position registration
  - Home position registration
  - Work home position registration



Use the robot detachment function (*chapter 8.28 "Robot Detachment Function"*) when performing the playback operation in the state that the specific manipulator, the base, or the station is detached.

Followings are the errors/alarms which may occur by the axes detachment.

Operation	**Alarm**
Playback	"ERROR 2762 This operation is not allowed, for axes detachment has been set." "ALARM4916/4917 WRONG JOB EXEC OF DETACHED AXIS"
Test run	"ERROR 2762 This operation is not allowed, for axes detachment has been set."
Job registration (insertion, modification, deletion)	"ERROR 2763 Cannot modify, for axes detachment has been set."
Second home position registration	"ERROR 2763 Cannot modify, for axes detachment has been set."
Home position registration	"ERROR 2763 Cannot modify, for axes detachment has been set."
Work home position registration	"ERROR 2763 Cannot modify, for axes detachment has been set."

CAUTION

- While the axes detachment function is set, the manipulator may not be able to move to the taught position or operate in the right posture, because some axes do not move.
  When performing one of the following operations while the axes detachment function is set, pay careful attention to the movement of the manipulator and prevent interference between the manipulator and peripheral devices.

• Operation without restrictions
The axes detachment function doesn't restrict the following operations, though be careful when performing.

- Jog operation (link, Cartesian, user, tool, cylindrical, and I/O jog)
- Next/Back operation
- Variable movement
- Second home position movement
- Work home position return

• Restriction in using with other function
Before using the following function, be sure to release the axes detachment function.

- Functional safety function
  If there is any detached axis, safety monitoring cannot be performed.

8.30 User Group Input and Output

8.30.1 Outline of the Function

The input and output of user group can be defined by one group of two or more GP I/O signals. The value of the group signal can be expressed in the numerical value.

For example, specify the start position and size of a GP I/O (#0xxxx or #1xxxx) area to allow the signals to be specified as IGU#(x) or OGU#(x). These user groups can be used in the job as shown next. The input range for data is two's complement (setting range from negative to positive).

SET D000 127

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 8, PARITY: NONE

The input range when the length is "8" is -128 to 127.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OGU#(6)							

ON

SET D000 32767

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: NONE

The input range when the length is "16" is -32768 to 32767.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OGU#(6)							

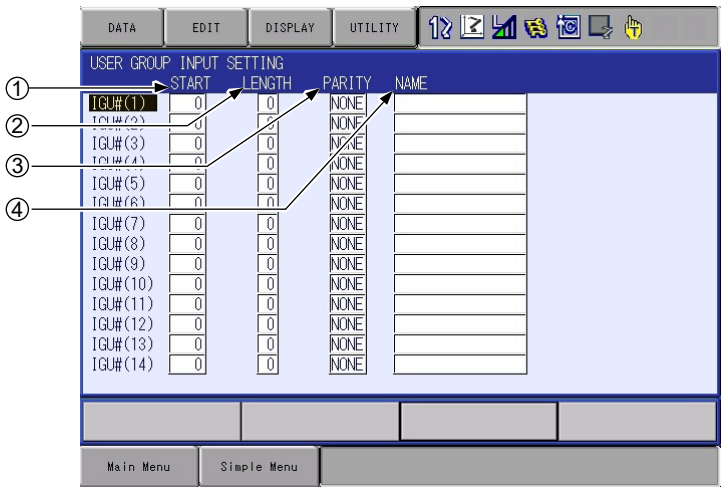
ON

8.30.2 User Group Input

8.30.2.1 User Group Input Setting

Set the security to the management mode.

1. Select {I/O} in the main menu.
2. Select {USER GROUP INPUT}.
   – The USER GROUP INPUT window is shown.
3. Select {SETTING} of {DISPLAY} in the pull down menu.
   – The USER GROUP INPUT SETTING window is shown.



①START
Specify the first number of the GP input signal to be allocated.

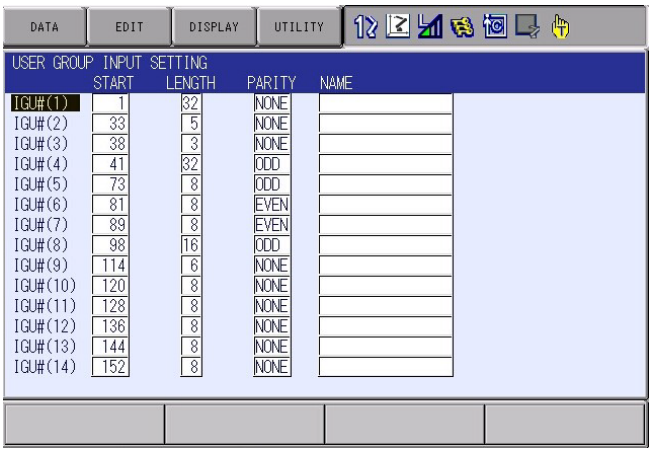
②LENGTH
Specify the number of the signals which is allocated to one group (1 to 32). When the parity check is specified, the parity bit is the highest bit. When the length is 1, the parity check cannot be specified.

③PARITY
Set the parity check to detect errors in data.
NONE : The parity check is not performed.
ODD : The parity check is performed with an odd number of ones.
EVEN : The parity check is performed with an even number of ones.

④NAME
The group signal name is set.

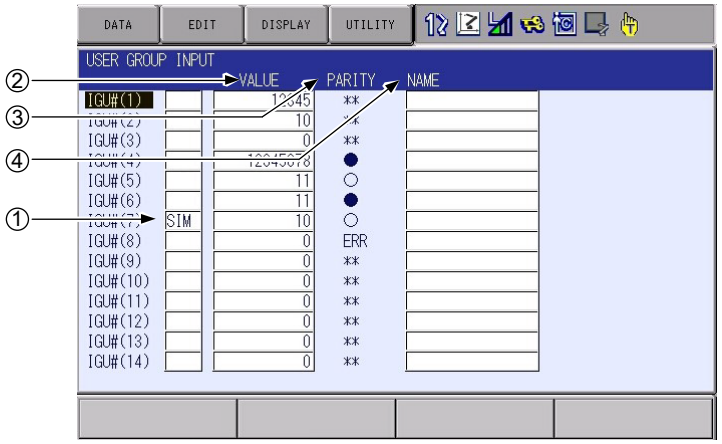
<Setting Example>

A setting example is shown below.



8.30.2.2 Display of User Group Input

1. Select {I/O} in the main menu.
2. Select {USER GROUP INPUT}.
   – The USER GROUP INPUT window is shown.



①SIM

Normally, the input status of the user group cannot be changed by manual operation. However, the status can be set to be changeable for the operation check and etc. The status is changed every time an item is selected.

- SIM : Manual operation is possible
- (Blank) : Normal status

NOTE

All the GP input signals which belong to the group in the status of “SIM” are in the status of “SIM”.
For details of this status, refer to "Changing Signal Status from GP Input Status Window” in chapter 13.2 of “YRC1000 OPTIONS INSTRUCTIONS FOR Concurrent I/O (RE-CKI-A467).

②VALUE

The input status of the user group.
When the group in the “SIM” status is selected, the value can be changed.

③PARITY

Set the parity check to detect errors in data.
The status of the parity bit

** : The parity check is not performed.
◯ : The parity check is performed with an odd number of ones.
● : The parity check is performed with an even number of ones.
ERR : Parity error

④NAME

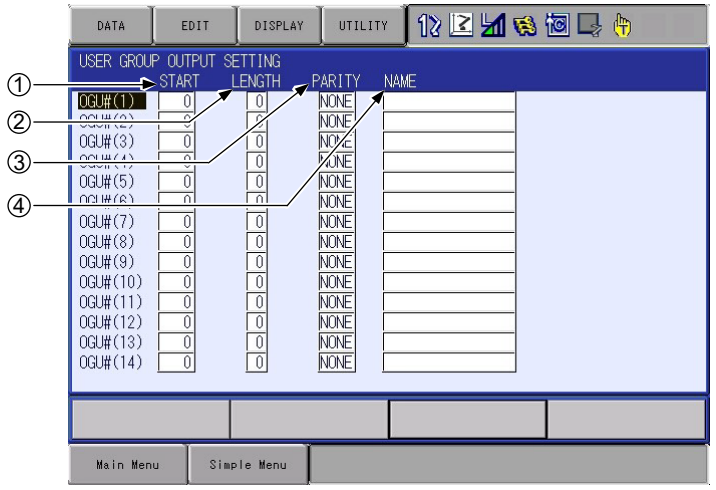
The group signal name

8.30.3 User Group Output

8.30.3.1 User Group Output Setting

Set the security to the management mode.

1. Select {I/O} in the main menu.
2. Select {USER GROUP OUTPUT}.
   – The USER GROUP OUTPUT window is shown.
3. Select {SETTING} of {DISPLAY} in the pull down menu.
   – The USER GROUP OUTPUT SETTING window is shown.
   – The USER GROUP INPUT SETTING window is shown.



①START

Specify the first number of the GP output signal to be allocated.

②LENGTH

Specify the number of the signals which is allocated to one group (1 to 32). When the parity check is specified, the parity bit is the highest bit. When the length is 1, the parity check cannot be specified.

③PARITY

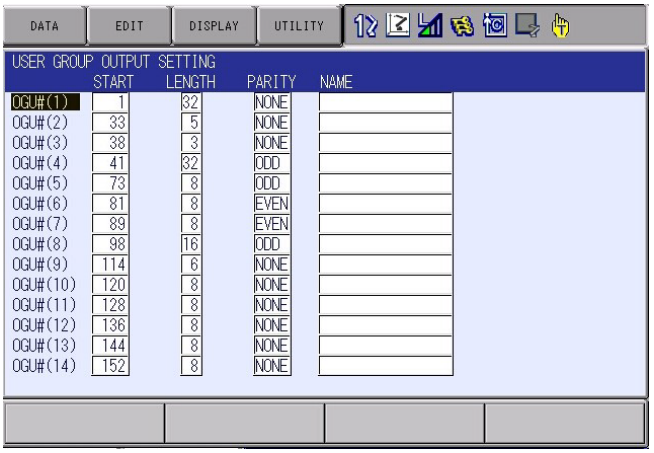
Set the parity check to detect errors in data.
NONE : The parity check is not performed.
ODD : The parity check is performed with an odd number of ones.
EVEN : The parity check is performed with an even number of ones.

④NAME

The group signal name is set.

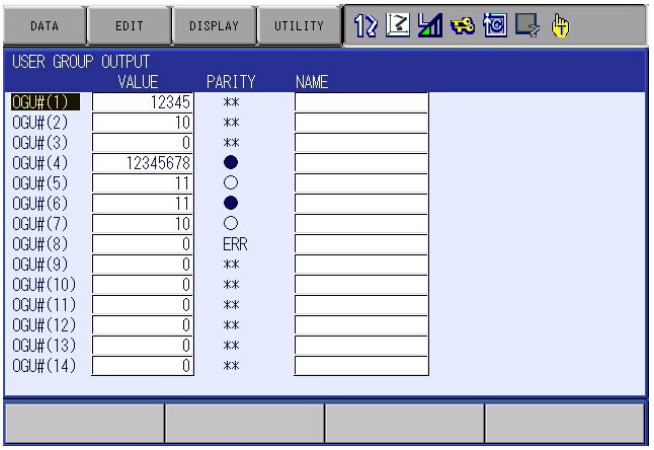
<Setting Example>

A setting example is shown below.



8.30.3.2 Display of User Group Output

1. Select {I/O} in the main menu.
2. Select {USER GROUP OUTPUT}.
   – The USER GROUP OUTPUT window is shown.



①**VALUE**
The output status of the user group.

②**PARITY**
The status of the parity bit

** : No parity check

○ : 0

● : 1

ERR : Parity error

③**NAME**
The group signal name

8.30.4 Examples of Use

This section gives several examples of use.

SET D000 255
DOUT OGU#(6) D000
<User group output settings: OGU#(6)>
START: 40, LENGTH: 8, PARITY: NONE
The input range when the length is "8" is -128 to 127.

NOTE

If a number is set outside the setting range, the alarm "4465: OVER BINARY RANGE(PARITY CHECK)" occurs and the user group output setting value does not change.



SET D000 65535
DOUT OGU#(6) D000
<User group output settings: OGU#(6)>
START: 40, LENGTH: 16, PARITY: NONE
The input range when the length is "16" is -32768 to 32767.

NOTE

If a number is set outside the setting range, the alarm "4465: OVER BINARY RANGE(PARITY CHECK)" occurs and the user group output setting value does not change.



SET D000 63

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 8, PARITY: EVEN

The input range when the length is "8" is -64 to 63.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OGU#(6)							

ON

SET D000 63

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 8, PARITY: ODD

The input range when the length is "8" is -64 to 63.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OGU#(6)							

ON

SET D000 300

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: EVEN

The input range when the length is "16" is -16384 to 16383.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OGU#(6)							

ON

SET D000 300

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: ODD

The input range when the length is "16" is -16384 to 16383.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OGU#(6)							

ON

SET D000 -2147483648

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 32, PARITY: NONE

The input range when the length is "32" is -2147483648 to 2147483647.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OT#(63)	OT#(62)	OT#(61)	OT#(60)	OT#(59)	OT#(58)	OT#(57)	OT#(56)
OT#(71)	OT#(70)	OT#(69)	OT#(68)	OT#(67)	OT#(66)	OT#(65)	OT#(64)
OGU#(6)							

ON

SET D000 -1

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 32, PARITY: NONE

The input range when the length is "32" is -2147483648 to 2147483647.

OT#(47)	OT#(46)	OT#(45)	OT#(44)	OT#(43)	OT#(42)	OT#(41)	OT#(40)
OT#(55)	OT#(54)	OT#(53)	OT#(52)	OT#(51)	OT#(50)	OT#(49)	OT#(48)
OT#(63)	OT#(62)	OT#(61)	OT#(60)	OT#(59)	OT#(58)	OT#(57)	OT#(56)
OT#(71)	OT#(70)	OT#(69)	OT#(68)	OT#(67)	OT#(66)	OT#(65)	OT#(64)
OGU#(6)							

ON

SET D000 65535

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: ODD

The input range when the length is "16" is -16384 to 16383.

NOTE

If a number is set outside the setting range, the alarm "4465: OVER BINARY RANGE (PARITY CHECK)" occurs and the user group output setting value does not change.



SET D000 65535

DOUT OGU#(6) D000

<User group output settings: OGU#(6)>

START: 40, LENGTH: 16, PARITY: EVEN

The input range when the length is "16" is -16384 to 16383.

NOTE

If a number is set outside the setting range, the alarm "4465: OVER BINARY RANGE (PARITY CHECK)" occurs and the user group output setting value does not change.



8.31 Variable Allocation

The number of the global variable allocation can be changed by performing the following operations. However, after performing this change operation, the data of the JOB, the user coordinate or etc. is initialized and the variable data or the variable name data saved before the change cannot be loaded. Thus, the following operations are allowed only for the administrator who can set the security mode to the management mode or higher.

1. By pressing [MAIN MENU] on the programming pendant, turn ON the power.
2. Change the security mode to the management mode.
3. Select {SYSTEM} in the main menu.
4. Select {SETUP}.
5. Select {OPTION FUNCTION}.
6. Select {DETAIL} of the variable allocation.
   – The DETAIL window of the variable allocation is shown.



The number can be changed by selecting “++” / “--” or inputting the number directly. The changeable minimum and maximum value are shown in “RANGE”. Since the global variable shares the determined section/area, the value shown in “RANGE” is changed along with the setting value.

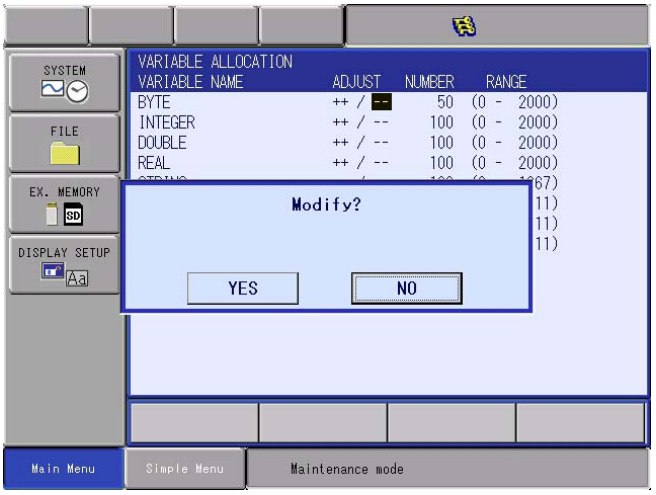
- When the “++” is selected, the allocation is increased by the increment of 50.

• When the “--” is selected, the allocation is decreased by the decrement of 50.



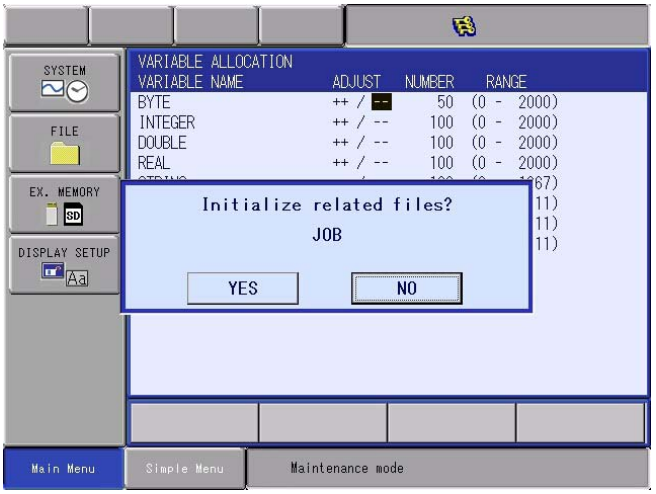
7. Press [ENTER].

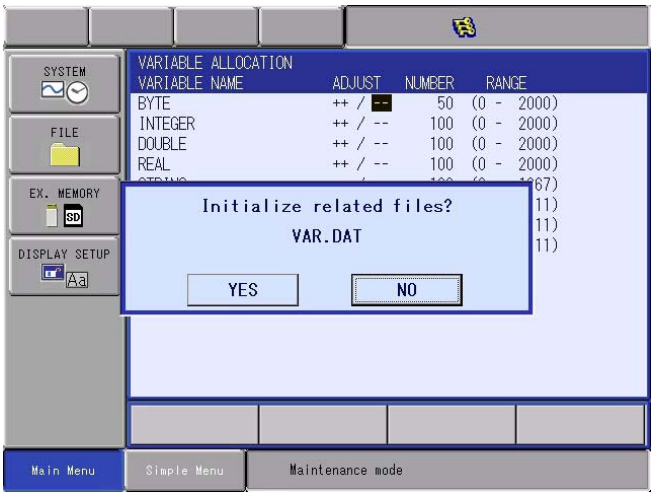
– The confirmation dialog of the parameter change shows up.

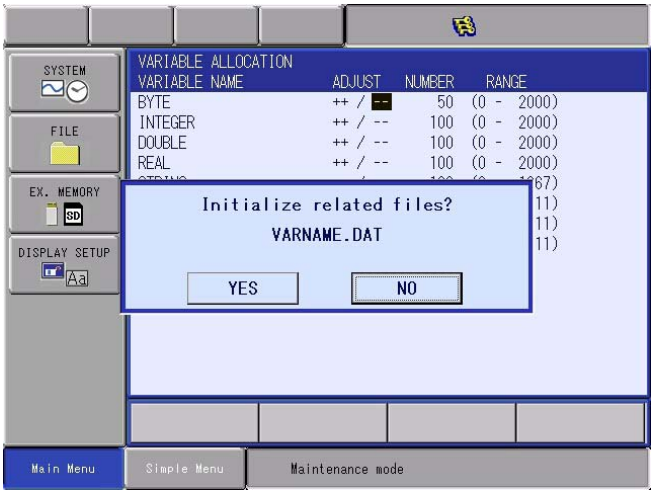


8. Select {YES}.

– Select {YES} for the confirmation dialog.
When a file needs to be initialized due to the change of the variable allocation, the confirmation dialog of initialization shows up.
Select {YES} for all the confirmation dialog of initialization.







9. After the initialization of file is completed, the option function window is shown.

NOTE

When the position variable allocation is changed, not only the data of variable/variable name but also the following files are cleared. Be sure to handle the data properly.

- User coordinate
- Memo play file
- Spot monitor data
- Robot calibration data
- Conveyor calibration data
- Job file
- Laser Welding Pos

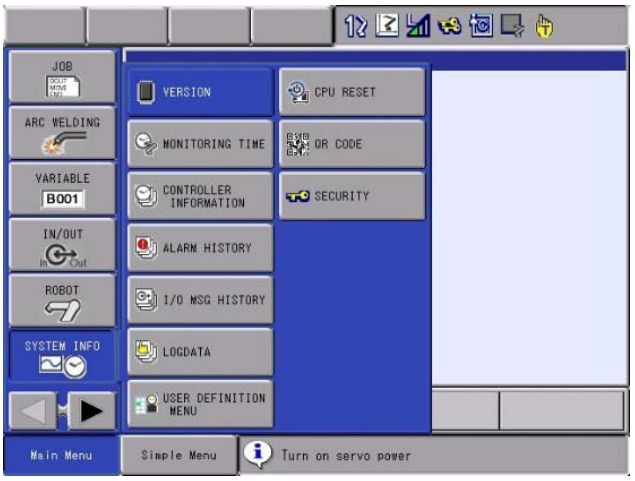
NOTE

The SD Card 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 SD Card may be damaged and the system may not start correctly or be operated.

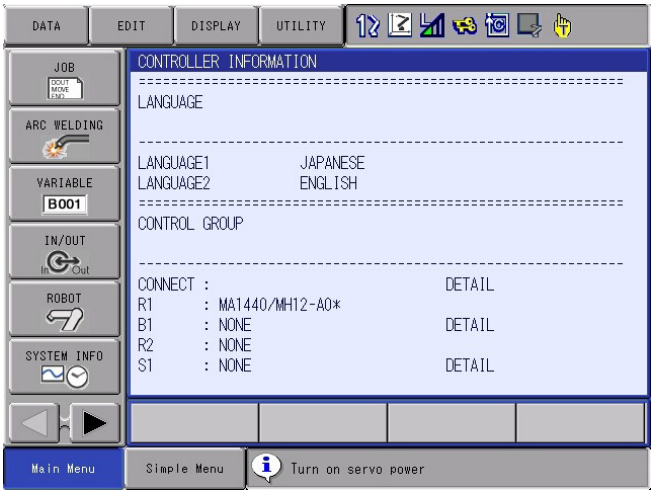
8.32 Controller Information Display Function

The configured information in this robot system can be checked by the following procedures.

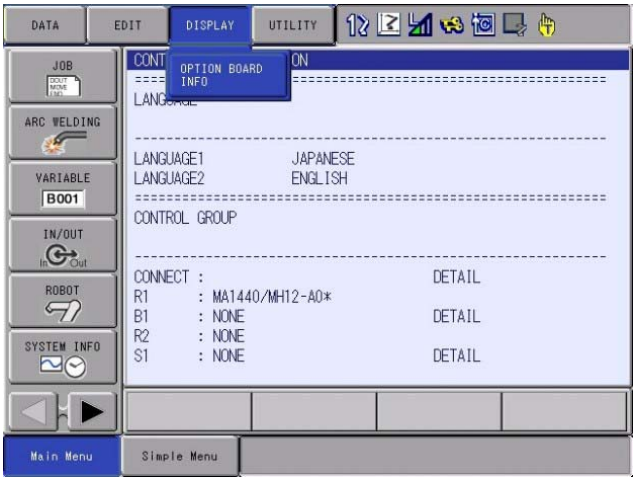
1. Select {SYSTEM INFO} in the main menu.



2. Select {CONTROLLER INFORMATION}.
   – The CONTROLLER INFORMATION window is shown.

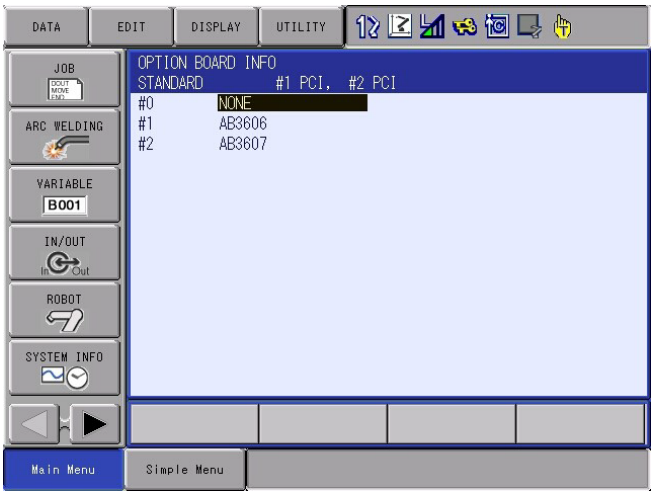


3. Select {DISPLAY}.



4. Select {OPTION BOARD INFO}.

– The OPTION BOARD INFO window is shown.Move the cursor to the option board to show the details.



5. Press [SELECT].

– The setting contents of the option board information is shown.



NOTE

While the CONTROLLER INFORMATION window is shown, the following display is shown by performing the bilingual operation ({SHIFT} and {AREA} on the programming pendant are pressed).
Select {CONTROLLER INFORMATION} from {SYSTEM INFO} once again.



8.33 Power Supply Regeneration Monitor Function

Control panels for medium- and large-capacity YRC1000 models support power supply regeneration, and power supply regeneration monitor function described in this section can be used.

The amount of regenerated power and the operating status can be checked on the programming pendant with power supply regeneration monitor function.

8.33.1 Outline

When the manipulator's arm decelerates, the motor becomes a generator that generates electrical energy. Then this electrical energy is returned to the primary power supply. This process is called "power supply regeneration".

Consumption power is reduced by performing power supply regeneration.

NOTE

Control panels for small-capacity models do not support power supply regeneration.

For the types of control panels, refer to the YRC1000 models in *chapter 13.4.1 "Arrangement of Units and Circuit Boards"* .

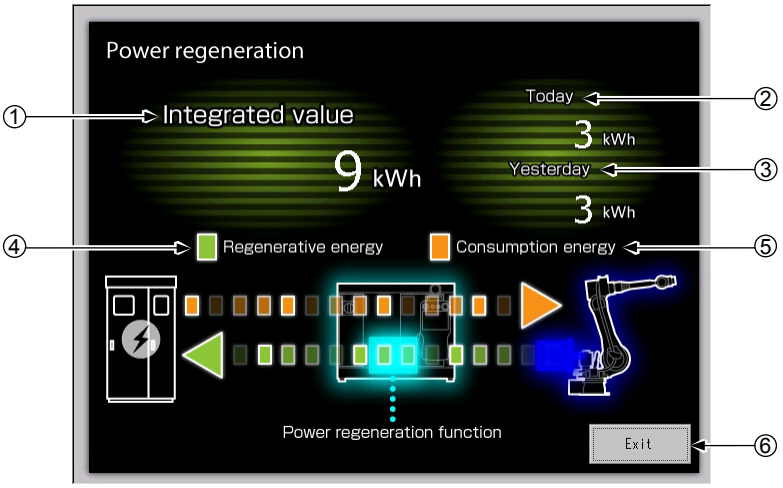
8.33.2 Power Regeneration Window

The amount of regenerated power and the operating status can be checked on this window.

Use the following procedure to display the power supply regeneration window.

Select {ROBOT} → {REGENERATION} in the main menu.

– The power regeneration window appears.



The description of the window is given next.

① Integrated value

Indicates the accumulated amount of regenerated power up to the present.

② **Today**
Indicates the accumulated amount of regenerated power for today.

③ **Yesterday**
Indicates the accumulated amount of regenerated power for yesterday.

④ **Regenerative energy**
Displays an arrow when power is being regenerated.

⑤ **Consumption energy**
Displays an arrow when power is being consumed from the power supply.

⑥ **Exit**
Exits the power regeneration window.

NOTE

For a coordinated panel in which two or more control panels are connected and used, one system may include multiple control panels that support power supply regeneration.

In this case, the total amount of power regenerated by all control panels in the system is indicated on the power regeneration window.

NOTE

The amount of regenerated power will vary by the job of the robot.

For jobs with little regenerated power, the accumulated amount may not increase very much (e.g., only a few kWh per day).

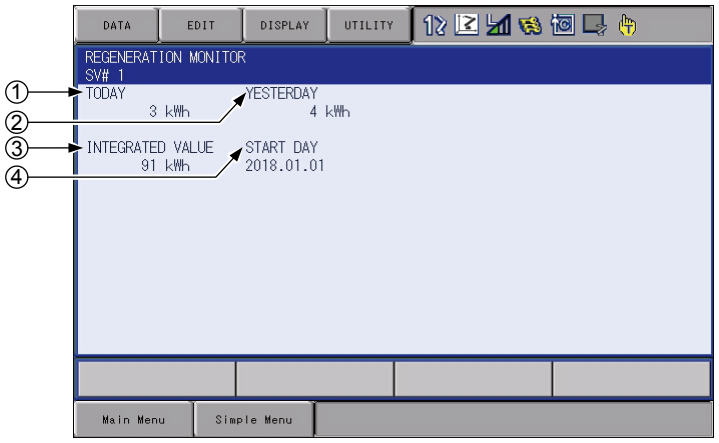
The normal functioning of power supply regeneration can be checked with the regenerative energy arrow displayed on the power regeneration window.

8.33.3 Regeneration Monitor Window

The amount of regenerated power for today and the accumulated amount of regenerated power can be checked on this window. For a system in which two or more control panels are connected, the data for each control panel can be checked.

Use the following procedure to display the regeneration monitor window.

1. Change the security mode to management mode or a higher mode.
   – For how to change the security mode, refer to *chapter 7.1.1.1 “Changing the Security Mode”* .
2. Select {ROBOT} → {REGENERATION SET} in the main menu.
   – The regeneration monitor window appears.



The description of the window is given next.

① TODAY
Indicates the accumulated amount of regenerated power for today for each control panel.

② YESTERDAY
Indicates the accumulated amount of regenerated power for yesterday for each control panel.

③ INTEGRATED VALUE
Indicates the accumulated amount of regenerated power up to the present for each control panel.

④ START DAY
Indicates the start date for measuring the accumulated amount of regenerated power.

NOTE

For a system in which two or more control panels are connected, the data for each control panel can be checked by pressing the {PAGE} key on the regeneration monitor window to change the page.

For control panels that do not support power supply regeneration, “***” is shown for the values of today, yesterday, integrated value, and start day.

8.33.4 Reset Time Setting

The time can be set that is used to reset the amount of regenerated power for today as described in *chapter 8.33.3 "Regeneration Monitor Window"* .

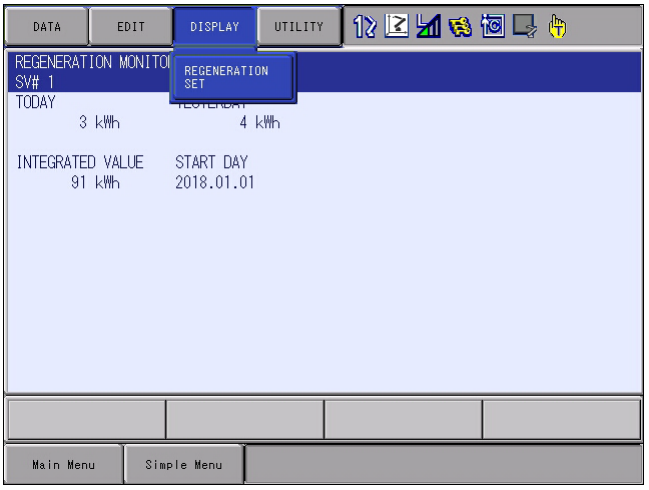
Once each day, the amount of regenerated power for today is reset to 0 at the set time, and the regenerated power starts being accumulated again from 0. Before the reset, the amount of regenerated power for yesterday is set to the amount of regenerated power for today, which eliminates the previous amount of regenerated power for yesterday. However, the reset does not affect the accumulated amount of regenerated power.

For a coordinated panel, all control panels in the system are reset.

NOTE The default value for the reset time is 12:00 AM (00:00 on the window). If the reset time is not changed, the system is reset at 12:00 AM.

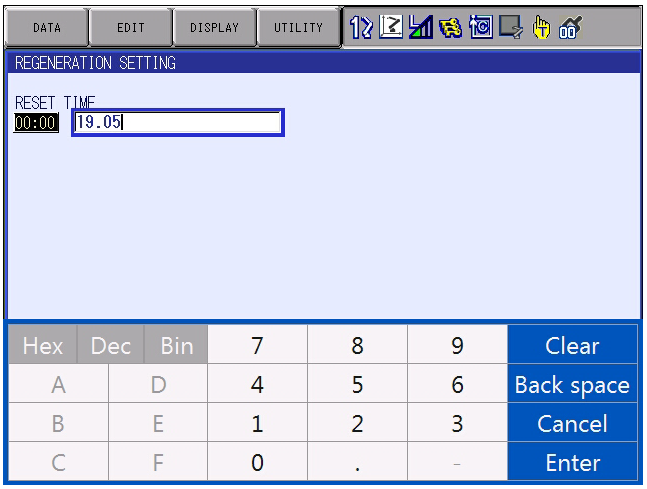
Use the following procedure to display the reset time setting window.

1. Change the security mode to management mode or a higher mode.
   – For how to change the security mode, refer to *chapter 7.1.1.1 "Changing the Security Mode"* .
2. Select {ROBOT} → {REGENERATION SET} in the main menu.
   – The regeneration monitor window appears.
3. Select {DISPLAY} → {REGENERATION SET} from the pull-down menu.
   – The regeneration setting window appears.



4. Select “00:00” (default value) and enter the new reset time.

   – The reset time can be set between 00:00 and 23:59.
   Example: To set 7:05 PM, enter "19.05".



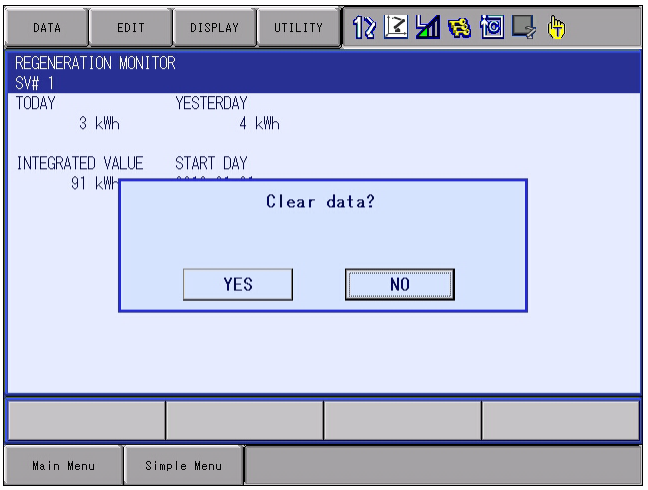
8.33.5 Resetting the Amount of Regenerated Power for Today

Use the following procedure to discard the amount of regenerated power for today and store 0 as that amount. The amount of regenerated power for yesterday and the accumulated amount of regenerated power are not changed.

1. Change the security mode to management mode or a higher mode.
   – For how to change the security mode, refer to *chapter 7.1.1.1 “Changing the Security Mode”* .
2. Select {ROBOT} → {REGENERATION SET} in the main menu.
   – The regeneration monitor window appears.
3. Select {DATA} → {RESET(TODAY VALUE)} from the pull-down menu.



4. The “Clear data?” confirmation dialog box appears.
   – Select “Yes” to reset the amount of regenerated power for today to 0.



The amount of regenerated power for today is reset on only the control panel that is displaying data at that time.

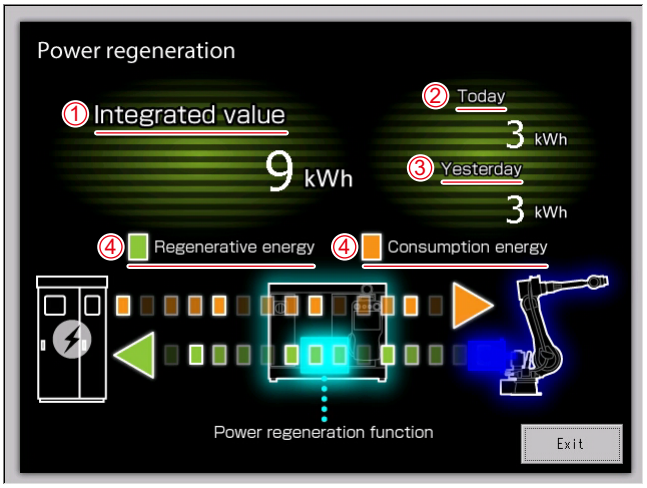
8.33.6 Power Regeneration Monitor Data Output Function

This function outputs the data (① to ④ below) displayed on the power regeneration monitor window to an external device. For the output methods to an external device, there is a method that outputs the data from the specified GP output signals, and a method that writes the data to the specified registers so an external device can read the data from those registers.

To output data to an external device using the field network function, create circuits to output the GP output signals specified in the parameters to external output signals in a CIO ladder program. After the previously mentioned CIO ladder program is created, use the external I/O allocation function to allocate the external output signals for the YRC1000 controller that are used to communicate with the external device over field network communication.

For the external I/O allocation function, refer to *chapter 12.2 "Allocating External I/O Signal"* .

This function is available in YAS5.25.00A-00 or later.



① **Integrated value data**

② **Today's value data**

③ **Yesterday's value data**

④ **Regenerative energy/consumption energy arrow data**

8.33.6.1 Output from GP Output Signals

Parameter	Item	Setting Description
S3C1470	Set the number to output the integrated value data from GP output signals.	Set a value between 1 and 4064. The data is output from the GP output signals (32 bits) with the specified number. The data is not output if the number is set to 0 or if set to 4065 or more.
S3C1471	Set the number to output today's value data from GP output signals.	Set a value between 1 and 4064. The data is output from the GP output signals (32 bits) with the specified number. The data is not output if the number is set to 0 or if set to 4065 or more.
S3C1472	Set the number to output yesterday's value data from GP output signals.	Set a value between 1 and 4064. The data is output from the GP output signals (32 bits) with the specified number. The data is not output if the number is set to 0 or if set to 4065 or more.
S3C1473	Set the number to output the regenerative energy/ consumption energy arrow data from GP output signals.	Set a value between 1 and 4095. The data is output from the GP output signals (2 bits) with the specified number. The data is not output if the number is set to 0 or if set to 4096 or more.

① Integrated value data

1.The integrated value is output from the GP output signal number set in parameter S3C1470 in 32 bits.

2.For example, if S3C1470 = 121, the integrated value is output from OT#121 to OT#152 (32 bits). When the integrated value is 9.00 kWh, the signal output from OT#121 to OT#152 is shown below. The value is output in units of 0.01 kWh.
Multiple 9.00 by 100. The value is 0x00000388 when the value multiplied by 100 is converted to hexadecimal data, and this value is output from the GP output signal numbers set in parameter S3C1470.

GP Output Signal	X=7	6	5	4	3	2	1	0	
OT#145 to OT#152 (#1019x)	0	0	0	0	0	0	0	0	0x00
OT#137 to OT#144 (#1018x)	0	0	0	0	0	0	0	0	0x00
OT#129 to OT#136 (#1017x)	0	0	0	0	0	0	1	1	0x03
OT#121 to OT#128 (#1016x)	1	0	0	0	0	1	0	0	0x84
								Hexa-deci-mal:	0x00000384
								Deci-mal:	900

OT#128	OT#127	OT#126	OT#125	OT#124	OT#123	OT#122	OT#121
#10167	#10166	#10165	#10164	#10163	#10162	#10161	#10160
d7	d6	d5	d4	d3	d2	d1	d0

OT#136	OT#135	OT#134	OT#133	OT#132	OT#131	OT#130	OT#129
#10177	#10176	#10175	#10174	#10173	#10172	#10171	#10170
d15	d14	d13	d12	d11	d10	d9	d8

OT#144	OT#143	OT#142	OT#141	OT#140	OT#139	OT#138	OT#137
#10187	#10186	#10185	#10184	#10183	#10182	#10181	#10180
d23	d22	d21	d20	d19	d18	d17	d16

OT#152	OT#151	OT#150	OT#149	OT#148	OT#147	OT#146	OT#145
#10197	#10196	#10195	#10194	#10193	#10192	#10191	#10190
d31	d30	d29	d28	d27	d26	d25	d24

② Today's value data

1.Today's value is output from the GP output signal number set in parameter S3C1471 in 32 bits.

2.For example, if S3C1470 = 153, today's value is output from OT#153 to OT#184 (32 bits). When today's value is 3.00 kWh, the signal output from OT#153 to OT#184 is shown below. The value is output in units of 0.01 kWh.
Multiple 3.00 by 100. The value is 0x0000012C when the value multiplied by 100 is converted to hexadecimal data, and this value is output from the GP output signal numbers set in parameter S3C1471.

GP Output Signal	X=7	6	5	4	3	2	1	0	
OT#177 to OT#184 (#1023x)	0	0	0	0	0	0	0	0	0x00
OT#169 to OT#176 (#1022x)	0	0	0	0	0	0	0	0	0x00
OT#161 to OT#168 (#1021x)	0	0	0	0	0	0	0	1	0x01
OT#153 to OT#160 (#1020x)	0	0	1	0	1	1	0	0	0x2C
								Hexa-deci-mal:	0x0000012C
								Deci-mal:	300

OT#160	OT#159	OT#158	OT#157	OT#156	OT#155	OT#154	OT#153
#10207	#10206	#10205	#10204	#10203	#10202	#10201	#10200
d7	d6	d5	d4	d3	d2	d1	d0

OT#168	OT#167	OT#166	OT#165	OT#164	OT#163	OT#162	OT#161
#10217	#10216	#10215	#10214	#10213	#10212	#10211	#10210
d15	d14	d13	d12	d11	d10	d9	d8

OT#176	OT#175	OT#174	OT#173	OT#172	OT#171	OT#170	OT#169
#10227	#10226	#10225	#10224	#10223	#10222	#10221	#10220
d23	d22	d21	d20	d19	d18	d17	d16

OT#184	OT#183	OT#182	OT#181	OT#180	OT#179	OT#178	OT#177
#10237	#10236	#10235	#10234	#10233	#10232	#10231	#10230
d31	d30	d29	d28	d27	d26	d25	d24

③ Yesterday's value data

1.Yesterday's value is output from the GP output signal number set in parameter S3C1472 in 32 bits.

2.For example, if S3C1472 = 185, yesterday's value is output from OT#185 to OT#216 (32 bits). When yesterday's value is 3.00 kWh, the signal output from OT#185 to OT#216 is shown below. The value is output in units of 0.01 kWh.
Multiple 3.00 by 100. The value is 0x0000012C when the value multiplied by 100 is converted to hexadecimal data, and this value is output from the GP output signal numbers set in parameter S3C1472.

GP Output Signal	**X=7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
OT#209 to OT#216 (#1027x)	0	0	0	0	0	0	0	0	0x00
OT#201 to OT#208 (#1026x)	0	0	0	0	0	0	0	0	0x00
OT#193 to OT#200 (#1025x)	0	0	0	0	0	0	0	1	0x01
OT#185 to OT#192 (#1024x)	0	0	1	0	1	1	0	0	0x2C
								Hexa-deci-mal:	0x0000012C
								Deci-mal:	300

OT#192	OT#191	OT#190	OT#189	OT#188	OT#187	OT#186	OT#185
#10247	#10246	#10245	#10244	#10243	#10242	#10241	#10240
d7	d6	d5	d4	d3	d2	d1	d0

OT#200	OT#199	OT#198	OT#197	OT#196	OT#195	OT#194	OT#193
#10257	#10256	#10255	#10254	#10253	#10252	#10251	#10250
d15	d14	d13	d12	d11	d10	d9	d8

OT#208	OT#207	OT#206	OT#205	OT#204	OT#203	OT#202	OT#201
#10267	#10266	#10265	#10264	#10263	#10262	#10261	#10260
d23	d22	d21	d20	d19	d18	d17	d16

OT#216	OT#215	OT#214	OT#213	OT#212	OT#211	OT#210	OT#209
#10277	#10276	#10275	#10274	#10273	#10272	#10271	#10270
d31	d30	d29	d28	d27	d26	d25	d24

④ Regenerative energy/consumption energy arrow data

The regenerative energy arrow is lit when the motor is regenerating energy while the robot is decelerating. The consumption energy arrow is lit when the servo is ON.

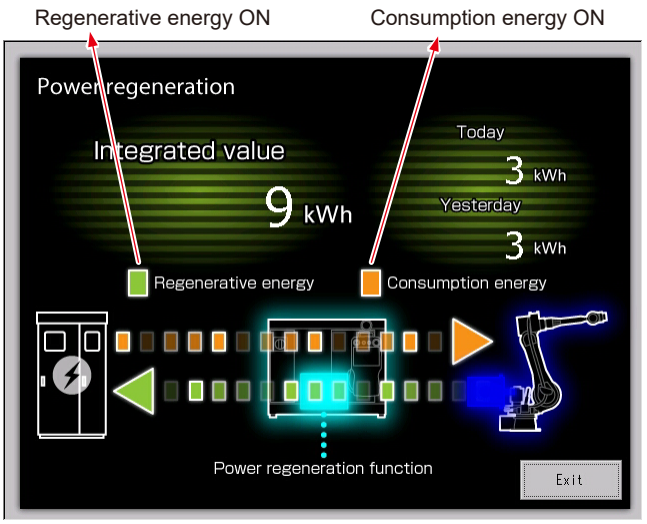
1. The regenerative energy/consumption energy arrows are output from the GP output signal number set in parameter S3C1473 in 2 bits.
2. For example, if S3C1473 = 217, the arrow status for regenerative energy is output from OT#217, and arrow status the consumption energy is output from OT#218.
   OFF means the arrow is not displayed and ON means the arrow is displayed.

GP Output Signal	X=7	6	5	4	3	2	1	0	
OT#217 to OT#224 (#1028x)							1	1	0x03

Regenerative energy

Consumption energy

Signal	Item	Description
OT#217	Regenerative energy	ON: arrow is displayed, OFF: arrow is not displayed
OT#218	Consumption energy	ON: arrow is displayed, OFF: arrow is not displayed



8.33.6.2 Writing Data to Register Addresses

Parameter	Item	Setting Description
S3C1474	Set the register address to output the integrated value data.	Set a value between 1 and 558. The data is written to the specified register address and register address +1. The data is not written if the address is set to 0 or if set to 559 or more.
S3C1475	Set the register address to output today's value data.	Set a value between 1 and 558. The data is written to the specified register address and register address +1. The data is not written if the address is set to 0 or if set to 559 or more.
S3C1476	Set the register address to output yesterday's value data.	Set a value between 1 and 558. The data is written to the specified register address and register address +1. The data is not written if the address is set to 0 or if set to 559 or more.
S3C1477	Set the register address to output the regenerative energy/ consumption energy arrow data.	Set a value between 1 and 559. The data is written to the specified register address and register address +1. The data is not written if the address is set to 0 or if set to 560 or more.

① Integrated value data

1.The integrated value data is written to the register address set in parameter S3C1474.

2.For example, if S3C1474 = 12, the integrated value is written to registers M012 and M013. When the integrated data is 9.00 kWh, registers M012 and M013 contain the values shown below. The value is output in units of 0.01 kWh.
Multiple 9.00 by 100. This value is written to the register address set in parameter S3C1474 as decimal data.

Register Address	Value	
M013	0	0x0000
M012	900	0x0384
	Hexa-deci-mal:	0x00000384
	Deci-mal:	900

② Today's value data

1.Today's value data is written to the register address set in parameter S3C1475.

2.For example, if S3C1475 = 14, today's value is written to registers M014 and M015. When today's value data is 3.00 kWh, registers M014 and M015 contain the values shown below. The value is output in units of 0.01 kWh.
Multiple 3.00 by 100. This value is written to the register address set in parameter S3C1474 as decimal data.

Register Address	Value	
M015	0	0x0000
M014	300	0x012C
	Hexa-deci-mal:	0x0000012C
	Deci-mal:	300

③ Yesterday's value data

1.Yesterday's value data is written to the register address set in parameter S3C1476.

2.For example, if S3C1476 = 16, yesterday's value data is written to registers M016 and M017. When yesterday's value data is 3.00 kWh, registers M016 and M017 contain the values shown below. The value is output in units of 0.01 kWh.
Multiple 3.00 by 100. This value is written to the register address set in parameter S3C1476 as decimal data.

Register Address	Value	
M017	0	0x0000
M016	300	0x12C
	Hexa-deci-mal:	0x0000012C
	Deci-mal:	300

④ Regenerative energy/consumption energy arrow data

The regenerative energy arrow is lit when the motor is regenerating energy while the robot is decelerating. The consumption energy arrow is lit when the servo is ON.

1. The regenerative energy/consumption energy arrow data is written to the register address set in parameter S3C1477.
2. For example, if S3C1477 = 18, the regenerative energy/consumption energy arrow data is written to register M018. OFF means the arrow is not displayed and ON means the arrow is displayed.
   When the regenerative energy arrow and the consumption energy arrow are displayed, both bits are ON and the value is 0x03, and this value is written to the register address set in parameter S3C1477 as decimal data.

Register Address	Value	
M018	3	0x0003
	Hexa-deci-mal:	0x00000003
	Deci-mal:	3

8.34 Step Diagnosis Function

This function displays the load ratio of each axis for one step. With this function, the following items are shown: job name, line, step, axis, and result (load ratio) when the motor torque load ratio exceeds the threshold value during play mode.

■ Measurement of Data

This function measures the data for all jobs. Measurements start automatically when playback is performed for a job. The load ratio of each axis is automatically updated every time the step is switched or the job is stopped (END, HOLD, PAUSE, Emergency stop).

■ Setting

The job name and step number are displayed when the load ratio exceeds the threshold value specified for the motor torque of each axis by parameter.

Settings can be changed to display a message when the load ratio exceed the threshold value.

NO.	Meaning	Setting Value	Note
S1CxG1400	Load ratio threshold value	0 (units: %)	The ratio is set as 100% when the value is 0.
S2C1339	Step diagnosis message displayed	0 (DISABLE) 1 (ENABLE)	A message is displayed when this setting is enabled and the load ratio exceed the threshold value.

NOTE

The message is not displayed even if S2C1339 is set to 1 under the following conditions.

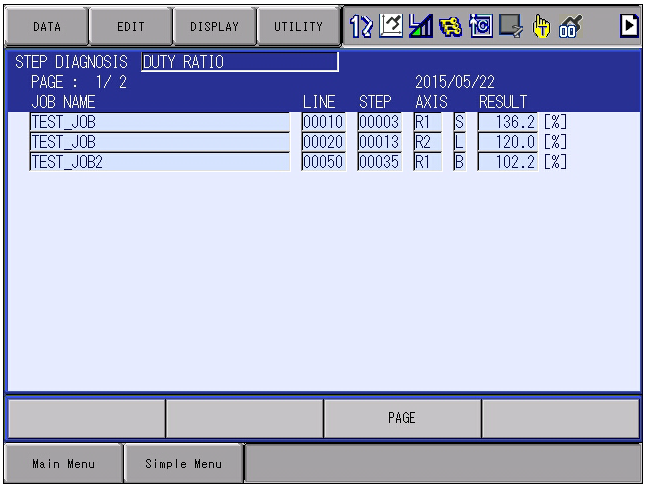
- When turning the control power supply ON and OFF.
- When the date is changed.

■ **Confirmation of Data**

The job name, line, step, axis, result (load ratio) when the load ratio exceeds the threshold value is displayed.

Use the following procedure to confirm the data.

1. Select {PM} in the main menu.
2. Select {STEP DIAGNOSIS}.
   – The STEP DIAGNOSIS window is shown.
   The maximum 50 measured data appears on the window.



3. Press {PAGE}
   – It is possible to check the data of the date whose number corresponds to the number of pressing {PAGE}. Modify if necessary. The data of the maximum 50 days can be checked.

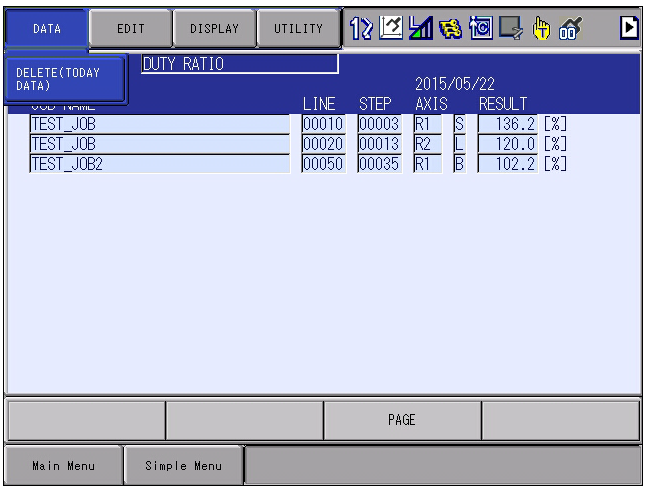
■ **Management of Data**

Use the following procedure to delete the measurement data for the current day.

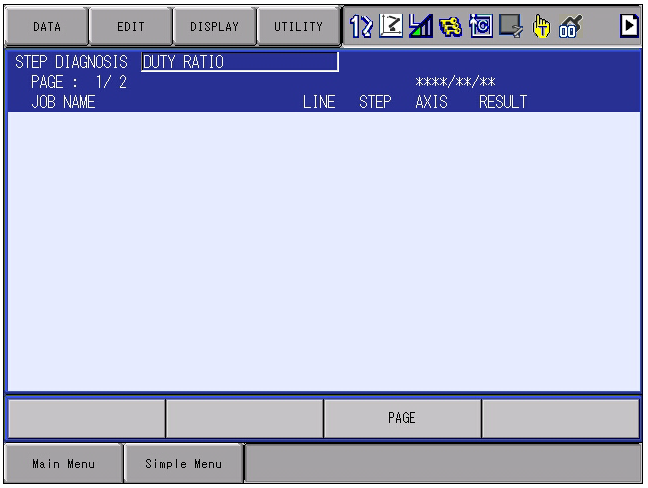
NOTE

- The measurement data for the current day can be deleted when the security mode is set to management mode or higher.

1. Select {DATA} in the menu.
   – The pull-down menu appears.



2. Select {DELETE (TODAY DATA)}
   – The measurement data for the current day is deleted.



The step diagnosis data can be saved by the external memory menu.

For details of the external memory menu, refer to chapter 7 “External Memory Devices” in “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051)”.

1. Select {EX.MEMORY} in the main menu.
2. Select {SAVE}.
3. Select “SYSTEM DATA”.
4. Select “STEP DIAGNOSIS DATA”.
   – The selected system data is displayed with “★”.
5. Press [ENTER].
6. Select {YES}.
   – “STEP DIAGNOSIS DATA” is saved.

8.35 Overload Detection Function

There may be a negative impact on the service life of the robot if the tool information in the tool file is incorrectly set. This function detects the overload that occurs in this state.
This function is available for YAS4.37-00 or later.

If the generated torque of each axis exceeds the upper limit value, a system output signal for overload detection is output and the following message appears.
"Robot might be getting overload. Check its load or settings of tool file."

<System Outputs>

51247	51246	51245	51244	51243	51242	51241	51240
SOUT#0992	SOUT#0991	SOUT#0990	SOUT#0989	SOUT#0988	SOUT#0987	SOUT#0986	SOUT#0985
DETECT OVERLOAD R8	DETECT OVERLOAD R7	DETECT OVERLOAD R6	DETECT OVERLOAD R5	DETECT OVERLOAD R4	DETECT OVERLOAD R3	DETECT OVERLOAD R2	DETECT OVERLOAD R1

This message and the system output signals continue until the operations listed below. The message is not reset by turning the control power supply OFF and ON.

- Editing on the tool coordinate window.
- Executing automatic measurement of the tool load and the center of gravity.
- Loading settings (TOOL.CND) from external memory devices.

8.36 Overload Alarm Management Function

When an abnormal load is applied to the robot due to interference between the robot and the workpiece or peripheral equipment, a load anomaly is detected and an alarm occurs. Since a recovery can be made from a minor failure by resetting the alarm, the robot may be restarted after the alarm is reset during operation. If the robot continues to be used without checking the effects of these anomalous loads, the robot may be damaged by the accumulation of those effects, which may lead to a serious problem.

This function manages the status of various alarms that occur when an abnormal load is applied to the robot, and it prompts the operator to inspect the robot.

(1) Overload Alarm Management
The number of times that alarms occur can be checked on the OVERLOAD ALARM MANAGEMENT window.

(2) Overload Anomaly Notification
When overload alarms occur at greater than or equal to the specified number of alarms, this function issues an alarm, displays a message, and prompts the operator to inspect the robot.

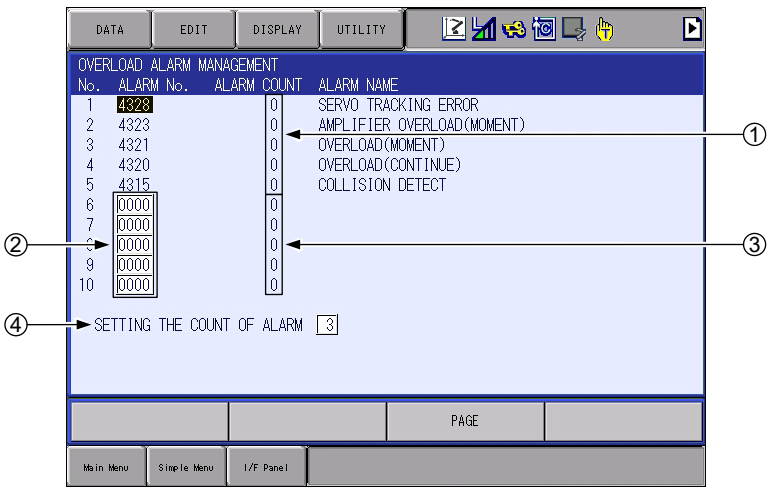
(3) Overload Anomaly Inspection
The inspection items are displayed on the INSPECTION ITEM window, where the inspection statuses can be entered and the inspection can be completed.

This function is available in system software version YAS5.50.00A(*)-00 or later.

8.36.1 OVERLOAD ALARM MANAGEMENT Window

This windows displays the counts of the various alarms that occur when an abnormal load is applied to the robot. Alarms to be managed can also be added here.

1. Select {ROBOT} under the main menu.
2. Select {OVERLOAD ALARM MANAGE.}.
   – The OVERLOAD ALARM MANAGEMENT window appears.



① Counts of overload alarms (manufacturer)
The counts of five types of overload alarms selected by YASKAWA. (Maximum value is 255)

② **Overload alarms (user)**

The overload alarms that can be added by the user.
Alarms in the 8000s and 9000s cannot be registered.

③ **Counts of overload alarms (user)**

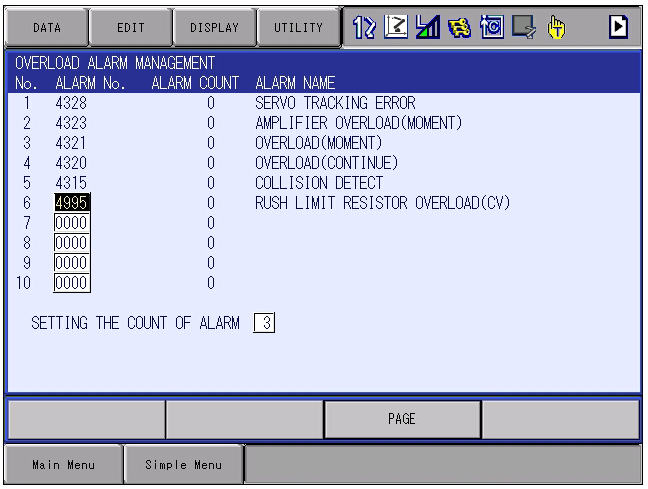
The counts of overload alarms (user).

④ **SETTING THE COUNT OF ALARM**

The specified count at which to provide notification of an overload anomaly by alarm and message.
Setting range: 0 to 99
Initial value: 3

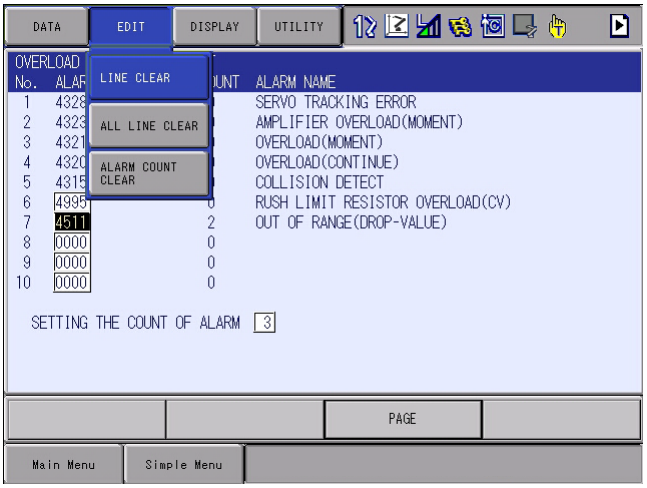
■ **Registration of User Alarms**

1. Change the security mode to management mode.
2. Select {ROBOT} under the main menu.
3. Select {OVERLOAD ALARM MANAGE.}.
4. Move the cursor to the alarm number to register.
5. Set the alarm number.
   If an alarm number is entered that is not registered in the robot controller, "ERROR 1284 The entered alarm number is not registered." appears.
   For the alarm numbers, refer to "YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS) (RE-CER-A600)".

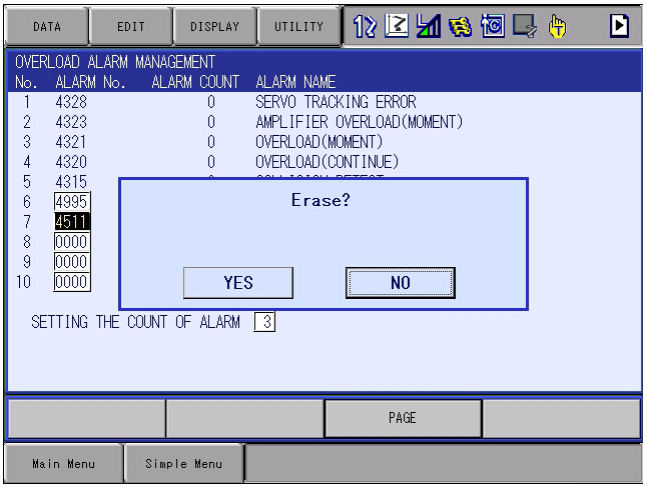


■ **Deletion of a User Alarm**

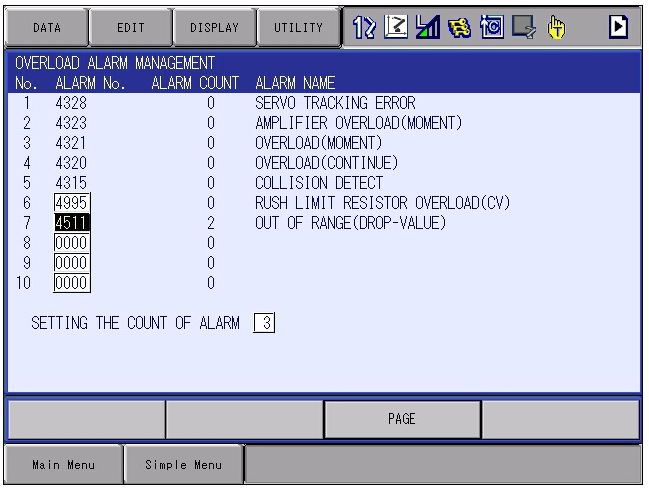
1. Perform steps 1 to 3 in *"Registration of User Alarms"* .
2. Move the cursor to the alarm number to delete.
3. Select {EDIT} - {LINE CLEAR}.
   However, when the "Confirm the check items on the overload alarm management display." message appears on the programming pendant, the menu does not appear even if {EDIT} is selected. The confirmation dialog box also does not appear when the cursor is on No. 1 to No. 5. The alarm numbers registered by YASKAWA cannot be erased.



4. The confirmation dialog box appears.

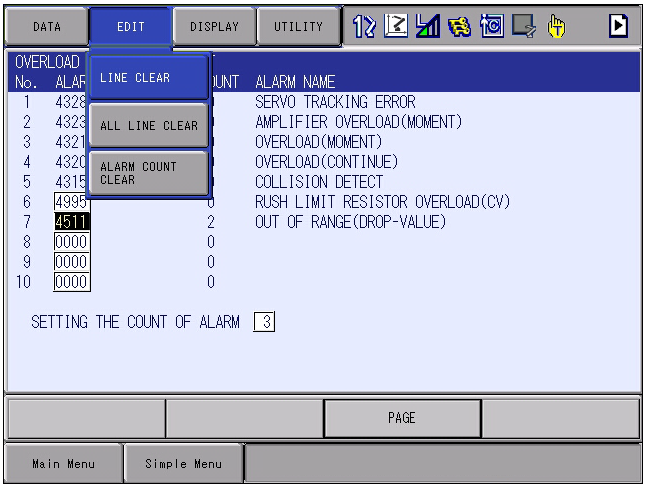


5. Select "YES".
   – The alarm number and the alarm count are erased on the line with the cursor.

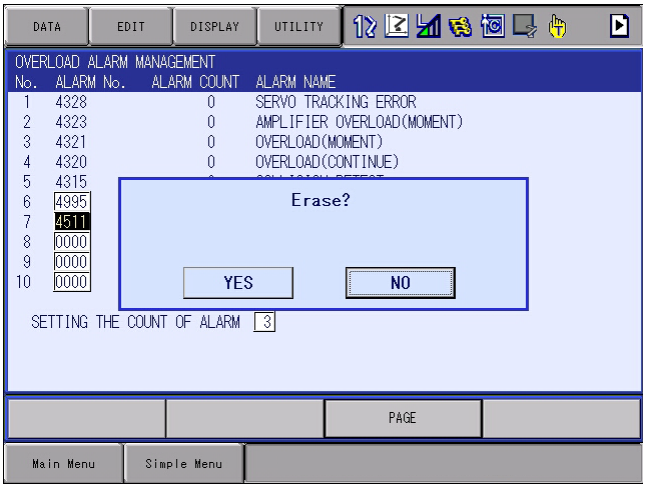


■ **Deletion of All User Alarms**

1. Perform steps 1 to 3 in *"Registration of User Alarms"* .
2. Select {EDIT} - {ALL LINE CLEAR}.
   However, when the "Confirm the check items on the overload alarm management display." message appears on the programming pendant, the menu does not appear even if {EDIT} is selected.

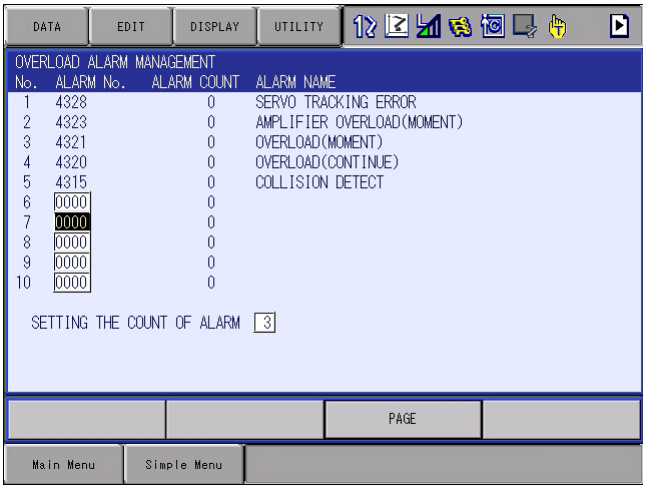


3. The confirmation dialog box appears.



4. Select "YES".

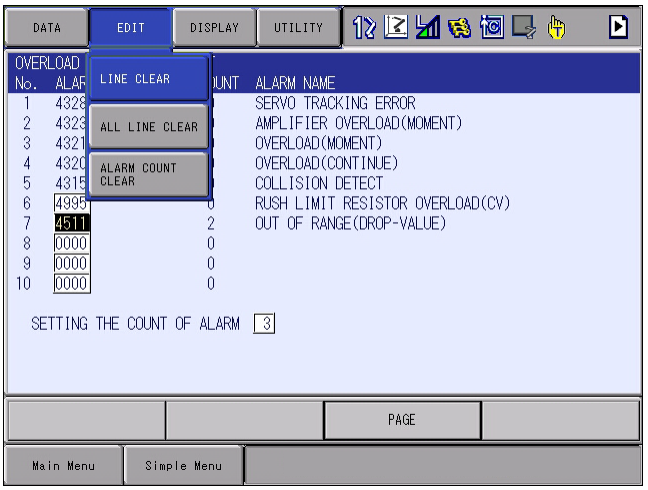
   – The alarm numbers and the alarm counts registered for No. 6 to No. 10 on the OVERLOAD ALARM MANAGEMENT window are erased. However, the alarm numbers registered by YASKAWA for No. 1 to No. 5 cannot be erased.



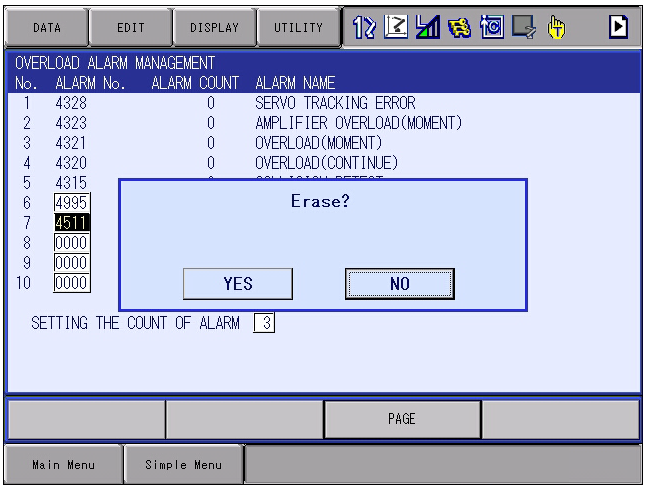
■ **User Alarm Count Reset**

1. Perform steps 1 to 3 in *"Registration of User Alarms"* .

2. Select {EDIT} - {ALARM COUNT CLEAR}.
   However, when the "Confirm the check items on the overload alarm management display." message appears on the programming pendant, the menu does not appear even if {EDIT} is selected.

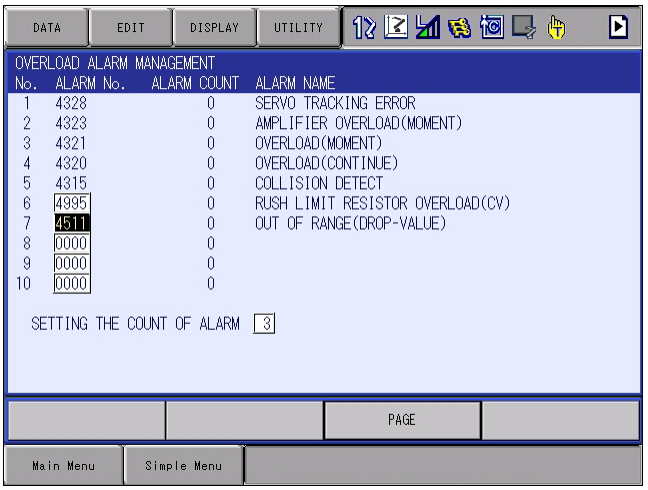


3. The confirmation dialog box appears.



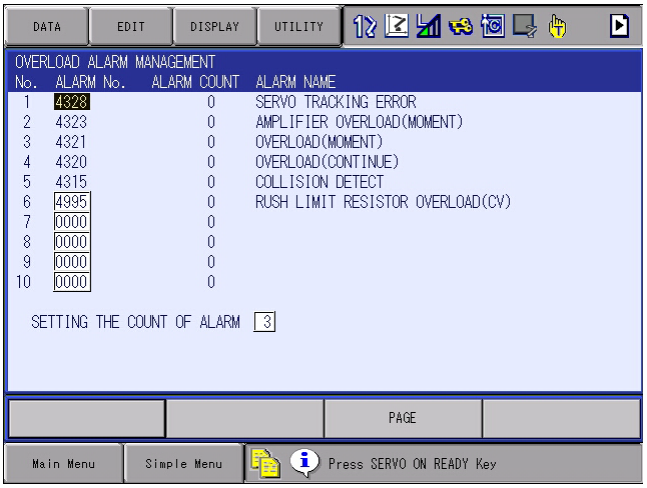
4. Select "YES".

   – The alarm count is erased on the line with the cursor.



■ Registration of the Alarm Count Setting

1. Perform steps 1 to 3 in *"Registration of User Alarms"* .
2. Move the cursor to {SETTING THE COUNT OF ALARM}.
3. Set the alarm count.
   The setting range is 0 to 99. The initial value is 3.



When the alarm count exceeds the alarm count setting value registered on the OVERLOAD ALARM MANAGEMENT window, the "OVERLOAD ALARM NOT INSPECTED" alarm occurs and the "Confirm the check items on the overload alarm management display" message appears when the power supply to the controller is turned OFF and then ON again.
When {SETTING THE COUNT OF ALARM} is set to 0, the "OVERLOAD ALARM NOT INSPECTED" alarm is not detected.



8.36.2 Overload Anomaly Notification

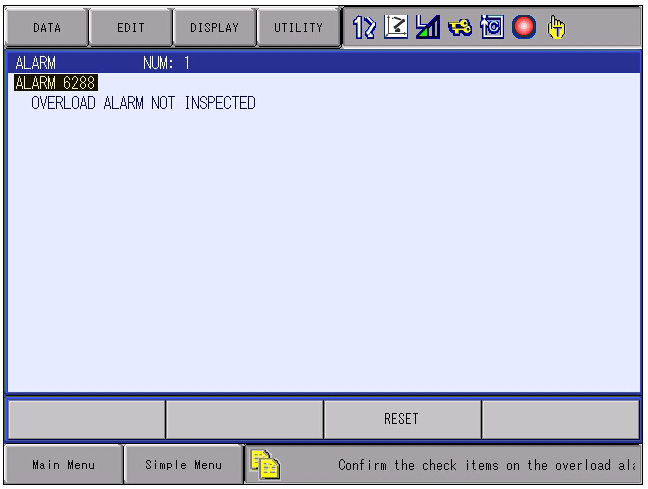
When overload alarms occur at greater than or equal to the specified number of alarms, the following message appears.

"Confirm the check items on the overload alarm management display."

When the power supply to the controller is turned ON, the following alarm occurs.

"ALARM 6288: OVERLOAD ALARM NOT INSPECTED"

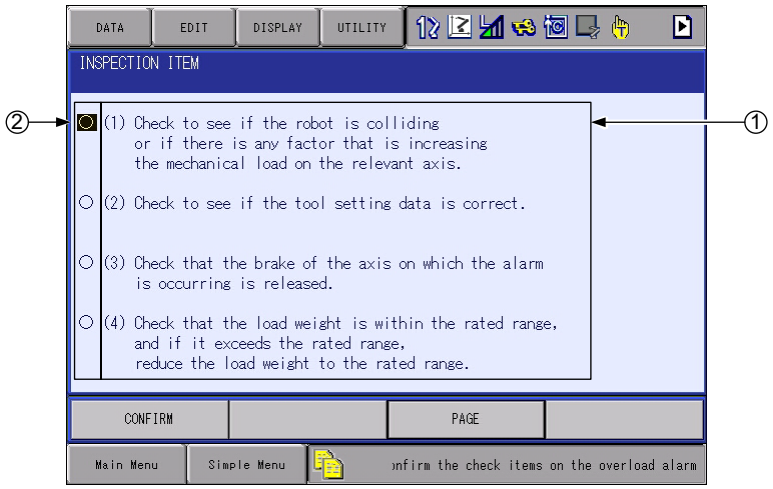
This alarm can be reset, and it does not occur again until the next time the power supply to the controller is turned ON.



This message disappears after the inspection work is completed and the alarm no longer occurs.

8.36.3 INSPECTION ITEM Window

When overload alarms occur at greater than or equal to the specified number of alarms, perform the inspection work. The necessary inspection items appear on this window. The inspection items that were performed can be ticked off and the work can be confirmed. When the work is confirmed, the message to perform the inspection disappears, and the alarm no longer occurs when the power supply is turned ON.



① Inspection items

Details on what to inspect for the cause of the overload anomaly alarm.

② Inspection check boxes

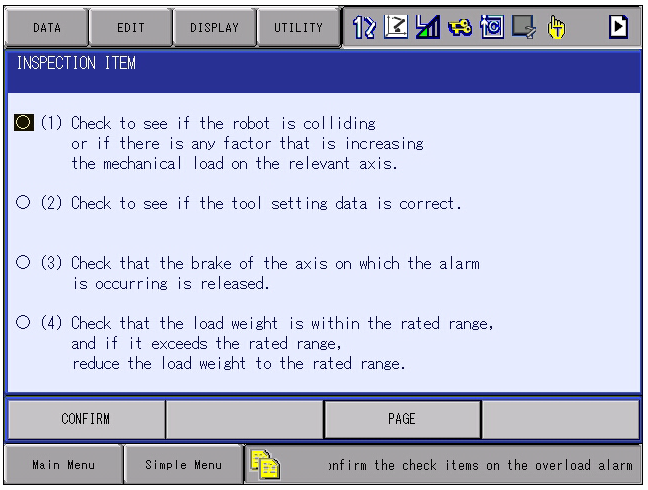
The completion status of the inspection.

○: Not completed

●: Completed

■ **Completion of Inspection Items**

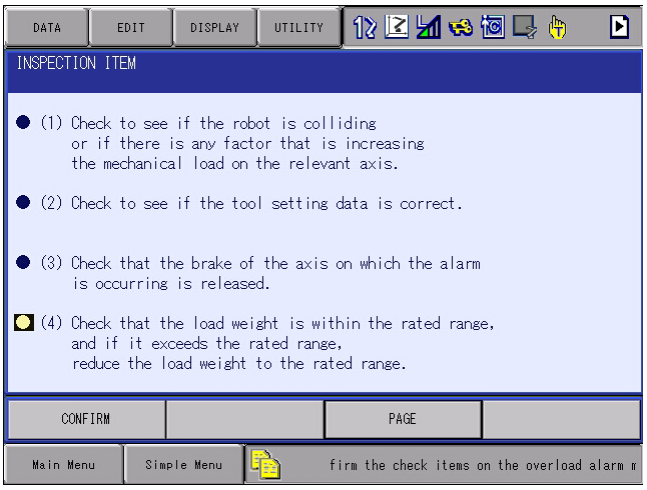
1. Change the security mode to management mode.
2. Select {ROBOT} under the main menu.
3. Select {OVERLOAD ALARM MANAGE.}.
4. Select {PAGE}.
   – The INSPECTION ITEM window appears.



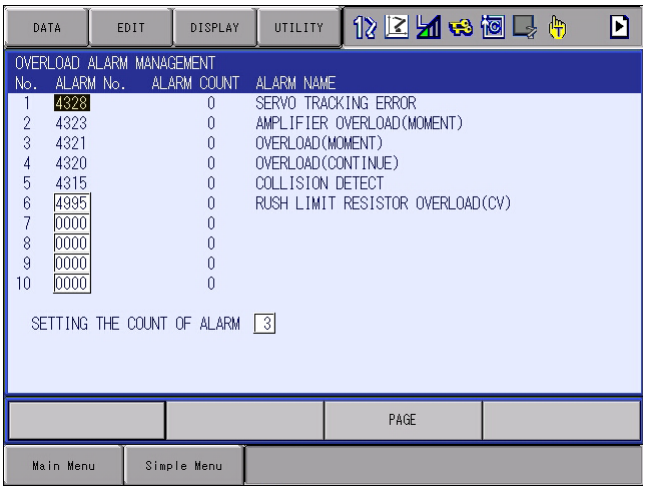
5. Move the cursor to an inspection item for which the inspection was completed and press [SELECT] to set the completed status (●). Press [SELECT] again to set the not completed status (○).

■ **Completion of the Entire Inspection**

1. Perform steps 1 to 3 in *"Completion of Inspection Items"* .
2. Confirm that the check boxes for all inspection items are the completed status.
3. Press {CONFIRM}.
   {CONFIRM} appears when the "Confirm the check items on the overload alarm management display." message appears.



– The alarm counts registered on the OVERLOAD ALARM MANAGEMENT window are erased.



9 System Backup

For the YRC1000, the system data can be collectively backed up in advance so that the data can be immediately loaded and restored in case of an unexpected trouble such as data loss.

NOTE

The maximum size of CMOS.BIN files that can be saved in the YRC1000 controller has been increased for the system software version “YAS4.00.00A-00” or later to support future functional expansion.

The CMOS.BIN file saved using the system software version “YAS4.00.00A-00” or later cannot be loaded into the controller with the system software version “YAS4.00.00A-00” or earlier. If an incompatible file is loaded, the error 3540 “CMOS not compatible” will occur.

The CMOS. BIN file saved using the system software version “YAS.3.11.00A-00” or earlier can be loaded into the controller with the system software version “YAS4.00.00A-00” or later.

9.1 System Backup with YRC1000

For the YRC1000, two types of collective backup are available: CMOS.BIN and CMOSBK.BIN.

9.1.1 Function Types of Data

9.1.1.1 CMOS.BIN

For the normal backup, use this data.

Save: Perform in the normal or maintenance mode.

Load: Perform in the maintenance mode.
(the management mode or higher mode)

The loading/saving procedures in the maintenance mode, refer to *chapter 9.2 “Backup by CMOS.BIN”* .
As for saving in the normal mode, refer to “Saving Data” in chapter 7.3 of “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051)”.

Target Area: All areas of the internally stored data.
(Note that the monitoring time is not loaded.)

9.1.1.2 CMOSBK.BIN

This data is used in the automatic backup function.

Save: Saves with the preset conditions in the normal mode.

Load: Perform for the system restoration in the maintenance mode (the management mode or higher mode)

For details, refer to *chapter 9.3 “Automatic Backup Function”* .

Target Area: All areas of the internally stored data.
(Note that the monitoring time is not loaded.)

9.1.2 Device

For the backup of the YRC1000 system, the SD card or the USB memory is used. (The USB connector of the programming pendant is not available in the automatic backup function.)

The following tables show the recommended SD card and USB memory.

<Recommended SD card>

No.	Manufacturer	Model	Capacity
1	Hagiwara Solutions	NSD6-512MS(P01SEI-YE NSD6-512MH(A01SDI-YE	512MB
2	Hagiwara Solutions	NSD6-001GS(P10SEI NSD6-001GH(A01SDI	1GB
3	Hagiwara Solutions	NSD6-002GS(P10SEI NSD6-002GH(A01SDI	2GB
4	Hagiwara Solutions	NSD6-004GH(B20SEI	4GB
5	Hagiwara Solutions	NSD6-008GH(B20SEI	8GB
6	Hagiwara Solutions	NSD6-016GH(B20SEI	16GB
7	Hagiwara Solutions	NSD4-032GH(B01MH)	32GB

< Recommended USB Memory>

No.	Manufacturer	Model	Remarks
1	Hagiwara Solutions	UBA2-xxxGSRB (TBAIA)	1GB, 2GB, and 4GB are available. “xxx” indicates “001” for “1GB”, “002” for “2GB” and “004” for “4GB”.

In order to save the batch data, the following free space per file is needed in the media.

Approx. 30MByte (YAS3.11.00A-00 or earlier)

Approx. 55MByte (YAS4.00.00A-00 or later)

Note that the free space to store the two files is needed when using the automatic backup function.

Also, it is recommended to store the backup data in two or more media cards to minimize problems if the media is damaged.

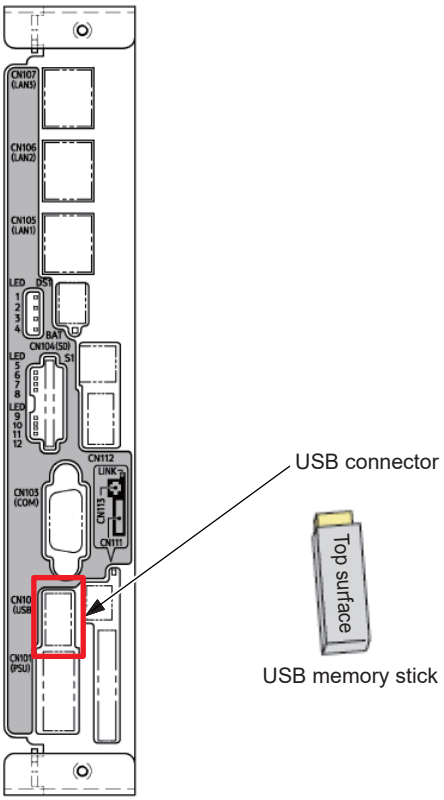


The water-proof function of the Pendant is not effective while the USB memory is connected.

If USB memory is connected constantly, there is a risk it drops off.

Use SD card if there is no measures to maintain water-proof function or to prevent USB memory from dropping off.

When using the USB memory, insert it in the USB connector of the CPU board. Be careful about the insertion direction of the connector: The USB memory should be inserted slowly with the upper surface right. Forcible insertion may result in the damage of the USB memory and the USB connector.



9.2 Backup by CMOS.BIN

Perform the backup by CMOS.BIN in the normal or maintenance mode.

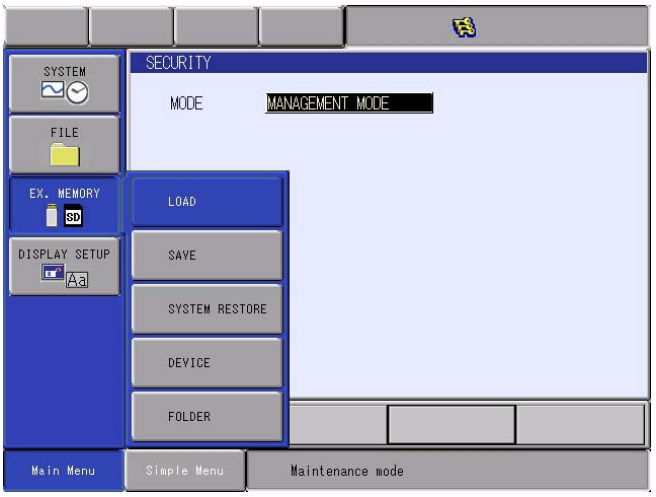
The chart below shows the availability of CMOS save/CMOS load in each security mode in the maintenance mode.

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 YRC1000 power supply while pressing [MAIN MENU].
2. Insert a SD card into the SD card slot on the programming pendant.
   – when USB memory is used instead of SD card, mount USB memory and select “USB: PENDANT” or “USB1: CONTROLLER” in the {DEVICE}.
3. Select {EX. MEMORY} under the main menu.
   – The sub menu appears.



4. Select {SAVE}.
   – The save display appears.



   – The items marked with "■" cannot be selected.

5. Select {CMOS}.
   – The confirmation dialog box appears.



6. Select {YES}.
   – Select {YES} to save the CMOS data into the SD card.
   – When saving the file, if the CMOS.BIN file exists in the SD card, the following confirmation dialog box appears.



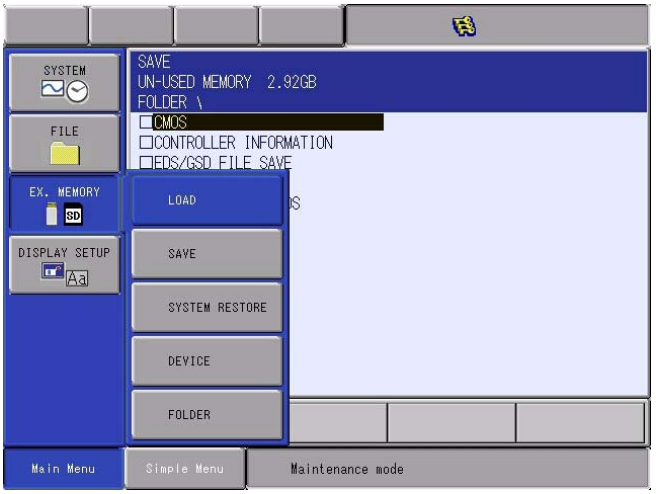
7. Select {YES}.
   – The CMOS.BIN file is overwritten in the SD card.

NOTE When not using the data stored in the portable memory device, make sure to keep the device under an appropriate management.

9.2.2 CMOS.BIN Load

Follow the procedures below to load CMOS.BIN.

1. Turn ON the YRC1000 power supply while pressing [MAIN MENU].
2. Change the security mode to the maintenance mode or higher mode.
3. Insert a SD card into the SD card on the programming pendant.
   – When USB memory is used instead of SD card, mount USB memory and select “USB: Pendant” or “USB1: Controller” in the {DEVICE}.
4. Select {EX. MEMORY} under the main menu.
   – The sub menu appears.



5. Select {LOAD}.
   – The load display appears.



   – The items marked with “■” cannot be selected.

6. Select {CMOS}.
   – The confirmation dialog box appears.



7. Select {YES}.
   – The loaded CMOS.BIN file contents are reflected in the data inside the robot.

NOTICE

When the “CMOS load” is performed, the current CMOS data is replaced with the CMOS data (the contents of “CMOS.BIN”) in the selected device. Therefore, before performing the load, make sure to perform the “CMOS Save” of the CMOS data to be loaded.

9.3 Automatic Backup Function

9.3.1 Automatic Backup Function

9.3.1.1 Objective

With the automatic backup function, the data saved in the YRC1000 such as system setting or operational condition are collectively backed up in the SD card, which is stored in the programming pendant, or the selected device at the automatic backup window.

Able to back up to the following devices.

- The SD card inserted in the programming pendant
- USB Memory connected to the ACP01 board
- The SD card of the ACP01 board
- The RAM AREA of the ACP01 board (It will display, when the high speed Ethernet server function is effective.)



The automatic backup function is enabled only while the YRC1000 power supply is ON whereas it isn't while in the maintenance mode or the power supply is OFF.

9.3.1.2 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 YRC1000.

The teaching operation is one of the factors that changes the internally stored data. Thus, a mode which backs up the latest data after the teaching operation is prepared. To confirm the termination of the teaching operation, check the mode key whether it is changed from teach mode to play mode.

Other than the teaching operation, the present position of the robot or the value of a variable can be pointed out as the factors to change the internally stored data. These data, however, are changed after each operation and have very little need to be retained permanently. Accordingly, backing up these data at regular interval should be well enough to operate and the mode to back up the data at regular interval is also prepared.

Furthermore, the mode to back up the data when starting up the YRC1000 and when inputting signals are also available for some specific versions.

With the automatic backup function, all the part where the internal data is stored in the physical memory area is collectively saved. If there is any data which is in the middle of changing while executing the automatic backup function, the data might not be usable for restoration because of its inconsistency. Therefore, the function is terminated with an error during the play back operation or while the manipulator is in motion so that the automatic backup cannot be operated. Set the automatic backup function to be executed while the manipulator is not in the playback status and while the manipulator is stopped.

The automatic backup function has the following functions and features.

No	Function/Feature	Explanation
1	Cyclic backup In the teach mode, the data in memory is backed up in a specified cycle from a specified starting time.	This function backs up as much of the latest data as possible during editing. The backup data saved in the SD card can be loaded to the YRC1000 in case of data loss so that the damage can be minimized.
2	Backup when switching modes When switching the mode from the teach mode to the play mode, the data in memory is backed up.	The editing data is backed up when editing is completed. The latest data is automatically backed up with this mode.
3	Backup when start-up When the YRC1000 is start-up, the data in memory is backed up.	When the YRC1000 starts up, the data in memory is backed up. Since the editing/playback operation is usually completed when the YRC1000 power is turned OFF, the latest data is automatically backed up with this mode.
4	Backup when inputting specified signals The data in memory is backed up when a specified signal (#40560) is input.	The data in memory is backed up by the signal from the host at the intended timing. Although the above mentioned items 1 to 3 are designed to back up the data automatically, this function backs up the data in accordance with the instruction from the host.
5	Backup while robot program is stopped The backup during playback is disabled. However, in the play mode, the backup is enabled if the robot is stopped. (“Cyclic backup” and “Backup when inputting specified signals”)	Backs up the variables for essential data.
6	Backup and retry at low priority The data in memory is backed up at low priority so that this operation does not affect the other operations. When other operations affect the backup operation, the backup is suspended and retried later.	The backup operation hardly affects the other operations so that the programming pendant can be used even during the backup operation.
7	Backup in binary The data is saved as binary data.	Backup in binary allows the system to be easily and speedily restored.
8	Setting of items Parameters can limit the settings of the backup condition.	Unnecessary settings can be avoided with this setting.

9.3.2 Settings for Automatic Backup

To set the automatic backup function, set each item at the automatic backup display.

NOTE

Four ways to perform the automatic backup are available: “Cyclic”, “Backup when switching modes”, “Backup when start-up”, and “Backup inputting specified signals”.

The automatic backup can be performed only when the robot is not during playback, and the robot is stopped.

Automatic backup function can be set from the command of the optional high speed Ethernet server function.

9.3.2.1 The SD Card inserted in the Programming Pendant

To use the automatic backup function, insert the SD card into the SD card slot on the programming pendant.

When the data could not be saved in the SD card during an automatic backup due to the absence or insufficient capacity of the SD card, the “Check the media insertion” error occurs. At the same time, the signal “occurrence of error” can be output to an external device, but the robot program will not be stopped. Check if the SD card is inserted and if it has enough capacity, and take the necessary actions.

YASKAWA recommends that the data be saved in the two or more SD cards to minimize problems if the SD card should be damaged.

Regarding the SD card for auto backup, refer to “Recommended SD card” in *chapter 9.1.2 “Device”* .

Storage capacities needed for SD card are as follows:

<YAS3.11.00A-00 or earlier>
(The number of stored files + 1) × approx. 30MByte

<YAS4.00.00A-00 or later>
(The number of stored files + 1) × approx. 55MByte

The number of storable files is automatically calculated and the MAX value is shown when AUTO BACKUP SET display appears.

9.3.2.2 USB Memory connected to the ACP01 Board

The USB memory connected to the ACP01 board can also be used as the backup device for the automatic backup function. The USB memory connected to the ACP01 board can be used in the same manner as the SD card inserted in the programming pendant.

For the USB memory for automatic backups, refer to "Recommended USB Memory" in *chapter 9.1.2 “Device”* .

9.3.2.3 The SD Card of the ACP01 Board

Set the following procedures in advance to back up to the SD card of the ACP01 board. If the following procedures are not done, “SD: Controller” would not be shown on the device list of the auto backup set display.

1. Turn ON the Power supply while pressing the [MAIN MENU] on the programming pendant.
2. After starting maintenance mode, change the security mode to the management or higher mode.
3. Select {SYSTEM} in the main menu.
   – When the sub menu will appear, select {SETTING}-{OPTION FUNCTION}. The list of the optional function will appear.
4. Select {Automatic backup (ACP01)}, and change the “NOT USED” to “USED”.
   – Select {YES}, when the confirmation dialog appears.
   – Select {YES}, when the confirmation dialog appears, and ask “initialized related files?” or “CMOSBK. BIN?”
   – It will allocate automatic backup to the SD card of the ACP01. During allocating, the massage of do not turn the power off appears.
   – The message of the maintenance mode will appear, when finished allocating.
5. Turn ON the power supply again.
6. The online window appears on the programming pendant.
7. Change the security mode to the management mode.
8. Select {SETUP}-{AUTO BACKUP SET}.
9. If the device is set to "SD: Pendant" or another value and that device is not connected, the "Check the media insertion" error occurs. Push down the [cancel], when the error occurs.
10. Select the device, and change to “SD: Controller”.



Backup setting to the SD card of the ACP01 board should be done while the robot is not operating.

When access to SD card of the ACP01 by using other than the auto backup function, the auto backup function and the exclusive process would be run. Therefore, the save time of the auto backup will extend.

(Normally, it takes about three minutes to finish backing-up. However, duplication access to the SD card of the ACP01 board takes three to ten minutes.)

9.3.2.4 RAMDISK on the ACP01 Board

RAMDISK will be shown when the high speed Ethernet server function is effective. Refer to “YRC1000 OPTIONS INSTRUCTIONS FOR ETHERNET FUNCTION (HW1483358)” for more details.

9.3.2.5 YRC1000 Status and Automatic Backup

Backup Timing	**YRC1000 Status**		**Automatic Backup**	
			SD card ready to save the data	**Absence or insufficient capacity of the SD card**
From a specified starting time	Teach mode	Editing (Accessing to the memory)	Retry	Retry
		When editing is interrupted	Backup	Error
	Play mode Remote mode	Executing jobs	Disabled	Disabled
		When stopped	Backup	Error
When a specified signal (#40560) is input	Teach mode	Editing (Accessing to the memory)	Error	Error
		When editing is interrupted	Backup	Error
	Play mode Remote mode	Executing jobs	Disabled	Disabled
		When stopped	Backup	Error
When switching the mode from the teach mode to the play mode	-		Backup	Error
When the YRC1000 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 YRC1000 memory is being edited or overwritten, the automatic backup is not performed at the specified backup starting time and is suspended and retried later. To start the backup at the reserved time, set to the time when the robot program is stopped and no job or file is edited.

■ **Backup when Switching from Teach Mode to Play Mode**
When the mode is repeatedly switched from the teach mode to the play mode or vice versa within 1 to 2 seconds, backup starts after the last time the mode is switched.

Execute the job after three second since starting the back-up.

■ **Backup when the YRC1000 starts up**
Since the automatic backup process is added to the YRC1000 start-up process, a few extra seconds are needed to start up the YRC1000.

■ **Backup when Specific Signal is Input**
While the YRC1000 memory is edited such as overwriting, the backup operation becomes an error even if there is an input to a specific signal (#40560). To start the specific input backup, perform it while the robot program is stopped and a job or file is not being modified.

Also, since the signal input is executed at rising detection, turn the signal to “0” if it is already “1”, return to “1” again.

Execute the job after three second since starting the back-up.

■ **Overwriting Limit in SD card**
The number of times that the SD card can be overwritten is limited. Because frequent backup operations may shorten the life of SD card, the number of backup times should be minimized as much as possible.

9.3.2.6 Setting Examples

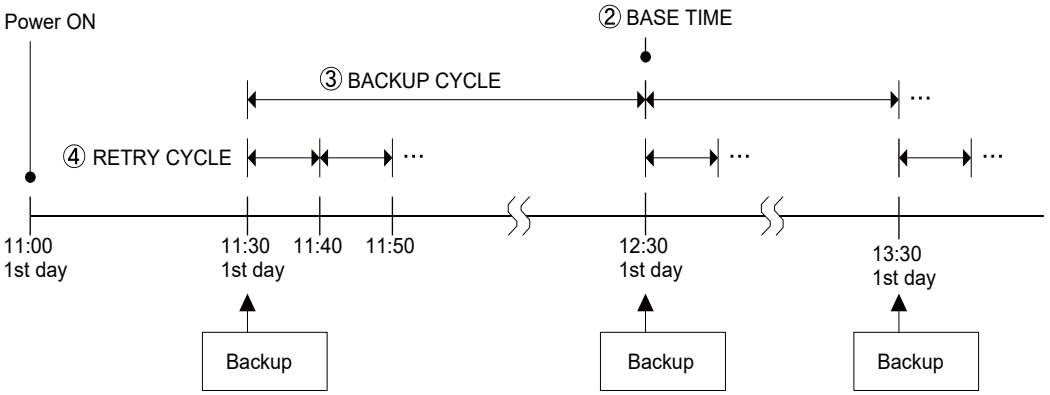
■ **Setting Example 1**

The following diagram shows a setting example with the following conditions:

BASE TIME: 12:30

BACKUP CYCLE: 60 (minutes)

RETRY CYCLE: 10 (minutes)



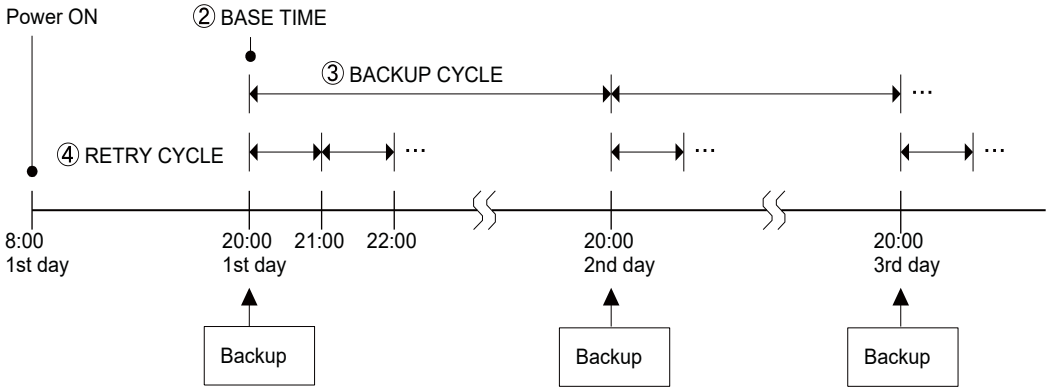
■ **Setting Example 2**

The following diagram shows a setting example with the following conditions:

BASE TIME: 20:00

BACKUP CYCLE: 1440 (minutes) (24 hours)

RETRY CYCLE: 60 (minutes)



NOTE While a job is being executed, the automatic backup or retry is not performed. Also, after an error occurs in writing into the SD card, the retry is not performed until the next backup starting time.

9.3.2.7 AUTO BACKUP FUNCTION SET Window

■ **Settings**

Automatic backup setting is performed by setting the following items on the AUTO BACKUP SET window:

- RESERVE TIME BACKUP
  (Setting for performing the backup on what day of the week, every day, or in a specific cycle)
- BASE TIME
- BACKUP CYCLE
- RETRY CYCLE
- MODE CHANGE BACKUP
  (VALID/INVALID of the backup when switching the mode from the teach mode to the play mode)
- STARTUP AUTO BACKUP
  (VALID/INVALID of the backup when the YRC1000 is started up)
- SPECIFIC INPUT BACKUP
  (VALID/INVALID of the backup when inputting specified signals)
- GP.OUT NO. ON ERROR
- DISPLAY AT EMERGENCY
- DURING ALARM OCCURENCE
- DEVICE
  (Setting of the device to store the automatic backup file)
- STORED FILE SETTING
  (It is possible to set when “SD: Pendant” or "USB1: Controller" is set in DEVICE.)

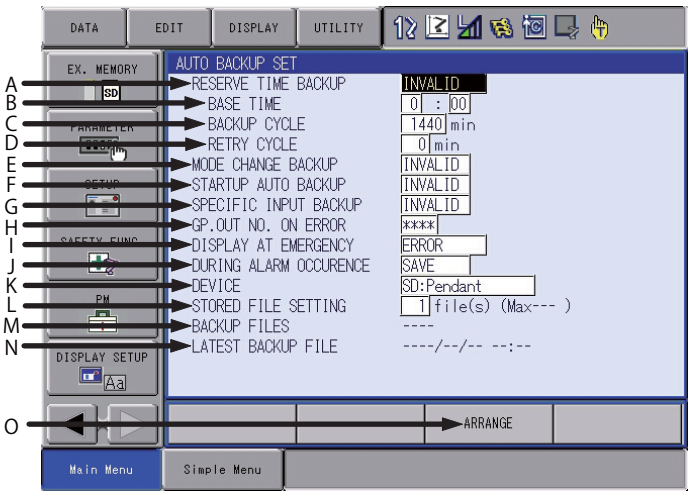
NOTE

When the “SD: Pendant”, "USB1: Controller", or “SD: Controller” is selected on the auto backup display, the capacity of the device will be checked. Therefore, a few seconds may be needed to open the setting window. For the “SD: Pendant” or "USB1: Controller", an error will occur without inserting the respective media.

When executing “ARRANGE”, the files “CMOSBK.BIN” and “CMOSBK??.BIN” (?? denotes figures) in the SD card or USB memory are changed in name or deleted. If a certain file of this type is needed to be saved before changed in name or deleted, evacuate it into a PC, etc. beforehand.

While an error occurring, the setting of the each item on the auto backup set display cannot be changed.

1. Turn ON the YRC1000.
   – Insert the SD card to the programming pendant, when the backup is set on the SD card inserted in the programming pendant. If the YRC1000 is set to make backups to the USB memory connected to the ACP01 board, connect the USB memory to the ACP01 board.
2. Change the security mode to the management mode.
3. Select {SETUP} under the main menu.
4. Select {AUTO BACKUP SET}.
   – The AUTO BACKUP SET display appears.



A. RESERVE TIME BACKUP

Pressing [SELECT] displays the following list. Select the item from “SET CYCLE”, “EVERY DAY”, or the day of the week (“MONDAY” to “SUNDAY”).

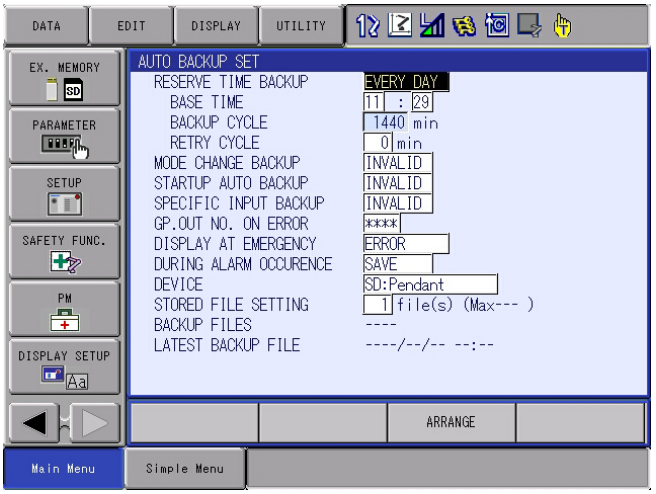
Please note that after setting the base time, the backup cycle, and the retry cycle, select the item from “SET CYCLE”, “EVERY DAY”, or the day of the week (“MONDAY” to “SUNDAY”).

If “SET CYCLE”, “EVERY DAY”, or the day of the week (“MONDAY” to “SUNDAY”) is set before setting one of the base time, the backup cycle, and the retry cycle, “INVALID” is selected for RESERVE TIME BACKUP.

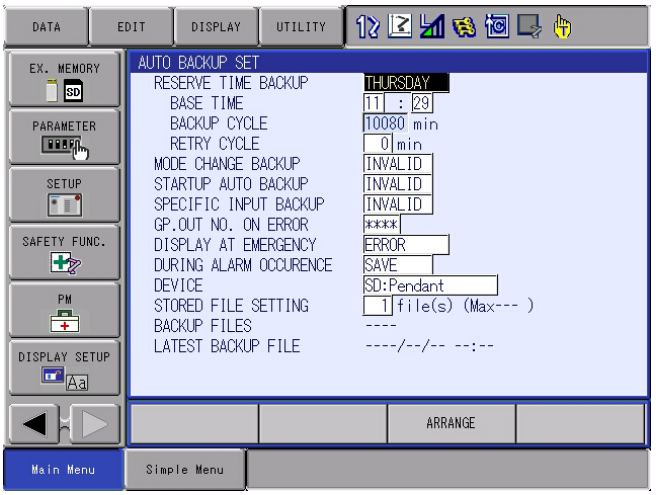


"INVALID": RESERVE TIME BACKUP is not performed.
"SET CYCLE": The automatic backup is performed every BACKUP CYCLE based on the specified BASE TIME.
"EVERY DAY": The automatic backup is performed at the specified BASE TIME every day.
"MONDAY" to "SUNDAY": The automatic backup is performed at the specified BASE TIME every week.

– Setting example for the automatic backup at 11:29 every day



– Setting example for the automatic backup at 11:29 on every Thursday



B. BASE TIME

Specify the reference time to start the automatic backup.
The reference time ranges from 0:00 to 23:59.

C. BACKUP CYCLE

Specify the backup cycle to perform the cyclic back up.
Set the backup cycle in units of minutes. The cycle setting ranges from 10 to 9999 minutes. After the first backup, the following backups are performed automatically in every BACKUP CYCLE.
When "EVERY DAY" or the day of the week ("MONDAY" to "SUNDAY") for RESERVE TIME BACKUP is selected, BACKUP CYCLE cannot be input.

D. RETRY CYCLE

Every time the automatic backup is implemented, the memory data in the controller is obtained, and the data is compared with the original memory data. If they are not the same, the retry of the automatic backup is implemented. However, please note that when the device is not inserted and the automatic backup is failed, for example, the retry is not executed.

Set the retry cycle in units of minutes. The cycle setting ranges from 0 to 255, and should be shorter than the BACKUP CYCLE. If the value is the same as or longer than the BACKUP CYCLE, RESERVE TIME BACKUP cannot set to “VALID”.

When it is set to 0, retry will not be performed.

E. MODE CHANGE BACKUP

Set the automatic backup function to be valid or invalid when the mode is switched from teach mode to play mode.

Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

F. STARTUP AUTO BACKUP

Set the backup function to be valid or invalid when the power of the YRC1000 is turned ON.

Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

G. SPECIFIC INPUT BACKUP

Set the backup function to be valid or invalid when specific input signal (# 40560) is input (rising edge from 0 to 1).

Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

H. GP.OUT NO. ON ERROR

Set “1” to the specified user output signal which was specified in this chapter when the automatic backup error occurs.
The term “automatic backup error” here means that the backup is not performed successfully before the next backup (including retry operation) starts.

I. DISPLAY AT EMERGENCY

Set the method of notification of the automatic backup error to “ERROR” or “MESSAGE”.

Each time [SELECT] is pressed, “ERROR” and “MESSAGE” are displayed alternately.

J. DURING ALARM OCCURENCE

Set the backup function to be valid or invalid when an alarm occurs.

Each time [SELECT] is pressed, “INVALID” and “VALID” are displayed alternately.

K.DEVICE

Press {SELECT} to display the device list.

The Device Name in Display	Explanation
SD: Pendant	Set the backup to the SD card inserted in the programming pendant.
SD: Controller	Set the backup to the SD card of the ACP01 board. When the “SD: Controller” of the device name is not shown, refer to *chapter 9.3.2.3 “The SD Card of the ACP01 Board”* .
RAMDISK	It will be shown when the optional function of High Speed Ethernet Server function is effective. It can back up by the YRC1000 high speed Ethernet server function command. Refer to “YRC1000 OPTIONS INSTRUCTIONS FOR HIGH-SPEED ETHERNET SERVER FUNCTION (HW1483358)”.
USB1: Controller	Set the backup to the USB memory connected to the ACP01 board.

L. STORED FILE SETTING

Set the number of files to be stored by the automatic backup function.
The number mentioned on the right side of this item with “(Max)” indication is the maximum number of files that can be stored in the SD card inserted in the Programming Pendant or USB memory connected to the ACP01 board when this window is displayed. (Max is 100.)
The settings range from 1 to (Max).

M. BACKUP FILES

Indicates the existence of the files or the number of backup files stored in the SD card inserted in the Programming Pendant or USB memory connected to the ACP01 board when this window is displayed.

N. LATEST BACKUP FILE

Indicates the date of the latest file in the SD card inserted in the Programming Pendant or USB memory connected to the ACP01 board when this window is displayed.

O. ARRANGE

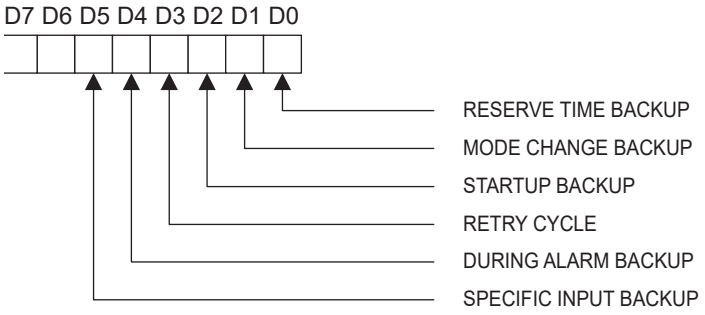
When "ARRANGE" is executed, the files with the name "CMOSBK.BIN" and "CMOSBK??.BIN" (?? denotes figures) on the selected device that exceed the maximum number of stored files are deleted.
The ?? (figures) part of the remaining "CMOSBK??.BIN" files is changed so that the number of remaining files does not exceed the maximum number of stored files.
Save any files with this name that should be kept to a PC or other device before deletion.
To reduce the number of files that are already backed up, change "STORED FILE SETTING" to the desired number of files and then select "ARRANGE".

5. Set the desired item, and press [ENTER].

■ **Window Settings**

RS parameter can restrict the settings of some items in the automatic backup window.

When setting the bit of RS096 parameter shown below to “1”, the corresponding items are restricted. The restricted items are indicated with “INVALID” in the display and inputting/modification to the item becomes impossible. Also, the automatic backup does not function with the restricted items.



■ **Output the Backup Processing Status**

Able to confirm the backup processing status by the system output signal.

<#50766> It is creating the auto backup data.
When this signal is turned ON, it is creating the backup data.
Some operations are limited. For example, the start signal is not accepted.

<#50767> It is transferring the backup data.
When this signal is turned ON, writes the data to the SD card after creating the backup data. Do not remove the SD card from the programming pendant during this period.

9.3.3 Limiting the Automatic Backup File Creation

9.3.3.1 Setting to Limit the Automatic Backup File Creation

It is applicable to limit the backup file creation executed by the automatic backup function to once a day.

To limit the backup file creation to once a day, set the following parameter.

Parameter number	Contents	Setting value
S2C682	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 FUNCTION SET Window”* .

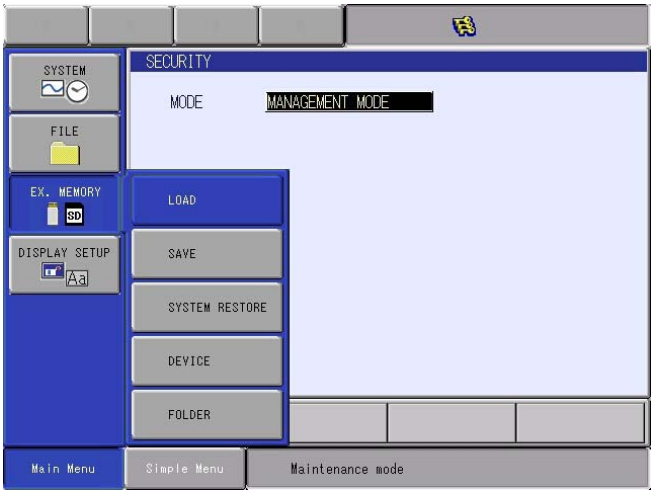
9.4 Loading the Backup Data from the SD Card

To restore the backup memory in the auto backup function is done in the maintenance mode. Otherwise, restore from the SD card of the programming pendant or USB memory when backup is done at the optional high speed Ethernet function command. Prepare either of the SD card or the USB memory to make copies.

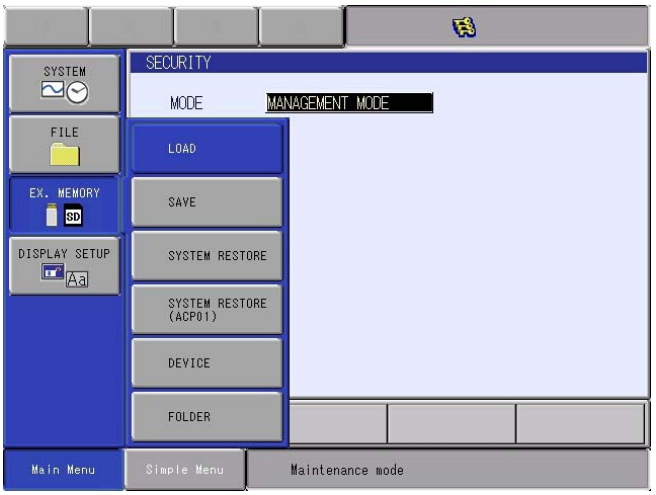
9.4.1 Loading Procedure

To restore from the SD card of the programming pendant, perform the following procedures No.1 to 8. To restore from the SD card on the ACP01 board, perform the following procedures from No.9.
For the USB memory, select “USB: Pendant” or “USB1: Controller” in the {EX. MEMORY} -{DEVICE} to restore.

1. Insert the SD card with the backup data in the SD card slot on the programming pendant.
   (When selecting “USB1: controller”, insert it in the ACP01 board.)
   – The backup data is stored under the file name “CMOSBK.BIN” or “CMOSBK??.BIN” (?? denotes figures.)
2. Turn ON the YRC1000 power supply while pressing [MAIN MENU].
3. Change the security mode to the management or higher mode.
4. Select {EX. MEMORY} under the main menu.
   – The sub menu appears.



– When set the {SYSTEM}- {SETUP}- {OPTIONAL FUNCTION}- {AUTO BACKUP (ACP01)} as “USE”, the following sub menu appears.



5. Select {SYSTEM RESTORE}.

– The BACKUP FILE LIST display appears.



6. Select the file to be loaded.
   – The dialog box appears for the AIF/ACP01 board replacement confirmation.



   – Select {YES} if the AIF/ACP01 board has been replaced, or select {NO} if it has not been replaced.
   – Selecting {YES} initializes the system monitoring time. Selecting {NO} continues the counting of the current system's monitoring time.

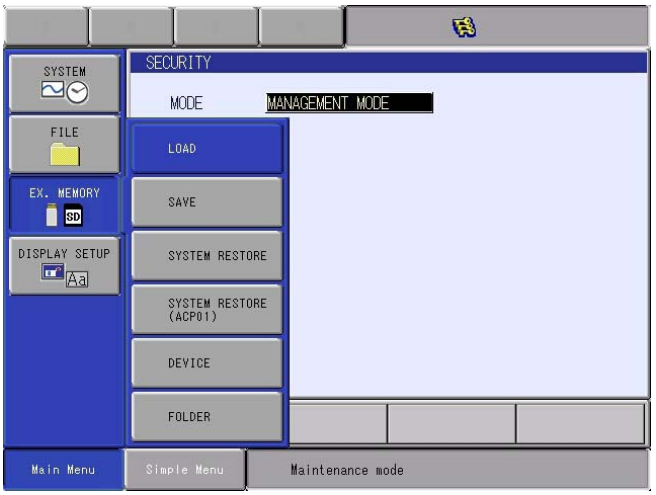
7. Select from the confirmation dialog box.
   – The dialog box appears for the loading confirmation.



   – Select {YES} in the loading confirmation dialog box to start loading the contents of "CMOSBK.BIN" or "CMOSBK??.BIN" (?? denotes figures) from the SD card to the YRC1000 CMOS.

8. Select {YES}.
9. Turn the power on, while pressing the [MAIN MENU].
10. Change the security mode to the management or higher mode.

11. Select {EX. MEMORY} in the main menu.
    – The sub menu will appear.



12. Select {SYSTEM RESTORE (ACP01)}.
    – The backup-file list display will appear.

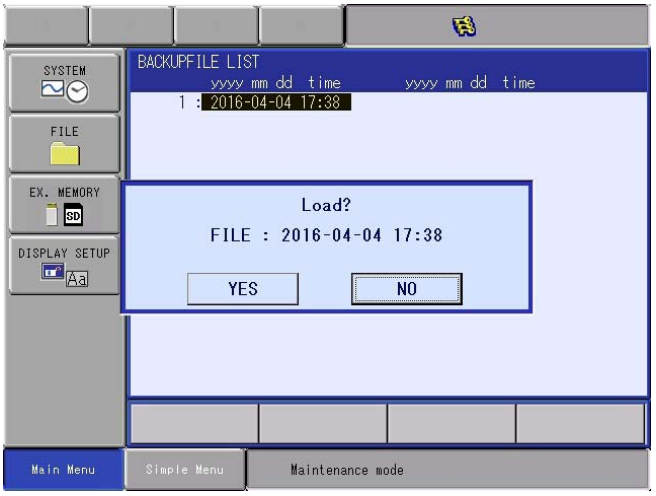


13. Select desired date file.
    – The AIF/ACP01 board dialog will appear.



    – Select [YES] when exchanged the AIF/ACP01 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 ACP01 board.

15. Select [YES].

CAUTION

Note that by executing “SYSTEM RESTORE” or “SYSTEM RESTORE (ACP01)”, the current CMOS data in the YRC1000 is replaced with the data of the file “CMOSBK.BIN” or “CMOSBK??.BIN” (?? denotes figures) in the external memory device.

After “CMOSBK.BIN” has been loaded, confirm that the new data is the same as the previously saved data in the CMOS. In addition, call the master job to confirm that the current manipulator position is correct and safe. After that, start operating the manipulator.

9.5 Error List

9.5.1 Error Contents

Error No.	Data	Message	Cause
0770	*	During robot or station operation	The automatic backup would not work when a manipulator or a station is in motion.
3390		File not found	The file to be loaded no longer exists.
3460	*	Cannot back up the media.	
	1		Insufficient capacity on backup media (e.g., SD card).
	2		Cannot access backup media (e.g., SD card).
3463	*	Cannot store the backup data. The value specified for STORED FILE SETTING exceeds the maximum number	Confirm that the value specified for STORED FILE SETTING does not exceed the maximum number.
3501	*	Check the media insertion.	Cannot access backup media (e.g., SD card).
3540	*	CMOS not compatible	The CMOS.BIN file to be loaded is not compatible with the system software version of the controller.
3550	*	Under automatic backup operation. Operate after the backup is completed.	The automatic backup window cannot be called to display while the automatic backup is being processed.
3551	*	Under automatic backup operation. Operate \“SORT FILE\” after the backup is completed.	The file arrangement cannot be operated during the automatic backup operation.
3560	*	Failed in sorting backup file.	Failed to re-arrange the backup file for another reason than the access to backup media (e.g., SD card).
3580	*	Under backup file access. Operate after the access is completed.	To display another window and then display the automatic backup window again after “ARRANGE” operation, “ARRANGE” process should be completely finished.
3581	*	Under backup file access. Operate \“SORT FILE\” after the access is completed.	The previous “ARRANGE” process should be completely finished to perform the next “ARRANGE” operation.

10 Upgrade Function

10.1 Functional Overview

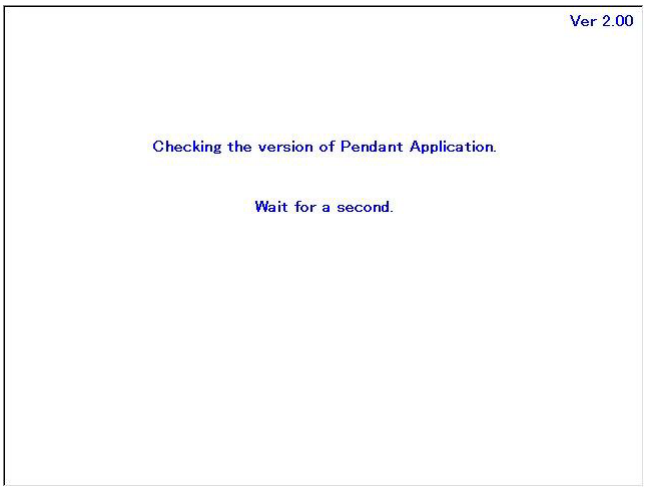
YRC1000 applies two software for the CPU configuration: a software for ACP01 (for the main CPU board) and a software for the programming pendant. The system works only with the combination of certain versions due to a compatibility problem of each software.

Therefore, YRC1000 can upgrade the software for the programming pendant if the combination of the software for ACP01 and the programming pendant is invalid.

10.2 Upgrade Procedure

10.2.1 Confirmation of Software Version

The compatibility of the versions of ACP01 and the programming pendant are automatically checked in 15 seconds after the YRC1000 power supply is turned on.



- In case the versions of ACP01 and the programming pendant matches.

1. Automatic upgrade process completes and the communication process between ACP01 and the programming pendant is restarted.

2. Initial window appears approx. 50 seconds later.

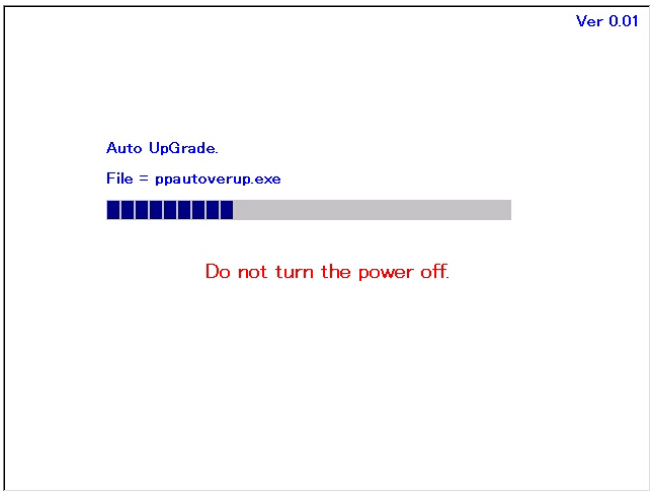


SUPPLE-MENT

The time until the initial window appears on the programming pendant may be longer if the system configuration includes an optional circuit board or if the Ethernet port of LAN2 or LAN3 is enabled, etc.

10.2.2 Automatic Upgrade of the Programming Pendant

In case that the pendant application version of the programming pendant is older than the one of SD card in ACP01 or the pendant application version of the programming pendant is not compatible to the one of ACP01, the programming pendant is automatically upgraded.



1. After the automatic upgrade process is completed, the communication process between ACP01 and the programming pendant is restarted.
   – The programming pendant is restarted depending on the upgraded software.
   In this case, the communication process between the programming pendant and ACP01 starts again after restart of the programming pendant is done.
2. Initial window appears approx. 50 seconds later.

NOTE If start the YRC1000 without the auto upgrade process, press all of the [Interlock]+[5]+[Select] keys on the programming pendant at the same time to start.

NOTE

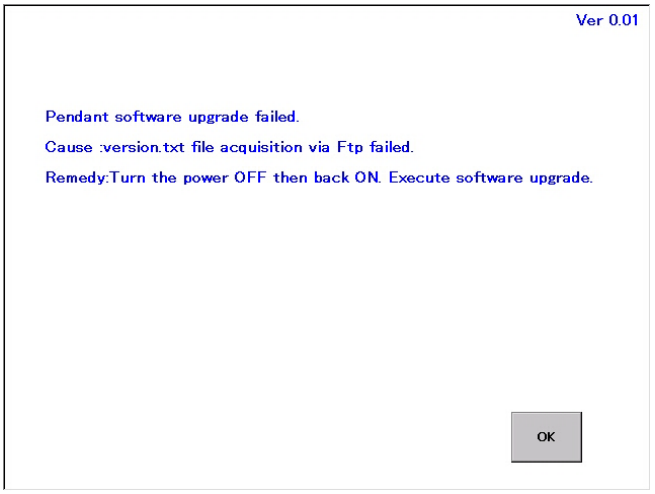
DO NOT turn off the main power supply during automatic upgrade process.

In case the main power supply is turned off, exercise the following process.

- Turn on the main power supply of YRC1000.
  - Automatic upgrade might be exercised again.
- In case error occurs during automatic upgrade process.
  (1) Prepare SD card for upgrading or USB memory.
  (2) Press [2]+[8]+[HIGH SPEED] of the programming pendant at the same time.
  - Upgrade of the OS of Programming Pendant
  (3) Press [INTERLOCK]+[8]+[SELECT] of the programming pendant at the same time and upgrade.
  - Refer to “YRC1000 UPGRADE PROCEDURE MANUAL (HW1483594)” for detail.
- If no recovery is made with all the operation above, replace the programming pendant.

10.3 Error Message

If Error occurs while automatic upgrading, exercise the following procedure.



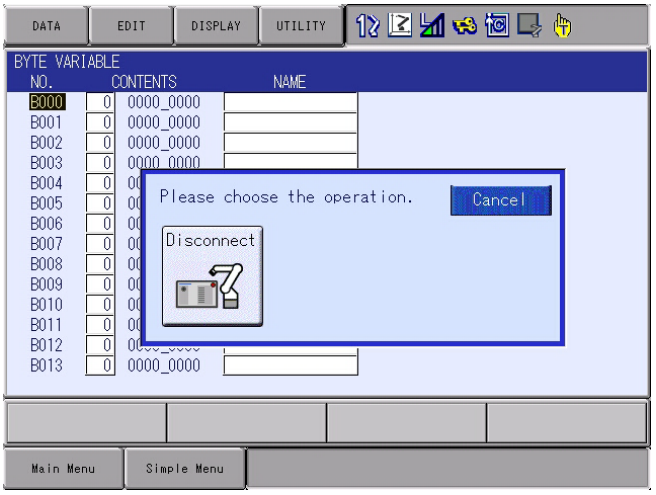
- Turn on the main power supply of YRC1000.
  - Automatic upgrade might be exercised again.
- In case error occurs during automatic upgrade process.
  (1) Prepare SD card or USB memory for upgrading.
  (2) Press [2]+[8]+[HIGH SPEED] of the programming pendant at the same time.
  - Upgrade of the OS of Programming Pendant
  (3) Press [INTERLOCK]+[8]+[SELECT] of the programming pendant at the same time and upgrade.
  - Refer to “YRC1000 UPGRADE PROCEDURE MANUAL (HW1483594)” for detail.

11 Programming Pendant

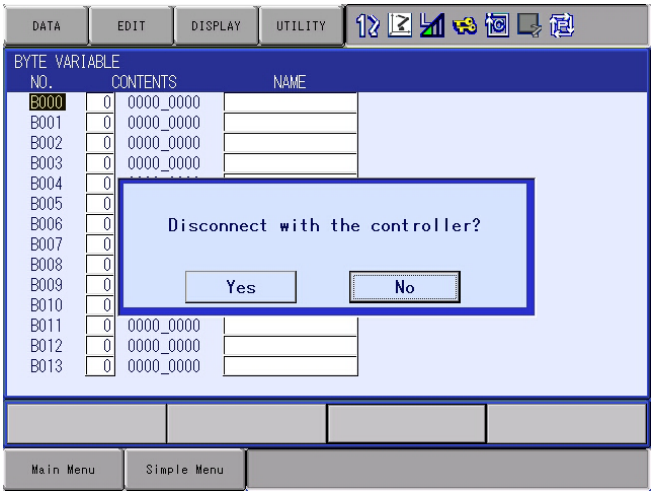
11.1 Disconnection Function

Disconnection function enables to cut off the communication between the programming pendant and the controller. Disconnection function enables only in remote mode.

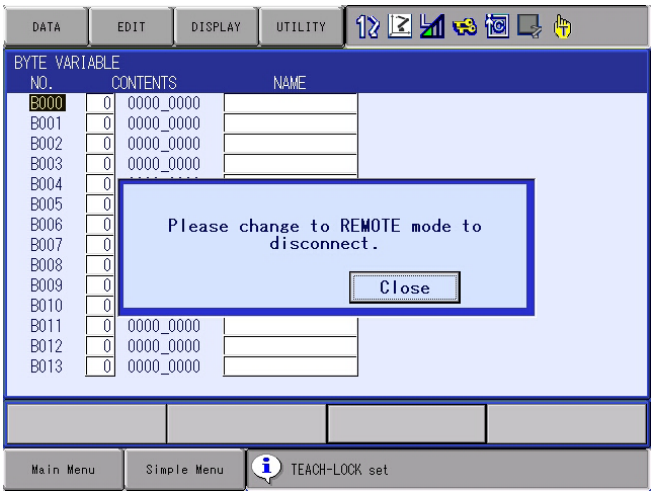
1. Change the mode key to management mode.
2. Long press [Simple Menu] key to show the pop-up menu.



3. Select “Disconnect” button, and the confirmation dialog appears.



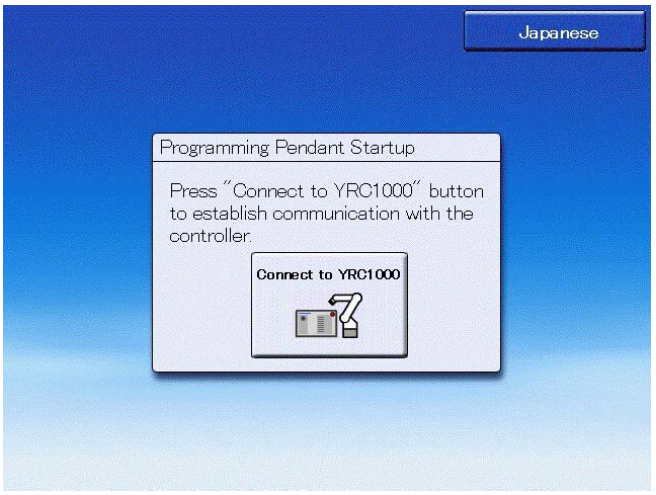
– An error dialog appears if {Disconnect the Communication} is selected in other than remote mode.



4. Select “YES” to disconnect the communication between the controller and the programming pendant. After disconnecting the communication, the message is displayed.



5. Press “OK” on the message dialog, otherwise the window is closed automatically after 10 seconds since the window appears on the screen, and then the programming pendant startup window is displayed.
   When connecting the controller and the programming pendant again, press “Connect to YRC1000” button.



CAUTION

- While the programming pendant startup window is displayed (while communication between the YRC1000 and the programming pendant is disconnected), the manipulator in operation cannot be stopped by using [HOLD]. To stop the manipulator's operation, press the emergency stop button.
- While the programming pendant startup window is displayed, the mode of the YRC1000 cannot be changed by using the Mode Switch. To change the mode of the YRC1000, press “Connect to YRC1000” button in the startup window to connect the YRC1000 and the programming pendant, and then turn the Mode Switch to the desired mode.

11.2 Reset Function

Reset function enables to restart only the programming pendant while the main power supply of the controller is ON.

If unable to operate the robot by the programming pendant causing from the communications error of the programming pendant, recover the programming pendant by following procedures.

1. Confirmation of the 7SEG-LED (DS1) display on the JANCD-ACP01-E

   – Check the 7SEG-LED display on the JANCD-ACP01-E.

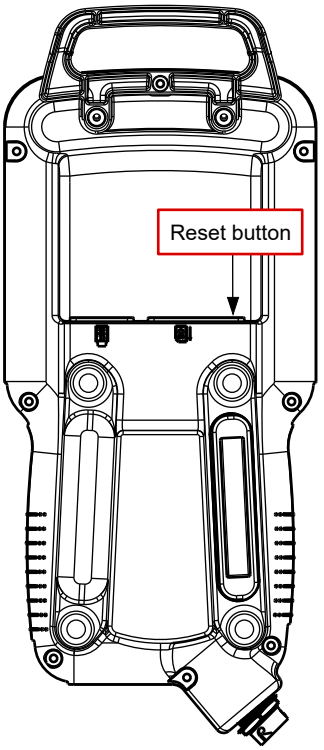
SUPPLE -MENT

- Check that an alphabet letter or a number is displayed on the 7SEG-LED display.
- Check that a dot is displayed at the lower right of the 7SEG-LED. If it is, check that the dot is blinking or lighted.
- If the displayed alphabet or the number is continuously changing, write down them in order.

2. Reset the programming pendant

   – Open the SD card slot cover on the programming pendant.

   – There is a small hole to the right of SD card insertion slot. Insert a spit into the hole to press the reset button.



   – The programming pendant is rebooted and it starts connecting to the controller again.

11.3 Touch Panel Invalidate Function

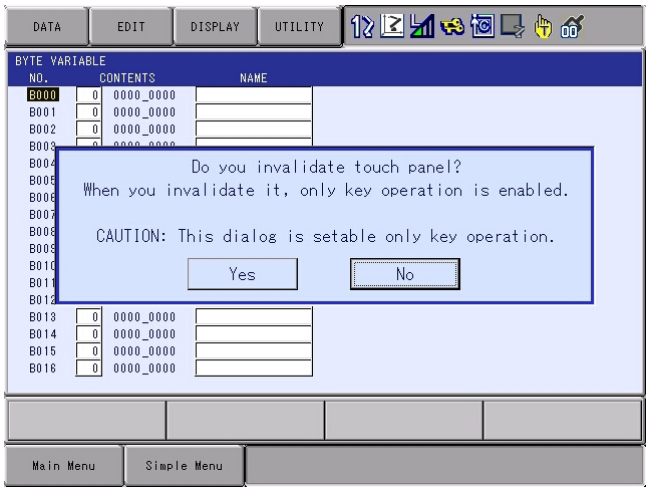
The touch panel invalidate function enables to invalidate the touch panel operation of the programming pendant (key operation is still valid).

Even if the touch panel is failure, it is able to prevent the mis-operation by using this function.

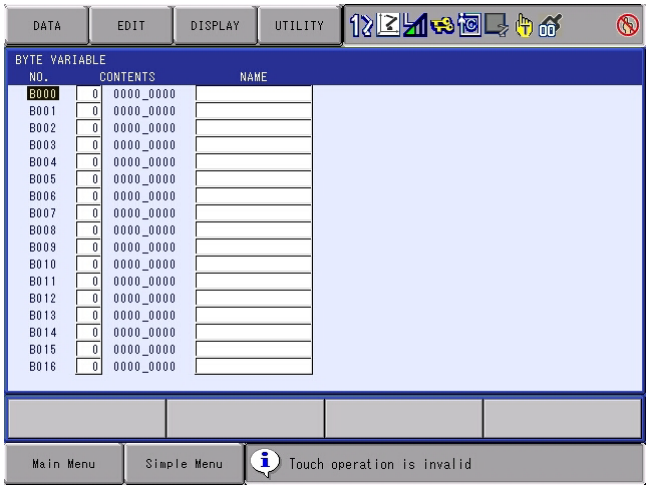
Operate the following procedures to valid/invalid the touch panel.

■ Invalidate the Touch Panel

1. Push down the [INTER LOCK]+[AUX] keys at the same time.
   The confirmation dialog to invalidate the touch panel appears.

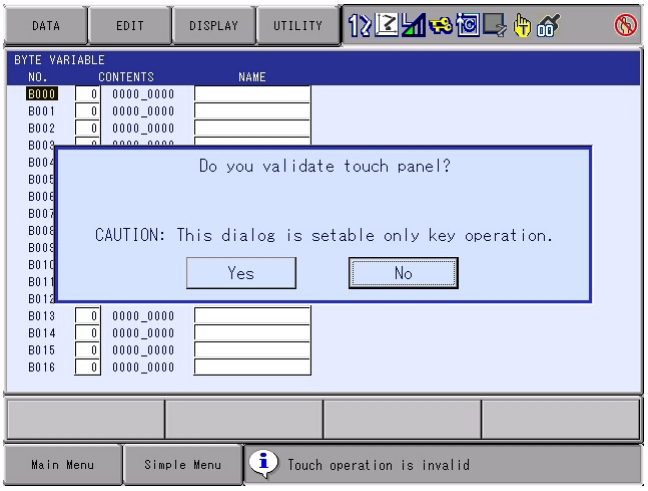


2. Move the focus area over the “YES” on the confirmation dialog by using [←] key.
3. Press [Select] key. The touch panel becomes invalid.
   When the touch panel is invalid, an icon, which shows the invalidating the touch panel, is displayed on the status area, and the message “Touch operation is invalid” is displayed on the message area.



■ **Validate the Touch Panel**

1. Push down the [INTER LOCK]+[AUX] keys at the same time.
   The confirmation dialog to validate the touch panel appears.



2. Move the focus area over the “YES” on the confirmation dialog by using [←] key.
3. Press [Select].
   The touch panel become valid.

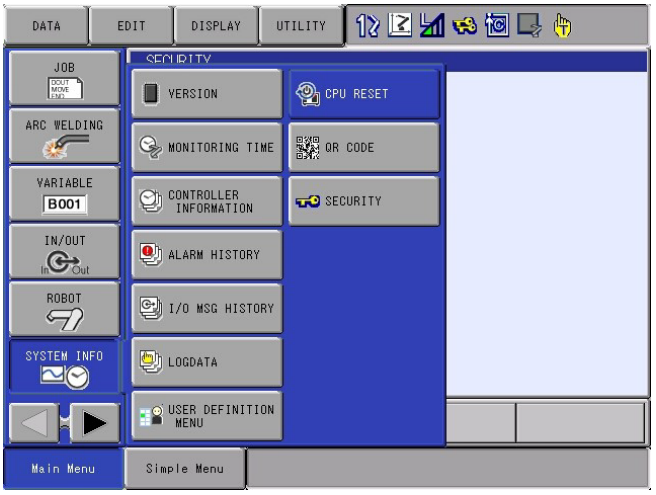
NOTE

- In the case of invalidating the touch panel, the touch panel invalidating status continues even though the power supply is turned ON/OFF.
- To validate the touch panel again, push down the [INTER LOCK]+[AUX] keys at the same time, and then validate the touch panel on the confirmation dialog.

11.4 Reboot Robot System

After change a parameter, repair or maintenance, following procedure to reboot the robot system.
The robot system cannot be rebooted when the servo power is ON. Confirm that the servo power is OFF before rebooting.

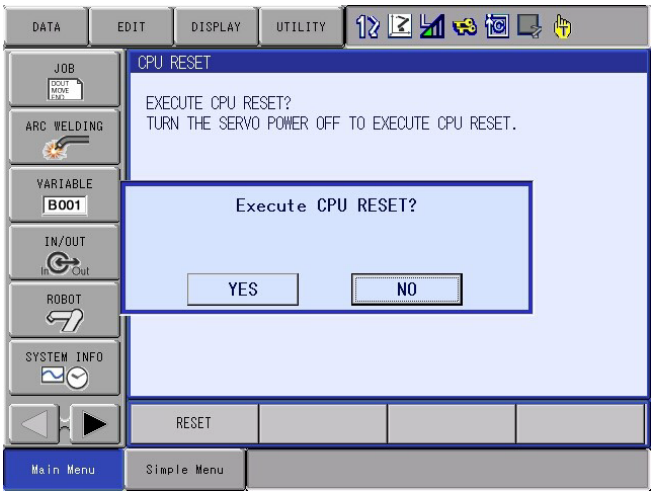
1. Select {SYSTEM INFO} - {CPU RESET} in the main menu.



2. Confirm the servo power is OFF and select {RESET}.



3. The confirmation dialog appears. Select “YES” to reboot the robot system.



4. If the operation to reboot the robot system is performed when the servo power is ON, the following error message appears.
   – Select “CANCEL” to cancel the error message.



12 Modification of System Configuration

12.1 Addition of I/O Modules

To add I/O modules, turn OFF the power supply.

SUPPLE-MENT

Addition operation must be performed in the management mode.
In the operation mode or editing mode, only reference of status setting is possible.

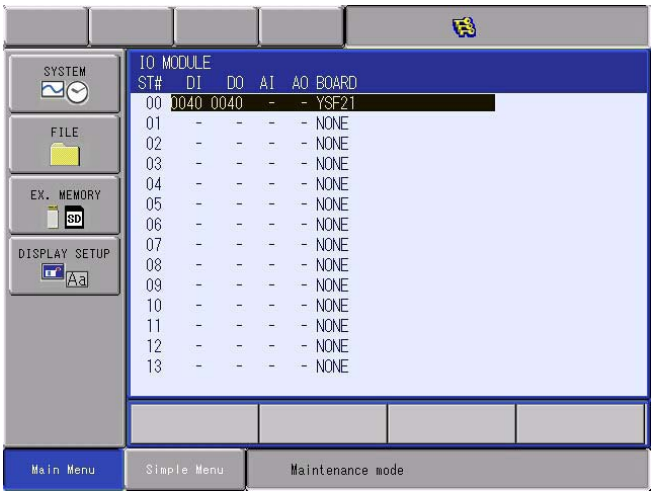
1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the “SECURITY MODE” to the management mode.
3. Select {SYSTEM} under the main menu.
   – The system window appears.



4. Select {SETUP}.
   – The SETUP window appears.
   – The items marked with “■” cannot be selected.



5. Select {IO MODULE}.
   – The current status of the mounted I/O module is shown.



6. Confirm the status of mounted I/O module.

ST#	Station address of I/O module
DI	Number of contact input 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)]

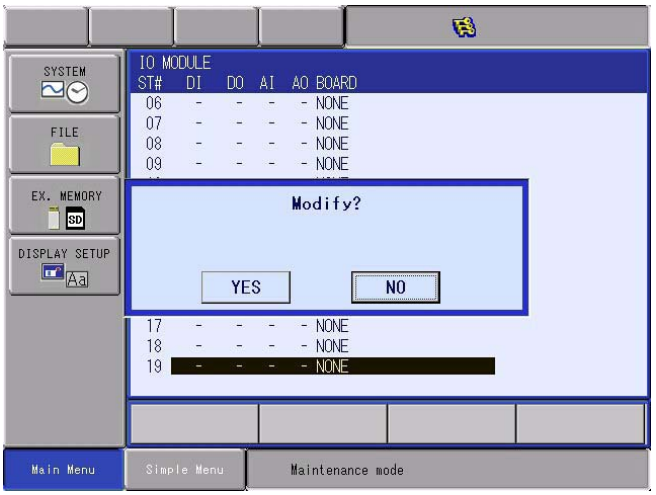
   – 1) A hyphen, -, indicates that the corresponding I/O section is not mounted.

   – 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.



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.

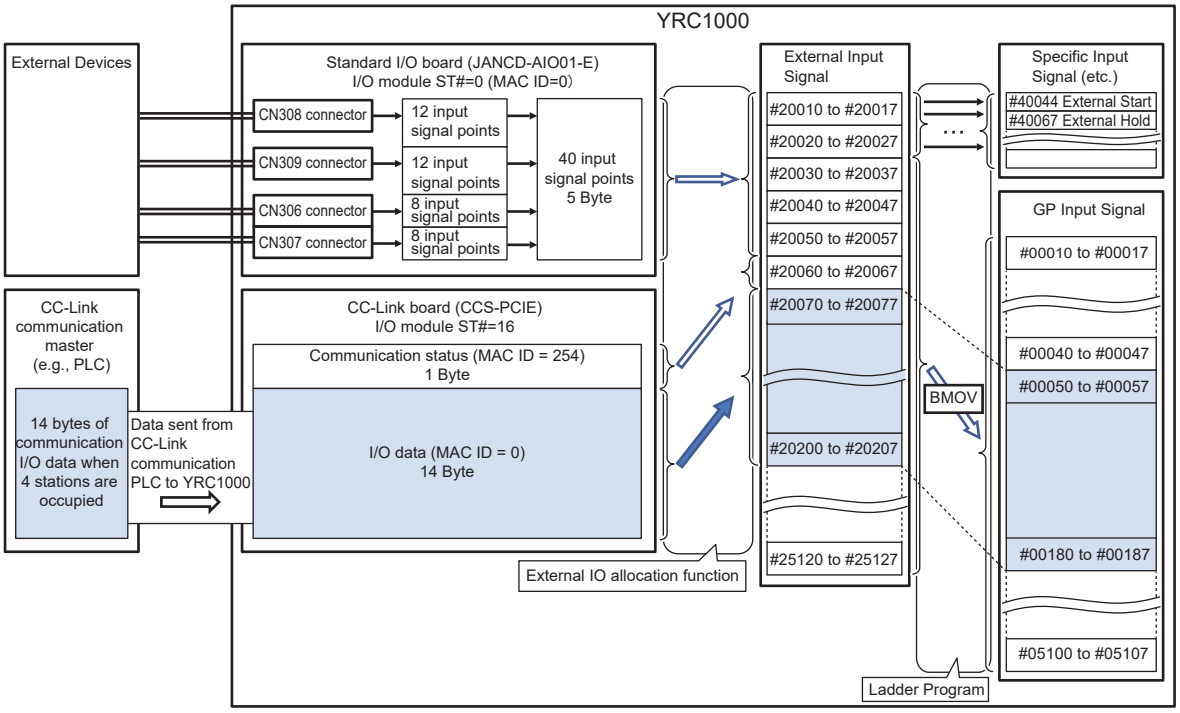
NOTE If there is a difference between the displayed contents and the actual mounted status, confirm the status again. If the status is correct, the I/O module may be defective: in such a case, contact your YASKAWA representative.

12.2 Allocating External I/O Signal

Use the external I/O allocation function to change the allocations of signals used in robot control without changing the ladder program.

12.2.1 Mechanism to Exchange I/O Signals with External Devices (Standard Settings)

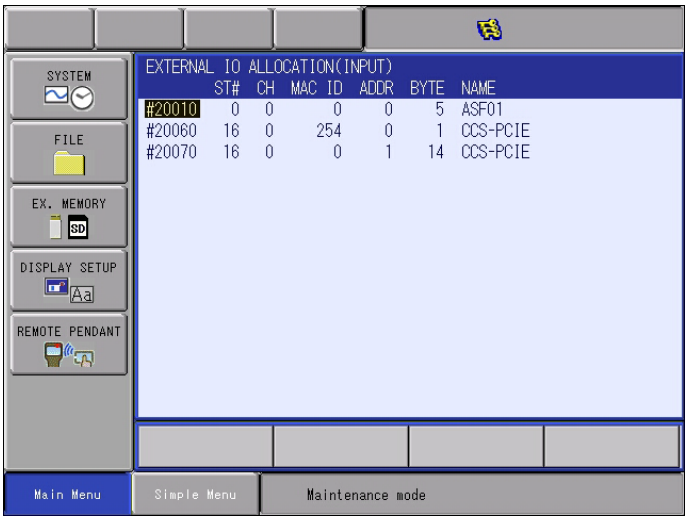
This example illustrates the mechanism to transfer I/O signals with the standard settings when the CC-Link communication function (for the SST-CCS-PCIE manufactured by Molex) (*option) is used occupying four stations in a general-purpose application.



14 bytes of I/O data are sent from the CC-Link communication master to the YRC1000, and the data is input to external input signals #20070 to #20207 via the CC-Link board by the external I/O allocation function as shown in the figure above. Then the I/O data is input to GP input signals #00050 to #00187 via the ladder program. For the output signals, the direction is the opposite of the input signals shown above, and the signals are sent from the YRC1000 to the CC-Link communication master in a similar flow.

For the manner in which external I/O signals are connected to specific I/O signals and GP I/O signals, refer to chapter 12 "Standard Ladder Program" in "YRC1000 OPTIONS INSTRUCTIONS FOR CONCURRENT I/O (RE-CKI-A467)" and *chapter 14.10 "Robot General-Purpose I/O Signal Assignment"* .

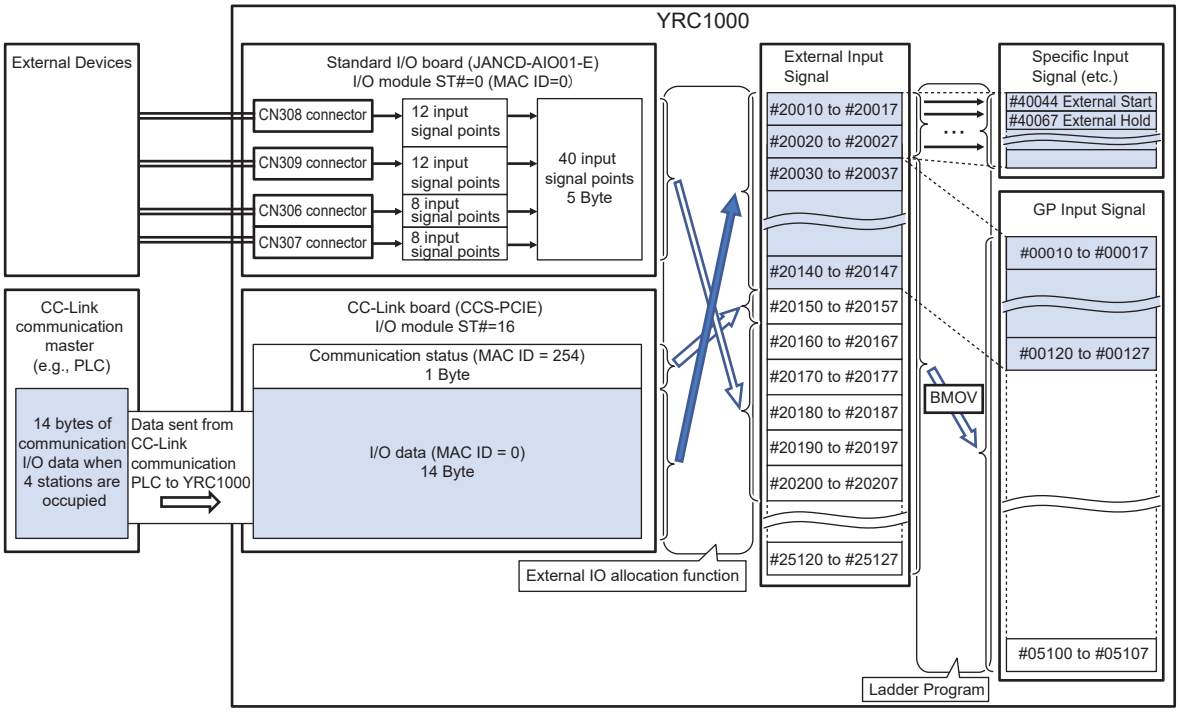
The following screenshot shows the settings on the EXTERNAL IO ALLOCATION(INPUT) window for the above information.



12.2.2 Mechanism to Exchange I/O Signals with External Devices (Example of Changing Signals with External I/O Signal Allocations)

In comparison to *chapter 12.2.1 "Mechanism to Exchange I/O Signals with External Devices (Standard Settings)"* , this section shows the signal flow when the settings on the external I/O allocation (input) window are changed as shown below.





14 bytes of I/O data are sent from the CC-Link communication master to the YRC1000, and the data is input to external input signals #20010 to #20147 via the CC-Link board by the external I/O allocation function as shown in the figure above. Then the I/O data is input to the specific input signals, such as #40044 "External Start", and GP input signals #00010 to #00127 via the ladder program.

As an example with the above settings, when the first bit of the 14 bytes sent from the CC-Link communication master is turned ON, that result is applied to #40044 "External Start".

12.2.3 Setup Procedure for the External I/O Allocation Function

Use the following setup procedure for the external I/O allocation function. This section shows the setup procedure that follows the procedure in *chapter 12.1 "Addition of I/O Modules"* , but even if an I/O module is not added, the settings can be accessed from {SYSTEM} - {SETUP} - {OPTION FUNCTION} - {EXTERNAL IO SETUP} when in maintenance mode.

1. The EXTERNAL IO SETUP window appears.



2. Select "AUTO" or "MANUAL" under the ALLOCATION MODE.
   – The selected menu appears.



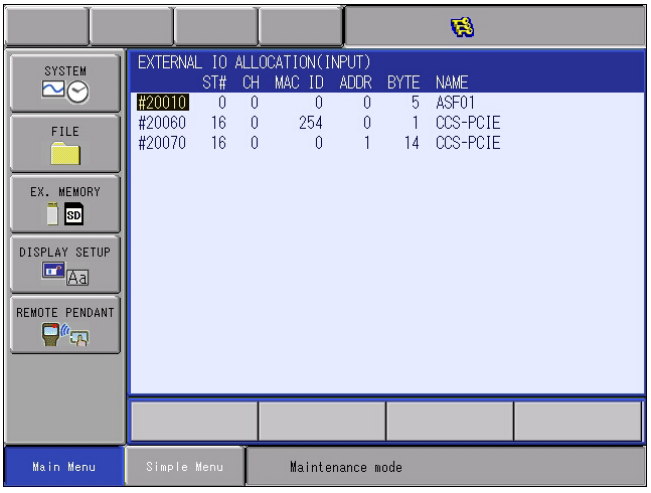
NOTE

When the allocation mode is changed from "MANUAL" to "AUTO", the set allocation data is discarded, and re-allocation in the Auto mode takes place.
If it is necessary to save the set allocation data, save it using the external memory menu in advance.

3. Select the allocation mode to set.
   - To operate the I/O signal allocation automatically, select the allocation mode “AUTO”.
   - To operate the I/O signal allocation manually, select the allocation mode “MANUAL”.
   - Selected allocation mode appears.



4. Select “DETAIL” under the “EXTERNAL IO ALLOCATION”.
   - The External Input Signals Allocation window appears.
   - The example screenshot below shows the window when the CC-Link communication board SST-CCS-PCIE (option) is added. In a standard system, only the "ASF01" line appears.
   - When select the allocation mode “AUTO”, skip the following procedures from No. 5 to No. 7. Operate from the procedure No. 8.
   - When select the allocation mode "MANUAL", operate the following procedure from No.5 to No.7 depending on the item to set by manual.



5. Select the external input signal number (at the change source) to be changed. (In the setting example, select “#20060”.)

   – 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 ‘20220’.)

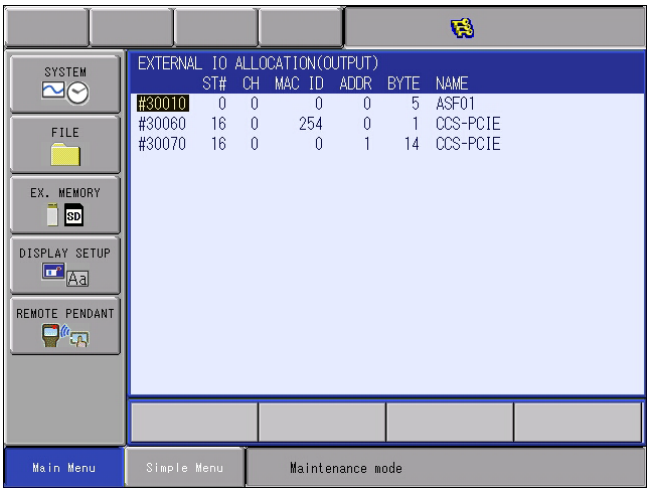
   – The external I/O signal is changed.



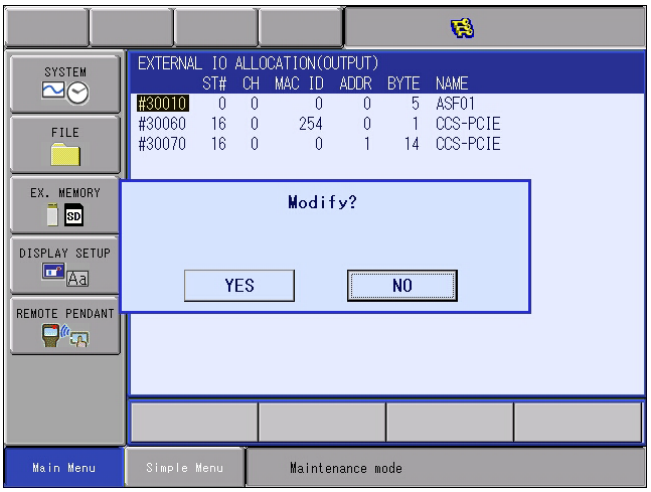
7. Likewise, select/modify the number of the external input signal.

   – Repeat select/modify until it becomes the desired allocation.

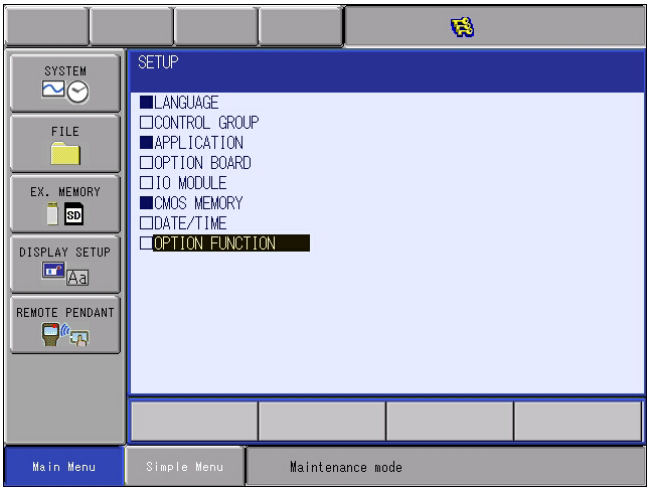
8. Press [ENTER].
   – The External Output Signals Allocation window appears.



9. Like the case of the external input signal, select/modify the external output signal.
   – Repeat select/modify until it becomes the desired allocation.
10. Press [ENTER].
   – The confirmation dialog box appears.

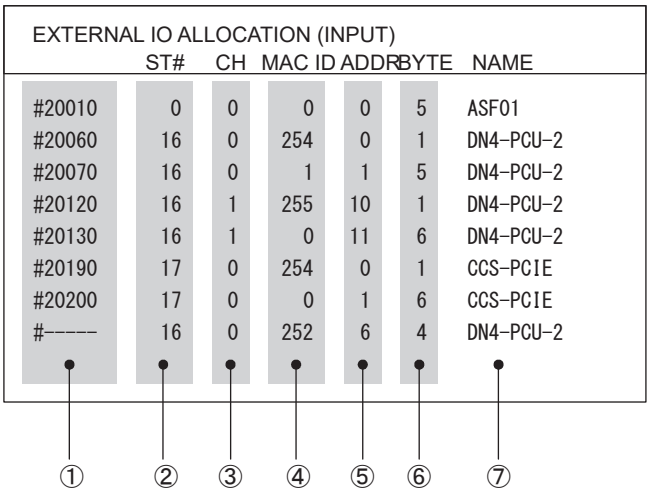


11. Select {YES}.
   – The settings are confirmed, and the SETUP window reappears.



■ Explanation about the External I/O Signal Allocation Window

The details of the window are explained using the window example. The range over which the cursor can move is the hatched area of the figure.



① External I/O signal numbers

Indicates the beginning number of the external I/O signals allocated to each I/O area. On the allocation window, the set values of these items are used and displayed in ascending order. The following contents are displayed.

#20010 to #25120 : The number of the signal allocated to the beginning of each I/O area, in the input signals

#30010 to #35120 : The number of the signal allocated to the beginning of each I/O area, in the output signals

#----- : Unallocated I/O area

② ST#

Indicates the station number of I/O module for YRC1000 allocated to each I/O board. The displayed contents include the following:

0 : Standard I/O board (JANCD-AIO0□-E). However, "ASF01" is displayed for the name.

1 to 13 : Optional I/O board which is connected to the JANCD-AIF01-□E using a serial communication cable (The station number of each I/O module is determined by the rotary switch setting on the board.)

15 : EtherNet/IP (CPU board)

16 : The first field bus board (Optional board inserted into Option Slot1 of the riser card in the CPU rack.)

17 : The second field bus board (Optional board inserted into Option Slot2 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 (CPU board) with standard settings
1 to 251	: Network communication station number '1' to '251' In the scanner setting of EtherNet/IP (CPU board), the adapter stations are assigned in the order of "1" to "32". In the extended adapter setting of EtherNet/IP (CPU board), the scanner stations are assigned in the order of "101" to "132".
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 in an I/O module with the same station number.

⑥ BYTE

Indicates the size (number of bytes) inside each I/O area.

⑦ NAME

Indicates the name of each I/O module.

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]

• If axis type is turn type, set the following items.
  • MOTION RANGE (+) [deg]
  • MOTION RANGE (-) [deg]
  • REDUCTION RATIO (numerator)
  • REDUCTION RATIO (denominator)
  • OFFSET (1st and 2nd axis) [mm]

• MOTOR SPECIFICATION

Set the following items.
  • MOTOR
  • SERVO AMP
  • CONVERTER
  • ROTATION DIRECTION [normal/reverse]
  • MAX. RPM [rpm]
  • ACCELERATION SPEED [sec]
  • INERTIA RATIO

* Select MOTOR, AMPLIFIER and CONVERTER from each type list on the display.

12.3.1 Base Axis Setting

12.3.1.1 Selection of Base Axis Type

Select the type of base axis to be added/modified.

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
2. Change the “SECURITY” to the “MANAGEMENT MODE”.
3. Select {SYSTEM} under the main menu.
   – The system window appears.

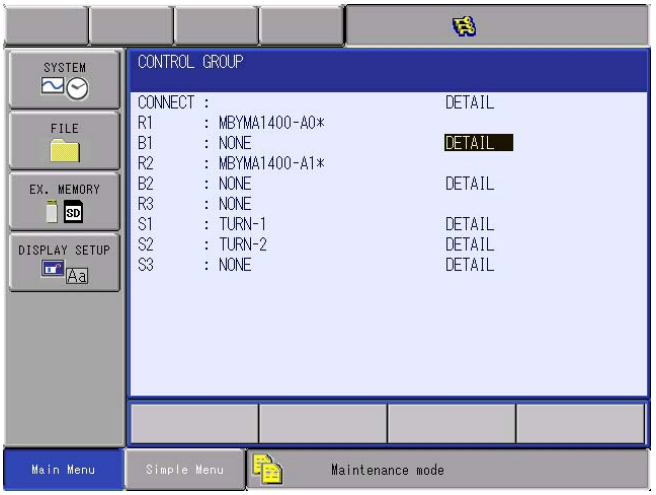


4. Select {SETUP}.
   – The SETUP window appears.
   – Note that the items marked with “■” cannot be set.



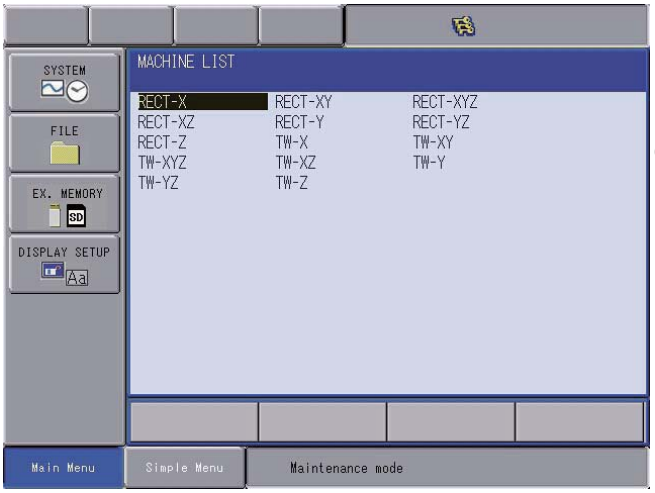
5. Select {CONTROL GROUP}.

   – The current control group type is displayed.



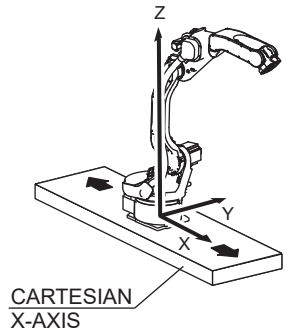
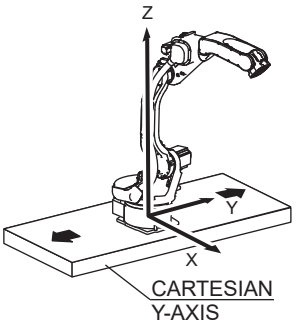
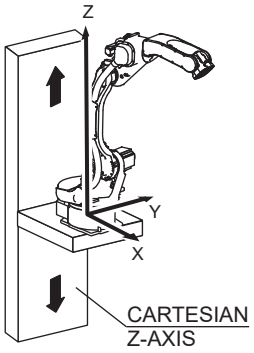
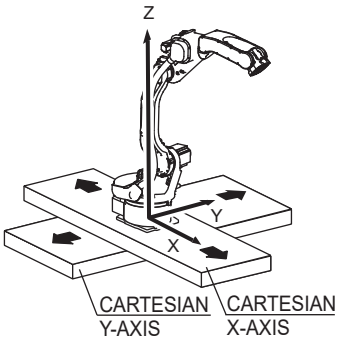
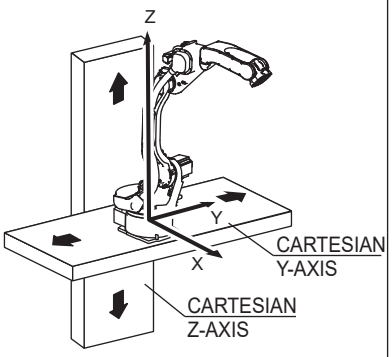
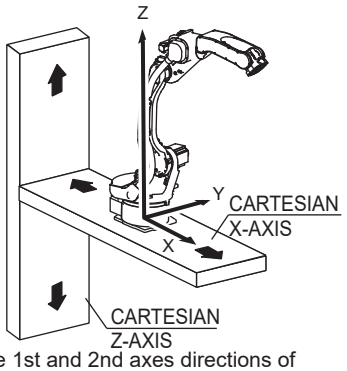
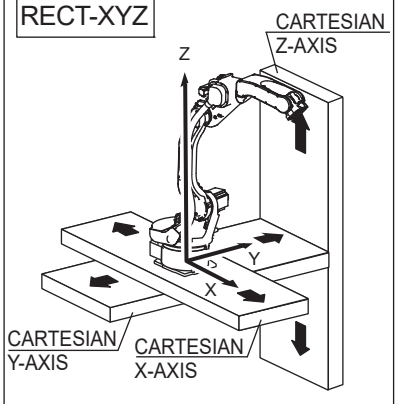
6. Move the cursor to the type of control group to be modified, and press [SELECT].

   – The MACHINE LIST window is displayed.



RECT-X: traverse X-axis base
RECT-Y: traverse Y-axis base
RECT-Z: traverse Z-axis base
RECT-XZ: traverse XZ-axis base
RECT-XY: traverse XY-axis base
RECT-XYZ: traverse XYZ-axis base
(See the figures on the next page)

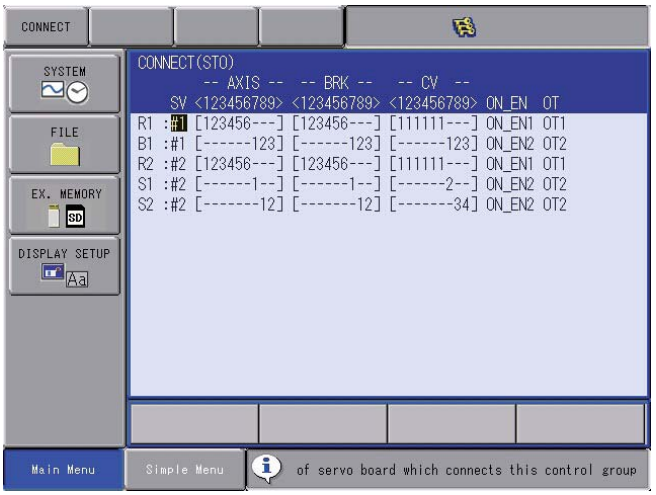
7. Select one in the type list.
   – After the type selection, the window returns to the CONNECT window.

RECT-X  Base axis direction of travel coincides with robot coordinate X-Axis.	RECT-Y  Base axis direction of travel coincides with robot coordinate Y-Axis.	RECT-Z  Base axis direction of travel coincides with robot coordinate Z-Axis.
RECT-XY  Base 1st and 2nd axes directions of travel coincide with robot coordinate X-Axis and Y-Axis, respecitively.	RECT-YZ  Base 1st and 2nd axes directions of travel coincide with robot coordinate Y-Axis and Z-Axis, respectively.	RECT-XZ  Base 1st and 2nd axes directions of travel coincide with robot coordinate X-Axis and Z-Axis,respectively.
	RECT-XYZ  Base 1st, 2nd, and 3rd axes directions of travel coincide with robot coordinate X-Axis, Y-Axis, and Z-Axis, respectively.	

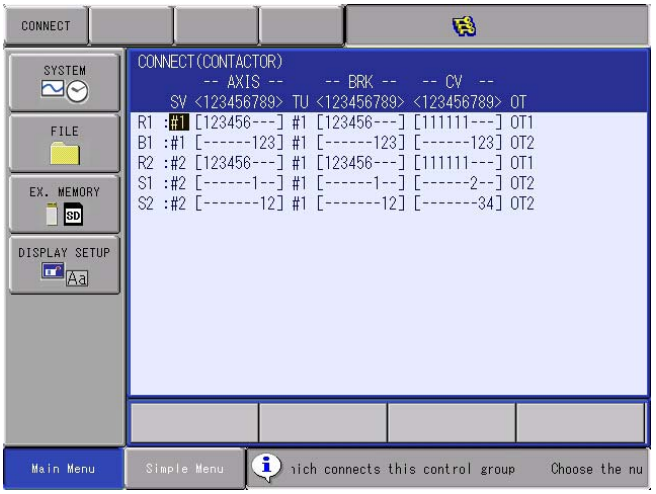
12.3.1.2 Connection Setting

In the CONNECT window, it is specified that each axis of each control group is connected to which connector of the SERVO board, which brake of the contactor unit, which converter, and which overrun signal.

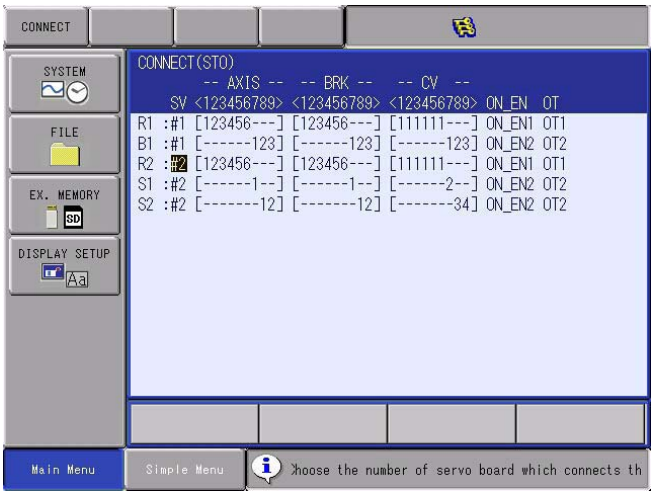
1. Confirm the type of each control group in the CONNECT window.
   - The connection status of each control group is displayed.
   - <CONNECT(STO) window>



   - <CONNECT (CONTACTOR) window>

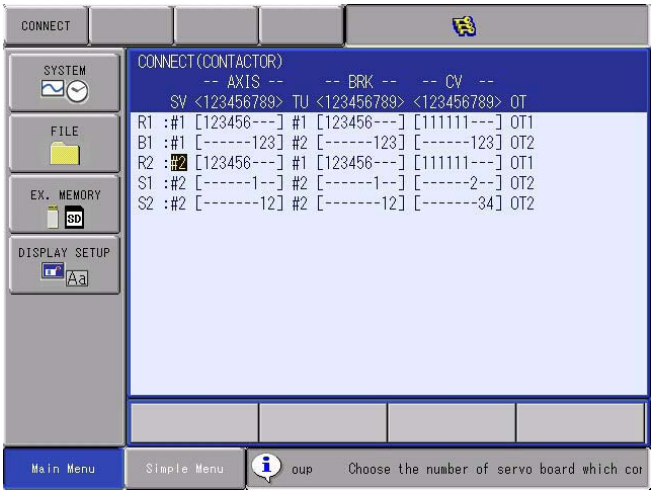


2. Select the connection item of a desired control group.
   – The settable items are displayed.
   – Select an item to change the setting. Select {Cancel} to return to the CONNECT window.
   – <CONNECT (STO) window>



   – 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 brake (BRK) of the each control group is connected to.
     The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which brake.
   – Specify which converter (CV) each axis of each control group is connected to.
     The numbers in [ ] represent the converter numbers, and indicate which axis is connected to which converter.
   – Specify which on enable signal (ON_EN) each control group is connected to.
   – Specify which overrun signal (OT) each control group is connected to.

– <CONNECT (CONTACTOR) window>



– Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [ ] represent axis numbers, and indicate which axis is connected to which connector.

– Specify which brake (BRK) of the contactor unit each axis of each control group is connected to.
The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which brake.

– Specify which converter (CV) each axis of each control group is connected to.
The numbers in [ ] represent the converter numbers, and indicate which axis is connected to which converter.

– Specify which overrun signal (OT) each control group is connected to.

– In this example, B1 (Base) is connected in the following manner:

1st axis	à	SERVO Board (SV #2), Contactor Unit (TU #1), Converter (CV #1)	Connector (7CN), brake Connector (BRK7),
2nd axis	à	SERVO Board (SV #2), Contactor Unit (TU #1), Converter (CV #2)	Connector (8CN) brake Connector (BRK8)
3rd axis	à	SERVO Board (SV #2), Contactor Unit (TU #1), Converter (CV #3)	Connector (9CN) brake Connector (BRK9)
Overrun	à	(OT2)	

3. Therefore, when an overrun alarm occurs, the subcode is indicated by the control group.
   However, select “NOT CONNECT” if an overrun switch is not installed to the control group or the allocation of the external axis overrun signal is not needed.
   Regarding the connection of the external axis overrun signal, refer to *chapter 14.7.5 “External Axes Overrun”* .
4. Select a desired item.
5. Press [ENTER] in the CONNECT window.
   – The setting in the CONNECT window is completed and the window moves to the AXES CONFIG window.

An error massage Error 8217 "Cannot change setting. Check the setting of spot high speed spec.” may appear when press [ENTER] in the CONNECT window.

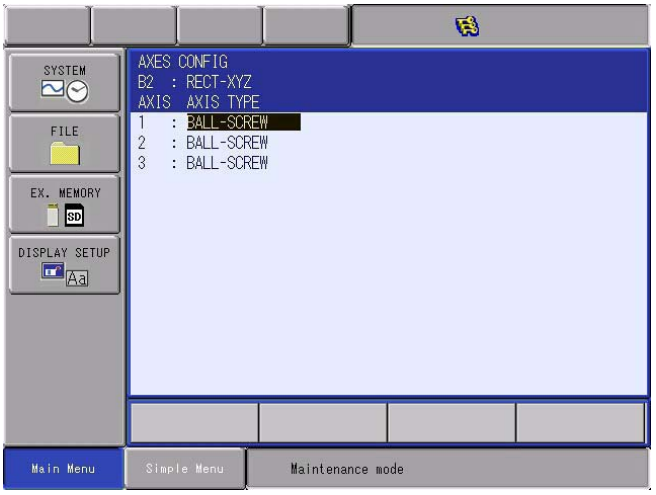
SUPPLE -MENT

When the error massage appears, invalid SPOT HIGH SPEED SPEC or review the configuration of the control group by referring to “YRC1000 OPERATOR’S MANUAL FOR SPOT WELDING USING MOTOR GUN (RE-CSO-A054)”.

12.3.1.3 Axis Configuration Setting

The axis type is specified in the AXES CONFIG window.

1. Confirm axis type of each axis in the AXES CONFIG window.
   – The axis type of each axis is displayed.



2. Select the axis type to be modified.
   (1) The settable axis type is displayed.



   (2) Select “BALL-SCREW” when the servo track is ball-screw type, and “RACK&PINION” when the servo track is rack & pinion type. After the selection, the window returns to the AXES CONFIG window.

   (3) Select the axis type.

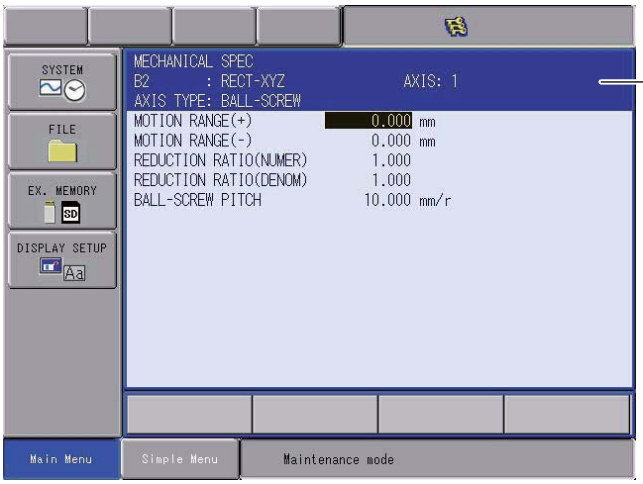
3. Press [ENTER] in the AXES CONFIG window.
4. The setting in the AXES CONFIG window is completed and the window moves to the MECHANICAL SPEC window.

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)

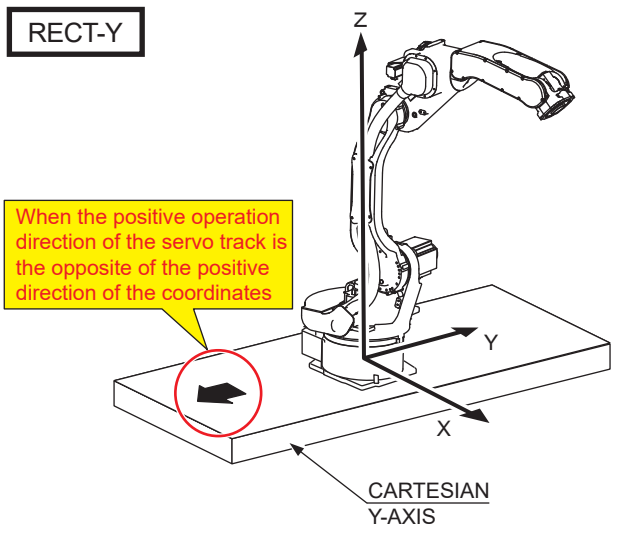


– MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

– 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.

NOTE

As shown below, when the servo track is operated in the rotation direction set in *chapter 12.3.1.5 "Motor Specification Setting"* and the direction is the opposite of the positive (+) direction of the coordinates, set the numerator to a negative value.



– BALL-SCREW PITCH : Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

The MECHANICAL SPEC window (in case of the RACK&PINION type)

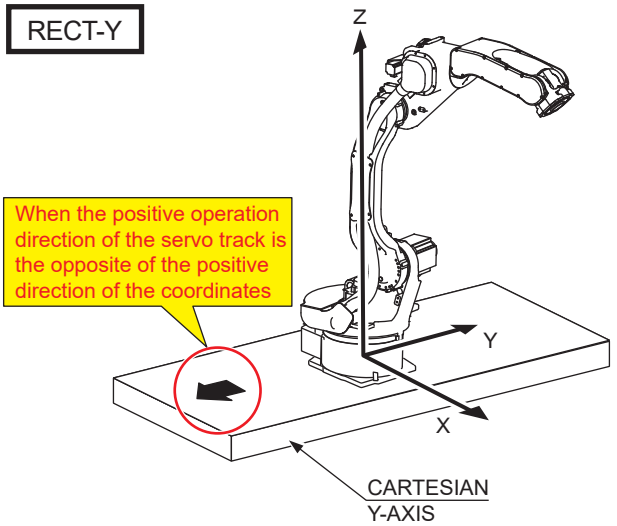


– MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.>If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

NOTE

As shown below, when the servo track is operated in the rotation direction set in *chapter 12.3.1.5 "Motor Specification Setting"* and the direction is the opposite of the positive (+) direction of the coordinates, set the numerator to a negative value.



– PINION DIAMETER : Input the diameter of a pinion. (Unit: mm)

2. Select the item to be modified.
   – Point the cursor to the item subject for setting value modification, and press [SELECT].
3. Modify the settings.
   – The selected item is in the input status.
   Input the setting value, and press [ENTER].
4. Press [ENTER] in the MECHANICAL SPEC window.
   – After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner.
   – When [ENTER] is pressed in the MECHANICAL SPEC window for the last axis, the setting in the MECHANICAL SPEC window is completed and the window moves to the MOTOR SPEC window.

12.3.1.5 Motor Specification Setting

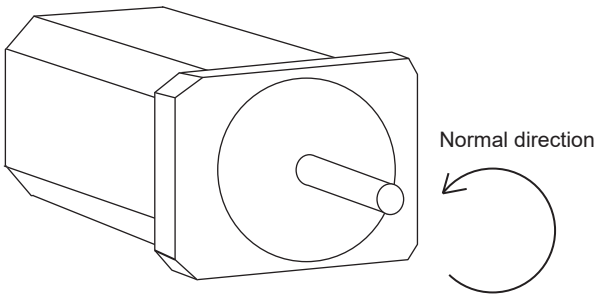
The motor data is specified in the MOTOR SPEC window.

1. Confirm specification of each axis in the MOTOR SPEC window.
   – The motor specification of each axis is displayed.



2. Select the desired item.
   – When a numerical value is selected, the number input buffer line appears.
   – When MOTOR (or SERVO AMP or CONVERTER) is selected, the list window of MOTOR (SERVO AMP, or CONVERTER) appears.
   – ROTATION DIRECTION : Set the rotation direction to which the current position is increased. (The counterclockwise view from the loaded side is the normal rotation.)

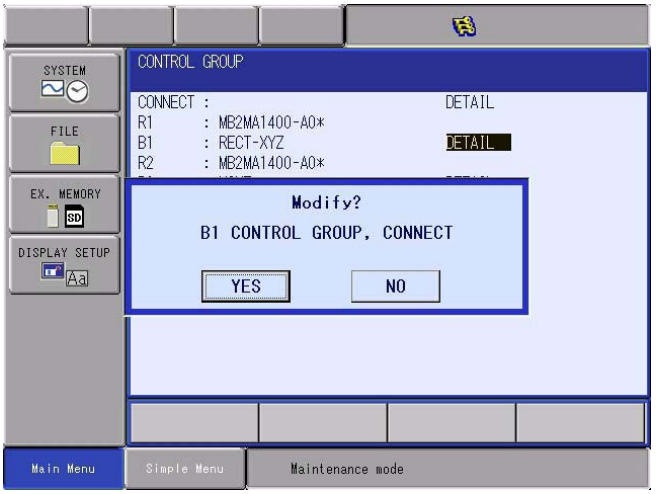
Fig. 12-1: AC Servo Motor



   – MAX. RPM : Input rated rotation speed of a motor. (Unit: rpm)
   – ACCELARATION TIME : Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)
   – INERTIA RATIO : The initial value is set at 300 in case of servo track; 0 in case of rotation axis. However, if the following phenomenon occurs in motion, deal with the following procedure.
   – <Phenomenon1>
     During motion, the axis moves unsteady on advance direction.
     → Confirm the motion with increasing this ratio in each 100.

– <Phenomenon2>
During pause, the motor makes a lot of noise.
→ Confirm the motion with decreasing this ratio in each 100.

3. Modify the settings.
4. Press [ENTER] in the MOTOR SPEC window.
   – After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner.
   – When [ENTER] is pressed in the MOTOR SPEC window for the last axis, the setting in the MOTOR SPEC window is completed and the confirmation dialog box appears.



   – If {YES} is selected, the system parameter is set automatically.
5. Initialize the related files.
   – To add and modify the base axis in completed.

12.3.2 Station Axis Setting

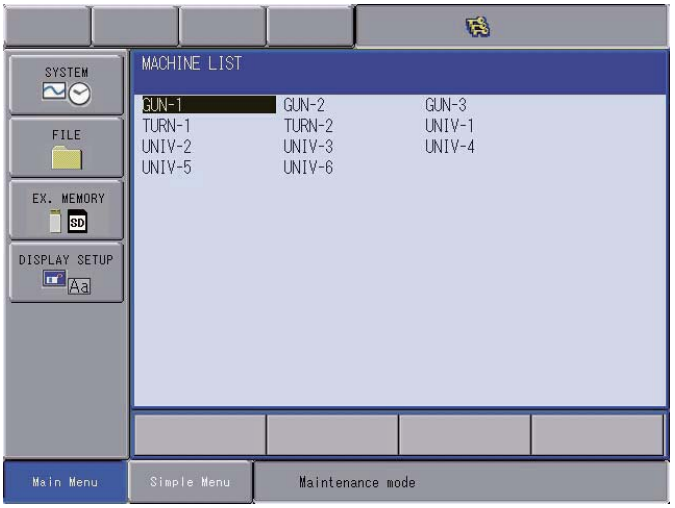
12.3.2.1 Selection of Station Axis Type

Select the type of station axis to be added/modified.

1. Confirm the type of control group in CONTROL GROUP window.
   – The CONTROL GROUP window appears.

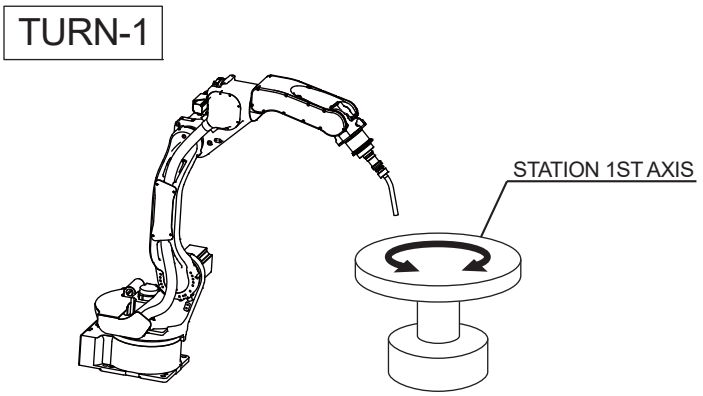


2. Select the type of control group to be modified.
   – The MACHINE LIST window appears.



TURN-1: TURN 1 AXIS STATION
TURN-2: TURN 2 AXIS STATION
UNIV-1: UNIVERSAL 1 AXIS STATION
UNIV-2: UNIVERSAL 2 AXIS STATION
...

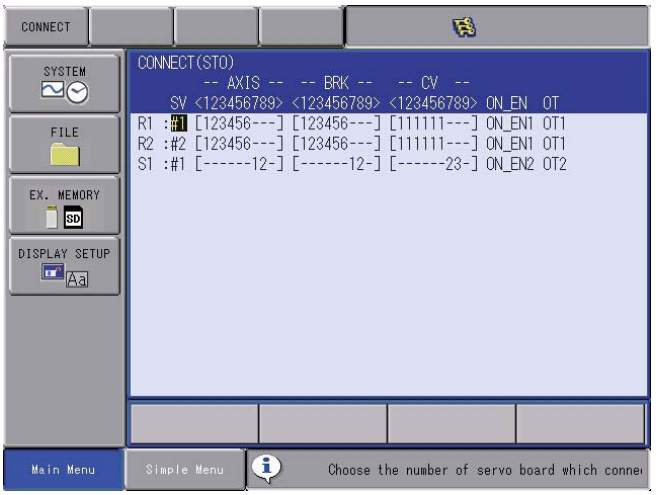
3. Select desired type in the type list.
   – After the type selection, the window returns to CONNECT window.
   – Select “UNIV” (universal) when using a mechanism other than the registered type (such as a servo track) as a station axis. When “UNIV” is selected, interpolation motion (linear, circular, etc.) is not supported.



12.3.2.2 Connection Setting

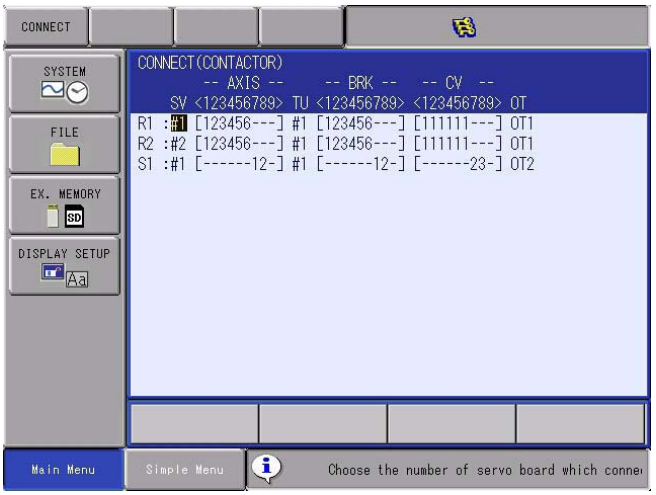
In the CONNECT window, it is specified that each axis of each control group is connected to which connector of the SERVO board, which brake of the contactor unit, which converter, and which overrun signal.

1. Confirm the type of each control group in the CONNECT window.
2. Connection status of each control group is displayed.Select the connection item of desired control group.
   - The settable items are displayed.
   - Select an item to change the setting. Select {Cancel} to return to the CONNECT window.
   - <CONNECT (STO) window>



   - Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
     The numbers in [ ] represent axis numbers, and indicate which axis is connected to which connector.
   - Specify which brake (BRK) of the each control group is connected to.
     The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which brake.
   - Specify which converter (CV) each axis of each control group is connected to.
     The numbers in [ ] represent the converter numbers, and indicate which axis is connected to which converter.
   - Specify which on enable signal (ON_EN) each control group is connected to.
   - Specify which overrun signal (OT) each control group is connected to.

– <CONNECT (CONTACTOR) window>



– Specify which connector (CN) of the SERVO board each axis of each control group is connected to.
The numbers in [ ] represent axis numbers, and indicate which axis is connected to which connector.

– Specify which brake (BRK) of the contactor unit each axis of each control group is connected to.
The numbers in [ ] represent the axis numbers, and indicate which axis is connected to which brake.

– Specify which converter (CV) each axis of each control group is connected to.
The numbers in [ ] represent the converter numbers, and indicate which axis is connected to which converter.

– Specify which overrun signal (OT) each control group is connected to.

– In this example, S1 (Station) is connected in the following manner:

1st axis	→	SERVO Board (SV #1),	Connector (7CN),
		Contactor Unit (TU #1),	brake Connector (BRK7),
		Converter (CV #2)	
2nd axis	→	SERVO Board (SV #1),	Connector (8CN),
		Contactor Unit (TU #1),	brake Connector (BRK8),
		Converter (CV #3)	
Overrun	→	(OT2)	

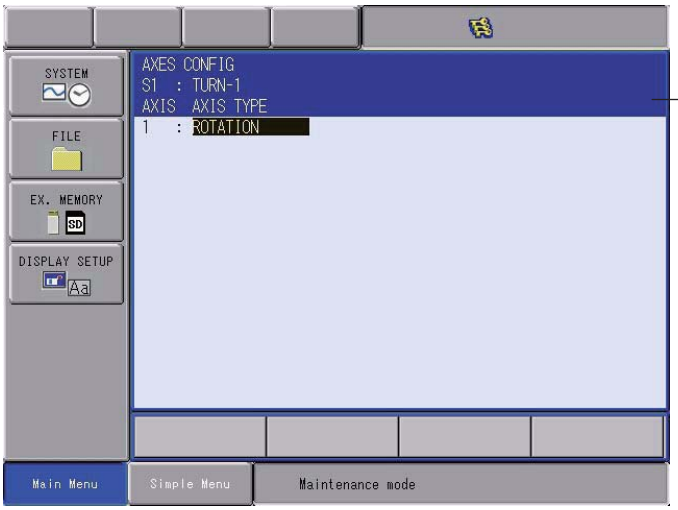
3. An overrun signal is allocated to a control group. Therefore, when an overrun alarm occurs, the subcode is indicated by the control group. However, select “NOT CONNECT” if an overrun switch is not installed to the control group or the allocation of the external axis overrun signal is not needed.
Regarding the connection of the external axis overrun signal, refer to *chapter 14.7.5 “External Axes Overrun”* .
4. Select a desired item.
5. Press [ENTER] in the CONNECT window.

– The setting in the CONNECT window is completed and the window moves to the AXES CONFIG window.

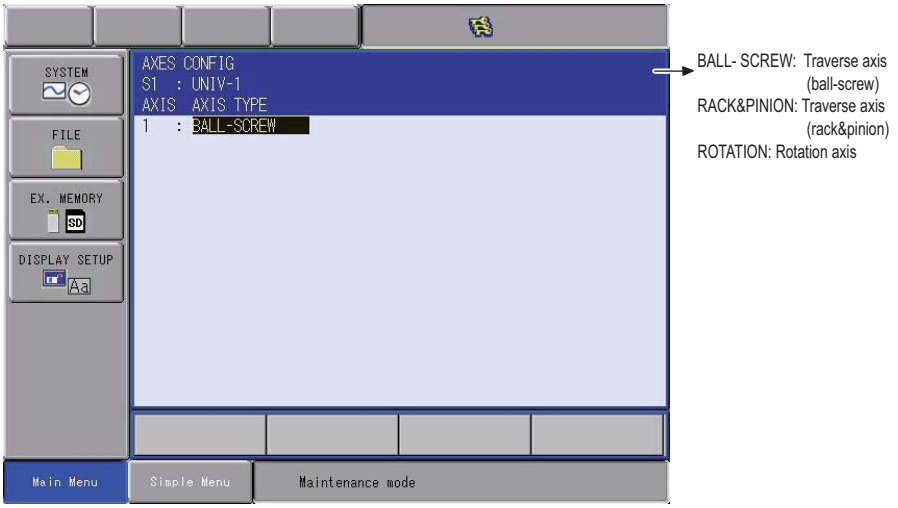
12.3.2.3 Axis Configuration Setting

The axis type and motor type are specified in the AXES CONFIG window.

1. Confirm axis type of each axis in the AXES CONFIG window.
   – The axis type of each axis is displayed.
   • The AXES CONFIG window (in case of the TURN type)



   • The AXES CONFIG window (in case of the UNIVERSAL type)



2. Select the axis type to be modified.
   – The settable axis type is displayed.



3. Select the desired axis type.
4. Press [ENTER] in the AXES CONFIG window
   – The setting in the AXES CONFIG window is completed and the window moves to the MECHANICAL SPEC window.

12.3.2.4 Mechanical Specification Setting

The mechanical data is specified in the MECHANICAL SPEC window.

1. Confirm specification of each axis in the MECHANICAL SPEC window.
   – The mechanical specification of axis is shown.

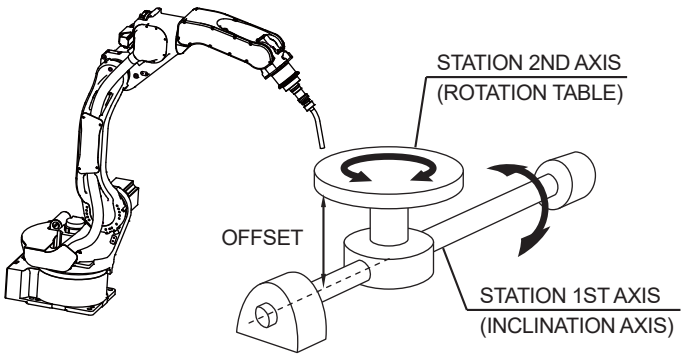


– MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: deg)

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

– OFFSET : Offset should be specified at "TURN-2" type only. Input length between the center of bending axis (1st axis) and the turning table (2nd axis). (Unit: mm)

TURN-2



• The MECHANICAL SPEC window (In case of the BALL-SCREW type)

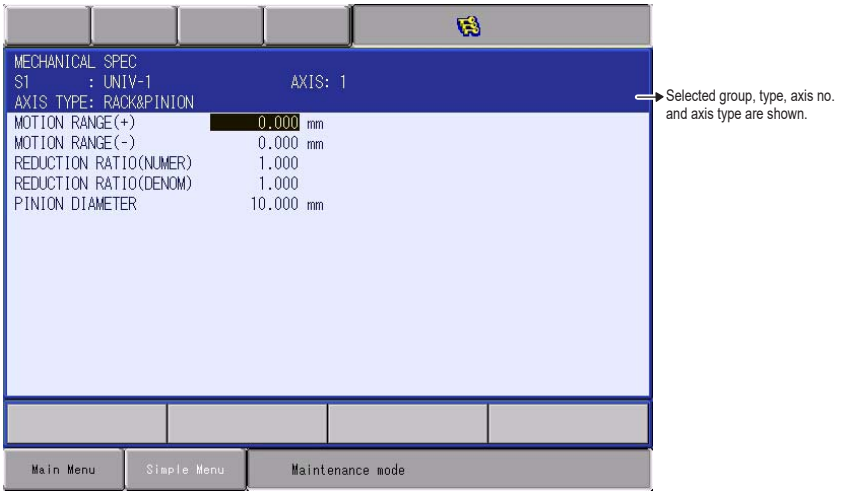


– MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/2, the numerator should be set as 1.0 and the denominator should be set as 2.0.

– BALL-SCREW PITCH : Input the traveling length when the ball-screw rotates once. (Unit: mm/r)

• The MECHANICAL SPEC window (In case of the RACK&PINION type)



– MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: mm)

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.>If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

– PINION DIAMETER : Input the diameter of a pinion. (Unit: mm)

• The MECHANICAL SPEC window (In case of the ROTATION type)



– MOTION RANGE : Input maximum moving position (positive (+) direction and negative (-) direction) from home position when setting the home position to 0. (Unit: deg)

– REDUCTION RATIO : Input the numerator and the denominator. <e.g.> If the reduction ratio is 1/120, the numerator should be set as 1.0 and the denominator should be set as 120.0.

2. Modify the settings.
3. Press [ENTER] in the MECHANICAL SPEC window.

– After the setting, the current window moves to the window for the next axis setting. Complete the settings for all axes in the same manner. When [ENTER] is pressed in the MECHANICAL SPEC window for the last axis, the setting in the MECHANICAL SPEC window is completed and the window moves to the MOTOR SPEC window.

12.3.2.5 Motor Specification Setting

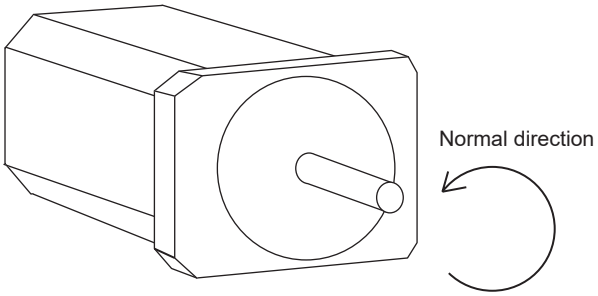
The motor data is specified in the MOTOR SPEC window.

1. Confirm specification of each axis in the MOTOR SPEC window.
   – The motor specification of each axis is displayed.



2. Select a desired item.
   – When a numerical value is selected, the number input buffer line appears.
   When MOTOR (or SERVO AMP or CONVERTER) is selected, the list window of MOTOR (SERVO AMP or CONVERTER) appears.
   – When the type is selected, the window returns to the MOTOR SPEC window.
   – ROTATION DIRECTION : Set the rotation direction to which the current position is increased.
   (The counterclockwise view from the loaded side is the normal rotation.)

Fig. 12-2: AC Servo Motor



   – MAX. RPM : Input rated rotation speed of a motor. (Unit: rpm)
   – ACCELARATION SPEED : Input time between 0.01 and 1.00 to reach maximum speed from stopping status at 100% JOINT speed. (Unit: sec)

– INERTIA RATIO : The initial value is set at 300 in case of servo track; 0 in case of rotation axis. However, if the following phenomenon occurs in motion, deal with the followed procedure.

– <Phenomenon1> During motion, the axis moves unsteady on advance direction.
→ Confirm the motion with increasing this ratio in each 100.

– <Phenomenon2> During pause, the motor makes a lot of noise.
→ Confirm the motion with decreasing this ratio in each 100.

3. Modify the settings.

NOTICE

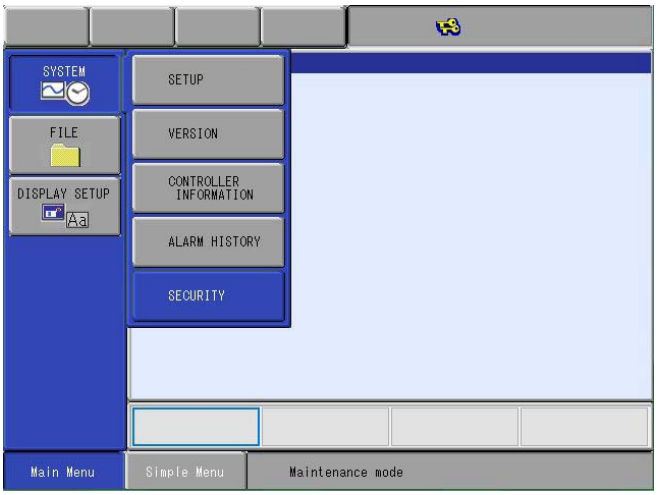
- If the control axis configuration is changed by addition of a base axis or station axis, the internal data of the job file are also changed so that the job file data should be initialized.
  Initialize the job file data with procedure “File Initialize” in this manual after changing the construction.
- When the data, motion range for example, should be changed after the addition of a base axis or station axis, the change can be done in the same procedure as shown above.
  In this case, the control axis configuration is not changed so the job file data should not be initialized.

12.4 Encoder Connection Settings

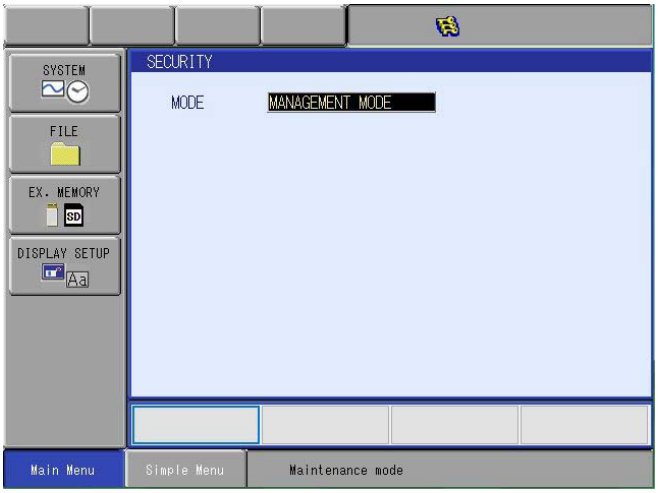
The encoder connection settings can be configured by using the encoder configuration function.

The encoder connection settings are necessary for recognizing to which connector on the servo control board an encoder is connected and to which axis an encoder is assigned. In a typical configuration, the encoder connection settings are automatically configured. However, when a system is configured with multiple control groups and multiple servo control boards, there may be cases where encoder connection settings cannot be automatically configured. In these cases, configure the encoder connection settings by using the encoder configuration function.

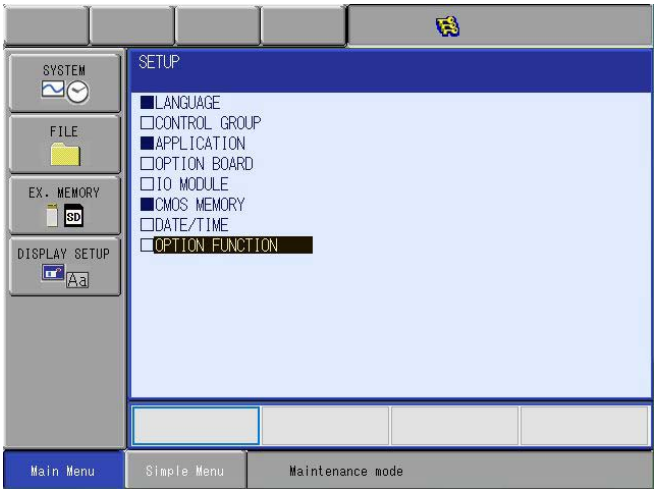
1. Turn the power ON while pressing [Main Menu].
   – The controller starts in maintenance mode.
2. Select {SYSTEM} under the main menu.
   – The SYSTEM window appears.



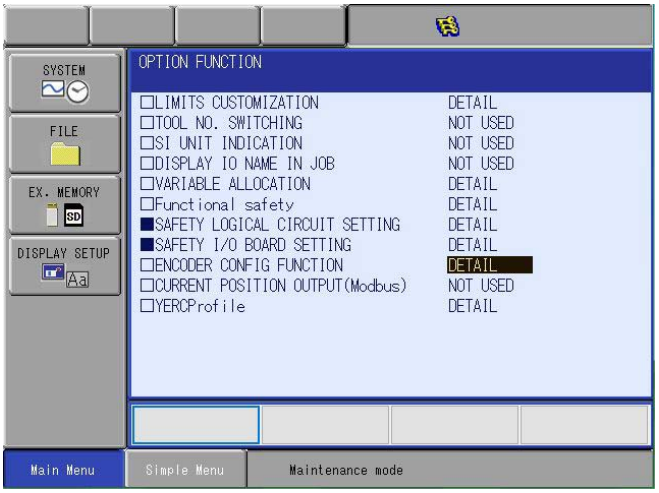
3. Select {SECURITY}.
   – Change the security mode to [MANAGEMENT MODE] or higher.



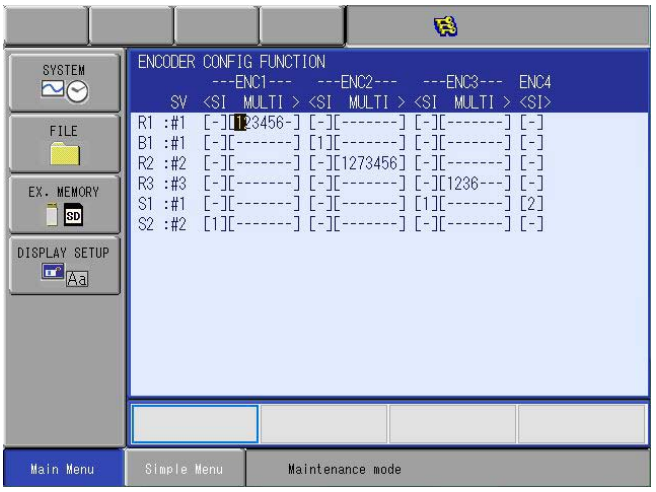
4. Select {SETUP}.
   – Select {SYSTEM} under the main menu, and select {SETUP}.
   – The SETUP window appears.
   – Items indicated by ■ cannot be selected.



5. Select {OPTION FUNCTION}.
   – The software options appear.



6. Select {DETAIL} for ENCODER CONFIG FUNCTION.
   – The ENCODER CONFIG FUNCTION window appears.



<ENCODER CONFIG FUNCTION Window>

– Set the connector on the servo control board (CN508, CN534, CN535, or CN536) and the communication method (serial communication or multi communication) to which each axis of each control group is connected.

– Numeric values inside [ ] are the axis numbers.

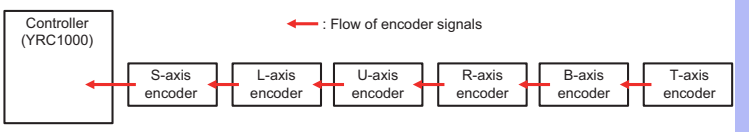
– SV stands for the servo control board.

– ENC1 stands for CN508 on the servo control board, ENC2 stands for CN534 on the servo control board, ENC3 stands for CN535 on the servo control board, and ENC4 stands for CN536 on the servo control board.

– SI stands for serial communication, and MULTI stands for multi communication.

SUPPLE-MENT

The encoders that detect the motor position of each axis for the YRC1000 use a communication method that obtains multiple items of encoder data over one communication line. This communication method is called multi communication.



– In the screen shown above:
Axis #1 to #6 of R1 (robot) are connected to the CN508 connector (ENC1) on the servo control board (SV#1) over multi communication.
Axis #1 of B1 (base) is connected to the CN534 connector (ENC2) on the servo control board (SV#1) over serial communication.
Axis #1 to #7 of R2 (robot) are connected to the CN534 connector (ENC2) on the servo control board (SV#2) over multi communication.
Axis #1 to #3 and #6 of R3 (robot) are connected to the CN535 connector (ENC3) on the servo control board (SV#3) over multi communication.
Axis #1 of S1 (station) is connected to the CN535 connector (ENC3) on the servo control board (SV#1) over serial communication.
Axis #2 of S1 (station) is connected to the CN536 connector (ENC4) on the servo control board (SV#1) over serial communication.
Axis #1 of S2 (station) is connected to the CN508 connector (ENC1) on the servo control board (SV#2) over serial communication.

7. Select the control group connection item to change.

– The settable axis numbers appear.

– The setting can be changed when an item is selected. Or press [CANCEL] to go back.

8. Press [ENTER] on the ENCODER CONFIG FUNCTION window.

– The encoder configuration function settings are finished and the OPTION FUNCTION window returns.

CAUTION

When using multi communication, configure the settings so that the encoders are connected to the same connector.

Communication is possible with up to seven axes over a single multi communication line.

Multiple control groups cannot be set to the same connector.

13 YRC1000 Specification

DANGER

- Always set the teach lock before starting teaching.
- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

WARNING

- When turning ON the YRC1000 power, confirm that no person is present in the manipulator's operating range and that the operator is in a safe location.

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the upper right of the programming pendant.

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

- Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.

13.1 Specification List

Controller	**Dust/Splash-proof construction**	IP54 (The back fan is IP2X.)
	Dimensions	598 (W) ×490 (H) ×427 (D) mm (without protrusion part)
	Cooling system	Indirect cooling
	Power supply	•3-phase 200 to 240 VAC (+10% to -15%) at 50/60 Hz (±2%) •3-phase 380 to 440 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing) •3-phase 380 to 480 VAC (+10% to -15%) at 50/60 Hz (±2%) (neutral earthing) The specification of power supply differs depending on the type of YRC1000. Refer to *table 4-1 "Power Supply Specification"* .
	Grounding	•For 200 to 240 VAC Grounding resistance: 100 Ω or less, exclusive grounding •For 380 to 440 VAC, 380 to 480 VAC Grounding resistance: 10 Ω or less, exclusive grounding
	Noise level	Less than 60 dB
	Digital I/O	Specific signal (hardware) 19 inputs and 6 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) Temperature change: 0.3°C/min or less
	Relative humidity	10% to 90%RH (non-condensing)
	Allowable altitude	1000 m or less (To use the YRC1000 at the altitude over 1000 m, calculate the maximum ambient temperature by decreasing it by 1% per 100 m. The maximum allowable altitude is 2000 m. When the altitude is 2000 m, the maximum ambient temperature during operation is 40.5°C.)
	Vibration acceleration	0.5G or less
	Others	Free from corrosive gas or liquid, or explosive gas Free from dirt, dust, cutting oil (including coolant), organic solvent, oil fume, water, salt, chemicals or anti-rust oil Free from excessive electrical noise (plasma) Free from strong microwave, UV light, X-ray or radiation

13.2 Function List

Programming Pendant Operation	**Coordinate System**	Joint, Rectangular/Cylindrical, Tool, User Coordinates
	Modification of Teaching Points	Adding, Deleting, Correcting (Robot axes and external axes respectively can be corrected.)
	Inching Operation	Possible
	Path Confirmation	Forward/Reverse step, Continuous feeding
	Speed Adjustment	Fine adjustment possible during operating or pausing
	Timer Setting	Possible every 0.01 s
	Short-cut Function	Direct-open function, Multi-window
	Interface	SD card slot, USB connector (USB2.0) (At Programming Pendant)
	Application	Arc welding, spot welding, material handling, press tending, cutting, and 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
	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
	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	152 (W) × 300 (H) × 49.5 (D) mm (excluding protrusions)
Protection Class	IP54
Displayed Units	TFT Color liquid crystal display, VGA (640 × 480)
	Touch panel
Operated Units	Three-position enable switch, start switch, hold switch, and mode select switch (with key, three mode) Type of the key for the mode select switch: AS6-SK-132 (manufactured by IDEC Corp.) * Two keys are shipped with the programming pendant.
Cable Length	Standard: 8m, maximum (optional): 36m (standard: 8m + extension: 28m)
Others	Provided with SD card slot (SD/SDHC/SDXC type) USB connector (USB2.0) X 1

Refer to *chapter 13.1 "Specification List"* for the ambient conditions.

13.4 Equipment Configuration

The YRC1000 is comprised of individual units and modules (circuit boards). Malfunctioning components can generally be easily repaired after a failure by replacing a unit or a module.

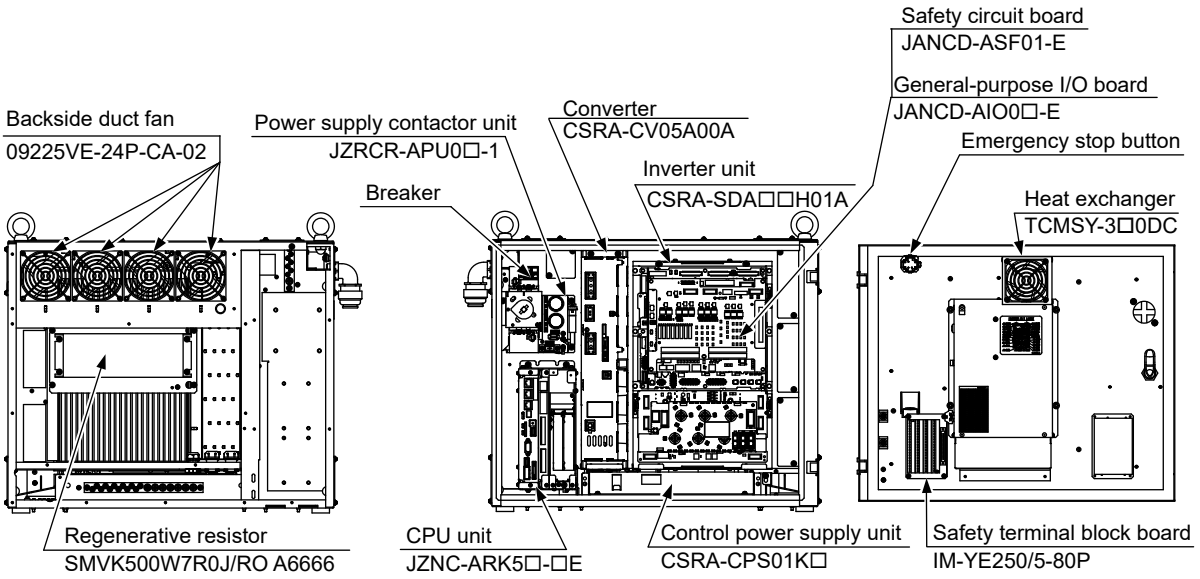
This section explains the configuration of the YRC1000 equipment.

SUPPLE -MENT

- For the YRC1000 type which is not described in this manual, refer to the YRC1000 SUPPLEMENTARY INSTRUCTIONS.
- The combination of the YRC1000 type and the manipulator, refer to this manual or the table 5-1 “Basic Specifications” of Chapter 5 in the INSTRUCTIONS for the manipulator.

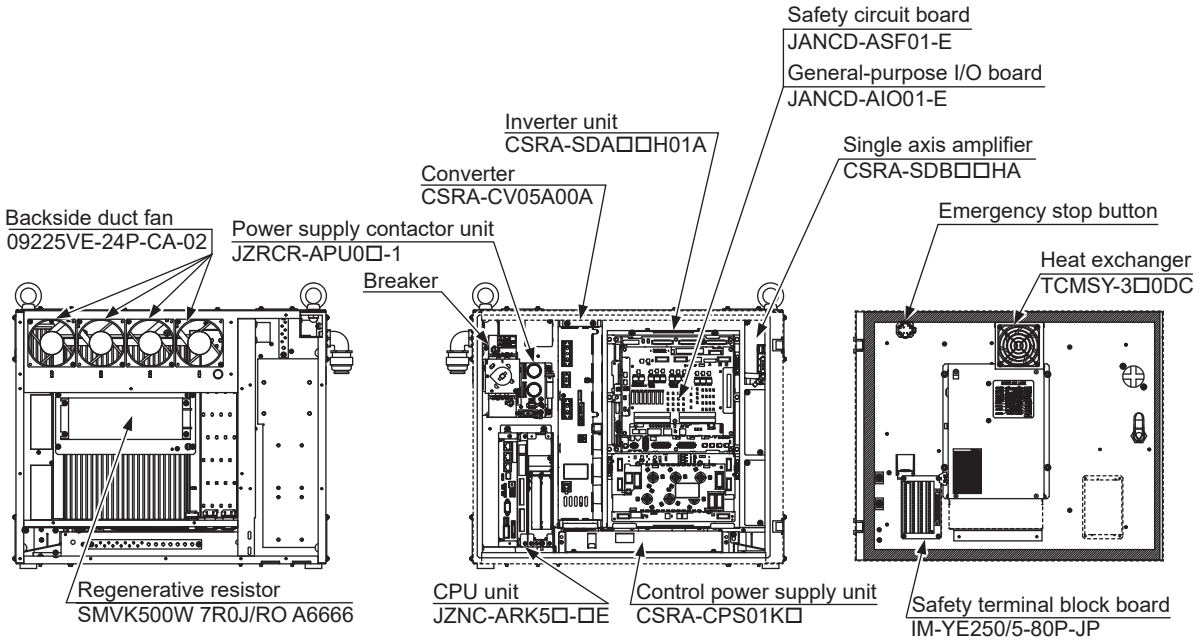
13.4.1 Arrangement of Units and Circuit Boards

Fig. 13-1(a): Configuration for 200 to 240 VAC Specification (Small-Capacity Model 1)



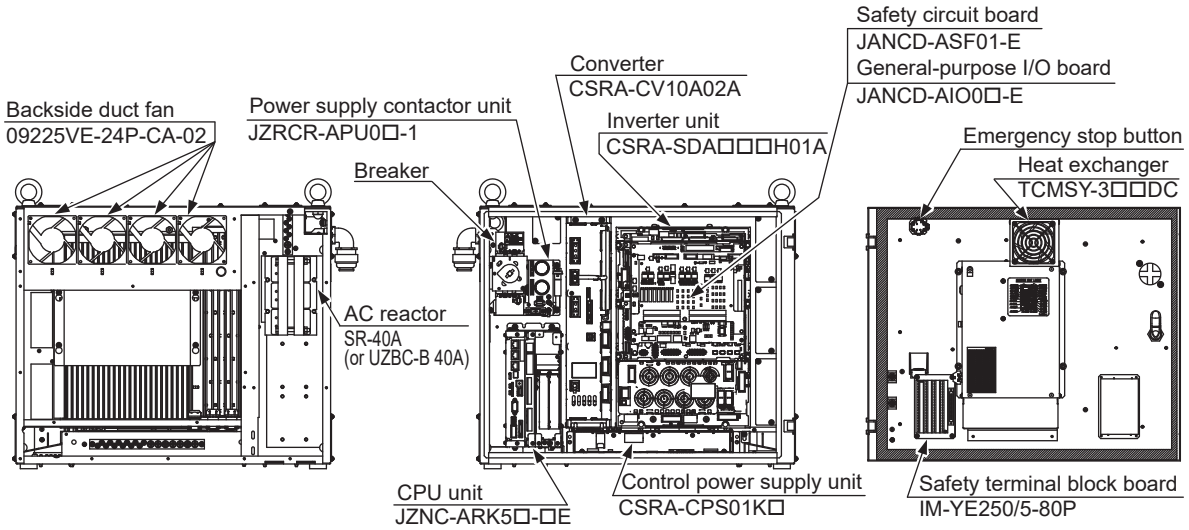
YRC1000 For Japan	Major manipulator type
ERAR-1000-06VX8-A00	GP7
	AR900
	GP8
	AR700
ERAR-1000-06VXH25-A00	GP10
	GP12
	AR1440
	GP25
	AR1730
	GP25-12
	AR2010

Fig. 13-1(b): Configuration for 200 to 240 VAC Specification (Small-Capacity Model 2)



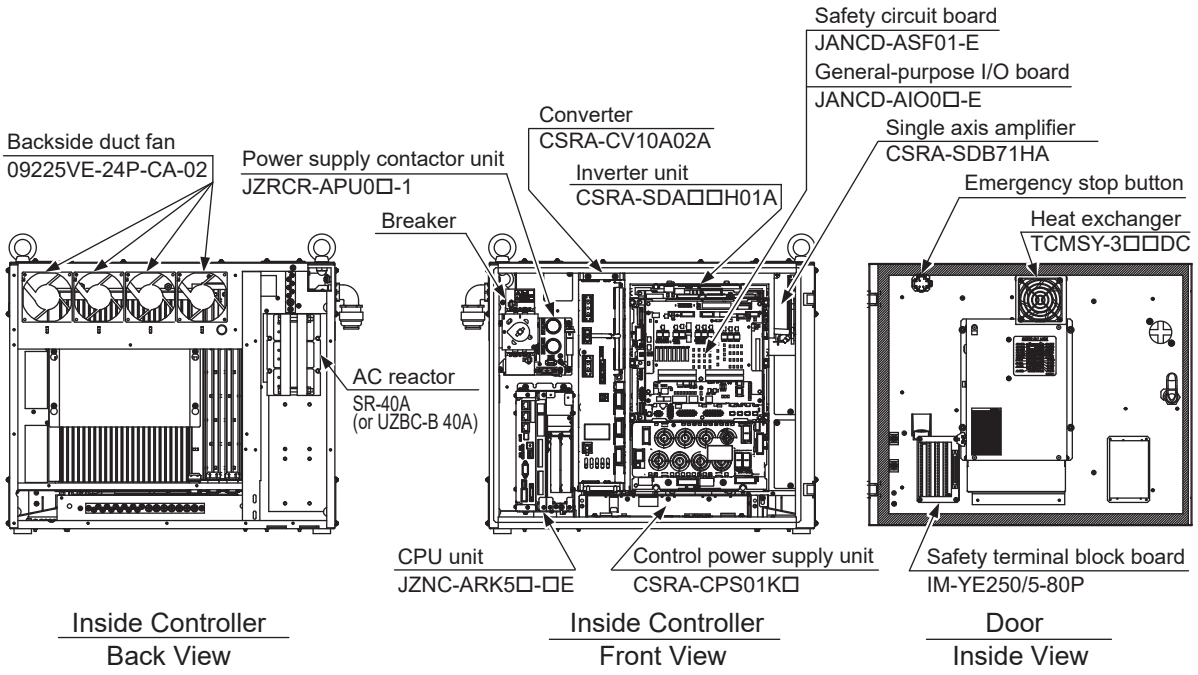
YRC1000	Major manipulator type
For Japan	
ERAR-1000-07VXHE6-A00	AR1440E

Fig. 13-1(c): Configuration for 200 to 240 VAC Specification (Medium/Large-Capacity Model 1)



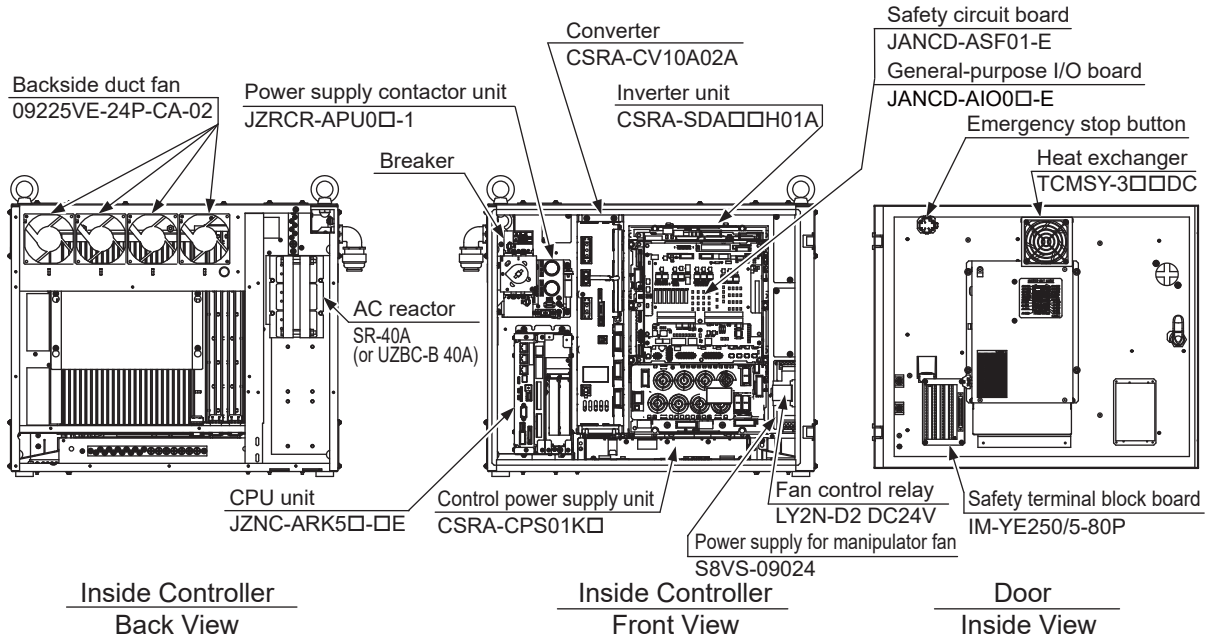
YRC1000 For Japan	Major manipulator type
ERAR-1000-06VXHL20-A00	GP20HL
	AR3120
ERAR-1000-06VX280-A00	GP50
	GP35L
	GP88
	SP80
	GP110
	SP100
	SP130
	GP180
	SP165
	GP180-120
	SP165-105
	GP200S
	GP215
	GP225
	SP210
	GP250
	SP235
	GP280
	GP280L
	GP165R
	SP150R
	GP200R
	SP185R
	SP110H
	SP180H
	SP180H-110
	SP225H
	GP360
	ME1000
ERAR-1000-06VX600-A00	GP400
	GP600
	GP400R

Fig. 13-1(d): Configuration for 200 to 240 VAC Specification (Medium/Large-Capacity Model 2)



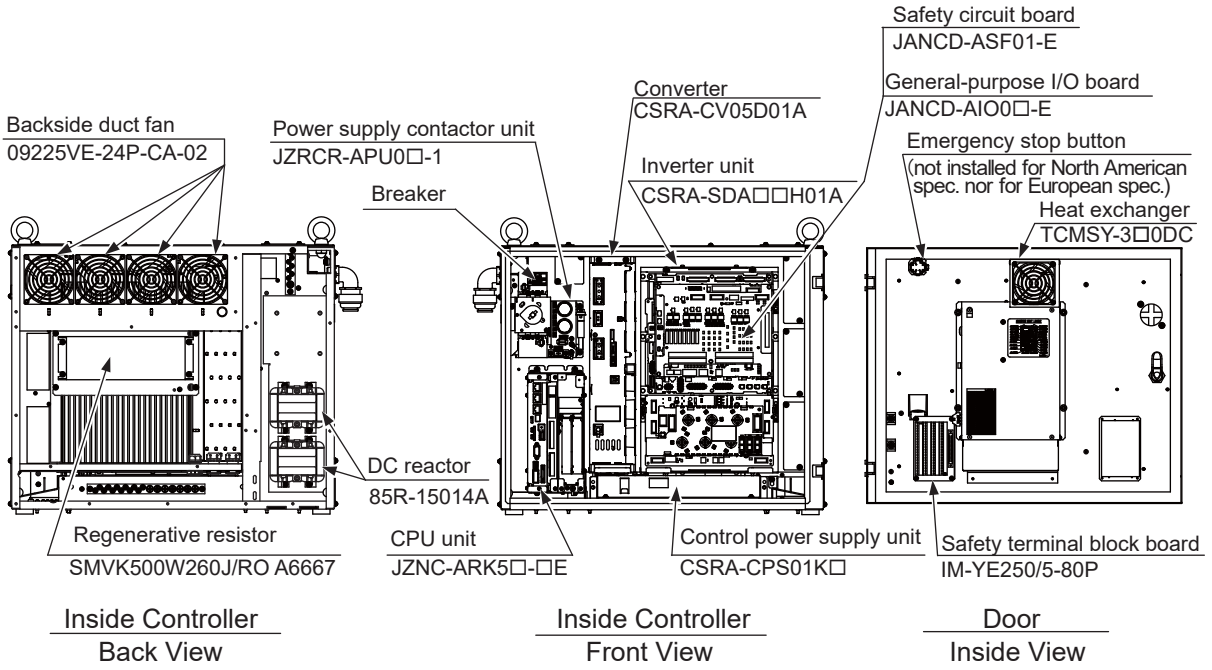
YRC1000	Major manipulator type
For Japan	
ERAR-1000-07VXB110-A00	GP110B
	SP100B

Fig. 13-1(e): Configuration for 200 to 240 VAC Specification (Medium/Large-Capacity Model 3)



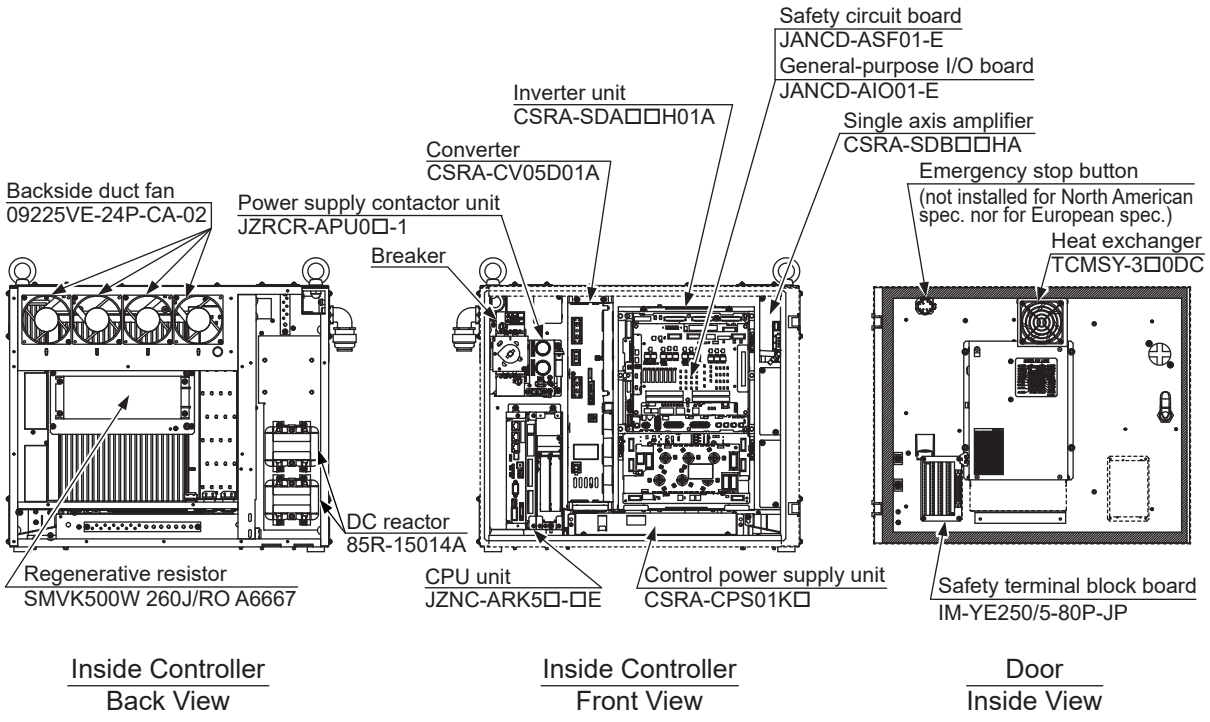
YRC1000 For Japan	Major manipulator type
ERAR-1000-06VRF130-A00	PH130RF
	PH130F
	PL500

Fig. 13-2(a): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Small-Capacity Model 1)



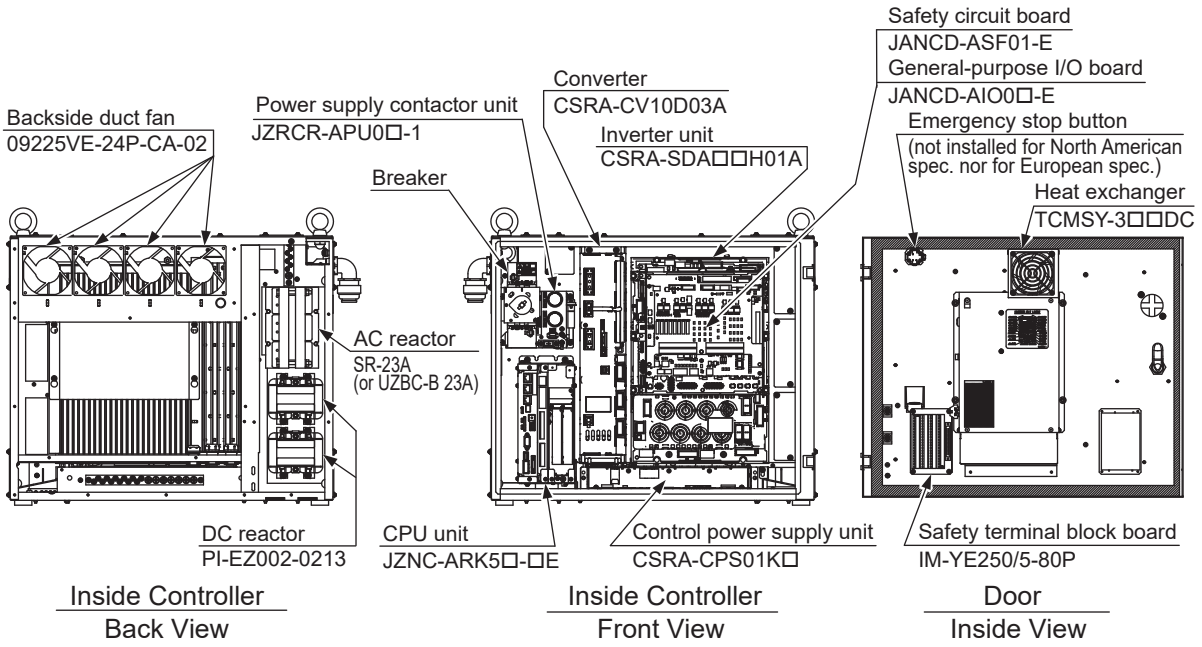
YRC1000			Major manipulator type
For Asia	For North America	For Europe	
ERAR-1000-06VX8-A10	ERAR-1000-06VX8-B15	ERAR-1000-06VX8-E10	GP7
			AR900
			GP8
			AR700
ERAR-1000-06VXH25-A10	ERAR-1000-06VXH25-B15	ERAR-1000-06VXH25-E10	GP10
			GP12
			AR1440
			GP25
			AR1730
			GP25-12
			AR2010

Fig. 13-2(b): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Small-Capacity Model 2)



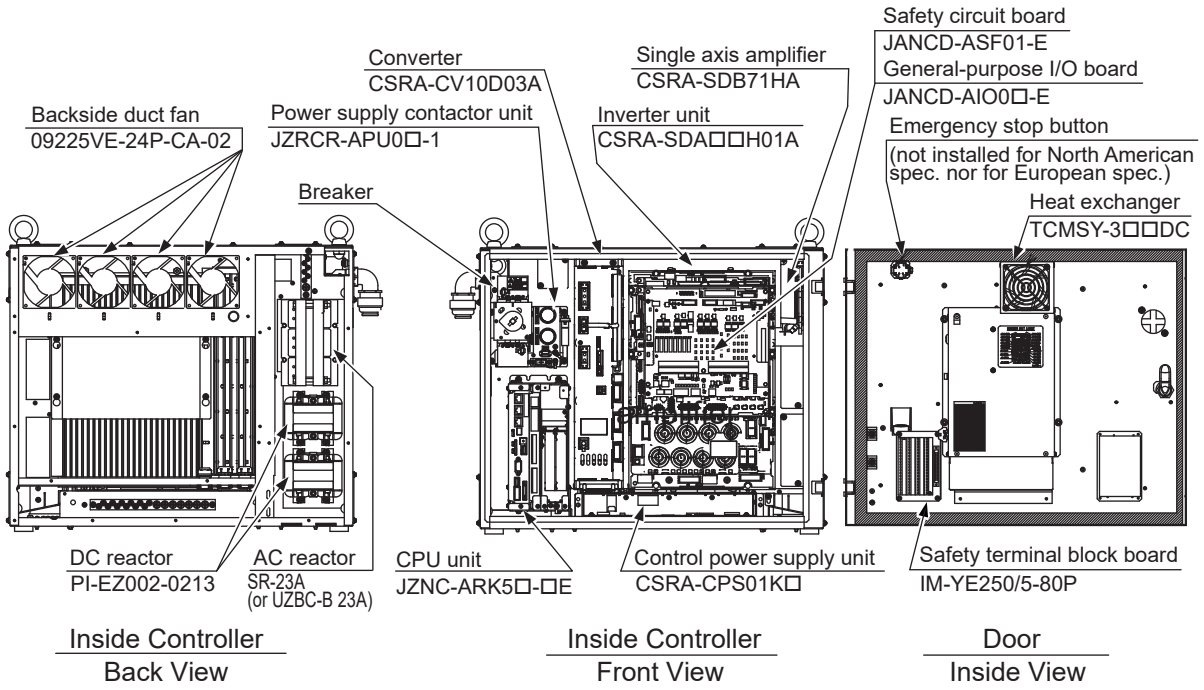
YRC1000			Major manipulator type
For Asia	**For North America**	**For Europe**	
ERAR-1000-07VXHE6-A10	ERAR-1000-07VXHE6-B15	ERAR-1000-07VXHE6-E10	AR1440E

Fig. 13-2(c): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Medium/Large-Capacity Model 1)



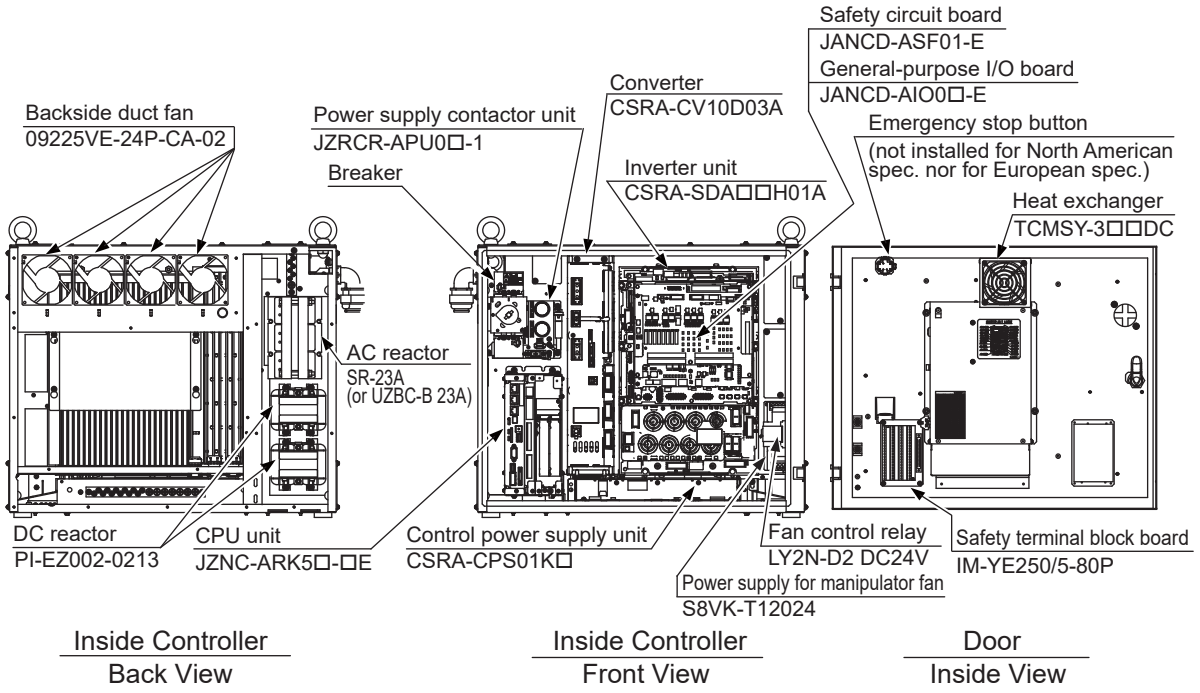
YRC1000			Major manipulator type
For Asia	**For North America**	**For Europe**	
ERAR-1000-06VXHL20-A10	ERAR-1000-06VXHL20-B15	ERAR-1000-06VXHL20-E10	GP20HL
			AR3120
ERAR-1000-06VX280-A10	ERAR-1000-06VX280-B15	ERAR-1000-06VX280-E10	GP50
			GP35L
			GP88
			SP80
			GP110
			SP100
			SP130
			GP180
			SP165
			GP180-120
			SP165-105
			GP200S
			GP215
			GP225
			SP210
			GP250
			SP235
			GP280
			GP280L
			GP165R
			SP150R
			GP200R
			SP185R
			SP110H
			SP180H
			SP180H-110
			SP225H
			GP360
			ME1000
ERAR-1000-06VX600-A10	ERAR-1000-06VX600-B15	ERAR-1000-06VX600-E10	GP400
			GP600
			GP400R

Fig. 13-2(d): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Medium/Large-Capacity Model 2)



YRC1000			Major manipulator type
For Asia	For North America	For Europe	
ERAR-1000-07VXB110-A10	ERAR-1000-07VXB110-B15	ERAR-1000-07VXB110-E10	GP110B
			SP100B

Fig. 13-2(e): Configuration for 380 to 440 VAC, 380 to 480 VAC Specification (Medium/Large-Capacity Model 3)

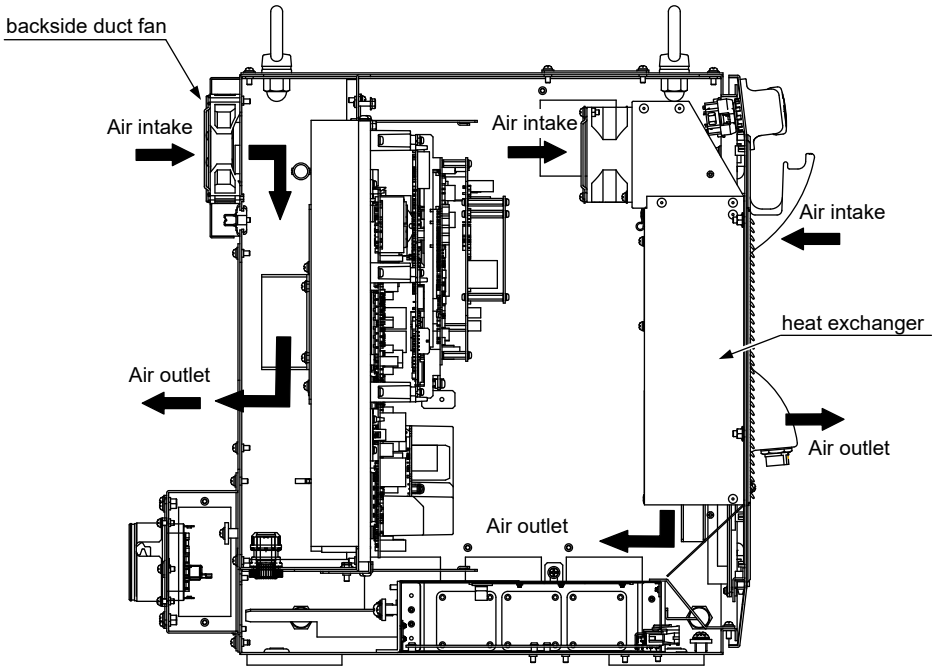


YRC1000			Major manipulator type
For Asia	For North America	For Europe	
ERAR-1000-06VRF130-A10	ERAR-1000-06VRF130-B15	ERAR-1000-06VRF130-E10	PH130RF
			PH130F
			PL500

13.4.2 Cooling System of the Controller Interior

The backside duct fan draws in air from the air intake and expels it from the air outlet to cool the SERVOPACK. The fan mounted inside the door circulates the air to keep temperature even throughout the interior of the YRC1000. Make sure the door of the YRC1000 is closed to keep this cooling system effective.

Fig. 13-3: .Cooling System



14 .Description of Units and Circuit Boards

DANGER

- Always set the teach lock before starting teaching.
- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode and the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

WARNING

- When turning ON the YRC1000 power, confirm that no person is present in the manipulator's operating range and that the operator is in a safe location.

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the upper right of the programming pendant.

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

- Make sure that a system administrator stores the key of the Mode Switch of the programming pendant. After operation is completed, the key must be removed and stored by the system administrator.

Failure to observe this instruction may result in personal injury due to inappropriate or unintended manipulator's operation. If the programming pendant is dropped with the key inserted, the key or the Mode Switch may be damaged.

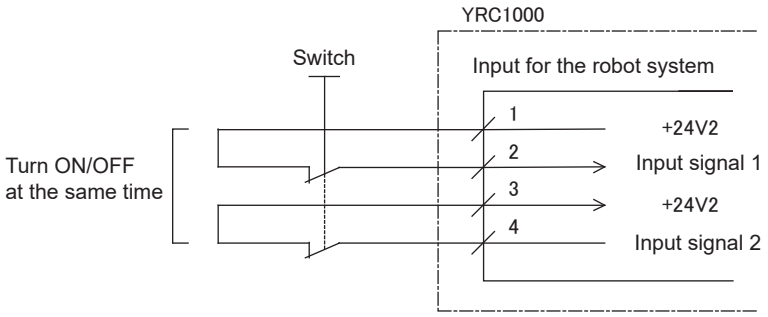
■ Cautions for Connection of Dual Input Signals

NOTICE

- Connect the switch (contact) that turns the dual signals ON and OFF simultaneously.

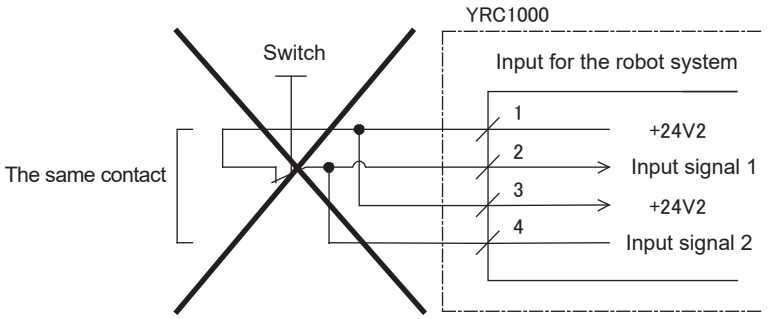
If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs. the figure below.

If one of the signals becomes abnormal, an alarm occurs.



- Do not connect two signals to the same contact point. (Prepare two individual contact points)

An alarm occurs due to the judgment of the safety circuit.

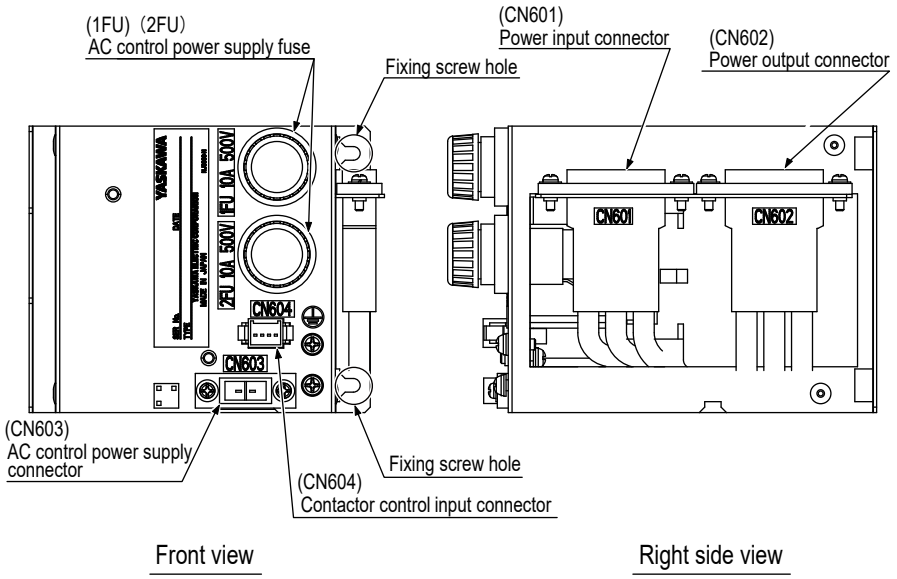


14.1 Power Supply Contactor Unit (JZRCR-APU0□-1)

The power supply contactor unit consists of the main circuit contactor. It turns the main circuit control contactor ON and OFF using the signal for the servo power control from the safety circuit board, and supplies power (three-phase) to the converter.

The power supply (single-phase) is supplied to the control power supply unit.

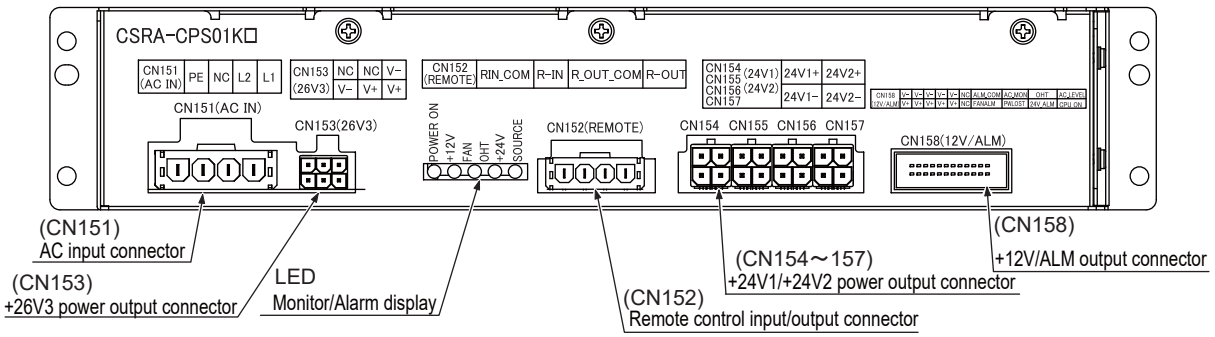
Fig. 14-1: Power Supply Contactor Unit (JZRCR-APU0□-1)

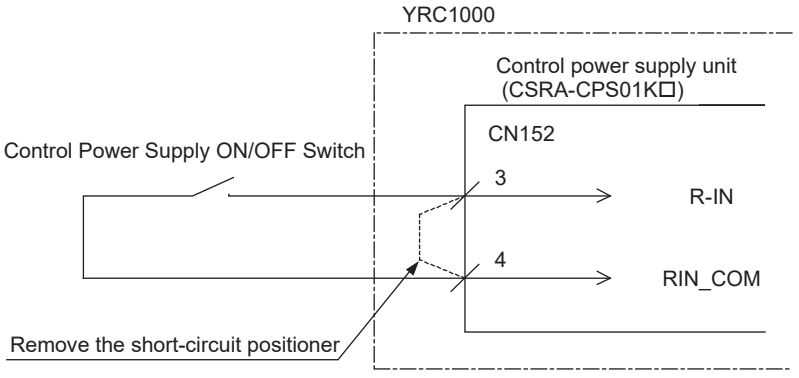


14.2 Control Power Supply Unit (CSRA-CPS01K□)

This unit (CSRA-CPS01K□) supplies the DC power (DC12V, DC24V, DC26V) for control (system, I/O, brake). It is also equipped with the input function for turning the control power supply ON and OFF.

Fig. 14-2: Control Power Supply Unit (CSRA-CPS01K□)



<table>
<tr><th>Items</th><th>Specifications</th></tr>
<tr><td>Input</td><td>Rating Input Voltage: 200 VAC to 480 VAC
Voltage Fluctuation Range: +10% to -15% (170 VAC to 528 VAC)
Frequency: 50/60 Hz ± 2 Hz (48 Hz to 62 Hz)</td></tr>
<tr><td>Output Voltage</td><td>DC + 12V
DC +24V (24V1: System, 24V2: I/O)
DC +26V</td></tr>
<tr><td>Indicator</td><td>
<table>
<tr><th>DISPLAY</th><th>Color</th><th>Status</th></tr>
<tr><td>POWER ON</td><td>White</td><td>Lights with +12V output
(Power supply status: being output)</td></tr>
<tr><td>+12V</td><td>Red</td><td>Lights with +12V low-voltage/over-current
(ON when abnormal)</td></tr>
<tr><td>FAN</td><td>Red</td><td>Lights when an error occurs with the fan inside the control power supply unit
(Error with the fan inside the control power supply unit)</td></tr>
<tr><td>OHT</td><td>Red</td><td>Lights when the temperature inside the control power supply unit exceeds the allowable maximum temperature during operation.
If the temperature keeps rising, the power supply will be cut off.
(Abnormal temperature inside the control power supply unit)</td></tr>
<tr><td>+24V</td><td>Red</td><td>Lights with +24V or +26V low-voltage/over-current
(ON when abnormal)</td></tr>
<tr><td>SOURCE</td><td>White</td><td>Lights with power supply input.
Lights out when internal live part completes discharge.
(Power supply status: being input)</td></tr>
</table>
</td></tr>
<tr><td>Control Power ON/OFF</td><td>To turn ON the YRC1000 controller power, turn ON the non-fuse breaker of the controller so that the control power supply is turned ON. If the controller is not located at the workplace, the control power supply can be turned ON/OFF by an external device, etc. after the non-fuse breaker of the controller is turned ON. It is operated by the external switch connected with CN152 of the Control power supply unit as shown in the following figure. (CN152-3 and CN152-4 are short-circuited when shipment)
Fig. 14-3: Connection to Control Power Supply Unit


See chapter 14.10 “Robot General-Purpose I/O Signal Assignment” for wiring of CN152 connector.</td></tr>
</table>

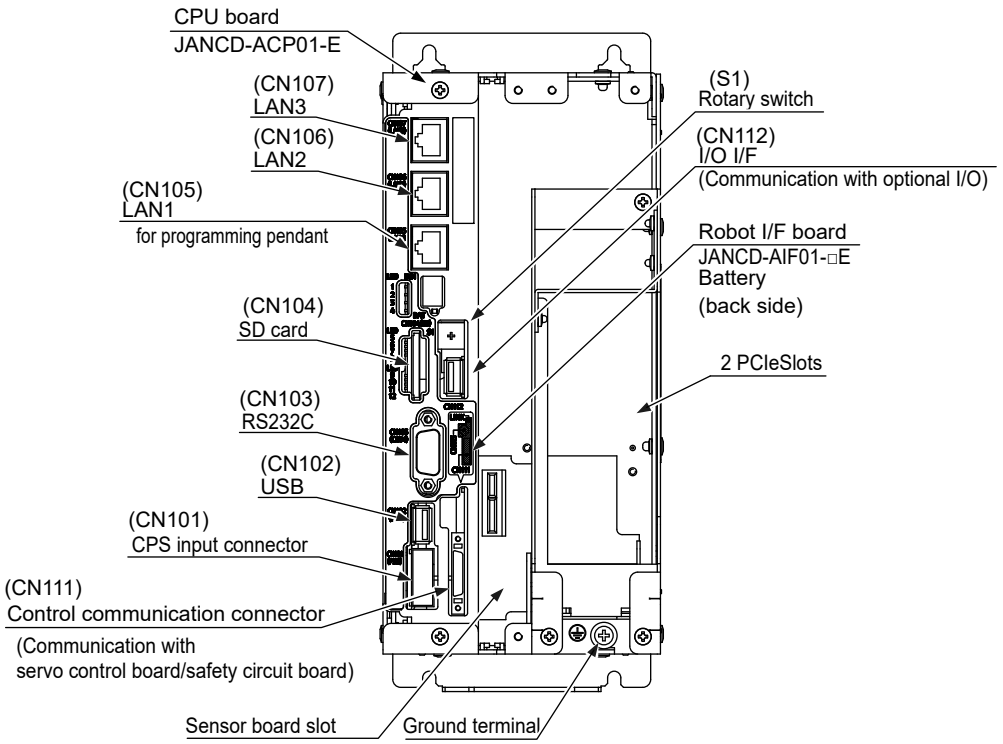
14.3 CPU Unit (JZNC-ARK5□-□E)

14.3.1 CPU Unit Configuration

CPU unit consists of circuit board racks (flame, back circuit board, PCI riser circuit board), CPU board and the robot I/F circuit board.

The JZNC-ARK01-E CPU rack contains only circuit board racks and CPU boards. Be sure that it does not contain robot I/F circuit board.

Fig. 14-4: CPU Unit Configuration (JZNC- ARK5□-□E)



14.3.2 Unit and Circuit Board in the CPU Unit

14.3.2.1 CPU Board (JANCD-ACP01-E)

This circuit board (JANCD-ACP01-E) performs to control the entire system, display to the programming pendant, control the operating keys, control operation and calculate interpolation.

14.3.2.2 Robot I/F Circuit Board (JANCD-AIF01- □ E)

The robot I/F circuit board (JANCD-AIF01- □ E) controls the entire robotic system. It is connected to the CPU board (JANCD-ACP01-E) with a communication connector, and to the servo control board (CSRA-SDCA01AA) with a communication cable.



Please do not change the factory setting of S1.
(Factory setting is [0])

14.4 Converter (CSRA-CV□□□0□A)

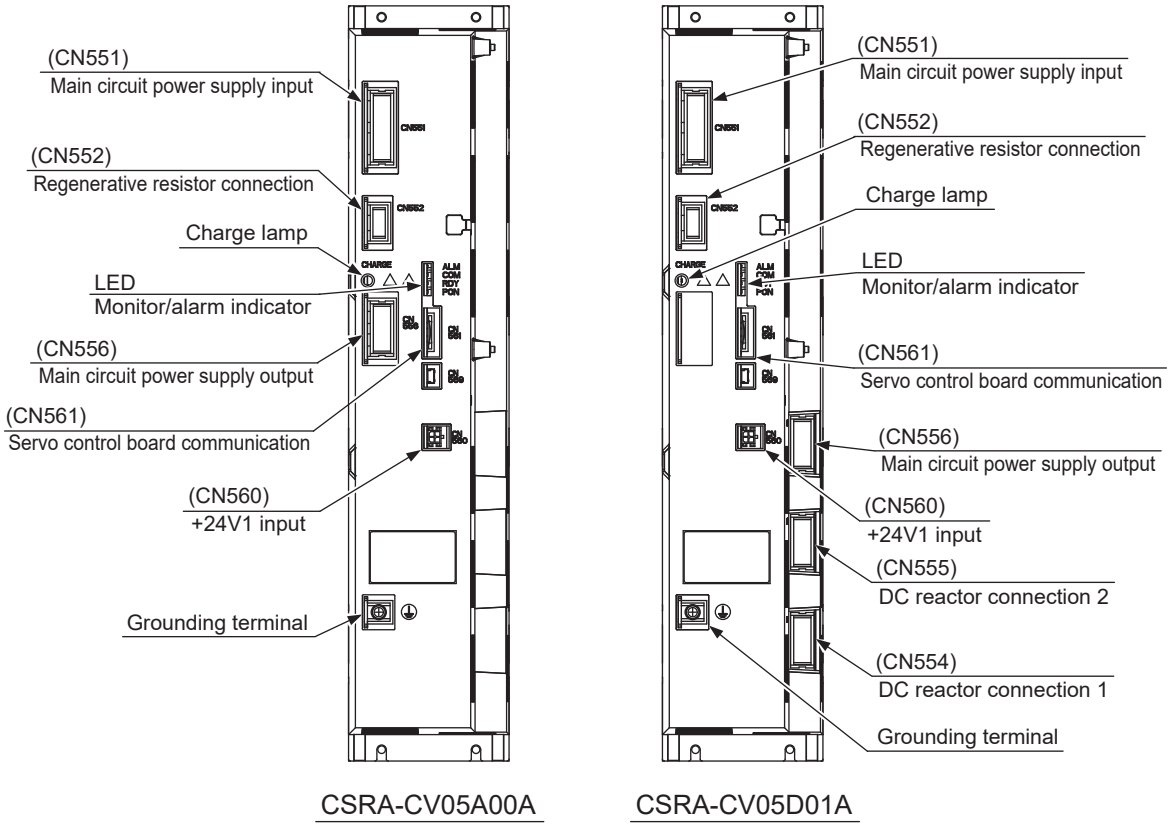
The converter (CSRA-CV□□□0□A) exchanges the power supply supplied by the power ON unit for DC power supply and supplies the power to the inverter unit.

14.4.1 Converter (Small-Capacity Model)

There are two types converter as below.

Input voltage	Type	Comment
Three-phase 200 to 240VAC	CSRA-CV05A00A	
Three-phase 380 to 480VAC	CSRA-CV05D01A	

Fig. 14-5: Converter (CSRA-CV05□0□A)

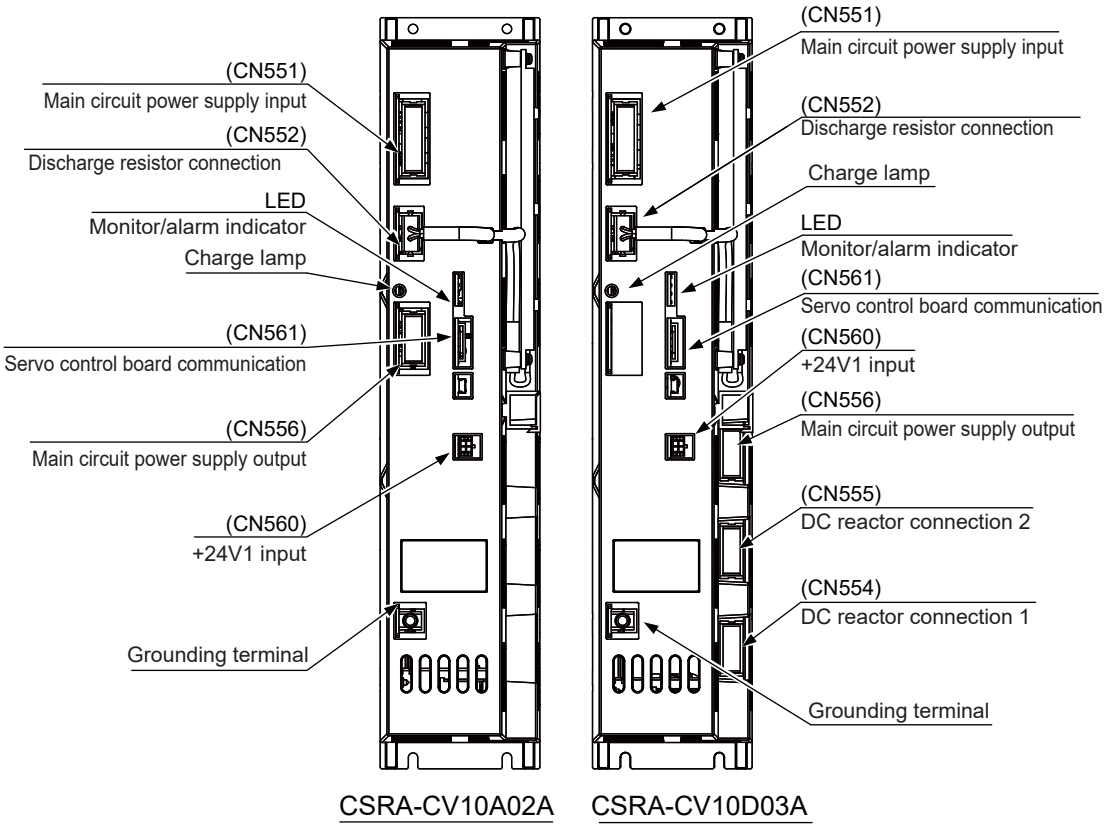


14.4.2 Converter (Medium/Large-Capacity Model)

There are two types converter as below.

Input voltage	Type	Comment
Three-phase 200 to 240VAC	CSRA-CV10A02A	
Three-phase 380 to 480VAC	CSRA-CV10D03A	

Fig. 14-6: Converter (CSRA-CV10□0□A)



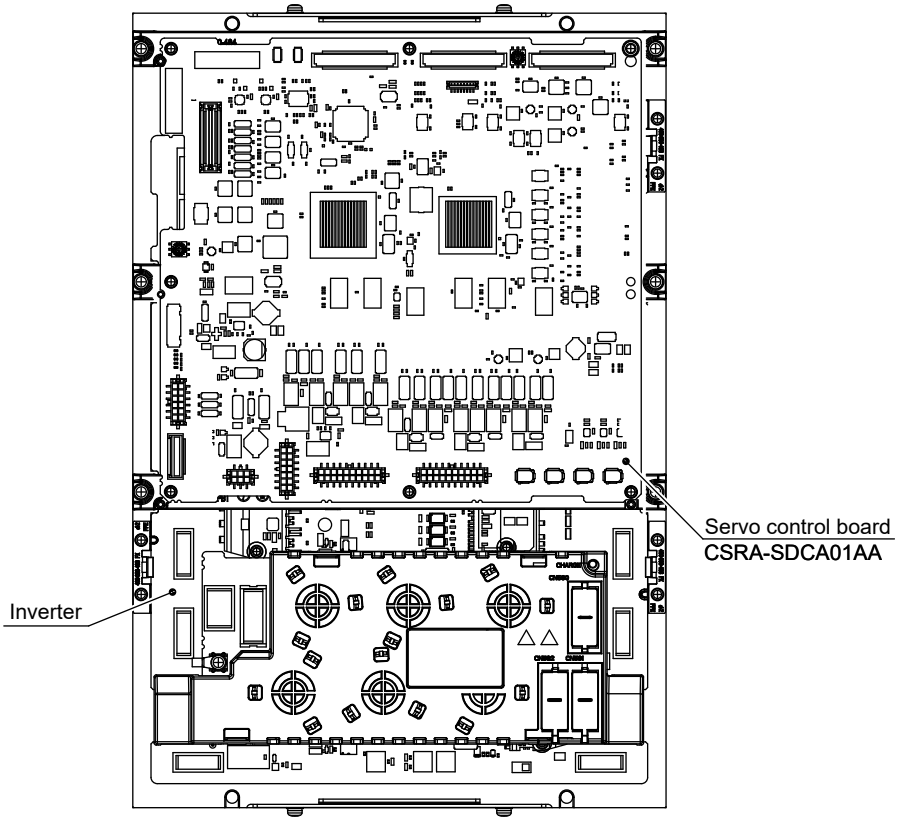
14.5 Inverter Unit (CSRA-SDA□□H01A)

14.5.1 Inverter Unit Configuration

The inverter unit consists of following circuit boards.
(Refer to *fig. 14-7 "Inverter Unit Configuration"* .)

- Inverter
- Servo control board (CSRA-SDCA01AA)

Fig. 14-7: Inverter Unit Configuration



14.5.2 Inverter

The inverter board and capacitor board exchange the DC power supply supplied by a converter for a 3-phase motor power source and outputs to each servo motor.

Fig. 14-8: Inverter (Small-Capacity Model)

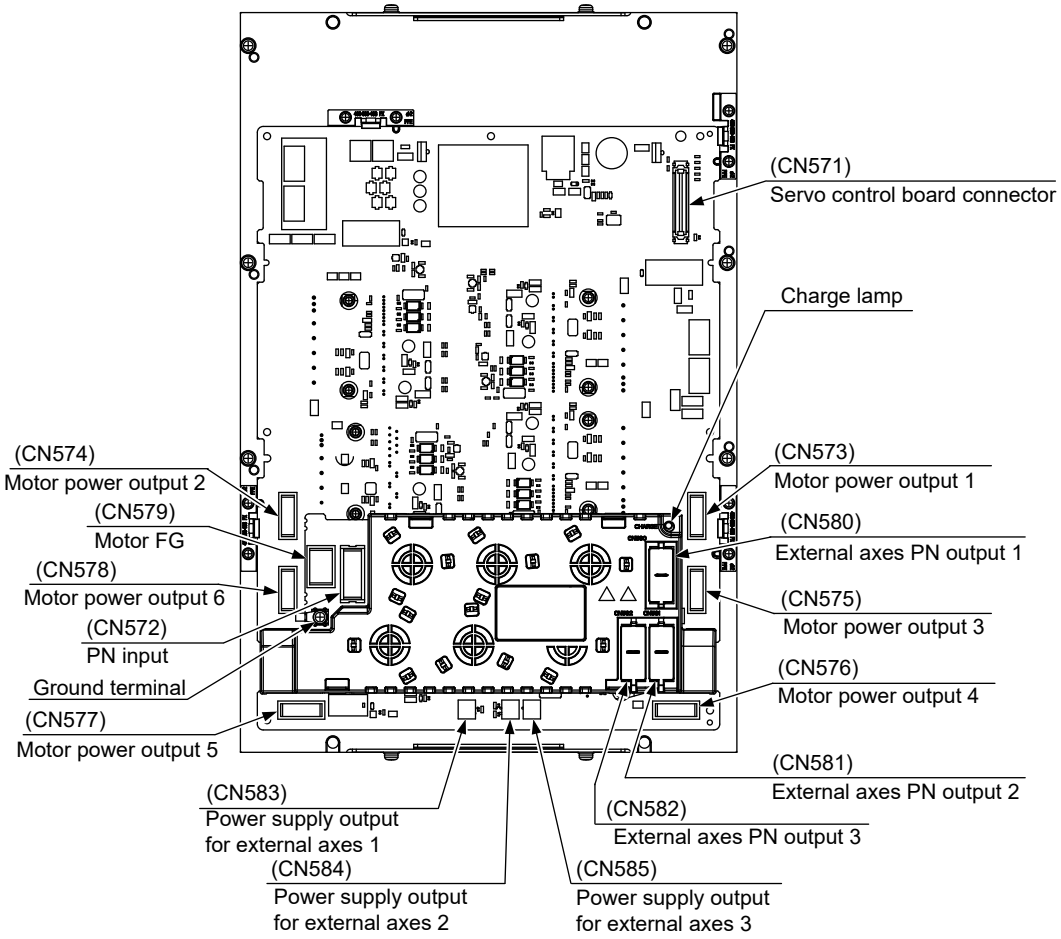
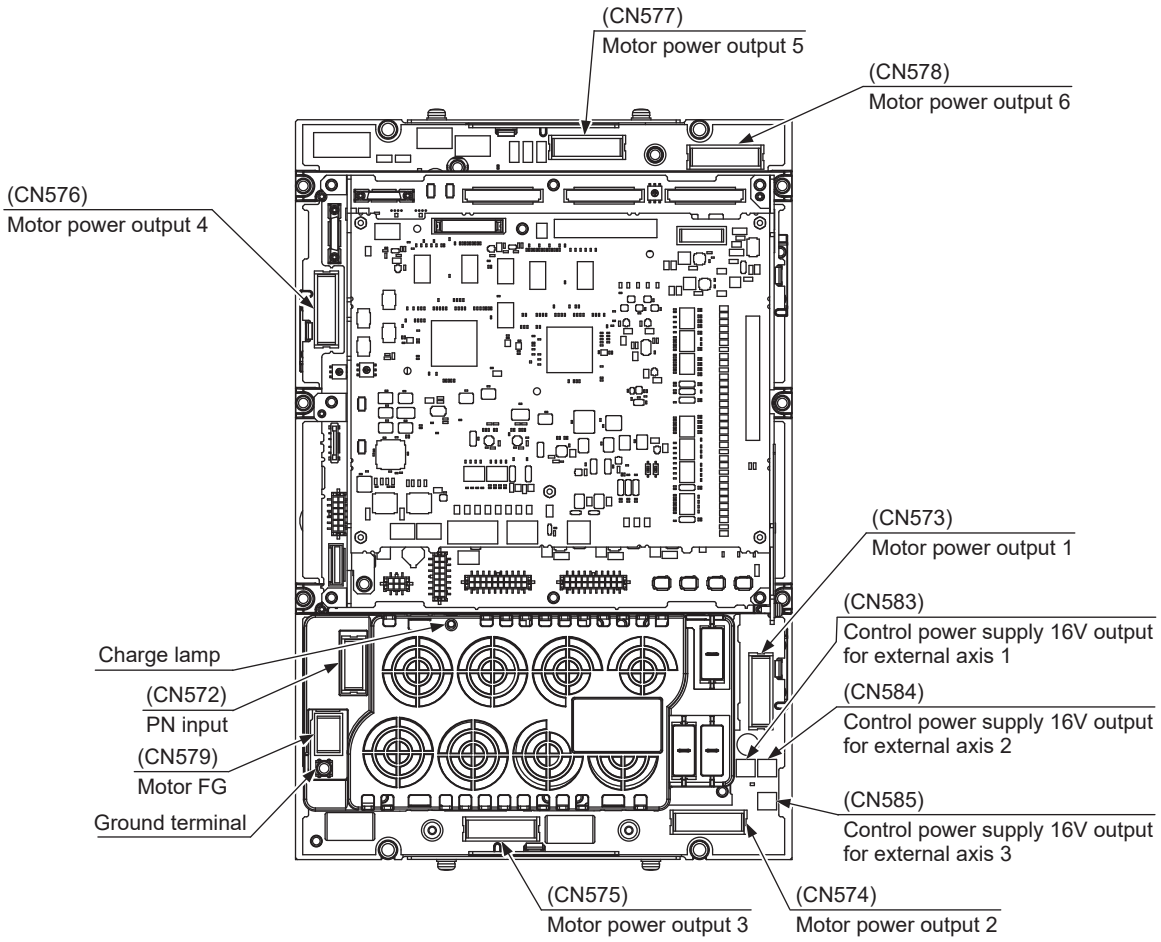


Fig. 14-9: Inverter (Medium/Large-Capacity Model)



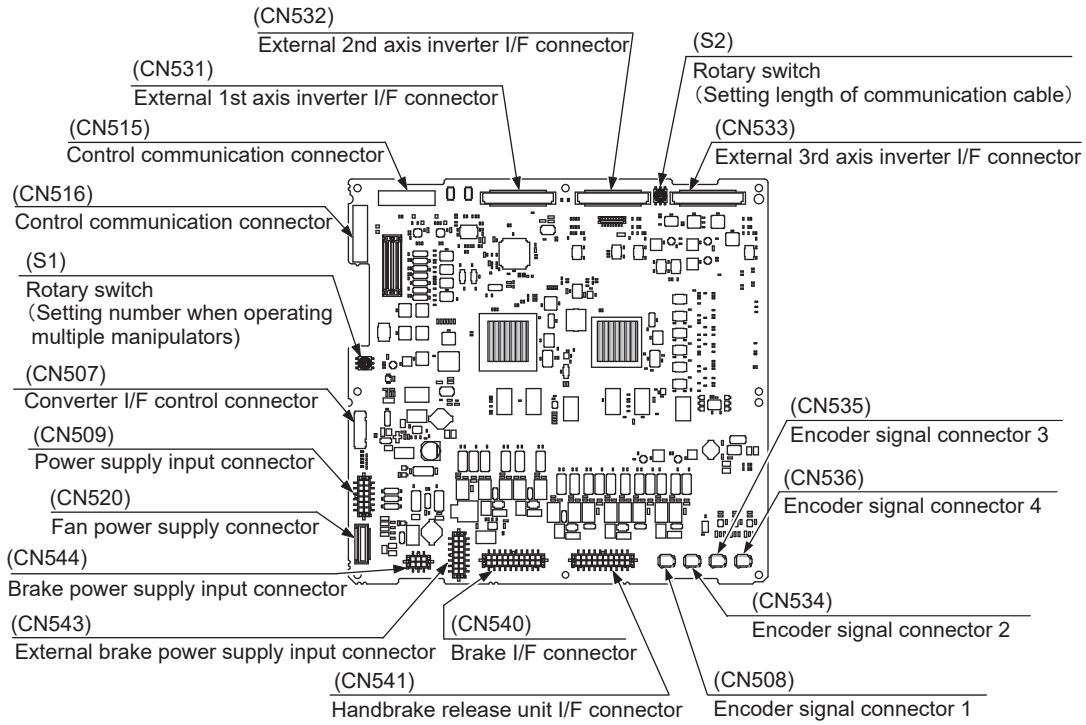
14.5.3 Servo Control Board (CSRA-SDCA01AA)

The servo control board controls the servomotors of the manipulator's six axes and the servomotors of the three external axes (up to nine axes). It also controls the converter and the inverter.

The servo control board (CSRA-SDCA01AA) also has the following functions.

- brake power supply control circuit
- Shock sensor (shock) input circuit
- Direct-in circuit

Fig. 14-10: Servo Control Board (CSRA-SDCA01AA)



14.6 Safety Circuit Board (JANCD-ASF01-E)

14.6.1 Safety Circuit Board (JANCD-ASF01-E)

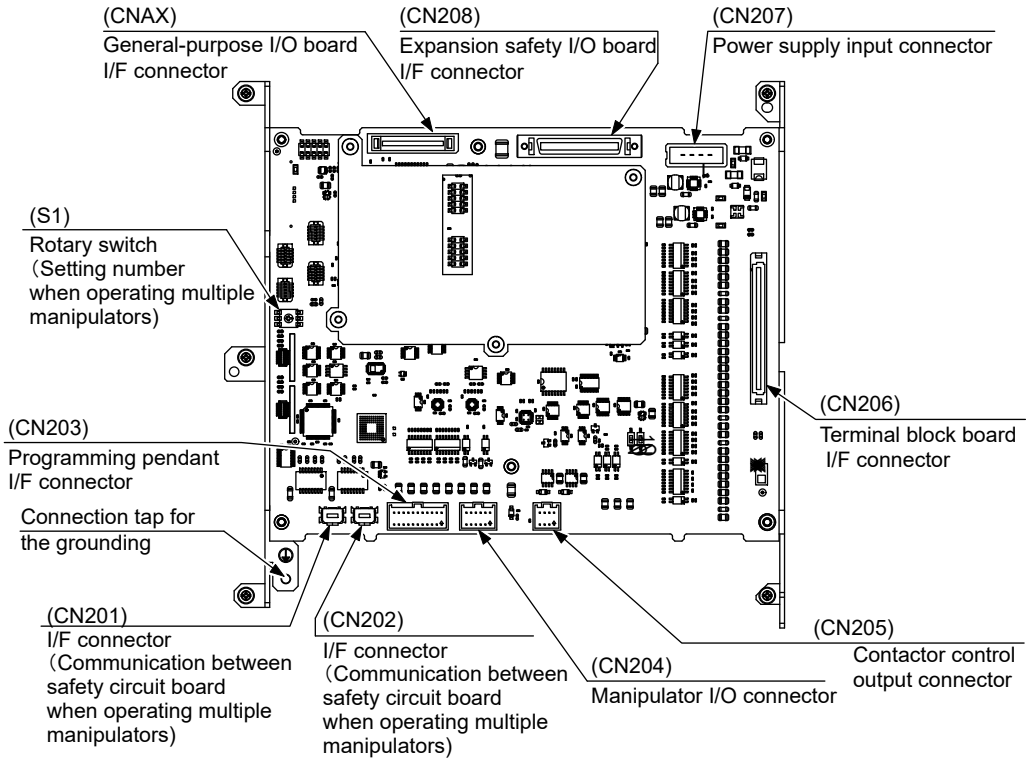
This circuit board contains dual processing circuits for safety signal and the I/O circuit for the un-safety signal.

It processes external safety signals with the dual processing circuits and control ON/OFF of the main circuit control contactor of the power supply contactor unit (JZRCR-APU0□-1) according to conditions.

Followings are the main functions of Machine Safety I/O Logic Unit.

- System safety input circuit (dual circuits)
- User safety input circuit (dual circuits)
- User safety output circuit (dual circuits)
- Emergency stop signal input circuit (dual circuits)
- Servo power control signal output circuit (dual circuits)
- Anti-safety I/O circuit for the robot system
- Safety terminal block board I/F

Fig. 14-11: Safety Circuit Board (JANCD-ASF01-E)



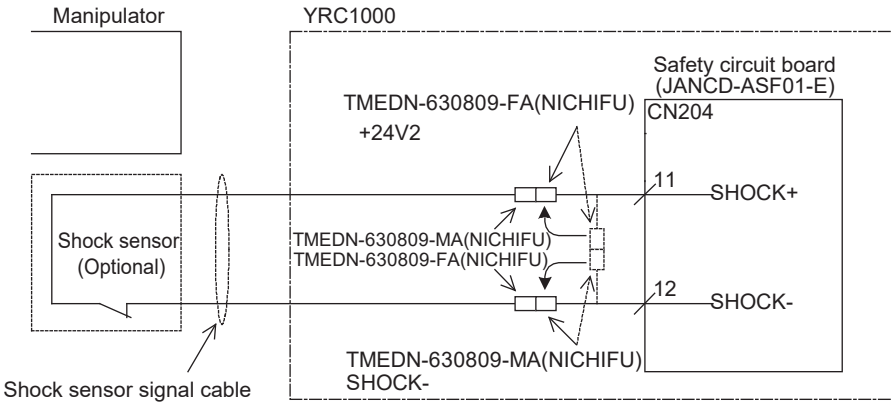
14.6.2 Connection for Tool Shock Sensor

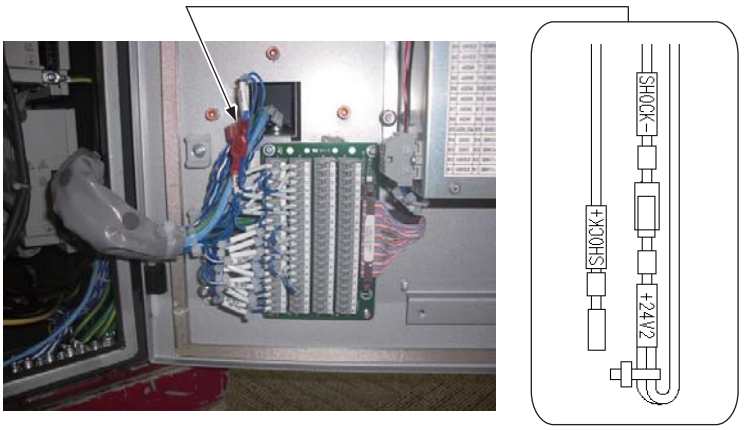
■ **To Connect the Tool Shock Sensor Directly to the Tool Shock Sensor Signal Line**

1. The minus SHOCK (-) pin is connected to the +24V2 pin on the inside of YRC1000's door. Remove the minus SHOCK (-) pin from the +24V2 pin.
2. Connect the minus SHOCK (-) and +24V2 pin terminals to the signal lines of the tool shock sensor. Use the following pin terminals for preparing the end of the signal line.

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. 14-12: Direct Connection to Tool Shock Sensor Signal Line





The pin terminal for the shock sensor is attached on the inside of the YRC1000's door.

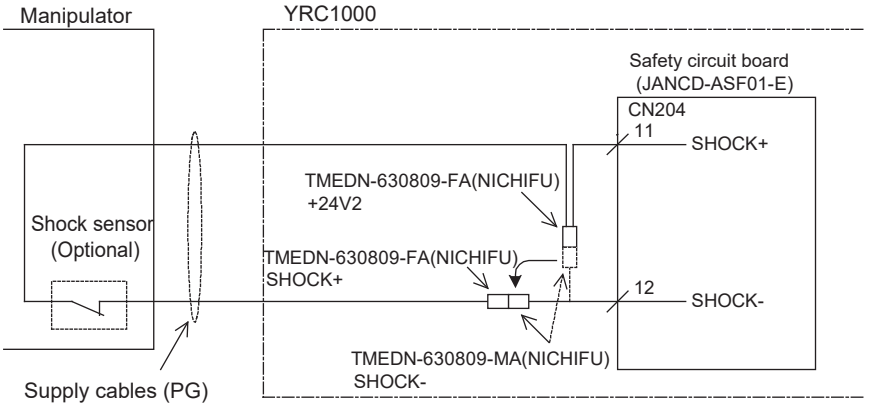
■ **To Connect the Tool Shock Sensor with the Cable That is Built into the Manipulator**

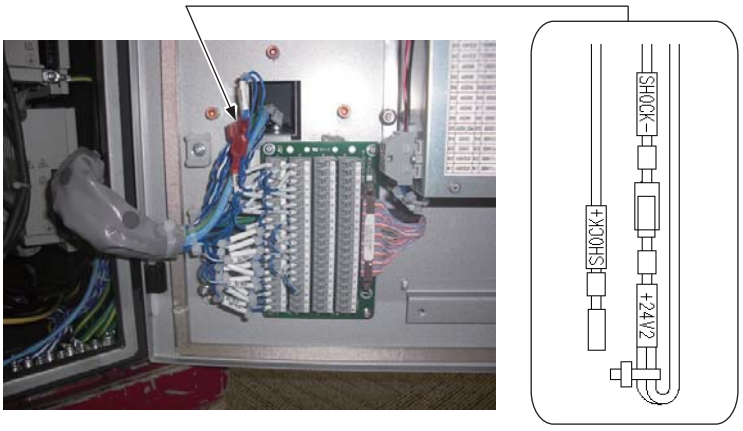
1. The minus SHOCK (-) pin is connected to the +24V2 pin on the inside of YRC1000's door. Remove the minus SHOCK (-) pin from the +24V2 pin.
2. Connect the minus SHOCK (-) pin to the plus SHOCK(+) pin of manipulator.

NOTE

The shock sensor is optional. In case of the standard specification, the cables for shock sensor of manipulator are not connected to the shock sensor.
For wiring, refer to the internal connection diagram of instruction manual corresponding to the manipulator's model.

Fig. 14-13: Connection with Manipulator Cable





The pin terminal for the shock sensor is attached on the inside of the YRC1000's door.

SUPPLE -MENT

When the tool shock sensor input signal is used, the stopping method of the manipulator can be specified.
The stopping methods are hold stop and servo power supply OFF. Selection of the stopping method is set in the display of the programing pendant. Refer to explanations in *chapter 8 "System Setup"* for details.

14.7 Safety Terminal Block Board (IM-YE250/5-80P)

The safety terminal block board (IM-YE250/5-80P) is the terminal block board to connect the external signal such as the safety I/O signals.

Connect the signals by following the instruction of each signal.

Fig. 14-14: Safety Terminal Block Board

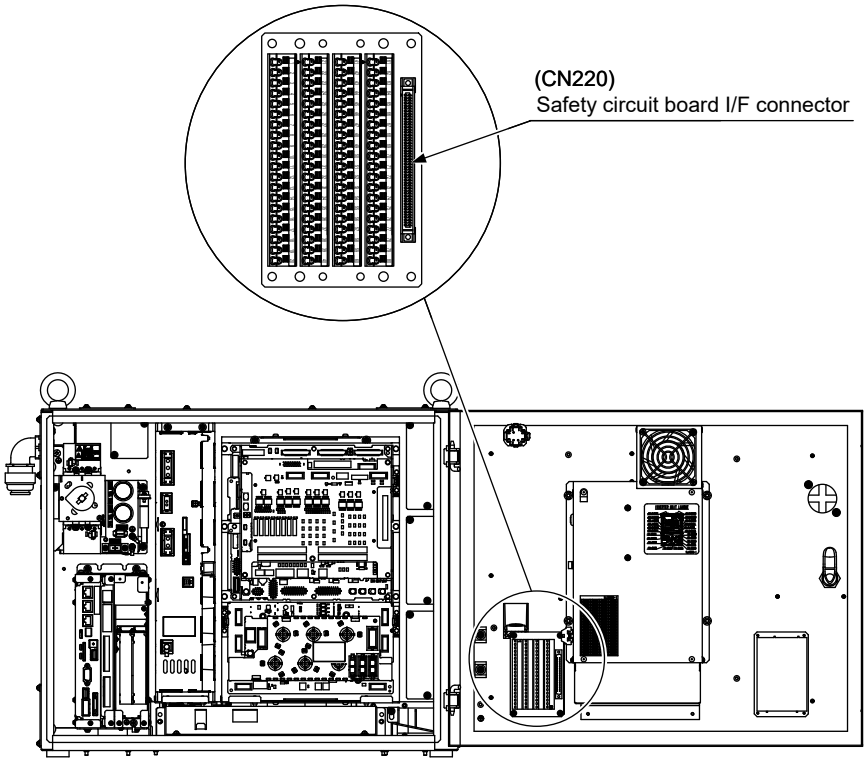


Table 14-1(a): IM-YE250/5-80P Details for the Connection Terminal

Signal Name	Connection No. (MXT)	Dual input	Function	Factory Setting
SAFF1+ SAFF1- SAFF2+ SAFF2-	-1 -2 -3 -4	Applicable	Safety Plug 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 OPEN, 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.	Short-circuit with a jumper cable
EXESP1+ EXESP1- EXESP2+ EXESP2-	-5 -6 -7 -8	Applicable	External Emergency Stop Used to connect the emergency stop switch of an external device. If the contact is OPEN, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON.	Short-circuit with a jumper cable
OT2_1+ OT2_1- OT2_2+ OT2_2-	-9 -10 -11 -12	Applicable	External Axes Overrun Used to input the overrun in the external axes other than the main body of the manipulator. If the contact is OPEN, the servo power is turned OFF and the job is stopped.	Open
OT3_1+ OT3_1- OT3_2+ OT3_2-	-13 -14 -15 -16	Applicable		
OT4_1+ OT4_1- OT4_2+ OT4_2-	-17 -18 -19 -20	Applicable		
ONEN1_1+ ONEN1_1- ONEN1_2+ ONEN1_2-	-21 -22 -23 -24	Applicable	Servo ON Enable Connected to use a function which distributes the robot system to the multiple servo systems, and turns the servo power ON/OFF. If the contact is OPEN, the servo power of corresponding system is turned OFF.	Short-circuit with a jumper cable
ONEN2_1+ ONEN2_1- ONEN2_2+ ONEN2_2-	-25 -26 -27 -28	Applicable		
ONEN3_1+ ONEN3_1- ONEN3_2+ ONEN3_2-	-29 -30 -31 -32	Applicable		
ONEN4_1+ ONEN4_1- ONEN4_2+ ONEN4_2-	-33 -34 -35 -36	Applicable		

Table 14-1(b): IM-YE250/5-80P Details for the Connection Terminal

Signal Name	Connection No. (MXT)	Dual input	Function	Factory Setting
ESPOUT1+ ESPOUT1- ESPOUT2+ ESPOUT2-	-37 -38 -39 -40	-	Emergency Stop Button Contact Output Used to output a contact point of the emergency stop button on the programing pendant and the front door of the YRC1000 Control panel.	Open
GSIN1_1+ GSIN1_1- GSIN1_2+ GSIN1_2-	-41 -42 -43 -44	Applicable	General-purpose Safety Input The general-purpose safety input signal is used in the safety logical circuit function.	Open
GSIN2_1+ GSIN2_1- GSIN2_2+ GSIN2_2-	-45 -46 -47 -48	Applicable		
GSOUT1_1+ GSOUT1_1- GSOUT1_2+ GSOUT1_2-	-49 -50 -51 -52	-	General-purpose Safety Output The general-purpose safety output signal is used in the safety logical circuit function. Also, inputs and uses the driven connection device status as the monitoring signal by the output signal.	Open
GSOUT2_1+ GSOUT2_1- GSOUT2_2+ GSOUT2_2-	-53 -54 -55 -56	-		
	-57 -58	-	SYSRUN signal	Open
SYSRUN+ SYSRUN-			Use to determine the normal/abnormal condition of the YRC1000 controller by SYSRUN signal.	
ALMIN2+ ALMIN2-	-59 -60		Only For YASKAWA This signal cannot be used, because this signal is only for YASKAWA.	Open
24VAX 24VAX	-61 -62 -70 -71 -77 -78	-	DC +24V2 output terminal Rated current output: 150mA or less	Open
024V2 024V2	-63 -64 -72 -73	-	DC024V2 output terminal -	Open
AXDIN_COM AXDIN1 AXDIN2 AXDIN3 AXDIN4	-65 -66 -67 -68 -69	-	Direct -in (Servo) Used to input the quick responding signals in the search function etc.	Open
AXIN_COM AXIN1 AXIN2	-74 -75 -76	-	General-purpose input (Servo) Used to input the general-purpose signal from the external device. This signal is optional. This signal cannot be used in case of standard specification.	Open
AXOUT1 AXOUT2	-79 -80	-	Only For YASKAWA This signal cannot be used, because this signal is only for YASKAWA.	Open

■ Wiring Procedure of the Terminal Block

For your safety, appropriate work must be done by following the instructions below.

NOTICE

If the length of cable between the safety terminal block board and the connected device is longer than 30 m, make sure to use the shielded cable so that the electromagnetic resistant can be properly performed. Then the shield of shielded cable must come into contact with the controller's body.

1. Tool: Screwdriver

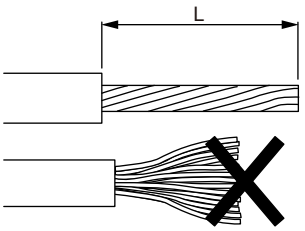
   – For the connection, be sure to use a screwdriver of an applicable size and configuration.

* WAGO standard screwdriver
WAGO 210-119
WAGO 210-119SB (Short, delivered with the product)



2. Peeling Wires

   (1) The length of the exposed conductor (L) should be as follows:



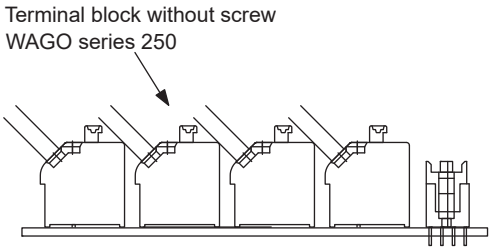
   – * The length of the exposed conductor for the terminal block (L)
     WAGO series 250 (with 5.0 mm pitch): 9-10 mm

   – * Applicable wire conductor: 0.2 mm^2 to 1.5 mm^2 (stranded wire)

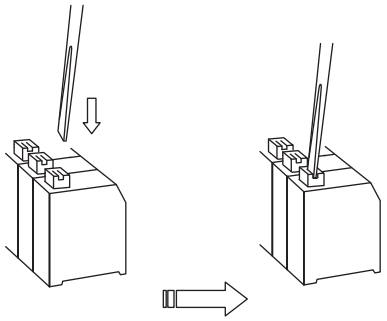
   – * Applicable maximum wire outside diameter: 3.1 mm dia.

   (2) If the wire is bent or loose, make it straight as illustrated in the figure above.

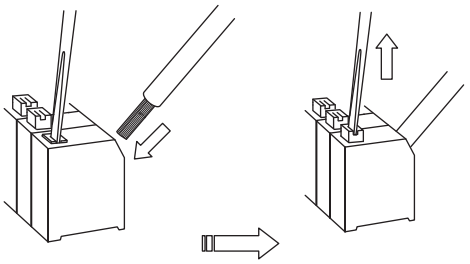
3. Wire Connection



(1) Place the screwdriver on the lever upright as shown in the figure below and push straight down.



(2) Insert the wire into the connection hole slowly until its leading end touches the end of the hole.
For thin wires, never insert the wire with force, or the wire jacket may get caught in.



(3) Pull out the screwdriver to clamp the conductor with a spring.

(4) Check if the wire is connected firmly by pulling the wire softly.

14.7.1 Safety Plug

This signal is used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is input, the servo power turns OFF. While the signal is turned ON. The servo power cannot be turned ON.
Note that these signals are disabled in teach mode. Make sure that no person go inside the safeguarding.

DANGER

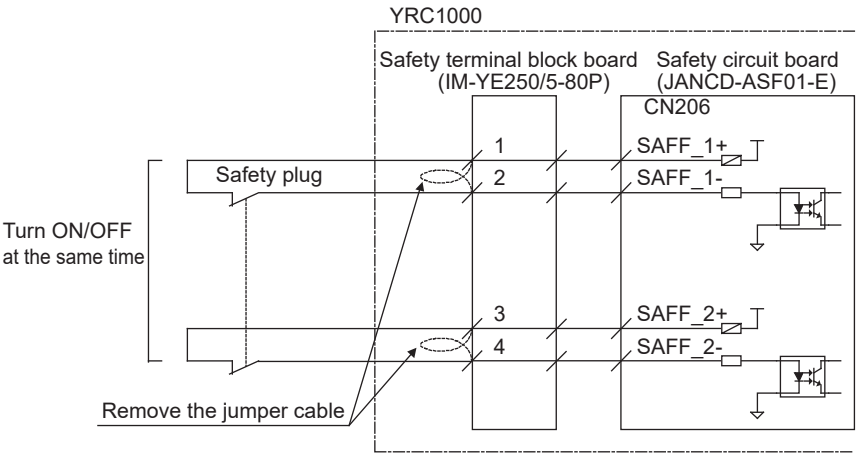
- Jumper cables are attached at the factory. Make sure to remove the jumper cables before use.

If the jumper cables are not removed, this function will not be activated even if the signal is input, thus personal injury and/or equipment damage may result.

SUPPLE -MENT

Because of the its dual circuits signal to input, the alarm occurs if the signal does not much. However, in the teach mode, even though the signal does not much, the alarm is not detected. The alarm is detected only in the play mode.

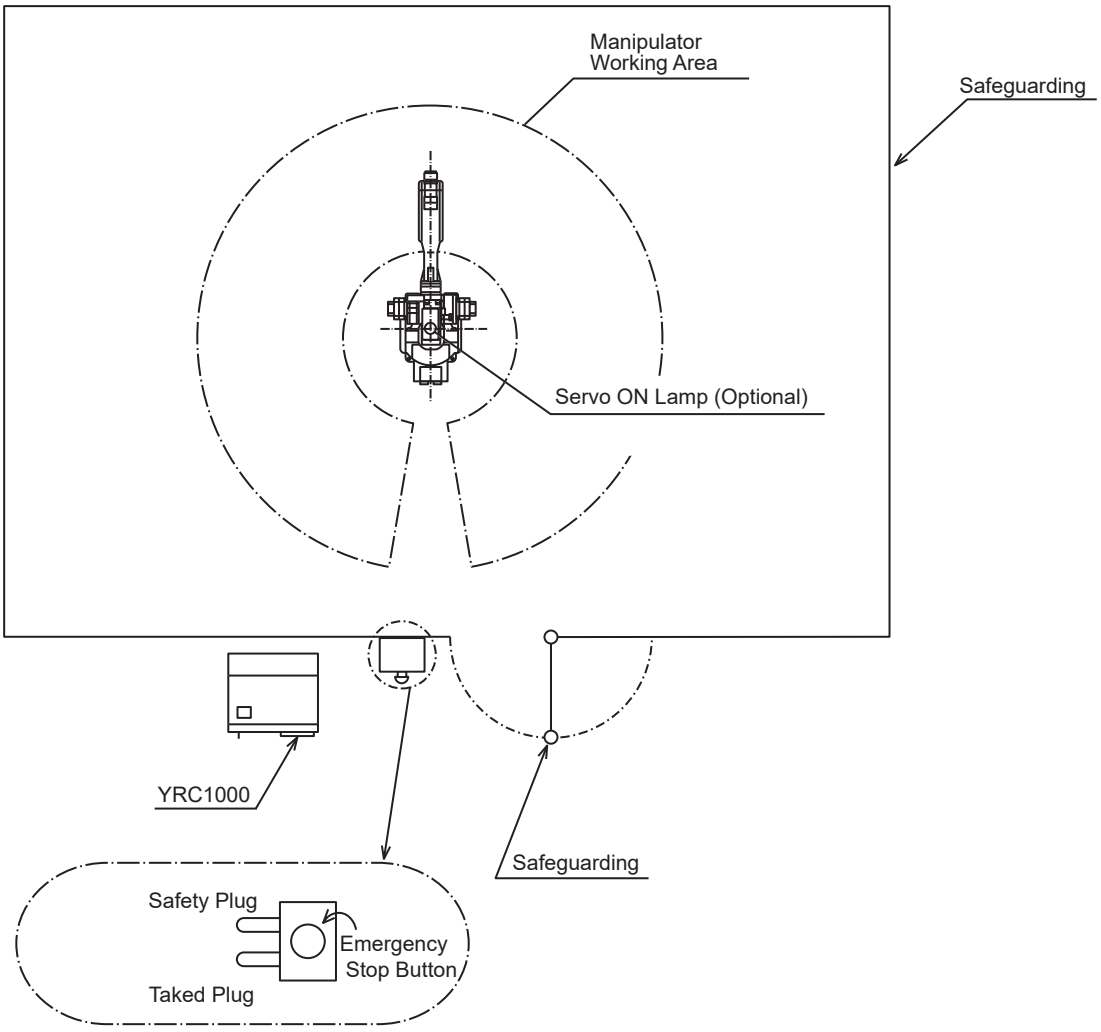
Fig. 14-15: Connection for Safety Plug



■ **Installation of Safety Plug**

The manipulator must be surrounded by a safeguarding and a door protected by an interlock function. The door must be opened by the technician to enter and the interlock function stops the robot operation when the door is open. The safety plug input signal is connected to the interlock signal from the gate.

Fig. 14-16: 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.

14.7.2 External Emergency Stop

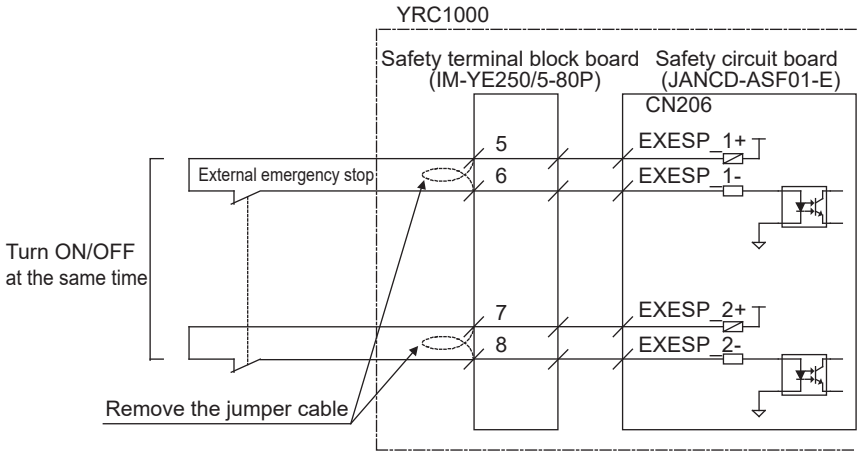
This signal is used to connect the emergency stop switch of an external device. If the signal is input, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON.

DANGER

- Jumper cables are attached at the factory. Make sure to remove the jumper cables before use.

If the jumper cables are not removed, this function will not be activated even if the signal is input, thus personal injury and/or equipment damage may result.

Fig. 14-17: Connection for External Emergency Stop



14.7.3 SYSRUN Signal Output

This signal is used to check whether the YRC1000's status is normal or abnormal.
This signal is output on the following conditions.

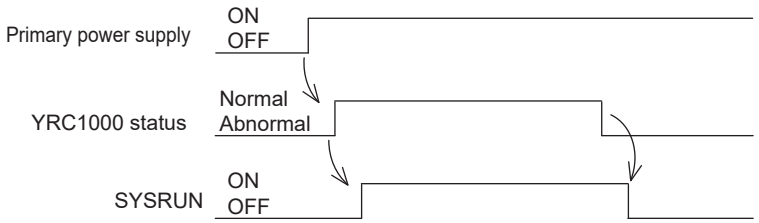
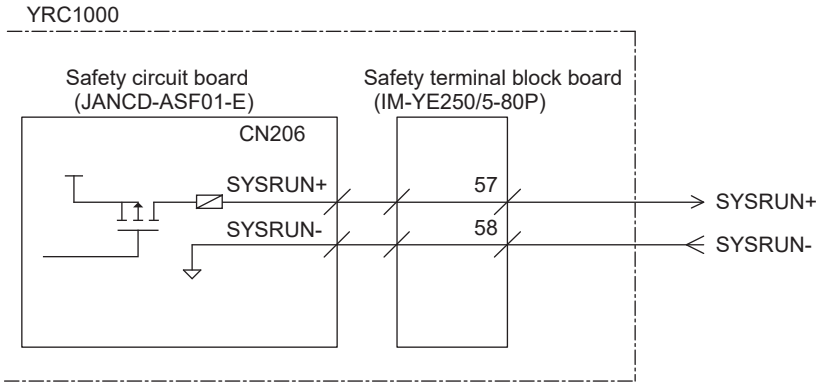


Fig. 14-18: Connection for SYSRUN Signal Output



Because the pulse signal is outputted from the specific output signal (#50911) to the external device for each 100ms, it is also able to check whether the YRC1000's control circuit board is normal or abnormal.

Refer to "YRC1000 OPTIONS INSTRUCTIONS FOR CONCURRENT I/O (RE-CKI-A467) 4.12 Specific Output Signals" for more details.

NOTE

- Rated output value is DC24V and less than 50mA. Avoid excessive load when connect.
- When connect the inductive load, such as the safety relay, with the output circuit, use of the built-in protective circuit for the surge suppressor or connect the flyback diode in parallel to the inductive load to suppress the surge voltage.
  It may cause the damage on the output circuit.

14.7.4 Connection for Servo-ON Enable Input

Connect the ONEN signal lines to enable the function to turn ON or OFF the servo power supply of an individual servo when a robotic system is divided into servo systems. Because these signals are not used for units of standard specifications, a jumper cable is connected as shown in the following figure.

For safety reasons, dual circuits are used for the Servo-ON Enable input signals. Connect the signal so that both input signals are turned ON or OFF at the same time. If only one signal is turned ON, an alarm occurs.

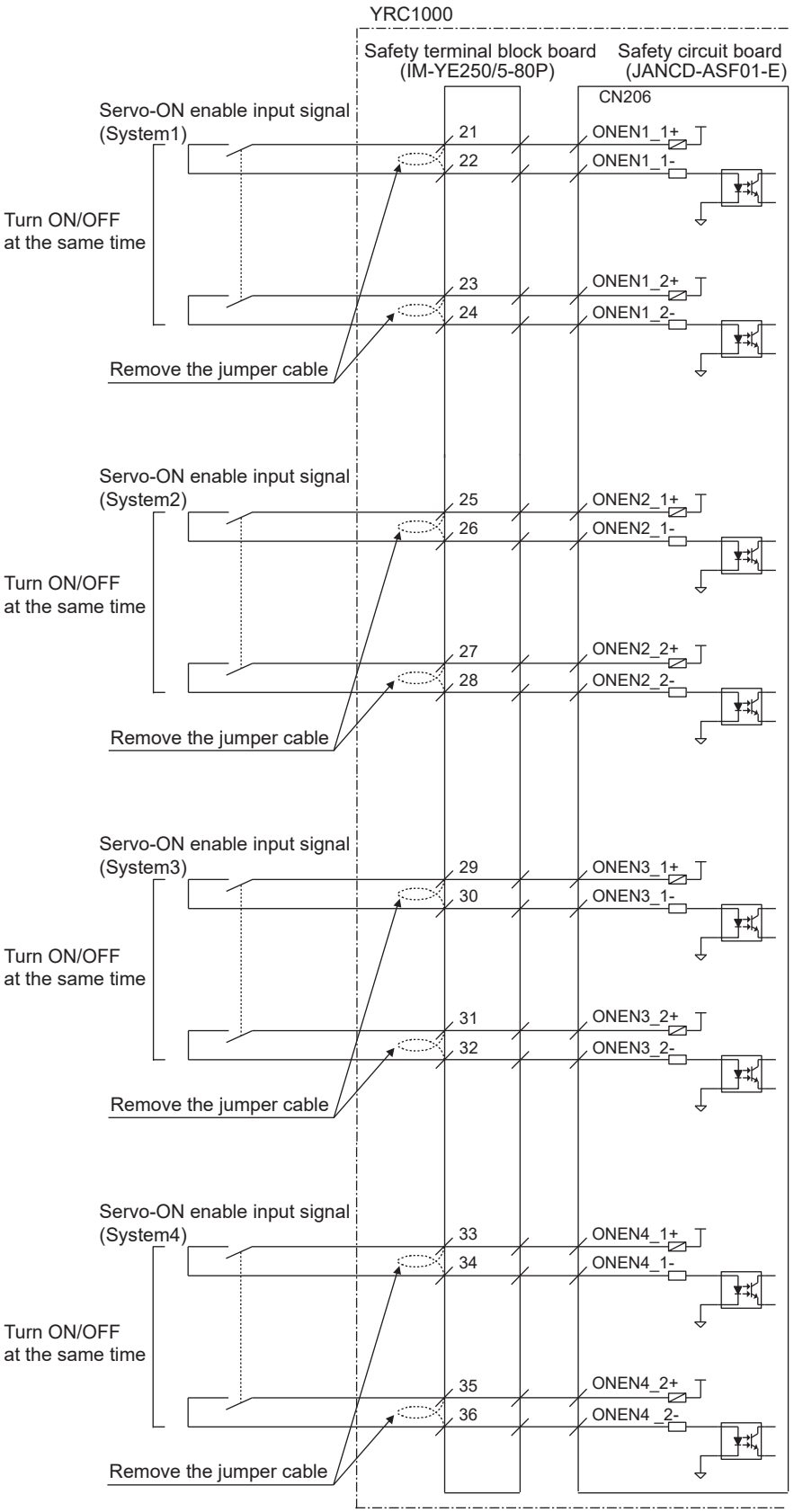
Refer to “YRC1000 OPTIONS?INSTRUCTIONS FOR INDEPENDENT/ COORDINATED CONTROL FUNCTION (HW1484042) 8. Servo Power Supply Individual Control Function” for the usage of the Servo-ON Enable signals.

DANGER

- Jumper cables are attached at the factory. Make sure to remove the jumper cables before use.

If the jumper cables are not removed, this function will not be activated even if the signal is input, thus personal injury and/or equipment damage may result.

Fig. 14-19: Connection for Servo-ON Enable Input



14.7.5 External Axes Overrun

If an overrun input signal for an axis other than manipulator axes, for example the external axis, is required, connect the signal input circuit in the following manner.

For safe reason, a dual circuits are used for the external axis overrun signal input. Connect the external axis overrun signal so that both input signals are turned ON or OFF at the same time.

If only one signal is turned ON, the machine safety signal error occurs.

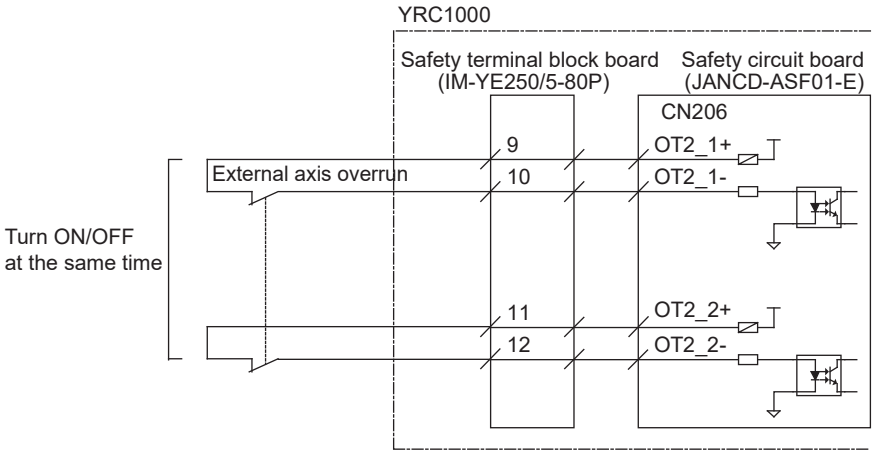
For the setting of the external axis overrun, refer to *chapter 12.3.1.2 “Connection Setting”* .

DANGER

- Before use, make sure to perform the settings of the external axis overrun. After that, confirm that the overrun alarm occurs by turning OFF the external axis overrun signal.

The settings must be performed to activate the external axis overrun. If not, this function will not be activated even if the signal is input, thus personal injury and/or equipment damage may result.

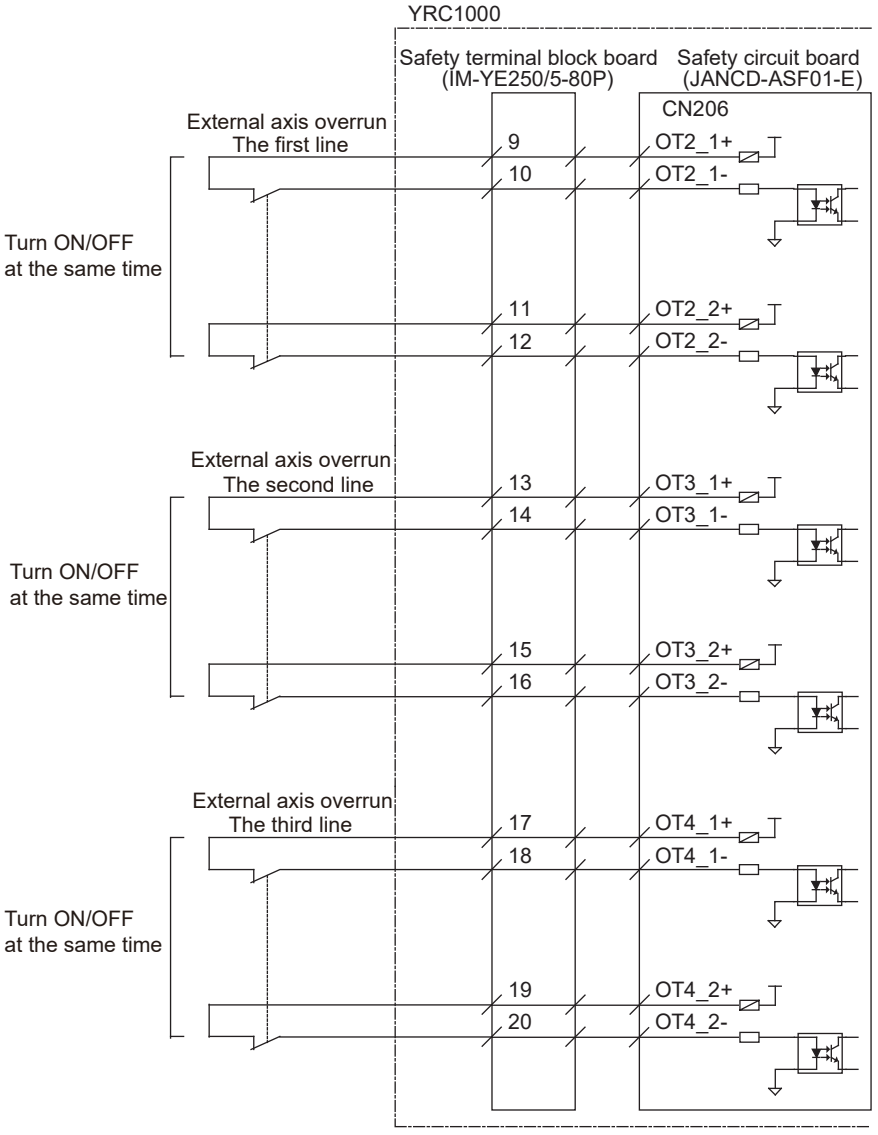
Fig. 14-20: Connection for External Axis Overrun



The following figure shows the external axis overrun wiring of the factory default setting when the external axes are connected to the YRC1000.

Please refer to the following figure to connect the external axes overrun signal to wire in the another route. On that occasion, confirm the external axes overrun setting to connect. (Refer to *chapter 12.3.1.2 "Connection Setting"* .)

Fig. 14-21: Connection for External Axis Overrun (Multiple Lines)



14.7.6 Emergency Stop Output

Outputs the contact output terminals for both emergency stop buttons on the programming pendant and on the front door.

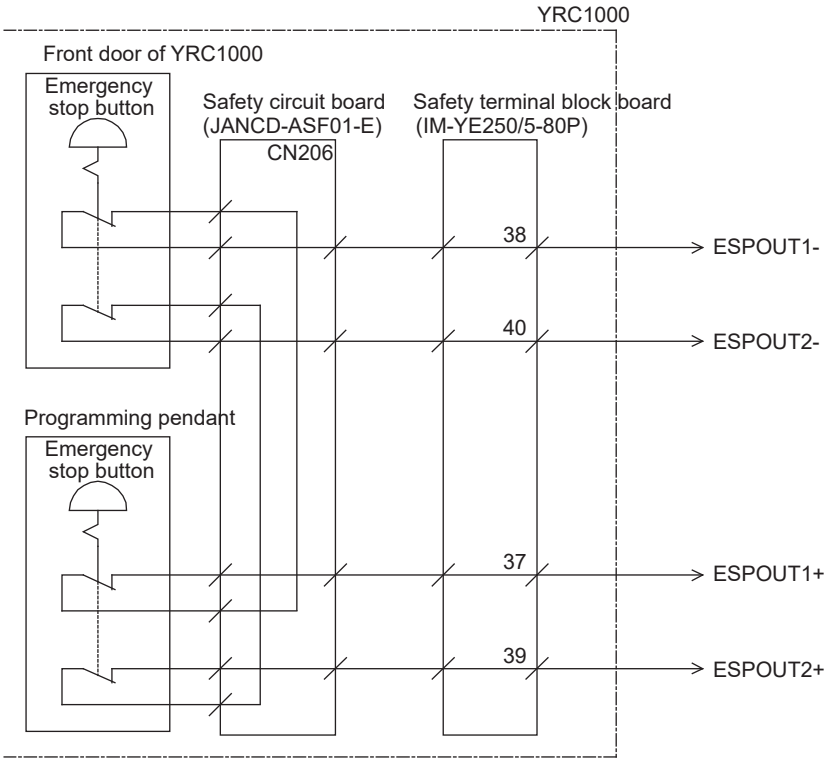
These contact outputs are always valid regardless of the YRC1000 main power supply status ON or OFF. (Status output signal: normally closed contact)

NOTICE

- Do not use the emergency stop button with 24 VAC, 0.1 A or more.
- When connect the inductive load, such as the relay, with the output circuit, use of the built-in protective circuit for the surge suppressor or connect the flyback diode in parallel to the inductive load to suppress the surge voltage.

Failure to observe this instruction may result in damage to equipment.

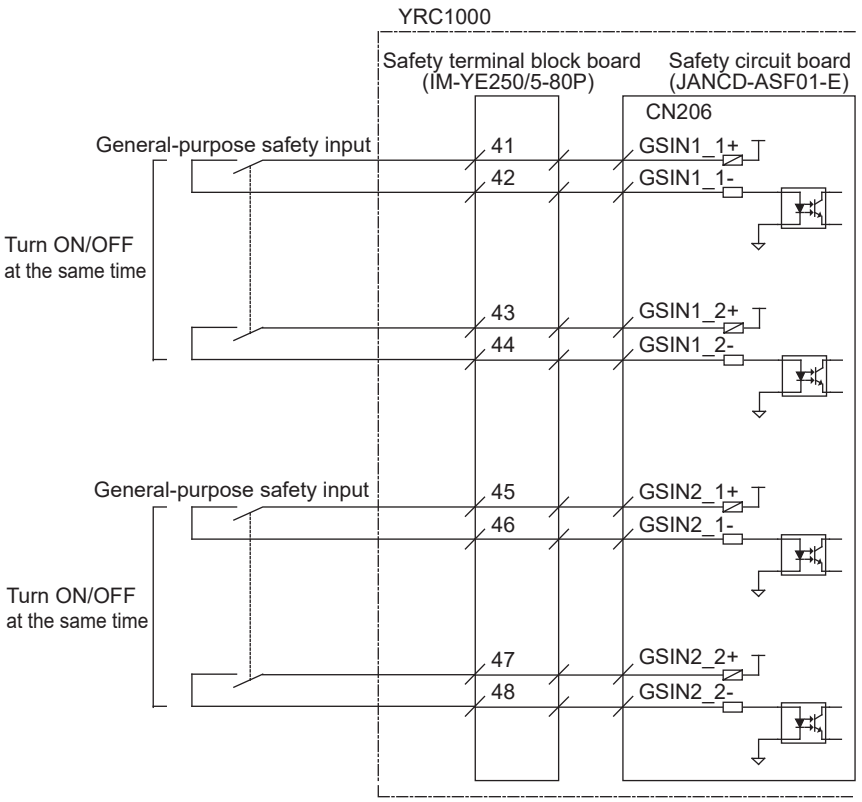
Fig. 14-22: Output of Emergency Button



14.7.7 General-Purpose Safety Input

The general-purpose safety input signal is used in the safety logic circuit function.

Fig. 14-23: General-Purpose Safety Input



SUPPLE -MENT

When use the external enable switch (EXDSW) or the full-speed test (FST), refer to *chapter 8.29 "Axes Detachment Function"*

14.7.8 General-Purpose Safety Output

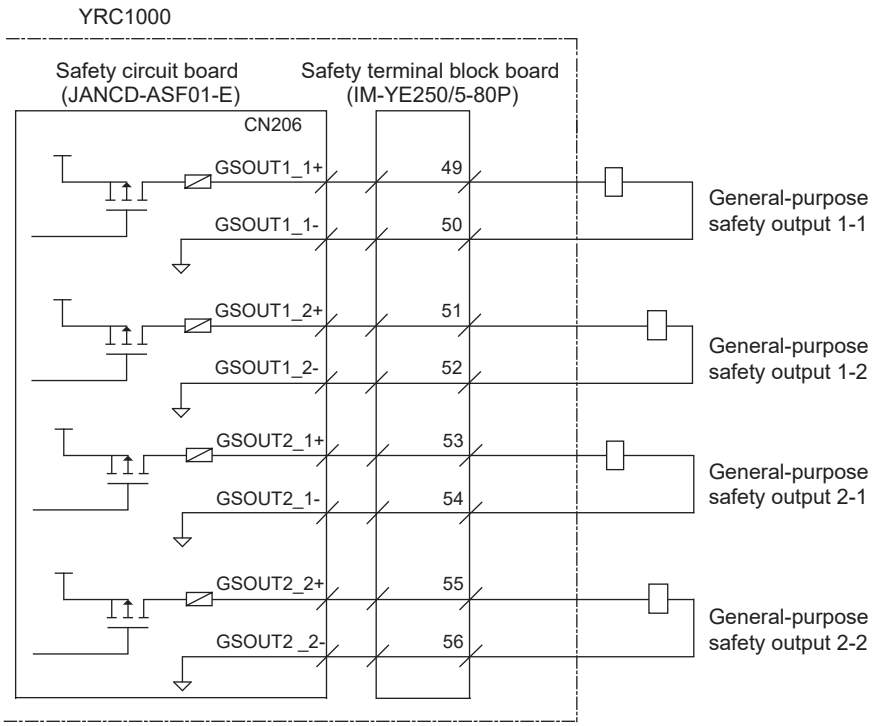
The general-purpose safety output signal is used in the safety logic circuit function.

For example, composing the circuit to output the status signal, such as the servo ON signal or the emergency stop button by the safety logic circuit function enables to output the signals to the external device.

The signal is outputted as the dual signals.

For the example of use of the general-purpose safety output signal, refer to *chapter 8.26 "Safety Logic Circuit"* .

Fig. 14-24: Example of Use of General-Purpose Safety Output Signal



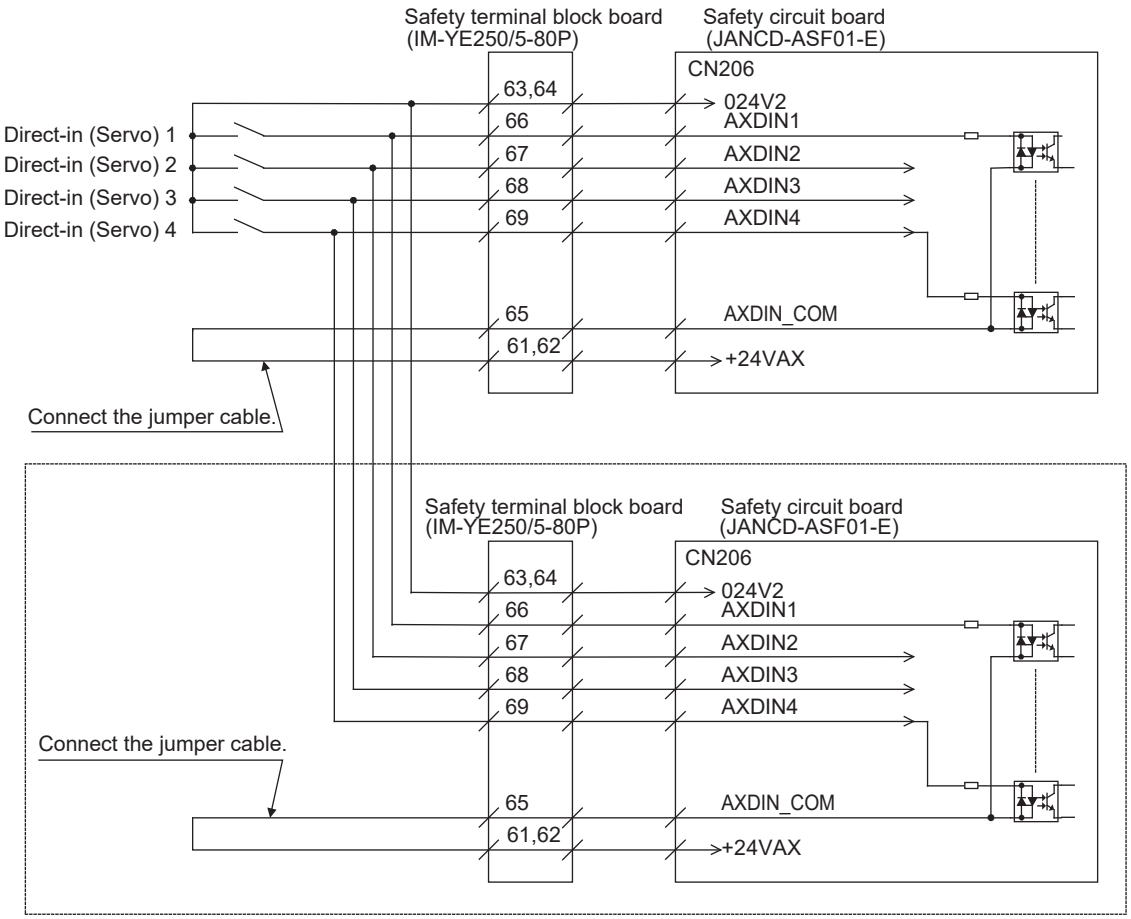
NOTE

- Rated output value is DC24V and less than 50mA. Avoid excessive load when connect.
- When connect the inductive load, such as the safety relay, with the output circuit, use of the built-in protective circuit for the surge suppressor or connect the flyback diode in parallel to the inductive load to suppress the surge voltage.
  It may cause the damage on the output circuit.
- An error (e.g., relay contact sticking) of the device (e.g., safety relay, contactor) controlled by the general-purpose safety output signal (GSOUT) must be detected (signal inconsistency) by the controlled device (e.g, by using a safety PLC).

14.7.9 Connection for Direct-In

■ **Direct-In (Servo) 1 to 4**
This signal is used to input a responsive signal in search functions.

Fig. 14-25: Connection for Direct-In (Servo) 1 to 4



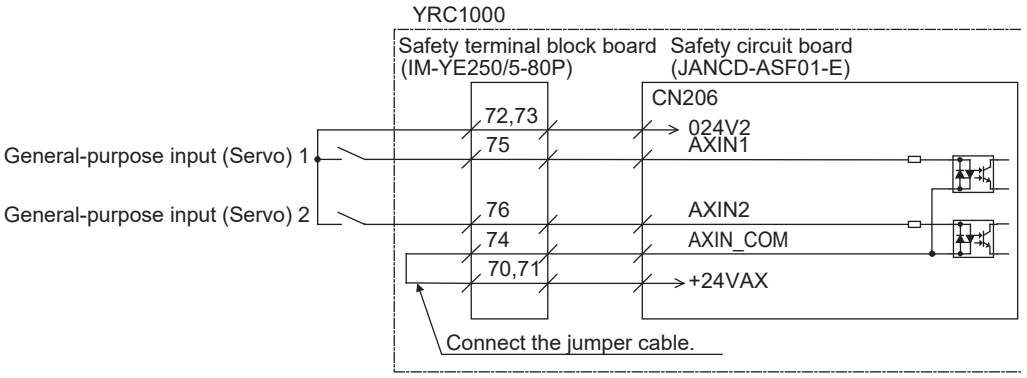
The ⬚ part of wiring is that if there is a slave for the coordinated control side servo control board (CSRA-SDCA01AA).

14.7.10 General-Purpose Input (Servo)

Connect when use the general-purpose signal.

This signal cannot be used for standard specification because this signal is optional.

Fig. 14-26: General-Purpose Input (Servo)



14.8 General-Purpose I/O Board (JANCD-AIO0□-E)

Four digital I/O connectors for the robot general-purpose I/O are provided: 40 inputs and 40 outputs.
The I/Os are divided into two types: general-purpose I/O and specific I/O. The I/O assignment differs depending on the application. Specific I/O is a signal in which the part is decided in advance. Specific I/O is used when the external operation equipment such as positioner controller and centralized controller control the manipulator and related equipment as a system. General-purpose I/O are mainly used as timing signals for the manipulator and peripheral devices in jobs that require robot motion.

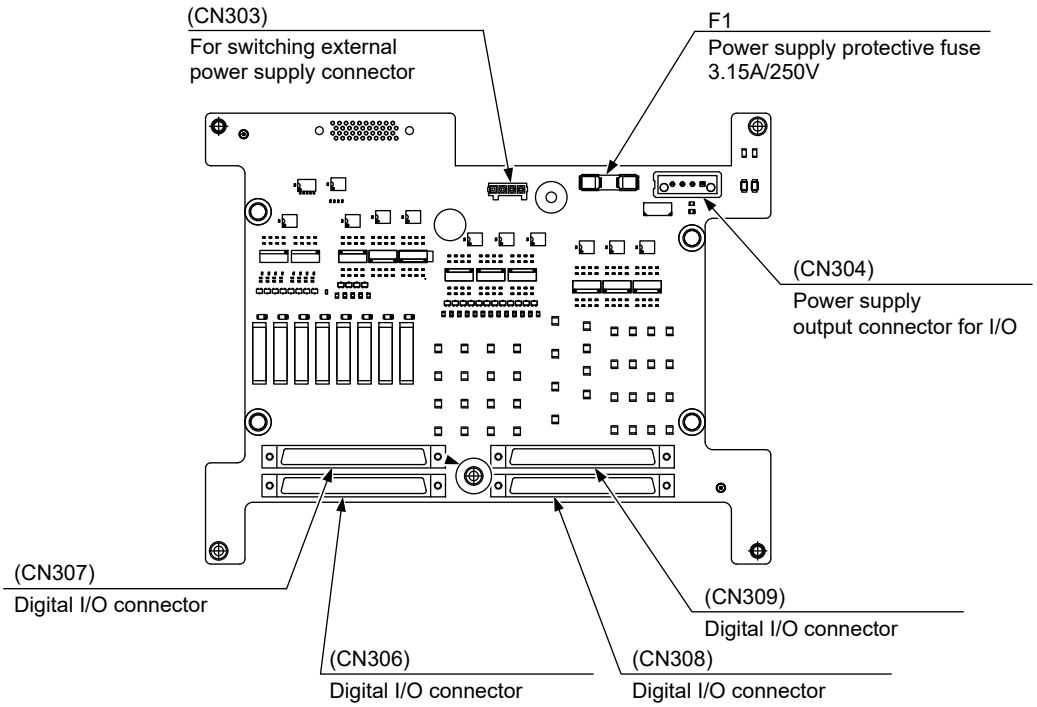
Refer to *chapter 14.10 "Robot General-Purpose I/O Signal Assignment"* for more details on signal allocation.

For the connection of the robot's general-purpose I/O signal connectors, and the I/O signal related to start and stop, refer to *"Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)"* and *"Specific I/O Signal Related to Start and Stop"* .

There are two types of general-purpose I/O board as below.

Specification	Type
NPN	JANCD-AIO01-E
PNP	JANCD-AIO02-E

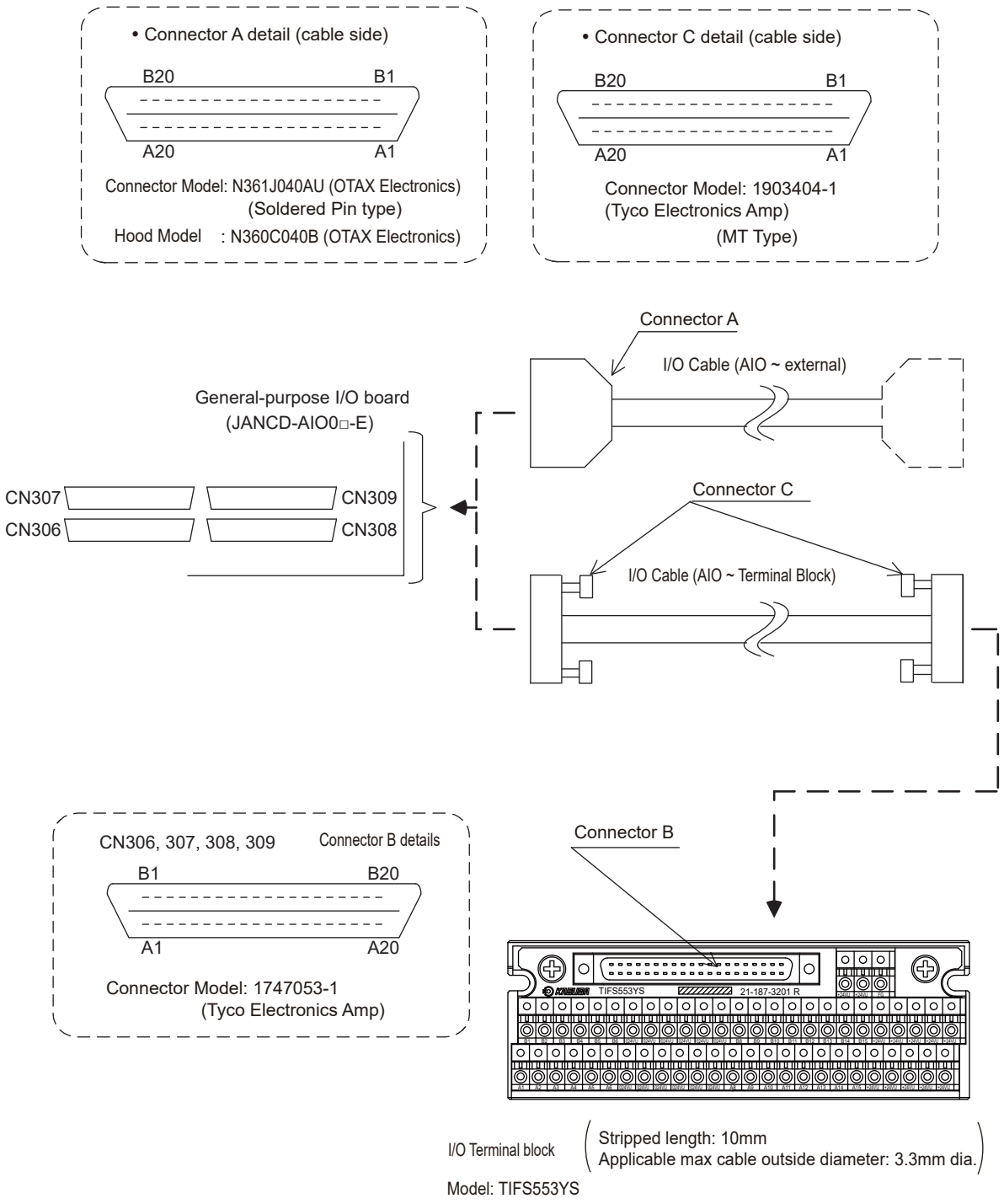
Fig. 14-27: General-Purpose I/O Board (JANCD-AIO0□-E)



■ **Connection Wire with Robot General-Purpose I/O Connector (CN306, 307, 308, 309)**

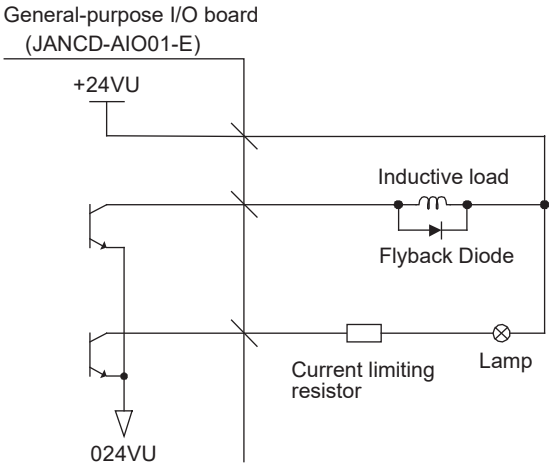
Please refer to the figure below when you manufacture the cable connecting with robot general-purpose I/O connector (CN306, 307, 308, 309) of robot general-purpose I/O board (JANCD-AIO0□-E).
(The cable side connector and the I/O terminal block are optional.)

Fig. 14-28: Robot General-Purpose I/O Connector (CN306, 307, 308, 309) Connection



When connecting an inductive load to the output circuit, connect a flyback (snubber) diode in parallel to the inductive load to suppress the surge voltage. Not using the flyback (snubber) diode may damage the output circuit.
When connecting the load with a large inrush current such as the lamp, connect the current limiting resistor in series to the load, so that the output current does not exceed its maximum value. Exceeding the maximum output current value may damage the output circuit.

NOTE



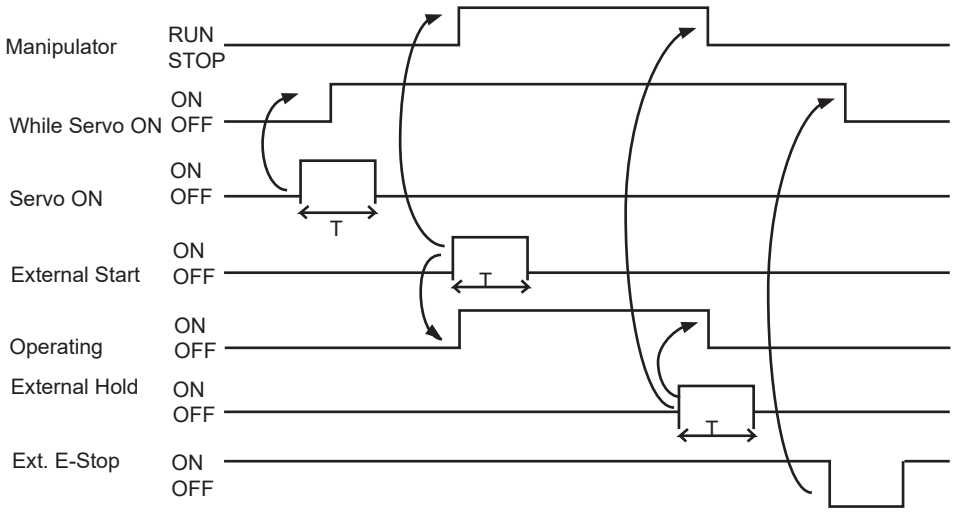
Refer to *chapter 14.10 "Robot General-Purpose I/O Signal Assignment" from page14-44 to 14-70* about the maximum current of the transistor and the relay output circuits.

■ **Specific I/O Signal Related to Start and Stop**

The following signals are specific I/O signals related to start and stop.

- Servo ON (depending on application: JANCD-AIO0□-E)
- External Servo ON (common to all application: JANCD-AIO0□-E)
- External Start (depending on application: JANCD-AIO0□-E)
- Operating (depending on application: JANCD-AIO0□-E)
- External Hold (common to all application: JANCD-AIO0□-E)
- External Emergency Stop (common to all application: IM-YE250/5-80P)

<Timing Chart>



Note: Set T=100msec or more

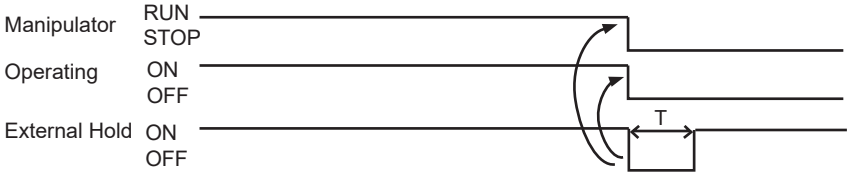
Note: External Hold
At the factory default setting, the status turns to the hold status by turning ON the External Hold.

NOTICE

At the factory default setting, by setting the External Input signal (20011) ON, EX. HOLD (SPECIFIC. IN TERMNL BLOCK) (40067) turns ON.

By turning ON the pseudo input signal (87017) (External hold b-contact), when the External Input signal (20011) is turned OFF, switching of the External Hold to ON is enabled.

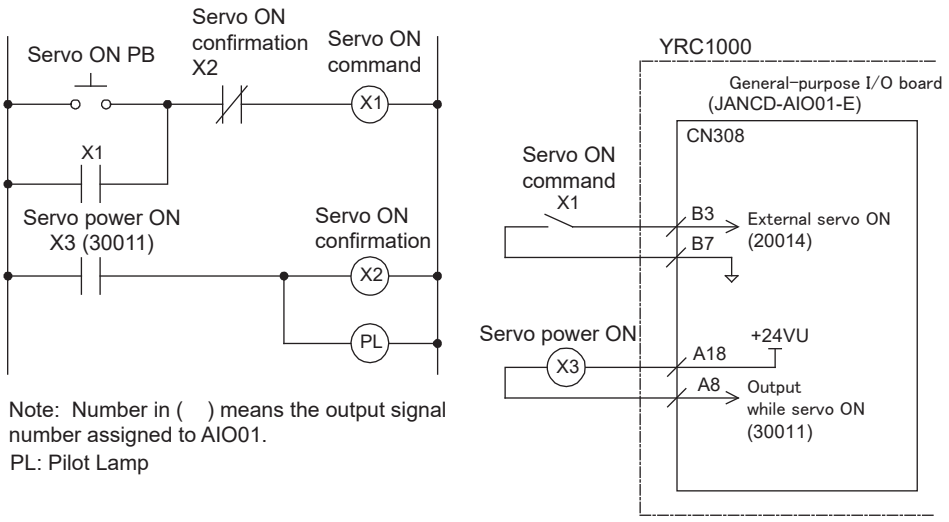
<Timing Chart (87017 is turned ON)>



■ **Example of Servo ON Sequence Circuit from External Device**

Only the rising edge of the servo ON signal is valid. This signal turns ON the manipulator servo power supply. The set and reset timings are shown in the following.

Fig. 14-29: Example of the Servo ON Sequence Circuit from the External Device



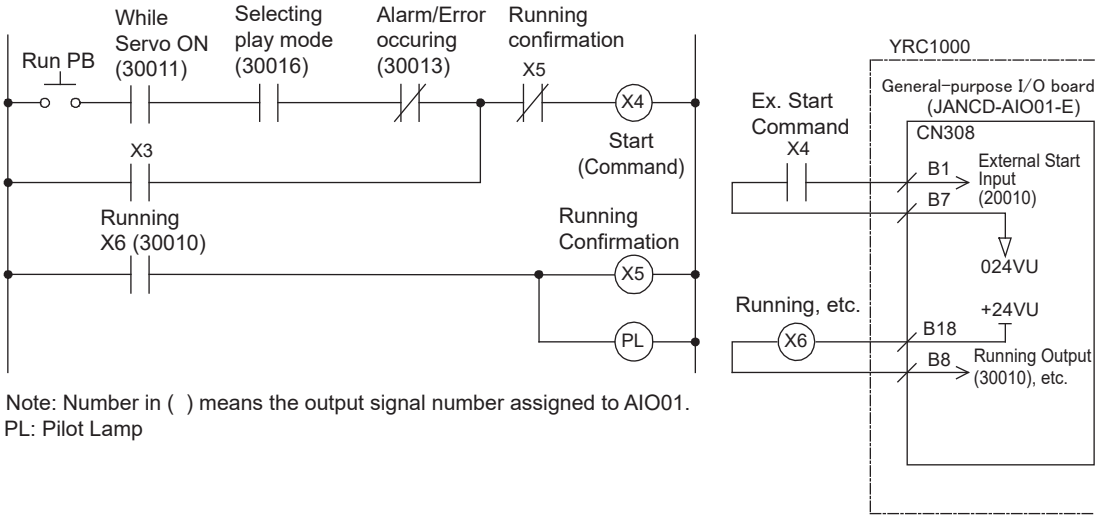
Note: Number in ( ) means the output signal number assigned to AIO01.
PL: Pilot Lamp

Note: This circuit is example in case of AIO01.

■ **Example of Start Sequence Circuit from External Device**

Only the rising edge of the external start signal is valid. This signal starts the manipulator. Reset this signal with the interlock configuration that determines if operation can start and with the playback (RUNNING) signal confirming that the manipulator has actually started moving.

Fig. 14-30: Example of Start Sequence Circuit from the External Device



Note: Number in ( ) means the output signal number assigned to AIO01.
PL: Pilot Lamp

Note: This circuit is example in case of AIO01.

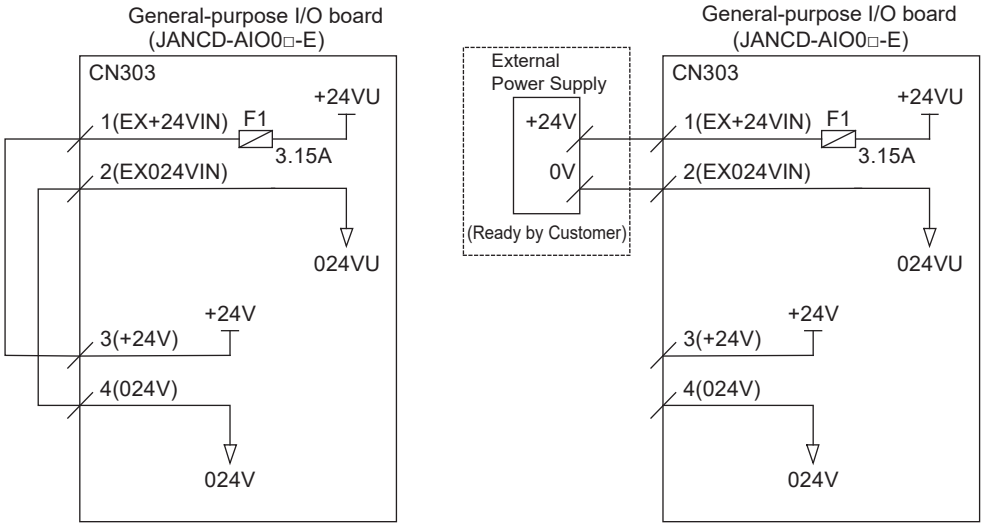
■ **Connection of External Power Supply for I/O**

At factory setting, the internal power supply for I/O is used. If the external power supply for I/O is used, connect it with following procedure.

1. Remove the wire connected between CN303-1 to -3 and CN303-2 to -4 of the general-purpose I/O circuit board.
2. Connect +24V of the external power supply to CN303-1 and 0V to CN303-2 of the robot I/O unit.

For the connection of the CN303 connector, refer to *chapter 14.9 "WAGO Connector Wiring"* .

Fig. 14-31: Connection of External Power Supply for I/O



In case of using internal power supply
(The factory default settings)

In case of using external power supply

NOTE

- The internal power supply of DC24V of about 1.5A of YRC1000 can be used for I/O.
  Use external 24V power supply for higher currents and to isolate the circuit inside and outside the YRC1000.
- Power supply circuit for I/O (+24VU) has 3.15A fuses (F1).
- Install the external power supply outside the YRC1000 to avoid electric noise problems.
- If the internal power supply is selected (CN303-1 to -3 and CN303-2 to -4 are connected), 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.

14.9 WAGO Connector Wiring

The control power supply unit: CN152 on (CSRA-CPS01K□), and CN303 on the general-purpose I/O board (JANCD-AIO0□-E) are equipped with a connector made by WAGO.

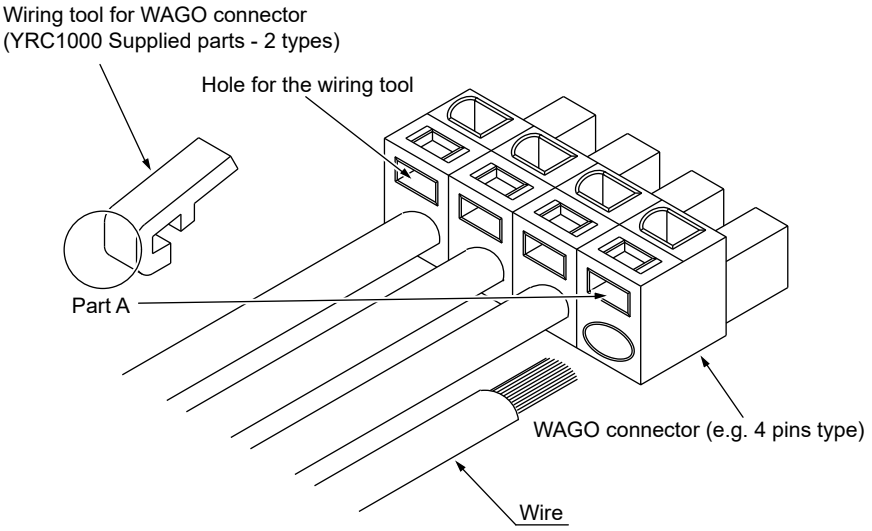
The “wiring tool for the WAGO connector” is necessary to wire the WAGO connector.

The tools (total 3, 2 types) are supplied with the YRC1000.

Use them with the appropriate sizes of connectors.

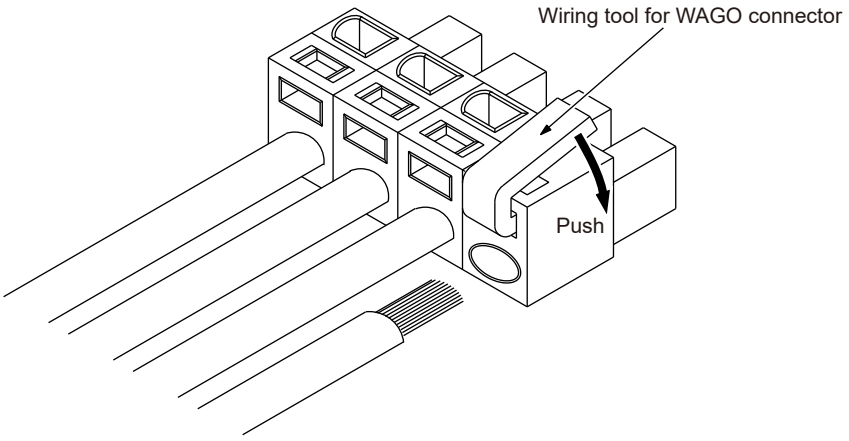
The wiring procedure is described as follows:

1. Insert part A of the wiring tool into one of the holes designed for the tool.



Connector to be applied	Specification
Control power supply unit (CSRA-CPS01K□) CN152	Max cable outside diameter: 4.1mm dia. Stripped lentgh: 8-9mm
General-purpose I/O board (JANCD-AIO0□-E) CN303	Max cable outside diameter: 3.4mm dia. Stripped lentgh: 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.

14.10 Robot General-Purpose I/O Signal Assignment

Refer to the following figure for connection of JANCD-AIO01-E (NPN Specification). Refer to “YRC1000 OPTIONS INSTRUCTIONS STANDARD I/O SIGNAL ASSIGNMENT TABLE (PNP SPECIFICATION) (HW1484105)” for connection of JANCD-AIO02-E (PNP Specification).

14.10.1 Arc Welding

Fig. 14-32: JANCD-AIO01-E (CN308 Connector) I/O Allocation and Connection Diagram (for Arc Welding)

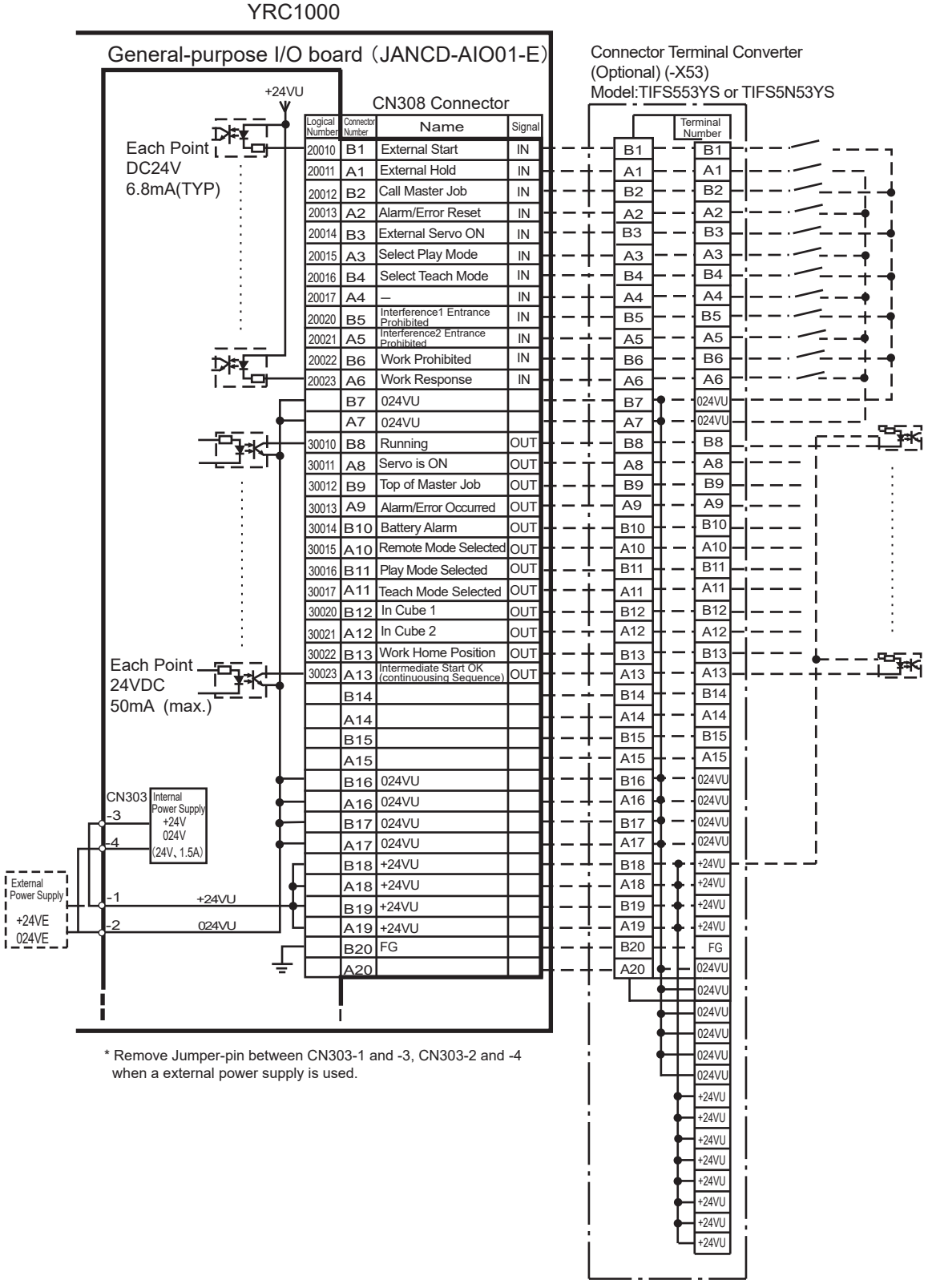
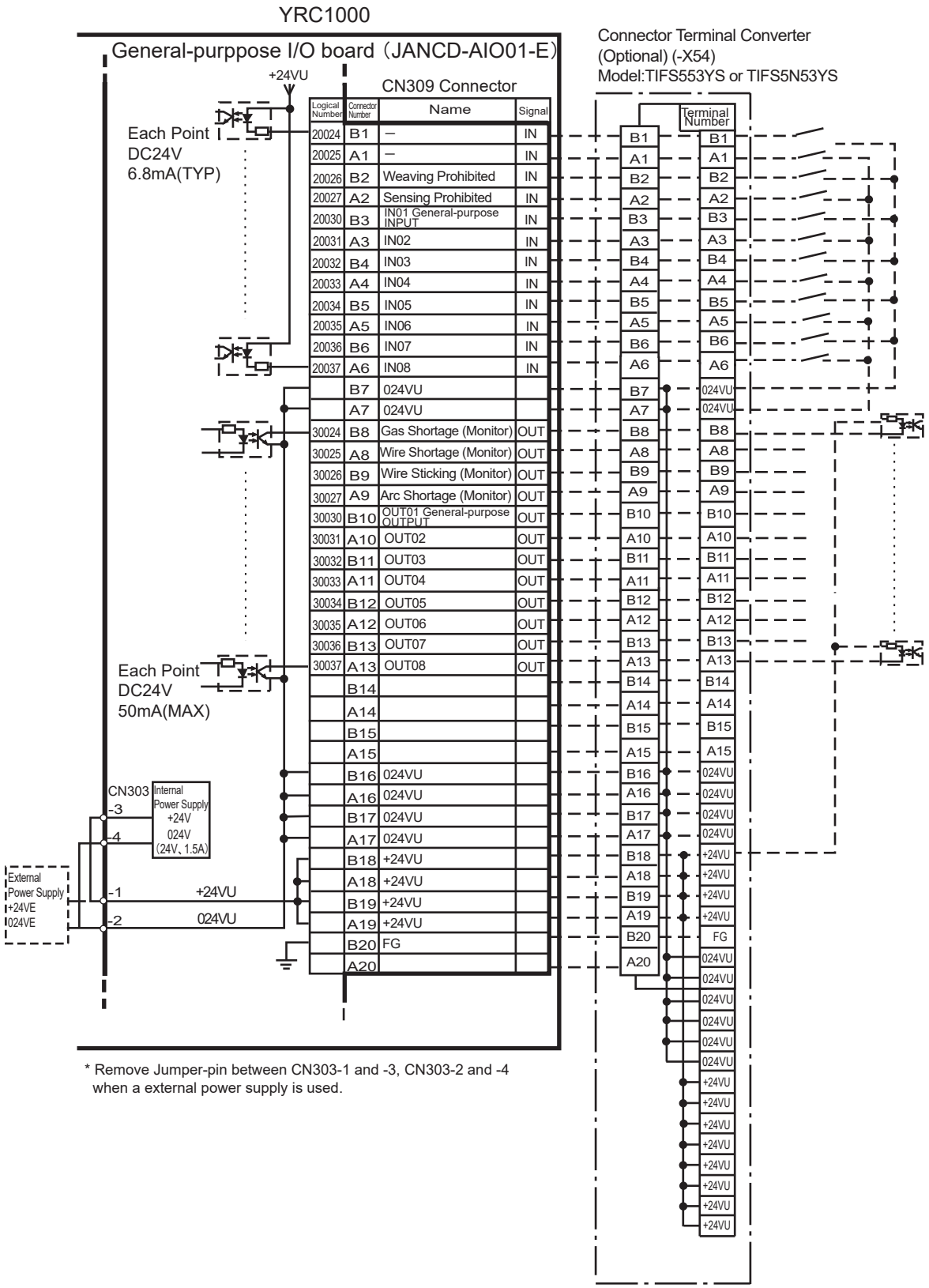


Fig. 14-33: JANCD-AIO01-E (CN309 Connector) I/O Allocation and Connection Diagram (for Arc Welding)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 14-34: JANCD-AIO01-E (CN306 Connector) I/O Allocation and Connection Diagram (for Arc Welding)

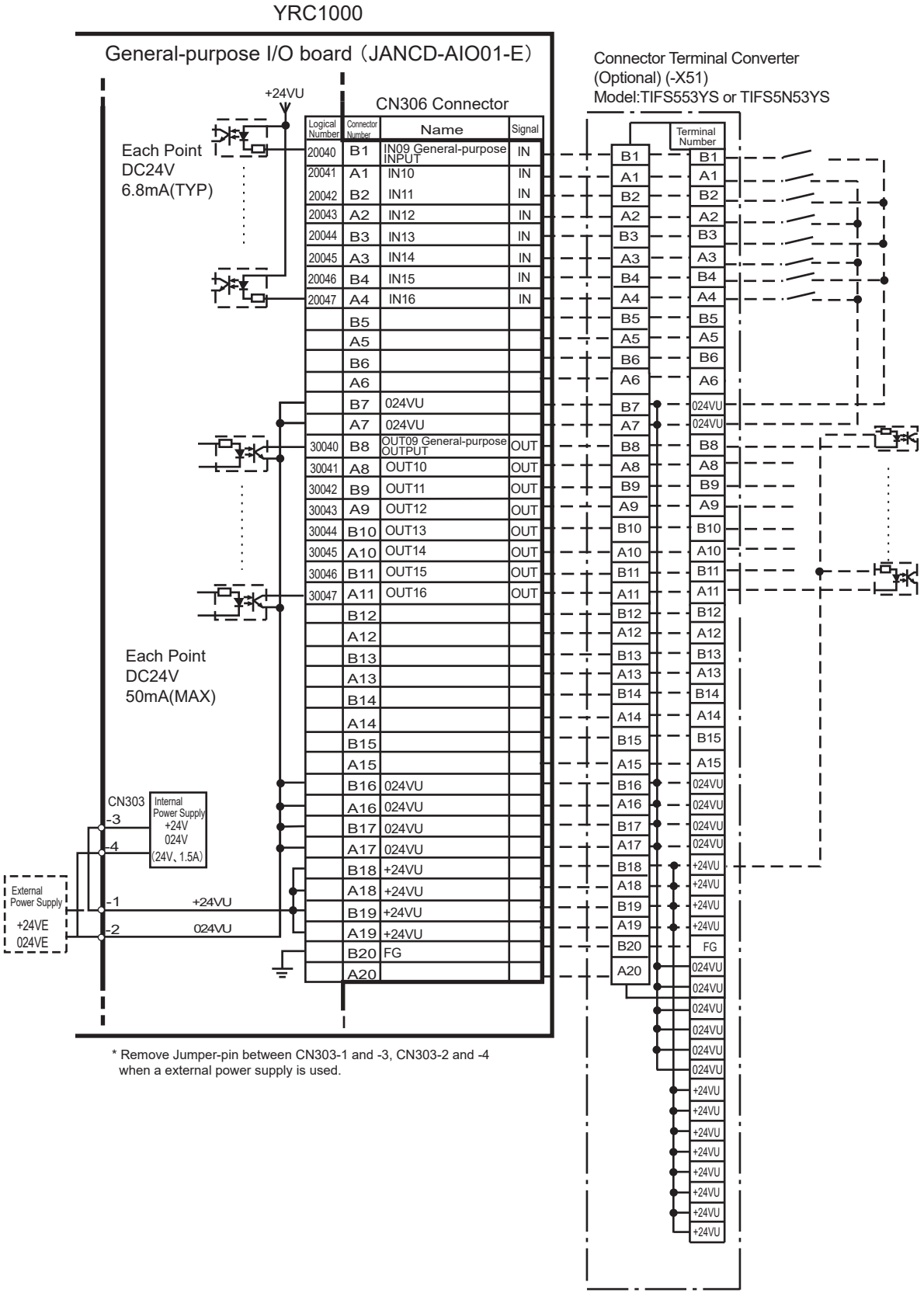


Fig. 14-35: JANCD-AIO01-E (CN307 Connector) I/O Allocation and Connection Diagram (for Arc Welding)

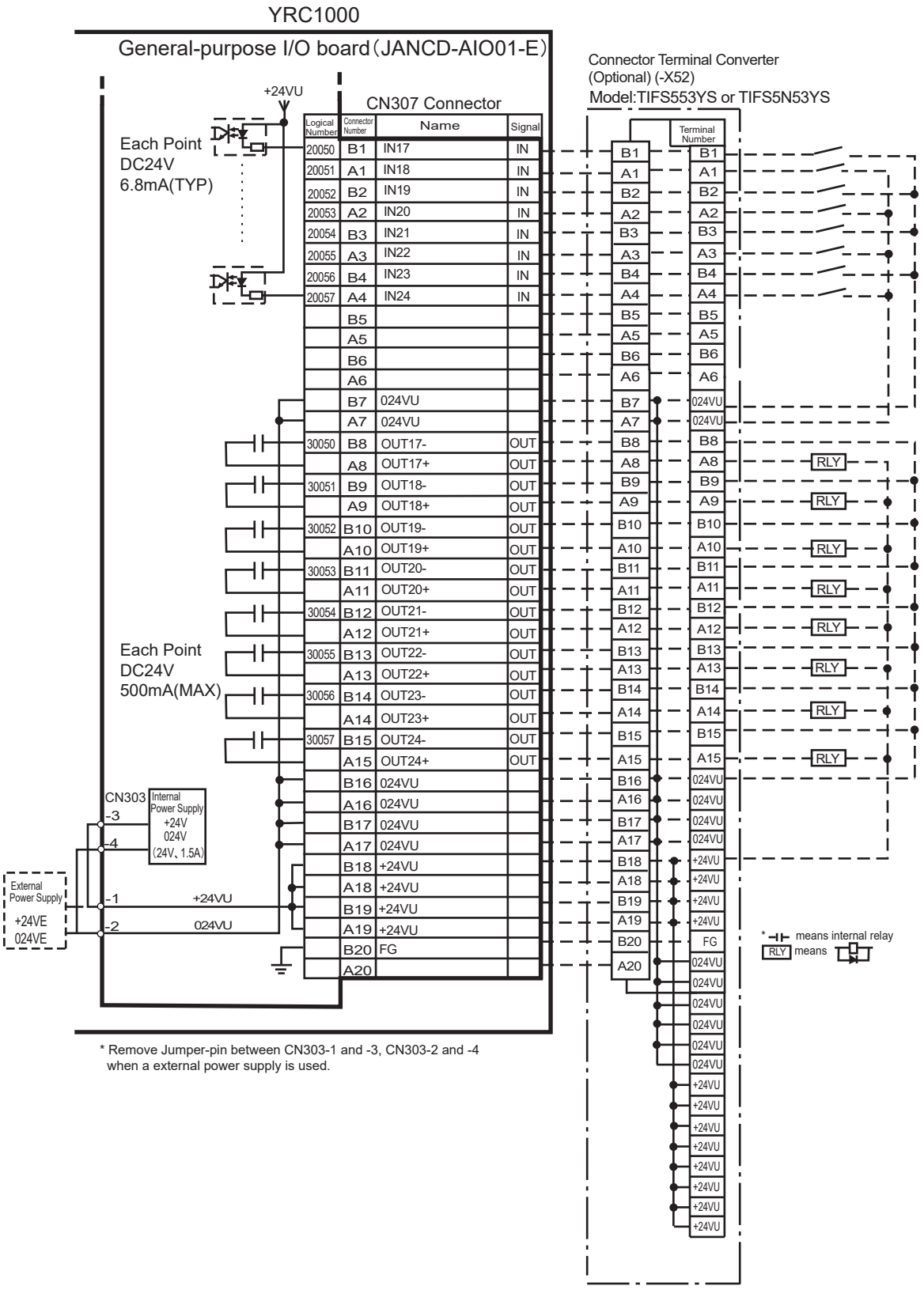


Table 14-2: Specific Input (Arc Welding)

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.
20011	EXTERNAL HOLD The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1)]. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20014	EXTERNAL SERVO ON Only the rising edge of this signal is valid. This signal turns ON the servo power. Use this signal to turn ON the servo power from an external device.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at “REMOTE”. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at “REMOTE”. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
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”* .

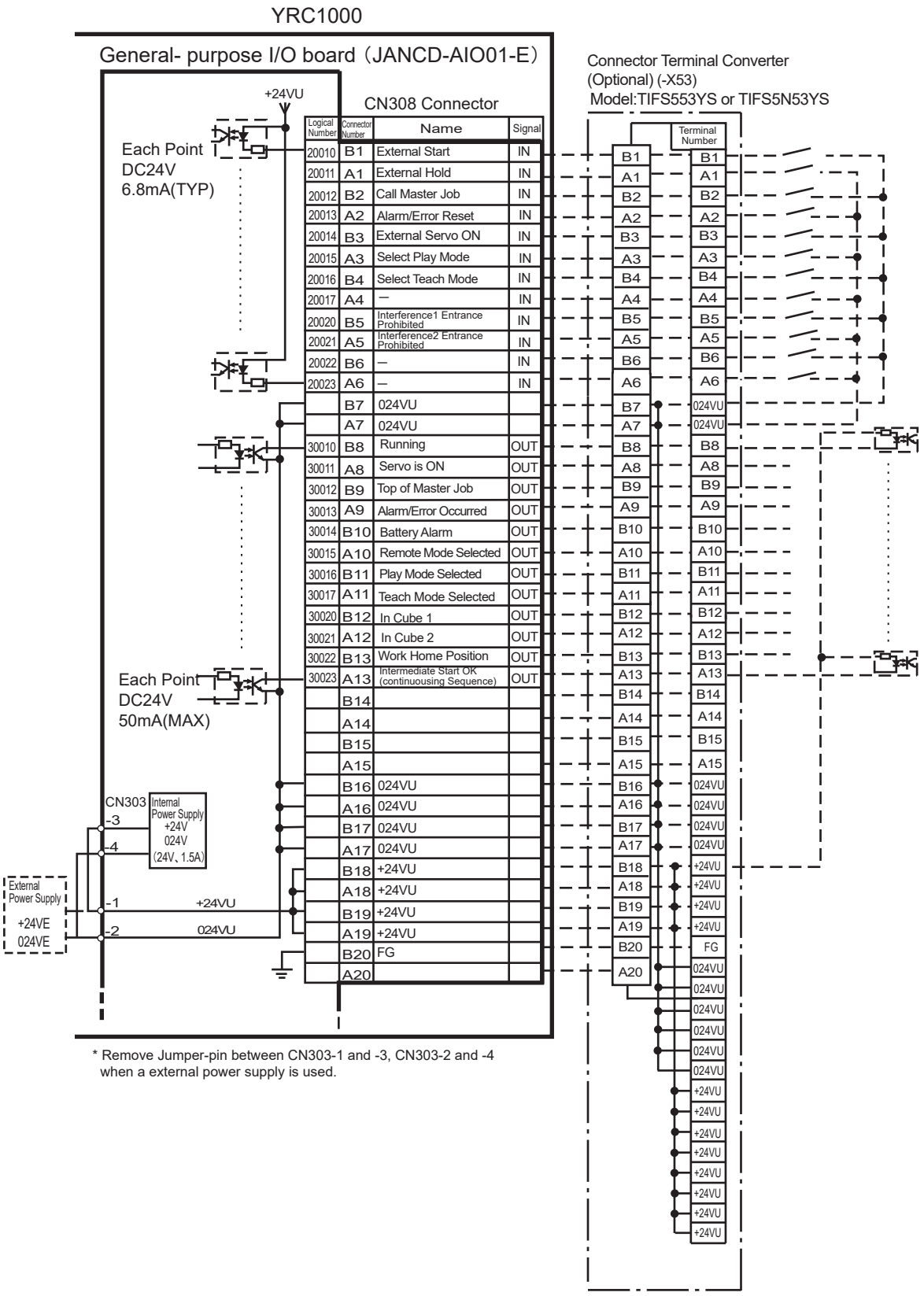
Table 14-3: Specific Output (Arc Welding)

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 YRC1000 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 64)[2)] This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.
30023	INTERMEDIATE START OK This signal turns ON when the manipulator operates. It turns OFF when the cursor is moved or 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.

14.10.2 Material Handling

Fig. 14-36: JANCD-AIO01-E (CN308 Connector) I/O Allocation and Connection Diagram (for Material Handling)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 14-37: JANCD-AIO01-E (CN309 Connector) I/O Allocation and Connection Diagram (for Material Handling)

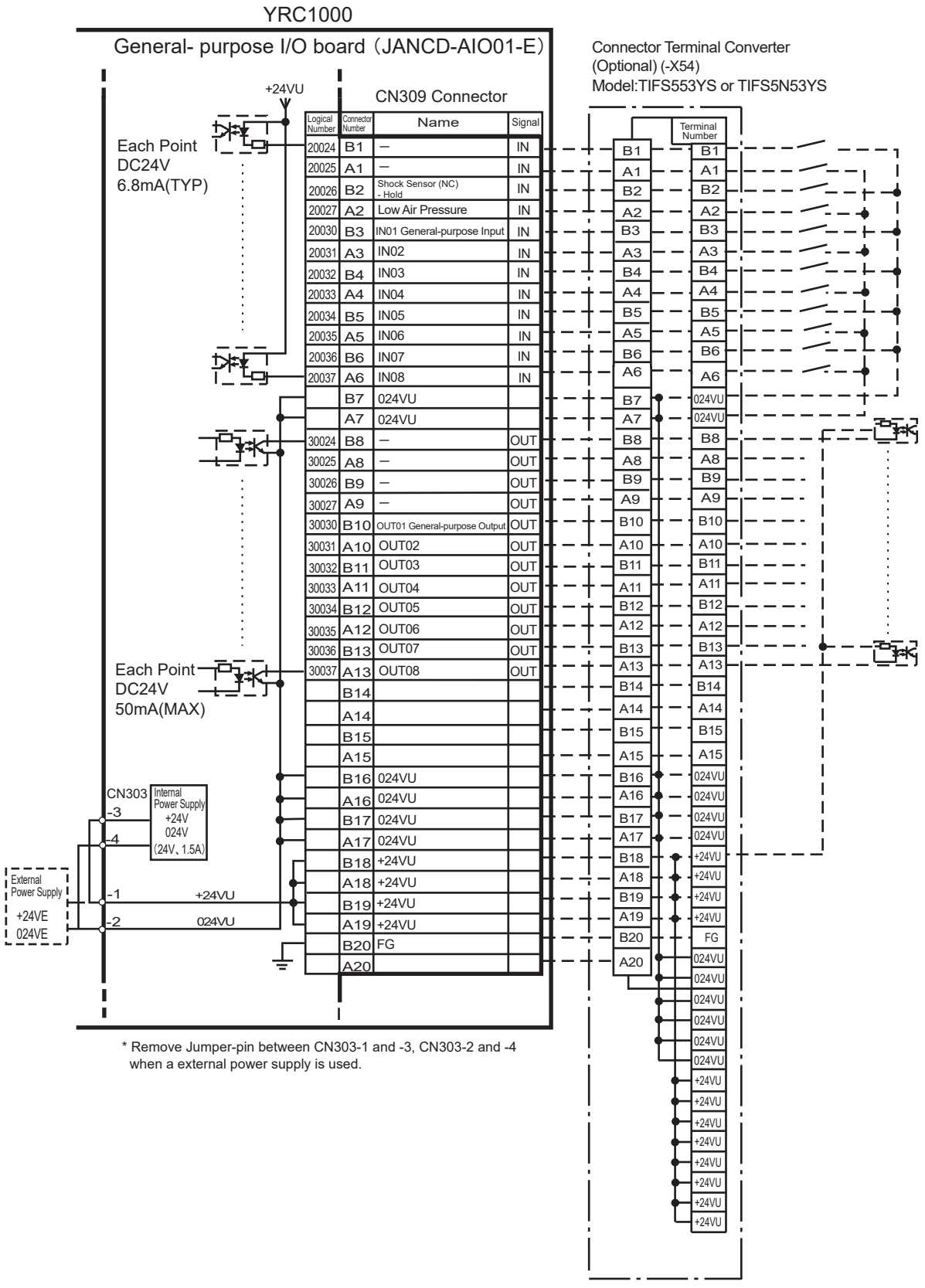


Fig. 14-38: JANCD-AIO01-E (CN306 Connector) I/O Allocation and Connection Diagram (for Material Handling)

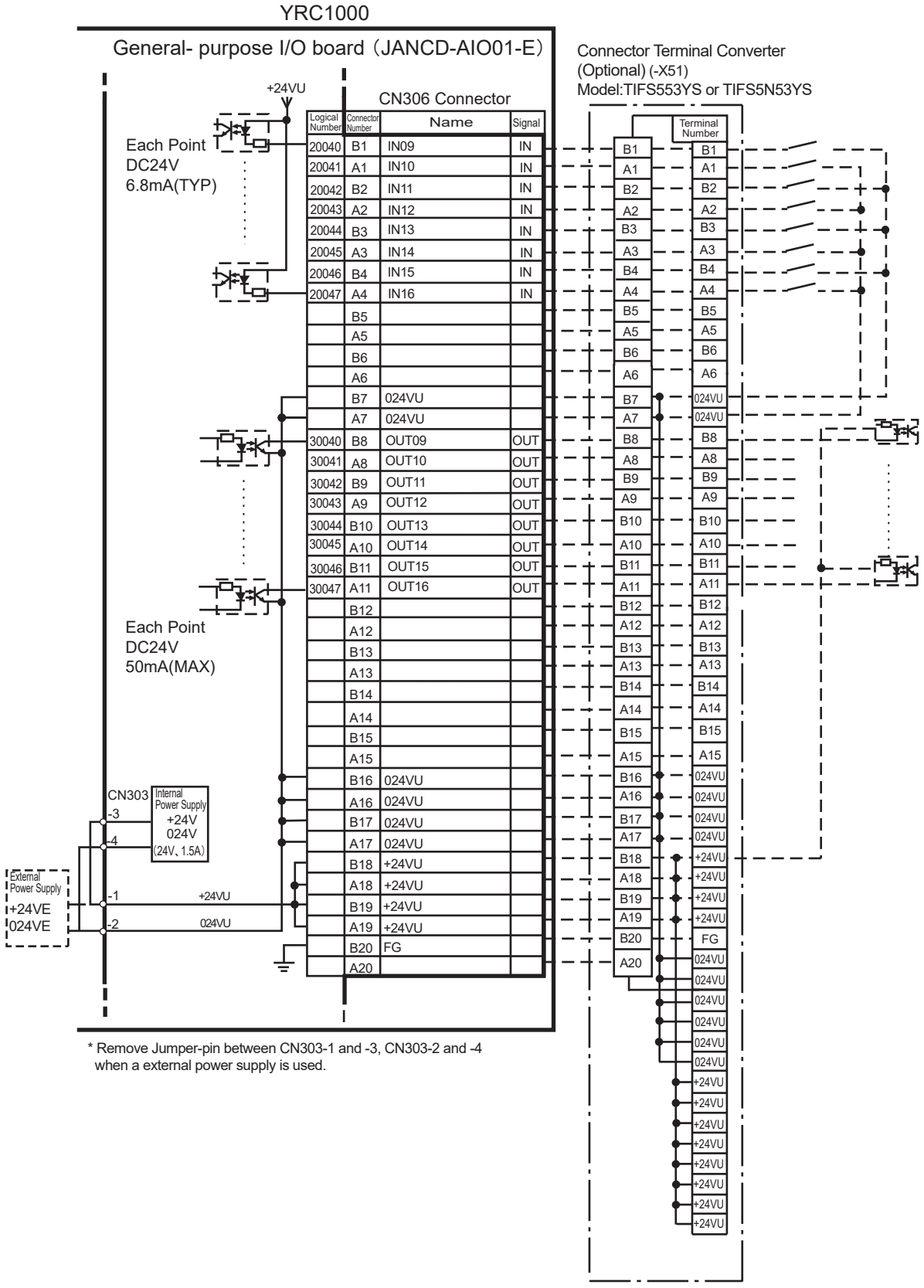


Fig. 14-39: JANCD-AIO01-E (CN307 Connector) I/O Allocation and Connection Diagram (for Material Handling)

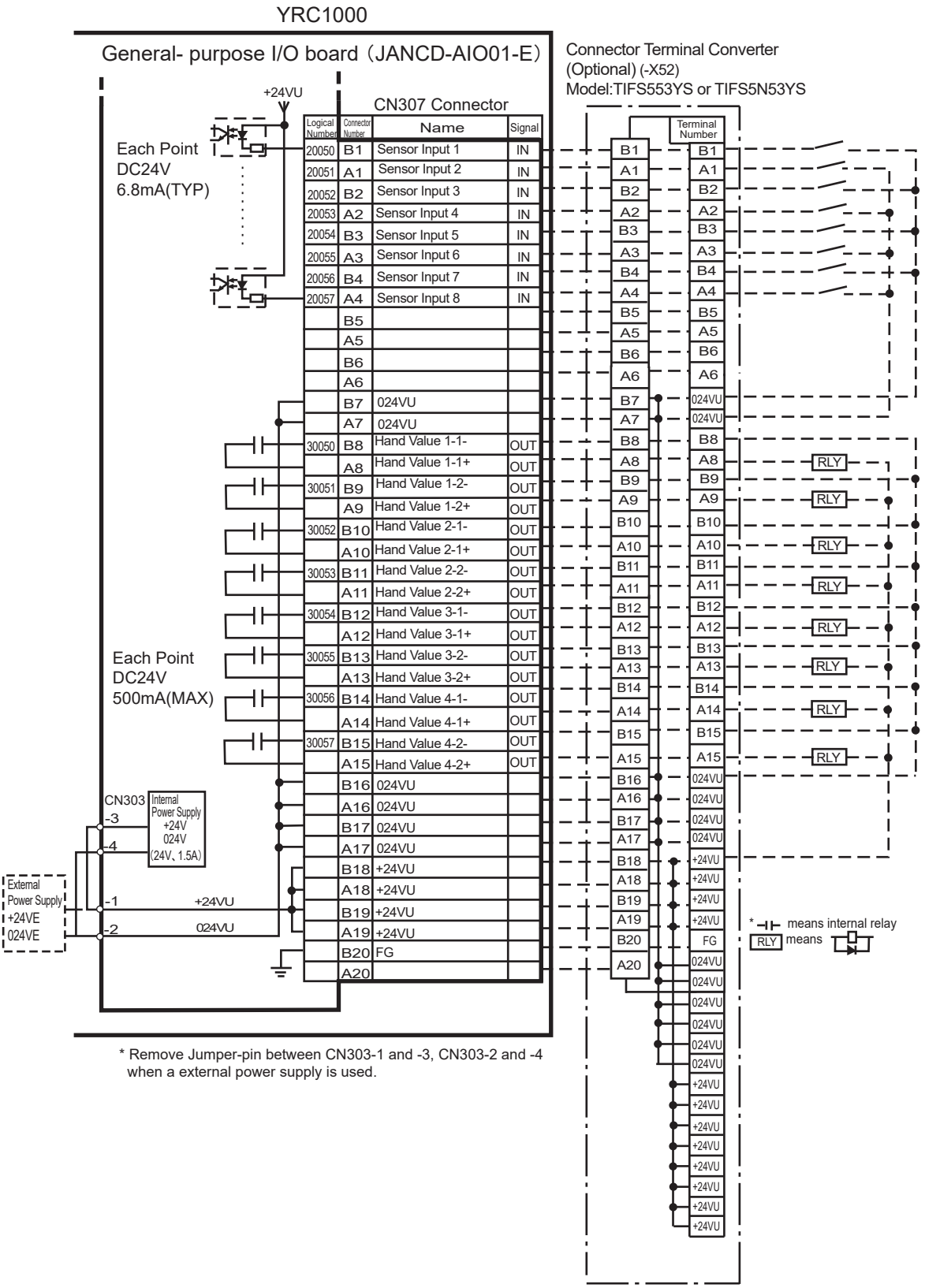


Table 14-4: Specific Input (Material Handling)

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.
20011	EXTERNAL HOLD The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1)]. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20014	EXTERNAL SERVO ON Only the rising edge of this signal is valid. This signal turns ON the servo power. Use this signal to turn ON the servo power from an external device.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at “REMOTE”. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at “REMOTE”. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
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 YRC1000 displays a message “HAND TOOL SHOCK SENSOR OPERATING” and a HOLD is applied. The releasing in teach mode is done on the handling application diagnostic display. Set tool shock sensor function “NOT USE” on the handling applications diagnostic display if this signal is not be used.
20027	LOW AIR PRESSURE This signal is normally OFF (NO). When it turns ON, YRC1000 displays user alarm in the PLAY mode or displays user message in the teach mode.
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”* .

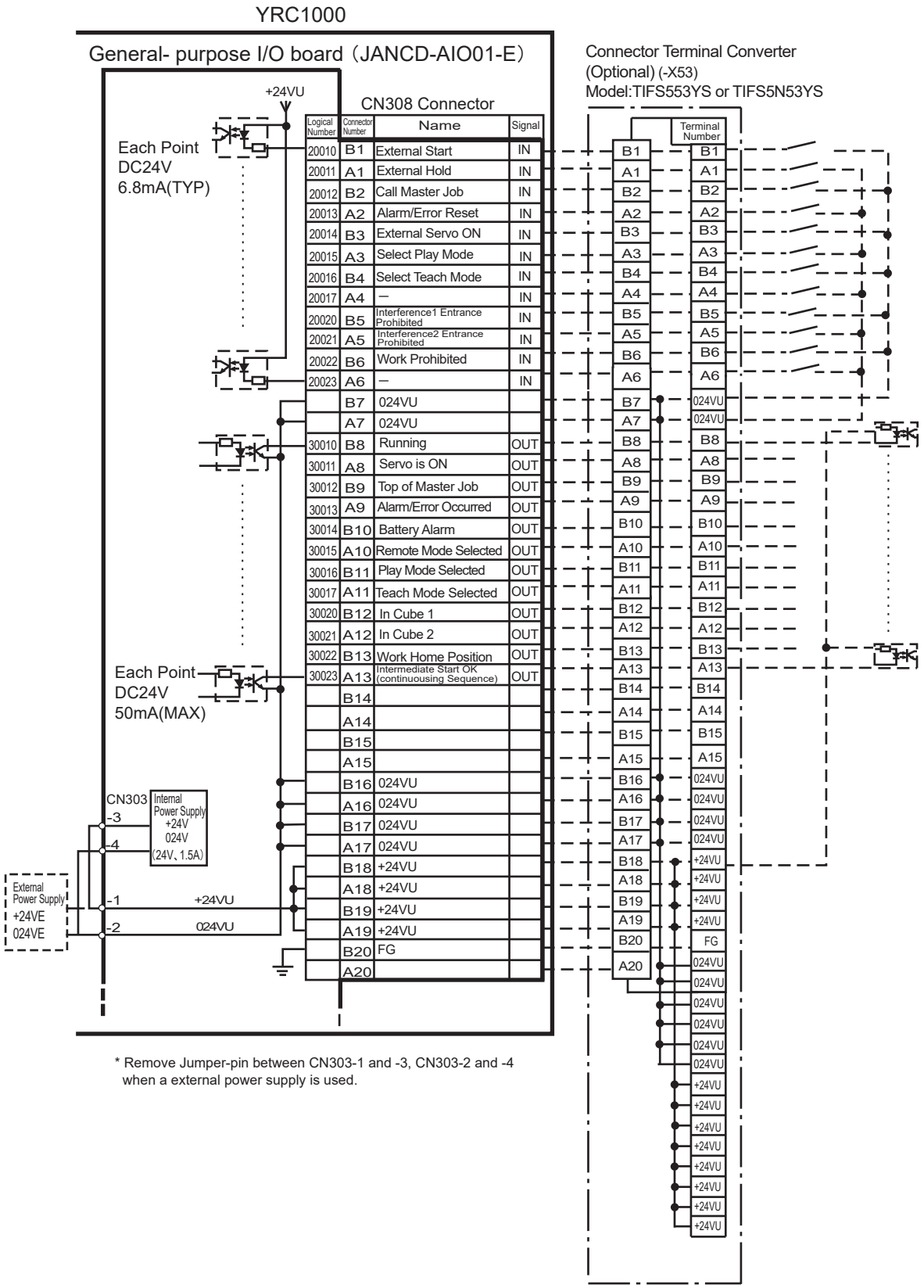
Table 14-5: Specific Output (Material Handling)

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 YRC1000 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]
30013	ALARM/ERROR OCCURRED This signal signifies that an alarm or an error occurred. If a major error occurs, this signal remains ON until the main power is turned OFF.
30014	BATTERY ALARM This signal turns ON to notify that the battery requires replacing when the voltage drops from the battery for backup memory of the encoder. Major problems may result if memory data is lost because of an expired battery. It is recommended to avoid these problems by using this signal as a warning signal.
30015 to 30017	REMOTE/PLAY/TEACH MODE SELECTED This signal notifies the current mode setting. These signals are synchronized with the mode select switch in the programming pendant. The signal corresponding to the selected mode turns ON.
30020	IN CUBE 1 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 1). Use this signal to prevent interference with other manipulators and positioners.
30021	IN CUBE 2 This signal turns ON when the current TCP lies inside a pre-defined space (Cube 2). Use this signal to prevent interference with other manipulators and positioners.
30022	WORK HOME POSITION (IN CUBE 64)[2)] This signal turns ON when the current TCP lies inside the work home position area. Use this signal to evaluate whether the manipulator is in the start position.
30023	INTERMEDIATE START OK This signal turns ON when the manipulator operates. It turns OFF when the cursor is moved or 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.

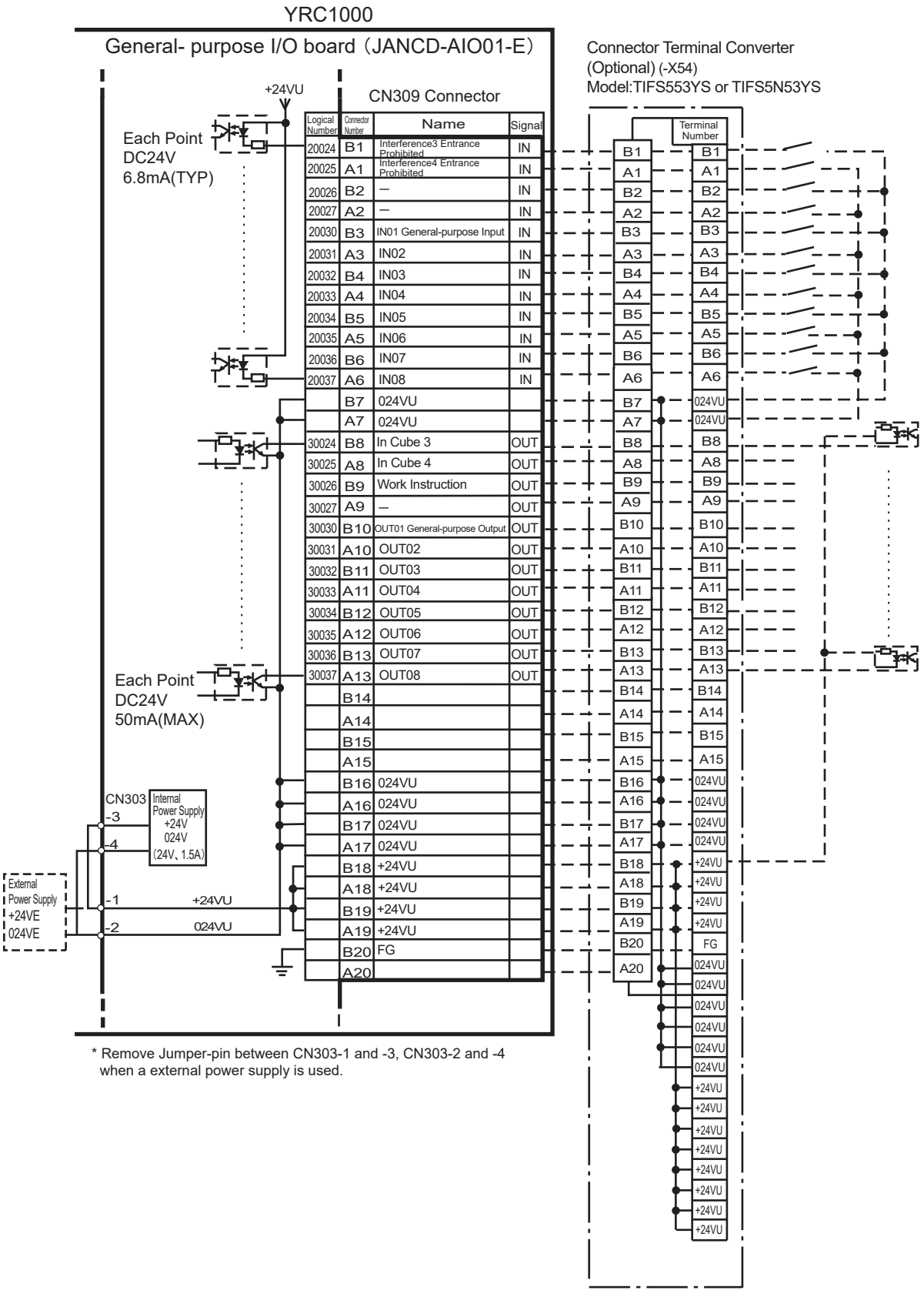
14.10.3 Press Tending, Cutting, and Other Applications

Fig. 14-40: JANCD-AIO01-E (CN308 Connector) I/O Allocation and Connection Diagram (for Press Tending, Cutting, and Other Applications)



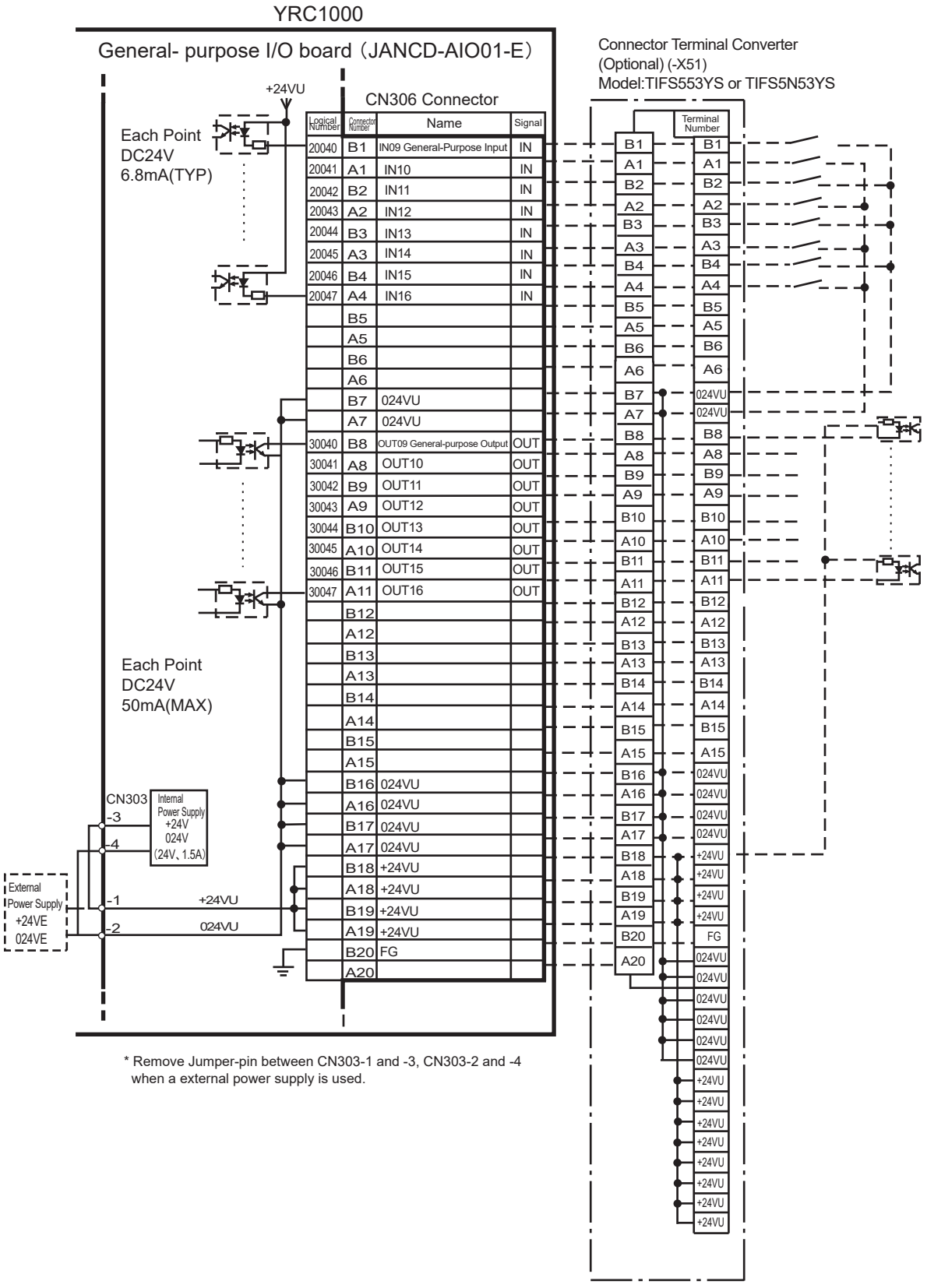
* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 14-41: JANCD-AIO01-E (CN309 Connector) I/O Allocation and Connection Diagram (for Press Tending, Cutting, and Other Applications)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 14-42: JANCD-AIO01-E (CN306 Connector) I/O Allocation and Connection Diagram (for Press Tending, Cutting, and Other Applications)



Logical Number	Connector Number	Name	Signal
20040	B1	IN09 General-Purpose Input	IN
20041	A1	IN10	IN
20042	B2	IN11	IN
20043	A2	IN12	IN
20044	B3	IN13	IN
20045	A3	IN14	IN
20046	B4	IN15	IN
20047	A4	IN16	IN
	B5		
	A5		
	B6		
	A6		
	B7	024VU	
	A7	024VU	
30040	B8	OUT09 General-purpose Output	OUT
30041	A8	OUT10	OUT
30042	B9	OUT11	OUT
30043	A9	OUT12	OUT
30044	B10	OUT13	OUT
30045	A10	OUT14	OUT
30046	B11	OUT15	OUT
30047	A11	OUT16	OUT
	B12		
	A12		
	B13		
	A13		
	B14		
	A14		
	B15		
	A15		
	B16	024VU	
	A16	024VU	
	B17	024VU	
	A17	024VU	
	B18	+24VU	
	A18	+24VU	
	B19	+24VU	
	A19	+24VU	
	B20	FG	
	A20		

Fig. 14-43: JANCD-AIO01-E (CN307 Connector) I/O Allocation and Connection Diagram (for Press Tending, Cutting, and Other Applications)

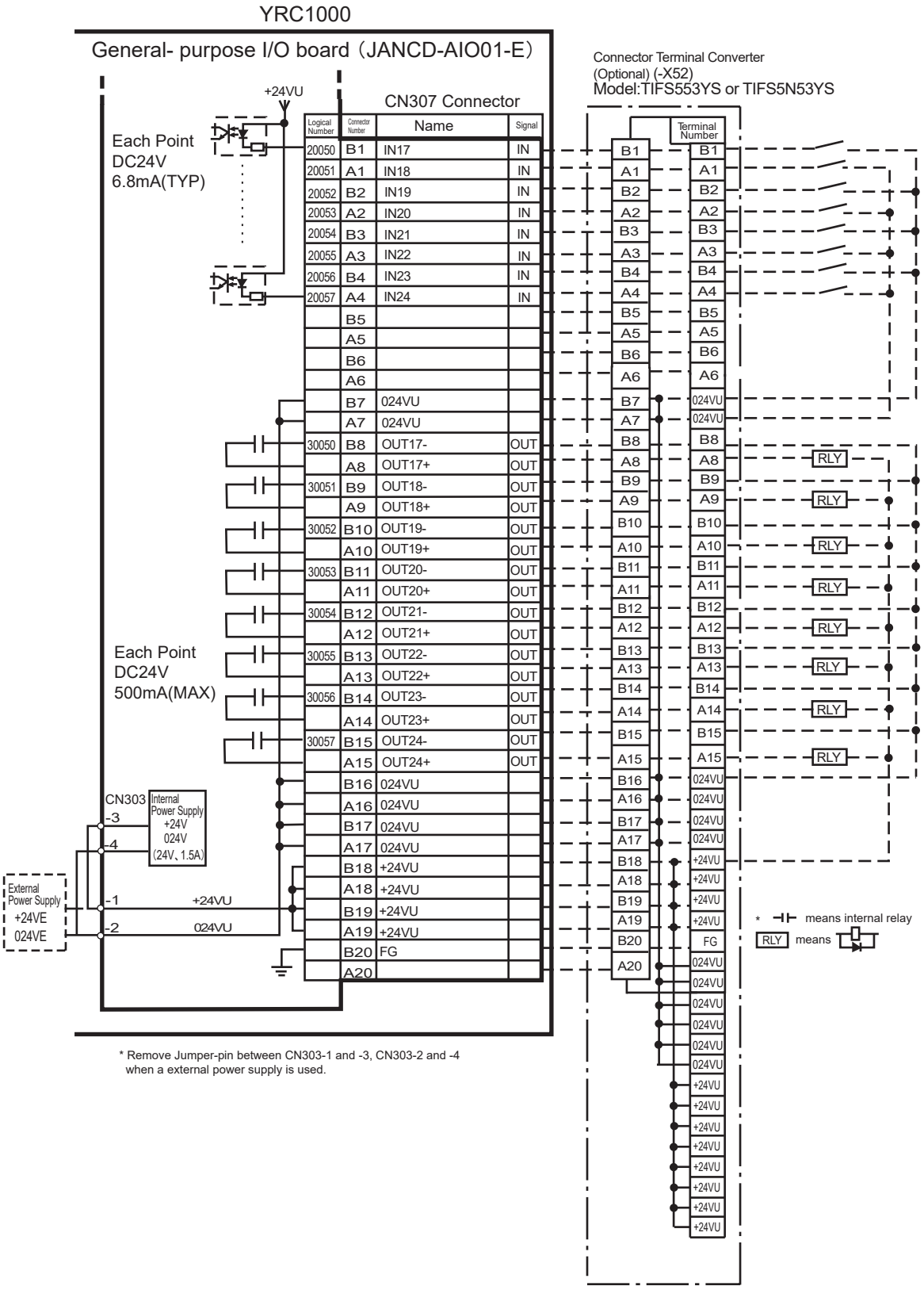


Table 14-6: Specific Input (Press Tending, Cutting, and Other Applications)

Logical Number	Input Name / Function
20010	EXTERNAL START Functions the same as the [START] button in the programming pendant. Only the rising edge of the signal is valid. It starts robot operation (playback). This signal is invalid if external start is prohibited from the playback condition display.
20011	EXTERNAL HOLD The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1)]. This signal is invalid during playback, during teach-lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20014	EXTERNAL SERVO ON Only the rising edge of this signal is valid. This signal turns ON the servo power. Use this signal to turn ON the servo power from an external device.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at “REMOTE”. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at “REMOTE”. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
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, YRC1000 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”* .

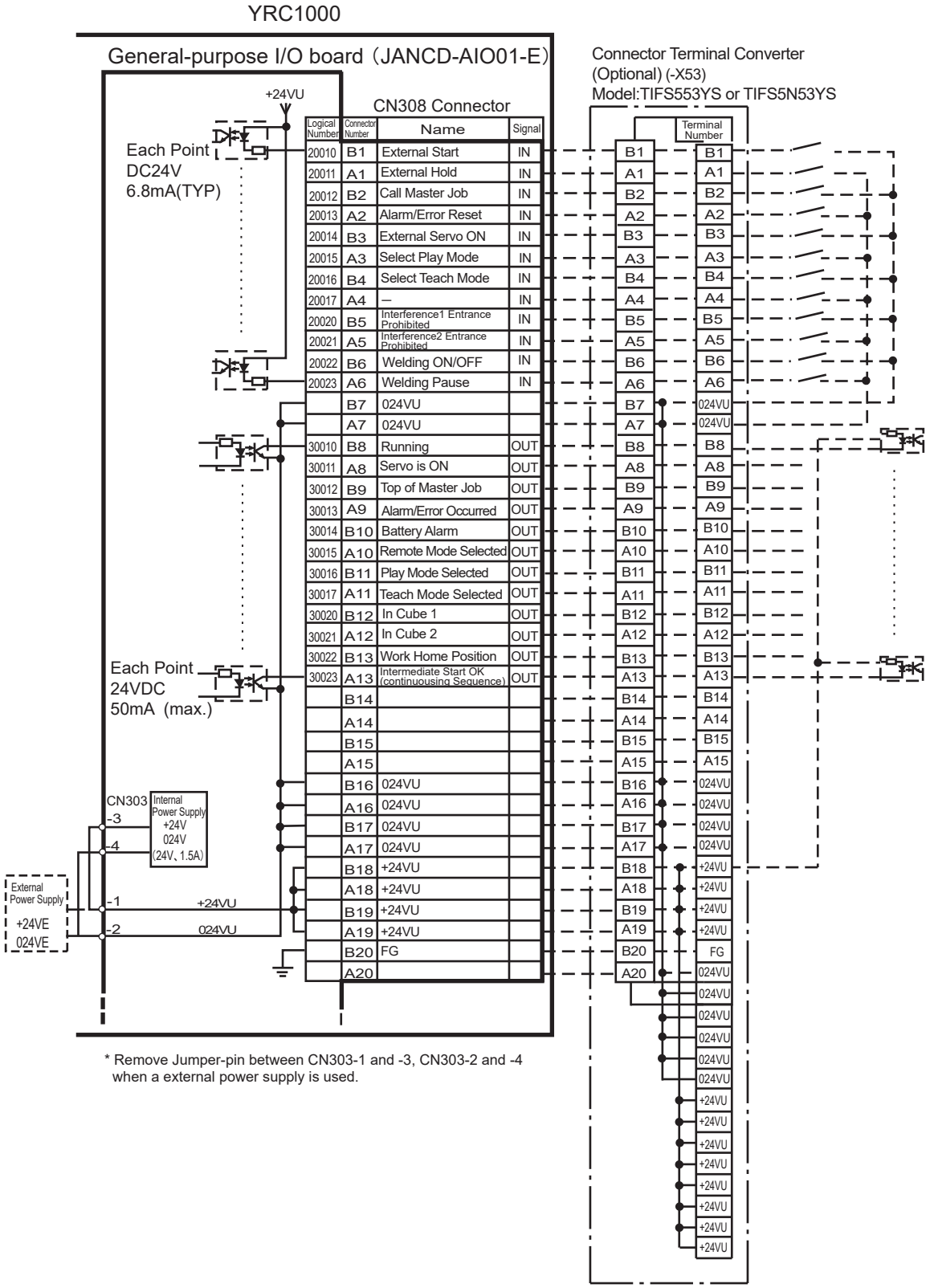
Table 14-7: Specific Output (Press Tending, Cutting, and Other Applications)

Logical Number	Output Name / Function
30010	RUNNING This signal signifies that the job is running. (Signifies that the job is running, system status is waiting reserved start, or test run is running.) This signal status is the same status as [START] in the programming pendant.
30011	SERVO IS ON This signal signifies that the servo power is turned ON, internal processing such as current position creation is complete, and the system is able to receive the START command. This signal turns OFF when the servo power supply turns OFF. It can be used for YRC1000 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]***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 cursor is moved or 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 (20022) 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.

14.10.4 Spot Welding

Fig. 14-44: JANCD-AIO01-E (CN308 Connector) I/O Allocation and Connection Diagram (for Spot Welding)



* Remove Jumper-pin between CN303-1 and -3, CN303-2 and -4 when a external power supply is used.

Fig. 14-45: JANCD-AIO01-E (CN309 Connector) I/O Allocation and Connection Diagram (for Spot Welding)

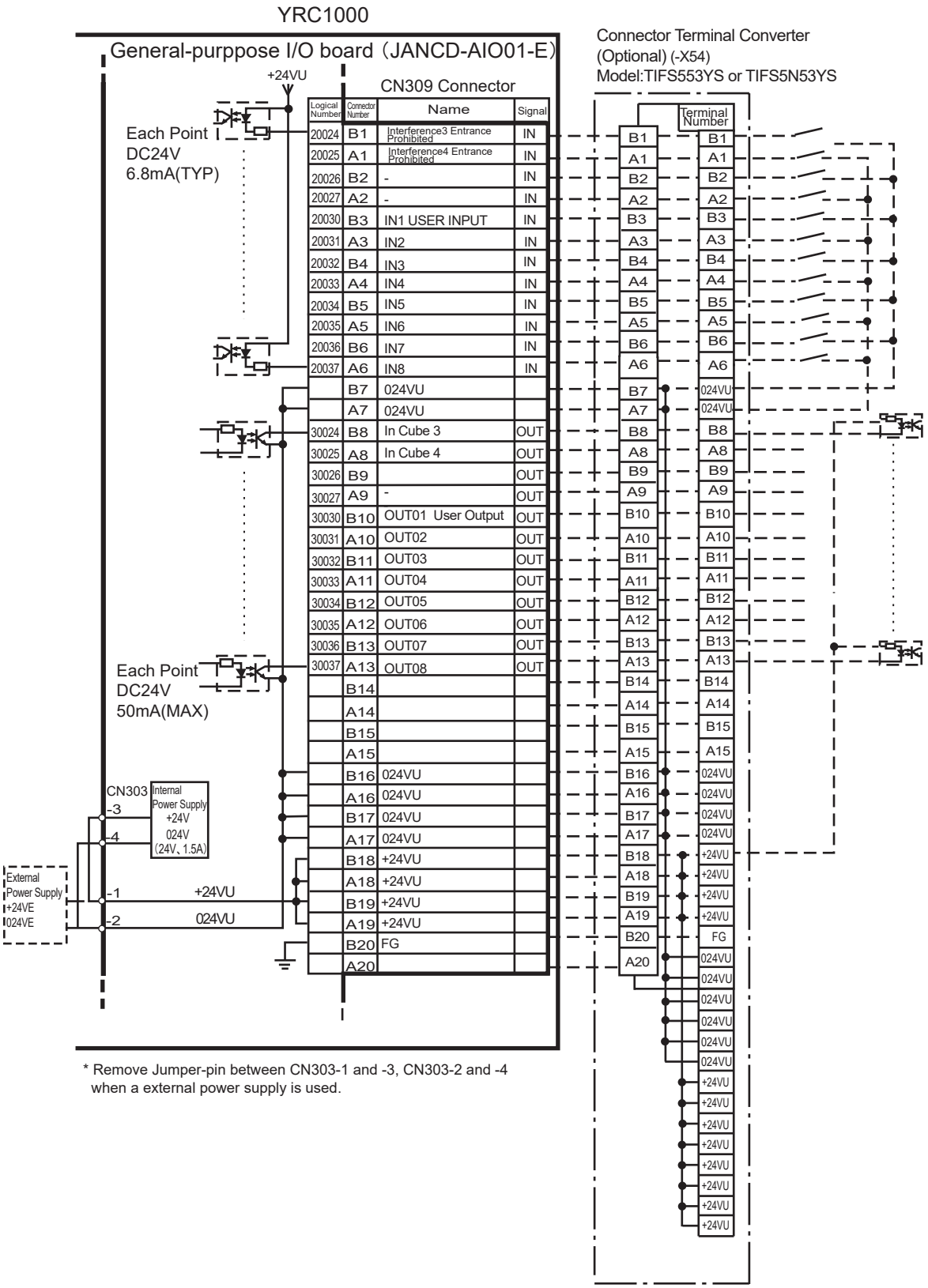


Fig. 14-46: JANCD-AIO01-E (CN306 Connector) I/O Allocation and Connection Diagram (for Spot Welding)

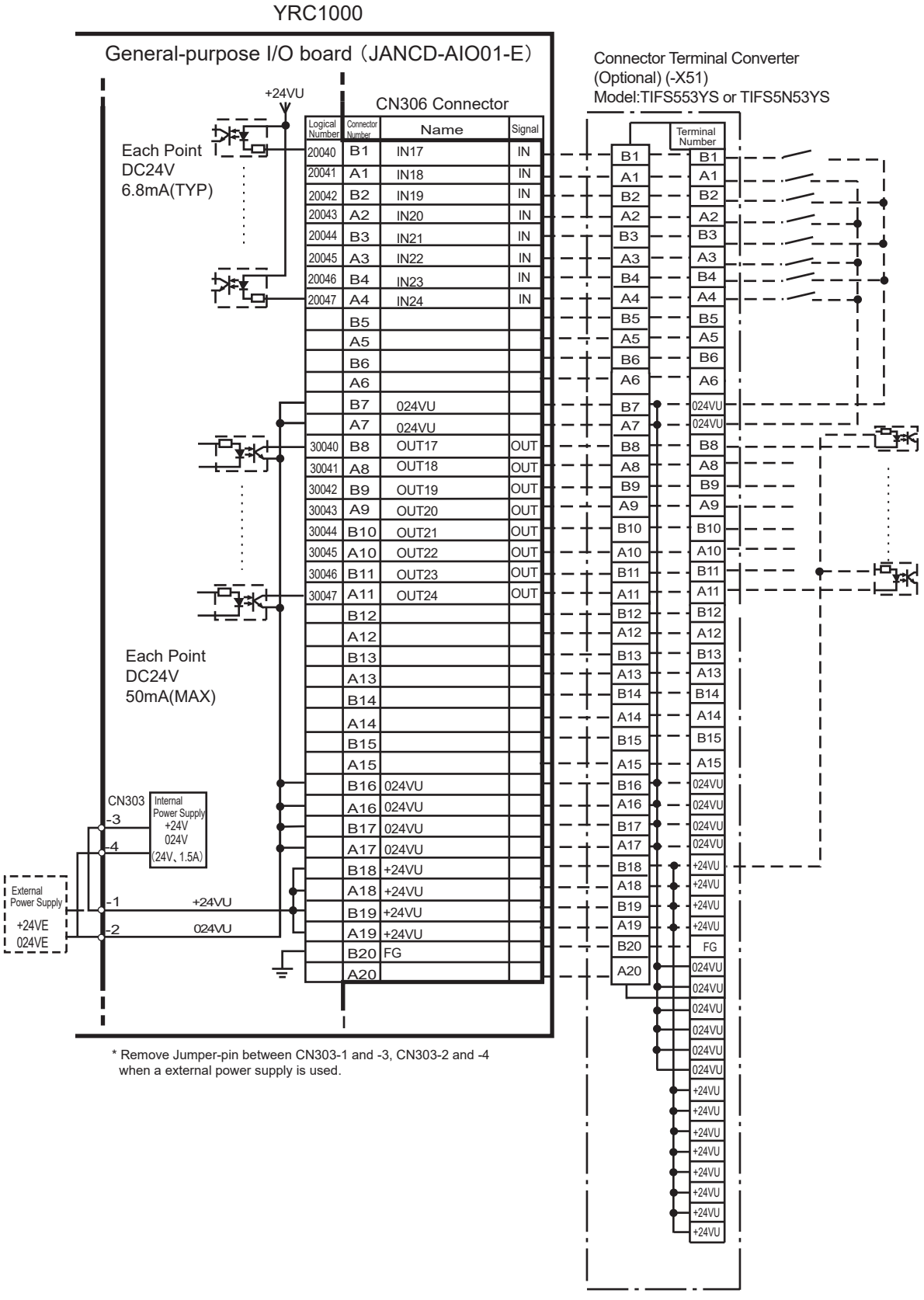


Fig. 14-47: JANCD-AIO01-E (CN307 Connector) I/O Allocation and Connection Diagram (for Spot Welding)

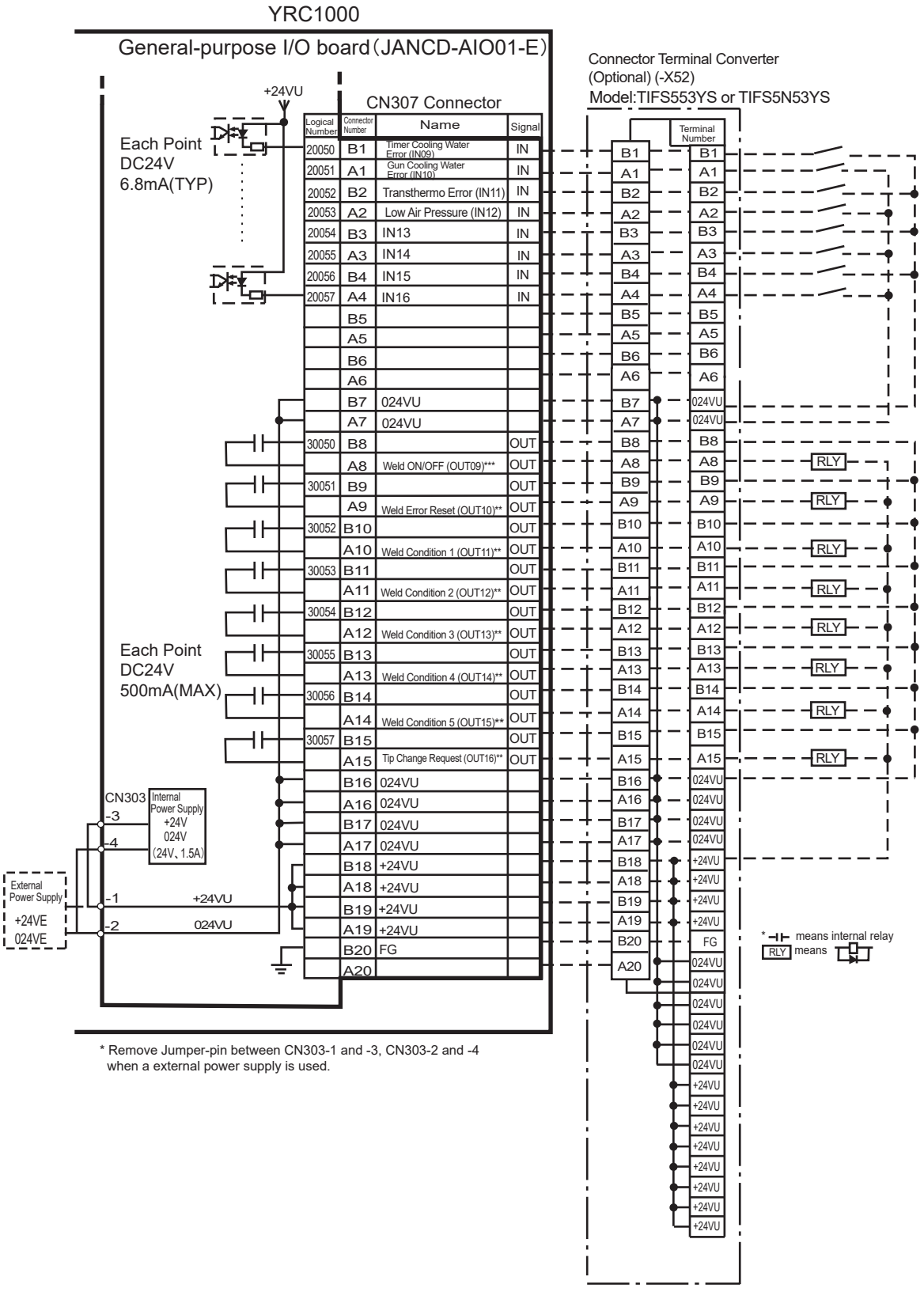


Table 14-8: Specific Input (Spot Welding)

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.
20011	EXTERNAL HOLD The hold lamp turns on and the signal “HOLDING (50071)” turns ON while this signal is ON. Depending on the setting, the status of manipulator can be “HOLDING” while this signal is OFF.
20012	CALL MASTER JOB Only the rising edge of the signal is valid. It calls up the top of the robot program, that is the top of the master job[1)]. This signal is invalid during playback, during teach lock and when play master or call is prohibited (set from the playback operation condition display).
20013	ALARM/ERROR RESET After an alarm or error has occurred and the cause been corrected, this signal resets the alarm or error.
20014	EXTERNAL SERVO ON Only the rising edge of this signal is valid. This signal turns ON the servo power. Use this signal to turn ON the servo power from an external device.
20015	SELECT PLAY MODE The play mode is selected when the mode key on the programming pendant is set at “REMOTE”. Only the rising edge of the signal is valid. When this selection signal assigned concurrently with other mode selection signal, the teach mode is selected on a priority basis. The signal is invalid while EXTERNAL MODE SWITCH is prohibited.
20016	SELECT TEACH MODE The teach mode is selected when the mode key of the programming pendant is set at “REMOTE”. The other mode selection is unavailable when this signal is ON; the signal is selected by priority even when the other selection signal is ON, enabling the teach mode selection.
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.
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)

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)

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 YRC1000 status diagnosis for an external start.
30012	TOP OF MASTER JOB This signal signifies that the execution position is the top of the master job. This signal can be used to confirm that the master job has been called.[1)]

Table 14-9: Specific Output (Spot Welding)

Logical Number	Output Name / Function
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 cursor is moved or 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.
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.

Table 14-9: Specific Output (Spot Welding)

Logical Number	**Output Name / Function**
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.
30057	TIP REPLACE REQUEST This signal is output when the stored number of welding reaches the number of welding set for the tip replacement.

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.

14.11 The List of the Equipment Configuration

Table 14-10(a): Equipment Configuration (for Small-Capacity Model 1-1)

			For Japan	For Asia	For North America	For Europe
YRC1000 type (last part) (ERAR-1000-xxxxxxx-□□□)			A00	A10	B15	E10
Input voltage			200 to 240 VAC	380 to 440 VAC	380 to 480 VAC	380 to 440 VAC
Dimension (W) x (H) x (D)			598 mm × 490 mm × 427 mm			
Breaker			NF32-SVF 3P 15 A		NF125-HVU 3P 15 A	NF32-SVF 3P 15 A
SCCR			200 to 240 VAC: 5.0 kA	380 to 415 VAC: 5.0 kA / 440 VAC: 2.5 kA	380 to 480 VAC: 5.0 kA	380 to 415 VAC: 5.0 kA / 440 VAC: 2.5 kA
Control power supply unit[1)]			CSRA-CPS01KB			
CPU unit			JZNC-ARK51-1E			
	CPU rack		JZNC-ARK01-E			
		CPU board	JANCD-ACP01-E			
		Back board	JANCD-ABB01-E			
		Riser board (PCIe/PCIe)	JANCD-ABB02-E			
	Robot I/F board		JANCD-AIF01-1E			
Safety terminal block board			IM-YE250/5-80P			
General-purpose I/O board			JANCD-AIO01-E			JANCD-AIO02-E
Power supply contactor unit			JZRCR-APU01-1		JZRCR-APU03-1	JZRCR-APU01-1
Inverter unit			Refer to *table 14-10(b) "Equipment Configuration (for Small-Capacity Model 1-2)"* .			
	Servo control board		CSRA-SDCA01AA			
Single axis amplifier			Refer to *table 14-10(b)*.			
Safety circuit board			JANCD-ASF01-E			
Converter			CSRA-CV05A00A	CSRA-CV05D01A		
Regenerative resistor	**Type**		SMVK500W7R0J/ RO A6666	SMVK500W260J/ RO A6667		
	Rated value		500 W	500 W		
	Resister value		7 Ω	26 Ω		
DC reactor			-	85R-15014A x2		
Heat exchanger			TCMSY-3□0DC			
Cooling fan			09225VE-24P-CA-02 x4			
Noise filter			-			NF3050C-SVB

1 Changed to CSRA-CPS01KB from CSRA-CPS01KA in controllers manufactured from October 28, 2019.

Table 14-10(b): Equipment Configuration (for Small-Capacity Model 1-2)

Type	Inverter unit	Single axis amplifier
ERAR-1000-06VX8- □□□	CSRA-SDA01H01A	No amplifier
ERAR-1000-06VXH25- □□□	CSRA-SDA02H01A	No amplifier
ERAR-1000-07VXHE6- □□□	CSRA-SDA02H01A	CSRA-SDB21HA

Table 14-10(c): Equipment Configuration (for Medium/Large-Capacity Model 1-1)

	For Japan	For Asia	For North America	For Europe
YRC1000 type (last part) (ERAR-1000-xxxxxxx-□□□)	A00	A10	B15	E10
Input voltage	200 to 240 VAC	380 to 440 VAC	380 to 480 VAC	380 to 440 VAC
Dimension (W) x (H) x (D)	598 mm×490 mm×427 mm			
Breaker	NF32-SVF 3P 30 A	NF32-SVF 3P 20 A	NF125-HVU 3P 20 A	NF32-SVF 3P 20 A
SCCR	200 to 240 VAC: 5.0 kA	380 to 415 VAC: 5.0 kA / 440 VAC: 2.5 kA	380 to 480 VAC: 5.0 kA	380 to 415 VAC: 5.0 kA / 440 VAC: 2.5 kA
Control power supply unit[1)]	CSRA-CPS01KB			
CPU unit	JZNC-ARK51-1E			
CPU rack	JZNC-ARK01-E			
CPU board	JANCD-ACP01-E			
Back board	JANCD-ABB01-E			
Riser board (PCIe/PCIe)	JANCD-ABB02-E			
Robot I/F board	JANCD-AIF01-1E			
Safety terminal block board	IM-YE250/5-80P			
General-purpose I/O board	JANCD-AIO01-E			JANCD-AIO02-E
Power supply contactor unit	JZRCR-APU01-1		JZRCR-APU03-1	JZRCR-APU01-1
Inverter unit	Refer to *table 14-10(d) "Equipment Configuration (for Medium and Large Capacity Model 1-2)"* .			
Servo control board	CSRA-SDCA01AA			
Single axis amplifier	Refer to *table 14-10(d)*.			
Safety circuit board	JANCD-ASF01-E			
Converter	CSRA-CV10A02A	CSRA-CV10D03A		
DC reactor	-	PI-EZ002-0213 x2		
AC reactor	SR-40A (or UZBC-B 40A)	SR-23A (or UZBC-B 23A)		
Heat exchanger	TCMSY-3□□DC			
Cooling fan	09225VE-24P-CA-02 x4			
Noise filter	-			NF3050C-SVB
Power supply for manipulator fan[2)]	S8VS-09024	S8VK-T12024		
Fan control relay[2)]	LY2N-D2 DC24V			

1 Changed to CSRA-CPS01KB from CSRA-CPS01KA in controllers manufactured from October 28, 2019.
2 The power supply for the manipulator fan and fan control relay are installed only in the ERAR-1000-06VRF130-□□□ type controllers.

Table 14-10(d): Equipment Configuration (for Medium and Large Capacity Model 1-2)

Type	Inverter unit	Single axis amplifier
ERAR-1000-06VXHL20- □□□	CSRA-SDA12H01A	No amplifier
ERAR-1000-06VX280- □□□	CSRA-SDA11H01A	
ERAR-1000-06VRF130- □□□		
ERAR-1000-06VX600- □□□		
ERAR-1000-07VXB110- □□□	CSRA-SDA11H01A	CSRA-SDB71HA

A

absolute data 8-4
absolute encoder 8-4
ACCELARATION SPEED 12-37
ACCELARATION TIME 12-26
Addition of Base and Station Axes 12-4
Addition of I/O Modules 11-4, 12-1
Alarm Display 13-4
ALARM HISTORY 7-3
Alarm list of the safety logic circuit 8-348
All Limit Release Function 8-139
Allocating an Operation 8-151
Allocation of I/O Control Instructions 8-162
Allocation Window 8-151
Alternate Output Allocation 8-150, 8-156
Ambient Temperature 13-3
Amplifier module 14-8
Analog Incremental Output Allocation 8-150, 8-161
analog incremental output allocation 8-150
ANALOG MONITOR 7-3
ANALOG OUTPUT 7-2
analog output allocation 8-150, 8-160
APPLI COND. 7-5
Application 13-4
APPLICATION CONDITION SETTING 7-5
APPLICATION SETTING 7-5
ARC AUX COND. 7-5
ARC END COND. 7-5
ARC MONITOR 7-5
ARC MONITOR (SAMPL) 7-5
ARC SHORTAGE (MONITOR) 14-47
ARC START COND. 7-5
ARC WELD DIAG. 7-5
ARC WELDING 7-5
ARM CONTROL 7-3
ARM control 8-50
AUTO BACK SET 7-4
Auto backup function 9-9
Automatic Measurement of the Tool Load and the Center of Gravity 8-41
AUXILIARY RELAY 7-2
AXES CONFIG window 12-22
Axes Control Circuit Board 14-13
Axis Interference Area 8-84
Axis keys 6-3

B

Back circuit board 14-6
BALL-SCREW PITCH 12-23, 12-35
Base axis setting 12-15
base coordinate 8-70
B-Axis 6-3
Brake line ground judgment function 8-260
BYTE 7-2

C

Cable Junctions 4-3
Capacitor Module 14-13
Cautions for Connection of Dual Input Signals 14-3
CHANGE BUTTON 7-5
CHANGE FONT 7-5
CHANGE WINDOW PATTERN 7-5
Changing the Absolute Data 8-11
Changing the Output Status 8-165
Changing the Parameter Setting 8-167
Checking the TCP 8-39
circuit board racks 14-6
CLEARANCE SETTING 7-5
Clearing Absolute Data 8-12
Clearing Calibration Data 8-38
Clearing the Interference Area Data 8-94
Clearing the User Coordinates 8-134
CMOS.BIN 9-1
CMOSBK. BIN 9-1
Collision proof Frames 13-4
COMMAND POSITION 7-3
COMMAND TO ALL APPLICATIONS 7-5
Condition Number 8-83, 8-93, 8-98, 8-102
Connecting the Manipulator Cable 4-13
Connecting the Primary Power Supply 4-10
Connecting the Programming Pendant 4-17
Connection 4-1
Connection methods 4-10
Construction 13-3
Contents Confirmation 2-1
control group 12-16
CONTROL INPUT 7-2
Control Power Supply Unit 14-13
converter 14-68, 14-70
Cooling System 13-3
Coordinate System 13-4
CPRIN 7-2
CPU Circuit Board 14-6, 14-7
CPU RESET 7-3
CPU unit 14-6, 14-68, 14-70
CPU Unit Configuration 14-6
CREATE NEW JOB 7-2
cube 8-72
Cube Interference 8-139
cube number 8-74
Cubic Interference Area 8-70
CURRENT POSITION 7-3
CYCLE 7-2

D

DATE/TIME 7-4
Definition of the User Coordinates 8-124
DELETE 7-3
DELETE JOB LIST 7-2
Detection level 8-98, 8-102
DEVICE 7-3
Digital I/O 13-3
Dimensions 13-3

Disconnection function 11-1
display allocation 8-149, 8-154
DISPLAY COLOR COND. 7-4
Display setting function 8-181
DISPLAY SETUP 7-5
Door Interlock 13-4
DOUBLE 7-2
Drive Unit 13-3
DROP AMOUNT 7-3
DX200 specification 13-1

E

E-Axis 6-3
Editing Mode 7-1
emergency stop 5-9
Enable Switch 5-7, 13-4
Encoder back-up error recovery function 8-193
ENCODER MAINTENANCE 7-4
ENERGY SAVING FUNCTION 7-4
Error list 9-29
Essential Measures 13-4
Executing the Display Allocation 8-164
Executing the I/O Control Allocation 8-164
Executing the Instruction/Output Control Allocation 8-164
Executing the Job Call Allocation 8-164
Execution of Allocation 8-164
Expanded Instruction Set 8-141
External Axes Control Circuit Board 14-11
External Emergency Stop 14-18, 14-38
External Hold 14-38
EXTERNAL INPUT 7-2
EXTERNAL OUTPUT 7-2
External Servo ON 14-19, 14-38
External Start 14-38

F

FD/CF 7-3
File Initialization 8-170
FOLDER 7-3
FUNCTION COND. 7-4
FUNCTION ENABLE 7-4
Function List 13-4
Function Select 8-98, 8-102

G

GAS SHORTAGE (MONITOR) 14-47
GENERAL 7-5
GENERAL DIAG. 7-5
GENERAL PURPOSE INPUT 7-2
GENERAL PURPOSE OUTPUT 7-2
general-purpose I/O board 14-68, 14-70
Graph display 8-216

Grounding 13-3
Group (4-bit/8-bit) Output Allocation 8-159
group output allocation (4-bit/8-bit) 8-150
GRP COMBINATION 7-4
GUN CONDITION 7-5
GUN COOLING WATER ERROR 14-64
GUN FULL OPEN DETECTION 14-65
GUN PRESSURE 7-5
GUN PRESSURE DETECTION 14-65
GUN SHORT OPEN DETECTION 14-65

H

HAND VALVE 14-53
HANDLING 7-5
HANDLING DIAGNOSIS 7-5
Handling Procedure 3-1
HOME POSITION 7-3
Home Position 8-4
Home Position Calibration 8-2
Home position calibration 8-4
How to Calculate Tool Load Information 8-56

I

I/O ALARM 7-2
I/O ALLOCATION 7-5
I/O Diagnosis 13-4
I/O Instructions 13-5
I/O MESSAGE 7-2
I/O modules 12-1
I/O MSG HISTORY 7-3
I/O SIMULATION LIST 7-2
I/O VARIABLE CUSTOMIZE 7-5
IN/OUT 7-2
Inching Operation 13-4
INERTIA RATIO 12-26, 12-38
Initial Diagnosis 5-2
INITIALIZE 7-3
INITIALIZE LAYOUT 7-5
Initializing Data File 8-171
Initializing I/O Data 8-174
Initializing Job File 8-170
Initializing Parameter File 8-173
Initializing System Data 8-176
Inspection notice function 8-221
INSPECTION RECORD 7-4
Installation 3-1
Installation and Wiring Safety 1-6
Instruction Allocation 8-149, 8-152
Instruction of Shock Detection Function 8-103
Instruction Set 8-141
INTEGER 7-2
Interface 13-4
INTERFERENCE 7-3
Interference area 8-70

J

JOB 7-2
Job Call Allocation 8-149, 8-154
JOB CAPACITY 7-2
JOB EDIT (PLAY) 7-2
JOB MONITOR 7-5
JOG COND. 7-4
JOG KEY ALLOC 7-4

K

KEY ALLOCATION 7-4
Key Allocation (EACH) 8-149
Key Allocation (SIM) 8-149

L

LADDER PROGRAM 7-2
Language 13-5
L-axis 6-3
Leakage Breaker Installation 4-6
Learning Function 8-142
Lifetime calculation 8-197
LIMIT RELEASE 7-3
limit switch 8-137
LOAD 7-3
LOCAL VARIABLE 7-2
LOW AIR PRESSURE 14-52, 14-65
L-U Interference 8-139

M

Machine Lock 13-4
Machine Safety CPU Circuit Board 14-7
Machine safety FLASH reset 8-332
Machine Safety I/O Logic Circuit Board 14-4, 14-13
Machine Safety Terminal Block Circuit Board 14-17
main CPU SD card ID 7-11
Main power supply 5-1
Major Axes Control Circuit Board 14-10
Management Mode 7-1
MANIPULATOR TYPE 7-3
Manufacturer allocation 8-149
Mask of replacement time display 8-235
MASTER JOB 7-2
Max. Disturbance Force 8-98
MAX. RPM 12-26, 12-37
Measurement of the Tool Load and the Center of Gravity 8-41
Mechanical Limit 8-139
MECHANICAL SPEC window 12-23, 12-24, 12-35, 12-36
Medium/Large-capacity model 1-7, 3-1, 13-8, 13-13, 14-9, 14-12, 14-70
Memory Capacity 13-3
Modification of System Configuration 12-1

Modification of Teaching Points 13-4
momentary output allocation 8-150, 8-157
MONITORING TIME 7-3
MOTION RANGE 12-23, 12-24, 12-34, 12-35, 12-36
Motor revolution and reverse revolution 8-237
MOTOR SPEC window 12-26
Mounting the controller 3-5
Movement of the Axes 6-3
Moving the MOTOMAN 1-14
M-SAFETY SIGNAL ALLOC 7-4

N

NETWORK INPUT 7-2
NETWORK OUTPUT 7-2
Noise Filter 4-6
Noise level 13-3
Number of Tool Files 8-23
Numeric Key Customize Function 8-149

O

One time manage mode 7-1
OPERATE COND 7-4
OPERATE ENABLE 7-4
Operating 14-38
OPERATING STATUS 7-5
Operation Instructions 13-5
Operation Mode 7-1
Operation Time Display 13-4
Order Number 2-2
ORG 8-124
Output of the Work Home Position Signal 8-69
Overrun 8-135
OVERRUN&S-SENSOR 7-3

P

PALY EDIT JOB LIST 7-2
PARAMETER 7-4
Path Confirmation 13-4
PINION DIAMETER 12-24, 12-35
PLAYBACK COND. 7-4
PM 7-4
PM (REDUCER) 7-4
POSITION (BASE) 7-2
POSITION (ROBOT) 7-2
POSITION (ST) 7-2
Positioning System 13-3
Power ON Unit 14-4
POWER ON/OFF POS 7-3
POWER SOURCE COND. 7-5
Power Supply 4-4, 13-3
PRESSURE 7-5
Preventive maintenance for the hard ware 8-229

Preventive maintenance function 8-196
Primary Power Supply Breaker Installation 4-7
Procedures of Stacking the Controllers 3-6
Program Control Instructions 13-5
Programming 13-5
Programming Pendant 13-5
PSEUDO INPUT SIG 7-2
pulse output allocation 8-150, 8-158

R

R-Axis 6-3
REAL 7-2
REDUCTION RATIO 12-23, 12-24, 12-34, 12-35, 12-36
REGISTER 7-2
Registering/Changing the Work Home Position 8-68
Relative Humidity 13-3
RES. START (CNCT) 7-4
RES. START (JOB) 7-2
RES. STATUS 7-2
RESERVE JOB NAME 7-4
Reset function 11-4
Reset Function of the Programming Pendant 11-1
Resetting the Shock Detected 8-110
Returning to the Work Home Position 8-69
RIN 7-2
riser board 14-68, 14-70
ROBOT 7-3
robot coordinate 8-70
robot I/F board 14-6
Robot I/F Circuit Board 14-6, 14-7
Robot installation angle 8-51
ROBOT MONITOR 7-5
Robot Motion Control 13-5
robot programming language (INFORM III) 8-141
Robot Select 8-98, 8-102
Robot Setup Condition 8-51
Running Speed Limit 13-4

S

safeguarding 5-3
Safety 1-3
SAFETY FUNC. 7-4
SAFETY LOGIC CIRCUIT 7-4
Safety logic circuit 8-266, 8-284
Safety mode 7-1
Safety Plug 14-18
safety terminal block board 14-68, 14-70
SAVE 7-3
S-Axis 6-3
SECOND HOME POS 7-3
Second home position 8-15
SECURITY 7-3
Security mode 7-1
Security system 7-1
SELECT JOB 7-2
Selecting the User Coordinate File 8-126

Self-Diagnosis 13-4
SENSOR INPUT 14-52
SERVO MONITOR 7-3
SERVO OFF FACTOR 7-2
SERVO ON 5-3, 14-38
SERVO ON FACTOR 7-2
SERVO ON READY 5-3
Servo-ON Enable Input 14-26
SET SPEED 7-4
SET WORD 7-4
Setting Contents 8-141
Setting the Controller Clock 8-146
Setting the learning function 8-145
Setting the Play Speed 8-147
Setting the Tool Load Information 8-27
Setting Work Home Position 8-66
SETUP 7-4
SHCKRST instruction 8-104
SHCKSET 8-97
SHCKSET instruction 8-103
S-head payload 8-52
SHIFT VALUE 7-3
Shock Detection Function 8-96
Shock Detection Function Setting 8-96
SHOCK SEN LV.(CURRENT) 7-3
SHOCK SENS LEVEL 7-3
Short-cut Function 13-4
Small-capacity 1-7, 3-1, 13-6, 13-11, 14-8, 14-11, 14-68
Soft Limit on Each Axis 8-139
Soft Limit Release Function 8-137
SOFTLIMIT SETTING 7-3
software limit 8-137
Special Training 1-2
Specification List 13-3
Speed Adjustment 13-4
Speed Setting 13-5
SPOT POWER SOURCE COND. 7-5
SPOT WELDING 7-5
SPOT WELDING (MOTOR GUN) 7-5
Standard Instruction Set 8-141
Station Axis Setting 12-28
STEP DIAGNOSIS 7-5
STICK DETECTION 14-65
STRING 7-2
Subset Instruction Set 8-141
SV POWER STATUS 7-2
Switch of the tool file 8-64
System backup 9-1
SYSTEM INFO 7-3
SYSTEM INPUT 7-2
SYSTEM OUTPUT 7-2

T

T.C.P. Calibration 13-4
T-Axis 6-3
TEACHING COND 7-4
Teaching the User Coordinates 8-126
TERMINAL 7-2
Test of program operation 6-1
three-phase noise filter 4-6

Three-Phase Power Supply 4-4
TIMER COOLING WATER ERROR..... 14-64
Timer delay 8-303
TIMER DELAY SET 7-4
Timer Setting..... 13-4
TIP INSTALLATION 7-5
TIP REPLACE COMPLETION 14-65
TIP REPLACE REQUEST 14-67
TOOL 7-3
Tool Calibration 8-29
Tool Data Setting 8-23
Tool File..... 8-23
Tool Load Information 8-56
Tool Load Information Registering 8-62
Tool Load Information Setting 8-55, 8-102
Tool Shock Sensor Releasing 8-135
Torque average value 8-203
TOUCH OPE. SETTING..... 7-5
Touch panel invalidate function 11-5, 11-7
Transferring the MOTOMAN 1-14
TRANSTHERMO ERROR 14-65
Tuning OFF the power supply 5-9
Turning OFF the Main Power 5-9
Turning OFF the Servo Power..... 5-9
Turning ON and OFF the Power Supply 5-1
Turning ON the Main Power Supply..... 5-1
Turning ON the Servo Power 5-3

U

U-arm payload..... 8-53
U-Axis..... 6-3
Upgrade function 10-1
User Alarm Display 13-4
USER COORDINATE 7-3
User Coordinate 8-70, 8-124
User Coordinate Files..... 8-125
User Coordinate Setting 8-124, 8-126
USER DIFFINITION MENU 7-3
User I/O cable connection..... 4-18
User ID 7-7, 7-9
user ID..... 7-4

V

VARIABLE 7-2
Variable 13-5
Variable Type 13-5
VERIFY 7-3
VERSION..... 7-3

W

WAGO connector..... 14-41
WEAVING..... 7-5

WEAVING PROHIBITED 14-46
WELD COMPLETION 14-65
WELD CONDITION 14-66
WELD DIAGNOSIS 7-5
WELD ERROR RESET 14-66
WELD ON/OFF 14-66
WELDING COMMAND 14-66
WELDING ERROR 14-65
WELDING ON/OFF (from sequencer) 14-64
WELDING PAUSE (from sequencer) 14-64
WIRE SHORTAGE (MONITOR) 14-47
WIRE STICKING (MONITOR) 14-47
WORK COMMAND 14-59
WORK HOME POS 7-3
Work Home Position 8-66
work home position cube length of its sides 8-68
WORK PROHIBITED (arc generation prohibited) 14-46
WORK RESPONSE (pseudo arc ON response) 14-46
WRONG DATA LOG 7-4

X

XX 8-124
XY 8-124

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