MRM2-M3X SERIES POSITIONER INSTRUCTIONS

MRM2-1000 M3X
MRM2-1200 M3X

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

MOTOMAN INSTRUCTIONS
MOTOMAN MRM2-M3X INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR’S MANUAL
DX100 MAINTENANCE MANUAL

The DX100 operator’s manual above corresponds to specific usage.
Be sure to use the appropriate manual.

Part Number: 151322-1CD
Revision: 2
MANDATORY

- This user guide provides an overview of the Yaskawa MRM2-M3X system. It gives general information about the system, a description of its major components, and the procedures for installation, system operation, and preventive and repair maintenance. Be sure to read and understand this manual thoroughly before installing and operating the MRM2-M3X system.
- General items related to safety are listed in Section 2 of the Controller Manual. To ensure correct and safe operation, carefully read the Controller Manual before reading this manual.
- The purchaser is responsible 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 obtaining and reviewing a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-1999). This document can be obtained 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 is tested and complies 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.
• Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure that all covers and shields are replaced before operating this product.

• The drawings and photos in this manual are a representative, 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 a 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 the product's warranty.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the Yaskawa MRM2-M3X system.

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.

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 manipulator, check that servo power is turned OFF by pressing the EMERGENCY STOP buttons on the operator station or Programming Pendant (refer to Figure 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 circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the EMERGENCY STOP buttons do not function.

Figure 1: EMERGENCY STOP Button

- Release the EMERGENCY STOP button (refer to Figure 2). Once this button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Figure 2: Release of EMERGENCY STOP Button

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator.
  - View the manipulator 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 P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning on the power for the DX100 controller.
  - Moving the manipulator with the Programming Pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator 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 manipulator is a YASKAWA industrial robot product. The manipulator usually consists of the controller, the Programming Pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 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>
Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system 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 equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.

• Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.

• The system 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).

Mechanical Safety Devices

The safe operation of this equipment is ultimately the users 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 this 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 barriers
• Door interlocks
• Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
Programming, Operation, and Maintenance Safety

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system 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 equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

• Inspect the equipment 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.

• Check the E-Stop button on the operator station for proper operation before programming. The equipment 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 the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from Yaskawa will void your warranty.

• Some operations require standard passwords and some require special passwords.

• The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.

• 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 equipment. All connections must be made within the standard voltage and current ratings of the equipment.
Maintenance Safety

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by Yaskawa-trained, qualified personnel.

Summary of Warning Information

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by Yaskawa. Address any questions regarding the safe and proper operation of the equipment to Yaskawa Motoman Customer Support.
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1 Introduction

1.1 About This Document

The MRM2-1000/1200M3X Positioner Manual provides instructions for the MRM2-1000/1200M3X positioner and is organized as follows:

- **CHAPTER 1 - INTRODUCTION**
  This chapter provides general information about the MRM2-1000/1200M3X positioner, a list of reference documents, and customer service information.

- **CHAPTER 2 - INSTALLATION**
  This chapter provides instructions for set up and installation of the MRM2-1000/1200M3X positioner.

- **CHAPTER 3 - MAINTENANCE**
  This chapter provides instructions for basic maintenance of the MRM2-1000/1200M3X positioner.

- **APPENDIX A - ILLUSTRATED PARTS LIST**
  This appendix contains spare parts lists for the MRM2-1000/1200M3X positioner.

1.2 Overview

The MRM2-1000/1200M3X positioner is a two-station, horizontal ferris wheel type positioner with AC servo-driven headstocks.

*Fig. 1-1: MRM2 - 1000/1200M3X Positioner*
1.2.1 Major Components

The MRM2-1000/1200M3X positioners include the following major components:

- Two-station horizontal positioner
- Cable set between positioner and controller
- Assembly kit for controller (servopacks, etc.)

1.2.2 Motoman Technical Specifications

Refer to Motoman dimension drawing No. 153083-1 (positioner kit)

*Table 1-1: Positioner Technical Specifications*

<table>
<thead>
<tr>
<th>Model P/N</th>
<th>152521-1 (-2)</th>
<th>152521-3 (-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Pay Load</td>
<td>1200</td>
<td>1000</td>
</tr>
<tr>
<td>Load Height</td>
<td>910</td>
<td>867</td>
</tr>
<tr>
<td>Programming</td>
<td>1436</td>
<td>1479</td>
</tr>
<tr>
<td>Max Cg Offset</td>
<td>76</td>
<td>76</td>
</tr>
<tr>
<td>Max. Load</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Number of Motors</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Index Motor Power</td>
<td>4.4 Sigma III</td>
<td>4.4 Sigma III</td>
</tr>
<tr>
<td>Tooling Motor Power</td>
<td>2.0 Sigma III</td>
<td>2.0 Sigma III</td>
</tr>
<tr>
<td>Side A to Side B Sweep Time</td>
<td>2.93 sec.</td>
<td>2.93 sec.</td>
</tr>
<tr>
<td>Index Axis Speed</td>
<td>0-13.7 rpm</td>
<td>0-13.7 rpm</td>
</tr>
<tr>
<td>Index Torque</td>
<td>5386 N•m</td>
<td>5386 N•m</td>
</tr>
<tr>
<td>Tooling Index Time</td>
<td>2.2 sec.</td>
<td>2.2 sec.</td>
</tr>
<tr>
<td>Tooling Axis Speed</td>
<td>12.9 rpm</td>
<td>12.9 rpm</td>
</tr>
<tr>
<td>Tooling Torque</td>
<td>1389 N•m</td>
<td>1389 N•m</td>
</tr>
<tr>
<td>Maximum Fixture Diameter</td>
<td>1300 (-3.0 m^d) (-3.5 m^d)</td>
<td>1525 (-3.0 m^e) (-3.5 m^e)</td>
</tr>
<tr>
<td>Standard Fixture Length</td>
<td>1300 (-3.0 m^f) (-3.5 m^g)</td>
<td>1300 (-3.0 m^f) (-3.5 m^g)</td>
</tr>
<tr>
<td>Position Repeatability</td>
<td>±0.1</td>
<td>±0.1</td>
</tr>
<tr>
<td>Standard Tooling Air Size</td>
<td>2 x 10 mm ID</td>
<td>2 x 10 mm ID</td>
</tr>
<tr>
<td>Standard Tooling Air Location</td>
<td>Headstock</td>
<td>Headstock</td>
</tr>
<tr>
<td>Tooling Axis Weld Ground Capacity (100% Duty Cycle)</td>
<td>1200 (opt. 1600)</td>
<td>1200 (opt. 1600)</td>
</tr>
<tr>
<td>Positioner Weight</td>
<td>4100</td>
<td>4100</td>
</tr>
</tbody>
</table>

a Signal-to-signal time for 180 degrees of main axis rotation.
b Signal-to-signal time for 180 degrees of main axis rotation.
c Total index time for M3X positioners includes only the A to B sweep time tooling can be rotated simultaneously.
d The tool that sweeps under is limited to 450 mm in depth to clear the floor, resulting in a “D” tooling shape.
e The tool that sweeps under is limited to 325 mm in depth to clear the floor, resulting in a “D” tooling shape.
f The pin-to-pin dimension is 2,920 ± 7.5 mm.
g The pin-to-pin dimension is 3,420 ± 7.5 mm.
1.3 Reference to Other Documentation

For additional information refer to the following:

- Motoman Operator’s Manual for Arc Welding (P/N 142098-1CD)
- Motoman Operator’s Manual for General Purpose (P/N 142099-1CD)
- Motoman Operator’s Manual for Handling (P/N 142100-1CD)
- Motoman Operator’s Manual for Spot Welding (P/N 142101-1CD)
- Motoman Manipulator manual for the robot type
- Motoman Controller manual for the controller type
- Vendor manuals for system components not manufactured by Motoman

1.4 Customer Support Information

If assistance is needed with any aspect of the MRM2 system, please contact Yaskawa Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

For **routine** technical inquiries, 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 the issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to the inquiry.

**NOTE**

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

1.2.3 Optional Equipment

### Table 1-2: Optional Equipment

<table>
<thead>
<tr>
<th>Air Options</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2-Channel I/O (12-channel - 12 conductors @ 10 amps)</td>
<td>148986-1 Tailstock</td>
</tr>
<tr>
<td>Multiple Angle Load Jog Switch</td>
<td>148092-4</td>
</tr>
<tr>
<td>Multiple Angle Load Thumbwheel</td>
<td>148092-3</td>
</tr>
<tr>
<td>Ground Block Kit, 1600 Amp</td>
<td>149291-1</td>
</tr>
</tbody>
</table>
Please have the following information ready before calling:

- **System**  
  MRM2 including name/model of laser sensor

- **Robots**  
  EA1400, EA1900, etc

- **Positioner**

- **Primary Application**

- **Controller**  
  MRC

- **Software Version**  
  Access this information on the Programming Pendant's LCD display by selecting (MAIN MENU) - (SYSTEM INFO) - (VERSION)

- **Robot Serial Number**  
  Located on the robot data plate

- **Robot Sales Order Number**  
  Located on the controller data plate
2 Installation

2.1 Lifting Instructions

When lifting the positioner, use two fork lifts and lift from both ends using the integrated fork pockets.

**WARNING**

Shipping brackets must be used when moving the positioner.

*Fig. 2-1: Lifting Instructions*

**WARNING**

Forklift truck operation should be performed only by licensed personnel. In handling the positioner, extra care must be taken regarding the following:

Never place a body part under a suspended load or move a suspended load over any part of person's body. Careless handling may result in severe personal injury or death.
2.2 Dimensions

Fig. 2-2: Dimensions

2.3 Mounting

The MRM2-1000/1200M3X positioner should be firmly mounted on a base plate or foundation rigid enough to support the positioner and withstand repulsion forces. The surface of the floor should be level and even. If it is uneven, grind the swell and flatten the surface. The concrete thickness of the floor must be at least 150 mm.

WARNING

The positioner weighs 4200 kg. Make sure the lifting devices used to move the positioner are capable of safely handling this much weight, or damage to the equipment or injury to personnel can result.

1. Before removing the shipping bracket, move the positioner in place for operation.
2. Using an M36 socket, turn each leveling bolt until they are in firm contact with the floor.
2.3.1 Squaring the Positioner

To prevent undue wear on the gear wheels, the swingarm must be square with the headstock and tailstock. The positioner is squared prior to shipment at the factory. However, it is recommended that the positioner is squared again prior to removing the shipping bracket. To square the positioner, proceed as follows:

1. Rotate the swingarm into place.

2. Measure the distance between the swingarm and the headstock unit in four locations; top and bottom of the swingarm on both sides of the main axis.

*Fig. 2-3: Measuring Distance Between Swingarm and Headstock*
2.3 Mounting

### 3. Using an M36 socket, turn each leveling bolt until the difference between the four measurements is ± 1 mm.

![Fig. 2-4: Leveling Bolts Location]

**NOTE**

The MRM2-1000/1200M3X does not require leveling. The leveling bolts are designed to square the swingarm with the headstock and tailstock and provide stability to the unit.

---

#### 2.3.2 Lagging the Positioner

1. Insert an M20 concrete drill bit through the primary anchor bolt holes on each end of the positioner and drill holes (at least four in. deep into concrete) for anchor bolts.

2. Anchor the primary bolt locations using four M20 or 3/4 in. anchor bolts.

**NOTE**

It is important that both the headstock and tailstock are anchored to the floor prior to the removal of the shipping brackets. This prevents misalignment between the headstock and tailstock.

---

![Fig. 2-5: Positioner Anchor Locations]
3. Use a M24 socket/wrench to remove the eight screws securing the shipping bracket.

Fig. 2-6: Positioner Shipping Brackets

4. Remove shipping bracket.

**NOTE** Positioner shipping brackets are required to move the positioner. Be sure to keep the positioner shipping brackets for future use.

5. Insert an M20 concrete drill bit through the secondary anchor bolt holes on each end of the positioner and drill holes (at least four in. deep into concrete) for anchor bolts.

6. Anchor the secondary bolt locations on both the headstock and tailstock using eight M20 or 3/4 in. anchor bolts.
### 2.3.3 Adjusting the Hardstops

Shock absorbing hardstops located on the head and tailstocks, prevent the positioner from rotating a full 360°. The head and tailstocks are equipped with spring-loaded shock absorbers to absorb some of the positioner swingarm impact. It is important that the both the head and tailstock swingarms strike the hardstop shock absorbers at approximately the same time. Adjustable wedge blocks are used to ensure that both the head and tailstock swingarms are striking the hardstops evenly. To adjust the wedge blocks, proceed as follows:

1. Rotate the swingarm into side A. With the programming pendant, rotate the swingarm so the stop block on the swing arm is just touching the top of the shock absorber plunder bolt. Make sure that the plunger bolt is not compressed.

![Fig. 2-7: Rotating Swingarm](image)

2. Locate and examine the shock absorber on the tailstock side. The wedge hardstop block needs to be touching the plunger bolt.

![Fig. 2-8: Locating Shock Absorber](image)
3. If there is a gap, loosen the bolt holding the wedge block and slide the wedge so it is just touching the plunger bolt. If it is compressing the plunger bolt, slide the wedge block so it is only touching the plunger bolt. Torque the wedge bolt to (100 N-m).

*Fig. 2-9: Adjusting Wedge Block*

4. Rotate the swingarm into side B and repeat steps 1 through 3.

**2.4 Connection to Motoman Controller3.**

Installation and connection to the controller comprises hardware as well as software installation, and must be carried out by Yaskawa Motoman-service personnel. When the positioner is delivered together with a robot, this installation is complete.

See separate schematics for electrical connections:

*Fig. 2-10: Positioner Connections*
2.5 Before First Start

Before starting the operation, the safety fence, shield screens, cover and protective devices must be connected. Personnel should be instructed to stay outside the robot/positioner work area.

**WARNING**

- Install all electrical cables connecting the positioner, controller, welding machine, and electrical supply wiring cables so that there is no possibility of their being walked on or run over. Do not put any object directly on the cables.
- Do not install cables across other cables, and do not lay cables underneath the welding machine.
- The positioner is controlled from the robot controller/operators panel. Install these so that the positioner is in full view from the controller.

**WARNING**

- Check all safety functions, emergency stop buttons etc. Failure to do so could result in serious personal injury or death.
- Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI) may cause unexpected positioner motion which may result in severe personal injury or death.
- If RFI or EMI are suspected, contact an electrical noise consultant.
- During operation, check the positioner for excessive vibration, unusual noise etc. If any of these occur, stop immediately by pushing EMERGENCY STOP button on the operator's panel, and contact Yaskawa Motoman service.
2.6 Tooling

Installation of tooling and fixtures should be performed by personnel who are familiar with the operation of this system. Tooling and fixtures are supplied by the customer.

**WARNING**

Care must be taken when sweeping the positioner while in Teach mode. A-side tooling can hit the floor as it is being swept causing damage to equipment and tooling.

The MRM2-1000/1200M3X is equipped with the MotoMount mounting system. MotoMount is a flexible tool fixture mounting system which improves tool repeatability and reduces loads on the headstock/tailstock bearing systems. MotoMount accommodates combined headstock/tailstock/tooling misalignments up to two degrees.

*Fig. 2-11: MotoMount*

To ensure that customer-supplied tooling fixtures fit properly to MotoMount, the following specifications must be met.

### 2.6.1 Parallelism

Inspect both mounting flanges for parallelism to one another. The combined angle of misalignment for both flanges should not exceed 1/2 degree (see Figure 2-13).

*Fig. 2-12: Parallelism of Mounting Flanges*
2.7 Mounting Hole Pattern

The tooling fixture flange that fastens to MotoMount must have the following hole pattern. Both primary and auxiliary mounting holes must be used for tooling greater than 600 kg (see Fig. 2-14).

**Fig. 2-13: Mounting Holes**

![Diagram of Mounting Holes]

**2.7.1 Headstock Flange Specifications**

**Fig. 2-14: Clearance Specifications**

![Diagram of Headstock Flange Specifications]
2.7.2 Tailstock Flange Specifications

*Fig. 2-15: Tailstock Adapter*

![Diagram of Tailstock Adapter]

*Fig. 2-16: Tailstock Component Clearance*

![Diagram of Tailstock Component Clearance]

2.8 Maximum Load

To guarantee long and safe operation with high positioning accuracy of your MRM2-1000/1200M3X positioner, the machine must not be overloaded.

If the difference in weight between the two sides (A - B) exceed 300 kg the servo motor is overloaded. (e.g. when mounting or exchanging fixtures).

Follow restrictions below:

- Maximum static torque of servo axis = 895 N·m.
- Maximum payload = 1200 kg (incl. fixtures).
- Maximum offset from rotation center at 1200 kg = 0.076 m
Fig. 2-17: Maximum Load

<table>
<thead>
<tr>
<th>TOTAL TOOLING MASS (kg)</th>
<th>CENTER OF MASS OFFSET (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>0.182</td>
</tr>
<tr>
<td>750</td>
<td>0.122</td>
</tr>
<tr>
<td>1000</td>
<td>0.091</td>
</tr>
<tr>
<td>1200</td>
<td>0.076</td>
</tr>
</tbody>
</table>

TOOLING MASS X 9.81 = MASS OFFSET

- 895
- 1300 MAX TOOLING ENVELOPE
- 450 MAX
- OPERATOR SIDE
- 1622
# 3 Maintenance

## 3.1 General

Maintenance of the positioner should be handled only by authorized personnel or Yaskawa Motoman Service, who are thoroughly familiar with the design and construction of the system. Before performing maintenance or service work, be sure to:
- Turn off and lockout all electrical supplies.
- Lock the wiring circuit breaker.

**WARNING**

Due to possible interconnections of the positioner controller with other equipment, more than one live circuit can exist. Be sure to have turned off all live circuits before servicing. In order to prevent inadvertent turning on of the machine, post a warning or danger notice on the disconnected main switch, indicating that maintenance is being performed. After completing maintenance work, be sure to check that all the cover clamping bolts are tight and that no tools are left in the interior of the working cell.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>133174-2</td>
<td>GREASE, C-SG, O ULTRA, RM2 400 G, 1 POUND UNIT</td>
<td>1</td>
</tr>
<tr>
<td>132412-2</td>
<td>GREASE, MOLY-WHITE #00 14 OZ CARTRIDGE</td>
<td>1</td>
</tr>
<tr>
<td>479014-3</td>
<td>ADHESIVE, GASKET, LIQUID 100 GRAM TUBE</td>
<td>1</td>
</tr>
</tbody>
</table>

## 3.2 VIGO Drive Gear Reducer

### 3.2.1 Condition at delivery

Check lubrication before putting into service when delivered as spare part.

### 3.2.2 Mounting of Motor

Seal between motor and housing with liquid gasket adhesive (P/N 479014-3).

### 3.2.3 Overhaul

After about 20,000 hours or 4 to 5 years operation, it is advisable to overhaul the unit and replace the grease.

### 3.2.4 Disassembly - Reassemble

In principle, disassembly of the reduction unit is not recommended. No attempt should be made to change the mesh or clearances within the unit. If the unit is disassembled by other than Teijin Seiki personnel then the operating and performance characteristic cannot be guaranteed.
3.3 Trunnion Axis VIGO Drive RD-320E-81

Table 3-2: Mounting Torque

<table>
<thead>
<tr>
<th>Mounting Torque Between:</th>
<th>Screws</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive - Drive Plate</td>
<td>16 x M12 x 45</td>
<td>128.4 Nm</td>
</tr>
<tr>
<td>Drive - Servo Motor</td>
<td>4 x M12 x 45</td>
<td>100 Nm</td>
</tr>
</tbody>
</table>

3.3.1 Lubrication

The VIGO Drive RD-320E-81 series is a completely sealed unit (pre-greased) ready to be mounted to the servomotor.

3.4 Tooling Axis VIGO Drive RV-160E-145

Table 3-3: Mounting Torque

<table>
<thead>
<tr>
<th>Mounting Torque Between:</th>
<th>Screws</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headstock Gear - Swing Arm Housing</td>
<td>16 x M12 x 40 SHC</td>
<td>128.4 Nm</td>
</tr>
<tr>
<td>Drive - Headstock Gear Adapter</td>
<td>12 x M12 x 60 SHC</td>
<td>128.4 Nm</td>
</tr>
<tr>
<td>Servomotor - Motor Mounting Plate</td>
<td>4 x M12 x 45 SHC</td>
<td>100 Nm</td>
</tr>
</tbody>
</table>

3.4.1 Lubrication

The series VIGO Drive RV-160E-145 is filled with grease at delivery from Motoman. However, if the gear drive is purchased directly from the manufacturer, grease is not in the drive. The drive must be lubricated before it is put into service. The amount of grease depends on direction of installation. Grease recommendation is TEIJIN SEIKI Molywhite R00. To lubricate the drive unit you must have the tooling drive covers removed to access the grease nipple. Remove the back access cover from the swing arm and remove the grease plug from the side of the drive. Pump grease into the drive until it starts to come out of the vent port.

3.5 Cleaning

The machine does not need any special cleaning beside normal cleaning once a shift (dust etc.). Keep an eye on the current transfer discs. If the surface is too worn, bad contact and bad welding result will occur.

3.6 AC Servo

3.6.1 Servo Motor

The AC servo motor has no wearing parts (e.g. brushes), so simple daily inspection is sufficient. The inspection schedule for the motor is shown in Table 3-5:

Do not disassemble the motor. If disassembly should become necessary, contact Yaskawa Motoman-service.
3.6.2 Servopack

The servopack does not require any special maintenance. Remove dust and tighten screws periodically.

Table 3-4: Maintenance of AC Servo Motor

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Frequency</th>
<th>Inspection Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration</td>
<td>Daily</td>
<td>Feel manually</td>
</tr>
<tr>
<td>Noise</td>
<td>Daily</td>
<td>Aurally</td>
</tr>
<tr>
<td>Exterior and cleaning</td>
<td>as required</td>
<td>Clean with dry cloth or compressed air</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>Annually</td>
<td>Make sure that it is more than 10 Mohm by measuring with a 500V megger after disconnection the motor from the controller</td>
</tr>
<tr>
<td>Shaft seal</td>
<td>Every 5,000 hr</td>
<td>Replace shaft seal</td>
</tr>
<tr>
<td>Overhaul</td>
<td>Every 20,000 hours or 5 years</td>
<td>If worn or damaged, replace after disconnecting the motor from the machine. Contact Motoman Service.</td>
</tr>
</tbody>
</table>

Table 3-5: Troubleshooting

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor does not start</td>
<td>Loose connection</td>
<td>Tighten connection</td>
</tr>
<tr>
<td></td>
<td>Wrong wiring</td>
<td>Correct wiring</td>
</tr>
<tr>
<td></td>
<td>Overload</td>
<td>Reduce load</td>
</tr>
<tr>
<td>Unstable operation</td>
<td>Wrong wiring</td>
<td>Inspect and correct wiring across motor terminals L1, L2, L3, and PE</td>
</tr>
<tr>
<td>Motor overheats</td>
<td>Excessive ambient temperature</td>
<td>Reduce ambient temperature below 40°C</td>
</tr>
<tr>
<td></td>
<td>Motor surface is dirty</td>
<td>Clean motor surface</td>
</tr>
<tr>
<td></td>
<td>Overload</td>
<td>Reduce load</td>
</tr>
<tr>
<td>Unusual noise</td>
<td>Motor loosely mounted</td>
<td>Tighten foundation bolts</td>
</tr>
<tr>
<td></td>
<td>Motor misaligned</td>
<td>Realign</td>
</tr>
<tr>
<td></td>
<td>Coupling out of balance</td>
<td>Balance coupling</td>
</tr>
<tr>
<td></td>
<td>Noisy bearing</td>
<td>Check alignment, noise of bearing, lubrication and contact Motoman-service</td>
</tr>
<tr>
<td></td>
<td>Vibration of driven machine</td>
<td>Contact machine manufacturer, Yaskawa Motoman-service</td>
</tr>
</tbody>
</table>

NOTE: Shaded text, remedies should be carried out after turning power off.
3.7 Lubrication and Maintenance Schedule

Table 3-6: Lubrication and Maintenance Schedule

<table>
<thead>
<tr>
<th>Interval</th>
<th>Point</th>
<th>Method</th>
<th>Lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly</td>
<td>Security Check bolts for fixtures and anchor bolts.</td>
<td>Visually, wrench key</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cables and hoses Check wear and condition</td>
<td>Visually</td>
<td></td>
</tr>
<tr>
<td>5000 h</td>
<td>Slew bearing gear It recommended to lube the pinion and gear with the same grease. The slew bearing is filled with LV 2 EP from the manufacturer. It is recommended to lube bearing with the same grease or equivalent as required.</td>
<td>Grease gun</td>
<td>O ULTRA C-SG GREASE</td>
</tr>
<tr>
<td>20,000 h</td>
<td>VIGO Drive RD-320E-81 Change grease after initially supplying the RV-E with specified quantity. 1040cc</td>
<td>Grease gun</td>
<td>TEIJIN SEIKI Molywhite R00</td>
</tr>
<tr>
<td></td>
<td>VIGO Drive RV-160E-145 Change grease after initially supplying the RV-E with specified quantity. 630cc Recommend grease is TEIJIN SEIKI Molywhite R00</td>
<td>Grease gun</td>
<td>TEIJIN SEIKI Molywhite R00</td>
</tr>
</tbody>
</table>

3.8 Pneumatic Options

Following options are available for the MRM2 S3X-Series positioners.

Table 3-7: Pneumatic Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Option P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Drive side = 2 x 1/4 in. BSPT. Drive unit has two separate 10 mm air passages</td>
<td></td>
</tr>
<tr>
<td>Option 1</td>
<td>Support side = Bus communication unit</td>
<td></td>
</tr>
<tr>
<td>Option 2</td>
<td>High volume air, 0.75 in. diameter air line at each tailstock faceplate</td>
<td>148927-1</td>
</tr>
</tbody>
</table>

3.9 Resetting Home Position

Resetting the MRM2-1000/1200M3X axes to Home position is typically done during initial installation or after a servo motor has been serviced. To reset Home position, proceed as follows:

- **S1**
  1. Place the programming pendant in MANAGEMENT MODE.
  2. Select the SERVO MONITOR screen.
  3. Jog S1 axis into positioner hard stop with Side B at robot. Increment positioner against hard stop until S1 axis Max Torque equals 60% (±5%).
  4. Press the TOP MENU key on the programming pendant.
  5. Cursor to ROBOT and press SELECT.
3. Maintenance
3.9 Resetting Home Position

6. Cursor to HOME POSITION and press SELECT.
7. Press the PAGE OVER key to the S1 station (indicated in the top right corner).
8. Make sure that axis is in the positioner that you want to teach as Home and press SELECT.
9. Cursor to YES and press SELECT. The S1 axis is now reset to zero.

---

**S2**

1. Place robot in TEACH MODE and slowly jog axis until homing pin hole on adaptor plate is accessible.
2. Install homing pin into homing pin hole in adaptor plate.
3. Jog the S2 axis slowly until homing pin just touches stationary edge to structure. If you jog the axis too far, the pin will bend, causing an inaccuracy. Slowly jog the axis in reverse until pin is straight, but still touching the edge of structure.
4. Place the programming pendant in MANAGEMENT MODE.
5. Press the TOP MENU key on the programming pendant.
6. Cursor to ROBOT and press SELECT.
7. Cursor to HOME POSITION and press SELECT.
8. Press the PAGE OVER key to the S2 station (indicated in the top right corner).
9. Make sure the axis is in the position that you want to teach as Home and press SELECT.
10. Cursor to YES and press SELECT. The S2 axis is now reset to zero.
11. Remove the homing pin from the adaptor plate.

*Fig. 3-1: Teaching Homing Position*
3.9 Resetting Home Position

S3

1. Place robot in TEACH MODE and slowly jog axis until homing pin hole on adaptor plate is accessible.

2. Install homing pin into homing pin hole in adaptor plate.

3. Jog the S3 axis slowly until homing pin just touches stationary edge to structure. If axis is jogged too far, the pin will bend, causing an inaccuracy. Slowly jog the axis in reverse until pin is straight, but still touching the edge of structure.

4. Place the programming pendant in MANAGEMENT MODE.

5. Press the TOP MENU key on the programming pendant.

6. Cursor to ROBOT and press SELECT.

7. Cursor to HOME POSITION and press SELECT.

8. Press the PAGE OVER key to the S3 station (indicated in the top right corner).

9. Make sure the axis is in the position that you want to teach as Home and press SELECT.

10. Cursor to YES and press SELECT. The S3 axis is now reset to zero.

11. Remove the homing pin from the adaptor plate.
A.1 Introduction

A.1.1 General
The Illustrated Parts List identifies, describes, and illustrates detail parts of the main assemblies for the Barrier Assembly Manual positioner manufactured by Yaskawa Motoman.

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 - Parts List

A.1.4 Explanation of Parts List
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.

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. A dash (-) preceding an item number indicates that the item is not shown in the illustration.
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 Explanation of Parts List Arrangement

The parts list is arranged so that the illustration will appear on left-hand page and the applicable parts list will appear on the opposite right-hand page. Unless the list is unusually long, the user will be able to look at the illustration and read the parts list without turning a page.

A.2.2 Symbols and Abbreviations

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

amp – ampere
AC – alternating current
cyl – cylinder
DC – direct current
fig – figure
hex – hexagon
ID – inside diameter
in. – inch
m – meter
mm – millimeter
No. – number
psi – pounds per square inch
v – voltage
Fig. A-1: MRM2-1000/1200M3X Components

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>PART NO</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>152526-1</td>
<td>POSITIONER, ASSY, HEADSTOCK, SIGMA III, MRM-1200-M3x</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>152523-1</td>
<td>ARM ASSY, SWING, HEADSTOCK, SIGMA III, MRM2-1200m3x</td>
<td>1</td>
</tr>
<tr>
<td>-3</td>
<td>152523-4</td>
<td>ARM ASSY, SWING, HEADSTOCK, SIGMA III, MRM2-1000m3x</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>148758-1</td>
<td>BEAM SPREADER</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>148777-1</td>
<td>ARM ASSY, SWING, TAILSTOCK, MRM-1200-M3x</td>
<td>1</td>
</tr>
<tr>
<td>-6</td>
<td>148777-2</td>
<td>ARM ASSY, SWING, TAILSTOCK, MRM-1000-M3x</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>148719-1</td>
<td>POSITIONER, ASSY, TAILSTOCK</td>
<td>1</td>
</tr>
</tbody>
</table>

NOTES A dash (-) preceding an item number indicates that the item is not shown in the illustration.
Fig. A-2: Headstock Assembly Components

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>148715-1</td>
<td>COVER, HOUSING, HEADSTOCK</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>148716-1</td>
<td>COVER, HOUSING</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>149172-1</td>
<td>SUPPORT, CABLE, HANGER</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>148709-1</td>
<td>HOUSING, HEADSTOCK</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>152527-1</td>
<td>DRIVE, ASSY, MAIN, SIGMA III, RH</td>
<td>1</td>
</tr>
</tbody>
</table>
### Illustrated Parts List

#### A.2 Parts List

**Fig. A-3: Main Drive Assembly Components**

<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>149568-10</td>
<td>MOTOR, AC, SERVO, SIGMA III</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>148712-5</td>
<td>REDUCER, RV, RD-320E-101</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>150074-1</td>
<td>GEAR ASSY, INPUT</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>148711-1</td>
<td>PLATE, MAIN</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>140786-2</td>
<td>POSITIONER BEARING, SLEWING</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>148813-1</td>
<td>GUARD, UPPER, MAIN DRIVE, (LH)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>148812-1</td>
<td>GUARD, LOWER, MAIN DRIVE</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>148813-2</td>
<td>GUARD, UPPER, MAIN DRIVE, (RH)</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>148814-1</td>
<td>SHOCK ABSORBER ASSY</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>132652-8</td>
<td>PIN, DOWEL M12X40</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>153084-1</td>
<td>COUPLING, TORQUE, RD320e</td>
<td>1</td>
</tr>
</tbody>
</table>
### Fig. A-4: Headstock Swing Arm Assembly Components

<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>148775-1</td>
<td>COVER, BACK</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>152524-1</td>
<td>DRIVE ASSY, HEADSTOCK</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>148780-1</td>
<td>GUARD, SWITCH (LH)</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>148761-1</td>
<td>PLATE, MTG, GROUND BRUSH</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>144371-1</td>
<td>BRUSH</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>144372-1</td>
<td>BRUSH HOLDER</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>148089-2</td>
<td>BLOCK, MTG, SENSOR</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>148093-2</td>
<td>SENSOR, SLOT</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>148090-2</td>
<td>ACTUATOR, SENSOR</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>148780-2</td>
<td>GUARD, SWITCH (RH)</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>148762-1</td>
<td>PLATE, FACE, HEADSTOCK</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>149202-1</td>
<td>BLOCK ASSY, HEADSTOCK, MOTOMOUNT</td>
<td>2</td>
</tr>
</tbody>
</table>
### Fig. A-5: Headstock Drive Assembly Components

<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>149568-12</td>
<td>MOTOR, 2.0 kW, SIGMA III</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>130425-2</td>
<td>SCREW BHCS M6X10</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>132527-7</td>
<td>WASHER, FLAT, M6</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>153064-1</td>
<td>GEAR, PINION, RV-160E</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>148819-2</td>
<td>REDUCER (RV-160E-171)</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>479147-5</td>
<td>WASHER, FLAT, M8</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>148781-1</td>
<td>ADAPTER, GEAR, HEADSTOCK</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>151349-1</td>
<td>SEAL, QUAD RING 234.5ID</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>148763-1</td>
<td>ADAPTER, GEAR</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>133997-1</td>
<td>SCREW, SET, M6X8</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>133997-1</td>
<td>SCREW, SET, M6X8</td>
<td>1</td>
</tr>
<tr>
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### Fig. A-6: Tailstock Swingarm Assembly Components

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