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SECTION 1
INTRODUCTION

The ArcWorld II-500S 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 II-500S features a Motoman arc welding robot, an XRC controller with menu-driven arc welding application software, complete welding package, two 180 degree reciprocating plane positioner modules, operator interface, and a total safety environment.

1.1 About this Document

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

SECTION 1 - INTRODUCTION
Provides general information about the ArcWorld II-500S and its components, a list of reference documents, and customer service information.

SECTION 2 - SAFETY
Provides information regarding the safe use and operation of the ArcWorld II-500S system.

SECTION 3 - DESCRIPTION OF EQUIPMENT
Provides a detailed description of the major components of the ArcWorld II-500S system. This section also includes a table of component specifications.

SECTION 4 - INSTALLATION
Provides instructions for set up and installation of the ArcWorld II-500S system.

SECTION 5 - OPERATION
Provides instructions for basic operation of the ArcWorld II-500S system. This section also 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
Contains a table listing periodic maintenance requirements for the components of the ArcWorld II-500S cell.
1.2 **System Overview**

The ArcWorld II-500S 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. Two positioner modules allow an operator to prepare and set up parts on one module while the robot welds on the other module. The two servo motor controlled positioners allow the robot to weld both the top and bottom of the part without reloading. 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 II-500S cell.

1.2.1 **System Layout**

The robot manipulator and reciprocating positioners share a common base for ease of installation and to help maintain proper alignment between the cell’s components. The XRC controller and welding power source also share a common base, but separate from the cell’s base. The robotic cell is fully enclosed by safety fencing and an interlocking door. Interlocked arc doors allow the operator to load parts on one positioner while the robot is welding parts on the other positioner. All operator controls, including those on the XRC and welding power supply, are accessible from outside of the robotic enclosure.

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

**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.
The ArcWorld II-500S includes the following major components:

- Motoman SK16X or UP6 manipulator and XRC controller
- Two servo driven positioner modules
- Two operator stations
- Welding equipment, including the following:
  - Welding power source
  - Motoman torch (water-cooled or air-cooled)
  - Wire feeder
  - Torch mount
- Safety equipment, including the following:
  - Safety fencing with arc curtains
  - Interlocked cell door
  - Arc doors
  - Zone ring
  - Door Interlock

1.2.2 Optional Equipment

The following optional equipment is available for use with the ArcWorld II-500S:

- 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 SK16X Manipulator Manual (P/N 142105-1)
- 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 SK16X)
- Application Type (welding)
- System Type (ArcWorld II-500S)
- Software Version (3.28)
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on back side of XRC controller)
SECTION 2
SAFETY

2.1 Introduction

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

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

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

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

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

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)
2.2 **Standard Conventions**

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

- DANGER
- WARNING
- CAUTION
- NOTE

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

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

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

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

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

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

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

2.4 **Mechanical Safety Devices**

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

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

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

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

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

2.6 Programming Safety

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

- Any modifications to PART 1 of the controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.
- Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
• Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
• Be sure that all safeguards are in place.
• Check the E-STOP button on the teach pendant for proper operation before programming.
• Carry the teach pendant with you when you enter the workcell.
• Be sure that only the person holding the teach pendant enters the workcell.
• Test any new or modified program at low speed for at least one full cycle.

2.7 Operation Safety

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

• Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.
• Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
• Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
• Ensure that all safeguards are in place.
• Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
• Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
• The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
• This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
• All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.
2.8 Maintenance Safety

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

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

EQUIPMENT DESCRIPTION

3.1 UP/SKX-Series Robot Description

The Motoman six-axis UP6 and SK16X robots and XRC robotic controller represent state-of-the-art technology in robotics today. The UP6 robot has a payload of 6 kg (13.2 lbs). It features a 1,325 mm (52.1-inch) reach and has a relative positioning accuracy of ± 0.08 mm (0.004-inch). The SK16X robot has a payload of 16 kg (35.2 lbs). It features a 1,555 mm (61.2-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 Controller

The XRC robotic controller, shown in Figure 3-1, coordinates the operation of the ArcWorld II-500S system. It controls manipulator movement and welding power supply, processes input and output signals, positioner headstock/tailstock movement, and provides the signals to operate the welding system. It maintains variable data and performs numeric processing to convert to and from different coordinate systems. In addition, the controller provides the following: main logic functions, servo control, program and constant data memory, and power distribution. For more information, refer to the manipulator manual that came with your system.

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

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

![Playback Panel Diagram]

Figure 3-2 XRC Playback panel

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

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

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

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

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

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

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

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

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

![Figure 3-3 Programming Pendant](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, \( \rightarrow \) World, \( \leftarrow \) Cylindrical, \( \rightarrow \) Tool, or \( \rightarrow \) User Frame

- **Manual Speed Setting**
  \( \rightarrow \) Inching, \( \leftarrow \) Low, \( \rightarrow \) Medium, or \( \rightarrow \) High

- **Cycle Mode**
  \( \uparrow \) Step, \( \downarrow \) 1-Cycle, or \( \hdash \) Auto

- **System Status**
  \( \rightarrow \) E-Stop, \( \rightarrow \) Stop, \( \rightarrow \) Running/Start, \( \rightarrow \) Hold, or \( \rightarrow \) 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 the floppy disk controller (FC1 or FC2), FDE (Floppy Disk Emulator) software, or other form of communication (see Figure 3-4).

**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.
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 feature that allows you to release the 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 (Section Figure 3-1).

3.3 Operator Station

The ArcWorld II-500S has two, identical operator stations (Section Figure 3-6). They are mounted on the right-hand door support of both stations. The operator station consists of three buttons: Cycle Start, Door Status, and Emergency Stop (E-Stop).

3.3.1 Cycle Start

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

The CYCLE START push button cycles the station doors and moves the robot to the appropriate station. The CYCLE START push button, located at the top of the operator station, completes the CYCLE START circuit when the operator presses this button.

3.3.2 Door Status

The DOOR STATUS button allows the operator to reopen a station after the operator door has closed. This is used primarily to reopen the operator door if part/fixture adjustments are required after the operator has already pressed CYCLE START and the operator door has closed. DOOR STATUS is disabled if the robot is presently working at the station.
3.3.3 **Emergency Stop (E-STOP)**

The operator station E-STOP, the robot E-STOP, and the sliding door interlocks are connected in series in the Emergency Stop circuit. Pressing an E-STOP button or interrupting a door interlock interrupts this circuit and 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. System operation can not resume until the E-Stop button is reset.

3.4 **Positioner Module**

The ArcWorld II-500S features two servo motor driven controlled positioner modules, each with a door to protect the operator from arc radiation, weld spatter, and physical contact with the robot arm. These AC-servomotor positioners are controlled by the XRC to provide harmonized motion between robot and positioner during operation. Precision welds are made as the positioner rotates the part while the robot welds it.

For information about the optional synchronized and coordinated motion, refer to the manipulator manual for your system.

Pneumatic and electrical signals can be run to the fixtures if required. Depending on part size and weight you can mount single, multiple, or a combination of parts to the headstock.

3.4.1 **Headstock**

The ArcWorld II-500S headstock consists of an AC servo driven motor mounted on a steel housing with a 24 cm. (9.45-inch) dia. faceplate. The headstock provides a +/- 360° rotary motion about the central axis. Mounting holes on the faceplate provide for mounting of parts fixtures.

*NOTE:* • In high humidity areas, the positioner mounting plate may rust or corrode. Surface protection should be used.
3.4.2 Tailstock

The tailstock is an independent, freewheeling axis mounted on a steel housing. Mounting holes on the faceplate provide for the mounting of parts fixtures.

![Faceplate](image-url)

Figure 3-8 ArcWorld II-500S Tailstock

3.4.3 Welding Ground System

The welding ground system consists of a rotary coupler on the tailstock. The ground cable to the welding power source is connected to the ground stud located on the right side of the positioner base as you face the back of the ArcWorld II-500S cell.

**NOTE:** The ground cable connection to the ground bar must be tight. If the connection is loose, arcing can occur.

3.4.4 Home Position Limit Switch

The Servo Driven Headstock is equipped with a home position limit switch. This limit switch is used as an operator safeguard, if the Door of the positioner is open and the servo home limit switch is not active an E-Stop condition will occur.

3.4.5 Arc Shield

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

Both positioners incorporate a pneumatically controlled sheet metal door. 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.
The ArcWorld II-500S system provides a complete complement of arc welding equipment. In its standard configuration, the ArcWorld II-500S system includes a 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 Power Source

Motoman offers several different power sources for use with the ArcWorld II-500S system depending on your system’s 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 3-9  Kobelco UC Series Power Source](image)

3.5.2 PWF4 Wire Feeder

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

![Figure 3-10  MotoArc Power Source](image)
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 II-500S 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**

A 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 eyewear!*

Two different types of arc screens are used on the ArcWorld II-500S. The first are the metal doors in front of the positioner modules. These doors block arc radiation and sparks from the welding operation. The curtain used to cover the safety fencing of the entire robotic cell acts as the second arc screen. This curtain reduces the amount of ultraviolet radiation that escapes from the robotic cell.
3.6.2 **Fencing**

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

3.6.3 **Emergency Stops (E-STOPS)**

In addition to the safety features described above, the ArcWorld II-500S 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 panel on the controller has one E-STOP button.
- The programming pendant has one E-STOP button.
- Each operator station has one E-STOP button.

3.6.4 **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. 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.

3.6.5 **Interlocked Cell Doors**

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.

3.6.6 **Zone Ring**

The zone ring monitors the position of the robot’s S-Axis. As the robot moves from Station 1 to Station 2, a signal is output to the XRC informing it of the robot’s position. This output and a signal from the operator door are interlocked with the “OK TO WORK” output, preventing the robot from welding when the operator door is open. If the robot is in PLAY MODE, the station doors must be in the up position for the robot to service. Otherwise the system will go into an E-STOP condition upon entering the defined zone.

3.6.7 **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 feature that releases the brakes on the robot in case of an emergency or robot failure.
3.6.8 **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 the activity of other manipulators or peripheral devices. The XRC has 24 possible cubes available. These cubes are internally tied to Specified Outputs:

R1 = SOUT #081 - 104

The ArcWorld II-500S 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. Before the positioner can sweep, the robot must be in this safe position.

Setup of these cubes is done at the factory prior to shipment. However, should any of these cubes need redefined or modified due to changes in tooling or system components, refer to Appendix A for basic interference cube setup.
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
- Incoming air supply: 1.5 scfm at 90 psi
- Stepladder
- Forklift and/or overhead crane

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 II-500S system will require a minimum area of 2.3 m (7.5 ft) by 4.8 m (16 ft). To make installation easier, however, an additional 2.43 to 3.05 m (8 to 10 ft) on all sides is recommended.

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

The ArcWorld II-500S robot/table cell — complete with robot, torch, two reciprocating positioner modules and fencing with arc curtains — is shipped on a large wooden shipping skid.

4.3.1 Installing the Robot/Positioner Common Base

To install the robot and positioner, proceed as follows:

**CAUTION!**
Handle ArcWorld II-500S components carefully to avoid damage.

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

![Figure 4-2 Unbolting the Robot/Table Common Base](image)

**CAUTION!**
The robot/positioner common base weighs 2,041 kg (4500 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 common base from wooden shipping skid.
3. Place robot/positioner common base in position (see Figure 4-1).
4. Carefully remove protective plastic wrapping from robot and torch.
5. Inspect robot, torch, positioner modules, and fencing for shipping damage.

**NOTE:** If damage is found, notify shipper immediately.
4.3.2 Removing the Shipping Brackets

**CAUTION!**
Failure to remove shipping brackets from robot before operating the ArcWorld II-500S 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*
4.4 Installing the Auxiliary Equipment Common Base

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

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

\[\text{WARNING!}\]
\text{The auxiliary equipment common base weighs 680 kg (1500 lbs). Be sure your crane or forklift is capable of handling this much weight or damage to equipment or injury to personnel can result.}\n
2. Using a forklift, lift base and remove it from wooden shipping skid.
3. Carefully remove protective plastic wrapping and cardboard from auxiliary equipment common base.
4. Remove accessories boxes from welding power source and set safely aside.
5. Inspect auxiliary equipment common base components for shipping damage.

\[\text{NOTE: If damage is found, notify shipper immediately.}\]

6. Use a forklift to place auxiliary equipment common base to left of cell (see Figure 4-5).

\[\text{NOTE: The auxiliary equipment common base can be located directly to the left of the cell. No space is needed between it and the robot/positioner common base.}\]
4.5 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 positioner common base by adjusting leveling bolts (see Figure 4-6).
2. Insert a 1/2-inch concrete drill bit through center of lag holes and drill holes in floor for lag bolts.
3. Vacuum concrete dust from holes.
4. Lag robot/positioner common base to floor.
5. Level auxiliary equipment common base by adjusting leveling bolts (see Figure 4-7).

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

After components are level and securely in place, 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.

4.6.1 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. To ground the robot and the 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 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.

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.

4.6.2 Connecting the Welding Ground

The ground welding cable is shipped with one end connected to the grounding bolt located in the base of the positioner. Connect the other end of the ground welding cable to the negative (-) terminal on the welding power source.

1. Remove ground welding cable from accessories box.
2. Connect one end of ground welding cable to grounding bolt located on robot/positioner common base.
4.6.3 Connecting the Robot Cables

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

**CAUTION!**

*Route wires and cables away from hazardous work areas to avoid wire breakage and unnecessary interruption of cell operation.*

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 4-8).

![Figure 4-8 Robot Cables Connecting XRC to Robot](image-url)
4.6.4 Connecting the Welding Equipment

Motoman offers a wide variety of welding equipment for use with the ArcWorld II-500S system depending on your system’s application. For more specific information on your system, refer to the vendor manual that came with your system. When connecting power source equipment please refer to the cable layout diagram (p/n 143870) that came with your system.

**Negative Cable**

A single negative ground cable is connected from the (-) post on the power supply and routed through a steel formed conduit located on the cell common base. The cable is fastened to a lug on the base then split off to each positioner at the headstock.

**Positive Cable**

A single positive power cable is connected from the (+) post on the power supply and routed to the wire feeder on the robot arm.

**Voltage Sensor Lead**

A voltage sensor lead wire is connected to the front of the power source on one end and coupled with the negative ground cable onto the positioner on the other end.

**Interface Cable**

The interface cable connects to the front of the power source and is run to the XRC controller.

**Feeder Control Lead Wire (Kobelco System only)**

Power to the feeder on Kobelco systems comes from the power source. This cable is connected from the front of the power source to the wire feeder.

**Power In Cable**

Input power to the welding power source comes from connect to the back panel. This cable comes from the grey breaker box.

4.6.5 Connecting the Door Interlock

**WARNING!**

The door interlock should NEVER be defeated. Entry into cell during operation is hazardous due to pinch points and robot movement.

For operator safety, the welding cell has an interlocked door. If this door is opened during automatic operation, the robot will come to an E-STOP. To connect the door interlock, proceed as follows:

1. Remove door interlock cable from accessories box.
2. Plug one end of cable into interlock unit on gate post (see Figure 4-9).
3. Close and latch cell door.
4. Make sure interlock unit latches smoothly.
5. Set ohmmeter to measure continuity.
6. Attach ohmmeter leads to pins in cable connected to interlock unit.
Figure 4-9  Door Interlock Connections

7. Ensure there is continuity when door is latched.
8. Test door interlock by opening door. When door opens, ohmmeter should show loss of continuity.
9. Plug other end of door interlock cable into Door Interlock connection on side of XRC.
10. Wire-tie door interlock cable to fencing.

4.6.6 Connecting the Com-Arc III and the Torch Tender (Optional)

The Com-Arc III and Torch Tender are typically shipped with cable connections already made. The Com-Arc III cable is connected to the left side of the XRC. Refer to Com-Arc III Instruction Manual (P/N 132753-1).

The torch Tender typically contains the wire cutter, nozzle cleaner, and torch alignment block. To connect the Torch Tender, proceed as follows:
1. Unwrap the wire cutter cable.
2. Plug the wire cutter cable into the connector on the wire cutter unit.
3. Connect wire cutter to an air supply set at 586 to 689.5 kPa (85 to 100 psi).

4.6.7 Connecting the Water Circulator (Option)

The optional water cooled torch system uses a water circulator to circulate water through the welding torch. Two water hoses are routed around the robot, from the welding torch to the water circulator, enclosed in leather casing. To connect the water circulator, proceed as follows:
1. Connect two water hoses from leather casing to connections on water circulator marked WATER-IN and WATER-OUT (see Figure 4-10).
2. Plug water circulator into AC plug on back of welding power source or other AC outlet.
**CAUTION!**

- **Use only antifreeze provided by Motoman. Automotive anti-freeze contains stop-leak additives that will clog small torch water-cooling ports and damage pump gaskets.**

- **Do not fill the water circulator past its fill line. Damage to the water circulator could occur.**

3. Fill water circulator tank with antifreeze/coolant provided (P/N 131224-1). Do not fill water circulator past fill line.

### 4.6.8 Connecting the Positioner Modules

Two cables connect the positioners to the XRC controller. To connect the robot and system cables and hoses, proceed as follows:

1. Locate positioner cables connected to back of positioner modules.
2. Remove two cable plates from side of XRC with Phillips head screwdriver.
3. Insert positioner cables and attach cable plates with screws provided.
4. Open XRC cabinet and connect positioner cables to matching numbered CPC connectors inside.
4.7 Connecting the Power

After all of the system components have been properly installed, connect the power to the ArcWorld II-500S. To connect incoming power to the ArcWorld II-500S, 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 to circuit breaker located inside right wall of XRC cabinet (see Figure 4-11). Table 4-1 shows 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 incoming ground wire.
4. Terminate ground wire to frame ground M5 stud with hardware provided.

**NOTE:** The ArcWorld II-500S is configured for three-phase 460/480V AC, unless other voltage was requested. If other voltage is required for your plant, modifications must be made to the transformer. For more information, refer to the 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.-inch)</td>
</tr>
</tbody>
</table>
4.8 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 4.3.2).
2. Be sure there is a clearance of at least 2.5 cm (1-inch) on either side of the positioner.
3. Be sure the safety mats are placed correctly.
4. Check that the cell door is closed and latched.
5. Check that all cable connections are tight.
6. Check air line connections to the positioner air line regulator and to the optional torch tender and wire cutter.
7. Be sure that the welding power source is set correctly (see the welding power source vendor's manual).
8. Verify that incoming line power matches the input power specified on the sticker on the front of the XRC.

Your ArcWorld II-500S 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, operator station, breakaways, playback panel).
10. Check system Hold buttons.

4.9 Installation of Tooling and Fixtures

**WARNING!**

*Tooling must be installed between positioner headstock and tailstock before positioner is swept. Damage to positioner headstock and face plate will occur if positioner is swept before tooling is in place.*

Your ArcWorld II-500S system is now ready for the installation of tooling and fixtures for your application (see Figure 4-12). 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.
Figure 4-12 Mounting Holes on Faceplate

After tooling is installed, test the positioner for proper operation:

- Verify that the air line FRL is set for 620.5 kPa (90 psi).

Positioner achieves full sweep time (4 to 5 seconds).
SECTION 5
OPERATION

The ArcWorld II-500S is a fully integrated robotic GMAW welding cell. The robot welds on one station while the operator loads the other station with parts. Once the robot is finished welding Side A, it moves clear of the sweep path. The positioner then rotates, enabling the robot to weld the bottom of the parts. When the robot is completely finished welding both sides, it again moves clear of the sweep path, the fixture rotates back to home, and the operator door opens, allowing the operator to safely remove the welded piece and load new production parts onto the station. This section provides operation instructions for the ArcWorld II-500S system.

A major advantage of the ArcWorld II-500S system is its high degree of flexibility. The operator can fine tune the movement of the robot and the positioner according to the parts configuration. The servomotor driven positioner, with its programmable primary axis and headstocks, proves highly versatile when configured with the UP6 or UP20 robot. The robot can be programmed to weld a part with the headstock stationary, or the robot and headstock can move simultaneously to weld a part while the headstock is turning. The robot can be programmed to weld different seams on the same part and to move from part to part to continue welding.

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).

With the programming pendant, the operator can develop a series of jobs for the robot. You can program the robot independently (R1 job), the station axis independently (S1 job), or the robot and station axis together (R1 + S1 job combinations). You must select the axis combination when teaching the job initially. Motoman recommends programming the robot and station axis together (R1 + S1 jobs) to reduce the risk of interference.
5.1.1 I/O Assignment

The ArcWorld II-500S 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 1
- Alarm Occurrence

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

### 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 INPUT STATION 1</td>
</tr>
<tr>
<td>IN#002</td>
<td>OK TO WORK STATION 1</td>
</tr>
<tr>
<td>IN#003</td>
<td>DOOR STATUS INPUT STATION 1</td>
</tr>
<tr>
<td>IN#004</td>
<td>CYCLE START INPUT STATION 2</td>
</tr>
<tr>
<td>IN#005</td>
<td>OK TO WORK STATION 2</td>
</tr>
<tr>
<td>IN#006</td>
<td>DOOR STATUS INPUT STATION 2</td>
</tr>
<tr>
<td>IN#007 thru 16</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>

### Table 5-2 XRC User Outputs

<table>
<thead>
<tr>
<th>Output</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT#001</td>
<td>OPEN OPERATOR DOOR STATION 1</td>
</tr>
<tr>
<td>OUT#002</td>
<td>CLOSE OPERATOR DOOR STATION 1</td>
</tr>
<tr>
<td>OUT#003</td>
<td>NOT USED</td>
</tr>
<tr>
<td>OUT#004</td>
<td>NOT USED</td>
</tr>
<tr>
<td>OUT#005</td>
<td>OPEN OPERATOR DOOR STATION 2</td>
</tr>
<tr>
<td>OUT#006</td>
<td>CLOSE OPERATOR DOOR STATION 2</td>
</tr>
<tr>
<td>OUT#007</td>
<td>NOT USED</td>
</tr>
<tr>
<td>OUT#008</td>
<td>NOT USED</td>
</tr>
<tr>
<td>OUT#009</td>
<td>WIRE CUTTER (OPTIONAL)</td>
</tr>
<tr>
<td>OUT#010 thru 16</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>
5.1.2 Sweeping the Positioner

The Moto HT 150/300 positioners use servo controlled motors to sweep the positioner from the operator’s loading zone, into the robot’s work zone, and back. A sheet metal screen is raised and lowered to visually divide each positioner table from the operator. Each screen is pneumatically raised and lowered using a button on the operator station located next to the screen. Contact switches send signals to the XRC controller to verify the location of each door. This system will not operate with either door in the up position.

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

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

5.1.3 Rotating the Headstock/Tailstock

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

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

NOTE: • The EX. AXIS LED lights when pressed only when R1 + S1 is selected and S1 (Station 1) is the Master control device. The Status line indicates which EX. AXIS is selected.
• The EX. AXIS key must be turned OFF to move the robot with the motion keys.

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

You can program three types of moves:

- Rotation of positioner during air-cut moves
- Robot motion with positioner stationary
- Rotation of positioner during welding

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

⚠️ CAUTION!

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

NOTE: Refer to your system’s Coordination Instructions for Multi-axes Systems Manual for information on coordinated motion, selecting synchronization, group axes, and tooling calibration.

Rotation of the Positioner During Air-Cut Moves

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

NOTE: The EX. AXIS LED lights only when S1 control is selected and the job EX. AXIS is R1 + S1 with S1 as the Master device.
   b. Press MAN SPEED button to select desired axis speed while teaching.
   c. Press first set of motion keys, +X or -X, to move axis in desired direction.
3. Record step after designating motion type and playback speed.
4. Check path with STEP FWD/BWD keys. The position for robot or positioner may need to be altered to prevent torch interference.

⚠️ WARNING!

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

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

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

**Rotation of the Positioner During Welding**

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

\[
\text{COORDINATED MOTION INSTRUCTION} = \{ \text{SMOVL}=138 \ SLAVE DEVICE (Manipulator with Torch) \ +\text{MOVL} \ MASTER DEVICE (Positioner with Workpiece) \}
\]

### 5.2 Daily Operation

The following is the typical sequence of operation for the ArcWorld II-500S cell after start-up:

By default, the operator doors of both positioner modules will rest in the down position to permit loading of parts. This condition will occur only when the robot is in the Safe position (Cube 24) and CYCLE START has not been activated on either station.

1. Load Station 1 with production parts.
2. Press CYCLE START button on Operator Station 1. Operator door rises, and robot moves to Home 1 position.
3. The XRC waits for “OK TO WORK” input, signaling operator door is up and robot is in Zone 1.
4. The robot moves into work area and begins welding. When robot finishes welding parts on Station 1, it returns to Home 1 position (clear of the positioner sweep area). Station 1 positioner then rotates the fixture and the robot proceeds to weld bottom of parts on the opposite side. When robot has finished welding both sides, it returns to Safe position, Station 1 positioner rotates fixture back to load position, and robot proceeds to Station 2. As soon as robot has left Station 1 and fixture has rotates to Load position, operator door lowers, giving operator access to welded parts on Station 1.
5. While robot is welding at Station 1, load Station 2 with production parts.
6. Press CYCLE START button on Operator Station 2. Operator door rises and robot begins welding at Station 2 after it has finished welding at Station 1.
7. While robot is welding on Station 2, unload welded parts from Station 1 and load new parts.
8. Activate CYCLE START to raise operator door and permit robot to return to Station 1.

**NOTE:** The robot will not return to Station 1 until CYCLE START has been activated, even if it has completed work at Station 2. If the robot finishes working at Station 2 before Station 1 is reloaded, the robot will return to the Safe position (Cube 24) and wait for a CYCLE START command from either station.

9. Once all production work is finished and robot completes work on last station, robot returns to Safe position and both operator doors open to permit unloading/loading. Doors remain in down position until CYCLE START is activated at one or both stations.
5.2.1 Start-Up

To start the ArcWorld II-500S cell from a Power-Off condition, proceed as follows:

1. Set Main Power switch on XRC to ON.
2. Make sure disconnect on welding power source is ON.
3. Set INPUT POWER switch on welding power source to ON.
4. Turn on air supply to both positioners.
5. Open regulator valve on welding gas supply.
6. Press TEACH MODE button on playback panel.
7. 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 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 1 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 playback panel. Job playback operation is enabled.
6. Press SERVO ON button on playback panel.
7. Reset START.

The ArcWorld II-500S cell is now ready for operation.
5.2.4 **Shutdown**

Use the following procedure to shut down the ArcWorld II-500S cell after operation is complete:

1. Make sure the robots are in the Safe position (Cube 24).
2. Turn off the system servo power by pressing the E-STOP button on the 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.

The ArcWorld II-500S 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 CANCEL 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.
- Actuating shock sensor on torch mount.

To restart the ArcWorld II-500S 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.
   - Clear Shock Sensor condition (refer to Section 5.3.3).
   - Restore operating air pressure.
2. Press SERVO ON button on operator station, or playback panel.
3. Move robot to home position
4. Press MASTER JOB START button on operator station.

The ArcWorld II-500S 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!](image)

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 II-500S 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. The brakes on S-, L-, U-, R-, B-, and T-axes are controlled by individual axis buttons. Simultaneously pressing ENABLE button and one of these axis buttons releases the indicated axis. To release the brakes, proceed as follows:

1. Press the E-STOP button on the programming pendant, playback panel, or the operator station, to be sure servo power is OFF.
2. Provide adequate support for the axis to be released. Support should withstand the payload of the robot and the approximate weight of the axis.

WARNING!

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

3. Release the specific axis brake by pressing and holding the corresponding axis button and the ENABLE button at the 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.
6.1 Periodic Maintenance

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

For periodic maintenance procedures and schedules for the individual components of your ArcWorld II-500S, 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>
<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</td>
<td>Check the fluid in the water circulator. Add fluid as required. Use only</td>
</tr>
<tr>
<td></td>
<td>application only.)</td>
<td>distilled water and approved antifreeze (Motoman P/N 131224-1).</td>
</tr>
<tr>
<td>Daily</td>
<td>Air system water trap on the front of the Moto</td>
<td>Check water trap and empty if required.</td>
</tr>
<tr>
<td></td>
<td>HT 150/300 positioner.</td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>Air filter/regulator for water (high-humidity</td>
<td>Inspect left glass cylinder for water. If water is present, loosen the</td>
</tr>
<tr>
<td></td>
<td>environments).</td>
<td>valve at the bottom of the cylinder to expel any moisture.</td>
</tr>
<tr>
<td>Daily</td>
<td>Limit Switches</td>
<td>Check operation of each.</td>
</tr>
<tr>
<td>Weekly</td>
<td>Air filter/regulator oil level</td>
<td>Inspect right glass cylinder and transparent neck on the top of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>regulator. If oil falls below half, add oil.</td>
</tr>
<tr>
<td>Monthly</td>
<td>Moto HT 150/300 servo head- stock RV drive unit</td>
<td>Check for proper grease levels and quality. Use Epinoc APO grease (Motoman</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P/N 132434-1) as required.</td>
</tr>
<tr>
<td>Period</td>
<td>Equipment</td>
<td>Maintenance Action</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>--------------------</td>
</tr>
<tr>
<td>1,000H</td>
<td>Moto HT 150/300 positioner gears</td>
<td>Lubricate with Shell 1029 or equivalent.</td>
</tr>
<tr>
<td>20,000H</td>
<td>Moto HT 150/300 servo head- stock RV drive</td>
<td>Change the grease in the drive unit. Use Epinoc APO grease (Motoman Part Number 132434-1).</td>
</tr>
<tr>
<td>20,000H</td>
<td>Moto HT 150/300 servo head- stock Cyclo drive unit</td>
<td>Change the grease in the drive unit. Use Shell Alvania RA.</td>
</tr>
</tbody>
</table>
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