Upon receipt of the product and prior to installation, initial operation, or maintenance read these instructions thoroughly and retain for future reference.

MOTOMAN INSTRUCTIONS
SIGMA 5 INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL
DX200 MAINTENANCE MANUAL

The DX200 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 169856-1CD
Revision: 1
MANDATORY

General items related to safety are listed in Section 2 of the DX200 Controller Manual. To ensure correct and safe operation, carefully read the DX200 Controller Manual before reading this manual.

CAUTION

• The drawings and photos in this manual are representative examples, and differences may exist between them and the delivered product.

• YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications.

• If such a modification is made, the manual number will also be revised.

• If the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

• YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the products warranty.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MSR355, MSR655, & MSR1055 Positioner.

In this manual, the Notes for Safe Operation are classified as “WARNING,” “CAUTION,” “MANDATORY,” or “PROHIBITED.”

**WARNING**
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

**CAUTION**
Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

**MANDATORY**
Always be sure to follow explicitly the items listed under this heading.

**PROHIBITED**
Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "CAUTION" and "WARNING."
WARNING

• Before operating the MSR355, MSR655, & MSR1055 Positioner, check that servo power is turned OFF by pressing the EMERGENCY STOP button on the operator station or Programming Pendant (refer to Fig. 1). When servo power is turned OFF, the SERVO ON LED on the Programming Pendant is turned OFF.

Injury or damage to machinery may result if the Emergency Stop button cannot stop the positioner during an emergency. The positioner should not be used if the EMERGENCY STOP buttons do not function.

Fig. 1: EMERGENCY STOP Button

• Release the EMERGENCY STOP button (refer to Fig. 2). Once this button is released, clear the cell of all items which could interfere with the operation of the positioner then, turn servo power ON.

Injury may result from unintentional or unexpected positioner motion.

Fig. 2 : Release of EMERGENCY STOP Button

• Observe the following precautions when performing teaching operations within the working envelope of the positioner:
  – View the positioner from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Ensure that there is a safe place to retreat to in case of emergency.

Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the working envelope of the positioner and that you are in a safe location before:
  – Turning on the power for the DX200 controller.
  – Moving the positioner with the Programming Pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

Injury may result if anyone enters the working envelope of the positioner during operation. Always press an EMERGENCY STOP button immediately if there is a problem. The EMERGENCY STOP buttons are located on the operator station and on the Programming Pendant.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the DX200 controller, manipulator cables, the DX200 programming pendant (optional), and the DX200 programming pendant dummy connector (optional).

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator Cable</td>
</tr>
</tbody>
</table>
Descriptions of the programming pendant keys, buttons, displays and keyboard of the PC are shown as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td></td>
</tr>
<tr>
<td>Character Keys</td>
<td>The keys which have characters printed on them are denoted with [.]. e.g. [ENTER]</td>
</tr>
<tr>
<td>Symbol Keys</td>
<td>The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. e.g. PAGE key. The cursor key is an exception, and a picture is not shown.</td>
</tr>
<tr>
<td>Axis Keys</td>
<td>&quot;Axis keys&quot; and &quot;Numeric keys&quot; are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Numeric Keys</td>
<td></td>
</tr>
<tr>
<td>Keys Pressed Simultaneously</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them. e.g. SHIFT key + COORD key</td>
</tr>
<tr>
<td>Mode Key</td>
<td>Three kinds of modes that can be selected by the mode key are denoted as follows: REMOTE, PLAY, or TEACH</td>
</tr>
<tr>
<td>Button</td>
<td>Three buttons on the upper side of the programming pendant are denoted as follows: HOLD button, START button, EMERGENCY STOP button</td>
</tr>
<tr>
<td>Displays</td>
<td>The menu displayed in the programming pendant is denoted with { }. e.g. {JOB}</td>
</tr>
<tr>
<td>PC Keyboard</td>
<td>The name of the key is denoted. e.g. Ctrl key on the keyboard</td>
</tr>
</tbody>
</table>

**Description of the Operation Procedure**

In the explanation of the operation procedure, the expression “Select • • • “ means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

**Registered Trademark**

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.
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1 Introduction

1.1 About this Document

This manual provides general information about the MSR355, MSR655, & MSR1055 Positioner, and contains the following sections:

- **Chapter 1 - Introduction**
  This section provides general information about the MSR355, MSR655, & MSR1055 Positioner, a list of reference documents, and customer service information.

- **Chapter 2 - Safety**
  This section provides information regarding the safe use and operation of the MSR355, MSR655, & MSR1055 Positioner.

- **Chapter 3 - Equipment Description**
  This section provides detailed descriptions of the major components of the MSR355, MSR655, & MSR1055 Positioner. It also includes a table, listing component specifications.

- **Chapter 4 - Installation**
  This section provides instructions for installing the positioner.

- **Chapter 5 - Tooling Recommendations**
  This section provides guidelines for customer-supplied tooling design.

- **Chapter 6 - Operation**
  This section provides operation instructions for the MSR355, MSR655, & MSR1055 Positioner.

- **Chapter 6 - Maintenance**
  This section provides detailed instructions for maintaining each MSR355, MSR655, & MSR1055 Positioner.

- **Appendix A - Illustrated Parts List**
  Appendix A provides exploded views and illustrated parts lists for the MSR355, MSR655, & MSR1055 Positioner.

- **Revision History**
1.2 Customer Service Information

If you need technical assistance, contact the Motoman service staff at 937.847.3200. Please have the following information ready before you call:

- Product (MSR355, MSR655, & MSR1055 Positioner)
- Serial Number

1.3 System Overview

The MSR355, MSR655, & MSR1055 Positioner controls rotary motion and can be mounted in any orientation needed. The standard configuration utilizes an AC servo-motor, a high-ratio gear reducer, table top, and housing.

1.3.1 System Layout

An arc screen divides the table top in half, providing two semicircular work areas labeled SIDE A and SIDE B. When SIDE A is in the robot welding zone, SIDE B is facing the operator and is ready to be loaded or unloaded with parts, and vice versa. Loading fixtures are supplied by the customer.

Fig. 1-1: System Layout
1.3.2 System Identification

Each MSR355, MSR655, & MSR1055 Positioner has an identification label, located on the drive assembly, that contains specifications for the positioner.

*Fig. 1-2: Typical Identification Label*

1.4 Reference to Other Documentation

For additional information refer to the Controller Manuals
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:

- Section 2.2 - "General Safeguarding Tips"
- Section 2.3 - "Safety Devices"
- Section 2.4 - "Installation Safety"
- Section 2.5 - "Programming Safety"
- Section 2.6 - "Operation Safety"
- Section 2.7 - "Maintenance Safety"
2.2 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).

2.3 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.
2.4 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.

2.5 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.
2.6 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.
2.7 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).
3 Equipment Description

The MSR Drive Assembly is for the DX200 Controller. The positioner kit combines the appropriate external axis control package along with 4-meter cables and a 1,524 mm (60") table to provide the complete basic positioner kit. Optional kits can be added to the base positioner kit to provide additional functionality.

The MSR355 positioner is for reciprocating applications only while the larger positioners are for continuous rotation.

Fig. 3-3: MSR-Series Sigma 5 Rotary Positioner

3.1 Positioner Specifications

See Table 3-1 for MSR-Series Sigma 5 positioner table specifications.

Table 3-1: Positioner Assembly Specifications

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th>MSR355</th>
<th>MSR655</th>
<th>MSR1055</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Load Inertia</td>
<td>kg(m)^2</td>
<td>461</td>
<td>1040</td>
<td>3000</td>
</tr>
<tr>
<td>180-degree Sweep Time</td>
<td>sec</td>
<td>4.0</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Rated Load (per side)</td>
<td>kg</td>
<td>355</td>
<td>655</td>
<td>1055</td>
</tr>
<tr>
<td>Thur Hole Diameter</td>
<td>mm/in.</td>
<td>75/2.95</td>
<td>120/4.7</td>
<td>120/4.7</td>
</tr>
<tr>
<td>Rated Weld Current</td>
<td>amps</td>
<td>800</td>
<td>800</td>
<td>800</td>
</tr>
</tbody>
</table>
3.2 Table Assembly

The table assembly is for higher productivity parts that do not require positioning parts for welding by allowing the operator to load and unload from a single point while the robot welds on the opposite side.

The table assembly consists of a rotary table and a steel arc screen. This table is a low-inertia “H-style” tabletop for higher performance and easy fixture mounting. A standard 1524 mm (60 in.) tabletop is included with the positioner though there is an option of a 1829 mm (72 in.) tabletop.

**CAUTION**

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

The arc screen that runs the width of the positioner table visually separates the loading zone from the welding zone. This screen acts as a shield to protect the operator from the arc radiation and sparks produced by the welding operation.

3.3 Drive Assembly

The modular Drive Assembly provides precision-controlled rotary motion and can be mounted in any orientation for welding, material handling, or dispensing applications. The standard configuration utilizes an internal AC servo motor, a high-ratio gear reducer with integral output bearing, faceplate, fabricated housing and two weld ground cables.

*Fig. 3-4: Drive Assembly*
3.4 Available Options

The positioner assembly has the following options available for the following positioner assemblies:

Table 3-2: Positioner Kit Options

<table>
<thead>
<tr>
<th>Options</th>
<th>MSR355</th>
<th>MSR655</th>
<th>MSR1055</th>
</tr>
</thead>
<tbody>
<tr>
<td>72&quot; Table</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Brush Kit(a)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Plate Kit (Brush/Switch Mount Plate)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2 Position Switch Kit(a)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3 Position Switch Kit(a)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Position Switch Kit(a)</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6 Position Switch Kit(a)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slip-Ring Kit</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hard Stop Kit</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

\(a\) Requires Plate Kit p/n 170040-1

3.4.1 1829 mm (72 in.) Table

The 1829 mm (72 in.) table top is designed with an H-frame design for low inertia.

3.4.2 Brush Kit

The brush kit is needed if the positioner will be used in continuous rotation or a slip-ring kit. This brush kit includes two weld ground brushes. A plate kit is required to mount the brush kit to the positioner. The weld ground brushes are rated at 400 amps per brush.

3.4.3 2,3,4, or 6 Position Switch Kit

The MSR355 has an optional 2 position switch kit for reciprocating motion. The MSR655 has an optional 2, 3, 4 or 6 position switch kit and can be used for continuous or reciprocating motion. The MSR1055 has an optional 2 or 4 position switch kit and can be used for continuous or reciprocating motion. A plate kit is required to mount the switch kit to the positioner. The switches are safety rated and intended for use in muting safeguards. The optional Functional Safety Unit (FSU) can be used instead of switches on DX200.

It is recommended that a MSR655/1055 positioner be used for continuous multi-station applications. MSR355 can not be used in a continuous motion application.
3.4.4 Slip Ring Kit

The available slip ring kit has a six channel discrete with DeviceNet with all cables to attach to the DX200. This kit is available for the MSR355, MSR655, and MSR1055 Sigma 5 Rotary Positioners.

3.4.5 Hard Stop Kit

The Hard Stop is a shock absorbing hard stop used to prevent the positioner from rotating a full 360°. In addition, the hard stop improves repeatability and stability.

**NOTE** When using the Hard Stop Kit the motion is limited to reciprocating.

3.4.6 Plate Kit

If either a brush kit or switch kit is used a plate kit is required to mount the kit to the positioner.

**NOTE** Only one plate kit is used when using both a brush kit and switch kit.
4 Installation

4.1 Materials Required

This section identifies customer-supplied items and tools required to complete installation.

4.1.1 Customer-Supplied Items

- Servo motion control unit
- Incoming power supply
- Two earth ground cables with two earth ground stakes

4.1.2 List of Tools

- Safety Glasses
- Level
- Adjustable Wrench Set
- Hammer drill with appropriate concrete bits
- Forklift and/or overhead crane
- Open-end wrench sets (standard and metric)
4  Installation

4.2  Site Preparation

Each MSR355, MSR655, & MSR1055 Positioner positioner should be firmly mounted on a machine base or foundation rigid enough to support the static and dynamic forces.

To prepare your site, proceed as follows:

1. Clear the floor space needed for the positioner see Fig. 4-1 and Table 4-3.

2. Gather all required tools listed in Section 4.1.2 “List of Tools”.

Fig. 4-1: Area Needed For Installation - Positioner

Table 4-3: Area Needed for Installation - Positioner Dimensions

<table>
<thead>
<tr>
<th></th>
<th>MSR355</th>
<th>MSR655 &amp; MSR1055</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1519 mm</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>850 mm</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>718 mm</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>1704 mm</td>
<td>1705 mm</td>
</tr>
</tbody>
</table>
4.2.1 Mounting Hole Pattern

Use the mounting hole pattern in Fig. 4-2 to accurately position the MSR355, MSR655, & MSR1055 Positioner on the floor or mounting base.

Fig. 4-2: Floor Mounting Hole Pattern

4.3 Installing the MSR-series Table

The MSR355, MSR655, & MSR1055 Positioner table must be firmly mounted on a machine base or on a foundation rigid enough to support the static and dynamic forces.

4.3.1 Unpack and Install

The positioner table is shipped on a wood shipping pallet. To install the table, proceed as follows:

**CAUTION**

The positioners weigh approximately 570 kg (1260 lbs), 630 kg (1390 lbs), and 660 kg (1460 lbs). Make sure the lifting device is capable of handling this much weight or damage to the equipment or injury to personnel can result.

1. Carefully remove protective plastic wrapping from system.
2. Inspect system for shipping damage.

**NOTE** If there is any equipment damage, notify the shipper immediately.
3. Unbolt table from wood shipping pallet using a 3/4-inch socket wrench.

Fig. 4-3: Unbolting the Table

4. Insert two eye bolts (four total) on each side of the arc screen. Use the four bolts that are closest to the arc screen see Fig. 4-3 Unbolting the Table.

5. Attach chains from lifting device to the eye bolts and raise the table from wood shipping pallet.

6. Place table in position.

7. Remove chains and eye bolts.

4.3.2 Connecting the Cables

Do not connect any cables until after the drive assembly is securely in place.

Connection to Motoman Controller

The I/O cable and power cables come from the controller to the positioner riser and attaches to the appropriate connections.

Fig. 4-4: Cable Connections on Positioner

When you receive the MSR355, MSR655, & MSR1055 Positioner with a Motoman robot, connections between the two have been made at the factory. See separate schematics and/or documentation specific to your system.
4.4 Conducting a Safety/Operation Check

Before operating the MSR355, MSR655, & MSR1055 Positioner system, take a few minutes to perform a safety/operation check. To perform a safety/operation check, proceed as follows:

1. Check that all cable connections are tight.
2. Check that the tooling is properly attached to table.
3. Make sure all loose components are removed from table.
5 Tooling Recommendations

The MSR355, MSR655, & MSR1055 Positioner table is now ready for the installation of tooling for your application. Installation of tooling should be performed by personnel who are familiar with the operation of this system. Tooling is supplied by the customer.

5.1 Tooling Recommendations

The customer-supplied tooling must be designed to fit the table top mounting holes Fig.5-1 Layout Fixture Mounting Holes for a Standard 60 in. Table.

Fig. 5-1: Layout Fixture Mounting Holes for a Standard 60 in. Table
6  Maintenance

6.1  Ordering Parts

When ordering spare parts, always state:

• Machine type (Positioner)
• Machine Name (MSR355/655/1055 Positioner)
• Motoman Part No.
• Part name
• Number of parts

Send orders to:

Customer Service
Yaskawa America Inc.
Motoman Robotics Division
100 Automation Way
Miamisburg, Ohio, 45342
Telephone:937.847.3200
Telefax:937.847.3211
6.2 Home Position

Any position of the table can be programmed as home. Resetting the factory home position is typically done before new tooling and fixturing is installed, or when the motor has been serviced.

6.2.1 Setting Home Position

Setting the homing position is done by either the Section 6.2.1.1 “Set Factory Home Position With No Hardstops using the Homing Surface” or Section 6.2.1.2 “Set Factory Home Position With Hardstops”.

6.2.1.1 Set Factory Home Position With No Hardstops using the Homing Surface

1. Locate the homing hole located on the bottom of the table mounting plate on the positioner. See Fig. 6-2 Factory Home Position.

2. Using the Programming Pendant, place the system into MANAGEMENT mode.

3. Jog the table until the homing hole and homing surface are close to each other.

4. Install the homing pin into the homing hole.

5. **Slowly** jog the table until the homing pin just touches the homing surface.
   - If the table is jogged to far the pin will bend causing an inaccuracy. Slowly jog the axis reverse until the pin is straight but still touching the edge of the structure.

6. Proceed to Section 6.2.2 “Programming” to program the home position into the controller.
6.2.1.2 Set Factory Home Position With Hardstops

1. Using the Programming Pendant, place the system into MANAGEMENT mode.
2. Jog the table into the positioner hardstop on the “A” side.
3. Increment positioner against hard stop until the axis holding torque equals 25% (+/- 5%).
4. Proceed to Section 6.2.2 “Programming” to program the home position into the controller.

6.2.2 Programming

With home position found program the home position in the controller:
1. Press the top {MENU} key on programming pendant.
2. Cursor to {ROBOT} and press [SELECT].
3. Cursor to {HOME POSITION} and press [SELECT].
4. Press the {PAGE OVER} key to the desired axis (indicated in the top right corner).
5. Make sure the table is in the position that you want to teach as home and press [SELECT].
6. Cursor to {YES} and press [SELECT]. The table is now reset to zero.
7. Remove the homing pin, if installed and repeat the required Set Factory Home Position” and Programming sections with the “B” side of the table.

NOTE: When programming the “B” side use station {EX040} for the S1 position variable instead of the {HOME POSITION}.
Appendix A     Illustrated Parts List

A.1 Introduction

A.1.1 General
The Illustrated Parts List identifies, describes, and illustrates detail parts of the main assemblies for the MSR355, MSR655, & MSR1055 Positioner manufactured by Yaskawa.

A.1.2 Purpose
This list provides parts identification and descriptive information for use in provisioning, requesting, purchasing, storing, and issuing spare parts.

A.1.3 Arrangement
Appendix A is arranged as follows:
• Appendix A.1 – Introduction
• Appendix A.2 – Illustrated Parts List

A.1.4 Explanation of Parts List

■ Contents
The parts list contains a breakdown of the equipment into detail parts. All parts of the equipment are listed except the following:
1. Standard hardware items (attaching parts) such as nuts, screws, washers, etc., which are available commercially.
2. Bulk items such as wire, cable, sleeving, tubing, etc., which are also commercially available.
3. Permanently attached parts which lose their identity by being welded, soldered, riveted, etc., to other parts, or assemblies.

■ Parts List Form
This form is divided into four columns as follows:
1. “Figure - Item Number” Column
This Figure column lists the figure number of the illustration applicable to a particular parts list and also identifies each part in the list by an item number. These item numbers also appear on the illustration. Each item number on the illustration is connected to the part to which it pertains by a leader line and arrow. Thus, the figure and item numbering system ties the parts list to the illustrations and vice versa.
2. “Part Number” Column
All part numbers appearing in this column are part numbers.
3. “Description” Column
The item nomenclature appears in this column.
4. “QTY” Column
This column indicates the quantity of parts required for an assembly or subassembly in which the part appears. This column does not necessarily reflect the total used in the complete end item.
A.2 Parts List

A.2.1 Symbols and Abbreviations

The following is a list of symbols and abbreviations used in the parts list.

- AC – alternating current
- ASSY – assembly
- amp – ampere
- cyl – cylinder
- DC – direct current
- fig – figure
- hex – hexagon
- ID – inside diameter
- in. – inch
- m – meter
- mm – millimeter
- na – not available
- No. – number
- p/n – part number
- Pos – position
- psi – pounds per square inch
- Qty – quantity
- v – voltage
Table A-1: MSR-Series Sigma 5 Positioner

<table>
<thead>
<tr>
<th>Item No.</th>
<th>MSR355 p/n</th>
<th>MSR655 p/n</th>
<th>MSR1055 p/n</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>148280-1</td>
<td></td>
<td></td>
<td>TABLE ASSY, POSITIONER, H-FRAME 1524 mm (60 in.)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>148280-4(^1)</td>
<td></td>
<td></td>
<td>TABLE ASSY, POSITIONER, H-FRAME 1829 mm (72 in.)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>170039-1</td>
<td>170366-1</td>
<td>170367-1</td>
<td>DRIVE ASSY</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>170052-1(^1)</td>
<td></td>
<td></td>
<td>BRUSH KIT, MSR POSITIONER</td>
<td>NA</td>
</tr>
<tr>
<td>4</td>
<td>170120-1</td>
<td></td>
<td></td>
<td>SWITCH KIT. 2 POSITION</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>170120-2(^1)</td>
<td></td>
<td>SWITCH KIT. 3 POSITION</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>170120-3(^1)</td>
<td></td>
<td>SWITCH KIT. 4 POSITION</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>170120-4(^1)</td>
<td></td>
<td>SWITCH KIT. 6 POSITION</td>
<td>NA</td>
</tr>
</tbody>
</table>
## Appendix A  Illustrated Parts List

### A.2 Parts List

<table>
<thead>
<tr>
<th>Item No.</th>
<th>MSR355 p/n</th>
<th>MSR655 p/n</th>
<th>MSR1055 p/n</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>170059-1(^1)</td>
<td>NA</td>
<td></td>
<td>SLIP-RING KIT</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>170363-1(^1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>170121-1(^1)</td>
<td></td>
<td></td>
<td>STOP KIT, HARD, POSITIONER</td>
<td>NA</td>
</tr>
<tr>
<td>7</td>
<td>170040-1(^1)</td>
<td></td>
<td></td>
<td>PLATE KIT, BRUSH CONTACT, SWITCH</td>
<td>NA</td>
</tr>
<tr>
<td>NS</td>
<td>146175-1(^1)</td>
<td></td>
<td></td>
<td>FIXTURE PLATE, 350 X 500 MM (60&quot; TABLE)</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>146175-2(^1)</td>
<td></td>
<td></td>
<td>FIXTURE PLATE, 650 X 1000 MM (60&quot; TABLE)</td>
<td></td>
</tr>
</tbody>
</table>

*This is an option that is available for the positioner.*
Fig. A-2: TABLE ASSY, POSITIONER, H-FRAME

![Diagram of TABLE ASSY, POSITIONER, H-FRAME]

Table A-2: TABLE ASSY, POSITIONER, H-FRAME

<table>
<thead>
<tr>
<th>Item No.</th>
<th>60&quot; Table P/N 148280-1</th>
<th>72&quot; Table P/N 148280-4</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>146174-1</td>
<td>146174-2</td>
<td>FRAME, TABLE POSITIONER</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>154891-1</td>
<td>154891-3</td>
<td>SCREEN ASSY</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>149053-1</td>
<td></td>
<td>LABEL, A/B</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>471378-1</td>
<td></td>
<td>LABEL, ARC FLASH, HORIZONTAL</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>471376-1</td>
<td></td>
<td>LABEL, MOVING PARTS</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>471359-1</td>
<td></td>
<td>LABEL, ROBOT, WARNING</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>159259-1</td>
<td></td>
<td>LABEL, YASKAWA MOTOMAN</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>170341-1</td>
<td></td>
<td>LABEL, SYMBOL COLLABRATIVE</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>159257-1</td>
<td></td>
<td>LABEL, ARCWORLD</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>146176-1</td>
<td>146176-2</td>
<td>SHIELD, TABLE</td>
<td>2</td>
</tr>
</tbody>
</table>
Fig. A-3(a): Drive Assembly External

ALTERNATE LOCATION FOR ITEM #8 AND ITEMS ON IT WHEN CABLES COME FROM THE SIDE.

Fig. A-3(b): Drive Assembly Internal
## Table A-3: Drive Assembly

<table>
<thead>
<tr>
<th>Item No.</th>
<th>MSR355 p/n 170039-1</th>
<th>MSR655 p/n 170366-1</th>
<th>MSR1055 p/n 170367-1</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>169760-1</td>
<td>169789-2</td>
<td>169789-1</td>
<td>REDUCER</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>170043-1</td>
<td></td>
<td>MOUNTING TABLE PLATE</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>170051-1</td>
<td>170313-1</td>
<td>170313-1</td>
<td>ROTARY DRIVE MOUNTING PLATE</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>170050-1</td>
<td></td>
<td>COVER RISER</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>170048-1</td>
<td></td>
<td></td>
<td>RISER,POSITIONER,MSR SERIES</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>156968-1</td>
<td></td>
<td></td>
<td>CABLE ASSY,PIGTAIL,ENC</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>156973-1</td>
<td></td>
<td></td>
<td>CABLE ASSY,PIGTAIL,PWR,10AWG</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>170050-2</td>
<td></td>
<td></td>
<td>COVER,RISER,CABLE MOUNT</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>143047-7</td>
<td></td>
<td></td>
<td>PLATE,GLAND,XRC/MRC,BLANK</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>130887-8</td>
<td></td>
<td></td>
<td>CABLE,WELD</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>170047-1</td>
<td></td>
<td></td>
<td>FLANGE,MOTOR</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>156009-5</td>
<td>156009-7</td>
<td>157280-1</td>
<td>MOTOR,AC SERVO</td>
<td>1</td>
</tr>
</tbody>
</table>
Fig. A-4: Brush Kit

Table A-4: Brush Kit Assembly

<table>
<thead>
<tr>
<th>Item No.</th>
<th>p/n 170052-1</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>144370-1</td>
<td>TERMINAL, QUICK DISC, WELD GROUND LUG</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>144372-1</td>
<td>BRUSH HOLDER, 1&quot; X 1.5&quot; X 2&quot;, WELD GROUNDING</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>170044-1</td>
<td>BRACKET, MOUNTING, BRUSH</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>144371-1</td>
<td>BRUSH, GROUND, METAL, GRAPHITE</td>
<td>2</td>
</tr>
</tbody>
</table>
Fig. A-5(a): 2 Position Switch Kit

1. Target Distance: 6.0±0.5

2. REMOVE RISER COVER TO REPLACE GLAND PLATE (143047-7) WITH GLAND PLATE SHOWN (143047-8) INSIDE RISER

3. “B” AT ROBOT ACTUATOR

4. “A” AT ROBOT ACTUATOR

5. 39/48
Appendix A Illustrated Parts List

Fig. A-5(b): 3 Position Switch Kit

- Target Distance 6.0±0.5

REMOVE RISER COVER TO REPLACE GLAND PLATE (143047-7) WITH GLAND PLATE SHOWN (143047-8) INSIDE RISER
Fig. A-5(c): 4 Position Switch Kit

1. Target Distance: 6.0±0.5

REMOVE RISER COVER TO REPLACE GLAND PLATE (143047-7) WITH GLAND PLATE SHOWN (143047-8) INSIDE RISER
Fig. A-5(d): 6 Position Switch Kit
### Table A-5: Position Switch Kit

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Part Number</th>
<th>Description</th>
<th>2 Pos Qty</th>
<th>3 Pos Qty</th>
<th>4 Pos Qty</th>
<th>6 Pos Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>168899-2</td>
<td>ACTUATOR, SAFETY SENSOR</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>168899-1</td>
<td>SENSOR, SAFETY SWITCH, M18</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>170105-1</td>
<td>BRACKET, MTG, PROX</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>170106-1</td>
<td>CABLE ASSY, LIMIT-SWITCH I/O</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>143047-8</td>
<td>PLATE, GLAND</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
### Fig. A-6: Slip-Ring Kit (6 channel - 10 amp w/DeviceNet)

#### Table A-6: Slip-Ring Kit

<table>
<thead>
<tr>
<th>Item No.</th>
<th>MSR355 p/n 170059-1</th>
<th>MSR 655 &amp;1055 p/n 170363-1</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>170054-2</td>
<td>170369-1</td>
<td>COLLAR, LOCK, SLIP-RING, TOP</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>170054-1</td>
<td></td>
<td>COLLAR, LOCK, SLIP-RING, BOTTOM</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>170263-1</td>
<td></td>
<td>CABLE ASSY, PIGTAIL, SLIP-RING, MALE, BKHD, AUX PWR &amp; I/O, DX200, SINGLE</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>159589-2</td>
<td></td>
<td>CABLE ASSY, I/O, SLIP-RING, DUAL, MALE/ FEM, RM2-1200-M3X, 4M</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>159588-1</td>
<td></td>
<td>CABLE ASSY, PIGTAIL, SLIP-RING, FEMALE, DUAL SLIP-RING, DISCRETE</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>165512-3</td>
<td></td>
<td>CABLE ASSY, SLIP-RING, DEVICE-NET, MALE/FEMALE, BKHD/STR, 3 KEY, 1M</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>165524-1</td>
<td></td>
<td>CABLE ASSY, PIGTAIL, FEMALE, DEVICE-NET, 2M</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>150779-1</td>
<td></td>
<td>CABLE, DEVICE-NET, 4 M, MID, 90 MALE, 90 FEMALE, MINIFAST.</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>165140-1</td>
<td></td>
<td>SLIP-RING KIT, DEVICE-NET, RM2</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>170053-1</td>
<td>170370-1</td>
<td>BRACKET, SLIP-RING, ANTI-ROTATE</td>
<td>1</td>
</tr>
</tbody>
</table>

REMOVE RISER ACCESS COVER (NOT SHOWN) REPLACE EXISTING GLAND PLATES WITH SWITCH ASSEMBLIES (RE-USE HARDWARE)
Appendix A  Illustrated Parts List

Fig. A-7: Hard Stop Kit

![Diagram of Hard Stop Kit]

2X REPLACE EXISTING SCREWS WITH ITEM #3

VIEW SHOWN WITH TABLE TOP PARTIALLY REMOVED FOR CLARITY

PRESS IN FROM THIS SIDE UNTIL FLUSH

Table A-7: Hard Stop Kit

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>143689-1</td>
<td>SHOCK, 20MM, STROKE,</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>170102-1</td>
<td>BLOCK, STOP, MSR POSITIONERS</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>479147-9</td>
<td>WASHER, FLAT, M16</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>130532-8</td>
<td>SCREW, SHC, M16 X 100 CLASS 12.9</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>143315-2</td>
<td>PIN, DOWEL, M16 X 60</td>
<td>2</td>
</tr>
</tbody>
</table>
Table A-8: Plate Kit

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>170108-1</td>
<td>BLOCK, MTG, SWITCH ASSY</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>170109-1</td>
<td>PLATE, NUT, M5</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>170107-1</td>
<td>PLATE, CONTACT, BRUSH</td>
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## Revision History

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<th>Date</th>
<th>CEN / ECN</th>
<th>Revision No.</th>
<th>Reason For Revision</th>
<th>Initials</th>
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<tr>
<td>7/23/2014</td>
<td>M2134</td>
<td>0</td>
<td>Original Release</td>
<td>JFC</td>
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<td>8/5/2014</td>
<td>14-1015M</td>
<td>1</td>
<td>Updated Chapter 6 with the new homing pin location and procedures.</td>
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Specifications are subject to change without notice for ongoing product modifications and improvements.