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

MOTOMAN INSTRUCTIONS

- MOTOMAN-[□□□] INSTRUCTIONS
- NX100/DX100 INSTRUCTIONS
- NX100/DX100 OPERATOR’S MANUAL
- NX100/DX100 MAINTENANCE MANUAL

The operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 154521-1CD
Revision: 3
MANDATORY

• This manual explains the EasyLoad™ software. Read this manual carefully and be sure to understand its contents before operation.
• General items related to safety are listed in Section 1: Safety, in the Controller Instructions. To ensure correct and safe operation, carefully read the Controller Instructions before reading this manual.
• For detailed instructions regarding additional equipment including controller, manipulator, or other components, refer to the specific equipment manuals included with your documentation package.

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.
• Software described in this manual is supplied against licensee only, with permission to use or copy under the conditions stated in the license. No part of this manual may be copied or reproduced in any form without written consent of YASKAWA.
Notes for Safe Operation

Before using this product, read this manual and all the other related documents carefully to ensure knowledge about the product and safety, including all the cautions.

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

⚠️ 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

NOTE
To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "CAUTION" and "WARNING".
### WARNING

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

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

*Fig. : Emergency Stop Button*

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

Injury may result from unintentional or unexpected manipulator motion.

*Fig. : Release of Emergency Stop*

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - 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 P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the controller and the programming pendant.
Notation for Menus and Buttons

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Menu</td>
<td>The menus displayed on screen are denoted with { }. ex. {TOOL}.</td>
</tr>
<tr>
<td>Button</td>
<td>The buttons, check boxes, radio buttons displayed on screen are denoted with [ ]. ex. [Close]; [Sync] check box; [Fast] radio button.</td>
</tr>
</tbody>
</table>

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means the following operations:

- To move the cursor to the object item by touching the item on the screen.
- To pick out the object item using the Area key and press the Enter key.

(In case of selecting a menu, use arrow keys instead of the tab key to pick out the object item, then press the Enter key.)

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.
EasyLoad™

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1 Introduction

1.1 Overview

EasyLoad™ is designed to allow an operator to setup a Motoman robot for machine tending with minimal pre-existing knowledge of robot operation and/or programming. Once the cell has been setup and configured, the EasyLoad™ application allows the operator to change existing tending processes for different parts as well as start new tending processes.

Through the use of an interactive touch-screen wizard, operators are able to follow step-by-step procedures for selecting desired tending processes. These selections are stored in a profile that is used to automatically generate the appropriate robot operations from pre-defined job-templates. For operators with advanced knowledge of robot programming, EasyLoad™ allows detailed customization of job-templates and profiles.

Through the use of these profiles and templates, operators can store a variety of different configurations that can be interchanged at any time. This provides the ability to produce a variety of parts using a single robot cell.

1.1.1 Features

- Quick and easy job setup
- Profile Wizard
- Compatible with a wide range of grippers
- Shared configuration between workcells
- Minimal robot teaching skills required

1.1.2 System Requirements

Motoman recommends that new users of the EasyLoad™ application first complete a Motoman robot programming class to gain a better understanding of robot operation.

Table 1-1: EasyLoad™ System Requirements

<table>
<thead>
<tr>
<th>Function</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot Controller</td>
<td>NX100, DX100</td>
</tr>
</tbody>
</table>
| Controller Software              | NX100 Version: 3.63-44, 3.71-44, or 3.74-44  
                                      DX100 Version: Any |
| Programming Pendant              | NX100: 64 MB Pendant  
                                      DX100: Any |
| Compact Flash memory card (ATA Flash) | 64 MB (or larger)  
                                      "CFI-****MBA" made by HAGIWARA sys-com.  
                                      "SDCFBI-**-****" made by SUN DISK. |
| Machining Stations               | Haas SL-series lathes with RobotReady interface and automatic door |

* Compact Flash is a registered trademark of SUN DISK.
1.2 About this Document

This User’s Manual provides a description of functionality, usage instructions, as well as application examples for the EasyLoad™ software application. For detailed information on specific system components listed in this document, please refer to the documentation package included with your system.

1.3 Learning EasyLoad™

Motoman provides a variety of options to help you learn to use EasyLoad™, including training and technical support.

1.3.1 Motoman Technical Education Center (MTEC)

The Motoman Technical Education Center offers over 56 different courses including Basic Programming, Advanced Programming, Maintenance, Concurrent I/O, Purchasable Options, and Customized Training. Web-based or Computer-based training is also available for selected topics.

Motoman training courses provide classroom instruction combined with hands-on training (normally 2-student-per-robot ratio). Class size is limited to provide a more effective and enhanced learning environment.

With three U.S. facilities and more than 60 training robots, Motoman offers the most complete training package in the industry. Since MTEC is an authorized provider for the International Association for Continuing Education and Training (IACET), each student who receives at least 70% on the final exam will receive Continuing Education Units (CEUs). These CEUs are transferable college credits, which are awarded based on contact hours of the course. The Motoman Technical Education Center is the first robotic training facility with IACET accreditation and is also approved for training of veterans.

Motoman offers training at our headquarters in West Carrollton, Ohio and at our remote facilities in Irvine, California; Wixom, Michigan; Mississauga, Canada; and Aguascalientes, Mexico. Motoman also performs On-Site training at customer sites if required but recommends training at Motoman since the environment is more conducive to effective learning. For more information, visit our website (http://www.motoman.com/support/training/training.htm).

1.4 Reference to Other Documentation

For additional information refer to the following:

- NX100 Controller Manual (P/N 149201-1CD)
- NX100 Maintenance Manual (P/N 150133-1CD)
- NX100 Operator’s Manual for General (P/N 150077-1CD)
- NX100 Operator’s Manual for Handling (P/N 149231-1CD)
- NX100 Concurrent I/O Parameter Manual (P/N 149230-1CD)
- NX100 Independent/Coordinated Control Function Manual (P/N 149648-1CD)
- NX100 INFORM User’s Manual (P/N 150078-1CD)
- DX100 Controller Manual (P/N 155494-1CD)
- DX100 Maintenance Manual (P/N 155492-1CD)
1.5 Customer Support Information

If you need technical assistance with any aspect of your EasyLoad™ application, please contact Motoman Customer Support. Please have the following information ready before you call:

- System: EasyLoad™
- Robot: HP165, HP20, etc.
- Primary Application: Machine Tending
- Controller: NX100, DX100
- Software Version: Select {MAIN MENU} > {SYSTEM INFO} > {VERSION}
- Robot Serial Number: Located on a data plate on the rear of each robot arm
- Robot Sales Order Number: Located on a data plate on the front door of the controller
2 Setup and Configuration

While the majority of cell setup can be completed using the EasyLoad™ Profile Wizard, there are a few minor procedures that must be completed before using the EasyLoad™ software.

2.1 Inserting the CF (Compact Flash) Card

A Compact Flash (CF) card is included with your software and must be inserted into the programming pendant before running EasyLoad™. The CF card contains all the necessary files and media required for use by the EasyLoad™ application. It is also used when generating robot jobs.

Observe the following precautions when using the CF card.

• Handle compact flash with care to protect the stored data.
• Do not store compact flash where strong static electricity or electronic noise may occur.
• Do not drop or exert any shock or strong force to the compact flash.
• Do not remove the compact flash or turn OFF power when accessing the compact flash (writing-in or reading-out compact flash data). The data in the compact flash may be lost.
• Back up data from the compact flash to other media such as hard disks.

If the CF card becomes lost or damaged, refer to Section 5.1 for detailed instructions on replacing a lost or damaged CF card.

Insert the CF card as follows:

1. Open the cover on the rear of the programming pendant.
2. Insert the compact flash so that the product label is on the front side. The card cannot be inserted in any other position. Do not forcibly insert the card.
3. After inserting the card, be sure to close the cover before starting operation.
2.2 Setting the Robot Safe Position

During the loading process, the robot returns to a designated Safe position when a sequence is complete. This position is stored using Position (P) variable 127 and must be defined in advance.

To set the robot Safe position, proceed as follows:

1. From the main menu, select {VARIABLE}.
2. Select {P} (Position) variable type from the submenu.
3. Press {PAGE}.
4. Type "127" using the numeric keypad and press [ENTER].

For detailed instructions on how to set position variables, refer to the Operator's manual supplied with your robot.
2.3 Setting Tool Data

Prior to launching EasyLoad ™, you must ensure that the tool data is configured correctly, including Tool Center Point (TCP), tool weight, and center of gravity. Configure tool data for the following tool files:

- Pointer Tool File (Default 0) - centered on tip of pointer.
- Gripper1 Tool File (Default 1) - centered on tip of fingers.
- Gripper2 Tool File (Default 2) - centered on tip of fingers.

2.3.1 Defining the Pointer Tool File

While the gripper TCP location is well defined, it is not always easy to use when defining the positions for the various machine stations in the cell. It is recommended that a pointer be created and held in place by the gripper fingers when defining these positions during cell setup.

**WARNING**

The gripper pointer must be removed before normal operation. Failure to remove the pointer can cause a robot crash and/or damage to the equipment.

*Fig. 2-3: Gripper Pointer*
2.3.2 Defining the Gripper Tool Files

Define the robot tool data according to the following requirements. Refer to Section “8.3 Tool Data Setting” in the controller manual (NX100: 149201-1, DX100: 155494-1CD) for detailed instructions on tool calibration TCP.

- The X-axis must point away from the robot. This keeps the robot arm away of the machine center when reaching inside to put or grab a part. In the default job templates, the X-axis of the gripper typically lines up with the X-axis of the user frame of the station.
- The Z-axis must be defined as the approach direction (grab direction).
- The Rx, Ry, Rz orientations are critical.

To define the robot tool data, proceed as follows:

1. From the main menu, select {ROBOT}.
2. Select {TOOL}. The TOOL COORDINATE window appears.
3. Select the desired tool number using the arrow key and press [Select]. The TOOL window appears
4. Select the desired tool data file to modify using the arrow key.
   - Pointer Tool File (Default 0) - centered on tip of pointer.
   - Gripper1 Tool File (Default 1) - centered on tip of fingers.
   - Gripper2 Tool File (Default 2) - centered on tip of fingers.
5. Enter tool data and press [Enter].

The following are examples of common gripper configurations:

Fig. 2-5: Gripper Configurations

---

2-4
2.4 Selecting the Correct Tool Number

Before starting EasyLoad™, the Pointer tool (default Tool No. 0) must be selected.

To change the current tool, proceed as follows:

1. Press [SHIFT] + [COORD].
2. Move the cursor to Tool No. 0.
3. Press [SHIFT] + [COORD].

2.5 Launching EasyLoad™

The EasyLoad™ application is accessed from the programming pendant. To start EasyLoad™ proceed as follows:

1. Turn the controller ON.
2. From the main menu, select {PP APPLICATION}. 

<table>
<thead>
<tr>
<th>Gripper #1</th>
<th>Gripper #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>150 mm</td>
</tr>
<tr>
<td>Y</td>
<td>0 mm</td>
</tr>
<tr>
<td>Z</td>
<td>200 mm</td>
</tr>
<tr>
<td>Rx</td>
<td>180 deg</td>
</tr>
<tr>
<td>Ry</td>
<td>-90 deg</td>
</tr>
<tr>
<td>Rz</td>
<td>0 deg</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<td>0 deg</td>
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<td>200 mm</td>
</tr>
<tr>
<td>Rx</td>
<td>0 deg</td>
</tr>
<tr>
<td>Ry</td>
<td>0 deg</td>
</tr>
<tr>
<td>Rz</td>
<td>180 deg</td>
</tr>
</tbody>
</table>
2.6 Changing the Controller Security Level

To modify data stored in an EasyLoad™ profile, you must be in the MANAGEMENT security level.

To change the controller security level, proceed as follows:
1. From the main menu, select {SYSTEM INFO}.
2. Select {SECURITY}.
3. Press [SELECT] and select “MANAGEMENT MODE.”
4. Type the MANAGEMENT password (default: 99999999).
5. Press [ENTER].
3 Basic Operation

The EasyLoad ™ application allows you to create profiles that contain all the necessary information for handling a specific part. Multiple profiles can be quickly created for a variety of different parts. Once created, an operator can select a desired profile from the Operation screen, and have EasyLoad ™ quickly generate all the necessary robot jobs, transfer them to the controller, and start production.

Profiles can be edited manually through the Setup screen (Section 3.2), or created using the Profile Wizard (Section 3.3) to guide you through the necessary steps.

NOTE

The EasyLoad ™ Profile Wizard launches the first time EasyLoad ™ is run or when there are no valid profiles stored in the application.

3.1 Operation Screen

The Operation screen is the first to be displayed when you launch the application. It allows you to start/stop the process, and monitor operation.

Fig. 3-1: Operation Screen

Current Status
The Current Status window displays status information for the current process. The job templates must be set up to use this feature. Refer to Section 4.3.4 for detailed instructions.

Current Profile
The (Current Profile) dropdown menu selects the profile to be used to create the robot jobs. To switch between profiles, the robot controller must be in Teach mode and the security level set to EDIT or higher.

Selecting a new profile will cause EasyLoad ™ to generate new robot jobs and download them to the controller. This can take up to a minute depending on the complexity of the profile.
3 Basic Operation

3.1 Operation Screen

Jogging Information
The Jogging Information icon shows the current robot coordinate system and robot speed.

Number of Parts Completed
The Number of Parts Completed window keeps a running tally of completed parts.

Running Time:
The Running Time window displays the amount of time the process has been running.

Monitor Tabs
The Robot, INF, OTF and MC tabs allow you to monitor I/O for the robot, feeds and all CNC machines. To monitor I/O signals during operation, simply touch the tab of the desired equipment to be monitored.

Setup
The {Setup} button opens the Setup screen and allows the operator to make changes to the profile. Changes can only be made when the process is not running. The controller must be in Teach mode and Management security mode to make changes to a profile. Refer to Section 2.6 for instructions on changing security level.

Start Process
The {Start Process} button starts the process or resumes operation after a pause command.

Test Run
The {Test Run} button allows you to test your process by running it at the slow speed programmed in the job template (typically 25% of regular speed). This is useful to verify proper operation before running at full speed.

Pause
The {Pause} button stops robot operation. It does not stop the machining centers.

Reset Process
The {Reset Process} button resets the process and assumes all parts have been cleared from the cell. The infeed must be full and the outfeed must be empty.

Exit
The {Exit} button exits the program.

3.1.1 Starting a Cell Operation
To start a cell operation, proceed as follows:
1. Close the safety gate on the robot enclosure.
2. Disable all E-Stops on the robot and machine.
3. Turn rotary switch on the programming pendant to PLAY.
4. Ensure there is no one inside the robot cell.
5. Push [SERVO ON READY] button on the programming pendant.
6. From the EasyLoad ™ interface, select {START PROCESS}.
3.2 Setup Screen

The Setup screen allows you to modify any settings associated with the current profile. You can also change the active profile and restore previous settings at any time.

**NOTE**
The robot controller must be in MANAGEMENT security mode to use the EasyLoad ™ setup.

**Fig. 3-2: Setup Screen**

- **Active Profile**
The (Active Profile) dropdown menu selects the active profile to be set up.

- **Current Process**
The Current Process window displays each step of the current process.

- **Profile Wizard**
The (Profile Wizard) button starts the step by step wizard to create a new part profile that contains all necessary information for handling a specific part. Refer to Section 3.3.

- **Import/Export Settings**
The (Import/Export Settings) button opens the Import/Export screen allowing the user to import or export necessary EasyLoad files. When setting up several identical cells, after the first cell is setup, the profile files can be exported to the subsequent identical cells to avoid reconfiguring each cell. Refer to Section 4.1.

- **Regenerate Robot Jobs**
The (Regenerate Robot Jobs) button regenerates the robot jobs according to the part profile and sends them to the robot controller.

- **Done**
The (Done) button exits the Setup screen and returns to the Operation screen.

When modifications are made to a cell profile, EasyLoad ™ prompts you to save the modifications. Click OK to accept the changes.
3.2.1 Profile Setup Area
The Profile Setup area allows the user to edit the active profile. Each button opens various screens of the Profile Wizard allowing the user to modify selected portions of the cell setup.

Profile Configuration
The {Profile Configuration} button opens the Profile Configuration screen, allowing the user to define the operations available in the profile. Refer to Section 3.4.

Chuck/Robot Fingers
The {Chuck/Robot Fingers} button opens the Machine/Robot Fingers screen, allowing the user to define the length of the machine chuck fingers and the mapping between grippers and tool files. Refer to Section 3.5.

Station Positioning
The {Station Positioning} button opens the Station Positioning screen, allowing the user to define or adjust the position of the stations within the cell. Refer to Section 3.6.

Pallet/Conveyor Configuration
The {Pallet/Conveyor Configuration} button opens the Pallet/Conveyor Configuration screen, allowing the user to define or adjust the number of parts and configuration of parts for the infeed and outfeed stations. Refer to Section 3.7.

Process Sequence
The {Process Sequence} button opens the Process Sequence screen, allowing the user to define or adjust the part flow within the cell. Refer to Section 3.8.

Part Dimensions
The {Part Dimensions} button opens the Part Dimensions screen, allowing the user to define or adjust the dimensions of the part. It also defines how the part should be picked after a given operation, and how it is to placed in the next operation. Refer to Section 3.9.

Speed Adjustments
The {Speed Adjustments} button opens a dialog allowing the user to change the speed of the generated robot jobs. Refer to Section 3.10.

3.2.2 Cell Setup Area
The Cell Setup area allows modification of the cell definition. This information is global and shared with all profiles. Cell setup is usually only defined during initial EasyLoad setup, but can be edited using these buttons should changes be made to the cell.

Machine Setup
The {Machine Setup} button allows the user to define or adjust the number and position of machine centers used in the cell. Refer to Section 3.11.

Mapping I/O
The {Mapping I/O} button allows the user to re-map the I/O signals used in the robot jobs. Refer to Section 3.13.

**NOTE**
Motoman recommends making backups using the Import/Export function after completing any modifications to the cell profile.
3.3 Profile Wizard

The EasyLoad ™ Profile Wizard allows you to create a robot profile that contains all the necessary information for handling a specific part. When a new part is added to the robot cell, the Profile Wizard is used to quickly create a new profile. This wizard can be run as many times as desired to create and store multiple profiles.

The Profile Wizard is launched from the Setup Screen by pressing the Profile Wizard button located in the top right corner of the screen.

The wizard steps you through the following procedures to set up a new profile:

- **Profile Configuration**: defines the operations available in the profiles (see Section 3.4).
- **Chuck/Robot Finger Configuration**: defines the length of the machine chuck fingers and maps gripper numbers to the specific Tool File No. (see Section 3.5).
- **Station Positioning**: defines the position of all stations within the cell (see Section 3.6).
- **Pallet/Conveyor Configuration**: defines the number of parts and configuration of parts for the infeed and outfeed stations (see Section 3.7).
- **Process Sequence**: defines the flow of the part in the cell (see Section 3.8).
- **Part Dimensions**: defines the dimension of the part and how the part is picked in the next operation (see Section 3.9).

When you are finished with the last Part Dimensions configuration and press {NEXT->}, you are prompted to save the new profile. You must provide a unique name for this profile. The name can be up to sixteen (16) characters long. The newly created profile becomes the active profile. An hourglass symbol appears while the new settings are saved to the controller and the robot jobs are created.

When the save process is complete, you are automatically taken back to the Operation screen.

When EasyLoad is first launched or when there is no existing data, it automatically displays the Machine Setup screen (Section 3.11) followed by the Profile Wizard. If you have a saved profile on the Compact Flash card, use the {Import Settings} button on the Import/Export screen (Section 4.1) to import the information without using the wizard.

NOTE
- The Compact Flash card must be available when running the EasyLoad ™ Profile Wizard.
- The Robot controller must be in MANAGEMENT security mode to use the EasyLoad ™ Profile Wizard.
- Before starting the EasyLoad ™ Profile Wizard, ensure that the Pointer tool (default Tool No. 0) is selected as active. Refer to Section 2.4 for tool change procedures.

NOTE
Pressing the {Cancel} button while in the Profile Wizard causes the Wizard to terminate. All information entered in the Wizard up to that point is deleted.
3.4 Profile Configuration

The Profile Configuration screen defines the setup of the robotic cell, including the stations and operations the part will go through. The Profile Configuration screen can be accessed directly from the Setup Screen by pressing the {Profile Configuration} button, or through the Profile Wizard.

**Fig. 3-3: Profile Configuration Screen**

<table>
<thead>
<tr>
<th>Feed Configuration Area</th>
<th>Number of Machining Operations Area</th>
<th>Auxiliary Stations Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Feed Configuration area defines the type of infeed and outfeed being used in this profile. The Pallet selection reflects parts that are picked and/or placed in a grid pattern, where the Conveyor selection reflects parts that are picked and/or placed at the same location. The infeed and outfeed can alternate between two sources. The two sources must have the same configuration, but their location can be different. This allows the robot to work at one location while the other location is being serviced by the operator. This alternating sequence is accomplished using I/O signals. Refer to Section 3.13 I/O Mapping for details on setting up the I/O.</td>
<td>The Number of Machining Operations area defines the number of unique machining operations. This does not always match the number of physical machines. A part being machined on one side, picked up by the robot, turned over, and loaded back into the same machine for a second operation requires two machining operations even though there is only one physical machine.</td>
<td>Auxiliary Stations area defines additional operations that may be required for processing the part through the cell.</td>
</tr>
<tr>
<td>The Auxiliary Stations area defines additional operations that may be required for processing the part through the cell.</td>
<td>• Regrip operations use a unique station to put the part down and then pick the part up again. Typically, this is done to change the orientation of the part. The most common application is when machining both ends of a part.</td>
<td></td>
</tr>
</tbody>
</table>
Every regrip function in the software has its own regrip station. In practice, the same station may be use for more than one regrip operation but the station must be re-taught for each operation. This is required because, as the part is machined, its dimensions change, affecting the part’s position in the regrip stand.

- A Blow-off Station simply moves the part to a given location to have air blown on it to remove any debris. The part is not released from the gripper or physically changed during this step. Therefore, there is no part dimension information associated with this operation.
- The Custom Station radio button provides a way to handle customer specific processes. A special job template must be developed to accommodate this station. This requires advanced knowledge of both EasyLoad ™ and Inform programming. This function should only be used by experienced programmers.

### 3.5 Chuck/Robot Fingers

The Chuck/Robot Fingers screen is used to define the length of the chuck fingers and map gripper numbers to tool file numbers.

**Fig. 3-4: Machine/Robot Finger Information**

#### Length of Chuck Fingers

Here you should put the length of the chuck fingers (in millimeters). This is the distance from the chuck face to the tip of the fingers. These should be input in the order they were configured on the Machines Setup.

#### Map Gripper Numbers to Tool File No.

These inputs allow you to specify which grippers correspond to which Tool File No. This is useful when swapping grippers for different part profiles. However, you must ensure the TCP is correct each time you switch grippers. This is critical.

**NOTE**

If you are unsure of TCP when switching grippers, you should accept the defaults.
3.6 Station Positioning

The Station Positioning screen is used to define the location of all objects in the cell, including infeed, outfeed, and auxiliary stations. The Station Positioning screen can be accessed from the Setup Screen by pressing the {Station Positioning} button, or through the Profile Wizard.

**Fig. 3-5: Station Positioning Screen**

Station Window
The station window lists the stations used in the profile along with their configuration status. As each position is recorded, the status is updated. When all four positions are recorded, the station's status is changed to “Configured.”

### 3.6.1 Set Position Area
The Set Position area contains the buttons used to configure each station.

**Help Buttons**
The {How to maneuver robot} and {Where to touch off} buttons open animated video files that provide graphical instructions on how to maneuver the robot and where the touch off points are located.

**NOTE**
The instructional videos change based on the type of station selected in the station window list.

**Clear Positions**
The {Clear Positions} button clears all recorded points. The station status is set to “Not Configured” and data for all four positions is cleared.

**Record Standby Point**
The {Record Standby Point} button saves the current robot position data as the standby point.

**Record Point 1**
(Record Point 1) button saves the current robot position data as Point 1.

**Record Point 2**
(Record Point 2) button saves the current robot position data as Point 2.
Record Point 3

The {Record Point 3} button saves the current robot position data as Point 3.

Verify Points

The Verify Points buttons allows the user to verify each recorded point by moving the robot back to the recorded point (See Section 3.6.4).

Minimize Application

The {Minimize Application} minimizes the application to enable access to the standard pendant interface. This is necessary when verifying correct tool selection (Tool (0) Pointer) or maneuvering a positioner turn table. To re-instate the EasyLoad™ interface; from the main menu, select {PP APP} and select {EasyLoad} from the submenu.

3.6.2 Station Positions

Four positions are used to configure each station, three points for the station, and one that defines the Standby position. How the points are recorded differs based on the station type.

3.6.2.1 Standby Position

The Standby position is a point located clear of the station where the robot goes before and after tending the station. With the robot in the Standby position, the station should be able to operate without hitting the robot. For machines, the door must be able to open or close. For turntable positioners, the turntable should have adequate clearance for operation.

In addition, each Standby position should be defined to allow the robot to move freely from the Standby position of one station to the Standby position of any other station or machine in the cell without interference.

When defining the Standby positions, make sure the robot wrist position is in a neutral position between gripper 1 and gripper 2. This minimizes wrist rotation regardless of which gripper is used to handle the part at the station.

Fig. 3-6: Standby Position

The Standby position must be defined clear of the turntable divider so the turntable can rotate without interference.
3.6 Station Positioning

3.6.2 Station Position

Three touch-off points are used to locate the coordinate system of a particular station.

- Point 1: Marks the origin (0,0,0) of the coordinate system
- Point 2: Marks the direction of the X axis of the station
- Point 3: Marks the Y axis plane where the part is resting

3.6.3 Defining a Station Position

To define the location of a station within the work cell, a pointer is installed on robot and used to "touch-off" on three specified points. These three points are recorded in the system along with a Standby position for the station.

To define a station position, proceed as follows:

1. Prepare the robot and machine for teaching. Install the pointer into the gripper and select the tool #0. Refer to Section 2.4 "Selecting the Correct Tool Number" for additional information. It may be necessary to minimize the EasyLoad ™ application to do this.

2. Select the station to be recorded or modified from the station list on the left of the screen.

3. Move the robot to bring the pointer to the desired position.

4. With the robot in the desired position and servo power ON, touch the button corresponding to the position you wish to record: {Record Standby Point}, {Record Point1}, {Record Point 2} or {Record Point 3}.

5. Repeat steps 3 and 4 until all the points have been recorded. Point locations are shown in the instructional videos accessed using the {Where to touch off} button.

6. Verify recorded points by moving the robot back to the recorded points using the Verify button. (See Section 3.6.4 for details).

7. Repeat the procedure until all stations are configured.

8. Remove the pointer from gripper.

9. Remove all teaching aides from the machine(s) before resuming normal operation.

NOTE The Standby position is not as critical as the three station positions. The pointer does not need to be at any specific position or orientation for the Standby position.

NOTE The point status in the station window changes from Not Recorded to Recorded the first time a point is recorded. When modifying previously recorded points, the status changes from Recorded to Overwritten.
3.6.4 Verifying Recorded Positions

You can verify recorded points by moving the robot back to each recorded point using the Verify button.

1. From the Station Positioning screen, press the {Verify Points} button. EasyLoad ™ transfers the point information to the controller and loads the VERIFY job. A message is displayed, explaining that the EasyLoad ™ application will be minimized to proceed with verification.

2. Press {OK} or [Enter] to minimize the EasyLoad ™ application.

3. Select {JOB} from the main menu.

4. Select {JOB}. The JOB CONTENT window appears.

5. Turn the Programming Pendant rotary switch to TEACH mode.

6. Push the [SERVO ON READY] button.

7. Squeeze and hold the ENABLE switch firmly enough so that it clicks ONCE. This enables the servos, as indicated by illumination of the SERVO ON indicator light.

8. Use the [FAST/SLOW] buttons to select from among 3 available robot speeds.

9. Use the [FWD] key to move the robot to the recorded point.

10. Release the [FWD] button to avoid collision with teaching aides or other obstructions. Use the axis keys to jog the robot clear from the obstruction and press [FWD] to continue to the recorded point.

11. Once the point has been verified, select {P.P.APPLICATION} from the main menu and select {EASYLOAD} from the submenu to resume the EasyLoad ™ application.

WARNING

The gripper pointer must be removed before normal operation. Failure to remove the pointer can cause a robot crash and/or damage to the equipment.

NOTE

Machine Center positions are configured in the Machine Setup screen (Section 3.11), and can not be modified from this screen.

NOTE

During verification, the robot takes the shortest path to the recorded point. This path may or may not be a straight line. Make sure the path is clear.
3.6.5 **Pallet Station Example**

Pallet - Touch-off positions with the front right corner of the pallet (relative to the robot)

- Point 1: Right corner, closest to the robot
- Point 2: Point along the right edge of the pallet
- Point 3: Point along the bottom edge of the pallet

**NOTE** The farther away the points are from each other, the more accurate the results will be.

![Pallet Example](image)

3.6.6 **Conveyor Station Example**

Conveyor - Touch-off positions with the front right corner of the conveyor belt (relative to the robot)

- Point 1: Right corner, closest to the robot
- Point 2: Point along the conveyor right edge
- Point 3: Point along the conveyor edge closest to the robot

3.6.7 **Regrip Station Example**

Regrip - For a regrip station with V-blocks, touch-off the bottom middle point of the part resting in the regrip stand. If the part diameter varies, it may be easier to use a simple cylinder of the same diameter as the part.

- Point 1: Bottom middle point of the front face of the part (or cylinder).
- Point 2: Bottom middle point of the back face of the part (or cylinder)
- Point 3: Point on the left of the imaginary line going from Point 1 to Point 2

**NOTE** As the diameter of the part changes, the bottom of the part resting in the V-blocks changes slightly as well.
3.6.8 Auxiliary Station Example

Blow-off Station -

- Point 1: Point in space where the robot should hold the part while it is blown off.
- Point 2: Anywhere in space in the direction from which you want to keep the robot arm away.
- Point 3: Defines which direction of the part is "left" relative to the robot so record point 3 to the left of point 2.

Custom Station - Depends on the design of the job template.

NOTE

When manufacturing the re-grip fixture, it is helpful to machine a groove for point 3. To ensure points 1 and 2 are on the bottom of the part, a square can be used.

NOTE

These are examples based on the use of the standard job templates. The actual touch-off point may differ if the job templates were modified.
3.7 Pallet/Conveyor Configuration

The Pallet/Conveyor Configuration screen is used to define part positions for infeed and outfeed equipment. All measurements are made relative to the front right corner of the pallet or the conveyor (or relative to the local coordinate system defined in the station positioning setup). The Pallet/Conveyor Configuration screen can be accessed directly from the Setup Screen by pressing the {Pallet/Conveyor Configuration} button, or through the Profile Wizard.

The typical coordinate system defines the X-axis along the right side of the pallet or conveyor, the Y-axis along the front edge of the pallet or conveyor, and the Z-axis as up.

Fig. 3-9: Pallet/Conveyor Configuration Screen

3.7.1 Pallet Tab

A Pallet tab defines the part positions in a grid pattern. You must define the number of parts in each direction (Rows - X-Axis, Columns - Y-Axis, and layers). The center position of the bottom face of the part relative to the front right corner of the pallet (Touch-off Point 1), and the distance between each parts (center to center), must also be defined.

3.7.2 Conveyor Tab

A conveyor has only one pick position. The conveyor operation replenishes each part after it is removed. Only the center position of the bottom face of the part (relative to the front right corner of the conveyor) must be defined.

NOTE: The use of layers requires customization of the pallet job template.
3.8 Setting the Process Sequence

The Process Sequence screen is used to define the sequence of operation for tending the machine. The Process Sequence screen can be accessed directly from the Setup Screen by pressing the (Process Sequence) button, or through the wizard.

The following steps illustrate how to select a sequence of operations for your robot cell.

When a new step is added, it is inserted immediately after the currently selected step in the list on the left.

**NOTE** All steps are executed in the order shown in the sequence list on the left.

To add a new step to a sequence, proceed as follows:

1. From the sequence list on the left, select the step you want to add a new step after, or a step you want to modify.
2. Select where the robot should go from the GOTO dropdown.
   - **Infeed**: Station where the part enters the cell. Parts can only be picked from the infeed.
   - **Outfeed**: Station where the parts are placed after being processed. Parts can only be placed on the outfeed. It is possible to have a part picked and placed to the same pallet. Simply configure the Infeed and Outfeed the same and overlap their positions (see Section 3.6, Section 3.7, and Section 3.8).
   - **Machine**: The machine the robot is tending.

When a dual end effector is used, it must be designed so the second gripper (or held part) does not hit the pallet or tooling during the load/unload operation.
3. Basic Operation
3.8 Setting the Process Sequence

- **WayPoint**: A reference point in physical space used for robot navigation. These points are added to avoid obstacles or adjust wrist orientation.

- **Start Loop** and **End Loop**: These instructions control the program flow, but do not cause the robot to move to any physically location. They are simply markers that allow sections of the sequence to be repeated. The loop repeats all steps between the Start Loop and End Loop commands. The loop terminates when the Purge input signal is received (see Section 3.13).

- **Call Inform Job**: Calls a user-created Inform job. These jobs can be used to perform special tasks, such as controlling I/O signals for another device. You can only call Utility jobs that have been imported into EasyLoad. See Section 4.3 for information on Utility jobs.

3. Select whether the robot is picking or placing a part.

4. Select the gripper to be used for this operation.

5. Select details about the GOTO destination -
   - **Machine Station**: Select the Operation# to be performed and the Machine# to go to.
   - **Aux Station**: Select the auxiliary station from the list.
   - **Call Inform Job**: Select the job to be called from the list.

6. Select whether you want the robot to return to the Standby position before and after executing this step. By default, the robot returns to the Standby position when first approaching the machine. In the standard job template, the robot does not return to the standby when swapping parts. This allows the robot to pick a finished part with one gripper, and place a raw part in the machine with the other gripper without having to exit the machine. In all other cases, the robot must return to the Standby position between operations.

7. Select the {Add} button to add an additional step after the currently selected step, or select the {Edit} button to modify the current step.

8. Repeat this process for each step in your sequence.

**NOTE**
- Throughput can be increased by picking a raw part with the second gripper while the first part is being machined.

**NOTE**
- Only those jobs that have been imported to the Job Template folder are displayed in the list. (see Section 4.1 for details).

**NOTE**
- **Record WayPoints**: Record a robot position for each waypoints being used. The procedure is similar to recording points for the stations. (see Section 3.6 for details)

**NOTE**
- EasyLoad ™ supports up to four (4) unique Waypoints or Regrip stations. You can GOTO any specific one as many times in a sequence as you like.
9. When your sequence is complete, press {Accept} or {Next} button to validate and save your sequence.

### 3.8.1 Process Sequence Validation

When the {Accept} or {Next} button is pressed, the sequence is first validated before being saved. If the sequence is invalid, you must review and correct before it can be saved.

The following sequence commands are ignored when determining is a process sequence is valid:

- Start Loop*
- End Loop*
- Waypoint
- Call INFORM Job

The following is a list of key steps that are checked during the validation process:

- The sequence can not be empty
- The first step must be PICK from INFEED
- The last step must be PLACE on OUTFEED
- For PICK operations:
  - Must pick from INFEED
  - or
  - There must be a previous command that PLACES a part at this station
  - Cannot PICK from the OUTFEED
- For PLACE operations:
  - There must be a previous command that PICKS a part with the selected gripper
  - For every PICK from INFEED command in the sequence there must be a PLACE on OUTFEED command

*There can only be one Begin Loop command
*There can only be one End Loop command
*For every Begin Loop command, there must be a corresponding End Loop command
3.9 Part Dimensions

The Part Dimension screen allows you to define part dimensions, where to grab the part, and how to place the part in the next station. The Part Dimension screen can be accessed directly from the Setup Screen by pressing the (Part Dimension) button, or through the Profile Wizard.

Fig. 3-11: Part Dimensions
### 3.9.1 Part Dimensions

The A, B, C part dimensions correspond to the X, Y, Z axes of the station coordinate system respectively. They are defined relative to the part orientation when picked. Side 1 is always defined as the side resting on the XY plane of the coordinate system. This is not always the flat end of a cylinder. In a regrip station, a cylinder may lie on its side in a V-block. In this case, Side 1 is still the face resting on the station.

*Fig. 3-12: Part Dimensions*

New part dimensions are required after each operation as the part is machined, except for the blow-off and outfeed stations. Working through the tabs, the user is prompted to enter values for each of the operations as the part dimensions change.

The pick from infeed operation uses the starting dimensions.
3.9.2 Define Pick Position Area

The Define Pick Position area allows the user to define how the gripper is oriented to the part. The figure below illustrates an example of how the robot grip position is identified in EasyLoad™.

**Fig. 3-13: Robot Grab Position**

When defining a cylindrical or irregular part, set the dimensions as though the object were placed inside a rectangular box.

**Pick up part on side #**
The Pick up part on side # window determines the part orientation as it is gripped. Remember that the side number is based on the part orientation as defined by the station coordinate system.

**Pick up part [ ] mm from side # [ ]**
This set of values locates the part in the gripper. This determines where along the part the gripper is located. It also determines the rotation of the gripper on the part.

**Pickup part [ ] mm into gripper**
This value determines the depth the part is inserted into the gripper.

**Place side # [ ] onto next surface (or into next chuck)**
This value determines the orientation of the part as it is placed into the next station or gripper coordinate system.

**Place part [ ] mm past next surface (or into chuck)**
This value typically determines how far a part is placed into a chuck. It can also be used when a part is inserted into a recessed surface.
Overdrive
The Overdrive value allows you to drive the part a short distance against the placement tooling or chuck to ensure tight and accurate placement.

The Overdrive value is used only during place operation; it is not used during pick operations. Some grippers include spring loaded pressure plates that allow you to push the part to seat it firmly against the back of the chuck. This ensures that the part is placed firmly and removes any positional error that may accumulate through multiple release and regrip of the part. The Overdrive distance is the additional distance traveled after the nominal insert distance has been reached.

**NOTE**
The Overdrive function should only be used with spring loaded, pressure plate grippers. Using this feature with a hard-fixed gripper may cause a collision alarm.

### 3.10 Speed Adjustments

The speed adjustment dialog allows you to adjust the speed of the generated robot jobs. This option is not available in the wizard, but can be accessed directly from the Setup Screen by touching the Speed Adjustments button.

![Speed Control](image)

This information is saved with the part profile. Therefore, modifying one profile will not affect the others.

**NOTE**
For safety reasons, if you do not know this information, you should accept the defaults.

**Air Speed**
This is the joint speed that is used when moving between stations in the cell (1-100%).
3 Basic Operation
3.11 Machine Configuration

Approach Speed for Joint Moves
This is the joint speed that is used when moving into position above a pick/place (1-100%).

Approach Speed for Linear Moves
This is the linear speed that is used when moving into position above a pick/place (1-1000 mm/sec).

Pick/Place Speed
This is the linear speed that is used when picking/placing the part at a station (1-400 mm/sec).

3.11 Machine Configuration

The Machine Configuration screen defines the number of machines in the cell, their type, and position. The Machine Configuration screen can be accessed directly from the Setup Screen by pressing the Machine Setup button. The Machine Configuration screen is automatically launched during the initial startup of the EasyLoad ™ software when no machines have been configured.

Fig. 3-15: Machine Configuration

3.11.1 Select the Number of CNC Machines
Up to three machine centers can be defined for use with EasyLoad ™. Select the number of machine centers that your robot will tend (1-3) at the top of the screen. Tabs corresponding to the number of selected machines appear in the section below, providing setup for each machine.

Help Buttons
The {How to maneuver robot} and {Where to touch off} buttons open animated video files that provide graphical instructions on how to maneuver the robot and where the touch off points are located.
3.11.2 Machine Tabs

Each machine is defined using the corresponding tab.

Select Machine Type:
For each machine tab, select the CNC machine type from the dropdown menu. Additional machine types can be added to the list by importing new machine type files. Refer to section 4.2 for more information.

Chuck Offset
This measurement is the distance (in millimeters) from the chuck face to the surface of the plane used for the three touch-off points (described below). Please note that this is referring to the face of the actual chuck, and not the end of the chuck fingers.

WARNING
Make sure you select the correct machine. Selecting the wrong machine can cause a collision (crash) between the robot and one or more parts of the work cell.

NOTE
The corresponding Machine Type (.mct) file must be present on either the CF card or programming pendant before a particular machine is available from the dropdown list. Refer to Section 4.2 for instructions on creating/adding new machine types.

3.11.3 Defining a Machine Center Position

Each machine in the work cell must be defined by the robot before EasyLoad™ can operate. To define the location of a machine within the work cell, a pointer is installed on robot and used to physically "touch-off" on three specified points on the machine. These three points are recorded in the system along with a Standby position for the machine.

NOTE
All teaching aids are supplied by the customer. Due to the infinite cell variations in machines, fixtures, and setup, teaching aids are not included with EasyLoad™. Refer to Section 3.12 for aid in designing your specific teaching aids.

To define a machine position, proceed as follows:

1. Prepare the robot and machine for teaching by installing the proper teaching aids. As required, install the pointer into the gripper and select the correct tool number. Refer to Section 2.4 “Selecting the Correct Tool Number” for additional information.

2. Jog the robot to bring the pointer to the desired position (Point 1 on the teaching aid).

NOTE
The Standby Point position is not as critical as the three Touch Off Points. The pointer does not need to be at any specific position or orientation for the Standby Point position.
3. With the robot in the desired position and servo power ON, touch the button corresponding to the position you wish to record: {Record Standby Point}, {Record Point1}, {Record Point 2} or {Record Point 3}.

4. Repeat steps 2 and 3 until all the points have been recorded. Point locations are shown in the instructional videos accessed using the {Where to touch off} button.

5. Verify recorded points by moving the robot back to the recorded points using the Verify button. (See Section 3.6 for details).

6. Repeat the procedure until all machines are defined.

7. Remove the pointer from gripper along with any teaching aides before resuming normal operation.

### 3.11.4 Verifying Recorded Positions

You can verify recorded points by moving the robot back to each recorded point using the Verify Point buttons.

1. From the Machine Configuration screen, press the {Verify Point} button. EasyLoad™ transfers the point information to the controller (variable P120) and loads the VERIFY job. A message explaining that the EasyLoad™ application will be minimized to proceed with verification displays.

2. Press (OK) or [ENTER] to minimize the EasyLoad™ application.

3. Select {JOB} from the main menu.

4. Select {JOB}. The JOB CONTENT window appears.

5. Turn the Programming Pendant rotary switch to TEACH mode.

6. Push the [SERVO ON READY] button.

7. Squeeze and hold the ENABLE switch firmly enough so that it clicks ONCE. This enables the servos, as indicated by illumination of the SERVO ON indicator light.

8. Use the [FAST/SLOW] buttons to select from among 3 available robot speeds.

9. Use the [FWD] key to move the robot to the recorded point.

### WARNING

The gripper pointer and teaching aids must be removed before normal operation. Failure to remove the pointer and teaching aids can cause a robot crash and/or damage to the equipment.

### NOTE

During verification, the robot takes the shortest path to the recorded point. This path may or may not be a straight line. Make sure the path is clear.
10. Release the [FWD] button to avoid collision with teaching aides or other obstructions. Use the axis keys to jog the robot clear from the obstruction and press [FWD] to continue to the recorded point.

11. Once the point has been verified, select (P.P.APPLICATION) from the main menu and select (EASYLOAD) from the submenu to resume the EasyLoad ™ application.

3.11.5 Machine Configuration Examples

Each Standby position should be defined so that the robot can move freely from the Standby position of one station to another station or machine in the cell without collision.

Standby Position
The Standby position is a point outside of the machining center where the robot goes before and after tending the machining center. With the robot in the Standby position, the machine should be able to operate without hitting the robot. This point should be defined so that the robot can move freely from the machining center to the Standby position of any other station in the cell without collision.

When defining the Standby position, make sure the robot wrist is in a neutral position between gripper 1 and gripper 2. This minimizes wrist rotation, and helps avoid cable bundle wrap-up.

Fig. 3-16: Standby Point

Three touch-off points are used to locate the chuck position and orientation inside the machining center.
Point 1: Records the position at the center of the chuck.  
*Fig. 3-17: Point 1*

Point 2: Records the direction of the machine X-axis. This point is typically defined furthest from the door opening. The X-axis must be defined parallel to the cell floor.  
*Fig. 3-18: Point 2*
Point 3: Defines the Y-axis perpendicular to the chuck rotation axis and 90 degrees from the X-axis.

Fig. 3-19: Point 3

3.12 Teaching Aides

Teaching aides are tools used to teach the position of a machine or station in the workcell.

NOTE
For instructions on how to maneuver the robot, or how to locate the "TOUCH-OFF" points, touch the HELP buttons on the screen to view an instructional video.

NOTE
All teaching aids are supplied by the customer. Due to the infinite cell variations in machines, fixtures, and setup, teaching aids are not included with EasyLoad ™.

Teaching is done using a sharp point held in the gripper and tool #0 is defined as the tip of that point. It is common to use a pointer that is simple cylinder with a point at the end. The pointer can be inserted in a gripper and the gripper closed on the pointer. See Section 2.3 for further detail on tool definition.

When defining the location of a horizontal machining center, a circular plate with an insert that fits in the chuck can be used as a teaching aid. The plate must be marked at its center along with X- and Y-axes positions located on the outer rim. The X- and Y-axes marks must be perpendicular for best results. Make sure that plate is perpendicular to the chuck rotation shaft. The X direction must point toward the inside of the machine center. Use a level to position the X-axis direction horizontal and parallel with the floor of the CNC machine.
For information about available teaching aide kits, please contact your local Motoman sales representative.

### 3.13 I/O Mapping

The I/O Mapping screen allows you to change the logical I/O points that are associated with corresponding physical actions. This is typically only performed during initial setup of the cell. Modifications should not be required unless changes are made to the cell. The I/O mapping screen can be accessed directly from the Setup Screen by pressing the {I/O Mapping} button or through the Profile Wizard.

> **WARNING**

Incorrect I/O mapping can cause robot collision (crash), with resultant damage to work cell components. Any changes to the I/O map will affect all profiles globally.
To assign a specified sign number to an action, proceed as follows:
1. Select the Input/Output group (IG#, OG#).
2. Select the Input/Output number you wish to assign.
3. Touch the button associated with the action you wish to assign to the I/O number.

**NOTE**
Station tabs provide different actions/signals for each cell component selected (see figure above).
4 Advanced Operation

This chapter provides procedures and instruction for using more advanced operating features of the EasyLoad™ application.

4.1 Import/Export Settings

The Import/Export screen allows import/export of profiles, machine types and job template. You can also manage profiles by deleting or making copies of existing profiles. The Import/Export screen can be accessed directly from the Setup screen by pressing the {Import/Export} button or through the first step of the Profile Wizard by pressing the {Import Settings} button in the lower left corner.

Fig. 4-1: Import/Export Screen

Select the desired file from the dropdown lists and touch the appropriate operation -

PROFILES - A profile contains all of the information collected during the Profile Wizard process.

MACHINE TYPES - A machine type file contains all necessary dimensions of a given machine center (refer to Section 4.2).

JOB TEMPLATES - A job template is a robot job that contains special tags indicating where the collected data should be inserted (refer to Section 4.3).

WARNING

• When importing a profile from another work cell, you must reconfigure the positions of all objects in the work cell. Failure to do so can result in a robot collision (crash) with work cell components.

• Importing and exporting will overwrite existing files.
4.2 Creating New Machine Type (.MCT) Files

A Machine Type file contains information regarding the dimensions of a particular machine as well as the location of the chuck. You will not be able to select a machine center for use in the application unless a machine type file is present with this information.

The Machine Type file is simply a text (.ini) file renamed with an (.mct) extension. The file can be created/edited with any standard text editor (such as Microsoft Notepad).

The data is stored in standard .INI format.

For example -

[SectionName]
  EntryName=Entry Value
  SecondEntry=Entry Value

[AnotherSection]
  AnotherEntry=Entry Value

[END]

The entry value can be an integer or text. Please note that all section names and entry names are case sensitive - "Hi there" is not the same as "HI THERE" or "hI ThEre".

**NOTE** When making a new Machine Type file, it is recommended that you export a current one and then modify the values.

The following is a list of required sections and entries for a Machine Type file -

**Information**

- MachineName - Text: The machine name or model
- MillOrLathe - Text: Either "Lathe" or "Mill"
4.3 Modifying the Job Templates

If your robot/machine cell requires specific customization, you can modify the robot's program to perform specific tasks.

**NOTE**
Modifications of the job templates must be performed by personnel who have received Motoman training in robot programming.

Job customization is performed by editing the robot Job Template (.JBT) files stored in the programming pendant. You can also create Utility jobs to handle custom tasks not supported by EasyLoad. These templates and Utility jobs are used by the application to generate the final robot jobs.

**NOTE**
You cannot create new job templates. You may only modify existing ones by exporting them from EasyLoad.

You can create as many Utility Jobs as needed.
4.3.1 Exporting Templates

To modify a job template, you must first export it from the application.

To export a Job Template (.JBT) file, proceed as follows:

1. Insert a 32 MB (or greater) memory card into the programming pendant.
2. From the Home/Operation screen, press the {Setup} button.
3. Press {Import / Export}.
4. Select the appropriate job template from the dropdown window and press {Export Job Template} or {Export All}.

The following is a list of all Job Template file names:

- **MCMAST.JBT** - Master job that calls all sub-jobs (DO NOT modify this job!).
- **TPALT.JBT** - Takes parts from an infeed pallet.
- **MAKEUF.JBT** - Creates user frames from the provided touch-off points (DO NOT modify this job!).
- **TCONV.JBT** - Takes parts from an infeed conveyor.
- **TBLow.JBT** - Takes parts from an auxiliary blow-off station.
- **TGRip.JBT** - Takes parts from an auxiliary re-gripping station.
- **TMC.JBT** - Takes parts from a machine center.
- **PPALT.JBT** - Puts parts on an outfeed pallet.
- **PCONV.JBT** - Puts parts on an outfeed conveyor.
- **PBLOW.JBT** - Puts parts on an auxiliary blow-off station.
- **PGRIP.JBT** - Puts parts on an auxiliary re-gripping station.
- **PMC.JBT** - Puts parts into a machine center.
- **TCUST.JBT** - Takes part from custom station.
- **PCUST.JBT** - Puts part on to custom station.

Utilities jobs (normal robot jobs with the .JBI extension) can also be used with EasyLoad™. Unlike job templates, these jobs cannot contain Job Template tags but can be called by job templates. All utility jobs that have been imported into EasyLoad, are downloaded to the controller every time robot jobs are regenerated. If a Utility job is in your JobTemplates folder on the CF, it is automatically imported if it is not already in EasyLoad. If the Utility job already exists, it will not be overwritten.

**NOTE**

The memory card should now contain the directory "JobTemplates" in the root directory. You can open / edit these files in Microsoft Notepad, or any basic text editor.

The following is a list of all Job Template file names:

**MCMAST.JBT** - Master job that calls all sub-jobs (DO NOT modify this job!).
**TPALT.JBT** - Takes parts from an infeed pallet.
**MAKEUF.JBT** - Creates user frames from the provided touch-off points (DO NOT modify this job!).
**TCONV.JBT** - Takes parts from an infeed conveyor.
**TBLow.JBT** - Takes parts from an auxiliary blow-off station.
**TGRip.JBT** - Takes parts from an auxiliary re-gripping station.
**TMC.JBT** - Takes parts from a machine center.
**PPALT.JBT** - Puts parts on an outfeed pallet.
**PCONV.JBT** - Puts parts on an outfeed conveyor.
**PBLOW.JBT** - Puts parts on an auxiliary blow-off station.
**PGRIP.JBT** - Puts parts on an auxiliary re-gripping station.
**PMC.JBT** - Puts parts into a machine center.
**TCUST.JBT** - Takes part from custom station.
**PCUST.JBT** - Puts part on to custom station.

**NOTE**

- When your modifications are complete, you must IMPORT your template into the EasyLoad™ application.
- Importing a template with OVERWRITE the previous template. Always make a BACKUP copy before making changes! Changing a job template will change the generated jobs for ALL profiles.
The following is a list of standard utility jobs:

**EASYLOAD.JBI** - Top level job that controls the cell operation. This job calls the MCM AST job to start the part processing sequence.

**TGETANG.JBI** - Calculates the destination point angular values to orient the gripper to take the part.

**PGETANG.JBI** - Translates the dimensions and sides of the part in the gripper to express them relative to station local frame and then calculates the destination point angular values to orient the gripper to put the part in the station.

**HOME.JBI** - Moves the robot to the safe home position recorded during initial setup (Position Variable 127).

**VERIFY.JBI** - Used when verifying recorded points during profile creation.

### 4.3.2 Importing Job Templates

In order for your changes to a Job Template or a Utility job to be recognized, you must import the modified file into EasyLoad.

1. From the Home/Operation screen, press the {Setup} button.
2. Press {Import / Export}.
3. Select the appropriate job template from the dropdown window and press {Import Job Template} or {Import All}.

### 4.3.3 Job Template Tags

The job templates contain placeholders and called tags, that tell the application where to fill in information. This is done for all information including I/O signal points, part dimensions, machine dimensions, and more. When creating/modifying a template, never use a hard-coded number for a measurement. Instead, use the appropriate tag so the application can change the number when appropriate during the process.

To place a tag in a template, you must type the name of the tag, surrounded by the percent (%) symbol.

Example: `WAIT IN#(%inRobotGrip1Open%)=ON`.

This allows the application to fill in the correct I/O point for the signal that states the gripper is open.

The following is a list of available tags:

#### 4.3.3.1 General Tags

<table>
<thead>
<tr>
<th>Tag</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>profileName</strong></td>
<td>Name of the current profile.</td>
</tr>
<tr>
<td><strong>uFToAdd</strong></td>
<td>Index of the user frame to the current job.</td>
</tr>
<tr>
<td><strong>currentTool</strong></td>
<td>Robot tool number to use for the current job.</td>
</tr>
<tr>
<td><strong>standbyIndex</strong></td>
<td>Index of the P-variable corresponding to the station Standby position.</td>
</tr>
</tbody>
</table>
skipStandby - Numeric flag indicates if the robot should go to the Standby position point or skip it.

- 0 - Go to Standby position.
- 1 - Skip (Do not go to) Standby position.

ivarIndexTestRun - I-variable index containing the bit that determines if the job should be run at low speed. (1 - Slow Speed).

speedAir - Speed for joint moves between stations.

dependApproachJ - Speed for joint moves at station.

dependApproachL - Speed for linear moves at station.

dependPickPlace - Speed picking/placing the part (linear move).

4.3.3.2 Input Signals

inRobotGrip1Open - Input number signaling gripper 1 is open.
inRobotGrip1Closed - Input number signaling gripper 1 is closed.
inRobotGrip1PartPresent - Input number signaling a part is present in gripper 1.
inRobotGrip2Open - Input number signaling gripper 2 is open.
inRobotGrip2Closed - Input number signaling gripper 2 is closed.
inRobotGrip2PartPresent - Input number signaling a part is present in gripper 2.
inInfPartPresent - Input number signaling part is present on the infeed.
inInfOkToEnter - Input number signaling that it is Ok To Enter on infeed area.
inInfUsePri - Input number signaling to use the primary infeed source.
inInfUseAlt - Input number signaling to use the alternative infeed source.
inOffPartPresent - Input number signaling part is present on the outfeed.
inOffOkToEnter - Input number signaling that it is Ok To Enter on outfeed area.
inOffUsePri - Input number signaling to use the primary outfeed source.
inOffUseAlt - Input number signaling to use the alternative outfeed source.
inMCChuckOpen - Input number signaling chuck is open.
inMCChuckClosed - Input number signaling chuck is closed.
inMCDoorOpen - Input number signaling door is open.
inMCLoadReq - Input number signaling a load request from the machine.
inMCUnloadReq - Input number signaling an unload request from the machine.
inMCReseatReq - Input number signaling a reseat request from the machine.
inMCExitReq - Input number signaling an exit request from the machine.
inMCUser1 - Input number signaling a user-defined request from the machine.
inMCUser2 - Input number signaling a user-defined request from the machine.
4. Advanced Operation

4.3 Modifying the Job Templates

inMCUser3 - Input number signaling a user-defined request from the machine.

inMCUser4 - Input number signaling a user-defined request from the machine.

ivarPartComplete - Index of the I variable used to count the completed parts put in outfeed.

ivarIndexPurge - Index of the I variable used to indicate that the robot should break out of a loop command and stop processing new parts from the infeed. If the I variable contains any value other than 0, the robot breaks out of the loop.

4.3.3 Output Signals

outRobotOpenGrip1 - Output number signaling to open gripper 1.

outRobotCloseGrip1 - Output number signaling to close gripper 1.

outRobotOpenGrip2 - Output number signaling to open gripper 2.

outRobotCloseGrip2 - Output number signaling to close gripper 2.

outMCACK - Output number signaling acknowledgment and completion of a machine request.

outMCCycleStart - Output number signaling to start the machine process.

4.3.4 Palletizing

ivarResetPallet - I-variable index containing the indicator to reset the palletizing for infeed/outfeed (changes based on current job).

ivarCounterX - I-variable index containing a counter for palletizing on infeed/outfeed (changes based on current job).

ivarCounterY - I-variable index containing a counter for palletizing on infeed/outfeed (changes based on current job).

ivarCounterZ - I-variable index containing a counter for palletizing on infeed/outfeed (changes based on current job).

numItemsX - Number of items along the x-axis of the pallet for the infeed/outfeed (changes based on current job).

numItemsY - Number of items along the y-axis of the pallet for the infeed/outfeed (changes based on current job).

numItemsZ - Number of items along the z-axis of the pallet for the infeed/outfeed (changes based on current job).

distancePartsX - Distance, in \( \mu \text{m} \), between part centers in the x-axis direction on the pallet for the infeed/outfeed (changes based on current job).

distancePartsY - Distance, in \( \mu \text{m} \), between part centers in the y-axis direction on the pallet for the infeed/outfeed (changes based on current job).

distancePartsZ - Distance, in \( \mu \text{m} \), between part bottoms in the z-axis direction on the pallet for the infeed/outfeed (changes based on current job). Used for stacks of multiple pallets.

distanceFromOrgX - Distance along the x-axis, in \( \mu \text{m} \), from the origin point (first touch-off point) of the infeed/outfeed (changes based on current job) to the center of the first part on the pallet.
distanceFromOrgY - Distance along the y-axis, in μm, from the origin point (first touch-off point) of the infeed/outfeed (changes based on current job) to the center of the first part on the pallet.

distanceFromOrgZ - Distance along the z-axis, in μm, from the origin point (first touch-off point) of the infeed/outfeed (changes based on current job) to the bottom of the first part on the pallet.

4.3.3.5 Conveyor

cDistanceFromOrgX - Distance along the x-axis, in μm, from the origin point (first touch-off point) of the infeed/outfeed (changes based on current job) to the center of the first part on the conveyor.

cDistanceFromOrgY - Distance along the y-axis, in μm, from the origin point (first touch-off point) of the infeed/outfeed (changes based on current job) to the center of the first part on the conveyor.

cDistanceFromOrgZ - Distance along the z-axis, in μm, from the origin point (first touch-off point) of the infeed/outfeed (changes based on current job) to the bottom of the first part on the conveyor.

4.3.3.6 Machine Center

mcNo - Number of the machine center.
opNo - Number of the machining operation.
chuckFingerLen - Length of the chuck fingers (μm).
plateSurfaceToChuck - Distance from the chuck face to the plane used for the touch-off points (μm).
SideOfChuck - Number representing which side of the machine the chuck is located.
   (1) - Bottom Floor
   (2) - Left Wall
   (3) - Top Ceiling
   (4) - Right Wall
DoorWidth - Width of the door opening (μm).
DoorHeight - Height of the door opening (μm).
DepthToChuck - Distance from the door opening to the center of the chuck (μm).
ClearancePastChuck - Distance from the center of the chuck to the rear wall of the machine (μm).
ClearanceAboveChuck - Distance, in μm, from the center of the chuck to the ceiling of the machine.
ClearanceBelowChuck - Distance, in μm, from the center of the chuck to the floor of the machine.
ClearanceOutFromChuck - Distance, in μm, from the center of the chuck to the opposite wall of the machine or tailstock.
4.3.3.7 Part Information

- The dimensions and grip-point of the part vary throughout the process. The tags listed here, under PART INFORMATION, will always fill in the correct value when they are referenced.

- Refer to Section 3.9 for an explanation of part dimensions.

aDimension - Length, in μm, of the part in the A direction (see Section 3.9).
bDimension - Length, in μm, of the part in the B direction (see Section 3.9).
cDimension - Length, in μm, of the part in the C direction (see Section 3.9).
sideToGrab - Number representing the side of the part to grab (see Sec 3.2).
sideInChuck - Number representing the side of the part to place in the chuck (see Sec 3.2).
sideToMeasFrom - Number representing the side to measure a grab-point from (see Sec 3.2).
distanceToGrab - Distance, in μm, from the sideToMeasFrom to the grab point (see Sec 3.2).
depthIntoGripper - Distance, in μm, from the sideToGrab to the grab center-point (see Sec 3.2).
distanceIntoChuck - Distance, in μm, to insert the part into the chuck.
overDrive - Extra distance, in μm, to travel after a part is inserted into the chuck.

4.3.3.8 Current Status Text

dvarIndexStr1 - Index of the D-variable to save the first ¼ of the Current Status string in (see Sec 4.4.3).
dvarIndexStr2 - Index of the D-variable to save the second ¼ of the Current Status string in (see Sec 4.4.3).
dvarIndexStr3 - Index of the D-variable to save the third ¼ of the Current Status string in (see Sec 4.4.3).
dvarIndexStr4 - Index of the D-variable to save the fourth ¼ of the Current Status string in (see Sec 4.4.3).

4.3.4 Modifying "Current Status" on Home Screen

At the top of the Home screen is a text box that displays the current status of the machining process. This display is controlled by the job templates as they are executed. You can modify the text that is displayed by changing the job template.

NOTE To be displayed properly, the text must consist of exactly four words with four characters each.
To modify the current status display, proceed as follows:

1. Set the value of any string variable, S-variable, to a four character word.
2. Set the value of byte variable 11 (B-variable 11) to the tag corresponding with the appropriate word in the text.
3. Set the value of B-variable (12) to the index of the S-variable above.
4. Call robot job STR2DVAR.
5. Repeat for each of the four words.

Example -

```
SET S007 "WAIT"
SET B011 %dvarIndexStr1%
SET B012 7
CALL JOB: STR2DVAR
SET S008 "MACH"
SET B011 %dvarIndexStr2%
SET B012 8
CALL JOB: STR2DVAR
SET S009 "LOAD"
SET B011 %dvarIndexStr3%
SET B012 9
CALL JOB: STR2DVAR
SET S010 "REQU"
SET B011 %dvarIndexStr4%
SET B012 10
CALL JOB: STR2DVAR
```

Produces - WAIT MACH LOAD REQU
5 Troubleshooting

5.1 Reconfiguring the CF (Compact Flash) Card

EasyLoad™ ships with a pre-configured CF card containing necessary files and media required for use by the EasyLoad™ application. However, if your CF card is lost or damaged, you can reconfigure a new CF card using the following procedures:

1. Obtain a 32 MB (or larger) Compact Flash card.
2. Contact Motoman to obtain a .ZIP file containing the needed files.
3. Extract the .ZIP file to the root directory of the CF card (outside of any folder).
4. After the .ZIP file extraction is complete, verify that the CF card contains the following folders:
   - \Images
   - \JobTemplates
   - \MachineTypes
   - \Videos

5.2 Application Issues

PP_APPLICATION button is not present on the Programming (teach) Pendant display.

Cause is most likely a robot alarm or error. Clearing the alarm will cause the button to display, allowing you to launch the application.
## 5.3 Error Messages

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Meaning</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot configure application without the CF card inserted</td>
<td>If there are no configured profiles on your system, a compact flash (CF) card containing the setup files must be plugged into the programming pendant.</td>
<td>Refer to Section 2.1 for information on the CF setup.</td>
</tr>
<tr>
<td>You must be in MANAGEMENT security mode to configure this application</td>
<td>You must be logged into the controller under MANAGEMENT security. This prevents unauthorized users from tampering with the profiles.</td>
<td>Refer to Section 2.6 for information on how to change security level.</td>
</tr>
<tr>
<td>You must set the robot to TEACH mode to configure this application</td>
<td>For safety reasons, the rotary-mode-selection switch on the top of the programming pendant must be set to TEACH.</td>
<td>Set the rotary-mode-selection switch on the top of the programming pendant to TEACH.</td>
</tr>
<tr>
<td>No machine type files found on CF or Programming (teach) Pendant! Cannot configure application.</td>
<td>If there are no configured profiles on your system, a compact flash (CF) card containing the setup files must be plugged into the programming pendant.</td>
<td>Refer to Section 5.1 for information on CF card setup.</td>
</tr>
<tr>
<td>You must finish the wizard once before you can use this application</td>
<td>If you attempt to cancel the wizard before you finish creating your first profile, you will be forced to work through the setup again.</td>
<td>Re-launch EasyLoad™ when you are ready perform setup.</td>
</tr>
<tr>
<td>Job templates not found on CF or Programming (teach) Pendant! Please re-run the wizard with the templates stored on the CF card.</td>
<td>If there are no configured profiles on your system, a CF card containing the setup files must be plugged into the programming pendant.</td>
<td>Refer to Section 5.1 for information on CF card setup.</td>
</tr>
<tr>
<td>Job template * not found on Programming (teach) Pendant! Either use the import screen or run the wizard again with the job templates loaded on the CF.</td>
<td>Your CF card was not properly configured with all of the correct files. If there are no configured profiles on your system, a CF card containing the setup files is required to be plugged into the programming pendant.</td>
<td>Refer to Section 5.1 for information on the CF setup.</td>
</tr>
<tr>
<td>Job template * contains uneven number of % characters! Cannot generate job.</td>
<td>There is a tag in the job template that is not fully surrounded by the % character on both sides.</td>
<td>Modify the job template and fix the incorrect tag. See Section 4.1 for information on exporting templates and modifying tags.</td>
</tr>
<tr>
<td>Unknown tag * found in job template! Cannot generate job.</td>
<td>There is a tag in the job template that the system does not recognize.</td>
<td>The tag may be misspelled, or is using the wrong capitalization. Refer to Section 4.3 for a list of all the valid tags and their correct spellings.</td>
</tr>
<tr>
<td>Failed to save robot job file * to controller! The process will not run. Please correct the job template and re-run the wizard.</td>
<td>This is most likely caused by a syntax error in your job template.</td>
<td>Motoman recommends creating job templates using the programming pendant. The controller verifies proper syntax as the template is created. The job template must be saved to a CF card and imported into the application. See Section 4.1 for information on importing templates.</td>
</tr>
<tr>
<td>Failed to backup profile settings!</td>
<td>EasyLoad™ was unable to backup profile settings.</td>
<td>Try your action again. If it fails again, contact Motoman support.</td>
</tr>
<tr>
<td>Failed to save pallet information to controller! Process may behave erratically if using pallet.</td>
<td>EasyLoad™ was unable to save pallet information to the controller.</td>
<td>Try your action again. If it fails again, contact Motoman support.</td>
</tr>
</tbody>
</table>
## Troubleshooting

### EasyLoad ™ 5.3 Error Messages

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Meaning</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed to set job cycle to CYCLE! Please do so manually.</td>
<td>When starting the process, the robot is set to run the job until the process is complete. This setting failed.</td>
<td>Exit the application and manually change the cycle to CYCLE.</td>
</tr>
<tr>
<td>Failed to start process! EasyLoad ™ was unable to start the process.</td>
<td></td>
<td>Try your action again. If it fails again, contact Motoman support.</td>
</tr>
<tr>
<td>Failed to stop process! Use Hold button on Programming (teach) Pendant, or E-Stop if necessary.</td>
<td>EasyLoad ™ was unable to stop the process.</td>
<td>Push the HOLD button or E-Stop push button to stop all robot motion. Try your action again. If it fails again, contact Motoman support.</td>
</tr>
<tr>
<td>Video file not found.</td>
<td>The CF card was not properly configured with all of the correct files. If there are no configured profiles on your system, a compact flash (CF) card containing the setup files is required to be plugged into the programming pendant.</td>
<td>Refer to Section 5.1 for information on CF card setup.</td>
</tr>
<tr>
<td>Unrecognized sequence step. Cannot create positioning information for this step. Please go back and verify your sequence configuration.</td>
<td>The sequence configuration is incorrect.</td>
<td>Verify that the sequence is configured properly.</td>
</tr>
<tr>
<td>Cannot continue positioning with an active alarm. Please return to the main Programming (teach) Pendant display and clear the alarm.</td>
<td>If you choose not to reset the alarm within the application, it must be reset from the outside the application before you can continue to the next step.</td>
<td>Allow the application to close, and then consult your robot manual for instructions on dealing with the alarm.</td>
</tr>
</tbody>
</table>
EASYLOAD

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Specifications are subject to change without notice for ongoing product modifications and improvements.