EcoTrim-6224SL Series
with Integrated Safety Logic
SYSTEM MANUAL
FOR DX200 CONTROLLER

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

MOTOMAN INSTRUCTIONS

EcoTrim-6224SL SERIES INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL
DX200 MAINTENANCE MANUAL

The DX200 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 174854-1CD
Revision: 0
MANDATORY

- This system manual provides an overview of the Motoman EcoTrim-6224SL Series system. It gives general information about the system, a description of its major components, and the procedures for installation, system operation, and preventive and repair maintenance. Be sure to read and understand this manual thoroughly before installing and operating the EcoTrim-6224SL Series system.

- General items related to safety are listed in Section 2 of the DX200 Controller Manual. To ensure correct and safe operation, carefully read the DX200 Controller Manual before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure that 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 a 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.
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 installation, operation, maintenance, or inspection of the Motoman EcoTrim-6224SL Series system.

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.

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 by pressing the EMERGENCY STOP buttons on the operator station or Programming Pendant (refer to Figure 1). When 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 1: EMERGENCY STOP Button

• Release the EMERGENCY STOP button (refer to Figure 2). Once this button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn 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:
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Ensure that you have a safe place to retreat to 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 DX200 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 operator station and on the Programming Pendant.
Definition of Terms Used Often in this Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product. The manipulator usually consists of the controller, the Programming Pendant, and supply 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>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>
Explanation of Warning Labels

The following warning labels are attached to the manipulator (refer to Figure 3).

Always follow the warnings on the labels.

Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Figure 3: Warning Label Locations
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1 Introduction

1.1 About This Document

This manual provides a “first look” and overview of the EcoTrim ETH-6224SL and EcoTrim ETU-6224SL series systems. You should read and understand this system manual before moving to the more detailed documentation that is included with your EcoTrim-6224SL system. Although basic in content, the system manual is intended for personnel who have received operator training from Motoman and are familiar with the operation of this particular Motoman system. For more detailed information on any specific component or peripheral of the EcoTrim-6224SL system, please review the full documentation package that is included with your EcoTrim-6224SL system (refer to section 1.3 "Reference Documentation" on page 1-15).

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.

This manual contains the following sections:

chapter 1 “Introduction”
This section provides general information about the EcoTrim-6224SL system, a list of reference documents, and customer support contact information.

chapter 2 “Equipment Description”
This section provides a description of the major components of the EcoTrim-6224SL system.

chapter 3 “Installation”
This section provides installation procedures for the EcoTrim-6224SL system.

chapter 4 “Operation”
This section provides an overview of EcoTrim-6224SL system operation, including start-up, loading, normal operations, fault recovery, and system shutdown.

chapter 5 “Maintenance”
This section provides preventive maintenance requirements for certain components of the EcoTrim-6224SL system.

chapter 6 “Anchoring”
This section gives recommended anchoring hardware specifications and foundation requirements for all the equipment that is part of the EcoTrim-6224SL system.
1.2 System Overview

The EcoTrim-6224SL system provides a complete ultrasonic trimming/routing process solution in a standard configuration (see Fig. 1-1 “System Layout”). The EcoTrim-6224SL systems are designed around the Motoman MH24 robots, a DX200 controller assembly, an Ultrasonic trimming tool or an Ultrasonic trimming tool/router hybrid tool, and a RM2-SL series positioner (RM2-755). Refer to Fig. 2.2 “DX200 Controller” on page 2-1 for a description of features and advantages of the DX200 controller. Refer to section 2.4 “RM2-SL Series Positioner” on page 2-6 for a description of the RM2-SL Series positioners.

The EcoTrim-6224SL system features a total safety environment that meets or exceeds the requirements of the ANSI/RIA R15.06 Robot Safety standard and is designed to safeguard both personnel and equipment. Heavy-gauge, wire-mesh safety fencing prevents unintended entry of personnel into the work cell while it is in operation. A dual-channel interlocked door at the rear of the work cell provides convenient access to equipment while providing a safety interlock to disable all equipment should the door be opened while the robots are active. A safety light curtain system provides a “sensing field” in front of the positioner to protect the operator. Positioner movement is prevented whenever an operator disrupts the sensing field of the light curtain system. In addition, maximum robot travel is physically limited by an S-axis “hard stop” at the base of each robot.

Safeguards for the system compliment the operation while protecting the various resources that will program, operate, and/or provide maintenance to the system. These safeguards and interlocks are based on possible pinch points or other hazards determined during the risk assessment. While the system design safeguards the support staff, it does not protect against misuse. Misuse of the system would include, but not limited to, climbing over/under barriers, climbing over/under interlocks, or disabling/bypassing of system interlocks.

During the installation and commissioning process the end user must ensure that tooling, ancillary equipment … etc. have not introduced additional hazards into the design. This evaluation ensures that the system will provide safe and reliable operation.
1.2.1 System Layout

The MH24 manipulator(s) (robots), an RM2-SL positioner, and heavy-gauge, welded wire safety fencing all share a common steel base for ease of installation and assure proper alignment between the robot(s) and positioner. The welded wire safety fencing completely surrounds the EcoTrim-6224SL work cell.

The common equipment platform is located outside and to the rear of the work cell. This arrangement allows most of the component wiring interconnects to be pre-wired at the factory, thus reducing the amount of point-to-point wiring required by the customer. All operator controls, including those on the Programming Pendant, DX200 controller and Operator Station pedestal, are accessible from outside the EcoTrim-6224SL work cell.
1.2.2 Major Components

The EcoTrim-6224SL system includes the following major components:

- Two Motoman MH24 manipulators (robots)
- One DX200 controller assembly
- One RM2-SL series positioner:
  - RM2-755SL
- One Programming Pendant (located on DX200 controller)

The DR2C controller configuration will include two programming pendants, but only one is required to run the system. DRC controller configurations only include one programming pendant.

- One Operator Station
- Ultrasonic trimmer or the Hybrid Ultrasonic trimmer/Router (one for each robot)
  - Complete pneumatic system
  - One accessory stand with blade sharper and blade sensor. (Optional second stand available)
  - Tool Control
- Safety equipment:
  - Heavy-gauge, welded wire safety fencing
  - Light curtain system
  - Interlocked work-cell access door
  - Steel screen on the positioner

1.2.3 Optional Equipment

The following optional equipment is available for use with the RM2-SL Series system:

- Accessory Stand Assembly
1.2.4 Theory of Operation and Safe Guarding

System Overview and Variations:
The DX200 EcoTrim-6224SL Series of cells are designed to accommodate one or two MH24 robot(s). The cells are available in two standard configurations:

- ETU-6224-755 (Optional: various robot and RM2 positioner combinations)
- ETH-6224-755 (Optional: various robot and RM2 positioner combinations)

The cell is designed for trimming applications where the robot controller(s) and ultrasonic controls are located behind the cell. In the EcoTrim 6224SL Series cells, the two robots utilize full-size controller cabinets in either a DRC or DR2C (optional) configuration. In the DRC robot configuration, the robots and controllers are paired such that they cannot be separated. The DR2C configurations are such that if the robots need to be redeployed, the robots and controllers could be separated to be used in individual robot applications.

The three-axis RM2 positioner provides high-speed and compact part positioning in a variety of spans and capacities. No matter which positioner is selected, they all operate the same. The positioner’s main axis (S1) allows for 180 degree motion. This “trunnion” axis is intended to be driven into welded hard-stops on both sides of the main casting.

Driving the trunnion axis into the hard-stops provides a fixed location where the servo motors can maintain position while parts are loaded and unloaded from the operator side fixturing. The two tooling axes (S2 & S3) are allowed to rotate more than 720 degrees and allow the robot(s) to coordinate motion while processing the part. Options for slip-rings are available and are not included in the standard cell.

Other items included in the cell are: A sliding door with safety interlock that allows access from the rear of the work cell. The MH24(s) sit(s) on a 915 mm raiser(s). Mounting provisions are provided in the base for in-cell blade sharpening station(s). A pedestal mounted operator station located in the front of the cell (can be relocated as desired). An operator station provides a [Cycle Start] push button, [Auto/Manual] selector switch, an [E-Stop] button, a [Servo On] button, a [Start] button, an [Alarm Reset] button, and a three position joystick to jog the operator side tooling. The operator station also provides indication of “Servo On”, “Alarm” status, and “Cycle Latched”. A L-shaped light curtain provides personnel detection on the front of the cell. This light curtain will detect when someone approaches the RM2 positioner and ensures that the RM2 positioner does not move while the light curtain is broken.
1.2 System Overview

The robot’s “Safety Logic Circuit” and R1’s Functional Safety Unit (FSU) are responsible for monitoring safety critical devices and controlling positioner motion (described in detail in later sections). In the standard configuration, a single FSU in provided in R1 to monitor the position and status of the RM2 positioner. The “Safety Logic Circuit” monitors safety critical external devices such as the light curtains and FSU generated signals like the RM2’s trunnion position (At side A/B) then generates signals to enable and disable other FSU functions such as “Standstill Monitoring” and “Speed Limiting” to ensure operator safety.

**NOTE**

FSU’s are not provided as standard for R2 or R3 but can be added if required for project execution or local safety requirements.

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**Fig. 1-2: EcoTrim-6224**

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1.2.5 Cell Related Safety Functions & Components:

Ensuring safety is paramount to Yaskawa. The following sections outline the various safety related functions and their operational interactions for proper operation. Functional Safety files are loaded and verified prior to shipment from Yaskawa and are continually checked to ensure they are active when expected through concurrent IO (CIO). The concurrent I/O is programmed to generate a “SYS CRITICAL FSU FUNCT DISABLED” alarm if any of the safety functions are disabled while in “Play” mode. A message on the bottom of the programming pendant will indicate “AxSpdMon#1-5/AxisRange#1,2 Dbled” which tells the operator which files are required to be active to make the system operational in “Play Mode”.
1.2.5.1 Trunnion axis position via “Axis Range Limit” Function:

These versions of cells do not utilize the trunnion axis limit switches used to determine “At Side A” or “At Side B”. Instead, the FSU’s “Axis Range Limit” function provides these status inputs to the “Safety Logic Circuit.” The physical switches may still reside in the positioner but they are not connected to the robot controller.

The following two “Axis Range Limit” files are used to report the trunnion axis position instead of mechanical limit switches. The two files are set as “Valid” which indicates that they are active at all times and their “Alarm” setting is set to “Off” to allow them to report actual status without interrupting cell operation. These two files will enable the specified “Output Signal” (FS-OUT01 or FS-OUT02) whenever the trunnion axis is within the 1 degree location specified.

File#1 “Trunnion A Side At Rbt(s)” may not read the (-179.5) to (-180.5) degrees as shown below. The values for this file could vary by as much as (± 3) degrees if the welded hardstop location varied on the particular positioner. Yaskawa will ensure proper setup prior to shipping the system, just be aware that the angular values in file#1 could vary based on the particular positioner.

Fig. 1-3(a): “Axis Range Limit” Files Used
1.2 System Overview

1.2.5.2 Safety Logic Circuit:

The “Safety Logic Circuit” acts as an internal safety PLC monitoring the status of inputs and generating controlling outputs. The inputs could be external switches or sensors connected to either the Machine Safety Board or the Functional Safety Board. In the case of the EcoTrim-6224 Series cell the Light Curtains are connected to the Functional Safety Board’s FSBIN1 input. The Safety Logic Circuit then monitors the light curtain status along with the trunnion axis position (at side A or B) to determine what axes need to be placed in “Standstill”, Speed Limited to 30% speed, and the status of fixture A & B tooling power.

Results of the “Safety Logic Circuit” can be utilized in Concurrent IO (CIO) if the signals are mapped/routed through a MS-OUT signal. In the case of the EcoTrim-6224 Series cells, the majority of logic is routed through the MS-OUT signals and subsequently mapped to Universal Inputs so the
status can be checked from within INFORM jobs or mapped to network PLC’s.

**NOTE** Detailed operation of the “Safety Logic Circuit” can be found in the “DX200 Instructions” part number 165292-1CD

**Fig. 1-4: Safety Logic Circuit**
1.2.5.3 FSU Functions Controlled by “Safety Logic Circuit”:

The results of the “Safety Logic Circuit” are then used to enable and disable various FSU functions. The MS-OUT signals generated as part of the “Safety Logic Circuit” can be used as “Input Signals” to activate various safety functions.

**Fig. 1-5(a): “Speed Limit (Stop Monitor)” Files Used:**

<table>
<thead>
<tr>
<th>Axis</th>
<th>S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Prohibit trunnion axis motion</td>
</tr>
<tr>
<td>Triggering Input</td>
<td>MS-OUT07</td>
</tr>
<tr>
<td>Triggering Logic</td>
<td>Light curtain is broken and the trunnion axis located at “Side A” or “Side B”.</td>
</tr>
</tbody>
</table>
### Fig. 1-5(c): File#2: “S2 (Tool A) Standstill (0 Spd)”

<table>
<thead>
<tr>
<th>Axis</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Prohibit S2 (Tool A) motion</td>
</tr>
<tr>
<td>Triggering Input</td>
<td>MS-OUT08</td>
</tr>
<tr>
<td>Triggering Logic</td>
<td>Light curtain is broken and S2 (Tool A) is at the Operator</td>
</tr>
</tbody>
</table>

### Fig. 1-5(d): File#3: “S3 (Tool B) Standstill (0 Spd)”

<table>
<thead>
<tr>
<th>Axis</th>
<th>S3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Prohibit S3 (Tool B) motion</td>
</tr>
<tr>
<td>Triggering Input</td>
<td>MS-OUT09</td>
</tr>
<tr>
<td>Triggering Logic</td>
<td>Light curtain is broken and S3 (Tool B) is at the Operator</td>
</tr>
</tbody>
</table>
### 1. Introduction

#### 1.2 System Overview

**Fig. 1-5(e): File#4: “S2 (Tool A) 30% Speed Limit”**

<table>
<thead>
<tr>
<th>Axis</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Limit S2 (Tool A) Speed &lt; 30%</td>
</tr>
<tr>
<td>Triggering Input</td>
<td>MS-OUT10</td>
</tr>
<tr>
<td>Triggering Logic</td>
<td>S3 (Tool B) is at robot/S2 (Tool A) is at the operator</td>
</tr>
</tbody>
</table>

**Fig. 1-5(f): File#5: “S3 (Tool B) 30% Speed Limit”**

<table>
<thead>
<tr>
<th>Axis</th>
<th>S3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Limit S3 (Tool A) Speed &lt; 30%</td>
</tr>
<tr>
<td>Triggering Input</td>
<td>MS-OUT11</td>
</tr>
<tr>
<td>Triggering Logic</td>
<td>S2 (Tool A) is at robot/S3 (Tool b) is at the operator</td>
</tr>
</tbody>
</table>
1.2.5.4 Tooling Power Outputs Controlled by “Safety Logic Circuit”

It is common for the EcoTrim-6224 Series cells to have automated tooling. To support this, relays have been added to allow tooling power to be switched On and Off based on the “Safety Logic Circuit”. The “Safety Logic Circuit” controls FSU outputs FSBOUT#1 and FSBOUT#2 which drive force-guided relays on a breakout card located on the door-mounted interface panel.

Fig. 1-6: Tooling Power Output Controlled by “Safety Logic Circuit”

<table>
<thead>
<tr>
<th>FSU Outout: FSBOUT#1</th>
<th>Function: Enable power to S2 (Tool A) tooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triggering Logic:</td>
<td>Power is applied anytime other than when S2 is at the operator and the light curtain is broken or any of the E-Stop buttons in the cell have been pressed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FSU Outout: FSBOUT#2</th>
<th>Function: Enable power to S3 (Tool B) tooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triggering Input:</td>
<td>MS-OUT13</td>
</tr>
<tr>
<td>Triggering Logic:</td>
<td>Power is applied anytime other than when S3 is at the operator and the light curtain is broken or any of the E-Stop buttons in the cell have been pressed.</td>
</tr>
</tbody>
</table>

1.2.5.5 External E-Stop & Safety Gate:

Other safety critical inputs such as “External E-Stop” and “Safety Gate” are wired directly into the “Machine Safety” card. Their status is then available to the “Safety Logic Circuit”, where it can be utilized in conjunction with other logic if required.

1.2.5.6 System Teaching:

All systems are intended to be programmed from within the cell. In order to program the robot, the controller needs to be in “Teach Mode” from the selector switch on the front of the pendant. This “Teach Mode” selection will limit all robot speeds to 250 mm/min. While in “Teach Mode”, the gate can be opened allowing the programmer to enter the cell. In order for the robot's servo motors to be turned on, the enabling switch on the pendant needs to be maintained in the “center” position. Once servo power is on, the operator is able to manipulate and program the part as desired. While in “Teach Mode”, the individual robot(s) and the RM2's trunnion axis (S1) and tooling axes (S2 & S3) can be manipulated via the teach pendant. The system will have preconfigured “Sweep” jobs that will allow rotating of “Side A” and “Side B” tooling. Selecting these jobs and pressing “Interlock” + “Test Start” will execute the job and rotate the tooling into the robot work area. In “Teach Mode”, if the operator or another person breaks the light curtain while teaching, the “Speed Limit” function will activate (if the
1.2.5.7 System Operation:

Once path and logic programming have been completed, the system can be placed into operation when the following conditions have been met:

1. Teach pendant must be in “Play” Mode
2. The safety gate must be closed
3. The “Master” job must be selected
4. The job “Cycle” needs to be set to “AUTO”
5. Servo power has to be applied from the teach pendant
6. The “Start” button on the pendant needs to be pressed to begin execution of the “Master” job.

Normal cell production begins with the assumption that the trunnion axis is at either “Side A” or “Side B” as reported by the “Range Limit” file #1 or #2. Anytime the light curtain on the front of the cell is clear, the positioner is free to move as directed by the “INFORM” job but the operator-side tooling axis is speed limited to 30%. When an operator approaches the cell to load a part and breaks the light curtain, the operator-side tooling axis (S2 or S3) and the trunnion axis (S1) will enter “Standstill Monitoring,” ensuring no motion of the trunnion or operator-side tool can occur. After the part has been loaded, the operator must step out of the light curtain, ending the “Standstill” monitoring and the operator-side tooling axis reverts back to the 30% speed limit. The operator should then press the “Cycle Start” button on the operator station signaling the INFORM job to sweep the positioner when the robot side part is complete. In the event that the robot(s) are still processing the part when the “Cycle Start” button is pressed, the “Cycle Start” button will illuminate indicating that the RM2 will automatically sweep once the robot(s) complete their processing. After the positioner has swept, the operator can unload the processed part and reload a new part while the robot works on the other side. Assuming there are no faults or issues during the production of the part, once completed, the robot will return to a safe position, and assuming the next part has been loaded and the “Cycle Start” button pressed/latched, the “INFORM” job will sweep the positioner from side-to-side so the operator can unload the processed part. Once a new part has been loaded, the process begins again.

A 3-position joystick is located on the operator station to allow manual movement of the operator-side tooling. The joystick allows jogging forward and reverse to any desired position within +/- 90 degrees of the final sweep position. The light curtain must remain clear while jogging the axis to the desired position, the light curtain can be entered to load parts (standstill monitoring is enabled when the curtain is entered). Once the light curtain is clear, the joystick can be used to jog the positioner to another position if desired or if placed in the “Home” position momentarily, the positioner will re-home itself to the pre-sweep position. If the “Cycle Start” button is pressed prior to re-homing the axis, an automatic re-homing will occur to minimize cycle time.
1.3 Reference Documentation

For additional information on individual components of the EcoTrim-6224SL system, refer to the following documentation that is included with your system:

- Motoman *MH24 Manipulator Manual* (P/N 171483-1CD)
- Motoman *DX200 Controller Manual* (P/N 165292-1CD)
- Motoman *Maintenance Manual for DX200* (P/N 165293-1CD)
- Motoman *Operator's Manual for Form Cutting Function* (P/N 165468-1CD)
- Motoman *Operator's Manual for Form Cutting Function (For Cutting Device)* (P/N 165266-1CD)
- Motoman *DX200 Concurrent I/O Manual* (P/N 165294-1CD)
- Motoman *RM2 Positioner Manual* (P/N 166006-1CD)
- Motoman *DX200 Independent/Coordinated Control Function Manual* (P/N 165836-1CD)
- Motoman *INFORM Language User’s Manual* (P/N 165301-1CD)
- Vendor manuals for system components not manufactured by Motoman

1.3.1 Location of Operations in Reference Documentation

The table below provides the location(s) for various operations within the included reference manuals.

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1.4 Customer Support Information

If you need assistance with any aspect of your EcoTrim-6224SL system, 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 use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact Motoman Customer Support at the telephone number shown above.

Please have the following information ready before you call:

- System: EcoTrim-6224SL
- Robots: MH24
- Positioner: RM2-755SL
- Primary Application: Trimming
- Controller: DX200
- 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 DX200 controller R1 data plate
2 Equipment Description

2.1 Robot Description

The EcoTrim-6224SL Series system uses the Motoman MH24 six-axis robot(s). The MH24 robot has a payload capacity of 6 kg and features a horizontal reach of 2010 mm. The MH24 robot also features a relative positioning accuracy of ±0.08 mm.

The MH24 robots feature an internal cabling design that streamlines the robot profile, allowing access into confined spaces. The robot’s B-axis (Pitch/Yaw) features an expanded range of motion that improves circumferential trimming on cylindrical work pieces. The T-axis ( Twist) can rotate the trimming process ± 200 degrees without cable interference.

The robot’s S-axis rotation is physically limited by a hard stop located in the base of each robot. For more information, refer to the MH24 Manipulator Manual that came with your EcoTrim-6224SL Series documentation package (see section 1.3 “Reference Documentation” on page 1-15).

2.2 DX200 Controller

The EcoTrim-6224SL Series system features one (single robot) or two (dual robot) full size DX200 controllers. Expansion cabinets are mated to the master cabinet for each additional robot. The DRC configuration provides the same functionality without the space requirement and weight of additional, full-size DX200 controllers. This configuration also reduces the cost by eliminating redundant components and circuitry.

Through internal cable connections, the DX200 and each expansion cabinet is configured as controller R1 and R2. This configuration allows the two robots to take advantage of all the unique functions available only in a multi-robot system configuration. With the EcoTrim-6224SL Series system, the full-size DX200 controller cabinet is designated R1, while the expansion cabinet is designated R2. The DX200 controller assembly is mounted on a Common Equipment Base, which is positioned outside the EcoTrim-6224SL Series work cell (see Fig. 1-1 “System Layout” on page 1-3 and Fig. 2-1 “DX200-DRC Controller” on page 2-2).

In addition to controlling the movement of the robots, the DX200 controls the trimming power sources, the positioner, and provides the signals necessary to operate the trimming systems.

The DX200 features an embedded real-time operating system (RTOS) and is programmed with the Motoman INFORM programming language. For more information on the DX200 controller, refer to the DX200 Controller manual that came with your EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).
2.2.1 Programming Pendant

The Programming Pendant (see Fig. 2-2 “DX200 Programming Pendant” on page 2-3) provides the primary means of programmer/operator interaction with the EcoTrim-6224SL Series system. The pendant features the Windows® CE operating system and displays information on a 5.7-inch, color LCD, touch-screen display (640 X 480 VGA). The pendant also incorporates a CompactFlash® card slot for program backups.

The Programming Pendant provides icon-driven system programming. It also features a menu-driven interface to simplify operator interaction with the robots. Most operator controls are located on the Programming Pendant. This allows remote installation of the DX200 controller. By using the Programming Pendant, the operator can teach the robots motion; perform programming, editing, maintenance, and diagnostic functions; and enable or disable Operator Station control of the EcoTrim-6224SL Series system. For detailed information on the pendant’s programming keys, programming functions, and display functions, please refer to the DX200 Operator’s Manual for Cutting that is included with your EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).
The Programming Pendant’s LCD display goes dark after a few minutes of inactivity. Press any key to restore the screen.

Operator Station Enable or Disable is accomplished with the Programming Pendant’s Mode Select Switch. To transfer control of the EcoTrim-6224SL Series system to the Operator Station, set the Mode Select Switch to REMOTE.
2.3 **Operator Station**

The Operator Station (see Fig. 2-3 "Operator Station") includes a NEMA enclosure on a stand-alone pedestal. The following paragraphs describe the controls on the Operator Station.

*Figure 2-3: Operator Station*

2.3.1 **Operator Station — CYCLE START/CYCLE LATCHED**

*WARNING*

The operation of the CYCLE START/CYCLE LATCHED button is dependent on the structure of the Control Master job. Any alteration of the Control Master Job could result in injury to personnel or damage to equipment.

Pushing the green CYCLE START/CYCLE LATCHED button initiates a positioner sweep cycle if the robots are in HOME (Safe) position. If the CYCLE START/CYCLE LATCHED push button is pressed while the robots are trimming, or otherwise not in HOME (Safe) position, the Cycle Start command is "latched" into (stored in) the DX200 controller circuitry. When the robots return to HOME (Safe) position, the "latched" Cycle Start command is executed and the positioner sweeps. Circuitry in the DX200 controller prevents the positioner from continuously cycling should the operator depress and hold the CYCLE START/CYCLE LATCHED push button.

2.3.2 **Operator Station — Emergency Stop (E-STOP)**

Pressing the Operator Station’s Emergency Stop (E-STOP) push button initiates an Emergency Stop (E-STOP). Refer to section 2.6.3 "Emergency Stop (E-STOP)" on page 2-8 for a discussion of the E-STOP function and the procedures for recovering the EcoTrim-6224SL Series system from the Emergency stop (E-STOP) condition.

2.3.3 **Operator Station — ROBOT HOLD**

Pressing the red ROBOT HOLD button stops robot operation and interrupts the job until the operator presses the green START button to resume operation. Operation resumes at the point in the program where the ROBOT HOLD state was initiated.
2.3.4 Operator Station — ALARM
A red ALARM lamp illuminates to indicate that the DX200 controller has encountered an alarm condition.

2.3.5 Operator Station — POSITIONER AUTO/MANUAL
The POSITIONER AUTO/MANUAL switch is used to select automatic or manual mode for the positioner. When the switch is set to the AUTO position, the robots trim the parts immediately after the positioner sweeps. When the switch is set to the MANUAL position, the robots do not immediately start to trim after the positioner sweeps. The robots remain in HOME position.

The POSITIONER AUTO/MANUAL signal depends upon the structure of the Control Master job.

2.3.6 Operator Station — START
Pressing the green START button starts the current, active job. The Programming Pendant’s Mode Select Switch must be set to REMOTE and servo power must be ON for the START button to function.

2.3.7 Operator Station — RESET
The black RESET button is used to clear a minor alarm or error condition.

2.3.8 Operator Station — SERVO ON
The green SERVO ON push button turns servo power on if the Programming Pendant’s Mode Select Switch is set to REMOTE.

2.3.9 Operator Station — JOYSTICK CONTROL
The RM2-SL Series positioners have the ability to position each tooling axis (orbital axis) ±360° for better part-loading and unloading ergonomics. This rotation of the orbital axis (also known as “jogging”) is accomplished with the JOYSTICK CONTROL located on the Operator Station (see Fig. 2-3 “Operator Station” on page 2-4).
2.4 RM2-SL Series Positioner

The RM2-SL Series positioners are high-speed, three-axis, AC servo-controlled "Ferris-wheel" type positioners. The RM2-755SL positioner provides 755-kg capacity per side and three servo axes for high speed positioning. Fixture length is 2 meters or 3 meter (optional).

One external axis is used to rotate the trunnion (swing arm) axis, while two additional servo motors are used to rotate the two orbital (parts fixture) axes independently of the trunnion (swing arm) axis. The positioner uses a reciprocating motion that sweeps each side of the “Ferris-wheel”, from the operator’s loading zone into the robot work zone and back to the operator again. A metal screen divides the positioner into two work areas: Side A and Side B. When Side A is in the robot's trimming zone, Side B is facing the operator and ready to be loaded or unloaded.

- The customer shall supply all tooling and fixtures for the positioner.
- Motoman recommends application of a corrosion/rust preventive compound to tooling and fixtures located in a high-humidity environment.

The EcoTrim-6224SL Series system is capable of synchronized motion between various components depending on the job configuration. Synchronized robots move at the same time during operation. R1, R2, and R3 can be synchronized with the positioner, and each robot can be synchronized with the other two. All three robots can work simultaneously on a rotating work piece. For additional information on this type of independent control and coordinated motion, refer to the DX200 Independent/Coordinated Control Function Manual that is included with the EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).

For additional positioner information, including specifications, an illustrated parts list, load capabilities, and dimensions, refer to the Motoman Positioner Manual included with the EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).

2.5 Trimming Equipment

These cutting tools are used for high-speed ultrasonic cutting, trimming deburring and chamfering applications. This method of cutting and trimming is ideal for a variety of non-metallic materials including plastics, film, fiberglass and non-woven fabrics. It can be used for automotive interior components such as carpet, headliners, door trim and instrument panels; also recreational vehicles such as boats, ATVs and snowmobiles. These tools can replace waterjet and laser cutting, hard tooling and manual routing.

The kits come complete with the cutting tool, cables, air lines and regulators, and all mounting hardware. Optional tools are available to maintain sharp blades.
2.5.1 Ultrasonic Cutting Tool

The ultrasonic cutting tool comes with built-in compliance to keep the cutting blade tight against part fixtures for precise and repeatable cuts. There are six different blades available, but it is recommended to try the standard blade first. The ultrasonic oscillator is cooled with compressed air (60 psi).

Ultrasonic Cutting Kit includes:

• Ultrasonic cutting tool w/compliance, oscillator, control and power cables
• Air regulators, valve pack, air lines
• DX200 top mount cabinet and mounting hardware

Items to be purchased separately:

• Cutting blade (174862-1 standard blade is recommended)
• Blade fixing screw (174868-1)

2.5.2 Hybrid Tool

The hybrid tool combines the ultrasonic cutting tool (w/o compliance) and a high-speed router for heavier materials. The ultrasonic cutting tool features a retractable ‘control ball’ that extends over the blade when cutting thick, soft material. This feature allows the tool to compress the material for cleaner, smoother cuts. The router has a ‘plunging’ cylinder used for starting holes in heavier materials. The router motor (40 psi) and ultrasonic oscillator (60 psi) are both air-cooled.

Hybrid Tool Kit includes:

• Ultrasonic cutting tool w/o compliance, oscillator, control and power cables
• High-speed end mill, motor controller, control and power cables
• Air regulators, valve pack, air lines
• DX200 top mount cabinet and mounting hardware

2.6 Safety Features

The EcoTrim-6224SL Series system includes a total safety environment. All safety instructions and precautions given in this manual must be complied with. This will ensure safe operation of the robot work cell.

**NOTE**

Users are responsible for determining that the safeguards provided with the EcoTrim-6224SL Series system are adequate for their plant conditions. Users must also ensure that all safeguards are maintained in working order.

2.6.1 Safety Fencing

The heavy-gauge, welded wire safety fencing that is provided with the EcoTrim-6224SL Series system encloses the entire work cell. It forms a physical barrier that prevents personnel from entering the work cell during automatic operation.
2.6.2 Safety Light Curtains

Infrared safety light curtains protect the operator from positioner movement. The positioner will not sweep if the light path (between the light curtain’s Send unit and Receive unit) is obstructed. Should any person or object enter this zone during a positioner sweep from A to B (or B to A), an E-STOP condition is triggered (refer to section 2.6.3 “Emergency Stop (E-STOP)” on page 2-8).

For additional information on the safety light curtain system, refer to the vendor documentation that is included with the EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).

2.6.3 Emergency Stop (E-STOP)

Emergency Stop (E-STOP) is a primary safety feature of the EcoTrim-6224SL Series system. A work-cell access door interlock, the safety light curtain system, and E-STOP push buttons can all trigger an E-STOP condition. An E-STOP condition immediately de-energizes the control system and activates the robot emergency braking system (refer to section 2.6.5 “Emergency Braking System” on page 2-8). The E-STOP push buttons are used for an intentional shutdown of the EcoTrim-6224SL Series system and are installed at the following locations:

- Programming Pendant
- Operator Station

To resume operation after an E-STOP system shutdown, the operator must clear and reset the action that caused the E-STOP condition (refer to section 4.4.2 “E-STOP Recovery” on page 4-7).

2.6.4 Programming Pendant’s ENABLE Switch

The ENABLE switch is part of the Programming Pendant and provides a safety feature that controls servo power while the system is in TEACH mode (see Fig. 2-2 “DX200 Programming Pendant” on page 2-3). When pressed in, this switch allows the operator to enable servo power. Should the operator release the switch or grasp it too tightly, however, servo power is immediately disabled, thus preventing further robot movement. For detailed information about the operation of the ENABLE switch, refer to the DX200 Operator’s Manual for Cutting that is included with the EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).

2.6.5 Emergency Braking System

Each robot incorporates a braking system that protects personnel from injury and prevents equipment damage if servo power is removed. Upon loss of servo power, the brake system activates to hold all robot axes in place. The brake system incorporates a feature that allows the operator to release the brake of a specific robot axis, even if drive power is disabled. Brake release is accomplished with the Programming Pendant. Refer to the DX200 Manual Brake Release manual included with the EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).
2.6.6 Interlocked Work-cell Access Door

The work-cell access door features a safety interlock (see Fig. 1-1 “System Layout” on page 1-3). Any attempt to open the access door while the robots are in PLAY mode triggers an E-STOP condition (refer to section 2.6.3 “Emergency Stop (E-STOP)” on page 2-8).
3 Installation

3.1 Required Materials

All system components and most hardware items required for installation of the EcoTrim-6224SL Series system are included with your shipment. There are, however, some required items that the customer must supply, such as typical installation and maintenance tools (refer to section 3.1.2 “Recommended List of Hand Tools and Equipment” on page 3-2) and special anchor bolts (refer to chapter 6 “Anchoring”).

3.1.1 Customer-supplied Items

- Local electrical service
- Earth ground wires for the robots, the DX200 controller, and peripheral equipment
- Earth ground rods and/or buried copper sheeting (quantity and placement depth as required to achieve specified resistance-to-ground reading of 100 ohms or less)
- Chemical (optional) to increase the conductivity of soil in the vicinity of the earth ground system
- Clean, dry air supply:
  - Flow Rate: 0.425 m³/min. (15 cfm)
  - Pressure: 620 kPa (gage) [90 psi (gage)]
- Forklift(s) and/or overhead crane
- Special anchor bolts and drill bits (refer to chapter 6 “Anchoring” for suggested anchoring hardware)

CAUTION

- The EcoTrim-6224SL Series system should be installed by qualified personnel who are familiar with the installation and setup of a robotic system.

Two to three qualified technicians can install the EcoTrim-6224SL Series system in a reasonable amount of time. Always comply with all the safety instructions and precautions given throughout this manual during the installation process.

The instructions given in this section are general guidelines for installing the EcoTrim-6224SL Series system. Refer to your system drawings and relevant system component manuals for specific installation information (see section 1.3 “Reference Documentation” on page 1-15).
3.1.2 Recommended List of Hand Tools and Equipment

- Hard hat
- Safety glasses
- Face shield
- Gloves (heavy-duty leather recommended)
- Levels (short and long)
- Ratchet handle (with 3/4-inch hex socket)
- Adjustable wrench
- Hammer drill with appropriate concrete bits
- Phillips and flat-blade screwdrivers
- Hammers (dead-blow and steel)
- Hammer (non-marring)
- Socket sets (SAE and metric)
- Air-impact gun (with 3/4-inch hex socket)
- Open-end wrench sets (SAE and metric)
- Allen® wrench sets (SAE and metric)
3.2 Site Preparation

**WARNING**

Be sure to provide sufficient room for access to the work-cell door, Operator Station, and system components that are exterior to the work cell. Failure to observe this precaution could result in injury to personnel during system operation and maintenance.

To prepare your site, proceed as follows:

1. Clear the floor and overhead space needed for the EcoTrim-6224SL Series system (see Figure 3-4(a) and Figure 3-4(b)). Allow an additional 1.2m to 1.5m on all sides of the work cell to provide the clearances needed for installation. Refer to the schematics that are included with your system documentation package.

2. Gather all the customer-supplied items and required tools (refer to section 3.1 “Required Materials” on page 3-1).

*Fig. 3-4(a): Plan View Overhead View - EcoTrim-6224SL Series*
3 Installation
3.2 Site Preparation

Fig. 3-4(b): Plan View Side View - EcoTrimSL-6224SL Series
3.3 Removal of System Components from Shipping Skids

**WARNING**

- The positioner weighs approximately 2550 kg. Be sure that your lifting device is rated to safely handle this load.
- The main robot/controller common equipment base (with equipment) weighs approximately 1670 kg Be sure that your lifting device is rated to safely handle this load.

System components are attached to shipping skids at the factory prior to shipment. The customer is responsible for removing the components from the skids and inspecting the components for shipping damage.

**NOTE** If you notice any equipment damage, notify your shipping contractor as soon as possible.

**CAUTION**

Do **not** remove the positioner shipping bracket assembly until the positioner is securely anchored to the foundation. The shipping bracket assembly retains the headstock and tailstock in correct alignment during shipping and installation.

1. Unbolt each component from its shipping skid using a 3/4-inch socket (see Fig. 3-5 “Typical Stabilizing Screw and Removal of A Shipping Lag Bolt” on page 3-6).

2. Use a forklift(s) or overhead crane to lift each component away from its shipping skid.

**NOTE** Two forklifts are required to lift or move the positioner. Forklift "pockets" are provided on each end of the positioner for this purpose.
3. Remove and discard or recycle all shipping materials, including the shipping skids. Do not remove the positioner shipping bracket assembly.
3.4 Installation — MRM2-M3XSL Series Positioner

Refer to Chapter 2 of the RM2-SL Positioner Manual for detailed installation instructions for your specific RM2-SL positioner.

**CAUTION**

Do not remove the positioner shipping bracket assembly until the positioner is securely anchored to the foundation. The shipping bracket assembly retains the headstock and tailstock in correct alignment during shipping and installation.

Mount the positioner on a foundation rigid and strong enough to support the positioner and withstand dynamic repulsion forces. If the foundation surface is not level and even, grind the swell to flatten the surface. Refer to chapter 6 “Anchoring” for a suggested minimum foundation thickness and strength.

**WARNING**

The positioner weighs approximately 2550 kg. Be sure that your lifting device is rated to safely handle this load.
3.5 Installation — Robot Common Base

**WARNING**

- The main robot/controller common equipment base (with equipment) weighs approximately 1670 kg (AWIV6200). Be sure that your lifting device is rated to safely handle this load.

1. Loosen and remove lag bolts securing the robot common base and associated panels to the wooden shipping skid.
2. Carefully remove all protective packaging materials and discard or recycle.
3. Carefully inspect the robot(s), robot equipment base, and associated panels for shipping damage.

**NOTE**

If you notice any equipment damage, notify your shipping contractor as soon as possible.

4. Using a forklift, lift the robot common base away from the wooden shipping skid (forklift pockets are located at each end of the base).
5. Fasten the two spanners to the robot common base with the supplied hardware.
6. Carefully place the robot common base in a position that will allow the spanners to be joined to the positioner base with supplied hardware (see Fig. 3-6 “Robot Common Base Installation” on page 3-9).
7. Fasten the spanners to the positioner base with the supplied hardware (see Fig. 3-6 “Robot Common Base Installation” on page 3-9).

**CAUTION**

Make certain the joined robot common base/positioner are positioned correctly before leveling and anchoring the unit.
WARNING

Wear protective eye wear and sturdy work gloves when you cut steel strapping bands. Make sure that all other personnel are clear of the area before you cut the bands. The steel strapping bands are under tension, and can cause injury to personnel when cut.
8. Cut the steel strapping bands that secure the floor cover plate and remove it from the Robot Common Base. The cover plate will be replaced after control and power cables are routed beneath the Robot Common Base and the Programming Platform.

9. Adjust the leveling screws as required to level and stabilize the Robot Common Base/Programming Platform (see Fig. 3-6 “Robot Common Base Installation” on page 3-9).

10. Insert a drill bit through the center of a leveling bolt on the Robot Common Base/Programming Platform and drill a hole into the foundation to accept an anchor bolt (refer to chapter 6 “Anchoring” for foundation and anchoring suggestions).

11. Repeat drilling process for each leveling bolt associated with the robot equipment base/positioner base assembly (see Fig. 3-6 “Robot Common Base Installation” on page 3-9).

12. Use compressed air to remove all concrete dust from each drilled hole.

13. At each drilled location, install and secure a suitable anchor bolt (refer to chapter 6 “Anchoring” for foundation and anchoring suggestions).
3.6 Installation — Safety Fence Assembly

The fencing that surrounds the positioner and completes the trimming cell’s protective walls is shipped on its own skid with all the hardware needed for installation.

![CAUTION]

Be careful when cutting the metal bands and wear protective gloves. The metal bands are under tension and may cause injury to anyone near the bands when cut.

See section 1-1 “System Layout” and section 3-4(a “Plan View Overhead View - EcoTrim-6224SL Series” for the general arrangement and positioning of the safety fence assembly. Refer to the safety fence manufacturer instructions for details of safety fence placement, erection, and anchoring. The safety fence instructions are included in the EcoTrim-6224SL Series system documentation package (refer to section 1.3 “Reference Documentation” on page 1-15).
The procedure for installing the safety light curtain system is as follows:

1. Unpack both safety light curtain fence panels from their shipping position and move them into position. The light curtain units are oriented properly when their status lights are located near the base of the positioner.

2. Use the three bolt holes located on the positioner housing to mount the light curtain fence panels (see Fig. 3-7 “Safety Light Curtain Installation”).

3. Unpack the light curtain cables and connect them to the matching connectors on the light curtain Send and Receive units.

4. Align the Send unit with the Receive unit. Refer to the light curtain manufacturer’s literature that is included in the EcoTrim-6224SL Series system documentation package (see Fig. 1.3 “Reference Documentation” on page 1-15).

5. After the light curtain units are installed and aligned, anchor the light curtain fence panel posts to the foundation (refer to chapter 6 “Anchoring” for suggested anchor drills and bolts).

6. Check the alignment of the light curtain Send and Receive units after the fence posts are anchored to the foundation. If indicated, readjust alignment of the light curtain Send unit and Receive unit.

Figure 3-7: Safety Light Curtain Installation
3.8 Installation — Operator Station

The procedure for installing the Operator Station is as follows:

1. Unload the Operator Station.
2. Remove the protective plastic wrapping from the Operator Station.
3. Inspect the Operator Station for shipping damage.

**NOTE** Notify your shipping contractor if you notice any shipping damage.

4. Place the Operator Station outside the fence in front of the positioner (see Fig. 1-1 “System Layout” on page 1-3 and Fig. 3-4(a “Plan View Overhead View - EcoTrim-6224SL Series” on page 3-3).

**CAUTION** Be absolutely certain of the correct location for the Operator Station before securing it with anchor (lag) bolts.

5. Anchor the Operator Station to the foundation (refer to chapter 6 “Anchoring” for suggested drill bits and anchor bolts).
3.9 Cable Connections

After the EcoTrim-6224SL Series system components and peripherals are anchored in their correct locations, locate the interconnect cables and route them according to the drawings and schematics included in the EcoTrim-6224SL Series system documentation package. All cables and connectors are labeled to ensure correct connection to the mating connectors on the applicable system component.

A small gap exists between the bottom of the work-cell safety fence and the floor. This gap provides a passage for cables that run between the components outside the work cell and those inside the work cell.

3.9.1 Connection to Earth Ground

WARNING

Do not use the EcoTrim-6224SL Series system unless specified components are connected to a low-resistance earth ground. Do not connect the earth ground wire with the wires for the electric power source, etc. The low-resistance earth ground must be a “dedicated” ground that is a direct connection between a component and the earth ground point. Operator injury or death, as well as equipment damage, can result from an inadequate or defective earth ground system.

The robots and DX200 controller must be connected to a low-resistance earth ground. If a ground stake is used, it should be driven at least 2.43m into the soil. The soil surrounding the driven ground stake should be treated with a chemical that increases the soil conductivity in the vicinity of the driven ground stake. This is often referred to as a “low-resistance earth ground” and may require more than a single driven ground rod, depending on soil conditions.

Multiple ground rods (bonded together) or even a bonded network of buried copper sheeting (plus conduction-enhancing chemicals) may be required, depending on local soil conditions. In any event, the “low-resistance earth ground” must indicate a resistance of 100 ohms or less (when measured directly between grounded equipment and the earth ground system). Be advised that specialized measuring equipment is usually required to get an accurate “resistance-to-ground” reading. Consult a specialist in this field, if required.

NOTE

The customer shall supply all wires associated with the earth ground. The customer is responsible for establishing the correct gauge of all wires associated with the earth ground and maintaining an adequate earth ground (measured resistance of 100 ohms or less).
3 Installation
3.9 Cable Connections

Connect the robots and controller assembly to the earth ground as follows:

1. Connect one end of an earth ground wire to the lug marked EARTH GROUND on the connector panel of robot R1. Connect the other end of the earth ground wire to the low-resistance earth ground. See Fig. 1-1 “System Layout” on page 1-3 for the location of robot R1.

2. Repeat Step 1 for robots R2 and R3.

3. Connect one end of an earth ground wire to the COMMON GROUND BUS BAR located inside DX200 controller R1 (see Fig. 2-1 “DX200-DRC Controller” on page 2-2). Connect the other end of the earth ground wire to the low-resistance earth ground.

4. Repeat Step 3 for DX200 expansion cabinets R2 and R3 as required.

Fig. 3-8: Grounding Method

3.9.2 Connecting the Robot Cables

Two cables, 1BC and 2BC, connect each robot to the controller. The 1BC cable provides position feedback from the robot to the controller. The 2BC cable provides power to the robot’s servo motors. To connect the robot cables, proceed as follows:

CAUTION

Use care when attaching the cable connectors to the mating connectors on the robot(s) and controller(s). Do not use excessive force. Make sure that the cable connectors are correctly aligned with the mating connectors. The connectors are of the “multi-pin” type and are easily damaged if forced into position.
3.9 Cable Connections

1. Unpack the Programming Pendant and plug its connector into the receptacle on the front door of the controller.

2. Unpack the two large black manipulator cables and route one to the controller and the other to the back of the robot.

3. Connect one end of each cable (labeled 1BC and 2BC) to the 1BC and 2BC connections on the back of the robot (see Fig. 3-9 "Manipulator Cables"). Connect the other ends of the 1BC and 2BC cables to the 1BC and 2BC connections on the side of the controller.

Fig. 3-9: Manipulator Cables

![Manipulator Cables Diagram]

The DX200 Side

The Manipulator Side

Encoder Cable

Power Cable
Fig. 3-10(a): Manipulator Cable Connectors (Manipulator Side)

Fig. 3-10(b): Manipulator Cable Connection to the DX200
3.9.3 Connection to Local Electrical Service

**WARNING**

Local electrical service connection to the EcoTrim-6224SL Series system must be performed by a qualified, licensed electrician. Electrical and grounding connections must comply with the National Electrical Code (NEC), as well as all local electrical codes.

**NOTE**

The EcoTrim-6224SL Series system is configured for three-phase 460/480V AC primary power. For additional information, refer to the electrical drawings and schematics that are included with your system documentation package (see section 1.3 “Reference Documentation” on page 1-15).

After all the system components have been properly installed and interconnected, connect local electrical service to the DX200 controller power sources (refer to section 3.9.3.1 “DX200 Controller” on page 3-18).

3.9.3.1 DX200 Controller

For detailed electrical service interconnect procedures for the DX200 controller, refer to the DX200 Controller Manual and EcoTrim-6224SL Series system drawings and schematics that are included with your system documentation package (see section 1.3 “Reference Documentation” on page 1-15).
3.10 Safety/Operation Check

Before installing the tooling and fixtures for your application, take a few minutes to perform the following safety/operation check:

1. Ensure the correct alignment and operation of the safety light curtain system (refer to the safety light curtain documentation that is included with the EcoTrim-6224SL Series system).

2. Check the security and integrity of all cable connections.

3. Ensure that the work-cell sliding access door is closed and the door interlock is engaged.

4. Verify the correct settings for the Ultrasonic cutter/router with the power requirements for your EcoTrim-6224SL Series system.

5. Verify that local electrical service is correctly wired into the DX200 controller assembly and the ultrasonic cutting power sources (refer to Fig. 3-8 “Grounding Method” on page 3-15).

6. Set the power ON-OFF switch on the DX200 controller to ON (see Fig. 2-1 “DX200-DRC Controller” on page 2-2).

7. Set the power ON-OFF switch on the ultrasonic cutting power sources to ON.

8. Check for correct operation of all E-STOP push buttons (refer to section 2.6.3 “Emergency Stop (E-STOP)” on page 2-8).

CAUTION

The EcoTrim-6224SL Series system is now ready for power-up. Qualified, trained personnel who are familiar with this system should perform the power-up sequence.

NOTE

An electrical service disconnect box for the DX200 controller shall be supplied (if desired) by the customer. It is not part of the EcoTrim-6224SL Series system shipment.

WARNING

Before operating the robots, verify that each E-STOP push button disables servo power when activated (pushed in). Each E-STOP push button must immediately stop robot and positioner movement when activated (pushed in).
9. Check for correct operation of the system HOLD buttons on the Programming Pendant and Operator Station (ROBOT HOLD). Refer to the Operator’s Manual for Cutting for more information on the pendant’s HOLD button (see section 1.3 “Reference Documentation” on page 1-15). Refer to section 2.3.3 “Operator Station — ROBOT HOLD” on page 2-4 and the manipulator manual for more information on the Operator Station’s ROBOT HOLD button (see section 1.3 “Reference Documentation” on page 1-15).

10. Check for correct operation of the work-cell access door safety interlock.

11. Remove power from the EcoTrim-6224SL Series system after completion of the safety/operation check.

### 3.11 Installation of Tooling and Fixtures

Your EcoTrim-6224SL Series system is now ready for installation of tooling and fixtures for your particular application. Personnel who are familiar with the operation of the EcoTrim-6224SL Series system should do the installation. After tooling installation, test the positioner for correct operation. Refer to the positioner manual for information on how to test that the positioner is operating correctly (see section 1.3 “Reference Documentation”).

**NOTE**

- All tooling and fixtures for the positioner shall be supplied by the customer.
- Motoman recommends application of a corrosion/rust preventive compound to tooling and fixtures located in a high-humidity environment.
This section provides a brief overview of the operating procedures and precautions for your EcoTrim-6224SL Series system. For more detailed operating information, refer to the specific component manuals that are part of the EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).

The EcoTrim-6224SL Series system is a fully integrated robotic Ultrasonic cutting cell. Motoman MH-Series robots trim parts on one side of the positioner, while the operator loads the opposite side with parts to be processed. When the robots complete the trimming process, they return to HOME (Safe) position. The operator can then initiate another positioner sweep cycle from the Operator Station. This moves the previously loaded parts into the robot work area, where the robots then move from HOME (Safe) position to complete another trimming cycle.

The customer shall supply all tooling fixtures for the positioner.

### 4.1 Programming

The operation of this system is programming dependent. The following operating instructions are based on one possible configuration of this system. Your system configuration and job structure may differ from that presented here; however, basic operation will be the same. For additional programming procedures and information, refer to the DX200 controller documentation that is included with your EcoTrim-6224SL Series system documentation package (see section 1.3 “Reference Documentation” on page 1-15).

Any changes made to your system configuration and/or job structure will alter the operation of the system. Motoman recommends that you do not modify the original jobs and system configuration of your EcoTrim-6224SL Series system. **If you need to modify the original jobs and system configuration, make any modifications to a copy of the original. Keep the original as a backup. Do not modify the original.** Modifications must be performed by trained and experienced personnel who are familiar with the operation of the EcoTrim-6224SL Series system. If you have questions concerning the configuration of your system, please contact Motoman’s 24-hour Customer Support (refer to section 1.4 “Customer Support Information” on page 1-18).
4.2 Sweeping the Positioner

The robots must be in HOME position before you can sweep the positioner.

Selecting MANUAL mode on the Operator Station’s POSITIONER AUTO/MANUAL switch allows the operator to sweep the positioner without activating the robots. Parts can be loaded onto the fixture to achieve the most efficient configuration and then swept into the trimming zone, before teaching the robots a series of moves. To sweep Side A or Side B of the positioner into the robot’s trimming zone, proceed as follows:

1. Place the robots in HOME position (refer to section 4.3.2 “Robot HOME Position” on page 4-4).
2. Make sure that the Operator Station is enabled (Programming Pendant’s Mode Select Switch set to REMOTE).
3. Set the Operator Station’s POSITIONER AUTO/MANUAL switch to MANUAL and start the Control Master job (refer to section 4.3.3 “Master Job” on page 4-4). Normally, the robots will not move out of HOME position when the POSITIONER AUTO/MANUAL switch is set to MANUAL (this depends on job structure).

Cycle Start latching is not operative in MANUAL mode.

4. Press the CYCLE START/CYCLE LATCHED button on the Operator Station (the positioner sweeps each time this button is pressed).
4.3 Daily Operation

The procedures below represent the typical operating sequence from power-up to shutdown. Your basic operating procedures may vary depending on your situation.

• Perform the start-up procedure (refer to section 4.3.1 “Start-up Procedure”).
• Move the robots to HOME position (refer to section 4.3.2 “Robot HOME Position” on page 4-4).
• Select the Control Master job (refer to section 4.3.3 “Master Job” on page 4-4).
• Perform the operation cycle (refer to section 4.3.4 “Operation Cycle” on page 4-4).
• Perform the shutdown procedure (refer to section 4.3.5 “Shutdown Procedure” on page 4-5).

4.3.1 Start-up Procedure

To start up the EcoTrim-6224SL Series work cell from a power-off condition, proceed as follows:

1. If installed, switch the DX200 controller electrical service disconnect box to ON.

An electrical service disconnect box for the DX200 controller shall be supplied (if desired) by the customer. It is not part of the EcoTrim-6224SL Series system shipment.

2. Set the power ON-OFF switch on the DX200 controller to ON (see Fig. 2-1 “DX200-DRC Controller” on page 2-2).

3. Make sure that the work-cell access door is closed and operating properly and the door safety interlock is engaged.

4. Make sure all E-STOP buttons are released. E-STOP buttons are installed at the following locations:
   • Programming Pendant
   • Operator Station

5. Select TEACH mode on the Programming Pendant.

6. Place the robots in HOME position (refer to section 4.3.2 “Robot HOME Position” on page 4-4).
4.3 Daily Operation

4.3.2 Robot HOME Position

To move the robots to HOME position:

1. Select TEACH mode on the Programming Pendant.
2. Select MAIN MENU on the Programming Pendant’s touch screen.
4. Select SELECT JOB on the Programming Pendant’s touch screen (a job list appears on the screen).
5. Use the navigation cursor key to move the cursor to SAFE job and then press SELECT (the job appears on the display screen).
6. Turn servo power ON by pressing SERVO ON and holding in the ENABLE switch.
7. Use the FWD button on the Programming Pendant to jog robot R1 to HOME position.
8. Repeat Steps 5 through 7 for robots R2 and R3 as required.

4.3.3 Master Job

With the system powered up and in TEACH mode, call up the Master job:

1. Select JOB on the Programming Pendant’s touch screen.
2. Select CTRL MASTER on the Programming Pendant’s touch screen.
3. Press SELECT twice to activate the Master job.
4. Select PLAY mode on the Programming Pendant (job playback operation is enabled).
5. Press the SERVO ON button on the Programming Pendant.
6. Press the START button on the Programming Pendant (the Control Master job cycles, waiting for a Cycle Start input from the Operator Station).
7. Transfer control to the Operator Station by selecting REMOTE on the Programming Pendant’s Mode Select Switch.

The EcoTrim-6224SL Series work cell is now ready for operation.

4.3.4 Operation Cycle

The following is the typical sequence of operation for the EcoTrim-6224SL Series work cell after start-up:

1. The operator loads the fixture on the operator side of the positioner with parts to be processed.
2. The operator steps out of the safety zone created by the safety light curtain system and moves to the Operator Station.
3. The operator presses the green CYCLE START/CYCLE LATCHED button on the Operator Station.
4. The positioner sweeps, placing parts to be trimmed into the robot work area. The robots then begin to trim the parts (if the Operator Station’s POSITIONER AUTO/MANUAL switch is set to AUTO).
5. While the robots are trimming, the operator loads the operator side of the positioner with the next group of parts to be processed.
4.3 Daily Operation

6. The operator again moves to the Operator Station and presses the green CYCLE START/CYCLE LATCHED button (the Cycle Latched light illuminates). When the robots are finished trimming, they return to HOME position. The positioner then sweeps again to return the completed, processed parts to the operator position, while moving the next group of parts into the robot work area.

7. The operator moves back to the operator side of the positioner and unloads the completed, processed parts.

4.3.5 Shutdown Procedure

Use the following procedure to perform a normal shutdown of the EcoTrim-6224SL Series system:

1. Make sure all robots are in HOME position.
2. Turn off the system servo power by pressing the E-STOP button on the Operator Station or Programming Pendant.
3. Select TEACH mode on the Programming Pendant.
4. Set the DX200 controller power ON-OFF switch to the OFF position.
5. Set both trimming power source power ON-OFF switches to the OFF position.
6. Close the regulator valve main shutoff valve.
7. Switch the DX200 controller disconnect box (if installed) to OFF.

An electrical service disconnect box for the DX200 controller shall be supplied (if desired) by the customer. It is not part of the EcoTrim-6224SL Series system shipment.

The EcoTrim-6224SL Series system is now shut down.
4.4 System Recovery

When a system error or alarm occurs, you must clear the error or alarm to return the system to normal operation. The paragraphs below describe the different types of alarms and errors you might encounter and how to remedy them when you do.

4.4.1 Alarms and Errors

There are three levels of alarms and errors that will stop the program:

- Error messages
- Minor alarms
- Major alarms

For more detailed information on alarm and error recovery, refer to the maintenance and DX200 controller documentation that is included with your EcoTrim-6224SL Series system (refer to section 1.3 “Reference Documentation” on page 1-15).

4.4.1.1 Error Messages

Error messages are usually the result of simple, easily cleared operation errors. One example of this type of error is pressing the START button when the robots are not in PLAY mode.

Clear errors of this type by pressing the CANCEL button on the Programming Pendant.

4.4.1.2 Minor Alarms

Minor alarms usually involve programming errors. Clear alarms of this type by pressing the CANCEL button on the Programming Pendant.

4.4.1.3 Major Alarms

Major alarms usually involve hardware failures. Examples of this type of error include an overload condition and abnormal speed.

Clear alarms of this type by cycling the DX200 controller in accordance with the following steps:

1. Rotate the DX200 controller’s power ON-OFF switch to OFF.
2. Allow the controller’s power ON-OFF switch to remain in the OFF position for approximately 10 seconds.
3. Rotate the controller’s power ON-OFF switch to ON.
4.4 System Recovery

4.4.2 E-STOP Recovery

An E-STOP (emergency stop) will occur under any of the following conditions:

- An E-STOP button is pushed in (activated).
- The work-cell access door is opened while the robots are not in TEACH mode.
- The safety light curtain system is triggered while the positioner is sweeping.

After an E-STOP condition occurs, restart the EcoTrim-6224SL Series system as follows:

1. To clear the E-STOP condition, perform any of the following actions that apply:
   - Release the activated E-STOP push button
   - Close the work-cell access door
   - Clear the area in front of the positioner that is protected by the safety light curtain system

2. Press the SERVO ON button on the Programming Pendant.
3. Select REMOTE mode on the Programming Pendant's Mode Select Switch to transfer control of the system to the Operator Station.
4. Press the green START button on the Operator Station.

The EcoTrim-6224SL Series system is now ready to continue operation.
Maintenance must be performed by authorized personnel who are familiar with the EcoTrim-6224SL Series system. Be sure to read and understand the documentation for a particular component before doing repair maintenance or preventive maintenance on that component. Be sure that you understand the maintenance procedures, have the proper tools at hand, and comply with all the safety instructions and precautions given throughout this manual.

The maintenance intervals given in Table 5-1 "Periodic Maintenance" are recommendations only. Adjust the frequency and level of repair maintenance and preventive maintenance to suit your specific equipment schedules and shop environment.

For periodic maintenance procedures and schedules for the individual components of your EcoTrim-6224SL Series system, refer to the documentation that is included with your system documentation package (refer to section 1.3 "Reference Documentation" on page 1-15).

Table 5-1: Periodic Maintenance

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>COMPONENT</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily (or on condition)</td>
<td>All safeguard items – work-cell door interlocks, E-STOP push buttons, safety light curtains, arc curtains, etc.</td>
<td>Check the physical condition of the safeguard item and ensure that it is working correctly.</td>
</tr>
<tr>
<td>One Month (or on condition)</td>
<td>EcoTrim-6224SL Series Work Cell</td>
<td>Remove accumulated dirt, grease, and debris from inside and outside the work cell.</td>
</tr>
<tr>
<td>Six Months (or on condition)</td>
<td>Spanner Plates</td>
<td>Check the integrity and torque of the hardware that secures the spanner plates to the robot equipment base and positioner (see Fig. 3-6 &quot;Robot Common Base Installation&quot; on page 3-9).</td>
</tr>
</tbody>
</table>
6 Anchoring

The purchaser must determine all anchoring and foundation requirements and supply the appropriate anchoring hardware for a particular installation. Before installing the EcoTrim-6224SL Series, refer to Table 6-1 "Minimum Recommended Equipment Anchor Requirements" to determine special anchor and foundation requirements.

**WARNING**

Do not mount robots directly to the floor without the indicated floor plate. Failure to follow floor-plate requirements can result in equipment damage or injury to personnel.

---

**Table 6-1: Minimum Recommended Equipment Anchor Requirements**

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>MINIMUM HILTI® ANCHOR ROD DIAMETER/TYEP</th>
<th>MINIMUM FLOOR-PLATE REQUIREMENTS</th>
<th>MINIMUM FOUNDATION REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROBOTS</td>
<td>Refer to the manipulator manual included with your system documentation package (section 1.3) for anchoring requirements. Always use chemical anchors for equipment with dynamic loads. Use appropriate sized anchors, relative to the clearance holes, to anchor equipment to the floor.</td>
<td>Not Applicable</td>
<td>3-inch minimum thickness or 1.3 embedment depth (whichever is larger) 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>POSITIONER</td>
<td>Refer to the positioner manual included with your system documentation package (section 1.3) for anchoring requirements. Always use chemical anchors for equipment with dynamic loads. Use appropriate sized anchors, relative to the clearance holes, to anchor equipment to the floor.</td>
<td>Not Applicable</td>
<td>3-inch minimum thickness or 1.3 embedment depth (whichever is larger) 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>PERIPHERAL EQUIPMENT</td>
<td>1/2-inch Kwik Bolt II Style Anchor &lt;Emphasis&gt;(Note 1)</td>
<td>Not Applicable</td>
<td>3-inch minimum thickness or 1.3 embedment depth (whichever is larger) 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>WORK-CELL FENCE POSTS</td>
<td>3/8-inch Kwik Bolt II Style Anchor &lt;Emphasis&gt;(Note 1)</td>
<td>Not Applicable</td>
<td>3-inch minimum thickness or 1.3 embedment depth (whichever is larger) 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>OPERATOR STATION PEDESTAI</td>
<td>1/4-inch Kwik Bolt II Style Anchor &lt;Emphasis&gt;(Note 1)</td>
<td>Not Applicable</td>
<td>3-inch minimum thickness or 1.3 embedment depth (whichever is larger) 4000 psi Reinforced Concrete</td>
</tr>
</tbody>
</table>

**NOTES:**

(1) Reference source: *Hilti® Product Technical Guide* (section 4.3.3) for hardware specifications or equivalent.

Refer to http://us.hilti.com or http://ca.hilti.com for further information.
Appendix A  Checklist

Since our customer is very important to us we include a checklist to use before start-ups and after maintenance for your convenience and safety.

<table>
<thead>
<tr>
<th>BEFORE APPLYING POWER (Refer to System Drawings)</th>
<th>Time/Date</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check Mounting (Refer to Installation Section in all Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Power (Refer to Connections, Controller Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Ground (Refer to Grounding in all Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Water (Refer to Operation and Vendor Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Air (Refer to Manipulator and Vendor Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Gas (Refer to Operation and Vendor Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Interlocks (Refer to Work Cells in all Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Limiting Devices (Refer to Limits in all Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Environment (Refer to Installation in Controller Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Version (Refer to Confirmation of Software Version)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Items to Check Before Applying Power (Vendor or Integrator Supplied)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFTER APPLYING POWER</td>
<td>Time/Date</td>
<td>Checked By</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Check Control Switches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Operator Station, Controller Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Axis Move and are Restricted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Basic Specifications, Manipulator Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Emergency Stop(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to E-Stop in all Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check External Power Disconnect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Turning OFF The Power Supply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Teach Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Teach Mode, Controller Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Playback Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Play Mode, Controller Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Location in Manipulator Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Safeguards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Safeguards in all Manuals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Manual Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Manual Mode in Operations Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Automatic Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Refer to Automatic Mode in Operations Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Items to Check After Applying Power</td>
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<tr>
<td>(Vendor or Integrator Supplied)</td>
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EcoTrim-6224SL Series
Appendix A Checklist
<table>
<thead>
<tr>
<th>DOCUMENTATION INCLUDED</th>
<th>Time/Date</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Drawings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modifications Made to Original Protective Equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End Effector Load Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructions on Synchronized Motion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(More than one piece of equipment)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programmed Limits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaborative Operation Declaration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Robot is suitable for integration that includes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance Documents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ANSI, ISO, RIA, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Documents to Include</strong> (Vendor or Integrator Supplied)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Vendor Manuals, Supplier Certifications, Compliance)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## MARKINGS INCLUDED ON EQUIPMENT

<table>
<thead>
<tr>
<th>Time/Date</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Business Name, Address, Info
- Machinery Designation and Type
- Year Built
- Explosive Proof
- **Order Number (Serial Number)**

## Other Markings on Equipment
(Vendor Machine Designation, Type, Serial No, Version, etc.)

<table>
<thead>
<tr>
<th>Time/Date</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

## OTHER ITEMS

<table>
<thead>
<tr>
<th>Time/Date</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Appendix B  Pneumatic Schematics**

CELL ASSEMBLY PNEUMATIC DIAGRAM

- END USER SUPPLIED AIR
- CELL ASSEMBLY MAIN SHUTOFF AND FILTER/REGULATOR
- SET PRESSURE REGULATOR TO 90 PSI MIN./MAX. 90/120 PSI
- MANIFOLD BLOCK
- SEE DRAWINGS

OPTIONAL EQUIPMENT:
- CELL ASSEMBLY MAIN SHUTOFF AND FILTER/REGULATOR
- SET PRESSURE REGULATOR TO 90 PSI MIN./MAX. 90/120 PSI

OPTIONAL SLIP-RINGS SHOWN
- SLIP-RING
- POSITIONER TAILSTOCK
- SLIP-RING

SEE DRAWINGS
- OPTIONAL EQUIPMENT
### Appendix C  Optional Equipment

#### C.1 Replacement Blades

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>174862-1</td>
<td>Blade, Oscillator, Standard Style</td>
</tr>
<tr>
<td>174863-1</td>
<td>Blade, Oscillator, Single Edge, Half Style</td>
</tr>
<tr>
<td>174864-1</td>
<td>Blade, Oscillator, Compliant, Standard Style</td>
</tr>
<tr>
<td>174865-1</td>
<td>Blade, Oscillator, Compliant Single Edge Style</td>
</tr>
<tr>
<td>174866-1</td>
<td>Blade, Oscillator, Compliant Single Edge Half Style</td>
</tr>
<tr>
<td>174867-1</td>
<td>Blade, Oscillator, Single Edge, Tip Tracing Style</td>
</tr>
<tr>
<td>174868-1</td>
<td>Tool, Blade Fixing Screw</td>
</tr>
</tbody>
</table>

#### C.2 Blade Maintenance Accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>174482-1</td>
<td>Accessory Kit, Blade, Sensor, Sharpening, Alignment (Includes 174474-1, 174860-1, 174457-1, 174454-1, Stand and Mounting Plate)</td>
</tr>
<tr>
<td>174474-1</td>
<td>Blade, Angle Adjuster Assembly</td>
</tr>
<tr>
<td>174860-1</td>
<td>Blade, Gauge, Parallel Alignment, Oscillator</td>
</tr>
<tr>
<td>174457-1</td>
<td>Blade, Sharpener Assy, NSK</td>
</tr>
<tr>
<td>174861-1</td>
<td>Tool, Sharpening Stone, #2000, Oscillator</td>
</tr>
<tr>
<td>174454-1</td>
<td>Sensor Assy, Blade Breakage</td>
</tr>
<tr>
<td>174869-1</td>
<td>Tool, Blade Holder, Oscillator</td>
</tr>
</tbody>
</table>

#### C.3 End Mill Accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>174870-1</td>
<td>Tool, End Mill, Specially Designed</td>
</tr>
<tr>
<td>174874-1</td>
<td>Collet, Spindle Motor</td>
</tr>
<tr>
<td>174871-1</td>
<td>Controller, Amplifier, Multi-motor E4000</td>
</tr>
<tr>
<td>174872-1</td>
<td>Motor, Spindle, Brushless, 20000 RPM</td>
</tr>
<tr>
<td>174873-1</td>
<td>Cable, Power/Signal, E4000 Controller, 8M</td>
</tr>
</tbody>
</table>
EcoTrim-6224SL Series with INTEGRATED SAFETY LOGIC SYSTEM MANUAL
FOR DX200 CONTROLLER

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