Motoman XRC Controller

ArcWorld 6000 System Manual for UP-Series Robot

Part Number: 142667-1
Release Date: January 25, 2001
Document Version: 2
Document Status: Final
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SECTION 1

INTRODUCTION

The ArcWorld 6000 is part of the ArcWorld family of standardized arc welding solutions. It is a fully integrated welding system, and is supported from wire to weld by Motoman, Inc.

The ArcWorld 6000 features a Motoman arc welding robot and XRC controller with menu-driven arc welding application software, complete welding package, 180 degree reciprocating plane positioner, operator interface, and a total safety environment.

1.1 About this Document

This manual is intended as an introduction and overview for personnel who have received operator training from Motoman, and who are familiar with the operation of this Motoman robot model. For more detailed information, refer to the manuals listed in Section 1.3. This manual contains the following sections:

SECTION 1 - INTRODUCTION
Provides general information about the ArcWorld 6000 and its components, a list of reference documents, and customer service information.

SECTION 2 - SAFETY
This section provides information regarding the safe use and operation of the ArcWorld 6000 system.

SECTION 3 - DESCRIPTION OF EQUIPMENT
This section provides a detailed description of the major components of the ArcWorld 6000 system. This section also includes a table of component specifications.

SECTION 4 - INSTALLATION
This section provides instructions for set up and installation of the ArcWorld 6000 system.

SECTION 5 - OPERATION
This section provides instructions for basic operation of the ArcWorld 6000 system. This section also provides procedures for start-up, loading, normal operation, fault recovery, and shutdown.

SECTION 6 - MAINTENANCE
This section contains a table listing periodic maintenance requirements for the components of the ArcWorld 6000 cell.
1.2 System Overview

The ArcWorld 6000 provides a complete arc welding solution in a standardized configuration. The system is designed around a Motoman arc welding robot and an XRC, and includes a complete welding package. A dual-station 180 degree reciprocating positioner with rotating headstock allows an operator to prepare and set up parts on one side while the robot welds on the other side. The cell provides a full complement of safety features designed to protect both personnel and equipment. Figure 1-1 illustrates the system layout of the ArcWorld 6000 cell.

1.2.1 System Layout

The XRC and welding power source share a common base. Additional options, such as the water circulator and the Com-Arc seam tracking unit, can be located on this auxiliary equipment common base. The robotic cell is fully enclosed by safety fencing and an interlocking door. Standing on the safety mat prevents positioner cycling. All operator controls, including those on the XRC and welding power supply, are accessible from outside of the robotic enclosure.

NOTE: Positioner arc screen and arc curtains not shown for clarity.
The ArcWorld 6000 includes the following major components:

- Motoman UP20 or UP6 manipulator and XRC controller
- MRM2-series dual-station 180 degree reciprocating positioner
- Master operator station
- Welding equipment, including the following:
  - MotoArc welding power source
  - Motoman torch (water-cooled or air-cooled)
  - Wire feeder
  - Torch mount
- Safety equipment, including the following:
  - Safety fencing with arc curtains
  - Interlocked safety mats
  - Interlocked cell door
  - Positioner arc screen

1.2.2 Optional Equipment

The following optional equipment is available for use with the ArcWorld 6000:

- Torch tender
- Com-Arc III seam tracking unit
- Water circulator
- Heavy duty positioner

1.3 Reference to Other Documentation

For additional information refer to the following:

- Motoman UP6 Manipulator Manual (P/N 142104-1)
- Motoman UP20 Manipulator Manual (P/N 144342-1)
- Motoman Operator's Manual for Arc Welding (P/N 142098-1)
- Motoman Concurrent I/O Parameter Manual (P/N 142102-1)
- Com-Arc III Instruction Manual (P/N 132753-1)
- Coordination Instructions for Multi-axes Systems (P/N 139418-1)
- Vendor manuals for system components not manufactured by Motoman

1.4 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (UP6 or UP20)
- Application Type (welding)
- System Type (ArcWorld 6000)
- Software Version
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on back side of XRC controller)
SECTION 2
SAFETY

2.1 Introduction

It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06. The address is as follows:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. The robot must not be operated by personnel who have not been trained!

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:
- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)
2.2 **Standard Conventions**

This manual includes information essential to the safety of personnel and equipment. As you read through this manual, be alert to the four signal words:

- **DANGER**
- **WARNING**
- **CAUTION**
- **NOTE**

Pay particular attention to the information provided under these headings which are defined below (in descending order of severity).

**DANGER!**
*Information appearing under the DANGER caption concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.*

**WARNING!**
*Information appearing under the WARNING caption concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.*

**CAUTION!**
*Information appearing under the CAUTION caption concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.*

**NOTE:** Information appearing in a NOTE caption provides additional information which is helpful in understanding the item being explained.
2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

• Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
• Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
• Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
• The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
• In accordance with ANSI/RIA R15.06, section 6.13.4 and 6.13.5, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety measures are available:

• Safety fences and barriers
• Light curtains
• Door interlocks
• Safety mats
• Floor markings
• Warning lights

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Programming tips are as follows:

- Any modifications to PART 1 of the controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.
- Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.
• Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.

• Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.

• Be sure that all safeguards are in place.

• Check the E-STOP button on the teach pendant for proper operation before programming.

• Carry the teach pendant with you when you enter the workcell.

• Be sure that only the person holding the teach pendant enters the workcell.

• Test any new or modified program at low speed for at least one full cycle.

2.7 Operation Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Operation tips are as follows:

• Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.

• Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.

• Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.

• Ensure that all safeguards are in place.

• Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.

• Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.

• The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.

• This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

• All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.
2.8 Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Maintenance tips are as follows:

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Back up all your programs and jobs onto a floppy disk whenever program changes are made. A backup must always be made before any servicing or changes are made to options, accessories, or equipment to avoid loss of information, programs, or jobs.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Be sure all safeguards are in place.
- Use proper replacement parts.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
SECTION 3
EQUIPMENT DESCRIPTION

3.1 UP-series Robot Description

The Motoman UP6 and UP20 robots and XRC robotic controller represent state-of-the-art technology in robotics today. The six-axis UP6 robot has a payload of 6kg (13.2 lbs). It features a 1,373mm (54.05 in.) reach and has a relative positioning accuracy of ± 0.08mm (0.004 in.). The six-axis UP20 robot has a payload of 20kg (44.09 lbs). It features a 1658mm (65.2 in.) reach and has a relative positioning accuracy of ± 0.1mm (0.004 in.).

Each robot can reach below its own base as well as behind itself and can be mounted on the floor, wall, or ceiling with few modifications. However, the S-axis has been restricted by hardstops for use in this system. For more information, refer to the manipulator manual that came with your system.

3.2 XRC Controller

The XRC robotic controller (see Figure 3-1) coordinates the operation of the ArcWorld 6000 system. It controls manipulator movement and welding power supply, processes input and output signals, and provides the signals to operate the welding system. It maintains variable data and performs numeric processing to convert to and from different coordinate systems. In addition, the controller provides the following: main logic functions, servo control, program and constant data memory, and power distribution. For more information, refer to the manipulator manual that came with your system.

![Figure 3-1 XRC Controller](image-url)
3.2.1 Playback Panel

The playback panel (see Figure 3-2) contains the primary system controls and consists of the features described below. For more information, refer to the manipulator manual that came with your system.

**Figure 3-2 XRC Playback Panel**

**Servo On Ready**
The SERVO ON READY pushbutton turns servo power ON. The switch lights when servo power is on. In TEACH mode, the SERVO ON READY pushbutton operates only when the TEACH LOCK button on the programming pendant is ON and the ENABLE switch on the programming pendant is held in.

**Mode**
The Mode push buttons (PLAY, TEACH and REMOTE) set the robot's mode of operation.

*NOTE:* Changing modes from PLAY to TEACH, during playback, will cause the program to cease execution (similar to HOLD); to resume operation, press PLAY and then START.

**Alarm/Error**
The ALARM/ERROR indicator light turns ON whenever an alarm or error condition occurs.

**Emergency Stop (E-STOP)**
The E-STOP button on the playback panel is connected in series with the system Emergency Stop circuit. Pressing E-STOP ceases all system operation.

**Start**
Pressing the START button while in PLAY mode with servo power on, causes playback execution of the current job to begin.

**Hold**
The HOLD button is a normally closed, momentarily actuated switch. Pressing HOLD halts operation of the manipulator until another Start signal is sent.
3.2.2 Programming Pendant

The programming pendant (see Figure 3-3) is the primary user interface for the system. The pendant has a 4x5-inch 12-line, 40-character LCD display and keypad. The system uses the INFORM II robot language and a menu-driven interface to simplify operator interaction with the robot. By using the pendant, the operator can teach robot motion, and perform programming, editing, maintenance, and diagnostic functions. The programming pendant consists of the items described below. For more information, refer to the manipulator manual that came with your system.

NOTE: The programming pendant LCD display goes dark after a few minutes of inactivity. Press any key to restore screen.

Figure 3-3  Programming Pendant

General Purpose Display Area
The General Purpose Display Area displays the currently selected menu choice.

Menu Area
The Menu Area contains menu selections for the currently selected screen.

Emergency Stop (E-STOP)
The E-STOP button on the programming pendant is connected in series with the system Emergency Stop circuit. Pressing the E-STOP button interrupts this circuit and stops all system operation.

Keypad
The user keypad on the programming pendant serves as an input device. The keys are grouped into different functional sections to simplify operator use.
**Status Area**

The Status Area shows system status via the following symbols:

- **Active Robot, External Axis, or Base Axis**
  R1, R2, R3; S1, S2, etc.; or B1, B2, etc.

- **Coordinate System**
  
  - Joint, World, Cylindrical, Tool, or User Frame

- **Manual Speed Setting**
  
  - Inching, Low, Medium, or High

- **Cycle Mode**
  
  - Step, 1-Cycle, or Auto

- **System Status**
  
  - E-Stop, Stop, Running/Start, Hold, or Alarm

- **Additional Pages** (when applicable)

**TOP MENU Key**

The TOP MENU key returns the pendant display to the initial start-up menu. The cursor key can then be used to choose from the following menu icons:

- **JOB**
  This icon accesses job selections including: Master Job, Select Job, Job Capacity, and Create New Job while in TEACH mode.

- **ARC WELDING, GENERAL, HANDLING, and SPOT WELDING**
  This icon allows you to select the applications available to the controller.

- **VARIABLE**
  This icon accesses the display and editing menu for the arithmetic variables and display of position variables.

- **IN/OUT**
  This icon accesses DETAIL and SIMPLE displays of all XRC I/O signals. In EDITING or MAINT. mode, Universal Outputs can be forced ON or OFF.

- **ROBOT**
  This icon accesses robot information including: CURR.POS, POWER ON/OFF, POS, COMMAND POS, SECOND HOME POS, OPE ORIGIN POS, and TOOL and USER COORDINATE.

- **SYSTEM INFO**
  This icon provides Version information for both hardware and software, Alarm History, and Monitoring Time.

**Area Key**

The Area key moves the cursor to the different areas of the display screen.

**Cursor Key**

The Cursor key is an 8-way, directional key that moves the up, down, left or right to highlight a desired item that can then be chosen using the SELECT key.
**SELECT Key**
The SELECT key is used to choose the item currently highlighted by the cursor.

**TEACH LOCK Key**
The TEACH LOCK key locks operation of the robot with the programming pendant. Operation is not possible from the playback panel or operator station. Servo power cannot be applied in TEACH mode unless TEACH LOCK is ON.

**RS-232C Serial Port**
This 9-pin serial port is used for data communication between the XRC and a floppy disk controller (FC1 or FC2), FDE (Floppy Disk Emulator) software, or other form of communication (see Figure 3-4).

![Figure 3-4 RS-232C Serial Port](image)

**ENABLE Switch**
The ENABLE switch (see Figure 3-5) is a three-position switch located on the left rear of the programming pendant. It is a safety feature that controls servo power while in TEACH mode. When pressed in, this switch enables servo power to be turned on. However, should the operator release the switch, or grasp it too tightly, servo power is immediately disabled, preventing further robot movement.

![Figure 3-5 Enable Switch](image)
3.2.3 Brake Release

**WARNING!**
*Releasing brakes could cause personal injury or machine damage. Always support the axis to be released BEFORE you release it.*

The Brake Release Control is a safety feature that allows you to release the automatic brakes on the robot in case of an emergency or robot failure. The Brake Release Control is mounted on the front of the XRC cabinet (see Figure 3-1).

3.3 Operator Station

The operator station (see Figure 3-6) includes a NEMA enclosure on a stand-alone pedestal. The following paragraphs describe the operator station controls.

3.3.1 Cycle Start

**WARNING!**
*The operation of the CYCLE START palm buttons is dependent on the structure of the Master job. Altering the Master job could result in injury to personnel or damage to the equipment.*

The green CYCLE START palm buttons, located on the sides of the operator station, initiate a positioner sweep cycle if the robot is in the Safe or Home position (Cube 24). If the CYCLE START buttons are pressed while the robot is outside Cube 24, the CYCLE START command is latched into the XRC. Once the robot returns to Cube 24 and Output #1 is on, the CYCLE START command is executed and the positioner sweeps. An anti-tiedown timer, normally set to 10 seconds, prevents the operator from holding the palm buttons down and continuously cycling the positioner. For more information on Cubic Interference Zones, refer to the manipulator manual. The following is an example of typical operation:
3.3.2 Emergency Stop (E-STOP)
Pressing an E-STOP button or interrupting a door interlock interrupts this circuit and stops all system operation. The operator station E-STOP, the robot E-STOP, and the sliding door interlocks are connected in series in the Emergency Stop circuit. Brakes are applied to the robot and all servo power is removed from the system. The system E-STOP lights come on and all positioner motion is stopped.

3.3.3 Hold
The HOLD button is a normally closed, momentarily actuated switch. Pressing the HOLD button stops the operation of the manipulator until another Start signal is sent. The indicator light stays ON only while the HOLD button is pressed. Operation resumes at the point in the program where the HOLD state was initiated. Refer to the manipulator manual for more information.

3.3.4 Cycle Latched
CYCLE LATCHED indicates that the positioner will sweep and begin to weld immediately after the current weld cycle is complete. The CYCLE LATCHED lamp operates illuminates when positioner CYCLE START command has been latched. It is not necessary to wait for the robots to finish welding and return to the Safe position (Cube 24) before pressing the CYCLE START palm buttons to sweep the positioner. Pressing the Cycle Start palm buttons while either robot is still in motion locks the CYCLE START command into the XRC. The CYCLE LATCHED light comes on, indicating CYCLE START latching. The positioner sweeps once the robots finish the current job and return to the Safe position (Cube 24). Stepping on the safety mats will unlatch the CYCLE START command from the XRC.

3.3.5 Alarm
The ALARM lamp is connected to the robot SERVO ON and ALARM OCCURRENCE outputs. The ALARM lamp turns on when the robot encounters an alarm condition or when servo power is cut.

3.3.6 Positioner Auto/Manual
The POSITIONER AUTO/MANUAL selector switch is used to select AUTOMATIC or MANUAL mode for the positioner. The selector switch is connected to robot Input #2. When the selector switch is in the AUTOMATIC position, the robot processes the part after the positioner sweeps. In MANUAL mode, the robot does not process the part after the positioner sweeps, but remains in the Safe position.

*NOTE:* The Positioner Auto/Manual command is dependent on the structure of the Master job.

3.3.7 Master Job Start
The robot will start the current active job when MASTER JOB START is pressed. The MASTER JOB START button is connected to the robot external start input. The operator station must be enabled and servo power ON for the MASTER JOB START button to work.
3.3.8 **Operator Station Enable/Disable**

The OPERATOR STATION ENABLE/DISABLE selector switch transfers primary control of the ArcWorld cell from the XRC to operator station. The REMOTE MODE button on XRC playback panel lights when the operator station is enabled. Most programming pendant functions are disabled while in REMOTE.

3.3.9 **Reset**

A minor alarm or error condition is cleared when the RESET button is pressed. The RESET button is connected to the robot alarm reset input. A minor alarm or error condition is cleared when this button is pressed. In addition, the RESET button and the RIGHT CYCLE START buttons are interlocked and, when pressed simultaneously, reset the positioner when servo power is ON in Play mode. In Teach mode, the positioner is automatically reset when servo power is turned ON. The positioner only needs to be reset after initial power-up and after an emergency stop while in Play mode.

*NOTE:* Resetting the positioner may cause positioner motion. Be careful when resetting the positioner while robot is close to tooling. If an Emergency Stop occurs during programming, be sure to reset the positioner before resuming programming.

3.3.10 **Servo On**

The SERVO-ON pushbutton enables servo power. In TEACH mode, the SERVO ON pushbutton operates only when the ENABLE switch on the programming pendant is held in.

3.4 **MRM2-Series Positioners**

The ArcWorld 6000 cell uses one of three different reciprocating positioners: the MRM2-250, MRM2-500, or MRM2-750. The MRM2-series positioners are AC-servomotor controlled by the XRC to provide coordinated motion. Standard distance between headstock and tailstock faceplates on the MRM2-250 positioner is 2.6 meters (approximately 102 inches), and 3.0 meters (exactly 118 inches) for the MRM2-500 and MRM2-750 positioners.

Refer to Tables 3-1, 3-2, and 3-3 for specifications for the MRM2-250, MRM2-500, and MRM2-750 positioners, respectively. The patented servomotor is used to sweep the positioner workstations into and out of the robot envelope, and also to turn the weld side of the positioner during welding.

A fixture frame is typically mounted between headstock and tailstock faceplates. Fixtures are either mounted on or integrated to these frames for positioning and clamping of production parts. Pneumatic signals and electrical signals can be run to the fixtures if required. Depending on part size and weight you can mount single, multiple, or a combination of parts to the frame.

The ArcWorld 6000 is capable of **synchronized motion** between robot and positioner in which the robot and positioner move at the same time during manual operation. The ArcWorld 6000 is also capable of **coordinated motion**, where the positioner rotates the parts while the robot welds. For more information about coordinated motion, refer to the manipulator manual for your system.

*NOTE:* In high humidity areas, use surface protection to prevent corrosion of the tooling plates.
3.4.1 Welding Ground System

The welding ground system consists of a spring-loaded copper brush that contacts the large gear inside the positioner gear housing. The ground cable to the welding power source is connected to the ground stud located on the right side of the positioner base as you face the back of the ArcWorld 6000 cell.

**NOTE:** The connection ground cable between to the insulated ground bar must be tight. If the connection is loose, arcing can occur and cause the insulator to melt.

### Table 3-1 MRM2-250 Positioner Specifications

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>250kg (550 lbs) combined part/fixture weight per side</td>
</tr>
<tr>
<td></td>
<td>500kg (1100 lbs) total</td>
</tr>
<tr>
<td>Maximum Weight Differential per Side (Offset Load)</td>
<td>190.6kg (375 lbs)</td>
</tr>
<tr>
<td>Swing Diameter</td>
<td>0.98meters (37.4 in.)</td>
</tr>
<tr>
<td>Temperature Operating Range</td>
<td>4–43°C (40–110°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>Non-condensing 10–90% relative humidity</td>
</tr>
<tr>
<td>Shock Rating</td>
<td>Less than 0.5 G</td>
</tr>
<tr>
<td>Sweep Speed (Torque/Time)</td>
<td>1000N•m in 5 to 7 seconds</td>
</tr>
<tr>
<td>Servo Head Stock Speed</td>
<td>1050N•m @ 0–16.8 rpm</td>
</tr>
<tr>
<td>Air Requirements</td>
<td>586 to 689.5kPa (85 to 100 psi)</td>
</tr>
<tr>
<td>Electrical Requirements</td>
<td>24V DC for interface</td>
</tr>
<tr>
<td></td>
<td>208V AC, 10 amp</td>
</tr>
<tr>
<td></td>
<td>3-phase power supplied by the XRC controller</td>
</tr>
<tr>
<td>Welding Current Rating</td>
<td>700 amperes at 100% duty cycle</td>
</tr>
</tbody>
</table>

### Table 3-2 MRM2-500 Positioner Specifications

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>500kg (1100 lbs) combined part/fixture weight per side</td>
</tr>
<tr>
<td></td>
<td>1000kg (2200 lbs) total</td>
</tr>
<tr>
<td>Maximum Weight Differential per Side (Offset Load)</td>
<td>289.8kg (639 lbs)</td>
</tr>
<tr>
<td>Swing Diameter</td>
<td>1.1meters (43.3 in.)</td>
</tr>
<tr>
<td>Temperature Operating Range</td>
<td>4–43°C (40–110°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>Non-condensing 10–90% relative humidity</td>
</tr>
<tr>
<td>Shock Rating</td>
<td>Less than 0.5 G</td>
</tr>
<tr>
<td>Sweep Speed (Torque/Time)</td>
<td>2000N•m in 5 to 7 seconds</td>
</tr>
<tr>
<td>Servo Head Stock Speed</td>
<td>1060N•m @ 0–16.8 rpm</td>
</tr>
<tr>
<td>Air Requirements</td>
<td>586 to 689.5kPa (85 to 100 psi)</td>
</tr>
</tbody>
</table>
### 3.4.2 Locking Pins

The MRM2-series positioners are equipped with fixture locking pins that prevent the headstock/tailstock faceplates from turning when the servo motor retracts. The fixture locking pins are spring loaded, so when the servo motor withdraws, the pins engage. Each headstock faceplate on the MRM2-series positioners has two locking pins.

The MRM2-500 and MRM2-750 positioners are also equipped with a pair of sweep lock drive pins that prevent the sweep axis from turning during the welding and loading cycles. One sweep lock drive pin is located on the headstock drive base and the other is located on the tailstock drive base.

---

### Table 3-2 MRM2-500 Positioner Specifications (Continued)

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Requirements</td>
<td>24V DC for interface</td>
</tr>
<tr>
<td></td>
<td>208V AC, 10 amp</td>
</tr>
<tr>
<td></td>
<td>3-phase power supplied by the XRC controller</td>
</tr>
<tr>
<td>Welding Current Rating</td>
<td>700 amperes at 100% duty cycle</td>
</tr>
</tbody>
</table>

### Table 3-3 MRM2-750 Positioner Specifications

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>750kg (550 lbs) combined part/fixture weight per side</td>
</tr>
<tr>
<td></td>
<td>1500kg (1100 lbs) total</td>
</tr>
<tr>
<td>Maximum Weight Differential per Side (Offset Load)</td>
<td>350kg (770 lbs)</td>
</tr>
<tr>
<td>Swing Diameter</td>
<td>1.1meters (43.3 in.)</td>
</tr>
<tr>
<td>Temperature Operating Range</td>
<td>4–43°C (40–110°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>Non-condensing 10–90% relative humidity</td>
</tr>
<tr>
<td>Shock Rating</td>
<td>Less than 0.5 G</td>
</tr>
<tr>
<td>Sweep Speed (Torque/Time)</td>
<td>3250N•m in 6 to 8 seconds</td>
</tr>
<tr>
<td>Servo Head Stock Speed</td>
<td>1725N•m @ 0–14.2 rpm</td>
</tr>
<tr>
<td>Air Requirements</td>
<td>586 to 689.5kPa (85 to 100 psi)</td>
</tr>
<tr>
<td>Electrical Requirements</td>
<td>24V DC for interface</td>
</tr>
<tr>
<td></td>
<td>208V AC, 10 amp</td>
</tr>
<tr>
<td></td>
<td>3-phase power supplied by the XRC controller</td>
</tr>
<tr>
<td>Welding Current Rating</td>
<td>700 amperes at 100% duty cycle</td>
</tr>
</tbody>
</table>
3.4.3 Arc Shield

WARNING!
Do not operate this equipment unless the arc screen is in place or eye damage can occur!

The MRM2-series positioners are equipped with a sheet metal screen that runs the length of the positioner table and visually separates the loading zone from the welding zone. This screen acts as a shield to protect the operator from the arc radiation and sparks produced by the welding operation. Do not operate this equipment unless the arc screen is in place.

3.5 Welding Equipment

In its standard configuration, the ArcWorld system includes a power source, wire feeder, torch, and torch mount. Optional equipment including water circulators, Com-Arc units, and torch tenders may included to enhance performance.

3.5.1 Wire Feeder

The PWF4 wire feeder mounts on the robot arm. This 4-roll wire feeder provides reliable wire feeding at rates up to 750 inches per minute (IPM). An integral gas valve provides fast gas response time. The wire feeder has an inch forward button to help simplify set-up and reduce change-over time. Interchangeable feed rolls are used to accommodate different types and sizes of wire. A Shock Sensor Override switch located on the front of the feeder is used to recover from torch impact.

3.5.2 Universal Welding Interface (UWI)

The UWI provides microprocessor control to the wire feeder and MotoArc series power source. It scales the signals from the XRC controller to the appropriate levels required for control of the welding components. It also provides isolation of the power source analog signals.

NOTE: Some power sources available with the ArcWorld 6000 system do not use the UWI. For more information specific to your system, refer to the vendor manuals shipped with your system.

3.5.3 GMAW Torch

The ArcWorld system uses either an air-cooled or a water-cooled robotic/automatic GMAW torch. These are heavy-duty torches designed for quick replacement while requiring minimum robot reprogramming. The GMAW torch is installed at the end of the robot wrist. For applications that use the water-cooled torch, the ArcWorld system includes a water circulator kit.

3.5.4 Motoman Torch Mount

The Motoman Torch Mount protects the robot, workpiece, fixture, and positioner. It provides multi-directional impact detection, including Z-axis collisions. Torch impact causes a system E-STOP and immediately stops all system operation. Servo power is removed from the system and brakes are applied to the robot. All positioner and door motion is also stopped.
3.5.5 Power Sources

Motoman offers several different power sources for use with the ArcWorld 6000 system depending on your system’s application. The following are some of the more common power sources used (see Figures 3-7 and 3-8). However, the power source your system uses may be different. For more specific information, refer to the vendor manual that came with your system.

Figure 3-7 Available Power Sources
3.6 **Safety Features**

The ArcWorld system incorporates a host of safety equipment. When all standard safety precautions are taken, the safety equipment helps to ensure safe operation of the robotic cell. The ANSI/RIA R15.06 Robot Safety Standard stipulates the user is responsible for safeguarding. *Users are responsible for determining whether the provided safeguards are adequate for plant conditions. Users must also ensure that safeguards are maintained in working order.*

3.6.1 **Arc Screens**

*WARNING!*  
**Although the arc curtain blocks dangerous arc radiation, never look directly at the arc without protective eyewear!**

Two separate arc screens are used on the ArcWorld system. The first is a metal arc screen on the positioner. This screen blocks arc radiation and sparks from the welding operation. The material used to cover the safety fencing of the entire robotic cell acts as the second arc screen. This material reduces the amount of ultra-violet radiation that escapes from the robotic cell.

3.6.2 **Fencing**

The safety fencing provided with the ArcWorld system encloses the entire robotic cell. It forms a physical barrier preventing entry into the robot operating envelope during automatic operation.

3.6.3 **Safety Mats**

The ArcWorld 6000 safety mats help prevent serious injury to anyone entering the positioner area during the sweeping process. In PLAY mode, if the positioner is sweeping and a safety mat is activated, servo power is removed from the system and all positioner motion stops. Servo power is reapplied by pressing SERVO ON. However, the positioner will only continue its motion after it is reset using the RESET and right CYCLE START buttons on the operator station.

If the positioner is not in motion but the CYCLE START input has been latched (indicated by the STATION READY light), the CYCLE START input is unlatched and the STATION READY light turns off when the safety mat is activated. Servo power remains ON.

3.6.4 **Emergency Stops (E-STOPs)**

In addition to the safety features described above, the ArcWorld 6000 has strategically placed E-STOPs. These are operator actuated devices that, when activated, immediately stop all system operation. Brakes are applied to the robot and all servo power is removed from the system. The system E-STOP lights come on and all positioner motion is stopped. The following is a list of their locations:

- The playback box on the controller
- The programming pendant
- The operator station
3.6.5 ENABLE Switch

The ENABLE switch is a safety feature which controls servo power while in TEACH mode. When pressed in, this switch allows the operator to turn servo power ON and initializes the system. However, should the operator release the switch or grasp it too tightly, servo power is immediately disabled, preventing further robot movement. For detailed information about the operation of the ENABLE switch, refer to the XRC section in the manipulator manual that came with your system.

3.6.6 Interlocked Cell Door

A safety interlock on the cell entrance door prevents entry into the cell during PLAY mode. Opening the cell door with the robot in PLAY causes an E-STOP. Brakes are applied to the robot and all servo power is removed from the system. The system E-STOP lights come on and all positioner motion is stopped.

3.6.7 Interference Cubes

Cubic interference zones prevent interference between multiple manipulators or a manipulator and peripheral devices. The XRC monitors the robot tool center point (TCP) during operation. If the TCP enters one of the these software-defined interference zones, an output is turned on in the XRC. These outputs can be used to interlock the activity of other manipulators or peripheral devices. The XRC has eight possible cubes available. These cubes are internally tied to the following Specified Outputs:

R1 = SOUT #081 - 104

The ArcWorld 6000 uses interference cubes to interlock robot position with positioner motion. The robot Home or Safe position (Cube 24) is defined behind the positioner, clear of the sweep zone. Each axis is placed in a position that provides the least amount of strain on the servo motors, with the U- and L- axes at 90 degree angles and the B axis in a relaxed, vertical position. This prevents drifting when servo power is off. Before the positioner can sweep, the robot must be in this safe position.

3.6.8 Brake Release

WARNING!

Releasing brakes could cause personal injury or machine damage. Always support the axis to be released BEFORE you release it.

The Brake Release Control is a safety feature that releases the automatic brakes on the robot in case of an emergency or robot failure. The Brake Release Control is mounted on the front of the XRC cabinet (see Figure 3-1). Refer to Section 5.3.4 for the proper operation of the brake release.
SECTION 4
INSTALLATION

The ArcWorld system can be installed easily in just a short time by three workers. The more people involved (within reason), the more quickly installation can be completed. Follow established safety procedures at all times throughout the installation process. Failure to use safe work practices can result in damage to the equipment and injury to the workers.

CAUTION!
Installation of the ArcWorld System is not a task for the novice. The ArcWorld System is not fragile, but it is a highly sophisticated robotic system. Handle components with care. Rough handling can damage system electronic components.

4.1 Materials Required
All system hardware necessary for installing the ArcWorld system is included with the system, except for the air line fitting on the filter/regulator/lubricator (FRL). This section identifies customer-supplied items and tools required to complete installation.

4.1.1 Customer-Supplied Items
- Gas bottles for the welding torches
- Incoming power supply
- Two earth ground cables with two earth ground stakes
- Weld wire
- Incoming air supply: 0.04cmm at 620.5kPa (1.5scfm at 90 psi)
- Stepladder
- Forklift and/or overhead crane
- Air line fitting on the filter/regulator/lubricator (FRL)

4.1.2 List of Tools
- Safety glasses
- Face shields
- Gloves
- Level
- Ratchet with 3/4-in. socket
- Adjustable wrench set
- Hammer drill with appropriate concrete bits
- Phillips and flat screwdrivers
- Hammer
- Socket set
- Forklift and/or overhead crane
- Air-impact gun with 3/4-in. socket
- Open-end wrench set
- Two socket-head (Allen)
- Wrench sets (standard and metric)
4.2 **Site Preparation**

To prepare your site, proceed as follows:

1. Clear floor space needed for unit (see Figure 4-1).

![Figure 4-1 Area Needed for Installation](image)

**NOTE:** The ArcWorld 6000 system will require a minimum area of 2.5m (8.2 ft.) by 3.9m (12.9 ft.). To get the most out of your ArcWorld system, it is a good idea to keep and additional 2.43 to 3.05m (8 to 10 ft.) of clear area on all sides of your system.

2. Gather all customer-supplied items and required tools listed in Section 4.1.
4.3 Installing the Robot and Positioner

The robot and the operator station are shipped in a wooden shipping crate. The positioner and the spanner and riser assembly are shipped on a large wooden shipping skid.

4.3.1 Installing the Robot in the Standard Position

⚠️ **CAUTION!**

*Handle ArcWorld 6000 components carefully to avoid damage.*

To install the robot and positioner, proceed as follows:

1. Unbolt positioner, spanner, and riser assembly from wooden shipping skid (see Figure 4-2).

⚠️ **CAUTION!**

*Lift the positioner from the operator's side NOT from the headstock or the tailstock ends or damage to cables may occur.*

2. Using a forklift or overhead crane, lift positioner and remove from shipping skid.

3. Carefully remove protective plastic wrapping from positioner.

4. Inspect positioner for shipping damage.

*NOTE:* If any equipment is damaged, notify shipper immediately.

5. Place the positioner in position, as shown in Figure 4-3.

*NOTE:* Make sure there is adequate room on all sides of the positioner for the fencing, the operator station, the safety mats, and the auxiliary equipment common base.

![Figure 4-2 Unbolting the Positioner, Spanner, and Riser Assembly](image-url)
WARNING!
The spanner and riser assembly weigh 136kg (300 lbs). Be sure that your crane or forklift is capable of handling this much weight or damage to the equipment or injury to personnel can result.

6. Using a forklift or overhead crane, lift spanner/riser assembly from skid.

7. Place spanner/riser assembly in position.
8. Bolt spanner/riser assembly to back of positioner with 4 bolts and washers (see Figure 4-4).
10. Carefully remove protective plastic wrapping from robot.
11. Inspect robot for any damage.

**NOTE:** If any equipment is damaged, notify shipper immediately.
WARNING!
The UP6 robot weighs 135kg (397 lbs) and the UP20 weighs 260kg (617 lbs). Be sure that your crane or forklift is capable of handling at least this much weight or damage to the equipment or injury to personnel can result.

12. To move robot into position, attach chains to a forklift or overhead crane, as shown in Figure 4-5.
13. Attach a chain hook (on the end of each chain) to each of the eyebolts on robot body.
14. Be sure to use a spreader bar to keep dual chains from pulling against robot assembly and causing damage.
15. Unbolt robot from base of crate.

Figure 4-5 Position of Robot on Riser and Spanner
16. Using a forklift or overhead crane, carefully lift robot and move to riser.
17. Align holes on robot with holes on riser.
18. Bolt robot securely to riser.
19. Remove operator station from crate and place safely out of way.

4.3.2 Changing the Position of the Robot

The ArcWorld 6000 robot and riser bolt to the spanner in their optimum shipping position. However, certain special welding applications may require a different positioning in relation to the positioner; therefore, the robot is designed so its position can be changed.

**NOTE:** If the position of the robot must be changed, the shipping brackets must be in place and the torch assembly not installed.

To change the position of the robot, proceed as follows:
1. Attach a chain hook to each of eyebolts on robot body.

**CAUTION!**
- **Always attach the lifting device to the robot before removing anchor bolts to prevent the robot from toppling.**
- **Be sure to use a spreader bar to keep the dual chains from pulling against the robot assembly and damaging it.**

2. Attach chains to overhead crane.
3. Remove four bolts holding robot riser to spanner (see Figure 4-5).
4. Carefully lift robot and move to desired position on spanner.
5. Align holes on robot riser with holes on spanner.
6. Bolt robot securely to spanner.

4.3.3 Removing the Shipping Brackets

**CAUTION!**

*Failure to remove shipping brackets from robot before operating the ArcWorld 6000 may result in damage to the robot drive mechanisms.*

Three yellow brackets (see Figure 4-6) prevent the robot from moving during shipping. Two rod brackets secure the lower arm assembly to the S-axis housing. The smaller bracket on the rear of the robot prevents the S-axis housing from pivoting. After the robot is in place, remove the shipping brackets. The positioner also has shipping brackets or bolts to prevent movement during shipment. After the positioner is in place, remove the shipping brackets or bolts.
4.4 **Leveling and Securing the Equipment**

Once the robot riser and positioner are in position, level the equipment and secure it to the floor. The lag bolts are shipped in the accessories box. To level and secure the equipment, proceed as follows:

1. Level robot spanner and positioner with leveling bolts (see Figure 4-7).
2. Insert a 1/2-in. concrete drill bit through center of lag holes and drill holes in floor for lag bolts.
3. Vacuum concrete dust from holes.
4. Lag robot spanner and positioner to floor.

4.5 Installing the Programming Platform

The ArcWorld 6000 system includes individual programming platforms that require assembly. Two configurations are available: a 24-inch assembly and a 36-inch assembly. The configuration you receive will depend on the height of the robot riser. The platform pieces are shipped on separate wooden shipping skids. Refer to assembly drawings 141208-1 (for 24-inch assembly) and 141209-1 (for 36-inch assembly) for more details. To assemble and install the 24-inch programming platform, proceed as follows:

1. Remove programming platform pieces from their shipping crates.
2. Using hardware provided, bolt steps to platform as shown in Figure 4-8.
3. Bolt kick plates to platform, as shown in Figure 4-8. Refer to assembly drawing 141208-1 or 141209-1 for location of kick plates for each platform.
4. Install brackets on platform for hand rail (see Figure 4-8). Refer to drawing 141208-1 or 141209-1 for location of brackets for each platform.
5. Insert pins in top two holes in hand rail. Insert handrail into holes in brackets as shown in Figure 4-8. Install hair pins in lower holes to secure handrail in bracket.

Figure 4-8  Assembling the Programming Platform (24")
6. Place platform sections around robot risers as shown in Figure 4-9.

![Diagram of Programming Platform and Torch Tender](Figure 4-9 Location of the Programming Platform and Torch Tender)

7. Insert a 1/2” concrete drill bit through center of lag holes on base of platforms and drill holes in floor for lag bolts.
8. Vacuum concrete dust from holes.
9. Lag programming platforms to floor.

### 4.6 Installing the Torch Tender Option

The optional torch tender is shipped in the crate with the robot. To install the torch tender, proceed as follows:

1. Remove torch tender from robot shipping crate.
2. Place torch tender in position, as shown in Figure 4-9. Be sure torch tender is within working range of robot. If unsure of robot’s working range, refer to manipulator manual that came with system.
3. Insert a 1/2” concrete drill bit through center of lag holes on base of torch tender and drill holes in floor for lag bolts.
4. Vacuum concrete dust from holes.
5. Lag torch tender to floor.

### 4.7 Installing the Fencing

The fencing that makes up the welding cell’s protective walls is shipped on its own skid, along with the safety mats and the safety mat trim, all the hardware needed for the fencing, and specific assembly documentation (see Figure 4-10). Additional documentation is included in the “Read Me First” documentation packet, which is connected to the XRC. To install the weld cell fencing, proceed as follows:

**NOTE:**

The rear wall is the wall behind the robot, and the front wall is the wall in front of the positioner. The right wall is the wall that is on the right as you are facing the front wall, and the left wall is the wall that is on the left as you are facing the front wall.

1. Carefully cut bands securing metal fencing, safety mats, and safety mat trim and remove everything from skid.
2. Place fence components on floor around robot/positioner (see Figure 4-11).
3. Connect three fence posts to two bottom sections of rear wall (see Figure 4-12, Step A).
4. Connect a fence post to front end of bottom section of right wall (see Step B).
5. Connect front wall, right post to right bottom and top sections of front wall (see Step C).
6. Connect front wall, right section to bottom section of right wall (see Step D).
7. Raise right wall/front wall right section and rear wall and bolt together at corner post (see Step E).

8. Connect a fence post to rear end of bottom and top sections of left wall (see Figure 4-13, Step F).
9. Connect front wall, left post to top and bottom sections of front wall, left section (see Step G).
10. Connect front wall, left section to bottom and top sections of left wall (see Figure 4-14, Step H).
11. Raise left wall/front wall, left section upright.

Figure 4-12 Assembly of the Fence Walls – Steps A thru E
12. With one installer steadying left wall, install top door rail across door opening, using clamps provided (see Figure 4-14, Step I).

13. Install top sections of rear wall and right wall by bolting them to bottom sections and middle and end posts (see Steps J and K).

14. Raise cell door and slide it into position on door rail.

15. Close door and install remaining door rail clamp (see Figure 4-15).

16. Install stop bolt and tighten clamp.

17. Adjust door hangers until latching mechanism latches firmly and securely.
Figure 4-15  Installation of Final Door Rail Clamp

18. Make sure cell walls are square.
19. Drill into floor through center of fence feet for lag bolts (see Figure 4-16).

Figure 4-16  Location of Places to Lag Fence Walls to Floor

20. Vacuum concrete dust from holes.
21. Lag cell walls to floor.
22. Using bottom cell door guide as a template (see Figure 4-15), mark location of two mounting holes.
23. Remove bottom cell door guide.
24. Insert a concrete drill bit through center of pads and drill holes for lag bolts.
25. Vacuum concrete dust from holes.
27. Lag cell door guide to floor to ensure smooth door operation.
4.8 Installing the Arc Curtains

DANGER!
Do not install the arc curtains until after the cell walls have been lagged to the floor. Unsecured cell walls can fall and injure personnel and damage equipment.

The arc curtains are shipped in an accessories box. To install the arc curtains, proceed as follows:

1. Unfold arc curtains and install one curtain on inside of each cell wall, using supplied wire ties and eyelets in material (see Figure 4-17).

![Figure 4-17 Securing the Arc Curtains](image)

NOTE: The arc curtains have been pre-cut to match the cell walls. Each arc curtain bag contains documentation that includes the arc curtain’s dimensions. If necessary, these dimensions can be used to match the arc curtain to the correct cell wall.

2. Make sure there are no gaps between arc curtains.
3. Install door panel arc curtain on outside of door panel, using supplied wire ties and eyelets in curtain material.
4.9 Installing the Auxiliary Equipment Common Base

The auxiliary equipment common base contains the XRC controller and the welding power sources. It may also include the optional water circulators and/or Com-Arc III units. The auxiliary equipment common base is shipped on a separate wooden shipping skid. The accessories box is secured to the top of the welding power source. To install the auxiliary equipment common base proceed as follows:

1. Unbolt auxiliary equipment common base from wooden shipping skid by removing four shipping bolts using 3/4-in. socket (see Figure 4-18).

![Figure 4-18 Unbolting the Auxiliary Equipment Common Base](image)

**WARNING!**
The auxiliary equipment common base weighs 680kg (1500 lbs). Be sure that your crane or forklift is capable of handling this much weight or damage to the equipment or injury to personnel can result.

2. Using a forklift, lift base and remove from wooden shipping skid.
3. Place auxiliary equipment common base approximately 0.6m (2 ft.) to left of ArcWorld 6000 cell (see Figure 4-19).
4. Remove protective plastic wrapping and cardboard from base.
5. Remove accessories boxes from welding power source and set safely aside.
6. Inspect auxiliary equipment common base for shipping damage.

**NOTE:** If any equipment is damaged, notify shipper immediately.
7. Level AEC base by adjusting the leveling bolts (see Figure 4-20).

8. Insert a 1/2-in. concrete drill bit through center of leveling bolts and drill a hole through each leveling bolt and into floor.

9. Vacuum concrete dust from holes.

10. Lag auxiliary equipment common base to floor.

NOTE: The auxiliary equipment common base does not have separate lag holes; lag holes are located in the center of the leveling bolts.
4.10 Installing the Operator Station

To install the operator station, proceed as follows:

1. Unload operator station.
2. Carefully remove protective plastic wrapping from operator station.
3. Inspect operator station for shipping damage.

**NOTE:** If any equipment is damaged, notify shipper immediately.

4. Place operator station outside fence to front of positioner (see Figure 4-19).
5. Insert a 1/4 in. concrete drill bit through center of lag holes in operator station base and drill holes for lag bolts.
6. Vacuum concrete dust from holes.
7. Lag operator station to floor.

4.11 Installing the Safety Mat

Safety mats require special handling to prevent damage to the internal electrode assembly. Grasp mat by its long edges and lift, causing a slight bow down the length of the mat (see Figure 4-21). This prevents the mat from kinking lengthwise. Place the mat cord and junction box on top of mat during handling to reduce tripping hazards.

**CAUTION!**

*Mats are susceptible to edge damage and damage from bending. Be careful not to impact the edges or corners of the mats. Do not attempt to lift large mats without help.*

![Figure 4-21 Handling a Safety Mat](image)

**NOTE:** The perimeter trim is placed along the outside of the safety mats.
Figure 4-22 Placement of the Positioner Safety Mat

A T-shaped aluminum extrusion, called the active joiner, is used to abut two safety mats together to increase sensitivity. On the extrusion there are adhesive strips that bond to each mat so that debris will not accumulate under the mats. At least three of the outside edges of the mat layout will need perimeter anchoring trim to hold the mats in place.

To install the safety mats, proceed as follows:

**Prepare Safety Mats**

To prepare the mats for installation with the active joiner proceed as follows:

1. Vacuum or sweep floor surface where mat will be mounted to ensure surface is flat, smooth, and free of debris.

2. Use a sharp utility knife and a straight edge to remove the lock lip from both mats at the point they will join one another. **Only remove the lip from the mat on the side that is joining another mat** (see Figure 4-23).
**Set up**

After the lock lips have been removed on adjoining mat ends, do a trial run. Location of safety mat must be in front of positioner with back perimeter trim even with fence ends (see Figure 4-24).

1. Put the safety mats, active joiner strips, and perimeter anchoring trim together in the desired configuration.
2. Once proper fit is ensured, expose one adhesive strip and secure the active joiner to one of the mats.
3. Expose the other adhesive strip and put the second mat in place.
4. Repeat this process until all mats using the active joiner are joined together.

*NOTE:* The active joiner should be positioned up to the mat’s dimensional edge, just inside the lock lip.

---

**Finish installation**

Once the trial run is complete and the mat is adhered to active joiner, the rest of the assembly can be anchored.

1. Using hardware provided, bolt safety mat junction box to front of positioner.
2. Place safety mat perimeter trim in position.

*NOTE:* For the perimeter trim, use a 1/4-in. drill bit.

3. Holding perimeter trim securely in place, drill 2.54cm (1 in.) deep through pre-drilled holes into floor.
4. Remove perimeter trim.
5. Remove any debris that may be underneath mat.
6. Reposition perimeter trim.
7. Insert appropriate anchors into holes for perimeter trim.
8. Insert #10 x 1-1/4-in. screws into perimeter trim, and tighten screws until they hold mat securely.
4.12 Connecting the Cables

After components are level and securely in place, unwrap the cables from around the equipment and arrange them according to the cable diagram included in the system drawing package.

4.12.1 Connecting the Earth Ground

The robot and the XRC must each be connected to an earth ground. An earth ground is a ground in which the equipment is connected to a ground stake driven into the earth. The ground stake must be driven a minimum of eight feet into the earth, and the earth must be treated with chemicals in order to reduce resistance to the ground stake. Deeper ground stakes may be required depending on area soil conditions. A maximum of 100 ohms ground resistance is recommended.

WARNING!

- If proper earth grounds cannot be provided, do not use the equipment! Serious injury or death can occur.
- Do not place the MIG system within 15.24m (50 ft) of other sources of noise (i.e., GTAW arc starters, plasma cutters, induction furnaces, high-power-resistance spot welders, dielectric heaters, etc.). Equipment that generates impulse or high-frequency noise can cause unexpected equipment operation and failure, which can result in serious injury or death.

NOTE: If the robot and the XRC are within 4.57m (15 ft) of each other, a common earth ground may be used. Otherwise, separate earth grounds must be used.

To ground the robot and the XRC proceed as follows:

1. Connect one end of robot earth ground cable to lug marked EARTH GROUND on bottom back of robot.
2. Connect other end of the robot earth ground cable to the earth ground stake.
3. Connect one end of second earth ground cable to common ground bus bar inside XRC.
4. Connect other end of the second earth ground cable to the earth ground stake.
4.12.2 Connecting the Welding Ground

The ground welding cable is shipped in an accessories box. To connect the ground welding cable, proceed as follows:

1. Remove the ground welding cable from the accessories box.
2. Connect one end of the ground welding cable to the grounding bolt located on the side of the positioner cabinet (see Figure 4-25).

3. Connect the other end of the ground welding cable to the negative (-) terminal on the welding power source (see Figure 4-26).
4.12.3 Connecting the Robot Cables

Two cables, 1BC and 2BC, connect the robot to the XRC controller. The 1BC cable supplies power to the robot servo motors. The 2BC cable provides communication between the controller and the robot. To connect the robot cables, proceed as follows:

NOTE: The right side of the XRC is on your right as you are facing the front of it.

1. Unpack programming pendant and plug connector into receptacle on right side of XRC controller.
2. Unpack two large black manipulator cables, connected to XRC controller, and route to back of robot.
3. Carefully engaging connectors, connect two cables (labeled 1BC and 2BC) to 1BC and 2BC connections on back of robot (see Figure 4-27).

![Figure 4-27 Robot Cables and Hoses Connecting the XRC to the Robot](image)

4.12.4 Connecting the System Interface Box

The system interface box is mounted on the back of the system fencing. To connect the system interface box, proceed as follows:

1. Locate and unpack Door Switch cable and connect to side of interface box.
2. Unpack safety mat cable and connect between safety mat junction box on front of positioner and interface box.
3. Unpack operator station cable and connect to interface box.
4. Unpack two positioner cables from interface box and connect to left side of XRC cabinet.
4.12.5 **Connecting the Water Circulator**

If your system uses the water cooled welding torch, it is necessary to connect the Motoman water circulator. To connect the water circulator, proceed as follows:

1. Connect two water hoses form weld torch to connections on water circulator marked WATER-IN and WATER-OUT (see Figure 4-28).

![Figure 4-28 Water Circulator Connections](image)

**CAUTION!**

- **Use only the antifreeze provided by Motoman.** Automotive anti-freeze contains stop-leak additives that will clog the small torch water-cooling ports and damage the pump gaskets.
- **Do not fill the water circulator past its fill line.** Damage to the water circulator could occur.

2. Fill water circulator tank with antifreeze coolant provided (P/N 131224-1). Do not fill water circulator past the fill line.
3. Plug power cable into electrical outlet on back of power source.

4.12.6 **Connecting the Positioner Pneumatic Air Line**

The positioner air line is regulated by the filter/regulator/lubricator (FRL) and is installed on the side of the positioner cabinet, as shown in Figure 4-25. The customer is responsible for providing and installing the air line connector fitting to the FRL. After the fitting is installed, connect the air line to the fitting. The incoming air supply should be 0.04cmm at 620.5kPa (1.5 scfm at 90 psi).
4.13 Connecting the Power

**DANGER!**

Power should be connected only by a qualified electrician. Electrical and grounding connections must comply with applicable portions of the national electrical code and/or local electrical codes.

To connect incoming power to the ArcWorld 6000, proceed as follows:

1. Install 3-phase power wiring to circuit breaker located inside left wall of cabinet (see Figure 4-29). Table 4-1 shows size and type of wire needed.
2. Tighten screws to torque indicated in Table 4-1.

![Figure 4-29 Incoming Power Connections](image)

3. Install an M5 lug on the incoming ground wire.
4. Terminate ground wire to frame ground stud with M5 hardware provided.

**NOTE:** The ArcWorld 6000 is configured for three-phase 460/480V AC, unless other voltage was requested. If other voltage is required for your plant, you must make the necessary modifications to the transformer. For more information, refer to the manipulator manual that came with your system.

<table>
<thead>
<tr>
<th>Lug Data</th>
<th>60/75° C wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog No.</td>
<td>TCAL14</td>
</tr>
<tr>
<td>Wire Size</td>
<td>#14-7 Copper, #12-8 Aluminum</td>
</tr>
<tr>
<td>Torque</td>
<td>#14-7, 4.0N•m (35 lb.-in.)</td>
</tr>
</tbody>
</table>
4.14 Conducting a Safety/Operation Check

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

1. Check that all three yellow shipping brackets have been removed from the robot (see Section 4.3.3).
2. Be sure there is a clearance of at least 2.5cm (1 in.) on either side of the positioner.
3. Be sure the safety mats are placed correctly.
4. Check that the cell door is closed and latched.
5. Check that all cable connections are tight.
6. Check air line connections to the positioner air line regulator and to the optional torch tender and wire cutter.
7. Be sure that the welding power source is set correctly (see the welding power source vendor's manual).
8. Verify that incoming line power matches the input power specified on the sticker on the front of the XRC.

Your ArcWorld 6000 is now ready for power-up. The ArcWorld system should be operated only by personnel who have received operator training from Motoman and who are familiar with the operation of this Motoman robot model. Turn the main power ON, and continue the safety/operation check.

9. Check all system E-STOPS (pendant, op-station, breakaways, playback box).
10. Check system Hold buttons.

4.15 Installation of Tooling and Fixtures

Your ArcWorld 6000 system is now ready for the installation of tooling and fixtures for your application. Installation of tooling and fixtures should be performed by personnel who are familiar with the operation of this system. Tooling and fixtures are supplied by the customer. After tooling is installed, test the positioner for proper operation:

**WARNING!**

*When loading fixturing and/or tooling on the positioner weighing over 90.7kg (200 lbs) per side, the arcscreen must be removed and the fixturing loaded on the robot side. Do Not sweep the positioner to load the robot side!*

- Verify that the air line FRL is set for 620.5kPa (90 psi).
- Positioner achieves full sweep time (4 to 8 seconds, depending on positioner).
SECTION 5
OPERATION

The ArcWorld 6000 is a fully integrated robotic gas metal arc welding (GMAW) cell. The Master job setup, and the sub-jobs programmed within it, determine how the robot performs the welding operation or other tasks. The robot welds parts on one side of the 180 degree reciprocating positioner, while the operator loads or unloads parts on the opposite side. Once the robot is finished with the welding process, it returns to the Safe position. The operator then sweeps the positioner 180 degrees to the opposite side, enabling the robot to start welding on the next set of parts.

The MRM2-250, MRM2-500, and MRM2-750 positioners use a 180 degree reciprocating motion that sweeps the positioner from the operator’s loading zone, into the robot’s work zone, and back. The positioner screen visually divides the positioner table into two rectangular halves, labeled Side A and Side B. As the positioner reciprocates, Side A moves under the primary axis and Side B moves over the primary axis. When Side A is in the robot’s welding zone, Side B is facing the operator, ready to be loaded or unloaded, and vice versa. Additionally, the headstock/tailstock on both Sides A and B rotate, which provides two welding surfaces per side. Loading fixtures and pneumatic or electric lines can be attached to the headstock and tailstock on both sides. Loading fixtures must be supplied by the customer.

5.1 Programming

The operation of this system is programming dependent. The operating instructions included in this section 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 be the same.

Any changes made to your system configuration and/or job structure will alter the operation of this cell. Motoman recommends you do not modify the original jobs and system configuration that came with your system. If modifications need to be made, they should be made to copies of these jobs and not to the originals. Modifications should only be performed by personnel who have received operator training from Motoman, and who are familiar with the operation of this Motoman system. If you have questions concerning the configuration of your system please contact the 24 hour Service Hotline, at (937) 847-3200 (see Section 1.4).

A major advantage of the ArcWorld 6000 system is its high degree of flexibility. The operator can fine tune the movement of the robot and the positioner according to the parts configuration. The MRM2-series positioner, with its programmable primary axis and headstocks, proves highly versatile when configured with the UP6 or UP20 robot. The robot can be programmed to weld a part with the headstock stationary, or the robot and headstock can move simultaneously to weld a part while the headstock is turning. The robot can be programmed to weld different seams on the same part and to move from part to part to continue welding.
With the programming pendant, the operator can develop a series of jobs for the robot. You can program the robot independently (R1 job), the station axis independently (S1 job), or the robot and station axis together (R1 + S1 job combinations). You must select the axis combination when teaching the job initially. Motoman recommends programming the robot and station axis together (R1 + S1 jobs) to reduce the risk of interference.

5.1.1 I/O Assignment

The ArcWorld 6000 uses the following user and dedicated inputs and outputs (see Tables 5-1 and 5-2).

**XRC Dedicated Inputs**
- Servo On
- External Job Start
- Alarm Reset
- REMOTE mode ON
- Hold
- External Emergency Stop

**XRC Dedicated Outputs**
- Servo Power ON
- TEACH mode
- Cube 24
- Alarm Occurrence

For more information on user and dedicated I/O’s, refer to the Concurrent I/O & Parameter Manual (Part Number 142102-1).

<table>
<thead>
<tr>
<th>Input</th>
<th>Assignment</th>
<th>Description</th>
</tr>
</thead>
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<td>CYCLE START</td>
<td>Cycle start input from op-station</td>
</tr>
<tr>
<td>IN#002</td>
<td>AUTO/MANUAL</td>
<td>Auto/Manual mode from op-station</td>
</tr>
<tr>
<td>IN#003 thru 008</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>IN#009</td>
<td>FIXTURE A LOCK ON</td>
<td>Fixture A Is Locked</td>
</tr>
<tr>
<td>IN#010</td>
<td>FIXTURE B LOCK ON</td>
<td>Fixture B Is Locked</td>
</tr>
<tr>
<td>IN#011</td>
<td>SERVO DRIVE RETURNED</td>
<td></td>
</tr>
<tr>
<td>IN#012</td>
<td>SERVO DRIVE FORWARD</td>
<td></td>
</tr>
<tr>
<td>IN#013</td>
<td>IN POSITION ON</td>
<td>for MRM2-250 positioner only</td>
</tr>
<tr>
<td>IN#013</td>
<td>SWEEP LOCK ON</td>
<td>for MRM2-500 and -750 positioners only</td>
</tr>
<tr>
<td>IN#014</td>
<td>SWEEP LOCK OFF</td>
<td>for MRM2-500 and -750 positioners only</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output</th>
<th>Assignment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT#001</td>
<td>CYCLE LATCHED</td>
<td>Cycle Start latched</td>
</tr>
<tr>
<td>OUT#002 thru 003</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>OUT#004</td>
<td>WIRE CUTTER</td>
<td>(Optional) close wire cutter</td>
</tr>
</tbody>
</table>
5.1.2 Sweeping the Positioner

NOTE: In order to sweep the positioner, the robot must be in the Safe position in Cube 24.

MANUAL mode allows you to sweep the positioner without activating the robot. Parts can be loaded onto the fixture to achieve the most efficient configuration and then swept into the welding zone, before teaching the robot a series of moves. To sweep Side A or Side B of the positioner into the robot’s welding zone, proceed as follows:

1. Move robot and positioner into Safe position (see Section 5.2.2).
2. Set operator station POSITIONER switch to MANUAL mode and start Master Control job (see Section 5.2.3). Robot will not move out of Safe position when POSITIONER switch is in MANUAL. (This normally depends on job structure.)

NOTE: Cycle Start latching is not operative in Manual mode.

3. Press CYCLE START palm buttons on operator station. XRC sweeps positioner each time CYCLE START buttons are pressed.

When the positioner sweeps Side A into the robot’s work area, the drive unit engages the headstock. Input #9 turns off. Side B faces the operator. Input #10 “FIXTURE B LOCK ON” turns on, indicating the fixture on Side B is locked.

When the positioner sweeps Side B into the robot’s work area, the drive unit engages the headstock and Input #10 turns off. Side A faces the operator. Input #9 “FIXTURE A LOCK ON” turns on, indicating the fixture on Side A is locked.

NOTE: The Cube function is a software feature that turns on an output when the robot tool center point is within established boundaries. If the robot moves outside of Cube 24, the output is lost and the positioner will not sweep. The cube position is factory set to be clear of the positioner. For more information on basic cube setup, refer to the manipulator manual.
5.1.3 Rotating the Headstock

To program a rotation of the Motoman MRM2 positioner headstock, proceed as follows:

1. With XRC in TEACH mode, turn servo power ON by holding in the ENABLE switch on programming pendant.
2. Press ENABLE soft key on programming pendant to enable robot motion control from programming pendant. Indicator light in button turns ON.
3. Press GROUP AXIS key.
4. Press X+ or X- motion keys on programming pendant to move headstock. Jog speed is set on programming pendant.

**NOTE:**
- The GROUP AXIS LED lights when pressed only when R1 + S1 is selected and S1 (Station 1) is the Master control device. The Status line indicates which GROUP AXIS is selected.
- The GROUP AXIS key must be turned OFF to move the robot with the motion keys.
- The ArcWorld 6000 robot S-axis is restricted by hard stops on the robot base and internal soft stops.

**WARNING!**
If the robot is working on a part and the headstock is not turning, DO NOT assume that the headstock will not turn. The robot is executing programmed steps which could index the headstock at any time.

5.1.4 Programming Specific Jobs

You can program three types of moves:
- Rotation of positioner during air-cut moves
- Robot motion with positioner stationary
- Rotation of positioner during welding

The job you create may consist of a combination of the above. The first two types of moves assume a robot-plus-station group axis specification (R1 + S1). The last type of move is called station synchronous and should be programmed with a station-plus-robot group axis specification (R1 + S1 S1) with S1 (Station 1) as the Master control device.

**CAUTION!**
Remember that the robot knows only where the Tool Center Point (TCP) is, and if not programmed carefully, the robot arm could still intersect with the loading fixture.

**NOTE:** Refer to your system's Coordination Instructions for Multi-axes Systems Manual for information on coordinated motion, selecting synchronization, group axes, and tooling calibration.
**Rotation of the Positioner During Air-Cut Moves**

1. Teach robot to desired position.
2. Rotate positioner to desired position.
   a. Press GROUP AXIS button on programming pendant.

**NOTE:** The GROUP AXIS LED lights only when S1 control is selected and the job Group Axis is R1 + S1 with S1 as the Master device.

b. Press MAN SPEED button to select desired axis speed while teaching.
c. Press first set of motion keys, +X or -X, to move axis in desired direction.
3. Record step after designating motion type and playback speed.
4. Check path with STEP FWD/BWD keys. The position for robot or positioner may need to be altered to prevent torch interference.

⚠️ **WARNING!**

The positioner axis operates as another robot axis and has the potential for hazardous motion.

**NOTE:**
- Press GROUP AXIS key until R1 is selected on the Status line in order to move the robot.
- Normally, air-cut moves are taught at joint moves. The speed for joint moves is specified as a percentage of maximum speed (VJ=0.01 to VJ=100.00). The axis which takes the longest time to complete the programmed motion automatically determines the speed of the system. This might be a wrist axis, a major robot axis, or the positioner axis. Cycle times can be reduced by changing wrist orientation, robot position, and headstock position simultaneously between program points rather than making the moves independently. Setting the speed at 100.00 will normally establish the quickest time between steps.

**Robot Motion with the Positioner Stationary**

1. Program robot position without moving positioner axis.
2. Set motion type and speeds in normal fashion;
   OR
3. Select GROUP AXIS as R1 only.

**Rotation of the Positioner During Welding**

The XRC controller can coordinate motion with the external axis. This requires calibration of the headstock and robot at the time of installation. Jobs programmed for coordinated motion must be taught as R1 + S1 jobs. Move instructions for coordinated motion are registered using the following format:

```plaintext
COORDINATED MOTION INSTRUCTION
{ SMOVL=138 SLAVE DEVICE (Manipulator with Torch) +MOVLO MASTER DEVICE (Positioner with Workpiece) }
```
5.1.5 Converting Programs from Side A to Side B

**CAUTION!**
Child jobs are not automatically converted. Be sure to convert all child jobs after converting the parent job.

By converting programs from Side A to Side B (or vice versa), you can develop duplicate jobs on opposite sides of the positioner. The positioner uses the external axis to sweep the positioner in addition to driving the headstock. This results in the external axis position being 180° offset from the other side. This offset amount can be determined from the difference in the external axis pulse counts at the two sweep positions. Software can be used to modify the position of the external axis in a job copied to run on the opposite side.

1. Determine pulse count difference of external axis between Side A and B. To do this, display the position (POSN) screen.
2. Set the pulse count offset amount into an EX variable.
3. Make copy of original job. Designate proper side in original and copied job name.
4. Use Modify Position (MODPOS) function to change position of external axis in the program.
5. Step through the new program to verify the path.

*NOTE:* Position variables will not be changed. These must be defined by the operator.

5.2 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 Start-up Procedures (see Section 5.2.1).
- Move robot to Safe position (see Section 5.2.2).
- Select master job (see Section 5.2.3).
- Perform Operation Cycle (see Section 5.2.4)
- Perform Shutdown Procedures (see Section 5.2.5)
5.2.1 Start-Up

To start up ArcWorld 6000 cell from a Power-Off condition, proceed as follows:

1. Turn on welding power source disconnect.
2. Set MAIN POWER switch on XRC to ON.
3. Set INPUT POWER switch on welding power source to ON. The pilot light on power source turns on.
4. Open regulator valve on welding gas supply.
5. Open air supply valve.
6. Make sure enclosure door is closed.
7. Disable operator station.
8. Press TEACH mode button on XRC playback panel. The indicator light in switch turns on.

5.2.2 Robot Safe (Cube 24) Position

To move the robot to the Safe position (cube 24) proceed as follows:

1. Press TEACH mode button on XRC playback panel.
2. Press TOP MENU on programming pendant.
3. Select JOB icon using cursor keys and press SELECT.
4. Cursor to SELECT JOB and press SELECT key.
5. Using cursor keys, move cursor to Cube 24 job and press SELECT. Cube 24 job appears on display screen.
6. Turn servo power ON by pressing SERVO ON, pressing TEACH LOCK and holding in ENABLE switch.
7. Use INTERLOCK and FWD buttons on programming pendant to jog robot to Safe (cube 24) position.

5.2.3 Starting the Master Job

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

1. Press TOP MENU key on programming pendant.
2. Select JOB icon using cursor keys and press SELECT.
3. Cursor to SELECT JOB and press SELECT key. Job list appears on display screen.
4. Using cursor keys, move cursor to Master job and press SELECT. Master job appears on display screen.
5. Make sure both enclosure doors are closed and securely latched.
6. Press PLAY mode button on playback panel. Playback operation is enabled.
7. Press SERVO ON button on playback panel.
8. Reset positioner by simultaneously pressing RESET and right CYCLE START buttons on operator station.
9. Place ENABLE/DISABLE switch on operator station in ENABLE position. XRC is placed in REMOTE mode and system control is transferred to operator station.

The ArcWorld 6000 cell is now ready for operation.
5.2.4 **Operation Cycle**

1. Load production parts on fixtures located on operator side of positioner.
2. Step off safety mats.

*NOTE:*
- Before sweeping at first power up, make sure the correct job has been loaded.
- Before sweeping, make sure the weight of the parts and fixtures is approximately equal on Sides A and B of the positioner (refer to Section 3.4).

3. Press both CYCLE START palm buttons on operator station to sweep positioner. The positioner sweeps, placing unwelded parts in robot’s welding area and turning empty side to operator’s loading area. The sweep can range from 90 to 180 degrees, and consist of a single move or a series of smaller moves.

4. After positioner sweeps, robot begins welding sequence on parts. Coordinated motion capabilities allow positioner to rotate parts on positioner, while robot moves and welds at same time.

5. Load more parts to be welded into fixture on operator’s side of positioner.

6. Press BOTH CYCLE START palm buttons on operator station. The positioner sweeps, returning welded parts outside cell and placing newly loaded, unwelded parts in robot’s work area.

7. Unload welded parts from fixture.

5.2.5 **Shutdown**

Use the following procedure to shut down the ArcWorld II-600 cell after operation is complete:

1. Make sure the robots are in the Safe position (Cube 24).
2. Turn off the system servo power by pressing the E-STOP button on the OP-station, programming pendant, or playback box.
3. Press TEACH mode button on playback box.
4. Set controller Main Power switch to OFF position.
5. Set Main Power switch on welding power source to OFF position.

The ArcWorld 6000 cell is now shut down.

5.3 **System Recovery**

Under certain conditions you will be required to clear an alarm or error. Clearing an alarm or error requires different operator actions depending on the type. The paragraphs below describe the different types of alarms and errors you may encounter and how to remedy them when you do.

5.3.1 **Alarms and Errors**

Alarms and errors will cause the program to stop. There are three levels of alarms and errors: Error Messages, Minor Alarms, and Major Alarms. For more detailed information about alarm recovery, refer to manipulator manual that came with your system.
**Error Messages**
These are simple errors such as pressing the START button when the robot is not in PLAY mode, or enabling the programming pendant without the servo power being live. Errors like these are cleared by pressing the CANCEL button on the programming pendant.

**Minor Alarms**
Minor alarms are usually programming errors. Minor alarms might occur if a circle has been programmed with fewer than three circular points, etc. These alarms are cleared by pressing the RESET (F5) soft key on the programming pendant.

**Major Alarms**
Major alarms are hardware failures. Major alarms might occur because of a servo tracking error or an abnormal speed and are usually associated with crashes. To clear these alarms, you must turn off the controller and then turn it on again.

### 5.3.2 E-STOP Recovery

An E-STOP can occur under any of the following conditions:
- Pressing E-STOP button on the operator station, programming pendant, or the playback panel.
- Opening sliding door on robot enclosure when robot is not in TEACH mode.
- Stepping on safety mat when positioner is sweeping.
- Actuating shock sensor on torch mount.
- Loss of air system pressure.

To restart the ArcWorld 6000 cell after an E-STOP condition occurs, follow the procedure below.

1. To clear E-STOP condition, perform any of the following actions that apply:
   - Release E-STOP button on operator station, programming pendant, or XRC playback panel.
   - Close sliding door.
   - Step off safety mat.
   - Clear Shock Sensor condition (refer to Section 5.3.3).
   - Restore operating air pressure.

\[\text{CAUTION!}\]

**If an emergency stop condition occurs while the positioner is sweeping, the positioner will continue the sweep when system is re initialized.**

2. Press SERVO ON button on operator station, programming pendant, or playback panel.
3. Press RESET button and right CYCLE START button on operator station to initialize system.
4. Ensure operator station is enabled.
5. Press MASTER JOB START button on the operator station.

The ArcWorld 6000 cell is now ready to continue operation.
5.3.3 Shock Sensor Recovery

The ArcWorld welding package includes a Motoman gun mount. This mount is designed to protect the torch from damage in case of a crash. A slight deflection of the torch activates a SHOCK SENSOR message which triggers an E-STOP condition. To clear the E-STOP condition, you must override the shock sensor and move the robot clear of the impact. To override the shock sensor, proceed as follows:

CAUTION!

It is possible to crash the robot with the Shock Sensor Override Switch left in the “Override” position. Always remember to reactivate the Shock Sensor before continuing system operation.

1. Press TOP MENU on programming pendant.
2. Select ROBOT icon using cursor keys and press SELECT.
3. Cursor to OVERRUN-S.SENSOR and press SELECT key.
4. Select RELEASE to release shock sensor.
5. Turn servo power ON by holding ENABLE switch on the programming pendant and pressing SERVO ON.

NOTE: TEACH LOCK must be ON to turn servo power on in TEACH mode.


The ArcWorld 6000 cell is now ready to continue operation.

5.3.4 Using the Brake Release

The brake release control panel is located on front of the XRC. Each axis brake is controlled by an individual axis button. Simultaneously pressing the ENABLE button and one of these axis buttons releases the indicated axis. To release the brakes, proceed as follows:

1. Press E-STOP button on programming pendant, playback panel, or operator station, to be sure servo power is OFF.
2. Provide adequate support for axis to be released. Support should withstand payload of robot and approximate weight of the robot. Listed below are weights of each robot available:
   - UP6 – 135kg (297 lb)
   - UP20 – 280kg (617 lb)

WARNING!

Releasing brakes could cause personal injury or machine damage.
Always support the axis to be released BEFORE you release it.

3. Release specific axis brake by pressing and holding corresponding axis button and ENABLE button at same time.

NOTE: You must hold both the axis and ENABLE buttons down for the axis to remain released. Releasing either button will automatically lock the brakes again.
SECTION 6
MAINTENANCE

6.1 Periodic Maintenance

For periodic maintenance procedures and schedules for the UP6 and UP20 robot and the XRC, refer to the manipulator manual or to the XRC Controller Maintenance Manual that came with your system. For additional maintenance information about the reciprocating positioner, refer to your positioner manual.

For maintenance information about the welding power source, refer to your MotoArc Owner’s Manual.

Table 6-1 provides a list of periodic maintenance to be performed on the ArcWorld 6000 cell. Keep in mind that the maintenance intervals given serve as guidelines only. You should adjust the frequency of maintenance to suit your specific work conditions.

CAUTION!

- **Use only the antifreeze provided by Motoman. Automotive antifreezes contain stop-leak additives that will clog the small torch water-cooling ports, and damage the gaskets in the water circulator pump.**

- **Excessive copper ground lubricant may damage weld ground due to electrical arcing through air pockets in grease.**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Component</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monthly</strong></td>
<td>MRM2-250 servo head-stock RV drive unit</td>
<td>Check for proper grease levels and quality. Use Epinoc APO grease (Motoman P/N 132434-1) as required.</td>
</tr>
<tr>
<td><strong>Daily</strong></td>
<td>Water circulator (For water-cooled torch application only.)</td>
<td>Check the fluid in the water circulator. Add fluid as required. Use only distilled water and approved antifreeze (Motoman P/N 131224-1).</td>
</tr>
<tr>
<td><strong>Daily</strong></td>
<td>Air system water trap on the front of the MRM2 positioner.</td>
<td>Check water trap and empty if required.</td>
</tr>
<tr>
<td><strong>Monthly</strong></td>
<td>MRM2 weld grounds</td>
<td>Lubricate with Burndy Penetrox E conductive copper lubricant (P/N PEN-E-8).</td>
</tr>
</tbody>
</table>
6.1 Periodic Maintenance

Table 6-1 provides periodic maintenance items and intervals for the ArcWorld II-500. Keep in mind that the maintenance intervals serve as guidelines only. You should adjust the frequency of maintenance to suit your specific work conditions.

For periodic maintenance procedures and schedules for the individual components of your ArcWorld II-500, refer to the manipulator and additional manuals that came with your system.

**CAUTION!**

*Use only the antifreeze provided by Motoman. Automotive antifreezes contain stop-leak additives that will clog the small torch water-cooling ports, and damage the gaskets in the water circulator pump.*

**Table 6-1 Periodic Maintenance**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Component</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daily</strong></td>
<td>Water circulator (For water-cooled torch application only.)</td>
<td>Check the fluid in the water circulator. Add fluid as required. Use only distilled water and approved antifreeze (Motoman P/N 131224-1).</td>
</tr>
<tr>
<td><strong>Daily</strong></td>
<td>Air filter/regulator for water (high-humidity environments)</td>
<td>Inspect left glass cylinder for water. If water is present, loosen the valve at the bottom of the cylinder to expel any moisture.</td>
</tr>
<tr>
<td><strong>Weekly</strong></td>
<td>Air filter/regulator oil level</td>
<td>Inspect right glass cylinder and transparent neck on the top of the regulator. If oil falls below half, add oil.</td>
</tr>
</tbody>
</table>
6.2 Fuse and Circuit Breaker Protection

Tables 6-2 through 6-4 give the locations of fuses and circuit breakers that are significant to the operation of the total system. In most cases, spare fuses are placed in the accessory bag with the controller.

**WARNING!**

*Replace fuses with those of same type and rating. Replacement with fuses of higher amperage rating or lower voltage will damage robot controller and/or auxiliary equipment, necessitating costly replacement.*

Abbreviations:

- CB — designates circuit breaker
- F, FU, or 101FU — designates fuse

**Table 6-2 MotoArc 450 CV Fuses and Circuit Breaker**

<table>
<thead>
<tr>
<th>Designator</th>
<th>Rating</th>
<th>Part #</th>
<th>Location</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB1</td>
<td>10A 115V</td>
<td>203627-7</td>
<td>Upper rear panel</td>
<td>Protects 115V circuit.</td>
</tr>
<tr>
<td>CB2</td>
<td>10A 24V</td>
<td>203627-7</td>
<td>Upper rear panel</td>
<td>Protects 24V circuit.</td>
</tr>
<tr>
<td>F1</td>
<td>0.5A</td>
<td>W-11166-11</td>
<td>On contactor box</td>
<td>Protects contactor circuit.</td>
</tr>
</tbody>
</table>

**Table 6-3 Universal Welding Interface (UWI) Fuses**

<table>
<thead>
<tr>
<th>Designator</th>
<th>Rating</th>
<th>Part #</th>
<th>Location</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>8A 250V</td>
<td>Wickman 19374K-4A</td>
<td>On KXA motor speed control</td>
<td>Limits damage from shorts or component breakdowns in DC power supply module.</td>
</tr>
<tr>
<td>FU2</td>
<td>0.25A 125V</td>
<td>Wickman 19303K-500A</td>
<td>On interface board</td>
<td>Protects shock sensor circuit.</td>
</tr>
<tr>
<td>FU3</td>
<td>0.5A 125V</td>
<td>Wickman 19303K-500A</td>
<td>On interface board</td>
<td>Protects 24V circuit.</td>
</tr>
<tr>
<td>Fuse</td>
<td>1A 250V</td>
<td>TD-1</td>
<td>Front of Com-Arc box</td>
<td>Protects 200V circuit.</td>
</tr>
</tbody>
</table>
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