Motoman XRC Controller
ArcWorld III-6000
System Manual
for UP-series Robot
Part Number 142709-1
Revised 7/15/01
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SECTION 1
INTRODUCTION

The ArcWorld III-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 III-6000 features a Motoman arc welding robot and XRC controller with menu-driven arc welding application software, complete welding package, 180-degree reciprocating positioner with servo driven headstock, operator interface, and 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
This section provides general information about the ArcWorld III-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 III-6000 system.

SECTION 3 - DESCRIPTION OF EQUIPMENT
This section provides a detailed description of the major components of the ArcWorld III-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 III-6000 system.

SECTION 5 - OPERATION
This section provides instructions for basic operation of the ArcWorld III-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 III-6000 cell.
1.2 **System Overview**

The ArcWorld III-6000 provides a complete arc welding solution in a standardized configuration. The system is designed around a Motoman arc welding robot and includes a complete welding package. A dual-station 180-degree reciprocating positioner with servo driven headstock allows the operator to prepare and set up parts on one side while the robot welds on the other side. The servo driven headstock allow parts to be prepared on both sides of the fixture. 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 III-6000 cell.

![Figure 1-1 System Layout](image)

1.2.1 **System Layout**

The robot manipulator and positioner share a common base for ease of installation and to help maintain proper alignment between the components. The XRC controller and welding power source also share a common base. Additional optional components, such as the water circulators and the Com-Arc III seam tracking units, can also be located on this common base.

The robotic cell is fully enclosed by safety fencing and an interlocking door. Safety mats prevent the positioner from cycling while anyone is standing directly in front of the positioner. All operator controls, including those on the XRC and welding power supply, are accessible from outside of the robotic enclosure.
1.2.2 **Major Components**

The ArcWorld III-6000 includes the following major components:

- Motoman UP6 or UP20 manipulator and XRC controller
- MRS2-250-XL reciprocating positioner with servo driven headstock.
- Master operator station
- Welding equipment, including the following:
  - MotoArc, Kobelco, or MotoArc welding power source
  - Motoman torch (water-cooled or air-cooled)
  - Wire feeders
  - Universal Welding Interface (UWI)
  - Torch mount
- Safety equipment, including the following:
  - Safety fencing with arc curtains
  - Interlocked safety mats
  - Interlocked cell door
  - Positioner arc screen

1.2.3 **Optional Equipment**

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

- Torch tender
- Wire cutter
- Com-Arc III seam tracking unit
- Water circulator

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)
- 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 III-6000)
- Software Version (3.74)
- 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: 313/994-6088  
FAX: 313/994-3338

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 MRC 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 2001 robotic controller represent state-of-the-art technology in robotics today. The six-axis UP6 robot has a payload of 6 kg (13.2 lbs). It features a 1,373 mm (54.05-inch) reach and has a relative positioning accuracy of ± 0.08 mm (0.004 in.). The six-axis UP20 robot has a payload of 20 kg (44.09 lbs). It features a 1658 mm (65.2-inch) reach and has a relative positioning accuracy of ± 0.1 mm (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, shown in Figure 3-1, coordinates the operation of the ArcWorld III-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 Box

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 Box**

**Servo On Ready**
The SERVO ON READY push button turns servo power ON. The switch lights when servo power is on. In TEACH mode, the SERVO ON READY push button 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)**
Pressing E-STOP ceases all system operation. The E-STOP button on the playback panel is connected in series with the system Emergency Stop circuit.

**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](image)

**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 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 can not 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).

![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.

![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). Provide adequate support for axis to be released. Support should be able to withstand the payload and the approximate weight of robot.

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**

Two green palm buttons, located on the sides of the operator station, initiate a positioner sweep cycle if the robot is in the Home position (Cube 23 or Cube 24).

**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.

If both CYCLE START buttons are pressed while the robot is outside home position, the CYCLE START (IN#9) command is latched into the XRC. Once the robot returns to home position, the CYCLE START command is executed and the positioner sweeps. An anti-tiedown timer, set to 10 seconds, prevents the operator from holding the palm buttons down and continuously cycling the positioner.
3.3.2 Emergency Stop (E-STOP)

Pressing an E-STOP button or interrupting a door interlock stops 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 operator station E-STOP, the robot E-STOP, and the sliding door interlocks are connected in series in the Emergency Stop circuit.

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 illuminates when the positioner CYCLE START command has been latched. It is not necessary to wait for the robots to finish welding and return to the home position (Cube 23 or 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 home position (Cube 23 or Cube 24). Stepping into the light curtain area will unlatch the CYCLE START command from the XRC.

3.3.5 Alarm

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

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 #10. When the selector switch is in the AUTOMATIC position, the robot will complete the weld cycle after the positioner sweeps. In MANUAL mode, the robot does not process the part after the positioner sweeps, but remains in the home 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 button is pressed. The operator station must be enabled and servo power ON for the MASTER JOB START button to work. The MASTER JOB START button is connected to the robot external start input.
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 the operator station. The REMOTE MODE button on the XRC playback panel lights when the operator station is enabled. Most pendant functions are disable 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. 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 some positioner motion. You must be careful when you reset the positioner with the robot 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 push button enables servo power. In TEACH mode, the SERVO ON push button operates only when the ENABLE switch on the programming pendant is held in.

3.4 **MRS2-250-XL Positioner**

The MRS2-250-XL positioner uses an AC motor to sweep the production parts from the operator side into the robot work area. Servo-driven headstocks allow the operator to prepare parts on both the top and bottom of the fixture. A steel arc screen separates the operator side from the robot work area.

A fixture frame is typically mounted between the headstock and tailstock faceplates to provide a highly flexible system. Fixtures are either mounted on, or integrated into, these frames for positioning and clamping of production parts. Pneumatic and electrical signals can be run to the fixtures if required. Depending on part size(s)/weights(s), you can mount single, multiple, or any combination to the fixture frame.

**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 welding power source ground cable is connected to the ground stud located on the right side of the positioner base as you face the rear of the ArcWorld III-6000 cell.

**NOTE:** The connection ground cable 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  MRS2-250-XL Positioner Specifications

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>250 kg (550 lbs) combined part/fixture weight per side</td>
</tr>
<tr>
<td></td>
<td>500 kg (1100 lbs) total</td>
</tr>
<tr>
<td>Maximum Weight Differential per Side (Offset Load)</td>
<td>90 kg (176.4 lbs)</td>
</tr>
<tr>
<td>Distance Between Headstock and Tailstock Face plates</td>
<td>2.6 m (approximately 102-inch)</td>
</tr>
<tr>
<td>Swing Diameter of Each Part Fixture</td>
<td>0.5 m (19.7-inch) maximum radial fixture clearance</td>
</tr>
<tr>
<td></td>
<td>(1.0 m (39.0-inch) diameter on center line)</td>
</tr>
<tr>
<td>Sweep Diameter of Positioner</td>
<td>2.05 m (80.7-inch)</td>
</tr>
<tr>
<td>Temperature Operating Range</td>
<td>4-43˚C (40-110˚F)</td>
</tr>
<tr>
<td>Shock (maximum)</td>
<td>Less than 0.5 G</td>
</tr>
<tr>
<td>Positioner Sweep Speed (Torque/Time)</td>
<td>4-5 sec</td>
</tr>
<tr>
<td>Pneumatic Headstock Speed</td>
<td>approximately 2 sec.</td>
</tr>
<tr>
<td>Serve Headstock Speed</td>
<td>1050 N•m (774.4 lb-ft) @ 0–16.8 rpm</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>800 amperes at 100% duty cycle</td>
</tr>
</tbody>
</table>

### 3.4.2 Arc Shield

**WARNING!**

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

The Motoman MRS2-250-XL positioner is equipped with a sheet metal screen for arc radiation protection between the operator loading zone and the welding zone. Do not operate this equipment unless the arc shield is in place.
3.5 **Welding Equipment**

In its standard configuration, the ArcWorld III-6000 system includes a power source, wire feeder, torch, and torch mount. Optional equipment, including water circulators, Com-Arc units, and torch tenders may be included for enhanced performance.

### 3.5.1 Power Sources

Motoman offers several different power sources for use with the ArcWorld III-6000 system depending on your system’s application. Figure 3-7 lists some of the more common power sources used. Your system may use a different power source. For more specific information, refer to the vendor manual that came with your system.

![Available Power Sources](image-url)
3.5.2 Wire Feeder

The 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.

3.5.3 Universal Welding Interface (UWI)

The UWI provides microprocessor control to the wire feeder and 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 system do not use the UWI. For more information specific to your system, refer to the vendor manuals shipped with your system.

3.5.4 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 suitable water circulator kit.

3.5.5 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.

3.6 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 eye wear!*

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 III-6000 system forms a physical barrier preventing entry into the robot and positioner operating envelope during automatic operation.

3.6.3 **Safety Mats**

The ArcWorld III-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 III-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 is activated and all positioner motion is stopped. The following is a list of their locations:

- The playback panel 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 initialize 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 is activated 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 these software-defined interference zones, an output is turned on in the XRC. These outputs can be used to interlock activity of other manipulators or peripheral devices. These cubes are internally tied to the following Specified Outputs:

R1 = SOUT #081 - 104

The ArcWorld III-6000 uses interference cubes to interlock robot position with positioner motion. The robot home or home position is defined behind the positioner, clear of the sweep zone. Before the positioner can sweep, the robot must be in this home position. 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 a 90-degree angle 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 home position.

Setup of these cubes is done at the factory prior to shipment. However, should any cube need redefined or modified due to changes in tooling or system components, refer to the manipulator manual for basic interference cube setup.

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). For more details on the brake release, refer to Section 5.
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. 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

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 III-6000 system requires a minimum area of 5.31 m (17.4 ft) by 4.08 m (13.4 ft). To ease installation, however, we recommend an additional 2.43 to 3.05 m (8 to 10 ft) on all sides.

2. Gather all customer-supplied items and required tools listed in Section 4.1.

4.3 Installing the Robot/Positioner Common Base

The robot/positioner common base and the operator station are shipped on a wooden shipping skid.

**CAUTION!**

Handle ArcWorld III-6000 components carefully to avoid damage.

To install the robot/positioner common base:

1. Unbolt robot/positioner common base from wooden shipping skid using 3/4-inch socket (see Figure 4-2).
Figure 4-2 Unbolting the Robot/Positioner Common Base

WARNING!
The robot/positioner common base weighs 5000 kg (2268 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, remove robot/positioner common base from shipping skid.
3. Place robot/positioner common base in position (see Figure 4-1).

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

4. Carefully remove protective plastic wrapping from robot and torch.
5. Inspect robot, torch, and positioner for shipping damage.

NOTE: If damage is found, notify the shipper immediately.

6. Remove operator station from skid and set safely aside.
4.3.1 Removing Shipping Brackets

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

Three yellow brackets (see Figure 4-3) prevent the robot from moving during shipping. Two angle 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.

![Figure 4-3 Location of Shipping Brackets](image)

4.4 Installing the Fencing

The fencing that makes up the welding cell’s protective walls is shipped on its own skid, all the hardware needed for the fencing, and specific assembly documentation (see Figure 4-4).

**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.
**CAUTION!**
Metal bands are under tension and, when cut, may cause injury. Be cautious when cutting the metal bands.

To install the weld cell fencing, proceed as follows:

1. Cut bands securing metal fencing and remove all items from skid.
2. Place fence components on floor around positioner (see Figure 4-5).
3. Connect two fence posts to left and right sides of rear wall, right section (see Figure 4-6, Step A).
4. Raise right panel and connect to rear wall, right section and right wall post (see Figure 4-6, Step B).
5. Raise tailstock panel and bolt to end post on the right wall (see Figure 4-6, Step C).
6. Connect a corner post to left side of left section rear wall and a gate post to right side of left section rear wall.

7. Raise left panel section and bolt to left wall (see Figure 4-7, Step D).
8. Raise left section rear wall and attach to left panel section (see Figure 4-7, Step E).
9. Attach positioner panel to positioner and left fence wall (see Figure 4-7, Step F).
10. Attach headstock panel to positioner and positioner fence panel (see Figure 4-7, Step G).
11. Steady left rear wall and install top door rail across door opening, using clamps provided (see Figure 4-7, Step H).
12. Raise cell door and slide into position on door rail.
13. Close door and install remaining door rail clamp (see Figure 4-8).

15. Adjust door hangers until door latches firmly and securely.
16. Ensure cell walls are square.
17. After fence is in final position, insert concrete drill bit through center of fence wall feet and drill holes in floor for lag bolts. Drill holes at locations shown in Figure 4-9. Drill two holes for each wall foot.

18. Vacuum concrete dust from holes.
19. Lag cell walls to floor (see Figure 4-9).
20. Using cell door guides as a template, mark location of mounting holes.
21. Remove bottom cell door guides.
22. Insert concrete drill bit through center of pads and drill holes for lag bolts.
23. Vacuum concrete dust from holes.
24. Position bottom cell door guide.
25. Lag cell door guides to floor to ensure smooth door operation.

![Figure 4-9 Location of Places to Lag Fence Walls to Floor](image)

### 4.5 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:

1. Unfold arc curtains and install one curtain on inside of each cell wall, using supplied wire ties and eyelets in material (see Figure 4-10).
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.

4.6 Installing the Auxiliary Equipment Common Base

The auxiliary equipment common base contains the XRC controller and the welding power source. It may also include an optional water circulator and/or Com-Arc III unit. The 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:

1. Unbolt auxiliary equipment common base from shipping skid by removing four shipping bolts using 3/4-inch deep well socket (see Figure 4-11).
**WARNING!**
The auxiliary equipment common base weighs 680 kg (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 shipping skid.
3. Place auxiliary equipment common base approximately 0.6 m (2 ft) to the left of the ArcWorld III-6000 cell (see Figure 4-12).
4. Carefully remove protective plastic wrapping and cardboard from auxiliary equipment common base.
5. Remove accessories boxes from welding power source and set safely aside.
6. Inspect auxiliary equipment common base components for shipping damage.

**NOTE:** If damage is found, notify the shipper immediately.

---

**4.7 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 damage is found, notify the shipper immediately.

4. Place operator station outside fence to front of positioner (see Figure 4-12).
5. Insert a 1/4-inch concrete drill bit through center of lag holes in operator station and drill holes for lag bolts.
6. Vacuum concrete dust from holes.
7. Lag operator station to floor.
4.8 Installing the Safety Mats

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 4-13). 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 4-13 Handling a Safety Mat](image)

**NOTE:** The perimeter trim is placed along the outside of the safety mats. The activation strips are the wider pieces of trim that are used to cover the seam where two safety mats join.

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 4-14).
**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.

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-inch drill bit.

3. Holding perimeter trim securely in place, drill 2.54 cm (1 in.) deep through pre-drilled holes into floor.
4. Remove perimeter trim.
5. Remove any debris that may be underneath mat.
4.9 Leveling and Securing the Equipment

After everything is 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/positioner common base by adjusting leveling bolts (see Figure 4-17).
2. Insert a 1/2-inch concrete drill bit through center of leveling bolts and drill holes for lag bolts.
3. Vacuum concrete dust from holes.
4. Lag robot/positioner common base to floor.
5. Level auxiliary equipment common base by adjusting leveling bolts (see Figure 4-18).

6. Insert a 1/2-inch concrete drill bit through center of leveling bolts and drill holes for lag bolts.
7. Vacuum concrete dust from holes.
8. Lag auxiliary equipment common base to floor.
4.10 Connecting the Cables

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

4.10.1 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 50 feet 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 15 feet of each other, a common earth ground may be used. Otherwise, separate earth grounds must be used.

To ground the robot and the XRC:

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

4.10.2 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:

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 4-12).
Figure 4-19 Connecting Robot to XRC Controller

4.10.3 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 the Door Switch cable and connect to side of interface box.
2. Unpack safety mat cable and connect between the safety mat junction box and the 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.
**4.10.4 Connecting Water Circulator (Optional)**

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 4-20).

![Water Circulator Connections](image)

2. Plug power cable into electrical outlet on back of power source.

**4.11 Connecting the Power**

After all of the system components have been properly installed, connect the power to the ArcWorld III-6000.

![Power Source](image)

**DANGER!**

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

To connect incoming power to the ArcWorld III-6000:

1. Install 3-phase power wiring to circuit breaker located inside right wall of XRC cabinet. Table 4-1 shows size and type of wire needed.
2. Tighten screws to the torque indicated in Table 4-1.
3. Install an M5 lug on incoming ground wire.
4. Terminate ground wire to frame ground with M5 hardware provided.

**NOTE:** The ArcWorld III-6000 is configured for 3-phase 460/480V AC, unless other voltage was requested. If other voltage is required for your plant, you must make necessary modifications to transformer. For more information, refer to manipulator manual that came with your system.

**Table 4-1 Incoming Power Specifications (Decal)**

<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</td>
</tr>
<tr>
<td></td>
<td>#12-8 Aluminum</td>
</tr>
<tr>
<td>Torque</td>
<td>#14-7, 4.0 N•m (35 lb-in.)</td>
</tr>
</tbody>
</table>
4.12 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 robot (see Section 4.3.1).
2. Check that the cell door is closed and latched.
3. Check that all cable connections are tight.
4. Be sure welding power source is set correctly (see welding power source vendor's manual).
5. Verify incoming line power matches input power specified on sticker on front of XRC.

Your ArcWorld III-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.

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

4.13 Installation of Tooling and Fixtures

WARNING!

When loading fixturing and/or tooling weighing over 90.7 kg (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!

Your ArcWorld III-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.
SECTION 5
OPERATION

The ArcWorld III-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 reciprocating positioner, while the operator loads or unloads parts on the opposite side. Once the robot finishes the welding process, it returns to the Safe position. The operator then sweeps the positioner 180-degrees to the opposite side, which moves the next set of parts into the welding zone and enables the robot to start welding.

The MRS2-250-XL positioner uses a 180-degree reciprocating motion that sweeps the table from the operator’s loading zone, into the robot work zone, and back. The positioner screen visually divides the positioner into 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 and ready to be loaded or unloaded, and vice versa. Additionally, the headstock/tailstock on both Sides A and B rotate, providing 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 III-6000 system is its high degree of flexibility. The operator can fine tune the movement of the robot and positioner according to the parts configuration. The MRS2-250-XL 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 turning.
5.1.1 I/O Assignment

The ArcWorld III-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

Table 5-1 XRC User Inputs

<table>
<thead>
<tr>
<th>Input</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN#001</td>
<td>CYCLE START</td>
</tr>
<tr>
<td>IN#002</td>
<td>AUTO/MANUAL</td>
</tr>
<tr>
<td>IN#003</td>
<td>ROTATE CW</td>
</tr>
<tr>
<td>IN#004</td>
<td>ROTATE CCW</td>
</tr>
<tr>
<td>IN#005-IN#008</td>
<td>NOT USED</td>
</tr>
<tr>
<td>IN#009</td>
<td>AT SIDE A</td>
</tr>
<tr>
<td>IN#010</td>
<td>AT SIDE B</td>
</tr>
<tr>
<td>IN#011</td>
<td>ZERO SPEED</td>
</tr>
<tr>
<td>IN#012</td>
<td>DRIVE FAULT</td>
</tr>
<tr>
<td>IN#013</td>
<td>HS A IS CW</td>
</tr>
<tr>
<td>IN#014</td>
<td>HS A IS CCW</td>
</tr>
<tr>
<td>IN#013</td>
<td>HS B IS CW</td>
</tr>
<tr>
<td>IN#014</td>
<td>HS B IS CCW</td>
</tr>
<tr>
<td>IN#015-IN#020</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>
5.1.2 Sweeping the Positioner

To sweep Side A or B of the Motoman positioner into the robot work area, proceed as follows:

1. Place robot in Safe position (see Section 5.2.2).
2. Place operator station in MANUAL mode and start Master job (see Section 5.2.3).
3. XRC will now sweep positioner each time CYCLE START palm buttons on operator station are pressed.

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 table. For more information on basic cube setup, refer to the manipulator manual that came with your system.

Table 5-2 XRC User Outputs

<table>
<thead>
<tr>
<th>Output</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT#001</td>
<td>CYCLE LATCHED</td>
</tr>
<tr>
<td>OUT#002-#003</td>
<td>NOT USED</td>
</tr>
<tr>
<td>OUT#004</td>
<td>WIRE CUTTER</td>
</tr>
<tr>
<td>OUT#009</td>
<td>FORWARD RUN</td>
</tr>
<tr>
<td>OUT#010</td>
<td>REVERSE RUN</td>
</tr>
<tr>
<td>OUT#011</td>
<td>FAULT RESET</td>
</tr>
<tr>
<td>OUT#012</td>
<td>SPEED 1</td>
</tr>
<tr>
<td>OUT#013</td>
<td>ROT HS A CW</td>
</tr>
<tr>
<td>OUT#014</td>
<td>ROT HS A CCW</td>
</tr>
<tr>
<td>OUT#015</td>
<td>ROT HS B CW</td>
</tr>
<tr>
<td>OUT#016</td>
<td>ROT HS B CCW</td>
</tr>
<tr>
<td>OUT#017-#020</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>
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 III-6000 cell from a Power-Off condition, proceed as follows:

1. Turn on welding power source disconnect.
2. Set MAIN POWER switch on XRC 2001 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 2001 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 the Master job:

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 XRC playback panel. Job 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 III-6000 cell is now ready for operation.

5.2.4 Operation Cycle

To start up the ArcWorld III-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. Pilot light on power source turns on.
4. Open regulator valve on welding gas supply.
5. Make sure enclosure door is closed.
6. Disable operator station.
7. Press TEACH mode button on XRC playback panel.

Place robot in Safe position (Cube 24).

5.2.5 Shutdown

Use the following procedure to shut down the ArcWorld III-6000 cell after operation is complete:

1. Make sure the robot is in the Safe position (Cube 24).
2. Turn off the system servo power by pressing E-STOP button on the operator 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 III-6000 cell is now shut down.
5.3  **System Recovery**

Under certain conditions you will be required to clear an alarm or error. 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 the E-STOP button on the operator station, programming pendant, or playback panel.
- Opening sliding door on robot enclosure when robot is in PLAY mode.
- Stepping on safety mat when positioner is sweeping.
- Actuating shock sensor on torch mount.

To restart the ArcWorld III-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 the E-STOP button on the 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).
CAUTION!
If an emergency stop condition occurs while the positioner is sweeping, the positioner will continue the sweep when system is reinitialized.

2. Press SERVO ON button on operator station, programming pendant, or playback box.
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 operator station.

The ArcWorld III-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 III-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 buttons. 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 robot. Listed below is the weight of each robot available:
   - UP6 – 135 kg (297 lb)
   - UP20 – 260 kg (573 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

Table 6-1 provides periodic maintenance items and intervals for the ArcWorld III-6000 cell. 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 III-6000, 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.

- 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>Daily</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>Monthly</td>
<td>MRS2-250-XL Headstock Drive Unit</td>
<td>Check for proper oil levels and quality. Use MobilGear 630 or 629 oil as required.</td>
</tr>
<tr>
<td>Monthly</td>
<td>MRS2-250-XL Weld Ground</td>
<td>Check the brushes for proper lubrication and signs of wear. Excessive heat buildup in the brushes indicates uneven wear or the lack of grease. Keep the contact area lubricated with Burundi Penetrox E conductive copper lubricant (part no. PEN-E-8).</td>
</tr>
<tr>
<td>20,000H</td>
<td>MRS2-250-XL Headstock Drive</td>
<td>Change the oil in the drive unit. Use MobilGear 630 or 629 oil.</td>
</tr>
<tr>
<td>Monthly</td>
<td>MRS2-250-XL Headstock Drive Unit</td>
<td>Check for proper oil levels and quality. Use MobilGear 630 or 629 oil as required.</td>
</tr>
<tr>
<td>Monthly</td>
<td>MRS2-250-XL Weld Ground</td>
<td>Check the brushes for proper lubrication and signs of wear. Excessive heat buildup in the brushes indicates uneven wear or the lack of grease. Keep the contact area lubricated with Burundi Penetrox E conductive copper lubricant (part no. PEN-E-8).</td>
</tr>
</tbody>
</table>

H=Hours of Operation
# 6.2 Spare Parts List

## Table 6-2  Spare Parts List

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArcWorld 6000 safety mat kit</td>
<td>130157-5</td>
</tr>
<tr>
<td>Safety mat controller box</td>
<td>131038-1</td>
</tr>
<tr>
<td>Positioner interface 4-pole relay, 24V DC</td>
<td>470108-5</td>
</tr>
<tr>
<td>Positioner interface fuse, 2A 250V</td>
<td>400647-3</td>
</tr>
<tr>
<td>Positioner interface fuse, 1/2A 250V</td>
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<tr>
<td>Positioner valve, 4-way, double solenoid</td>
<td>132108-1</td>
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