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

MOTOMAN INSTRUCTIONS

MOTOMAN LOADWORLD® INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR'S MANUAL
DX100 MAINTENANCE MANUAL

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

Part Number: 161138-1CD
Revision: 1
MANDATORY

- This user guide provides an overview of the Yaskawa LoadWorld® system. It gives general information about the system, a description of its major components, and the procedures for installation, system operation, and preventive and repair maintenance. Be sure to read and understand this manual thoroughly before installing and operating the LoadWorld® system.

- General items related to safety are listed in Section 2 of the DX100 Controller Manual. To ensure correct and safe operation, carefully read the DX100 Controller Manual before reading this manual.

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

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-1999). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

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

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

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

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

• Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure that all covers and shields are replaced before operating this product.

• The drawings and photos in this manual are representative examples, and differences may exist between them and the delivered product.

• YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such a modification is made, the manual number will also be revised.

• If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

• YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the Yaskawa LoadWorld® system.

In this manual, the Notes for Safe Operation are classified as "WARNING," "CAUTION," "MANDATORY," or "PROHIBITED."

- **WARNING**: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

- **CAUTION**: Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

- **MANDATORY**: Always be sure to follow explicitly the items listed under this heading.

- **PROHIBITED**: Must never be performed

Even items described as "CAUTION" may result in a serious accident in some situations. At any rate, be sure to follow these important items.

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

• Before operating the manipulator, check that servo power is turned OFF by pressing the EMERGENCY STOP buttons on the operator station or Programming Pendant (refer to Figure 1). When servo power is turned OFF, the SERVO ON LED on the Programming Pendant is turned OFF.

Injury or damage to machinery may result if the Emergency Stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the EMERGENCY STOP buttons do not function.

*Figure 1: EMERGENCY STOP Button*

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

Injury may result from unintentional or unexpected manipulator motion.

*Figure 2: Release of EMERGENCY STOP Button*

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

Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning on the power for the DX100 controller.
  – Moving the manipulator with the Programming Pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an EMERGENCY STOP button immediately if there is a problem. The EMERGENCY STOP buttons are located on the operator station and on the Programming Pendant.
Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product. The manipulator usually consists of the controller, the Programming Pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>
Explanation of Warning Labels

The following warning labels are attached to the LoadWorld® (refer to Figure 3).

Always follow the warnings on the labels.

Also, an identification label with important information is placed on the body of the LoadWorld®. Prior to operating the manipulator, confirm the contents.

Figure 3: Warning Labels Location

Nameplate:

WARNING Label A:

WARNING Label B:

Moving parts may cause injury

Do not enter robot work area.
Safeguarding Tips

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

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.

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

- The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.

- In accordance with ANSI/RIA R15.06-1999, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

Mechanical Safety Devices

The safe operation of this equipment is ultimately the 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 this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

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

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

- Inspect the equipment to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Check the E-Stop button on the operator station for proper operation before programming. The equipment must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- Any modifications to the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission of Yaskawa will VOID YOUR WARRANTY!
- Some operations require standard passwords and some require special passwords. Special passwords are for Yaskawa use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.
- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that you have not created hazards or dangerous situations.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
Fire Safety

All locations where combustible materials are used or stored have the risk of fire. Fire can cause extensive damage, injury, and loss of life.

It is the purchaser’s responsibility to provide a workspace for LoadWorld® that meets state and local occupancy classification requirements. This use classification may require certain design features such as automatic fire protection systems. The following are sample requirements:

- Locate fire extinguishers in the workspace.
- Provide access control. Limit access to authorized personnel only. Yaskawa recommends the placement of warning signs: “Authorized Personnel Only” where appropriate.
- Hazard communication: provide and properly indicate location of emergency exits per local codes.

Ignition sources must be controlled and eliminated where possible to reduce the risk of fire.

- Post hazard warning signs: “Danger, Combustible Dust May Be Present. No Smoking, No Sparks, No Open Flame.”
- All maintenance work that can produce heat or sparks must be done following standard hot work procedures.

Certain electrical circuits within this equipment are protected by fuses against over-current conditions. For continued protection against risk of fire, replace fuses only with the same type and rating specified.

Maintenance Safety

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

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

Summary of Warning Information

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

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

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1 Introduction

1.1 About This Document

This system manual provides a “first look” and overview of the complete Yaskawa LoadWorld® system. You should read and understand this manual before moving on to the more detailed documentation that is included with your LoadWorld® system. Although basic in content, this manual is intended for personnel who have received operator training from Yaskawa and who are familiar with the operation of this particular Yaskawa system. For more detailed information on any specific component or peripheral of the LoadWorld® system, please review the full documentation package that is included with your LoadWorld® system (refer to chapter 1.3).

This manual documents a standard Yaskawa system. If your system is custom or modified, please use this manual in conjunction with the drawings, schematics, and parts listing (Bill of Material) for your specific system. The drawings, schematics, and parts listing are included in the documentation package supplied with your Yaskawa system.

This system manual contains the following sections:

chapter 1 Introduction
This section provides general information about the LoadWorld® system, a list of reference documents, and customer support contact information.

Section 2 – Equipment Description
This section provides a description of the major components of the LoadWorld® system.

chapter 3 Installation
This section provides installation procedures for the LoadWorld® system.

chapter 4 Operation
This section provides an overview of LoadWorld® system operation, including start-up, loading, normal operations, fault recovery, and system shutdown.

chapter 5 Maintenance
This section provides preventive maintenance requirements for certain components of the LoadWorld® system.
1.2 System Overview

The LoadWorld® system provides a complete machine tending solution with multiple station configurations (see Figure 1-1). The LoadWorld® system is designed around the Yaskawa HP20D, MH6, or MH50 robot, DX100 controller assembly, and 4-drawer part stocker.

The LoadWorld® system features a total safety environment that meets or exceeds the requirements of the ANSI/RIA R15.06 Robot Safety standard and is designed to safeguard both personnel and equipment. Heavy gauge wire mesh safety fencing prevents unintended entry of personnel into the work cell while it is in operation. A dual-interlocked access door provides convenient access to the equipment, while providing a safety interlock to disable all equipment should the access door be opened while the robot is active. An optional safety light curtain system provides a "sensing field" in front of the drawers to protect the operator from drawer movement. In addition, maximum robot travel is physically limited by an S-axis "hard stop" at the base of the robot.

A differential pressure switch ensures that negative pressure is maintained during operation. A dual-interlocked access door at the front of the work cell provides convenient access to equipment while providing a safety interlock to disable all equipment should the access door be opened while the robot is active.

Figure 1-1: System Layout

Standard layout shown. Application specific variations to this layout are common.
1.2.1 System Layout

The LoadWorld® provides multiple configuration options for different machine requirements. Several robot options are available for different applications. HP20D, MH6, or MH50 robot cells are available. The robot manipulator is mounted at the center of the cell for easy access to machines and part stocker.

The HP20D manipulator (robot) and drawer assembly share a common base for ease of installation and assurance of proper alignment between the robot and the drawer assembly. The LoadWorld® unit has been designed to accommodate multiple machine layouts, making installation extremely flexible. The safety fencing can be modified to accommodate multiple layouts and machines.

1.2.2 Major Components

The standard LoadWorld® system includes the following major components:

- Motoman manipulator (HP20D, MH6, or MH50)
- One DX100 controller assembly
- One 4-drawer Part Stocker
- One Programming Pendant (located on DX100 controller)
- Safety equipment:
  - Heavy gauge, wire-mesh safety fencing
  - Interlocked work cell entry door
  - Application Specific Machine Interface
  - Two-jaw, back-to-back pneumatic gripper package

1.3 Reference Documentation

For additional information on individual components of the LoadWorld® system, refer to the following documentation that is included with your system:

- Motoman HP20D Manipulator Manual (P/N 156192-1CD)
- Motoman MH6 Manipulator Manual (P/N 156160-1CD)
- Motoman MH50 Manipulator Manual (P/N 156228-1CD)
- Motoman DX100 Controller Manual (P/N 155494-1CD)
- Motoman Maintenance Manual for DX100 (P/N 155492-1CD)
- Motoman Operator's Manual for General (P/N 155507-1CD)
- Motoman DX100 Concurrent I/O Manual (P/N 155491-1CD)
- Motoman Manual Brake Release Manual (P/N 156239-1CD)
- Motoman INFORM User's Manual (P/N 155493-1CD)
- Vendor manuals for system components not manufactured by Motoman
1.4 Customer Support Information

If you need assistance with any aspect of your LoadWorld® system, please contact Yaskawa Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

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

techsupport@motoman.com

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

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

Please have the following information ready before you call:

• System LoadWorld®
• Robots HP20D, MH6, or MH50
• Positioner 4-Drawer Part Stocker
• Primary Application Machine Tending
• Controller DX100
• Software Version Access this information on the Programming Pendant’s LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
• Robot Serial Number Located on the robot data plate
• Robot Sales Order Number Located on the DX100 controller data plate
## 2 Equipment Description

### 2.1 Robot Description

The LoadWorld® system is available with three different Motoman six-axis robot(s). These robots are specifically designed for machine-tending applications. The HP20D robot has a payload capability of 20 kg and features a horizontal reach of 1717 mm. The HP20D robot features a repeatability of ±0.06 mm. The MH6 robot has a payload capability of 6 kg and features a horizontal reach of 1,422 mm. The MH6 robot features a repeatability of ±0.08 mm. The MH50 robot has a payload capability of 50 kg and features a horizontal reach of 2,061 mm. The MH50 robot features a repeatability of ±0.07 mm.

The robots feature an internal cabling design that provides high flexibility and streamlines the robot profile, thus allowing access into confined spaces. The robot’s B-axis (Pitch/Yaw) features an expanded range of motion that improves circumferential cutting on cylindrical work pieces. The T-axis (Twist) can rotate the gripper ± 360 degrees without cable interference.

The robot’s S-axis rotation is physically limited by hard stops located in the base of each robot. For more information, refer to the HP20D, MH6, or MH50 Manipulator Manual that came with your LoadWorld® documentation package (see section 1.3).

### 2.2 DX100 Controller

The LoadWorld® system features a DX100 controller (see Figure 1-1 and Figure 2-1). In addition to controlling the movement of the robot, the DX100 controls the headstock and provides the signals necessary to operate the carving system.

The DX100 features an embedded real-time operating system (RTOS) and is programmed with the Motoman INFORM programming language. For more information on the DX100 controller, refer to DX100 Controller manual that came with your LoadWorld® system documentation package (see section 1.3).

*Figure 2-1: DX100 Controller*
2.2 DX100 Controller

2.2.1 Programming Pendant

The Programming Pendant (see Figure 2-2) provides the primary means of programmer/operator interaction with the LoadWorld® system. The pendant features the Windows® CE operating system and displays information on a 5.7-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 the robots. Most operator controls are located on the Programming Pendant. This allows remote installation of the DX100 controller. By using the Programming Pendant, the operator can teach the robots motion; perform programming, editing, maintenance, and diagnostic functions; and enable or disable Operator Station control of the LoadWorld® system. For detailed information on the pendant's programming keys, programming functions, and display functions, please refer to the DX100 Operator’s Manual for General that is included with your LoadWorld® system documentation package (see section 1.3).

Figure 2-2: DX100 Programming Pendant
2.3 4-Drawer Part Stocker

The 4-drawer part stocker provides storage for inbound part blanks that enables the cell to store a high volume of inbound materials inside a compact area that is easily accessible from outside the work cell. The four independent drawers each provide 150 lb storage capacity, in a 24 in x 24 in x 6 in tall cavity. Each drawer can be pulled out of the cabinet for access by the robot on one side (inside the cell), or the operator/parts stocker on the opposite side (outside the cell). This feature allows for replenishment or change-over of part blanks at any of the three drawers not currently being serviced by the robot. Change-over can be done without interrupting production, or “zero-time” changeover.

Easily removable nests provide quick changeover. Indicator lights, push button controls and an integrated latch allow drawer loading while robot is working. Custom drawer units are also available.

*Fig. 2-3: 4-Drawer Part Stocker*
2.3.1 Cycle Start In Cycle

The operation of the Cycle Start In Cycle button depends upon the structure of the Control Master job. The green Cycle Start In Cycle button, located on the right side of each Parts Stocker drawer, initiates a process cycle if the robot is in Home position. If the Cycle Start In Cycle button is pressed while the robot is outside Home position, the Cycle Start command does not execute until the robot returns to Home position. The green lamp illuminates when the Cycle Start In Cycle button is pressed during operation. When the lamp is illuminated, the robot begins to process the part immediately after the current process is complete. The robot returns to Home position. It is not necessary to wait for the robot to finish the current process and return to Home position before pressing the Cycle Start In Cycle button. Pressing the Cycle Start In Cycle button while the robot is still in motion latches the Cycle Start command into the controller. If a drawers latch is opened, the Cycle Start command will unlatch and the robot will not process the drawer.

2.3.2 Cycle Complete

The white Cycle Complete lamp illuminates when the process is complete.

2.4 Gripper Assembly

The two-jaw back-to-back gripper and pneumatics package provides a pre-engineered gripping solution for most parts. Varying size, gripper fingers are available for a variety of part applications.
2.5 Safety Features

The LoadWorld® system includes a total safety environment. If you comply with all the safety instructions and precautions given throughout this manual, the safety equipment helps to ensure safe operation of the robot work cell.

Users are responsible for determining that the safeguards provided with the LoadWorld® system are adequate for their installation conditions. Users must also ensure that all safeguards are maintained in working order.

2.5.1 Safety Fencing

The heavy-gauge steel mesh safety fencing provided with the LoadWorld® system is designed to enclose the entire robotic work cell. After installation, it forms a physical barrier that prevents the movement of personnel or objects into the work cell during automatic operation. An interlocked sliding door is part of the safety fencing, and provides an entrance for personnel into the work cell.
2.5.2 Emergency Stop (E-STOP)

Emergency Stop (E-STOP) is a primary safety feature of the LoadWorld® system. Both the work-cell access door interlock, and an E-STOP push button can trigger an E-STOP condition. An E-STOP condition immediately de-energizes the control system and activates the robot emergency braking system (refer to Figure 2.5.4). The E-STOP push button is used for an intentional shutdown of the LoadWorld® system and is installed at the following location:

- Programming Pendant

To resume operation after an E-STOP system shutdown, the operator must clear and reset the action that caused the E-STOP condition (refer to section 4.3.2).

2.5.3 Programming Pendant’s 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 2-2). When pressed in, this switch allows the operator to enable servo power. Should the operator release the switch or grasp it too tightly, however, servo power is immediately disabled, thus preventing further robot movement. For detailed information about the operation of the ENABLE switch, refer to the DX100 Operator’s Manual for General Purpose that is included with the LoadWorld® system documentation package (see section 1.3).

2.5.4 Emergency Braking System

The robot incorporates 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 the DX100 Manual Brake Release manual included with the LoadWorld® system documentation package (see section 1.3).

2.5.5 Interlocked Work-cell Access Door

The work-cell access door features a safety interlock (see Figure 1-1). Any attempt to open the access door while the robot is in PLAY mode triggers an E-STOP condition (refer to section 2.5.2).
3  Installation

3.1  System Requirements

Two to three qualified technicians can install the LoadWorld® system in a reasonable amount of time. Always comply with all the safety instructions and precautions given throughout this manual during the installation process.

The instructions given in this section are general guidelines for installing a standard LoadWorld® system. As appropriate, refer to your custom system drawings for clarification or alterations.

3.1 System Requirements

All system components and most hardware items required for installation of the LoadWorld® system are included with your shipment. There are, however, some required items that the customer must supply.

The environment in which LoadWorld® with filtration is installed should meet the following requirements:

3.1.1 Customer-Supplied Items

- CNC Workstations
- Local electrical service
- Earth ground wires for the robot and the DX100 controller
- Earth ground rods and/or buried copper sheeting (quantity and placement depth as required to achieve specified resistance-to-ground reading of 100 ohms or less)
- Chemical (optional) to increase conductivity of soil in the vicinity of the earth ground system
- Clean, dry air supply (for gripper assembly) –
  - Flow Rate - 0.425 m³/min (15 cfm)
  - Pressure - 620 kPa (gage) [90 psi (gage)]
- Forklift(s) and/or overhead crane
- Qty 6, M12 chemical anchors with minimum dynamic load rating of 3400 kgf, or equivalent.

CAUTION

- The LoadWorld® system should be installed by qualified personnel who are familiar with the installation and setup of a robotic system.
- Be sure to handle all system components with care. While the LoadWorld® system is not extremely fragile, it is a sophisticated robotic system that can be damaged by rough handling.
3.2 Site Preparation

The LoadWorld® unit must be installed on a flat surface capable of supporting 1500 kg (or approximately 3300 lbs). The surface must be level and stable. Allow an additional 1.2 - 1.5 m (4 to 5 ft.) on all sides of the system to provide clearance needed for installation and servicing.

*Fig. 3-1: General System Dimensions*
3.3 Unpacking the LoadWorld® Unit

System components are attached to wooden shipping skids and/or wooden blocks at the factory, prior to shipment to the customer. The customer is responsible for removing the shipping skids and/or blocks and inspecting the components for shipping damage.

NOTE

If you notice any equipment damage, notify your shipping contractor as soon as possible.

WARNING

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

Unpack the LoadWorld® system from the shipping container as follows:

1. Unbolt the LoadWorld® system from the shipping platform. The bolts that secure the bases to the wooden platform go down through the hollow leveling screws and are threaded into the wooden platform. It may be necessary to hold the leveling screws in place with a suitable open-end wrench while removing the shipping bolts. Discard or recycle the shipping skids and other shipping materials.

WARNING

- The LoadWorld® unit weighs approximately 1000 kg (2200 lbs). Ensure that your lifting device is rated to safely handle this load.

2. Using a forklift or overhead crane, lift the LoadWorld® unit from the shipping skid.
3.4 Installing the System Base

**WARNING**

- The controller and base unit weighs approximately 1400 kg (3100 lb). Use caution when moving the LoadWorld® unit on inclines to avoid damage to the equipment or injury to personnel.

The LoadWorld® unit should be firmly fixed to the floor or foundation rigid enough to support the unit. The surface of the floor should be level and even.

1. Carefully remove the protective plastic wrapping from the robot base.
2. Inspect the equipment for shipping damage. Using the integrated fork lift pockets in the base, move the LoadWorld® unit into position. Allow an additional 1.2 - 1.5m (4 to 5 ft) on all sides of the system to provide the clearance needed for installation and servicing.
3. Place the system base in position according to the layout drawings.
4. Loosen the four part stocker mounting screws to finger tight.
5. Using a 46 mm socket, loosen the 6, M30x60 anchor-stabilizer bolts so they do not contact the floor.
6. Using the center, 17 mm hole, as a guide, install the chemical anchors per manufacturer's instructions. Take care not to contaminate the stabilizer bolt threads with the anchor adhesive.
7. Allow the anchor adhesive to cure per manufacturer's instruction.
8. Starting with the four anchor points near the robot, drive the stabilizer bolts to the floor, then + 1/8 turn and tighten the anchors to specified torque. This would be best done going in a cross corner sequence.
9. Repeat this on the other 2 anchor points.

**WARNING**

- If damage is found, notify the shipper immediately.

**CAUTION**

Be absolutely certain of the correct location for the system before securing the base with anchor (lag) bolts.

**NOTE**

Due to variations in floor construction and preferences, this manual will not specify anchoring systems beyond what is provided in section 3.1.1.

3-4
3 Installation
3.4 Installing the System Base

10. After 30 days of system use, it is recommended the stabilizer bolt contact and anchor torques are checked.

**NOTE**
The stabilizer bolts are not intended to level the system base, only eliminate any rocking inherent when setting a steel fabrication on a concrete floor.

3.4.1 Leveling the Part Stocker

After the base as been properly anchored, the part stocker should be leveled and secured to the base as follows.

1. Confirm the four part stocker mounting screws are still finger tight.
2. Loosen the four leveling screws to finger tight.
3. Using only three of the four leveling screws, level the part stocker left to right. Continue to loosen mounting screws as required.
4. Using the same three screws, level the part stocker with a slight angle down towards the robot (1/8 -1/4 inch per foot).
5. Screw the fourth leveling screw to strike the system base +1/8 turn.
6. Tighten the four mounting screws to 44 Nm
7. Double check level and adjust as required.
3.5 Installing the Fence Panels

In its standard configuration, the majority of fence panels are shipped and remain mounted on the base. Only the two extensions and front panel of the part stocker need to be mounted on the floor.

Remove the fence panels from their shipping positions and install them per Fig. 3-2 with the system drawings and vendor documentation (included with the safety fence package).

Once the fence panels have been properly attached and located, anchor the fence posts to the concrete floor (refer to chapter 6).

If your system is a custom configuration, refer to the system prints for fence panel locations.

Fig. 3-2: Fencing Panels

3.6 Connecting the Cables

After the components are level and securely in place, unwrap the cables from around the equipment and lay them out according to the cable diagram included in the system drawing package. Each cable connection is clearly identified for ease of installation.

3.6.1 Connecting the Earth Ground

The robot and DX100 controller must each be connected to an earth ground. A ground stake should be driven a minimum of 2.43m into the earth, and the earth must be treated with chemicals in order to reduce resistance to the ground stake. Deeper ground stakes may be required depending on area soil conditions. A maximum of 100 ohms ground
3.6 Connecting the Cables

Resistance is recommended. To ground the robots and controller, proceed as follows:

**WARNING**

Do not use LoadWorld® robotic work cell without a good low-resistance earth ground. Use of the work cell without the correct earth ground can result in injury or death to personnel.

1. Connect one end of the robot earth ground cable to the lug marked **EARTH GROUND** on the bottom back of robot.
2. Connect the other end of the robot earth ground cable to the earth ground stake.
3. Connect one end of the second earth ground cable to the common ground bus bar inside the controller.
4. Connect the other end of the second earth ground cable to the earth ground stake.

### 3.6.2 Connecting the Robot Cables

Two cables, 1BC and 2BC, connect the robot to the controller. The 1BC cable provides position feedback from the robot to the controller, while the 2BC cable provides power to the robot’s servo motors. To connect the robot cables, proceed as follows:

**NOTE**

If the robot and DX100 controller are within 4.57m of each other, a common earth ground may be used. Otherwise separate earth grounds must be used.

1. Connect one end of the robot earth ground cable to the lug marked **EARTH GROUND** on the bottom back of robot.
2. Connect the other end of the robot earth ground cable to the earth ground stake.
3. Connect one end of the second earth ground cable to the common ground bus bar inside the controller.
4. Connect the other end of the second earth ground cable to the earth ground stake.
5. Unpack the Programming Pendant and plug its connector into the receptacle located on the access door on the front of the controller.
6. Unpack the two large black manipulator cables and route one to the controller and the other to the back of the robot.
7. Carefully engaging connectors, connect one end of each cable (labeled 1BC and 2BC) to the 1BC and 2BC connections on the back of the robot. Connect the other ends of the 1BC and 2BC cables to the 1BC and 2BC connections on the back of the controller.
3.7 Connecting the Power

A qualified, licensed electrician must make all power connections. Power and ground connections must comply with the National Electrical Code and/or local electrical codes.

After all the system components have been properly installed, refer to Table 3-1 and connect the primary power to the LoadWorld® system as follows:

1. Install three-phase power wiring to the fused disconnect (located near the inside left wall of the DX100 controller’s cabinet). Table 3-1 shows the size and type of wire needed.

2. Tighten screws to the torque indicated in Table 3-1.

3. Install an M5 lug on the incoming ground wire.

4. Terminate the ground wire to the frame ground stud with the hardware provided.

The LoadWorld® system is configured for three-phase 460/480V AC unless the customer requested a different configuration. If a different configuration is required for your plant, you must make the necessary modification the transformer. For more information, refer to the electrical diagrams that are included with the LoadWorld® documentation package (see section 1.3).

Table 3-1: Incoming Power Specifications (Decal)

<table>
<thead>
<tr>
<th>Lug Data</th>
<th>60/75° C wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog Number</td>
<td>TCAL14</td>
</tr>
<tr>
<td>Wire Size</td>
<td>#14-7 Copper</td>
</tr>
<tr>
<td></td>
<td>#12-8 Aluminum</td>
</tr>
<tr>
<td>Torque</td>
<td>14-7, 4.0 Nm (35 in-lb)</td>
</tr>
</tbody>
</table>
3.8 Conducting a Safety/Operation Check

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

1. Check that the work-cell access door is closed and latched.
2. Check that all cable connections are tight.
3. Verify that incoming line power matches the input power specified on the sticker on the front of the DX100 controller.

Your LoadWorld® is now ready for power-up. The system should be operated only by personnel who have received operator training from Motoman and who are familiar with the operation of this Motoman robot model. Turn the main power ON and continue the safety/operation check, as follows:

4. Check for correct operation of the E-STOP push buttons at the following locations:
   - Programming Pendant
5. Check for correct operation of the system HOLD button on the Programming Pendant. Refer to the Operator’s Manual for more information on the pendant’s HOLD button see section 1.3.
6. Check for correct operation of the work-cell access door interlock.

3.9 Installation of Tooling and Fixtures

Your LoadWorld® system is now ready for installation of stocker nests for your particular application. Personnel who are familiar with the operation of the LoadWorld® system should perform the installation.

NOTE

Yaskawa recommends application of a corrosion/rust preventive compound to tooling and fixtures located in a high-humidity environment.
This section provides a brief overview of the operating procedures and precautions for your LoadWorld® system. For more detailed operating information, refer to the specific component manuals that are part of the LoadWorld® system documentation package (see section 1.3).

The operator loads the part drawer with parts to be machined. The robot then processes the parts at the CNC workstations. When the machining process is complete, the robot returns the finished parts to the part drawer and returns to a Home (Safe) position allowing the operator to remove finished parts and load new parts to be processed.

4.1 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 (see section 1.3).

Any changes made to your system configuration and/or job structure will alter the operation of the system. Yaskawa recommends that you do not modify the original programs and system configuration of your LoadWorld® system. If you determine a need to modify the original programs and system configuration, make any modifications to a copy of the original. Keep the original as a backup. Do not modify the original. Modifications must be performed by trained and experienced personnel who are familiar with the operation of the LoadWorld® system. If you have questions concerning the configuration of your system, please (refer to section 1.4).

4.2 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 the start-up procedure (refer to section 4.2.1).
- Move the robot to HOME position (refer to section 4.2.2).
- Select the Control Master job (refer to section 4.2.3).
- Perform the operation cycle (refer to section 4.2.4).
- Perform the shutdown procedure (refer to section 4.2.5).
4.2 Daily Operation

4.2.1 Start-up Procedure
To start up the LoadWorld® work cell from a power-off condition, proceed as follows:

1. Set the main power switch on the DX100 controller to ON.
2. Make sure that the work-cell access door is closed and the safety plug connected.
3. Make sure that the E-STOP button on the Programming Pendant is released.
5. Place the robot in HOME (safe) position (refer to section 4.2.2).

4.2.2 Robot HOME Position
To move the robot to HOME position:

1. Select TEACH mode on the Programming Pendant.
2. Select {MAIN MENU} on the Programming Pendant’s touch screen.
3. Select {JOB} on the Programming Pendant’s touch screen.
4. Select SELECT JOB on the Programming Pendant’s touch screen (a job list appears on the screen).
5. Use the navigation cursor key to move the cursor to SAFE job and then 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 the Programming Pendant to jog the robot to HOME position.

4.2.3 Master Job
With the system powered up and in TEACH mode, call up the Master job:

1. Select {JOB} on the Programming Pendant’s touch screen.
2. Select {CTRL MASTER} on the Programming Pendant’s touch screen.
3. Press [SELECT] twice to activate the Master job.
4. Select [PLAY] mode on the Programming Pendant (job playback operation is enabled).
5. Press the [SERVO ON] button on the Programming Pendant.
6. Press the [START] button on the Programming Pendant (the Control Master job cycles, waiting for a Cycle Start input from the Part Stocker).
7. Transfer control to the Part Stocker by selecting REMOTE on the Programming Pendant’s Mode Select Switch.

The LoadWorld® work cell is now ready for operation.
4.2.4 Operation Cycle

The following is the typical sequence of operation for the LoadWorld® work cell after start-up:

1. Open the drawer latch.
2. The operator opens the drawer.
3. The operator loads the drawer with parts to be processed.
4. The operator closes the drawer.
5. Close the drawer latch.
6. The operator pushes the green cycle start button to initiate the cycle.
7. The cycle is now in progress.

**NOTE** If the operator opens the latch, the cycle immediately shuts down.

8. While the robot is working, load an additional drawer on the operator side with additional parts to be processed.
9. After the robot completes the process, it returns to HOME (safe) position and returns the processed parts to the parts drawer for unloading. The previously loaded parts to be processed are moved into the robot's work area.
10. Once the robot has processed all the parts in a given drawer, it will close the drawer, close the robot side latch, turn off the green light and turn on the white light.
11. Unload the processed parts from the parts drawer.

*Fig. 4-3: Operator Station*
4 Operation

4.3 System Recovery

4.2.5 Shutdown Procedure

Use the following procedure to perform a normal shutdown of the LoadWorld® system:

1. Make sure the robot is in HOME position.
2. Turn off the system servo power by pressing the E-STOP button on the Programming Pendant.
3. Select TEACH mode on the Programming Pendant.
4. Set the DX100 controller’s main power switch to the OFF position.

The LoadWorld® system is now shut down.

4.3 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 might encounter and how to remedy them when you do.

4.3.1 Alarms and Errors

There are three levels of alarms and errors that will stop the program:

- Error messages
- Minor alarms
- Major alarms

For more detailed information on alarm and error recovery, refer to the maintenance and DX100 controller documentation that is included with your LoadWorld® system (refer to section 1.3).

4.3.1.1 Error Messages

Error messages are usually the result of simple, easily cleared operation errors. One example of this type of error is pressing the START button when the robots are not in PLAY mode.

Clear errors of this type by pressing the CANCEL button on the Programming Pendant.

4.3.1.2 Minor Alarms

Minor alarms usually involve programming errors. Clear alarms of this type by pressing the CANCEL button on the Programming Pendant.

4.3.1.3 Major Alarms

Major alarms usually involve hardware failures. Examples of this type of error include an overload condition and abnormal speed.

Clear alarms of this type by cycling the DX100 controller in accordance with the following steps:

1. Rotate the DX100 controller’s power ON-OFF switch to OFF.
2. Allow the controller’s power ON-OFF switch to remain in the OFF position for approximately 10 seconds.
3. Rotate the controller’s power ON-OFF switch to ON.
4.3.2 E-STOP Recovery

An E-STOP (emergency stop) will occur under any of the following conditions:

- An E-STOP button is pushed in (activated).
- The work-cell access door is opened while the robot is not in TEACH mode.

After an E-STOP condition occurs, restart the LoadWorld® system as follows:

1. To clear the E-STOP condition, perform any of the following actions that apply:
   - Release the activated E-STOP push button
   - Close the work-cell access door

2. Press the SERVO ON button on the Programming Pendant.

3. Select REMOTE mode on the Programming Pendant's Mode Select Switch to transfer control of the system to the Part Stocker

4. Press the green START button on the Part Stocker.

The LoadWorld® system is now ready to continue operation.
5 Maintenance

Maintenance must be performed by authorized personnel who are familiar with the LoadWorld® system. Be sure to read and understand the documentation for a particular component before doing repair maintenance or preventive maintenance on that component. Be sure that you understand the maintenance procedures, have the proper tools at hand, and comply with all the safety instructions and precautions given throughout this manual.

The maintenance intervals given in Table 5-1 are recommendations only. Adjust the frequency and level of repair maintenance and preventive maintenance to suit your specific equipment schedules and shop environment.

For periodic maintenance procedures and schedules for the individual components of your LoadWorld® system, refer to the documentation that is included with your system documentation package (refer to section 1.3).

**CAUTION**

- Maintenance procedures inside the machine enclosure may only be performed after the machine has been cleaned.
- Do not use compressed air to clean the carver. This will send dust into the bearing seals and the surrounding atmosphere.
- Yaskawa recommends wearing a particle mask/respirator during cleaning for protection against fine dust particles.

**Table 5-1: Periodic Maintenance**

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>COMPONENT</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily (or on condition)</td>
<td>LoadWorld® Work Cell</td>
<td>Clean machine after each use.</td>
</tr>
<tr>
<td></td>
<td>All safeguard items – work-cell door interlocks, E-STOP push buttons, etc.</td>
<td>Check the physical condition of the safeguard item and ensure that it is working correctly.</td>
</tr>
<tr>
<td>One Month (or on condition)</td>
<td>LoadWorld® Work Cell</td>
<td>Remove accumulated dirt, grease, and debris from inside and outside the work cell.</td>
</tr>
</tbody>
</table>
A Appendix - Drawings

The following drawing are included in this manual:

• Cabinet Assembly, 4 Drawer Drawing
• Cell Assembly, HP20D, DX, DLC, 4Drawer Cabinet, Machine Drawing
• Controller Kit, LoadWorld®, DX100 Cable Entry Diagram
• Gripper/Valve Module Assembly DLC HP20D, BTB Drawing
• Gripper Kit, HP20D, DLC, BTB, 180 Degree Offset, 3 Jaw Shunk Drawing
• Module Pneumatic, HP200, 2 Stat., Upper Arm, BTB, Dual Gripper Drawing
NOTES:
1. ALL DIMENSIONS ARE REFERENCE ONLY.
2. BECAUSE MOTOMAN INC. IS CONSTANTLY IMPROVING PRODUCTS, MOTOMAN RESERVES THE RIGHT TO CHANGE DESIGN AND/OR SPECIFICATIONS WITHOUT NOTICE.
3. ITEMS TO BE INSTALLED AT CELL ASSEMBLY.
4. COAT THREADS WITH LOCTITE 242 PRIOR TO INSTALLATION.
5. TORQUE VALUES ARE TO BE PER MOTOMAN DRAFTING STANDARD SSGW-020, APPENDIX B, UNLESS OTHERWISE SPECIFIED.
6. LABEL AS SHOWN.
7. PERMANENT MARK WITH MOTOMAN PART NUMBER AND DRAWING REVISION PER MOTOMAN DESIGN STANDARD SSGW-077 PARA 2.3.

87 6 5 4 3 2 1

2. BECAUSE MOTOMAN INC. IS CONSTANTLY IMPROVING PRODUCTS, MOTOMAN RESERVES THE RIGHT TO CHANGE DESIGN AND/OR SPECIFICATIONS WITHOUT NOTICE.

ITEMS TO BE INSTALLED AT CELL ASSEMBLY.

COAT THREADS WITH LOCTITE 242 PRIOR TO INSTALLATION.

TORQUE VALUES ARE TO BE PER MOTOMAN DRAFTING STANDARD SSGW-020, APPENDIX B, UNLESS OTHERWISE SPECIFIED.

LABEL AS SHOWN.

PERMANENT MARK WITH MOTOMAN PART NUMBER AND DRAWING REVISION PER MOTOMAN DESIGN STANDARD SSGW-077 PARA 2.3.
NOTE: LIMIT SWITCH CABLES TO BE CONNECTED AT ASSEMBLY. SEE 159779-1 FOR CONNECTION DETAILS.
NOTE: CUT ITEM TO LENGTH AS SHOWN. INSURE ALL SHARP EDGES ARE REMOVED.

EXPLODED VIEW
1:2.5
DRAWER STOPS AND DETENTS

DETAILED D
1:1

SECTION A-A
1:2.5

A1

CABINET ASSY: DRAWER

159668-1

MAP 12/12/11
KAT 12/16/11

DO NOT SCALE DRAWING
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NOTE: DIAMOND PIN SHOULD BE INSTALLED PERPENDICULAR TO PIN ALIGNMENT TOOL.

EXPLODED VIEW
1:4

DRAWER AND GUARD INSTALL

MASS 263.7 kg

OPERATOR SIDE (OS)

DRAWER FACE

NOTE: DIAMOND PIN SHOULD BE INSTALLED PERPENDICULAR TO PIN ALIGNMENT TOOL.

SECTION F-F

DETAIL G 1:1

CASSETTE ASSY, 4 DRAWER

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GHS 12-13-11

KAT 12-16-11

EXPLODED VIEW 1:4

DRAWER AND GUARD INSTALL

TORQUE TO 5.5 N-M

PIN ALIGNMENT TOOL (T50919)

SECTION F-F

DETAIL G 1:1

CASSETTE ASSY, 4 DRAWER

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EXPLODED VIEW 1:4

DRAWER AND GUARD INSTALL

TORQUE TO 5.5 N-M

PIN ALIGNMENT TOOL (T50919)

NOTE: DIAMOND PIN SHOULD BE INSTALLED PERPENDICULAR TO PIN ALIGNMENT TOOL.
1. Install the top panel (Item 4) and eye bolts (Item 25) with appropriate hardware.
2. Install leveling bolts and jam nut (Item 30 & 65) into frame (Item 1), and level as needed.
3. Install each guide bearing assembly (Item 2), as follows:
   a. Unpack, inspect the guide, and insure smooth motion.
   b. Position the bearing guide in the frame weldment (Item 3), as shown, and insure it is properly resting on the location surface.
   c. Install a screw at each end using specified thread lock and torque.
   d. Confirm smooth motion of the bearing system.
4. Install the four strikers (Item 38) and proxes (Item 39), on the RS left leg, using specified thread lock and torque (per Detail C). OS and RS are indicated on Sheet 2 of drawing.
5. Install the twelve plain strikers (Item 37), on the other 3 legs, using specified thread lock and torque (per Detail B).
6. Install each drawer as follows:
   a. Remove the four screws (2 each guide) required to install the tie plate (Item 32).
   b. Chase the threads with a tap where these screws were removed and insure no debris is left on the guide rail.
   c. Install a spring (Item 61), and drag bumper (Item 62) in each bumper mount.
   d. Fully extend the bearing assembly to the RS.
   e. Place 2 angle nut plates (Item 54) in a drawer.
   f. Place the drawer on the tie strap assembly with the upper holes towards the OS. This would also have the deeper pull relief towards the RS.
   g. Install all accessible screws on each side. Use specified thread lock, but leave each screw about 1/4 turn loose.
   h. Fully extend the drawer assembly to the OS and repeat step i.
   i. Install round locating pins (Item 51), into each angle nut plate. Pins will be a slip fit in reamed hole of angle plate. (See Detail G of Sec F-F) USE PIN ALIGNMENT TOOL (TS919Y) TO PROPERLY ALIGN THE ANGLE NUT PLATES.
   j. Position the drawer assembly towards the center position, leaving just enough extend to access the outer most mounting screw. While pushing down on left OS drawer corner, tighten this screw to the specified torque.
   k. Reposition the drawer assembly so the outer most screw on the OS just accessible. While pushing down on right RS drawer corner, tighten this screw to the specified torque. Both tightened screws should be on the same drawer side.
   l. Tighten the remaining drawer screws on the RS side to the specified torque. Confirm smooth motion of the drawer system. Note the drag bumpers should be controlling the tie strap.
   m. Insure the drawer screws on the RS left side are still installed, but loose.
   n. Use a feeler gauge to measure the gap between the drawer side and the bearing guide.
   o. Drop in the appropriate shim (Item 58 & 59) to provide maximum 0.0-0.5mm gap per side. Insure Drawer slides smoothly after shim installation.
   p. Repeat the steps j thru m for the drawer screws on the RS left side.
   q. Remove pin alignment tool and replace the round pin in the front right corner on OS with a diamond pin, (Item 50). Orient diamond pin as shown in Detail G.
   r. Secure locating pins with washer and hex nut (Items 52 & 55).
7. Install the RS drawer stops and detents for each drawer as follows:
   a. Apply a small amount of Alvania grease (or equivalent) to left and right striker pins.
   b. Open the drawer to the full extent on OS.
   c. Assemble stop cushion, (Item 43), (jam nut to opposite side), ball plunger, (Item 46), stop screw bracket and stop screw, (Item 44 & 31), with the hard stop bracket (Item 45). Reference Detail E.
   d. Install hard stop bracket assembly in the right front corner (from OS) of the drawer using the specified thread lock. Insure the fingers tight only. This will be RS stop and detent.
   e. Assemble stop cushion, (Item 43), (jam nut to opposite side) and ball plunger, (Item 46), with the hard stop bracket, (Item 45).
   f. Install hard stop bracket assembly in the left front (from OS) corner of the drawer using the specified thread lock. Insure fingers tight only.
   g. Assurance the prox switch is not limiting drawer stroke.
   h. Open the drawer to RS and adjust each ball plunger to equally engage the respective detent striker and final tighten the bracket mounting screws, (Item 40) to specified torque.
   i. When properly adjusted BOTH PLUNGERS WILL COMPLETELY ENGAGE THE STRIKER SLOT AND THE PLUNGER BARREL SHOULD HAVE CLEARANCE TO THE STRIKER FACE.
   j. Adjust each stop cushion to provide 0.5 – 1.0mm clearance in the detented position.
   k. Close and open the drawer to insure proper functioning of the stop and detent.
   l. Move drawer to closed position and adjust detents to hold drawer in closed position. Some movement is acceptable in detented position.
   m. With the drawer open on RS, adjusted position, adjust the prox switch gap to 1.5mm +/- 0.5mm. (1-2 turns on the prox switch).
8. Install the OS drawer stops and closed position detents for each drawer as follows:
   a. Apply a small amount of Alvania grease (or equivalent) to left and right striker plates.
   b. Open the drawer to the full extent on OS.
   c. Assemble stop cushion, (Item 43), (jam nut to opposite side) with the hard stop bracket, (Item 48). Reference Detail D.
   d. Install both hard stop bracket assemblies in the front (from RS) corners of the drawer using the specified thread lock, tightenscrews and torque.
   e. Install Ball Plunger (Item 46) into Drawer with Jam Nut (Item 43) and Washer (Item 42) on inside of drawer, Use additional jam nut on outside of drawer.
   f. Move drawer to closed position and adjust detents to hold drawer in closed position. Some movement is acceptable in detented position.
   g. Open drawer completely on OS. It will be stopped by internal nail stops. Adjust each stop cushion to contact detent striker (hard stops). Turn Left and right side stop cushions an addition 2-3 turns. Left and right side should be adjusted equally. Close and open the drawer to insure proper functioning of the stop and detent.
   h. Test the action again to insure the stop position is repeatable and leaves a small stroke left on the bearing assembly. Re-verify RS at this time.
   i. Adjust as required.
8. Assemble the latch components, (Items 11, 12, & 13) and install each latch assembly as shown using specified thread lock and torque.
9. Confirm smooth drawer and latch motion, simulating robot action, operator action, and center lock position.
10. Install all the limit switches (Item 35) using specified thread lock and torque. Confirm proper latch action and switch detenting.
11. Install the FS shoulder screws, (Item 27), into the left side cover, (Item 9).
12. Install the green push button switches, (Item 17), and cycle start legend plates, (Item 18) into switch housing cover (Item 6).
13. Install the white push button switches, (Item 19), and cycle complete legend plates, (Item 20) into switch housing cover (Item 6).
14. Mount the BL 67 Gateway module assy, (Item 57).
15. Install switch housing cover (Item 6) and rear side cover (Item 10).
16. Complete wiring the switches with the gateway module including proper routing and strain relief.
17. Install the switch side frame cover cover, (Item 5).
18. Install shipping rod (Item 24) thru RS top cover, frame, drawer 1-4 and lower frame member. Secure with nylon washer and nut (Items 22 & 23).
19. Place labels (Item 21) as shown, 3 per drawer.
20. Label drawer as shown DRA WER 1 – DRA WER 4. 4.
21. Place label (Item 8) onto Front floor guard (Item 7).
22. Bag and tag Front floor guard and label (Item 7 & 8) and appropriate hardware and secure to cabinet assembly.
23. Cabinet is ready to install in cell.
NOTES:

1. ALL DIMENSIONS ARE REFERENCE ONLY.

2. GENERAL INSTALLATION SEQUENCE
   A. STABILIZE AND LAG AT LOCATIONS DEFINED ON SUGGESTED CELL MOUNTING PLAN.
   B. CONNECT POWER/CONTROL CABLES PER SHEETS 101 AND 102.
   C. REFER TO USER'S MANUAL FOR INSTALLATION DETAILS.

3. RESTRICT S-AXIS LIMIT OF ROBOT AS SHOWN IN VIEW E-E USING ROBOT BASE HARD STOP.

4. FOR CABLE LAYOUT, REFER TO 119731-1 SHEET 16.

5. CORROSION VALUES ARE TO BE USED FOR MOTOVISION DRAFTING STANDARD SSGW-020, APPENDIX B, UNLESS OTHERWISE SPECIFIED.

6. UNFINISHED STEEL SURFACES TO BE COATED WITH BEST PRACTICES PER MOTOVISION DESIGN STANDARD SSGW-020, PARA. 2.3.3.

7. INSTALL SHAPING W/O SUPPLIED DURING ASSEMBLY PRIOR TO SHAPING.

8. PERMANENT MARK WITH MOTOVISION PART NUMBER 119731-1 AND DRAWING REVISION PER MOTOVISION DESIGN STANDARD SSGW-020, PARA. 2.3.

9. UNFINISHED STEEL SURFACES TO BE COATED WITH RUST INHIBITOR PER MOTOVISION DESIGN STANDARD SSGW-077, PARA. 3.3.2.

10. INSTALL SHIPPING ROD SUPPLIED WITH CABINET ASSEMBLY PRIOR TO SHIPPING.

11. PERMANENT MARK WITH MOTOVISION PART NUMBER 119730-1 AND DRAWING REVISION PER MOTOVISION DESIGN STANDARD SSGW-077 PARA 2.3.

12. BECAUSE MOTOMAN INC IS CONSTANTLY IMPROVING PRODUCTS, MOTOMAN RESERVES THE RIGHT TO CHANGE DESIGN PRIOR TO SPECIFICATIONS WITHOUT NOTICE.

13. FOR CABLE LAYOUT, REFER TO 159731-1 SHEET 101.

14. TORQUE VALUES ARE TO BE PER MOTOVISION DRAFTING STANDARD SSGW-020, APPENDIX B, UNLESS OTHERWISE SPECIFIED.

15. UNFINISHED STEEL SURFACES TO BE COATED WITH RUST INHIBITOR PER MOTOVISION DESIGN STANDARD SSGW-077, PARA. 3.3.2.

16. INSTALL COMMON EQUIPMENT CENTER.

17. INSTALL SHIPPING ROD SUPPLIED WITH CABINET ASSEMBLY PRIOR TO SHIPPING.

18. PERMANENT MARK WITH MOTOVISION PART NUMBER 119730-1 AND DRAWING REVISION PER MOTOVISION DESIGN STANDARD SSGW-077 PARA 2.3.

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No E.C.N. DATE

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LABEL AS SHOWN

DETAIL B
1:2

DETAIL C
1:2

50

47/74

SHIPPING ROD TO BE INSTALLED PRIOR TO SHIPMENT

FRONT FLOOR GUARD INSTALLED AT CELL ASSEMBLY

480V 10A

MM P/N: 159787-1 (OPTIONAL) BLANK DRAWER TRAY

MM P/N: 159788-1 (OPTIONAL) RE-GRIP MOUNTING PLATE

1179

150 PSI MAX

SHOP AIR SUPPLY

480V 10A

5000

3434 MAX

ROBOT ENVELOPE

3577

1356

92

2926

2180

1:2

LABEL AS SHOWN

1000

274

122

10

20

19

16

14

5

20

19

26

21

27

24

21

26

VIEW A-A

MAP 12/20/11

KAT 01/06/12

GHS 12/20/11

MIAMISBURG, OHIO 45342 USA (937-847-6200)

YASKAWA MOTOMAN ROBOTICS

CONFIDENTIAL

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GD & T

r 0.5

a 0.5

g 0.5

v 3.2

DECIMAL

0 : 1.0
0.2 : 0.4
0.01 : 0.1
0.001 : 0.01

ANGLES : 90°

10

5

14

2

28

19

17

21

12

10

11

4

3

2

1

DRAWER 1

DRAWER 2

DRAWER 3

DRAWER 4

VIEW A-A

GHS
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**YASKAWA**

**MOTOMAN ROBOTICS**

**CONTROLLER MILLIWORKS, CEDCO**

**4 DRAWER CABINET, MACHINE CELL CONTENTS**

**159731-INDEX**
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KAT 12/16/11

Sheet 1 of 3

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