MLX100

INSTRUCTIONS

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

• This manual explains setup, diagnosis, maintenance, hardware, etc. of the MLX100 Controller. Read this manual carefully and be sure to understand its contents before using the MLX100 Controller.
• General items related to safety are listed in Section 1. To ensure correct and safe operation, carefully read the section.

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.
MLX100 Controller

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MLX100 Controller.

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

- 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 MLX power
  - Moving the manipulator with programming pendant or MLX HMI
  - 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 the emergency stop button immediately if there are problems. The emergency stop button is located on the right of the programming pendant.

- 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 in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Before operating the manipulator, check that servo power is turned OFF when the emergency stop button on programming pendant is pressed.
  When the servo power is turned OFF, the SERVO ON INDICATOR on the programming pendant or MLX HMI is turned OFF.

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

*Figure 14: EMERGENCY STOP Button*

- Release the EMERGENCY STOP button (refer to *Figure 15*). Once this button is released, clear the cell of all items which could interfere with the operation of the positioner. Then turn servo power ON.

Injury may result from unintentional or unexpected positioner motion.

*Figure 15: Release of EMERGENCY STOP Button*
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN consists of the manipulator, the drive panel, and manipulator cables.

In this manual, the equipment is designated as follows.

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<td>MLX100 Controller</td>
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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 manipulator.

Fully comply with the precautions on the warning labels.

WARNING

- The label described below is attached to the manipulator. Observe the precautions on the warning labels.
- Failure to observe this caution may result in injury or damage to equipment.

Refer to the manipulator manual for the warning label location.
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1 Introduction

The MLX100 Controller enables the user to replace the traditional DX100 robot controller with PLC-based software and general purpose motion control hardware.

The MLX100 Controller enables the user to integrate select Yaskawa manipulator models with Rockwell Automation ControlLogix Programmable Automation Controller (PAC) and RSLogix 5000 development software via Agile Planet’s set of RLX software modules and associated computer hardware.

Fig. 1-1: Layout (MPL160 Shown)

1.1 MLX100 Controller Components

Several MLX100 Controller configurations are available and include the appropriate control panel, servo amplifiers, cables, and components required to interface with the Rockwell ControlLogix controller and target manipulator.

The robot gateway module includes the RLX-R (runtime license) from Agile Planet. This is the operating system for the robot and provides full kinematics for the supplied manipulator. In addition, the software provides interference zones, robot jogging controls in multiple coordinate systems, and tool frame control. The gateway module handles all motion control tasks. This architecture limits backplane communications to a minimum and allows multiple MLX100 Controller controlled robots to be run from a single ControlLogix processor.
1.1.1 User Supplied Components

When using an MLX100 Controller controlled robot, the user must supply the following items:

- RockWell ControlLogix Programmable Automation Controller (PAC) (1756-L61 minimum processor)
- ControlLogix Rack with communication card (1756-ENTB suggested)
- RockWell Automation RSLogix 5000 software (v19)
- Network communication modules
- EtherNet switch (managed switch suggested)
- I/O and safety modules
- FactoryTalk View Machine Edition or Studio Edition (v6)

Many of these items can be purchased from Yaskawa Motoman. Contact your Yaskawa sales representative for more information.

1.2 For Your Safety

Robots generally have requirements which are different from other manufacturing equipment, such as larger working areas, high-speed operation, rapid arm movements, etc., which can pose safety hazards.

Read and understand the instruction manuals and related documents, and observe all precautions in order to avoid the risk of injury to personnel and damage to equipment.

It is the user’s responsibility to ensure that all local, state, and national codes, regulations rules, or laws relating to safety and safe operating conditions are met and followed.
1.3 Special Training

MANDATORY

- Teaching maintenance of the robot must conform to:
  - Industrial Safety and Health Law
  - Enforcement Order of Industrial Safety and Health Law
  - Ordinance of Industrial Safety and Health Law

Other related laws are:
- Occupational Safety and Health Act in USA
- Factory Act (Gewerbeordnung) in Germany
- Health and Safety at Work, etc. Act in UK
- EC Machinery Directive 98/37/EC

- Prepare
  - SAFETY WORK REGULATIONS
    based on concrete policies for safety management complying with related laws.

- Observe the
  - MANIPULATING INDUSTRIAL ROBOTS-SAFETY (ISO 10218)
    for safe operation of the robot. (Japan Only) (JIS B 8433)

- Reinforce the
  - SAFETY MANAGEMENT SYSTEM
    by designating authorized workers and safety managers, as well as giving continuing safety education.

- Teaching and maintaining the robot are specified as
  "Hazardous Operations" in the Industrial Safety and Health Law

MANDATORY

- Persons who teach or inspect the manipulator must undergo required training before using the manipulator.

- For more information on training, inquire at the nearest YASKAWA branch office.

The telephone numbers are listed on the back cover of this manual.
This supplementary instruction manual describes how manipulators with the MLX100 Controller are different from those with the standard DX100 controller.

MANDATORY

Read this supplementary instruction manual thoroughly together with the following instruction manuals:

- Yaskawa Motoman Manipulator Instructions for your model. Disregard all references to the “DX100” controller when reading using the manipulator manual. This manual is to be used for manipulator hardware only.
  - Motoman-MH5 Instructions (P/N 156411-1CD)
  - Motoman-MH5L Instructions (P/N 156483-1CD)
  - Motoman-MH5LS Instructions (P/N 161052-1CD)
  - Motoman-MH5S Instructions (P/N 160475-1CD)
  - Motoman-MPK50 Instructions (P/N 156865-1CD)
  - Motoman-MPL80 Instructions (P/N 157283-1CD)
  - Motoman-MPL160 Instructions (P/N 156830-1CD)
  - Motoman-MPL300 Instructions (P/N 157284-1CD)
  - Motoman-SIA20D Instructions (P/N 156387-1CD)
- RLX User Guide and Instruction Manual (P/N 159133-1CD)

Confirm that you have the appropriate manipulator manual and RLX user guide on hand. If any manuals are missing, contact your salesman from YASKAWA’s local branch office. The relevant telephone numbers are listed on the back cover.
1.5 Personnel Safety

The entire manipulator P-point maximum envelope is potentially dangerous.

All personnel working with the MOTOMAN (safety administration, installation, operation, and maintenance personnel) must always be prepared and "Safety First" minded, to ensure the safety of all personnel.

<table>
<thead>
<tr>
<th><strong>CAUTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Avoid any dangerous actions in the area where the MOTOMAN is installed.</td>
</tr>
<tr>
<td>There is a danger of injury if there is contact with the manipulator or peripheral equipment.</td>
</tr>
<tr>
<td>• Please take strict safety precautions by placing signs such as &quot;Flammable&quot;, &quot;High Voltage&quot;, &quot;Waiting&quot;, and &quot;Off-limits to Unauthorized Personnel&quot; in necessary areas in the factory.</td>
</tr>
<tr>
<td>Failure to observe these cautions may result in fire, electric shock, or injury due to contact with the manipulator and other equipment.</td>
</tr>
<tr>
<td>• Strictly observe the following items:</td>
</tr>
<tr>
<td>– Always wear approved work clothes (no loose-fitting clothes).</td>
</tr>
<tr>
<td>– Do not wear gloves when operating the MOTOMAN.</td>
</tr>
<tr>
<td>– Do not allow underwear, shirts, or neckties to hang out from the work clothes.</td>
</tr>
<tr>
<td>– Do not wear large jewelry, such as earrings, rings, or pendants.</td>
</tr>
<tr>
<td>Always wear protective safety equipment such as helmets, safety shoes (with slip-proof soles), face shields, safety glasses, and gloves as necessary.</td>
</tr>
<tr>
<td>Improper clothing may result in injury.</td>
</tr>
<tr>
<td>• Unauthorized persons should not approach the manipulator or associated peripheral equipment.</td>
</tr>
<tr>
<td>Failure to observe this caution may result in injury due to contact with the MLX100 Controller, the workpiece, the positioner, etc.</td>
</tr>
</tbody>
</table>


**CAUTION**

- Never forcibly move the manipulator axes. Failure to observe this caution may result in injury or equipment damage.

- Never lean on MLX100 Controller or other controllers, and avoid inadvertently pushing buttons. Failure to observe this caution may result in injury or damage by unexpected movement of the manipulator.

- Never allow unauthorized personnel to touch the MLX100 Controller during operation. Failure to observe this caution may result in injury or damage resulting from unexpected movement of the manipulator.
1.6 Motoman Safety

1.6.1 Installation and Wiring Safety

In planning installation, adapt an easy to observe arrangement to ensure safety. Take safety into consideration when planning the installation. Observe the following when installing the manipulator:

**WARNING**

- Select an area such as that described below to install the manipulator:
  Confirm that the area is large enough so that the fully extended manipulator arm with tool will not reach a side wall, safeguarding, or the drive panel.

Failure to observe this caution may result in injury or damage resulting from unexpected movement of the manipulator.

- Perform grounding in accordance with all applicable electrical codes.

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

**CAUTION**

- Operation of cranes, slings, or forklifts should only be performed by authorized personnel.

Failure to observe this precaution may result in injury or equipment damage.
MOTOMAN should be lifted with a crane using appropriately rated cable or strapping threaded through the provided lifting eyes and lifted in an upright posture as described in the manipulator instruction manual.

Failure to observe these precautions may cause the manipulator to turn downward, potentially causing injury or damage to equipment.

**CAUTION**

- When lifting the MLX100 drive panel, please check the following:
  - As a rule, handling of the MLX100 drive panel can be performed by two or more people.
  - The MLX100 drive panel weighs approximately 31 - 47 kg (69 - 104 lbs). Be sure movers are strong enough to handle this weight.

Failure to observe this caution may result in injury or damage to equipment.

- If storing the manipulator temporarily before installation, be sure to place it on a stable and flat surface and take precautions to prevent unauthorized personnel from touching it.

Failure to observe this precaution may result in injury of damage to equipment.

**CAUTION**

- Be sure there is sufficient room for maintenance on the manipulator, MLX100 Controller, and other peripheral equipment.

Failure to observe this precaution could result in injury during maintenance.

- To ensure safety, be sure to operate the drive panel from a location where the manipulator is easily visible.

Operation by unauthorized personnel may result in injury or equipment damage.

- Install the MLX100 drive panel outside the safeguarding of the manipulator's safety enclosure.

Failure to observe this precaution may result in injury or damage to equipment resulting from contact with the manipulator.

- Install the manipulator using bolts of the size and type specified for each MOTOMAN in the MOTOMAN INSTRUCTION MANUAL.

Failure to observe this caution may result in injury or damage to equipment.
1.6.2 Work Area Safety

Carelessness contributes to serious accidents in the work area. To ensure safety, enforce the following precautions:

**WARNING**

- Install a safeguarding around the manipulator to prevent any accidental contact with the manipulator while power is ON. Post a warning sign stating "Off-limits During Operation" at the entrance of the enclosure. The gate of the safeguarding must be equipped with a safety interlock. Be sure the interlock operates correctly before use.

Failure to observe this caution may result in a serious accident due to contact with the manipulator.

**CAUTION**

- Store tools and similar equipment in proper locations outside of the enclosure.

Tools and loose equipment should not be left on the floor around the manipulator, MLX100 Controller, or welding fixture, etc., as injury or damage to equipment can occur if the manipulator comes in contact with objects or equipment left in the work area.
1.6.3 Operation Safety

**WARNING**

- When attaching a tool such as the welding torch to the manipulator, be sure to turn OFF the power supply of the MLX100 Controller and the tool, lock the switch, and display a warning sign. Turning the power ON during tool installation may cause electric shock or injury due to unexpected movement of the manipulator.

- Never exceed the rated capacity of the manipulator (capacity can be found in the specifications section of the manipulator manual.) Failure to observe this caution may result in injury or damage to equipment.

- Teach jobs from outside the manipulator’s work area whenever possible.

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Always view the manipulator from the front.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
  - Ensure that you have a place to retreat to in case of emergency. Improper or unintentional manipulator operation can result in injury.

**WARNING**

- Before operating the manipulator, check that all emergency stop buttons are pressed. And confirm that the servo power is turned OFF. Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

- Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator when:
  - Turning ON the MLX100 Controller power
  - Moving the manipulator.
  - Running the system in the check mode
  - Performing automatic operations

Injury may result from contact with the manipulator if persons enter the P-point maximum envelope of the manipulator.

Press the emergency stop button immediately if there are problems.
1.7 Notes for Moving and Transferring the MOTOMAN

When moving or transferring the Motoman, observe the following safety precautions:

---

**CAUTION**

- Perform the following inspection procedures prior to teaching the manipulator. If problems are found, correct them immediately, and be sure that all other necessary tasks have been performed.
  - Check for problems in manipulator movement.
  - Check for damage to the insulation and sheathing of external wires.
- Always return the optional programming pendant to a safe location after use.

If the programming pendant is inadvertently left on the manipulator, a fixture, or on the floor, the manipulator or a tool could collide with it during manipulator movement, possibly causing injury or equipment damage.

---

**MANDATORY**

- Persons operating or inspecting the manipulator should be trained as required by applicable laws and company policies.
- Refer to chapter 1.3 “Special Training” at page 1-3

---

**CAUTION**

- Attach the instructions to the drive panel cabinet so that all users have access to necessary manuals. See chapter 1.4 “Motoman Manual List” at page 1-4 for a complete list of manuals.

If any manuals are missing, contact your Yaskawa representative.

- If the warning labels on the manipulator and MLX100 Controller are illegible, clean the labels so that they can be read clearly. Note that some local laws may prohibit equipment operation if safety labels are not in place.

Contact your YASKAWA representative if you require new warning labels.

- When the MOTOMAN is transferred, it is recommended to check with Yaskawa Engineering Co. which is listed on back cover of this manual.

Incorrect installation or wiring may result in personal injury and property damage.
1.8 Notes on MOTOMAN Disposal

PROHIBITED

- Never modify the manipulator.
  Failure to observe this precaution could result in injury or damage resulting from fire, power failure, or operation error.

CAUTION

- When disposing of the MOTOMAN, follow the applicable national/local laws and regulations.
- Anchor the manipulator well, even when temporarily storing it before disposal.
  Failure to observe this precaution may result in injury due to the manipulator falling down.
2 Product Confirmation

2.1 Before Unpacking

Carefully inspect all shipping crates for evidence of damage during transit. Pay special attention to tilt and shock indication labels on the exterior of the containers. If any damage is indicated, request that the carrier's agent be present at the time the container is unpacked.

2.2 Unpacking

The MLX100 drive panel is shipped in a crate along with any miscellaneous hardware, and any accessories ordered.

2.3 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

Standard delivery includes the following five items (information for the content of optional goods is given separately):

- Manipulator
- MLX100 Drive Panel
- MLX100 Robot Gateway module
- Regen Cabinet
- Manipulator Cables (Between Manipulator and MLX100)
- Complete Set of Manuals

Fig. 2-1: Standard Items
2.3.1 Optional Programming Pendant

The optional Programming Pendant (see Fig. 2-2) provides the primary means of programmer/operator interaction with the MLX100 Controller system. The pendant features a 7.5-inch, color LCD, touch-screen display (640 X 480 VGA).

The features include a menu-driven interface unique to the MLX environment, by using the Programming Pendant, the operator can teach and adjust the robots points; perform programming, editing, maintenance, and diagnostic functions.

*Figure 2-2: MLX100 Programming Pendant*

<table>
<thead>
<tr>
<th>Call Out</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enable/Deadman Switch</td>
<td>Enables and disables the teach pendant. The unit is operative when the switch is pressed.</td>
</tr>
<tr>
<td>2</td>
<td>Emergency Stop Switch</td>
<td>Implements an emergency stop condition and sends an emergency stop signal to the external equipment.</td>
</tr>
<tr>
<td>3</td>
<td>Display</td>
<td>7.5-inch, color LCD, touch-screen display (640 X 480 VGA)</td>
</tr>
</tbody>
</table>
2.4 Warranty ID Confirmation

Confirm that the warranty ID pasted on the manipulator and hardware match.

The warranty ID stickers are affixed as shown in the figure.

THE MANIPULATOR, DRIVE PANEL AMPLIFIERS, GATEWAY MODULE, AND REGEN CABINET SHOULD HAVE THE SAME WARRANTY ID.
3 Installation

3.1 Handling Procedure

3.1.1 Moving the Drive Panel

The MLX100 drive panel weighs approximately 31 - 47 kg (68 - 104 lbs). Be sure movers are strong enough to handle this weight.

3.2 Installation Environment

The conditions listed below must be met before installing the MLX100 Controller:

- Ambient temperature must be -5 to +55°C (23 to 131°F) during operation, transportation and maintenance.
- Humidity must be low with no condensation (10~85%RH).
- It must be a place with little dirt, dust, or water.
- No flammable or corrosive liquids or gases, etc. in the area.
- Little jarring or potential for striking of the MLX100 Controller (under 0.5 g oscillation).
- No large electric noise source (such as a TIG welding device, etc.) nearby.
- No potential for collision with moving equipment such as forklifts.

CAUTION

- Avoid jarring, dropping, or hitting the drive panel during handling. Excessive vibration or impacting the MLX100 Controller may adversely affect the performance of the MLX100 Controller.
3.3 Location

1. The MLX100 drive panel is designed to be installed in a suitable industrial cabinet located outside of the P-point maximum envelope of the manipulator (outside of the safeguarding.)

*Fig. 3-1: Location of MLX100 Controller*

2. Install the drive panel in a location from which the manipulator is easily visible.

3. Install the drive panel in a location from which you can easily inspect it.

4. Install the drive panel at least 500 mm from the nearest wall to allow maintenance access.

5. See fig bone and table bone for drive panel dimension requirements.

Refer to the Instruction Manual for information on installation of the manipulator.
6. The customer supplied cabinet must be modified as appropriate to accept the drive panel pigtails for the manipulator and regen cables. See fig. 3-3(a), fig. 3-3(b), and fig. 3-3(c).
3 Installation
3.3 Location

Fig. 3-3(a): MPK50/MPL80 Pigtail Connections

Cutout For Pigtail, Power 28C Manipulator Cable

Cutout For Optional Teach Pendant Cable

Cutout For Pigtail, Encoder 1BC Manipulator Cable

Cutout For Pigtail, Regen Resistors

Fig. 3-3(b): MPL160/300 Pigtail Connections

Cutout For Pigtail, Regen Resistors

Cutout For Pigtail, Encoder 1BC Manipulator Cable

Cutout For Optional Teach Pendant Cable

Cutout For Pigtail, Power 28C Manipulator Cable

Cutout For Pigtail, Power 3BC Manipulator Cable

Cutout For Pigtail, Power 3BC Manipulator Cable

2X M4 Clearance or Tap
7. The regen cabinet may produce significant heat and should be mounted outside the main cabinet with the fans directed up. See figures fig. 3-4(a) and fig. 3-4(b).

Fig. 3-4(a): MH5 / MH5L / MH5S / MH5LS Regen Cabinet Mounting Dimensions and Weight

Weight: 8 kg
Installation
3.3 Location

Fig. 3-4(b): MPK50 and MPL80/160/300 Regen Cabinet Mounting Dimensions and Weight

Weight: 13 kg
4 Connections

**WARNING**

- The system must be grounded. Failure to ground equipment may result in injury from fire or electric shock.
- Before wiring, make sure to turn OFF the primary power supply, and put up a warning sign. (ex. DO NOT TURN THE POWER ON) Failure to observe this caution may result in injury and electric shock.
- Do not touch any board inside the drive panel for five minutes after turning OFF the power supply. Capacitors inside the drive panel store electricity after power is turned OFF. Exercise caution whenever handling circuit boards. Failure to observe this caution may cause electrical shock.
- Power cannot be turned ON unless the door is closed. Interlocks prevent power from being turned ON. Failure to observe this caution may result in fire and electric shock.
- Any occurrence during wiring while the MLX100 Controller is in the emergency stop mode is the user’s responsibility. Do an operation check once the wiring is completed. Failure to observe this caution could lead to injury or mechanical failure.

**CAUTION**

- Wiring must be performed only by authorized personnel. Incorrect wiring may cause fire and electric shock.
- Perform wiring in accordance with the rated capacity as specified in the Instructions. Incorrect wiring may cause fire or mechanical breakdown.
- Be sure the power circuit screws are securely tightened. Loose power circuit wires can cause fire and electric shock.
- Do not handle the circuit board directly by hand. The IC board may malfunction due to electrostatics.
4.1 Notes on Cable Junctions

- The cables that connect the drive panel to peripheral device are low voltage circuits. Keep drive panel signal cables away from the primary power circuit. High voltage power lines should not be run in parallel to drive panel signal cables. If running parallel cables is unavoidable, use metal ducts or conduit to isolate electrical signal interference. If cables must be crossed, run the power cables perpendicular across the signal cables.

- Confirm the connector and cable numbers to prevent misconnection and equipment damage. One connects the manipulator and MLX100 Controller. Another connects the MLX100 Controller and peripheral device. A wrong connection can cause damage to electronic equipment.

- Clear the area of all unauthorized personnel while making cable connections. Place all cables in a covered cable channel in the floor.

Fig. 4-1: MLX100 Controller Cable Junction Diagram

4.2 Power Supply

4.2.1 Three-Phase Power Supply

The power failure processing circuit operates when there is a black out or drop in voltage, and the servo power turns OFF.

Connect the power supply to a stable power source that is not prone to power fluctuations.

The three-phase power supply consists as follows:

- Without built-in transformer: 230 VAC at 50/60 Hz
4.2.2 Primary Power Supply Breaker/Fuse Installation

It is the customer’s responsibility to provide adequate breaker/fusing for their application.

Install the primary power supply breaker/fuse as shown.

*Fig. 4-2: Installation of the Primary Power Supply Breaker/Fuse*

![Diagram showing the installation of the primary power supply breaker/fuse](image)

**Table 4-1: MLX100 Controller Power Capacity, Cable Sizes, and Breaker/Fuse Capacities**

<table>
<thead>
<tr>
<th>Manipulator</th>
<th>Power Capacity (kVA)</th>
<th>Cable size (In case of Cabtyre cable (three cores)) (AWG)</th>
<th>Capacity of breaker/fuse in MLX (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHS, MHS5, MHS5S, MHS5LS</td>
<td>1</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>MPL160/300</td>
<td>10.0</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>MPL80</td>
<td>6.0</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>MPK50</td>
<td>6.0</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

Select and utilize the breaker/fuse with appropriate breaking capacity in consideration of the MLX100 panel power capacity for the manipulator to be used.

The maximum load value (payload, operation speed, and frequency, etc.) is displayed.

However, the power capacity is different depending on work conditions.

Inquire at the nearest branch office listed on the back cover for information when selecting the transformer.
4.3 Connection Methods

A connection diagram for the manipulator, manipulator cable, primary power cable and optional programming pendant is shown below.

*Fig. 4-3: Cable Connection*

### 4.3.1 Connecting the Primary Power Supply

1. Confirm that the primary power supply is OFF.
2. Run the primary power supply through fuses to TB1-1, TB1-2, and TB1-3. Connect a ground wire to reduce noise and prevent electric shock (Customer must provide fusing).

*Fig. 4-4: Details for Running the Primary Power Supply Cable*

Perform grounding in accordance with all relevant local and national electrical codes. The size of ground wire must the same as listed on table 4-1 “MLX100 Controller Power Capacity, Cable Sizes, and Breaker/ Fuse Capacities” at page 4-3.

**NOTE**

The customer must prepare the ground wire.
4.3.2 Connecting the Manipulator Cable

1. Remove the package, and take out the manipulator cable. Connect the cable to the MLX100 Controller connectors.

2. Connect the manipulator to the MLX100 Controller.
   - Confirm the shape and size of the cable connector, the key fitting, and the position of the pins of the manipulator. Push the cable connector into the manipulator side connector firmly, and tighten securely.

**NOTE**

Don’t connect the grounding wire with the wires for the electric power source, the welder, etc.

Ground in accordance with all relevant governmental regulations when using metallic ducts, metallic conduits, and cable tray to construct the cable.

**NOTE**

For more information on connecting the manipulator cable, please refer to the Instruction Manual which corresponds to the particular robot model.

**CAUTION**

Always keep the MLX100 panel in an isolated enclosure.
If dust or water enter inside the drive panel, electric shock or breakdown of MLX100 Controller may result.
5 Turning ON and OFF the Power Supply

5.1 Turning ON the Main Power Supply

The main power supply is turned ON when the customer prepared, 3-phase power supply is engaged.

5.2 Turning OFF the Power Supply

5.2.1 Turning OFF the Servo Power (Emergency Stop)

The manipulator cannot be operated when an emergency stop button is pressed.

- Press the emergency stop button and the servo power supply is turned off.
- The brake operates once the servo power supply is turned OFF, and the manipulator can no longer operate. The emergency stop can be operated at any mode. (Teach mode, Play mode)

WARNING

Confirm that nobody is present in the P-point maximum envelope of the manipulator when turning ON the MLX power supply.
Failure to observe this caution could result in injury caused by accidental contact with the manipulator.
Press an emergency stop button immediately if any problems occur.

The main power supply is turned ON when the customer prepared, 3-phase power supply is engaged.
6 Test of Program Operation

6.1 Movement of the Axes

Move each axis of the manipulator by pressing the appropriate axis buttons on the MLX HMI.

**WARNING**

- Press an emergency stop button before operating the manipulator. Confirm that servo power is turned OFF.

Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Always view the manipulator from the front.
  - Always follow the predetermined operating procedure.
  - Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
  - Ensure that you have a place to retreat to in case of emergency.

Improper or unintentional manipulator operation can result in injury.

- Prior to performing the following operations, be sure that there is no one within the P-point maximum envelope of the manipulator, and be sure that you are in a safe place yourself.
  - Turning ON the MLX power
  - Moving the manipulator with the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Injury may result from collision with the manipulator to anyone entering the P-point maximum envelope of the manipulator.

**CAUTION**

- Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to the insulation and sheathing of external wires.
The following figures illustrate each axis of motion in the joint coordinates.

**NOTE**
Be sure to remove all items from the area before moving the manipulator.
Refer to the INSTRUCTION MANUAL for the appropriate position of the fixture.

*Fig. 6-1: 4-Axis Manipulator*

*Fig. 6-2: 5-Axis Manipulator*
Fig. 6-3: 6-Axis Manipulator

Fig. 6-4: 7-Axis Manipulator
7 System Setup

7.1 Home Position Calibration

**WARNING**

- Various settings control system compatibility and manipulator performance characteristics. Exercise caution when changing settings that can result in improper manipulator operation.

Personal injury and/or equipment damage may result if incorrect settings are applied by the user.
- Observe the following precautions to safeguarding system settings:
  - Maintain supervisory control of user functions.
  - Retain data backups of control settings each time settings are changed.

**WARNING**

- Before operating the manipulator, check that the servo power turns OFF when the system emergency stop buttons are pressed.

Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.
- 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.
  - Always prepare your reactions to a manipulator’s unexpected approach toward you.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.
- Prior to performing the following operations, be sure that no one is in the P-point maximum envelope of the manipulator, and be sure that you are in a safe place when:
  - Turning ON the MLX100 Controller power.

Injury may result from contact with the manipulator if persons enter the P-point maximum envelope of the manipulator.
Always press an emergency stop button immediately if there are problems.
Emergency stop buttons should be located within easy access of the MLX100 Controller.
7.1 Home Position Calibration

Home position calibration is an operation in which the home position and absolute encoder position coincide. Although this operation is performed prior to shipment at the factory, the following cases require this operation to be performed again:

- Change in the combination of the manipulator and MLX100 Controller drive panel
- Replacement of the motor or absolute encoder
- Clearing stored memory (MLX Gateway, weak battery, etc.)
- Home position deviation caused by hitting the manipulator against a workpiece, etc.

To calibrate the home position, use the axis keys to calibrate the home position mark on each axis so that the manipulator can take its posture for the home position. There are two operations for home position calibration:

- Axes can be moved individually: Recalibrate the home position for the individual axes that were affected by the replacement, if replacing the motor or absolute encoder.

If the absolute data of its posture for the home position is already known, set the absolute data again after completing home position registration.

CAUTION

- Perform the following inspection procedures prior to teaching the manipulator. If problems are found, correct them immediately, and be sure that all other necessary tasks have been performed.
  - Check for problems in manipulator movement.
  - Check for damage to the insulation and sheathing of external wires.

NOTE

Teaching and playback are not possible before the completion of the home position calibration.

In a system with two or more manipulators, the home position of all the manipulators must be calibrated before starting teaching or playback.
7.1.2 Calibrating Operation

Home position calibration can only be performed in management mode.

1. From the [Login] screen, enter User: "manager" and Password: "manager". The main screen shows "MANAGER" when successful.

2. Press the [Teach Screen] button. The RLX - Teaching and Jogging screen appears.

3. Set Jog Speed to "Inch" and Coordinate System to "Axis."

4. Turn servo power ON by pressing [Reset], and then the [Enable Servos] button.

NOTE: Home position calibration can only be performed in management mode.
5. Jog the robot to its home position marks. Adjust the Jog Speed as required.

6. When in home position, press [MENU], then [Robot Configuration].


8. Wait 10 seconds and press [Save Home Offsets].
   • Observe a WARNING appears.

9. Press the [Save Home Offsets] on the !!WARNING!! pop-up screen.
10. Wait five seconds then press [MENU] in the lower left and press the [Restart RLX-R] button.

11. The robot is now homed.

**NOTE**

When communication is re-established, the Axis Position list values should be close to zero, Motoman may have drifted slightly at servo off. It should take 15 to 30 seconds for the Robot Gateway to return to active communication.
7.1.3 Home Position of the Robot

In case of MH5, the home position are as follows.

Other manipulator models have different positions. Always refer to "MANIPULATOR INSTRUCTIONS" for the correct manipulator model.
7.1.4 Purpose of Position Check Operation

If the absolute number of rotation detected at power supply ON does not match the data stored in the absolute encoder the last time the power supply was turned OFF, an alarm is issued when the drive panel power is turned ON.

There are two possible causes of this alarm:

• Error in the encoder system
• The manipulator was moved after the power supply was turned OFF.

If there is an error with the encoder system, the manipulator may stall when playback is started. If the absolute data allowable range error alarm has occurred, playback and test runs will not function and the position must be checked.

7.1.5 Procedure after the Alarm

WARNING

• Be aware of safety hazards when performing the position confirmation of the specified point.

Abnormality of the encoder system may be the cause of the alarm. The manipulator may operate in an unexpected manner, and there is a risk of damage to equipment or injury to personnel.
### 7.2 Tool Data Setting

#### 7.2.1 Registering Tools

**7.2.1.1 Number of Tools**

There are 24 tool files numbered 0 to 23.

#### 7.2.1.2 Registering Coordinate Data

When the number input operation is used for registering the tool file, input the TCP of the tool on the flange coordinates.

1. From the Teach screen, select [Set Tool].
2. The system must be in Teach mode with all errors cleared before adjustments can be made to Tool Data. The message "Switch to TEACH mode to set" appears if the system is left in Play mode.

Fig. 7-1: Setup Tool Properties

3. While in Teach Mode, press the tool number to select the Tool Number and modify. Press the Return key after the tool number is entered.
4. Click the box to the right of the tool number to enter a text description.
5. Enter the tool data following the examples shown below in Tool A and Tool B:
7 System Setup

7.2 Tool Data Setting

Fig. 7-2: Tool A

![Tool Properties Setup](image)

Robot 0: MHEA
Tool Number 2: Tool A
Active Tool: -1

**Tool Size**
- X: 0.00 mm, Rz: 0.00 deg
- Y: 260.00 mm, Ry: 0.00 deg
- Z: 0.00 mm, Rz: 0.00 deg

**Tool Mass**
- Xg: 0.00 mm, lx: 0.00 Kg m^2
- Yg: 0.00 mm, ly: 0.00 Kg m^2
- Zg: 0.00 mm, lz: 0.00 Kg m^2
- W: 0.00 kg

Save Tool Data
Execute Change Tool

TCP
Zf

Tool A

260 mm
6. Click the [Save Tool Data] button to store the modified tool information.

**NOTE**

Tool data is not saved to the MLX until the [Save Tool Data] button is clicked. If data is incorrectly modified, simply close this screen and no changes will be made to the tool data. Similarly, changes are not retained until the [Save Tool Data] button is clicked.

7. Click on the [Execute Change Tool] button to have the robot use this tool when moving in the Tool Coordinate system. The tool appears as the active tool on the Teach screen.
8. The active tool can also be changed by entering the [Active Tool] button.
7.2.1.3 Registering Tool Angle

The tool pose data is angle data which shows the relation between the flange coordinates and the tool coordinates. The angle when the flange coordinates are rotated to meet to the tool coordinates becomes an input value. Clockwise toward the arrow is the positive direction.

In the following case, register $R_z=180$, $R_y=90$, $R_x=0$
Ry must be the input rotation angle around Y'\(_F\) flange coordinates.

\[ \text{Ry} = 90 \]

Rx must be the input rotation angle around X'\(_F\) of flange coordinates.

\[ \text{Rx} = 0 \]
7.2.1.4 Setting the Tool Load Information

The tool load information includes weight, a center of gravity position, and moment of inertia at the center of gravity of the tool installed at the flange.

7.2.2 Tool Calibration

To ensure that the manipulator can perform motion type operations such as linear and circular motion types correctly, accurate dimensional information on tools such as torches, tools, and guns must be registered and the position of the TCP must be defined.

Tool calibration is a function that enables this dimensional information to be registered easily and accurately. When this function is used, the TCP is automatically calculated and registered in the tool file.

What is registered in tool calibration is the coordinates of the TCP and the tool posture data in the flange coordinates.
After registering the tool file, check if the TCP is correctly registered by performing a TCP fixed operation like the one shown below, in any coordinate system other than the joint.

1. Move the R, B, or T axes using the axis key.
   - By pressing the axis keys for the A3, A4, and A5 axes, change the manipulator pose without changing the TCP position. If this operation shows a large TCP error, adjust the tool data.
WARNING

• When turning ON the power to MLX, be sure that there is no one within the P-point maximum envelope of the manipulator, and that you are in a safe place.

Injury may result from collision with the manipulator to anyone entering the P-point maximum envelope of the manipulator. Always press the emergency stop button immediately if there are problems.

• Always set the teach lock before starting teaching.

• 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.
  – Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
  – Ensure that you have a place to retreat to in case of emergency.

Improper or unintentional manipulator operation can result in injury.

• Before operating the manipulator, check that servo power is removed when an emergency stop button is pressed.

Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

CAUTION

• Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.
  – Check for problems in manipulator movement.
  – Check for damage to the insulation and sheathing of external wires.
### 8.1 Specification List

<table>
<thead>
<tr>
<th>Drive Panel</th>
<th>Construction</th>
<th>Dimensions</th>
<th>Cooling System</th>
<th>Ambient Temperature</th>
<th>Relative Humidity</th>
<th>Power Supply (24 VDC)</th>
<th>Grounding</th>
<th>Digital I/O</th>
<th>Positioning System</th>
<th>Drive Unit</th>
<th>Acceleration/Deceleration</th>
<th>Memory Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Free-standing, open sub panel</td>
<td>Refer to following</td>
<td>Indirect cooling</td>
<td>-5°C to + 55°C (During operation)</td>
<td>-5°C to + 55°C (During transit and storage)</td>
<td>10% to 85%RH (non-condensing)</td>
<td>Allen Bradley</td>
<td>- None provided</td>
<td>By serial communication (absolute encoder)</td>
<td>SERVOPACK for AC servomotors</td>
<td>Software servo control</td>
<td>PLC processor dependent</td>
</tr>
</tbody>
</table>

### 8.1.1 Panel Heat Loss (Estimate)

Table 8-1 “Total Amplifier Power Loss” does not include heat from the external regenerative resistor unit.

<table>
<thead>
<tr>
<th>Model Type</th>
<th>Power Loss [Watts (W)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPK50</td>
<td>1025W</td>
</tr>
<tr>
<td>MPL160 / MPL300</td>
<td>1080W</td>
</tr>
<tr>
<td>MH5 / MH5S / MH5L / MH5LS</td>
<td>190W</td>
</tr>
<tr>
<td>MPL80</td>
<td>910W</td>
</tr>
</tbody>
</table>
8.2 Equipment Configuration

The MLX100 Controller drive panel is comprised of individual units and modules. Malfunctioning components can generally be easily repaired after a failure by replacing a unit or a module.

This section explains the configuration of the MLX100 Controller equipment.

8.2.1 Arrangement of Units and Circuit Boards

The arrangements of units and circuit boards in one robot model is shown. Other robot models follow a similar layout.

- Small Capacity
  
  Fig. 8-1: Configuration - MPL160 Shown

![Diagram of MPL160 configuration]

Table 8-2: MLX100 Parts

<table>
<thead>
<tr>
<th>Description</th>
<th>MPK50</th>
<th>MPL160</th>
<th>MPL300</th>
<th>MH5*</th>
<th>MH5L*</th>
<th>MH5S</th>
<th>MH5LS</th>
<th>MPL80</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLX100 Robot Package</td>
<td>159078-1</td>
<td>159079-1</td>
<td>159433-1</td>
<td>159185-1</td>
<td>160622-1</td>
<td>161997-1</td>
<td>161965-1</td>
<td>159432-1</td>
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<tr>
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<td>158547-1</td>
<td>158546-1</td>
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<td>159181-1</td>
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<tr>
<td>Robot Manipulator</td>
<td>158465-1</td>
<td>158466-1</td>
<td>159473-1</td>
<td>159134-1</td>
<td>157710-9</td>
<td>160427-5</td>
<td>160741-5</td>
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<tr>
<td>Manipulator 1BC Cable Length, 5M</td>
<td>155685-2</td>
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<tr>
<td>Manipulator 2BC Cable Length, 5M</td>
<td>155688-2</td>
<td>151482-2</td>
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<td>155686-2</td>
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</tbody>
</table>
Table 8-2: MLX100 Parts

<table>
<thead>
<tr>
<th>Description</th>
<th>MPK50</th>
<th>MPL160</th>
<th>MPL300</th>
<th>MH5*</th>
<th>MH5L*</th>
<th>MH5S</th>
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<tr>
<td>Regen Resistor Unit</td>
<td>159036-1</td>
<td>159036-2</td>
<td>159036-2</td>
<td>160268-1</td>
<td>160268-1</td>
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<td>160268-1</td>
<td>159036-3</td>
</tr>
<tr>
<td>Cable, Regen Resistor Unit, 1M</td>
<td>159081-1</td>
<td>159081-1</td>
<td>159081-1</td>
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<td>MLX100 Gateway Module</td>
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*Discontinued June 1, 2012

Table 8-3: Configuration

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<thead>
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<th>Model Type</th>
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<td>REGEN RESISTOR</td>
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<td>MPL160/300</td>
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<td>143137-1</td>
<td>143137-1</td>
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<td>143138-1</td>
</tr>
<tr>
<td>MH5*, MH5L*, MH5S, MH5LS</td>
<td>MLX100 AXIS NAME</td>
<td>SV0</td>
<td>SV1</td>
<td>SV2</td>
<td>SV3</td>
<td>SV4</td>
<td>SV5</td>
</tr>
<tr>
<td>SERVO AMPLIFIER</td>
<td></td>
<td>157430-5</td>
<td>157430-5</td>
<td>157430-3</td>
<td>157430-10</td>
<td></td>
<td>157430-10</td>
</tr>
<tr>
<td>REGEN RESISTOR</td>
<td></td>
<td>143138-3</td>
<td>143138-3</td>
<td>143138-3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>MPL80</td>
<td>MLX100 NAME</td>
<td>SV0</td>
<td>SV1</td>
<td>SV2</td>
<td>SV3</td>
<td>SV4</td>
<td></td>
</tr>
<tr>
<td>SERVO AMP</td>
<td></td>
<td>157430-9</td>
<td>157430-9</td>
<td>157430-11</td>
<td></td>
<td></td>
<td>157430-6</td>
</tr>
<tr>
<td>REGEN RESISTOR</td>
<td></td>
<td>143137-1</td>
<td>143137-1</td>
<td>143138-1</td>
<td>NONE</td>
<td></td>
<td>143138-2</td>
</tr>
</tbody>
</table>

*Discontinued June 1, 2012
WARNING

• When turning ON the power to MLX100, be sure that there is no one within the P-point maximum envelope of the manipulator, and that you are in a safe place.

Injury may result from collision with the manipulator to anyone entering the P-point maximum envelope of the manipulator. Always press the emergency stop button immediately if there are problems.

• Always set the teach lock before starting teaching.

• 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.
  – Always have an escape plan in mind in case the manipulator comes toward you unexpectedly.
  – Ensure that you have a place to retreat to in case of emergency.

Improper or unintentional manipulator operation can result in injury.

• Before operating the manipulator, check that servo power is removed when an emergency stop button is pressed.

Injury or damage to machinery may result if the manipulator cannot be stopped in case of an emergency.

CAUTION

Perform the following inspection procedures prior to performing teaching operations. If problems are found, correct them immediately, and be sure that all other necessary processing has been performed.

– Check for problems in manipulator movement.

– Check for damage to insulation and sheathing of external wires.
Cautions for Connection of Dual Channel Safety Input Signals

**CAUTION**

- Connect the switch (contact) that turns the dual signals ON and OFF simultaneously.
- If the timing that turns the two signals ON and OFF is not right, a disagreement alarm occurs. Refer to the figure below.

![Diagram 1](image1)

**CAUTION**

- Do not connect two signals to the same contact point. (Prepare two individual contact points)
- Since the power supply for each signal is unique, it will cause a fault in the safety relay (CR502) if the signals are connected to the same contact point.

![Diagram 2](image2)
External Emergency Stop

This signal is used to connect the emergency stop switch of an external device. If the signal is input, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON.

**CAUTION**

- Always connect the signals after removing the jumpers.

If the jumpers are not removed, injury or damage to machinery may result and the external emergency stop will not work even if the signal is input.

Fig. 9-1: Connection for External Emergency Stop

If multiple E-Stop buttons are present in the system, all contacts must be wired in series to the TB2-4 status input.
**Gaurd Device / Gate Interlock**

This signal is used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is input, the servo power turns OFF. While the signal is turned ON, the servo power cannot be turned ON. Note that these signals are disabled in teach mode.

- Example devices include Light Curtains and Safety Gates

---

**CAUTION**

- Always connect the signals after removing the jumpers. If the jumpers are not removed, injury or damage to machinery may result and the external emergency stop will not work even if the signal is input.

---

**Fig. 9-2: Connection for Safety Plug**

If multiple guarding devices are present in the system, all contacts must be wired in series to the TB2-3 status input.
Installation of Safety Plug

The manipulator must be surrounded by a safeguarding and a door protected by an interlock function. The door must be opened by the technician to enter and the interlock function stops the robot operation when the door is open. The safety plug input signal is connected to the interlock signal from the gate.

If the servo power is ON when the interlock signal is input, the servo power turns OFF. The servo power cannot be turned ON while the interlock signal is input. However, the servo power does not turn OFF when the door is opened only during the teach mode. In this case, the servo power can be turned ON while the interlock signal is input.
**External Enable Switch (Deadman Switch on Teach Pendant)**

This signal is used to connect an Enable switch such as the one on the programming pendant or an additional device when two people are teaching.

---

**CAUTION**

- Always connect the signals after removing the jumpers. Injury or damage to machinery may result because the external emergency stop do not work even if the signal is input.

---

**Fig. 9-3: Connection for External Enable Switch**

If multiple External Enable Switches are present in the system, all contacts must be wired in series to the TB2-5 status input.

---

### Signal Name | Connection No. (TB2) | Dual input | Function | Factory Setting
---|---|---|---|---
EXTESP1+ | TB2-7 | Applicable | External Emergency Stop | Switch included and wired.
EXTESP1- | TB2-8 |
EXTESP2+ | TB2-14 |
EXTESP2- | TB2-15 |
PPESP1+ | TB2-8 | Applicable | Programming Pendant Emergency Stop | Short-circuit jumpers (Wired if purchased with Teach Pendant.)
PPESP1- | TB2-9 |
PPESP2+ | TB2-15 |
PPESP2- | TB2-16 |
### Signal Name | Connection No. (TB2) | Dual input | Function | Factory Setting
--- | --- | --- | --- | ---
PBESP1+ + | TB2-9 TB2-10 | Applicable | Push Button Emergency Stop | Short-circuit with jumpers
PBESP1- | TB2-16 TB2-17 | | Used to connect the emergency stop switch of an external device. If the signal is input, the servo power is turned OFF and the job is stopped. While the signal is input, the servo power cannot be turned ON. | 
PBESP2+ | TB2-10 TB2-11 | Applicable | Safety Plug/Gate Interlock | Short-circuit with a jumper cable
PBESP2- | TB2-17 TB2-18 | | Used to turn OFF the servo power if the door on the safeguarding is opened. Connect to the interlock signal from the safety plug on the safeguarding door. If the interlock signal is input, the servo power turns OFF. While the signal is turned ON. The servo power cannot be turned ON. Note that these signals are disabled in teach mode. | 
E-Stop Status | TB2-4 | Single | Emergency Stop Status Monitor | Wired to include switch (with or without Teach Pendant)
GATEINT1+ | TB2-10 TB2-11 | Applicable | Safety Plug/Gate Interlock Status Monitor | Jumpered to 0 VDC by default
GATEINT1- | TB2-17 TB2-18 | | Allows the software to know the state of the E-Stop button(s). | 
GATEINT2+ | TB2-10 TB2-11 | Applicable | External Enable Switch | Short-circuit with a jumper cable
GATEINT2- | TB2-17 TB2-18 | | Used to connect the Enable/3-Position Switch from the programming pendant used for teaching. | 
GUARD STATUS | TB2-3 | Single | Safety Plug/Gate Interlock Status Monitor | Jumpered to 0 VDC by default
EXDSW1+ | TB2-10 TB2-11 | Applicable | External Enable Switch Status Monitor | Allows the software to know the status of the External Enable Switch.
EXDSW1- | TB2-17 TB2-20 | | | 
EXDSW2+ | TB2-10 TB2-11 | Applicable | Auto (Play) Mode Selection | Switch included and wired.
EXDSW2- | TB2-17 TB2-20 | | Used to indicate mode selection. When these signals are ON the Safety Gate must remain closed for the robot to maintain the SERVO ON state. | 
MANUAL 1+ | TB2-18 TB2-19 | Applicable | Manual (Teach) Mode Selection | Switch included and wired.
MANUAL 1- | TB2-18 TB2-19 | | Used to indicate mode selection. When these signals are ON the Enable/Disable signals must remain closed to maintain the SERVO ON state. | 
MANUAL 2+ | TB2-20 TB2-19 | | | 
MANUAL 2- | TB2-20 TB2-19 | | | 
AUTO 1+ | TB2-11 TB2-12 | Applicable | Auto/Manual or Play/Teach Status Monitor | Wired to the included switch.
AUTO 1- | TB2-11 TB2-12 | | Allows the software to know the state of this switch. | 
AUTO 2+ | TB2-13 TB2-12 | | | 
AUTO 2- | TB2-13 TB2-12 | | | 
AUTO/ MANUAL PLAY/ TEACH STATUS | TB2-6 | Single | Auto/Manual or Play/Teach Status Monitor | Wired to the included switch.
9.1 SERVOPACK

A SERVOPACK consists of a converter and a PWM amplifier.

9.1.1 SERVOPACK Configuration

Table 9-1: Servopack Configuration

<table>
<thead>
<tr>
<th>Configuration Device</th>
<th>MH5, MH5L, MHSS, MH5LS</th>
<th>MPK50</th>
<th>MPL80</th>
<th>MPL160, MPL300</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model</td>
<td>Model</td>
<td>Model</td>
<td>Model</td>
</tr>
<tr>
<td>SERVOPACK</td>
<td>SV0 157430-5</td>
<td>SV0</td>
<td>157430-9</td>
<td>SV0 157430-9</td>
</tr>
<tr>
<td></td>
<td>SV1 157430-5</td>
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<td>157430-9</td>
<td>SV1 157430-9</td>
</tr>
<tr>
<td></td>
<td>SV2 157430-3</td>
<td>SV2</td>
<td>157430-9</td>
<td>SV2 157430-11</td>
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<tr>
<td></td>
<td>SV3 157430-10</td>
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<td>SV4 157430-10</td>
<td>SV4</td>
<td>157430-6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SV5 157430-10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10 MLX Software Version Upgrade Procedure

Follow the steps below when installing a new MLX software version. By following the steps below this ensures the cell specifics and system operations data is imported.

10.1 Export Robot Data for RSLogix Ladder

1. Using the MLxData Software export the teach points, interference zones, tools, and user frames. Installing the exported data into the new RSLogic takes place later.

   a) With the PC connected to the Ethernet switch, double click on the MLxData.exe file.

   **NOTE**

   Make sure the MfgControl.AdvancedHMI.Drivers.dll and Microsoft.VisualBasic.PowerPack.Vs.dll files are in the same directory as the MLxData.exe file.

2. On the MLxData screen, select the robot number the PLC processor slot number and the IP address of the PLC Ethernet card.

3. Press […] in the Export Data section of the MLxData screen to select the desired storage data directory location.
4. Select [Export All User Data] from the pull down list, and press [Start Export]. The following files will be exported.

<table>
<thead>
<tr>
<th>Actual File Name</th>
<th>What the File Is</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLx Data-RO Teach Point Export.txt</td>
<td>Teach Points of each Job</td>
</tr>
<tr>
<td>MLx Data-RO Tools Export.txt</td>
<td>Tools</td>
</tr>
<tr>
<td>MLx Data-RO User Frame Export.txt</td>
<td>User Frames</td>
</tr>
<tr>
<td>MLx Data-RO Interference Zones Export.txt</td>
<td>Interference Zones</td>
</tr>
</tbody>
</table>

* There is an option to transfer all files at one time.

**Note:** If there are files already in the directory, they will be overwritten.

**10.2 Export non-RLX Tasks from the RSLogix Ladder**

Export all PLC ladder tasks to the new PLC ladder if the tasks are to be operational after a software upgrade.

1. In the RSLogix Controller Organizer, right-click on the task, and select [Export program].
2. Confirm the file name and storage location, and press [Export].

**10.3 Backup and Load New MLX Gateway Files**

1. Use FTP software, such as Filezilla, to copy new data files to the MLX Gateway card.

A free copy of Filezilla can be downloaded from the internet at:

http://filezilla-project.org/download.php
2. Connect to the Gateway via FTP using these settings:

<table>
<thead>
<tr>
<th>Host</th>
<th>192.168.1.200</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>admin</td>
</tr>
<tr>
<td>Password</td>
<td>admin</td>
</tr>
</tbody>
</table>

3. Navigate to directory > IDE DISK2

4. Copy the "IDE Disk2" directory and paste in to the backup directory on the PC.

5. Open the IDE Disk2 directory on the Gateway and rename "_run.bat" to "_run.sav".

6. Stop RLX-R execution by cycling power on the Gateway. The "_run.bat" file normally starts at boot up.
7. Copy all new files to the following directories:
   • > ide disk2 > RLX-R.exe
   • > ide disk2 > AtEcat.dll
   • > ide disk2 > emll8255x.dll
   • > ide disk2 > DataFiles > RLxENI.xml
   • > ide disk2 > DataFiles > Robot0 > RLxInternalData.dat
   • > ide disk2 > DataFiles > Robot0 > RLxInternalData.xml
   • > ide disk2 > DataFiles > Robot1 > RLxInternalData.dat
   • > ide disk2 > DataFiles > Robot1 > RLxInternalData.xml
   • > ide disk2 > DataFiles > RLxAlarms.dat
   • > ide disk2 > DataFiles > RLxAlarms.xml

8. Rename the file “_run.sav” to “_run.bat” in the >ide disk2 directory on the Gateway.

1  Only if using a dual robot.

• Sometimes a software upgrade does not require replacement of all of these files. If the RLX-R file is sent with the revision number in the file name (example, RLX-R-3.1.0.exe), renamed the file to “RLX-R.exe”.
• Do not replace the RLxUser Data file(s) during a software upgrade. These files contain the current home offsets and axis limit data for the cell.
10.4 Download New Version of MLX Software

1. Download new version of RLX_D_x_x_x.ACD to the PLC.

The “x_x_x” represents the software version number in the file name. An example of the actual file name may be RLX_D_3_1_0.ACD.

10.5 Setup I/O Configuration in RSLogix Ladder

1. Insert devices into the I/O Configuration of the ladder and copy board software revision numbers from the old ladder.

10.6 Import Tasks into the New RSLogix Ladder

1. In the RSLogix Controller Organizer, right click on [Unscheduled Programs/Phases], and select [Import Program].

2. Browse to the desired file and press [OK] by referencing Section 10.2 “Export non-RLX Tasks from the RSLogix Ladder”.

3. Resolve alarms after importing tasks. For instance, if a modified AOI has different data types or new entries, the old AOI needs to be deleted and replaced with the new AOI. Re-establish tags by right-clicking on the tag, and selecting [New].

10.7 Import the Robot Data into RSLogix

Using MLxJob software, re-load the Job Teach Points, Interference Zones, Tools and User Frames by referencing Section 10.1 “Export Robot Data for RSLogix Ladder”.

1. Place the PLC in program mode.

2. In the Import Data area of the MLxJob main screen, press [...] to browse to a directory location where the data was stored.

3. Highlight each file to be imported, by pressing [Cntrl]-[Left Mouse Button], and press [Open]. Observe all data in Section 10.1 “Export Robot Data for RSLogix Ladder” is imported into the new RSLogix ladder.

4. Press [Start Import of Listed Files].
MLX100 Controller

10 MLX Software Version Upgrade Procedure

10.8 Configure the new RLX_HMI_x_x_x.mer file to see the “RLXx_x_x” processor.

5. After files are imported, a confirmation message will be displayed. Press [OK] to continue.

10.8 Configure the new RLX_HMI_x_x_x.mer file to see the “RLXx_x_x” processor.

The “x_x_x” represents the software version number in the file name. An example of the actual file name may be RLX_HMI_3_1_0.mer.

1. Refer to Chapter 12 Factory Talk View HMI and complete the steps on how to setup the Factory Talk View HMI.

10.9 Teach Pendant Software Upgrade.

If a teach pendant is installed on the cell complete Chapter 11 for How to Upgrade the Teach Pendant Software steps.
11 Teach Pendant Software Upgrade Procedure

Follow the steps below when installing a new MLX software version. By following the steps below this ensures the cell specifics and system operations data is imported.

11.1 Configure PC to use a Static IP.

1. Attach ethernet cable between the teach pendant and the PC.
2. Open the Internet Protocol (TCP/IP) Properties screen.
3. Select “Use the following IP address”:

![Internet Protocol (TCP/IP) Properties](image)

11.1.1 Prepare Pendant to Set the IP Address for the NEW / UN-PROGRAMMED System

After power up, if the screen below is displayed, this is an un-programmed pendant if this screen does not appear complete Section 11.1.2 “Prepare Pendant to Change IP Address for an Upgraded System”
11 Teach Pendant Software Upgrade Procedure

11.1 Configure PC to use a Static IP.

3. Proceed to Section 11.1.3 “Setting IP Address for Pendant”

11.1.2 Prepare Pendant to Change IP Address for an Upgraded System

Ensure the screen in Section 11.1.1 “Prepare Pendant to Set the IP Address for the NEW / UN-PROGRAMMED System” is not present before performing the following steps. If the screen is present perform Section 11.1.1 “Prepare Pendant to Set the IP Address for the NEW / UN-PROGRAMMED System” instead of the following steps.

1. Press the SYSTEM key on the pendant (purple, right side).
2. Press the F1 key (this should say MODE on the screen).
6. Proceed to Section 11.1.3 “Setting IP Address for Pendant”

11.1.3 Setting IP Address for Pendant

The following steps are completed after either Section 11.1.1 “Prepare Pendant to Set the IP Address for the NEW / UN-PROGRAMMED System” or Section 11.1.2 “Prepare Pendant to Change IP Address for an Upgraded System”.

1. Set the IP address to 192.168.1.100, if required.
2. Set the Gateway to 0.0.0.0, if required.
3. Set the Sub-mask to 255.255.255.0, if required.
5. Verify Communication between the computer and the teach pendant
   a) Start a command prompt (cmd.exe).
   b) Type PING 192.168.1.100

NOTE: If the command is not successful the IP address is not set correctly in the Teach Pendant or PC, or there is a failure with the Ethernet cable connection.
11.2 Setup the Fuji V-SFTV5 Monitouch Program

1. Start the Fuji V-SFTV5 Monitouch programming software.

2. Open the project file (*.v8).

3. From the left hand window, navigate to Device Connection Settings and then double click on “PLC1”. In the window on the right, change the tabbed view to show “Target Settings” as shown.

4. Enter the IP address as 192.168.1.2

   • The IP address may differ and should be checked with the IP address on the bare arm PLC test station - this will cycle across the EtherNet/IP module.

   • Do not change the port or communication problems will occur.

   • If this is a custom system this IP address should be set the same as the address of the ControlLogix Ethernet/IP card.
5. Adjust the network table by navigating to Ethernet and double clicking on “Network Table” in the left hand window.

6. Set the “PLC” IP to 192.168.1.2 refer to step 3 for a custom setting.

7. Set the “Monitouch” IP to 192.168.1.100.

**NOTE** To modify an address, first click on the No. next to the port name.
11.3 Transfer Screen Data to Teach Pendant

1. Select “Transfer” from the File menu and verify the IP address of the pendant at bottom of the screen is correct (192.168.1.100)

If the correct address is not displayed, press [Communication Setting...], and select “Ethernet”. Enter the correct IP address and press [OK].

2. Press the first [PC->] button to transfer from the PC to the Teach Pendant

3. Observe the following screen appears and press [OK].
4. Observe the following screens appear on the PC and a blue message in the bottom left corner of the Teach Pendant saying “Transfer Data” indicating a transfer is taking place.

5. Observe when transfer is complete nothing appears to confirm success.

- If this message appears means some failure in the communication setup.

- If a “ping” was verified in Section 11.1.3 “Setting IP Address for Pendant” step 5 then check all other settings in the software setup and repeat.
11.4 Install the RLx Version Label

Place the RLx version label on the back of the pendant to indicate the software version.
12 Sigma-5 Amplifier Parameter Upgrade Procedure

1. Attach a USB cable between the PC, and the SV0 port labeled CN7.

2. Start the SigmaWin+ program, select [Online] mode and then click [Search].

3. When the “Search Condition Setting” screen appears select:
   - Only [Sigma ΣV] under the “Target Servopack Series Setting” section.
   - [Search] under the “USB” tab

   **NOTE**
   If Search was missed or not selected contact Motoman Customer Service for driver help.

4. Press the [Search] button at the bottom of the Search Condition Setting screen.
5. Observe the Searching screen appears indicating that SigmaWin has begun searching.

6. Observe a Servopack and Servomotor with Option is available, if successful. Click on the item in the list and select [Connect].

7. Go to the Parameters menu and select Edit Parameters.
8. Select [Import] from the Parameter Editing screen.

9. Select the file for this servopack and press [Open].

10. Select the checkbox “Select All” and press [Write].
12 Sigma-5 Amplifier Parameter Upgrade Procedure

11. Observe transfer screen appears showing parameters are transferring.


13. Move the USB cable to the next servo pack. Select the [File] tab, and press [Connect].

14. Repeat step 2 through step 12 for all servo packs on the panel.

**NOTE**
The number of servo packs will vary based on the robot model.

15. Cycle power to the off position and then reapply power after 15 seconds.
13 HMI COMMUNICATIONS SETUP PROCEDURE

13.1 Configuring Factory Talk Administration Console

1. Factory Talk ME station requires a few configuration steps to display the RLX HMI correctly. Before you can run the HMI runtime file, you need to confirm that the PLC is visible to all Rockwell Tools.

2. Select Start -> Programs -> Rockwell Software -> Factory Talk Administration Console.

3. Select the “Local” directory and press [OK].

*Fig. 13-1: FT Administration Console Directory*

4. The FactoryTalk “Administration Console Explorer” opens and you will see something like *Fig. 13-2 “FT Administration Console Explorer”*. If a PLC has already been configured on the local computer you will see something like *Fig. 13-3 “FT Administration Console Explorer with PLCs”*. If your system’s setup looks like *Fig. 13-2 “FT Administration Console Explorer”* then continue to step 5. If not then skip to Section 13.2 “Configuring Factory Talk ME Station” on page 13-5.

*Fig. 13-2: FT Administration Console Explorer*

*Fig. 13-3: FT Administration Console Explorer with PLCs*
5. To have Factory Talk Administration Console see a PLC you need to add a driver. Right click on the “RSLinx Enterprise” in the Explorer window and select “Add Driver”, see Fig. 13-4 “Administration Console - Adding a Driver”.

Fig. 13-4: Administration Console - Adding a Driver

6. The add driver selection screen is shown in Fig. 13-5 “FT Administration Console - Driver Selection”. Select the Ethernet driver and click OK.

Fig. 13-5: FT Administration Console - Driver Selection
7. Next you will be presented with the “Ethernet Driver” properties screen shown in Fig. 13-6 “Administration Console - Driver Configuration”.

Fig. 13-6: Administration Console - Driver Configuration

8. If the computer is connected to the PLC then you will start to see the PLC’s on the network. If you do not see your PLC then right click on the “Ethernet” driver and add a device. See Fig. 13-7 “Administration Console - Add Device”.

Fig. 13-7: Administration Console - Add Device
9. Now a “Device Properties” screen will open. Here you can name the device and assign it an IP address, see Figure 8.

Fig. 13-8: Administration Console - Device Properties

10. Once you have entered the correct IP address, click OK. After this step you should see your PLC in the Explorer window.
13.2 Configuring Factory Talk ME Station

1. After confirming that your PLC shows up in Factory Talk Administration Console go ahead and start Factory Talk ME Station.

Fig. 13-9: Initial FT ME Station Screen

2. Press “Terminal Settings”.

3. Click on the “Network and Communications” button to confirm that ME station is pointing to the correct IP address of the PLC that is running RLX.

Fig. 13-10: FT ME Station Terminal Settings
4. On the “Network and Communications” screen select the RSLinx option then, press enter.

*Fig. 13-11: FT ME Station Networks and Communications*

*Fig. 13-12: FT ME RSLinx Configuration*
5. Select the PLC that holds the RLX-CPU module. If the IP address of the PLC is not correct then click the “Edit Device” button and enter the correct IP address, see Figure 13.

Fig. 13-13: FT ME Station Edit Device Address

6. After confirming that the IP address is correct, highlight the Logix CPU that is running the robot’s program then click the “Close” button. Click the ‘Close’ button through the screens until you get back to the start screen shown in Section 13-9 “Initial FT ME Station Screen” on page 13-5.

7. Now select the “Load Application” button and choose the .mer file to run. When you load a .mer file you will be prompted to replace the Communications settings with the application settings, select NO for this confirmation, see Fig. 13-14 “FT ME Replace Communications”.

Fig. 13-14: FT ME Replace Communications
8. After the .mer file is loaded, Factory Talk ME will present the screen shown in Fig. 13-15 “FT ME Replace System Directory”. This is just letting you know that the existing Factory Talk configuration will be saved and restored later, select “Yes”.

Fig. 13-15: FT ME Replace System Directory

9. Now that the .mer file is loaded, we need to confirm that the application settings are correct. Do this by clicking the “Application Settings” button from the FT View ME Station main screen.

Fig. 13-16: FT View ME Station Application Settings
10. Highlight the “Device Shortcuts” and click enter. You will now see a screen that has a shortcut named “rlx”. See Fig. 13-17 “FT View ME Station Short Cutt Settings”. This is the name used for the PLC inside the HMI. Because of this the local computer must also have a target with the same name.

Fig. 13-17: FT View ME Station Short Cutt Settings

11. Press the “Enter” button and a screen will open that shows the PLC’s you have configured using FactoryTalk Administration Console. See Fig. 13-18 “FT View ME Station Edit Short Cuts”. Highlight the PLC that runs the RLX software and press “Ok”.

Fig. 13-18: FT View ME Station Edit Short Cuts
12. Now press “Close” until you are taken back to the Factory Talk ME Station main screen. Now that the .mer file is loaded, select “Run Application”, Fig. 13-19 “FT View ME Station Run Application”. The RLX HMI will now be displayed.

*Fig. 13-19: FT View ME Station Run Application*
MLX100
INSTRUCTIONS

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