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Chapter 1

Introduction

1.1 About This Document

This document provides information about the Motoman® MotoSweep O 20/50 SIGMA III Transporter. It is organized as follows –

CHAPTER 1 – INTRODUCTION

Chapter 1 introduces this Transporter Manual, provides an overview and technical specifications for the MotoSweep O 20/50 SIGMA III Transporter, and provides contact information for Motoman 24-hour Customer Support.

CHAPTER 2 – SAFETY

Chapter 2 provides general information regarding the safe installation, maintenance, and operation of the MotoSweep O 20/50 SIGMA III Transporter.

CHAPTER 3 – DESCRIPTION OF EQUIPMENT

Chapter 3 provides detailed descriptions of MotoSweep O 20/50 SIGMA III Transporter components.

CHAPTER 4 – INSTALLATION

Chapter 4 provides installation procedures for the MotoSweep O 20/50 SIGMA III Transporter.

CHAPTER 5 – OPERATION

Chapter 5 provides instructions for basic operation of the MotoSweep O 20/50 SIGMA III Transporter. This chapter also provides procedures for start-up, loading, normal operation, fault recovery, and shutdown. Sample robot programs are also included in this chapter.

CHAPTER 6 – MAINTENANCE

Chapter 6 provides suggested procedures on basic and preventive maintenance for the MotoSweep O 20/50 SIGMA III Transporter.

APPENDIX A - FOUNDATION DIAGRAM

Appendix A gives foundation requirements for the various riser options for the MotoSweep O 20/50 SIGMA III Transporter.

APPENDIX B - OPTIONS INSTALLATION

Appendix B provides installation and setup instructions for MotoSweep O 20/50 SIGMA III Transporter options.

APPENDIX C - ILLUSTRATED PARTS LIST

Appendix C contains the Illustrated Parts List (IPL). The IPL provides detailed views (with part numbers) of MotoSweep O 20/50 SIGMA III Transporter components.
1.2 Overview

Note: This manual documents a standard Motoman system. If your system is custom or modified, please use this manual in conjunction with the engineering drawings, schematics, and parts listing (Bill of Material) for your specific system. The engineering drawings, schematics, and Bill of Materials are included in the documentation package supplied with your MotoSweep O 20/50 SIGMA III Transporter.

The MotoSweep O 20/50 SIGMA III Transporter is designed to extend the working range of several models of Motoman robots. The MotoSweep O 20/50 SIGMA III Transporter working range, coupled with the working range of the attached robot, allows work on units and assemblies, the size of which would exceed the working range of the robot alone.

The MotoSweep O 20/50 SIGMA III Transporter incorporates an AC servomotor-driven overhead radial transport beam (boom) that provides overhead support (thus the MotoSweep “O” designation) for any one of a number of standard NX100 robots (see Figure 1 and Table 1). The boom can be mounted on an offset C-frame riser or a straight-frame riser (see Figure 5 and Figure 6). The straight-frame riser is typically specified for welding applications, while the offset C-frame riser is typically specified for machine tending applications. Robot mounting platforms (wall-mount and ceiling-mount) are located at the end of the boom (see Figure 1 and Table 11).

Figure 1 Overview and Component Location — MotoSweep O 20/50 SIGMA III Transporter

NOTES –
1. Offset C-Frame riser shown. Straight-Frame riser similar.
2. HP20 robot shown. See Table 1 for a list of robots that are approved by Motoman for use with this transporter unit.
3. Boom shown 90° from HOME position.
1.3 Foundation Requirements

CAUTION!
Make sure that you select the correct foundation plan and anchoring specifications for securing the specific MotoSweep O 20/50 SIGMA III Transporter riser. The transporter will generate substantial overhang (pull-out) and torsional (twist) floor loads, and requires special anchoring and foundation considerations.

Three foundation plans exist for the MotoSweep O 20/50 SIGMA III Transporter. These foundation plans, along with recommended anchoring specifications, are given in Appendix A.

CAUTION!
The customer is responsible for the stability of a MotoSweep O 20/50 SIGMA III Transporter that is installed on an existing floor.

Section 4.2.2 gives installation recommendations for mounting the MotoSweep O 20/50 SIGMA III Transporter on an existing floor.

1.4 Data Plate

A data plate is attached to the MotoSweep riser (see Figure 1). The data plate gives specific identifying information, ratings, and specifications associated with the particular MotoSweep unit to which it is attached (see Figure 2).

Table 1  Applicable Robots — MotoSweep O 20/50 SIGMA III Transporter

<table>
<thead>
<tr>
<th>MTG PLATFORM ORIENTATION</th>
<th>HP20</th>
<th>HP20-6</th>
<th>EA1900N</th>
<th>HP50</th>
<th>HP50-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;CEILING-MOUNT&quot;</td>
<td>^1</td>
<td>^1</td>
<td>^1</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>&quot;WALL-MOUNT&quot;</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>

^1 When used with optional 2.5 meter boom (P/N 150895-1)
^2 S-Axis limits constrain robot S-axis rotation to ±30° from vertical

Figure 2  Data Plate — MotoSweep O 20/50 SIGMA III Transporter
1.5 **Major Components**

A standard MotoSweep O 20/50 SIGMA III Transporter unit includes the following major components –

- Robot (see Table 1)
- Riser (C-Frame or Straight-Frame)
- Overhead Radial Transport Beam (Boom)
- AC Servomotor / Drive Assembly
- External Axis Kit
- External Axis Cables (15-meter)
- Robot Cables (15-meter)

*Note: The standard 15-meter cables allow placement of the NX100 controller within 8 meters of the riser base. Longer cables are available as optional equipment.*

*Note: Specific I/O or process control cables are configured per application and, depending upon the specific customer order, are supplied by Motoman or the customer.*

1.6 **Optional Equipment**

Refer to Section 3.5 for descriptions of optional equipment available for use with the MotoSweep O 20/50 SIGMA III Transporter.

1.7 **Reference Documentation**

- Motoman *HP20 Manipulator Manual* (P/N 149615-1)
- Motoman *HP20-6 Manipulator Manual* (P/N 150085-1)
- Motoman *EA1900N Manipulator Manual* (P/N 149894-1)
- Motoman *HP50 Manipulator Manual* (P/N 151170-1)
- Motoman *HP50-20 Manipulator Manual* (P/N 149467-1)
- Motoman *NX100 Controller Manual* (P/N 149201-1)
- Motoman *NX100 Concurrent I/O Manual* (P/N 149230-1)
- Motoman *NX100 Operator’s Manual for Arc Welding* (P/N 149235-1)
- Vendor manuals for system components not manufactured by Motoman
1.8 Customer Support Contact Information

If you need assistance with any aspect of your MotoSweep O 20/50 SIGMA III Transporter, please contact Motoman Customer Support at the following 24-hour telephone number –

937. 847. 3200

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

technicalsupport@motoman.com

When using e-mail to contact 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.

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

Please have the following information ready before you contact Motoman Customer Support –

• Robot Model . . . . . . . . . . . . . HP20, HP20-6, EA1900N, HP50, or HP50-20
• System . . . . . . . . . . . . . . . . MotoSweep O 20/50 SIGMA III Transporter
• Software Version . . . . . . . . Access using MAIN MENU ➔ SYSTEM INFO ➔ VERSION on the Programming Pendant
• Robot Serial Number . . . . Located on robot data plate
• Robot Sales Order Number . . . . Located on door of NX100 controller
### 1.9 Transporter Technical Specifications

**Table 2 MotoSweep O 20/50 SIGMA III Transporter Technical Specifications**

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model P/N</td>
<td>—</td>
<td>152551–1, –2, –3, –4</td>
</tr>
<tr>
<td>Robot Base Offset Distance</td>
<td>mm</td>
<td>2000</td>
</tr>
<tr>
<td>Boom Velocity</td>
<td>rpm</td>
<td>6.7</td>
</tr>
<tr>
<td>Boom Range</td>
<td>degrees</td>
<td>±180</td>
</tr>
<tr>
<td>Axis Type</td>
<td>—</td>
<td>Rotation</td>
</tr>
<tr>
<td>Reduction Ratio (Number)</td>
<td>—</td>
<td>39</td>
</tr>
<tr>
<td>Reduction Ratio (Denominator)</td>
<td>—</td>
<td>11575</td>
</tr>
<tr>
<td>Motor Power</td>
<td>kW</td>
<td>4.4</td>
</tr>
<tr>
<td>Motor P/N (Yaskawa Electric Corp)</td>
<td>—</td>
<td>SGMRS–44A2A–YR21</td>
</tr>
<tr>
<td>Motor P/N (Motoman, Inc.)</td>
<td>—</td>
<td>149568–10</td>
</tr>
<tr>
<td>Servo Amp P/N (Yaskawa Electric Corp)</td>
<td>—</td>
<td>SGDR–SDB950AØ1B</td>
</tr>
<tr>
<td>Servo Amp P/N (Motoman, Inc.)</td>
<td>—</td>
<td>149472–4</td>
</tr>
<tr>
<td>Maximum Motor Speed</td>
<td>rpm</td>
<td>2000</td>
</tr>
<tr>
<td>Inertia Ratio</td>
<td>—</td>
<td>300</td>
</tr>
<tr>
<td>Repeatability(^1)</td>
<td>mm</td>
<td>±0.1</td>
</tr>
<tr>
<td>Settling Time(^2)</td>
<td>sec</td>
<td>0.75</td>
</tr>
<tr>
<td>E-Stop Response Time (Boom)(^3)</td>
<td>sec</td>
<td>0.55</td>
</tr>
<tr>
<td>E-Stop Response Travel (Boom)(^3)</td>
<td>degrees</td>
<td>13</td>
</tr>
</tbody>
</table>

**Notes**

1. Temperature-stable system, combined boom and robot, X, Y, and Z
2. Definition – Time required for the TCP (Tool Control Point) "bounce" to settle within the repeatability band. Measurement Condition – 100% approach velocity to via point; 4-inch creep at 20% velocity to repeatability pose point. Tested with HP50 robot.
3. Typical with HP50 robot
Chapter 2
Safety

2.1 Introduction

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

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

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
1.734.994.6088 (voice)
1.734.994.3338 (fax)
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 ROBOTIC SYSTEM 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 chapter 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, transporter, 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.

• Be sure that only qualified personnel familiar with national codes, local codes, and the ANSI/RIA R15.06-1999 Robot Safety standard 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).
Chapter 3

Equipment Description

3.1 MotoSweep O 20/50 SIGMA III Transporter

The Motoman MotoSweep O 20/50 SIGMA III Transporter consists of major component groups (refer to Section 1.5) that work together to position a robot in applications that require extended reach. Examples of such applications include machine loading, material handling, welding, deburring, trimming, deflashing, and load/unload of injection mold machines.

The overhead radial transport beam (boom) can be mounted on an offset C-frame riser or a straight-frame riser (see Figure 5 and Figure 6). The C-frame riser is typically specified for machine tending applications, while the straight-frame riser is typically specified for welding applications. Robot mounting platforms (“wall-mount” and “ceiling-mount”) are located at the end of the boom (see Figure 1 and Table 1).

The MotoSweep O 20/50 SIGMA III Transporter features a 7-axis design (single-axis transporter and 6-axis robot). One NX100 controller provides power and data I/O for the robot, the transporter, and certain ancillary components (refer to Section 3.3 and Section 3.4).

The MotoSweep O 20/50 SIGMA III Transporter can reduce floorspace requirements and provide better access to parts through machine tool front doors or tops, when compared to other robotic solutions. The MotoSweep O 20/50 SIGMA III Transporter also provides easy access for tool changes and part setups. The extended reach of the MotoSweep O 20/50 SIGMA III Transporter also allows one robot to service multiple workstations located in linear or cluster/star configurations, thus maximizing productivity and use of capital equipment.

3.2 Robots

Table 3 lists basic specifications for each of the robots that Motoman approves for use with the MotoSweep O 20/50 SIGMA III Transporter. For additional information on your specific robot, refer to the robot manual that is included with your MotoSweep O 20/50 SIGMA III Transporter documentation package (refer to Section 1.7).
Table 3  Robot Specifications

<table>
<thead>
<tr>
<th>ROBOT MODEL</th>
<th>PAYLOAD</th>
<th>REACH</th>
<th>REPEATABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP20</td>
<td>20 kg</td>
<td>1,717 mm</td>
<td>±0.06 mm</td>
</tr>
<tr>
<td>HP20–6</td>
<td>6 kg</td>
<td>1,915 mm</td>
<td>±0.06 mm</td>
</tr>
<tr>
<td>EA1900N</td>
<td>3 kg</td>
<td>1,904 mm</td>
<td>±0.08 mm</td>
</tr>
<tr>
<td>HP50</td>
<td>50 kg</td>
<td>2,046 mm</td>
<td>±0.07 mm</td>
</tr>
<tr>
<td>HP50–20</td>
<td>20 kg</td>
<td>3,106 mm</td>
<td>±0.15 mm</td>
</tr>
</tbody>
</table>

### 3.3 NX100 Controller

**CAUTION!**

The NX100 is the only controller approved by Motoman for use with the MotoSweep O 20/50 SIGMA III Transporter. Use (or attempted use) of any other brand or type of controller could damage equipment and void your Motoman warranty.

One Motoman NX100 controller (see Figure 3) coordinates operation of the MotoSweep O 20/50 SIGMA III Transporter. The NX100 features a Programming Pendant (see Figure 4) that provides an interface with the MotoSweep O 20/50 SIGMA III system for operation, programming, and maintenance personnel (refer to Section 3.4).

In addition to controlling the movement of the robot, the NX100 also controls the welding power source, the AC servomotor/drive assembly, the welding system, and power distribution. For additional information, refer to the **NX100 Controller Manual** and the **NX100 Concurrent I/O Manual** that are included with your MotoSweep O 20/50 SIGMA III Transporter documentation package (refer to Section 1.7).

**Figure 3  NX100 Controller**
3.4 Programming Pendant

The Programming Pendant (see Figure 4) provides the primary means of programmer/operator interaction with the MotoSweep O 20/50 SIGMA III Transporter and attached Motoman robot. The pendant features the Windows® CE operating system, and displays information on a 6½-inch, color LCD, touch-screen display (640 X 480 VGA). The pendant also incorporates a CompactFlash® card slot for program backups. The Programming Pendant provides icon-driven system programming. It also features a menu-driven interface to simplify operator interaction with transporter and attached robot. Most operator controls are located on the Programming Pendant. This allows remote installation of the NX100 controller. By using the Programming Pendant, the operator can teach robot motion and perform programming, editing, maintenance, and diagnostic functions for the MotoSweep O 20/50 SIGMA III Transporter. For detailed information on the pendant programming keys, programming functions, and display functions, please refer to the NX100 Operator's Manual for Arc Welding that is included with your MotoSweep O 20/50 SIGMA III Transporter documentation package (refer to Section 1.7).

Figure 4 NX100 Programming Pendant

Note: The Programming Pendant LCD Touch Screen display goes dark after a few minutes of inactivity. Press any key to restore the screen.
3.5 Optional Equipment

- Zone Ring ................................................. .P/N 147680-1
  This assembly allows the definition of three zones that will activate dynamically with boom motion. Resolution is ±15°.

- Stop Assembly ........................................... .P/N 148235-1
  This limit switch/hard stop option can limit boom travel from approximately ±5° to ±175° in 10° increments. The integral limit switch is wired into the E-Stop circuitry, thus preventing impact with the mechanical hard stop.

- Safety Clip Kit (Inverted HP20 Robot) .................. .P/N 148473-1
  Fail-safe clips for "ceiling-mount" HP20 robot. These clips provide a safety backup to the standard robot-mounting hardware.

- Safety Clip Kit (Inverted HP50 Robot) .................. .P/N 148473-2
  Fail-safe clips for "ceiling-mount" HP50 robot. These clips provide a safety backup to the standard robot-mounting hardware.

- Conduit Kit .............................................. .P/N 150589-1
  This kit provides feedwire conduit, adapters, hoses, and brackets for EA1900TN welding applications with Miller wire feeder.

- Conduit Kit .............................................. .P/N 150589-3
  Same as 150589-1, but for use with HP50/HP50-20 robots.

- Feeder Assist Kit ....................................... .P/N 149858-1
  This kit includes a constant-torque, air-driven assist wire feeder, filter, lubricator, regulator (FRL), ON-OFF valve, support stand, and drum hood for a 20.4 inch diameter bulk wire drum. Wire feed "push" is controlled by regulating the air pressure. Wire feed speed is controlled by demand of the welding wire feeder. Maximum speed is 1200 IPM.

- Boom Option (2.5-meter boom) ............................ .P/N 150895-1
  This extended boom option provides a 2.5 meter sweep radius (2.0 meter is standard) for the HP20, HP20-6, or EA1900N robots in a “ceiling-mount” configuration.

- Straight-Frame Riser Height (150 mm increments) ........ .P/N 151838-()
  The straight-frame riser is available in optional heights (–1 through –8). Refer to Figure 8, Figure 10, and Appendix A for additional information.
3.6 Risers

CAUTION!
An oversize foundation is required for the 151838-7 and 151838-8 versions of the optional height Straight-Frame (pedestal) riser. See Figure 8, Figure 10, and Appendix A for foundation and installation details for these risers.

The MotoSweep O 20/50 SIGMA III Transporter is available with a C-Frame riser (see Figure 5) or a Straight-Frame (pedestal) riser (see Figure 6).

---

**Figure 5** C–Frame Riser — MotoSweep O 20/50 SIGMA III Transporter

---

**Figure 6** Straight–Frame Riser — MotoSweep O 20/50 SIGMA III Transporter
3.7 Transporter / Robot Combinations

Five Motoman robots are currently approved for use with the MotoSweep O 20/50 SIGMA III Transporter. Refer to Table 4 for a listing of approved Transporter/Robot combinations.

Table 4 MotoSweep O 20/50 SIGMA III Transporter — Approved Transporter / Robot Combinations

<table>
<thead>
<tr>
<th>MOTOMAN P/N</th>
<th>MODEL</th>
<th>APPROVED ROBOTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>152551-1</td>
<td>MotoSweep O 20, SIGMA III, C-Frame Riser</td>
<td>HP20, HP20-6, EA1900N</td>
</tr>
<tr>
<td>152551-2</td>
<td>MotoSweep O 50, SIGMA III, C-Frame Riser</td>
<td>HP50, HP50-20</td>
</tr>
<tr>
<td>152551-3</td>
<td>MotoSweep O 20, SIGMA III, Straight-Frame Riser</td>
<td>HP20, HP20-6, EA1900N</td>
</tr>
<tr>
<td>152551-4</td>
<td>MotoSweep O 50, SIGMA III, Straight-Frame Riser</td>
<td>HP50, HP50-20</td>
</tr>
</tbody>
</table>

3.8 Transporter / Robot Dimensions and Working Ranges

3.8.1 Ceiling-Mount Robot / C-Frame Riser

Figure 7 MotoSweep O 20/50 SIGMA III Transporter — Ceiling-Mount Robot / C-Frame Riser

<table>
<thead>
<tr>
<th>ROBOT</th>
<th>WORKING RANGE X</th>
<th>WORKING RANGE Z</th>
<th>HEIGHT HR</th>
<th>HEIGHT HB</th>
<th>COMBINED WORK RANGE RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP20</td>
<td>1,717 mm</td>
<td>2,072 mm</td>
<td>1,235 mm</td>
<td>2,640 mm</td>
<td>3,717 mm</td>
</tr>
<tr>
<td>HP20-6</td>
<td>1,915 mm</td>
<td>2,270 mm</td>
<td>1,235 mm</td>
<td>2,640 mm</td>
<td>3,915 mm</td>
</tr>
<tr>
<td>HP50-20</td>
<td>3,160 mm</td>
<td>3,501 mm</td>
<td>750 mm</td>
<td>2,640 mm</td>
<td>5,106 mm</td>
</tr>
<tr>
<td>HP50</td>
<td>2,046 mm</td>
<td>2,441 mm</td>
<td>1,117 mm</td>
<td>2,640 mm</td>
<td>4,046 mm</td>
</tr>
<tr>
<td>EA1900N</td>
<td>1,904 mm</td>
<td>2,259 mm</td>
<td>1,155 mm</td>
<td>2,640 mm</td>
<td>3,904 mm</td>
</tr>
</tbody>
</table>
3.8.2 Ceiling-Mount Robot / Straight-Frame Riser

Figure 8 MotoSweep O 20/50 SIGMA III Transporter — Ceiling-Mount Robot / Straight-Frame Riser

<table>
<thead>
<tr>
<th>ROBOT</th>
<th>WORKING RANGE X</th>
<th>WORKING RANGE Z</th>
<th>HEIGHT HR @HB=2600mm</th>
<th>COMBINED WORK RANGE RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP20</td>
<td>1,717 mm</td>
<td>2,072 mm</td>
<td>1,175 mm</td>
<td>3,717 mm</td>
</tr>
<tr>
<td>HP20-6</td>
<td>1,915 mm</td>
<td>2,270 mm</td>
<td>1,175 mm</td>
<td>3,915 mm</td>
</tr>
<tr>
<td>HP50-20</td>
<td>3,160 mm</td>
<td>3,501 mm</td>
<td>690 mm</td>
<td>5,106 mm</td>
</tr>
<tr>
<td>HP50</td>
<td>2,046 mm</td>
<td>2,441 mm</td>
<td>1,057 mm</td>
<td>4,046 mm</td>
</tr>
<tr>
<td>EA1900N</td>
<td>1,904 mm</td>
<td>2,259 mm</td>
<td>1,095 mm</td>
<td>3,904 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VERTICAL RISER HEIGHT OPTION (P/N 151838-)</th>
<th>HEIGHT HB</th>
</tr>
</thead>
<tbody>
<tr>
<td>–1</td>
<td>2,600 mm</td>
</tr>
<tr>
<td>–2</td>
<td>2,750 mm</td>
</tr>
<tr>
<td>–3</td>
<td>2,900 mm</td>
</tr>
<tr>
<td>–4</td>
<td>3,050 mm</td>
</tr>
<tr>
<td>–5</td>
<td>3,200 mm</td>
</tr>
<tr>
<td>–6</td>
<td>3,350 mm</td>
</tr>
<tr>
<td>–7</td>
<td>3,500 mm</td>
</tr>
<tr>
<td>–8</td>
<td>3,650 mm</td>
</tr>
</tbody>
</table>

* Oversize foundation required for –7 and –8 risers.
### 3.8.3 Wall-Mount Robot / C-Frame Riser

![Diagram of MotoSweep O 20/50 SIGMA III Transporter — Wall-Mount Robot / C-Frame Riser](image)

**Table:**

<table>
<thead>
<tr>
<th>ROBOT</th>
<th>WORKING RANGE X</th>
<th>WORKING RANGE Z</th>
<th>HEIGHT HR</th>
<th>HEIGHT HB</th>
<th>COMBINED WORK RANGE RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP20</td>
<td>1,717 mm</td>
<td>2,072 mm</td>
<td>1,235 mm</td>
<td>2,640 mm</td>
<td>3,717 mm</td>
</tr>
<tr>
<td>HP20-6</td>
<td>1,915 mm</td>
<td>2,270 mm</td>
<td>1,235 mm</td>
<td>2,640 mm</td>
<td>3,915 mm</td>
</tr>
<tr>
<td>HP50-20</td>
<td>3,160 mm</td>
<td>3,501 mm</td>
<td>750 mm</td>
<td>2,640 mm</td>
<td>5,106 mm</td>
</tr>
<tr>
<td>HP50</td>
<td>2,046 mm</td>
<td>2,441 mm</td>
<td>1,117 mm</td>
<td>2,640 mm</td>
<td>4,046 mm</td>
</tr>
<tr>
<td>EA1900N</td>
<td>1,904 mm</td>
<td>2,259 mm</td>
<td>1,155 mm</td>
<td>2,640 mm</td>
<td>3,904 mm</td>
</tr>
</tbody>
</table>
### 3.8.4 Wall-Mount Robot / Straight-Frame Riser

#### Table 1

<table>
<thead>
<tr>
<th>ROBOT</th>
<th>WORKING RANGE X</th>
<th>WORKING RANGE Z</th>
<th>COMBINED WORK RANGE RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP20</td>
<td>2,072 mm</td>
<td>1,717 mm</td>
<td>4,032 mm</td>
</tr>
<tr>
<td>HP20-6</td>
<td>2,270 mm</td>
<td>1,915 mm</td>
<td>4,230 mm</td>
</tr>
<tr>
<td>EA1900N</td>
<td>2,259 mm</td>
<td>1,904 mm</td>
<td>4,219 mm</td>
</tr>
</tbody>
</table>

#### Table 2

<table>
<thead>
<tr>
<th>VERTICAL RISER HEIGHT OPTION (P/N 151838-)</th>
<th>HEIGHT HB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>2,880 mm</td>
</tr>
<tr>
<td>-2</td>
<td>3,030 mm</td>
</tr>
<tr>
<td>-3</td>
<td>3,180 mm</td>
</tr>
<tr>
<td>-4</td>
<td>3,330 mm</td>
</tr>
<tr>
<td>-5</td>
<td>3,480 mm</td>
</tr>
<tr>
<td>-6</td>
<td>3,630 mm</td>
</tr>
<tr>
<td>-7*</td>
<td>3,780 mm</td>
</tr>
<tr>
<td>-8*</td>
<td>3,930 mm</td>
</tr>
</tbody>
</table>

* Oversize foundation required for –7 and –8 risers.

Figure 10 MotoSweep O 20/50 SIGMA III Transporter — Wall-Mount Robot / Straight-Frame Riser
3.9 Safety Features

CAUTION!
The user is responsible for safeguarding and verifying that safeguards are adequate for plant conditions per ANSI/RIA R15.06–1999 Robot Safety Standard.

CAUTION!
The user is responsible for performing preventive and on-condition maintenance that will keep safeguards in working order.

3.9.1 Programming Pendant ENABLE Switch

The ENABLE switch is part of the Programming Pendant, and provides a safety feature that controls servo power while the system is in TEACH mode (see Figure 4 and Figure 11). When pressed in, this switch allows the operator to enable servo power. However, should the operator release the switch or grasp it too tightly, servo power is immediately disabled, thus preventing further robot movement.

![Programming Pendant ENABLE Switch](image)

3.9.2 Emergency Braking System

Each of the five robots that are approved for use with the MotoSweep O 20/50 SIGMA III Transport, incorporate a braking system that protects personnel from injury and prevents equipment damage if servo power is removed. Upon loss of servo power, the brake system activates to hold all robot axes in place. The brake system incorporates a feature that allows the operator to release the brake of a specific robot axis, even if drive power is disabled. Brake release is accomplished with the Programming Pendant (refer to Section 5.3.3).

3.9.3 Emergency Stops (E-Stops)

The MotoSweep O 20/50 SIGMA III Transporter incorporates E-Stop actuation buttons at the following locations –

- NX100 controller access door (see Figure 3)
- Programming Pendant (see Figure 4)

If either of the E-Stop actuation buttons is depressed, all system operation and movement immediately stops.
Chapter 4
Installation

WARNING!
The MotoSweep O 20/50 SIGMA III Transporter should be installed by qualified personnel who are familiar with the installation and set-up of this type of unit.

CAUTION!
The MotoSweep O 20/50 SIGMA III Transporter is not extremely fragile. It is, however, a sophisticated robotic system that can be damaged by rough handling. Be sure to handle all system components with care.

Two to three qualified technicians can install the MotoSweep O 20/50 SIGMA III Transporter in a reasonable amount of time. Always comply with established safety procedures throughout the installation process (refer to Chapter 2).

Typically, this transporter is shipped with the robot mounted on the boom. If not, the robot installation must be performed by a Motoman technician. For more information, contact Motoman Customer Support (refer to Section 1.8).

4.1 Required Materials

All system components and most hardware items required for installation of the MotoSweep O 20/50 SIGMA III system are included with your shipment. There are, however, some required items that the customer must supply, such as typical installation and maintenance tools (refer to Section 4.1.2) and anchoring system (refer to Appendix A).

4.1.1 Customer-Supplied Items

- Incoming power supply to controller – 240/480/575 volts
- Internal air lines for manual/fixed configuration.
4.1.2 Recommended List of Hand Tools and Equipment

- Safety glasses
- Torque Wrench, 255 N m (188 ft-lbf)
- Gloves (heavy-duty leather recommended)
- Level (short and long)
- Ratchet Handle (with ¾-inch hex socket)
- Adjustable wrench
- Hammer drill with appropriate concrete bits
- Phillips and flat-blade screwdrivers
- Hammer (dead-blow and steel)
- Hammer (non-marring)
- Socket set (SAE and Metric)
- Air-impact gun (with ¾-inch hex socket)
- Open-end wrench set (SAE and Metric)
- "Allen" wrench set (SAE and metric)

4.2 Site Preparation

The MotoSweep O 20/50 SIGMA III transporter is shipped on two wooden shipping pallets. The riser is shipped on one pallet and the boom with robot are shipped on a second pallet. Six configurations are available:

- Servo boom with C-frame riser base
- Servo boom with straight riser base
- Fixed boom with C-frame riser base
- Fixed boom with straight riser base
- Manually movable boom with C-frame riser base
- Manually movable boom with straight riser base

All configurations are shipped partially assembled, with the drive assembly/adaptor plate mounted on the riser base, robot mounted on the boom arm, and cables partially installed. The user must install the base riser, install the boom arm on the riser, and route / connect the cables.

4.2.1 Recommended Foundation

CAUTION!

The MotoSweep O 20/50 SIGMA III Transporter must be mounted on a robust concrete foundation that will support the transporter's static and dynamic forces.

CAUTION!

Due to various riser options, three different foundation plans exist. Make sure that you select the correct foundation plan for your specific riser's base plate configuration. Refer to Section 3.6, Section 3.7, and Section 3.8 for details.

1. Prepare the foundation for a C-frame configuration as instructed in the foundation diagram located in Appendix A.
2. Allow foundation to cure for 21 days.
3. The floor space needed for the MotoSweep O 20/50 SIGMA III positioner varies depending upon the robot used, and the type of riser base selected for the application. Refer to Section 3.6, Section 3.7, and Section 3.8 and your system layout drawings for details.
4.2.2 Existing Floor Installation

CAUTION!
The customer is responsible for system stability when installed on an existing floor.

The MotoSweep O 20/50 SIGMA III positioner can generate high overhang (pull-out) and torsional (twist) floor loads and therefore requires special anchoring considerations. The existing floor must provide sufficient ballast to keep the system upright and stable relative to the other equipment in the cell (machine tools, weld positioners, conveyors, etc.).

4.2.2.1 Anchoring and Floor Requirements:

- Number of anchor holes — 12
- Anchor hole diameter — 26 mm (1"+)
- Dynamic Load Rating, per anchor, minimum — 2040 kgf (4500 lbf)
- Total System Weight (approx) — 3650 kg (8050 lb)
- Bending Moment, Centered at Riser Base (C-frame) — 75,000 Nm (55,300 lbf-ft)
- Peak Torsional Moment, Centered at Riser Base (C-frame) — 30,000 Nm (22,125 lbf-ft)
- Grout — Use an epoxy-sand grout system

Note: Contact your local HILTI representative if you need assistance with selecting a suitable anchor system for your floor.

Note: Contact Resource International, Inc. (www.resourceinternational.com) if you need assistance with evaluating the structural characteristics and capacity of your floor.

4.2.2.2 Surface Preparation

Identify and mark out the riser base location. Use a concrete surface grinder to clean the existing floor. This will provide a clean, rough surface for the epoxy grout to lock and transfer the torsional loads to the floor.

Having procured the appropriate anchors and prepared the floor, continue on with the riser installation.
4.3 Installing the Riser Base

To install the MotoSweep O 20/50 SIGMA III riser base, proceed as follows –

**WARNING!**
The positioner weighs 2000 kg (4400 lbs), make sure the lifting device used to move these objects are capable of safely handling this much weight.

1. Carefully remove protective plastic wrapping from riser base.
2. Gather all customer-supplied items and required tools listed in Section 4.1.
3. Inspect riser base for shipping damage.

*Note: If any equipment is damaged, notify the shipper immediately.*

4. Locate the metal shipping bands that fasten the riser base to the pallet.

**Figure 12** Metal Shipping Bands

**WARNING!**
Metal bands are under tension and, when cut, may cause injury. Be cautious when cutting the metal bands.

5. Cut the bands securing the riser base to the skid.
WARNING!
The MotoSweep O 20/50 SIGMA III C-frame riser with drive assembly weighs approximately 2600 kg (5730 lb). The vertical riser with drive assembly weighs approximately 2300 kg (5070 lb). Be sure that your lifting device is capable of handling this much weight or damage to the equipment or injury to personnel can result.

6. Install two M16 swivel eyebolts in the front two boom mounting holes in the drive assembly mounting plate. Hook 60-inch overhead sling straps to the swivel eyebolts and 72-inch sling straps to the cutouts in the side of the riser base (see Figure 12).

7. Raise the base upright on the wooden shipping pallet.

8. Set the riser base in position on the foundation.

9. Secure the riser base as instructed in the foundation diagram located in Appendix A.

10. Use the four (4) jacking screws to level riser top plate and provide a 38 - 50 mm (1.5 - 2 inch) clearance for the grout.

11. Remove the cable connection plate (servo boom) or cable cover (manual/fixed boom) to gain access to the grout fill hole.

12. Fill gap underneath base with grout.

WARNING!
Secure the riser base to the foundation before removing the lifting straps. C-frame risers will tilt forward and fall over if not properly secured.

13. Remove lifting straps.

14. Once the grout has cured, remove the jacking screws prior to final tightening of the anchor nuts (see foundation drawing in Appendix A).

4.4 Installing the MotoSweep O 20/50 SIGMA III Boom

Procedure –

1. Carefully remove all protective plastic wrapping from boom and robot.

2. Inspect boom and robot for shipping damage.

Note: If any equipment is damaged, notify the shipper immediately.

3. If hoisting overhead, attach two 84-inch slings from lifting device to the boom’s front lifting eyes and two 60-inch slings to the boom’s rear lifting eyes (see Figure 13).

WARNING!
The MotoSweep O 20/50 SIGMA III boom with a UP20 robot weighs approximately 750 kg (1654 lb). The boom with a UP50 robot weighs approximately 1050 kg (2315 lb). Be sure that your lifting device is capable of handling this much weight or damage to the equipment or injury to personnel can result.

WARNING!
Make sure the boom is securely supported by the lifting device before attempting to remove
the boom from the shipping brackets or serious damage to equipment or injury to personnel can result.

4. The boom and robot are secured to the shipping pallet with four yellow shipping brackets (see Figure 13). In addition, the upper robot arm is secured to the lower arm with a yellow shipping bracket.

5. Using a suitable wrench, remove the 4 M16 bolts that fasten the rear of the boom to the shipping brackets (see Figure 13).

6. Using a suitable wrench, remove the four M16 bolts that fasten the front of the boom to the shipping brackets (see Figure 13).

7. Using the lifting device, lift the boom and robot assembly.

   Note: Add shackles at the overhead crane hook, as necessary to ensure the assembly is level (with robot slightly higher) as it is lifted.

8. Position the boom and robot assembly over the drive assembly mounting plate, making sure to stay clear of drive motor and robot cables (see Figure 14).
9. Align the three (3) rear (inside) mounting bolts on the boom and loosely install three (3) M16 X 45 socket head cap screws with three (3) conical washers.

10. Loosely install the ten (10) remaining M16 X 45 socket head cap screws and ten (10) conical washers in the right and left sides of the boom.

11. Torque the 13 M16 screws to 125 Nm (92 lb-ft) per torque sequence shown in Figure 15. Then torque the 13 M16 screws to 255 Nm (188 lb-ft) per torque sequence. Remove covers as necessary to access bolts.

Note: The manual and fixed boom configurations are adjustable in 10-degree increments. If the factory-set orientation is not suitable for your application, refer to detailed adjustment procedures given in Sections 6.4 and 6.5.

12. Remove yellow shipping bracket from robot upper and lower arm.

CAUTION!
To avoid damage to robot cables and air hoses which extend through the positioner servo motor, move them safely out of the way during boom installation.
13. The boom is now fully supported on the riser base. Lower the lifting device and remove the four (4) slings from the boom eye plates.

4.5 Connecting the Controller Cables

After components are level and securely in place, unwrap the cables and connect them according to the cable diagram included in the system drawing package. All cables are labeled to match the labels at the connection points.

4.5.1 Connecting the Cables (MotoSweep O 20/50 SIGMA III Servo)

In the servo configuration, the robot-controller cables are shipped pre-installed in the MotoSweep riser. Unpack controller/robot cables. Use Table 5 to identify cables.
Two cables (1BC and 2BC) connect the robot to the controller. The 1BC cable provides communication between the controller and the robot. The 2BC cable supplies power to the robot servo motors.

**Larger Robots (HP50)**

Three cables (1BC, 2BC, and 3BC) connect the robot to the controller. The 1BC cable provides communication between the controller and the robot. The 2BC and 3BC cables supply power to the robot servo motors.

**CAUTION!**

Route cable carefully to avoid cable damage.

1. Unpack programming pendant and plug connector into receptacle on front door of controller.
2. Route controller end of cables from the riser to the controller.
3. Carefully engaging connectors, connect one end of each cable (labeled 1BC, 2BC, etc.) to the connections on side of controller.
4. Route robot end of cables through the boom to the robot. Use the 2 J-Hooks in the top of the boom to provide cable strain relief (see Figure 16).

**Table 5 Robot Cable Connections**

<table>
<thead>
<tr>
<th>MotoSweep O 20</th>
<th>MotoSweep O 50</th>
<th>Cable Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1BC-A</td>
<td>1BC-A</td>
<td>Robot encoder communication</td>
</tr>
<tr>
<td>2BC-A</td>
<td>2BC-A</td>
<td>Robot motor power and brakes</td>
</tr>
<tr>
<td>—</td>
<td>3BC-A</td>
<td>Robot motor power and brakes</td>
</tr>
<tr>
<td>CA-25</td>
<td>CA-25</td>
<td>MotoSweep motor power and brakes</td>
</tr>
<tr>
<td>CA-26</td>
<td>CA-26</td>
<td>MotoSweep encoder cables</td>
</tr>
</tbody>
</table>

**Smaller Robots (HP20)**

If the robot is ceiling-mounted, remove rear access panel on the bottom of boom and route cables through the opening in the front access panel.
6. If the robot is wall-mounted, remove access panel on top of boom and route cables through this opening.

7. Carefully engaging connectors, connect one end of each cable (labelled 1BC, 2BC, etc.) to the connections on back of robot (see Figure 17).

![Figure 17 Robot Connections](image)

---

### 4.5.2 Removing the Robot Shipping Bracket

**CAUTION!**

Failure to remove shipping brackets from robot before operating the MotoSweep O 20/50 SIGMA III transporter may result in damage to the robot drive mechanisms.

A yellow bracket (see Figure 18) prevents the robot from moving during shipping. The bracket secures the lower arm assembly to the S-axis housing. After the robot is in place, remove the shipping bracket.

![Figure 18 Location of Shipping Brackets](image)
4.6 Connecting the Power

After all of the system components have been properly installed, connect the power to the MotoSweep O 20/50 SIGMA III transporter as follows –

**DANGER!**
Power should be connected only by a qualified electrician. Electrical and grounding connections must comply with applicable portions of the National Electrical Code and/or local electrical codes.

1. Install 3-phase power wiring to the fused service disconnect located in the controller. Table 6 shows size and type of wire needed.
2. Tighten screws to the torque indicated in Table 6.
3. Install an M5 lug on incoming ground wire.
4. Terminate ground wire to frame ground stud with hardware provided.

Note: The MotoSweep O 20/50 SIGMA III transporter is configured for 3-phase 460/480V AC, unless other voltage was requested at the time of order. If other voltage is required for your plant, you must make the necessary modifications to the transformer. For more information, refer to the electrical diagrams that are included with your system.

<table>
<thead>
<tr>
<th>LUG DATA</th>
<th>60/75° C wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATALOG NO.</td>
<td>TCAL14</td>
</tr>
<tr>
<td>WIRE SIZE</td>
<td>#14-7 Copper, #12-8 Aluminum</td>
</tr>
<tr>
<td>TORQUE</td>
<td>#14-7, 4.0 Nm (35 lb-in.)</td>
</tr>
</tbody>
</table>

4.7 Conducting a Safety/Operation Check

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

Procedure –

1. Ensure that the yellow shipping bracket is removed from the robot (refer to Section 4.5.2).
2. Check that all safeguards are installed, functioning, and adequate for your plant conditions in accordance with the ANSI/RIA R15.06-1999 Robot Safety Standard.
3. Verify that incoming line power matches the input power specified on the label located on the front of the NX100 controller.

Your MotoSweep O 20/50 SIGMA III transporter 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 operation of the Motoman robot model installed for your system.

4. Turn the main power ON
5. Check all system E-STOPS for correct operation (pendant, operator-station, controller door)
6. Check system Hold buttons for correct operation

4.8 Installation of Tooling and Fixtures

Your MotoSweep O 20/50 SIGMA III transporter is now ready for the installation of tooling and fixtures for your application.

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

After tooling installation, check the MotoSweep O 20/50 SIGMA III transporter again for correct operation.

*Note: All tooling and fixtures shall be supplied by the customer.*
Chapter 5
Operation

5.1 Programming

The operation of this system is programming dependent. The following operating instructions are based on one possible configuration of this system. Your system configuration and job structure may differ slightly from that presented here; however, basic operation will be the same. For additional programming instructions, refer to the controller and operator manuals that came with your system.

Any changes made to your system configuration and/or job structure will alter the operation of this cell. Motoman recommends you do not modify the original jobs and system configuration that came with your system. If modifications need to be made, they should be made to copies of these jobs and not to the originals. Modifications should only be performed by personnel who have received operator training from Motoman, and who are familiar with the operation of this Motoman system. If you have questions concerning the configuration of your system please contact Motoman Customer Support (refer to Section 1.8).

5.2 Daily Operation

The procedures below represent the typical operating sequence from power up to shutdown. Your basic operating procedures may vary depending on your situation.

- Perform Start-up Procedures (refer to Section 5.2.1).
- Perform Shutdown Procedures (refer to Section 5.2.3)

5.2.1 Start-Up

Procedure –

1. Set MAIN POWER switch on NX100 controller to ON.
2. Make sure all E-Stop push buttons are deactivated (released).
3. Select TEACH mode on the Programming Pendant.
4. Place system in HOME position or other dedicated start position.
5.2.2 **HOME Position**

Procedure –

1. Select TEACH mode on the Programming Pendant.
2. Select MAIN MENU on Programming Pendant touch screen.
5. Using cursor keys, move cursor to HOME job and press SELECT. The job appears on the display screen.
6. Turn servo power ON by pressing SERVO ON and holding in the ENABLE switch.
7. Use the FWD button on Programming Pendant to jog robots to HOME position.

The MotoSweep O 20/50 SIGMA III transporter is now ready for operation.

5.2.3 **Shutdown**

Use the following procedure to shut down the MotoSweep O 20/50 SIGMA III transporter after operation is complete:

1. Make sure robot is in HOME position.
2. Turn off system servo power by pressing E-Stop push button on controller door or Programming Pendant.
3. Select TEACH mode on the Programming Pendant.
4. Set controller Main Power switch to OFF position.

The MotoSweep O 20/50 SIGMA III transporter is now shut down.

5.3 **System Recovery**

When a system error or alarm occurs, you must clear the error or alarm to return the system to normal operation. The paragraphs below describe the different types of alarms and errors you may encounter and how to remedy them when you do.

5.3.1 **Alarms and Errors**

Alarms and errors will cause the current job program to stop.

Three levels of alarms and errors exist – Error Messages, Minor Alarms, and Major Alarms. For more detailed information about alarm recovery, refer to operator’s manual that is included with your MotoSweep O 20/50 SIGMA III system documentation package (refer to Section 1.7).
5.3.1.1 Error Messages

These are simple errors such as pressing the START button when the robots are not in PLAY mode, or enabling the Programming Pendant when servo power is off. Clear these errors by pressing the CANCEL button on the Programming Pendant.

5.3.1.2 Minor Alarms

Minor alarms usually involve programming errors. Minor alarms might occur if a circle has been programmed with fewer than three circular points, etc. Clear these errors by pressing the CANCEL button on the Programming Pendant.

5.3.1.3 Major Alarms

Major alarms usually involve hardware failures. Major alarms might occur because of a servo tracking error or an abnormal speed. To clear these alarms, you must set the controller Main Power switch to OFF and then rotate it back to the ON position.

5.3.2 E-Stop Recovery

An E-Stop can occur under any of the following conditions –

- Pressing E-Stop push button on the Operator Station, Programming Pendant, or controller door.

To restart the MotoSweep O 20/50 SIGMA III transporter after an E-Stop condition occurs, follow the procedure below.

1. Release any activated E-Stop button (Operator Station, Programming Pendant, or controller door).

CAUTION!

If an E-Stop condition occurs while the positioner is sweeping, the positioner will continue the sweep when system is restarted.

2. Press SERVO ON button on Operator Station or Programming Pendant.
3. Ensure Operator Station is enabled.
4. Press START button on the Operator Station.

The MotoSweep O 20/50 SIGMA III transporter is now ready to continue operation.

5.3.3 Brake Release

The robot brakes are designed to protect the robot and other system components from damage in the event of a system or robot failure and loss of drive power. If a system or robot failure occurs, you must release the brakes on the robot in order to move it.

To release robot brakes, proceed as follows –
**WARNING!**
Always support the axis to be released BEFORE releasing the brakes for that axis. Releasing brakes without adequate support can result in personal injury or equipment damage.

1. On the Programming Pendant, select TEACH mode and turn servo power OFF.
2. Select ROBOT on the Programming Pendant touch screen.
3. Select the MANUAL BRAKE RELEASE option.
5. Select the axis to be released using the cursor key.
6. Engage the ENABLE switch and press the Interlock and Select keys.
7. The brake for the selected axis releases.
Chapter 6
Maintenance

Maintenance of MotoSweep O 20/50 SIGMA III transporter components should be performed by authorized personnel who are familiar with the design and construction of this positioner. The following procedures should be performed only as needed. Read through the instructions completely before performing any maintenance procedure. Be sure that you understand the procedure, have the proper tools, and observe all applicable safety precautions.

**DANGER!**
Ensure power is off before performing the following procedures. Observe standard lockout/tagout practices.

6.1 Spare Parts

When a part malfunctions, it is helpful to have replacement parts in stock for quick replacement. Table 7 lists recommended spare parts and associated Motoman part numbers.

**DANGER!**
Always use Motoman spare parts when servicing your MotoSweep O 20/50 SIGMA III transporter. Use of non-Motoman parts may void your warranty and may result in machine malfunction, machine damage, or injury to personnel.

<table>
<thead>
<tr>
<th>PART NAME</th>
<th>MOTOMAN P/N</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12 CONICAL SPRING WASHER</td>
<td>471075-1</td>
<td>4</td>
</tr>
<tr>
<td>M16 CONICAL SPRING WASHER</td>
<td>132049-1</td>
<td>2</td>
</tr>
<tr>
<td>BRAKE PAD</td>
<td>150002-1</td>
<td>2</td>
</tr>
<tr>
<td>STRIPPER BOLTS (BRAKE)</td>
<td>148385-2</td>
<td>4</td>
</tr>
<tr>
<td>BATTERY, 3 V, LITHIUM</td>
<td>479348-1</td>
<td>1</td>
</tr>
<tr>
<td>FUSE, 10 AMP ATTDR</td>
<td>133653-3</td>
<td>1</td>
</tr>
<tr>
<td>LIMIT SWITCH</td>
<td>143963-1</td>
<td>1</td>
</tr>
</tbody>
</table>
6.2 Ordering Parts

Contact Motoman Customer Support to inquire about spare parts or to place an order (refer to Section 1.8).

Please have the following information ready before you call –

- Machine type (Robot Transporter)
- Machine Name (MotoSweep O 20/50 SIGMA III)
- Motoman Part Number
- Motoman Part Name
- Quantity of each part required

6.3 Servomotor / Gear Reduction Unit Maintenance

The AC servomotor and Gear Reduction Unit do not require field or customer-performed maintenance.

If either of these unit is physically damaged due to a load collision or misuse, or if there is grinding or excessive noise, contact Motoman Customer Support (refer to Section 1.8).

6.4 Resetting the Servomotor to Home Position

Resetting the MotoSweep O 20/50 SIGMA III transporter servomotor to HOME position is typically done after initial installation or after the servomotor is serviced or replaced.

Procedure –

1. Place robot in TEACH MODE and slowly jog boom until homing pin hole on boom mounting plate is accessible (within the homing notch).
2. Install the polymer homing pin into homing pin hole. The pin may need to be tapped in with a hammer.
3. Jog the boom slowly until homing pin just contacts the edge of notch in riser top plate (see Figure 19). If you jog the positioner too far, the pin will bend, causing an inaccuracy. If this happens, recover by slowly jogging the boom in reverse until pin is straight, but still touching the edge of the notch.
4. Place the programming pendant in MAINTENANCE 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 desired station (indicated in the top right corner).
9. Make sure the boom is in the position that you want to teach as HOME and press SELECT.

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

11. Remove the homing pin from the boom mounting plate and store it in a secure location for future use.

6.5 Inspecting Brake Pads

Procedure –

1. Remove the lower boom access panel closest to the riser base. The two (2) brake assemblies are located on the drive assembly mounting plate inside the boom (see Figure 20).

2. On each brake assembly, measure the gap between the brake pad and weldment plate.

3. If gap is more than 5 mm (0.2 inches), replace brake pad (see Figure 20 and refer to Section 6.6).
6.6 Replacing Brake Pads

Procedure –

1. Order replacement brake pads and stripper bolts, as necessary (refer to Section 6.1 and Section 6.2).

2. To replace the brake pad/stripper bolts, remove the brake assembly by removing the two (2) M12 bolts and one (1) M16 bolt that secure the brake assembly to the mounting plate.

3. Clamp the weldment plate in a vise.
4. Using a suitable punch, remove the spring retaining roll pins. You may need to depress the retaining washer with a screwdriver or pair of pliers.

5. Remove the retaining and tension spring washers. Take care to maintain the assembly sequence.

6. Loosen the vise, and re-clamp on the brake pad.

7. Remove the stripper bolts and discard.

8. Clamp the new pad in the vise for assembly.

9. Coat the new stripper bolts with EP Moly (black) grease before installation. Install both bolts and torque to 100 Nm (74 lbf-ft).

10. Confirm the bolt and brake assembly slide smoothly in the brake plate bores.

11. Clamp the lower part of the weldment plate in the vise.

12. Install the retaining and tension spring washers. Take care to maintain original sequence.

13. While depressing the retaining washer, tap the roll pins into final location.

14. Confirm smooth operation of the assembly. The best way is to use an arbor press to compress the tension springs (take care to keep the brake material free of grease). Alternatively, you can use a vise to compress the springs.

15. Before installation, use a vacuum cleaner to remove accumulated brake dust from riser top.

16. Install the assembly using new conical spring washers with the mounting bolts (M12: P/N 471075-1, M16: P/N 132049-1). Torque the M12 bolts to 100 Nm (74 lbf-ft) and the M16 bolts to 255 Nm (188 lbf-ft).
6.7 Repositioning the Fixed Boom (Non-Servo)

Orientation of the MotoSweep O 20/50 SIGMA III transporter fixed boom is set at the factory. If this orientation is not suitable for your application, reposition the boom as follows –

1. Turn servo power OFF.

2. Attach two 84-inch slings from a lifting device to the boom’s front lifting eyes and two 60-inch slings to the boom’s rear lifting eyes.

![WARNING!](image)
The combination of the MotoSweep O 20/50 SIGMA III transporter boom arm and a UP20 robot weighs approximately 750 kg (1654 lb). The boom arm with a UP50 robot weighs approximately 1050 kg (2315 lb). Make sure that your lifting device is capable of handling at least this much weight.

![WARNING!](image)
Make sure boom arm is securely supported by the lifting device before attempting to loosen the M16 bolts that secure the boom to the riser base.

3. Using a suitable wrench, remove the 12 M16 bolts that fasten the boom to the riser base. See Figure 22.

4. Using the overhead lifting device, move the boom to the desired new position. The boom can be repositioned in increments of 10 degrees around the base.

5. When the boom is in the desired position, replace the M16 bolts and torque them to 255 Nm (188 lbf-ft).

6. Remove the lifting slings from the MotoSweep O 20/50 SIGMA III transporter boom.
6.8 Repositioning the Manually-Adjustable Boom (Non-Servo)

Procedure –

1. Turn servo power OFF.

2. Using a suitable socket or box-end wrench, loosen and remove the four M16 bolts (two bolts on each side) that lock the boom to the hard stops (see Figure 23).

![Figure 23 Repositioning the Manually-Adjustable Boom]

3. Loosen the two stabilizing bolts (see Figure 23). The boom can now rotate ± 150 degrees for maintenance or tooling changes.

4. When you have completed maintenance or tooling changes, rotate the boom back to its HOME position.

5. Install and tighten the four M16 bolts removed in Step 2. Torque to 255 Nm (188 lbf-ft).

6. Tighten stabilizing bolts.

To move the manual boom to a permanent new position, follow steps 1 - 4 to loosen M16 bolts and stabilizing bolts. Rotate boom to new position.

7. When the boom is in the desired position, loosen and remove the eight M20 bolts that mount the two hard stops to the riser top plate (see Figure 23).

8. Move the two hard stops to the new position (180 degrees apart). Install the eight M20 bolts and torque to 370 Nm (273 lbf-ft).

9. Follow steps 5 and 6 above to secure the boom to the hard stops in the new position.
6.9 Troubleshooting

Table 8 identifies common problems associated with the MotoSweep O 20/50 SIGMA III transporter.

Be aware that sometimes more than one problem can occur at the same time. After identifying and resolving a problem, test the MotoSweep O 20/50 SIGMA III transporter to make sure that no other problems exist.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>No positioner movement</td>
<td>Loose connection</td>
<td>Check all wire connections.</td>
</tr>
<tr>
<td></td>
<td>Incorrect wiring</td>
<td>Check that system is wired correctly.</td>
</tr>
<tr>
<td></td>
<td>Overload</td>
<td>Reduce load and re-check. Repeat until problem stops.</td>
</tr>
<tr>
<td>Unstable operation</td>
<td>No brake operation</td>
<td>If positioner movement is unstable, check brakes and replace if necessary (refer to Section 6.5 and Section 6.6).</td>
</tr>
<tr>
<td></td>
<td>Loose mounting</td>
<td>Check torque of all mounting bolts. Tighten as needed.</td>
</tr>
<tr>
<td>Motor overheats</td>
<td>Excessive ambient temperature</td>
<td>Reduce ambient temperature below 45 °C (104 °F). The MotoSweep O 20/50 SIGMA III transporter has an operating temperature range of 0 to 45 °C (32 to 113 °F).</td>
</tr>
<tr>
<td></td>
<td>Motor surface is dirty</td>
<td>Clean motor surface.</td>
</tr>
<tr>
<td>Unusual or excessive</td>
<td>Motor is approaching end of its</td>
<td>Contact Motoman Customer Support (refer to Section 1.8)</td>
</tr>
<tr>
<td>noise</td>
<td>service life</td>
<td></td>
</tr>
<tr>
<td>Brakes</td>
<td></td>
<td>Inspect / replace the brake pads (refer to Section 6.5 and Section 6.6).</td>
</tr>
</tbody>
</table>
Appendix A
Foundation Requirements

A.1 Overview

CAUTION!
Make sure that you select the correct foundation plan and anchoring specifications for securing the specific MotoSweep O 20/50 SIGMA III Transporter riser. The transporter will generate substantial overhang (pull-out) and torsional (twist) floor loads, and requires special anchoring and foundation considerations.

CAUTION!
The customer is responsible for the stability of a MotoSweep O 20/50 SIGMA III Transporter that is installed on an existing floor. Section 4.2.2 gives installation recommendations for mounting the MotoSweep O 20/50 SIGMA III Transporter on an existing floor.

Three foundation plans exist for the MotoSweep O 20/50 SIGMA III Transporter, and are based upon specific MotoSweep O 20/50 SIGMA III Transporter / Riser configurations.

The three foundation plans, along with recommended anchoring specifications, are given in this section of the manual.

A.2 Configurations

A.2.1 Configuration 1 — Offset (C-Frame) Riser

Install riser such that the Overhead Radial Transport Beam (Boom) axis is centered on the foundation (see Figure A.1 and Figure A.2).
A.2.2 Configuration 2 — Straight Riser (P/N 151838–1 thru –6)

Riser bases in this configuration have a 1250 mm x 1250 mm footprint (refer to Section 3.8 and foundation information given in this Appendix).

The Riser bases should be centered on the foundation (refer to foundation information given in this Appendix, see Figure A.3).

A.2.3 Configuration 3 — Straight Riser (P/N 151838–7, –8)

Riser bases in this configuration have a 1500 mm x 1500 mm footprint (refer to Section 3.8 and foundation information given in this Appendix).

The Riser bases should be centered on the foundation (refer to foundation information given in this Appendix, see Figure A.4).
Figure A.2  Foundation Details — Configuration 1
Figure A.3 Foundation Details — Configuration 2
Figure A.4  Foundation Details — Configuration 3
Appendix B
Illustrated Parts List

B.1 Introduction

The Illustrated Parts List identifies, describes, and illustrates detail parts of the main assemblies for the MotoSweep O 20/50 SIGMA III transporter manufactured by Motoman.

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

B.1.1 Explanation of Parts List

Contents

The parts list contains a breakdown of the equipment into detail parts. All parts of the equipment are listed except the following:

1. Standard hardware items (attaching parts) such as nuts, screws, washers, etc., which are available commercially.
2. Bulk items such as wire, cable, sleeving, tubing, etc., which are also commercially available.
3. Permanently attached parts which lose their identity by being welded, soldered, riveted, etc., to other parts, or assemblies.

Parts List Form

This form is divided into four columns as follows:

1. “Item” Column
   This column lists the figure number of the illustration applicable to a particular parts list and also identifies each part in the list by an item number. These item numbers also appear on the illustration. Each item number on the illustration is connected to the part to which it pertains by a leader line and arrow. Thus, the figure and item numbering system ties the parts list to the illustrations and vice versa.

2. “Motoman Part Number” Column
   All part numbers appearing in this column are Motoman 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.

B.2 Parts List

B.2.2 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.

B.2.3 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
   REF – Reference
   V – voltage
Table B.1 Parts List — MotoSweep O 20/50 SIGMA III Transporter

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MOTOMAN P/N</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>152551-1</td>
<td>MOTOSWEEP O 20/50 SIGMA III TRANSPORTER</td>
<td>REF</td>
</tr>
<tr>
<td>1A</td>
<td>147609-1</td>
<td>ARM, POSITIONER, 2.0 M</td>
<td>1</td>
</tr>
<tr>
<td>-1B</td>
<td>150895-1</td>
<td>ARM, POSITIONER, 2.5 M</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>147938-1</td>
<td>COVER, ARM, SIDE</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>147308-1</td>
<td>COVER, ARM, UPPER</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>147939-1</td>
<td>COVER, ARM, END</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>148412-1</td>
<td>COVER, ARM LOWER</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>148413-1</td>
<td>COVER, ARM LOWER</td>
<td>1</td>
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<td>7</td>
<td>152550-1</td>
<td>DRIVE ASSY (see Figure B.2)</td>
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<tr>
<td>9A</td>
<td>151838-1</td>
<td>RISER, STRAIGHT</td>
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<td>-9B</td>
<td>147608-1</td>
<td>RISER, C-FRAME</td>
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<tr>
<td>10</td>
<td>148418-1</td>
<td>COVER, RISER, CABLE ENTRANCE</td>
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<td>11</td>
<td>148419-1</td>
<td>COVER, ARM, CABLE EXIT</td>
<td>1</td>
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<tr>
<td>12</td>
<td>147310-1</td>
<td>COVER RISER, ACCESS</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure B.1 Exploded View — MotoSweep O 20/50 SIGMA III Transporter
**Figure B.2** Exploded View — Drive Assembly

**Table B.2** Parts List — Drive Assembly

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MOTOMAN P/N</th>
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<th>QTY</th>
</tr>
</thead>
<tbody>
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<td>—</td>
<td>152550-1</td>
<td>DRIVE ASSEMBLY, TYPE II, SIGMA III</td>
<td>REF</td>
</tr>
<tr>
<td>1</td>
<td>147611-1</td>
<td>PLATE, ADAPTER, DRIVE ASSY</td>
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<tr>
<td>2</td>
<td>147610-1</td>
<td>PLATE, ARM ASSY, MOTOSWEEP, SERVOMOTOR</td>
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<td>3</td>
<td>146010-1</td>
<td>HOUSING, CAST, DRIVE ASSY</td>
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<td>152562-1</td>
<td>PLATE, MTG, DRIVE ASSY, TYPE II, SIGMA III</td>
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<tr>
<td>5</td>
<td>146022-1</td>
<td>POST, MTG, DRIVE GEAR, RV DRIVE ASSY</td>
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<td>6</td>
<td>146009-1</td>
<td>REDUCER, RV DRIVE ASSY</td>
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<tr>
<td>7</td>
<td>149993-1</td>
<td>BRAKE ASSY, FRICTION</td>
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<td>8</td>
<td>146743-1</td>
<td>GEAR ASSY, DRIVE ASSY</td>
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<td>9</td>
<td>140568-4</td>
<td>SEAL, OIL, 130 mm X 160 mm X 14 mm, VITON®</td>
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<td>146071-3</td>
<td>SEAL, O–RING, 380.59 mm X 353 mm</td>
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<td>146742-2</td>
<td>GEAR ASSY, COMPOUND, DRIVE ASSY, LOW SPEED</td>
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<td>12</td>
<td>146970-1</td>
<td>GEAR ASSY, IDLER, DRIVE ASSY</td>
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<tr>
<td>13</td>
<td>152861-1</td>
<td>MOTOR ASSY, TYPE II, SIGMA III</td>
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</table>
Figure B.3 Exploded View — Optional Zone Ring Assembly

Table B.3 Parts List — Optional Zone Ring Assembly

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MOTOMAN P/N</th>
<th>DESCRIPTION</th>
<th>QTY</th>
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</thead>
<tbody>
<tr>
<td>—</td>
<td>147680-2</td>
<td>ZONE RING ASSY</td>
<td>REF</td>
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<tr>
<td>1</td>
<td>152063-1</td>
<td>PLATE, LIMIT SWITCH, MTG</td>
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<td>2</td>
<td>152065-1</td>
<td>ACTUATOR, ZONE RING</td>
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<td>3</td>
<td>152064-1</td>
<td>BRACKET, LIMIT SWITCH</td>
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<td>4</td>
<td>143789-1</td>
<td>PLATE, MTG, SWITCH, THREADED</td>
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<td>5</td>
<td>143963-1</td>
<td>SWITCH, LIMIT, MINIATURE ROLLER ACTUATED</td>
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<tr>
<td>6</td>
<td>147937-1</td>
<td>PLATE, MTG, LIMIT SWITCH</td>
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</tr>
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</table>
### Table B.4 Parts List — Optional Hard Stop Assembly

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MOTOMAN P/N</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
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<tr>
<td>—</td>
<td>148235-1</td>
<td>HARD STOP ASSEMBLY</td>
<td>REF</td>
</tr>
<tr>
<td>1</td>
<td>143963-1</td>
<td>SWITCH, LIMIT, MINIATURE, ROLLER ACTUATED</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>148238-1</td>
<td>CLAMP, SHAFT, HARD STOP</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>148239-1</td>
<td>SHAFT, HARD STOP</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>148236-1</td>
<td>ACTUATOR, HARD STOP</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>130077-5</td>
<td>RING, RETAINING, EXTERNAL, 20 MM</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>148655-1</td>
<td>CORD ASSY, BUNGEE, MOTOSWEEP LIMIT STOP</td>
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<tr>
<td>7</td>
<td>148531-1</td>
<td>POST, TENSION SPRING</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>148240-1</td>
<td>BLOCK, MTG, HARD STOP</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>148882-1</td>
<td>BLOCK, STOP, HARD</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>148883-1</td>
<td>BUMPER, STOP, HARD</td>
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</tbody>
</table>

*Figure B.4 Exploded View — Optional Hard Stop Assembly*
Appendix C
Optional Equipment Installation

C.1 Remote Wire Feeder Kit

The optional Remote Wire Feeder Kit (P/N 149858-1) includes a feed motor designed to be collocated with a bulk wire container. The feed motor pushes the welding wire through a conduit to the welding wire feeder. The conduit is part of a Conduit Kit (P/N 149862-1). Refer to your system drawings for additional information.

Installation procedure –

1. Lag stand in desired location.
2. Position bulk wire drum and install hood.
3. Mount Assist Feeder and adjust stand so inlet of feeder sets on hood.
4. Connect air and adjust per Assist Feeder instructions.
5. Place a 180° tight bend in the wire end before feeding into the conduit. The smooth, rounded end will feed better than the sharp cut end.

Figure C.1 Remote Wire Feeder Kit
C.2 Conduit Kit

1. Install the spring female quick disconnect (QD) fitting, as follows –
   - Remove spring nut and slide onto blue conduit
   - Slide split ferrule onto conduit
   - Push female QD connector onto conduit until it bottoms out
   - Tighten spring nut on the female QD
2. Feed female QD and blue poly conduit through cable entrance at base of riser.
3. Continue to feed conduit up the riser, through the boom, and out the appropriate boom opening (lower for ceiling mount and upper for wall mount). Do not allow conduit to kink.
4. Install cable bracket using existing connector plate screws.
5. Position and clamp conduit just above spring as required on the support bracket.
6. Trim length as required by bulk wire placement.
7. Install male QD in the same manner as the female QD, and connect with Assist Feeder.
8. Install Miller feeder adapter.
9. Install high flex conduit QD connector per spring QD connections and connect high flex conduit to blue conduit.
10. Trim high flex conduit as required and remove internal burrs.
11. Route high flex conduit to wire feeder, and secure as appropriate for application.
12. Install high flex conduit QD connector per spring QD connectors.
13. Connect high flex conduit to wire feeder adapter.

C.3 Hard Stop

Installation procedure –

1. Jog the boom to the desired stop (end of travel) position.
2. Slide one hard stop bracket into the opening between the top of the riser and boom mounting plate.
3. Locate bracket at the stop position and position the bumper so that it faces the operating zone.
4. Secure the bracket to the top plate of the riser column with two (2) M20 head cap screws. Drop the screws through the access hole and jog the boom to facilitate access to tighten screws.
5. Torque screws to 100 N • m (73.7 lb. ft).

*Note: Repeat steps 1 through 5 above to install the second hard stop bracket.*

6. Insert the hard stop assembly through the access hole in the boom and position on the drive assembly mounting plate.

7. Install four (4) M12 screws with conical washers through the flange in the hard stop housing and torque to 100 N • m (73.7 lb. ft).

8. Install tension spring posts with hex nuts to the boom flange.

9. Attach the spring hook ends of the two elasticized (bungee) cord assemblies to the spring posts (see Figure C.4).
10. Slip the loop of the bungee cord over the shoulder bolt.

11. Connect the limit switch Turck cable (PL34) on the main MotoSweep harness assembly to the hard stop limit switch (see Figure C.5).

12. Reset the soft limits to appropriate values. Refer to the *NX100 Concurrent I/O Manual* that is included with your MotoSweep O 20/50 SIGMA III Transporter documentation package (refer to Section 1.7).

### C.4 Zone Ring

Installation procedure –

1. Install drive plate with the hardware supplied.
2. Install limit switch plate with the hardware supplied.
3. Install actuator ring with the hardware supplied.
4. Install switch bracket with the hardware supplied.
5. Mount limit switch per application print using the nut plates.
6. Adjust as required to get desired zones.
Figure C.5 Zone Ring — Component Locations

Figure C.6 Limit Switch — Component Locations
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