MOTOMAN MH1605-505TR POSITIONER INSTALLATION AND OPERATION INSTRUCTIONS

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

MOTOMAN INSTRUCTIONS

MOTOMAN MANIPULATOR INSTRUCTIONS
MOTOMAN MH-SERIES POSITIONER MANUAL
MOTOMAN CONTROLLER MANUAL
MOTOMAN MAINTENANCE MANUAL
MOTOMAN OPERATOR’S MANUAL FOR ARC WELDING
MOTOMAN CONCURRENT I/O PARAMETER MANUAL

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

Part Number: 162069-1CD
Revision: 0
MANDATORY

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.

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 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 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 MH1605-505TR.

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 MH1605-505TR, 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 positioner during an emergency. The positioner 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 positioner then, turn servo power ON.

Injury may result from unintentional or unexpected positioner motion.

Figure 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 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 positioner 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>Controller</td>
<td>Controller</td>
</tr>
<tr>
<td>Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the positioner and</td>
<td>Power cables</td>
</tr>
<tr>
<td>the controller</td>
<td></td>
</tr>
</tbody>
</table>

CAUTION

- Perform the following inspection procedures prior to conducting positioner teaching. If problems are found, repair them immediately and be sure that all other necessary processing has been performed.
  - Check for problems in positioner movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the Programming Pendant to the hook on the cabinet of the controller after use.
- The Programming Pendant can be damaged if it is left in the work area, on the floor, or near fixtures.
- Read and understand the Explanation of Warning Labels in the Controller Manual before operating the MH1605-505TR.
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1 Introduction

1.1 About This Document

This manual is intended as an introduction and overview for personnel who have received operator training from Motoman, and who are familiar with operation of the MH1605-505TR positioner kit. For more detailed information, refer to the manuals listed in Chapter 1.3 Reference Documentation. This manual contains the following chapters:

- **CHAPTER 1 - INTRODUCTION**
  This section provides general information about the MH1605-505TR positioner and its components, a list of reference documents, and customer support information.

- **CHAPTER 2 - SAFETY**
  This section provides information regarding the safe use and operation of the MH1605-505TR positioner.

- **CHAPTER 3 - INSTALLATION**
  This section provides instructions for set up and installation of the MH1605-505TR positioner.

- **CHAPTER 4 - MAINTENANCE**
  This section contains a table listing periodic maintenance requirements for the components of the MH1605-505TR positioner.

1.2 System Overview

The MH1605-505TR positioner kit features a two-axis positioner rated at 505 kg payload. The MH1605-505TR provides both tilt and rotation axes for flexible part positioning with the ability to provide coordinated motion with the robot. The tilt/rotate positioner is a combination of the MH1605 and MH505 headstock modules and features integral weld ground brushes and position switches. The positioner kit includes a dual external axis kit for the Sigma 5 motors and 7-meter cables. Up to three external axis drives can be mounted inside the controller; therefore, two tilt/rotate positioners will require the addition of an external cabinet.
1.2 System Overview

Fig. 1-1: System Overview

1.2.1 Specifications

Table 1-1: MH1605-505TR Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Load</td>
<td>kgf</td>
<td>505</td>
</tr>
<tr>
<td>Table Speed (motor @ 1500 rpm)</td>
<td>rpm</td>
<td>9.8</td>
</tr>
<tr>
<td>180-degree Rotation</td>
<td>sec</td>
<td>3.56</td>
</tr>
<tr>
<td>Rated Load CG Off Center</td>
<td>mm</td>
<td>0</td>
</tr>
<tr>
<td>Rated Load CG Overhang</td>
<td>mm</td>
<td>100</td>
</tr>
<tr>
<td>Rated Load Inertia</td>
<td>kg*m²</td>
<td>119</td>
</tr>
<tr>
<td>Tilt Axis Speed</td>
<td>rpm</td>
<td>10.8</td>
</tr>
<tr>
<td>Rated Weld Ground (STD/Optional)</td>
<td>A/brush</td>
<td>800/1200</td>
</tr>
<tr>
<td>Repeatability</td>
<td>mm/mm</td>
<td>0.00003</td>
</tr>
</tbody>
</table>
1.3 Reference Documentation

For additional information refer to the following:
- Motoman Manipulator Manual
- Motoman MH-Series Positioner Manual
- Motoman Controller Manual
- Motoman Maintenance Manual
- Motoman Operator's Manual for Arc Welding
- Motoman Concurrent I/O Parameter Manual
- Vendor manuals for system components not manufactured by Yaskawa Motoman

1.4 Customer Support Information

If you need assistance with any aspect of your MH1605-505TR 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:

<table>
<thead>
<tr>
<th>Item</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>MH1605-505TR</td>
</tr>
<tr>
<td>Robots</td>
<td></td>
</tr>
<tr>
<td>Software Version</td>
<td>Access this information on the Programming Pendant's LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}</td>
</tr>
<tr>
<td>Robot Serial Number</td>
<td>Located on the robot data plate</td>
</tr>
<tr>
<td>Robot Sales Order Number</td>
<td>Located on the DX100 controller data plate</td>
</tr>
</tbody>
</table>
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 (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 robot system. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the robot cell. **NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE ROBOT SYSTEM!**

We recommend approved Motoman training courses for all personnel involved with the operation, programming, or repair of the robot system. This training familiarizes personnel with the safe and correct operation of the robot system.

This safety section addresses the following:

- Chapter 2.2 General Safeguarding Tips
- Chapter 2.3 Mechanical Safety Devices
- Chapter 2.4 Installation Safety
- Chapter 2.5 Programming, Operation, and 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 with the robot, operator's manuals, and system equipment should operate the 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 within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be in Emergency Stop (E-Stop) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-1999, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety, and Health Standards for General Industry (OSHA).

2.3 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-1999 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

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

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
2.4 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 R15.06-1999 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.5 Programming, Operation, and Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-Stop button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
2 Safety
2.5 Programming, Operation, and Maintenance Safety

• Any modifications to PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!

• Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.

• The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.

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

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

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

• Use proper replacement parts.

• Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
3 Installation

Installation of the MH1605-505TR positioner should be performed by personnel who are familiar with this Motoman product. Follow established safety procedures at all times throughout the installation process. Failure to use safe work practices may result in damage to the equipment and/or injury to the workers.

Due to the variety of installation applications, it is not possible to provide detailed installation instructions for the MH1605-505TR module. However, general installation guidelines are provided. Contact the Motoman Service Staff for help integrating the MH1605-505TR module into your system.

3.1 Materials Required

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

3.1.1 Customer-Supplied Items

- Incoming power supply to controller - 240/480/575 volts
- Appropriate mounting hardware

3.1.2 List of Tools

- Safety glasses
- Gloves
- Level
- Ratchet with 3/4-in. socket
- Adjustable wrench set
- Phillips and flat screwdrivers
- Socket set
- Forklift and/or overhead crane
- Air-impact gun with 3/4-in. socket
- Open-end wrench set
- Wrench sets (standard and metric)
- 255 N•m (188 ft. lb) torque wrench

CAUTION

Installation of the MH1605-505TR is not a task for the novice. The MH1605-505TR is not fragile, but it is a highly sophisticated positioning system. Handle components with care. Rough handling can damage system electronic components.
3 Installation
3.2 Lifting Instructions

The MH1605-505TR positioner is shipped on a wooden shipping skid. The customer is responsible for removing the positioner from the shipping skid and inspecting for shipping damage. The MH1605-505TR positioner can be moved by forklift or by overhead crane and straps using M16 eyebolts. To install the MH1605-505TR positioner proceed as follows:

1. Carefully remove protective plastic wrapping from positioner.
2. Inspect positioner for shipping damage.
3. Unbolt the positioner from the shipping skid using a 3/4-in. socket.
4. Attach slings from lifting device to the four M16 lifting eyes, refer to Fig.3-2 Dimensions.
5. Using the lifting device, lift the MH1605-505TR positioner and place in the desired location.

### WARNING

Forklift truck operation should be performed only by licensed personnel. Never place any part of your body under a suspended load or move a suspended load over any part of another person's body. Careless handling may result in severe personal injury or death.

### NOTE

Notify shipping contractor if any shipping damage.

### CAUTION

The MH1605-505TR positioner weighs approximately 770 kg. Make sure lifting device is rated to safely handle this load.

3.2.1 Dimensions

*Fig. 3-2: Dimensions*
3.2.2 Mounting

The MH1605-505TR positioner should be firmly mounted on a base plate or foundation rigid enough to support the weight and also withstand repulsion forces. If mounted directly to a concrete floor, each anchor must have a minimum dynamic rating of 2,000 kgf. The six leveling bolts should rest on the provided square washers and the weight uniformly distributed over the six bolts prior to final anchoring.

3.3 Connection to Motoman Controller

Installation and connection to the controller comprises hardware as well as software installation and must be carried out by Motoman Service personnel. When the MH1605-505TR positioner is delivered together with a robot, this installation is complete. See separate schematics for electrical connections:

![WARNING]

Install all electrical cables connecting the MH1605-505TR positioner and electrical supply wiring cables so that there is not possibility of their being walked on or run over. Do not put any object directly on the cables and do not install cables across other cables.

3.3.1 Conducting a Safety/Operation Check

Before installing the tooling and fixtures for your application, take a few minutes to perform a safety/operation check. To conduct a safety/operation check:

1. Check that safeguards have been installed and are adequate for plant conditions per ANSI/RIA R15.06-1999 Robot Safety Standard.
2. Verify that cable connections are tight and system is level and secure.

The MH1605-505TR positioner is now ready for power-up. This system should be operated only by personnel who have received operator training from Motoman and who are familiar with the operation of this Motoman robot model.

3. Turn the main power ON, and continue the safety/operation check.
4. Check all system E- Stops (pendant, operator station, control door).
5. Check system Hold buttons.

3.4 Installation of Tooling and Fixtures

The MH1605-505TR positioner is now ready for the installation of tooling and fixtures for the application. 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. After tooling is installed, test the module for proper operation.
4 Maintenance

4.1 Ordering Parts

Contact the Motoman service staff at (937) 847-3200 to order spare parts. Please have the following information ready before you call:

- Machine type (Positioner)
- Machine Name (MH1605-505TR)
- Motoman Part No.
- Part(s) name
- Number of parts

Place orders with:

Motoman Customer Service
Telephone (937) 847-3200
Telefax: (937) 847-3211

For additional information on the MH1605-505TR positioners please refer to the MH-Series Positioner Manual that is included with the MH1605-505TR system documentation package.
Specifications are subject to change without notice for ongoing product modifications and improvements.