AutoSorter-III™
USER GUIDE
Automated Tube Processor

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

MOTOMAN INSTRUCTIONS
MOTOMAN XXXXXXX INSTRUCTIONS

Part Number: 154591-2CD
Revision: 2
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 Motoman 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.
Notes for Safe Operation

Read this manual carefully before operation, maintenance, or inspection of the Motoman AutoSorter-III™ 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.
General 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 laboratory 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 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 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 the handlers and other 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

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.
Chemical and Biological Safety

Normal operation of this equipment sometimes involves the use of reagents which are toxic, flammable, or biologically harmful. When using such reagents, observe the following precautions:

• Infectious samples must be handled according to good laboratory procedures and methods to prevent the spread of disease.

• Observe all cautionary information printed on the original solution containers prior to their use.

• All waste solutions must be disposed of according to your facility’s waste disposal procedures.

• Liquid transfers may generate aerosols. Take all necessary precautions when using biohazardous, pathologic, toxic, or radioactive materials.

• Objects dropped onto deck, accidental tool release, or other accidental collisions may result in splashing of liquids; therefore, take appropriate safety precautions, such as the use of safety glasses when working with potentially hazardous liquids.

• Use an appropriate containment environment when using hazardous materials.

• Observe the appropriate cautionary procedures as defined by your safety officer when using flammable solvents in or near a powered-up instrument.

Cleaning Safety

Contact your laboratory safety officer and refer to the guidelines in the section titled "Chemical and Biological Safety" before cleaning equipment that may have been exposed to hazardous solutions.

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 and in the AutoSorter-III™ Maintenance and Troubleshooting Guide. Maintenance other than specified in these manuals should be performed only by Motoman-trained, qualified personnel.

It is your responsibility to decontaminate components of the AutoSorter-III™ before requesting service by a Motoman Field Service Representative or returning parts to Motoman for repair. Motoman will NOT accept any items which have not been decontaminated where it is appropriate to do so. If any parts are returned, they must be enclosed in a sealed plastic bag stating that the contents are safe to handle and are not contaminated.

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 Motoman. Address any questions regarding the safe and proper operation of your equipment to Motoman Customer Support.
Notation for Menus and Buttons

Descriptions of the programming pendant, buttons, and displays are shown as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Menu</td>
<td>The menus displayed on screen are denoted with {.} e.g., {MAIN}.</td>
</tr>
<tr>
<td>Button</td>
<td>The buttons, check boxes, radio buttons displayed on screen are denoted with [ ].</td>
</tr>
<tr>
<td></td>
<td>e.g., [Close]; [Sync] check box; [Fast] radio button.</td>
</tr>
</tbody>
</table>

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means the following operations:

- To move the cursor to the object item and left-click on it with the mouse.
- To pick out the object item by the tab key and press the Enter key.

(In case of selecting a menu, use arrow keys instead of the tab key to pick out the object item, then press the Enter key.)

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.
Explanation of Warning Labels

The following warning labels are attached to the AutoSorter-III™ (refer to *Figure 1*).

Always follow the warnings on the labels.

Also, an identification label with important information is placed on the body of the AutoSorter-III™. Prior to operating the AutoSorter-III™, confirm the contents.

*Figure 1: Warning Labels Location*
AutoSorter-III™ Contents

1 Introduction ..................................................................................................................................... 1-1
  1.1 About This Document ........................................................................................................ 1-1
  1.2 System Overview............................................................................................................... 1-2
    1.2.1 System Layout...................................................................................................... 1-2
    1.2.2 Major Components ............................................................................................... 1-3
    1.2.3 System Configurations ......................................................................................... 1-3
  1.3 System Requirements ....................................................................................................... 1-4
  1.4 Technical Specifications .................................................................................................... 1-4
  1.5 Learning to Use AutoSorter-III™ ........................................................................................ 1-5
    1.5.1 Motoman Technical Education Center (MTEC).................................................... 1-5
  1.6 Reference Documentation................................................................................................. 1-6
  1.7 Customer Support Information........................................................................................... 1-6

2 Equipment Description.................................................................................................................... 2-1
  2.1 Specimen Handlers ........................................................................................................... 2-1
    2.1.1 Grippers................................................................................................................ 2-1
    2.1.2 Bar Code Readers................................................................................................ 2-1
  2.2 Motion Control Unit............................................................................................................ 2-2
  2.3 Operator Control Station.................................................................................................... 2-2
    2.3.1 PC......................................................................................................................... 2-2
    2.3.2 Servo ON.............................................................................................................. 2-2
    2.3.3 Emergency Stop (E-Stop)..................................................................................... 2-2
    2.3.4 Process Stop ........................................................................................................ 2-2
    2.3.5 Process Resume .................................................................................................. 2-2
  2.4 Sort Deck........................................................................................................................... 2-3
    2.4.1 Input Drawers ....................................................................................................... 2-3
    2.4.2 STAT/REJECT Drawer ......................................................................................... 2-3
    2.4.3 Output Drawers .................................................................................................... 2-3
  2.5 Handheld Bar Code Reader .............................................................................................. 2-4
  2.6 Centrifuge .......................................................................................................................... 2-4
    2.6.1 Centrifuge Rack.................................................................................................... 2-5
  2.7 Decapping Station ............................................................................................................. 2-5
    2.7.1 HEPA Filtering System ......................................................................................... 2-5
    2.7.2 Decap Hazardous Waste Bin ............................................................................... 2-6
2.8 Safety Features

2.8.1 Service Hood

2.8.2 Emergency Stop (E-Stop)

2.8.3 Light Beacon Assembly

3 Operation

3.1 AutoSorter-III™ Software

3.1.1 Main Tab

3.1.2 Work Cell Tab

3.1.2.1 Misc. Controls

3.1.2.2 Gripper Control/Status

3.1.2.3 Centrifuge Manual Control

3.1.3 Maintenance Tab

3.1.3.1 Homing

3.1.3.2 Servo Control/Status

3.1.3.3 Gripper Control/Status

3.1.3.4 Decapper

3.1.3.5 Axis Jog

3.1.3.6 Scale Analog Value

3.1.3.7 Centrifuge Bucket Sensors

3.1.3.8 Gripper Collision

3.1.3.9 Safety Circuit

3.1.3.10 Operator Control

3.1.3.11 Waste Bin

3.1.3.12 Motion ALARM

3.1.3.13 Gripper Encoders

3.2 System Configuration

3.3 Daily Operation

3.4 Perform Operation Cycle

4 Maintenance and Troubleshooting

4.1 Emptying the Biohazard Waste Bin

4.2 System Recovery

4.2.1 Controller Alarms

4.2.2 Hardware Alarms and Errors
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.2.1 E-Stop Condition</td>
<td>4-2</td>
</tr>
<tr>
<td>4.2.3 Recovery from a Crash</td>
<td>4-2</td>
</tr>
<tr>
<td>4.2.4 Software Alarms and Errors</td>
<td>4-4</td>
</tr>
</tbody>
</table>
1 Introduction

The Motoman AutoSorter-III™ is a fully integrated pre- and post-analytical sample-processing system providing hands-free sample handling, processing and preparation. The unit increases productivity and efficiency in your sample processing tasks by automating labor-intensive tasks such as sample identification, decapping, centrifuging, and out sorting.

Sample tubes can be sorted, decapped, centrifuged, oriented and archived with absolutely no intervention from lab personnel necessary. The customizable architecture enables AutoSorter-III™ to accommodate any personality rack. A bar code scanner eliminates any need to manually pre-sort samples. With an easy-to-use graphic user interface and Windows® based operating system, operators merely load and unload samples and move on to other vital functions with less exposure to biohazards and repetitive motion injuries.

Features include:

• Random Sample Loading – eliminates need to sort and orient tubes by specimen type.
• Receipt/Check-In – system scans the bar coded label on specimen tube for positive identification.
• Records of processed tubes are sent to the facility’s Laboratory Information System (LIS) network.
• Hands-Free Decapping – for safer, more efficient handling and preparation of a wide variety of tube caps.
• Automated Centrifuging – sort and place specimen tubes in centrifuge trays for centrifuging by integrated Hettich centrifuge unit.
• Sorting – sorts sample tubes to customer specified analyzer rack and orients bar codes in proper position for analysis.

1.1 About This Document

This manual is intended as an introduction and overview for personnel who are familiar with the operation of their laboratory and Microsoft® Windows®/PC usage. For more detailed information, refer to the manuals listed in Section 1.4.

This User’s Guide provides an overview of the Motoman AutoSorter-III™ system. For detailed information on specific system components listed in this document, please refer to the documentation package included with your AutoSorter-III™ system (refer to Section 1.4).

This system manual contains the following sections:

Section 1 – Introduction

This chapter introduces the AutoSorter-III™ User’s Manual, provides an overview of the AutoSorter-III™ system, lists reference documents that are included with the documentation package, and provides Motoman Customer Support contact information.

Section 2 – Equipment Description

This section provides a more detailed description of AutoSorter-III™ systems and subsystems than that provided in Section 1 of this document.
Section 3 – Operation

This section provides basic operating procedures for the AutoSorter-III™ Automated Specimen Processor. This section also provides procedures for start-up, loading, normal operation, fault recovery, and shutdown.

Section 4 – Maintenance and Troubleshooting

This section provides a listing of preventive maintenance requirements for certain components of the AutoSorter-III™ system.

1.2 System Overview

The AutoSorter-III™ Automated Specimen Processor is a fully integrated specimen processor. Integrated casters provide easy locating and integral weldments on the AutoSorter-III™ frame accept anchoring hardware to secure the unit at a desired location.

Fig. 1-1: AutoSorter-III - Typical Configuration

1.2.1 System Layout

The AutoSorter-III™ has been designed to accommodate standard building access points such as elevators, hallways, and doorways, making installation extremely flexible (some disassembly may be required to for 36 inch wide access points). The AutoSorter-III™ sort deck and handlers are isolated from unauthorized access by a protective cabinet and hood assembly (see Figure 1). The cabinet and hood assembly also protects the sort deck from dust and other contaminants.
Hospital/lab technologist(s) interaction with the AutoSorter-III™ typically involves the following tasks –

- Lab personnel use the touch screen HMI to initialize and setup AutoSorter-III™ operation.
- Lab personnel load and unload specimen trays.

While the AutoSorter-III™ completes its programmed tasks, hospital/lab personnel are free to move on to other duties, such as manual assays, that require their specialized laboratory skills. Human intervention is typically not required during completion of the AutoSorter-III™ programmed tasks other than loading input racks when available and unloading output racks when full.

1.2.2 Major Components

The AutoSorter-III™ system includes the following major components:

- Two Specimen Handlers
- System Controller
- PC based operator station with touchscreen
- Integrated cabinet with protective hood
- Bar code readers
- Centrifuge
- Specimen decapper
- Specimen grippers
- Input Drawers
- Output Drawers
- STAT/REJECT drawer
- Safety equipment:
  - Protective system enclosure and interlock
  - Safety light beacon
  - Emergency Stop button (E-Stop)
  - Computer Back-up Power

1.2.3 System Configurations

The following system configurations are available for the AutoSorter-III™:

- Sort, Decap, Centrifuge (SDC) (P/N 155479-1)
- Sort, Decap (SD) (P/N 155480-1)
1.3 System Requirements

Table 1-1: System Requirements

<table>
<thead>
<tr>
<th>Electrical Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Consumption</td>
</tr>
<tr>
<td>Current</td>
</tr>
<tr>
<td>Circuit</td>
</tr>
<tr>
<td>Voltage</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Ground Requirements</td>
</tr>
<tr>
<td>Conformity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
</tr>
<tr>
<td>Ambient Humidity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
</tr>
<tr>
<td>Depth</td>
</tr>
<tr>
<td>Height (Door Closed)</td>
</tr>
<tr>
<td>Height (Door Open)</td>
</tr>
<tr>
<td>Approximate Weight, SD</td>
</tr>
<tr>
<td>Approx. Shipping Weight, SD</td>
</tr>
<tr>
<td>Approximate Weight, SDC</td>
</tr>
<tr>
<td>Approx. Shipping Weight, SDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Space Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Space</td>
</tr>
</tbody>
</table>

1.4 Technical Specifications

Table 1-2: Technical Specifications

<table>
<thead>
<tr>
<th>General Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorting Throughput</td>
</tr>
<tr>
<td>Sample Tube Types Processed</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Sample Identification</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Sample Bar Code Orientation</td>
</tr>
</tbody>
</table>
1.5 Learning to Use AutoSorter-III™

Motoman provides a variety of options to help you to learn to use your AutoSorter-III™ automated tube processor, including training and technical support. Additional resources, including technical support information, can be found at the Motoman website (www.motoman.com).

1.5.1 Motoman Technical Education Center (MTEC)

The Motoman Technical Education Center offers over 56 different courses including Basic Programming, Advanced Programming, Maintenance, Concurrent I/O, Purchasable Options, and Customized Training. Web-based or Computer-based training is also available for selected topics.

Motoman training courses provide classroom instruction combined with hands-on training (normally 2-student-per-robot ratio). Class size is limited to provide a more effective and enhanced learning environment.

With three U.S. facilities and more than 60 training robots, Motoman offers the most complete training package in the industry. Since MTEC is an authorized provider for the International Association for Continuing Education and Training (IACET), each student who receives at least 70% on the final exam will receive Continuing Education Units (CEUs). These CEUs are transferable college credits, which are awarded based on contact hours of the course. The Motoman Technical Education Center is the first robotic training facility with IACET accreditation and is also approved for training of veterans.

### Table 1-2: Technical Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Input</strong></td>
<td>2 input drawers - 150 tubes each, 1 STAT drawer - two trays, 30 tubes each up to 17 mm in diameter</td>
</tr>
<tr>
<td><strong>Output Area</strong></td>
<td>5 output sorting drawers capable of holding up to 750 samples depending on configuration of user defined trays</td>
</tr>
<tr>
<td><strong>“Error” Sorting</strong></td>
<td>User defined: can sort out “exception tubes” due to no bar code read, no test order download, etc.</td>
</tr>
<tr>
<td><strong>Automated Archive Preparation</strong></td>
<td>Transfers tube to any sorting location; records and transfers an archive rack number and location (XY) information</td>
</tr>
<tr>
<td><strong>Decapping</strong></td>
<td>BD Vacutainer™ and Hemoguard™, Sarstedt Monovette™ and screw top closures</td>
</tr>
<tr>
<td><strong>Automated Decapping</strong></td>
<td>User defined: Selective on a tube-by-tube basis</td>
</tr>
<tr>
<td><strong>Data Processor</strong></td>
<td>Windows® XP icon driven user interface</td>
</tr>
<tr>
<td><strong>Graphic User Interface</strong></td>
<td>Windows® XP-based software, Oracle Database, Graphic User Interface</td>
</tr>
<tr>
<td><strong>Program Storage</strong></td>
<td>&gt; 20 GB (hard drive); CD-ROM drive</td>
</tr>
<tr>
<td><strong>Database</strong></td>
<td>Data containing sample ID with XY plot in tray transferred to LIS</td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td>Windows® XP-based software, Oracle Database, Graphic User Interface</td>
</tr>
</tbody>
</table>
Motoman offers training at our headquarters in West Carrollton, Ohio and at our remote facilities in Irvine, California; Wixom, Michigan; Mississauga, Canada; and Aguascalientes, Mexico. Motoman also performs On-Site training at customer sites if required but recommends training at Motoman as the environment is more conducive to effective learning.

For more information, visit our website (http://www.motoman.com/support/training/training.htm).

1.6 **Reference Documentation**

For additional information on individual components of the AutoSorter-III™ system, refer to the following documentation that is included with your delivered system:

- Hettich Operator’s Manual for Rotanta 46 RSC Robotic Centrifuge (P/N AB4817N)
- Vendor manuals for system components not manufactured by Motoman

1.7 **Customer Support Information**

If you need technical assistance with any aspect of your AutoSorter-III™ system, please contact Motoman Customer Support at the following 24-hour support telephone number:

**(937) 847-3200**

Please have the following information ready before you call:

- **System** AutoSorter-III™
- **Software Version** Located on the main log
- **Serial Number** Located inside the controller cabinet door
- **Sales Order Number** Located inside the controller cabinet door

It is the user’s responsibility to decontaminate components of AutoSorter – III™ before requesting service by a Motoman Field Service Representative or returning parts to Motoman for repair.

Motoman will NOT accept any items which have not been decontaminated where it is appropriate to do so. If any parts are returned, they must be enclosed in a sealed plastic bag stating that the contents are safe to handle and are not contaminated.
2 Equipment Description

2.1 Specimen Handlers

The typical AutoSorter-III™ uses two specimen handlers specifically designed for specimen handling applications. The specimen handlers operate cooperatively within four degrees of freedom (DOF) X, Y, Z, and theta, moving specimens between input drawers, centrifuge, decapper, and output drawers.

2.1.1 Grippers

Each specimen handler uses a four-fingered gripper designed to accommodate varying test tube diameters (10-16 mm diameter) and centrifuge buckets. Specimen tubes are grasped by closing the fingers and holding with a specified closing force. The force is determined by monitoring the motor current. Tube diameter is determined by monitoring the finger stroke.

Figure 2-2: Grippers

2.1.2 Bar Code Readers

Each specimen handler has an integrated bar code reader. The handler picks up a specimen from the input rack and rotates it to permit reading of the bar code. The system scans the bar coded label on each specimen tube for positive identification. The specimen ID (SID) is compared to a local database (which is periodically updated from the Laboratory Information System (LIS)) for processing instructions. Records of processed specimens are sent to the facility’s LIS network.
2.2 Motion Control Unit

The motion control unit (see Figure 2-2) features the Yaskawa MP2300 compact machine controller. The MP2300 machine controller easily handles multiple tasks and can process large-capacity programs at high speeds, and carry out complete synchronous control of multiple axes. Communication between the PC and controller unit is accomplished using Modbus/TCP protocol over built-in Ethernet.

2.3 Operator Control Station

The operator control station is the main control for the AutoSorter – III™ unit as well as the interface to the AutoSorter – III™ software.

2.3.1 PC

The AutoSorter-III™ computer is used to run the AutoSorter-III™ software as well as additional diagnostic and troubleshooting programs. The PC links the local Specimen ID (SID) database with the Laboratory Information System (LIS) for processing instructions.

2.3.2 Servo ON

The green SERVO ON push button places the system in ready mode allowing the controller to begin the sorting process.

2.3.3 Emergency Stop (E-Stop)

Pressing the E-Stop push button stops all system motion, and the door interlock is released.

2.3.4 Process Stop

Pressing the black PROCESS STOP button pauses equipment operation and interrupts the job until the operator presses the green PROCESS RESUME button to resume operation. Servo motor power remains ON. Operation resumes at the point in the program where the PROCESS STOP state was initiated. System power remains on. The PROCESS STOP button performs the same function as the PAUSE button located on the AutoSorter-III™ software screen.

2.3.5 Process Resume

The green PROCESS RESUME button is used to clear the PROCESS STOP state and resume operation. The Process Stop and Process Resume buttons are typically used to briefly interrupt operation. The PROCESS RESUME button performs the same function as the RESUME button located on the AutoSorter-III™ software screen.
2.4 Sort Deck

---

**WARNING**

Moving parts may cause injury. Do not reach through drawers. E-stop the machine and follow the procedures in the manual for entering the sort deck area.

---

The AutoSorter-III™ sort deck holds the specimen trays, racks, centrifuge buckets and specimen tubes during processing. Stainless steel construction enables ease of cleaning and decontamination. Input and output drawers are configurable to permit use of most popular instrument racks, including Siemens, Olympus, Hitachi/Roche, Sysmex and Motoman.

2.4.1 Input Drawers

The typical AutoSorter-III™ unit has two input drawers capable of holding a variety of different specimen racks. These drawers can be configured to hold new unsorted tubes, reject tubes or any combination required. Each specimen rack is uniquely identified using bar code labels located on the side of the rack. The specimen racks have a molded plastic insert designed to hold the sample upright for automated handling. Control buttons located at the front of each drawer allow for loading of racks with specimens, and removal of empty racks.

2.4.2 STAT/REJECT Drawer

The STAT/REJECT drawer is typically used for servicing high priority samples and storing rejected samples. The STAT/REJECT drawer has two trays capable of holding racks of 30 specimen tubes each. Typically, one rack holds STAT samples while the other rack holds rejected samples. However, this can be modified during setup. Each rack has a molded plastic insert designed to hold the sample upright for automated handling.

2.4.3 Output Drawers

The typical AutoSorter-III™ unit has five user-defined output drawers designed to accommodate a variety of instrument specific racks of varying configurations. Output racks are arranged in drawers, permitting the use of generic and/or instrument-specific racks as targets. Each rack is uniquely identified using bar code labels located on the side of the rack. Racksites are also identified using bar code labels on the bottom of the output drawer. The output racks may be changed as necessary to facilitate specimen mix, conversion to use of a new instrument, etc. The output drawer may be accessed at any time to allow a rack of specimens to be removed. Control buttons located at the front of each drawer allow for loading of new racks, and removal of filled racks.
2.5 Handheld Bar Code Reader

AutoSorter-III™ uses a handheld bar code reader that can be used to scan each new drawer as it is loaded. Each tray loaded into the system must have its own bar code label. When the tray is loaded, the operator scans the tray bar code with the handheld bar code reader. This data is then loaded into the local database. Drawers can be configured to not require scanning.

2.6 Centrifuge

AutoSorter-III™ uses the Hettich Rotanta 46 RSC Robotic Centrifuge. The Hettich Rotanta 46 RSC Robotic Centrifuge is a refrigerated centrifuge with PC control and rotor positioning with a wide range of user programmable features such as, speed, rcf, time, and ramp up/down time. The centrifuge reaches a speed of 6,200 minimum, or a maximum of 6,446 RCF with a capacity of 72 specimens. The centrifuge is mounted to a dockable centrifuge cart for ease of service and maintenance. Refer to the Hettich Operator's Manual for Rotanta 46 RSC Robotic Centrifuge (P/N AB4817N), for detailed information.

Figure 2-4: Centrifuge

Specimens requiring centrifugation are first loaded to one of the available centrifuge racks. The racks are weighed, and loaded to maintain balance within the allowable range of the centrifuge. The centrifuge racks are loaded until the centrifuge completes its cycle, at which time the centrifuge is unloaded, and reloaded with racks of specimens awaiting centrifugation. Once the centrifuge has completed its cycle, the racks of centrifuged tubes are unloaded, and each specimen is transferred to decapping, or directly to its sort target if decapping is not required.
2.6.1 Centrifuge Rack

The centrifuge racks are used to load and unload sample tubes in and out of the centrifuge. Each bucket can hold 18 sample tubes.

Figure 2-5: Sample Centrifuge Rack

2.7 Decapping Station

The decapping station uses a servo controlled, three position index plate, and servo-controlled decapping head to remove specimen caps. The decapping station can remove both stopper and screw type caps. The handler places a specimen tube into the index plate input position. The index plate rotates, placing the specimen tube under the decapping head where the cap is removed. The index plate then rotates, placing the specimen to the output position to be picked up by the handler. Removed caps are dropped through a chute to the hazardous waste bin located beneath the sort deck. Specimen cross contamination is minimized by isolating the decapping head and managing air flow using a HEPA filtration system.

Figure 2-6: Decapping Station

2.7.1 HEPA Filtering System

A HEPA filtering system is attached to the decapping unit to minimize cross contamination and exposure to biohazards during the decapping process. HEPA filters are critical in the prevention of the spread of airborne bacterial and viral organisms and, therefore, infection.
2.7.2 Decap Hazardous Waste Bin

Removed caps are collected in a hazardous waste bin located beneath the sort deck. Access to the waste bin is achieved through the front door, located beneath the operator station. The waste bin is mounted on a sliding drawer for easy access through the left front door. Sensors on the waste bin indicate when the bin is full as well as if the bin has been removed.

2.8 Safety Features

The AutoSorter-III™ system includes a total safety environment. When all standard safety precautions are observed, the safety equipment helps to ensure safe operation of the work cell. The ANSI/RIA R15.06-1999 Robot Safety Standard stipulates that the user is responsible for safeguarding.

**NOTE**

Users are responsible for determining whether the provided safeguards are adequate for laboratory conditions. Users must also ensure that safeguards are maintained in working order.

2.8.1 Service Hood

**WARNING**

Never operate the AutoSorter-III™ with the service hood open.

The service hood provides protection from motion hazards. The service hood automatically locks when servo power is ON. The system will not operate unless the door is closed and locked.

2.8.2 Emergency Stop (E-Stop)

In addition to the safety features described above, the AutoSorter-III™ has a strategically placed E-Stop push button. This is an operator-actuated device that immediately stops all system motion when activated. A software dialog appears and the red light on the light beacon lights indicating an E-stop condition. The service hood is automatically unlocked once the system is stopped.

To resume operation after an E-Stop, proceed as follows:

1. Reset the activated E-Stop button (1/4-turn clockwise turn). The light beacon changes to green.
2. Close the protective hood and ensure that it is properly latched.
3. Press the Servo On button.
4. Restart the sort process by pressing the [Start] button on the touchscreen.
2.8.3 Light Beacon Assembly

The AutoSorter-III™ Automated Specimen Processor features an advisory light beacon assembly. The light beacon assembly is mounted on top of the AutoSorter-III™ cabinet and is visible from a considerable line-of-sight distance.

The light beacon assembly consists of a red lamp, an amber lamp, and a green lamp. Illumination of these lamps provides laboratory personnel with a visual indication of both normal and abnormal AutoSorter-III™ operational status. In addition to the visual indicators, the light beacon assembly also includes an audible alarm that sounds during certain faults and errors.

<table>
<thead>
<tr>
<th>LAMP</th>
<th>STATUS</th>
<th>INDICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>STEADY ON</td>
<td>SYSTEM SHUTDOWN BY SAFETY E-STOP TRIGGER</td>
</tr>
<tr>
<td>AMBER</td>
<td>NOT USED</td>
<td>NOT USED</td>
</tr>
<tr>
<td>GREEN</td>
<td>STEADY ON</td>
<td>PROCESS RUNNING</td>
</tr>
<tr>
<td></td>
<td>FLASHING</td>
<td>SYSTEM REQUIRES OPERATOR ATTENTION</td>
</tr>
</tbody>
</table>
3 Operation

The Motoman AutoSorter-III™ is a fully integrated pre- and post-analytical sample-processing system providing hands-free sample handling, processing and preparation. Two specimen handlers sort specimen tubes from the operator loaded input drawers to personality racks for various analytical equipment. Centrifuging and decapping processes are performed as specified for each individual specimen.

Incoming specimens are prepared for processing simply by loading them into an input rack (in random order). The input rack is in turn loaded into an input drawer. The system is started from the PC at the operator station. Once the correct deck configuration program is selected, the operator starts the system from the PC. The handler picks up a specimen from the input rack and rotates it to permit reading of the bar code. The specimen ID (SID) is compared to a local database (which is periodically updated from the LIS) for processing instructions. The processing instructions direct the specimen processing sequence, which may include any combination of centrifugation, decapping and/or sorting to target racks.

Operator duties include:

- Loading specimen trays/racks into the input drawers
- Unloading empty trays/racks from the input drawers
- Unloading populated archive trays from the output drawers
- Removing test tubes that have been rejected due to no-read/no-database bar code scan.
- Emptying removed caps collected in the hazardous waste bin

3.1 AutoSorter-III™ Software

Training and day-to-day operation are well addressed with easy-to-use graphic user interfaces and Windows®-based operating system.

The AutoSorter-III™ Automated Specimen Processor uses an Oracle database to track and manage all samples that are processed. ODBC or HL7 connectivity provides access to your LIS for specimen processing instructions. Likewise, it allows pre- and post-clinical specimen processing status and archive information to be reported back to these systems. Additionally the system records the target rack bar code (if provided) and row/column tube location.

This tracking is very useful in providing archive consolidation of post-clinical specimens, as well as maintaining trace-ability of specimens through the pre-clinical sequence.
3.1.1 Main Tab

The {Main} tab contains all the basic operation controls and settings.

**Start**

The [Start] button begins the operation cycle. AutoSorter-III™ begins processing specimen tubes according to the specified deck configuration.

**Stop**

The [Stop] button ends the operation cycle. AutoSorter-III™ stops processing specimen tubes.

**Pause/Resume**

The [Pause] button pauses the operation cycle. Pressing the [Pause] button stops operation and interrupts the job until the operator presses the [Resume] button to resume operation. Operation resumes at the point in the program where the Pause state was initiated.

**Tray/Rack ID**

The {Tray/Rack ID} window records the identification number of the tray or rack as it is scanned into the system. Tray/Rack identification numbers can also be manually entered, bypassing the handheld bar code scanner.
3 Operation
3.1 AutoSorter-III™ Software

**Drawer ID**
The (Drawer ID) window records the identification number of the drawer as it is scanned into the system. Drawer identification numbers can also be manually entered, bypassing the handheld bar code scanner.

**Exit**
The [Exit] button closes the AutoSorter-III™ application.

**Deck Configuration**
The (Deck Configuration) dropdown menu allows the operator to select the appropriate deck configuration from a list of pre-programmed configurations. Each deck configuration file has been programmed to reflect the variety of instrument specific racks and varying configurations. If your system is setup for multiple deck configurations, make sure the proper racks are inserted onto the sort deck for the chosen deck configuration.

**Clear Log**
The [Clear Log] button clears the main log window.

### 3.1.2 Work Cell Tab

The (Workcell) tab contains real-time monitoring of the sort deck as well as limited control of servo motor power, door locks, grippers, decapper index, and centrifuge. Monitoring of substation processes can also be performed from the (Work Cell) tab. Controls on this screen are disabled while the AutoSorter is actively processing tubes. The system must be paused or stopped to use the controls on this tab.
3.1.2.1 Misc. Controls

The Misc. Controls area contains control buttons for servo motor power, door locks, as well as the decapper and specimen handlers.

**Servos On**

The Servos On button applies the necessary servo motor power to manually manipulate the AutoSorter-III™ components directly from the Work Cell tab.

**Servos Off**

The Servos Off button removes servo motor power from the AutoSorter-III™ unit.

**Motion Alarm**

The Motion Alarm indicator light notifies the operator when there is a motion alarm. Additional information regarding the alarm can typically be found in the system log located on the Main tab.

**Clear Alarm**

The Clear Alarm button is used to clear motion alarms, if possible.

**Index Decapper**

The Index Decapper button initiates an index sequence. The index plate rotates the input station into the decapping unit. Any tube located in the decapper unit is rotated out to the output station.

**Clear Decapper**

The Clear Decapper button removes all tubes from the 3 stations of the decapper in AutoSorter's internal database. Click this button when tubes are manually removed from the decapper.

**Clear All Tubes**

Click the Clear All Tubes button when manually clearing the sort deck of all tubes to "start over". This notifies AutoSorter's internal database to sort from an empty starting point.

**Park A**

The Park A button returns the A specimen handler to the Park position at the left rear corner of the sort deck.

**Park B**

The Park B button returns the B specimen handler to the Park position at the right rear corner of the sort deck.

3.1.2.2 Gripper Control/Status

The Gripper Control/Status area allows the user to monitor and control the status of each gripper. Grippers can be opened and closed. Red and green indicators monitor the status in real-time.

**Open A**

The Open A button opens the gripper on Handler A.
Close A
The [Close A] button closes the gripper on Handler A.

Open B
The [Open B] button opens the gripper on Handler B.

Close B
The [Close B] button closes the gripper on Handler B.

Tube in Gripper
The {Tube in Gripper} indicators verify correct gripping of specimen tubes.

3.1.2.3 Centrifuge Manual Control
The {Centrifuge Manual Control} area manually controls the centrifuge unit. The hatch can be opened and closed, spin cycle started and stopped, and errors monitored.

Open Hatch
The [Open Hatch] button opens the centrifuge hatch. The centrifuge hatch lid can only be opened when the rotor is at rest and power is ON. The lid cannot be opened during power failure. An emergency release must be executed by hand. Refer to vendor documentation for additional information.

![Centrifuge Manual Control](image)

WARNING

To avoid serious injury and or damage to the equipment:

- Never attempt to perform an emergency release with power ON. Disconnect centrifuge from main power.
- Never open hatch lid while rotor is still in motion.
- Only use the plastic release pin provided for emergency release.

Refer to vendor documentation for additional safety precautions.

Close Hatch
The [Close Hatch] button closes the centrifuge hatch lid.

Start Spin
The [Start Spin] button initiates a centrifuge spin cycle.

Stop Spin
The [Stop Spin] button stops the centrifuge spin cycle.

Clear All Centrifuge Inserts
The [Clear All Centrifuge Inserts] button resets AutoSorter's internal database indicating that all centrifuge racks are removed from the centrifuge, and all racks on the sort deck are empty. This button should be clicked when aborting a run or otherwise clearing all tubes from all the centrifuge racks.
3 Operation
3.1 AutoSorter-III™ Software

Clear Inserts IN Centrifuge
The [Clear Inserts IN Centrifuge] button resets AutoSorter’s internal database indicating that all centrifuge racks are removed from the centrifuge, and those racks that were in the centrifuge are now empty. This button should be clicked when aborting a run or otherwise removing racks from the centrifuge, but it is not desired to clear tubes from racks that were previously on the sort deck.

Index Rotor
The [Index Rotor] button advances the centrifuge rotor so that the next rotor position lies under the hatch. This is useful for manually loading or unloading buckets in/out of the centrifuge.

Clear Error
The [Clear Error] button is used to clear centrifuge errors from the system.

Status
The [Status] button displays the current centrifuge status.

3.1.3 Maintenance Tab
The {Maintenance} tab provides detailed monitoring and manual control of various AutoSorter-III™ substations including; monitoring and manual control of servo power, grippers, decapper and centrifuge; homing of the specimen handlers, and monitoring of specimen drawers and basic system operation. The Maintenance tab is password protected. See Section bone for instructions on setting the password.
3.1.3.1 Homing

Home position calibration is an operation in which the physical position of the handler and absolute encoder position coincide. Although this operation is performed prior to system startup, handler crashes and other deviations may require this operation to be performed again. The (Homing) area allows the user to home each handler and decapper individually or as a group. Red and green indicator lights follow the process and report errors or completion of homing task.

**Home Handler A**

The [Home Handler A] button initiates the homing sequence for Handler A.

**Abort Home A**

The [Abort Home A] button stops the homing process.

**Home Handler B**

The [Home Handler B] button initiates the homing sequence for Handler B.

**Abort Home B**

The [Abort Home B] button stops the homing process.

**Home Decapper**

The [Home Decapper] button initiates the homing sequence for the decapper.

**Abort Home D**

The [Abort Home D] button stops the homing process.

**Recheck Homing**

The [Recheck Homing] button initiates the homing sequence for the entire AutoSorter-III™ unit. Both handlers and the decapper unit are homed.

3.1.3.2 Servo Control/Status

The (Servo Control/Status) area allows the user to manually control servo power to both handlers and the decapper. Red and green indicator lights monitor servo power to each handler and the decapper.

**Servo A On**

The [Servo A On] button applies servo power to Handler A only.

**Servo A Off**

The [Servo A Off] button removes servo power from Handler A only.

**Servo B On**

The [Servo B On] button applies servo power to Handler B only.

**Servo B Off**

The [Servo B Off] button removes servo power from Handler B only.
3 Operation
3.1 AutoSorter-III™ Software

Servo D On
The [Servo D On] button applies servo power to the decapper only.

Servo D Off
The [Servo D Off] button removes servo power from the decapper only.

3.1.3.3 Gripper Control/Status
The {Gripper Control/Status} area allows the user to monitor and control the status of each gripper. Grippers can be opened and closed. Red and green indicators monitor the status in real-time.

Open A
The [Open A] button opens the gripper on Handler A.

Close A
The [Close A] button closes the gripper on Handler A.

Open B
The [Open B] button opens the gripper on Handler B.

Close B
The [Close B] button closes the gripper on Handler B.

Tube in Gripper
The {Tube in Gripper} indicators verify correct gripping of specimen tubes.

3.1.3.4 Decapper
The {Decapper} area allows the user to manually activate various components of the decapper substation.

Decap/Index
The [Decap/Index] button initiates a full decap/index sequence. The decapping unit performs the decap sequence and then the index plate rotates the specimen to the output target.

Index
The Index button rotates the input target into the decapping unit.

3.1.3.5 Axis Jog
The {Axis Jog} area allows the user to manually jog various components of the AutoSorter-III™ unit including the specimen handlers, grippers, and decapper.

Enable Axis
The {Enable Axis} dropdown menu allows the user to select an axis to enable.
3 Operation

AutoSorter-III™ 3.1 AutoSorter-III™ Software

Figure 3-7: Jog Axes

Jog Forward On
The [Jog Forward On] button moves the selected axis forward in the positive direction.

Jog Reverse On
The [Jog Reverse On] button moves the selected axis backwards in the negative direction.

Park A
The [Park A] button returns the A specimen handler to the Park position at the rear corner of the sort deck.

Park B
The [Park B] button returns the B specimen handler to the Park position at the rear corner of the sort deck.

Abort Handler A MOVE
The [Abort Handler A MOVE] button stops all A specimen handler motion.

Abort Handler B MOVE
The [Abort Handler B MOVE] button stops all B specimen handler motion.

3.1.3.6 Scale Analog Value
The {Scale Analog Value} area measures the weight, in grams, of each of four centrifuge buckets. Centrifuge buckets must be weighed and loaded to maintain balance within the allowable range of the centrifuge.

3.1.3.7 Centrifuge Bucket Sensors
The {Centrifuge Bucket Sensors} indicate placement of the centrifuge buckets in up to ten locations, depending on your system’s configuration.
3 Operation

3.1 AutoSorter-III™ Software

3.1.3.8 Gripper Collision

The {Gripper Collision} area monitors gripper collision for both the A and B specimen handlers.

3.1.3.9 Safety Circuit

The {Safety Circuit} area monitors safety circuit conditions including E-Stop and Door Closed.

3.1.3.10 Operator Control

The {Operator Control} area monitors Process Resume and Process Stop conditions as well as light beacon status.

3.1.3.11 Waste Bin

The {Waste Bin} area monitors the condition of the waste bin including bin presence, and full.

3.1.3.12 Motion ALARM

The motion alarm indicator light monitors the system for motion alarm occurrences.

Clear Alarm

The [CLEAR ALARM] buttons clears minor motion alarms such as gripper collisions. Press the [CLEAR ALARM] button after the alarm condition has been cleared.

System Reset

The [SYSTEM RESET] buttons clears certain major motion alarms. AutoSorter-III™ must be re-homed after pushing the [SYSTEM RESET] button.

NOTE

The system must be re-homed following a system reset.

3.1.3.13 Gripper Encoders

Gripper Encoder outputs are displayed for troubleshooting purposes.
3.2 System Configuration

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 from that presented here; however, basic operation will be the same.

Any changes made to your system configuration and/or job structure will alter the operation of this equipment. 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 1.4).

3.3 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 3.3.1).
Perform operation cycle (refer to Section 3.4).
Perform system shutdown (refer to Section 3.4.4)

3.3.1 System Start-up

Procedure –
1. Set MAIN POWER switch on the controller unit to ON.

Fig. 3-1: Turning Main Power ON

[Image of a power switch]

CAUTION

Read and understand the vendor supplied centrifuge instructions shipped with your system before initial operation. Only personnel who have read and understood the centrifuge operating instructions should be allowed to operate the device.

2. Set POWER switch on centrifuge to ON; [Servo On] button blinks and the display panel turns on.
3. Set power on both PC and monitor to ON.
4. Start AutoSorter-III™ software from the PC Start Menu or Desktop icon. A dialog box appears requesting the sort deck be cleared for operation.

5. Make sure the sort deck is clear for safe operation.
6. Make sure the grippers are not holding a specimen.
7. Make sure the enclosure door is closed and latched.
8. Make sure E-Stop button on the Operator Station is released.
9. Place system in ready mode by pressing the SERVO ON button on the Operator Station.
10. Click [OK]. AutoSorter-III™ automatically begins the homing/alignment process.

3.4 Perform Operation Cycle

**WARNING**

Before operating AutoSorter-III™, verify correct operation of the system E-Stop button. Check that the green light beacon goes out and the red light comes on when the emergency stop button is pressed. Injury or damage to machinery may result if the system cannot be stopped in case of an emergency.

**CAUTION**

Before operating AutoSorter-III™, verify correct deck configuration selection from dropdown menu. Operating AutoSorter-III™ with the incorrect deck configuration will cause damage to system components as well as specimen samples.
3.4 Perform Operation Cycle

3.4.1 Loading the Infeed Drawer(s)

1. Select the correct deck configuration from the dropdown menu for your application.

2. Prepare incoming specimens for processing simply by loading them into an input rack (in random order).

   Option:

   a) Scan the bar code on the input specimen rack and reject rack (typically drawer 3A) using the handheld bar code scanner. The specimen rack number appears in the {Tray/Rack ID} window of the AutoSorter-III™ software.

   b) Scan the bar code on an empty input drawer. The input drawer number appears in the {Drawer ID} window of the AutoSorter-III™ software.

3. Insert the specimen rack into the input drawer and press the lockdown button. The rack and drawer are securely locked in place.

3.4.2 Loading the Outfeed Drawer(s)

1. Scan the bar code on the output personality rack using the handheld bar code scanner (if required for your system configuration). The output personality rack number appears in the Tray/Rack ID window of the AutoSorter-III™ software.

2. Scan the bar code on the correct output drawer. The output drawer number appears in the {Drawer ID} window of the AutoSorter-III™ software.

3. Insert the personality rack into the output drawer.

4. Load all personality racks correctly into output drawer according to deck configuration and press the lockdown button. The racks and drawer are now securely locked in place.

5. Press the [START] button on the PC screen. AutoSorter-III™ begins processing the tubes.

AutoSorter-III™ will not operate without the Reject rack scanned and in place.

It is important that the specimen racks and reject rack are inserted properly. If the rack is not oriented properly specimen locations will be logged incorrectly by the LIS.

Depending on your configuration, there may be several different personality racks loaded into a single drawer. Be sure to correctly load and scan both the personality racks and racksite bar codes according to your deck configuration to avoid damage to equipment.

WARNING

Depending on your configuration, there may be several different personality racks loaded into a single drawer. Be sure to correctly load and scan both the personality racks and racksite bar codes according to your deck configuration to avoid damage to equipment.

154591-2CD

3-13
Automated Operation –

1. Each specimen tube bar code is scanned to determine sort location as well as additional process requirements such as centrifuging and decapping.
   
   a) The centrifuge racks are weighed, and loaded to maintain balance within the allowable tolerance of the centrifuge.

2. If the specimen requires centrifuging, it is placed into a centrifuge rack and waits for additional specimens requiring centrifuging.

3. If the specimen requires decapping, it is placed in the input station of the decapper.
   
   a) The specimen is rotated into the decapping unit where the tube is decapped and the cap discarded into the biohazard waste bin.
   
   b) The specimen is moved to the output station to be removed by the specimen handler.

4. After all substation processes are complete, the specimen handler places the specimen tube into the specified output rack for the required analytical equipment.

5. The local database is updated with archive tray ID, sample tray location, and sample ID. Data is uploaded to the host laboratory LIS as designated.

6. When the personality rack is filled, the output drawer light blinks and the light beacon flashes green, indicating operator attention is required.

7. The personality rack can be removed from the drawer and is ready for further processing according to your laboratory procedures.

3.4.3 Removing a Full Reject Rack

When a Reject rack is filled, the light beacon flashes green indicating operator attention is required. The operator must replace the full rack with an empty one. It is not necessary to stop or pause sorting. To replace a full reject rack, proceed as follows:

1. Press the drawer lock button to unlock the drawer.

2. Remove the full reject rack and replace with an empty rack, scanning both the reject rack as well as the racksite as required.

3. Press the drawer lock button located above the drawer to lock it in place. AutoSorter-III™ resumes processing of specimens tubes.
3.4.4 Shut Down the System

Procedure –

1. Click on the [Stop] button on the PC screen. AutoSorter-III™ stops processing the tubes. The specimen handlers return to the Home position.

2. Press the E-Stop button.

3. Click on the [Exit] button to close the AutoSorter-III™ application.

4. Shut down the PC.

5. Set POWER switch on centrifuge to OFF; centrifuge pilot light turns off.

6. Set MAIN POWER switch on the controller unit to OFF.

*Fig. 3-1: Turning Main Power OFF*

AutoSorter-III™ is now shut down.
4 Maintenance and Troubleshooting

4.1 Emptying the Biohazard Waste Bin

Maintenance of the AutoSorter-III™ system and components must be performed by authorized personnel who are familiar with the AutoSorter – III™ system. Be sure to read and understand the documentation for a particular component before doing actual 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 safety precautions given in Chapter 2.

For detailed troubleshooting and maintenance procedures, refer to the RobotPro software for AutoSorter – III™ installed on the system PC. Contact Motoman customer support for more information.

Maintenance intervals given in this chapter are recommendations only. Adjust the frequency and level of repair maintenance and preventive maintenance to suit your specific equipment schedules and laboratory environment.

For periodic maintenance procedures and schedules for the individual components of your AutoSorter – III™ system, refer to the documentation package that is included with your system (refer to Section 1.3).

It is your responsibility to decontaminate components of AutoSorter – III™ before requesting service by a Motoman Field Service Representative or returning parts to Motoman for repair. Motoman will NOT accept any items which have not been decontaminated where it is appropriate to do so. If any parts are returned, they must be enclosed in a sealed plastic bag stating that the contents are safe to handle and are not contaminated.

The AutoSorter – III™ system should not require extensive regular maintenance, other than making operational choices, and emptying the biohazard waste bin.

4.1 Emptying the Biohazard Waste Bin

As the decap process occurs, caps are discarded through a chute into a biohazard waste bin. When full, the biohazard bag (customer supplied) should be removed, disposed of properly, and replaced with a new one.

4.2 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. AutoSorter-III™ uses on-screen dialog boxes to guide the user through most error and alarm recovery.

4.2.1 Controller Alarms

Controller alarms typically cause the system to stop and require operator intervention to recover. Depending on the error, the operator may need to reset the system, recalibrate home position, or cycle power. AutoSorter – III™ onscreen dialog boxes guide the user through these controller errors.
4.2.2 Hardware Alarms and Errors

**WARNING**

Moving parts may cause injury. Do not reach through drawers. E-stop the machine and follow the procedures in the manual for entering the sort deck area.

Hardware alarms and errors are typically caused by physical conditions of the unit including:

- Collision of handler or gripper
- Drawer improperly closed
- Protective hood not properly closed and latched
- Waste bin improperly seated or full

To clear a hardware alarm or error:

1. Correct the condition that caused the alarm or error.
2. Press the [Clear Alarm] button on the {Work Cell} or {Maintenance} tab.
3. Press the SERVO ON button on the Operator Station.
4. Press the [Start] or [Resume] button on the computer screen.

4.2.2.1 E-Stop Condition

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

- Pressing the E-Stop push button on the Operator Station
- Opening the access door

Procedure –

1. Correct the condition that caused the E-Stop.
2. Clear an E-Stop condition by performing any of the following actions that apply –
   - Release the E-Stop push button.
   - Close the AutoSorter-III™ access door.
3. Press SERVO ON button on the Operator Station.
4. Press the [Start] or [Resume] button on the computer screen.

The AutoSorter-III™ cell is now ready to continue operation.

4.2.3 Recovery from a Crash

AutoSorter-III™ includes two Motoman specimen handlers with servo grippers that incorporate a shock sensor assembly. The shock sensor assembly protects the servo gripper from damage in the event of a collision (crash) involving the gripper and a component or part within the work cell. A slight deflection of the gripper activates a SHOCK SENSOR signal that triggers an error message and stops motion.
Occasionally a specimen handler may place a tube incorrectly. The result may be enough to engage a sensor. Handler motion is stopped and motor power is removed. To clear the error message, you must move the specimen handler clear of the impact.

Procedure –

1. Upon gripper collision or other motion error, the system stops and the following dialog appears. Most errors can be cleared by pressing the [Clear Alarm] button.

2. If pressing the [Clear Alarm] button is unsuccessful, visually inspect the system to determine the cause of the error.

3. If it is safe to move the handler without causing further damage to the specimens or equipment, use the {Manually Raise Handlers} control buttons in the {Error Detect} dialog to move the handler away from the impact site. Skip to step 5.

4. If you determine that it is unsafe to move the handler without further intervention, you will need to remove motor power before entering the unit.
   a) Press the E-Stop button to remove motor power and unlock the door.
   b) Open the unit door to access the sort deck.
c) Manually correct the collision or cause of motion error. Physically move the handler and gripper as required to correct the collision or cause of motion error.

A small pen or plastic rod can be used to manually open the gripper fingers.

d) Close the door.

e) Reset the E-Stop button. Motor power returns.

5. From the {Error Detect} dialog, press the [Clear Alarm] button to clear the alarm condition. AutoSorter-III™ is now ready to continue operation.

6. Visually inspect the system to determine if it is safe to continue sorting or if further maintenance or cleanup is required.

7. Press the [Continue Sorting] button on the {Error Detect} dialog to continue operation or press the [Stop Sorting and Idle] button to pause the system for further maintenance.

4.2.4 Software Alarms and Errors

Software alarms and errors are typically resolved by following the onscreen dialog boxes that guide the user through these alarms and errors.
AutoSorter-III™
User Guide
Automated Tube Processor

Specifications are subject to change without notice for ongoing product modifications and improvements.