Modular ArcWorld® C-200/500
SYSTEM MANUAL

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: 156987-1CD
Revision: 0
MANDATORY

• This system manual provides an overview of the Motoman Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 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 ArcWorld® C-200/500 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 ArcWorld® C-200/500 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:

<table>
<thead>
<tr>
<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.

Figure 3: Warning Labels Location
Modular ArcWorld® C-200/500

Contents

1 Introduction .....................................................................................................................................1-1
   1.1 About This Document ........................................................................................................1-1
   1.2 System Overview ........................................................................................................... 1-2
       1.2.1 System Layout ......................................................................................................1-3
       1.2.2 Major Components ...............................................................................................1-3
       1.2.3 Optional Equipment ..............................................................................................1-4
   1.3 Reference Documentation .................................................................................................1-5
   1.4 Customer Support Information ..........................................................................................1-5

2 Equipment Description ............................................................................................................... 2-1
   2.1 Robot Description ..............................................................................................................2-1
   2.2 DX100 Controller ...............................................................................................................2-1
       2.2.1 Programming Pendant ..........................................................................................2-2
   2.3 Operator Station .................................................................................................................2-4
       2.3.1 Operator Station — CYCLE START/CYCLE LATCHED ......................................2-4
       2.3.2 Operator Station — Emergency Stop (E-STOP) ..................................................2-5
       2.3.3 Operator Station — POSITIONER AUTO/MANUAL ..............................................2-5
       2.3.4 Operator Station — JOYSTICK CONTROL (Option) .............................................2-5
   2.4 Positioner Kits .................................................................................................................2-5
       2.4.1 MHTH-300/600/900 ..............................................................................................2-5
       2.4.2 MDMT-500 ...........................................................................................................2-5
       2.4.3 MHTH900-500TR ...............................................................................................2-6
   2.5 Welding Equipment ............................................................................................................2-6
       2.5.1 Welding Power Sources .......................................................................................2-6
       2.5.2 Wire Feeder ..........................................................................................................2-6
       2.5.3 GMAW Torch ........................................................................................................2-6
   2.6 Safety Features ..................................................................................................................2-7
       2.6.1 Welding Arc Protection ..........................................................................................2-7
       2.6.2 Safety Fencing ......................................................................................................2-7
       2.6.3 Roll-up Barrier Door .............................................................................................2-7
       2.6.4 Safety Light Curtains ............................................................................................2-8
       2.6.5 Emergency Stop (E-STOP) ..................................................................................2-8
       2.6.6 Programming Pendant’s ENABLE Switch ............................................................2-8
       2.6.7 Emergency Braking System ..................................................................................2-8
       2.6.8 Interlocked Work-cell Access Door .......................................................................2-8
Modular ArcWorld® C-200/500

## Contents

3 Installation
   3.1 Required Materials
      3.1.1 Customer-supplied Items
      3.1.2 Recommended List of Hand Tools and Equipment
   3.2 Site Preparation
   3.3 Removal of System from Shipping Skids
   3.4 System Installation
      3.4.1 Anchoring and Leveling
      3.4.2 Cable Boom
      3.4.3 Door Latch Alignment
   3.5 Cable Connections
      3.5.1 Connection to Earth Ground
      3.5.2 Connection to Local Electrical Service
         3.5.2.1 DX100 Controller
         3.5.2.2 Welding Power Source
   3.6 Safety/Operation Check
   3.7 Installation of Tooling and Fixtures

4 Operation
   4.1 Programming
   4.2 Daily Operation
      4.2.1 Start-up Procedure
      4.2.2 Robot HOME Position
      4.2.3 Control Master Job
      4.2.4 Operation Cycle
      4.2.5 Shutdown
   4.3 System Recovery
      4.3.1 Alarms and Errors
         4.3.1.1 Error Messages
         4.3.1.2 Minor Alarms
         4.3.1.3 Major Alarms
      4.3.2 E-STOP Recovery
      4.3.3 Shock Sensor Recovery

5 Maintenance

6 Anchoring
1 Introduction

The Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 system. You should read and understand this system manual before moving on to the more detailed documentation that is included with your Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 system, please review the full documentation package that is included with your Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 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 ArcWorld® C-200/500 system.

Section 3 – Installation

This section provides installation procedures for the Modular ArcWorld® C-200/500 system.

Section 4 – Operation

This section provides an overview of Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 system.

Section 6 – Anchoring

This section gives recommended anchoring hardware specifications and foundation requirements for all the equipment that is part of the Modular ArcWorld® C-200/500 system.
1.2 System Overview

The Modular ArcWorld® C-200/500 system provides a complete arc-welding solution in a standardized configuration (see Figure 1-1). The system is designed around an MA1400 robot, a DX100 controller, welding power source, and two work stations, Station 1 and Station 2. The system can contain any combination of the following positioner:

- MHTH-300 kg positioner
- MHTH-600 kg positioner
- MHTH-900 kg positioner
- MDMT-500 kg positioner
- MHTH900-500TR Tilt/Rotate positioner
- Stationary Table Kit positioner.

The maximum tooling diameter for the positioners is 1,100 mm.

The Modular ArcWorld® C-200/500 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 back 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.

Safety light curtains are located next to the floor and provide a “sensing field” in front of each station to detect if anyone is in the work area. Each station also includes a heavy duty, motor driven safety barrier (roll up door) located in front of the curtains to protect the operator from weld flash or other debris and prevents entry into the robot work area during robot operation. In addition, a cylindrical physical barrier is mounted on the robot to limit operator access to the robot to one opening. The physical barrier is mounted on the robot using existing mounting points. Maximum robot travel is also physically limited by an S-axis “hard stop” at the base of the robot.
1.2 System Overview

1.2.1 System Layout

All components of the Modular ArcWorld® C-200/500 system are mounted to the common cell assembly base. Heavy-gauge, wire mesh safety fencing is provided for installation at the customer’s location. The DX100 controller assembly and both welding power sources are located outside the work cell. All system controls, including those on the Programming Pendant, DX100 controller assembly, welding power supplies, and Operator Station, are safely accessible from outside the Modular ArcWorld® C-200/500 work cell (see Figure 1-1 for the location of these components).

1.2.2 Major Components

The Modular ArcWorld® C-200/500 system includes the following major components:

- Motoman MA1400 manipulator
- One DX100 controller assembly
- Positioner Kit (two):
  - MHTH-300/600/900
  - MDMT-500
  - MHTH900-500TR Tilt/Rotate
- Stationary Table
• External Axis Kits (one; not required with Stationary Table):
  • DX100 Single External Axis Kit
  • DX100 Dual External Axis Kit
  • DX100 Dual External Axis Kit for single tilt/rotate positioner
  • DX100 Triple External Axis Kit
  • DX100 Quad External Axis Kit (Full size controller mounted to top of robot controller - required for two tilt/rotate positioners)
• One Programming Pendant (located on DX100 controller)
• Operator Station
• 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
  • Vertical roll up door for each station

1.2.3 Optional Equipment

The following optional equipment is available for use with the Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 system, refer to the following documentation that is included with your system:

- Motoman MA1400 Manipulator Manual (P/N 155557-1CD)
- 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 MHTH Headstock Manual (P/N 152568-1CD)
- 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 ArcWorld® C-200/500 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.

NOTE

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact Motoman Customer Support at the telephone number shown above.
Please have the following information ready before you call:

- **System**: Modular ArcWorld® C-200/500
- **Robots**: MA1400
- **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 ArcWorld® C-200/500 system includes the Motoman MA1400 six-axis robot. This robot is specifically designed for arc-welding applications. The MA1400 robot has a payload capacity of 3 kg and features a horizontal reach of 1,434 mm. The robot features a relative positioning accuracy of ±0.08 mm.

The MA1400 robot features 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 MA1400 Manipulator Manual that came with your Modular ArcWorld® C-200/500 system documentation package (see Section 1.3).

2.2 DX100 Controller

The DX100 robotic controller, shown in Figure 2-1, features a Windows® CE Programming Pendant with a color touch screen, high-speed processing, built-in Ethernet, and 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 ArcWorld® C-200/500 system. It controls manipulator movement and welding power supply, processes input and output signals, and provides the signals to operate the welding system.

For more information on the DX100 controller, please refer to the DX100 Controller Manual that is included with your Modular ArcWorld® C-200/500 system documentation package (see Section 1.3).
2.2.1 **Programming Pendant**

The Programming Pendant (see Figure 2-2) provides the primary means of programmer/operator interaction with the Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 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 ArcWorld® C-200/500 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.

**NOTE**

Operator Station Enable or Disable is accomplished with the Programming Pendant’s Mode Select Switch. To transfer control of the Modular ArcWorld® C-200/500 system to the Operator Station, set the Mode Select Switch to REMOTE.
2.3 Operator Station

The Operator Station (see Figure 2-3) is mounted on a panel between the two safety roll-up doors. See Figure 1-1 for the location of the Operator Station in relation to the other components of the Modular ArcWorld® C-200/500 system. The following paragraphs describe the controls on the Operator Station.

**NOTE**

Operator Station “enable” or “disable” is accomplished with the Programming Pendant’s Mode Select Switch. To transfer control of the Modular ArcWorld® C-200/500 system to the Operator Station, set the Mode Select Switch to REMOTE.

*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 cycle if the robot is in the HOME (Safe) position. If the CYCLE START/CYCLE LATCHED push button is pressed while the robot is still welding, or otherwise not in the HOME (Safe) position, the CYCLE START/CYCLE LATCHED command is “latched” in (stored in) the DX100 controller’s circuitry. When the robot returns to the HOME (Safe) position, the “latched” CYCLE START/CYCLE LATCHED command is automatically executed in the second station. Circuitry in the DX100 controller prevents the positioner from continuously cycling should the operator depress and hold the CYCLE START/CYCLE LATCHED 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 2.6.5 for a discussion of the E-STOP function and the procedures for recovering the Modular ArcWorld® C-200/500 system from the Emergency stop (E-STOP) condition.

2.3.3 Operator Station – POSITIONER AUTO/MANUAL
The POSITIONER AUTO/MANUAL selector switch is used to select automatic or manual mode for the positioner. When the selector switch is in the AUTO position, the robot welds parts immediately after the positioner rotates. In MANUAL mode, the positioner rotates, but the robot does not weld parts until the operator selects AUTO mode.

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

2.3.4 Operator Station — JOYSTICK CONTROL (Option)
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 Positioner Kits
The Modular ArcWorld® C-200/500 includes two workstations; Station 1 and Station 2 and can contain any combination of the following positioners: MHTH-300 kg positioner, MHTH-600 kg positioner, MHTH-900 kg positioner, MDMT-500 kg positioner, MHTH900-500TR Tilt/Rotate, and stationary table kit. The maximum tooling diameter for these positioners is 1,100 mm.

2.4.1 MHTH-300/600/900
Each of these Motoman positioners has a 110-mm diameter thru-hole to allow cables, pneumatics, and/or hydraulic lines, and none requires a tailstock or MotoMount. The load capacity corresponds to the model number: the MHTH-300 has a capacity of 300 kg and indexes 180 degrees in 1.4 seconds; the MHTH-600 has a capacity of 600 kg and indexes 180 degrees in 2.1 seconds; and the MHTH-900 has a capacity of 900 kg and indexes 180 degrees in 2.9 seconds. These load capacities are 152 mm from the center of rotation, and the overhang load capacity for all three models is 1578 kg at 500 mm from the face plate with a maximum tooling length of 1300 mm.

2.4.2 MDMT-500
The MDMT-500 positioner is equipped with Motoman's patent-pending MotoMount™ flexible fixture system, which eliminates the need for precision headstock/tailstock alignment. The pin-to-pin dimension of the MotoMount is 1100 mm ±7.5 mm. The MDMT-500 has a load capacity of 500 kg at 152 mm from the center of rotation and overhang load capacity of 1,000 kg at 500 mm from the faceplate. The MDMT-500 indexes 180 degrees in 3.56 seconds.
2.4.3 MHTH900-500TR

The MHTH900-500TR skyhook positioner has a load capacity of 500 kg at 152 mm from the center of rotation of the MH positioner and an overhang load capacity of 500 kg at 140 mm from the MH-500 faceplate. The combined working envelope of the tilt/rotate is 1100 mm diameter.

For additional positioner information, including specifications, an illustrated parts list, load capabilities, and dimensions, refer to the Motoman Positioner Manuals included with the Modular ArcWorld® C-200/500 system documentation package (see Section 1.3).

• 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.

2.5 Welding Equipment

In its standard configuration, the Modular ArcWorld® C-200/500 system includes a welding power source, wire feeder, torch, and torch mount for the robot. Optional equipment may also be included with your Modular ArcWorld® C-200/500 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 source supplied with the Modular ArcWorld® C-200/500 system depends on the customer’s specific application and preference. For specific information on the welding power source supplied with your Modular ArcWorld® C-200/500 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 the 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 ArcWorld® C-200/500 system documentation package (see Section 1.3).

2.5.3 GMAW Torch

The Modular ArcWorld® C-200/500 system uses either an air-cooled or water-cooled robotic/automatic GMAW torch. These are heavy-duty torches designed for quick replacement and a 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).
For applications that use the optional water-cooled torch, the Modular ArcWorld® C-200/500 system includes a water circulator kit. For additional information on the torches that are supplied with your system, refer to the vendor documentation that is included with the Modular ArcWorld® C-200/500 system documentation package (see Section 1.3).

### 2.6 Safety Features

The Modular ArcWorld® C-200/500 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.

**NOTE**

Users are responsible for determining that the safeguards provided with the Modular ArcWorld® C-200/500 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.

**WARNING**

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 ArcWorld® C-200/500 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 Roll-up Barrier Door

Each work station features a heavy duty, motor driven roll-up door. This safety barrier provides protection from weld flash and debris and prevents entry into the robot work area. Soft bottom edge design protects personnel and property, while the motor provides 30" per second operation for quick access.
2.6.4 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 ArcWorld® C-200/500 system documentation package (see Section 1.3).

2.6.5 Emergency Stop (E-STOP)

Emergency Stop (E-STOP) is a primary safety feature of the Modular ArcWorld® C-200/500 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 2.6.7). The E-STOP push buttons are used for an intentional shutdown of the Modular ArcWorld® C-200/500 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).

2.6.6 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 ArcWorld® C-200/500 system documentation package (see Section 1.3).

2.6.7 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 ArcWorld® C-200/500 system documentation package (see Section 1.3).

2.6.8 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 2.6.5).
3 Installation

3.1 Required Materials

Two to three qualified technicians can install the Modular ArcWorld® C-200/500 system in a reasonable amount of time. Always comply with all the safety instructions and precautions given throughout this manual.

The instructions given in this section are general guidelines for installing the Modular ArcWorld® C-200/500 system. Refer to your system drawings for more specific installation information.

3.1.1 Customer-supplied Items

- Shielding gas for the welding torches
- Local electrical service
- Earth ground wires for the robots and the DX100 controller assembly
- 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 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
- Special anchor bolts and drill bits (refer to Section 6 for suggested anchoring hardware)

CAUTION

- The Modular ArcWorld® C-200/500 system should be installed by qualified personnel who are familiar with the installation and setup of a robotic system.
- Handle all system components with care. The Modular ArcWorld® C-200/500 system is not extremely fragile, but it is a sophisticated robotic system that can be damaged by rough handling.

NOTE

The customer must supply all anchoring hardware for the Modular ArcWorld® C-200/500 system. Please refer to Section 6 of this document for suggested anchoring hardware and foundation specifications.

The customer must supply all anchoring hardware for the Modular ArcWorld® C-200/500 system. Please refer to Section 6 of this document for suggested anchoring hardware and foundation specifications.
3.2 Site Preparation

WARNING

During installation planning, allow sufficient room for access to the work-cell door and system components that are exterior to the work cell. Failure to observe this warning could result in injury to personnel during system operation and maintenance.

To prepare your site, proceed as follows:

1. Clear the floor space and overhead area needed for the Modular ArcWorld® C-200/500 system (see Figure 3-1 and Figure 3-2). 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 customer-supplied items and required tools (refer to Section 3.1).
Figure 3-1: Modular ArcWorld® C-200/500 — Installation Dimensions and Component Locations (Plan View)

Figure 3-2: Modular ArcWorld® C-200/500 — Installation Dimensions and Component Locations (Elevation View)
3.3 Removal of System from Shipping Skids

### WARNING

The Modular ArcWorld® C-200/500 weighs approximately 5200 kg. Ensure that your forklift is rated to handle this load safely.

The Modular ArcWorld® C-200/500 is attached to a wooden shipping skid at the factory, prior to shipment to the customer. The customer is responsible for removing the shipping skids and inspecting the components for shipping damage.

1. Unbolt the Modular ArcWorld® C-200/500 from its shipping skid using a 3/4-inch hex socket (see Figure 3-3).

   **Figure 3-3: 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.

2. Place the tongs of the forklift under the yellow shipping brackets protruding from under the access door opening (see Figure 1-1).

3. Slowly move the Modular ArcWorld® C-200/500 to its installation position.

4. Remove the yellow shipping brackets and its hardware and store in a safe location for reuse if the Modular ArcWorld® C-200/500 is ever moved to another location.

5. Discard and recycle the shipping skids and other shipping material.

### NOTE

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

Ensure that the Modular ArcWorld® C-200/500 is complete and verify that the correct amount of floor space is available for installation. Motoman recommends that the system be set in place prior to anchoring the system to the foundation.

3.4.1 Anchoring and Leveling

Refer to Figure 3-4 for the four (4) locations of the lag bolts needed to anchor the Modular ArcWorld® C-200/500 system to the foundation. Once the system is anchored, install an angle guard, supplied with the Modular ArcWorld® C-200/500 (see Figure 1-1), on each side of the robot riser.

To reduce the “rocking” or to level the system, adjust any of the six (6) leveling bolts (see Figure 3-4).

**WARNING**

Wear protective eye wear during the anchoring process. Failure to observe this warning could result in an eye injury for the installation technician.

1. After positioning the system, insert a drill bit through the center of each leveling bolt and drill a hole into the foundation for an anchor bolt (refer to Section 6 for foundation and anchoring suggestions).
2. Use compressed air to remove all concrete dust from each drilled hole.
3. Anchor the system to the foundation with suitable anchor bolts (refer to Section 6 for foundation and anchoring suggestions).
4. If required, level the system by adjusting the leveling bolts (see Figure 3-4 insert).

*Figure 3-4: Lagging and Leveling Locations*
3.4.2 Cable Boom

The cable boom is shipped in a stowage position. Loosen the two bolts on the cable boom and pull the rail straight up until you see the line on the cable boom. Then tighten the bolts (see Figure 3-5).

*Figure 3-5: Cable Boom Installation*
3.4.3 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 3-6.

Figure 3-6: Door Latch Alignment
3.5 Cable Connections

All system cables connections for the Modular ArcWorld® C-200/500 cell assembly are made at the factory. After the Modular ArcWorld® C-200/500 system is anchored in its correct locations, locate the interconnect cables check for correct and secure connections. All cables and connectors are labeled to ensure correct connection to the mating connectors on the applicable system component.

3.5.1 Connection to Earth Ground

**WARNING**

Do not use the Modular ArcWorld® C-200/500 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.

**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).

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. Connect the other end of the earth ground wire to the low-resistance earth ground.
3.5.2 Connection to Local Electrical Service

**WARNING**

Local electrical service connection to the Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 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 chapter 3.5.2.1 and chapter 3.5.2.2).

### 3.5.2.1 DX100 Controller

For detailed electrical service interconnect procedures for the DX100 controller, refer to the *DX100 Controller Manual* and Modular ArcWorld® C-200/500 system drawings and schematics that are included with your system documentation package (see Section 1.3).
3.5.2.2 Welding Power Source

Refer to the welding power source documentation and Modular ArcWorld® C-200/500 system drawings and schematics for electrical service connection procedures and diagrams for the welding power sources.

3.6 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 that all shipping brackets and material are removed from the system.
2. Check the security and integrity of all cable connections.
3. Ensure that the work-cell sliding access door closes and the door interlock engages properly.
4. Verify the correct settings for the welding power source (refer to the welding power source documentation that is included with your Modular ArcWorld® C-200/500 system).
5. Verify that local electrical service complies with the power requirements for your Modular ArcWorld® C-200/500 system.
6. Verify that local electrical service is correctly wired into the DX100 controller assembly and the welding power source (refer to Section 3.5.1).

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

8. Check for correct operation of all E-STOP push buttons (refer to Section 2.6.5).
9. Check for correct operation of the system HOLD button on the Programming Pendant. Refer to the Operator’s Manual for Arc Welding for more information on the pendant’s HOLD button (see Section 1.3).
10. Check for correct action of the work-cell access door safety interlock.
11. Remove power from the Modular ArcWorld® C-200/500 system after completion of the safety/operation check.

CAUTION

The Modular ArcWorld® C-200/500 system is now ready for power-up. Qualified, trained personnel who are familiar with this system should perform the power-up sequence.

WARNING

Before operating the robot, 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.
3.7 Installation of Tooling and Fixtures

The Modular ArcWorld® C-200/500 system is now ready for attachment of tooling fixtures to the positioner kits. Motoman recommends that you assign this task to personnel who are familiar with Modular ArcWorld® C-200/500 system operation and setup. After installation of the tooling and fixtures, test the positioner kit for correct operation. Refer to the positioner manual for instructions on how to test the positioner kit for correct operation (see Section 1.3).

- All tooling and fixtures for the positioner kit 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.

NOTE
This section provides a brief overview of the operating procedures and precautions for your Modular ArcWorld® C-200/500 system. For more detailed operating information, refer to specific component manuals that are part of the Modular ArcWorld® C-200/500 system documentation package (refer to Section 1.3).

The Modular ArcWorld® C-200/500 system is a fully integrated robotic GMAW welding cell. The MA1400 robot welds parts in Station 1 of the two-positioner system while the operator loads Station 2 with parts to be welded. When the robot completes the welding program at Station 1, it returns to the HOME (Safe) position. The operator can then initiate a CYCLE START/CYCLE LATCHED from the Operator Station for the new set of parts at Station 2. This moves the robot to Station 2, and the welding processes continues. The operator moves into Station 1 and replaces the completed welded parts with parts for another welding cycle.

### 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 ArcWorld® C-200/500 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 ArcWorld® C-200/500 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 ArcWorld® C-200/500 system. If you have questions concerning the configuration of your system, please contact Motoman’s 24-hour Customer Support (refer to Section 1.4).
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 (see Section 4.2.1).
- Move the robot to HOME position (see Section 4.2.2).
- Select the Control Master job (see Section 4.2.3).
- Perform the operation cycle (see Section 4.2.4).
- Perform the shutdown procedure (see Section 4.2.5).

4.2.1 Start-up Procedure

To start up the Modular ArcWorld® C-200/500 work cell from a power-off condition, proceed as follows:

1. Rotate the DX100 controller’s power ON-OFF switch to ON (see Figure 2-1).
2. Set the power ON-OFF switch on the welding power source to ON (the ON-OFF indicator lamp on the welding power source will illuminate).
3. Open the regulator valve for the welding gas supply.
4. Make sure that the work-cell access door is closed and operating properly and the door safety interlock is engaged.
5. Make sure that all E-STOP buttons are released. E-STOP buttons are installed at the following locations:
   - Programming Pendant
   - Operator Station
7. Place the robot in HOME position (refer to Section 4.2.2).

4.2.2 Robot HOME Position

To move the robot 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 move the robot to HOME position.
4.2.3 Control Master Job

With the system powered up and in TEACH mode, call up the Control 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 Control Master job.
4. Select PLAY mode on the Programming Pendant and press the PLAY MODE ENABLE button on the DX100 controller’s door (job playback operation is enabled). See Figure 2-1 for the location of the PLAY MODE ENABLE button on the controller.
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/CYCLE LATCHED 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 ArcWorld® C-200/500 work cell is now ready for operation.

4.2.4 Operation Cycle

The following is the typical sequence of operation for the Modular ArcWorld® C-200/500 work cell after start-up:

1. The operator loads the fixture on Station 1 with parts to be welded.
2. The operator steps out of the safety zone created by the safety roll-up doors and moves to the Operator Station.
3. At the Operator Station, the operator presses the green CYCLE START/CYCLE LATCHED button for Station 1. The safety roll-up door closes, and the robot moves into Station 1 to perform the welding program.
4. While the robot is welding, the operator moves to Station 2 and starts loading the next group of parts to be welded.
5. When the welding program in Station 1 is complete, the robot returns to HOME (Safe) position, and the safety roll-up door automatically opens.
6. When Station 2 is ready, the operator steps out of the safety zone created by the safety roll-up doors, moves to the Operator Station, and presses the CYCLE START/CYCLE LATCHED button for Station 2. The safety roll-up door closes, and the robot moves into Station 2 to perform the welding program.

**NOTE**

If the safety roll-up door is not open, press the CYCLE START/CYCLE LATCHED button for Station 2 to open it.

If the robot is still welding at the opposite welding station when the CYCLE START/CYCLE LATCHED button is pressed, the robot will finish and then proceed to the other station automatically (see Section 2.3.1).
7. The operator moves into Station 1, removes the welded parts, replaces them with non-welded parts, and the process continues.

4.2.5 Shutdown

Use the following procedure to perform a normal shutdown of the Modular ArcWorld® C-200/500 system:

1. Make sure that the robot is 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. Rotate the DX100 controller’s power ON-OFF switch to OFF (see Figure 2-1).
5. Set the welding power source’s power ON-OFF switch to OFF.
6. Close the regulator valve for the welding gas supply.

The Modular ArcWorld® C-200/500 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 clear them.

4.3.1 Alarms and Errors

Alarms and errors will stop the program. The three levels of alarms and errors are as follows:

- Error Messages
- Minor Alarms
- Major Alarms

For more detailed information on alarm and error recovery, refer to the DX100 controller and SSA2000 robot documentation that is included with your Modular ArcWorld® C-200/500 documentation package (see 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 robot is 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

Clear alarms of this type by cycling the DX100 controller in accordance with the following steps:

1. Rotate the DX100 power ON-OFF switch to OFF (see Figure 2-1).
2. Allow the DX100 power ON-OFF switch to remain in the OFF position for approximately 10 seconds.

3. Rotate the DX100 power ON-OFF switch back to ON.

### 4.3.2 E-STOP Recovery

An E-STOP (Emergency Stop) condition is triggered by any of the following conditions:

- An E-STOP push button switch is activated.
- A work-cell access door is opened while the robot is not in TEACH mode.
- The light curtain system is tripped.
- A welding torch collision triggers a shock sensor output (refer to Section 4.3.3).

If an E-STOP condition is triggered, restart the Modular ArcWorld® C-200/500 system as follows:

1. Press the SERVO ON button on the Programming Pendant.
2. Select the REMOTE mode on the Programming Pendant’s Mode Select Switch to transfer control of the system to the Operator Station.
3. Press the green CYCLE START/CYCLE LATCHED button on the Operator Station.

The Modular ArcWorld® C-200/500 system is now ready to continue operation.

### 4.3.3 Shock Sensor Recovery

The Modular ArcWorld® C-200/500 welding package includes a Motoman gun mount for the MA1400 robot. This mount is designed to protect the torch from damage in case of an impact (collision). A slight deflection of the torch activates a SHOCK SENSOR signal that triggers a system E-STOP condition. To clear the E-STOP condition, you must override the shock sensor and move the robot clear of the impact. Refer to the following procedure to override the shock sensor:

1. Press MAIN MENU on the Programming Pendant.

**CAUTION**

If an E-STOP condition occurs while the positioner is rotating, the positioner will complete the rotation when the Modular ArcWorld® C-200/500 system is restarted.

1. Press the SERVO ON button on the Programming Pendant.
2. Select the REMOTE mode on the Programming Pendant’s Mode Select Switch to transfer control of the system to the Operator Station.
3. Press the green CYCLE START/CYCLE LATCHED button on the Operator Station.

The Modular ArcWorld® C-200/500 system is now ready to continue operation.

**CAUTION**

Always reactivate the Shock Sensor before continuing system operation. The robot can be damaged if the Shock Sensor Override Switch remains in the “Override” position.

1. Press MAIN MENU on the Programming Pendant.
2. Use the Programming Pendant cursor key to select the ROBOT icon, then press SELECT.

3. Use the Programming Pendant cursor key to select OVERRUN-S.SENSOR, then press the SELECT key.

4. Select RELEASE to release the shock sensor.

5. Turn servo power ON by depressing and holding the Programming Pendant’s ENABLE switch in the middle position while pressing the SERVO ON/READY push button.

6. Move the robot clear of the impact position.

The Modular ArcWorld® C-200/500 system is now ready to continue operation.
5 Maintenance

Maintenance must be performed by authorized personnel who are familiar with the Modular ArcWorld® C-200/500 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 ArcWorld® C-200/500 system, refer to the documentation that is included with your system documentation package (refer to Section 1.3).

**CAUTION**

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

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>COMPONENT</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>Water Circulator (optional) (see note below)</td>
<td>Check level of coolant/antifreeze. If necessary, add a mixture of Motoman coolant/antifreeze (P/N 131224-1) and distilled water. Mix antifreeze and distilled water in proportions shown on the antifreeze container.</td>
</tr>
<tr>
<td>Daily</td>
<td>All safeguard items – work-cell door interlocks, E-STOP push buttons, safety light curtains, arc curtains, etc.</td>
<td>Check physical condition of each safeguard item and ensure that the safeguard item is working correctly.</td>
</tr>
<tr>
<td>One Month (or on condition)</td>
<td>Modular ArcWorld® C-200/500</td>
<td>Remove accumulated dirt, grease, and debris from inside and outside the work cell.</td>
</tr>
<tr>
<td>Every Six Months</td>
<td>Common Base Common Equipment Table (optional)</td>
<td>Check the integrity and security of anchor hardware in accordance with Hilti® documentation. Check the torque of hold-down nuts in accordance with Hilti® documentation (refer to Section 6).</td>
</tr>
</tbody>
</table>
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/TYPENOTE 1</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 (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](http://us.hilti.com) or [http://ca.hilti.com](http://ca.hilti.com) for further information.