

Motoman XRC 2001 Controller

**ArcWorld 1000
System Manual
for UP-Series Robot**

Part Number:	145844-1
Release Date:	March 22, 2007
Document Status:	Final

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SECTION 1

INTRODUCTION

The ArcWorld 1000 (Heavy Duty) 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 1000 features a Motoman arc welding robot and XRC 2001 controller with menu-driven arc welding application software, complete welding package, reciprocating rotary positioner, operator interface, and a total safety environment.

Because we are constantly improving our products, some sections of this manual may be incomplete. If you have any questions or would like to order an updated manual, please contact the Motoman service staff at (937) 847-3200.

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 1000 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 1000 system.

SECTION 3 - DESCRIPTION OF EQUIPMENT

This section provides a detailed description of the major components of the ArcWorld 1000 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 1000 system.

SECTION 5 - OPERATION

This section provides instructions for basic operation of the ArcWorld 1000 system. This also section provides procedures for start-up, loading, normal operation, fault recovery, and shutdown. A number of sample robot programs are also included in this section.

SECTION 6 - MAINTENANCE

This section contains a table listing periodic maintenance requirements for the components of the ArcWorld 1000 cell.

1.2 System Overview

The ArcWorld 1000 provides a complete arc welding solution in a standardized configuration. The system is designed around a Motoman arc welding robot and XRC 2001 robot controller, and includes a complete welding package. A reciprocating rotary positioner 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 1000 cell.

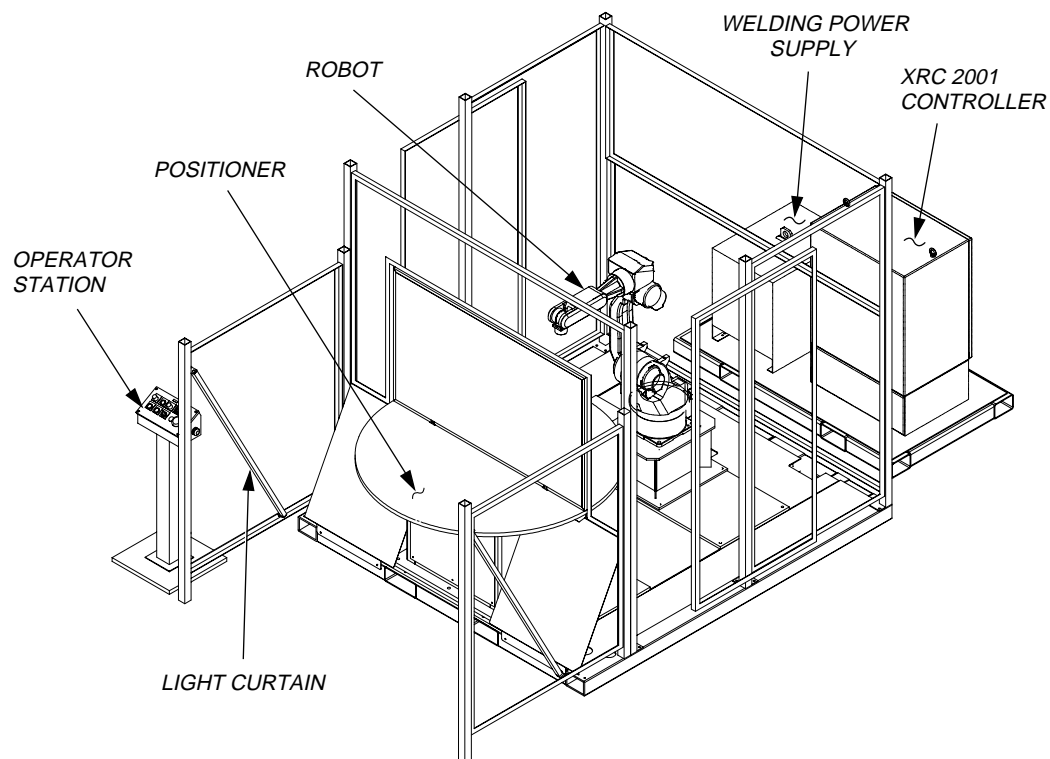


Figure 1-1 System Layout

NOTE: *This manual is for a standard Motoman system. If your system is a custom or modified system, please use the drawing and Bill of Material (BOM) provided with the system for troubleshooting and spares provisioning.*

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 two components. The XRC 2001 controller and welding power source also share a common base. The robotic cell is fully enclosed by safety fencing and an interlocking door. Light curtains provide a safety zone to prevent the positioner from cycling while anyone is standing within the zone. All operator controls, including those on the XRC 2001 controller and welding power supply, are accessible from outside the robotic enclosure.

1.2.2 Major Components

The ArcWorld 1000 includes the following major components:

- A Motoman UP6 or UP20 manipulator and XRC 2001 controller
- MR-300 series reciprocating rotary positioner
- Operator station
- Welding equipment, including the following:
 - Welding power source
 - Motoman torch (water-cooled or air-cooled)
 - Wire feeder
 - Universal Welding Interface (UWI)
 - Torch mount
- Safety equipment, including the following:
 - Safety fencing with arc curtains
 - Interlocked safety light curtain
 - Interlocked cell door
 - Positioner arc screen

1.2.3 Optional Equipment

The following equipment is available for use with the ArcWorld 1000:

- Torch cleaner
- Wire cutter
- Com-Arc III seam tracking unit
- Water circulator
- Touch Sense-Starting Point Detection unit

1.3 Reference to Other Documentation

For additional information refer to the following:

- Motoman UP6 Manipulator Manual (P/N 145886-1)
- Motoman UP20 Manipulator Manual (P/N 145887-1)
- 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 144075-1)
- Vendor manuals for system components not manufactured by Motoman
- Touch Sense Instruction Manual (142970-1)

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 1000)
- Software Version (3.74A)
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on front door of XRC 2001 controller)

NOTES

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 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-inch). 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-inch).

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 2001 Controller

The XRC 2001 robotic controller (see Figure 3-1) coordinates the operation of the ArcWorld 1000 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.

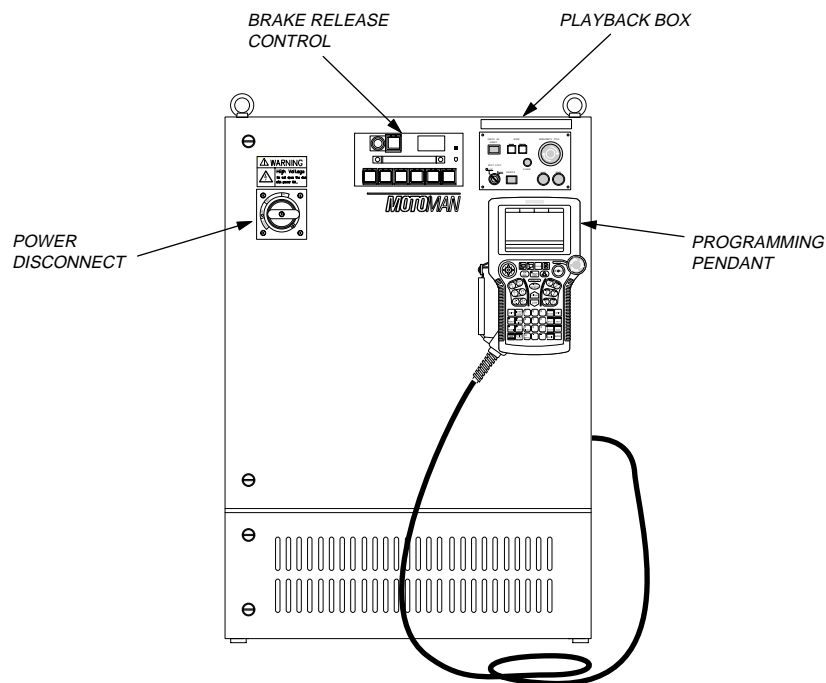


Figure 3-1 XRC 2001 Controller

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.

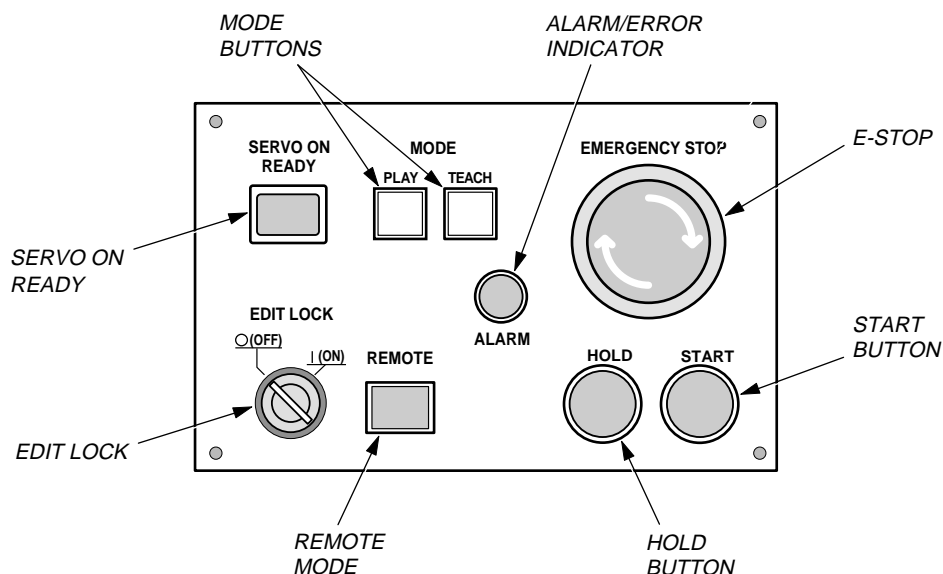


Figure 3-2 XRC 2001 Playback Panel

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.

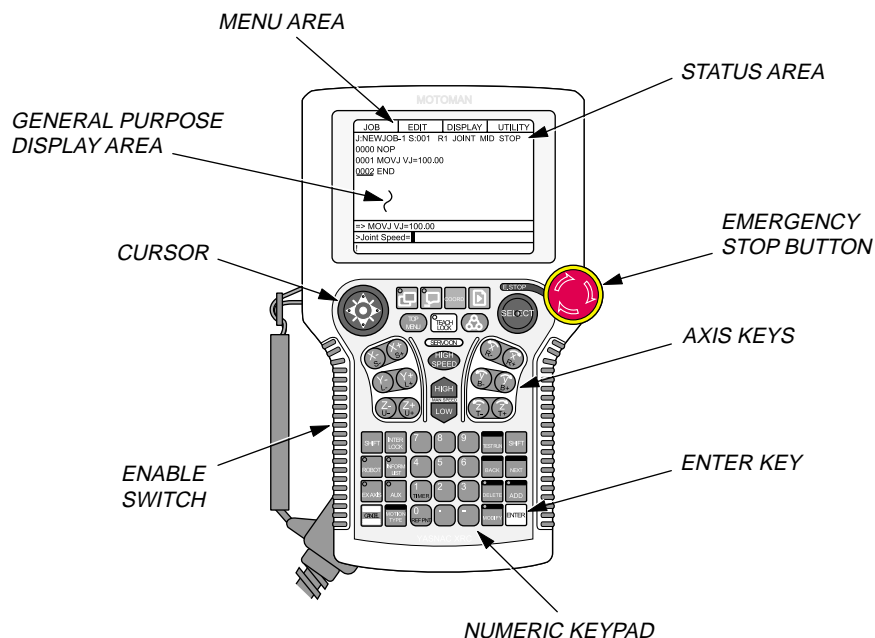


Figure 3-3 Programming Pendant

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 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 2001 and a floppy disk controller (FC1 or FC2), FDE (Floppy Disk Emulator) software, or other form of communication (see Figure 3-4).

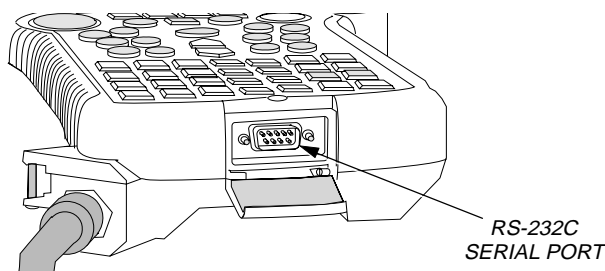


Figure 3-4 RS-232C Serial Port

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.

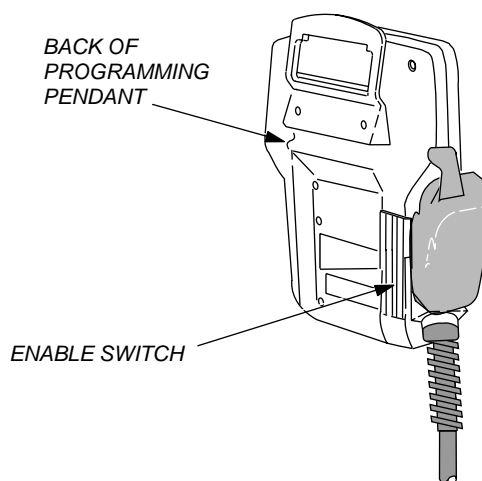


Figure 3-5 Enable Switch

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 2001 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.

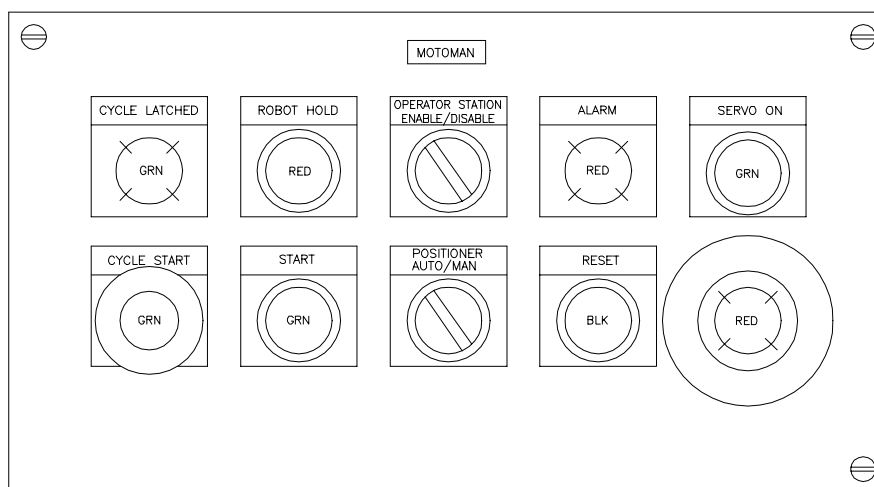


Figure 3-6 Operator Station

3.3.1 Cycle Start



WARNING!

The operation of the CYCLE START button 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 button, located on the operator station, initiates a positioner sweep cycle if the robot is in the Safe or Home position (Cube 24). If the CYCLE START button is 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. A pulse instruction prevents the operator from holding the CYCLE START button 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. The operator station E-STOP, the robot E-STOP, and the sliding door interlocks are connected to a safety PLC and 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 button to sweep the positioner. Pressing the Cycle Start button 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). If a person enters the safety zone created by the light curtains, the CYCLE START command will be unlatched from the XRC 2001 controller.

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 MASTER JOB START button is connected to the robot external start input. The robot will start the current active job when MASTER JOB START is pressed. 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 2001 controller 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

The RESET button is connected to the robot alarm reset input. A minor alarm or error condition is cleared when this button is pressed. 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 pushbutton turns servo power ON. In TEACH mode, the SERVO ON pushbutton operates only when the ENABLE switch on the programming pendant is held in.

3.4 MR-300 Positioner

The MR-300 positioner uses a reciprocating motion that sweeps each side of the circular turntable from the operator's loading zone, into the robot's work zone, and back to the operator again. A metal arc screen divides the positioner into two semicircular work areas labeled Side A and Side B. When Side A is in the robot's welding zone, Side B is facing the operator and ready to be loaded or unloaded with parts, and vice versa. Loading fixtures are supplied by the customer. For positioner specifications, refer to Table 3-1. Refer to Section 6.2 for maintenance procedures.

NOTE: In high humidity areas, use surface protection to prevent corrosion of the tooling plates.

Table 3-1 MR-300 Positioner Specifications

Conditions	Specifications
Table Diameter	152.4 cm (60 in.)
Maximum Tooling Weight with Part	598 kg (1320 lbs) total weight, or 299 kg (660 lbs) per side. Load must be balanced within 20%.
Maximum Tooling Size	914 x 432 x 889 mm (36 x 17 x 35-inch)
Sweep Time with Capacity	4.0 seconds for 180 degree sweep with maximum total load of 598 kg (1,320 lbs)
Temperature Operating Range	4–43°C (40–110°F)
Humidity (maximum)	Non-condensing 10–90% relative humidity
Shock (maximum)	Less than 0.5 G
Electrical Requirements	208V AC/120 Hz/Two-Phase supplied by the XRC 2001 controller
Welding Current Rating	500 amperes at 100% duty cycle

3.4.1 Arc Shield



WARNING!

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

The Motoman ArcWorld 1000 (MR-300) positioner has a steel sheet metal screen that runs the diameter 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 welding power source, wire feeder, torch, and torch mount. Optional equipment, including water circulators, Com-Arc units, and torch tenders, may also be included with your system.

3.5.1 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. 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 for the MotoArc series power source. It scales the signals from the XRC 2001 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 1000 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 and 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 1000 system depending on the application. The following are some of the more common power sources used. However, the power source your system uses may be different. For more specific information, refer to the vendor manual that came with your system.

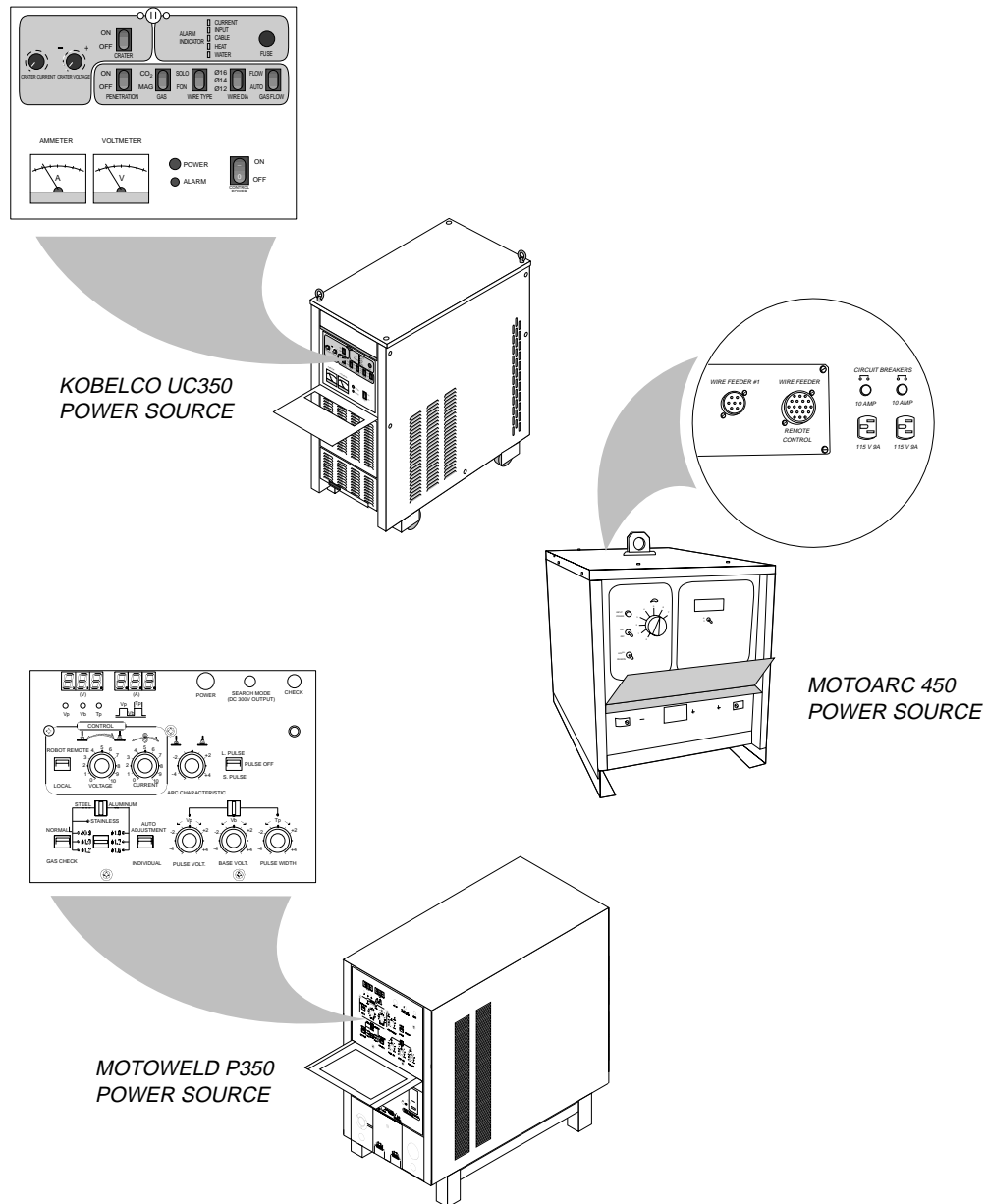


Figure 3-7 Available Power Sources

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.

3.5.6 **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 includes a total safety environment. 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.

NOTE: 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 **Safety PLC – Programmable Logic Controller**

The ArcWorld 1000 system comes with a safety PLC (see Figure 3-8). The PLC monitors a large portion of the cell's safety components. These cell components are first interfaced into the PLC and then into the XRC 2001 Controller. The safety PLC is responsible for monitoring gate interlock 1, gate interlock 2, safety light curtains, operator station E-stop, and the In-position signals generated from the table. (Refer to system prints for additional signals that may be interfaced to the PLC.) The PLC monitors the status of the safety devices and is dependant on the status of the inputs. The PLC determines if an E-stop condition should occur. Refer to the safety PLC manual provided with the system for more details on the operation of the PLC and its associated fault codes.

- Due to the boot-time of the safety PLC, a Safety Gate Fault condition will occur each time power is applied to the system. Once the safety PLC is fully booted, the Safety Gate Fault condition will clear if all other conditions are met.
- Modifications to the PLC program without prior approval could cause personnel injury or invalidate the system warranty.
- All safety-related function blocks used in the ladder program, resident in the safety PLC, have been created and tested by the PLC manufacturer.
- The safety PLC will auto-reset itself in the event of a predictable error (for example: breaking light beams while sweeping, opening safety gate while in PLAY). In some instances, a nonauto-resetting error may occur. In this case, either cycle power to the whole system or simply toggle the switch on the front of the safety PLC from RUN to STOP back to RUN. If the fault occurs again after resetting, consult the safety PLC manual and the system prints.

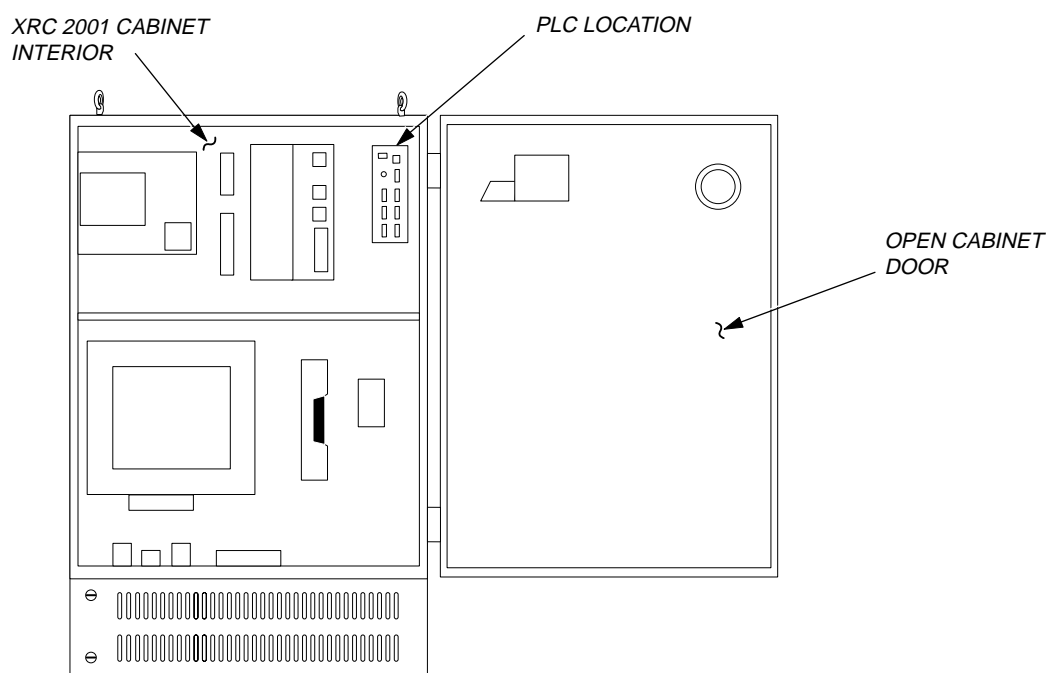


Figure 3-8 Safety PLC Location

3.6.2 Arc Screens



WARNING!

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

Two 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.

3.6.3 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.

3.6.4 Safety Light Curtains

The safety light curtains 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 light curtain is activated, servo power is removed from the system and all positioner motion stops. Servo power can be reapplied by pressing SERVO ON. However, the positioner will only continue its motion after it is reset by pressing the reset button on the operator station.

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

3.6.5 Emergency Stops (E-STOPS)

In addition to the safety features described above, the ArcWorld 1000 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

3.6.6 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 2001 controller section in the manipulator manual that came with your system.

3.6.7 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 a Gate Interlock Error. Brakes are applied to the robot and all servo power is removed from the system, the E-Stop lights come on, and all positioner motion is stopped.

3.6.8 Interference Cubes

Cubic interference zones prevent interference between multiple manipulators or a manipulator and peripheral devices. The XRC 2001 controller 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 2001 controller has eight possible cubes available. These cubes are internally tied to the following **Specified Outputs**:

R1 = SOUT #081 - 104

The ArcWorld 1000 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.

3.6.9 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 2001 controller cabinet (see Figure 3-1). Refer to the Operation section of this manual 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: 0.04cm at 620.5 kPa (1.5scfm at 90 psi)
- Stepladder
- Forklift and/or overhead crane

4.1.2 List of Tools

- | | |
|---|---------------------------------------|
| • Safety glasses | • Hammer |
| • Face shields | • Socket set |
| • Gloves | • Forklift and/or overhead crane |
| • Level | • Air-impact gun with 3/4-inch socket |
| • Ratchet with 3/4-inch socket | • Open-end wrench set |
| • Adjustable wrench set | • Two socket-head (Allen) |
| • Hammer drill with appropriate concrete bits | • Wrench sets (standard and metric) |
| • Phillips and flat screwdrivers | |

4.2 Site Preparation

To prepare your site, proceed as follows:

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

NOTE: To make installation easier, allow an additional 1.2 m to 1.5 m (4 to 5 ft) on all sides of cell.

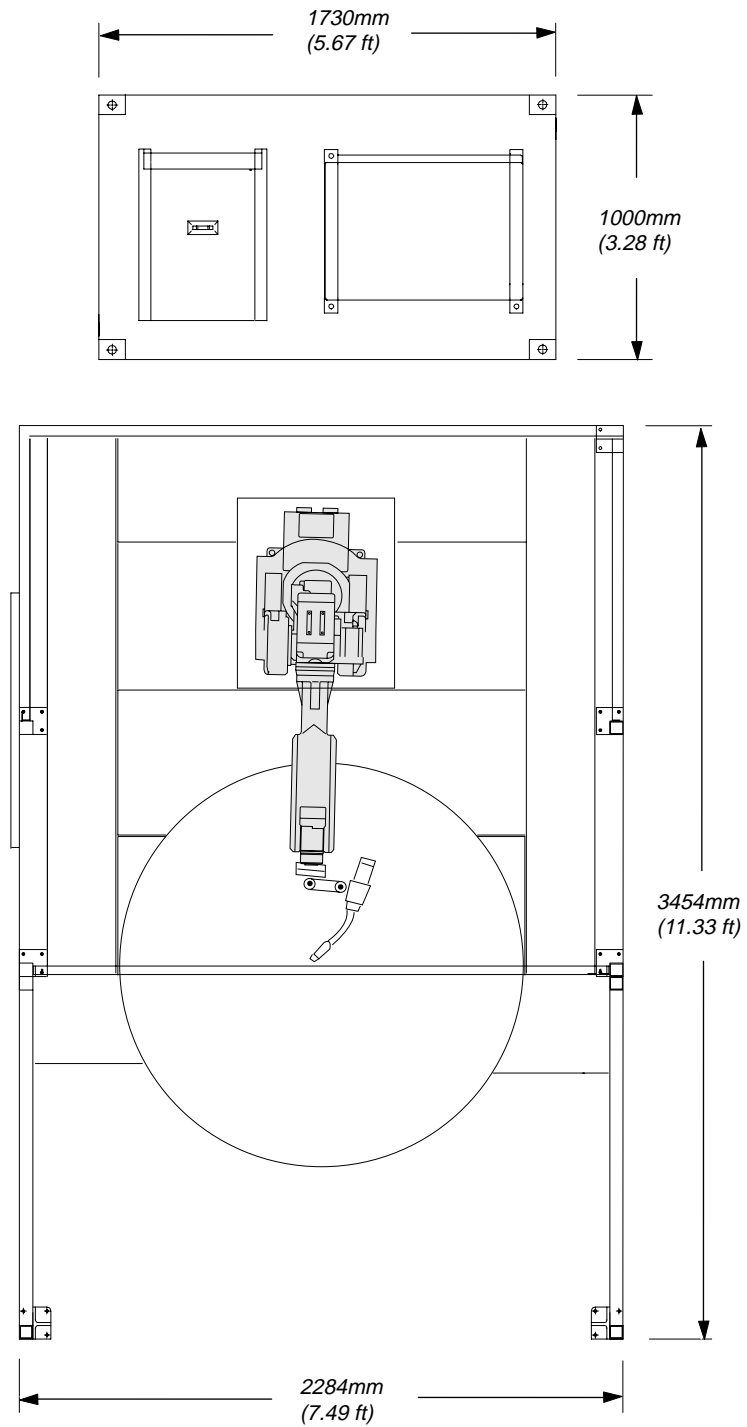


Figure 4-1 Area Needed for Installation

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. To install the robot/positioner common base, proceed as follows:



CAUTION!

Handle ArcWorld 1000 components carefully to avoid damage.

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

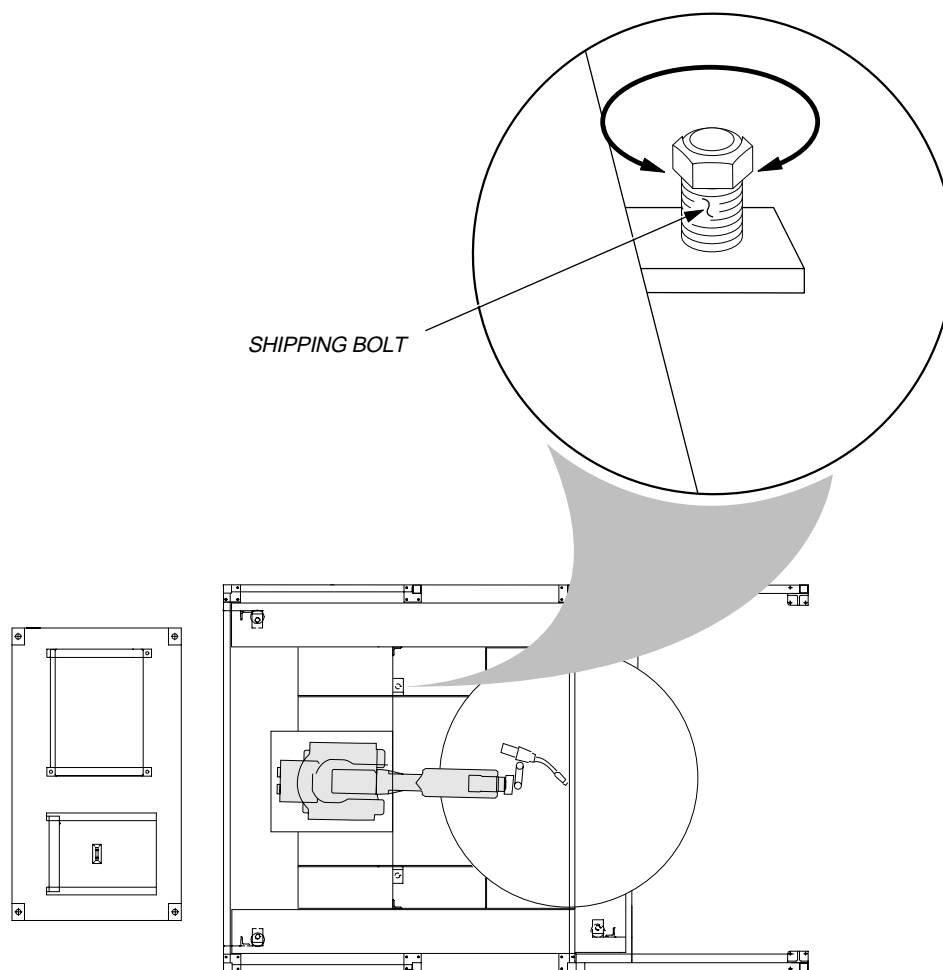


Figure 4-2 Unbolting the Positioner, Spanner, and Riser Assembly



WARNING!

The robot/positioner common base weighs 2200 kg (4409.2 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 the common base from the wooden shipping skid.
3. Place the 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 fencing, the operator station, the 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 shipper immediately.

6. Remove the operator station from the skid and set it safely aside.

4.3.1 Removing the Shipping Brackets



CAUTION!

Failure to remove shipping brackets from robot before operating the ArcWorld 1000 may result in damage to the robot drive mechanisms.

Three yellow brackets (see Figure 4-3) 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.

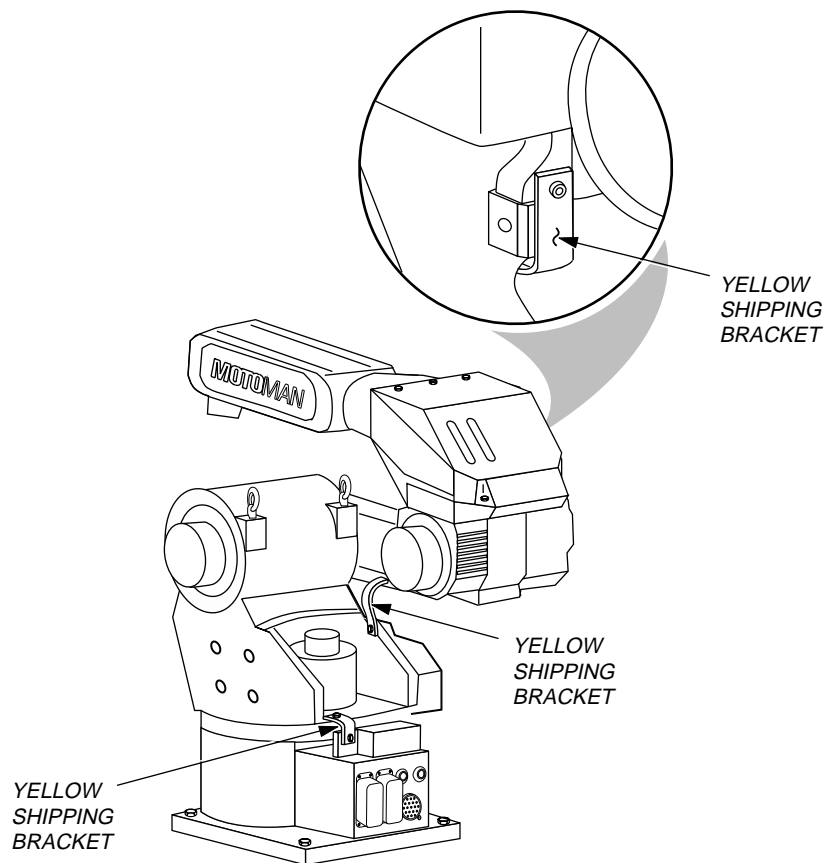


Figure 4-3 Location of Shipping Brackets

4.3.2 Installing the Wire Guide

The wire guide is shipped in an accessories box. To install the wire guide, proceed as follows:

1. Remove wire guide from accessories box.
2. Install connector end of wire guide into feeder housing (see Figure 4-4) by turning connector clockwise until hand-tight.
3. Insert other end of wire guide into side mount; tighten thumbscrew.

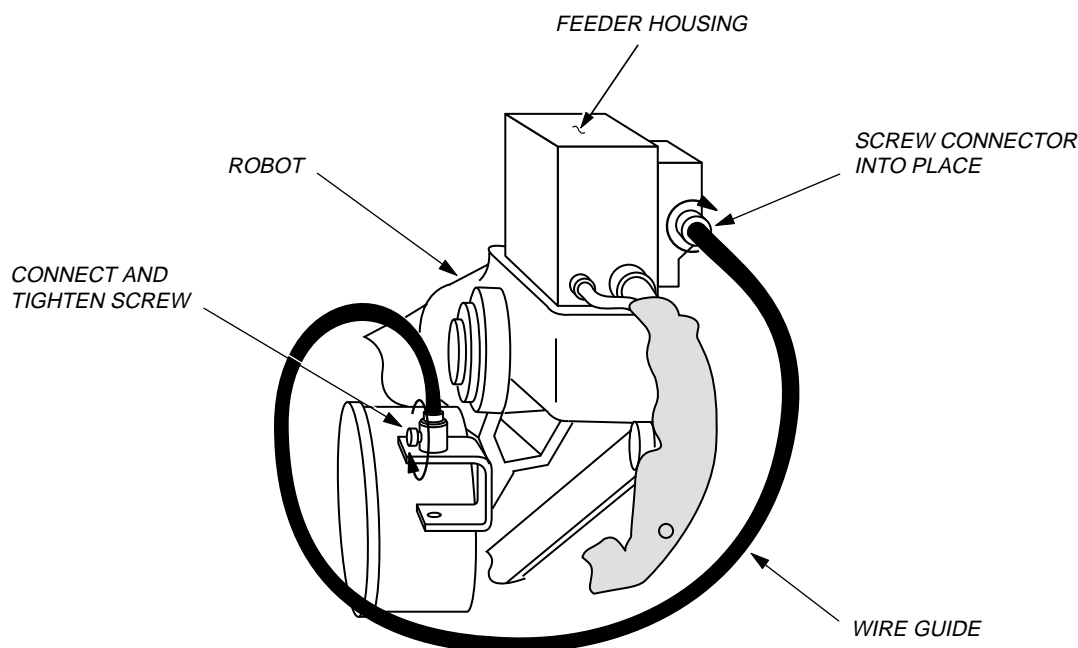


Figure 4-4 Installing the Wire Guide

4.4 Installing the Auxiliary Equipment Common Base

The auxiliary equipment common (AEC) base contains the XRC 2001 controller and the welding power source. It may also include the optional water circulator and/or Com-Arc III unit. The AEC 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 AEC base, proceed as follows:

1. Unbolt AEC base from wooden shipping skid by removing four shipping bolts using 3/4-inch socket (see Figure 4-5).



WARNING!

The AEC base can weigh as much as 600 kg (1320 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 the base and remove it from the wooden shipping skid.
3. Place AEC base approximately 0.6 m (2 ft) behind ArcWorld 1000 cell (see Figure 4-6).
4. Carefully remove plastic wrapping and cardboard from AEC base.
5. Remove any accessories boxes from welding power source and set them safely aside.
6. Inspect AEC base for any shipping damage.

NOTE: If damage is found, notify shipper immediately.

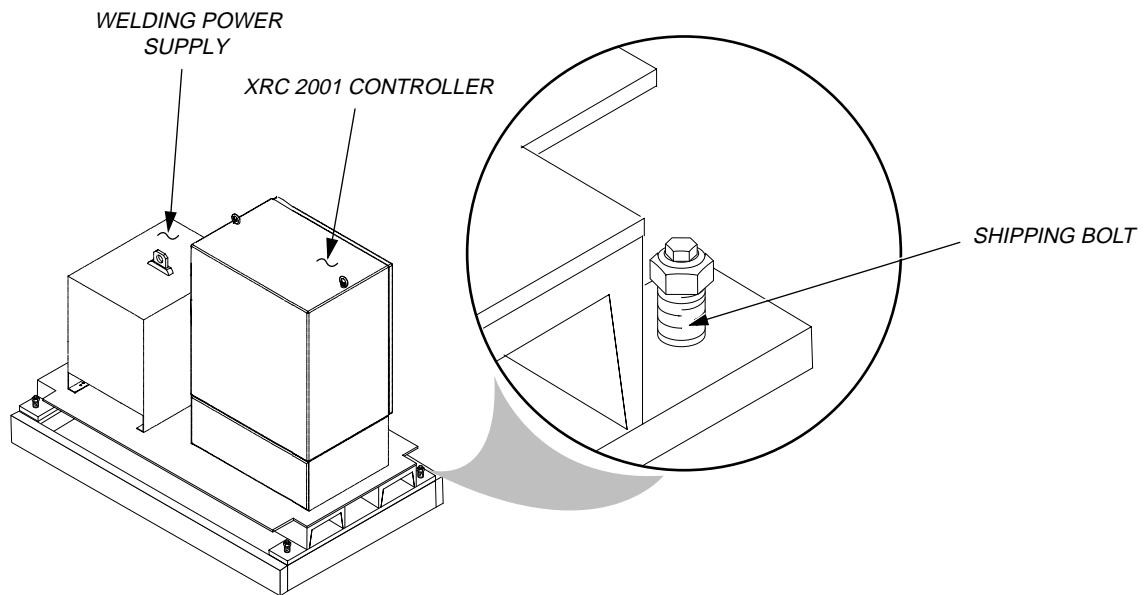


Figure 4-5 Unbolting Auxiliary Equipment Common (AEC) Base

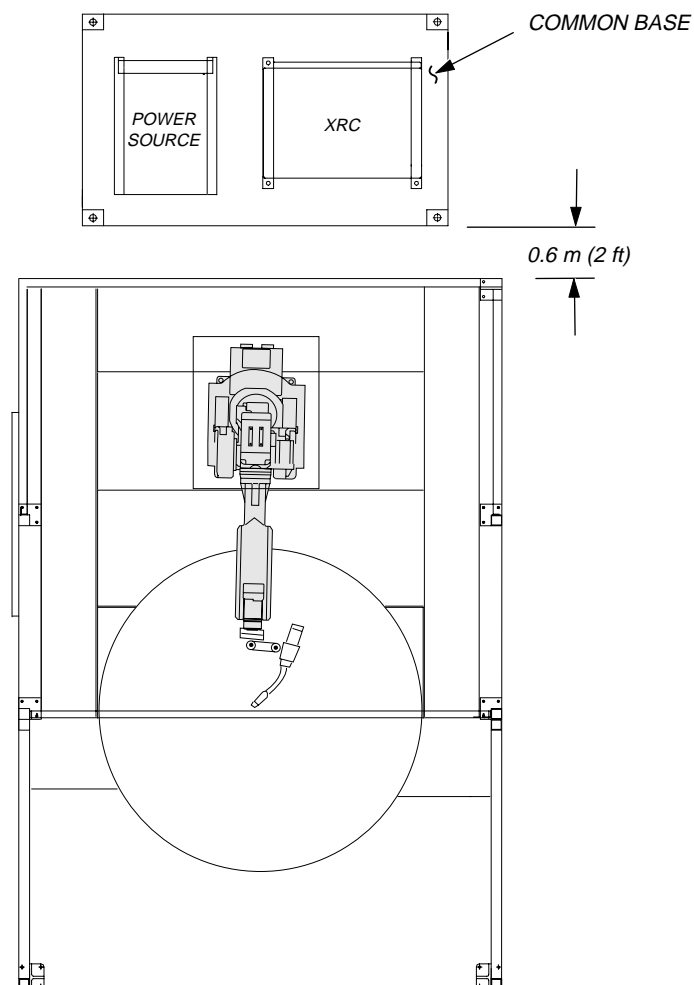


Figure 4-6 AEC Location

4.5 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 shipper immediately.

4. Place operator station outside ArcWorld fence to front of positioner.
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.

4.6 Installing the Safety Light Curtains

4.6.1 Installation

The three light curtain components, the emitter, collector, and safety fence comes preassembled and fastened inside the cell for shipping purposes.

Unfasten both light curtain components from the fencing and install onto the base. The light curtains are oriented properly with the status lights located near the base of the positioner. Use the three bolt holes (see Figure 4-7) located on the fence posts to mount the light curtain assembly onto the fencing. The wiring connections are provided and are tucked underneath the positioner base. Pull those wires out and match them with the connectors from the light curtains.

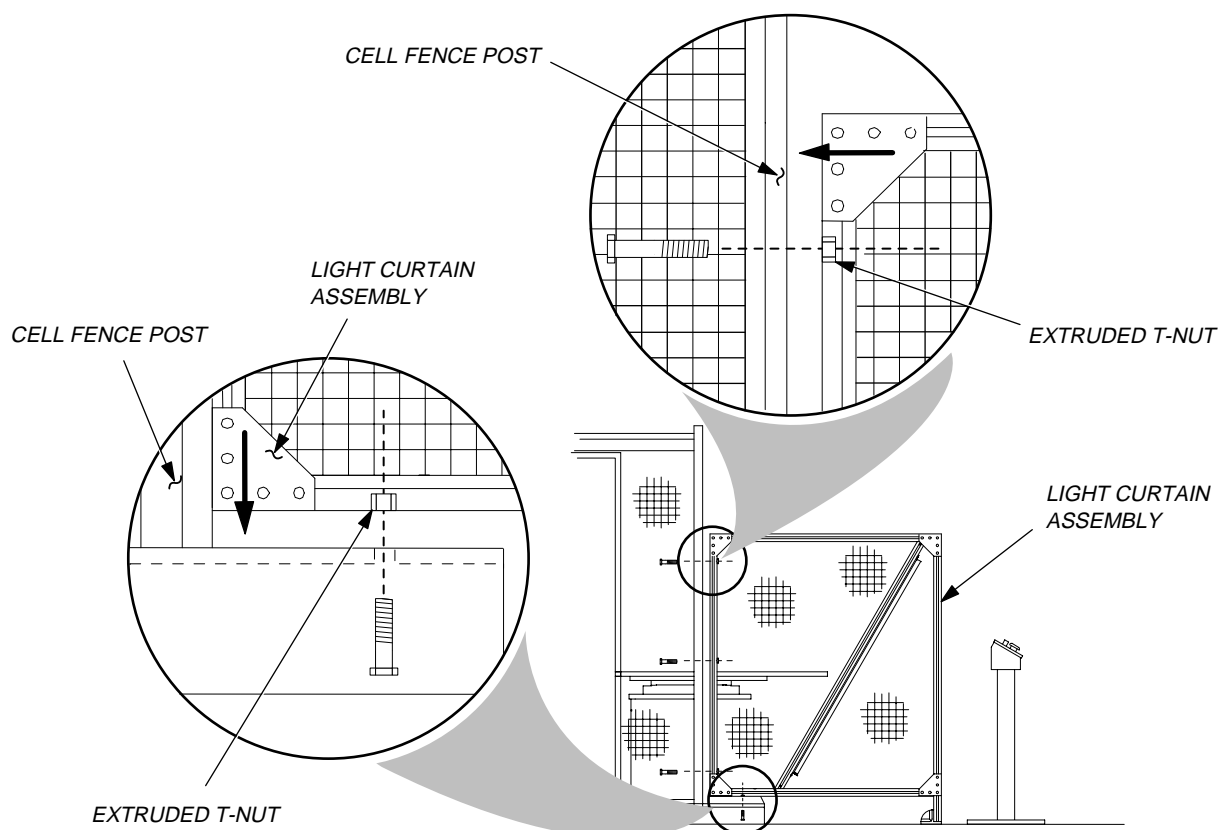


Figure 4-7 Light Curtain Installation

4.6.2 Alignment

The emitter and collector must be aligned properly. Refer to the light curtain manufacture's literature that accompanies the robot cell for exact alignment procedures.

4.6.3 Fencing

Once the light curtains have been properly installed onto the fencing, tightly fasten the fence posts to the concrete floor. Check the alignment of the light curtains again after fence posts have been anchored. Readjust as necessary.

4.7 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 4-8).

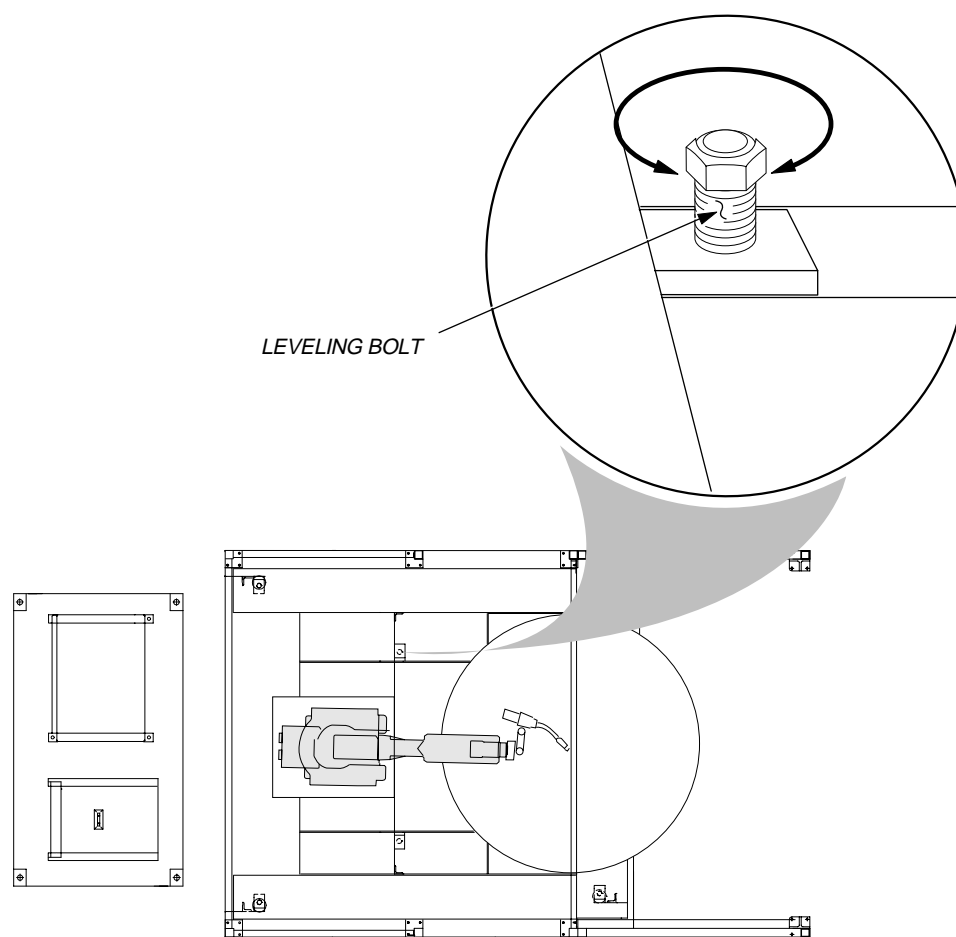


Figure 4-8 Leveling Bolts

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 4-9).

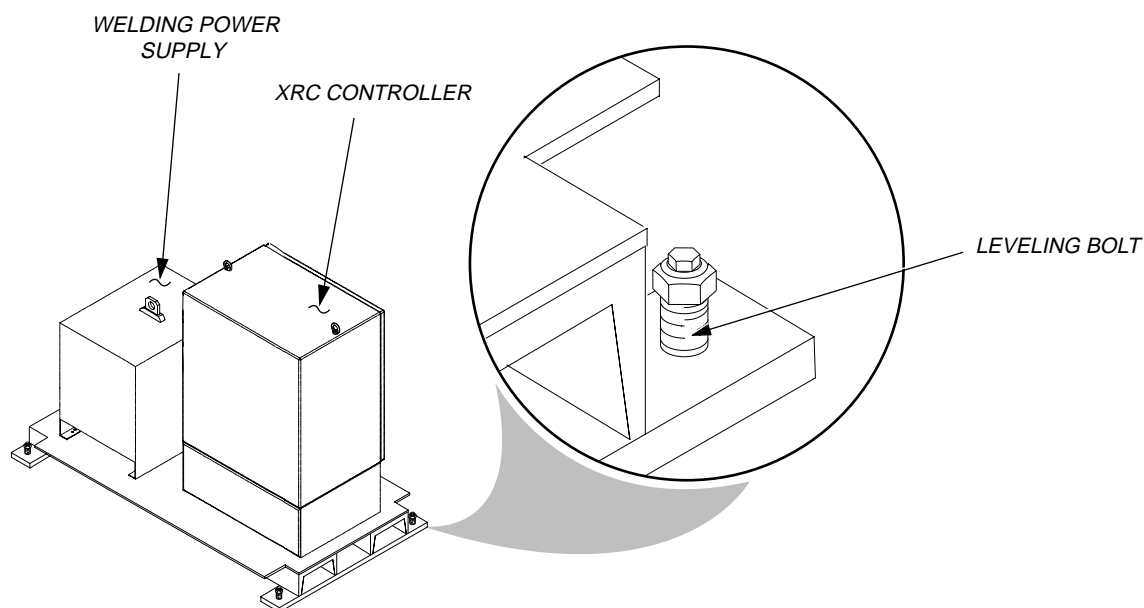


Figure 4-9 Auxiliary Equipment Common Base Leveling Bolts

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.
9. Level AEC base by adjusting leveling bolts (see Figure 4-9).
10. Insert a 1/2-inch concrete drill bit through center of leveling bolts and drill holes for lag bolts.
11. Lag AEC base to floor.

4.8 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.

4.8.1 Connecting the Earth Ground

Each robot and XRC 2001 controller must each be connected to an earth ground, which is a ground stake driven into the earth. The ground stake must be driven a minimum of 2.43 m (8 ft) 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. To ground the robots and XRC, proceed as follows:

**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 15.24 m (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 2001 controller are within 4.57 m (15 ft) of each other, a common earth ground may be used. Otherwise, separate earth grounds must be used.

1. Connect one end of each 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.

4.8.2 Connecting the Robot Cables

Two cables, 1BC and 2BC, connect the robot to the XRC 2001 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 2001 controller 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 2001 controller.
2. Unpack two large black manipulator cables, connected to XRC 2001 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 4-10).

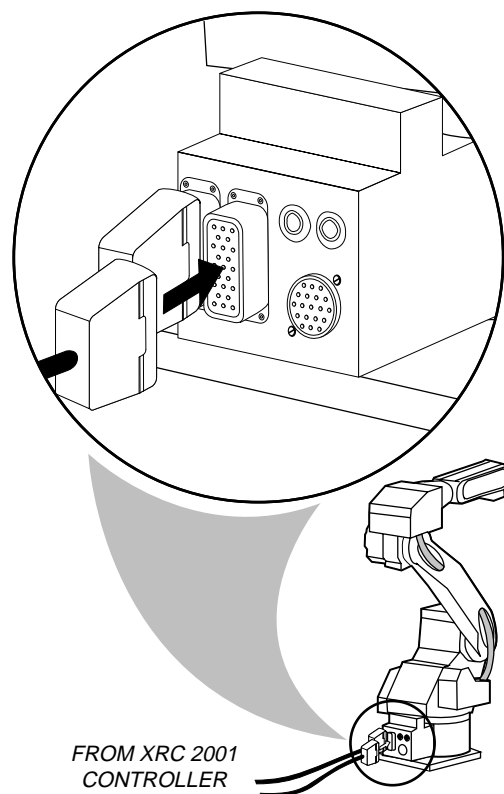


Figure 4-10 Connecting Robot to XRC 2001 Controller

4.9 Connecting the Power

After all of the system components have been properly installed, connect the power to the ArcWorld 1000. To connect incoming power to the ArcWorld 1000, proceed as follows:



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.

1. Install 3-phase power wiring to the circuit breaker located inside the left wall of the XRC 2001 cabinet (see Figure 4-11). Table 4-1 shows the size and type of wire needed.
2. Tighten screws to the torque indicated in Table 4-1.

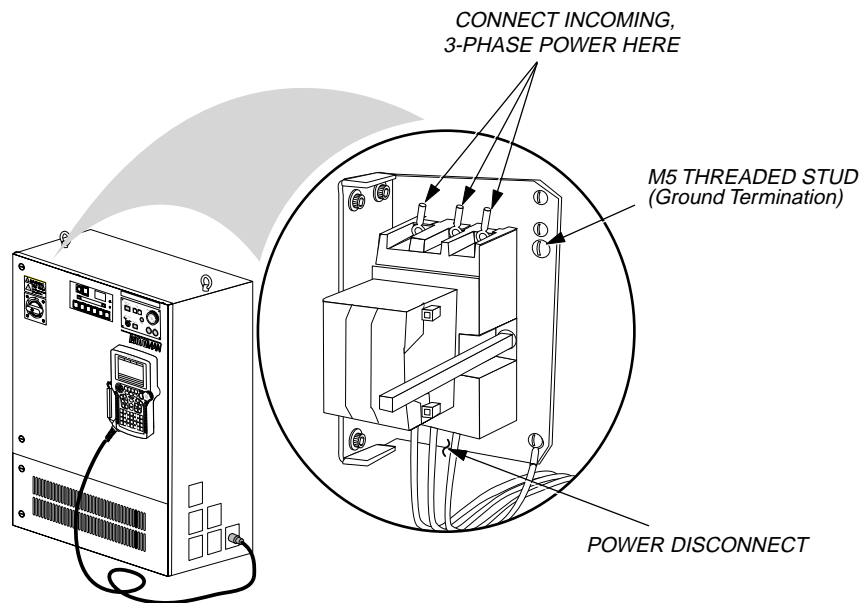


Figure 4-11 Incoming Power Connections

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

NOTE:

The ArcWorld 1000 is configured for 3-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 4-1 Incoming Power Specifications (Decal)

Lug Data	60/75° C wire
Catalog No.	TCAL14
Wire Size	#14-7 Copper #12-8 Aluminum
Torque	#14-7, 4.0 N•m (35 lb-in.)

4.10 *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 4.3.1).
2. Be sure there is a clearance of at least 2.5 cm (1 in.) on either side of the positioner.
3. Be sure the safety light curtains are aligned 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 1000 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.

4.11 *Installation of Tooling and Fixtures*

Your ArcWorld 1000 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.

NOTES

SECTION 5

OPERATION

The ArcWorld 1000 is a fully integrated robotic GMAW welding cell. The robot welds on one side of the turntable positioner while the operator loads the opposite side with parts. Once the robot is finished with its process, it returns to the Safe position. The operator sweeps the turntable, enabling the robot to start welding on the next part.

This section provides operating procedures for the ArcWorld 1000 system. These include the following:

5.1 Programming

The operation of this system is programming dependent. The following operating instructions are based on one possible configuration of this system. Your system configuration and job structure may differ slightly from that presented here; however, basic operation will 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. The application programs may assign values to memory locations in the controller. Consult your system documentation before modifying your system. 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).

5.1.1 I/O Assignment

The ArcWorld 1000 uses the following user and dedicated inputs and outputs (see Tables 5-1 and 5-2).

XRC 2001 Dedicated Inputs

- Servo On
- External Job Start
- Alarm Reset
- REMOTE mode ON
- Hold
- External Emergency Stop
- Safety Device Interference

XRC 2001 Dedicated Outputs

- Servo Power ON
- TEACH mode
- Cube 24
- Alarm Occurrence

For more information on user and dedicated I/O, refer to the XRC 2001 Concurrent I/O Parameters Manual (P/N 142102-1).

Table 5-1 XRC 2001 User Inputs

Input	Assignment
IN#001	CYCLE START
IN#002	AUTO/MANUAL
IN#003 thru 008	NOT USED
IN#009	AT SIDE A
IN#010	AT SIDE B
IN#011	ZERO SPEED
IN#012	DRIVE FAULT
IN#013 thru 016	NOT USED

Table 5-2 XRC 2001 User Outputs

Output	Assignment
OUT#001	CYCLE LATCHED
OUT#002 thru 003	NOT USED
OUT#004	NOT USED
OUT#005 thru 008	NOT USED
OUT#009	FWD RUN
OUT#010	REV RUN
OUT#011	FAULT RESET
OUT#012	SPEED 1
OUT#013 thru 016	NOT USED

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 B of the positioner into the robot work area:

1. Place robot in 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). Normally robot will not move out of Safe position when POSITIONER switch is in MANUAL. (This depends on job structure.)

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

3. Press CYCLE START button on the operator station. XRC 2001 will sweep the positioner each time the CYCLE START buttons are pressed.

When the table sweeps into position at Side A, the positioner provides an input to IN #9 "AT SIDE A." When this input is turned on, robot Output #9 should be turned off.

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.

5.2 Daily Operation

The procedures below represent the typical operating sequence from power up to shutdown. Yours 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 the ArcWorld 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.
4. Open regulator valve on welding gas supply.
5. Make sure both enclosure doors are closed and securely latched.
6. Disable operator station.
7. Press TEACH mode button on XRC 2001 playback panel.
8. Place robot in Safe position (Cube 24).

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 2001 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 R1 SAFE 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. Press PLAY mode button on XRC 2001 playback panel. Job playback operation is enabled.
6. Press SERVO ON button on playback panel.
7. Reset positioner by pressing the RESET button on the operator station.
8. Press MASTER JOB START button on operator station. The Master job cycles, waiting for a Cycle Start input from operator station.

The ArcWorld 1000 cell is now ready for operation.

5.2.4 Perform Operation Cycle

The following is the typical sequence of operation for the ArcWorld 1000 cell after start-up:

1. Load fixture on operator side of positioner table with parts to be welded.
2. Step out of safety light curtain.
3. Press the CYCLE START button on operator station. STATION READY light comes on and positioner sweeps, placing unwelded parts in robot work area. The robots then begin welding parts.
4. While robot is welding, load operator side.
5. When parts are loaded, press CYCLE START button on operator station. The CYCLE LATCHED light comes on. When robot is finished welding, it returns to Safe Position (Cube 24) and positioner sweeps, returning welded parts to the outside of the cell and placing newly loaded, unwelded parts in robot work area.
6. Unload welded parts from fixture.

NOTE: Before sweeping at first power up, make sure the correct job has been loaded.

5.2.5 **Shutdown**

Use the following procedure to shut down the ArcWorld 1000 cell after operation is complete:

1. Make sure the robot is in the Safe position (Cube 24).
2. Turn off system servo power by pressing E-STOP button on operator station, programming pendant, or playback panel.
3. Press TEACH mode button on playback panel.
4. Set controller Main Power switch to OFF position.
5. Set Main Power switch on welding power source to OFF position.
6. Close regulator valve on welding gas supply.

The ArcWorld 1000 cell is now shut down.

5.3 **System Recovery**

When a system error or alarm occurs, you must clear the error or alarm to return the system to normal operation. The paragraphs below describe the different types of alarms and errors you 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. Clear these errors 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. Clear these errors 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 the cell door on robot enclosure when robot is not in TEACH mode.
- Stepping into light curtain when positioner is sweeping.
- Actuating shock sensor on torch mount.

To restart the ArcWorld 1000 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 2001 playback panel.
 - Close cell door.
 - Step out of safety curtain.
 - 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 re initialized.

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

The ArcWorld 1000 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.*

6. Move manipulator clear of impact position.

The ArcWorld 1000 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 – 135 kg (297 lb)

UP20 – 280 kg (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 the 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.

NOTES

SECTION 6

MAINTENANCE

6.1 Periodic Maintenance

Table 6-1 provides periodic maintenance items and intervals for the ArcWorld 1000 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 1000, 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

<i>Frequency</i>	<i>Component</i>	<i>Procedure</i>
<i>Daily</i>	Water circulator (For water-cooled torch application only.)	Check the fluid in the water circulator. Add fluid as required. Use only distilled water and approved antifreeze (Motoman P/N 131224-1).
<i>Monthly</i>	Bull Gear and Pinion	Grease with Motoman P/N 133174-2.
<ul style="list-style-type: none"> • <i>1st Month</i> • <i>Semi-annual</i> 	Drive Motor and Gear Reducer	Check for loose fasteners, tighten as required. Check for oil leaks. If more than 50cc is needed to refill, this indicates reducer problem. Reducer is lubricated for life.

H=Hours of Operation

6.2 **MR-300 Maintenance Procedures**

Read through the instructions completely before performing any maintenance procedure. Be sure that you understand the procedure, have the proper tools, and observe all applicable safety precautions.



WARNING!

Ensure that servo power is off before performing the following procedures. Observe standard lockout/tagout practices.

6.2.1 **MR-300 Hardstop/Shock Absorbers**

Proper adjustment of the positioner hardstop/shock absorbers is important to achieve reliable positioning of the parts fixtures. All units are preset at the factory for maximum performance before shipping. Should a hardstop/shock absorber need replaced, care must be taken not to alter the position of the parts fixtures or performance of weld jobs will be compromised. For more information, call the Motoman Customer Service Department 24-Hour Hot Line at (937) 847-3200.

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