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

MOTOMAN INSTRUCTIONS
- DX100 OR DX200 MANIPULATOR MANUAL
- DX100 OR DX200 OPERATOR’S MANUAL
- DX100 OR DX200 MAINTENANCE MANUAL
- FS100 MANIPULATOR MANUAL
- FS100 OPERATOR’S MANUAL
- FS100 MAINTENANCE MANUAL

The DX100, DX200, or FS100 operator’s manuals above correspond to specific usage. Be sure to use the appropriate manual.
MANDATORY

• This manual explains SPI Pendant Interface. Read this manual carefully and be sure to understand its contents before handling the controller.

• General items related to safety are listed in Section 1: Safety of the DX100, DX200 or FS100 CONTROLLER MANUAL. To ensure correct and safe operation, carefully read the DX100, DX200, or FS100 CONTROLLER MANUALS 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.

NOTE

This instruction manual is applicable to both FS100 (a controller for small-sized manipulators) and FS100L (a controller for large and medium-sized manipulators). The description of “FS100” refers to both “FS100” and “FS100L” in this manual unless otherwise specified.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before maintenance or inspection of the DX100, DX200, or FS100 Controller.

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”.
**DX100 or DX200:**

**WARNING**

- Before operating the manipulator, check that servo power is turned off when the emergency stop buttons on the front door of the controller and program pendant are pressed. When the servo power is turned off, the SERVO ON LED on the Program Pendant is turned off.

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

*Figure 1: Emergency Stop Button*

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

Injury may result from unintentional or unexpected manipulator motion.

*Figure 2: Release of Emergency Stop Button*

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

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning on the power for the Controller.
  - Moving the manipulator with the Programming Pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

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 button is located on the right of the front door of the DX100 or DX200 Controller and Program Pendant.
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 buttons do not function.

Figure 3: 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 prepare 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 4: Release of Emergency Stop

Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:

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

Improper or unintended manipulator operation may result in injury.
CAUTION

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

- Always return the Programming Pendant to the hook on the Controller Cabinet after use.

The Programming Pendant can be damaged if it is left in the P-point maximum envelope of the manipulator, on the floor, or near fixtures.

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

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.
SPI Pendant Interface

Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is a YASKAWA industrial robot product. The MOTOMAN usually consists of a Controller, Programming Pendant, and manipulator cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX100, DX200, or FS100 Controller</td>
<td>Controller</td>
</tr>
<tr>
<td>DX100, DX200 or 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</td>
</tr>
</tbody>
</table>
|                            | The keys which have characters printed on them are denoted with [ ].
|                            | ex. [ENTER]                                            |
|                            | Symbol Keys                                            |
|                            | The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture.
|                            | ex. page key                                           |
|                            | The cursor key is an exception, and a picture is not shown. |
|                            | Axis Keys                                              |
|                            | “Axis Keys” and “Numeric Keys” are generic names for the keys for axis operation and number input. |
|                            | Numeric Keys                                           |
|                            | Keys pressed simultaneously                            |
|                            | When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD] |
|                            | Displays                                               |
|                            | The menu displayed in the programming pendant is denoted with { }.
|                            | ex. {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 key is pressed, or the item is directly selected by touching the screen.
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1 Introduction

The SPI Pendant Interface allows for an interface between the Controller Teach Pendant, Injection Molding Machines, and unlimited Robots and Conveyors as long as they comply with the Society of the Plastic Industry (SPI) interfacing standards.

Though the SPI Pendant Interface was designed to work with various robots it will not work with a robot that has seven axes.

If the SPI Pendant Interface is not configured a 'Setup Wizard' program launches and walks through the configuration of available options and all major components.
1.1 About This Document

This manual provides a “first look” and overview of the complete Motoman SPI Pendant Interface system. You should read and understand this manual and all referenced documentation before using the Motoman SPI Pendant Interface. Although basic in content, this manual is for personnel who have received operator training from Motoman and is familiar with the operation of the SPI Pendant Interface program. For more detailed information on any specific component or peripheral of the SPI Pendant Interface program, please review the full documentation package included with your SPI Pendant Interface Software (refer to section 1.3 “Reference Documentation”) and all supporting documents for your system.

NOTE

This manual documents a standard Motoman system. If your system is custom or modified, please use this manual in conjunction with the drawings, schematics, and parts listing (Bill of Material) for your specific system. The drawings, schematics, and parts listing are included in the documentation package supplied with your Motoman system.

1.2 SPI Pendant Interface System Manual Breakdown

This system manual contains the following chapters:

- Chapter 1 Introduction
- Chapter 2 Setup Wizard - Configure Injection Molding Machine
- Chapter 3 Setup Wizard - Configure the Robot(s)
- Chapter 4 Setup Wizard - Configure Conveyor(s)
- Chapter 5 Setup Wizard - Configure Degating
- Chapter 6 Template Screen
- Chapter 7 Teach Screen
- Chapter 8 System Screen
- Chapter 9 Security Screen
- Chapter 10 Production Screens
- Chapter 11 Status Screens
- Appendix A - Robot Jobs and Variables
- Appendix B - Quick Start
1.3 Reference Documentation

For additional information on individual components of the SPI Pendant Interface Systems, refer to the following documentation that is included with your delivered system depending on your controller:

1.3.1 DX100 Controller

- Motoman DX100 MANIPULATOR or POSITIONER Manual
- Motoman D100 CONTROLLER Manual (P/N 165478-1CD)
- Motoman DX100 MAINTENANCE Manual (P/N 155492-1CD)
- Motoman DX100 Manual (P/N 162536-1CD)
- Motoman DX100 OPERATOR’S Manual
- Motoman DX100 CONCURRENT I/O Manual (P/N 155491-1CD)
- Motoman DX100 INDEPENDENT/COORDINATED CONTROL FUNCTION Manual (P/N 156431-1CD)
- Motoman DX100 INFORM USER’S Manual (P/N 155493-1CD)
- Vendor manuals for system components not manufactured by Motoman

1.3.2 DX200 Controller

- Motoman DX200 MANIPULATOR or POSITIONER Manual
- Motoman DX200 CONTROLLER Manual (P/N 165292-1CD)
- Motoman DX200 MAINTENANCE Manual (P/N 165293-1CD)
- Motoman DX200 OPERATOR’S Manual
- Motoman DX200 CONCURRENT I/O Manual (P/N 165294-1CD)
- Motoman DX200 INDEPENDENT/COORDINATED CONTROL FUNCTION Manual (P/N 165836-1CD)
- Motoman DX200 INFORM USER’S Manual (P/N 165301-1CD)
- Vendor manuals for system components not manufactured by Motoman

1.3.3 FS100 Controller

- Motoman FS100 MANIPULATOR or POSITIONER Manual
- Motoman FS100 CONTROLLER Manual (P/N 159550-1CD)
- Motoman FS100 MAINTENANCE Manual (P/N 159645-1CD)
- Motoman FS100 OPERATOR’S Manual
- Motoman FS100 CONCURRENT I/O Manual (P/N 164103-1CD)
- Motoman FS100 INDEPENDENT/COORDINATED CONTROL FUNCTION Manual (P/N 159647-1CD)
- Motoman FS100 INFORM USER’S Manual (P/N 159549-1CD)
- Vendor manuals for system components not manufactured by Motoman
1.4 Customer Support Information

If you need assistance with any aspect of your SPI Pendant Interface program, please contact Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact Motoman Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact Motoman Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please have the following information ready before you call:

- System: SPI Pendant Interface
- Robots
- Primary Application
- Controller: DX100, DX200, or FS100
- Software Version: Access this information on the Programming Pendant’s LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
- Robot Serial Number: Located on the robot data plate
- Robot Sales Order Number: Located on the Controller data plate
2 Setup Wizard - Configure Injection Molding Machine

This chapter will use the Setup Wizard software to interface the Injection Molding System(s) with the Teach Pendant.

2.1 Setup Wizard Screen

If the system has not been previously configured, upon startup a Setup Wizard will launch. The Setup Wizard will walk you through the available options and ensure that all the major components are available for use.

2.1.1 Setting Interface

**CAUTION**

- Do not stop using the “Setup Wizard” after starting to configure the system.
  - After starting to configure the system, using the “Setup Wizard” then stopping can cause parts of the system not to interface with other parts of the system.

Stopping the “Setup Wizard” once started can cause damage to equipment.

1. Press the [Configure IMM] button on the Setup Wizard screen on the Teach Pendant and observe the Injection Molding Machine Setup screen appears.

![Setup Wizard Screen Diagram]

On the Setup Wizard screen notice the [Configure IMM] button is the only button available.
2. Setup Wizard - Configure Injection Molding Machine

2.1 Setup Wizard Screen

2. Select the desired pre-configured interface using the pull down menu.
   • EuroMap 67 standard
   • EuroMap 12 standard

   **NOTE**
   In the Selected Interface pull down, a “Custom” interface is available if there are modifications to a pre-configured interface.

3. If the pre-configured Interface needs modified “Select the Inputs/Outputs point” that needs to be modified using the Teach Pendant keypad and press [Select], otherwise go to step 6
4. Enter the new I/O point desired on the numeric keypad and press [ENTER].

5. Press the [Save Custom Interface] button on the (Injection Molding Machine Setup) screen to save the I/O changes.

6. Press the [Back] button and observe the Setup Wizard main screen reappears and the [Configure IMM] is green indicating the Injection Molding Machine interface is setup. Also, notice the [Configure Robot(s)] button is available.

**NOTE**
Pressing the [Configure IMM] button will re-open the injection molding machine interface setup in the Setup Wizard.
3 Setup Wizard - Configure the Robot(s)

Before starting this chapter, complete chapter 2 “Setup Wizard - Configure Injection Molding Machine”.

After selecting the IMM interface you will be returned to the Main screen of the Setup Wizard. On this screen the [Configure Robot] button is now available for selection. Click the [Configure Robot] button.
3.1 Configuring Robot(s)

The default style for the Setup Wizard is a side mounted robot.

If the robot configuration is “Top” mounted, click the {Robot 1} item in the list. The “Robot Style” drop down becomes active then select the required configuration. To save the desired selection, click the [Update] button.

To add additional robots highlight and select the {Injection Molding Machine} entry in the list. The [Add Robot] button becomes active and clicking the [Add Robot] button adds another robot.

To remove a robot from the system, select the desired robot entry from the list. The [Remove Robot] button will become active. Clicking the [Remove Robot] button will present a confirmation dialog box. Confirming the deletion will remove the robot from the system.

Removing a robot from the system removes any external axes and grippers that are associated with the robot.

Once done with adding, deleting and setting the style of the robot configuration click the [Back] button to continue with the Wizard Setup software.
3.1 Configuring Robot(s)

3.1.1 Configuring External Axes

Configuring the external axes' allows the addition and removal of the external axes for the configured robot(s).

To Configure the external axes highlight and select the {Robot (*)} entry in the list. (The (*) indicates the robot number in the listing.) After selecting the robot from the listing the “External Axes” configuration screen appears.

Each axis is configurable as a base or station axis by selecting the appropriate entry from the “Style” drop down menu. After selecting the appropriate entry style, pressing the [Update] button saves the selected style.

After configuring the external axes return to the “Setup Wizard” by clicking the [Back] button and observe the Setup Wizard Gripper(s) screen displays.
3.1.2 Configuring Gripper(s)

**NOTE**

By default Wizard Setup application includes one gripper with one zone.

To add a gripper, highlight the robot the gripper is to be associated with and the [Add Gripper] button will become active.

To remove a gripper or add a zone, select the appropriate gripper in the list. The [Remove Gripper] and [Add Zone] buttons become enabled.
The “Gripper Editor” allows the configuration of a gripper ID. This feature protects the system from a potentially damaging collision with the mold by accidentally using the wrong gripper.

These inputs require a hardwired series of uniquely identified user inputs to a physical gripper. The reading of these inputs are in binary numbers. The end user determines the configurations of these inputs.

The gripper ID listed here is placed into variable I026 when the id check command is used in the job. The end user then assigns the actual id read from the gripper to I027 in the STARTUP job.

If the gripper id does not match the actual id the program will not run.
Each zone can be edited in the “Zone Editor” by selecting the appropriate zone name from the list. The zone “style” can be one of the following.

- **MAINTAINED** – A maintained gripper operates by energizing the “Grip” signal continuously to hold the part. To release the part, the “Grip” signal is turned off. The “Release” signal is not used.

- **PULSED** – The “Grip” and “Release” signals are pulsed using the robot pulse output. It is expected that the gripper handles any additional logic to ensure the holding and release of the part.

- **MAIN+BLOWOFF** – A main+blowoff gripper operates by energizing the “Grip” signal continuously to hold the part. To release the part, the “Grip” signal is turned off and the “Release” signal on and off are used to control the blow-off operation.

**PART PRESENT** - The part present setting is self-explanatory.

After updating the appropriate zone, press the [Update] button to save the changes.

Click the [Back] button and observe the “Setup Wizard” displays the main screen.
4  Setup Wizard - Configure Conveyor(s)

Before starting this chapter complete, chapter 3 “Setup Wizard - Configure the Robot(s)”.

The Setup Wizard main screen has both the [Configure IMM] and the [Configure Robot(s)] green indicating the injection molding machine and the robot(s) interface are setup. Also, notice the [Configure Conveyor(s)] button is available.

**NOTE**

Pressing the [Configure IMM] or [Configure Robot(s)] button will re-open the interface setup in the Setup Wizard.
4.1 Configuring Conveyor(s)

Click on the [Configure Conveyor(s)] button and observe the “Conveyor(s) Setup Wizard” screen appears.

**NOTE** The default the Setup Wizard has one conveyor.

4.1.1 Adding and Removing Conveyor(s)

Conveyors can be added to the system, as required. The conveyor(s) do not actually have to be a conveyor. A conveyor is a generic label for any destination point. For example, it can be a table or some other type of device that clears parts between drops.

Additional conveyors can be added by highlighting the “Injection Molding Machine” entry in the list. The [Add Conveyor] button becomes enabled.

To remove a conveyor, select the appropriate conveyor in the list. The [Remove Conveyor] button becomes enabled. When removing a conveyor confirmation message is displayed before removing.
4.1.2 Conveyor Detail Editor

Enabling the “Conveyor Detail Editor”, by selecting the appropriate conveyor in the list. The following attributes are modifiable:

- **Style** - There are three styles available for selection.
  - **CONTINUOUS** - Waits for the ‘Clear’ signal to be on before depositing parts.
  - **INDEXING** - Indexing gives you commands for turning the ‘Run’ signal ON and OFF. If a value is entered for the ‘Clear’ signal a command to wait for conveyor clear is also available.
  - **PULSED** - The ‘Run’ signal is pulsed to index the conveyor for the next drop off. The placement job delays the number of seconds entered in the ‘Run Time’ value before continuing.

- **Run Signal** - The signal that indexes the conveyor.
- **Clear Signal** - The signal that signifies the drop point is clear.
- **Run Time** - The amount of seconds to delay after using a pulsed index.

Click on the [Update] button to save these changes.

![Conveyor Detail Editor](image)

Click on the [Back] button and observe the “Setup Wizard” displays the main screen.
5  Setup Wizard - Configure Degating

Before starting this chapter complete, chapter 4 “Setup Wizard - Configure Conveyor(s)“.

The Setup Wizard main screen will have the [Configure IMM], [Configure Robot(s)] and [Configure Conveyor(s)] green indicating the injection molding machine, robot(s), and conveyor(s) interfaces setup. Also, notice the [Configure Degating] button is now available.
5.1 Configure Degating

The Degating configuration screen gives the ability to add and configure degating stations.

Click on the [Configure Degating] button and observe the “Degate Station(s) Setup Wizard” screen appears.

5.1.1 Adding and Removing Degating Stations

Additional degating stations can be added by highlighting the “Injection Molding Machine” entry in the list. The [Add Degate] button becomes enabled.

To remove a degating stations, select the appropriate degating station in the list. The [Remove Degate] button becomes enabled. When removing a removal degating confirmation message is received before removing.

5.1.2 Degating Station Editor

The “Cut Signal” designates the I/O output that actuates the cutting mechanism.

Press the [Update] button saves the “Cut Signal” setting.

Press the [Back] button after completing the configuration of the degating stations.

NOTE: After pressing the [Back] button a message indicating the configuration is complete. To make modifications to these items they can be accessed from the “System Menu” located on the dashboard.
6 Template Screen

The template screen gives the ability to create and manage job templates.

Job templates are a way to use a pre-defined sequence of job actions in the teaching process. The use of templates fast tracks the process of job creation as well as enabling a defined job structure.

The template screen is very similar to the teach screen with the exception of the ability to record positions and create robot jobs.

For information on the various functions refer to the Teach Screen explanation.
The teach screen gives the ability to create robot jobs by creating a sequence of actions. This sequence of actions can be created by loading them from a template, loading an existing job, or by creating a sequence of actions from scratch.
7.1 Sequence Box

The sequence box occupies the center of the screen. As actions are added to the list they can be re-ordered or removed using the order controls located at the left edge of the list.

- Moves the selected action higher in the list.
- Removes the selected action from the list.
- Moves the selected action lower in the list.
7.1.1 Loading a Sequence using a Template

To load a sequence from a template, click the [Load] button in the upper left. This will bring up an open file dialog box.

Click the [Type] drop down box and select {Sequence Template (.SEQ)} as the source. The dialog box will list all the available sequences. Select the desired template and click [OK].

The sequence list will now be filled with the saved sequence of operations. Notice that some items are golden colored. These items represent move points. Move points that do not have a position recorded for them will be gold. Move points that have position data will be blue.

Since the template screen does not have the ability to move the robot all the move points that are loaded from a template will not have a position associated with them.
7. Teach Screen
7.1 Sequence Box

However, move points that are part of a sequence loaded from an existing robot job will have position data.

7.1.2 Recording Position for Move Points

Before you can save a sequence as a robot job you must record position for any move points. To do that you place the robot in 'Teach' mode via the pendant key switch and enable the servos. Then using the axis control buttons you position the robot at the appropriate location for that operation. Before recording the point select the speed and tool that you want to associate with this point.

The speed slider has ten positions. These ten positions represent the following speeds.

Table 7-1: Speed Slider Positions

<table>
<thead>
<tr>
<th>Slider Position</th>
<th>Linear Moves (mm/min)</th>
<th>Joint Moves (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50.00</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>150.00</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>225.00</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>375.00</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>450.00</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>600.00</td>
<td>40</td>
</tr>
<tr>
<td>7</td>
<td>750.00</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>975.00</td>
<td>65</td>
</tr>
<tr>
<td>9</td>
<td>1200.00</td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>1500.00</td>
<td>100</td>
</tr>
</tbody>
</table>

When satisfied with the robot position press the [RECORD]. A confirmation message saying that the position is recorded, is received. Continue to record the remaining move points.
7.1.3 Creating a Sequence

To create a sequence, select a predefined action and add or insert it to the sequence list. To view the available actions, select one of the four categories represented by the four icons.

- **ROBOT** - Within the robot selection, the available actions are divided into four categories.
  - **CONTROL** - Actions dealing with control of job sequence or miscellaneous I/O.
  - **MOTION** - Move points associated with the robot.
7 Teach Screen
7.1 Sequence Box

• **INPUTS** - Inputs dealing with the IMM interface

• **OUTPUTS** - Outputs dealing with the IMM interface
7.1.4 Selecting a Gripper

Selecting the gripper icon will list all the actions available for the gripper(s). These actions will include both gripper actions and zone actions. The available zone actions will vary depending upon the choices made for the gripper zone configurations.

7.1.5 Selecting a Conveyor

Selecting the conveyor icon will list the available actions for each conveyor. The available conveyor actions will vary depending upon the choices made for the conveyor configuration.
7.1.6 Selecting Degate Station

Selecting the degate icon will list the available actions for each degate station.
The system screen lets the user have access to any of the component configuration screens.

8.1 Part Stacking Screen

The part stacking screen allows the user to create an unlimited number of stacking configurations. These configurations can then be used in a job by selecting one of the stacking actions from the conveyor action list.

A maximum of eight (8) stacking configurations can be active in a robot job at one time.
8.1.1 Configuring Stacking Configuration

To configure a stacking configuration, click 'New'. The user will be taken to a keyboard screen and asked to enter a unique name for the configuration. A new stack configuration will be created with default values.

The stack configuration is depicted from the robot point of view. The row 1, col1 position has special significance. That position is the one position that is recorded for each configuration. The stack configuration is unique to the conveyor it was taught on. This means that if you wish to stack the same part on multiple conveyors, a new configuration must be created on each conveyor.

The gray color of the row 1, col1 position indicates that this position has not been recorded. When it is recorded, the box will be shown in blue but still have the heavy black edge lines.

CL Spacing refers to the total distance between the center lines of the parts in the direction indicated. For example, rows work in and out from the robot perspective (x). Columns work left to right (y). The row 1, col 1 position will always be the furthest part from the front right edge of the conveyor (robot perspective).

The escape height is the distance that the user wants the robot to move up after releasing the part. It can be a different distance than the layer spacing.

The sequence to create a new stack configuration is as follows:

1. Click [New]
2. Name the configuration
3. Set the desired values for rows, cols, layer height, and all the cl spacing values.
4. Set the "Escape Height"
5. Set the row, col, and order selections
6. Select the conveyor from the “Conveyor” drop down box
7. Using the pendant motion buttons place the robot at the desired row 1, col1 position.
8. Click the [Record] button
9. You will receive a confirmation message that the position was recorded
10. Click [Save], recording the point does not replace the need to click [Save] or [Save As].

The red box signifies the starting point based on the user sequence selections.
8. System Screen

8.1 Part Stacking Screen

[Diagram of Part Stacking Screen]

- Stack Selection
  - NEW
  - Delete
  - New

- Conveyor
  - RECORD
  - Move To...

- Row
  - 1 to n
  - n to 1

- Column
  - 1 to n
  - n to 1

- Order
  - Rows
  - Coils

- Cancel
- Save
- Save As

[Diagram of Part Stacking Screen]
SPI Pendant Interface

8 System Screen

8.1 Part Stacking Screen
8 System Screen
8.1 Part Stacking Screen
The security screen supports three user levels. By default they are:

- **USER** - This is the default access level (no password required)
- **PROG** - This user level can modify/change their own password (default password is “motoman”)
- **ADMIN** - This user can add/remove any level of user as well as modify any user password. (default password is “m0t0man”)
9 Security Screen

Security Administration
- Add User
- Modify User
- Remove User

Modify User
- User Name: ADMIN
- Password
- New Password
- New Password
- Level: Level 1

User Log In
- User Name
- Password

Current User
- ADMIN
- Log Out

YASKAWA
- Products
- Teaching
- System
- Template
- Security
- Status
- Quit
10 Production Screens

The production screen allows the user to select a job that was created within the SPI Interface to run on the robot.

- **Selected Job:** This drop down lets the user select the job to run.

The remainder of the production control screen is divided into functional areas of control.

10.1 Functional Areas of Control

10.1.1 Position

This area deals with moving the robot to various pre-defined positions.

- **ENABLE MOVE HOME** - When this button is selected it will change to green. When the robot completes the current cycle it will move to the designated home position and servos will be turned off.

- **ENABLE HOME (w/RESET)** - When this button is selected it will change to green. When the robot completes the current cycle it will move to the designated home position and servos will be turned off. In addition, the production data counters will be reset to zero. This selection requires a programmer or higher security level.

- **ENABLE TOOL RESET POS** - When this button is selected it will change to green. When the robot completes the current cycle it will move to the designated tool maintenance position and servos will be turned off.
10.1.2 Operating Mode

This area controls the various operating modes of the system.

- **AUTO LOCAL** - This places the system in Auto Local mode which allows the user to start the selected job by using the [RUN] button in the Cycle control section.

- **AUTO REMOTE** - This places the system in Auto Remote mode which allows the system to be controlled from a remote operator HMI.

- **MANUAL** - This places the system in Manual mode which does not allow the robot system to be started from the SPI Interface.

10.1.3 Degate

This area controls the bypass of degating on a global level.

- **“Degate Enabled”** - Degating operation occurs as requested within the user created jobs.

- **Degate Disable** - “Degate Enabled” is turned off, and any degating operations are ignored.

10.1.4 Robot Operation

This area controls/displays information about the robot operation.

- **SPEED** - This status will display the current special operation speed setting. If any of the following special operation modes are active they will be displayed here. The special operation modes monitored are:
  - Dry-Run Speed
  - Check-Run Speed
  - Safe Speed
  - Machine Lock

- **ROBOT ENABLED/ROBOT OFF** -
  - “ROBOT ENABLED” - Default operating mode.
  - “ROBOT OFF” - A special mode where the robot servos are turned off and all the interface permission signals are enabled to the injection molding machine. This mode allows the injection molding machine to be operated in a semi-manual mode. The robot must be in the home position to enable “ROBOT OFF” mode.

10.1.5 CYCLE CONTROL

This area deals with various cycle controls.

- **RUN** - This enables the servos and starts the selected job.

- **ENABLE EOCS** - (End Of Cycle Stop) By enabling the [EOCS] button the robot will complete the current cycle, pause at the top of the master job, and turn off servos. The robot can be restarted by selecting “RUN.”

- **ENABLE EORS** - (End Of Run Stop) By enabling the [EORS] button the robot will decrement the remaining cycles count with each complete cycle. When the remaining cycle count reaches zero the robot will pause at the top of the master job and turn off the servos. The robot can be restarted by selecting “RUN.”
10.1.6 WARM-UP

This area deals with warm up mode controls.

- **ENABLE WARMUP** - Enabling warm-up mode instructs the robot to run the warm-up job. The warm-up can be a set number of cycles or a defined amount of time.

- **CYCLES** - This instructs the warm-up mode to count cycles when monitoring the warm-up mode. The remaining cycles count will decrease with each completed cycle. When the count reaches zero the robot will quit executing the warm-up job and start executing the currently selected job.

- **TIME** - This instructs the warm-up mode to count down the amount of minutes during in warm-up mode. The remaining minute count will decrease with each minute. When the count reaches zero the robot will quit executing the warm-up job and start executing the selected current job.
10.2 View Production Data

The production data screen displays the current production data. This data can be reset manually by pressing the Reset button or it can be reset by sending the robot home with a data reset from the production control screen.

- **Reset** - This button resets the current production value counters. This button requires a security level of programmer or higher and the robot must not be currently operating.
11 Status Screens

The status screens allows the user to view the real time status of robot I/O. The viewing is broken into three areas, IMM, Gripper, and Robot.

11.1 IMM

The [IMM] button (Injection Molding Machine Interface button) shows all the I/O defined in the selected injection molding machine interface. Outputs can be forced On or OFF (except for 'Mold Clear' which is a hardware dedicated signal).
11.2 GRIPPER

The gripper screen shows any I/O that has been defined for gripper operations. Outputs can be forced ON or OFF.

11.3 ROBOT

Pressing the [ROBOT] button displays all robot Universal I/O’s are in numeric order and the outputs can be forced to turn ON or OFF.
A.1 ROBOT JOBS

The operation of the SPI Pendant Interface relies on a few dedicated robot jobs for proper operation.

- **MASTER** - This job contains no movement points and is included with the SPI Pendant Interface. It is not intended to be modified by the end user.

- **RESET** - This job contains no movement points and is included with the SPI Pendant Interface. It is not intended to be modified by the end user.

- **STARTUP** - This job is empty upon initial setup of the system. The intent is to provide a place for any special setup or configuration actions to take place. This job is only run when starting the master job.

- **HOMEPOS** - This job contains a move position that has not been taught by default. It can be loaded in the teach screen and assigned a position value. This position should be your starting and stopping position for normal operation.

- **WARMUP** - This job contains the basic functions to continuously unload the injection mold machine while it is warming up. The template does not include any degating with the intention that warm up parts would be dropped into the regrind during the warm up cycle.

- **TOOLMAINT** - This job contains a move position that has not been taught by default. It can be loaded in the teach screen and assigned a position value. This position is where the robot will position the tool when the 'Enable Tool Maint Pos' button is activated. Additional points can be added as required.

- **LAUNCH** - The launch job is auto created when a job is selected from the production screen. It is how the fixed master job is able to call any user created job.
A.2 Robot Variables

A number of robot variables are reserved for exclusive use by the SPI Pendant Interface. Here is a listing of those variables.

A.2.1 B Variables

<table>
<thead>
<tr>
<th>B Variable</th>
<th>Description</th>
<th>Notes</th>
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<td>Gate Cutting</td>
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<td>Warm-Up Mode</td>
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</tr>
<tr>
<td>22</td>
<td>EOC Select</td>
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</tr>
<tr>
<td>23</td>
<td>EOR Select</td>
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<td>24</td>
<td>Warm-Up by cycles</td>
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<td>25</td>
<td>Warm-Up by time</td>
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<td>26</td>
<td>Home request</td>
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</tr>
<tr>
<td>27</td>
<td>Home + data reset request</td>
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<tr>
<td>28</td>
<td>Tool maint request</td>
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</tr>
<tr>
<td>54</td>
<td>Col Seq</td>
<td>0 = low to high, 1 = high to low</td>
</tr>
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<td>55</td>
<td>Seq Priority</td>
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<td>Max Cols</td>
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<td>Seq Priority</td>
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</tr>
<tr>
<td>63</td>
<td>Max Cols</td>
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### A.2.2 D Variables

<table>
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<tr>
<th>D Variable</th>
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<tr>
<td>41</td>
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## I Variable

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<td>25</td>
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<td>26</td>
<td>Gripper Target ID</td>
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<tr>
<td>27</td>
<td>Current Gripper ID</td>
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<tr>
<td>50</td>
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### A.2.4 R Variables

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<tr>
<td>50</td>
<td>Row Spacing (mm)</td>
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<tr>
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<td>Escape Height (mm)</td>
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## A.2 Robot Variables

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</tr>
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<td>95</td>
<td>Escape Height (mm)</td>
<td></td>
</tr>
</tbody>
</table>

### A.2.5 P Variables

<table>
<thead>
<tr>
<th>P Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Current Stack Pvar</td>
</tr>
</tbody>
</table>
Welcome...

...to the Yaskawa Motoman family of robotic products. We at YASKAWA take pride in the work we do and would like to take this opportunity to thank you for your business. This instruction is a quick-start guide for personnel who are familiar with the operations of a Yaskawa robot model, SPI Pendant Interface software, and robot programing. If you are not familiar with these processes, read and understand all related items.

**WARNING**

- When purchased as a robot package insure the safe guards in place follow ANSI RIA 15.06 2012 standards and all applicable local and national codes.
  - The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system and robot application. Safeguarding may include but not limited to safeguarding devices, barriers, interlock barriers, perimeter guarding, awareness barriers, and awareness signals.

Failure to observe this WARNING may result in a potentially hazardous situation that may result in death or serious injury to personnel.

Customer Support Information

If you need assistance, please contact Yaskawa Motoman Customer Support at the 24-hour telephone number (937) 847-3200.

For **routine** technical inquiries, you can contact Yaskawa Motoman Customer Support at techsupport@motoman.com.

When using e-mail to contact Yaskawa Motoman Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

**NOTE** Please use e-mail for **routine** inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact Yaskawa Motoman Customer Support at (937) 847-3200.

Setup and Operation

1. If using part stacking, teach one user frame for each conveyor. This user frame is located at the front right corner of the conveyor (closest to the robot). Teach user frame (1) at the conveyor (1). Teach user frame (2) at conveyor (2), etc. Please refer to the robot documentation on details of how to teach a user frame.
2. Launch the SPI Pendant Interface from the robot pendant.
3. If your system was not previously configured, follow the “Setup Wizard” to complete the initial system configuration.
4. If needing to adjust any settings or configure part stacking, they are available through the (System) menu.
5. Go to the “Template” screen and create a template for the default job action sequence.
6. Go to the “Teaching” screen and load the following templates. Add positions as required and save the resulting robot jobs.
   - HOMEPOS
   - STARTUP
   - WARMUP
   - TOOLMAINT
7. Load the default job template and assign robot positions. Save the job.
8. Go to the ‘Production’ screen and select the job from the dropdown job list.
9. Place the system in “Auto Local” mode.
10. Place the robot in ‘Play’ mode.
11. Press the [Run] button.