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

MOTOMAN INSTRUCTIONS
MOTOMAN XXXXXX INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR’S MANUAL
DX100 MAINTENANCE MANUAL

The DX100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 156720-1CD
Revision: 0
MANDATORY

• This system manual provides an overview of the Motoman Modular FabWorld® 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 Modular FabWorld® system.

• General items related to safety are listed in Section 2 of the DX100 Controller Manual. To ensure correct and safe operation, carefully read the DX100 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.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the Motoman Modular FabWorld® 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.

**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 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 DX100 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.
**CAUTION**

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the Programming Pendant to the hook on the cabinet of the DX100 controller after use.

The Programming Pendant can be damaged if it is left in the manipulator’s work area, on the floor, or near fixtures.

- Read and understand the Explanation of Warning Labels in the DX100 Controller Manual before operating the Modular FabWorld® system.

**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:

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<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 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.

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1 Introduction

The Modular FabWorld® system is part of the Motoman family of standardized arc welding solutions. It is a fully integrated welding system, and is supported from wire to weld by Motoman, Inc.

1.1 About This Document

This system manual provides a “first look” and overview of the complete Motoman Modular FabWorld® system. You should read and understand this system manual before moving on to the more detailed documentation that is included with your Modular FabWorld® system. Although basic in content, the system manual is intended for personnel who have received operator training from Motoman and who are familiar with the operation of this particular Motoman system. For more detailed information on any specific component or peripheral of the Modular FabWorld® system, please review the full documentation package that is included with your Modular FabWorld® system (refer to Section 1.3).

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 system manual contains the following sections:

Section 1 – Introduction
This section provides general information about the Modular FabWorld® system, a list of reference documents, and customer support contact information.

Section 2 – Equipment Description
This section provides a description of the major components of the Modular FabWorld® system.

Section 3 – Installation
This section provides installation procedures for the Modular FabWorld® system.

Section 4 – Operation
This section provides an overview of Modular FabWorld® system operation, including start-up, loading, normal operations, fault recovery, and system shutdown.

Section 5 – Maintenance
This section provides preventive maintenance requirements for certain components of the Modular FabWorld® system.

Section 6 – Anchoring
This section gives recommended anchoring hardware specifications and foundation requirements for all the equipment that is part of the Modular FabWorld® system.
1.2 System Overview

The Modular FabWorld® system provides a complete arc-welding solution with multiple robot and station kit configurations (see Figure 1-1). The system is designed around either a single or dual Motoman MA1900, -MA3100 or MH50-20 robot, a DX100 controller, welding power source(s), and MHT-series positioners. Refer to Section 2.2 for a description of features and advantages of the DX100 controller configuration. Refer to Section 2.4 for a description of the MHT-Series positioners.

The Modular FabWorld® 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. Arc curtains cover the wire-mesh fencing to attenuate the amount of arc radiation that escapes the work cell during welding operations. A dual-interlocked access door at the side of the work cell provides convenient access to equipment while providing a safety interlock to disable all equipment should the access door be opened while the robot(s) are active. A safety light curtain system provides a “sensing field” in front of each positioner to protect the operator. Positioner movement is prevented whenever an operator is in a position that disrupts the sensing field of the light curtain system.

Figure 1-1: System Layout (dual controller shown)
1.2.1 System Layout

The Modular FabWorld® provides multiple configuration options for different application requirements. Several robot options are available for different applications and weld lengths. Single robot MA1900, MA3100, and MH50-20 cells are available as well as dual robot configurations. The robot manipulators are mounted directly to the floor at the center of the cell for easy access to both stations.

Several MHT-series positioners are available from 500 kg to 3100 kg capacities to comprise the two work stations. Each positioner is equipped with Motoman’s patented MotoMount flexible fixture system, allowing the positioners to be mounted directly to the floor. The robot controller and welding power sources share a common base outside the welding cell. The robotic cell is fully enclosed by safety fencing with an interlocking door. S-axis zone rings, upper are limit switch kit, and light curtains provide reliable safeguarding. All operator controls, including those on the Programming Pendant, DX100 controller, welding power supply, and Operator Station, are accessible from outside the Modular FabWorld® work cell.

1.2.2 Major Components

The Modular FabWorld® system includes the following major components:

- Motoman MA1900 manipulator
- Motoman MA3100 manipulator
- Motoman MH50-20 manipulator
- One DX100 controller assembly
- MHT-Series positioners
- One Programming Pendant (located on DX100 controller)
- Operator Stations
- Welding equipment:
  - Welding power supply
  - Welding torch (air-cooled)
  - Wire feeder
  - Applicable welding interface
  - Torch mount
- Safety equipment:
  - Heavy-gauge, wire-mesh safety fencing
  - Arc curtains (cover the safety fencing)
  - Light curtain system
  - Interlocked work-cell access door
1.2.3 Optional Equipment

The following optional equipment is available for use with the Modular FabWorld® system:

- Torch cleaner
- Wire cutter
- Water-cooled torch (with water circulator)
- TouchSense™ (starting point detection)
- ComArc™ (seam tracking)

1.3 Reference Documentation

For additional information on individual components of the Modular FabWorld® system, refer to the following documentation that is included with your system:

- Motoman MA1900 Manipulator Manual (P/N 156226-1CD)
- Motoman MA3100 Manipulator Manual (P/N 157532-1CD)
- Motoman MH50-20 Manipulator Manual (P/N 156229-1CD)
- Motoman Brake Release Manual (P/N 156239-1CD)
- Motoman DX100 Controller Manual (P/N 155494-1CD)
- Motoman Maintenance Manual for DX100 (P/N 155492-1CD)
- Motoman Operator's Manual for Arc Welding (P/N 155490-1CD)
- Motoman DX100 Concurrent I/O Manual (P/N 155491-1CD)
- Motoman MH-Series Positioner Manual (P/N 156488-1CD)
- Motoman DX100 Independent/Coordinated Control Function Manual
- Motoman INFORM User's Manual (P/N 155493-1CD)
- Vendor manuals for system components not manufactured by Motoman

1.4 Customer Support Information

If you need assistance with any aspect of your Modular FabWorld® 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: Modular FabWorld®
- Robots: MA1900, MA3100, or MH50-20
- Positioner: MH-Series Positioner
- Primary Application: Arc Welding
- Controller: DX100
- 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 DX100 controller data plate
2 Equipment Description

2.1 Robot Description

The Modular FabWorld® system is available with three different Motoman six-axis robot(s). These robots are specifically designed for arc-welding applications. The MH50-20 robot has a payload capacity of 20 kg and features a horizontal reach of 3,106 mm. The MH50-20 robot features a relative positioning accuracy of ±0.15 mm. The MA1900 robot has a payload capacity of 3 kg and features a horizontal reach of 1,904 mm. The MA1900 robot features a relative positioning accuracy of ±0.08 mm. The MA3100 robot has a payload capacity of 3 kg and features a horizontal reach of 3,121 mm. The MA3100 robot features a relative positioning accuracy of ±0.15 mm.

The MA-Series robots feature an internal cabling design that provides high flexibility and streamlines the robot profile, thus allowing access into confined spaces. The robot's B-axis (Pitch/Yaw) features an expanded range of motion that improves circumferential welding on cylindrical work pieces. The T-axis (Twist) can rotate the welding torch ± 200 degrees without cable interference.

The robot's S-axis rotation is physically limited by hard stops located in the base of each robot. For more information, refer to the MH50-20, MA1900, or MA3100 Manipulator Manual that came with your Modular FabWorld® system documentation package (see Section 1.3).

2.2 DX100 Controller

The Modular FabWorld® system features a single or dual DX100 controller. The dual robot controller assembly consists of a DX100 controller mated to an expansion cabinet (see Figure 2-1). This combination provides the same functionality of two full-size controllers, while reducing the overall width when compared to two, full-size DX100 controllers. This configuration also reduces the cost by eliminating redundant components and circuit assemblies.

Through specific internal cable interconnections, the DX100–DRC is configured as controller R1 and controller R2 (see Figure 2-1). This configuration allows the two robots to operate as a dual system that takes advantage of all the unique functions available only in a dual system configuration. With the two robot Modular FabWorld® system, the full-size DX100 controller cabinet is designated R1, while the smaller, expansion cabinet is designated R2.

Both the single and dual DX100 robotic controllers (see Figure 2-1) include a Windows® CE Programming Pendant with a color touch screen, high-speed processing, built-in Ethernet, and a robust PC architecture. The DX100 easily handles multiple tasks and can control up to eight robots (up to 72 axes, including robots and external axes) and input/output (I/O) devices. Advanced Robot Motion (ARM) control provides high-performance path accuracy and vibration control.

The DX100 coordinates the operation of the Modular FabWorld® system. It controls manipulator movement and welding power supply, processes input and output signals, and provides the signals to operate the welding system.
2 Equipment Description

2.2 DX100 Controller

For additional information on the Motoman DX100 controller, please refer to the DX100 Controller Manual that is included with your Modular FabWorld® documentation package (see Section 1.3).

Figure 2-1: DX100 Controller (Dual Controller Shown)

2.2.1 Programming Pendant

The Programming Pendant (see Figure 2-2) provides the primary means of programmer/operator interaction with the Modular FabWorld® system. The pendant features the Windows® CE operating system and displays information on a 6½-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 DX100 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 Modular FabWorld® system. For detailed information on the pendant’s programming keys, programming functions, and display functions, please refer to the DX100 Operator’s Manual for Arc Welding that is included with your Modular FabWorld® system documentation package (see Section 1.3).
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 Modular FabWorld® system to the Operator Station, set the Mode Select Switch to REMOTE.
2.3 Operator Station

The Operator Station (see Figure 2-3) includes a fence mounted NEMA enclosure. The following paragraphs describe the controls on the Operator Station.

Figure 2-3: Operator Station

2.3.1 Operator Station — CYCLE START/CYCLE LATCHED

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 robot(s) are in HOME (Safe) position. If the CYCLE START/CYCLE LATCHED push button is pressed while the robot(s) are welding, or otherwise not in HOME (Safe) position, the Cycle Start command is “latched” into (stored in) the DX100 controller circuitry. When the robots return to HOME (Safe) position, the “latched” Cycle Start command is executed and the positioner sweeps. Circuitry in the DX100 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 2.6.4 for a discussion of the E-STOP function and the procedures for recovering the Modular FabWorld® 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/RESET

A red ALARM lamp illuminates to indicate that the DX100 controller has encountered an alarm condition.

2.3.5 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.

2.3.6 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.

2.3.7 Operator Station — JOYSTICK CONTROL

The Home joystick controls positioner rotation and user defined load positions. The MH-Series positioners have the ability to position the headstock ±360° in 2.5° increments for better part-loading and unloading ergonomics. This rotation of the headstock in 2.5° increments (also known as "jogging") is accomplished with the JOYSTICK CONTROL located on the Operator Station (see Figure 2-3).

2.4 MHT-Series Positioner

The MHT-series positioners consist of the following Motoman positioners:

• MHT-500
• MHT-1600
• MHT-3100

These positioner systems include a headstock drive assembly, tailstock column, and the MotoMount tool mounting system. Parts fixturing is mounted between the headstock and tailstock faceplates providing a highly versatile work area.

Refer to the MH-series Positioner Manual with MotoMount and Drive Assemblies (P/N 156488-1) for MotoMount and technical details.

The Modular FabWorld® system is capable of synchronized motion between various components depending on the job configuration. The robot can be synchronized with the positioner to work simultaneously with a rotating work piece. For additional information on this type of independent control and coordinated motion, refer to the DX100 Independent/Coordinated Control Function Manual that is included with the Modular FabWorld® system documentation package (see Section 1.3).

For additional positioner information, including specifications, an illustrated parts list, load capabilities, and dimensions, refer to the Motoman Positioner Manuals included with the Modular FabWorld® system documentation package (see Section 1.3).
2.5 Welding Equipment

In its standard configuration, the Modular FabWorld® system includes a welding power source, wire feeder, torch, and torch mount for each robot. Optional equipment may also be included with your Modular FabWorld® system (refer to Section 1.2.3).

2.5.1 Welding Power Sources

Motoman offers various brands and types of welding power sources. The welding power sources supplied with the Modular FabWorld® system depends on the customer’s specific application and preference. For specific information on the welding power sources supplied with your Modular FabWorld® system, refer to the welding power source manual that is included with the system documentation package (see Section 1.3).

2.5.2 Wire Feeder

A welding wire feeder is mounted on the upper arm (U-Axis) of each robot. The wire feeder is the “4-roll” type and provides reliable wire feeding at rates up to 750 inches per minute (ipm). An electronically controlled gas valve provides fast welding gas response time. Interchangeable feed rolls are used to accommodate different wire gauges and wire types. For additional information on how the wire feeder is mounted to the robot’s upper arm, including allowable load and installation position, refer to the wire feeder documentation that is included with the Modular FabWorld® system documentation package (see Section 1.3).

2.5.3 GMAW Torch

The Modular FabWorld® system uses either an air-cooled or water-cooled robotic/automatic GMAW torch for each robot. These are heavy-duty torches designed for quick replacement and minimum of robot reprogramming. The GMAW torch is installed in a torch mount at the end of the robot’s wrist flange. The torch mount provides multi-dimensional impact (collision) detection to protect the robot, torch, fixture, positioner, and work piece from damage in the event of a collision. Any torch impact (collision) triggers an Emergency Stop condition (refer to Section 4.3.2 and Section 4.3.3).

For applications that use the optional water-cooled torch, the Modular FabWorld® system includes a water circulator kit for each robot. For additional information on the torches that are supplied with your system, refer to the vendor documentation that is included with the Modular FabWorld® system documentation package (see Section 1.3).

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- 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.
2.6 Safety Features

The Modular FabWorld® system includes a total safety environment. If you comply with all the safety instructions and precautions given throughout this manual, the safety equipment helps to ensure safe operation of the robot work cell.

Users are responsible for determining that the safeguards provided with the Modular FabWorld® system are adequate for their plant conditions. Users must also ensure that all safeguards are maintained in working order.

2.6.1 Welding Arc Protection

One by-product of the welding arc is an intense level of ultraviolet light. The ultraviolet light radiates outwardly (equal strength in all directions) from the weld point whenever an arc is established. If not attenuated, the radiated ultraviolet light can present a health risk to personnel near the welding arc.

Although safety fence arc curtains block the radiation of ultraviolet light, never look directly at the welding arc without protective eye wear.

The arc curtains filter (or "block") most of the ultraviolet light radiation that would otherwise escape the work cell. Just as the arc screen on the positioner protects the operator from intense ultraviolet light, the arc curtains protect other personnel who are near the work cell.

2.6.2 Safety Fencing

The heavy-gauge, welded wire safety fencing that is provided with the Modular FabWorld® system encloses the entire work cell. It forms a physical barrier that prevents personnel from entering the work cell during automatic operation.

2.6.3 Safety Light Curtains

The safety light curtains work in conjunction with the robot zone rings to help prevent serious injury to anyone entering a station safety zone while the robot is working in that area. In PLAY mode, if the robot is at station 1 and the operator steps into the station 1 safety zone, servo power is removed from the system and all positioner motion stops. Servo power can be re-applied and operation resumed by pressing SERVO ON and START.

For additional information on the safety light curtain system, refer to the vendor documentation that is included with the Modular FabWorld® system documentation package (see Section 1.3).
2.6.4 Emergency Stop (E-STOP)

Emergency Stop (E-STOP) is a primary safety feature of the Modular FabWorld® system. A work-cell access door interlock, the safety light curtain system, robot welding torch impact (collision) detection circuitry (refer to Section 2.5.3), 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 2.6.6). The E-STOP push buttons are used for an intentional shutdown of the Modular FabWorld® 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 4.3.2).

2.6.5 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 Figure 2-2). 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 DX100 Operator’s Manual for Arc Welding that is included with the Modular FabWorld® system documentation package (see Section 1.3).

2.6.6 Emergency Braking System

The 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 DX100 Manual Brake Release manual included with the Modular FabWorld® system documentation package (see Section 1.3).

2.6.7 Interlocked Work-cell Access Door

The work-cell access door features a safety interlock (see Figure 1-1). Any attempt to open the access door while the robots are in PLAY mode triggers an E-STOP condition (refer to Section 2.6.4).
Two to three qualified technicians can install the Modular FabWorld® system in a reasonable amount of time. Always comply 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 Modular FabWorld® system. Refer to your system drawings and relevant system component manuals for specific installation information (see Section 1.3).

### 3.1 Required Materials

All system components and most hardware items required for installation of the Modular FabWorld® 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) and special anchor bolts (refer to Section 6).

#### 3.1.1 Customer-supplied Items

- Shielding gas for the welding torches
- Local electrical service
- Earth ground wires for the robots, the DX100 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
- Welding wire
- Clean, dry air supply (for torch tender or wire cutter options):
  - 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 Section 6 for suggested anchoring hardware)
3.1.2 Recommended List of Hand Tools and Equipment

- 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 Modular FabWorld® system (see Figure 3-1). Allow an additional 1.2 m to 1.5 m on all sides of the work cell to provide the clearances needed for installation.

2. Gather all the customer-supplied items and required tools (refer to Section 3.1).
3.3 Removal of System Components from Shipping Skids

WARNING

- Each robot weighs approximately 250 kg. Be sure that your lifting device is rated to safely handle this load.
- The Controller Base (with equipment) weighs approximately 1600 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 to the customer. 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.

1. Unbolt each component from its shipping skid using a 3/4-inch socket (see Figure 3-2).
2. Use a forklift(s) or overhead crane to lift each component away from its shipping skid.

Figure 3-2: Typical Stabilizing Screw and Removal of A Shipping Lag Bolt

NOTE – An air-powered tool is not required for removal of the shipping bolts, as these fasteners can be removed with ordinary hand tools. However, the air-powered tool does make quick work of the task.

3. Remove and discard or recycle all shipping materials, including the shipping skids.

3.4 Installation — Robot(s)

The robot(s) should be firmly mounted on a base plate or foundation rigid enough to support the robot(s) and withstand repulsion forces. The surface of the floor should be level and even. The concrete thickness of the floor must be at least 150 mm.

WARNING

Each robot weighs approximately 250 kg. Be sure that your lifting device is rated to safely handle this load.

1. Move robot(s) in place according to system drawings.
2. Carefully remove protective plastic wrapping from robots and torches.
3. Inspect each robot for shipping damage.
4. Anchor each robot securely in place (refer to chapter 6 "Anchoring" for anchor requirements).
3.5 Installation — MHT-Series Positioner Modules

Refer to the appropriate positioner manual for detailed instructions on installation of your MHT-Series positioner.

Mount the positioners 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. The minimum thickness for a concrete foundation is 150 mm (6 in).

3.6 Installation — Controller Base

The Modular FabWorld® uses a separate controller base mounted on the outside of the system fencing. The controller base contains the robot controller, welders, service disconnects, and optional water circulators. The base is shipped on wood blocks. To install the controller base, proceed as follows:

1. Loosen and remove lag bolts securing the base to the wooden shipping skid.
2. Carefully remove all protective packaging materials and discard or recycle.
3. Carefully inspect the base, and associated equipment for shipping damage.
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. Using the dimensions in your system drawings, carefully place the controller base in position.

**WARNING**

The controller base (with equipment) weighs approximately 1600 kg. Be sure that your lifting device is rated to safely handle this load.

6. Adjust the leveling screws as required to level and stabilize the controller base.
7. Insert a drill bit through the center of a leveling bolt on the controller base and drill a hole into the foundation to accept an anchor bolt (refer to Section 6 for foundation and anchoring suggestions).

**WARNING**

Be sure to wear protective eye wear during the anchoring process. Failure to observe this precaution could result in eye injury for the installation technician.

**NOTE**

If you notice any equipment damage, notify your shipping contractor as soon as possible.
8. Repeat the drilling process for each leveling bolt associated with the controller base.

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

10. At each drilled location, install and secure a suitable anchor bolt (refer to Section 6 for foundation and anchoring suggestions).

### 3.7 Installation — Safety Fence Assembly

The fencing that surrounds the positioner and completes the welding 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 Figure 1-1 and Figure 3-1 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 Modular FabWorld® system documentation package (refer to Section 1.3).
3.7.1 Door Latch Alignment

Adjust the location of the door latch as necessary to provide smooth operation of the door assembly. A #14 spanner bit is provided to loosen and adjust the location of the latch assembly. Metal shims are also provided and can be placed beneath the fence posts to make gross adjustments. See Figure 3-3.

Figure 3-3: Door Latch Alignment
3.8 Installation — Arc Curtains

The arc curtains are packaged in an accessories box that is shipped with the Modular FabWorld® system.

**WARNING**

Ensure that the work-cell safety fence is anchored in place before installing the arc curtains. Unanchored fence panels can fall and injure personnel or damage equipment.

Install the arc curtains as follows:

1. Unfold each arc curtain and install one on the inside of each work-cell safety fence panel using the supplied plastic cable ties and the eyelets in each arc curtain (see Figure 3-4).

![Figure 3-4: Arc Curtain Installation on Typical Safety Fence Panel](image)

The arc curtains are precut to match the work-cell fence panels. Each arc curtain bag contains documentation that includes the arc curtain dimensions. If necessary, these dimensions can be used to match the arc curtain to the correct work-cell fence panel.

2. Make sure that there are no gaps between the arc curtains.

3. Install the work-cell door arc curtain on the inside of the door panel using the supplied plastic cable ties and the eyelets in the arc curtain (see Figure 3-4).

**NOTE** — Arc curtain is installed on the fence panel side that faces the INTERIOR of the robotic work cell.
3.9 Installation — Safety Light Curtain System

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 fence post to mount the light curtain fence panels.

3. Unpack the floor mounted safety light curtain units and move them into position.

4. Mount the light curtain units to the floor. Refer to the light curtain manufacturer’s literature included in the Modular FabWorld® system documentation package (see Section 1.3).

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

6. Align the Send unit with the Receive unit. Refer to the light curtain manufacturer’s literature included in the Modular FabWorld® system documentation package (see Section 1.3).

7. After the light curtain units are installed and aligned, anchor the light curtain fence panel posts to the foundation (refer to Section 6 for suggested anchor drills and bolts).

8. 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.

3.10 Installation — Operator Stations

The operator stations are mounted to safety fence panels at the factory and then secured for shipment to the customer.

The procedure for installing the Operator Station is as follows:

1. Unpack both operator station fence panels from their shipping position and move them into position according to the system drawings.

2. Use the three bolt holes located on the fence post to mount the operator station fence panels.

3. Remove the protective plastic wrapping from the Operator Station.

4. Inspect the Operator Station for shipping damage.
3.11 Cable Connections

After the Modular FabWorld® system components and peripherals are anchored in their correct locations, locate the interconnect cables for the system components and route them according to the system drawings and schematics included in the Modular FabWorld® system documentation package. All cables and connectors are labeled to ensure correct connection to the mating connectors on the applicable system component.

3.11.1 Connection to Earth Ground

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.

**WARNING**

Do not use the Modular FabWorld® 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, welder, 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 robot and DX100 controller must be connected to a low-resistance earth ground. If a ground stake is used, it should be driven at least 2.43 m 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.
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 Figure 1-1 for the location of robot R1.

2. Connect one end of an earth ground wire to the COMMON GROUND BUS BAR located inside DX100 controller (see Figure 2-1). Connect the other end of the earth ground wire to the low-resistance earth ground.

**Fig. 3-5: Grounding Method**

3.11.2 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:

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

2. Unpack the large black manipulator cables and route one end 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 each robot (see Figure 3-6). Connect the other ends of the 1BC and 2BC cables to the 1BC and 2BC connections on the side of the controller.

Fig. 3-6: Manipulator Cables

**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.
3.11.3 Connection to Local Electrical Service

**WARNING**

Local electrical service connection to the Modular FabWorld® 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.

---

*The Modular FabWorld® 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).*
After all the system components have been properly installed and interconnected, connect local electrical service to the DX100 controller and welding power source (refer to Section 3.11.3.1 and Section 3.11.3.2).

3.11.3.1 DX100 Controller

For detailed electrical service interconnect procedures for the DX100 controller, refer to the DX100 Controller Manual and Modular FabWorld® system drawings and schematics that are included with your system documentation package (see Section 1.3).

3.11.3.2 Welding Power Sources

Refer to the welding power source documentation and Modular FabWorld® system drawings and schematics for electrical service connection procedures and diagrams for the welding power sources.

3.12 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 Modular FabWorld® 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 welding power sources (refer to the welding power source documentation that is included with your Modular FabWorld® system).
5. Verify that local electrical service complies with the power requirements for your Modular FabWorld® system.
6. Verify that local electrical service is correctly wired into the DX100 controller assembly and the welding power sources (refer to Section 3.11.1).

CAUTION

The Modular FabWorld® system is now ready for power-up. Only qualified, trained personnel who are familiar with this system should perform the power-up sequence.

7. Set the power ON-OFF switch on the DX100 controller to ON (see Figure 2-1).

NOTE

An electrical service disconnect box for the DX100 controller shall be supplied (if desired) by the customer. It is not part of the Modular FabWorld® system shipment.

8. Set the service disconnect boxes for the welding power sources to ON (see Figure 2-1).
9. Set the power ON-OFF switch on the welding power sources to ON.

**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).

10. Check for correct operation of all E-STOP push buttons (refer to Section 2.6.4).

11. 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 Arc Welding for more information on the pendant’s HOLD button (see Section 1.3). Refer to Section 2.3.3 and the manipulator manual for more information on the Operator Station’s ROBOT HOLD button (see Section 1.3).

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

13. Remove power from the Modular FabWorld® system after completion of the safety/operation check.

### 3.13 Installation of Tooling and Fixtures

Your Modular FabWorld® system is now ready for installation of tooling and fixtures for your particular application. Personnel who are familiar with the operation of the Modular FabWorld® system should do the installation. After tooling installation, test the positioners for correct operation. Refer to the positioner manual for information on how to test that the positioners are operating correctly (see Section 1.3).

- All tooling and fixtures for the positioner shall be supplied by the customer.

**NOTE**

- 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 Modular FabWorld® system. For more detailed operating information, refer to the specific component manuals that are part of the Modular FabWorld® system documentation package (see Section 1.3).

The Modular FabWorld® system is a fully integrated robotic GMAW welding cell. The robot(s) weld parts on the active station, while the operator loads or unloads parts on the opposite side. Once the robot(s) are finished with the welding process, they return to the Home position. The operator is then able to enter the safety zone and safely process the parts while the robot works at the opposite station.

The Modular FabWorld® offers two workstations containing any combination of the following station kits: MHT-500 kg capacity, MHT 1600 kg capacity, and MHT 3100 kg capacity.

**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 slightly from that presented here; however, basic operation will remain the same. For additional programming procedures and information, refer to the DX100 controller documentation included with your Modular FabWorld® system documentation package (see Section 1.3).

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 Modular FabWorld® system. **If you determine a 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 Modular FabWorld® system. If you have questions concerning the configuration of your system, please contact Motoman’s 24-hour Customer Support (refer to Section 1.4).

A major advantage of the Modular FabWorld system is its high degree of flexibility. The operator can fine tune the movement of both the robots and positioners according to parts configuration. The robots can be programmed to weld parts with the headstock stationary, or the robots and headstock can move simultaneously. The robots can be programmed to weld different seams on the same part and to move from part to part to continue welding.

With the programming pendant, the operator can develop a series of jobs for the robots. You can program the robots independently, the station axis independently, or the robots and station axis together. You must select the axis combination when teaching the job initially (see Section 5.1.4). Motoman recommends programming the robots and station axis together to reduce the risk of interference.

**NOTE** The customer shall supply all tooling fixtures for the positioner.
4.2 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 4.2.1).
- Move the robot(s) to HOME position (refer to Section 4.2.2).
- Select the Control Master job (refer to Section 4.2.3).
- Perform the operation cycle (refer to Section 4.2.4).
- Perform the shutdown procedure (refer to Section 4.2.5).

4.2.1 Start-up Procedure

To start up the Modular FabWorld® work cell from a power-off condition, proceed as follows:

1. If installed, switch the DX100 controller electrical service disconnect box to ON.

2. Set the power ON-OFF switch on the DX100 controller to ON (see Figure 2-1).

3. Switch the welding power source electrical service disconnect box to ON (see Figure 2-1).

4. Set the power ON-OFF switch on the welding power source(s) to ON (the ON-OFF indicator lamp on each welding power source illuminates).

5. Open the regulator valve for the welding gas supply.

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

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

8. Select TEACH mode on the Programming Pendant.

9. Place the robot in HOME position (refer to Section 4.2.2).

4.2.2 Robot HOME Position

To move the robot(s) 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).
4 Operation
4.2 Daily Operation

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 the robot to HOME position.

4.2.3 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 Modular FabWorld® work cell is now ready for operation.

4.2.4 Operation Cycle

The following is the typical sequence of operation for the Modular FabWorld® work cell after start-up:

1. The operator loads the fixture on the operator side of station 1 with parts to be welded.

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 robot(s) begin welding the parts.

5. While the robot(s) are welding, the operator loads the operator side of station 2 with the next group of parts to be welded.

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 robot(s) are finished welding at station 1, they return to Home position allowing the operator to process parts at station 1.

7. The operator moves back to the operator side of station 1 and unloads the completed, welded parts.
4.2.5 Shutdown Procedure

Use the following procedure to perform a normal shutdown of the Modular FabWorld® system:

1. Make sure the robot(s) 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 DX100 controller power ON-OFF switch to the OFF position.
5. Set both welding power source power ON-OFF switches to the OFF position.
6. Close the regulator valve for the welding gas supply.
7. Switch the DX100 controller disconnect box (if installed) to OFF.
8. Switch the welding power source disconnect box to OFF (see Figure 2-1).

The Modular FabWorld® system is now shut down.

4.3 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.

4.3.1 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 DX100 controller documentation that is included with your Modular FabWorld® system (refer to Section 1.3).

4.3.1.1 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.

4.3.1.2 Minor Alarms

Minor alarms usually involve programming errors. Clear alarms of this type by pressing the CANCEL button on the Programming Pendant.
4.3.1.3 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 DX100 controller in accordance with the following steps:

1. Rotate the DX100 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.

4.3.2 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.
- A welding torch collision triggers a shock sensor output (refer to Section 4.3.3).

After an E-STOP condition occurs, restart the Modular FabWorld® 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
   - Clear the shock sensor condition (refer to Section 4.3.3).

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 Modular FabWorld® system is now ready to continue operation.

CAUTION

If an E-STOP condition occurs while the positioner is sweeping, the positioner will continue the sweep when the Modular FabWorld® system is restarted.
4.3.3 Shock Sensor Recovery

Each robot is equipped with a Motoman gun mount. This mount is designed to protect the torch from damage in case of a crash (collision). A slight deflection of the torch activates a SHOCK SENSOR signal that triggers an E-STOP condition. To clear the E-STOP condition, you must override the shock sensor and move the affected robot clear of the impact. To override the shock sensor, proceed as follows:

1. Select MAIN MENU on the Programming Pendant’s touch screen.
2. Select ROBOT on the Programming Pendant’s touch screen.
4. Select RELEASE to release the shock sensor.
5. Turn servo power ON (press in on the pendant’s ENABLE switch while pressing SERVO ON READY).
6. Move the affected robot clear of the impact position.

The Modular FabWorld® system is now ready to continue operation.
5 Maintenance

Maintenance must be performed by authorized personnel who are familiar with the Modular FabWorld® 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 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 Modular FabWorld® system, refer to the documentation that is included with your system documentation package (refer to Section 1.3).

CAUTION

If your system uses water-cooled torches, use only Motoman-specified antifreeze. Typical automotive antifreeze contains additives that can clog the small cooling ports in the torches and damage sealing gaskets in the water circulator pumps.

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>Water Circulators (water-cooled torch application only)</td>
<td>Add a mixture of Motoman antifreeze (P/N 131224-1) and distilled water, as required. Mix antifreeze and distilled water in proportions shown on the antifreeze container.</td>
</tr>
<tr>
<td></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>Modular FabWorld® Work Cell</td>
<td>Remove accumulated dirt, grease, and debris from inside and outside the work cell.</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. Always use chemical anchors for equipment with dynamic loads. Use appropriate sized anchors, relative to the clearance holes, to anchor equipment to the floor. Table 6-1 provides sample anchor and foundation requirements for peripheral equipment. Refer to equipment manuals included with your system documentation package (Section 1.3) for anchoring 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/TYP</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></td>
<td></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></td>
<td></td>
</tr>
<tr>
<td>PERIPHERAL EQUIPMENT</td>
<td>1/2-inch Kwik Bolt II Style Anchor (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 (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 PEDESTAL</td>
<td>1/4-inch Kwik Bolt II Style Anchor (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.