

# ArcWorld<sup>®</sup> II-200/500 SYSTEM MANUAL

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

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## 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: 156988-1CD  
Revision: 0



YASKAWA

MANUAL NO.

156988-1CD 



## MANDATORY

- This system manual provides an overview of the Motoman ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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.



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.

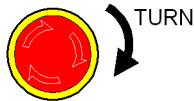
*Figure 1: EMERGENCY STOP Button*



- 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 ArcWorld® II-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:

Equipment	Manual Designation
DX100 controller	DX100
DX100 Programming Pendant	Programming Pendant
Cable between the manipulator and the controller	Manipulator cable

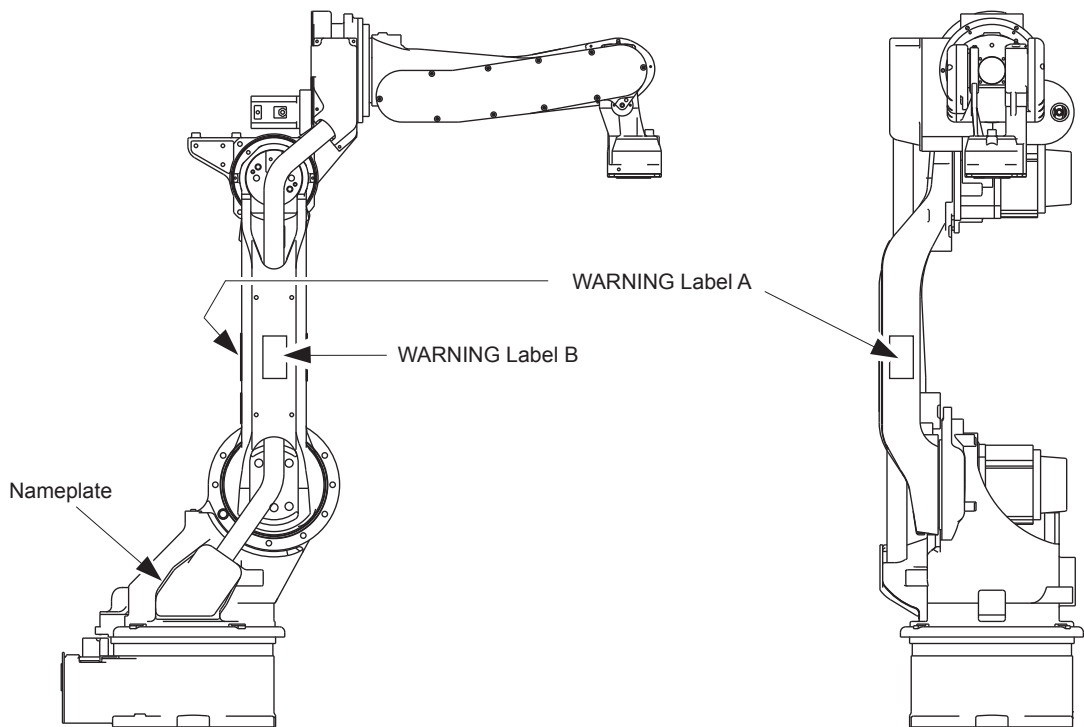
## Explanation of Warning Labels

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*



Nameplate:

MOTOMAN	
TYPE □□□□□	
PAYLOAD □□ kg	MASS □□□ kg
ORDER NO. □□□□□□	DATE □□
SERIAL NO. □□□□□□	
 YASKAWA ELECTRIC CORPORATION JAPAN	

WARNING Label A:



WARNING Label B:



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# 1 Introduction

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

### *Section 3 – Installation*

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

### *Section 4 – Operation*

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

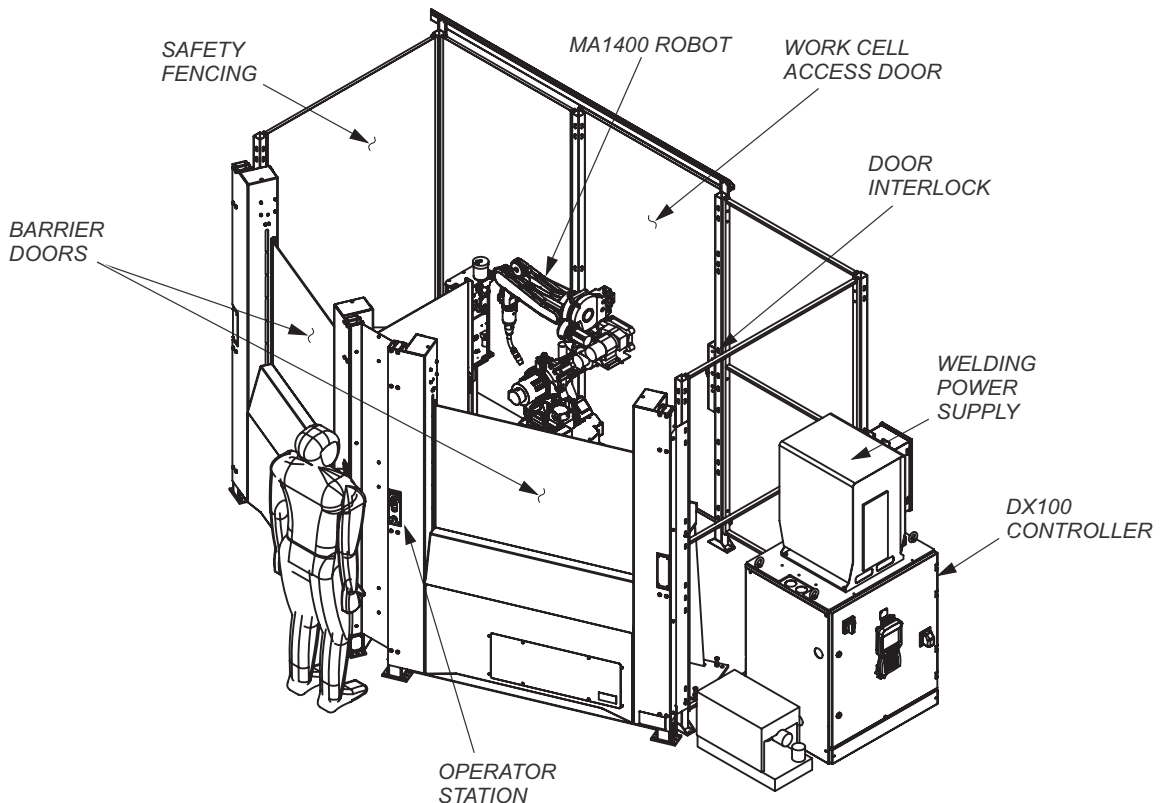
## 1.2 System Overview

The ArcWorld® II-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 ArcWorld II-200 work stations each provide a work area of 600 mm x 1,300 mm with a door opening of 1,200 mm. The ArcWorld II-500 work stations include MHT-180 positioners to provide coordinated part positioning. Each ArcWorld II-500 station accommodates a work envelope of 800 mm diameter x 1,000 mm long, with a door opening of 1,200 mm. Stationary tables are also available as an option on both systems.

The ArcWorld® II-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.

Each station also includes a heavy duty, motor driven safety barrier (roll up door) located in front of each positioner module to protect the operator from weld flash or other debris and prevents entry into the robot work area during robot operation. Maximum robot travel is also physically limited by an S-axis “hard stop” at the base of the robot.

*Figure 1-1: System Layout*



### 1.2.1 System Layout

All components of the ArcWorld® II-200/500 system are mounted directly to the floor. A spanner plate is used to help maintain proper alignment between the robot and work station modules. An optional common mounting base is also available.

The robotic cell is fully enclosed by safety fencing and an interlocking door. The interlocking barrier doors allow the operator to load parts at one station while the robot is welding at the other station. Integrated light curtains provide a safety zone to prevent the robot from entering an occupied station. All system controls, including those on the programming pendant, DX100 controller assembly, welding power supply, and operator station, are safely accessible from outside the ArcWorld® II-200/500 work cell (see Figure 1-1 for the location of these components).

### 1.2.2 Major Components

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

- Motoman MA1400 manipulator
- One DX100 controller assembly
- Two work stations
- MHT-180 headstock/tailstock drive assemblies (AWII-500 only)
- One Programming Pendant (located on DX100 controller)
- Operator Station
- Barrier Assemblies
- 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
  - Barrier door for each station

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ArcWorld® II-200/500	1	Introduction
	1.3	Reference Documentation

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### 1.2.3 Optional Equipment

The following optional equipment is available for use with the ArcWorld® II-200/500 system:

- Torch cleaner
- Wire cutter
- Water-cooled torch (with water circulator)
- TouchSense™ (starting point detection)
- ComArc™ (seam tracking)
- Stationary tables
- Common mounting base for robot, positioners, and fencing
- Common mounting base for controller and welding power source

### 1.3 Reference Documentation

For additional information on individual components of the ArcWorld® II-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 *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 ArcWorld® II-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](mailto: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                   | ArcWorld® II-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   |

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ArcWorld® II-200/500	2	Equipment Description
	2.1	Robot Description

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## 2 Equipment Description

### 2.1 Robot Description

The ArcWorld® II-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  $\pm 0.08$  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  $\pm 200$  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 ArcWorld® II-200/500 system documentation package (see *Section 1.3*).

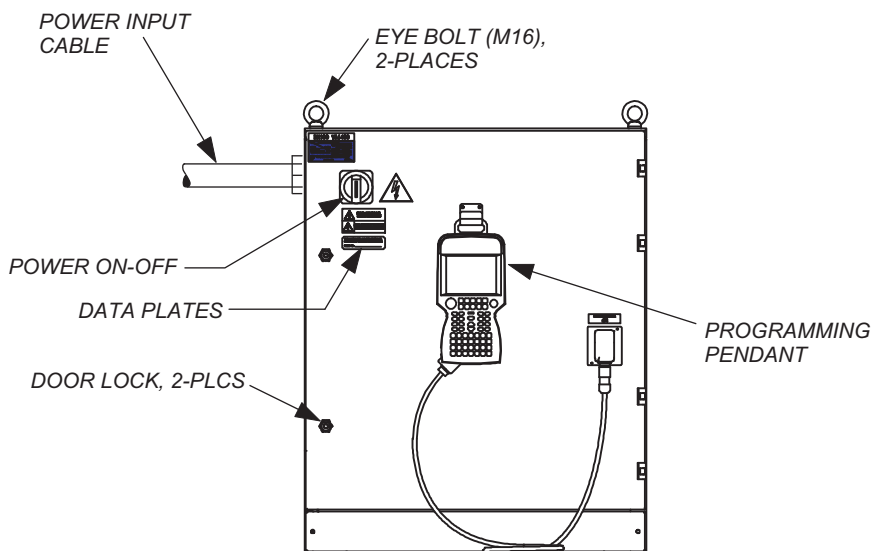
### 2.2 DX100 Controller

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 ArcWorld® II-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 ArcWorld® II-200/500 system documentation package (see *Section 1.3*).

Figure 2-1: DX100 Controller

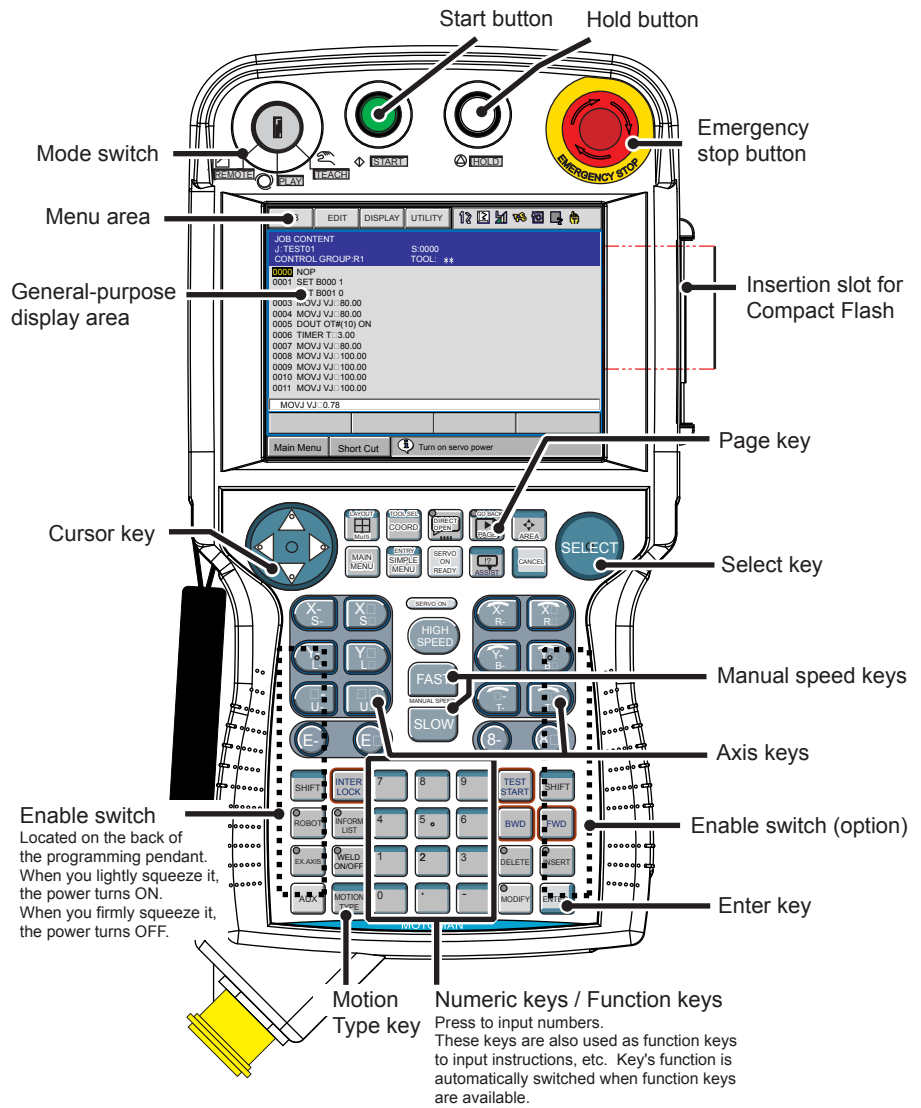


### 2.2.1 Programming Pendant

The Programming Pendant (see *Figure 2-2*) provides the primary means of programmer/operator interaction with the ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-200/500 system documentation package (see *Section 1.3*).

Figure 2-2: DX100 Programming Pendant



- 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 ArcWorld® II-200/500 system to the Operator Station, set the Mode Select Switch to REMOTE.



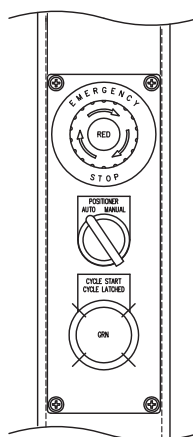
## 2.3 Operator Station

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 ArcWorld® II-200/500 system. The following paragraphs describe the controls on the Operator Station.



Operator Station “enable” or “disable” is accomplished with the Programming Pendant’s Mode Select Switch. To transfer control of the ArcWorld® II-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 ArcWorld® II-200/500 system from the Emergency stop (E-STOP) condition.

	2	Equipment Description
ArcWorld® II-200/500	2.4	Weld Station - MHT-180 (AWII-500 Only)

### 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.



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

### 2.4 Weld Station - MHT-180 (AWII-500 Only)

The ArcWorld II-500 includes two workstations; Station 1 and Station 2 and feature the MHT-180 positioner. The maximum tooling diameter for this positioner is 1,100 mm.

The MHT-180 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.

For additional positioner information, including specifications, an illustrated parts list, load capabilities, and dimensions, refer to the *Motoman Positioner Manuals* included with the ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-200/500 system depends on the customer's specific application and preference. For specific information on the welding power source supplied with your ArcWorld® II-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 ArcWorld® II-200/500 system documentation package (see *Section 1.3*).

### 2.5.3 GMAW Torch

The ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-200/500 system documentation package (see *Section 1.3*).

## 2.6 Safety Features

The ArcWorld® II-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.



Users are responsible for determining that the safeguards provided with the ArcWorld® II-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 ArcWorld® II-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 Motoman Door Guard

The Motoman Door Guard (MDG) is an AC motor driven door. The AC motor is controlled by a programmable Yaskawa J1000 inverter drive. The inverter drive provides full control of the MDG requiring only "up", "down" and "brake release" signals to operate. The barrier is designed with rounded edges and guards to minimize pinch points. The motor circuit is designed to slow or stall when impeded by an obstacle.

Integrated light curtains are built into the frame assembly to prevent contact with any component while in motion, adding an additional measure of safety. The MDG moves from a fully closed position to a fully opened position in 2.0 seconds. In the fully opened position, the moveable section retracts within the door frame assembly preventing any damage from the operator leaning on the door. The MDG is designed for a 4-second duty cycle.

### 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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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



### CAUTION

- The ArcWorld® II-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 ArcWorld® II-200/500 system is not extremely fragile, but it is a sophisticated robotic system that can be damaged by rough handling.



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

Two to three qualified technicians can install the ArcWorld® II-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 ArcWorld® II-200/500 system. Refer to your system drawings for more specific installation information.

### 3.1 Required Materials

All system components and **most** of the materials and fasteners needed for installation of the ArcWorld® II-200/500 system are included with shipment from the factory; however, the customer must supply some required items and installation tools (refer to *Section 3.1.1* and *Section 3.1.2*).

#### 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 m<sup>3</sup>/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)

### 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 wrenches (large and small)
- Hammer drill with appropriate concrete bits
- Phillips and flat-blade screwdrivers
- Hammers (dead-blow, steel, and 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



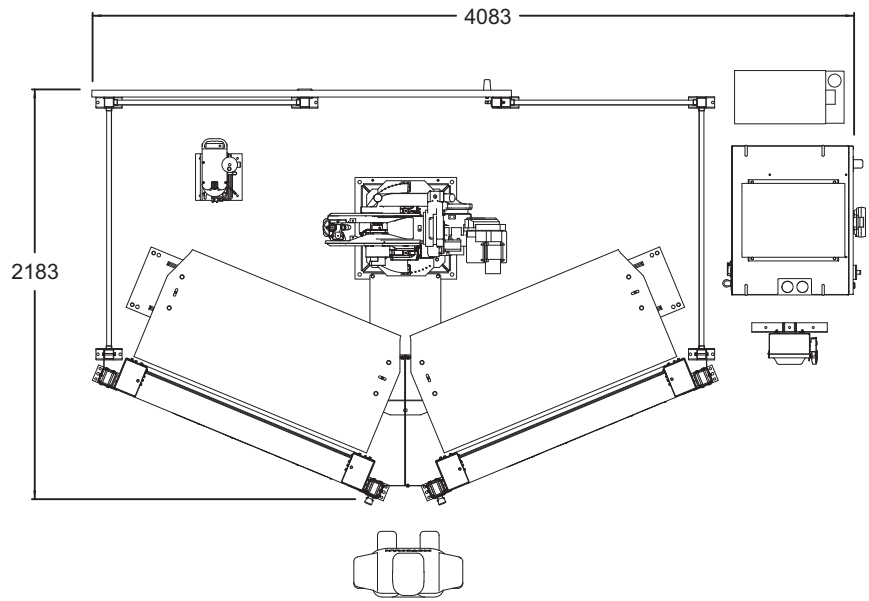
### WARNING

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 ArcWorld® II-200/500 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 customer-supplied items and required tools (refer to *Section 3.1*).

Figure 3-1: Installation Dimensions (ArcWorld II-200 Shown)





### 3.3 Removal of System Components from Shipping Skids

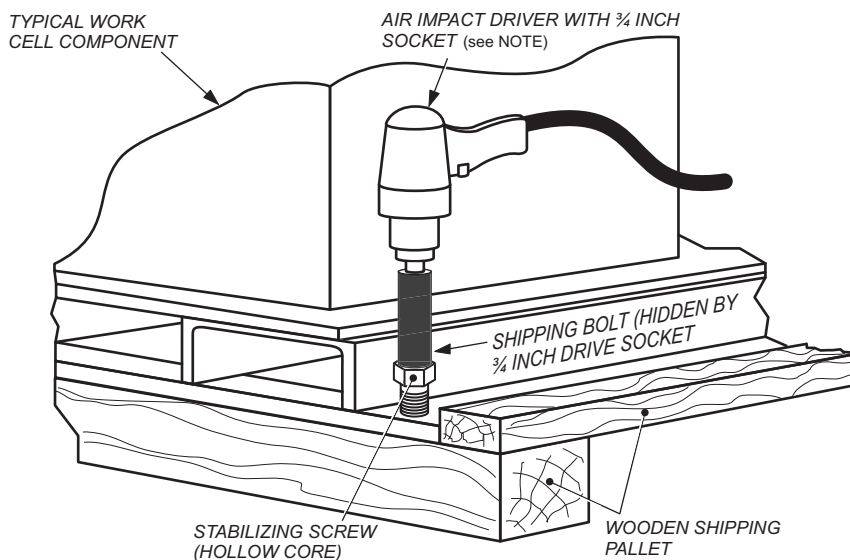
The ArcWorld® II-200/500 components are attached to wooden shipping skids at the factory, prior to shipment to the customer. The customer is responsible for removing the shipping skids and inspecting the components for shipping damage.

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

1. Unbolt the ArcWorld® II-200/500 components from the shipping skids using a 3/4-inch hex socket (see *Figure 3-2*).

*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.



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

### 3.4 Installing the System Components



#### WARNING

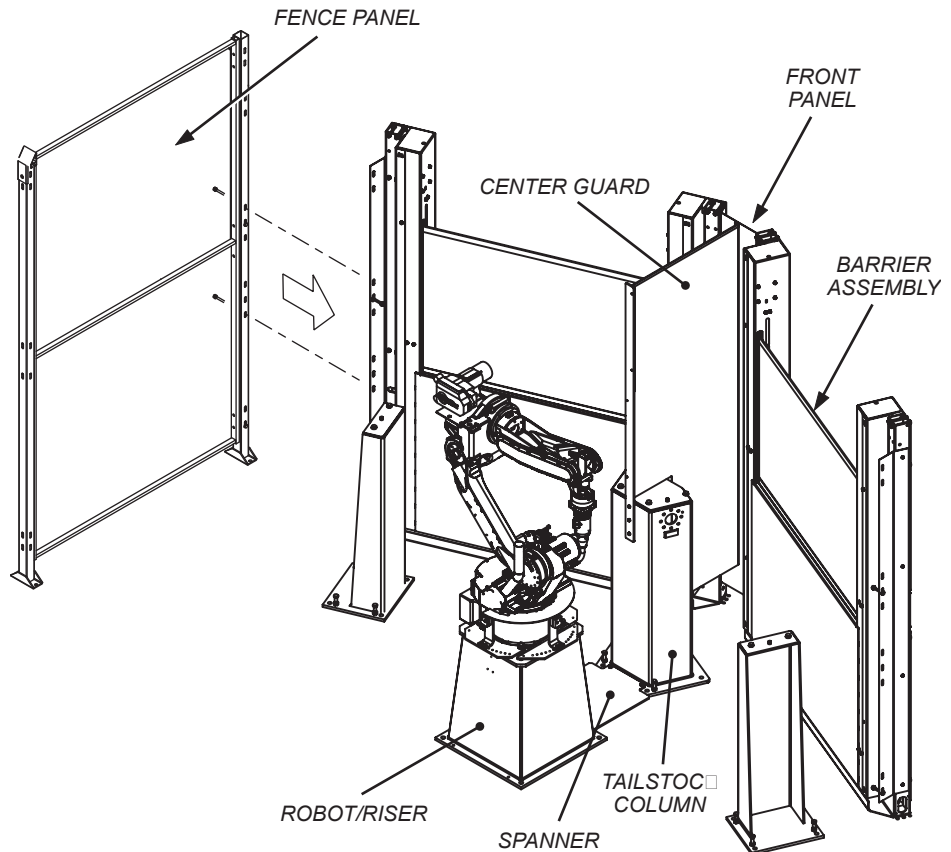
The robot/riser weighs approximately 450 kg. Be sure your crane or forklift is capable of handling this much weight or damage to the equipment or injury to personnel can result.

1. Unbolt robot/riser base from shipping skid using 3/4 inch socket wrench.
2. Inspect robot, torch, and riser for shipping damage.



If damage is found, notify shipper immediately.

Fig. 3-3:



3. Place the robot/riser assembly according to the system prints.
4. Locate the tailstock column directly in front of the robot riser.
5. Install the spanner plate between the robot riser and tailstock column using the hardware provided.
6. Install the front panel and center guard assembly to the tailstock column using the hardware provided.



## WARNING

The barrier stations weigh 222 kg, make sure the lifting device used to move these objects are capable of safely handling this much weight.

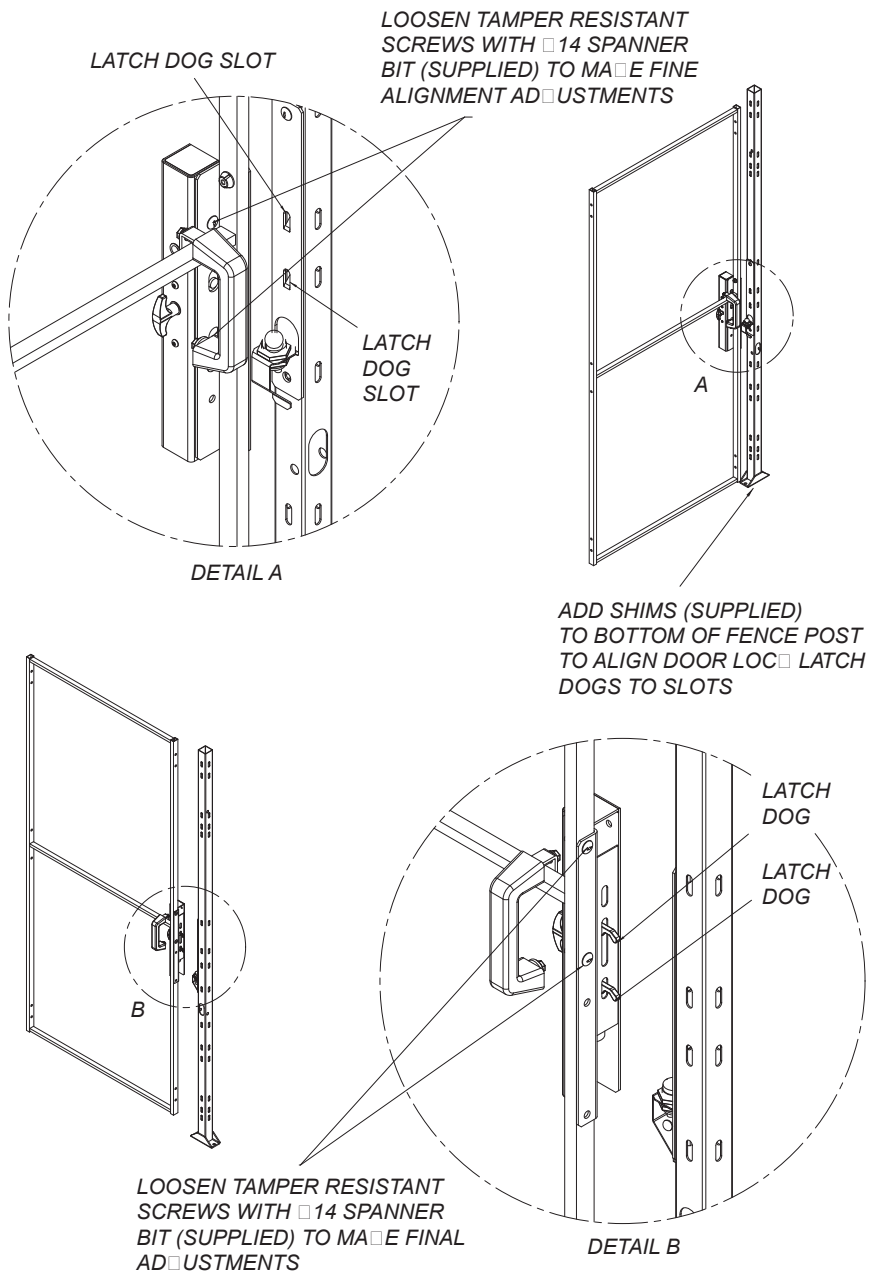
7. Attach each barrier station to the front panel posts with the doors defining the front of the cell.
8. (AWII-200) Locate and attach the table assemblies to the tailstock column using the hardware provided.
9. (AWII-500) Locate the headstock assembly for each station. Refer to system prints and MH-Series Positioner Manual (P/N 156488-1CD).

10. Attach the side fence panels to the barrier assembly side guards.
11. Install remaining fence panels to fence posts using the hardware provided.
12. Once components are correctly installed, anchor each component securely in place (refer to Appendix A for anchor requirements).

### 3.4.1 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 3-4*.

*Figure 3-4: Door Latch Alignment*



### 3.4.2 Installing the Arc Curtains



## WARNING

Do not install the arc curtains until the cell walls have been secured. Unsecured cell walls can fall and injure personnel and damage equipment.

The arc curtains are shipped in an accessories box. Unfold arc curtains and install one curtain on inside of each cell wall section.

### 3.4.3 Installing the Auxiliary Equipment

The controller, welder, and main service disconnect are typically installed just outside the cell fencing. To install the auxiliary equipment, proceed as follows:

1. Unbolt the auxiliary equipment from the shipping skid.
2. Carefully remove plastic wrapping and cardboard from controller and welder.
3. Inspect for any shipping damage.



## WARNING

The controller weighs approximately 150 kg (330 lbs). Be sure your lifting device is capable of handling this much weight or damage to the equipment or injury to personnel can result.

4. Using a forklift, lift the controller and remove from shipping skid.
5. Using the system drawings, place the controller and welder next to the cell.
6. Once components are correctly installed, anchor each component securely in place (refer to Appendix A for anchor requirements).

### 3.5 Cable Connections

After components are level and securely in place, the cables should be unwrapped from around the equipment and laid out according to the cable diagram included in the system drawing package. Each cable connection is clearly identified for ease of installation.

#### 3.5.1 Connection to Earth Ground



### WARNING

Do not use the ArcWorld® II-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.

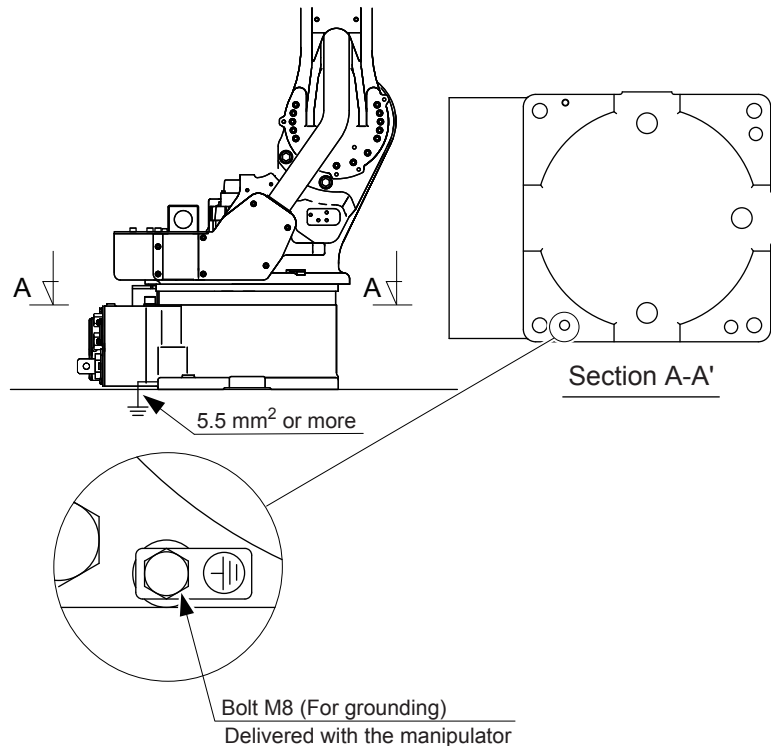


The customer shall supply all wires associated with the earth ground. The customer is responsible for establishing the correct gauge of all wires associated with the earth ground and maintaining an adequate earth ground (measured resistance of 100 ohms or less).

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.

Fig. 3-5: Grounding Method



### 3.5.2 Connection to Local Electrical Service



## WARNING

Local electrical service connection to the ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-200/500 system).
5. Verify that local electrical service complies with the power requirements for your ArcWorld® II-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*).



### CAUTION

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

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



### 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.

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 ArcWorld® II-200/500 system after completion of the safety/operation check.

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	3	Installation
ArcWorld® II-200/500	3.7	Installation of Tooling and Fixtures

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### 3.7 Installation of Tooling and Fixtures

The ArcWorld® II-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 ArcWorld® II-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.



## 4 Operation



### CAUTION

The customer is responsible for providing trained operators to run the equipment. The customer is also responsible for making sure that the equipment is operated in accordance with the ANSI/RIA R15.06-1999 Robot Safety standard, as well as any other local or state standards.

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

The ArcWorld® II-200/500 system is a fully integrated robotic GMAW welding cell. The MA1400 robot welds parts in Station 1 of the two-station 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.



The customer shall supply all tooling fixtures for the positioner.

### 4.1 Programming

The operation of this system is programming dependent. The following operating instructions are based on one possible configuration of this system. Your system configuration and job structure may differ 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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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*).

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ArcWorld® II-200/500	4	Operation
	4.2	Daily Operation

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## 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 ArcWorld® II-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
6. Select TEACH mode on the Programming Pendant.
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.
3. Select JOB 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 ArcWorld® II-200/500 work cell is now ready for operation.

### 4.2.4 Operation Cycle

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

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



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*).

6. 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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-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 ArcWorld® II-200/500 system as follows:



## CAUTION

If an E-STOP condition occurs while the positioner is rotating, the positioner will complete the rotation when the ArcWorld® II-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 ArcWorld® II-200/500 system is now ready to continue operation.

### 4.3.3 Shock Sensor Recovery

The ArcWorld® II-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:



## 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.

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ArcWorld® II-200/500	4	Operation
	4.3	System Recovery

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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 ArcWorld® II-200/500 system is now ready to continue operation.

## 5 Maintenance

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

 <b>CAUTION</b>
<p>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.</p>

*Table 5-1: Periodic Maintenance*

FREQUENCY	COMPONENT	PROCEDURE
Daily	Water Circulator (optional) (see note below))	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.
Daily	All safeguard items – work-cell door interlocks, E-STOP push buttons, safety light curtains, arc curtains, etc.	Check physical condition of each safeguard item and ensure that the safeguard item is working correctly.
One Month (or on condition)	ArcWorld® II-200/500	Remove accumulated dirt, grease, and debris from inside and outside the work cell.
Every Six Months	System Components  Common Equipment Base (optional)	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 <i>Section 6</i> ).

## 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*

EQUIPMENT	MINIMUM HILTI® ANCHOR ROD DIAMETER/TYPE	MINIMUM FLOOR-PLATE REQUIREMENTS	MINIMUM FOUNDATION REQUIREMENTS
<b>ROBOTS</b>	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.		
<b>POSITIONER</b>	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.		
<b>PERIPHERAL EQUIPMENT</b>	1/2-inch Kwik Bolt II Style Anchor (Note 1)	Not Applicable	3-inch minimum thickness or 1.3 embedment depth (whichever is larger) 4000 psi Reinforced Concrete
<b>WORK-CELL FENCE POSTS</b>	3/8-inch Kwik Bolt II Style Anchor (Note 1)	Not Applicable	3-inch minimum thickness or 1.3 embedment depth (whichever is larger) 4000 psi Reinforced Concrete
<b>OPERATOR STATION PEDESTAL</b>	1/4-inch Kwik Bolt II Style Anchor (Note 1)	Not Applicable	3-inch minimum thickness or 1.3 embedment depth (whichever is larger) 4000 psi Reinforced Concrete
NOTES: (1) Reference source: <i>Hilti® Product Technical Guide</i> (Section 4.3.3) for hardware specifications or equivalent. Refer to <a href="http://us.hilti.com">http://us.hilti.com</a> or <a href="http://ca.hilti.com">http://ca.hilti.com</a> for further information.			



# ArcWorld® II-200/500 SYSTEM MANUAL

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YASKAWA

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

MANUAL NO.

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