Chapter 1

Introduction

1.1 About This Document

This manual provides information for the MotoPos D250 positioner and contains the following sections:

CHAPTER 1 - INTRODUCTION
Provides general information about the structure of this manual, a list of reference documents, and customer service information.

CHAPTER 2 - SAFETY
This section provides information regarding the safe use and operation of Motoman products.

CHAPTER 3 - MOTOPOS D250 INSTRUCTIONS
Provides detailed instructions for the MotoPos D250.

1.2 Reference to Other Documentation

For additional information refer to the following:

• NX100 Controller Manual (P/N 149201-1)
• Concurrent I/O Manual (P/N 149230-1)
• Operator's Manual for your application
• Vendor manuals for system components not manufactured by Motoman

1.3 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

• Robot Type (EA1400, HP50, etc.)
• Application Type (handling, welding, etc.)
• Robot Serial Number (located on back side of robot arm)
• Robot Sales Order Number (located on back of controller)
Notes
2.1 Introduction

It is the purchaser’s responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06-1999. The address is as follows:

RoboticIndustriesAssociation
900VictorsWay
P.O.Box3724
AnnArbor,Michigan48106
TEL:(734)994-6088
FAX:(734)994-3338
INTERNET:www.roboticsonline.com

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. The robot must not be operated by personnel who have not been trained!

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.
This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming, Operation, and Maintenance Safety (Section 2.6)

### 2.2 Standard Conventions

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

**DANGER!**

Information appearing in a DANGER concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

**WARNING!**

Information appearing in a WARNING concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

**CAUTION!**

Information appearing in a CAUTION concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

Note: Information appearing in a Note provides additional information which is helpful in understanding the item being explained.
2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-1999, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

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

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

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06-1999 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming, Operation, and Maintenance Safety

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

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-STOP button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
• Any modifications to PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!

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

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

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

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

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

• Use proper replacement parts.

• Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
MOTOPOS-D250B POSITIONER INSTRUCTIONS

TYPE: YR-MPD250B-A00
YR-MPD250B-A04 (FOR EUROPEAN STANDARD)
YR-MPD250B-A05 (FOR EUROPEAN STANDARD/ WITH DOWEL PIN)
YR-MPD250B-B00 (WITH ROTARY JOINT)

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

MOTOPOS INSTRUCTIONS
MOTOPOS-D250B POSITIONER INSTRUCTIONS
NX100 INSTRUCTIONS
NX100 OPERATOR’S MANUAL
NX100 MAINTENANCE MANUAL

The NX100 operators manuals above correspond to specific usage. Be sure to use the appropriate manual.
• This instruction manual is intended to explain operating instructions and maintenance procedures primarily for the MOTOPOS.

• General items related to safety are listed in the Section 1: Safety of the NX100 instructions. To ensure correct and safe operation, carefully read the NX100 instructions before reading this manual.

• 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 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 your product's warranty.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOPOS and the NX100.

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".
Before operating the MOTOPOS, check that servo power is turned OFF when the emergency stop buttons on the front door of the NX100 and programming pendant are pressed. When the 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 MOTOPOS during an emergency. The MOTOPOS should not be used if the emergency stop buttons do not function.

Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the MOTOPOS. Then turn the servo power ON.

Injury may result from unintentional or unexpected MOTOPOS motion.

Observe the following precautions when performing teaching operations within the working envelope of the MOTOPOS:
- View the MOTOPOS from the front whenever possible.
- Always follow the predetermined operating procedure.
- Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended MOTOPOS operation may result in injury.

Confirm that no persons are present in the work envelope of the MOTOPOS and that you are in a safe location before:
- Turning ON the NX100 power.
- Operating the MOTOPOS with the programming pendant.
- Running check operations.
- Performing automatic operations.

Injury may result if anyone enters the working envelope of the MOTOPOS during operation. Always press an emergency stop button immediately if there is a problem. The emergency stop buttons are located on the right of the front door of the NX100 and programming pendant.
Definition of Terms Used Often in This Manual

The MOTOPOS is the positioner for the YASKAWA industrial robot.
The MOTOPOS usually consists of MOTOPOS positioner unit, a controller unit, a programming pendant, and power cables.
In this manual, the equipment is defined as follows:

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<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NX100 Controller Unit</td>
<td>NX100</td>
</tr>
<tr>
<td>NX100 Programing Pendant</td>
<td>Programing Pendant</td>
</tr>
<tr>
<td>MOTOPOS to NX100 Cable</td>
<td>Power Cable</td>
</tr>
</tbody>
</table>
Explanation of Warning Labels

The following warning labels are attached to the MOTOPOS. Always follow the warnings on the labels. Also, an identification label with important information is placed on the body of the MOTOPOS. Prior to operating the MOTOPOS, confirm the contents.
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               Grease Exchange
               (Refer to " Fig. 21 Rotary Axis Speed Reducer Diagram "). 9-9

10 Recommended Spare Parts
Receiving

1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives. Standard delivery includes the following six items (information for the content of optional goods is given separately):

- Manipulator
- NX100
- Programming pendant
- Cable between the NX100 and the manipulator (2 cables or 3 cables)
- MOTOPOS
- Cable between the MOTOPOS and the NX100 (2 cables)

CAUTION

- Confirm that the MOTOPOS and the NX100 have the same order number. Special care must be taken when more than one units of MOTOPOS are to be installed.

If the numbers do not match, MOTOPOS may not perform as expected and cause injury or damage.
1.2 Checking the Order Number

Check that the order number of the MOTOPOS corresponds to the NX100. The order number is located on a label as shown below.

Fig. 1 Location of Order Number Labels
2 Transporting

### CAUTION

- **Sling applications and crane or forklift operations must be performed by authorized personnel only.**
  
  Failure to observe this caution may result in injury or damage.

- **Avoid excessive vibration or shock during transportation.**
  
  The system consists of precision components. Failure to observe this caution may adversely affect the performance.

#### 2.1 Transporting Method

##### 2.1.1 Using a Crane

As a rule, when unpacking the MOTOPOS and moving it, a crane should be used. The MOTOPOS should be lifted using wire rope threaded through attached eyebolts. Be sure that the MOTOPOS is fixed with shipping bolts and bracket before transportation, and lift it in the posture as shown in "Fig. 2 Transporting Position".

Fig. 2 Transporting Position
2.2 Shipping Bolts and Bracket

The MOTOPOS is provided with shipping bolts and bracket ("Fig. 2 Transporting Position").

- The shipping bolts and bracket are painted yellow.
- The shipping bracket is mounted with four hexagon socket head cap screws M8 (length: 16 mm; tensile strength: 1200 N/mm² or more).

**NOTE**

- Check that the eyebolts are securely fastened.
- The weight of the MOTOPOS is approximately 220 kg including the shipping bolts and bracket. Use a wire rope strong enough to withstand the weight.
- Attached eyebolts are designed to support the MOTOPOS weight. Never use them for anything other than transporting the MOTOPOS.
- Be sure to mount the shipping bolts and brackets before transporting the MOTOPOS.
- Avoid exerting force on the table or motors when transporting. To avoid injury, be careful when using transporting equipment other than a crane or forklift.
- Remove the eyebolts after transportation and installation, and cover the tapped holes with the attached caps. Operating the MOTOPOS with the eyebolts on may cause the jigs to interfere with the eyebolts. The eyebolts must be stored for future use in the event that the MOTOPOS must be moved again.

Before turning ON the power, check to be sure that the shipping bolts and bracket are all removed. The shipping bolts and brackets then must be stored for future use, in the event that the MOTOPOS must be moved again.
3 Installation

**WARNING**

- **Install the safeguarding.**
  Failure to observe this warning may result in injury or damage.

- **Install the MOTOPOS in a location where the MOTOPOS with a jig does not hit against anything such as the wall or the safeguarding.**
  Failure to observe this warning may result in injury or damage.

- **Do not start operating the MOTOPOS or turn ON the power before it is firmly anchored.**
  The MOTOPOS may overturn and cause injury or damage.

**CAUTION**

- **Do not install or operate a MOTOPOS which is damaged or lacks parts.**
  Failure to observe this caution may cause injury or damage.

- **Before turning ON the power, check to be sure that the shipping bolts and brackets are removed.**
  Failure to observe this caution may cause damage to the major driving parts.
3.1 Installation of the Safeguarding

To insure safety, be sure to install safeguarding. It prevents unforeseen accidents with personnel and damage to equipment. The following is quoted for your information and guidance.

Responsibility for Safeguarding (ISO10218)
The user of a manipulator or robot system shall ensure that safeguards are provided and used in accordance with Sections 6, 7, and 8 of this standard. The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system consistent with the robot application. Safeguarding may include but not be limited to safeguarding devices, barriers, interlock barriers, perimeter guarding, awareness barriers, and awareness signals.

3.2 Mounting Procedures for MOTOPOS Baseplate

The MOTOPOS should be firmly mounted on a baseplate or foundation strong enough to support the MOTOPOS and withstand repulsion forces in acceleration and deceleration. Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the MOTOPOS. The flatness for installation must be kept at 0.5 mm or less: if the flatness of the mounting face is insufficient, the shape of the MOTOPOS may deform and its functional ability may be compromised. Mount the baseplate either as shown in "3.2.1 In Case of Installing the MOTOPOS and Manipulator on a Common Baseplate" or "3.2.2 In Case of Mounting the MOTOPOS on the Floor".

<table>
<thead>
<tr>
<th>Table 1 Maximum repulsion forces of the MOTOPOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum torque when rotary axis used</td>
</tr>
<tr>
<td>Maximum torque when tilting axis used</td>
</tr>
</tbody>
</table>
3.2 Mounting Procedures for MOTOPOS Baseplate

3.2.1 In Case of Installing the MOTOPOS and Manipulator on a Common Baseplate

The baseplate should be rugged and durable to ensure that the MOTOPOS and the manipulator are in the correct relative position. Thickness of the baseplate and the size of the mounting anchor bolts should meet the recommendations in the manual for the manipulator to be combined.

Mount the MOTOPOS base securely with four hexagon head screws M16 (recommended length: 60 mm). Tighten the screws and anchor bolts securely so that they will not work loose during the operation.

![Diagram of MOTOPOS Base on a Common Baseplate](image)

3.2.2 In Case of Mounting the MOTOPOS on the Floor

The floor should be strong enough to support the MOTOPOS. Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the MOTOPOS as shown in "Table 1 Maximum repulsion forces of the MOTOPOS". As a rough standard, when there is a concrete floor thickness of 200 mm or more, a baseplate (MOTOPOS baseplate thickness of 28 mm or more) can be fixed directly to the floor with anchor bolts M20.

Before mounting the MOTOPOS on the floor, check the flatness, cracks, etc. of the floor. If there are any cracks and the like on the floor, they should be repaired before installation. Any thickness less than 200 mm is insufficient for mounting, even if the floor is concrete.
3.3 Location

When the MOTOPOS is installed, it is necessary to satisfy the undermentioned environmental conditions:

- Ambient Temperature: 0° to +45°C
- Humidity: 20 to 80%RH (at constant temperature)
- Free from dust, soot, or water
- Free from corrosive gases or liquids, or explosive gases
- Free from excessive vibration (Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation: 0.5 mm or less
4  Wiring

**WARNING**

- **Ground resistance must be 100 Ω or less.**
  Failure to observe this warning may result in fire or electric shock.
- **Before wiring, make sure to turn OFF the primary power supply, and put up a warning sign. (ex. DO NOT TURN ON THE POWER.)**
  Failure to observe this warning may result in fire or electric shock.

**CAUTION**

- **Wiring must be performed by authorized or certified personnel.**
  Failure to observe this caution may result in fire or electric shock.

4.1  Grounding

Follow the local regulations and electrical installation standards for grounding. The recommended grounding wire size is 5.5 mm² or more.

**NOTE**

- Never use this line sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or distributing racks are used for cable laying, ground in accordance with Electric Equipment Technical Standards.
4.2 Cable Connection

There are two cables for the power supply: a power cable (1BC) and an encoder cable for detection (2BC). Connect these cables to the MOTOPOS base connectors and the NX100 respectively. Refer to (a) to (c) of “Fig. 6 Connection between the MOTOPOS and the NX100”.

4.2.1 Connection to the MOTOPOS

Before connecting the cables to the MOTOPOS, check the numbers on both cables and the MOTOPOS base connectors. Connect each cable adjusting the cable connector positions to the main key positions of the MOTOPOS, and then tighten the nut until it clicks.

4.2.2 Connection to the NX100

Remove the cover of the lower side on the NX100 side. Pass the power cable (1BC) and the encoder cable (2BC) through the opening for the cables, and then fasten bolts on the opening. Connect the power cable (1BC) to the relay connector (CNEX_PW and CNEX_BRK). Check the numbers on both the cable and the relay connectors before connecting. Connect the encoder cable (2BC) to the relay connector (CNEX_SG and CNEX_T). Check the numbers on both the cable and the relay connector before connection.
Fig. 6 (a) Connection between the MOTOPOS and the NX100
4.2 Cable Connection

Fig. 6 (b) Connection between the MOTOPOS and the NX100 (MOTOPOS Side)

Details in Power Cable Connection (MOTOPOS-D250B-B00)

Details in Power Cable Connection (MOTOPOS-D250B-A00,-A04,-A05)
Fig. 6 (c) Connection between the MOTOPOS and the Power Cable (NX100 Side)
5 Basic Specifications

5.1 Basic Specifications List

Table 2 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>YR-MPD250B-A00</th>
<th>YR-MPD250B-A04</th>
<th>YR-MPD250B-A05</th>
<th>YR-MPD250B-B00</th>
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<tr>
<td>Degree of Freedom</td>
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<td></td>
<td></td>
</tr>
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<td>Payload</td>
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<td>2000g</td>
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<td></td>
</tr>
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<td>Repetitive Positioning Accuracy</td>
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<td>±0.1 mm (R250 mm)</td>
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<td>Motion Range</td>
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<td>Rotary Axis</td>
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<td>±200°</td>
<td></td>
<td></td>
<td>±370° (Endless*)</td>
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<tr>
<td>Maximum Speed</td>
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<td>Tiling Axis</td>
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<td>Allowable Moment*4</td>
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<td>Allowable Inertia (GD²/4)</td>
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<td>Tiling Axis</td>
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<td>50 kg·m²</td>
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<tr>
<td>Rotary Axis</td>
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<td>17 kg·m²</td>
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<td></td>
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<tr>
<td>Equipment Specifications</td>
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<td></td>
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<tr>
<td>Signal</td>
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<td>0.5 mm² × 12 wires, 0.75 mm² × 22 wires</td>
<td>0.5 mm² × 12 wires, AWG19 × 22 wires</td>
<td>0.5 mm² × 6 wires</td>
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<td>Air</td>
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<td>3/8 &quot; × 1 line</td>
<td>3/8 &quot; × 2 lines</td>
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<td>Standard Painted Color</td>
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<td>Mass</td>
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<td>Ambient Conditions</td>
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<td>Temperature</td>
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<td></td>
</tr>
<tr>
<td>Humidity</td>
<td></td>
<td>20 to 80% RH (non-condensing)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td></td>
<td>4.9 m/s² (0.5 G) or less</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>Free from corrosive gasses or liquids, or explosive gasses</td>
<td>Clean and dry</td>
<td>Free from excessive electrical noise (plasma)</td>
<td></td>
</tr>
<tr>
<td>Power Capacity</td>
<td></td>
<td>2.5 kVA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 SI units are used in this table. However, gravitational unit is used in ()
*2 Conformed to ISO9283.
*3 The rotary axis endless function is optional.
*4 Refer to 6.1 "Allowable Load" for details on the permissible moment of inertia.
5.2 Part Names and Working Axes

Fig. 7 Part Names and Working Axes

5.3 Baseplate Dimensions

Fig. 8 Baseplate Dimensions (mm)

Units: mm
*1: -A05 only
5.4 Dimensions and Working Envelope

Fig. 9 Dimensions and Working Envelope

Units: mm
6 Load Specifications and Jig Mounting Section

6.1 Allowable Load

This section describes the allowable values and various limitations. The payload of the MOTOPOS is 250 kg. The moment and moment of inertia are limited as shown in "Table 3: Moment and Total Inertia".

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Moment N·m (kgf·m)</th>
<th>( \Theta^2/4 ) Total Inertia kgf·m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tilting Axis</td>
<td>539 (55)</td>
<td>50</td>
</tr>
<tr>
<td>Rotary Axis</td>
<td>196 (20)</td>
<td>17</td>
</tr>
</tbody>
</table>

*\( *\): Gravitational unit

When the volume load is relatively small, refer to the moment rating shown in "Fig. 10 Moment Rating".

The allowable total inertia is calculated when the moment is at the maximum. Contact your Yaskawa representative when only inertia moment, or load moment is small while inertia moment is large. Also, when the load is combined as a force but a mass, contact your Yaskawa representative.

![Fig. 10 Moment Rating](image-url)
6.2 Details of Jig Mounting Face

The jig mounting dimensions are shown in "Fig. 11 Details of Jig Mounting Face". It is recommended that the table and the jig be mounted using an inside dowel and dowel pin, or two dowel pins. The dowel pins are to be prepared by customers.

![Fig. 11 Details of Jig Mounting Face](image)

**NOTE**

Wash OFF anti-corrosive paint (solid color) on the jig mounting surface with thinner or light oil before mounting the tools.

Provide a space for positioner maintenance on the jig side as shown in the following figure.
# 7 System Application

## 7.1 Internal User I/O Wiring Harness and Air Line

For the drives of the devices such as a jig, internal user I/O wiring harness and air lines are built into the MOTOPOS as shown in "Fig. 12 Internal Wires and Air Line".

YR-MPD250B-A00: Internal user I/O wiring harness  
(0.5 mm$^2 \times 12$ wires, 0.75 mm$^2 \times 22$ wires)  
Air line (inner diameter: 8 mm $\times$ 1 line)

YR-MPD250B-A04, -A05: Internal user I/O wiring harness  
(0.5 mm$^2 \times 12$ wires, AWG19$ \times$ 22 wires)  
Air line (inner diameter: 8 mm $\times$ 1 line)

YR-MPD250B-B00: Internal user I/O wiring harness (0.5 mm$^2 \times 6$ wires)  
Air line (inner diameter: 8 mm $\times$ 2 lines)

Connector pins are assigned as shown in Fig. 12. Wiring must be performed by user.  
- The allowable current for internal user I/O wiring harness: 3 A or less for each wire  
  (30 A or less in total)  
- The maximum pressure for the air line: 490 kPa (5 kgf/cm$^2$) or less
7.1 Internal User I/O Wiring Harness and Air Line

Fig. 12 Internal Wires and Air Line

Table 4 List of Connector Types

<table>
<thead>
<tr>
<th>Positioner</th>
<th>Name</th>
<th>Connector Type</th>
<th>Applicable Pin No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>YR-MPD250B-A00</td>
<td>Connector base section:</td>
<td>JL05-2A28-21PCW (JL05-6A28-21SCW: Optional)</td>
<td>1 to 35</td>
</tr>
<tr>
<td></td>
<td>Internal I/O wiring harness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Table section:</td>
<td>Crimped contact-pin PC2005-W (Crimped contact-pin PC2005-M: Optional)</td>
<td>1 to 35</td>
</tr>
<tr>
<td></td>
<td>Internal I/O wiring harness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YR-MPD250B-A04</td>
<td>Connector base section:</td>
<td>JL05-2A28-21PCW (JL05-6A28-21SCW: Optional)</td>
<td>1 to 35</td>
</tr>
<tr>
<td>-A05</td>
<td>Internal I/O wiring harness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Table section:</td>
<td>Crimped contact-pin PC2005-W (Crimped contact-pin PC2005-M: Optional)</td>
<td>1 to 35</td>
</tr>
<tr>
<td></td>
<td>Internal I/O wiring harness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YR-MPD250B-B00</td>
<td>Connector base section:</td>
<td>JL05-2A18-1PC (JL05-6A18-1SC: Optional)</td>
<td>1 to 6</td>
</tr>
<tr>
<td></td>
<td>Internal I/O wiring harness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Table section:</td>
<td>Crimped contact-pin PC2005-W (Crimped contact-pin PC2005-M: Optional)</td>
<td>1 to 6</td>
</tr>
<tr>
<td></td>
<td>Internal I/O wiring harness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The internal wiring harness and the air line on the table side are designed to be pulled out from the center part. Provide a hole for pullout on the jig base plate. Be sure to mount a cover on the hole to avoid spatters going inside the MOTOPOS. Refer to a mounting example in "Fig. 13 Pullout Section of Internal Wiring Harness and Air Line".

![Diagram]

**NOTE**
Be sure to provide a cover for the internal user I/O wiring harness and air line pullout section on the table side. Otherwise, spatters may go inside the MOTOPOS resulting in a failure.


7.2 Minus Cable for Welding

Minus cable for welding is equipped inside the MOTOPOS.

- Allowable current for minus cable: 500 A

The minus cable on the table side is connected directly to the table. It is connected to the jig base plate through the table, requiring no minus cable on the jig side. However, to connect the cable to any place near the welded part, connect the minus cable to the jig base plate as shown in "Fig. 14 Minus Cable Connection".

![Fig. 14 Minus Cable Connection](image-url)
8 Electrical Equipment Specification

8.1 Position of Limit Switch

The overrun limit switch is provided only for the tilting axis. For the location, refer to "Fig. 15 Position of Limit Switch".

![Fig. 15 Position of Limit Switch](image)

8.2 Internal Connections

High reliability connectors which can be easily put on and removed are used in each connector part.
Fig. 16 (a) Internal Connection Diagram (Type: YR-MPD250B-A00,-A04,-A05)
8.2 Internal Connections

Fig. 16 (b) Internal Connection Diagram (Type: YR-MPD250B-B00)
9 Maintenance and Inspection

### WARNING

- **Before maintenance or inspection, be sure to turn OFF the main power supply, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)**

Failure to observe this warning may result in electric shock or injury.

### CAUTION

- **Maintenance and inspection must be performed by specified personnel.**

Failure to observe this caution may result in electric shock or injury.

- **For disassembly or repair, contact your Yaskawa representative.**

- **Do not remove the motor, or release the brake.**

Failure to observe this caution may result in injury from unexpected turning of the table.

#### 9.1 Inspection Interval

Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation. Inspection intervals are classified into six levels as shown in Table 5. Conduct periodical inspections according to the inspection schedule in "Table 5 Inspection Items".

In "Table 5 Inspection Items", the inspection items are categorized by 3 types of operations: operations which can be performed by personnel authorized by the user, operations which can be performed by personnel being trained, and operations which can be performed by service company personnel. Only specified personnel are to do inspection work.

- The inspection interval depends on the total servo operation time.

- For axes which are used very frequently other than arc welding, it is recommended that inspections be conducted at shorter intervals. Contact your Yaskawa representative.
### Table 5 Inspection Items

<table>
<thead>
<tr>
<th>Items[^1]</th>
<th>Inspection Interval</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>1000 H Cycle</td>
<td>6000 H Cycle</td>
<td>12000 H Cycle</td>
</tr>
<tr>
<td>1 Tram mark</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>2 External lead paths</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>3 Working area and whole exterior of MOTOPOS</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>4 Tilting axis motor</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>5 Earth brush</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>6 Baseplate mounting bolts</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>7 Cover mounting screws</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>8 Connectors</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>9 Air line</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>10 Rotary joint (only for model: B00)</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>11 Wire harness in MOTOPOS</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

[^1]: Items marked with a star may require special procedures or tools.
[^2]: Ensure that the motor is not overloaded.
[^3]: For model B00 only.
[^4]: Replace only when necessary.
9.1 Inspection Interval

Table 5  Inspection Items

<table>
<thead>
<tr>
<th>Items*4</th>
<th>Inspection Interval</th>
<th>Method</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>1000 H Cycle</td>
<td>6000 H Cycle</td>
</tr>
<tr>
<td>13</td>
<td>Tiling axis speed reducer, S-axis gear</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>14</td>
<td>Rotary axis speed reducer</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>15</td>
<td>Overhaul</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

*1 When checking for conduction with multimeter, remove connectors on detector side for each axis from the motor.

*2 Wire harness in MOTOPOS should be replaced at 24000H inspection.

*3 For the grease, refer to "Table 6 Inspection Parts and Grease Used".

*4 Corresponds to the numbers in "Fig. 17 Inspection Parts and Inspection Numbers".

*5 A grease leakage indicates the possibility that grease has seeped into the motor, which can cause a motor breakdown. Contact your Yaskawa representative.

Fig. 17  Inspection Parts and Inspection Numbers

Table 6  Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>13, 14</td>
<td>VIGO Grease RE No. 0</td>
<td>All axes speed reducers</td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in "Table 5 Inspection Items".
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

The battery pack is mounted in the location indicated in "Fig. 18 Battery Location". If a battery alarm occurs in the NX100, replace the battery according to the following procedure:

1. Turn OFF the NX100 main power supply.
2. Remove the cover of the tilting frame section and pull out the battery pack to replace.
3. Remove the battery pack mounting screw.
4. Remove the plastic tape (insulation tape) protecting the connection part of the battery pack in the MOTOPOS.
5. Connect the new battery.
6. Remove the old battery.
Remove the old battery pack after connecting the new one so that the encoder absolute data do not disappear.

7. Protect the connection part of the battery pack in the MOTOPOS with plastic tape (insulation tape).
8. Mount the battery pack with the screws, and then reinstall the cover to complete the replacement.

Be sure not to pinch cables in reinstalling the cover of the frame section.
9.2 Notes on Maintenance Procedures

9.2.2 Grease Replenishment/Exchange for Tilting Axis Speed Reducer

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Remove the motor cover.</td>
</tr>
<tr>
<td>2.</td>
<td>Remove the plug from Bo grease exhaust port.</td>
</tr>
<tr>
<td>3.</td>
<td>Inject the grease into the Bi grease inlet using a grease gun.</td>
</tr>
<tr>
<td>4.</td>
<td>Move the tilting axis for a few minutes to discharge the excess grease.</td>
</tr>
<tr>
<td>5.</td>
<td>Wipe the Bo grease exhaust port with a cloth and reinstall the plug. (Apply the Modifier silicon Caulk on the thread part of the plug.)</td>
</tr>
<tr>
<td>6.</td>
<td>Reinstall the motor cover.</td>
</tr>
</tbody>
</table>

**Grease Replenishment (Refer to "Fig. 20 Tilting Axis Speed Reducer Diagram".)**

If grease is added with the plug on, the grease will go inside the motor and may damage it. Never fail to remove the plug before the grease injection.

Grease type: VIGO Grease RE No. 0

![Fig. 20 Tilting Axis Speed Reducer Diagram](image-url)
9.2 Notes on Maintenance Procedures

- **Grease Exchange (Refer to "Fig. 20 Tilting Axis Speed Reducer Diagram ")**

1. Remove the motor cover.
2. Remove the plug from Bo grease exhaust port.

   **NOTE** If grease is added with the plug on, the grease will go inside the motor and may damage it. Never fail to remove the plug before the grease injection.

3. Inject the grease into the Bi grease inlet using a grease gun.

   - Grease type: VIGO Grease RE No. 0

4. The grease replacement is completed when new grease appears in the Bo grease exhaust port. The new grease can be distinguished from the old grease by color.
5. Move the tilting axis for a few minutes to discharge the excess grease.
6. Wipe the Bo grease exhaust port with a cloth and reinstall the plug. (Apply the Modifier silicon Caulk on the thread part of the plug.)
7. Reinstall the motor cover.
9.2.3 Grease Replenishment/Exchange for Rotary Axis Speed Reducer

![Diagram of Rotary Axis Speed Reducer]

- **Grease Replenishment (Refer to "Fig. 21 Rotary Axis Speed Reducer Diagram ")**
  1. Stop the tilting axis at the following position.
     - A00 : home position
     - B00 : +90° position
  2. Remove the plug from To grease exhaust port.
  3. Inject grease into the Ti grease inlet using a grease gun.
    - **Grease type: VIGO Grease RE No. 0**
  4. Move the rotary axis for a few minutes to discharge the excess grease.
  5. Wipe the To grease exhaust port with a cloth and reinstall the plug. (Apply the Modifier silicon Caulk on the thread part of the plug.)

**NOTE**
If grease is added with the plug on, the grease will go inside the motor and may damage it. Never fail to remove the plug before the grease injection.
9.2 Notes on Maintenance Procedures

Grease Exchange (Refer to "Fig. 21 Rotary Axis Speed Reducer Diagram ")

1. Remove the plug from To grease exhaust port.

   **NOTE** If grease is added with the plug on, the grease will go inside the motor and may damage it. Never fail to remove the plug before the grease injection.

2. Inject grease into the Ti grease inlets using a grease gun.

   Grease type: VIGO Grease RE No. 0

3. The grease exchange is completed when new grease appears in the To grease exhaust port. The new grease can be distinguished from the old grease by color.

4. Move the rotary axis for a few minutes to discharge the excess grease.

5. Wipe the To grease exhaust port with a cloth and reinstall the plug. (Apply the Modifier silicon Caulk on the thread part of the plug.)
10 Recommended Spare Parts

It is recommended that the parts and components in the following table be kept in stock as spare parts for the MOTOPOS. Product performance can not be guaranteed when using spare parts from any company other than Yaskawa. The spare parts are ranked as follows:

- Rank A: Expendable and frequently replaced parts
- Rank B: Parts for which replacement may be necessary as a result of frequent operation
- Rank C: Drive Unit

To replace parts in Rank B or Rank C, contact your Yaskawa representative.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Grease</td>
<td>VIGO Grease RE No. 0</td>
<td>Yaskawa Electric Corporation</td>
<td>16kg</td>
<td>For all axes speed reducers</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Silicone Rubber Compound Tube</td>
<td>Modifier Silicon Caulk</td>
<td>Konishi Co., Ltd.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Battery Pack</td>
<td>HWB471030-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>Brush Unit</td>
<td>HS9381711-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>Bearing</td>
<td>6026LLU</td>
<td>Nippon Seiko K.K.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>Tilting Axis Speed Reducer</td>
<td>HW9380614-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>Rotary Axis Speed Reducer</td>
<td>HW9280663-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>For YR-MPD250B-A00, -A04-A05</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>Rotary Joint (Only for YR-MPD250B-B00)</td>
<td>HSO381083-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>For YR-MPD250B-B00</td>
</tr>
<tr>
<td>C</td>
<td>9</td>
<td>AC Servomotor for Tilting Axis</td>
<td>SGMR-12A2B-YR11</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>10</td>
<td>AC Servomotor for Rotary Axis</td>
<td>SGMR-08A2B-YR11</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Table 7  Spare Parts for the MOTOPOS

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>11</td>
<td>Wire Harness in MOTOPOS</td>
<td>HS0170247-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>For YR-MPD250B-A00-A04-A05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HS0170244-A</td>
<td></td>
<td>1</td>
<td>1</td>
<td>For YR-MPD250B-B00</td>
</tr>
</tbody>
</table>