MRM2-255/755-M3X
SIGMA-5
POSITIONER MANUAL

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

This manual explains the MRM2-255/755 SIGMA-5 Positioner. Read this manual carefully and be sure to understand its contents before handling the MRM2-255/755 SIGMA-5 Positioner.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- 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 modification is made, the revision number will also be revised.
- If your copy of 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 part number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product’s warranty.
We suggest obtaining and reviewing a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-1999). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

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

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
NOTES FOR SAFE OPERATION

Read this manual carefully before installation, operation, maintenance, or inspection of the MRM2-255/755 SIGMA-5 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. At any rate, be sure to follow these important items.

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

Injury or damage to machinery may result if the emergency stop circuit cannot stop the MRM2-255/755 SIGMA-5 Positioner during an emergency. The MRM2-255/755 SIGMA-5 Positioner should not be used if the emergency stop buttons do not function.

Fig. : Emergency Stop Button

• Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the MRM2-255/755 SIGMA-5 Positioner. Then turn the servo power ON.

Injury may result from unintentional or unexpected MRM2-255/755 SIGMA-5 Positioner motion.

• Always follow the predetermined operating procedure.
• Ensure there is a safe place to retreat in case of emergency.

Improper or unintended MRM2-255/755 SIGMA-5 Positioner operation may result in injury.

• Confirm that no person is present in the P-point maximum moveable area of the MRM2-255/755 SIGMA-5 Positioner and that you are in a safe location before:
  – Turning ON the MRM2-255/755 SIGMA-5 Positioner
  – Moving the MRM2-255/755 SIGMA-5 Positioner
  – Running the system in the check mode
  – Performing automatic operations

Always press an emergency stop button immediately if there is a problem.

CAUTION

• Perform the following inspection procedures prior to conducting MRM2-255/755 SIGMA-5 Positioner teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.

  – Check for problems in MRM2-255/755 SIGMA-5 Positioner movement.
  – Check for damage to insulation and sheathing of external wires.
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.

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 system manual provides a “first look” and overview of the complete Yaskawa MRM2-255/755 SIGMA-5 Positioner system. Read and understand this manual before moving on to the more detailed documentation that is included with the MRM2-255/755 SIGMA-5 Positioner system. Although basic in content, this manual is intended for personnel who have received operator training from Yaskawa and who are familiar with the operation of this particular Yaskawa system. For more detailed information on any specific component or peripheral of the MRM2-255/755 SIGMA-5 Positioner system, please review the full documentation package that is included with the MRM2-255/755 SIGMA-5 Positioner system (refer to chapter 1.8).

This system manual contains the following sections:

Chapter 1 “Introduction”

This chapter provides general information about the MRM2-255/755 SIGMA-5 Positioner system, and customer support contact information.

Chapter 2 “Installation”

This section provides installation and setup procedures for the MRM2-255/755 SIGMA-5 Positioner system.

Chapter 3 “Maintenance”

This section provides preventive maintenance requirements for certain components of the MRM2-255/755 SIGMA-5 Positioner system.

Appendix A “Illustrated Parts List”

Appendix A contains the Illustrated Parts List (IPL). The IPL provides detailed views (with part numbers) of MRM2-255/755 SIGMA-5 Positioner components.

1.2 System Overview

The MRM2-255/755 SIGMA-5 Positioner can be used with a variety of applications that require precise parts movement. Typically, the MRM2-255/755 SIGMA-5 Positioner is integrated with a Motoman robot and controller in a work cell arrangement.

The MRM2-255/755 SIGMA-5 Positioner is a two station headstock / tailstock (HS/TS) positioner. Because of certain operational dynamics, this type of positioner is often referred to as a “Ferris wheel” positioner.
The main (sweep) axis and both face plate (orbital) axes are rotated by individual SIGMA 5-AC servomotors (working through gear reduction units) that are controlled by circuitry in the controller.

All three axes can be driven simultaneously during a sweep motion. In addition, movement of the MRM2-255/755 SIGMA-5 Positioner can be coordinated with robot motion to allow complex jobs such as the welding of circumferential joints.

*Fig. 1-1: System Layout*
The main drive swingarm, the tooling drive swingarm, and the arc shield rotate around a main (sweep) axis and are limited in rotation by hardstops located on the tooling drive swing arm.

Dual “in position” switches are mounted in the headstock housing (see Figure 1-2). These provide switch closures, as a backup to encoder data, to indicate to safety circuitry whether or not the swingarm assemblies are in the correct and safe position after a positioner sweep.

Fig. 1-2: Main (Sweep) Axis — Side-A, Side-B “In Position” Safety Switches
A face plate multiple angle control feature allows the programmer to define the angle of the tooling presented to the operator (with a resolution of approximately 6° for locations between 0° and 30°). This improves load station ergonomics and part tacking (see Figure 1-3).

**Fig. 1-3: Tooling (Orbital) Axis — Face Plate Multiple Angle Control Components**
A Light Emitting Diode (LED) is installed at each end of the tooling drive swingarm. When illuminated (green), each LED indicates that the associated face plate has reached the desired, operator-selected rotation angle (see Figure 1-4).

Fig. 1-4: Tooling (Orbital) Axis - Face Plate “In-Position” Indicators

All MRM2-255/755 SIGMA-5 Positioner face plates are fitted with the MotoMount™ flexible tool mounting system as the tooling interface (see Figure 1-1 and Figure 1-3).

Each SIGMA-5 AC servomotor incorporates a small, external Lithium-Ion “keep alive” battery that maintains servo positioning data in memory, should the main cables between the positioner and controller be disconnected. This battery is a part of each cable assembly (internal to the MRM2-255/755 SIGMA-5 Positioner) that connects each AC servomotor to its associated multi-pin plug on the positioner base (see Figure 2-6). These batteries have a very long life. However, if they drop below a certain charge level, a “low battery” indication appears on the Programming Pendant LCD screen.

Refer to Table 1-1: for MRM2-255/755 SIGMA-5 Positioner technical specifications.
1.3 Positioner Configuration

The MRM2-255/755 SIGMA-5 Positioner positioner assembly is available in two configurations. Both are identical except for some dimensional differences (see Figure 2-5).

The main axis SIGMA-5 AC servomotor is located at the tailstock end of the positioner, while the tooling drive SIGMA-5 AC servomotors are located at the headstock end of the positioner. This configuration, along with other proprietary features, endow the MRM2-255/755 SIGMA-5 Positioner with an exceptional Total Index Time (refer to Table 1-1: for a complete listing of MRM2-255/755 SIGMA-5 Positioner specifications).

1.4 Welding Ground System

The MRM2-255/755 SIGMA-5 Positioner positioner incorporates spring-loaded carbon brushes to connect each face plate to the welding ground system. A gang of 3 carbon brushes contact the posterior side of each face plate. The negative (−) ground cable to the welding power source is connected to a ground block located inside the MRM2-255/755 SIGMA-5 Positioner positioner headstock assembly.

1.5 Major Components

The MRM2-255/755 SIGMA-5 Positioner includes the following major components –

– One headstock housing
– One tailstock housing
– One main axis SIGMA-5 AC servomotor (and associated gear reduction unit)
– Two tooling axes SIGMA-5 AC servomotors (and associated gear reduction units)
– One arc screen
– Three positioner-to-controller interconnect cables (2 data, 1 power)
– One assembly kit for the controller (servo packs, etc.)

1.6 Optional Equipment

This manual documents a standard MRM2-255/755 SIGMA-5 Positioner assembly. If the positioner assembly is modified or incorporates optional equipment, refer to the Engineering Drawing Package and associated Bill of Materials (BOM) in addition to this manual. The Engineering Drawing Package and BOM are included with the positioner shipment. Please refer to those documents, along with this manual, when troubleshooting or provisioning spare parts for the positioner assembly.

The following optional equipment is available for use with the MRM2-255/755 SIGMA-5 Positioner –

1.6.1 Air Supply Options

– Air Supply, Tailstock, ¾ inch ID ........................................... P/N 148927-1
– Air Supply, Tailstock, 10 mm ID ........................................... P/N 151823-1
### 1.7 Positioner Technical Specifications

#### Table 1-1: MRM2-255/755 SIGMA-5 Positioner Technical Specifications

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>UNITS</th>
<th>255</th>
<th>755</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model P/N</td>
<td>—</td>
<td>158814 –1, –2</td>
<td>158814 –3, –4</td>
</tr>
<tr>
<td>Rated Payload</td>
<td>kg (lb)</td>
<td>255 (560)</td>
<td>755 (1660)</td>
</tr>
<tr>
<td>Load Height (floor to centerline)</td>
<td>mm (in)</td>
<td>900 (35.4)</td>
<td>900 (35.4)</td>
</tr>
<tr>
<td>Maximum Cg Offset</td>
<td>mm (in)</td>
<td>76 (3.0)</td>
<td>76 (3.0)</td>
</tr>
<tr>
<td>Maximum Load Imbalance (Side A – Side B)</td>
<td>kg (lb)</td>
<td>150 (330)</td>
<td>250 (551)</td>
</tr>
<tr>
<td>Number of SIGMA-5 AC Servomotors</td>
<td>—</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Index Motor Power</td>
<td>kW</td>
<td>4.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Tooling Motor Power</td>
<td>kW</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>Side A–Side B Sweep Time</td>
<td>sec</td>
<td>1.5</td>
<td>2.25</td>
</tr>
<tr>
<td>Index Axis Speed</td>
<td>rpm</td>
<td>25.3</td>
<td>17.5</td>
</tr>
<tr>
<td>Index Torque</td>
<td>N·m (ft·lbf)</td>
<td>1683 (1241.3)</td>
<td>2428 (1790.8)</td>
</tr>
<tr>
<td>Tooling Index Time</td>
<td>sec</td>
<td>1.42</td>
<td>1.89</td>
</tr>
<tr>
<td>Tooling Axis Speed</td>
<td>rpm</td>
<td>0 – 32.7</td>
<td>0 – 21.6</td>
</tr>
<tr>
<td>Tooling Torque</td>
<td>N·m (ft·lbf)</td>
<td>277 (204.3)</td>
<td>412 (303.9)</td>
</tr>
<tr>
<td>Total Index Time</td>
<td>sec</td>
<td>1.5</td>
<td>2.25</td>
</tr>
<tr>
<td>Max Fixture Diameter</td>
<td>mm (in)</td>
<td>1300 (51.2)*</td>
<td>1300 (51.2)*</td>
</tr>
<tr>
<td>Standard Fixture Length</td>
<td>mm (in)</td>
<td>2000 (78.7)</td>
<td>2000 (78.7)</td>
</tr>
<tr>
<td>Position Accuracy</td>
<td>mm (in)</td>
<td>± 0.1 (± 0.004)</td>
<td>± 0.1 (± 0.004)</td>
</tr>
<tr>
<td>Thru-Hole Headstock</td>
<td>—</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Thru-Hole Tailstock</td>
<td>—</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Tooling Axis Weld Ground Capacity (100%)</td>
<td>Amps</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>Positioner Weight</td>
<td>kg (lb)</td>
<td>2550 (5622)</td>
<td>2550 (5622)</td>
</tr>
</tbody>
</table>

* Tooling fixture that passes under is limited to a MAXIMUM depth of 450 mm (17.7 in). See Figure 2-6 for a graphical representation of this requirement.
If you need assistance with any aspect of your MRM2-255/755 SIGMA-5 Positioner system, please contact Yaskawa Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact Yaskawa Motoman Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact Yaskawa Motoman Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for routine inquiries only. If an urgent or emergency need for service, replacement parts, or information, contact Yaskawa Motoman Customer Support at the telephone number shown above.

Please have the following information ready before you call:

| • System         | MRM2-255/755 SIGMA-5 Positioner |
|• Primary Application | ARC Welding                     |
|• Controller      | Located on front of controller  |
|• Serial Number   | Located on the data plate       |
2 Installation

2.1 Required Materials

All positioner components and most of the hardware items required for installation of the MRM2-255/755 SIGMA-5 Positioner are included with your shipment. There are, however, some required items that the customer must supply, such as typical installation and maintenance tools (refer to Section 2.1.2) and special anchor bolts.

2.1.1 Customer-Supplied Items

- Local electrical service for the controller (all power to the MRM2-255/755 SIGMA-5 Positioner is supplied by the controller)
- Earth ground wires
- Earth ground rods and/or buried copper sheeting (quantity and placement depth 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
- Forklifts (two)
- Special anchor bolts and drill bits (used to secure the MRM2-255/755 SIGMA-5 Positioner to the foundation)
- Compressed air source (used to power air-driven tools and to remove concrete dust from drilled anchor holes)

WARNING

- The MRM2-255/755 SIGMA-5 Positioner must be installed by qualified personnel who are familiar with the installation and set-up of this type of parts positioner.
- Always comply with established safety procedures during installation of the MRM2-255/755 SIGMA-5 Positioner.

NOTE

All anchoring hardware for the MRM2-255/755 SIGMA-5 Positioner must be supplied by the customer.
2 Installation

2.1 Required Materials

2.1.2 Recommended List of Hand Tools and Equipment

- Safety glasses or full-face shield
- Air nozzle (OSHA-approved, pressure-limited)
- Gloves (heavy-duty leather recommended)
- Level (short and long)
- Adjustable wrench (large and small)
- Air impact wrench / hammer drill with concrete drill bits
- Phillips and flat-blade screwdrivers
- Ratchet handle and breaker bar (3/8-inch and 1/2-inch drive)
- Socket set, 3/8-inch and 1/2-inch drive (SAE and Metric)
2.2 Site Preparation

1. Clear floor and overhead space needed for the MRM2-255/755 SIGMA-5 Positioner (see Figure 2-1 and Figure 2-2). Allow an additional 1.2 – 1.5 m (4 – 5 ft) on all sides of the positioner to provide the clearances needed for installation.

*Fig. 2-1: MMRM2-255/755 SIGMA-5 Positioner — Plan View*

2. Gather all customer-supplied items and required tools (refer to Section 2.1).
2.3 Remove the Positioner from the Shipping Skid

The MRM2-255/755 SIGMA-5 Positioner is attached to a wooden shipping skid at the factory, prior to shipment to the customer. The customer is responsible for removing the positioner from the shipping skid and inspecting for shipping damage.

**NOTE** Notify your shipping agent immediately if there is any shipping damage.

1. Unbolt the positioner from the shipping skid using a ¾-inch socket (see Figure 2-3).

**Fig. 2-3: Typical Shipping Bolt Removal**

![](image)

2. Remove protective plastic, cardboard, etc. shipping material from the MRM2-255/755 SIGMA-5 Positioner.
2 Installation

2.3 Remove the Positioner from the Shipping Skid

![Diagram of forklift lift points]

**WARNING**

- All forklift operators should be licensed and trained in correct forklift operation and safety.
- Never place any part of your body under a suspended load or move a suspended load over any part of another person's body. A shifted or dropped load could result in serious injury or death.

**CAUTION**

Ensure that the forklift is rated to handle the weight of the MRM2-255/755 SIGMA-5 Positioner. The positioner weighs approximately 2550 kg (5622 lb).

**NOTE**

The following procedures require two forklifts and two forklift operators.

3. Carefully position forklift tangs under the lifting points on the headstock and tailstock end of the MRM2-255/755 SIGMA-5 Positioner (see Figure 2-4).

**Fig. 2-4: Forklift Lift Points — MRM2-255/755 SIGMA-5 Positioner**

4. In a coordinated effort, slowly lift the MRM2-255/755 SIGMA-5 Positioner positioner up and away from the wooden shipping skid.

5. Discard or recycle the wooden shipping skid and all shipping materials.
2.4 Place and Anchor the Positioner

**WARNING**

Use protective eye wear during the anchoring process. Lack of protective eye wear could result in permanent eye damage.

**CAUTION**

- Place the MRM2-255/755 SIGMA-5 Positioner on a base plate or foundation that is strong enough to support positioner weight and withstand repulsion forces. Make sure that the foundation surface is level and even.
- Minimum thickness of a concrete foundation for the MRM2-255/755 SIGMA-5 Positioner is 150 mm (6 in).
- Ensure that the forklifts are rated to handle the weight of the MRM2-255/755 SIGMA-5 Positioner. The positioner weighs approximately 2550 kg (5622 lb).

1. Use two forklifts to lift and place the MRM2-255/755 SIGMA-5 Positioner in the desired installation location and position (see Figure 2.4).

2. Adjust the stabilizing bolts, as required, to stabilize the positioner (see Figure 2-5).

- Be absolutely certain of the desired installation location for the MRM2-255/755 SIGMA-5 Positioner before anchoring it to the foundation.
1. Insert an M20 concrete drill bit into one of the lag point holes shown in Figure 2-5.

Fig. 2-5: Lag Points and Stabilizing Bolts - MRM2-255/755 SIGMA-5 Positioner (Plan View)

2. Drill a hole in the foundation to a minimum depth of 102 mm (4 in) to accept an anchor bolt. Repeat this process for all lag point holes shown in Figure 2-5.

3. Use compressed air to remove all concrete dust from the drilled holes.

4. Use M20 or 3/4-inch anchor bolts to anchor the MRM2-255/755 SIGMA-5 Positioner to the foundation.
2.5 Connect the Positioner to the Controller

Three multi-pin connectors are installed on the MRM2-255/755 SIGMA-5 Positioner base (see Figure 2.6). These connectors accept cables (2 data, 1 power) that interconnect the positioner with a controller.

NOTE
When the MRM2-255/755 SIGMA-5 Positioner is delivered with a complete robotic welding system, additional documentation of data and power interconnects is included in the robotic welding system documentation package.

Fig. 2-6: MRM2-255/755 SIGMA-5 Positioner — External Data / Power Connectors and Cables
2.6 Customer-Supplied Tooling Fixtures

The MRM2-255/755 SIGMA-5 Positioner is equipped with the MotoMount™ tool mounting system (see Figure 1-1 and Figure 1-3). MotoMount is a flexible tool mounting system for headstock/tailstock style positioners, such as the MRM2-255/755 SIGMA-5 Positioner. MotoMount provides improved part presentation repeatability compared to traditional hard-mounted systems.

The MotoMount system also minimizes headstock/tailstock bearing loads induced by tooling and headstock/tailstock misalignment (up to a maximum of ±2 degrees), transmitting only the predictable moment loads resulting from simple beam loading.

For additional information on the correct use and care of the MotoMount tool mounting system, please contact Yaskawa Customer Support (refer to Section 1.8).

- The customer shall supply all tooling fixtures for the MRM2-255/755 SIGMA-5 Positioner.
- Yaskawa recommends application of a corrosion/rust preventive compound to tooling fixtures located in a high-humidity environment.
3 Maintenance

3.1 General

WARNING

- Make sure that all sources of hazardous energies are de-energized / disconnected before inspecting or servicing the MRM2-255/755 SIGMA-5 Positioner. Because of typical interconnections between the positioner and related peripheral equipment (such as the controller), more than one source of hazardous energy can exist.
- Ensure that servo power is OFF before performing maintenance or inspection procedures. Always use standard lockout / tagout procedures.

MRM2-255/755 SIGMA-5 Positioner maintenance should be performed only by Yaskawa service technicians or authorized personnel who are familiar with the design and construction of this type of positioner. The following procedures should be performed only as necessary (on condition). Read through the instructions completely, or contact Yaskawa Customer Service (refer to Section 1.8) before performing any maintenance procedure. Be sure that you understand the procedure, have the proper tools, and comply with all safety precautions.

3.2 Recommended Spare Parts List

Table 3-1: Recommended Spare Parts List

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>PART NUMBER</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brush, Ground, Metal / Graphite (GR-K076, Style QP5)</td>
<td>144371-1</td>
<td>6</td>
</tr>
<tr>
<td>Terminal, Quick Disconnect, Weld Ground</td>
<td>144370-1</td>
<td>4</td>
</tr>
<tr>
<td>Homing Pin</td>
<td>145896-1</td>
<td>2</td>
</tr>
<tr>
<td>Battery Assy, Encoder “Keep Alive” Backup</td>
<td>479348-2</td>
<td>3</td>
</tr>
</tbody>
</table>

3.3 How to Order Spare or Replacement Parts

To order spare parts or replacement parts for the MRM2-255/755 SIGMA-5 Positioner, please contact Customer Support (refer to Section 1.8).
3.4 General Cleaning

The MRM2-255/755 SIGMA-5 Positioner requires only occasional cleaning to remove dust and welding by-products. Use compressed air or vacuum, and a bristle brush (if required).

NOTE
YASKAWA recommends application of a corrosion/rust preventive compound to tooling fixtures located in a high-humidity environment.

3.5 SIGMA-5 AC Servomotors

The SIGMA-5 AC servomotors (1 sweep axis, 2 face plate axis) are sealed units and have no parts that need inspection or replacement on a regular basis. Do NOT disassemble a SIGMA-5 AC servomotor. If you suspect that a servomotor requires maintenance or overhaul, please contact Customer Support (refer to Section 1.8).

3.6 Servo Pack

The servo pack (located in the controller) does not require customer maintenance. If you suspect a problem with the servo pack, please contact Customer Support (refer to Section 1.8).

3.7 Main (Sweep) Axis Reduction Gear Unit

The main (sweep) axis reduction gear unit is located on the main drive housing assembly (see Figure 1-1). This unit is sealed and contains no parts that need inspection or replacement on a regular basis. Do NOT disassemble the reduction gear unit or remove it from its associated AC servomotor. If you suspect that the reduction gear unit requires maintenance or overhaul, please contact Customer Support (refer to Section 1.8).

3.8 Tooling (Orbital) Axis Reduction Gear Units

Two tooling (orbital) axis reduction gear units are located in the tooling drive swingarm assembly, one for each face plate (see Figure 1-1). These units are sealed and contain no parts that need inspection or replacement on a regular basis. Do NOT disassemble the reduction gear unit or remove it from its associated AC servomotor. If you suspect that the Reduction Gear Unit requires maintenance or overhaul, please contact Customer Support (refer to Section 1.8).
3.9 Main (Swing) Axis Hardstops

The MRM2-255/755 SIGMA-5 Positioner incorporates two buffered hardstops that are welded to the tooling drive swingarm assembly. The hardstops provide a positive stop for the tooling drive swingarm assembly (and thus the arc shield and main axis swingarm assembly) during a sweep cycle. The hardstops are preset at the factory for correct performance, and should need no further adjustment. Should you suspect that the hardstops need replacement or adjustment, please contact Customer Support (refer to Section 1.8).

3.10 Welding Ground System

3.10.1 Inspection and Cleaning of Carbon Brushes

Inspect the ground brushes where they contact the rear of tooling drive face plates. Make sure that the contact area is clean and free of dust and welding by-products. Use compressed air and a small bristle brush to clean the ground brushes where they contact the face plates.

 Always ensure that welding ground connections and brushes in the MRM2-255/755 SIGMA-5 Positioner are clean and tight. If the ground points are not properly made and kept clean and secure, high welding currents can bypass the normal return path and, instead, pass through the drive components of the positioner. This is especially hard on positioner drive bearings when they are under load. The high welding current, if allowed to pass through the drive components, can result in increased bearing wear and premature need for replacement.

3.10.2 Ground Brush Replacement

3.10.2.1 Ground Brush Removal

1. Remove all hazardous energies from the MRM2-255/755 SIGMA-5 Positioner positioner and other system components

 Each ground brush is enclosed in a box-shaped brush holder that is attached to a mounting plate. The brush holder incorporates a spring tensioner device that holds the ground brush, under spring tension, against the rear of the face plate when locked into position (see IPL Figure A-4).

2. Release the spring tensioner by squeezing together both of the black levers that are visible on each brush holder. While squeezing the levers together, pull out and away from the brush holder. This should produce the ground brush.
3. Each ground brush has two braided copper leads that connect to silver-plated, high current quick disconnect posts on the ground brush mounting plate (see IPL Figure A-4). After the ground brush is free and clear of the brush holder, use a flat blade screwdriver or needle nose pliers to disconnect each of the braided copper brush leads from the quick disconnect posts.

3.10.2.2 Ground Brush Installation

1. Connect braided copper brush cables (from the new brush) to the quick disconnect posts on the ground brush mounting plate (see IPL Figure A-4).

   This is a good time to check the cleanliness and condition of the quick disconnect posts. If you notice dirt or grease buildup on the posts, clean them. Use a small bristle brush (toothbrush size) and compressed air.

2. Make sure that the spring tensioner in the brush holder is released and pulled as far back as possible.

3. Insert the new brush into the brush holder and push forward as far as possible.

4. Lock the new brush into position by squeezing together the black tensioner levers and pushing the tensioner forward into the brush holder until it “clicks” into the locked position.

3.10.3 Inspection of Welding Ground Connections

Inspect all welding ground cable connections for cleanliness and security.

   Ground cable connections must be clean and tight. A loose or dirty connection can cause excess heat (high resistance connection) or arcing. Either of these conditions can damage the cable and cable connection point.
3.11 AC Servomotor Encoder Back-Up Battery

The main (sweep) axis and tooling (orbital) axis SIGMA-5 AC servomotors all incorporate a small, external Lithium-Ion “keep alive” battery that maintains encoder positioning data in memory should the main cables between the MRM2-255/755 SIGMA-5 Positioner and controller be disconnected (see Figure 3-1).

**Fig. 3-1: Typical Encoder Back-Up Battery Location.**

The batteries have a very long life in this particular application. Should one or more of these batteries drop below a certain charge level, an indication will appear on the Programming Pendant display screen, indicating the need for battery renewal.

Changing a depleted encoder back-up battery is a simple matter of accessing the encoder plug on the applicable AC servomotor, locating the depleted battery, and replacing it with a new battery of the same type (see Figure 3-1).
3.12 Positioner Home Position

**Home Position Definition:**
- S1 with Side B at Robot & Side A at Operator
- S2 Tooling Down (At Operator Side)
- S3 Tooling Up (At Robot Side)

### 3.12.1 Setting the Main Axis (S1) to Home (Zero) Position

1. Using the Programming Pendant, place the robotic system into MANAGEMENT mode.
2. Jog the S1 axis into the positioner hard stop with Side B at robot.
3. Increment positioner against hard stop until the axis holding torque equals 25% (+/- 5%).
4. Press the {MAIN MENU} on the programming pendant.
5. Cursor to {ROBOT} and press [SELECT].
6. Cursor to [HOME POSITION] and press [SELECT].
7. Press the {PAGE OVER} key to the S1 station (indicated in top right corner of Programming Pendant display panel).
8. Press [SELECT].
9. Cursor to {YES}, then press [SELECT].

### 3.12.2 Setting the Tooling Axis (S2 & S3) to Home (Zero) Position

1. Using the Programming Pendant, place the robotic system into MANAGEMENT mode.
2. Remove the cover to gain access to the ground brushes.
3. Jog the S1 axis into the positioner hard stop with S3 tooling at robot, and S3 tooling side up and level in the horizontal plane.
4. Slowly rotate the face plate until the homing pin hole in the face plate is accessible.
5. Install the plastic homing pin (see Figure 3-2) into the homing pin hole in the face plate (see Figure 3-3.)

---

**Fig. 3-2: Homing Pin Details**

**MATERIAL:** Delrin™ Polymer

70 mm (2.8 in)

20 mm (0.8 in)

5.0 mm (0.20 in) DIA

6.35 mm (0.250 in) DIA

**HOMING PIN (PIN 145896-1)**
6. Slowly jog the face plate in the direction indicated in Figure 3-3 until the homing pin just contacts the grounded brushes.

**NOTE**

If face plate rotation goes too far, the plastic alignment pin will bend and result in an inaccurate adjustment. If this happens, slowly reverse the face plate rotation until the pin returns to a straight position.

7. Press the {MAIN MENU} on the Programming Pendant display.

8. Move the cursor to the {ROBOT} and press [SELECT] on the programming pendant.

9. Move the cursor to the {HOME POSITION} and press [SELECT] on the programming pendant.

10. Press {PAGE OVER} to the desired station (indicated in top right corner of Programming Pendant display panel) and press [SELECT].

11. Move cursor to {YES}, then press [SELECT] on the programming pendant.

**NOTE**

The face plate is now reset to zero.

12. Remove the homing pin from the face plate and store in a secure location.
### 3.13 Positioner Inspection Schedule

Table 3-2: Inspection Schedule

<table>
<thead>
<tr>
<th>INSPECTION ITEM</th>
<th>FREQUENCY</th>
<th>INSPECTION OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioner</td>
<td>Daily</td>
<td>Check for physical damage that could indicate a load collision and/or evidence of misuse.</td>
</tr>
<tr>
<td>Positioner</td>
<td>Daily</td>
<td>Listen for unusual noise. If present, contact YASKAWA Customer Support (refer to Section 1.8).</td>
</tr>
<tr>
<td>Positioner</td>
<td>On condition</td>
<td>Clean with dry cloth, bristle brush, and compressed air.</td>
</tr>
<tr>
<td>Ground brushes</td>
<td>Weekly</td>
<td>Check for dirt between brushes and face plates. Check for full contact with the face plates.</td>
</tr>
<tr>
<td>AC servomotor</td>
<td>Daily</td>
<td>Check manually for excess vibration. If present, contact YASKAWA Customer Support (refer to Section 1.8).</td>
</tr>
<tr>
<td>AC servomotor</td>
<td>Daily</td>
<td>Listen for unusual or excessive noise. If present, contact YASKAWA Customer Support (refer to Section 1.8).</td>
</tr>
<tr>
<td>AC servomotor</td>
<td>Every 20,000 hours or 5 years</td>
<td>Check for wear or damage. If present, contact YASKAWA Customer Support (refer to Section 1.8).</td>
</tr>
<tr>
<td>Anchor bolts</td>
<td>6 months (or on condition)</td>
<td>Visual inspection; Check torque and security.</td>
</tr>
<tr>
<td>Cables and hoses</td>
<td>6 months (or on condition)</td>
<td>Check visually and manually (bend cables and hoses to check for cracks, checking, scuffing, etc).</td>
</tr>
</tbody>
</table>
Appendix A Illustrated Parts List

A.1 Introduction

A.1.1 Arrangement

Appendix A is arranged as follows –

- Appendix A.1, "Introduction"
- Appendix A.2, "Illustrated Parts List (IPL)"

A.1.2 General

The Illustrated Parts List (IPL) identifies, describes, and illustrates detail parts of the MRM2-255/755 SIGMA-5 Positioner.

A.1.3 Purpose

The IPL provides parts identification and descriptive information for use in provisioning, purchasing, storing, and issuing spare parts.

A.2 Illustrated Parts List (IPL)

The Illustrated Parts List contains illustrations (exploded views) and associated parts list tables that show detail parts of a particular component, assembly, or subassembly.

A.2.1 IPL Layout

The IPL is arranged so that the illustration (exploded view) for an assembly appears directly above the parts list table for that illustration. When this is not possible, due to a large illustration or an extensive parts list table, the parts list table will be listed on the facing page. This format always attempts to present the illustration and its associated parts list table to the reader in one view, regardless of viewing format (PDF or printed).

A.2.2 Item Categories Not Included in the IPL

The following item categories are not included in the IPL –

1. Standard hardware items (attaching parts) such as nuts, screws, washers, etc. These are commercially available to the customer.
2. Bulk items and consumables such as wire, cable, sleeving, tubing, certain fluids, etc. These are commercially available to the customer.
3. Permanently attached parts that lose their identity because they are welded, soldered, riveted, etc., to other parts, assemblies, or subassemblies.
A.2.3 Parts List Table Structure

Each figure’s parts list table contains the following data columns –

- **ITEM NUMBER**
  An entry in this column gives the item number for a part shown in the associated illustration (exploded view). The item number listed in this column is the same as the item number shown on the illustration. Item numbers on the illustration are identified by a circled number and leader line that points to the particular part (item) on the illustration.

- **PART NUMBER**
  An entry in this column gives the part number for an item. Refer to this number when ordering or referencing the part.

- **DESCRIPTION**
  An entry in this column gives the description (nomenclature) for an item number or part number.

- **QTY**
  An entry in this column gives the total quantity of an item or part number required for an assembly or subassembly in which the part appears. The quantity given in this column may or may not be the total quantity required for the complete end item.

  The letters “REF” in this column indicate a reference to the top assembly in the figure.

**NOTE**
Items not shown in the illustration are indicated by a dash (–) prefix to the item number. An example could include a right-hand (RH) part that is otherwise identical to the illustrated left-hand (LH) part.
<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>– 1</td>
<td>151442-1</td>
<td>POSITIONER KIT, MRM2-255-M3X, 3000 mm, REF</td>
<td>1</td>
</tr>
<tr>
<td>– 2</td>
<td>151442-2</td>
<td>POSITIONER KIT, MRM2-755-M3X, 3000 mm, REF</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>151515-1</td>
<td>HOUSING ASSY, TOOLING DRIVE,</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>158817-1</td>
<td>HOUSING ASSY, SWINGARM, TOOLING, MRM2-255-M3X</td>
<td>1</td>
</tr>
<tr>
<td>– 4A</td>
<td>158817-2</td>
<td>HOUSING ASSY, SWINGARM, TOOLING, MRM2-755-M3X</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>151449-2</td>
<td>BEAM SPREADER (ARC SHIELD), 3 METER</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>158816-1</td>
<td>HOUSING ASSY, MAIN DRIVE, MRM2-255-M3X</td>
<td>1</td>
</tr>
<tr>
<td>– 6A</td>
<td>158816-2</td>
<td>HOUSING ASSY, MAIN DRIVE, MRM2-755-M3X</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>151443-1</td>
<td>HOUSING ASSY, SWINGARM, MAIN</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>156665-2</td>
<td>BASE, POSITIONER</td>
<td>1</td>
</tr>
<tr>
<td>– 9</td>
<td>159769-1</td>
<td>CABLE ASSY, ENC, 2.2 KW, PIGTAIL, NX100</td>
<td>1</td>
</tr>
<tr>
<td>– 10</td>
<td>159768-1</td>
<td>CABLE ASSY, PIGTAIL, PWR, NX100I</td>
<td>1</td>
</tr>
<tr>
<td>– 11</td>
<td>159770-1</td>
<td>CABLE ASSY, P/T/I/O, 255/755-M3X</td>
<td>1</td>
</tr>
<tr>
<td>– 12</td>
<td>479348-2</td>
<td>BATTERY ASSEMBLY, ENCODER BACKUP</td>
<td>3</td>
</tr>
</tbody>
</table>
### MRM2-255/755

**SIGMA-5 Positioner**

**Appendix All Illustrated Parts List**

**A.2 Illustrated Parts List (IPL)**

**Fig. A-2: Tooling Drive Housing Assembly**

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>PART NO</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>151515-1</td>
<td>HOUSING ASSY, TOOLING DRIVE</td>
<td>REF</td>
</tr>
<tr>
<td>2</td>
<td>151583-1</td>
<td>HOUSING, TOOLING DRIVE</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>151697-1</td>
<td>BEARING, 6-BOLT FLANGE, 4-½ inch</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>148748-1</td>
<td>SWITCH ASSY, TOP ROLLER PLUNGER, 2 N.C. CONTACTS</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>151450-1</td>
<td>ACTUATOR DISK, A-B SIDE</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>151843-1</td>
<td>HANGAR, SUPPORT, CABLE</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>151603-1</td>
<td>COVER, HEAD / TAIL STOCK</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>131278-6</td>
<td>SCREW, SHC, M6X20, W/CAPTIVE FLAT &amp; LOCK WASHER</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>152986-1</td>
<td>BRACKET, MOUNTING, LIMIT SWITCHES</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE** – Limit switch mounting bracket not shown in this view. Refer to Item 9 in IPL Table for part number.
### Appendix Allillustrated Parts List

#### A.2 Illustrated Parts List (IPL)

**Fig. A-3: Housing Assembly, Swingarm Tooling, MRM2-255-M3X**

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>–1</td>
<td>158817-1</td>
<td>HOUSING ASSY, SWINGARM, TOOLING, MRM2-255-M3X</td>
<td>REF</td>
</tr>
<tr>
<td>–1A</td>
<td>158817-2</td>
<td>HOUSING ASSY, SWINGARM, TOOLING, MRM2-755-M3X</td>
<td>REF</td>
</tr>
<tr>
<td>2</td>
<td>151583-2</td>
<td>COVER TOOLING, RIGHT HAND</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>156009-2</td>
<td>MOTOR, AC SERVO, SIGMA V, 0.85 kW</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>151595-3</td>
<td>GEAR, INPUT, PINION, RV-80E-101, MRM2-255-M3X</td>
<td>2</td>
</tr>
<tr>
<td>–4A</td>
<td>151595-5</td>
<td>GEAR, INPUT, PINION, RV-80E-153, MRM2-755-M3X</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>144370-1</td>
<td>TERMINAL, QUICK DISC, WELD GROUND LUG</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>144372-1</td>
<td>BRUSH HOLDER, 1&quot; X 1.5&quot; X 2&quot;, WELD GROUNDING</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>144371-1</td>
<td>BRUSH, GROUND, METAL, GRAPHITE</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>158959-1</td>
<td>BRACKET, MTG, LIMIT SWITCH</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>149473-1</td>
<td>LIMIT SWITCH</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>151583-1</td>
<td>COVER TOOLING, LEFT HAND</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>145896-1</td>
<td>HOMING PIN</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>158824-1</td>
<td>PLATE, FACE, TOOLING DRIVE</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>149202-2</td>
<td>BLOCK ASSY, HEADSTOCK, MOTO MOUNT</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>151594-3</td>
<td>REDUCER, RV, RV-80E-101, MRM2-255-M3X</td>
<td>2</td>
</tr>
<tr>
<td>–14A</td>
<td>151594-5</td>
<td>REDUCER, RV, RV-80E-153, MRM2-755-M3X</td>
<td>2</td>
</tr>
</tbody>
</table>
### Illustrated Parts List (IPL)

**Fig. A-4: Components — Housing Assy, Swingarm, Tooling Drive**

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>REF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>158816-1</td>
<td>HOUSING ASSEMBLY, SWINGARM, TOOLING DRIVE, MRM2-255-M3X</td>
<td>REF</td>
<td></td>
</tr>
<tr>
<td>1A</td>
<td>158816-2</td>
<td>HOUSING ASSEMBLY, SWINGARM, TOOLING DRIVE, MRM2-755-M3X</td>
<td>REF</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>156009-7</td>
<td>MOTOR, AC SERVO, SIGMA V, 4.4 kW</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>152538-1</td>
<td>ADAPTER, FLYWHEEL, MRM2-250/750-M3X</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>151446-1</td>
<td>HOUSING, MAIN DRIVE</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>151592-3</td>
<td>REDUCER, RV, RV-320E, MRM2-255-M3X</td>
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<td></td>
</tr>
<tr>
<td>5A</td>
<td>151592-6</td>
<td>REDUCER, RV, RV-320E, MRM2-755-M3X</td>
<td>REF</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>157143-1</td>
<td>PLATE, MTG, ASSY, MOTOMOUNT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>149768-1</td>
<td>BEARING, CAN FOLLOWER, 47MM OD</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>157143-1</td>
<td>PLATE, MTG, ASSY, MOTOMOUNT</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>145753-2</td>
<td>BUSHING, SPHERICAL, 50 ID</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>146196-4</td>
<td>BLOCK, MTG, FIXTURE, 75 mm, BEARING, MOTOMOUNT HD</td>
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<tr>
<td>11</td>
<td>151593-3</td>
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</tr>
<tr>
<td>11A</td>
<td>151593-6</td>
<td>GEAR, INPUT, PINION</td>
<td>REF</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>151603-1</td>
<td>COVER, HEAD/TAIL STOCK</td>
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</tbody>
</table>
### Illustrated Parts List

**Fig. A-5: Components — Housing Assembly, Swingarm, Main Drive**

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
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<tr>
<td>–1</td>
<td>151443-1</td>
<td>HOUSING ASSEMBLY, SWINGARM, MAIN DRIVE</td>
<td>REF</td>
</tr>
<tr>
<td>2</td>
<td>151447-1</td>
<td>HOUSING, SWINGARM, MAIN DRIVE</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>479297-6</td>
<td>SCREW, SHC, M10 X 35, CLASS 12.9</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>470541-1</td>
<td>WASHER, CONICAL SPRING, GTS10</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>148824-1</td>
<td>ADAPTER ASSEMBLY, TAILSTOCK</td>
<td>2</td>
</tr>
</tbody>
</table>
MRM2-255/755-M3X
SIGMA-5 POSITIONER MANUAL

Specifications are subject to change without notice
for ongoing product modifications and improvements.