# Table of Contents

## Chapter 1

**Introduction**

- 1.1 About This Document ............................................. 1
- 1.2 System Overview .................................................. 2
  - 1.2.1 System Layout .................................................. 3
  - 1.2.2 Major Components ............................................. 3
  - 1.2.3 Optional Equipment ........................................... 4
- 1.3 Reference Documentation .......................................... 4
- 1.4 Customer Support Information ..................................... 4

## Chapter 2

**Safety**

- 2.1 Introduction ...................................................... 5
- 2.2 Standard Conventions ............................................. 6
- 2.3 General Safeguarding Tips ....................................... 7
- 2.4 Mechanical Safety Devices ....................................... 7
- 2.5 Installation Safety ............................................... 8
- 2.6 Programming, Operation, and Maintenance Safety ............... 8

## Chapter 3

**Equipment Description** ........................................... 11

- 3.1 Robot Description .................................................. 11
- 3.2 NX100 Controllers .................................................. 11
- 3.3 Programming Pendant ............................................. 12
- 3.4 Operator Station ................................................... 14
- 3.5 MSR-500 Positioner ................................................. 15
- 3.6 Welding Equipment .................................................. 16
  - 3.6.1 Welding Power Sources ....................................... 16
  - 3.6.2 Wire Feeder ...................................................... 16
  - 3.6.3 GMAW Torch ...................................................... 17
- 3.7 Safety Features ..................................................... 17
  - 3.7.1 Welding Arc Protection ....................................... 17
  - 3.7.2 Safety Fencing .................................................. 17
  - 3.7.3 Safety Light Curtains ......................................... 17
  - 3.7.4 Emergency Stops (E-STOPs) ................................... 18
  - 3.7.5 Programming Pendant ENABLE Switch ......................... 18
  - 3.7.6 Emergency Braking System ................................... 19
  - 3.7.7 Interlocked Work Cell Doors ................................. 19
Chapter 4

Installation

4.1 Required Materials

4.1.1 Customer-Supplied Items

4.1.2 Recommended List of Hand Tools and Equipment

4.2 Site Preparation

4.3 Installing and Levelling the Robot / Positioner Common Base

4.4 Installing the NX100 Controller Common Base

4.5 Installing the Welding Power Source Common Base

4.6 Installing the Operator Station Pedestal

4.7 Installing the Light Curtains

4.7.1 Installation

4.7.2 Light Curtain Alignment

4.7.3 Anchoring Light Curtain Fence Panels

4.8 Removing the Robot Shipping Bracket

4.9 Cable Connections

4.9.1 Connection to Earth Ground

4.9.2 Connection to Local Electrical Service

4.10 Safety / Operation Check

4.11 Installation of Tooling and Fixtures

Chapter 5

Operation

5.1 Programming

5.2 Sweeping the Positioner

5.3 Daily Operation

5.3.1 Start-Up

5.3.2 Robot Home Position

5.3.3 Master Job

5.3.4 Operation Cycle

5.3.5 Shutdown

5.4 System Recovery

5.4.1 Alarms and Errors

5.4.1.1 Error Messages

5.4.1.2 Minor Alarms

5.4.1.3 Major Alarms

5.4.2 E-STOP Recovery

5.4.3 Shock Sensor Recovery

5.4.4 Brake Release
Chapter 1

Introduction

1.1 About This Document

This System Manual is delivered with the ArcWorld® III-1200 system to provide a “first look” and overview of the complete Motoman ArcWorld® III-1200 system. You should read and understand this System Manual before moving on to the more detailed documentation that is included with your ArcWorld® III-1200 system. Although basic in content, the System Manual is intended for personnel who have received operator training from Motoman, and who are familiar with the operation of this particular Motoman system. For more detailed information on any specific component or peripheral of the ArcWorld® III-1200 system, please review the full documentation package that is included with your ArcWorld® III-1200 system (refer to Section 1.3).

This System Manual contains the following chapters:

CHAPTER 1 – INTRODUCTION
This chapter provides general information about the ArcWorld® III-1200 and its components, a list of reference documents, and information on how you can reach Motoman Customer Support.

CHAPTER 2 – SAFETY
This chapter provides general information regarding the safe installation, maintenance, and operation of the ArcWorld® III-1200 system.

CHAPTER 3 – DESCRIPTION OF EQUIPMENT
This chapter provides a description of the major components of the ArcWorld® III-1200 system.

CHAPTER 4 – INSTALLATION
This chapter provides instructions for installation of the ArcWorld® III-1200 system.

CHAPTER 5 – OPERATION
This chapter provides an overview of ArcWorld® III-1200 system operation, including start-up, loading, normal operations, fault recovery, and system shutdown.

CHAPTER 6 – MAINTENANCE
This chapter provides a listing of preventive maintenance requirements for certain components of the ArcWorld® III-1200 system.

APPENDIX A – ANCHOR REQUIREMENTS
Appendix A gives recommended anchoring hardware specifications and foundation requirements for components of the ArcWorld® III-1200 system.
1.2 System Overview

The ArcWorld® III-1200 system provides a complete arc welding solution in a standardized configuration. The system is designed around two Motoman EA1400N robots, two NX100 controllers, two welding power sources, and an MSR-500 rotary positioner. The rotary positioner allows an operator to prepare and set-up parts on one side of the positioner, while the robots weld parts on the other side of the positioner.

The ArcWorld® III-1200 system is delivered to the customer in the DR2C configuration. Refer to Section 3.2 for a more detailed description of the features and advantages of the DR2C configuration.

The ArcWorld® III-1200 system features a total safety environment that meets or exceeds the requirements of the ANSI/RIA R15.06-1999 standard, and is designed to safeguard both personnel and equipment. Heavy-gauge wire mesh safety fencing prevents unintended entry of personnel into the work cell while it is in operation. Arc curtains cover the wire mesh fencing to attenuate the amount of arc radiation that escapes the work cell during the welding operations. Dual-interlocked access doors on each side of the work cell provide convenient access to equipment while providing a safety interlock to disable all equipment should these doors be opened while the robots are active. A dual-channel, safety light curtain system provides a “sensing field” in front of the rotary positioner through use of an infrared light beam. Rotary positioner motion is prevented whenever an operator or object is in a position to disrupt the sensing field of the safety light curtain system. In addition, maximum robot travel is physically limited by an S-axis “hard stop” at the base of each robot.

Figure 1 illustrates the layout and component location for the ArcWorld® III-1200 system.
1.2.1 System Layout

Two EA1400N manipulators (robots), an MSR-500 180° rotary positioner, and heavy-gauge wire mesh safety fencing all share a common equipment base for ease of installation and assurance of proper alignment between the robots and rotary positioner. The wire mesh safety fencing completely surrounds the ArcWorld® III-1200 work cell. Both NX100 controllers share a common equipment base, as do both welding power sources. Both of these equipment bases are located outside of, and to the rear of, the work cell. This arrangement allows most of the component wiring interconnects to be accomplished at the factory, thus reducing the amount of point-to-point wiring tasks required of the customer. All operator controls, including those on the programming pendant, NX100 controllers, welding power supplies, and operator station pedestal are accessible from outside the ArcWorld® III-1200 work cell.

1.2.2 Major Components

The ArcWorld® III-1200 system includes the following major components:

- Two Motoman EA1400N manipulators (robots)
- Two NX100 controllers (DR2C configuration)
- One MSR-500 180° rotary positioner
- One programming pendant (located on the R1 NX100 controller)
- Operator station pedestal
- Welding equipment (for each robot):
  - Welding power supply
  - Welding torch (water-cooled or air-cooled)
  - Wire feeder
  - Applicable welding interface
  - Torch mount
- Safety equipment:
  - Heavy gauge, wire-mesh safety fencing
  - Arc curtains (cover the safety fencing)
  - Dual-channel, interlocked safety light curtain system
  - Dual-channel, interlocked work cell entry doors
  - Steel arc screen on the MSR-500 rotary positioner
1.2.3 Optional Equipment

The following optional equipment is available for use with the ArcWorld® III-1200 system:

- Torch cleaner
- Wire cutter
- Water circulator (for water-cooled torch unit)
- Touch Sense-Starting Point detection unit
- ComArc Seam Tracking

1.3 Reference Documentation

For additional information on individual components of the ArcWorld® III-1200 system, refer to the following documentation that is included with your delivered system:

- Motoman EA1400N Manipulator Manual (P/N 149208-1)
- Motoman NX100 Operator's Manual for General Purpose (P/N 150077-1)
- Motoman NX100 Controller Manual (P/N 149201-1)
- Motoman NX100 Maintenance Manual (P/N 150133-1)
- Motoman NX100 Operator's Manual for Arc Welding (P/N 149235-1)
- Motoman NX100 Concurrent I/O Parameter Manual (P/N 149230-1)
- Motoman NX100 Independent/Coordinated Control Function Manual (P/N 149648-1)
- Motoman MSR-Series Positioner Manual (P/N 147043-1)
- Motoman INFORM (Programming Language) User's Manual (P/N 150078-1)
- Vendor manuals for system components not manufactured by Motoman

1.4 Customer Support Information

If you need technical assistance with any aspect of your ArcWorld® III-1200 system, please contact Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

Please have the following information ready before you call:

- System (ArcWorld® III-1200, NX-Series)
- Robots (two EA1400N)
- Controller Type (NX100, DR2C configuration)
- Number of Controllers (2)
- Positioner Type (MSR-500)
- Application Type (welding)
- Software Version (access this information on the Programming Pendant LCD display screen by accessing MAIN MENU ➔ SYSTEM INFO ➔ VERSION)
- Robot Serial Number (located on data plate on each robot)
- Robot Sales Order Number (located on data plate on the front door of NX100 controller)
- Warranty ID Code (located on back of the programming pendant)
Chapter 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 R15.06-1999. The address is as follows:

**RoboticIndustriesAssociation**

900 Victors Way  
P.O.Box3724  
Ann Arbor, Michigan 48106  
TEL:(734)994-6088  
FAX:(734)994-3538  
http://www.roboticsonline.com

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 chapter 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, Operation, and Maintenance Safety (Section 2.6)

### 2.2 Standard Conventions

This manual includes the following alerts – in descending order of severity – that are essential to the safety of personnel and equipment. As you read this manual, pay close attention to these alerts to insure safety when installing, operating, programming, and maintaining this equipment.

**DANGER!**
Information appearing in a DANGER 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 in a WARNING 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 in a CAUTION 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 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 R15.06-1999, section 4.2.5, Sources of Energy, 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 R15.06-1999 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 equipment is provided as standard:

- Safety fences and barriers
- Light curtains and/or safety mats
- Door interlocks
- Emergency stop palm buttons located on operator station, robot controller, and programming pendant

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 R15.06-1999 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, Operation, and 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. 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 program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- 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 all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-STOP button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before 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.
• Any modifications to PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. 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.

• The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. 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 and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.

• Check and test any new or modified program at low speed for at least one full cycle.

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

• Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.

• Use proper replacement parts.

• 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).
NOTES
Chapter 3

Equipment Description

3.1 Robot Description

The ArcWorld®III-1200 system uses two Motoman EA1400N six-axis robots. Each EA1400N robot is specifically designed for arc welding applications. Each robot has a payload capability of 3 kg (6.6 lbs.) and features a horizontal reach of 1388 mm (54.6 inches). Each robot features a relative positioning accuracy of ±0.08 mm (±0.003 inch). The EA1400N robot has an internal cabling design that provides high flexibility and streamlines the robot profile, thus allowing access into confined spaces. The robot’s B-axis (Pitch/Yaw) features an expanded range of motion that improves circumferential welding on cylindrical work pieces. The T-axis (Twist) can rotate the welding torch ±360 degrees without cable interference.

For additional information on the Motoman EA1400N robots, please refer to the EA1400N Manipulator Manual that is included with your ArcWorld®III-1200 system (refer to Section 1.3).

3.2 NX100 Controllers

The ArcWorld®III-1200 system features two NX100 controllers (see Figure 2). The NX100 controllers are wired in a DR2C configuration. The DR2C configuration involves the interconnection of the two NX100 controllers, and how they control the operation of the two Motoman EA1400N robots and certain other system peripheral equipment. Through specific cable interconnections, the NX100 controllers are configured as NX100 controller (R1) and NX100 controller (R2). This configuration allows the two robots to operate as a dual system that takes advantage of all the unique functions available only in a dual system configuration. Yet, unlike a single-controller, dual-robot system, the DR2C configuration allows the system to be divided into two completely separate, stand-alone units, should that need arise in the future.

Note: Re-initialization of the NX100 controller after set-up, or separation of the system, must be performed by a trained Motoman technician. Re-initialization of the NX100 controller by a non-Motoman employee can VOID YOUR WARRANTY. Please contact Motoman 24-Hour Customer Support if you desire to change the configuration of the NX100 controllers (refer to Section 1.4).

The NX100 controllers also feature an integrated “soft PLC” with increased processing of input/output signals (I/O), faster scan time, and support for larger ladder programs when compared...
with earlier controllers. In addition to controlling the movement of the two robots, the NX100 controllers also control the two welding power sources, the MSR-500 rotary positioner, and provide the signals necessary to operate the two welding systems.

The NX100 controllers feature a real-time operating system (RTOS) and are programmed with the proprietary Motoman INFORM programming language.

For more detailed information on the NX100 controllers, refer to the *NX100 Controller Manual* that is included with your ArcWorld® III-1200 system (refer to Section 1.3).

![Diagram of NX100 Controllers](image)

**Figure 2** NX100 Controllers

### 3.3 Programming Pendant

The Programming Pendant (see Figure 3) provides the primary means of programmer/operator interaction with the ArcWorld® III-1200 system. The pendant features the Windows® CE operating system and displays information on a 6½-inch, color LCD, touch-screen display (640 X 480 VGA). The pendant also incorporates a Compact Flash card slot for program backups. An optional on-line troubleshooting guide for expert system maintenance is also available on the pendant display. The pendant provides icon-driven system programming. It also features a menu-driven interface to simplify operator interaction with the robots. Most operator controls are located on the programming pendant. This allows the NX100 controller cabinets to be mounted remotely. By using the pendant, the operator can teach robot motion; perform programming, editing, maintenance, and diagnostic functions; and transfer control of the ArcWorld® III-1200 system to or from the Operator Station. For detailed information on the pendant programming keys, programming functions, and display
functions, please refer to the NX100 Operator's Manual for Arc Welding that is included with your ArcWorld® III-1200 system (refer to Section 1.3).

Figure 3 NX100 Programming Pendant

Note: The Programming Pendant LCD display goes dark after a few minutes of inactivity. Press any key to restore the screen.

Note: Operator Station ENABLE/DISABLE is accomplished with the Programming Pendant MODE SELECT SWITCH. To transfer control of the ArcWorld® III-1200 system to the Operator Station, set the Programming Pendant MODE SELECT SWITCH to REMOTE. The Operator Station ENABLE/DISABLE function cannot be selected at the Operator Station.
3.4 **Operator Station**

The Operator Station (see Figure 4) includes a NEMA enclosure on a stand-alone pedestal. See Figure 1 for location of the Operator Station Pedestal in relation to other components of the ArcWorld®III-1200 system.

![Operator Station Controls](image)

**Figure 4 Operator Station Controls**

The following paragraphs describe the Operator Station controls:

**Cycle Start/Cycle Latched**

The operation of the CYCLE START/CYCLE LATCHED button depends upon the structure of the Master job.

The green CYCLE START/CYCLE LATCHED button, located on the operator station, initiates a positioner sweep cycle if the robots are in Home position. If the CYCLE START button is pressed while the robots are outside Home position, the CYCLE START command does not execute, and the positioner does not sweep until the robots return to Home position.

The green CYCLE LATCHED lamp illuminates when the CYCLE START button is pressed during operation. When the lamp is illuminated, the positioner will sweep and the robots will begin to weld immediately after the current weld cycle is complete, and the robots have returned to the Home position. It is not necessary to wait for the robots to finish welding and return to Home position before pressing the CYCLE START button to sweep the positioner. Pressing the CYCLE START button, while the robots are still in motion, latches the CYCLE START command into the controller.
If a person or object enters the safety zone created by the safety light curtain system, the CYCLE START command will unlatch and the positioner will not sweep.

**Emergency Stop (E-STOP)**
Pressing the red E-STOP button on the Operator Station removes servo power and stops all system operation. Brakes are applied to the robot and all positioner motion is stopped.

**Robot Hold**
Pressing the red ROBOT HOLD button stops robot operation and interrupts the job until the operator presses the green START button to resume operation. Operation resumes at the point in the program where the ROBOT HOLD state was initiated.

**Alarm**
A red ALARM lamp illuminates to indicate that a NX100 controller has encountered an alarm condition.

**Positioner Auto/Manual**
The POSITIONER AUTO/MANUAL switch is used to select AUTO or MANUAL mode for the MSR-500 rotary positioner. With the switch set to the AUTO position, the robots weld the parts immediately after the positioner sweeps. With the switch set to the MANUAL position, the robots do not immediately start to weld after the positioner sweeps. The robots remain in the Home position.

*Note: The POSITIONER AUTO/MANUAL signal depends upon the structure of the Master job.*

**Start**
Pressing the green START button starts the current, active job. The operator station must be enabled and servo power must be ON for the START button to function.

**Reset**
The black RESET button is used to clear a minor alarm or error condition.

**Servo On**
The green SERVO-ON push button turns servo power ON when the robot is in PLAY mode and the operator station is enabled.

### 3.5 MSR-500 Positioner
The MSR-500 positioner is part of the ArcWorld® III-1200 system. It is mounted on the same common equipment base as the EA1400N robots and the wire mesh safety fencing. The MSR-500 is a high-speed rotary positioner that features controlled rotary motion and a 500 kg (1,102.5 lb) payload capacity per side. A steel arc screen divides the positioner table top, providing two semicircular work areas (Side A and Side B). The steel arc screen creates a barrier that safeguards the operator from arc radiation and sparks produced during the welding operation. The MSR-500 uses a rotary motion to sweep each side of the circular turntable 180° from the operator’s loading zone, into the robot work zone, and back to the operator again. The positioner can accept optional external axis control for
coordinated motion between the positioner and the robots. See Figure 1 for a general view of the MSR-500 positioner.

**DANGER!**
Do not operate the MSR-500 positioner unless the arc screen is in place. Operation of the positioner without the arc screen in place can result in burns or serious eye damage for the operator.

For detailed positioner information, including illustrated parts lists, load capabilities, and dimensions, refer to the MSR-Series Positioner Manual that is included with your ArcWorld® III-1200 system (refer to Section 1.3).

*Note: All tooling and fixtures for the MSR-500 rotary positioner are supplied by the customer.*

*Note: In high humidity areas, use a surface protection compound to prevent corrosion of the tooling plates.*

### 3.6 Welding Equipment

In its standard configuration, the ArcWorld® III-1200 system includes a welding power source, wire feeder, torch, and torch mount for each of the two EA1400N robots. Optional equipment – water-cooled torches, water circulators, ComArc seam tracking units, and torch tenders – may also be included with your ArcWorld® III-1200 system.

#### 3.6.1 Welding Power Sources

Motoman offers various brands and types of welding power sources. The actual brand and type of welding power source supplied with the ArcWorld® III-1200 system depends on the customer’s specific application and preference. For specific information on the welding power sources supplied with your ArcWorld® III-1200 system, refer to the welding power source vendor manual that is included with your system (refer to Section 1.3).

#### 3.6.2 Wire Feeder

A welding wire feeder is mounted on the upper arm (U-Axis) of each EA1400N robot. The wire feeder is the “4-roll” type and provides reliable wire feeding at rates up to 750 inches per minute (ipm). An integral gas valve provides fast shielding gas response time. Interchangeable feed rolls are used to accommodate different wire gauges and wire types. For additional information on how the wire feeder is mounted to the robot upper arm, including allowable load and installation position, refer to the EA1400N Manipulator Manual that is included with your ArcWorld® III-1200 system (refer to Section 1.3).
3.6.3 **GMAW Torch**

The ArcWorld® III-1200 system uses either an air-cooled or a water-cooled robotic/automatic GMAW torch for each robot. These are heavy-duty torches designed for quick replacement and a minimum of robot reprogramming. The GMAW torch is installed at the end of the robot wrist flange. For applications that use the optional water-cooled torch, the ArcWorld® III-1200 system includes a water circulator kit for each robot. For additional information on the torches that are supplied with your system, refer to the documentation that is included with your ArcWorld® III-1200 system (refer to Section 1.3).

3.7 **Safety Features**

The ArcWorld® III-1200 system includes a total safety environment. If you comply with all standard safety precautions, the safety equipment helps to ensure safe operation of the robot work cell.

Note: Users are responsible for determining that the safeguards provided with the ArcWorld® III-1200 system are adequate for their plant conditions. Users must also ensure that all safeguards are maintained in working order.

3.7.1 **Welding Arc Protection**

Two forms of welding arc protection are part of the ArcWorld® III-1200 system –

- a steel arc screen on the MSR-500 rotary positioner
- arc curtains that cover the steel mesh safety fencing

The steel arc screen on the MSR-500 rotary positioner protects the operator from arc radiation and sparks that result from the welding operation (see Figure 1).

**WARNING!**

Although safety fence arc curtains block dangerous arc radiation, never look directly at the arc without protective eye wear.

Arc curtains cover the steel mesh safety fencing that surrounds the entire work cell. The curtains provide protection from arc flash and reduce the amount of ultra-violet radiation that escapes from the work cell during welding operations.

3.7.2 **Safety Fencing**

The heavy-gauge steel mesh safety fencing that is provided with the ArcWorld® III-1200 system attaches to the robot/controller common base and encloses the entire work cell. It forms a physical barrier that prevents personnel from entering the work cell during automatic operation.

3.7.3 **Safety Light Curtains**

The safety light curtain system consist of two units (a SEND unit and a RECEIVE unit) that emit and receive infrared light pulses to create an invisible protective field. The infrared light pulses, coded by the SEND unit, are sent to the RECEIVE unit, which evaluates them. If an object or person
penetrates the protective field created by the infrared light, outputs of the safety light curtain system change state to stop all machine motion. The safety light curtain system incorporates a dual-channel safety feature. The dual-channel feature provides redundant operation to ensure a continuous field of coverage for the area protected by the light curtain units.

With the ArcWorld® III-1200 system, the safety light curtains are set-up to protect personnel who might unintentionally enter the MSR-500 rotary positioner area during the positioner sweeping process. In PLAY mode, if the positioner is sweeping and the operator steps into the safety zone (defined by the light curtain SEND and RECEIVE units), servo power is removed from the ArcWorld® III-1200 system and all MSR-500 positioner motion stops. Servo power can be reapplied and the operation resumed (after the operator is clear of the protected area) by pressing SERVO ON and START on the Operator Panel. Refer to Figure 10 for the location and installation of the safety light curtains in the ArcWorld® III-1200 system.

3.7.4 Emergency Stops (E-STOPS)

In addition to the safety features described above, the ArcWorld® III-1200 system incorporates large, red, E-STOP push button switches, that are placed in accessible locations. When any E-STOP push button is activated (pushed in), the E-STOP circuitry immediately stops all system operation and robot movement.

E-STOP push button switches are found in the following locations:
- The door of NX100 Controller (R1)
- The Programming Pendant
- The Operator Station Pedestal

3.7.5 Programming Pendant ENABLE Switch

The ENABLE switch is part of the Programming Pendant, and provides a safety feature that controls servo power while the system is in TEACH mode (see Figure 5). 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 removed, thus preventing further robot movement. For detailed information about the operation of the ENABLE switch, refer to the NX100 Operator’s Manual for Arc Welding that is included with your ArcWorld® III-1200 system (refer to Section 1.3).

![Figure 5 Programming Pendant ENABLE Switch – Location and Operation](image.png)
3.7.6 **Emergency Braking System**

Each robot incorporates a series of brakes that are designed to protect the robot and other system components from damage in the event of a software or hardware robot control failure. Upon activation, the brake system stops all robot motion. The brake system incorporates a feature that allows the operator to release the brake of a specific robot axis when drive power has been removed from the system. Use the Programming Pendant to access the brake release function. Refer to Section 5.4.4 for brake release procedures.

3.7.7 **Interlocked Work Cell Doors**

A dual-redundant safety interlock is installed on each work cell access door to protect personnel. If either one of the work cell doors is opened while the robots are in PLAY mode, the robot Emergency Braking System activates, all servo power is removed from the system, and all positioner motion stops.
NOTES
Chapter 4
Installation

CAUTION!
The ArcWorld®III-1200 system should be installed by qualified personnel who are familiar with the installation and set-up of a robotic system.

CAUTION!
The ArcWorld®III-1200 system is not extremely fragile. It is, however, a sophisticated robotic system that can be damaged by rough handling. Be sure to handle all system components with care.

The ArcWorld®III-1200 system can be installed in a short amount of time by two to three qualified technicians. Always comply with established safety procedures throughout the installation process (refer to Chapter 2).

4.1 Required Materials

All system components and most hardware items required for installation of the ArcWorld®III-1200 system are included with your shipment. There are, however, some required items that the customer must supply (hand tools, special anchor bolts, etc.). These are not included with your shipment.

4.1.1 Customer-Supplied Items

- Shielding gas for the welding torches
- Local electrical service
- Earth ground wires for EA1400N robots, NX100 controllers, and peripheral equipment
- Ground rods and/or buried copper sheeting (quantity as required to achieve specified resistance-to-ground reading of 100 ohms or less)
- Chemical (optional) to increase conductivity of soil in the vicinity of the earth ground system
- Welding wire
- Clean, dry air supply (15 scfm @ 90 psig) for torch tender or wire cutter options
- Stepladder
- Forklift and/or overhead crane
4.1.2 Recommended List of Hand Tools and Equipment

- Safety glasses
- Face shield
- Gloves (heavy-duty leather recommended)
- Level (short and long)
- Ratchet Handle (with 3/4-inch hex socket)
- Adjustable wrench
- Hammer drill with appropriate concrete bits
- Phillips and flat-blade screwdrivers
- Hammer (dead-blow and steel)
- Hammer (non-marring)
- Socket set (SAE and Metric)
- Air-impact gun (with 3/4-inch hex socket)
- Open-end wrench set (SAE and Metric)
- Socket head wrench set (Allen®, Bondhaus®, etc)

Note: Special anchor bolts (lag bolts) will be supplied by the customer. Refer to Appendix A for a listing of special bolts that are required for anchoring the common equipment bases and other components of the ArcWorld® III-1200 system.

4.2 Site Preparation

**WARNING!**
Be sure to allow for sufficient room for maintenance on the robots, NX100 controllers, and other peripheral equipment. Failure to observe this precaution could result in injury to personnel during system maintenance.

To prepare your site, proceed as follows:

1. Clear floor space needed for the ArcWorld® III-1200 system (see Figure 6). Allow an additional 1.2 - 1.5 m (4 to 5 ft) on all sides of the work cell to facilitate installation.

2. Gather all customer-supplied items and required tools (refer to Section 4.1).

---

![Figure 6](image)

**Figure 6** Installation Dimensions for the ArcWorld® III-1200 System
4.3 Installing and Levelling the Robot / Positioner Common Base

The robot/positioner common base and operator station are shipped on a wooden shipping skid. To install the robot/positioner common base, proceed as follows:

CAUTION!

Handle system components carefully. Some components can be damaged if dropped or otherwise handled roughly.

1. Unbolt the robot/positioner common base from the wooden shipping skid. The bolts that secure the common base to the wooden shipping skid go down through the hollow levelling screws and are threaded into the wooden shipping skid (see Figure 7). It may be necessary to hold the levelling screws in place with a suitable open-end wrench, while removing the shipping bolts.

2. Locate the operator station pedestal and set aside in a secure location for later installation (refer to Section 4.6).

Figure 7  Stabilizing and Lag Points (Robot / Positioner Common Equipment Base)

WARNING!

As shipped, the robot / positioner common base (with equipment) weighs approximately 2200 kg (4409 lbs). Use an overhead crane that is rated for this amount of weight load.

3. Using an overhead crane, lift the common base from wooden shipping skid. Discard or recycle the wooden shipping skid.
4. Place robot/positioner common base in position (see Figure 6).

   Note: Make sure there is adequate room on all sides of the robot/positioner common base for the operator station, the light curtains, and the auxiliary equipment common bases (see Figure 6).

5. Carefully remove protective plastic wrapping from the robots, torches, and the rotary positioner.

6. Inspect the robots, torches, and rotary positioner for shipping damage.

   Note: If you notice any equipment damage, notify your shipping contractor as soon as possible.

7. Use an M36 socket to loosen or tighten each levelling bolt to level the robot/rotary positioner common base (see Figure 7).

   **CAUTION!**
   
   Be absolutely certain of the correct location for the robot/positioner common base before securing the base with anchor (lag) bolts.

8. Secure the robot/positioner common base to the floor. Use a suitable concrete drill bit and special anchor (lag) bolts (refer to Appendix A for the correct drill bit and anchor bolt). Be sure to remove all concrete dust from the drilled hole before driving each anchor bolt.
4.4 Installing the NX100 Controller Common Base

The two NX100 controllers, along with a fused electrical service disconnect box, are mounted on a common base (see Figure 2 and Figure 8). As delivered to the customer, the common base is attached to wooden shipping blocks by four shipping bolts. To install the NX100 controllers common base, proceed as follows:

1. Separate the wooden shipping blocks from the NX100 controllers common base by removing all four shipping bolts (see Figure 8).

WARNING!
As shipped, the NX100 controllers common base (with equipment) weighs approximately 600 kg (1320 lbs). Use an overhead crane or forklift that is rated for this amount of weight load.

2. After you remove the shipping bolts, use an overhead crane or forklift to lift the NX100 controllers common base just enough to allow the wooden shipping blocks to be pushed out of the way. Discard or recycle the shipping blocks.

3. Place the NX100 controllers common base in position behind the ArcWorld® III-1200 work cell (see Figure 6).

4. Remove protective plastic wrapping and cardboard from the NX100 controllers common base. Also, carefully remove any protective plastic wrapping from each of the NX100 controllers.

5. Inspect the NX100 controllers, fused electrical service disconnect, and common base for shipping damage.

Note: Notify your shipping contractor as soon as possible, if you notice any shipping damage.
CAUTION!

Be absolutely certain of the correct location for the NX100 controllers common base before securing the base with anchor (lag) bolts.

6. Secure the NX100 controller common base to the floor. Use a suitable concrete drill bit and special anchor (lag) bolts (refer to Appendix A for correct drill bit and anchor bolt). Be sure to remove all concrete dust from the drilled hole before driving each anchor bolt.

*Note: The lag bolts use the same holes in the NX100 common base as did the previously removed shipping bolts.*

4.5 Installing the Welding Power Source Common Base

The two welding power sources, along with two fused electrical service disconnect boxes, are mounted on a common base (see Figure 9). As delivered to the customer, the common base is attached to wooden shipping blocks by four shipping bolts. To install the welding power source common base, proceed as follows:

1. Separate the wooden shipping blocks from the welding power source common base by removing all four shipping bolts (see Figure 9).
**WARNING!**
As shipped, the welding power source common base (with equipment) weighs approximately 1600 kg (3520 lbs). Use an overhead crane or forklift that is rated for this amount of weight load.

1. After you remove the shipping bolts, use an overhead crane or forklift to lift the welding power source common base just enough to allow the wooden shipping blocks to be pushed out of the way. Discard or recycle the shipping blocks.
2. Place the welding power source common base in position behind the ArcWorld® III-1200 work cell (see Figure 6).
3. Remove protective plastic wrapping and cardboard from the welding power sources common base. Also, remove any protective plastic wrapping from the welding power sources.
4. Inspect the welding power sources and common base for shipping damage.

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

**CAUTION!**
Be absolutely certain of the correct location for the welding power source common base before securing the base with anchor (lag) bolts.

5. Secure the welding power source common base to the floor. Use a suitable concrete drill bit and special anchor (lag) bolts (refer to Appendix A for correct drill bit and anchor bolt). Be sure to remove all concrete dust from the drilled hole before driving each anchor bolt.

*Note: The lag bolts use the same holes in the welding power source common base as did the previously removed shipping bolts.*

### 4.6 Installing the Operator Station Pedestal

To install the operator station pedestal, proceed as follows:

1. Locate operator station pedestal (previously put aside in secure location).
2. Carefully remove protective plastic wrapping from operator station pedestal.
3. Inspect operator station pedestal for shipping damage.

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

4. Place operator station pedestal outside light curtain fence panels (see Figure 6 and Figure 10 for recommended location).

**CAUTION!**
Be absolutely certain of the correct location for the operator station pedestal before securing the pedestal with anchor (lag) bolts.

5. Secure the Operator Station Pedestal to the floor. Use a suitable concrete drill bit and special anchor (lag) bolts (refer to Appendix A for correct drill bit and anchor bolt). Be sure to remove all concrete dust from the drilled hole before driving each anchor bolt.
4.7 Installing the Light Curtains

4.7.1 Installation

The light curtain components — the sender unit, the receiver unit, and the two fence panels to which the light curtain units are attached — are pre-assembled and secured inside the work cell for shipping. Refer to Figure 10 and install the light curtain assemblies to the work cell safety fencing as follows:

1. Remove both light curtain fence panels from their shipping position.
2. Install the light curtain fence panels to the wire mesh safety fencing. Use the three bolt holes located on the safety fence posts to mount the light curtain fence panels to the safety fencing (see Figure 10).

Note: The light curtains are oriented properly when the light curtain status indicator lamps (on each light curtain unit) are located closest to the floor.

3. The light curtain signal cables are secured and stowed under the base of the MSR-500 rotary positioner prior to shipping. Locate those cables and attach them to the light curtain sender unit and receiver unit.

4.7.2 Light Curtain Alignment

The light curtain sender unit and receiver unit must be accurately positioned, relative to each other, to ensure correct operation. Complete alignment procedures are included in the light curtain documentation that is included with your ArcWorld® III-1200 system (refer to Section 1.3).

4.7.3 Anchoring Light Curtain Fence Panels

When the light curtain fence panels are correctly attached to and aligned with the wire mesh safety fencing, perform the following steps to complete the installation of the light curtain fence panels:

1. Secure the safety light curtain fence panel posts to the floor (see Figure 10). Use a suitable concrete drill bit and special anchor (lag) bolts (refer to Appendix A for correct drill bit and anchor bolt). Be sure to remove all concrete dust from the drilled hole before driving each anchor bolt.

2. After installing the anchor (lag) bolts, check the alignment of the light curtain sender unit and receiver unit, and adjust as necessary for correct operation. If necessary, refer to the safety light curtain documentation that is included with your ArcWorld® III-1200 system (refer to Section 1.3).
CAUTION!

Be sure to remove the shipping bracket from each EA1400N robot prior to power-up or operation. Operation of a robot, without removal of the shipping bracket, can damage the robot drive components.

A bracket is installed on each robot at the factory to prevent undesired movement during shipping (see Figure 11). The bracket is painted a bright yellow color for easy location and identification. The bracket secures the lower arm (L-axis) of the robot to the S-axis housing. In addition, the bracket provides the correct hoisting points should either of the robots need to be removed from the ArcWorld®III-1200 work cell. Upon bracket removal, be sure to keep both brackets and attaching hardware in a safe location, should they be needed in the future.
4.9 **Cable Connections**

After the ArcWorld® III-1200 components and peripherals are secured in their correct locations, unwrap the cables from around the equipment and route them according to the cable diagrams included in the documentation supplied with your ArcWorld® III-1200 system. All cables and connectors are labelled for ease of installation.

*Note:* A small gap exists between the bottom of the work cell safety fence and the robot/positioner common equipment base. This gap provides a passage for cables that must run between components that are outside the work cell and those that are inside the work cell.

4.9.1 **Connection to Earth Ground**

**WARNING!**

Do not use the ArcWorld® III-1200 system unless specified components are connected to a low-resistance earth ground. Do not connect the earth ground wire with the wires for the electric power source, welder, etc. The low-resistance earth ground must be a “dedicated” ground that is a direct connection between the component and the earth ground point. Operator injury or death, as well as equipment damage, can result from an inadequate or defective earth ground system.

Each robot and both NX100 controllers must be connected to an earth ground. If a ground stake is used, it should be driven at least 2.43 m (8 ft) into the soil. The soil surrounding the driven ground stake should be treated with a chemical that increases the soil conductivity in the vicinity of the driven ground stake. This is often referred to as a “low-resistance earth ground” and may require quite a bit more than a single driven ground rod, depending on soil conditions. Often, multiple ground stakes (bonded together) or even a bonded network of buried copper sheeting (plus conduction-enhancing chemicals) may be required, depending on local soil condition. In any event, the “low-resistance earth ground...
“ground” must indicate a resistance of **100 ohms or less** (when measured directly between grounded equipment and the earth ground system). Be advised that specialized measuring equipment is usually required to get an accurate “resistance-to-ground” reading. Consult a specialist in this field, if required.

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

Connect both robots and NX100 controllers to the earth ground as follows:

1. Connect one end of an earth ground wire to the lug marked EARTH GROUND on the connector panel of EA1400N robot (R1). Connect the other end of the earth ground wire to the low-resistance earth ground.
2. Connect one end of an earth ground wire to the lug marked EARTH GROUND on the connector panel of EA1400N robot (R2). Connect the other end of the earth ground wire to the low-resistance earth ground.
3. Connect one end of an earth ground wire to the COMMON GROUND BUS BAR located inside NX100 controller (R1). Connect the other end of the earth ground wire to the low-resistance earth ground.
4. Connect one end of an earth ground wire to the COMMON GROUND BUS BAR located inside NX100 controller (R2). Connect the other end of the earth ground wire to the low-resistance earth ground.

### 4.9.2 Connection to Local Electrical Service

**DANGER!**

Connection of the ArcWorld®1200 system to local electrical service must be done by a qualified licensed electrician. Electrical and grounding connections must comply with the National Electrical Code (NEC) as well as local electrical codes.

After all of the system components have been properly installed and interconnected, connect local electrical service to the fused electrical service disconnect boxes. The boxes are installed at the following locations:

- One disconnect box located on the NX100 controller common base (see Figure 1 and Figure 2).
- Two disconnect boxes located on the welding power source common base (see Figure 1 and Figure 9)

Note: The ArcWorld®III-1200 system is configured for 3-phase 460/480V AC primary power. For additional information, please refer to the electrical drawings and schematics that are included with your ArcWorld®III-1200 system.
4.10 Safety / Operation Check

Before installing the tooling and fixtures for your application, take a few minutes to perform the following safety/operation check –

1. Ensure that the shipping bracket is removed from each EA1400N robot (refer to Section 4.8).
2. Ensure that a clearance of at least 2.5 cm (1 in.) exists on either side of the MSR-500 rotary positioner.
3. Ensure correct alignment and operation of the safety light curtain sender and receiver units.
4. Ensure that both work cell access doors are closed and door interlocks engaged.
5. Check the torque and security of all cable connections.
6. Ensure the correct setting of the welding power sources (refer to the welding power source documentation that is included with your ArcWorld® III-1200 system).
7. Verify that local electrical service is correctly wired into the fused disconnect boxes on the NX100 controllers common base and the welding power source common base (refer to Section 4.9.2).
8. Verify that the local electrical service specifications comply with the power requirements for your ArcWorld® III-1200 system.

CAUTION!
The ArcWorld®1200 system is now ready for power-up. Ensure that qualified, trained operators, who are familiar with the ArcWorld®1200 system, perform this power-up sequence.

9. Switch ON the electrical service disconnect box located on the NX100 controllers common base (see Figure 2).
10. Set POWER ON-OFF switch on NX100 controller (R2) to ON (see Figure 2).
11. Set POWER ON-OFF switch on NX100 controller (R1) to ON (see Figure 2).
12. Switch ON the electrical service disconnect boxes located on the welding power source common base (see Figure 9).

WARNING!
Before operating the robots, check each E-STOP push button to verify that servo power can be disabled by activation of the E-STOP. Injury to personnel or equipment damage can result from an E-STOP circuit defect. The E-STOP push buttons must be able to positively stop robot and positioner movement during an emergency situation.

13. Check system E-STOP push buttons
14. Check system HOLD buttons.
15. Ensure correct action of safety interlocks on both work cell access doors.
16. Remove power from the ArcWorld®III-1200 system after completion of the safety / operation check.
4.11 Installation of Tooling and Fixtures

Your ArcWorld® III-1200 system is now ready for installation of tooling and fixtures for your particular application. Personnel who are familiar with the operation of the ArcWorld® III-1200 system should do the installation. After tooling installation, test the MSR-500 positioner for correct operation.

Note: All tooling and fixtures for the MSR-500 rotary positioner are supplied by the customer.
NOTES
Chapter 5
Operation

The ArcWorld®III-1200 system is a fully integrated robotic GMAW welding cell. Two Motoman EA1400N robots weld on one side of the MSR-500 rotary positioner while the operator loads the opposite side with parts to be welded. Once the robots are finished with the welding process, they return to a Home (Safe) position. The operator then enables the positioner sweep, allowing the robots to start welding on the next parts. This section provides operation instructions for the ArcWorld®III-1200 system.

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. For additional programming procedures and information, refer to the NX100 controller and operator documentation that is included with your ArcWorld®III-1200 system (refer to Section 1.3).

Any changes made to your system configuration and/or job structure will alter the operation of the system. Motoman recommends that you DO NOT modify the original jobs and system configuration of your ArcWorld®III-1200 system. If you determine a need to modify the original jobs and system configuration, make any modifications to a copy of the original. Keep the original as a backup. Do not modify the original. Modifications must be performed by trained and experienced personnel, who are familiar with the operation of the ArcWorld®III-1200 system. If you have questions concerning the configuration of your ArcWorld®III-1200 system, please contact Motoman 24 hour Customer Support (refer to Section 1.4).

5.2 Sweeping the Positioner

Note: The robots must be in the Home position before you can sweep the positioner.

MANUAL mode allows you to sweep the MSR-500 positioner without activating the robots. Parts can be loaded onto the fixture to achieve the most efficient configuration and then swept into the welding zone, before teaching the robots a series of moves. To sweep Side A or Side B of the positioner into the robot’s welding zone, proceed as follows:
1. Place both robots in Home position (refer to Section 5.3.2).

2. Make sure that the operator station is enabled (programming pendant MODE SELECT SWITCH set to REMOTE).

3. Set the operator station POSITIONER switch to MANUAL mode and start Master job (refer to Section 5.3.3). Normally, robots will not move out of Home position when the POSITIONER switch is in MANUAL. (This depends on job structure.)

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

4. Press the CYCLE START button on operator station (the MSR-500 positioner sweeps each time the CYCLE START button is pressed).

### 5.3 Daily Operation

The procedures below represent the typical operating sequence from power up to shutdown. Your basic operating procedures may vary depending on your situation.

- Perform start-up procedures (refer to Section 5.3.1).
- Move robots to Home position (refer to Section 5.3.2).
- Select master job (refer to Section 5.3.3).
- Perform operation cycle (refer to Section 5.3.4)
- Perform shutdown procedures (refer to Section 5.3.5)

#### 5.3.1 Start-Up

To start up the ArcWorld® III-1200 work cell from a power-off condition, proceed as follows:

1. Switch the NX100 controller electrical service disconnect box to ON (see Figure 1).
2. Set POWER ON-OFF switch on NX100 controller (R2) to ON (see Figure 2).
3. Set POWER ON-OFF switch on NX100 controller (R1) to ON (see Figure 2).
4. Switch both welding power source electrical service disconnect boxes to ON (see Figure 9).
5. Set POWER ON-OFF switch on each welding power source to ON (ON-OFF indicator lamp on each welding power source will illuminate).
6. Open regulator valve on welding gas supply.
7. Make sure that both work cell doors are closed and door safety interlocks engaged.
8. Make sure all E-STOP buttons are released. E-STOP buttons are installed at the following locations:
   - Programming pendant
   - Door of the NX100 controller (R1)
   - Operator station pedestal
9. Select TEACH mode on the programming pendant.
10. Place robots in Home position (refer to Section 5.3.2).
5.3.2 **Robot Home Position**

To move the robot to the Home position:

1. Select TEACH mode on the programming pendant.
2. Select MAIN MENU on programming pendant touch screen.
3. Select JOB on programming pendant touch screen.
4. Select SELECT JOB on programming pendant touch screen (a job list appears on the screen).
5. Use the navigation cursor key to move the cursor to R1 SAFE job and press SELECT (the job appears on the display screen).
6. Turn servo power ON by pressing SERVO ON and holding in the ENABLE switch.
7. Use the FWD button on programming pendant to jog robot (R1) to Home position.
8. Use the navigation cursor key to move the cursor to R2 SAFE job and press SELECT (the job appears on the display screen).
9. Turn servo power ON by pressing SERVO ON and holding in the ENABLE switch.
10. Use the FWD button on programming pendant to jog robot (R2) to Home position.

5.3.3 **Master Job**

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

1. Select JOB on programming pendant touch screen.
2. Select CTRL MASTER on programming pendant touch screen. Press SELECT twice to activate the Master job.
3. Select PLAY mode on programming pendant and press the PLAY ENABLE button on the NX100 controller (R1) door (job playback operation is enabled).
4. Press SERVO ON button on the programming pendant.
5. Press START button on programming pendant (the Master job cycles, waiting for a CYCLE START input from operator station).
6. Transfer control to the operator station by selecting REMOTE on the programming pendant MODE SELECT SWITCH.

The ArcWorld®III-1200 work cell is now ready for operation.

5.3.4 **Operation Cycle**

The following is the typical sequence of operation for the ArcWorld®III-1200 work cell after start-up:

1. Operator loads the fixture (on operator side of positioner) with parts to be welded.
2. Operator steps out of safety zone created by the safety light curtain system, and moves to front of operator station pedestal.
3. Operator presses the green CYCLE START button on operator station pedestal. The MSR-500 positioner sweeps 180°, thus placing parts to be welded into the robot work area. The robots then begin to weld the parts (if the operator station POSITIONER AUTO/MANUAL switch is set to AUTO).

4. While the robots are welding, the operator loads operator side of the positioner with the next group of parts to be welded.

5. The operator again moves to the operator station pedestal and presses the green CYCLE START button (CYCLE LATCHED light illuminates). When the robots are finished welding, they return to Home position. The MSR-500 positioner then sweeps 180° to return completed, welded parts to the operator position, while moving the next group of parts into the robot work area.

6. Operator moves back to the operator side of the MSR-500 positioner and unloads completed, welded parts.

5.3.5 Shutdown

Use the following procedure to perform a normal shut down of the ArcWorld® III-1200 system:

1. Make sure the robots are in Home position.
2. Turn off system servo power by pressing the E-STOP button on operator station pedestal or programming pendant.
3. Select TEACH mode on the programming pendant.
4. Set both NX100 controller POWER ON-OFF switches to OFF position.
5. Set both welding power source POWER ON-OFF switches to OFF position.
7. Switch all electrical service disconnect boxes to OFF.

The ArcWorld® III-1200 system is now shut down.

5.4 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 clear them.

5.4.1 Alarms and Errors

Alarms and errors will stop the program. There are three levels:

- Error Messages
- Minor Alarms
- Major Alarms.
For more detailed information on alarm and error recovery, refer to the NX100 controller and EA1400N robot documentation that is included with your ArcWorld® III-1200 system (refer to Section 1.3).

5.4.1.1 Error Messages

Error messages are usually the result of simple, easily-cleared operation errors. An example could include:

- Pressing the START button when the robots are not in PLAY mode

Clear errors of this type by pressing the CANCEL button on the programming pendant.

5.4.1.2 Minor Alarms

Minor alarms usually involve programming errors. Clear alarms of this type by pressing the CANCEL button on the programming pendant.

5.4.1.3 Major Alarms

Major alarms usually involve hardware failures. Examples could include:

- An overload condition
- An abnormal speed

Clear alarms of this type by cycling the NX100 controllers (switch the POWER ON-OFF switch on each controller to OFF, then back to ON).

5.4.2 E-STOP Recovery

An E-STOP (emergency stop) will occur under any of the following conditions:

- An E-STOP switch is pushed in (activated)
- A work cell access door is opened while the robots are not in TEACH mode
- The safety light curtain system is triggered while the MSR-500 positioner is sweeping
- A collision triggers a shock sensor output

To restart the ArcWorld® III-1200 system after an E-STOP condition occurs, follow the procedures below.

1. To clear the E-STOP condition, perform any of the following actions that apply:
   - Release the activated E-STOP push button
   - Close work cell access door(s)
   - Clear the area (in front of the MSR-500 positioner) that is protected by the safety light curtain system
   - Clear shock sensor condition (refer to Section 5.4.3).
CAUTION!
If an emergency stop condition occurs while the positioner is sweeping, the positioner will continue the sweep when the ArcWorld®III-1200 system is restarted.

2. Press the SERVO ON button on operator station or programming pendant.
3. Ensure that the programming pendant is in REMOTE mode (programming pendant MODE SELECT SWITCH set to REMOTE).
4. Press the green START button on the operator station.

The ArcWorld®III-1200 system is now ready to continue operation.

5.4.3 Shock Sensor Recovery

Each EA1400N robot 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 signal that triggers an E-STOP condition. To clear the E-STOP condition, you must override the shock sensor and move the affected robot clear of the impact. To override the shock sensor, proceed as follows:

1. Select MAIN MENU on programming pendant touch screen.
2. Select ROBOT on programming pendant touch screen.
3. Select OVERRUN-S.SENSOR on programming pendant touch screen.
4. Select RELEASE to release shock sensor.
5. Turn servo power ON (press in on the pendant ENABLE switch while pressing SERVO ON READY).
6. Move the affected robot clear of the impact position.

The ArcWorld®III-1200 system is now ready to continue operation.

5.4.4 Brake Release

The emergency braking system is designed to protect the robots and other system components from damage in the event of a system/robot failure or loss of drive power. If a system or robot failure occurs, you must release the brakes on the affected robot in order to move it. To release the brakes, proceed as follows:

WARNING!
Always support the robot axis to be released BEFORE you release it. Without adequate robot axis support, brake release could cause personal injury or machine damage.

1. On the programming pendant, select TEACH mode and turn servo power OFF.
2. Select ROBOT on the pendant display (touch) screen.
3. Select the BRAKE RELEASE option.
4. Select the control group (R1, R2, S1).
5. While pressing in on the pendant ENABLE switch, hold down the minus key for the axis to be released (S-, L-, U-, etc.).
6. The brake for the selected axis will release.
Chapter 6
Maintenance

Maintenance of the ArcWorld®III-1200 system and components must be performed by authorized personnel who are familiar with the ArcWorld®III-1200 system. Perform the procedures given in this chapter only as needed (on condition). Be sure to read and understand the documentation for a particular component before doing repair maintenance or preventive maintenance on that component. Be sure that you understand the maintenance procedures, have the proper tools at hand, and comply with safety precautions given in Chapter 2.

Be advised that the maintenance intervals given in this chapter are recommendations, only. Adjust the frequency and level of repair maintenance and preventive maintenance to suit your specific equipment schedules and shop environment.

For periodic maintenance procedures and schedules for the individual components of your ArcWorld®III-1200 system, refer to the documentation that is included with your ArcWorld®III-1200 system (refer to Section 1.3).

CAUTION!
If your system uses a water-cooled torch, use only Motoman-specified antifreeze. Typical automotive antifreeze contains additives that can clog the small cooling ports in the torch, and can damage sealing gaskets in the water circulator pump.

Table 1 Periodic Maintenance

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>COMPONENT</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily (or on condition)</td>
<td>Water Circulator (water-cooled torch application, only)</td>
<td>Add a mixture of Motoman antifreeze (P/N 131224-1) and distilled water, as required. Mix antifreeze and distilled water in proportions shown on the antifreeze container.</td>
</tr>
<tr>
<td></td>
<td>All safeguard items – work cell door interlocks, E-STOP push buttons, safety light curtains, arc curtains, etc.</td>
<td>Check physical condition of safeguard item and ensure that the safeguard item is working correctly</td>
</tr>
<tr>
<td>Monthly (or on condition)</td>
<td>ArcWorld®III-1200 work cell</td>
<td>Remove accumulated dirt, grease, and debris from inside and outside the work cell.</td>
</tr>
</tbody>
</table>
Appendix A

Anchor Requirements

The purchaser must determine all anchoring and foundation requirements, and supply the appropriate anchoring hardware for a particular installation. Before installing the ArcWorld® III-1200 system, refer to Table A.1 to determine special anchor and foundation requirements.

WARNING!
Do not mount robots directly to the floor without the indicated floor plate. Failure to follow floor plate requirements can result in equipment damage or injury to personnel.

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>MINIMUM 'HILTI' ANCHOR ROD DIAMETER AND TYPE</th>
<th>MINIMUM FLOOR PLATE REQUIREMENTS</th>
<th>MINIMUM FOUNDATION REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROBOTS: UP6, UP20, UP20-6, EA1400, EA1900</td>
<td>5/8” HVA Chemical Style anchor (Note 3)</td>
<td>600mm (24 inches) Length 600mm (24 inches) Width 38.1mm (1.5 inches) Thick</td>
<td>30” x 30” x 7&quot; thick, 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>ROBOTS: UP20M, UP50, SP80 (Note 2)</td>
<td>7/8” HVA Chemical Style anchor (Note 3)</td>
<td>900mm (35 inches) Length 900mm (35 inches) Width 50.8mm (2 inches) Thick</td>
<td>60” x 60” x 9&quot; thick, 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>ROBOTS: UP120, UP130, UP165, SP100, SP160, SP250, SP400 (Note 2)</td>
<td>7/8” HVA Chemical Style anchor (Note 3)</td>
<td>1200mm (47 inches) Length 1200mm (47 inches) Width 50.8mm (2 inches) Thick</td>
<td>72” x 72” x 9&quot; thick, 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>ROBOTS: UP200</td>
<td>7/8” HVA Chemical Style anchor (Note 3)</td>
<td>1200mm (47 inches) Length 1200mm (47 inches) Width 50.8mm (2 inches) Thick</td>
<td>72” x 72” x 9&quot; thick, 4000 psi Reinforced Concrete</td>
</tr>
</tbody>
</table>
### Table A.1 Minimum Recommended Equipment Anchor Requirements

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>MINIMUM 'HILTI' ANCHOR ROD DIAMETER AND TYPE</th>
<th>MINIMUM FLOOR PLATE REQUIREMENTS</th>
<th>MINIMUM FOUNDATION REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROBOTS: UP350, UP500, SK300X</td>
<td>7/8” HVA Chemical Style anchor (Note 3)</td>
<td>1500mm (59 inches) Length 1500mm (59 inches) Width 50.8mm (2 inches) Thickness</td>
<td>72” x 72” x 9” thick, 4000 psi Reinforced Concrete</td>
</tr>
<tr>
<td>POSITIONER: Rotary-Style</td>
<td>5/8” HVA Chemical Style anchor (Note 3)</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>POSITIONER: Trunnion-Style</td>
<td>7/8” HVA Chemical Style anchor (Note 3)</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Peripheral Equipment:</td>
<td>1/2” Kwik Bolt II Style anchor (Note 4)</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>Work cell Fence Posts:</td>
<td>3/8” Kwik Bolt II Style anchor (Note 4)</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>Operator Station Pedestal</td>
<td>1/4” Kwik Bolt II Style anchor (Note 4)</td>
<td>Not Applicable</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

1. Minimum Robot Lagging Requirements are based on Maximum Repulsion Forces and Hilti Anchor Design Program (v3.3b).
2. SP series robots require base plates and/or risers to be level within ± 2°. Grout if necessary.
3. Reference source: Hilti Product Technical Guide (section 4.2.1) for hardware specifications or equivalent.
4. Reference source: Hilti Product Technical Guide (section 4.3.3) for hardware specifications or equivalent.
5. Robot manual requirements calling for cast-in anchors may be substituted with the recommendations listed.

Refer to [http://us.hilti.com](http://us.hilti.com) or [http://ca.hilti.com](http://ca.hilti.com) for further information.
## Index

### Symbols / Numerics

- (ANSI/RIA R15.06-1999) 5
- DR2C 2, 11
- MSR-500 15
- NX100
  - description 11
  - DR2C configuration 11
  - installation 25

### A

- about this document 1
- alarms and error messages 39
- anchor requirements and special hardware 43
- antifreeze, special requirement 41
- appendix A 43

### B

- back-ups, original jobs and configuration 35
- brake release 40

### C

- cable connections 30
- common equipment base 3
- components, ArcWorld®III-1200 system 3
- controller
  - description 11
  - DR2C configuration 11
  - installation 25
- customer-supplied items 21
- customer support information 4

### D

- daily operation 36
- documentation (included with ArcWorld®III-1200) 4
- doors, safety interlocks 19

### E

- earth ground
  - connections 31
  - importance of 30
  - theory 30
- (cont)
  - E-STOPs (emergency stops) 18
  - ENABLE switch 18
  - equipment description 11

### I

- installation
  - robot/positioner common base 23
  - NX100 controller common base 25
  - welding power source common base 26
  - qualified personnel 21
  - required materials 21
  - safety 8
  - operator station pedestal 27
  - light curtains 28
  - site preparation 22
  - tooling and fixtures 33
  - interlocked work cell doors 19

### L

- layout, ArcWorld®III-1200 System 3
- light curtain
  - alignment 28
  - anchoring light curtain fence panels 28
  - as a mechanical safety device 7
  - as part of ArcWorld®III-1200 system 2, 17
- installation 28
- low-resistance earth ground (see earth ground)

### M

- master job 37
- mechanical safety devices 7

### O

- operation
  - alarms and errors 38
  - daily 36
  - E-STOP recovery 39
  - operation cycle 37
  - programming 35
  - robot home position 37
  - shutdown 38
  - start-up 36
  - sweeping the positioner 35
O (cont)

operation (cont.)
  system recovery 38
  shock sensor recovery 40
  brake release 40
operator station 14
optional equipment 4
overview, ArcWorld® III-1200 system 2

P

power sources, welding 16
preventive maintenance 41
programming
  ENABLE switch 18
  language 12
  modification 35
  pendant 12
  safety 8

R

reference documentation 4
required installation materials 21
robot
  description (EA1400N) 11
  home position 37
  shipping bracket, removal 29
  rotary positioner 15

S

safety
  equipment 3

S (cont)

safety (cont.)
  features 17
  fencing 17
  general safeguarding tips 6
  introduction 5
  programming, operation, and maintenance 8
  and operation check 32
  standard conventions 6

  safety fence anchoring 28
  safety light curtains (see light curtains)
  shipping bracket, removal 29
  shock sensor 40

  site preparation 22

  system
    layout 3
    overview 2
    recovery 38
    shutdown 38
    start-up 36

T

tools, recommended 22

W

water circulator 41
welding equipment
  supplied with the ArcWorld® III-1200 system 16
  power sources 16
  wire feeder 16
  GMAW torch 17
  arc protection (see safety: features)