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

MOTOMAN INSTRUCTIONS
(FOR SMALL-SIZED MANIPULATORS)

MOTOMAN-□□□ INSTRUCTIONS
FS100 INSTRUCTIONS
FS100 OPERATOR’S MANUAL
FS100 MAINTENANCE MANUAL

FS100 INSTRUCTIONS SUPPLEMENTARY FOR BMDA3
FS100 OPERATOR’S MANUAL SUPPLEMENTARY FOR BMDA3
FS100 MAINTENANCE MANUAL SUPPLEMENTARY FOR BMDA3

The FS100 OPERATOR’S MANUAL above is applicable to both FS100 and FS100L controllers.

Part Number: 170531-1CD
Revision: 1
MANDATORY

- This manual explains maintenance procedures of the FS100 system. Read this manual carefully and be sure to understand its contents before handling the FS100.
- General items related to safety are listed in Chapter 1: Safety of the FS100 INSTRUCTIONS. To ensure correct and safe operation, carefully read the FS100 Instructions before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
This manual is a supplementary maintenance manual for the FS100 controller. This supplementary manual describes the differences from the FS100 Maintenance manual. Read this supplementary manual thoroughly together with the FS100 Maintenance manual (159645-1CD).

MANDATORY

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

You should have the four manuals listed below:

– MOTOMAN-□□□ INSTRUCTIONS
– FS100 INSTRUCTIONS
– FS100 OPERATOR’S MANUAL
– FS100 MAINTENANCE MANUAL

– FS100 INSTRUCTIONS SUPPLEMENTARY FOR BMDA3
– FS100 OPERATOR’S MANUAL SUPPLEMENTARY FOR BMDA3
– FS100 MAINTENANCE MANUAL SUPPLEMENTARY FOR BMDA3

Confirm that you have all these manuals on hand.

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

The relevant telephone numbers are listed on the back cover.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the FS100.

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

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

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

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

![MANDATORY]
Always be sure to follow explicitly the items listed under this heading.

![PROHIBITED]
Must never be performed.

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

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

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

WARNING

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

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

Figure 1: Emergency Stop Button

• In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button. Connect the external emergency stop button to the 5-6 pin and 16-17 pin of the robot system signal connector (CN2).

• Upon shipment of the FS100, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

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

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

Injury may result from unintentional or unexpected manipulator motion.

Figure 2: Release of Emergency Stop Button

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

Improper or unintended manipulator operation may result in injury.
The MOTOMAN is the YASKAWA industrial robot product. The MOTOMAN usually consists of the manipulator, the FS100 controller, manipulator cables, the FS100 programming pendant (optional), and the FS100 programming pendant dummy connector (optional). In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS100 controller</td>
<td>FS100</td>
</tr>
<tr>
<td>FS100 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator Cable</td>
</tr>
<tr>
<td>FS100 programming pendant dummy connector</td>
<td>Programming pendant dummy connector</td>
</tr>
</tbody>
</table>
Descriptions of the programming pendant keys, buttons, and displays are shown as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td>Character Keys: The keys which have characters printed on them are denoted with [ ].</td>
</tr>
<tr>
<td></td>
<td>Symbol Keys: The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture.</td>
</tr>
<tr>
<td></td>
<td>Mode Key: Three kinds of modes that can be selected by the mode key are denoted as follows:</td>
</tr>
<tr>
<td></td>
<td>Button: Three buttons on the upper side of the programming pendant are denoted as follows:</td>
</tr>
<tr>
<td></td>
<td>Displays: The menu displayed in the programming pendant is denoted with { }.</td>
</tr>
<tr>
<td>PC Keyboard</td>
<td>The name of the key is denoted ex. Ctrl key on the keyboard</td>
</tr>
</tbody>
</table>

### Description of the Operation Procedure

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

**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.

*Figure 3: Warning Labels*

**WARNING**

- Moving parts may cause injury

**WARNING**

- Do not enter robot work area.

*Figure 4: Location of Warning Labels*

**WARNING Label A:**

**WARNING Label B:**

- The following warning labels are attached to FS100. Observe the precautions on the warning labels. Failure to observe this warning may result in injury or damage to equipment.

*Figure 4: Location of Warning Labels*

**WARNING**

- Electric Shock Warning NP

**WARNING**

- Heavy Object Warning NP
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1 Equipment Configuration

1.1 Arrangement of Units and Circuit Boards

Fig. 1-1: Arrangement of Units and Circuit Boards

- Mounting base unit: CSTR-MBB08AAA
- PWM amplifier module: CSTR-SDB *** AAA
- Major axes control circuit board: CSTR-IFBM3LA
- I/O relay circuit board: CSTR-FFBCA8R03AA
- User I/O circuit board:
  - for Japan and North America: JAPMC-IO2308R-E (abbreviated as LIO-08R)
  - for Europe: JAPMC-IO2309R-E (abbreviated as LIO-09R)
- Machine safety circuit board: JAPMC-SF2300R-E (abbreviated as SF2300R)
- DC Power Supply(1): SBVS-09024
- DC Power Supply(2): SBVS-48024
- Power relay circuit board: JEPMC-PSD3007R-E
- Control circuit board: JEPMC-CP3201R-E (abbreviated as CPU-201R)
- Gripper controller(1)(2): LECP6P-LEHF20K2-48
- I/O terminal block: AB00XB-16U
- I/O relay circuit board: G7SA-3A1B
- Applicable controller:
  - (R1) for Europe: JAPMC-IO2309R-E (abbreviated as LIO-09R)
  - (R2) for Japan and North America: JAPMC-IO2308R-E (abbreviated as LIO-08R)
  - (R3)
1.2 Power Flow (R1)
1.3 Signal Flow (R2)

- (Mounting base board)
- (Main circuit board)
- (Encoder signal)
- (Overtravel signal)
- (Feedback signal)
- (Control signal)
- (Control power supply) (Main circuit)
- (Control power supply) (Servo control)
- (Break power supply)
- (FBB control)
- (External axis PG signal)
- (External IO)
- (Break release)
- (Relay IO)
- (Control power supply)
- (External axis PG signal)
- (Encoder signal)
- (Guard power supply)
- (Control power supply)
- (FBB control)
- (Encoder signal)
- (Manipulator IO)
- (Ethernet (to PP))
- (PP emergency stop DSW signal)
- (MANIPULATOR POWER)
- (RELAY)
- (MC1)
- (CONVERTER)
- (CV1)
- (CONVERTER (CSTR-CONVER))
- (CN102)
- (AMPS)
- (CN101)
- (CN51)
- (CN3)
- (CN206)
- (CN200)
- (CN201)
- (CN209)
- (CN203)
- (CN204)
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- (CN301)
- (CN309)
- (CN305)
- (CN306)
- (CN307)
- (CN304)
- (CN55)
- (CN56)
- (Mechatronix II)
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1.4 System Flow (R3)
2 Security System

2.1 Protection Through Security Mode Settings

The FS100 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.

2.1.1 Security Mode

There are three security modes. Editing mode and management mode require a user ID. The user ID consists of numbers and letters, and contains no less than 4 and no more than 8 characters. (Significant numbers and signs: "0 to 9", ",", ".", ".".

Security Mode | Explanation
--- | ---
Operation Mode | This mode allows basic operation of the robot (stopping, starting, etc.) for people operating the robot 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.

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

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOB</td>
<td>JOB</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SELECT JOB</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>CREATE NEW JOB</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>MASTER JOB</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>JOB CAPACITY</td>
<td>Operation</td>
</tr>
<tr>
<td>CYCLE</td>
<td></td>
<td>Operation</td>
</tr>
</tbody>
</table>
## 2.1 Protection Through Security Mode Settings

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

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>VARIABLE</td>
<td>VARIABLE BYTE</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>INTEGER</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>DOUBLE</td>
<td>Operation Edit</td>
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<tr>
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<td>REAL</td>
<td>Operation Edit</td>
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<tr>
<td></td>
<td>STRING</td>
<td>Operation Edit</td>
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<td></td>
<td>POSITION (ROBOT)</td>
<td>Operation Edit</td>
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<tr>
<td></td>
<td>POSITION (BASE)</td>
<td>Operation Edit</td>
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<td></td>
<td>POSITION (ST)</td>
<td>Operation Edit</td>
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<td>LOCAL VARIABLE</td>
<td>Operation</td>
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<td>IN/OUT</td>
<td>EXTERNAL INPUT</td>
<td>Operation Edit</td>
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<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>UNIVERSAL INPUT</td>
<td>Operation Operation</td>
</tr>
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<td>UNIVERSAL OUTPUT</td>
<td>Operation Operation</td>
</tr>
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<td>SPECIFIC INPUT</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SPECIFIC OUTPUT</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>RIN</td>
<td>Operation</td>
</tr>
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<td></td>
<td>CPRIN</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>REGISTER</td>
<td>Operation Management</td>
</tr>
<tr>
<td></td>
<td>AUXILIARY RELAY</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>CONTROL INPUT</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>PSEUDO INPUT SIG</td>
<td>Operation Management</td>
</tr>
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<td></td>
<td>NETWORK INPUT</td>
<td>Operation</td>
</tr>
<tr>
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<td>NETWORK OUTPUT</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>ANALOG OUTPUT</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SV POWER STATUS</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>TERMINAL</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>LADDER PROGRAM</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>I/O ALARM</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>I/O MESSAGE</td>
<td>Management Management</td>
</tr>
</tbody>
</table>

1) Displayed in the teach mode only.
### Table 2-1: Menu & Security Mode  (Sheet 3 of 4)

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DISPLAY</strong></td>
<td><strong>EDIT</strong></td>
<td></td>
</tr>
<tr>
<td><strong>EDIT</strong></td>
<td><strong>EDIT</strong></td>
<td></td>
</tr>
<tr>
<td>ROBOT</td>
<td>CURRENT POSITION</td>
<td>Operation</td>
</tr>
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<td></td>
<td>COMMAND POSITION</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SERVO MONITOR</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>WORK HOME POS</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SECOND HOME POS</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>DROP AMOUNT</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>POWER ON/OFF POS</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>TOOL</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>INTERFERENCE</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>SHOCK SENS LEVEL</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>USER COORDINATE</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>HOME POSITION</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>MANIPULATOR TYPE</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>ANALOG MONITOR</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>OVERRUN&amp;S-SENSOR[1]</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>LIMIT RELEASE[1]</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>SHIFT VALUE</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>HAND VIBRATION CONTROL</td>
<td>Operation</td>
</tr>
<tr>
<td>SYSTEM INFO</td>
<td>VERSION</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>MONITORING TIME</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>ALARM HISTORY</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>I/O MSG HISTORY</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>NETWORK SERVICE</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>USER DEFINITION MENU</td>
<td>Operation</td>
</tr>
<tr>
<td>SECURITY</td>
<td>Operation</td>
<td>Operation</td>
</tr>
<tr>
<td>FD/CF</td>
<td>LOAD</td>
<td>Edit</td>
</tr>
<tr>
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<td>SAVE</td>
<td>Operation</td>
</tr>
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<td>VERIFY</td>
<td>Operation</td>
</tr>
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<td></td>
<td>DELETE</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>DEVICE</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>FOLDER</td>
<td>Edit</td>
</tr>
</tbody>
</table>

1) Displayed in the teach mode only.
## Table 2-1: Menu & Security Mode (Sheet 4 of 4)

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARAMETER</td>
<td>S1CxG</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S2C</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S3C</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S4C</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>A1P</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>A2P</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>RS</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S1E</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S2E</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S3E</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S4E</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S5E</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S6E</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>S7E</td>
<td>Management Management</td>
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<tr>
<td></td>
<td>S8E</td>
<td>Management Management</td>
</tr>
<tr>
<td>SETUP</td>
<td>TEACHING COND.</td>
<td>Edit Edit</td>
</tr>
<tr>
<td></td>
<td>OPERATE COND.</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>OPERATE ENABLE</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>FUNCTION ENABLE</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>JOG COND.</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>PLAYBACK COND.</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>FUNCTION COND.</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>DISPLAYING COLOR COND.</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>DATE/TIME</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>GRP COMBINATION</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>RESERVE JOB NAME</td>
<td>Edit Edit</td>
</tr>
<tr>
<td></td>
<td>USER ID</td>
<td>Edit Edit</td>
</tr>
<tr>
<td></td>
<td>SET SPEED</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>KEY ALLOCATION</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>JOG KEY ALLOC.</td>
<td>Edit Management</td>
</tr>
<tr>
<td></td>
<td>RES. START (CNCT)</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>AUTO BACK SET</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>WRONG DATA LOG</td>
<td>Edit Management</td>
</tr>
<tr>
<td></td>
<td>ENERGY SAVING FUNCTION</td>
<td>Edit Management</td>
</tr>
<tr>
<td></td>
<td>ENCODER MAINTENANE</td>
<td>Edit Management</td>
</tr>
<tr>
<td>DISPLAY SETUP</td>
<td>CHANGE FONT</td>
<td>Operation Operation</td>
</tr>
<tr>
<td></td>
<td>CHANGE BUTTON</td>
<td>Operation Operation</td>
</tr>
<tr>
<td></td>
<td>INITIALIZE LAYOUT</td>
<td>Operation Operation</td>
</tr>
<tr>
<td></td>
<td>CHANGE WINDOW PATTERN</td>
<td>Operation Operation</td>
</tr>
<tr>
<td>GENERAL</td>
<td>GENERAL DIAG.</td>
<td>Operation Edit</td>
</tr>
</tbody>
</table>
2.1.1.1 Changing the Security Mode

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

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

3. Press [SELECT] and select "SECURITY MODE".
4. Input the user ID.
   – The user ID input window appears.

   ![User ID Input Window]

   At the factory, the following below user ID number is preset.
   • Editing Mode:[00000000]
   Management Mode:[99999999]

5. Press [ENTER].
   – The input user ID is compared with the user ID of the selected security mode. When the correct user ID is entered, the security mode is changed.
**2.1.2 User ID**

User ID is requested when Editing Mode or Management Mode is operated.

User ID must be between 4 characters and 8, and they must be numbers and symbols. ("0 to 9","-" and ".")

**2.1.2.1 Changing a User ID**

In order to change the user ID, the FS100 must be in Editing Mode or Management 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.
2-8

3. Select the desired ID.
   – The character input line appears, and the message "Input current ID no. (4 to 8 digits)" is shown.

4. Input 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 to 8 digits)" appears.

5. Input new ID and press [ENTER].
   – User ID is changed.
3 Maintenance and Inspections

Operator’s manual for daily inspection and parts replacement are explained in this section. Be sure to read and understand this instruction before operating the FS100.

To ensure correct and safe operation, carefully read the FS100 INSTRUCTIONS SUPPLEMENTARY FOR BMDA3 (170530-1CD).

3.1 Daily Inspections

CAUTION

- Maintenance and inspections should be carried out by the qualified worker.

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

CAUTION

- Do not touch the cooling fan or other equipment while the power is turned ON.

Failure to observe this caution may result in electric shock or injury.
### 3.1 Daily Inspections

Carry out the following inspections.

<table>
<thead>
<tr>
<th>Inspection Equipment</th>
<th>Inspection Item</th>
<th>Method</th>
<th>Inspection Interval</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS100 Controller exterior</td>
<td>Check for damages and cracks</td>
<td>Check visually</td>
<td>As required</td>
<td>Check for damages and loose connectors</td>
</tr>
<tr>
<td>Power supply cable</td>
<td>Check for damages or connections</td>
<td>Check visually</td>
<td>As required</td>
<td>Check for damages and loose connectors</td>
</tr>
<tr>
<td>Manipulator cable (between the FS100 and the manipulator)</td>
<td>Check for damages or connections</td>
<td>Check visually</td>
<td>As required</td>
<td>Check for damages and loose connectors</td>
</tr>
<tr>
<td>Cover mounting screws</td>
<td>Check for defect or loose of the screws</td>
<td>Use screw driver</td>
<td>As required</td>
<td>Tighten loose screws</td>
</tr>
<tr>
<td>Cooling fan</td>
<td>Check the operation</td>
<td>Check visually</td>
<td>As required</td>
<td>When the power is turned ON</td>
</tr>
<tr>
<td>Emergency stop button 1) (programming pendant)</td>
<td>Check the operation</td>
<td>By activating the button</td>
<td>Before the manipulator operation</td>
<td>When the SERVO is turned ON</td>
</tr>
<tr>
<td>Enable switch (programming pendant)</td>
<td>Check the operation</td>
<td>By activating the switch</td>
<td>Before the manipulator operation</td>
<td>During the teach mode</td>
</tr>
<tr>
<td>Battery (for the system)</td>
<td>Message indication</td>
<td>Check visually</td>
<td>As required</td>
<td>Before blocking the power supply</td>
</tr>
</tbody>
</table>

1. Be sure to confirm that the SERVO can be turned OFF by pressing the external emergency button when the programming pendant is not used.
The external emergency button is prepared by the user.
3.2 Cooling Fan Inspections

Inspect the cooling fans as required. A defective fan can cause the FS100 to malfunction because of excessive high temperatures inside.

The interior circulation fan and cooling fan normally operate while the power is turned ON. Check if the fans are operating correctly by visual inspection and by feeling air moving into the air inlet and from the outlet.
3.2 Cooling Fan Inspections

Air intake (Top View)

Cooling wind direction

Air intake (Backside View)

Cooling fan installing direction

Applicable controller: (R3)

Air intake

Air outlet (Top View)

Cooling wind direction
3.3 Emergency Stop Button Inspections

The emergency stop button is located on the programming pendant. Before operating the manipulator, confirm that the SERVO power is ON/OFF by pressing the emergency stop button after the SERVO is ON.

- Be sure to confirm that the SERVO can be turned OFF by pressing the external emergency button when the programming pendant is not used.
  The external emergency button is prepared by the user.

3.4 Enable Switch Inspections

The programming pendant is equipped with a three-position enable switch. Perform the following operations to confirm that the enable switch is firmly operated.

1. Set the Mode key on the programming pendant to "TEACH".

   Mode key with a switch

2. Press [SERVO ON READY] on the programming pendant. Then [SERVO ON] lamp blinks.

3. When the enable switch is grasped lightly, the servo power is turned ON.
   When the enable switch is grasped firmly or released, the servo power is turned OFF.

   If the [SERVO ON] lamp does not blink in previous operation (2), check the following:
   - The emergency stop button on the programming pendant is pressed.
   - The emergency stop signal is externally input.

   If the [SERVO ON] lamp does not blink in previous operation (3), check the following:
   - If a major alarm is occurring.
3.5 Battery Inspections

The FS100 has a battery that backs up the important program files for user data in the CMOS memory. A battery alarm is indicated when a battery is weakened to be replaced. Also, a message "Memory battery weak" appears on the programming pendant display. Refer to section 5.3 “Battery Replacement” for the battery replacement.

When the programming pendant is not used, be sure to confirm, from the LED audit window on the FS100 front door, that the battery alarm LED of the CPU unit (CPU-201R) is not lit up. Also, the battery alarm status can be confirmed by “battery alarm” of a system input.
4 Preparation before Replacing Parts

**WARNING**

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

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

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.

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

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the manipulator’s operating range and that you are in a safe location before:
  - Turning ON the power for the FS100.
  - Moving the manipulator with the programming pendant.

Injury may result if anyone enters the manipulator’s operating range during operation. Always press an emergency stop button immediately if there are problems.

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

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

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the manipulator or a tool may collide with the programming pendant during manipulator movement, which may result in personal injury or equipment damage.

The following flowchart shows the operations for replacing parts.

This chapter describes how to create a check program as a preparation for replacing parts. The check program is a program to check the position deviation. If positions are deviated, home position calibration is required. For the calibration, this program data is used to correct the home position data. In the following cases particularly, the home position calibration using the check program is needed. Be sure to create a check program referring to section 4.1 “Creating a Check Program”.

- Change in the combination of the manipulator and FS100
- Replacement of the motor or absolute encoder
- Clearing stored memory (by replacement of main CPU board, weak battery, etc.)
- Home position deviation caused by hitting the manipulator against a workpiece, etc.
4.1 Creating a Check Program

To check position deviation whenever necessary, create a program in which a check point is taught (the job for the check point). In the job for the check point, teach two points; one as a check point and the other as the point to approach the check point. This program checks for any deviation between the tool tip position and the check point.

Fig. 4-1: <Enlarged View>
5.1 Fuse Replacement

Following fuses\(^1\) are mounted in the FS100.

<table>
<thead>
<tr>
<th>Fuse name</th>
<th>Where to mount</th>
<th>Type</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O power supply fuse</td>
<td>Front side of the FS100</td>
<td>0312.600, 250V, 0.6A, 6.3 dia. x 32 mm, fast-blow type</td>
<td>Littelfuse Ltd.</td>
</tr>
</tbody>
</table>

\(^1\) A fuse is delivered with the FS100 before shipment for replacement.
If the fuse seems to be blown, check its conduction. If it is blown, replace it with the same type of fuse (supplied).

**NOTE**

If the fuse seems to be blown, be sure to investigate its cause, or blown again after the replacement.
5.2 Interior Circulation Fan Replacement

Only interior cooling fan EV2, EV3, EV11 and EV12 can be replaced.

**NOTE**

Turn OFF the power before replacing the fan.

- **Replacement Procedures**
  1. Disconnect plug codes connected to the fan.
     (Remove the ground wirings screwed to the fan, too)
  2. Remove the screws (3 places) fixing the fan and the fan guard.
  3. Uninstall the fan from the FS100.
  4. Install the new fan to the FS100.
     (When installing the fan, be careful to its installing direction so that the air is drawn inside the FS100.)
  5. Tighten the screws (3 places) to fix the fan and the fan guard.
  6. Connect all the disconnected plug codes and the ground wirings.
     (Connect the plug code securely so that there is no space between the plug code and the fan. Also, connect the ground wirings firmly.)

**Interior Circulation Fan for Replacement**

- **Cooling fan (EV3)**
- **Cooling fan (EV2)**
- **Applicable controller:**
  - (R1) (R2)
  - (R3)

- **Cooling fan (EV12)**
- **Cooling fan (EV11)**

**Applicable controller:**

- **(R3)**
The battery must be replaced as soon as the battery alarm occurred. Please be sure to replace it within 1 hour after the power is turned OFF.

(When the programming pendant is used, a message to ask battery replacement appears on its window. Also, the timing can be confirmed by the lighting-up of the battery alarm LED on the CPU unit (CPU-201R) or the battery alarm of the specified output.)

**WARNING**

- To perform this operation, it is required to open the top plate of the FS100 while the power is turned ON.

Do NOT open the plate to perform the operation within five minutes after turning OFF the FS100 power supply and primary power source.

- Do NOT touch units or terminal parts within five minutes after turning OFF the FS100 power supply.

Failure to observe this warning may result in electric shocks.

- Close the top plate as soon as the maintenance work such as the inspection or maintenance, etc. is completed.

Failure to observe this warning may result in electric shocks.

**CAUTION**

- To prevent anyone inadvertently turning ON the power supply during maintenance operation, put up a warning sign such as “DO NOT TURN ON THE POWER” at the primary power supply (knife switch, wiring circuit breaker, etc.)

Failure to observe this warning may result in electric shocks or injury.
Replacement Procedure

1. Uninstall the top plate and loosen the strap which is fixing the battery.

2. Disconnect the connector from the battery extension lead wire and remove the battery.

3. Connect the new battery to the battery extension lead wire.
4. Fix the battery with the strap. Fasten the strap till the third hole of it. When fixing the battery, put the black lead wire toward inner side of the FS100.
5.3 Battery Replacement

Although the CMOS memory is backed up by super capacitor, the battery must be replaced as soon as the message "Memory battery weak" appears.

The job data and other data may be lost if the message "Memory battery weak" appears and the breaker is turned OFF for more than 1 hours.

Fix the battery lead wire to the inner side of the controller.
The battery might fall off due to the vibration, etc., if the lead wire is fixed parallel to the controller.

Wrong example
Do not fix the battery lead parallel to the inner side of the controller.
5.4 Method of Removing Controllers

**CAUTION**

- To prevent anyone inadvertently turning ON the power supply during maintenance operation, put up a warning sign such as “DO NOT TURN ON THE POWER” at the primary power supply (knife switch, wiring circuit breaker, etc.).

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

1. Disconnect the primary power cable.
2. Remove the front cover (1 place) and the shaft covers (4 places).
   - To remove the front cover, turn the “cover lock A and B” which fix the front cover to unlock them. The cover is supported by the “metal fitting A, B, C and D”, so move the cover up to remove it.
   - To remove the shaft covers, remove the shaft cover screws which fix the shaft cover A, B, C and D.
3. Remove the switch base. Remove the connector (CN1), loosen the fixing screws (4 places) which fix the switch base and move it up to remove the switch base. Put the switch base on the stable and flat place.

4. Disconnect the cables connected to the controller to be removed. Check both the front side and the back side.

5. Loosen 4 fixing screws (fixing screws A, B or C) which are at the upper 4 corners of the controller to be removed. Then remove the guides (L shaped acrylic boards), turn the fixing screws completely and remove them.
5.4 Method of Removing Controllers

6. Slide the controller backward to remove it.
   The uppermost controller can be also removed by sliding it upward.

7. For the installation of controllers, perform the reverse procedure.
# Recommended Spare Parts

## 6.1 List of Accessories

Accessories of FS100 are as follows.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty.</th>
<th>Qty. per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply connector</td>
<td>CE05-6A18-10SD-D-BSS</td>
<td>DDK</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Waterproof cable clamp</td>
<td>CE3057-10A-1-D</td>
<td>DDK</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>I/O power supply protection fuse</td>
<td>0312.600MXP</td>
<td>Littel</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Wiring tool kit for WAGO connector</td>
<td>734-230</td>
<td>WAGO</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

![Accessories](image)
6.2 Recommended Spare Parts

The spare parts are ranked as follows.

**CAUTION**

- It is recommended to use the parts and components in the following table as spare parts for the FS100.

Product performance cannot be guaranteed when using spare parts from any company other than Yaskawa.

- Rank A: Expendable and frequently replaced parts.
- Rank B: Parts for which replacement may be necessary as a result of frequent operation.
- Rank C: Drive unit.

<p>| Table 6-1: Spare Parts for the FS100 |
|--------------------------|----------------|-----------------|-----------|</p>
<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty.</th>
<th>Qty. per unit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Battery</td>
<td>BR-1/2AA 3.0V</td>
<td>Panasonic</td>
<td>1</td>
<td>1</td>
<td>When the battery alarm occurred</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>I/O power supply protection fuse</td>
<td>0312.600MXP</td>
<td>Littel</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>Cooling fan (EV2, EV3) (EV11,EV12)</td>
<td>3610PS-23T-B30-A00 or 09225PB-B3L-EA-01</td>
<td>MINEBEA</td>
<td>2</td>
<td>6</td>
<td>After 6 years or 36000h, whichever is earlier.</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>DC power supply (PS1)(PS2)</td>
<td>S8VS-48024 S8VS-09024</td>
<td>OMRON</td>
<td>1</td>
<td>1 for each</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>Safety relay</td>
<td>G7SA-3A1B</td>
<td>OMRON</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>Gripper controller</td>
<td>LECP6P-LEHF20K2-48</td>
<td>SMC</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
7 Operations After Replacing Parts

WARNING

- Before operating the manipulator, check that servo power is turned OFF when the emergency stop button on the programming pendant is pressed.

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

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.

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

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the manipulator’s operating range and that you are in a safe location before:
  - Turning ON the power for the FS100.
  - Moving the manipulator with the programming pendant.

Injury may result if anyone enters the working envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems. The emergency stop buttons are located on the right of the programming pendant and on the front right of the controller.
CAUTION

• Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  – Check for problems in manipulator movement.
  – Check for damage to the insulation and sheathing of external wires.
• Return the programming pendant to a safe place after use.

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the manipulator or a tool may collide with the programming pendant during manipulator movement, which may result in personal injury or equipment damage.
7.1 Home Position Calibration

7.1.1 Home Position Calibration

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

- Change in the combination of the manipulator and FS100
- Replacement of the motor or absolute encoder
- Clearing stored memory (by replacement of main CPU 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 mark for the home position 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
- Axes can be moved individually

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

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- All the axes can be moved at the same time
- Axes can be moved individually

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

Home Position

The home position is the position with the pulse value "0" for each axis. See section 7.1.3 “Manipulator Home Position”.
7.1.2 Calibrating Operation

7.1.2.1 Registering All Axes at One Time

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

3. Select {DISPLAY} under the menu,
   or select "PAGE" to display the selection window for the control group,
   or press page key .
   – The pull-down menu appears.
7. Operations After Replacing Parts

7.1 Home Position Calibration

4. Select the desired control group.

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

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

7. Select “YES”.
   – Displayed position data of all axes are registered as home position. When “NO” is selected, the registration will be canceled.
7.1.2.2 Registering Individual Axes

1. Select (ROBOT) under the main menu.
2. Select (HOME POSITION).
3. Select the desired control group.
   - Perform steps 3 and 4 which have been described in section 7.1.2.1 “Registering All Axes at One Time” to select the desired control group.
4. Select the axis to be registered.

   – The confirmation dialog box appears.

5. Select “YES”.
   – Displayed position data of the axis are registered as home position. When “NO” is selected, the registration will be canceled.
7.1.2.3 Changing the Absolute Data

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

1. Select {ROBOT} under the main menu.
2. Select {HOME POSITION}.
3. Select the desired control group.
   - Perform steps 3 and 4 which have been described in section 7.1.2.1 “Registering All Axes at One Time” to select the desired control group
4. Select the absolute data to be registered.
   - The number can now be entered.
5. Enter the absolute data using the numeric keys.
6. Press [ENTER].
   - Absolute data are modified.
7.1.2.4 Clearing Absolute Data

1. Select {ROBOT} under the main menu.

2. Select {HOME POSITION}.
   - Perform steps 2, 3, and 4 which have been described in section 7.1.2.1 “Registering All Axes at One Time” to display the HOME POSITIONING window and select the desired control group.

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

4. Select {CLEAR ALL DATA}.
   - The confirmation dialog box appears.
5. Select "YES".

- The all absolute data are cleared. When "NO" is selected, the operation will be canceled.
7.1.3 Manipulator Home Position

With the BMDA3, the home position is as follows.

![Top View](image)

![Side View](image)

![Front View](image)

**NOTE**

Other manipulator models have different positions. Always consult the documentation for the correct manipulator model.
7.2 Position Deviation Check Using the Check Program

Use the check program to check if positions are deviated with the following procedure.

1. Call up the check program in which the check point is taught (the job for) and operate the manipulator at low speed.

2. Check the tool tip position.
   
   - If it points the check point exactly as shown in the following figure, there is no deviation from the positions. Proceed to section 7.4 “Setting the Second Home Position (Check Point)”. 
   
   - If not, there is a deviation. When the motor or encoder, etc. was replaced, move the corresponding axis only, when the stored memory was cleared or the manipulator was hit against a workpiece, move all axes, to the check point by joint motion. Then, proceed to section 7.3.3 “Home Position Data Correction”.

![Image of check program and manipulator]
7.3 Checking of the Check Program

7.3.1 Motion of the Check Program

Call up the check program in which the check point is taught (the job for avoiding the position deviation) and operate the manipulator at low speed.

7.3.2 Checking of the Check Program

Check the deviation in to the check point. If the tool tip position is deviated, there is a deviation.

When the motor or encoder, etc. was replaced, move the corresponding axis only, when the stored memory was cleared or the manipulator was hit against a workpiece, move all axes, to the check point by joint motion.
7.3.3 **Home Position Data Correction**

When there is a deviation from the positions, correct the home position data with the following procedure.

1. Check the values of the following pulses.
   - If there is no deviation, the following two values coincide. Then, proceed to section 7.4 “Setting the Second Home Position (Check Point)”.
   - If there is a deviation, execute the following procedures to correct it.
     1. Command position pulse of the check point which was taught in advance
        Displaying the Command Position Pulse
        I) Select {ROBOT} under the main menu.
        II) Select {COMMAND POSITION}.
     2. Current position pulse where the manipulator (tool tip) was moved to the check point after performing the check program
        Displaying the Current Position Pulse
        I) Select {ROBOT} under the main menu.
        II) Select {CURRENT POSITION}.

2. Calculate the difference between the command position pulse and the current position pulse.
   
   The difference pulse = Command position pulse – Current position pulse

3. On the HOME POSITIONING window, add the difference pulse value to the absolute data of the axis whose motor or encoder, etc. was replaced.

4. Modify the home position data by following the procedures described in section 7.1.2.3 “Changing the Absolute Data” in section 7.1.2 “Calibrating Operation”.

5. Confirm that the command position pulse and the current position pulse coincide.
   - The home position data have been corrected.
   - Proceed to section 7.4 “Setting the Second Home Position (Check Point)”.


7.4 Setting the Second Home Position (Check Point)

**WARNING**

- Be aware of safety hazards when performing the position confirmation of the second home position (check point). Abnormality of the PG system may be a cause for alarm. The manipulator may operate in an unexpected manner, and there is a risk of damage to equipment or injury to personnel.

- Before operating the manipulator, check that the SERVO ON lamp goes out when the emergency stop button on the programming pendant is pressed. Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.

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

Improper or unintended manipulator operation may result in injury.

- Prior to performing the following operations, be sure that no one is in the manipulator's operating range, and be sure that you are in a safe place when:
  - Turning ON the FS100 power.
  - Moving the manipulator with the programming pendant.

Injury may result from contact with the manipulator if persons enter the manipulator's operating range. Always press the emergency stop button immediately if there are problems. The emergency stop buttons are located on the right of the programming pendant and on the front right of the controller.
CAUTION

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

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the manipulator or a tool may collide with the programming pendant during manipulator movement, which may result in personal injury or equipment damage.
7.4 Setting the Second Home Position (Check Point)

7.4.1 Purpose of Position Check Operation

If the absolute number of rotation detected at power supply ON does not match the data stored in the absolute encoder the last time the power supply was turned OFF, an alarm is issued when the FS100 power is turned ON.

There are two possible causes of this alarm:

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

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

1. Position Check

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

2. Pulse Difference Check

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

- The allowable range pulse is the number of pulses per rotation of the
7 Operations After Replacing Parts

7.4 Setting the Second Home Position (Check Point)

- The initial value of the second home position is the home position (where all axes are at pulse 0). The second home position can be changed. For details, refer to section 7.4.2 "Procedure for the Second Home Position Setting (Check Point)"

3. Alarm Occurrence

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

- Home position calibration of all the axes at the same time enables playback operations without having to check the position.

- Sometimes in a system with a manipulator that has 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 starting, the manipulator moves at low speed (1/10 of the maximum speed) to the step indicated by the cursor.

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

  Starting the manipulator again then moves it at the programmed speed and cycle of the job.
7.4.2 Procedure for the Second Home Position Setting (Check Point)

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

If two or more manipulators or stations are controlled by one FS100, the second home position must be set for each manipulator or station.

1. Select (ROBOT) under the main menu.
2. Select (SECOND HOME POS).
   - The SECOND HOME POS window appears.

   The message "Available to move to and modify specified point" is shown.

3. Press the page key , or select "PAGE" to display the selection window for the control group.
   - The group axes by which the second home position is set is selected when there are two or more group axes.

4. Press the axis keys.
   - Move the manipulator to the new second home position.
5. Press [MODIFY] and [ENTER].
   - The second home position is changed.
7.4.3 Procedure after the Alarm

**WARNING**

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

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

If the "OUT OF RANGE (ABSO DATA)" alarm occurs, perform the followings

- Reset the alarm
- Turn Servo power ON

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

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

---

Refer to section 8.7 "Position Data When Power is Turned ON/OFF" of the FS100 MAINTENANCE MANUAL (159645-1CD) for details on the "POWER ON/OFF POS" window.

1. Select {ROBOT} under the main menu.
2. Select {SECOND HOME POS}.
   - The SECOND HOME POS window appears.
3. Press the page key \(<\) or select "PAGE" to display the selection window for the control group.
   - The group axes by which the second home position is set is selected when there are two or more group axes.

4. Press \([\text{FWD}]\).
   - TCP moves to the second home position. The robot moving speed is set as selected manual speed.

5. Select \{DATA\} under the menu.

6. Select \{CONFIRM POSITION\}.
   - The message "Home position checked" is shown.
     Pulse data of the second home position and current pulse data are compared. If the compared error is in allowed range, playback operation can be done.
     If the error is beyond the allowed range, the alarm occurs again.
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