



User Manual  
version 3-2





# Contents

- Section 1 - Introduction .....1-1**
  - 1.1 Intended Use ..... 1-1
  - 1.2 Release Details ..... 1-1
  - 1.3 Warranty ..... 1-1
  - 1.4 Return Policy ..... 1-1
  - 1.5 Movement or Resale of Mold-Masters Products or Systems ..... 1-1
  - 1.6 Copyright ..... 1-2
  - 1.7 Units of Measure and Conversion Factors ..... 1-2
  
- Section 2 - Global Support .....2-1**
  - 2.1 Corporate Offices..... 2-1
  - 2.2 International Representatives..... 2-2
  
- Section 3 - Safety.....3-1**
  - 3.1 Introduction ..... 3-1
  - 3.2 Safety Hazards ..... 3-2
  - 3.3 Operational Hazards..... 3-5
  - 3.4 General Safety Symbols..... 3-7
  - 3.5 Wiring Check ..... 3-8
  - 3.6 Lockout Safety ..... 3-9
    - 3.6.1 Electrical Lockout..... 3-10
    - 3.6.2 Energy Forms and Lockout Guidelines..... 3-11
  - 3.7 Ground Connections..... 3-12
  - 3.8 Disposal..... 3-12
  - 3.9 M-Ax Safety Hazards..... 3-13
    - 3.9.1 Operational Environment..... 3-13
  
- Section 4 - Hardware Overview .....4-1**
  - 4.1 System Overview..... 4-1
  - 4.2 Controller Back ..... 4-2
  - 4.3 Maximum Cable Lengths..... 4-3
  
- Section 5 - Software Overview .....5-1**
  - 5.1 Main Screen ..... 5-1
    - 5.1.1 Header ..... 5-1
    - 5.1.2 Navigation Bar ..... 5-2
    - 5.1.3 Left Panel..... 5-4
    - 5.1.4 Contextual (Right) Panel..... 5-6
    - 5.1.5 Footer ..... 5-7
    - 5.1.6 Home Screen..... 5-10
  - 5.2 Page Directory ..... 5-12
  - 5.3 Axis ..... 5-16
    - 5.3.1 Motion Page..... 5-16
    - 5.3.2 Motion Detailed-Dialog Box ..... 5-19
    - 5.3.3 Interlock Detailed-Dialog Box ..... 5-24

- 5.3.4 Dynamic Monitoring .....5-27
- 5.3.5 Axis Configuration.....5-33
  - 5.3.5.1 Axis Tab .....5-33
  - 5.3.5.2 General Tab .....5-34
  - 5.3.5.3 Motion Tab .....5-36
  - 5.3.5.4 Shot Pin Tab .....5-37
- 5.3.6 Drive Configuration .....5-39
- 5.3.7 Motor Configuration .....5-41
  - 5.3.7.1 Motor-Selection Dialog Box .....5-42
- 5.3.8 Calibration.....5-46
- 5.4 Custom I/O .....5-48
- 5.5 Trace.....5-53
  - 5.5.1 Trace Page .....5-53
  - 5.5.2 Trace Configuration Page .....5-54
- 5.6 HMI Configuration.....5-57
- 5.7 Euromap 67 (EM67) .....5-59
- 5.8 Alarms.....5-62
- 5.9 Data .....5-64
  - 5.9.1 Recipe.....5-64
  - 5.9.2 Fixed .....5-66
  - 5.9.3 User Data.....5-68
- 5.10 Documents .....5-70
  - 5.10.1 PDF/Documents Page .....5-70
  - 5.10.2 Web .....5-71
    - 5.10.2.1 System Diagnostics Manager (SDM) .....5-72
    - 5.10.2.2 Mapp Cockpit.....5-72
- 5.11 Production.....5-74
  - 5.11.1 Production Page .....5-74
  - 5.11.2 Mold Coding (Option).....5-76
- 5.12 Wait Timers.....5-77
- 5.13 Schedule.....5-78
- 5.14 Change Log .....5-81
- 5.15 Log Book .....5-82
- 5.16 Machine Information .....5-84
- 5.17 Data Logger.....5-85
  - 5.17.1 Data Logger Page.....5-85
  - 5.17.2 Data Logger Configuration.....5-87
- 5.18 Cycle Information.....5-89
- 5.19 Material Data .....5-91
- 5.20 Free Timers .....5-93
- 5.21 Counters .....5-95
- 5.22 Key Switch.....5-96

**Section 6 - System Setup.....6-1**

- 6.1 Installation .....6-1
- 6.2 Connecting the M-Ax to a power supply.....6-2
- 6.3 Connecting the molding machine to the M-Ax.....6-2
- 6.4 Connecting a robot to the M-Ax.....6-2



<b>Section 7 - Operation .....</b>	<b>7-1</b>
7.1 Logging in .....	7-1
7.2 Configuring the Controller.....	7-2
7.2.1 Configuring the I/O.....	7-2
7.2.1.1 Navigating to the Custom I/O page .....	7-2
7.2.1.2 Assigning a custom name.....	7-2
7.2.1.3 Adding an output condition .....	7-3
7.2.1.4 Editing an output condition .....	7-5
7.2.1.5 Deleting an output condition .....	7-6
7.2.1.6 Editing an output setting .....	7-6
7.2.2 Configuring an axis.....	7-7
7.2.2.1 Navigating to an axis page .....	7-7
7.2.2.2 Enabling an axis .....	7-8
7.2.2.3 Configuring axis position, torque, and motion parameters .....	7-9
7.2.2.4 Configuring a motor.....	7-10
7.2.2.5 Determining a commutation offset.....	7-10
7.2.2.6 Configuring a drive .....	7-11
7.2.2.7 Auto-tuning a controller.....	7-11
7.2.2.8 Manually calibrating an axis .....	7-11
7.2.2.9 Using automatic calibration of an axis .....	7-12
7.2.2.10 Configuring the axis motion.....	7-12
7.2.3 Recipe/Fixed Data .....	7-14
7.2.3.1 Creating a recipe file.....	7-14
7.2.3.2 Saving recipe data.....	7-14
7.2.3.3 Deleting a recipe file.....	7-14
7.2.3.4 Creating a fixed data file.....	7-15
7.2.3.5 Saving fixed data .....	7-15
7.2.3.6 Deleting a fixed data file .....	7-15
7.2.4 User Management .....	7-16
7.2.4.1 Navigating to the User Management Page .....	7-16
7.2.4.2 Creating a user .....	7-17
7.2.4.3 Deleting a user .....	7-18
7.2.4.4 Exporting user management data .....	7-18
7.2.4.5 Importing user management data .....	7-19
7.3 Using the controller.....	7-20
7.3.1 Powering the motors.....	7-20
7.3.2 Turning off power to the motors .....	7-20
7.3.3 Putting the controller into setup mode .....	7-21
7.3.4 Putting the controller into calibration mode.....	7-21
7.3.5 Putting the controller into manual mode .....	7-22
7.3.6 Putting the controller into auto mode.....	7-22
<b>Section 8 - Maintenance.....</b>	<b>8-1</b>
8.1 Replacement Parts .....	8-1
8.2 Cleaning and Inspection .....	8-1
<b>Index .....</b>	<b>I</b>

# Section 1 - Introduction

The purpose of this manual is to assist users in the integration, operation and maintenance of the M-Ax controller. This manual is designed to cover most system configurations. If you need additional information specific to your system please contact your representative or a *Mold-Masters* office whose location can be found in the “Global Support” section.

## 1.1 Intended Use

The M-Ax controller is a servo drive controller, which is designed to be safe during normal operation. Any other uses would fall outside the engineered intent of this machine and may result in safety hazards. Use of this unit outside of its intended scope will void any and all warranties.

This manual is written to be used by skilled persons who are familiar with hot runner controllers and their terminology. Operators should be familiar with plastic injection molding machines and the controls of such equipment. Maintenance persons should have sufficient understanding of electrical safety to appreciate the dangers of 3-phase supplies. They should know how to take appropriate measures to avoid any danger from electrical supplies.

## 1.2 Release Details

Table 1-1 Release Details		
Document Number	Release Date	Version
UM--M-Ax--ENG--00--03	September 2022	03
UM--M-Ax--ENG--03-1	August 2023	03-1
UM--M-Ax--ENG--03-2	May 2024	03-2

## 1.3 Warranty

For current warranty information please refer to the documents available on the website [www.moldmasters.com/support/warranty](http://www.moldmasters.com/support/warranty) or contact your *Mold-Masters* representative.

## 1.4 Return Policy

Please do not return any parts to *Mold-Masters* without a pre-authorization and a return authorization number supplied by *Mold-Masters*.

Our policy is one of continuous improvement, and *Mold-Masters* reserves the right to alter product specifications at any time without giving notice.

## 1.5 Movement or Resale of Mold-Masters Products or Systems

This documentation is intended for use in the country of destination for which the product or system was purchased.

Mold-Masters takes no responsibility for documentation of products or systems if they are relocated or resold outside the intended country of destination, as stated on the accompanying invoice and/or waybill.

## 1.6 Copyright

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## 1.7 Units of Measure and Conversion Factors



### NOTE

The dimensions given in this manual are from original manufacturing drawings.

All values in this manual are in S.I. units or subdivisions of these units. Imperial units are given in parenthesis immediately after the S.I. units.

Table 1-2 Units of Measure and Conversion Factors		
Abbreviation	Unit	Conversion Value
bar	Bar	14.5 psi
in.	Inch	25.4 mm
kg	Kilogram	2.205 lb
kPa	Kilopascal	0.145 psi
gal	Gallon	3.785 l
lb	Pound	0.4536 kg
lbf	Pound force	4.448 N
lbf.in.	Pound force inch	0.113 Nm
l	Litre	0.264 gallon
min	Minute	
mm	Millimeter	0.03937 in.
mΩ	Milli Ohm	
N	Newton	0.2248 lbf
Nm	Newton Meter	8.851 lbf.in.
psi	Pound per square inch	0.069 bar
psi	Pound per square inch	6.895 kPa
rpm	Revolutions per minute	
s	Second	
°	Degree	
°C	Degree Celsius	0.556 (°F -32)
°F	Degree Fahrenheit	1.8 °C +32

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# Section 3 - Safety

## 3.1 Introduction

Please be aware that the safety information provided by *Mold-Masters* does not absolve the integrator and employer from understanding and following international and local standards for safety of machinery. It is the responsibility of the end integrator to integrate the final system, provide necessary e-stop connections, safety interlocks and guarding, to select the appropriate electrical cable for the region of use and to ensure compliance with all relevant standards.

It is the responsibility of the employer to:

- Properly train and instruct its personnel in the safe operation of equipment, including the use of all the safety devices.
- Provide its personnel with all necessary protective clothing, including such items as a face shield and heat resistant gloves.
- Ensure the original and continuing competence of personnel caring for, setting up, inspecting and maintaining injection molding equipment.
- Establish and follow a program of periodic and regular inspections of injection molding equipment to ensure it is in safe operating condition and proper adjustment.
- Ensure that no modifications, repairs or rebuild of portions are made to the equipment that reduces the level of safety existing at time of manufacture or remanufacture.

### 3.2 Safety Hazards



**WARNING**

Also refer to all machine manuals and local regulations and codes for safety information.

The following safety hazards are most commonly associated with injection molding equipment. See European Standard EN201 or American Standard ANSI/SPI B151.1.

Refer to the illustration of hazard areas below when reading the Safety Hazards Table 3-1 on page 3-3.

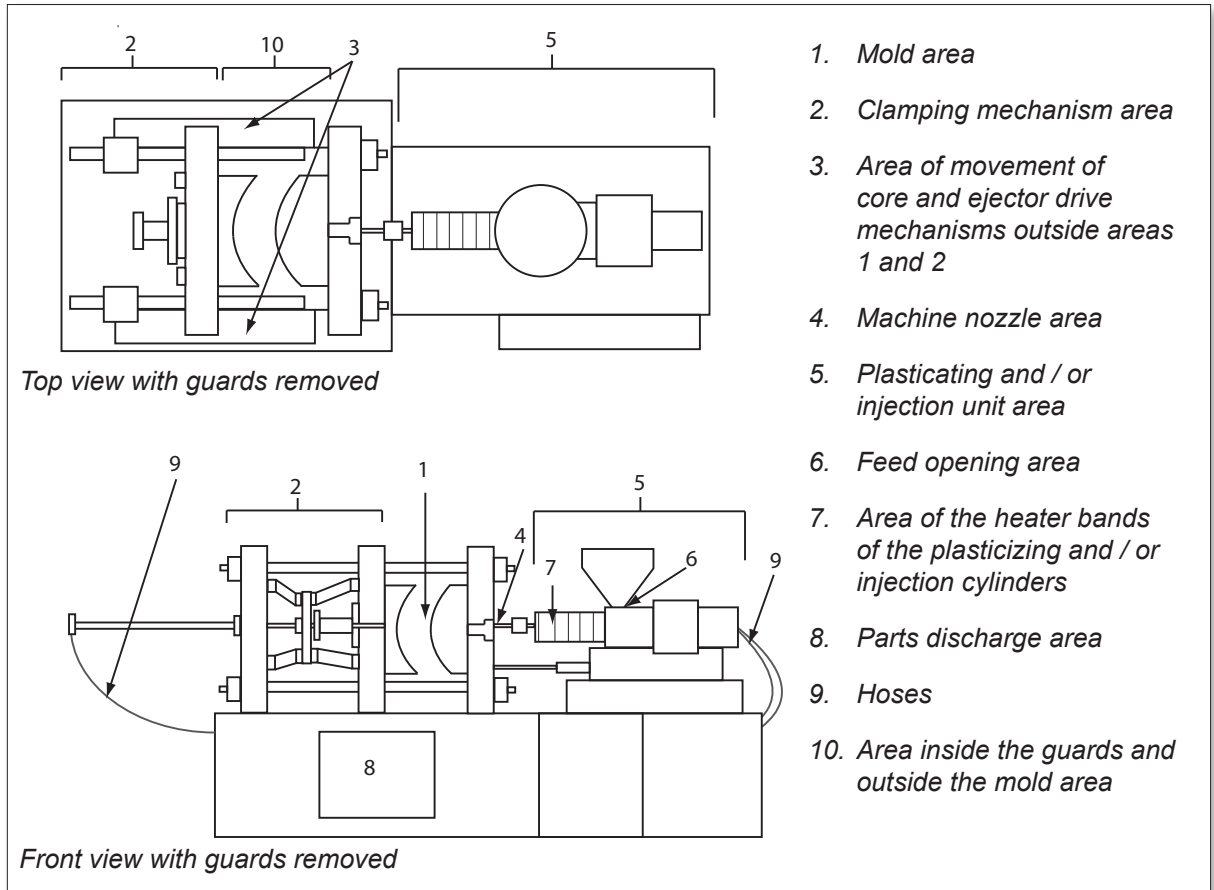


Figure 3-1 Injection molding machine hazard areas

<b>Table 3-1 Safety Hazards</b>	
<b>Hazard Area</b>	<b>Potential Hazards</b>
<p><b>Mold Area</b> Area between the platens.</p>	<p><b>Mechanical Hazards</b> Crushing and/or shearing and / or impact hazards caused by:</p> <ul style="list-style-type: none"> <li>• Movement of the platen</li> <li>• Movements of the injection barrel(s) into the mold area</li> <li>• Movements of cores and ejectors and their drive mechanisms</li> <li>• Tie bar motion</li> </ul> <p><b>Thermal Hazards</b> Burns and / or scalds due to operating temperature of: The mold heating elements Plasticized material released from / through the mold.</p>
<p><b>Clamping Mechanism Area</b></p>	<p><b>Mechanical Hazards</b> Crushing and / or shearing and / or impact hazards caused by:</p> <ul style="list-style-type: none"> <li>• Movement of the platen</li> <li>• Movement of the drive mechanism of the platen</li> <li>• Movement of the core and ejector drive mechanism</li> </ul>
<p><b>Movement of Drive Mechanisms Outside the Mold Area and Outside the Clamping Mechanism Area</b></p>	<p><b>Mechanical Hazards</b> Mechanical hazards of crushing, shearing and / or impact caused by the movements of:</p> <ul style="list-style-type: none"> <li>• Core and ejector drive mechanisms</li> </ul>
<p><b>Nozzle Area</b> The nozzle area is the area between the barrel and the sprue bushing.</p>	<p><b>Mechanical Hazards</b> Crushing, shearing hazards, and / or impact hazards caused by:</p> <ul style="list-style-type: none"> <li>• Forward movement of the plasticizing and / or injection unit including nozzle</li> <li>• Movements of parts of-the power operated nozzle shutoff and their drives</li> <li>• Over pressurization in the nozzle</li> </ul> <p><b>Thermal Hazards</b> Burns and or scalds due to operating temperature of:</p> <ul style="list-style-type: none"> <li>• The nozzle</li> <li>• Plasticized material discharging from the nozzle</li> </ul>
<p><b>Plasticizing and / or Injection Unit Area</b> Area from the adapter / barrel head / end cap to the extruder motor above the sled including the carriage cylinders.</p>	<p><b>Mechanical Hazards</b> Crushing, shearing and / or drawn-into hazards caused by:</p> <ul style="list-style-type: none"> <li>• Unintentional gravity movements e.g. for machines with plasticizing and / or injection unit positioned above the mold area</li> <li>• The movements of the screw and / or the injection plunger in the cylinder accessible through the feed opening</li> <li>• Movement of the carriage unit</li> </ul> <p><b>Thermal Hazards</b> Burns and or scalds due to operating temperature of:</p> <ul style="list-style-type: none"> <li>• The plasticizing and / or injection unit</li> <li>• The heating elements e.g. heater bands</li> <li>• The plasticized material and / or vapors discharging from the vent opening, feed throat or hopper</li> </ul> <p><b>Mechanical and / or Thermal Hazard</b> Hazards due to reduction in mechanical strength of the plasticizing and / or injection cylinder due to overheating</p>
<p><b>Feed Opening</b></p>	<p>Pinching and crushing between injection screw movement and housing</p>



<b>Table 3-1 Safety Hazards</b>	
<b>Hazard Area</b>	<b>Potential Hazards</b>
<b>Area of the Heater Bands of the Plasticizing and / or Injection Cylinders</b>	<p>Burns and / or scalds due to operating temperature of:</p> <ul style="list-style-type: none"> <li>• The plasticizing and / or injection unit</li> <li>• The heating elements e.g. heater bands</li> <li>• The plasticized material and / or vapors discharging from the vent opening, feed throat or hopper</li> </ul>
<b>Parts Discharge Area</b>	<p><b>Mechanical Hazards</b>            Accessible Through the Discharge Area            Crushing, shearing and / or impact hazards caused by:</p> <ul style="list-style-type: none"> <li>• Closing movement of the platen</li> <li>• Movements of cores and ejectors and their drive mechanisms</li> </ul> <p><b>Thermal Hazards</b>            Accessible Through the Discharge Area            Burns and / or scalds due to operating temperature of:</p> <ul style="list-style-type: none"> <li>• The mold</li> <li>• Heating elements of the mold</li> <li>• Plasticized material released from/through the mold</li> </ul>
<b>Hoses</b>	<ul style="list-style-type: none"> <li>• Whipping action caused by hose assembly failure</li> <li>• Possible release of fluid under pressure that can cause injury</li> <li>• Thermal hazards associated with hot fluid</li> </ul>
<b>Area Inside the Guards and Outside the Mold Area</b>	<p>Crushing and / or shearing and / or impact hazards caused by:</p> <ul style="list-style-type: none"> <li>• Movement of the platen</li> <li>• Movement of the drive mechanism of the platen</li> <li>• Movement of the core and ejector drive mechanism</li> <li>• Clamp opening movement</li> </ul>
<b>Electrical Hazards</b>	<ul style="list-style-type: none"> <li>• Electrical or electromagnetic disturbance generated by the motor control unit</li> <li>• Electrical or electromagnetic disturbance that can cause failures in the machine control systems and adjacent machine controls</li> <li>• Electrical or electromagnetic disturbance generated by the motor control unit</li> </ul>
<b>Hydraulic Accumulators</b>	High pressure discharge
<b>Power Operated Gate</b>	Crush or impact hazards caused by the movement of the power operated gates
<b>Vapors and Gases</b>	Certain processing conditions and / or resins can cause hazardous fumes or vapors

### 3.3 Operational Hazards



#### WARNINGS



- Refer to all machine manuals and local regulations and codes for safety information.
- The equipment supplied is subjected to high injection pressures and high temperatures. Ensure that extreme caution is observed in the operation and maintenance of the injection molding machines.
- Only fully trained personnel should operate or maintain equipment.
- Do not operate the equipment with unconfined long hair, loose clothing or jewelry, including name badges, neckties, etc. These may get caught in the equipment and can cause death or serious injury.
- Never disable or bypass a safety device.
- Ensure that the protective guards are placed around the nozzle to prevent the material from splashing or drooling.
- A burn hazard exists from material during routine purging. Wear heat-resistant personal protective equipment (PPE) to prevent burns from contact with hot surfaces or splatter of hot material and gases.
- Material purged from machine may be extremely hot. Ensure protective guards are in place around the nozzle to prevent material from splashing. Use proper personal protective equipment.
- All operators should wear personal protective equipment, such as face shields and use heat resistant gloves when working around the feed inlet, purging the machine or cleaning the gates of the mold.
- Remove purged material from the machine immediately.
- Decomposing or burning material could result in noxious gases being emitted from the purged material, feed inlet or mold.
- Ensure proper ventilation and exhaust systems are in place to help prevent inhalation of harmful gases and vapors.
- Consult manufacturer's Material Safety Data Sheets (MSDS).
- Hoses fitted to the mold will contain high or low temperature fluids or air under high pressure. The operator must shut down and lockout these systems as well as relieving any pressure before performing any work with these hoses. Regularly inspect and replace all flexible hoses and restraints.
- Water and / or hydraulics on the mold may be in close proximity to electrical connections and equipment. Water leakage may cause an electrical short circuit. Hydraulic fluid leakage may cause a fire hazard. Always keep water and / or hydraulic hoses and fittings in good condition to avoid leaks.
- Never perform any work on the mold machine unless the hydraulic pump has been stopped.
- Check frequently for possible oil leaks / water leaks. Stop the machine and make repairs.

**WARNING**

- Make sure that the cables are connected to the correct motors. Cables and motors are clearly labeled. Reversing the cables can result in unexpected and uncontrolled motion causing a safety risk or damage to the machine.
- A crushing hazard exists between the nozzle and mold melt inlet during carriage forward motion.
- A possible shearing hazard exists between the edge of the injection guard and the injection housing during injection.
- The open feed port could present a hazard to a finger or a hand inserted during operation of the machine.
- The electric servo motors could overheat presenting a hot surface which could cause burns to someone touching it.
- The barrel, barrel head, nozzle, heater bands and mold components are hot surfaces which could result in burns.
- Keep flammable liquids or dust away from the hot surfaces as they could ignite.
- Follow good housekeeping procedures and keep floors clean to prevent slips, trips and falls due to spilled material on the work floor.
- Apply engineering controls or hearing conservation programs as necessary to control noise.
- When doing any work on the machine that requires moving and lifting the machine, ensure that lifting equipment (eyebolts, fork lift truck, cranes, etc.) will have sufficient capacity to handle mold, auxiliary injection unit or Hot Runner weight.
- Connect all lifting devices and support the machine using a crane of adequate capacity before commencing work. Failure to support the machine can result in severe injury or death.
- Mold cable from the controller to the mold must be removed before servicing the mold.

### 3.4 General Safety Symbols

Table 3-2 Typical Safety Symbols	
Symbol	General Description
	<b>General – Warning</b> Indicates an immediate or potentially hazardous situation, which if not avoided, could result in a serious injury or death, and / or damage to equipment.
	<b>Warning – Barrel Cover Grounding Strap</b> Lockout / tagout procedures must be followed before removing the barrel cover. Barrel cover can become energized upon removal of grounding straps and contact can result in death or serious injury. Grounding straps must be reconnected before reconnecting power to machine.
	<b>Warning – Crushing and / or Impact Points</b> Contact with moving parts can cause serious crushing injury. Always keep guards in place.
	<b>Warning – Crush Hazard Closing Mold</b>
	<b>Warning – Hazardous Voltage</b> Contact with hazardous voltages will cause death or serious injury. Turn off power and review electrical schematics before servicing equipment. May contain more than one live circuit. Test all circuits before handling to make sure circuits have been de-energized.
	<b>Warning – High Pressure</b> Overheated fluids may cause severe burns. Discharge pressure before disconnecting water lines.
	<b>Warning – High Pressure Accumulator</b> Sudden release of high pressure gas or oil can cause death or serious injury. Discharge all gas and hydraulic pressure before disconnecting or disassembling accumulator.
	<b>Warning – Hot Surfaces</b> Contact with exposed hot surfaces will cause serious burn injury. Wear protective gloves when working near these areas.
	<b>Mandatory – Lockout / Tagout</b> Ensure that all energies are properly locked out, and remain locked out until the service work is completed. Servicing equipment without disabling all internal and external power sources can cause death or serious injury. De-energize all internal and external power sources (electrical, hydraulic, pneumatic, kinetic, potential, and thermal).
	<b>Warning – Molten Material Splashing Hazard</b> Molten material or high pressure gas can cause death or severe burns. Wear personal protective equipment while servicing the feed throat, nozzle, mold areas and when purging the injection unit.
	<b>Warning – Read Manual Before Operation</b> Personnel should read and understand all instructions in the manuals before working on equipment. Only properly trained personnel should operate the equipment.
	<b>Warning – Slip, Trip or Fall Hazard</b> Do not climb on equipment surfaces. Serious slip, trip or fall injuries can result from personnel climbing on equipment surfaces.

Table 3-2 Typical Safety Symbols	
Symbol	General Description
	<b>Caution</b> Failure to follow instructions may damage equipment
	<b>Important</b> Indicates additional information or used as a reminder

### 3.5 Wiring Check



#### CAUTION

System Mains Supply Wiring:

- Before connecting the system to a power supply, it is important to check that the wiring between the system and the power supply has been done correctly.
- Particular attention must be given to the current rating of the power supply. For example, if a controller is rated at 63A, then the power supply must also be rated at 63A.
- Check that the phases of power supply are wired correctly.

Controller to Mold Wiring:

- For separate power and thermocouple connections, ensure that the power cables are never connected to the thermocouple connectors and vice-versa.
- For mixed power and thermocouple connections, ensure that the power and thermocouple connections have not been wired incorrectly.

Communications Interface and Control Sequence:

- It is the customer’s responsibility to verify functionality of any custom machine interface at safe speeds, prior to operating equipment in the production environment at full speed in automatic mode.
- It is the customer’s responsibility to verify all required motion sequences are correct, prior to operating equipment in the production environment at full speed in automatic mode.
- Switching the machinery into Auto mode without having verified the control interlocks and motion sequence are correct, may cause damage to machinery and / or equipment.

Failure to do wiring or connections properly will result in equipment failure.

The use of *Mold-Masters* standard connections can help to eliminate the potential for wiring errors.

*Mold-Masters Ltd.* cannot be responsible for damage caused by customer wiring and / or connection errors.

### 3.6 Lockout Safety



#### **WARNING**

DO NOT enter the cabinet without first ISOLATING the supplies.

Voltage and amperage cables are connected to the controller and the mold. Electric power must be shut off and lockout / tagout procedures followed prior to installing or removing any cables.

Use lockout / tagout to prevent operation during maintenance.

All maintenance should be performed by properly trained personnel based on local laws and regulation. Electrical products may not be grounded when removed from the assembled or normal operating condition.

Ensure proper grounding of all electrical components before performing any maintenance to avoid potential risk of electrical shock.

Often power sources are inadvertently turned on or valves are opened mistakenly before maintenance work is completed, resulting in serious injuries and fatalities. Therefore, it is important to ensure that all energies are properly locked out and that they remain locked out until the work is completed.

If a lockout is not performed, uncontrolled energies could cause:

- Electrocution from contact with live circuits
- Cuts, bruises, crushing, amputations or death, resulting from entanglement with belts, chains, conveyors, rollers, shafts, impellers
- Burns from contact with hot parts, materials or equipment such as furnaces
- Fires and explosions
- Chemical exposures from gases or liquids released from pipelines

### 3.6.1 Electrical Lockout



#### **WARNING - READ MANUAL**

Refer to all machine manuals and local regulations and codes.

#### **NOTE**

In some instances, there may be more than one power source feeding equipment and steps must be taken to ensure that all sources are effectively locked out.

Employers must provide an effective lockout / tagout program.

1. Shut down machine using normal operational shutdown procedure and controls. This should be done by, or in consultation with the machine operator.
2. After ensuring that the machinery has been completely shut down, and all controls in the “off” position, open the main disconnect switch located in the field.
3. Using your own personal padlock, or one assigned by your supervisor, lock the disconnect switch in the off position. Do not lock only the box. Remove the key and retain. Complete a lockout tag and affix to the disconnect switch. Each person working on the equipment must follow this step. The lock of the person doing the work or in charge must be installed first, remain throughout and be removed last. Test the main disconnect switch and make sure it cannot be moved to the “on” position.
4. Try to start the machine using the normal operation controls and point of operation switches to make sure that the power has been disconnected.
5. Other sources of energy that could create a hazard while working on the equipment must also be de-energized and appropriately “locked-out”. This can include gravity, compressed air, hydraulics, steam and other pressurized or hazardous liquids and gases. See Table 3-3.
6. When the work is completed, prior to removing the last lock, make sure the operational controls are in the “off” position so that the main disconnect switching is done under “no load”. Ensure all blocks, tools and other foreign materials are removed from machine. Also ensure that all personnel that may be affected are informed that the lock(s) will be removed.
7. Remove lock and tag, and close the main disconnect switch if permission has been given.
8. When the work has not been completed on the first shift, the next operator should install a personal lock and tag before the first operator removes the original lock and tag. If the next operator is delayed, a lock and tag could be installed by the next supervisor. Lockout procedures should indicate how the transfer is to be conducted.
9. It is important that, for their personal protection, each worker and/or fore person working in or on a machine places his/her own safety lock on the disconnect switch. Use tags to spotlight work in progress and give details of work being done. Only when the work is completed and the work permit signed off, may each worker remove his/her lock. The last lock to be removed should be that of the person supervising the lockout and this responsibility should not be delegated.

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### 3.6.2 Energy Forms and Lockout Guidelines

Table 3-3 Energy Forms, Energy Sources and General Lockout Guidelines		
Energy Form	Energy Source	Lockout Guidelines
<b>Electrical Energy</b>	<ul style="list-style-type: none"> <li>Power transmission lines</li> <li>Machine power cords</li> <li>Motors</li> <li>Solenoids</li> <li>Capacitors (stored electrical energy)</li> </ul>	<ul style="list-style-type: none"> <li>Turn off power at machine first (i.e., at point of operation switch), and then at the main disconnect switch for the machine.</li> <li>Lock and tag the main disconnect switch.</li> <li>Fully discharge all capacitive systems (e.g., cycle machine to drain power from capacitors) according to the manufacturer's instructions.</li> </ul>
<b>Hydraulic Energy</b>	<ul style="list-style-type: none"> <li>Hydraulic systems (e.g., hydraulic presses, rams, cylinders, hammers)</li> </ul>	<ul style="list-style-type: none"> <li>Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves.</li> <li>Bleed off and blank lines as necessary.</li> </ul>
<b>Pneumatic Energy</b>	<ul style="list-style-type: none"> <li>Pneumatic systems (e.g., lines, pressure reservoirs, accumulators, air surge tanks, rams, cylinders)</li> </ul>	<ul style="list-style-type: none"> <li>Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves.</li> <li>Bleed off excess air.</li> <li>If pressure cannot be relieved, block any possible movement of machinery.</li> </ul>
<b>Kinetic Energy</b> (Energy of a moving object or materials. Moving object may be powered or coasting)	<ul style="list-style-type: none"> <li>Blades</li> <li>Flywheels</li> <li>Materials in supply lines</li> </ul>	<ul style="list-style-type: none"> <li>Stop and block machine parts (e.g. stop flywheels and ensure that they do not recycle). Review entire cycle of mechanical motion and ensure that all motions are stopped.</li> <li>Block material from moving into area of work.</li> <li>Blank as required.</li> </ul>
<b>Potential Energy</b> (Stored energy that an object has the potential to release due to its position)	<ul style="list-style-type: none"> <li>Springs (e.g., in air brake cylinders)</li> <li>Actuators</li> <li>Counterweights</li> <li>Raised loads</li> <li>Top or movable part of a press or lifting device</li> </ul>	<ul style="list-style-type: none"> <li>If possible, lower all suspended parts and loads to the lowest (rest) position.</li> <li>Block parts that might be moved by gravity.</li> <li>Release or block spring energy.</li> </ul>
<b>Thermal Energy</b>	<ul style="list-style-type: none"> <li>Supply lines</li> <li>Storage tanks and vessels</li> </ul>	<ul style="list-style-type: none"> <li>Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves.</li> <li>Bleed off excess liquids or gases.</li> <li>Blank lines as necessary.</li> </ul>



### 3.7 Ground Connections

Ground connections are located on self-clinching studs attached to the metallic panels of the controller cabinet. See Figure 3-1.

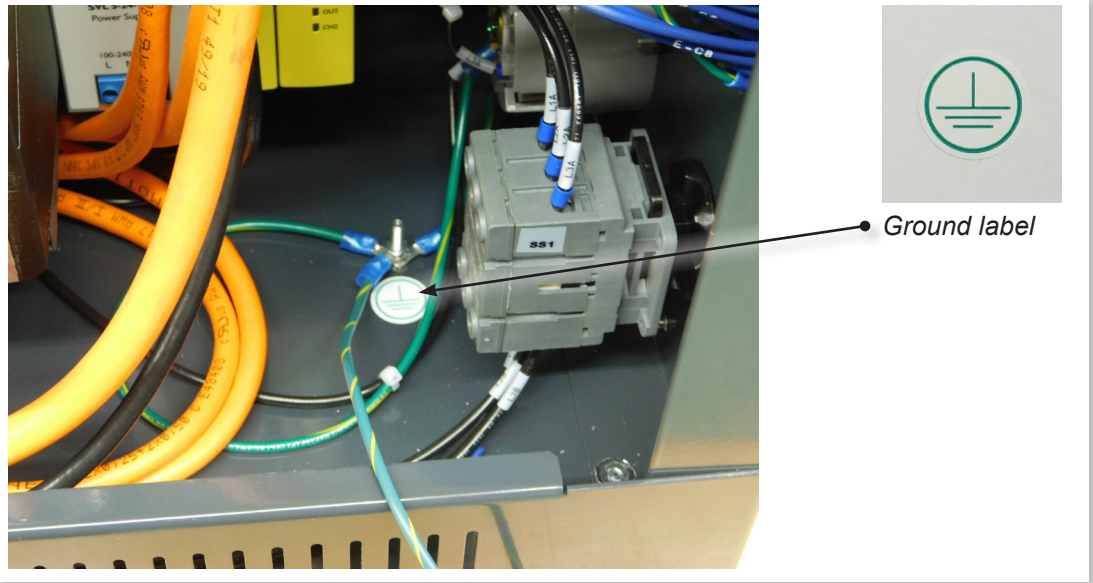


Figure 3-1 Ground connection

### 3.8 Disposal



#### WARNING

*Mold-Masters* declines any responsibility for personal injury or personal damage arising from reuse of the individual components, if these parts are used other than for the original and proper intended purpose.

1. Hot runner and system components must be disconnected from the power supply fully and properly before disposal, including electricity, hydraulics, pneumatics and cooling.
2. Ensure that the system to be disposed of is free from fluids. In the case of hydraulic needle valve systems, drain the oil from the lines and cylinders and dispose it in an environmentally responsible manner.
3. The electrical components are to be dismantled, separating them accordingly as environmentally-friendly waste or disposed as hazardous waste if necessary.
4. Remove the wiring. The electronic components are to be disposed in accordance with the national electric scrap ordinance.
5. The metal parts are to be returned for metal recycling (waste metal and scrap trade). The instructions of the corresponding waste disposal company are to be observed in this case.

Recycling of all possible materials should be at the forefront of the disposal process.

## 3.9 M-Ax Safety Hazards



### WARNING - ELECTRIC SHOCK HAZARD

It is crucial to comply with these warnings to minimize any personal danger.

- Ensure that all energies are properly locked out in the controller and mold machine before installation of the controller into the system.
- DO NOT enter the cabinet without first ISOLATING the supplies. There are unguarded terminals inside the cabinet which may have a dangerous potential across them. Where a three-phase supply is used, this potential may be up to 600VAC.
- Voltage and amperage cables are connected to the controller and the mold. Electric power must be shut off and lockout / tagout procedures followed prior to installing or removing any cables.
- Integration should be done by properly trained personnel based on local codes and regulations. Electrical products may not be grounded when removed from the assembled or normal operating condition.
- The main power disconnect is a 3-pole breaker, which is located at the rear of the cabinet. This main power breaker is used to safely disconnect the total load current at the time of switch on and switch off.
- The main power breaker can be locked using a padlock applied under the lockout / tagout procedure found in "3.6 Lockout Safety" on page 3-9.
- Use lockout / tagout to prevent operation during maintenance.
- All maintenance should be performed by properly trained personnel based on local laws and regulation. Electrical products may not be grounded when removed from the assembled or normal operating condition.
- Ensure proper grounding of all electrical components before performing any maintenance to avoid potential risk of electrical shock.

### 3.9.1 Operational Environment



#### WARNING

The display console and controller cabinet together are designed for use in the plastic injection molding industry as with Mold-Masters and third party servo axis control, commonly used in mold tools. They must not be used in residential, commercial or light industrial environments. They must not be used in an explosive atmosphere or where there is a possibility of such an atmosphere.

The controller cabinet and its touchscreen console should be installed in a clean and dry environment where the ambient conditions do not exceed the limits that follow:

- Temperature           +5 to +45°C
- Relative Humidity    90% (non-condensing)

Do not make changes to the factory settings without the help of *Mold-Masters* service personnel. Changes to these settings can result in hazardous out-of-control or unexpected movement. It can also damage the machine, and it will void the warranty.

# Section 4 - Hardware Overview

## 4.1 System Overview

This controller is a very flexible multi-servo axis auxiliary controller.

The servo axis can be used to control linear and rotary axis movements.

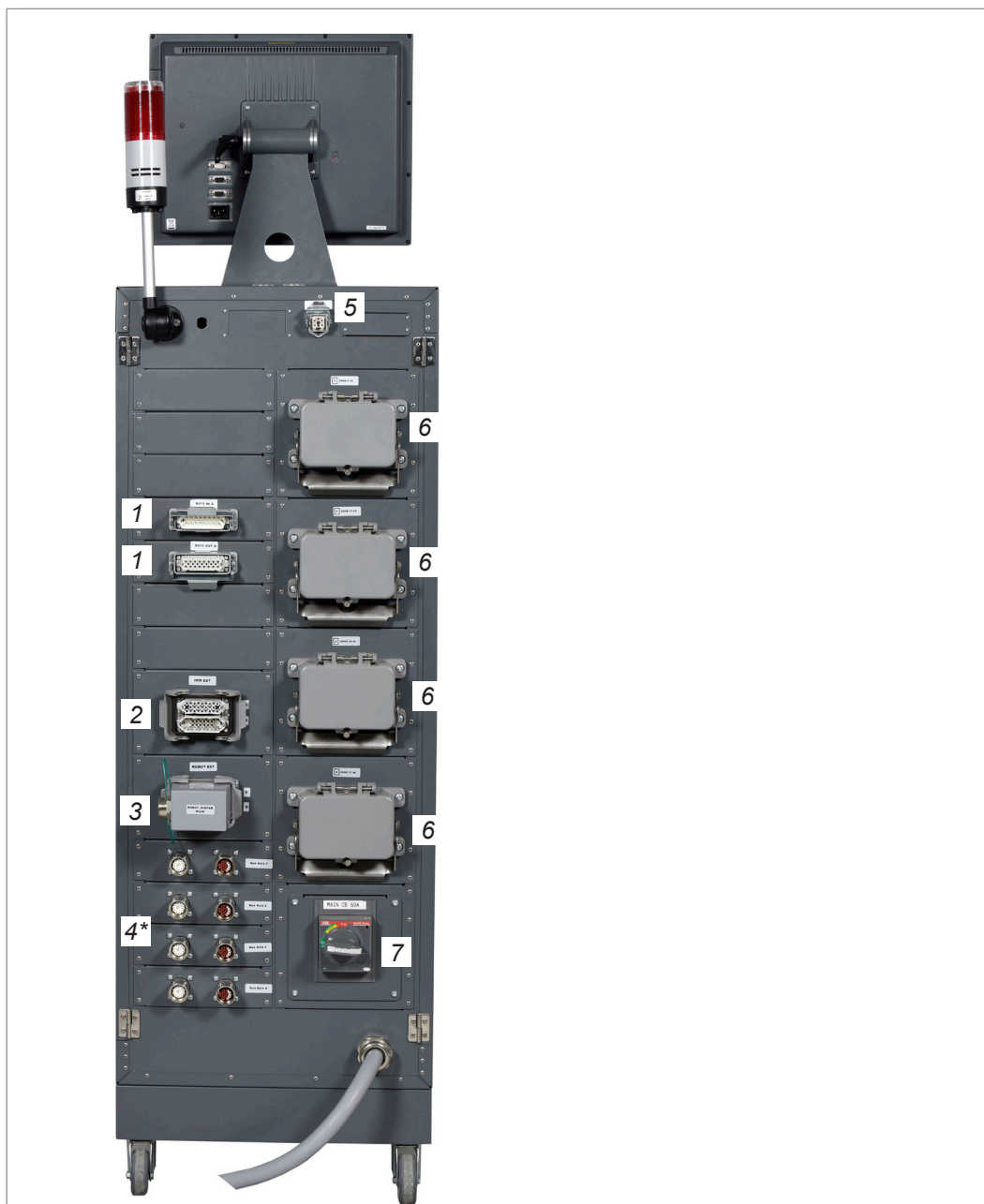
The input triggers, input confirmation signals and the status outputs can be connected and used to control and monitor each axis.

You can add axis interlocks and motion conditions to prevent unwanted motions.

This controller includes:

1. Up to six programmable servo axes, with the capability of more.
2. Quick view help screen.
3. Axis configuration interface.
4. Input and output configuration.
5. Euromap 67 interface and monitoring.

## 4.2 Controller Back



*Shown with optional bulkhead connectors*

1. M-Ax I/O connection
2. E67 connection to IMM
3. E67 connection to robot
4. Servo power and encoder connection / cables [*\* = optional bulkhead connectors*]
5. Remote HRC interface
6. Hot runner heater / thermocouple connections
7. Main power breaker

*Figure 4-2 M-Ax controller back - connections side*

### 4.3 Maximum Cable Lengths

Type of Cable	Maximum Length (m)	Note
Motor cables	75	The sum of the length of all motor cables connected to this module is not permitted to exceed the maximum value.
Encoder cables	75	The usable cable length depends on the cross section of the power supply wires of the encoder cable.

# Section 5 - Software Overview

## 5.1 Main Screen

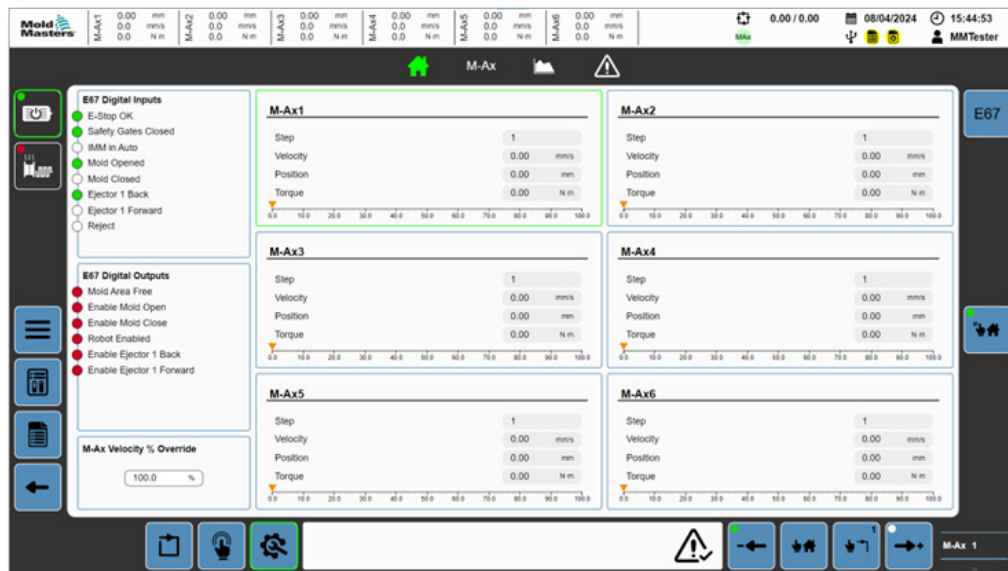


Figure 5-1 Main screen

### 5.1.1 Header

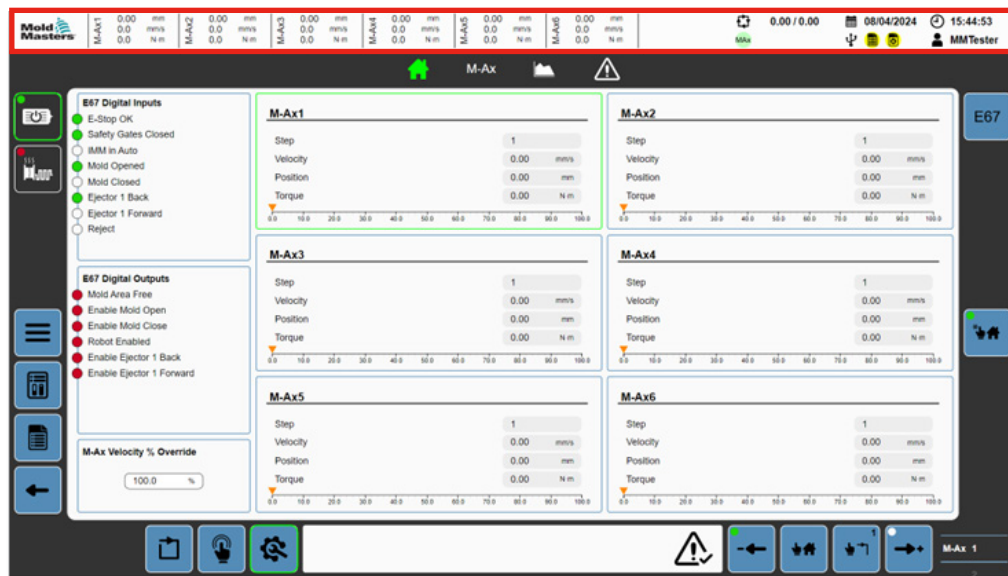


Figure 5-2 Header of the Main screen

Table 5-1 Header	
Field	Description
	Tap this button to go to the Home screen.

Table 5-1 Header		
M-Ax1	0.00 mm 0.0 mm/s 0.0 N·m	Displays M-Ax axis live data: position, velocity, and torque A section exists for each M-Ax axis that exists on the machine.
	0.00 / 0.00	Displays the current/last cycle time data
		Tap this area to show a dialog box that shows enabled systems. Enabled systems have a green background. Disabled systems will not run in automatic mode.
	17/08/2022  11:22:22	Displays the machine's date and time The date and time can be set on the HMI configuration page.
	Supervisor	Displays the current logged-in user
	17/08/2022  11:25:12 Supervisor	Tap anywhere in this area to bring up a login/logout popup window to change profiles or log out.

### 5.1.2 Navigation Bar

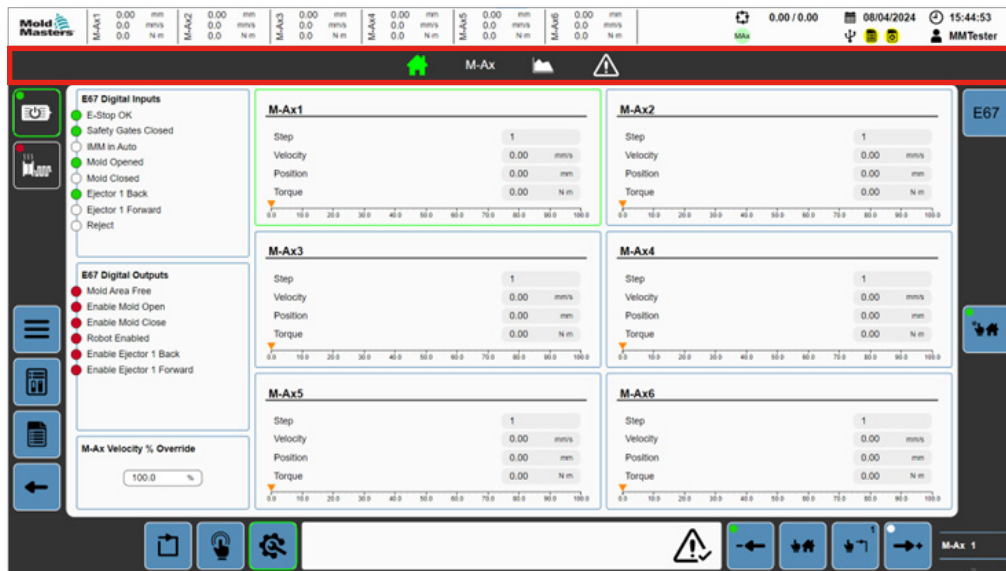





Figure 5-3 Navigation bar of the Main screen

Table 5-2 Navigation Bar	
Button/Panel	Description
	Tap this button to go to the Home screen.
	Tap this button to show the M-Ax navigation dialog box. M-Ax buttons will only be displayed for axes that exist on the machine.
	Tap this button to go to the Trace page.



Table 5-2 Navigation Bar	
Button/Panel	Description
	<p>Tap this button to go to the Alarm and Alarm history page.</p>
<p>Changes require restart  </p>	<p>If changes require a power cycle, a message is displayed in the top right of the navigation panel. If you tap anywhere in this area, the following Power restart dialog box will be displayed.</p> <div data-bbox="696 495 1438 753" style="border: 1px solid blue; padding: 10px; margin: 10px 0;"> <p><b>Power</b></p> <p>Changes Require Restart</p> <p style="text-align: center;"> <input type="button" value="Restart"/> <span style="float: right;"><input type="button" value="Ok"/></span> </p> </div> <p>Press the Restart button to restart the controller.</p>



### 5.1.3 Left Panel

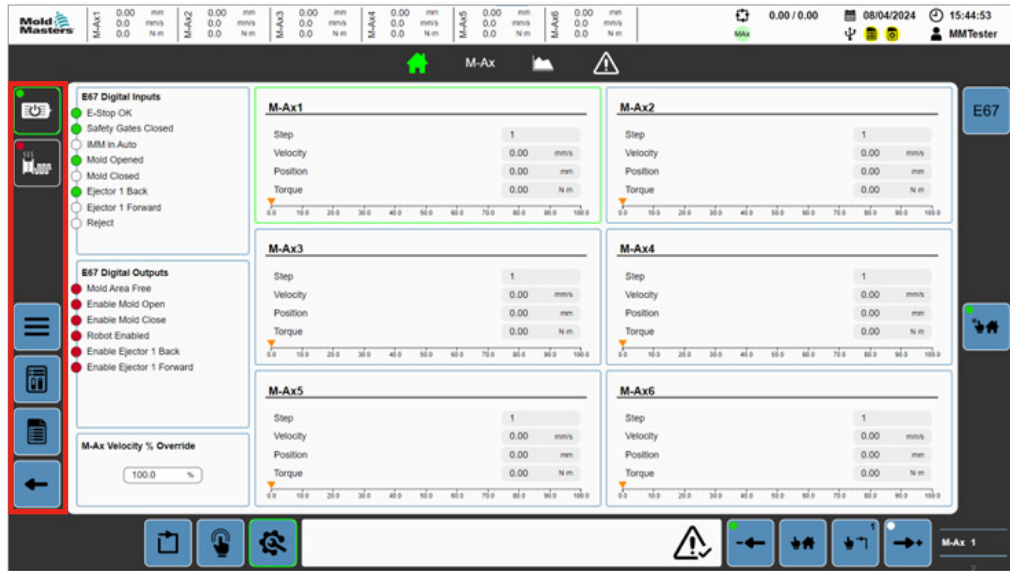







Figure 5-4 Left panel of the Main screen

Table 5-3 Left Panel	
Button	Description
	Tap this button to power the motors.
	When the motors are powered, the LED and the border will turn green. To turn the power off, tap this button again. A confirmation dialog box will be displayed. Tap Ok..
	Tap this button (Integrated Hot Runner button) to turn on the hot runner heats.
	When the hot runner heats are turned on, the border turns green.
	When the hot runner heats are on but below the set temperature, the LED will turn blue.
	When the hot runner heats are on and within tolerance, the LED turns green.


Table 5-3 Left Panel	
Button	Description
	When the hot runner heaters are on but there is no connection to the hot runner, the LED turns red.
	Tap this button to go to the directory page.
	Tap this button to go to the systems overview page.
	Tap this button to go to the data page.
	Tap this button to go to the last active page.

### 5.1.4 Contextual (Right) Panel

The Contextual menu enables page-dependent content navigation.



Figure 5-1 Contextual menu of the Main screen

Table 5-4 Contextual Menu	
Button	Description
	The default menu provides a button to access the EM67 page.

### 5.1.5 Footer

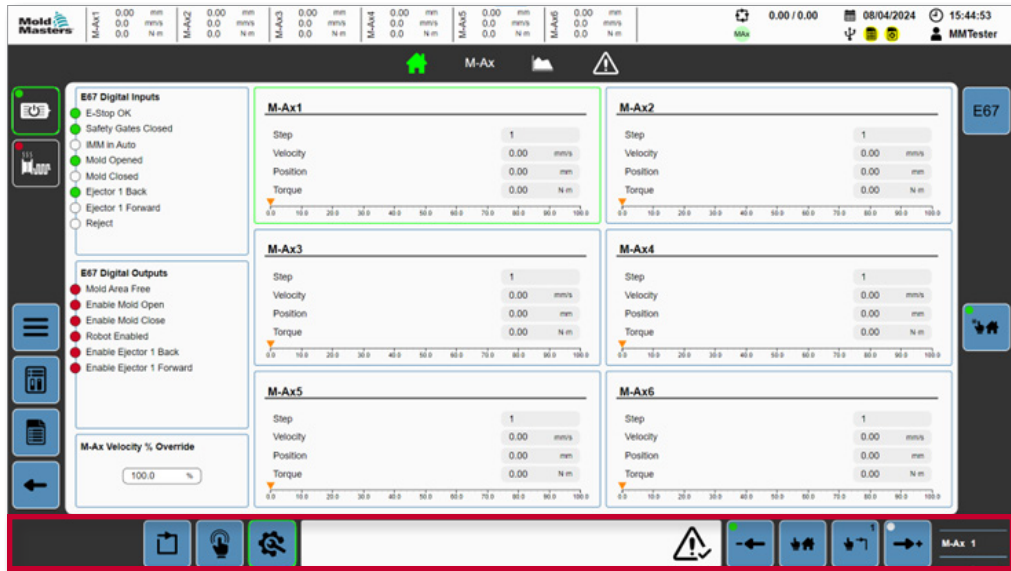


Figure 5-5 Footer of the Main screen

Table 5-5 Footer	
Button/Panel	Description
	Tap this button to request that the machine enter automatic mode. When the machine enters automatic mode, the border of the button will turn green.
	Tap this button to request that the machine enter manual mode. When the machine enters manual mode, the border of the button will turn green.
	Tap this button to request that the machine enter setup mode. When the machine enters setup mode, the border of the button will turn green.
	This alarm panel displays the most recent alarm. If there is an active alarm, this panel will turn red with white text.  Tap the acknowledge button to acknowledge all active alarms.




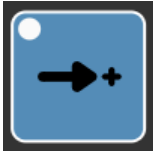

<b>Table 5-5 Footer</b>	
<b>Button/Panel</b>	<b>Description</b>
	<p>Tap this button to do a negative jog. Operation depends on the machine mode:</p> <p><b>LED</b>            Off: Axis position is greater than the lowest motion step position (negative end position)            Blinking green: Axis is active in the negative direction            Solid green: Axis position is within the tolerance of the lowest motion-step position</p> <p><b>Manual Mode</b>            Finds the last negative move motion step that the axis current position is within and executes it.            This requires the interlocks are OK for motion to execute.</p> <p>Holding this button will continue to search for the next motion step and execute them until the axis is at the minimum profile position.</p> <p><b>Setup Mode</b>            Performs a negative move using the setup velocity and torque            If the stroke is within the profile this moves to the lowest motion step position            If the stroke is at the lowest motion step position, this moves to the 0 position</p> <p><b>Calibration Mode</b>            Performs a negative move using the calibration velocity and torque            Moves until it hits a hard stop, if button is held while against the end stop, axis will calibrate this as the 0 position</p>
	<p>Tap this button to execute a move to home. Operation depends on the machine mode:</p> <p><b>Manual Mode</b>            Finds and executes the first motion step that will move the axis from its current position to the axis Home position. This takes into account both motion step direction, and interlocks.</p> <p><b>Setup Mode</b>            Performs a move using the setup velocity and torque directly from the current position to the home position. This does not take into account interlocks.</p> <p><b>Calibration Mode</b>            Performs a move using the calibration velocity and torque directly from the current position to the home position. This does not take into account interlocks.</p>

Table 5-5 Footer	
Button/Panel	Description
	<p>Tap and hold this button to execute the currently displayed step. The current step is displayed in the top right corner of the button.</p> <p><b>Manual Mode:</b> Only executes the step if the interlocks are all OK.</p> <p><b>Setup Mode</b> Executes a move directly to the step end positions using the setup velocity and torque. This does not account for interlocks.</p> <p><b>Calibration Mode:</b> Executes a move directly to the step end positions using the calibration velocity and torque. This does not account for interlocks.</p>
	<p>Tap this button to do a positive jog. Operation depends on the machine mode.</p> <p><b>LED:</b> Off: Axis position is less than the highest motion-step position (positive end position) Blinking green: Axis is active in the positive direction Solid green: Axis position is within the tolerance of the highest motion-step position</p> <p><b>Manual Mode</b> Finds the first positive move motion step that the axis current position is within and executes it. This requires the interlocks are OK for motion to execute.</p> <p>Holding this button will continue to search for the next motion step and executing them until there are no more available positive move steps.</p> <p><b>Setup Mode</b> Performs a positive move using the setup velocity and torque If the stroke is within the profile this moves to the highest motion step position If the stroke is at the highest motion step position, this moves to the maximum position</p> <p><b>Calibration Mode</b> Performs a positive move using the calibration velocity and torque Moves until it hits a hard stop, if button is held while against the end stop, axis will calibrate this as the maximum position</p>
	<p>M-Ax axis index selection</p> <p>Motion buttons will execute the movement of the currently displayed M-Ax axis index.</p>

### 5.1.6 Home Screen

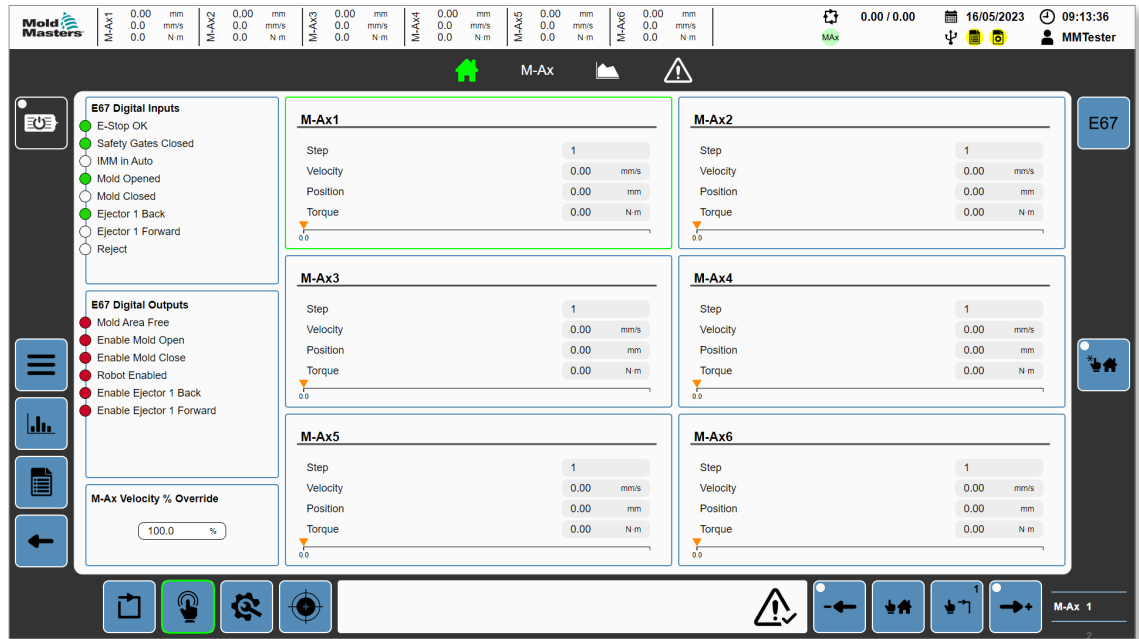
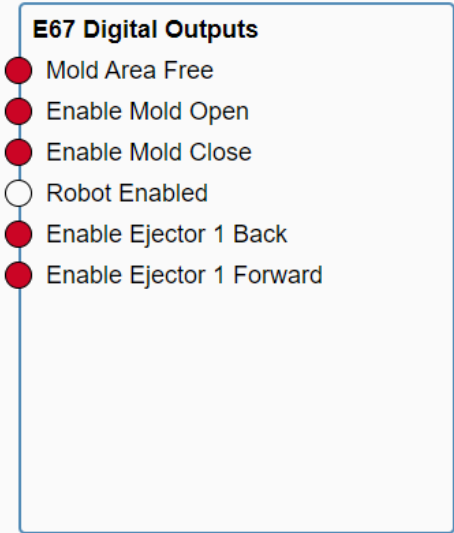
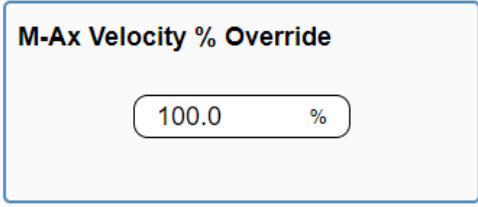



Figure 5-6 Home screen

Table 5-6 Home Screen	
Panel	Description
<p><b>E67 Digital Inputs</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> E-Stop OK</li> <li><input checked="" type="checkbox"/> Safety Gates Closed</li> <li><input type="checkbox"/> IMM in Auto</li> <li><input checked="" type="checkbox"/> Mold Opened</li> <li><input type="checkbox"/> Mold Closed</li> <li><input checked="" type="checkbox"/> Ejector 1 Back</li> <li><input type="checkbox"/> Ejector 1 Forward</li> <li><input type="checkbox"/> Reject</li> </ul>	<p>Displays critical input signals from the EM67 interface</p> <p>Green LED's are inputs from the IMM to the machine</p>

Table 5-6 Home Screen	
Panel	Description
 <p><b>E67 Digital Outputs</b></p> <ul style="list-style-type: none"> <li><span style="color: red;">●</span> Mold Area Free</li> <li><span style="color: red;">●</span> Enable Mold Open</li> <li><span style="color: red;">●</span> Enable Mold Close</li> <li><span style="color: white;">○</span> Robot Enabled</li> <li><span style="color: red;">●</span> Enable Ejector 1 Back</li> <li><span style="color: red;">●</span> Enable Ejector 1 Forward</li> </ul>	<p>Displays critical output signals from the EM67 interface</p> <p>Red LED's are outputs from the machine to the IMM</p>
 <p><b>M-Ax Velocity % Override</b></p> <p>100.0 %</p>	<p>0–100% multiplicative factor that is applied to all move velocity set points in manual and automatic mode.</p>
 <p><b>M-Ax1</b></p> <p>Step 1</p> <p>Velocity 0.00 mm/s</p> <p>Position 0.00 mm</p> <p>Torque 0.00 N.m</p> <p>0.0</p>	<p>Only displays axes that currently exist on the machine</p> <p>Displays the current motion step, velocity, position and torque</p> <p>Visual indicator where the axis is between 0 and the maximum stroke</p> <p>The currently selected axis is highlighted. Tap any of the axes to change the axis selection. This axis selection is the same as the axis selection index in the footer.</p>



## 5.2 Page Directory

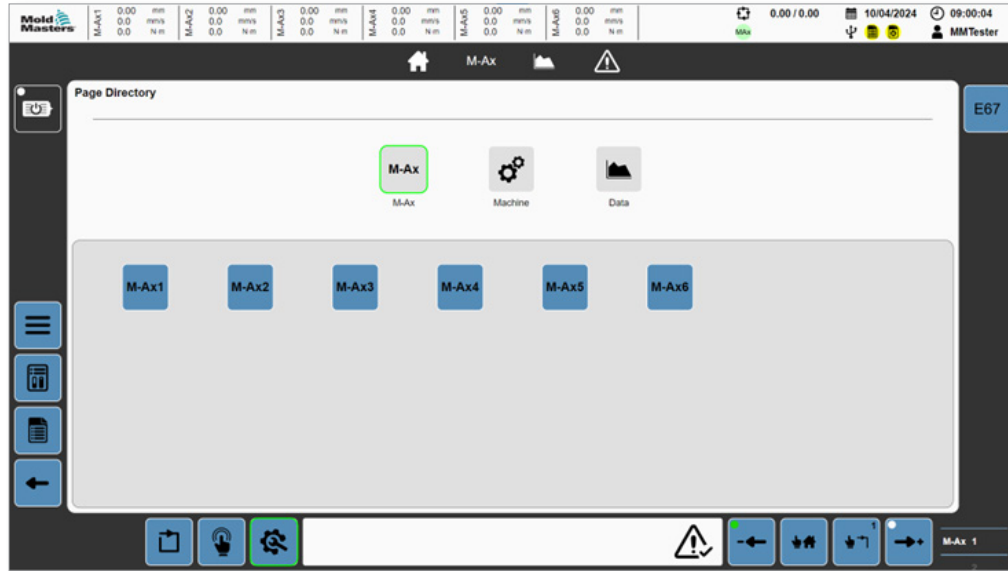


Figure 5-7 Page directory with the M-Ax button selected

M-Ax buttons will only be displayed for axes that exist on the machine.

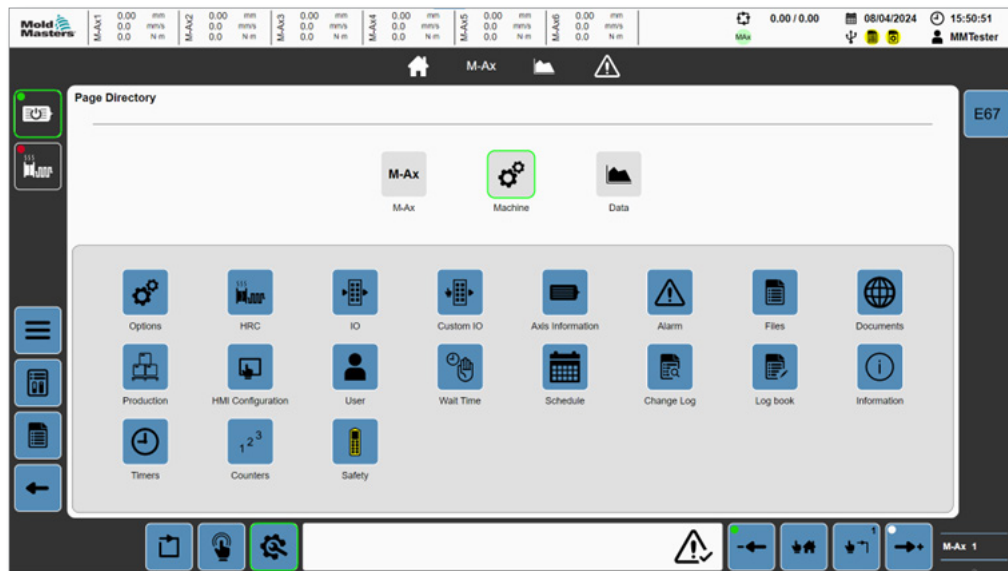


Figure 5-8 Page directory with the Machine button selected

Table 5-7 Machine Buttons


Button	Description
	Tap the Machine Options button to go to the Machine Options page. You must be logged in as an administrator to view this page.



















Table 5-7 Machine Buttons	
Button	Description
	Tap the Hot Runner Controller button to go to the Hot Runner Controller page.
	Tap the Hardware I/O button to go to the Hardware I/O page.
	Tap the Custom Digital/Analog I/O button to go to the Custom Digital/Analog Inputs and Outputs page.
	Tap the Machine Axis Information button to go to the Machine Axis Information page.
	Tap the Alarms button to go to the Alarms page. The Alarms history can be viewed on this page.
	Tap the Data button to go to the Data page. Here, you can view the recipe, fixed, and user data.
	Tap the Additional Documents button to go to the Additional Documents page. This page displays controller schematics and the user manual. If you are logged in as an admin, you can view the systems diagnostics here.
	Tap the Production button to go to the Production page.
	Tap the HMI Configuration button to go to the HMI Configuration page.

Table 5-7 Machine Buttons	
Button	Description
	Tap the User Management button to go to the User Management page.
	Tap the Wait Time button to go to the Wait Messages page.
	Tap the Schedule button to go to the Schedule page.
	Tap the Change Log button to go to the Change Log page.
	Tap the Log Book button to go to the Log Book page.
	Tap the Machine Information button to go to the Machine Information page.
	Tap this button to go to the Free Timers page.
	Tap this button to go to the Counters page.
	Tap this button to go to the Safety PLC page.

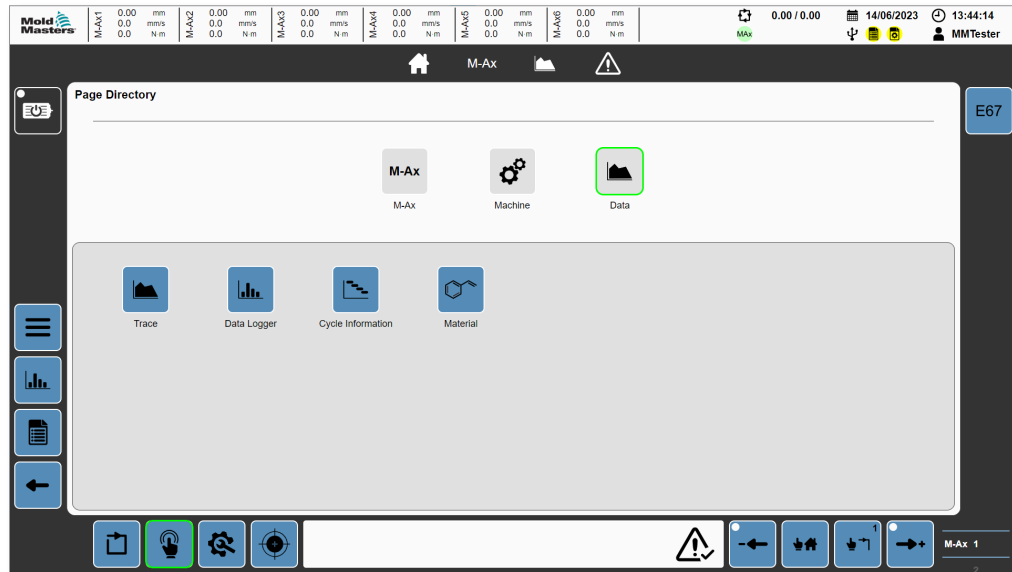


Figure 5-9 Page directory with Data button selected

Table 5-8 Data Buttons	
Button	Description
	Tap the Trace button to go to the Trace page.
	Tap the Data Logger button to go to the Data Logger page.
	Tap the Cycle Information button to go to the Cycle Information page.
	Tap the Material button to go to the Material Data page.

## 5.3 Axis

### 5.3.1 Motion Page

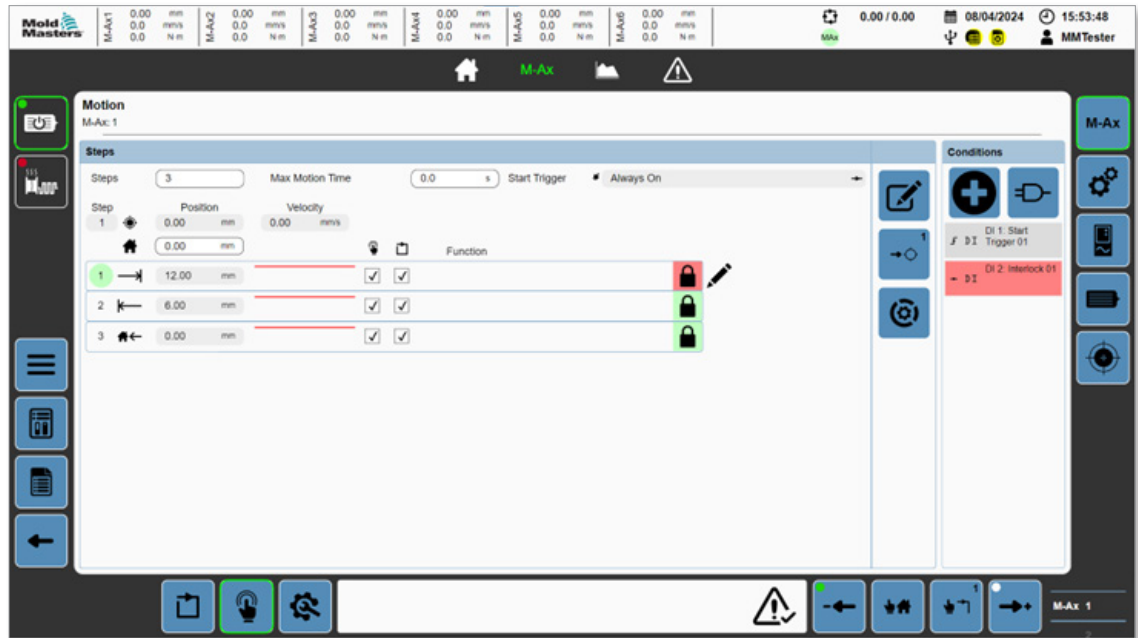


Figure 5-10 Motion page

Table 5-9 Motion Page	
Button/Field	Description
Steps <input type="text" value="4"/>	Number of motion steps. 2–10
Max Motion Time <input type="text" value="0.0"/> s	Maximum allowed motion time Only monitored in auto mode If set time is exceeded, an alarm is generated and the machine mode switches from auto to manual. A value of 0 disables this feature
Start Trigger <input type="text" value="Always On"/>	Start trigger to begin axis motion steps Only used in auto mode Press this field to open the conditions dialog box to select a start trigger.
Step 1 <input type="text" value="50.0"/> Position <input type="text" value="0.0"/> Velocity	Displays live axis values: <ul style="list-style-type: none"> <li>• Current Step</li> <li>• Current Position</li> <li>• Current Velocity</li> </ul>
Home <input type="text" value="30.0"/>	Axis motion start position Axis must be in this position to allow a switch to auto mode Last motion step must return back to this position





Table 5-9 Motion Page	
Button/Field	Description
	<p>Simple display of the motion step</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• Step Index</li> <li>• Motion Direction Graphic</li> <li>• End Position</li> <li>• Velocity Profile Graphic</li> <li>• Execute In Manual</li> <li>• Execute In Auto</li> <li>• Function Text</li> <li>• Conditions Graphic</li> </ul> <p>Active motion steps are indicated by a green highlight over the step index. Motion steps can be selected; a selected step is indicated by the edit icon to the right of the step.</p> <p>The condition lock background will be displayed in red if the motion conditions are not met, and green if they are.</p>
	<p>Edit button</p> <p>Tap this button to open the detailed motion-step dialog box and edit the selected step.</p>
	<p>Go-to position button</p> <p>Press the Go-to position button to move the axis directly to the selected-step end position.</p> <p>In manual mode, tap this button to find the shortest path to the position, following the motion profile steps and interlocks.</p> <p>In setup/calibration mode, tap and hold this button to move the axis directly to the selected-step end position. This move ignores interlocks. Uses setup/calibration mode settings</p>
	<p>Dynamic monitoring Button</p> <p>Tap this button to navigate to the Dynamic Monitoring page for the selected step. Torque and velocity monitoring can be configured for the step.</p>

Table 5-9 Motion Page	
Button/Field	Description
	<p>Conditions panel</p>
	<p>New condition button Tap this button to open a new condition dialog for the selected motion step.</p>
	<p>Edit logic button Tap the edit logic button to set up the conditions of the AND/OR evaluation. By default all conditions are ANDed together.</p>
	<p>Tap a condition to open the detailed condition dialog and edit or delete the selected condition's data. Each motion step can have up to 9 individually configured conditions.</p> <p>Condition backgrounds display their current state. Conditions used as motion start triggers will appear as gray in manual mode as they are only monitored in automatic mode to start the motion. Condition backgrounds are displayed in red if the condition is currently not valid, and green if it is.</p> <p>Caution: Start triggers OR'ed with an interlock in the logic dialog could result in the interlock being ignored.</p>

### 5.3.2 Motion Detailed-Dialog Box

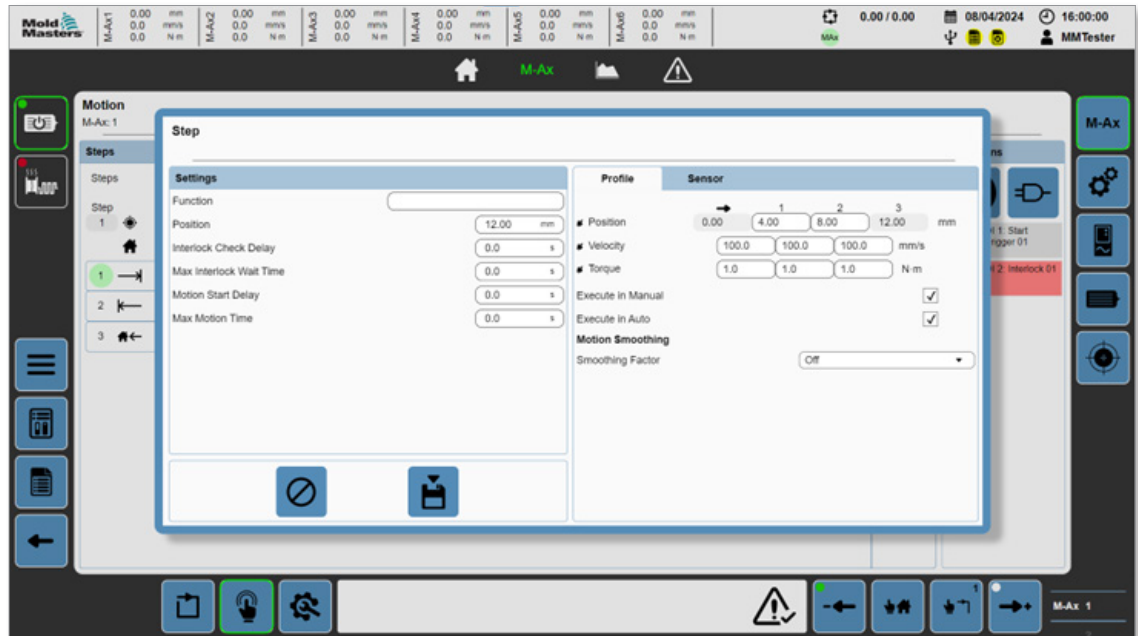




Figure 5-11 Motion-detailed-dialog box

Table 5-10 Settings Fields	
Field	Description
Function	<p>Custom name for the motion step. It is displayed on the motion page.</p> <p>Values: Any string</p>
Position	<p>Motion-steps end position</p> <p>Value: Any number between 0 and the Axis Maximum Position</p>
Interlock check delay	<p>Value: Any positive number</p> <p>Only available in auto mode</p> <p>Adds an additional delay when entering the motion step before the steps conditions are evaluated</p> <p>A value of 0 disables this feature.</p>
Max Interlock Wait Time	<p>Value: Any positive number</p> <p>Only available in auto mode</p> <p>Maximum allowed wait time for the interlock check to start a motion step. If this time is exceeded it is assumed something has gone wrong, an alarm is generated and the machine changes to manual mode.</p> <p>A value of 0 disables this feature.</p>
Motion Start Delay	<p>Value: Any positive number</p> <p>Only available in auto mode</p> <p>Adds an additional delay before a executing a motion step, but only after the motion start conditions are met</p> <p>A value of 0 disables this feature.</p>



Table 5-10 Settings Fields	
Field	Description
Max Motion Time	<p>Value: Any positive number                      Only available in auto mode                      Maximum allowed time for the step to complete its motion. If this time is exceeded it is assumed something has gone wrong, an alarm is thrown and the machine drops to manual mode.</p> <p>A value of 0 disables this feature</p>

Table 5-11 Dialog Buttons	
Button	Description
	<p>Cancel button                      Tap this button to discard changes and close the dialog box.</p>
	<p>Save button                      Tap this button to save changes to the selected steps Recipe data.</p>

<b>Table 5-12 Profile Fields</b>	
<b>Field</b>	<b>Description</b>
Position	<p>Value: Any number between the start position and the end position</p> <p>Defines the transition positions of the motion steps profile. As the axis moves from its start position to end position, as it passes through the profile position it will transition the axis velocity and torque to the associated velocity and torque.</p> <p>These values can be entered manually or tapping the Position label will pop up a Yes/No dialog to automatically evenly distribute the positions.</p>
Velocity	<p>Value: Any number between 0 and the Axis Maximum Velocity</p> <p>Velocity profile for the current step; follows the profile positions.</p> <p>These values can be entered individually or by tapping the Velocity label to pop up a numeric input field to enter a value for all three profile steps.</p>
Torque	<p>Value: Any number between 0 and the Axis Maximum Torque</p> <p>Torque profile for the current step; follows the profile positions.</p> <p>These values can be entered manually or by tapping the Torque to bring up a numeric input field to enter a value for all three profile steps.</p>
Execute in Manual	<p>If checked, the axis will execute this step in manual mode when stepping through the motion steps.</p> <p>If this is not checked, this step will be skipped in manual mode stepped execution. You must ensure that the following step can be executed or the motion will not execute.</p>
Execute in Auto	<p>If checked, the axis will execute this step in auto mode when stepping through the motion steps.</p> <p>If this is not checked, this step will be skipped in auto mode. You must ensure the following step can be executed or the axis can get hung up.</p>
Motion Smoothing	<p>A motion smoothing factor can be set if the motion profile curve needs to be smoothed into more of an S-curve. A value of Off, Low, Medium, High or Custom can be selected; these values will adjust the motion's Jerk (rate of change of acceleration).</p>
Custom Smoothing Factor	<p>If custom is selected, a Jerk value can be entered manually for the motion. The lower the value, the slower the accelerations' rate of change will be.</p>

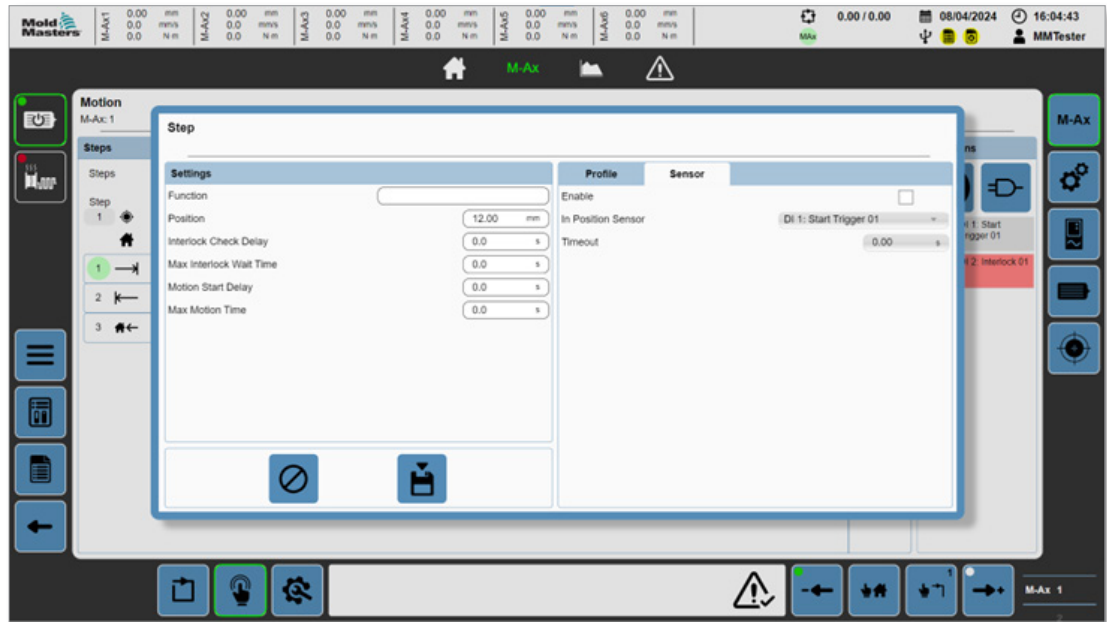


Figure 5-12 Motion-detailed-dialog box with Sensor tab selected

Table 5-13 Sensor Fields	
Field	Description
Enable	Enables the steps end position, in position sensor monitoring. Values: 0, 1 If enabled, when the step finishes the in position sensor must be high to move onto the next step. If it is not high within the set amount of time of the motion finishing, an alarm is generated and the machine is taken out of automatic mode.
In-Position Sensor	Custom digital inputs Values: 0–n Tap this dropdown box to select a custom digital input to use as the in-position sensor.
Timeout	Allowed amount of time for the sensor to show the axis is in position once motion has been completed. If the sensor does not go high after Timeout seconds, an error is generated.

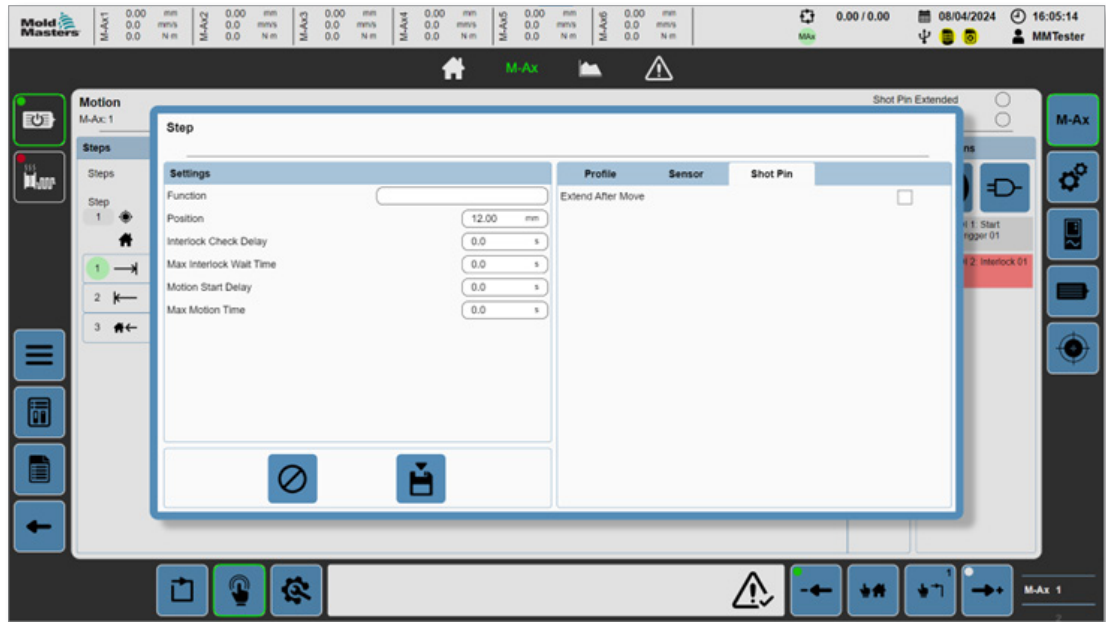


Figure 5-13 Motion-detailed-dialog box with Shot pin tab selected

Table 5-14 Shot Pin Fields	
Field	Description
Extend After Move	Only visible if the axis has shot pin enabled To have the shot pin extended after the selected motion step has completed its move, tap this check box. Note: If the shot pin is not retracted, it will automatically be retracted before any move occurs.

### 5.3.3 Interlock Detailed-Dialog Box

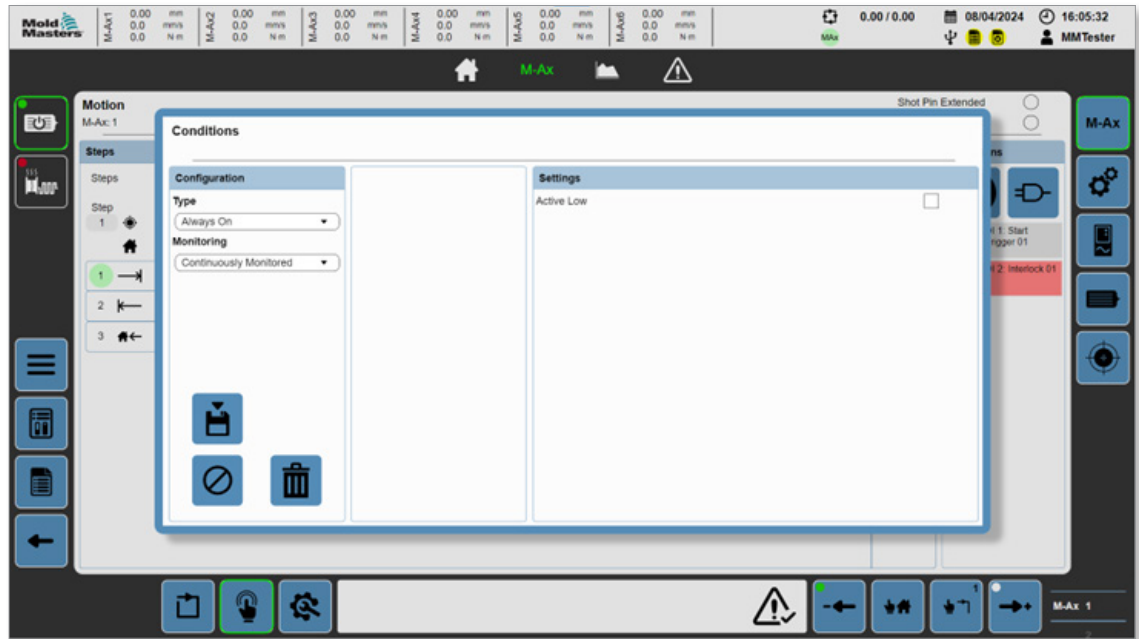






Figure 5-14 Interlock-detailed-dialog box

Table 5-15 Interlock Detailed-Dialog Box	
Field/Button	Description
<p><b>Type</b></p> <p>None</p>	<p>Interlock type selection</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• None</li> <li>• Euromap 67</li> <li>• Emulti</li> <li>• M-Ax Axis</li> <li>• Digital Inputs</li> <li>• Digital Outputs</li> <li>• Analog Inputs</li> <li>• Analog Outputs</li> <li>• Mode</li> <li>• System</li> <li>• Cycle</li> <li>• E-Drive</li> <li>• Timers</li> <li>• Counters</li> </ul> <p>After you choose an interlock type, the right panel will display related options.</p>

Table 5-15 Interlock Detailed-Dialog Box	
Field/Button	Description
<p><b>Monitoring</b></p> 	<p>Interlock monitoring type</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• Start Condition—Interlock only needs to be OK to start the motion. Ignored outside of auto mode</li> <li>• Continuously Monitored—Interlock must be OK throughout the motion, If the motion begins and the interlock is not OK, an error is generated, motion is stopped, and the machine changes to manual mode.</li> </ul>
<p><b>Evaluation</b></p> 	<p>Start condition—Evaluation type</p> <ul style="list-style-type: none"> <li>• Direct—Is true when the variable is true</li> <li>• Rising Edge—Is true as soon as the variable changes from false to true</li> <li>• Falling Edge—Is true as soon as the variable changes from true to false</li> </ul>
	<p>Delete button</p> <p>If this dialog was opened from an existing interlock, the delete button will remove the interlock from the motion step.</p> <p>If the dialog was opened from the New Interlock button, this will close the dialog and not affect the motion step.</p>
	<p>Save button</p> <p>Tap this button to save the new or changed interlock to the selected motion step.</p>

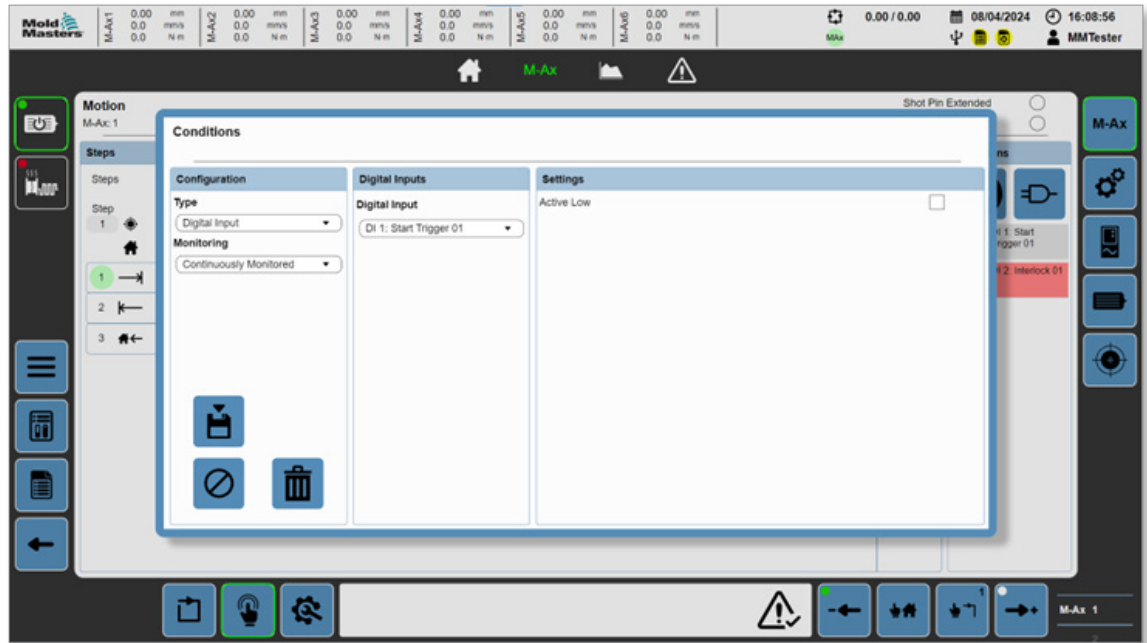


Figure 5-15 Sample interlock-detailed-dialog box

For example, to configure the selected motion step to be interlocked with one of the custom digital inputs, the configuration type can be changed to "Digital Input". The panels to the right are populated depending on the selections of the left panels. In this example, a dropdown list of all the custom digital inputs is displayed. If active low is checked, the condition will be true when the selected digital input is low. If active low is not checked, the condition will be true when the input is high.

### 5.3.4 Dynamic Monitoring

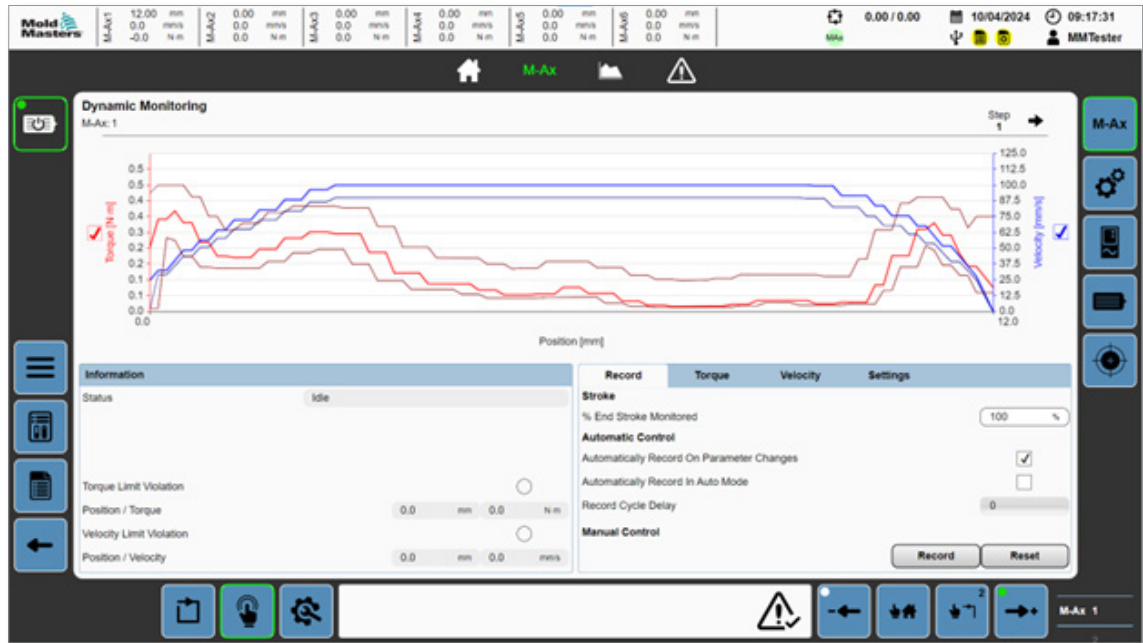


Figure 5-16 Dynamic monitoring page

Table 5-16 Graph	
Field/Button	Description
	Torque check box—Shows or hides the actual torque curve and the tolerance bands
	Velocity check box—Shows or hides the actual velocity curve and the tolerance band



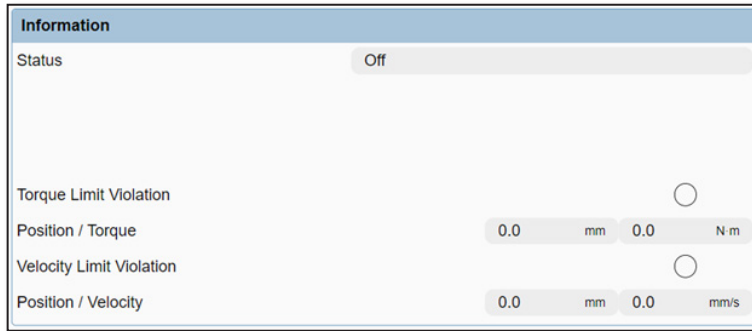


Figure 5-17 Information panel

Table 5-17 Information Panel	
Field/Button	Description
	<p>Dynamic Monitoring Status Values:</p> <ul style="list-style-type: none"> <li>• Off</li> <li>• Idle</li> <li>• Monitoring</li> <li>• Record—Waiting for motion</li> <li>• Record—Active</li> <li>• Record—Finished</li> <li>• Record—Failed</li> <li>• Error</li> </ul>
	<p>Limit Violations</p> <p>If there is a torque or velocity limit violation, the associated LED will light up and the position and value where the violation occurred will be displayed.</p>

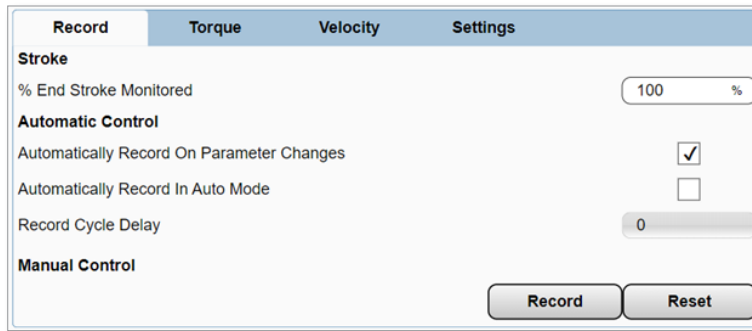


Figure 5-18 Record tab

Table 5-18 Record Tab	
Field/Button	Description
	<p><b>Stroke</b> Percent End Stroke Monitored Values: 0–100% The percent of the current move to be monitored by the dynamic monitoring program The monitored stroke range is displayed below the left and right Y-axis of the graph.</p>
	<p><b>Automatic Control</b> Automatically record on parameter change: Triggers a new record trace when any of the motion profile settings have changed. If this is not enabled, it is very likely that changes to the motion will cause a violation.</p> <p>Automatically record in auto mode: Triggers a new record trace when the machine enters auto mode and the active cycle count reaches the number entered in the Record Cycle Delay field</p>
	<p><b>Manual Control</b> Allows the operator to manually record or reset a trace</p> <p>Record button: Dynamic Monitoring goes into the Record—Waiting For Motion state and will record the motion the next time it is run.</p> <p>Reset button: Dynamic Monitoring goes into the Off state and the existing trace is deleted.</p>

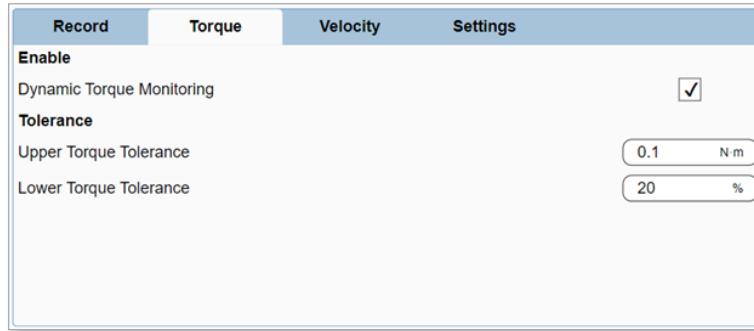


Figure 5-19 Torque tab

Table 5-19 Torque Tab	
Field/Button	Description
<b>Enable</b> Dynamic Torque Monitoring <input checked="" type="checkbox"/>	Enable Dynamic Torque Monitoring
<b>Tolerance</b> Upper Torque Tolerance <input type="text" value="0.1"/> N·m Lower Torque Tolerance <input type="text" value="20"/> %	Dynamic Torque Monitoring Tolerance. Individual values for the upper and lower tolerance bands can be set individually. Depending on the settings, these will be in units force or percent.

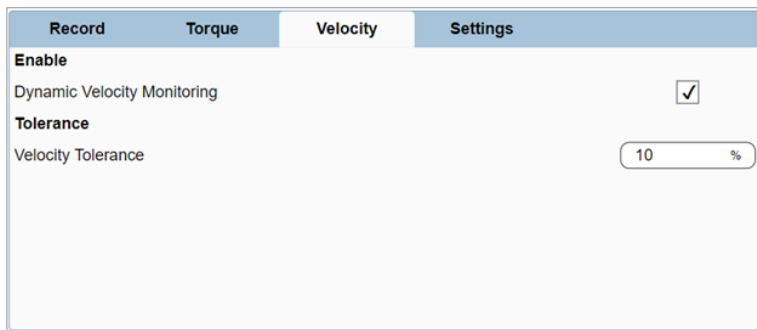


Figure 5-20 Velocity tab

Table 5-20 Velocity Tab	
Field/Button	Description
<b>Enable</b> Dynamic Velocity Monitoring <input checked="" type="checkbox"/>	Enable Dynamic Velocity Monitoring
<b>Tolerance</b> Velocity Tolerance <input type="text" value="10"/> %	Dynamic Velocity Monitoring Tolerance A lower tolerance band can be set. Depending on the settings, these will be in units of velocity or percent.

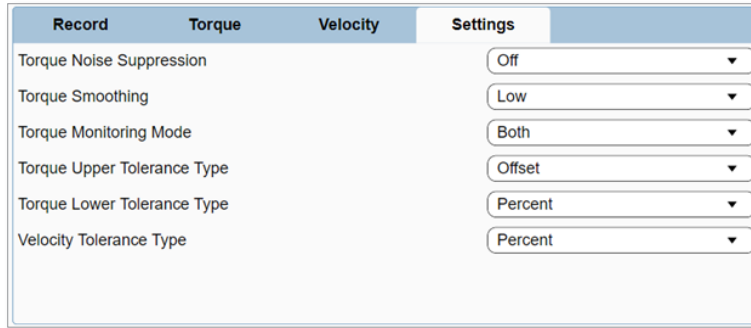


Figure 5-21 Settings tab

Table 5-21 Settings Tab	
Field/Button	Description
Torque Noise Suppression	<p>Torque Noise Suppression: Limits the minimum value of the upper band torque tolerance to a percentage of the motor's peak torque.</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• Low</li> <li>• Medium</li> <li>• High</li> <li>• Off</li> </ul>
Torque Smoothing	<p>Torque Smoothing: Adjusts the number of entries used in the torque moving average filter. The higher the setting the less susceptible the torque will be to random spikes and noise; however, this may reduce the response time by some milliseconds.</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• Low</li> <li>• Medium</li> <li>• High</li> <li>• Off</li> </ul>
Torque Monitoring Mode	<p>Torque Monitoring Mode: Selects which torque tolerance bands to monitor.</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• Positive Limit</li> <li>• Negative Limit</li> <li>• Both</li> </ul>
Tolerance Types	<p>Set the tolerance type for the tolerance band.</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• Percent</li> <li>• Offset</li> </ul>

### 5.3.5 Axis Configuration

When the title bars are divided into sections with only one highlighted, these are separate tabs that you can select to display more content on the same page.

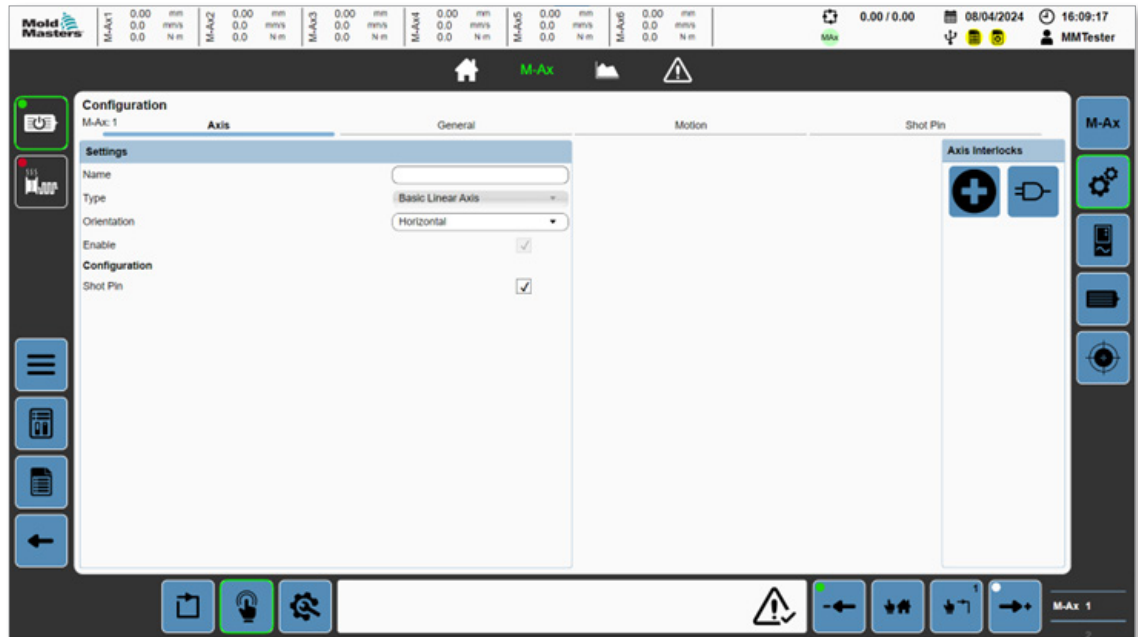


Figure 5-22 Axis configuration page with the Axis tab selected

#### 5.3.5.1 Axis Tab

Table 5-22 Settings Panel	
Field	Description
Name	Custom name for the axis. Appears on the directory/M-Ax navigation sections Values: Any string
Type	Axis Type Values: <ul style="list-style-type: none"> <li>• Basic Linear Axis</li> <li>• Basic Rotary Axis</li> <li>• Periodic Rotary Axis</li> </ul>
Enable	Enables and disables the axis Values: Checked or unchecked
Configuration	
Shot Pin	Enables shot pin functionality

Table 5-23 Axis Interlocks Panel	
Axis Interlocks	Axis interlock conditions All configured interlocks must be true for the axis to move. If there are any movement requests/attempts while the axis interlocks are not ok, the system will generate an error.

### 5.3.5.2 General Tab

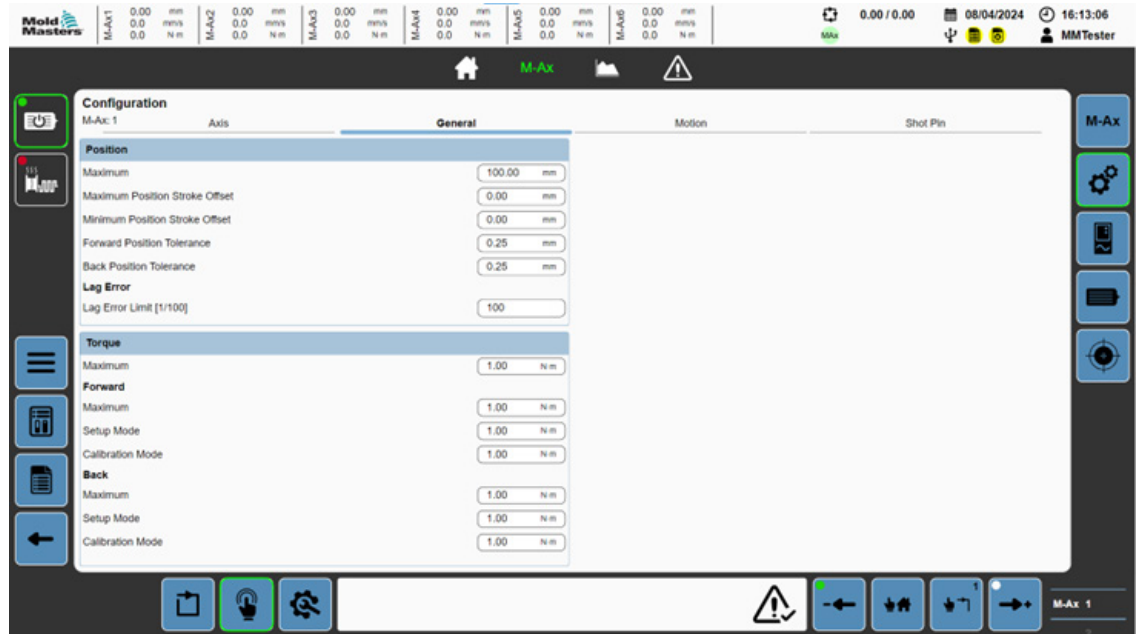
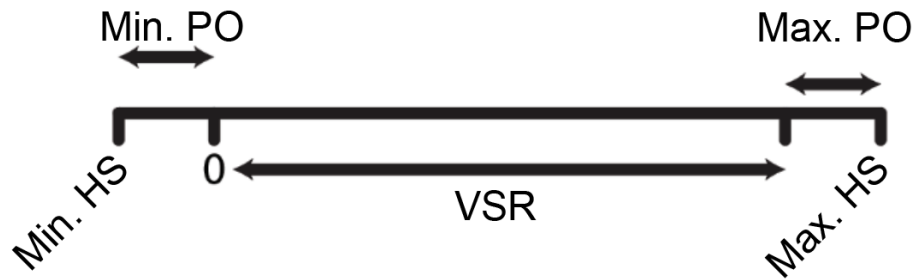


Figure 5-23 Axis configuration page with the General tab selected

Table 5-24 Position Panel	
Field	Description
Maximum	Physical maximum axis stroke Values: Any positive value For a rotary periodic axis, the Maximum Position is used as the Axis Period.
Max Position Offset	Offset from the maximum stroke to determine the software maximum stroke Values: Any positive value
Min Position Offset	Offset from the minimum stroke to determine the software minimum stroke Values: Any positive value
Forward Position Tolerance	Tolerance for a forward movement to be in position Values: Any positive value
Back Position Tolerance	Tolerance for a backward movement to be in position Values: Any positive value
Lag error limit	Allowed difference between the set and the actual position in 1/100 <sup>th</sup> of a unit.



- Min. PO = Minimum position offset
- Max. PO = Maximum position offset
- HS = Hard stop
- VSR = Valid stroke range
- Max. HS = Maximum hard stop

- Minimum hard stop = 0 – Min position offset
- Maximum hard stop = Maximum position – Min position offset
- Minimum software (SW) position = 0
- Maximum SW position = Maximum Hard stop – Max position offset

Table 5-25 Torque Panel	
Field	Description
Maximum	Maximum allowed torque for the axis Values: Any positive value
Forward—Maximum	Maximum allowed torque for forward moves Values: Any positive value up to the Maximum
Forward—Setup Mode	Torque used for forward moves in setup mode Values: Any positive value up to the Forward Maximum
Forward—Calibration Mode	Torque used for forward moves in calibration mode Any positive value up to the Forward Maximum
Back—Maximum	Maximum allowed torque for backward moves Any positive value up to the Maximum
Back—Setup Mode	Torque used for backward moves in setup mode Any positive value up to the Back Maximum
Back—Calibration Mode	Torque used for backward moves in calibration mode Any positive value up to the Back Maximum



### 5.3.5.3 Motion Tab

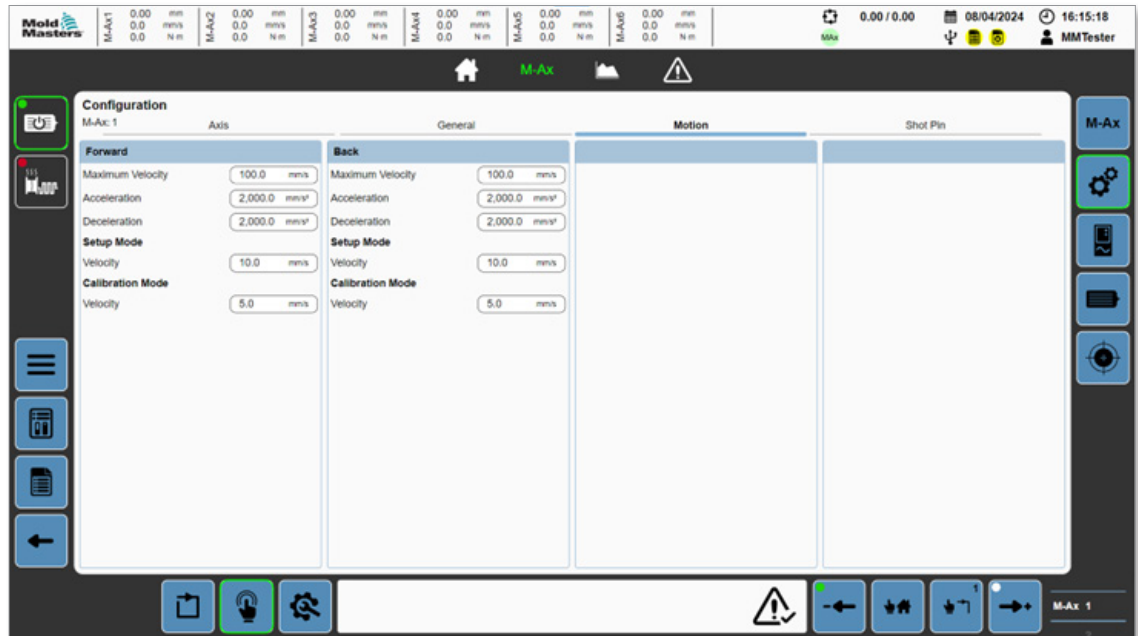


Figure 5-24 Axis configuration page with Motion tab selected

Table 5-26 Forward Panel	
Field	Description
Max Velocity	Maximum allowed velocity for forward moves Values: Any positive value
Acceleration	Acceleration for forward moves Values: Any positive value
Deceleration	Deceleration for forward moves Values: Any positive value
Setup Mode—Velocity	Velocity for forward moves in setup mode Values: Any positive value
Calibration Mode—Velocity	Velocity for forward moves in calibration mode Values: Any positive value

Table 5-27 Back Panel	
Field	Description
Max Velocity	Maximum allowed velocity for backward moves Values: Any positive value
Acceleration	Acceleration for backward moves Values: Any positive value
Deceleration	Deceleration for backward moves Values: Any positive value
Setup Mode—Velocity	Velocity for backward moves in setup mode Values: Any positive value
Calibration Mode—Velocity	Velocity for backward moves in calibration mode Values: Any positive value

### 5.3.5.4 Shot Pin Tab

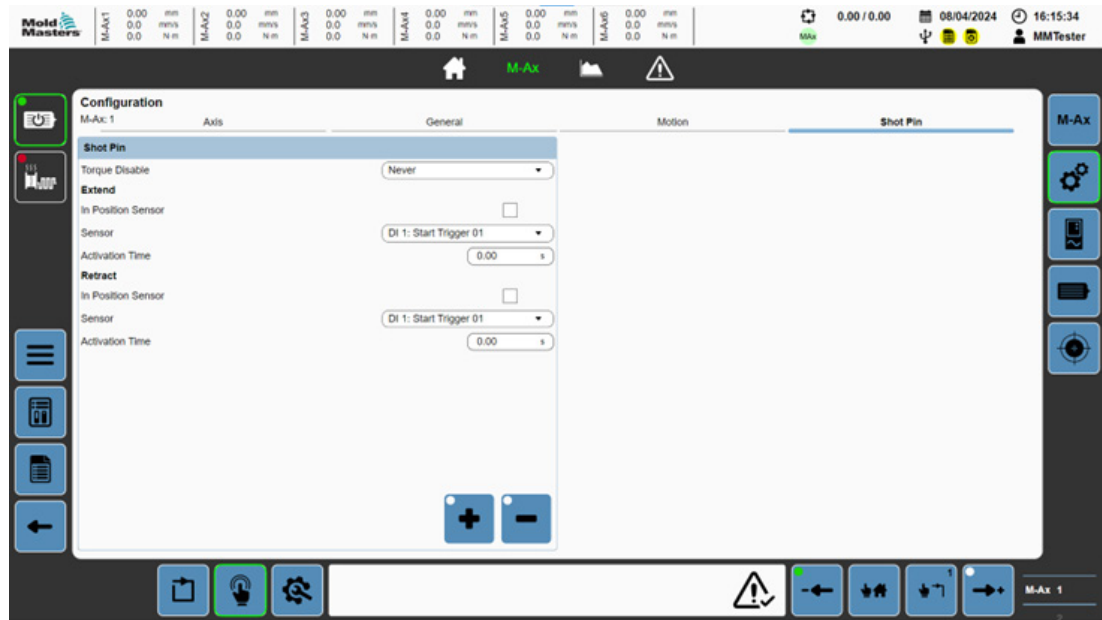




Figure 5-25 Axis configuration page with the Shot pin tab selected

Table 5-28 Shot Pin Fields	
Field	Description
Torque Disable	Axis torque can be disabled before or after the shot pin is extended if the mechanical system requires Values: <ul style="list-style-type: none"> <li>• Never</li> <li>• Before Shot Pin Extended</li> <li>• After Shot Pin Extended</li> </ul>
Extend	
In-Position Sensor	This check box is shown If the shot pin extend has an in-position feedback sensor.
Sensor	Selected custom digital input that the shot pin extend feedback sensor is wired to
Activation Time	Values: Time in seconds If there is an in-position sensor: the Activation time is the maximum allowable time after the shot pin extend signal is set before seeing the in position feedback signal go high. If the feedback signal is not high in the set amount of time, an error is generated. If there is no in-position sensor: the Activation time is the required activation time for the shot pin to travel from retracted to the extended position. After the activation time has elapsed, the system will assume the shot pin is extended.

Table 5-28 Shot Pin Fields	
Field	Description
Retract	
In-Position Sensor	This check box is shown If the shot pin retract has an in-position feedback sensor.
Sensor	Selected custom digital input that the shot pin retract feedback sensor is wired to
Activation Time	<p>Values: Time in seconds</p> <p>If there is an in-position sensor: Activation time is the maximum allowable time after the shot pin retract signal is set before the in-position feedback signal goes high. If the feedback signal does not go high in the set amount of time, an error is generated.</p> <p>If there is no in position sensor: Activation time is the required activation time for the shot pin to travel from extended to the retracted position. After the activation time has elapsed, the system will assume the shot pin is retracted.</p>
	Manual push button to extend the shot pin
	Manual push button to retract the shot pin

### 5.3.6 Drive Configuration

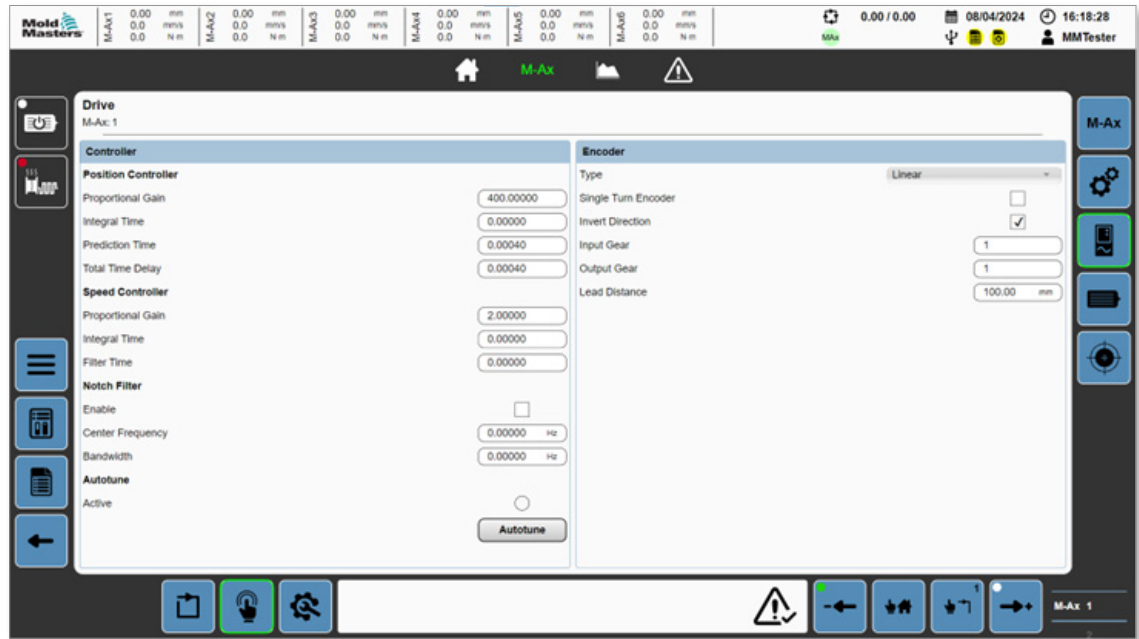


Figure 5-26 Drive page

Table 5-29 Controller Panel	
Field/Button	Description
Position Controller—Proportional Gain	Proportional Gain Values: Any number
Position Controller—Integral Time	Integral Time Values: Any number
Position Controller—Prediction Time	Prediction Time Values: Any number
Position Controller—Total Time Delay	Total Time Delay Values: Any number
Speed Controller—Proportional Gain	Proportional Gain Values: Any number
Speed Controller—Integral Time	Integral Time Values: Any number
Speed Controller—Filter Time	Filter Time Values: Any number
Notch Filter—Enabled	Enables notch filter Values: Checked or unchecked
Notch Filter—Center Frequency	Center Frequency Values: Any number
Notch Filter—Bandwidth	Bandwidth Values: Any number


Table 5-29 Controller Panel	
Field/Button	Description
Autotune—Active	Values: Off or green If auto-tuning is active, the LED will appear green.
	Autotune Controllers Tap this button to open a dialog box to start auto-tuning. Tap OK to start the controllers auto-tuning, if possible. If it is not possible to start auto-tuning, an error will be displayed. Only visible if the logged-in user has commissioning permissions

Table 5-30 Encoder Panel	
Field	Description
Type	Updates based on axis type Values: <ul style="list-style-type: none"> <li>• Linear</li> <li>• Rotary</li> <li>• Rotary Periodic</li> </ul>
Single Turn Encoder	Multi-turn/single-turn encoder selection If configured with a single turn encoder, the axis must be calibrated every time the unit is powered on.
Invert Direction	Reverses the direction of the motor rotation
Input Gear	Number of rotations on the encoder side Values: Any number
Output Gear	Number of rotations on the load side which correspond to the number of rotations on the encoder side Values: Any number
Lead Distance	The distance moved by the axis while the output of the gearbox (on the load side) moves one rotation.

### 5.3.7 Motor Configuration

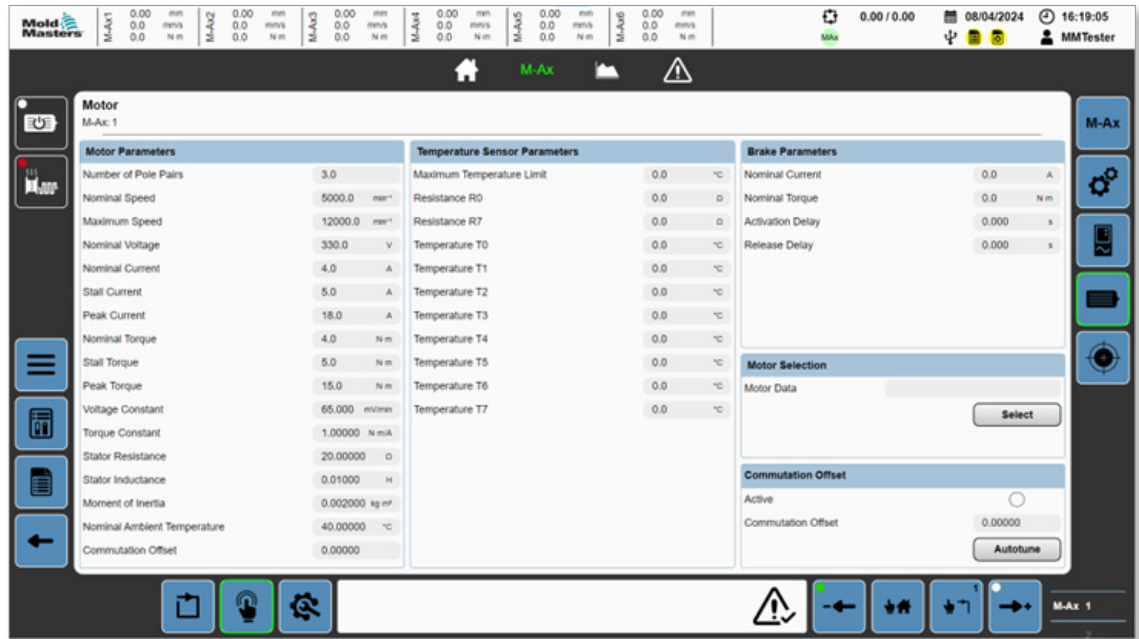



Figure 5-27 Motor configuration page

Table 5-31 Panels of the Motor Configuration Page	
Panel	Description
Motor Parameters	Active motor parameters
Temperature Sensor Parameters	Active-motor temperature-sensor parameters
Brake Parameters	Active-motor brake parameters

Table 5-32 Motor Selection Panel	
Field/Button	Description
Motor Data <input type="text" value="MSK040C_0450_NN.xml"/>	Active motor data file Values: Motor Type
<input type="button" value="Select"/>	Tap this button to update the motor data. Any changes made to the motor selection must be updated on the drive, and a power cycle is required for the changes to take effect. Only visible if the logged-in user has edit configuration permissions

Table 5-33 Commutation Offset Panel	
Button	Description
Active	Values: Off or green If commutation offset auto-tuning is active, the LED will appear green.
Commutation Offset	Current commutation offset value
	Tap this button to start auto-tuning. If it is not possible to start auto-tuning, an error will be displayed. Only visible if logged-in user has commissioning permissions.

### 5.3.7.1 Motor-Selection Dialog Box

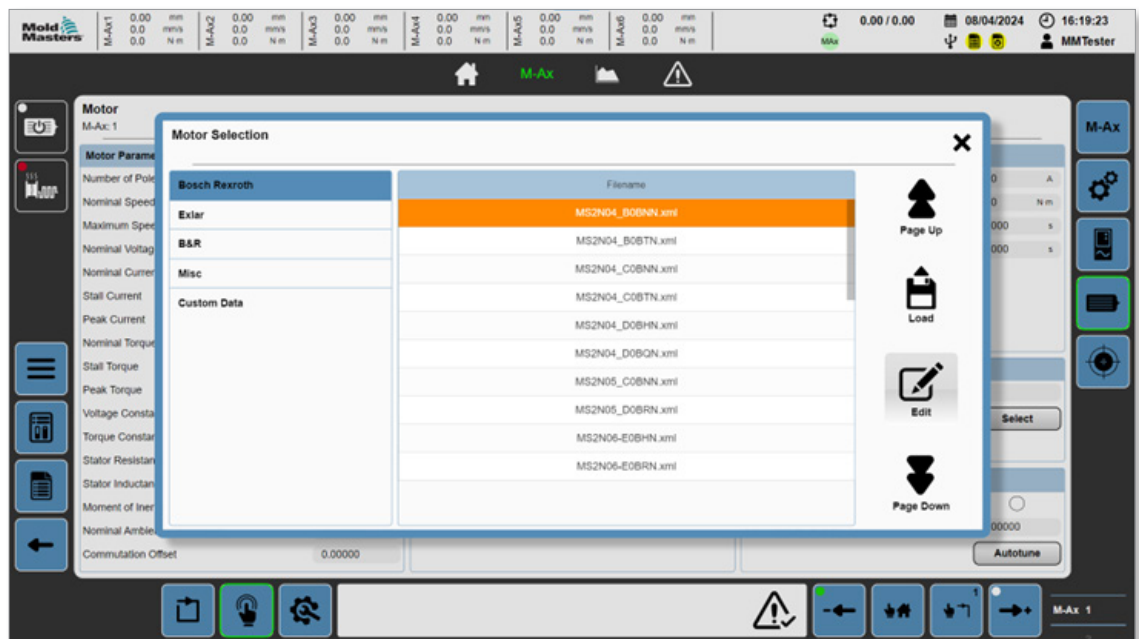



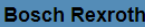

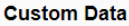

Table 5-34 Motor-Selection Dialog Box	
Field/Button	Description
	List of available motor groups Tap to select a specific motor group Values: <ul style="list-style-type: none"> <li>• B&amp;R</li> <li>• Exlar</li> <li>• Bosch Rexroth</li> <li>• Misc</li> <li>• Custom Data</li> </ul>
	
	
	
	

Table 5-34 Motor-Selection Dialog Box	
Field/Button	Description
	<p>List of available motors in a motor group Tap to select a specific motor.</p>
<p>Page Up</p>	<p>Page Up button Tap this button to navigate up through the motor list.</p>
<p>Page Down</p>	<p>Page Down button Tap this button to navigate down through the motor list.</p>
<p>Load</p>	<p>Load button Tap this button to open the Load dialog box; additional options can be selected.</p> <p>Save button: Tap this button to load the selected motor data file to the axis. Changes made to the motor selection take over on boot up and a power cycle is required for them to take effect.</p>
<p>Edit</p>	<p>Edit button Only available when the Custom Data motor group is selected. Opens the Edit Motor Data dialog box for the selected motor data file.</p>



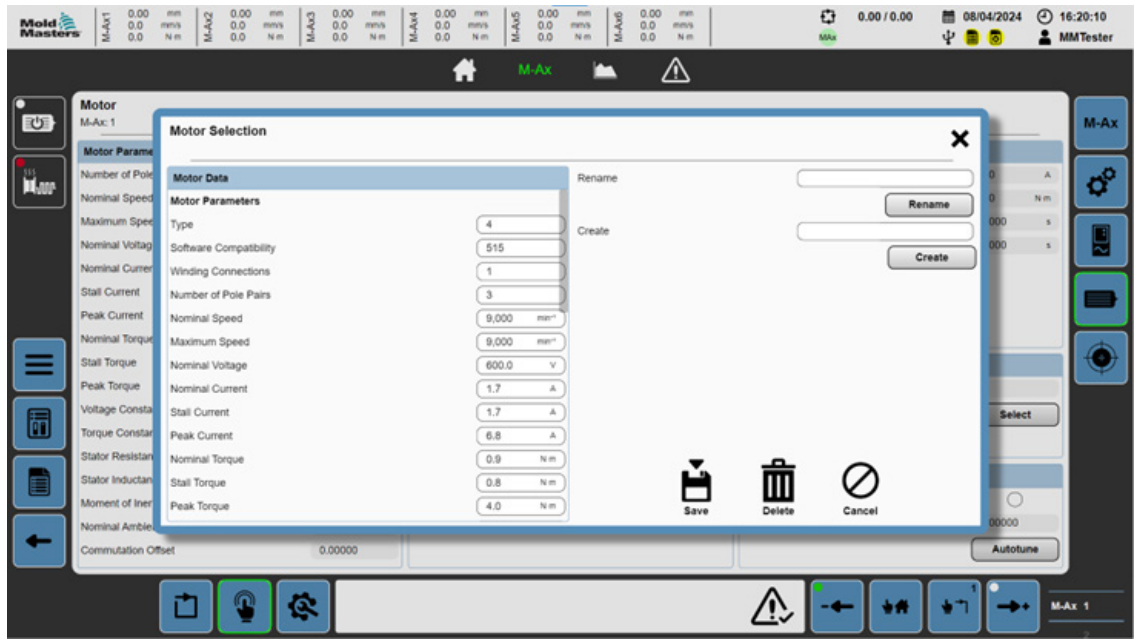





Figure 5-28 Motor-data dialog box

Table 5-35 Motor-Data Dialog Box	
Field/Button	Description
	<p>Editable list of motor parameters required for creating a custom motor data table</p>
	<p>Rename Rename box Rename button</p> <p>To rename the selected custom motor-data file, enter text in the Rename box and tap the Rename button.</p>
	<p>Create Create box Create button</p> <p>To create a new motor data file, enter text in the Create box and tap the Create button.</p>

Table 5-35 Motor-Data Dialog Box	
Field/Button	Description
 Save	Save button  Tap the Save button to save the motor data to the selected custom motor-data file.
 Delete	Delete button  Tap the Delete button to delete the selected motor data file.
 Cancel	Cancel button  Tap the Cancel button to close the Edit Motor-Data Dialog box without making any changes.

### 5.3.8 Calibration

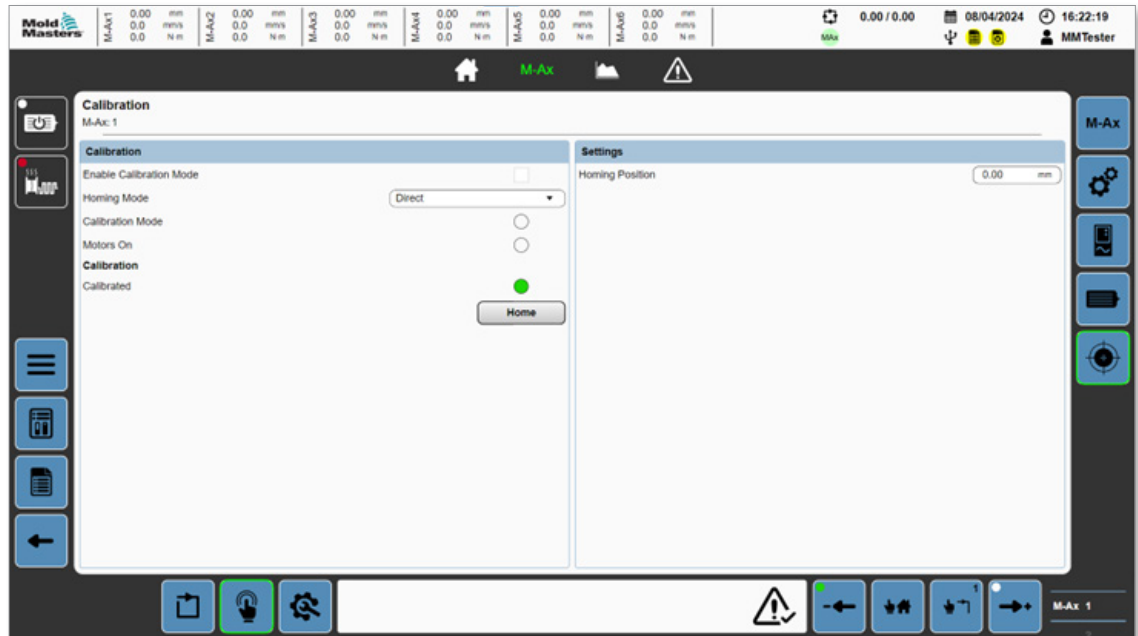


Figure 5-29 Calibration page

Table 5-36 Calibration Panel	
Field/Button	Description
Enable Calibration Mode	Tap this check box to enter calibration mode. Calibrating the axis or changing pages will automatically exit calibration mode.
Homing Mode	Values: <ul style="list-style-type: none"> <li>• Direct</li> <li>• Switch</li> <li>• End Stop</li> <li>• Automatic</li> </ul>
Calibration Mode	Values: Off or green Prerequisite for automatic calibration; machine must be in calibration mode. The LED is green if the condition is met.
Motors On	Values: Off or green Prerequisite for automatic calibration; machine must have the motors on. The LED is green if the condition is met.
Calibrated	Values: Off or green The LED is green if the axis is calibrated successfully.

Table 5-36 Calibration Panel	
Field/Button	Description
Home	<p>Home button</p> <p>Tap the Start button to begin the calibration. If the conditions are all met, the calibration will begin.</p> <p>Direct: Homes the axis to the Homing Position.</p> <p>Switch: Homes the axis to the selected input using the set parameters.</p> <p>End Stop: Homes the axis to either the positive or negative hard stop based on your selection.</p> <p>Automatic: *You must ensure that the axis can move the full stroke unobstructed.</p> <p>Procedure:</p> <ol style="list-style-type: none"> <li>1. The axis moves positive until it hits a hard stop.</li> <li>2. The axis is homed to the maximum position.</li> <li>3. The axis moves negative until it hits a hard stop.</li> <li>4. If the hard stop position is within the forward tolerance to the 0 position, then automatic calibration is successful and the calibrated LED will turn green.</li> <li>5. If automatic calibration fails, an error is displayed.</li> </ol>

Table 5-37 Settings Panel	
Field	Description
Homing Position	Homing position of the axis Values: Any positive value
Homing Acceleration	Acceleration used for homing to switch Values: Any positive value
Start Velocity	Starting velocity used for homing to switch Values: A positive calibration velocity
Homing Velocity	Homing Velocity Values: A positive calibration velocity Should be a very small value. Once the switch is found this is used to find the edge of the switch for homing.
Start Direction	Initial direction of travel to find the homing switch Values: Positive or Negative
Homing Direction	Final direction of motion to find the homing switch edge Values: Positive or Negative
Homing Switch	Selection of custom digital input to be used for homing procedure Values: Custom digital inputs

## 5.4 Custom I/O

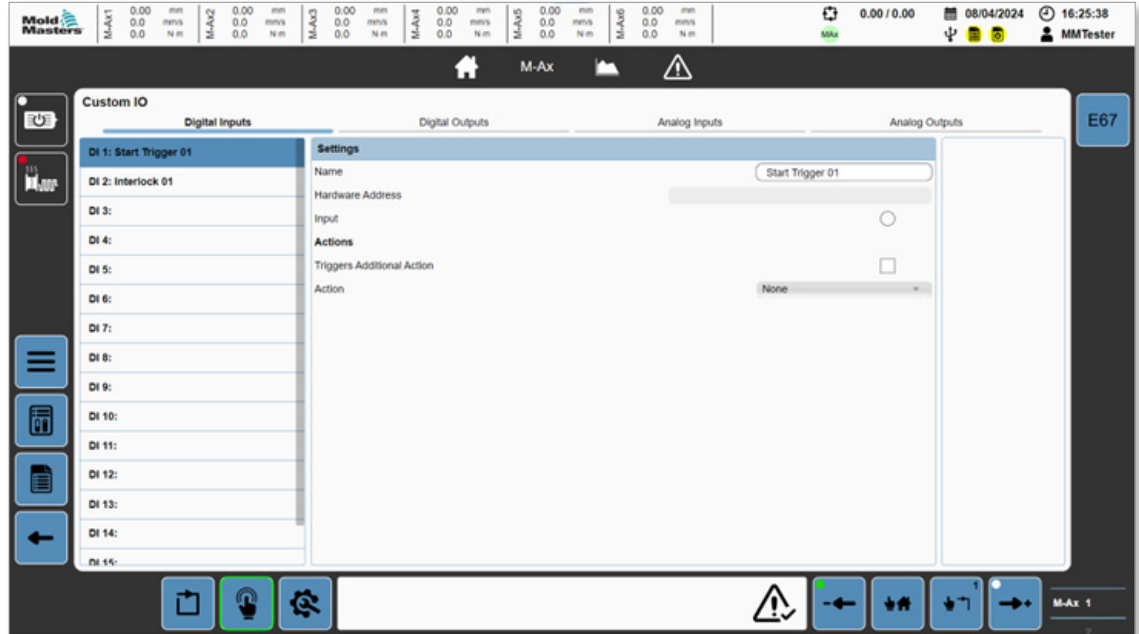


Figure 5-30 Custom I/O page with Digital Inputs tab selected

Table 5-38 Fields of the Digital Inputs Panel	
Field	Description
Name	Custom name Values: Any string
Hardware Address	Address of the hardware location for the selected I/O Values: Hardware Location
Input	Shows the current status of the input Values: Red or off
Triggers Additional Actions	If this checkbox is checked, a rising edge of the I/O can trigger additional actions. Values: Checked or unchecked
Action	The selected additional action will be triggered on a rising edge of the digital input. Values: <ul style="list-style-type: none"> <li>• None</li> <li>• Heats On (E-Multi only)</li> <li>• Integrated HRC On</li> </ul>

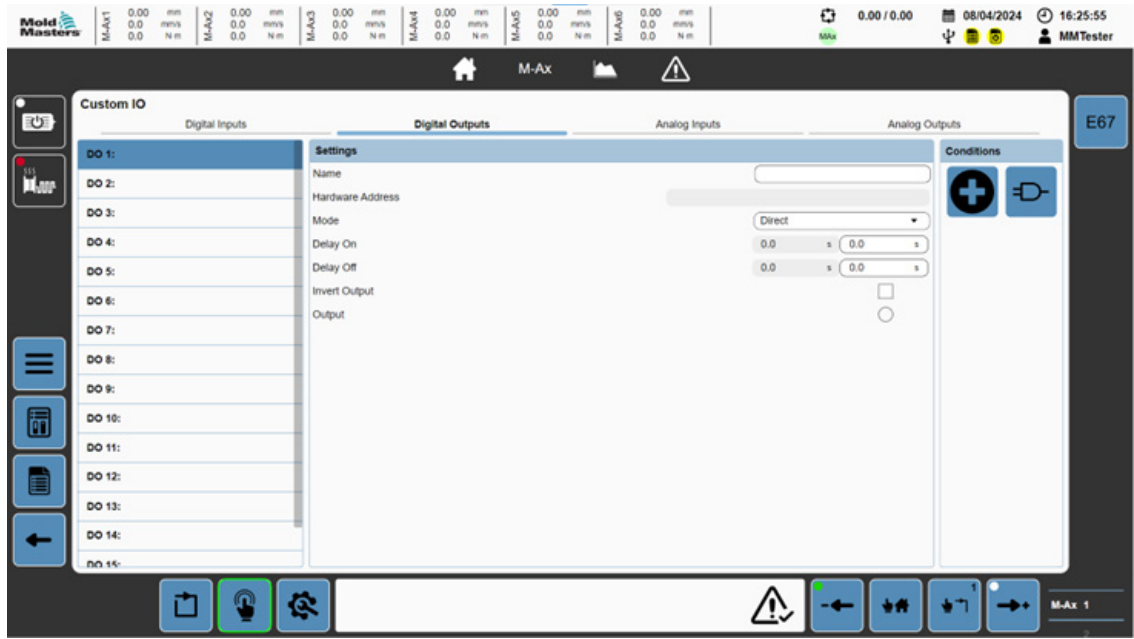


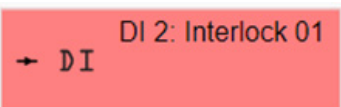


Figure 5-31 Custom I/O page with Digital Outputs tab selected

Table 5-39 Digital Outputs Panel	
Field/Button	Description
Name	Custom name Values: Any string
Hardware Address	Address of the hardware location for the selected I/O Values: Hardware Location
Mode	Digital output mode  Values: <ul style="list-style-type: none"> <li>• Direct</li> <li>• Timed</li> <li>• Pulsed</li> <li>• Switched</li> </ul> <p>Direct: Controlled directly from the conditions evaluation. If the evaluation is true, the output is on; if it is false, the output is off.</p> <p>Timed: On a rising edge of the condition evaluation, the output is turned on for the set amount of time. If the conditions evaluation is false before the time has elapsed or once the timer has elapsed, then the output is turned off.</p> <p>Pulsed: While the condition evaluation is true, the output is pulsed for the set pulse time.</p> <p>Switched: Turns the output on/off using user defined conditions</p>
Delay On	Delay On Values: Any positive value When the condition evaluation is true, there is a delay of this amount of time before controlling the output based on the mode.

Table 5-39 Digital Outputs Panel	
Field/Button	Description
Delay On	Trigger to turn on the output for Switched mode. Pressing this field will open the conditions dialog box.
Delay Off	Trigger to turn of the output for Switched mode. Pressing this field will open the conditions dialog box.
Invert Output	Invert the output after all the evaluations Values: Checked or unchecked
Output	Values: Red or off

Table 5-40 Conditions Panel	
Field	Description
	New conditions button Add new conditions Tap the new condition button to open a new detailed-condition dialog box for the selected motion step.
	Edit condition logic Tap the edit logic button to set up the conditions AND/OR evaluation. By default all conditions are ANDed together.
	Edit or delete existing conditions Tap a condition to edit or delete the selected conditions data.  Each motion step can have up to nine individually configured conditions.  Condition backgrounds will display their current state. The condition background will be red if the condition is not valid and green if it is.

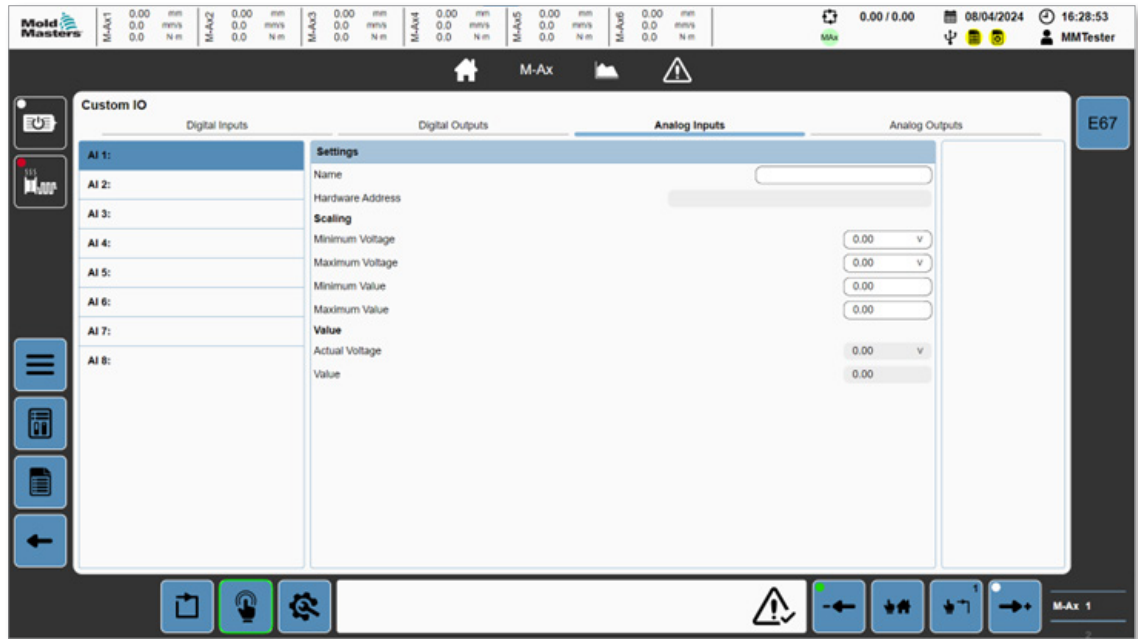


Figure 5-32 Custom I/O page with the Analog Inputs tab selected

Table 5-41 Analog Inputs Tab	
Field	Description
Name	Custom name Values: Any string
Hardware Address	Address of the hardware location for the selected I/O Values: Hardware location
Minimum Voltage	Minimum input voltage for scaling the input Values: -10 V to +10 V
Maximum Voltage	Maximum input voltage for scaling the input Values: -10 V to +10 V
Minimum Value	Minimum value for scaling the input Values: Any value
Maximum Value	Maximum value for scaling the input Values: Any value
Actual Voltage	Actual voltage at the card Values: -10 V to +10 V
Value	Scaled value Values: Any value



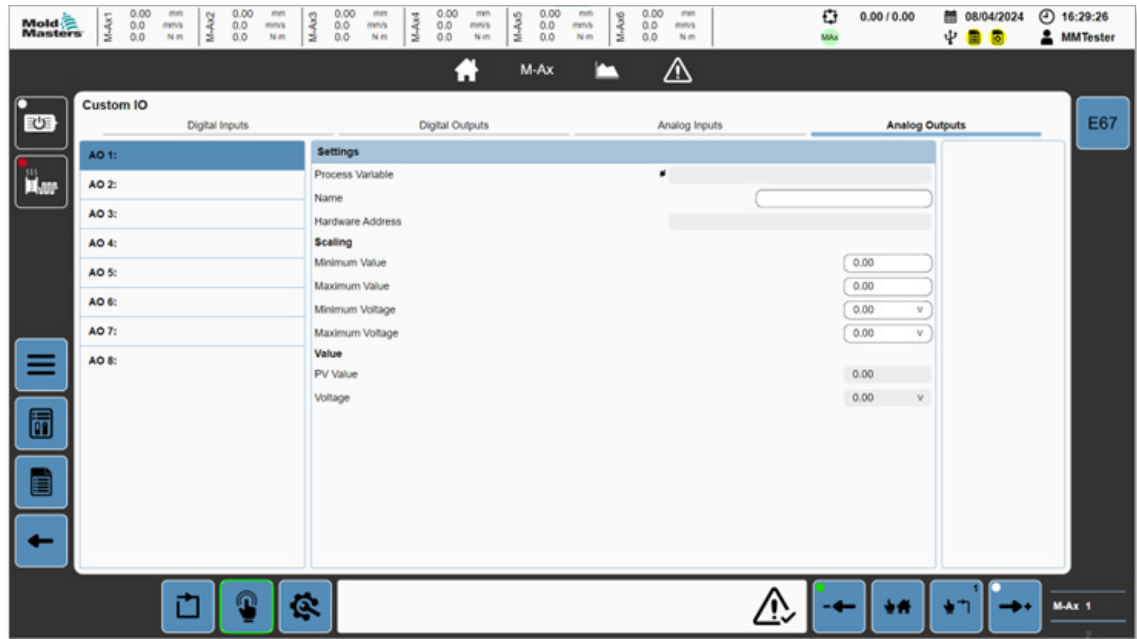


Figure 5-33 Custom I/O page with the Analog Output tab selected

**Table 5-42 Analog Outputs Tab**

Field	Description
Process Variable	Tap anywhere in this field to select a process variable (PV). Values: Process variable
Name	Custom name Values: Any string
Hardware Address	Address of the hardware location for the selected I/O
Minimum Value	Minimum value for scaling the input Values: Any value
Maximum Value	Maximum value for scaling the input Values: Any value
Minimum Voltage	Minimum input voltage for scaling the input Values: -10 V to +10 V
Maximum Voltage	Maximum input voltage for scaling the input Values: -10 V to +10 V
PV Value	Current value of the selected process variable
Voltage	Scaled voltage output of the selected process variable



## 5.5 Trace

### 5.5.1 Trace Page



Figure 5-34 Trace page

Table 5-43 Trace Page																	
Field/Button	Description																
	<p>Move Cursor</p> <p>Move the cursor one step left or right</p> <p>The cursor time stamp is displayed to the right of the buttons.</p>																
	<p>Display Trace</p> <p>Y-axis: Percent</p> <p>X-axis: Time</p> <p>All percent values are scaled to be between 0 and 100.</p> <p>Pinch to zoom.</p> <p>You can drag the cursor to the required location. You can make fine adjustments with the Move Cursor buttons.</p>																
<table border="1"> <thead> <tr> <th colspan="2">M-Ax1 Actual Position</th> <th colspan="2">M-Ax1 Actual Velocity</th> </tr> </thead> <tbody> <tr> <td>Cursor</td> <td>67.7</td> <td>Cursor</td> <td>12.0</td> </tr> <tr> <td>Min</td> <td>42.1</td> <td>Min</td> <td>-5.0</td> </tr> <tr> <td>Max</td> <td>80.0</td> <td>Max</td> <td>24.0</td> </tr> </tbody> </table>	M-Ax1 Actual Position		M-Ax1 Actual Velocity		Cursor	67.7	Cursor	12.0	Min	42.1	Min	-5.0	Max	80.0	Max	24.0	<p>PV (Process Variable) Overview</p> <p>Displays the traced PV name, value at cursor, minimum/maximum values and the line colors of the traces.</p>
M-Ax1 Actual Position		M-Ax1 Actual Velocity															
Cursor	67.7	Cursor	12.0														
Min	42.1	Min	-5.0														
Max	80.0	Max	24.0														
<p><b>Autoscale</b></p>	<p>Autoscale button</p> <p>Automatically scales minimum and maximum scaling values of PV's</p> <p>Scale maximum = Max value + 0.1*max value</p> <p>Scale minimum = Min value - 0.1*min value</p> <p>Custom scaling can be set on the trace configuration page</p>																

Table 5-43 Trace Page	
Field/Button	Description
 <b>Start / Stop</b>	Start/Stop Button Tap this button to start recording the trace. Tap this button to stop recording the trace.
 <b>Save</b>	Save Button Tap this button to save trace data as a csv file. If a USB memory stick is plugged into the system, the trace data is saved to the USB memory stick. Otherwise, the trace is saved to the user data. The trace data can be exported from the user data page.

### 5.5.2 Trace Configuration Page

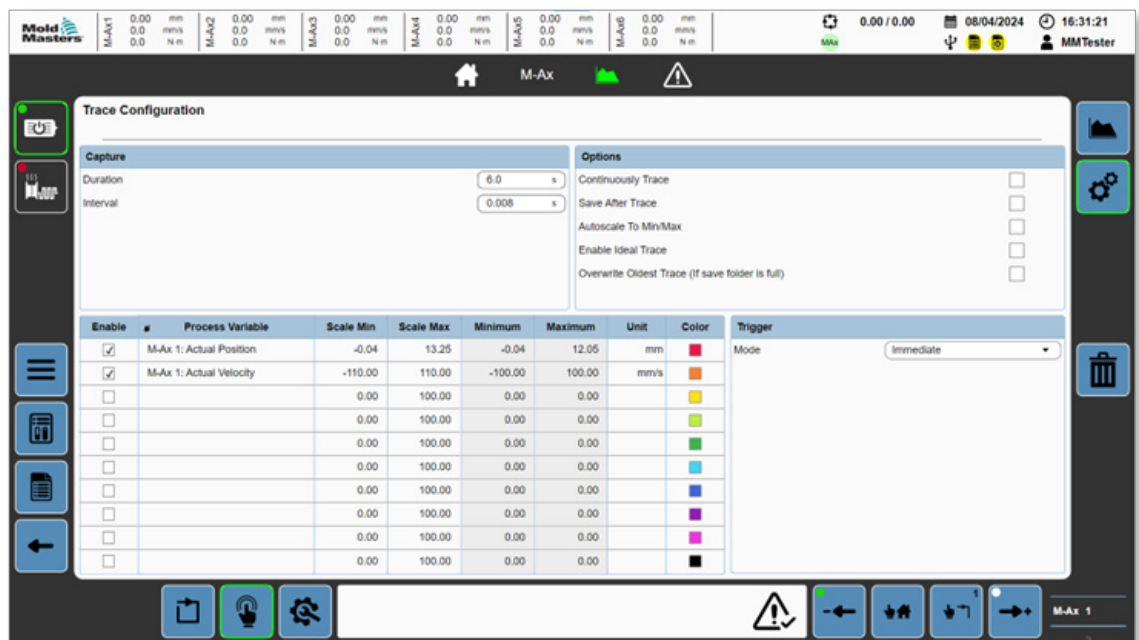


Figure 5-35 Trace configuration page

Table 5-44 Capture Panel	
Field	Description
Interval	Process variable (PV) sampling time Every interval the current values of the selected PV values are recorded. The entered value will automatically be adjusted to a multiple of 0.008 s. Changing the interval will adjust the Duration to the maximum time possible at that interval.
Duration	Total PV capture duration Changing the duration will adjust the Interval to the lowest possible interval.

Table 5-45 Options Panel	
Field	Description
Continuously Trace	Once the trace has finished, the trace automatically returns to checking the trigger state waiting to start again.
Save After Trace	Automatically saves the trace after it finishes
Autoscale to Min/Max	When checked, after a trace is finished it will automatically scale the PV's min and max values to fit the trace onto the graph.
Enable Ideal Trace	<p>Enabling Ideal Trace converts process variables (PV's) 6 to 10 into ideal traces. Ideal traces are copies of PV's 1 to 5 and allow the user to save a trace for comparison on future traces.</p> <p>After enabling ideal trace, an icon will appear on PV's 6 to 10. Tapping this field will open up a confirmation dialog box to copy the paired trace into this index.</p> <p>This is available on both the trace page or the configuration page.</p>
Overwrite Oldest Trace	The trace folder is restricted in size. If the size limit is reached, an error will be displayed when saving if not overwriting the oldest file. This requires that space be made in the user data trace folder or the oldest file be overwritten.


Table 5-46 Process-Variable (PV) Settings Panel								
Field								Description
<input type="checkbox"/>		0.00	100.00	0.00	0.00			<p>Process Variable Settings</p> <p>Checkbox: Hide/show trace on graph</p> <p>Process Variable: Name of the process variable. Tapping anywhere in this area opens the PV selection dialog box.</p> <p>Scale Min: Minimum value to scale process variable</p> <p>Scale Max: Maximum value to scale process variable</p> <p>Min: Minimum value recorded during the trace</p> <p>Max: Maximum value recorded during the trace</p> <p>Trace color: Displays the trace color. Tap it to change the color.</p>

Table 5-47 Trigger Panel	
Field/Button	Description
Mode	<p>Select the trigger mode to begin the trace.</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• Immediate</li> <li>• Threshold</li> <li>• Cycle Start</li> </ul> <p>Immediate: Trace begins as soon as the start/stop button is pressed            Threshold: Trace begins as soon as the threshold conditions are met            Cycle Start: Trace begins as soon as a new cycle is started</p>
Threshold—Variable	<p>Selected Trace PV's</p> <p>Values: Any value</p> <p>Dropdown list is populated with the currently selected trace variables.</p> <p>Selected variable will be compared to the threshold variable and condition.</p>
Threshold—Value	Value to be compared to selected variable
Threshold—Condition	<p>Values: &gt; or &lt;</p> <p>Condition used to compare the selected variable to the Value</p>

## 5.6 HMI Configuration

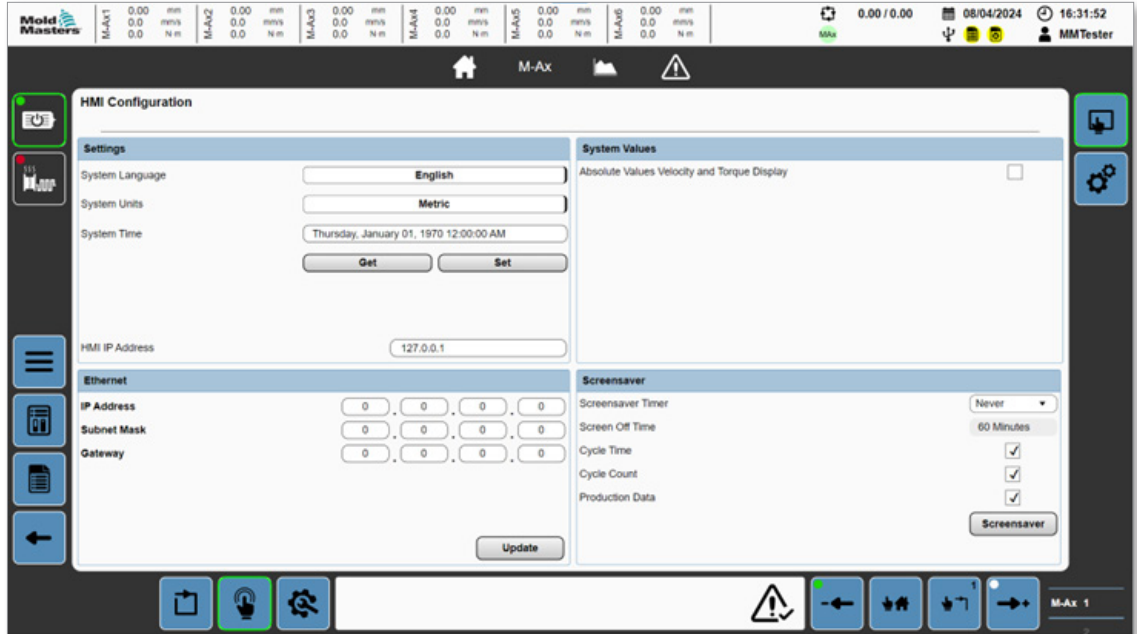


Figure 5-36 HMI configuration page

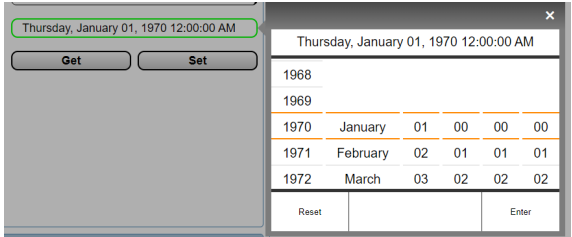
Table 5-48 Settings Panel	
Field	Description
System Language	System language selector
System Units	System unit selector
System Time	<p>Tap the Get button to update the Date and Time values to the current date and time.</p> <p>Tap the Set button to update the system time to the Date and Time value.</p> <p>Tap the Date and Time field to change the Date and Time value manually.</p> 



Table 5-49 Ethernet Panel	
Field	Description
	<p>IP Address Subnet Mask Gateway</p> <p>Update button Tap the update button to change the system's Ethernet parameters.</p>

Table 5-50 System Values Panel	
Field	Description
Absolute Values Velocity and Torque Display	If checked, the velocity and torque displays will be converted to absolute values. If unchecked, the velocity and torque will be positive or negative depending on the direction of motion.

Table 5-51 Screensaver Panel	
Field	Description
Screensaver Timer	Tap this selector to change the screensaver timer. After the selected amount of time without any activity, the HMI will display the screensaver.
Screen Off Time	After an hour of no activity, the backlight on the HMI will turn off. Any activity will wake up the HMI.
	<p>Screensaver Button Tap this button to go to the Screensaver.</p>

## 5.7 Euromap 67 (EM67)

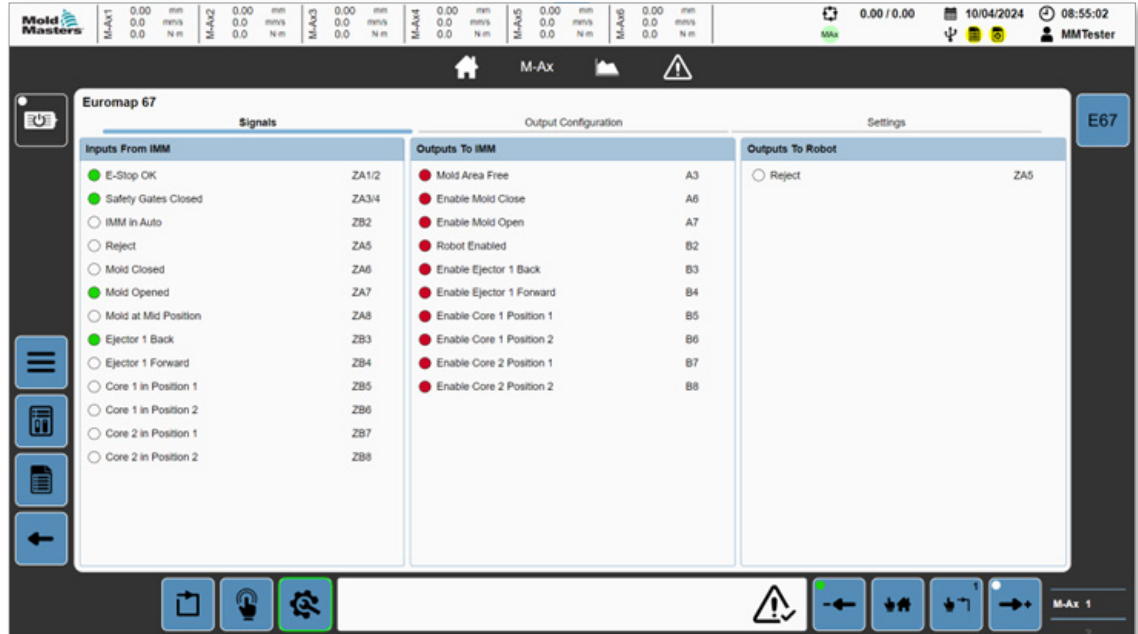


Figure 5-37 EM67 page with the Signals tab selected

Table 5-52 Signals Panel	
Fields	Description
Inputs from IMM	A summary of digital input signals from the IMM through the Euromap 67 interface Values: Green or off
Outputs to IMM	A summary of digital output signals to the IMM through the Euromap 67 interface Values: Red or off
Outputs to Robot	A summary of signals passed to the robot (In the case that the EM67 interface is daisy-chained to another device.)



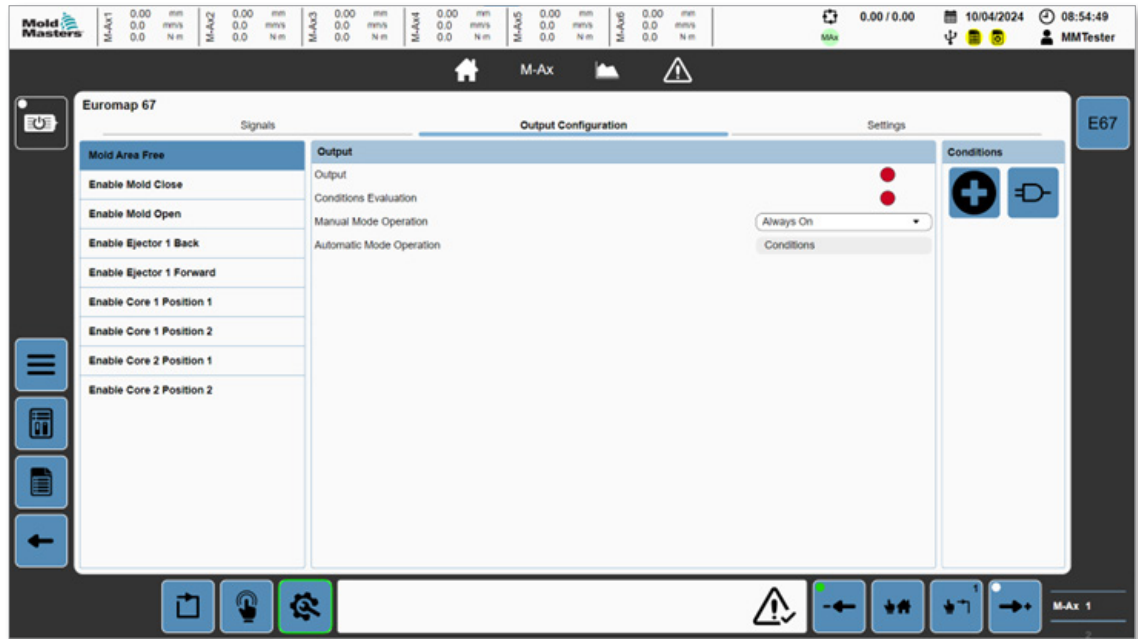


Figure 5-38 EM67 page with the Output Configuration tab selected

Configurable EM67 outputs are listed in the left panel. Tap the buttons in the Conditions Panel (right panel) to modify a selected output.

Table 5-53 Output Configuration Panel	
Field	Description
Output	Output status Values: Red or off
Conditions Evaluation	Evaluation of the configured conditions If no conditions are configured, it is OK by default. Values: Red or off
Manual Mode Operation	If a specific output for one of the EM67 signals is required while outside of automatic mode, you can configure it to always be on, always off, or rely on the configured conditions.  Values: <ul style="list-style-type: none"> <li>• Always On</li> <li>• Always Off</li> <li>• Conditions</li> </ul>
Automatic Mode Operation	Automatic mode will always use the condition evaluation  If any signals are automatically interlocked with the machine, a message is displayed at the bottom of the Output panel informing this. For example, Enable Mold Close is always interlocked with critical alarms. If there are any active critical alarms, the Enable mold closed signal will be FALSE.

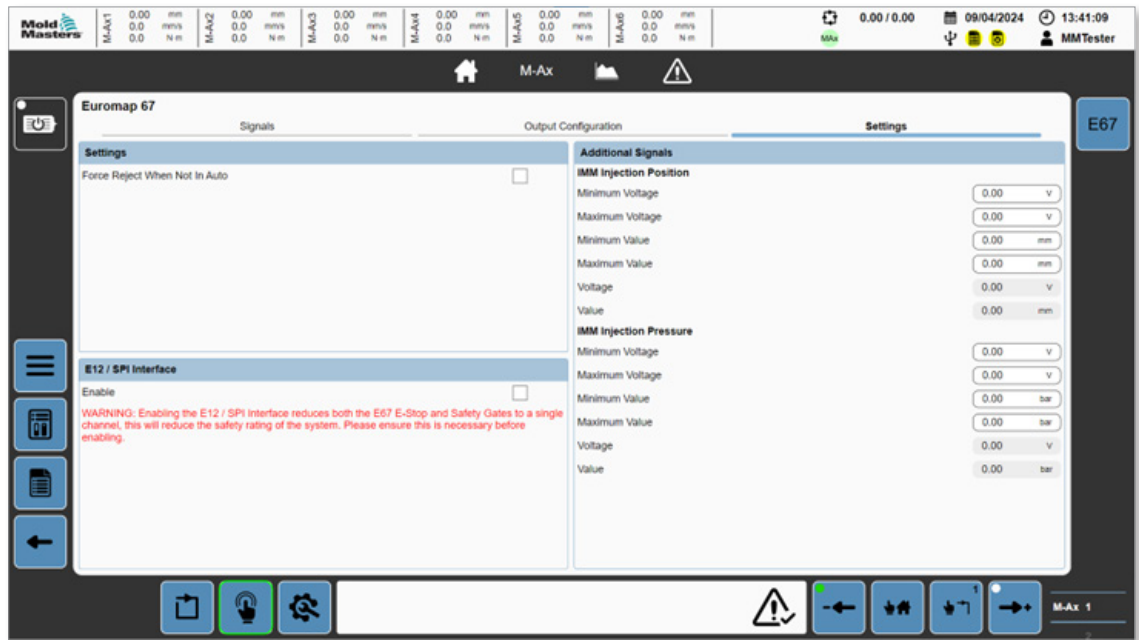


Figure 5-39 EM67 page with the Settings tab selected

Table 5-54 Settings Panel	
Field	Description
Force Reject When Not in Auto	Always force the reject signal to be TRUE when not in automatic mode

Table 5-55 E12/SPI Interface Panel	
Field	Description
Enable	Enables the E67 to E12/SPI Interface. This reduces the number of E-Stop and Safety Gate channels to one to make the E67 interface compatible with E12 and SPI interfaces.

## 5.8 Alarms

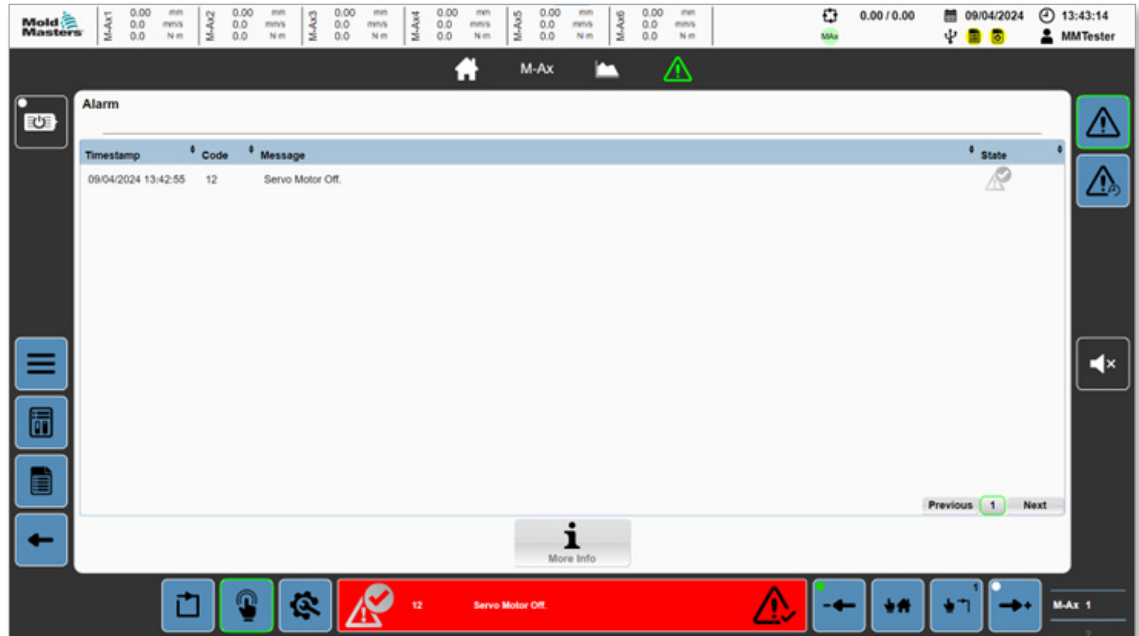


Figure 5-40 Alarm page

Table 5-56 Alarm Page	
Field/Button	Description
	<p>Displays all active alarms</p> <p>Click a header to sort alarms by timestamp, code, message, and state.</p>
	<p>More Information Button</p> <p>Alarm messages preceded by an integer and followed by a colon have more detailed information available. To view this information, select an alarm and press this button to open the detailed alarm-dialog box.</p>
	<p>Alarm Paging Button</p> <p>If there are more alarms than the page can display, use the previous, next, and page index buttons to navigate the alarms.</p>

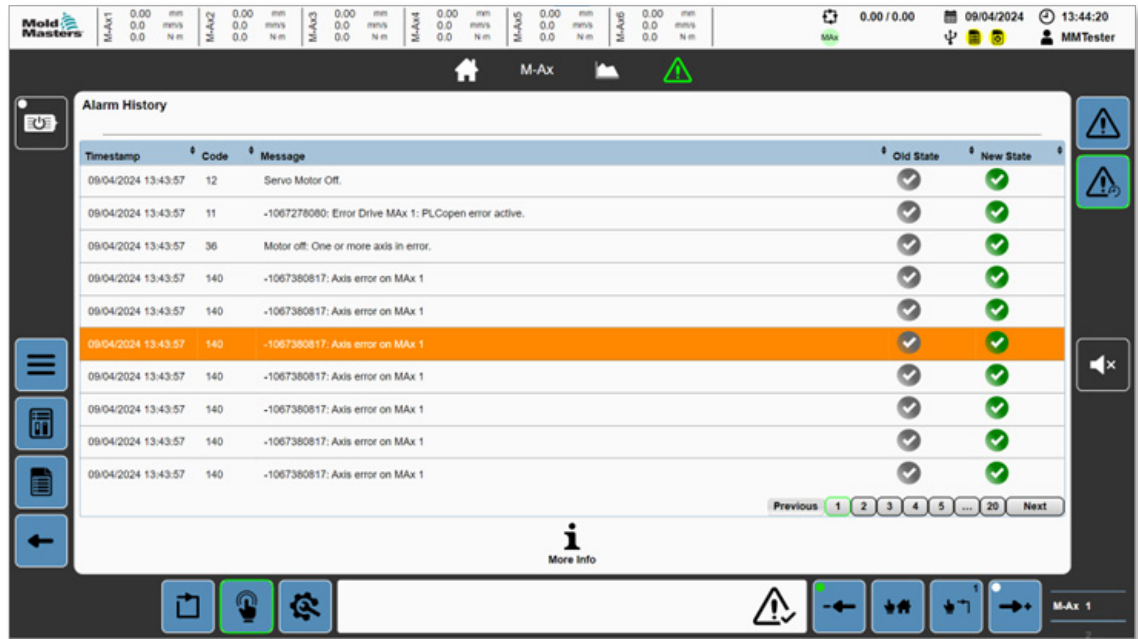


Figure 5-41 Alarm history page

The Alarm history page has the same interface as the Alarms page.

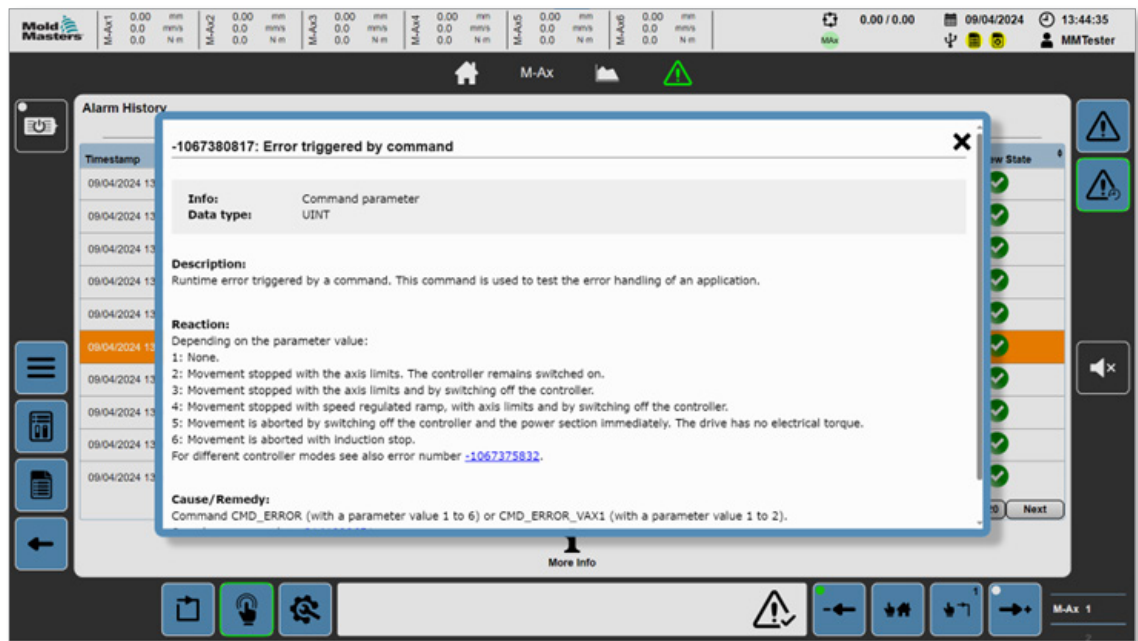


Figure 5-42 Detailed alarm box

The Detailed alarm box provides additional alarm information about internal errors.

## 5.9 Data

All interactions with data files are done through this page: Loading, saving, deleting, creating, and renaming Recipe and Fixed data files. You can also import and export user data here.

### 5.9.1 Recipe

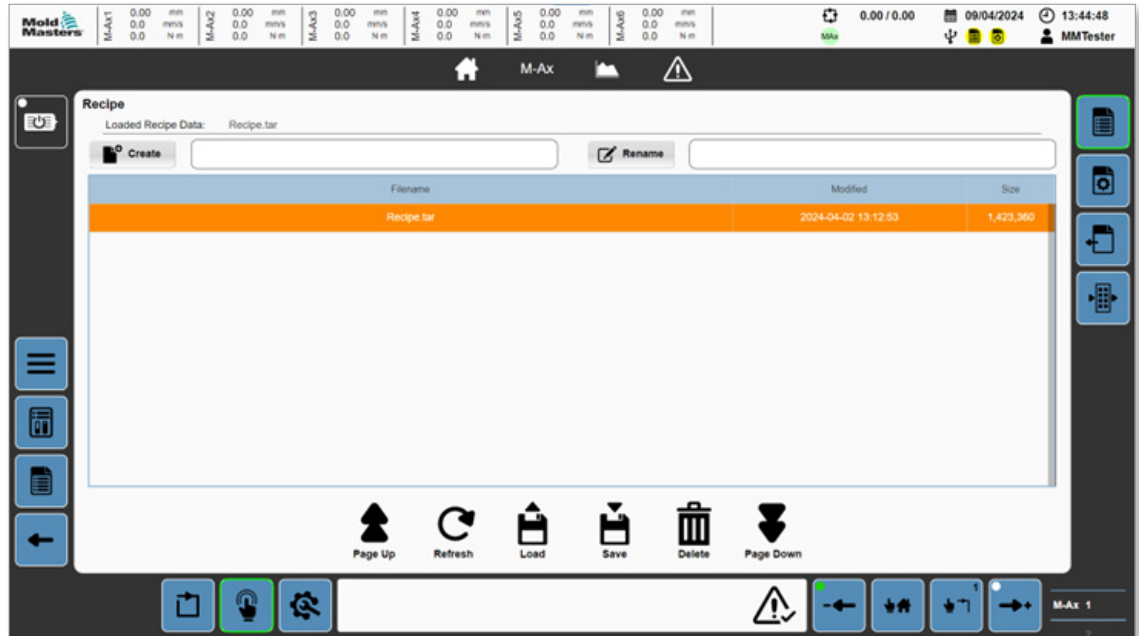








Figure 5-43 Recipe data page

Table 5-57 Recipe Data Page	
Field/Button	Description
Loaded Recipe Data: Recipe.tar	Displays the last loaded recipe file
Create <input type="text"/>	Create File Field To create a file containing all the current recipe values, enter a filename in the text field, and press the Create button.
Rename <input type="text"/>	Rename File Field To rename a file, enter a filename in the Rename text field, and press the Rename button.
	Displays Recipe Files Select a recipe file to interact with using the other buttons.

Table 5-57 Recipe Data Page	
Field/Button	Description
 Page Up	Page Up Button  If multiple recipe files are displayed on one page, use the Page Up button to scroll up through the recipe file list.
 Refresh	Refresh Button  Tap this button to refresh the recipe file list.
 Load	Load Button  Tap this button to load the selected recipe file.
 Save	Save Button  Tap the Save button to save the selected recipe file.
 Delete	Delete Button  Tap the Delete Button to delete the selected recipe file.
 Page Down	Page Down Button  If there are multiple recipe files displayed on one page, use the Page Down button to scroll down through the recipe file list.

### 5.9.2 Fixed

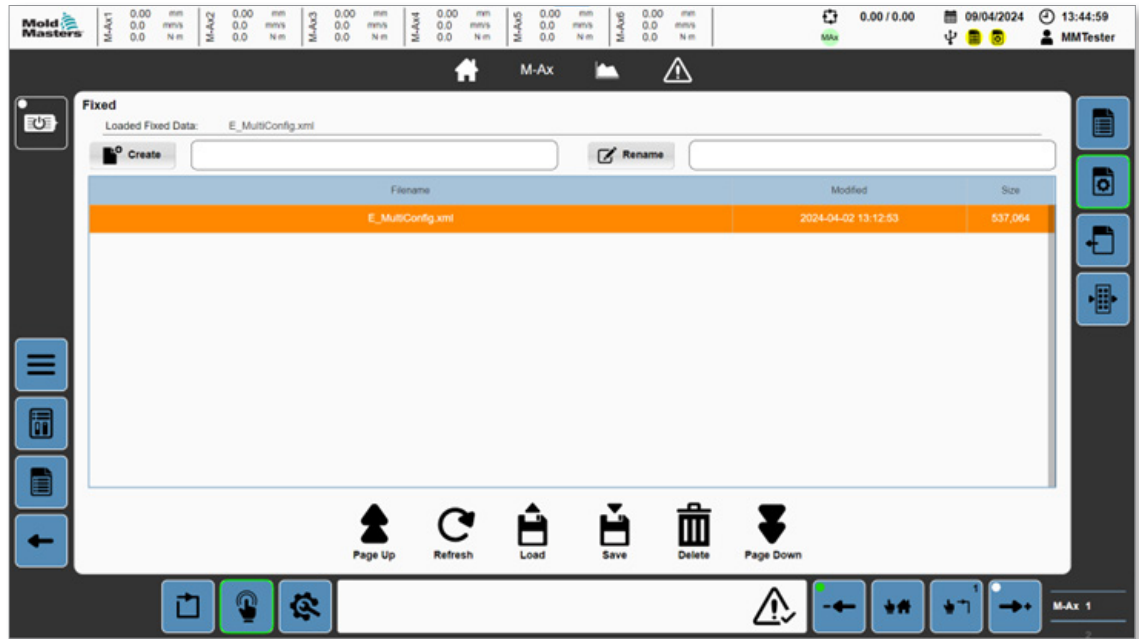







Figure 5-44 Fixed data page

Table 5-58 Fixed Data Page	
Field/Button	Description
Loaded Fixed Data: <code>MAx_Config.xml</code>	Displays the last-loaded fixed data file
Create <input type="text"/>	<b>Create File Field</b> Enter a filename in the Create File text field, and press the Create button to create a file with that name containing all the current fixed values.
Rename <input type="text"/>	<b>Rename File Field</b> Enter a filename in the Rename text field, and press the Rename button to rename a file.
	Select a fixed file to interact with using the other buttons.
 Page Up	<b>Page Up Button</b> If multiple recipe files are displayed on one page, use the Page Up button to scroll up through the recipe file list.

Table 5-58 Fixed Data Page	
Field/Button	Description
 <b>Refresh</b>	<p>Refresh Button</p> <p>Tap this button to refresh the recipe file list.</p>
 <b>Load</b>	<p>Load Button</p> <p>Tap this button to load the selected recipe file.</p>
 <b>Save</b>	<p>Save Button</p> <p>Tap the Save button to save the selected recipe file.</p>
 <b>Delete</b>	<p>Delete Button</p> <p>Tap the Delete Button to delete the selected recipe file.</p>
 <b>Page Down</b>	<p>Page Down Button</p> <p>If there are multiple recipe files displayed on one page, use the Page Down button to scroll down through the recipe file list.</p>



### 5.9.3 User Data

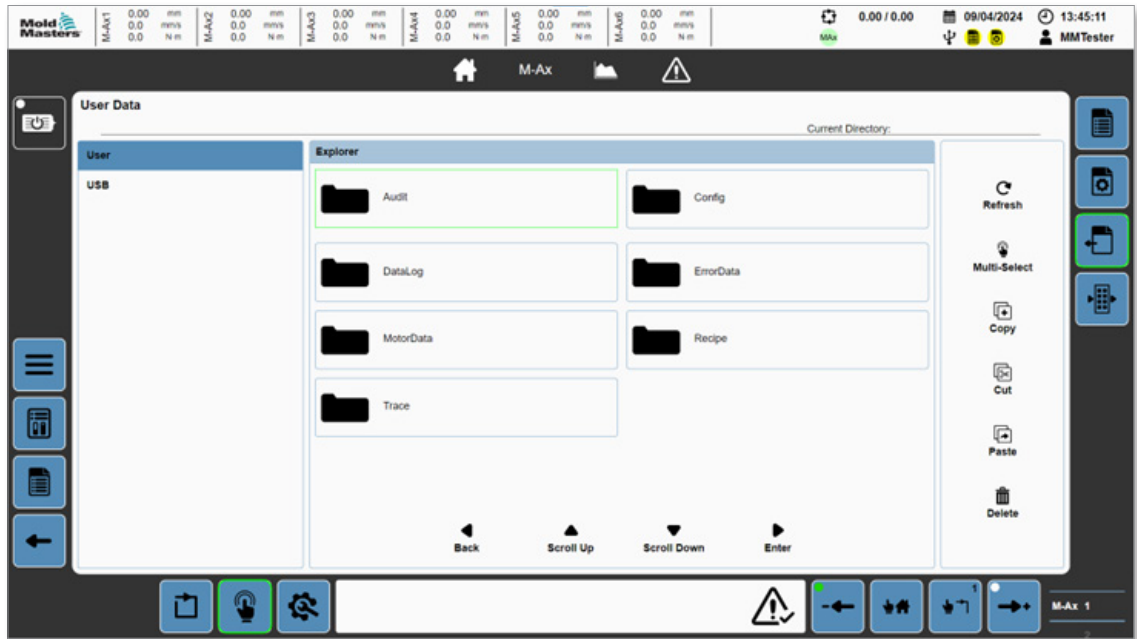











Figure 5-45 User data page

Table 5-59 User Data Page	
Field/Button	Description
	File device selector panel Values: User, USB
	Current Directory Shows the directory path. The path is blank when at the directory root.
	Displays all files/folders in the active directory
	Back button Tap the Back button to go back to the parent folder.

Table 5-59 User Data Page	
Field/Button	Description
 <b>Scroll Up</b>	<p>Scroll Up button            Tap the Scroll Up button to scroll up through the contents of the current folder.</p>
 <b>Scroll Down</b>	<p>Scroll Down button            Tap the Scroll Down button to scroll down through the contents of the current folder.</p>
 <b>Enter</b>	<p>Enter button            Tap the Enter button to open the selected folder.</p>
 <b>Refresh</b>	<p>Refresh button            Tap the Refresh button to refresh the content list.</p>
 <b>Multi-Select</b>	<p>Multi-Select button            Tap the Multi-Select button to enable the selection of multiple files/folders. This button does not work concurrently with the scrolling buttons.</p>
 <b>Copy</b>	<p>Copy button            Tap the Copy button to copy the selected files/folders.</p>
 <b>Cut</b>	<p>Cut button            Tap the Cut button to cut the selected files/folders.</p>
 <b>Paste</b>	<p>Paste button            Tap the Paste button to paste previously cut or copied files/folders in the current directory.</p>
 <b>Delete</b>	<p>Delete button            Tap this button to delete the selected files/folders.</p> <p>All deleted files are permanently deleted and cannot be recovered.</p>

## 5.10 Documents

### 5.10.1 PDF/Documents Page

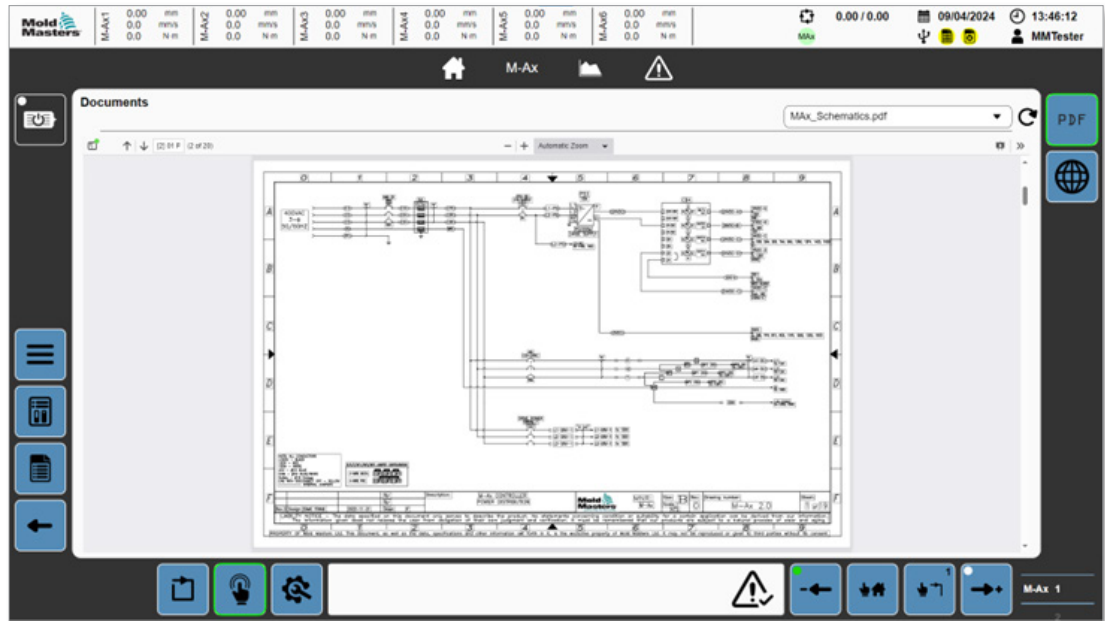


Figure 5-46 PDF/Documents page

Table 5-60 Documents Page	
Field/Button	Description
	Dropdown list of all available PDF files on the controller Tap a PDF file to view the file.
	Refresh button Tap this button to update the list of PDF files.
	Standard PDF interface control buttons: sidebar display and page selection
	Standard PDF interface control button: zoom control
	Standard PDF interface control button: presentation mode on/off

5.10.2 Web

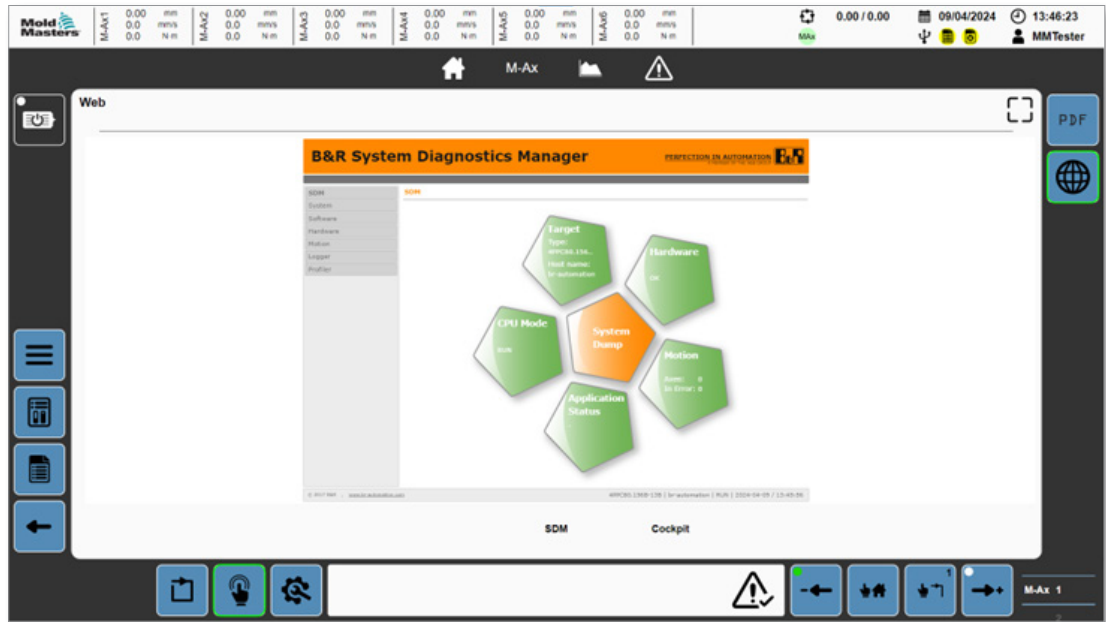




Figure 5-47 Web page

Table 5-61 Web Page	
Button	Description
	Full screen button Tap the Full screen button to switch to full screen view.
	Tap the Mold-Masters logo to switch from full screen view to the PDF Viewer page.

### 5.10.2.1 System Diagnostics Manager (SDM)

To go to the SDM page, tap the SDM button at the bottom of the Web page.

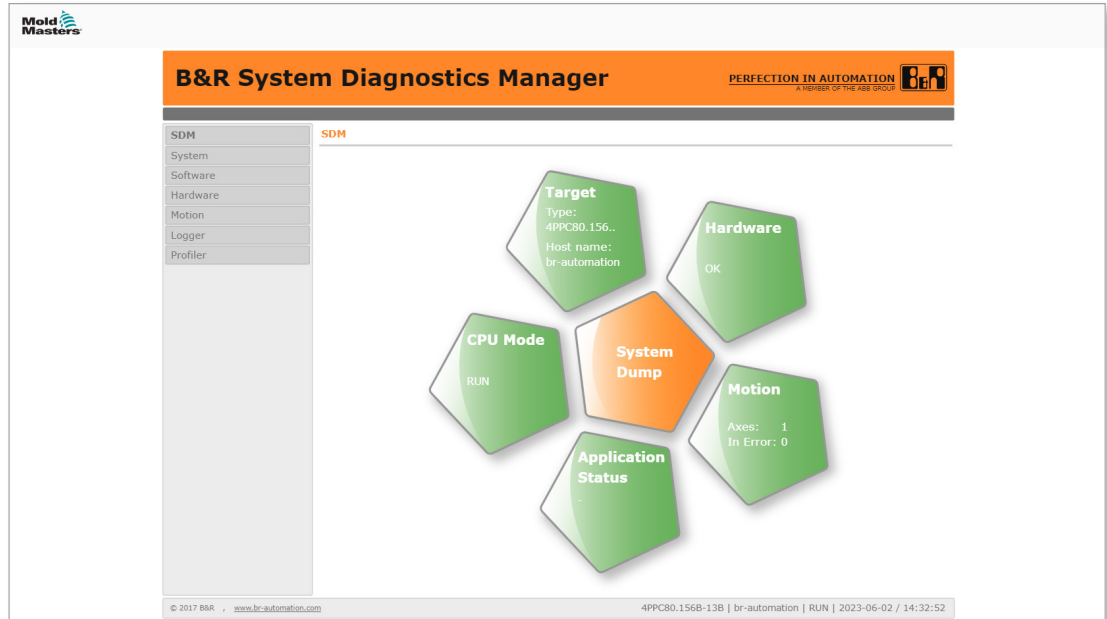
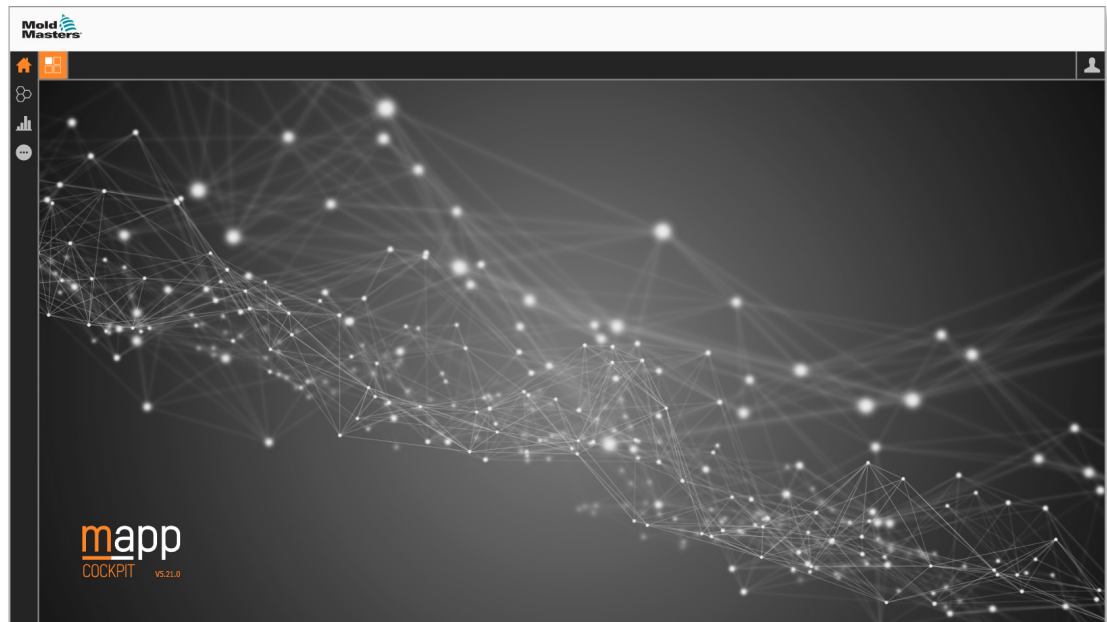


Figure 5-48 SDM interface (Full page)

Use the SDM interface to diagnose the controller. You can generate a system dump, view hardware and application statuses, and get information on the CPU system.

### 5.10.2.2 Mapp Cockpit

To go to the Mapp Cockpit, tap the Cockpit button at the bottom of the Web page.



The Mapp Cockpit is a web-based HMI application that enables the commissioning of automation components.

The Mapp Cockpit has troubleshooting options and enables additional interaction with automation components. You can:

1. Test the behavior by executing a command of a component
2. Monitor the behavior of a component (observe live values, record a trace, and check logged events).
3. Change the configuration of a component to achieve a desired behavior, and, if necessary, test the behavior again.
4. Permanently save changes to the configuration.
5. Merge the changed configuration with the configuration of the Automation Studio project.

The Mapp Cockpit provides additional troubleshooting functions such as universal trace, which enables a decentralized trace on ACOPOS servo drives and in the PLC.

## 5.11 Production

### 5.11.1 Production Page

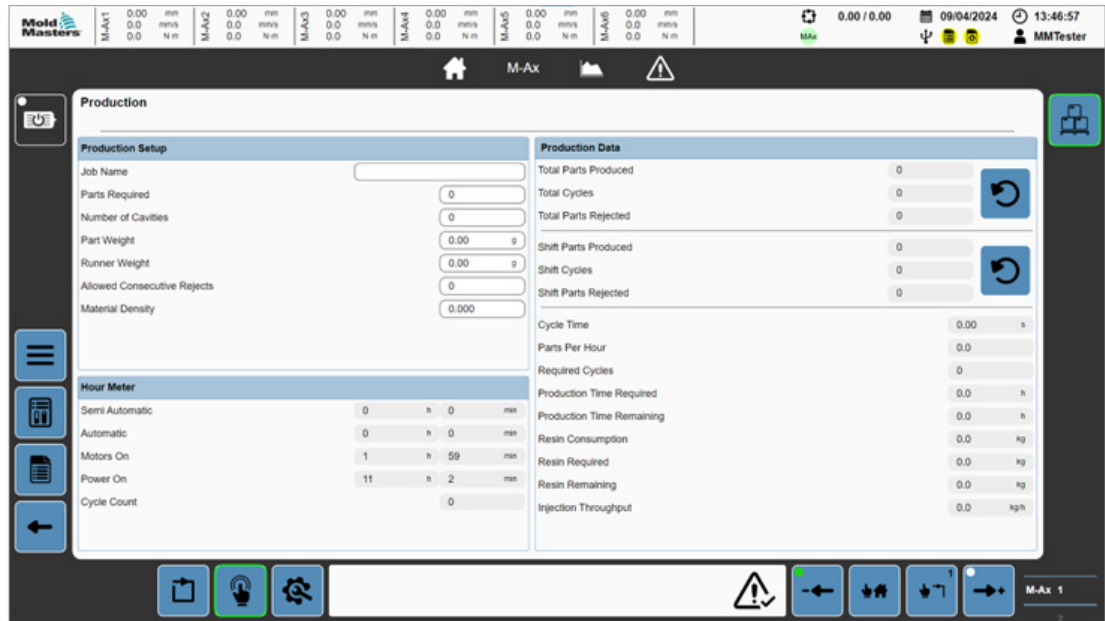




Figure 5-49 Production page

Table 5-62 Production Setup Panel	
Field	Description
Job Name	User defined name for the current production job Values: Any text string, 27 characters displayed
Parts Required	Number of produced parts required for current job Values: Any positive integer
Number of Cavities	Number of cavities in mold / number of parts produced per injection cycle Values: Any positive integer
Part Weight	Average weight of finished part Values: Any positive value
Runner Weight	Average weight of runner Values: Any positive value
Allowed Consecutive Rejects	Maximum allowed number of consecutive reject cycles before the machine exits automatic cycling with an error Values: Any positive integer
Material Density	Density of material being used Values: Any positive integer

Table 5-63 Hour Meter Panel	
Field	Description
Semi Automatic	Hours spent in semi-automatic mode of operation
Automatic	Hours spent in full automatic mode of operation Full automatic is not normally available on the machine.
Motors On	Hours spent with the motors enabled
Power On	Hours spent with the power enabled
Cycle Count	Current machine cycle count

Table 5-64 Production Data Panel	
Field/Button	Description
Total Parts Produced	Total number of parts produced by the machine
Total Cycles	Total number of production cycles of this machine
	Reset Totals button Tap the Resets Totals button to reset the total parts produced and total cycles to 0.
Shift Parts Produced	Total number of parts produced on current shift
Shift Cycles	Total number of production cycles on current shift
	Reset Shifts button Tap the Reset Shifts button to reset the shift parts produced and shift cycles to 0.
Cycle Time	Current cycle time
Parts Per Hour	Average number of parts produced per hour of cycling
Required Cycles	The number of machine cycles required to produce the parts required. Equal to parts required / number of cavities
Production Time Required	The amount of time to produce the parts required. Equal to required cycles * cycle time
Production Time Remaining	The amount of time remaining to finish the production run
Resin Consumption	The weight of resin already consumed during the current production run
Resin Required	The weight of resin required to make the parts required for current production run
Resin Remaining	The weight of resin required for remaining production
Injection Throughput	The weight of resin consumed per hour
Estimated kWh/kg	The estimated energy in kWh required to process one kg of material



### 5.11.2 Mold Coding (Option)

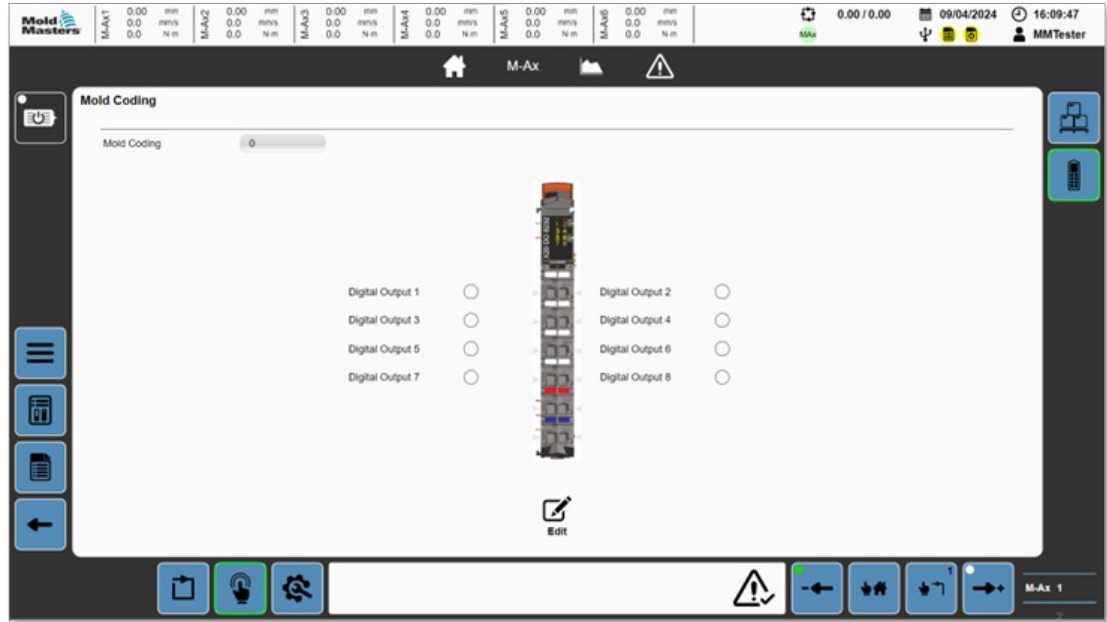


Figure 5-50 Mold coding page

Table 5-65 Mold Coding Page	
Field/Button	Description
Mold Coding	Mold identifier attached to the currently loaded recipe Values: Any positive integer up to 255
	Indicates the output status for the binary decimal coding of the mold code  Values: Off or red
<p><b>Edit</b></p>	Edit button  Tap the Edit button to edit the mold coding value.

## 5.12 Wait Timers

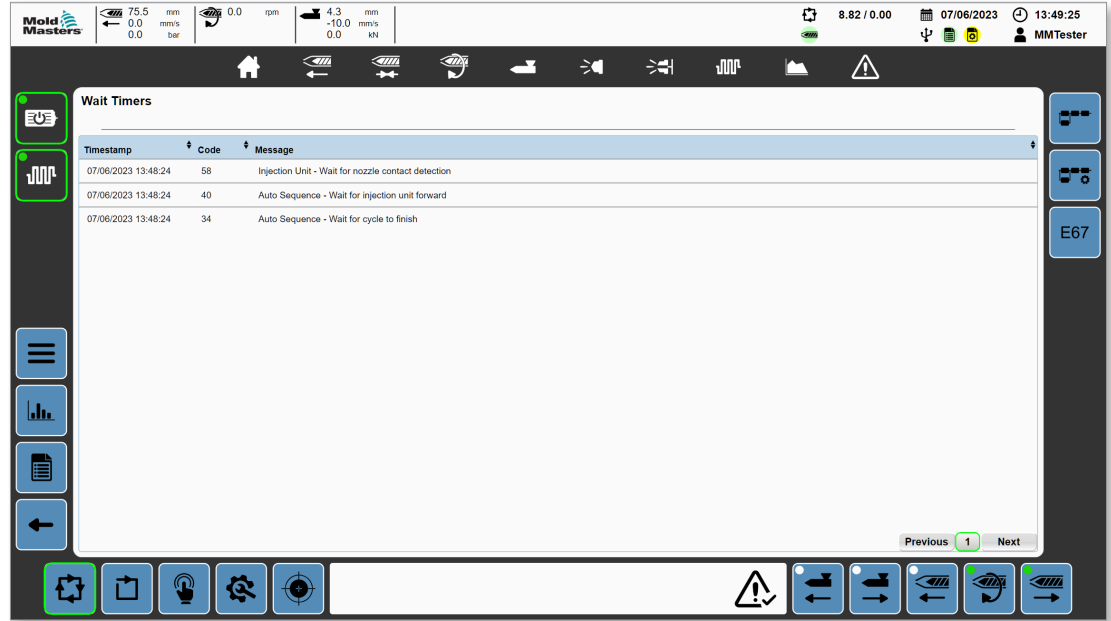


Figure 5-51 Wait timers page

Table 5-66 Wait Timers Page										
Field	Description									
<table border="1"> <thead> <tr> <th>Timestamp</th> <th>Code</th> <th>Message</th> </tr> </thead> <tbody> <tr> <td>07/06/2023 13:48:24</td> <td>58</td> <td>Injection Unit - Wait for nozzle contact detection</td> </tr> <tr> <td>07/06/2023 13:48:24</td> <td>40</td> <td>Auto Sequence - Wait for injection unit forward</td> </tr> </tbody> </table>	Timestamp	Code	Message	07/06/2023 13:48:24	58	Injection Unit - Wait for nozzle contact detection	07/06/2023 13:48:24	40	Auto Sequence - Wait for injection unit forward	<p>Displays all active wait points (conditions a program is waiting for to continue) Alarms can be sorted by timestamp, code, and message by tapping their header section.</p>
Timestamp	Code	Message								
07/06/2023 13:48:24	58	Injection Unit - Wait for nozzle contact detection								
07/06/2023 13:48:24	40	Auto Sequence - Wait for injection unit forward								
<p>Previous <b>1</b> Next</p>	<p>Page navigation buttons If there are more wait timers than the page can display, you can use the previous, next, and page index buttons to navigate to the wait timers.</p>									

### 5.13 Schedule

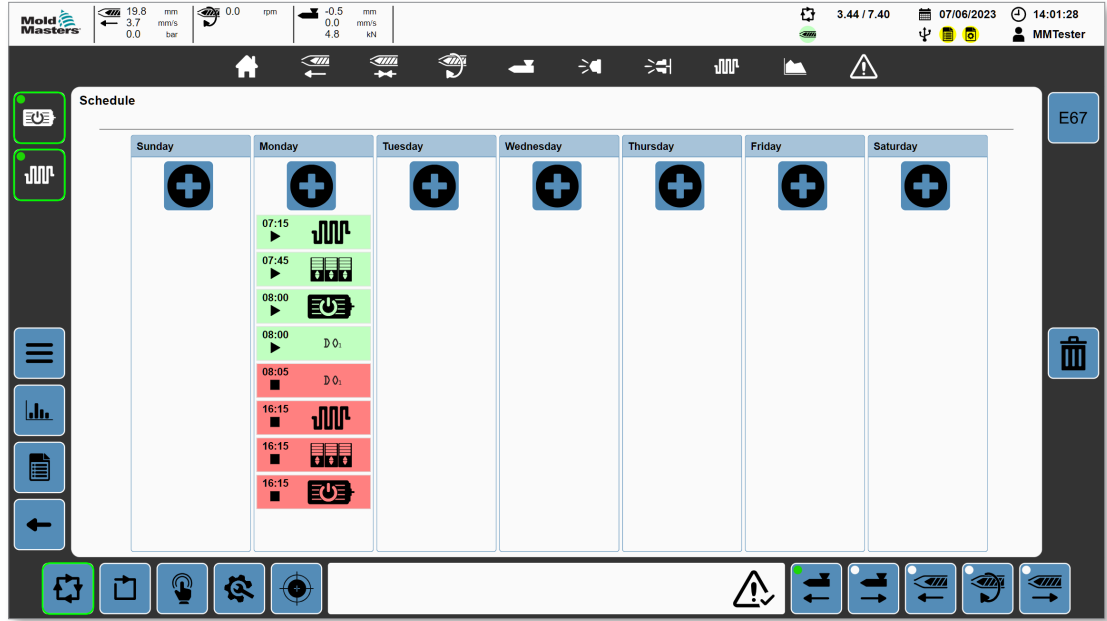






Figure 5-52 Schedule page

Table 5-67 Schedule Page	
Field/Button	Description
	Week schedule
	Add event button Tap the Add event button to add an event to the schedule for that day. Events can be set for multiple days.
	Green: Start event for barrel heats Red: Stop event for barrel heats Tap the event to modify or delete the event.
	Green: Start event for motors Red: Stop event for motors Tap the event to modify or delete the event.

Table 5-67 Schedule Page	
Field/Button	Description
	<p>Green: Start event for digital output</p> <p>Red: Stop event for digital output</p>
	<p>The digital output number is indicated.</p> <p>Tap the event to modify or delete the event.</p>
	<p>Green: Start event for integrated hot runner controller</p> <p>Red: Stop event for integrated hot runner controller</p>
	<p>Tap the event to modify or delete the event.</p>

When you tap an event, the add/modify dialog box is displayed.

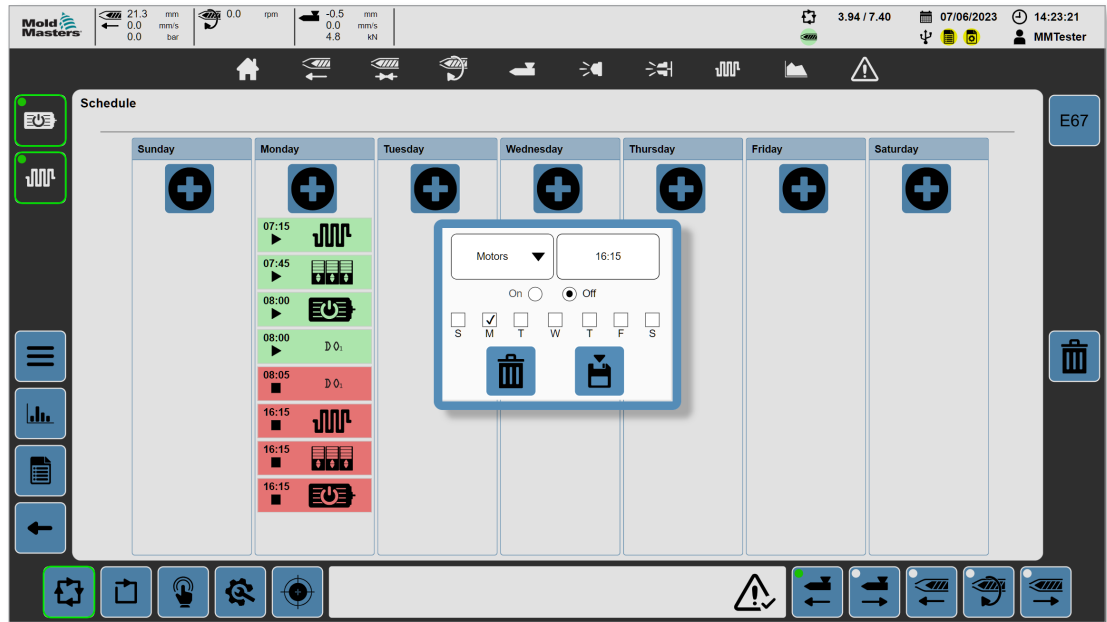


Table 5-68 Dialog Box of the Schedule Page

Field/Button	Description
	Event function Values: Heats, Motors, HRC, Output 1, Output 2, Output 3, Output 4 Tap this button to select the event function.
	Time entry Values: Any time Tap this box to enter a time for the event.
	Values: On, Off Tap the On option button to enable the event. Tap the Off option button to disable the event.
	Day(s) of the week for the event Values: S (Sunday), M (Monday), T (Tuesday), W (Wednesday), T (Thursday), F (Friday), S (Saturday)
	Cancel/Delete button Tap the Cancel/Delete button to cancel the adding of a new event or to delete an existing event.
	Save button Tap the Save button to save the new or modified event.

## 5.14 Change Log

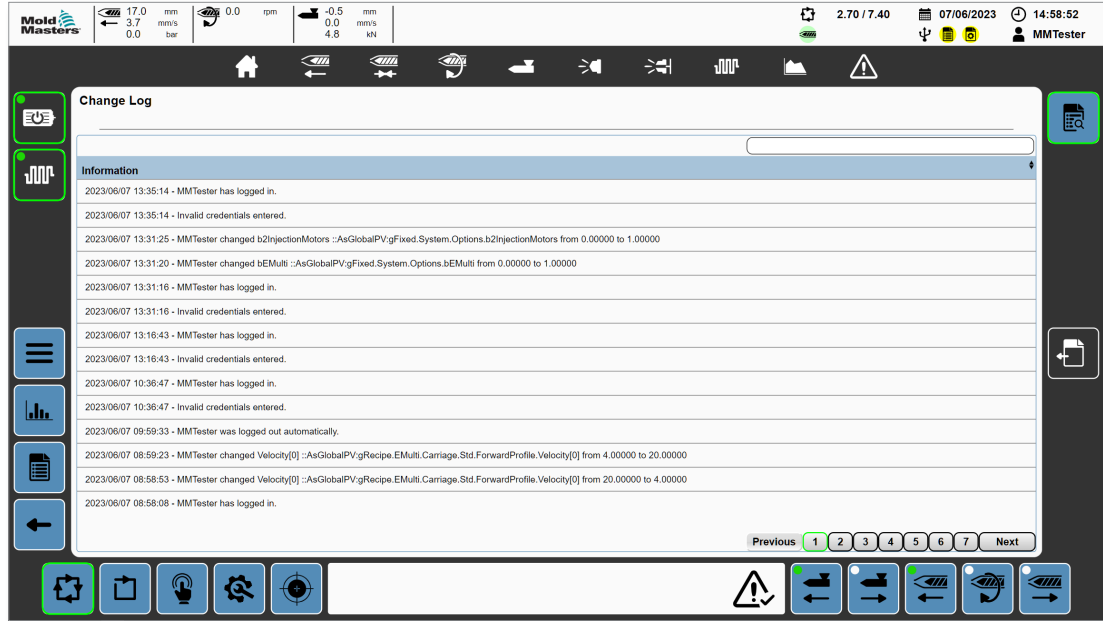


Figure 5-53 Change log page

Table 5-69 Change Log Page	
Field/Button	Description
	Information filter Enter information into this box to filter the list of entries so that the list only contains entries with the entered information.
	List of all recorded changes Changes are sorted by date and time.
	Page navigation buttons If there are more entries that the page can display, use the previous, next, and page index buttons to navigate to the other entries.
	Export change log button Tap the Export change log button to export the change log to the user data as a text file. To delete the exported text file or copy the file to a USB drive, see section "8.26.3 User Data" on page 8-144.

## 5.15 Log Book

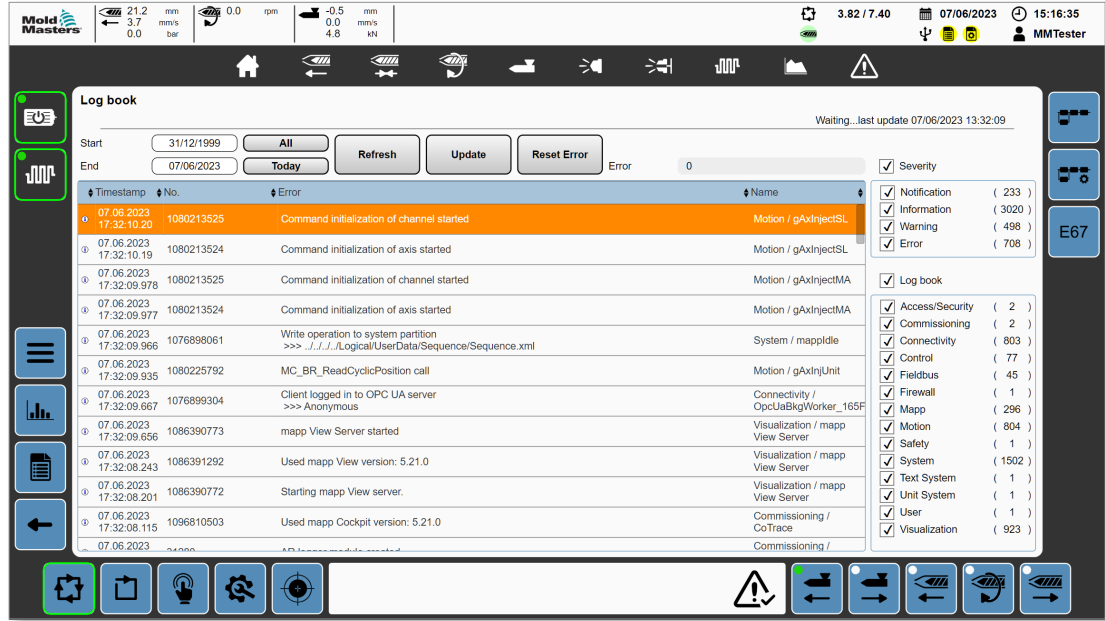


Figure 5-54 Log book page

Table 5-70 Log Book Page	
Field/Button	Description
Start <input type="text" value="01/01/2000"/>	Start date for displaying log book entries
End <input type="text" value="07/06/2023"/>	End date for displaying log book entries
<input type="button" value="All"/>	Select All button Tap the All button to set the Start and End dates to include all log book entries.
<input type="button" value="Today"/>	Select Today button Tap the Today button to set the Start and End dates to include all log book entries for today only.
<input type="button" value="Refresh"/>	Refresh button Tap the Refresh button to refresh the list of log book entries.
<input type="button" value="Update"/>	Update button Tap the Update button to update the list of log entries according the type, severity, and date selections.
<input type="button" value="Reset Error"/>	Reset Error button Tap the Reset Error button to reset errors from reading the log book.
Error <input type="text" value="0"/>	Error code for log book access functions

Table 5-70 Log Book Page	
Field/Button	Description
	<p>Log book entries</p> <p>Tap the timestamp, ID number, error message, or log book name header to sort the log book entries by the header.</p>
<input checked="" type="checkbox"/> Severity	<p>Severity check box</p> <p>Tap the Severity check box to select entries of all severity levels.</p>
<input checked="" type="checkbox"/> Notification ( 239 ) <input checked="" type="checkbox"/> Information ( 3038 ) <input checked="" type="checkbox"/> Warning ( 508 ) <input checked="" type="checkbox"/> Error ( 727 )	<p>Severity level check boxes</p> <ul style="list-style-type: none"> <li>• Notification</li> <li>• Information</li> <li>• Warning</li> <li>• Error</li> </ul> <p>The number in parentheses indicates the number of log book entries having that severity level.</p>
<input checked="" type="checkbox"/> Log book	<p>Log book check box</p> <p>Tap the Log book check box to select the entries of all log books.</p>
<input checked="" type="checkbox"/> Access/Security ( 2 ) <input checked="" type="checkbox"/> Commissioning ( 2 ) <input checked="" type="checkbox"/> Connectivity ( 824 ) <input checked="" type="checkbox"/> Control ( 80 ) <input checked="" type="checkbox"/> Fieldbus ( 46 ) <input checked="" type="checkbox"/> Firewall ( 1 ) <input checked="" type="checkbox"/> Mapp ( 299 ) <input checked="" type="checkbox"/> Motion ( 801 ) <input checked="" type="checkbox"/> Safety ( 1 ) <input checked="" type="checkbox"/> System ( 1502 ) <input checked="" type="checkbox"/> Text System ( 1 ) <input checked="" type="checkbox"/> Unit System ( 1 ) <input checked="" type="checkbox"/> User ( 1 ) <input checked="" type="checkbox"/> Visualization ( 951 )	<p>Log book check boxes</p> <ul style="list-style-type: none"> <li>• Access/Security</li> <li>• Commissioning</li> <li>• Connectivity</li> <li>• Control</li> <li>• Fieldbus</li> <li>• Firewall</li> <li>• Mapp</li> <li>• Motion</li> <li>• Safety</li> <li>• System</li> <li>• Text System</li> <li>• Unit System</li> <li>• User</li> <li>• Visualization</li> </ul> <p>The number in parentheses indicates the number of entries in the log book.</p>



## 5.16 Machine Information

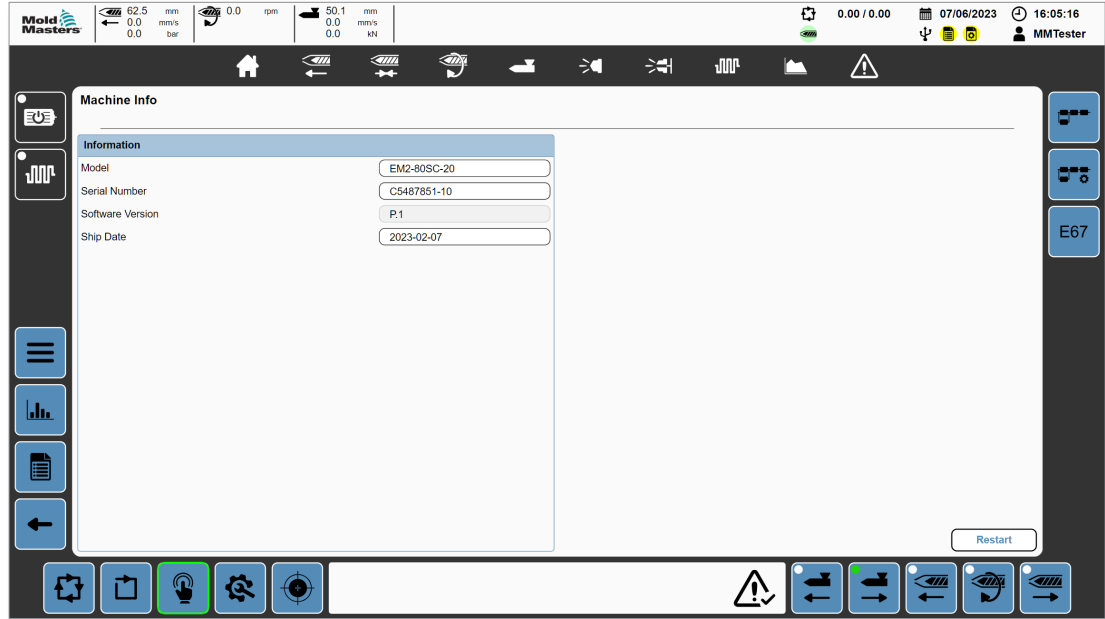


Figure 5-55 Machine Information page

Table 5-71 Machine Information Page	
Field/Button	Description
Model	Model type of the machine
Serial number	Serial number of the machine
Software Version	Release version of the software
Ship date	Date the machine was shipped from Mold-Masters
	Restart button Tap the Restart button to restart the controller.

## 5.17 Data Logger

### 5.17.1 Data Logger Page

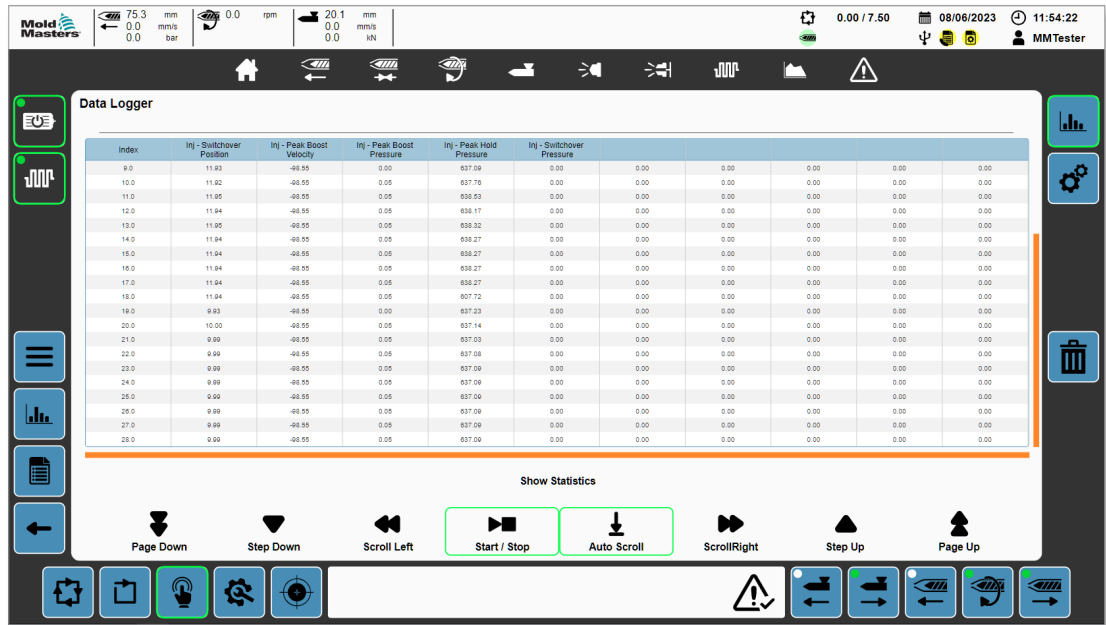


Figure 5-56 Data logger page

Table 5-72 Data Logger Page

Field	Description																																				
<table border="1"> <thead> <tr> <th>Index</th> <th>Inj - Switchover Position</th> <th>Inj - Peak Boost Velocity</th> <th>Inj - Peak Boost Pressure</th> <th>Inj - Peak Hold Pressure</th> <th>Inj - Switchover Pressure</th> </tr> </thead> <tbody> <tr><td>9.0</td><td>11.93</td><td>-68.55</td><td>0.05</td><td>637.08</td><td>0.00</td></tr> <tr><td>10.0</td><td>11.92</td><td>-68.55</td><td>0.05</td><td>637.76</td><td>0.00</td></tr> <tr><td>11.0</td><td>11.95</td><td>-68.55</td><td>0.05</td><td>638.53</td><td>0.00</td></tr> <tr><td>12.0</td><td>11.94</td><td>-68.55</td><td>0.05</td><td>638.17</td><td>0.00</td></tr> <tr><td>13.0</td><td>11.95</td><td>-68.55</td><td>0.05</td><td>638.32</td><td>0.00</td></tr> </tbody> </table>	Index	Inj - Switchover Position	Inj - Peak Boost Velocity	Inj - Peak Boost Pressure	Inj - Peak Hold Pressure	Inj - Switchover Pressure	9.0	11.93	-68.55	0.05	637.08	0.00	10.0	11.92	-68.55	0.05	637.76	0.00	11.0	11.95	-68.55	0.05	638.53	0.00	12.0	11.94	-68.55	0.05	638.17	0.00	13.0	11.95	-68.55	0.05	638.32	0.00	A list of values recorded over time for the selected process variables
Index	Inj - Switchover Position	Inj - Peak Boost Velocity	Inj - Peak Boost Pressure	Inj - Peak Hold Pressure	Inj - Switchover Pressure																																
9.0	11.93	-68.55	0.05	637.08	0.00																																
10.0	11.92	-68.55	0.05	637.76	0.00																																
11.0	11.95	-68.55	0.05	638.53	0.00																																
12.0	11.94	-68.55	0.05	638.17	0.00																																
13.0	11.95	-68.55	0.05	638.32	0.00																																
<b>Show Statistics</b>	Show Statistics button Tap the Show Statistics button to display the statistics overlay panel.																																				

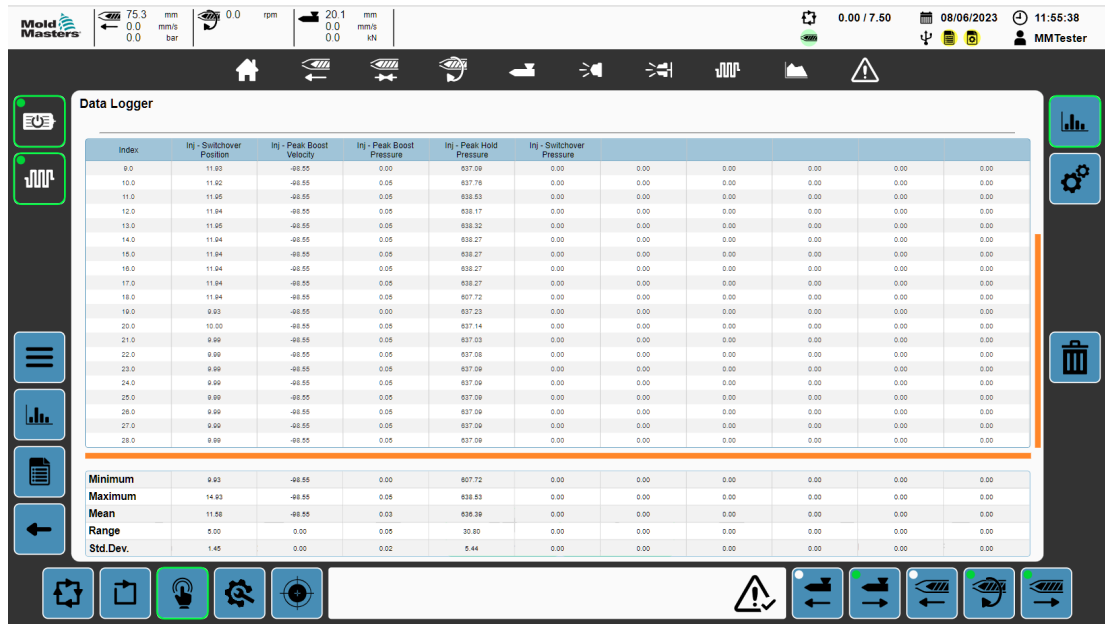


Figure 5-57 Data logger page with statistics

Table 5-73 Statistics Panel of the Data Logger Page	
Field	Description
Minimum	Minimum value recorded
Maximum	Maximum value recorded
Mean	Mean (average) for the column
Range	Range between the maximum and the minimum value for the column
Std. Dev.	Standard deviation

### 5.17.2 Data Logger Configuration

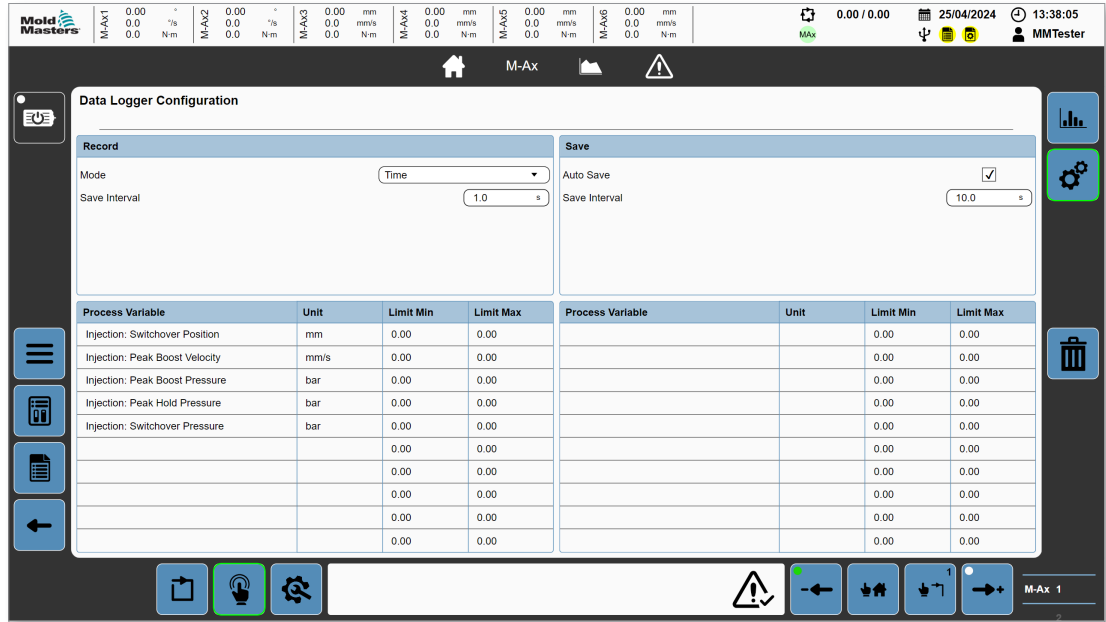


Figure 5-58 Data logger configuration page

Table 5-74 Record Panel	
Field	Description
Mode	Values: Time, Cycle Start Data sampling can be performed on a time interval or after a trigger
Save Interval	Time interval between data sampling Values: Any positive value Can only be changed when the Mode is set to Time

Table 5-75 Save Panel	
Field	Description
Auto Save	Values: No, Yes When set to yes, the collected data is saved as a CSV file to local memory or a USB drive after each save interval.
Save Interval	Time interval between automatic saving of the collected data to a CSV file Values: Any positive value

Table 5-76 Process Variables Panel				
Field				Description
<b>Process Variable</b>		<b>Unit</b>	<b>Limit Min</b>	<b>Limit Max</b>
Inj - Switchover Position	mm	19.00	20.50	Process Variable (PV) settings <ul style="list-style-type: none"> <li>• <b>Process Variable:</b> Name of process variable Tap anywhere in this area to open the PV selection dialog.</li> <li>• <b>Unit:</b> Associated units for the selected process variable</li> <li>• <b>Minimum:</b> Minimum value recorded during the trace</li> <li>• <b>Maximum:</b> Maximum value recorded during the trace</li> </ul>
Inj - Peak Boost Velocity	mm/s	-110.00	-90.00	

## 5.18 Cycle Information

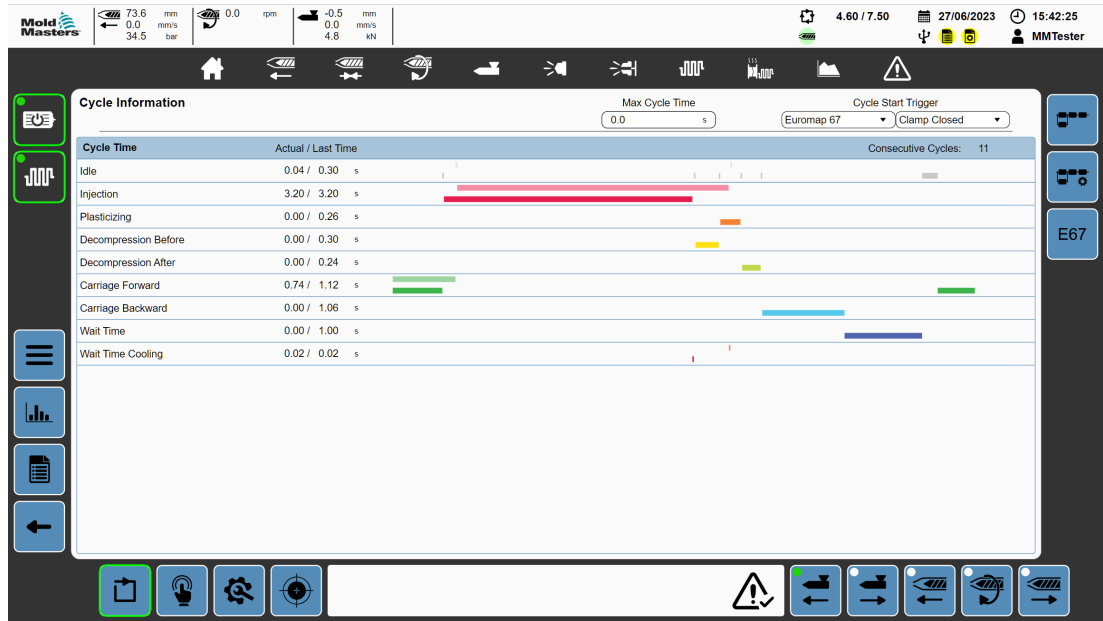


Figure 5-59 Cycle information page

Table 5-77 Cycle Information Page

Field	Description
Max Cycle Time	Maximum allowed cycle time before cycling quits with an alarm Values: Any positive number To disable the limit, set the Max Cycle Time to 0.0 seconds.
<p style="text-align: center;">Cycle Start Trigger</p> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-around;"> <span>Euromap 67 ▼</span> <span>Clamp Closed ▼</span> </div>	<p>Cycle Start Trigger</p> <p>Values:</p> <ul style="list-style-type: none"> <li>• Euromap 67</li> <li>• E-Multi, M-Ax</li> <li>• Digital Input</li> <li>• E-Drive</li> </ul> <p>Tap the left dropdown list box to select the primary component to use for cycle start triggering.</p>

Table 5-77 Cycle Information Page	
Field	Description
<p style="text-align: center;">Cycle Start Trigger</p> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-around;"> <span style="border: 1px solid black; border-radius: 10px; padding: 2px 10px;">Euromap 67 ▼</span> <span style="border: 1px solid black; border-radius: 10px; padding: 2px 10px;">Clamp Closed ▼</span> </div>	<p>Cycle Start Trigger Values:</p> <p>Euromap 67:</p> <ul style="list-style-type: none"> <li>• Clamp Closed,</li> <li>• Clamp Open,</li> <li>• Ejector 1 Forward,</li> <li>• Ejector 1 Back</li> </ul> <p>E-Multi:</p> <ul style="list-style-type: none"> <li>• Injection Start</li> <li>• Carriage Forward</li> <li>• Carriage Backward</li> <li>• Plasticizing Start</li> </ul> <p>M-Ax:</p> <ul style="list-style-type: none"> <li>• M-Ax1</li> <li>• M-Ax2</li> <li>• M-Ax3</li> <li>• M-Ax4</li> <li>• M-Ax5</li> <li>• M-Ax6</li> </ul> <p>Digital Input:</p> <ul style="list-style-type: none"> <li>• DI 1 through DI 16</li> </ul> <p>E-Drive:</p> <ul style="list-style-type: none"> <li>• E-Drive 1</li> <li>• E-Drive 2</li> </ul> <p>Tap the right dropdown list box to select the specific condition to trigger a new cycle recording..</p>
<p><b>Consecutive Cycles:</b> 11</p>	<p>Consecutive Cycles</p> <p>Current count of consecutive automatic cycles</p> <p>Resets when the machine exits automatic mode</p>
	<p>List of current and previous cycles</p> <p>Displays a colour bar for each cycle component representing the portion of the cycle each component required</p> <p>A pale shade of a colour is used for the current cycle while a darker shade of the same colour is used for the previous cycle uses.</p>

## 5.19 Material Data



Figure 5-60 Material data page

Tap a material in the left panel to see the material's data.

Table 5-78 Material Data Panel	
Field	Description
Material: ABS Acrylonitrile/Butadiene/Styrene Manufacturer: Bayer Trade Name: Novodur Grade: P2H-AT Structure: Amorphous Filler Content: 0.0 % Filler Structure:	Origin information for the selected material
Density at 23°C: 1.1 g/cm³ Glass Transition or Melting Temperature: 115.0 °C Vicat Softening Temperature: 95.0 °C Viscosity Measured at Shear Rate of 1000/s: 208.0 Pa s Viscosity Measured at Melt Temperature: 220.0 °C Flow Length By Wall Thickness of 1mm / 2mm: 90.0 mm / 370.0 mm Melt Temperature: 220.0 °C / 260.0 °C Mold Temperature: 60.0 °C / 80.0 °C Max. Peripheral Screw Speed: 0.2 m/s	Material data Values: Any numeric value Tap a field to modify the values used by the calculator.



Table 5-79 Calculator Panel	
Field	Description
Shot Weight	Weight of plastic injected into mold each cycle Values: Any Numeric Value
Flowpath	Length of plastic flow from the sprue to the edge of the part Values: Any Numeric Value
Wall Thickness	Thickness of part wall Values: Any Numeric Value
Wall Thickness Factor	Multiplication factor used in the calculation of the filling pressure based on the wall thickness
Projected Area	Total of the projected areas of the cavities and runners in relation to the parting surface Values: Any Numeric Value
Mold Reaction Pressure	Cavity pressure inside the mold Values: Any Numeric Value
Screw Diameter	Diameter of the injection screw Values: Any Numeric Value
Material Throughput	Weight of plastic resin processed by the machine per hour Values: Any Numeric Value
Calculated Values	
Stroke Volume	Volume of material required (shot size)
Filling Pressure	Approximate injection pressure required
Clamping Force	Clamping force required
Cooling Time	Minimum part cooling time after the injection and hold process is completed
Screw Speed	Rotational screw speed during plasticizing
Heat Loss	The heat received by the system multiplied by the material throughput

## 5.20 Free Timers

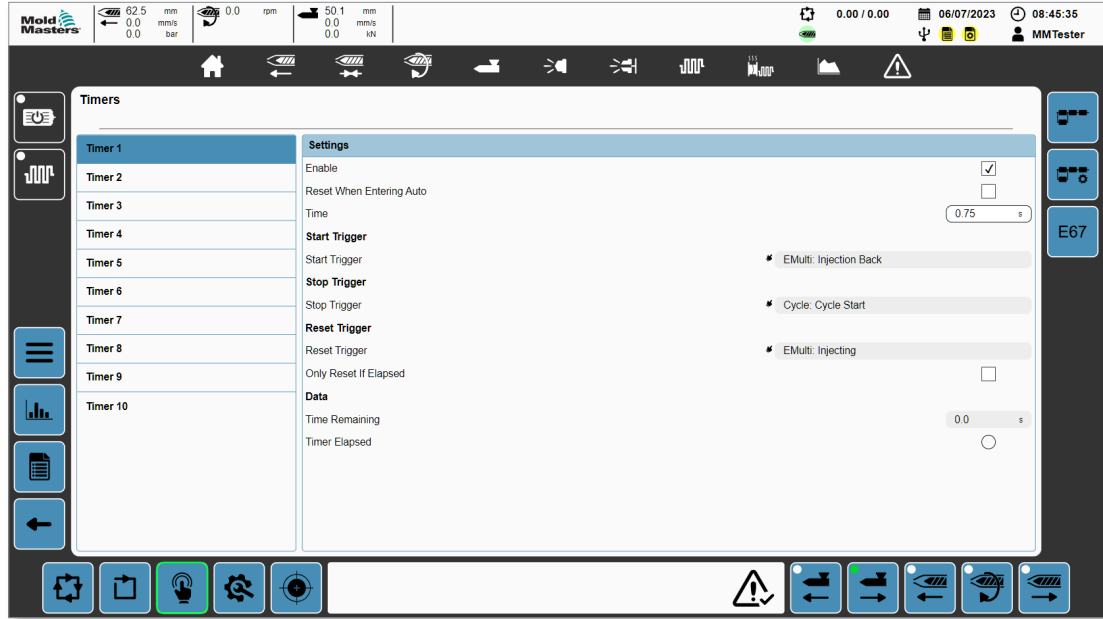


Figure 5-61 Timers page

Tap a timer in the left panel to see the timer’s settings.

Table 5-80 Settings Panel	
Field	Description
Enable	Tap this check box to enable the timer.
Reset When Entering Auto	Tap this check box to have the timer reset when the mode of operation changes from manual, setup, or configuration to automatic. The timer stops counting down, the Time Remaining is reset to full, set delay time, and returns to idle to wait for the start trigger.
Time	Set delay time Values: Any positive number
Start Trigger	
Start Trigger	Trigger condition to start the timer counting  Once the Time Remaining equals zero, the Timer Elapsed flag is set.
Stop Trigger	
Stop Trigger	Trigger condition to stop the timer counting down and return to idle  The stop trigger does not cause the timer to reset.

Table 5-80 Settings Panel	
Field	Description
Reset Trigger	
Reset Trigger	Trigger for the timer to stop counting down, reset Time Remaining to the full, set delay time, and return to idle to wait for the start trigger
Only Reset If Elapsed	Tap this check box to have the reset trigger processed only if the time remaining is zero.
Data	
Time Remaining	Remaining delay time before the timer has elapsed
Timer Elapsed	Values: Off or red If red, the timer delay is complete.

## 5.21 Counters

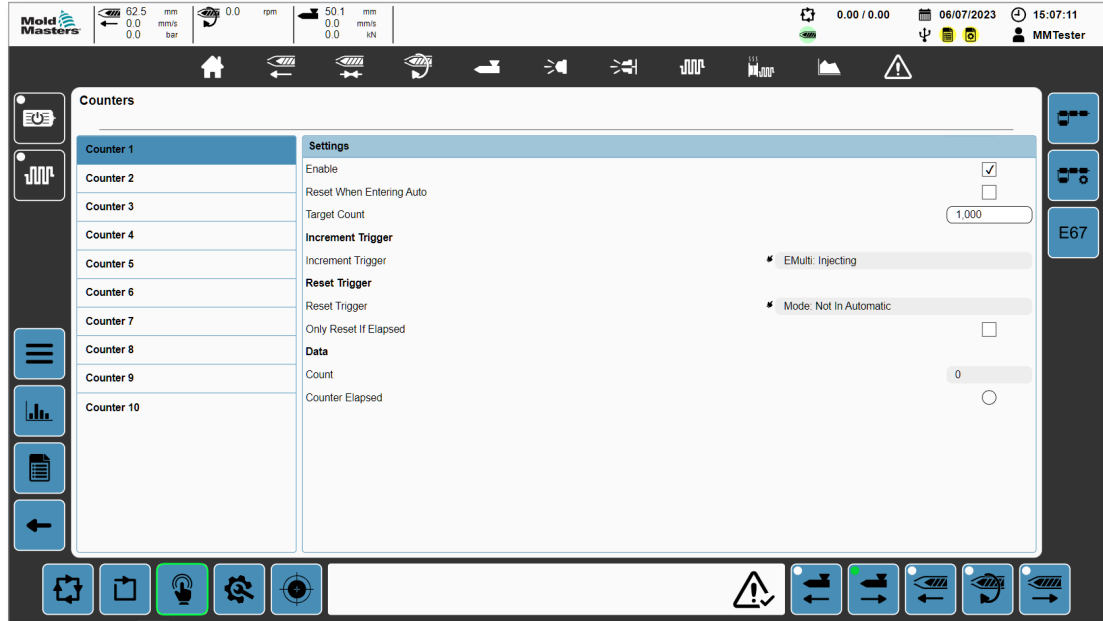


Figure 5-62 Counters page

Tap a counter in the left panel to see the counter’s settings.

Table 5-81 Counters Page	
Field	Description
Enable	Tap this check box to enable the timer.
Reset When Entering Auto	Tap this check box to have the counter reset when the mode of operation changes from manual, setup, or configuration to automatic. The Counter stops counting, the Count is reset to zero, and returns to idle to wait for the start trigger.
Target Count	Set number of start trigger events that need to be counted before the count is complete Values: Any positive integer
Increment Trigger	
Increment Trigger	Trigger condition to start the counter Once the Count equals the Target Count, the Counter Elapsed flag is set.
Reset Trigger	
Reset Trigger	Trigger for the counter to stop counting, reset the Count to 0, and return to idle to wait for the start trigger
Only Reset If Elapsed	Tap this check box to have the reset trigger processed only if the Count equals the Target Count.
Data	
Count	Actual number of start trigger events counted
Counter Elapsed	Values: Off or red If red, the count is complete.

## 5.22 Key Switch

If additional, non-standard functionality is required, a key switch has been provided to make the functionality available. The key switch is a momentary switch with a spring return so the key switch can only be operated intentionally and cannot be left in the active position. The following is a list of available secondary functionality available when the key switch is active:

### All Axes:

- If a motor is equipped with a brake, the brake can be forced off on the Axis page when the key switch input is active, allowing the axis to be moved freely if required.
- Direct calibration—In calibration mode with the motors powered on, an axis can be calibrated directly to the minimum or maximum position when the key switch is active by holding the negative or positive jog button.

### Custom I/O:

- Displays additional buttons on the Custom I/O Digital Outputs page that when pressed force the selected output on or off.

# Section 6 - System Setup

## 6.1 Installation

It is important to comply with the following warnings to avoid an accident or injury.



### **WARNING**

Make sure that you read "Section 3 - Safety" before connecting or operating the controller.

The integrator is responsible for understanding and following international and local standards for machinery safety when integrating the controller with the injection molding system.

M-Ax controllers are supplied with a properly sized power cable to run the M-Ax controller at the maximum current capacity. The integrator must use the appropriate connection-device/connector at the power source to withstand the full system load.

The M-Ax controller power supply must have a fused disconnect or a main circuit breaker, according to local safety codes. The M-Ax controller must be located so that the controller disconnect switch and supply disconnect switch are easily accessible.

Refer to the controller nameplate on the cabinet for confirmation of the main supply requirements. Please contact Mold-Masters for advice if the local power supply is outside the specified range.



### **WARNING - ELECTRIC SHOCK HAZARD**

- Make sure that all energies are properly locked out in the controller and the injection molding system before installing the controller in the system.
- Do not open the cabinet without isolating the main power supply. The exposed terminals inside the cabinet may have a dangerous potential of up to 600 VAC across them.
- Power and signal cables are connected between the controller and the molding system. Electric power must be shut off, and lockout/tagout procedures must be followed before installing or removing cables.
- Integration should be done by properly trained personnel based on local codes and regulations.
- Do not mix electrical power cables with thermocouple extension cables. They are not designed to carry the power load or list accurate temperature readings of the other's application.



### **WARNING - TRIP HAZARD**

The integrator should make sure that the controller cables do not create a trip hazard on the floor between the controller and the molding machine.

## 6.2 Connecting the M-Ax to a power supply



### **WARNING - ELECTRIC SHOCK HAZARD**

Use extreme care when connecting the controller to a three-phase power supply. Incorrect connection may result in damage to the controller.

For all M-Ax controllers, the main power switch is a rotary circuit breaker at the rear or front of the cabinet. This switch is rated to safely handle the total load current during switch on and switch off. You can use a padlock or a similar device to lock the switch in the off position to lockout electrical supply during maintenance.

An authorized electrician must connect the M-Ax to the power supply using appropriate plugs and terminals, and follow the local electrical safety and protection code. Cables have L1, L2, L3, N, and ground markings for identification.

## 6.3 Connecting the molding machine to the M-Ax

There are four sets of cables that connect the molding machine to the M-Ax:

1. Servo power and feedback cables
2. IMM E67 cable
3. Heater-I/O-IMM cables (optional)
4. EU13 input and output cables

The correct sequence must be followed when installing the cables.

The servo power and feedback cables must be routed through the cable track before being connected to the motors.

M-Ax units are compatible with both E67 and SPI injection machines. All units ship with an IMM E67 cable. For injection molding machines with E67, connect the cable to the E67 terminal on the molding machine. For injection molding machines with SPI, use the optional IMM SPI adapter on the E67 cable.

The heater-I/O-IMM cables can be connected directly, and all the cables should be routed so they do not interfere with the operation of the molding machine.

M-Ax controllers have Euromap (EM) 13 input and output terminals on the back of the cabinet. The controller is supplied with 10 m long EU13 input and output cables.

## 6.4 Connecting a robot to the M-Ax

M-Ax units are compatible with both E67 and SPI robots. All units are shipped with a robot jumper plug on the ROBOT E67 connector on the controller

If an E67 robot is to be used, connect the robot's E67 cable to the ROBOT E67 terminal on the controller. If an SPI robot is to be used, attach the optional ROBOT SPI ADAPTER to the ROBOT E67 terminal on the controller and connect the robot's SPI cable thereto.

# Section 7 - Operation



## WARNING

Ensure that you have fully read "Section 3 - Safety" before operating the M-Ax controller. Always ensure that the M-Ax controller is in a safe to start position before operating the controller.

## 7.1 Logging in

Figure 7-1 M-Ax login



## NOTE

Anonymous logins are not allowed.

1. Tap the User box, and choose a user type from the dropdown menu.

2. Tap the Password box and enter the password.

3. Tap the Login button.



## 7.2 Configuring the Controller

### 7.2.1 Configuring the I/O

All changes made on this page are saved in Recipe data. After making changes, save the Recipe data so that no changes are lost. See section "7.2.3.2 Saving recipe data" on page 7-14 for more information.

#### 7.2.1.1 Navigating to the Custom I/O page

1. Tap the Directory page button in the left panel.



2. Tap the Machine button.



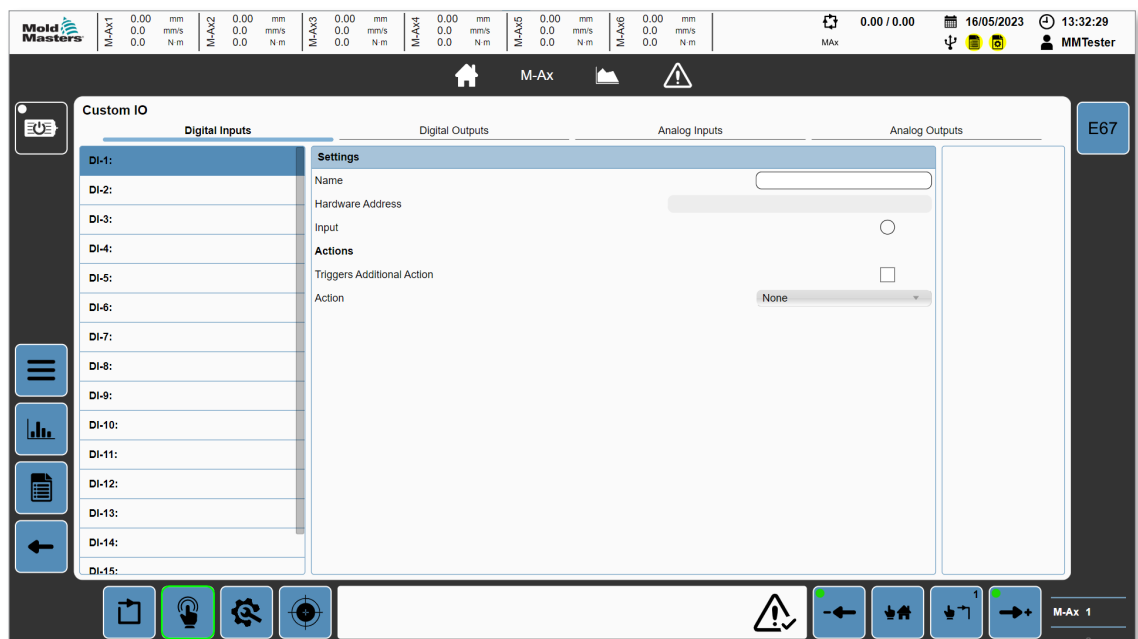
3. Tap the Custom I/O page button.



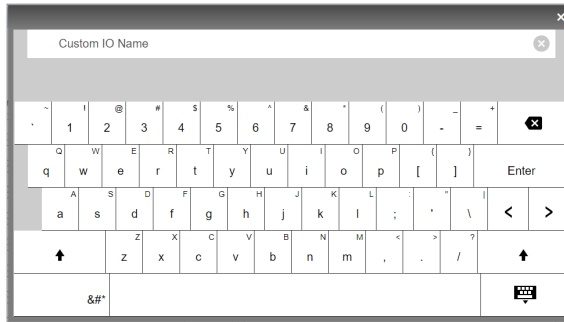
Note: All changes made on the Custom I/O page are saved to Recipe Data.

#### 7.2.1.2 Assigning a custom name

1. Tap a digital input in the list on the left side of the Custom I/O page.



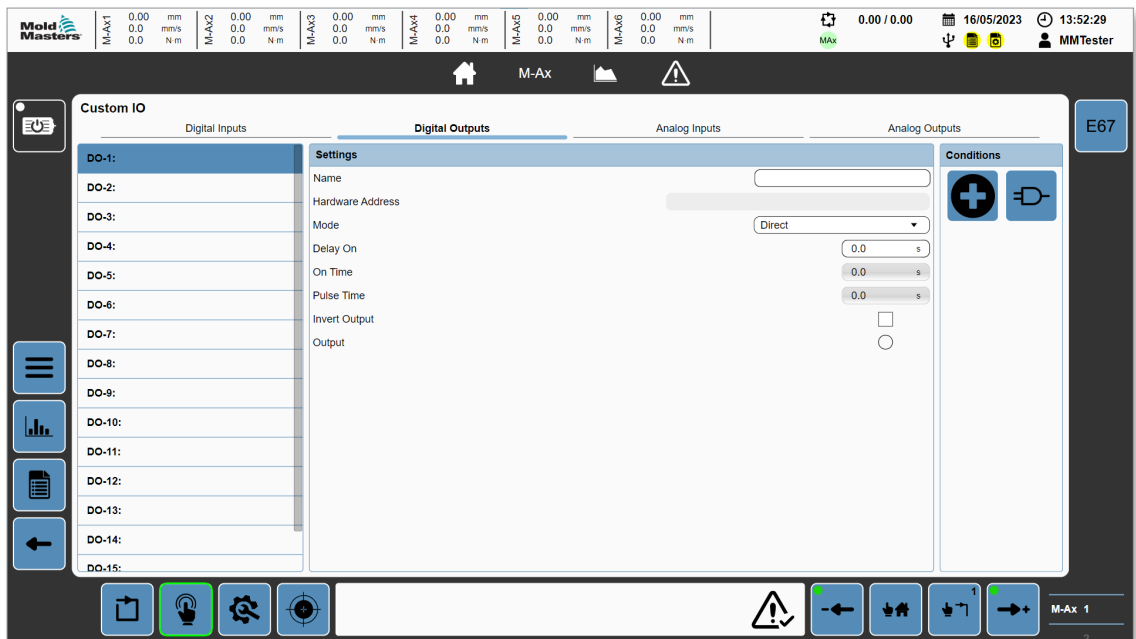
2. Tap in the Name box.
3. Enter text, and tap Enter.



To close the keyboard without assigning text to the I/O function, tap outside of the keyboard area.

### 7.2.1.3 Adding an output condition

1. Tap the Digital Outputs tab of the Custom I/O page.
2. Tap a digital output in the list on the left side of the Custom I/O page.

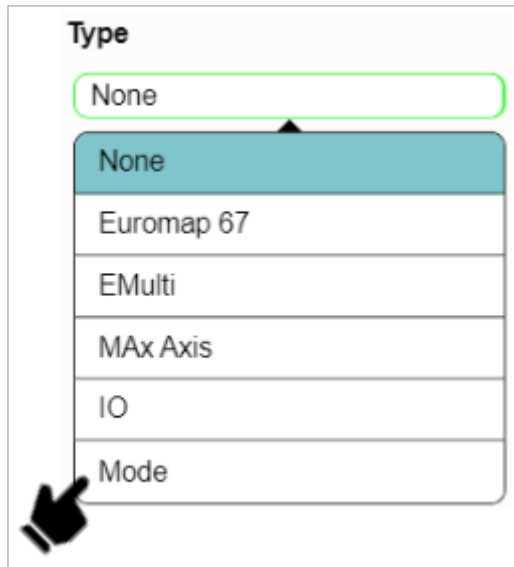


The digital output will be OFF by default if there are no conditions defined.

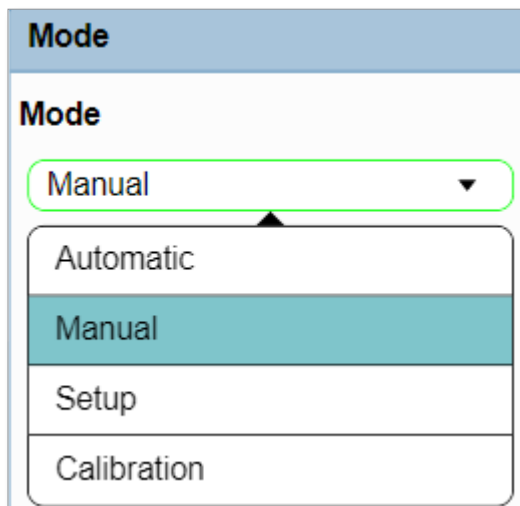
3. Tap the New Conditions button.



4. Select a condition type from the Type dropdown list box.



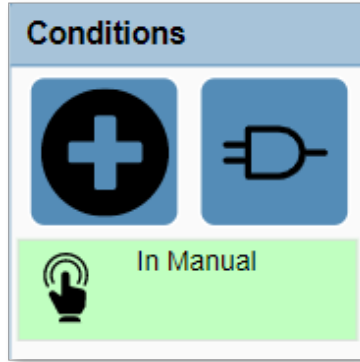
If you tap Mode, the Conditions panel will be display the mode options.



5. Tap the Save button.

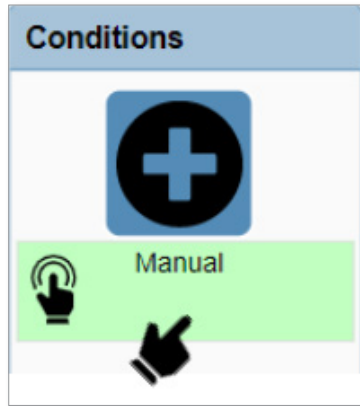


The Conditions panel shows the conditions for the selected digital output.



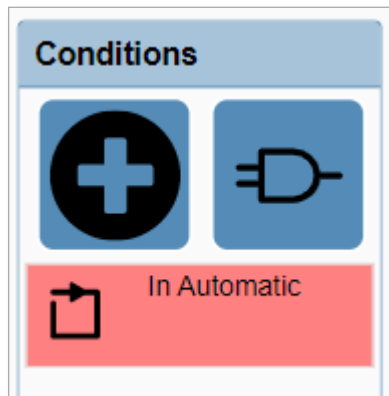
### 7.2.1.4 Editing an output condition

1. Tap a condition in the Conditions panel.



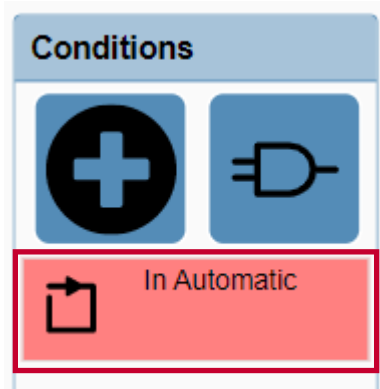
2. Edit the condition. See "7.2.1.3 Adding an output condition" on page 7-3 for further information.

If you change the Mode selection from Manual to Automatic and tap save, the interlock in the conditions panel will be updated.



### 7.2.1.5 Deleting an output condition

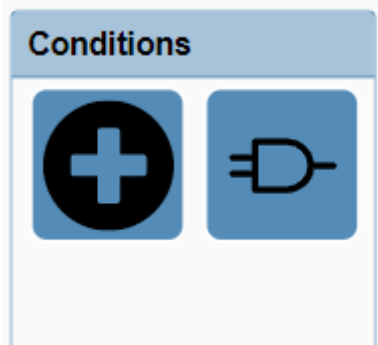
1. Tap the output condition in the condition panel.



2. Tap the delete button.



The Conditions Panel will be updated.



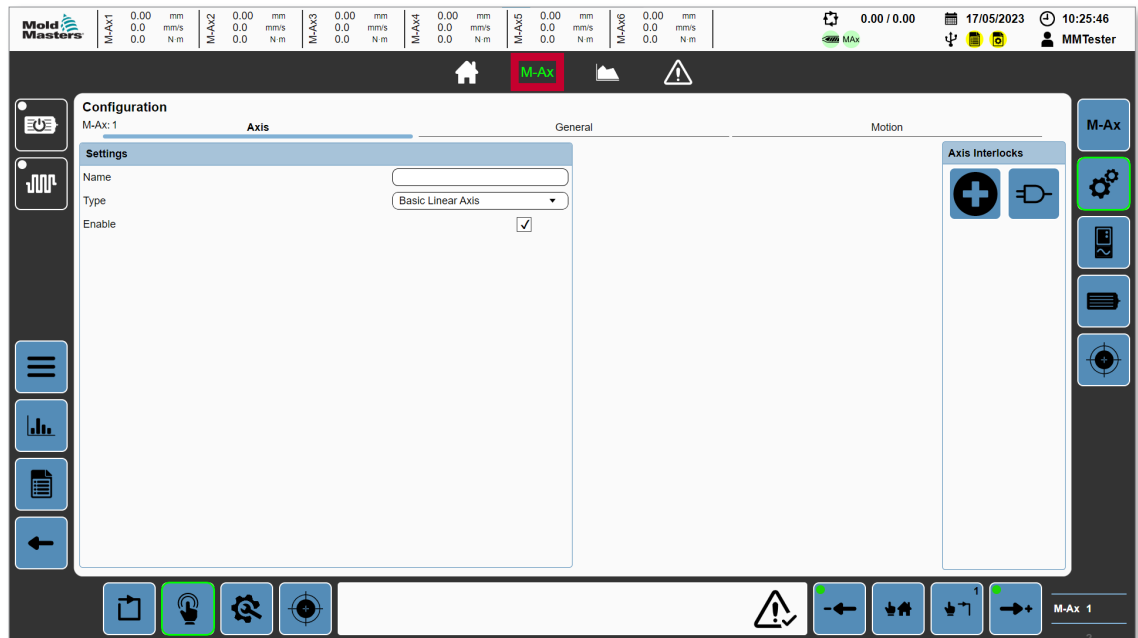
### 7.2.1.6 Editing an output setting

1. In the Settings panel, tap any field or tap a field and enter the new information. See "5.4 Custom I/O" on page 5-48 for more information.

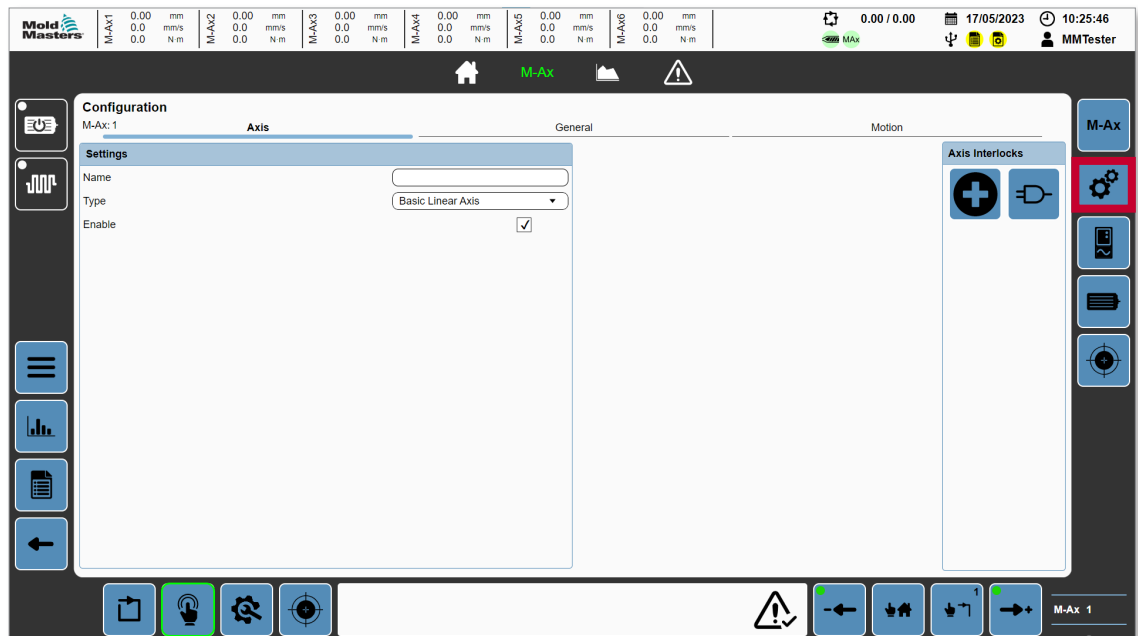
## 7.2.2 Configuring an axis

### 7.2.2.1 Navigating to an axis page

1. Select the M-Ax button in the Navigation panel.



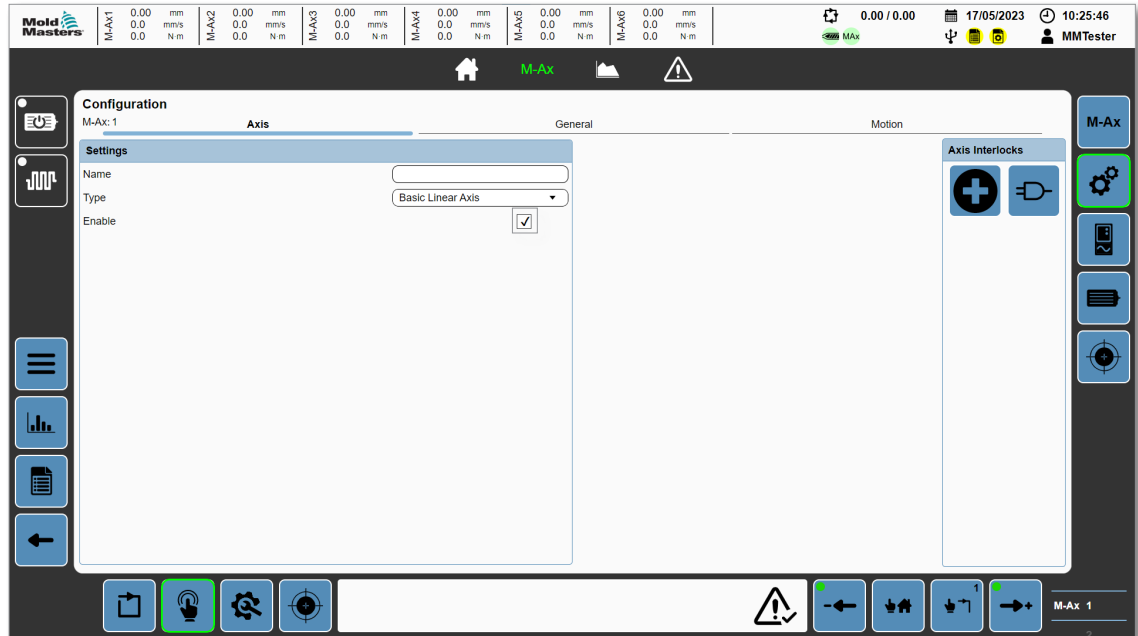
2. Tap the M-Ax axis to configure.
3. Tap the Settings button in the Contextual panel.



### 7.2.2.2 Enabling an axis

The motors must be off to perform the following task.

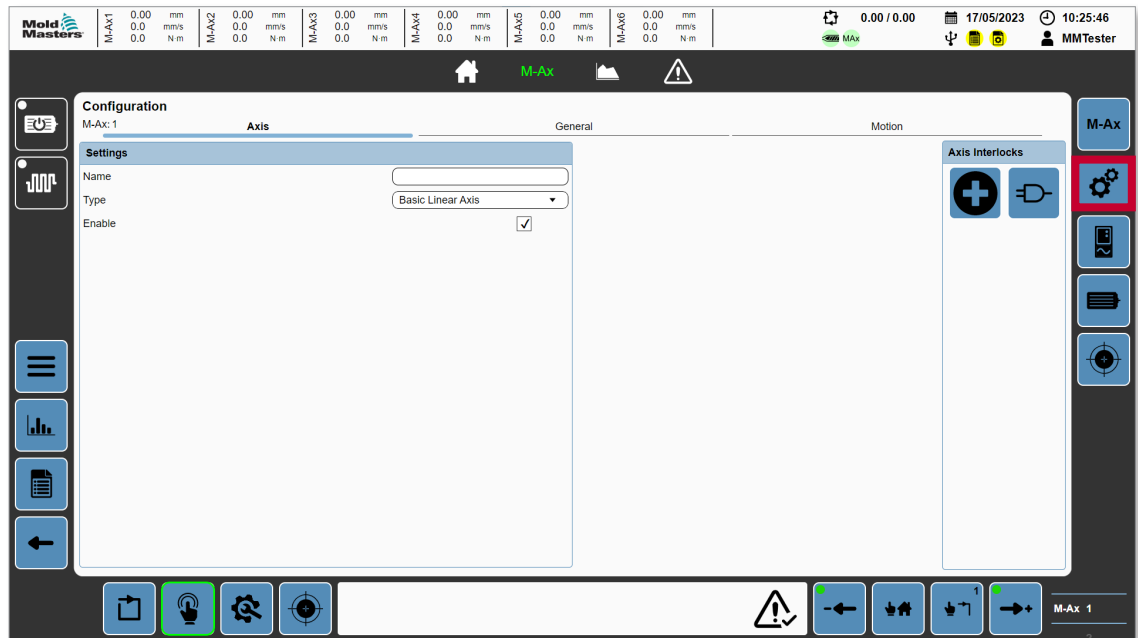
1. Navigate to an axis page. See section "7.2.2.1 Navigating to an axis page" on page 7-7.
2. Tap the Enable checkbox.



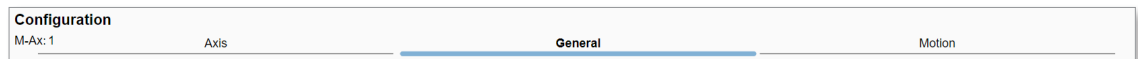
If there are any axis interlocks required, they can be added using the Axis Interlock panel. See section "5.3.5 Axis Configuration" on page 5-33 and section "5.3.3 Interlock Detailed-Dialog Box" on page 5-24 for more information.

### 7.2.2.3 Configuring axis position, torque, and motion parameters

1. Navigate to an axis page. See section "7.2.2.1 Navigating to an axis page" on page 7-7.
2. Tap the Settings button in the Contextual panel.



3. Tap the General tab.



4. Enter the axis position settings in the Position group box.
  5. Enter torque limits and values in the Torque group box.
  6. Tap the Motion tab.
  7. Enter the motion parameters in the Motion group box.
- See "5.3.5 Axis Configuration" on page 5-33 for more information.



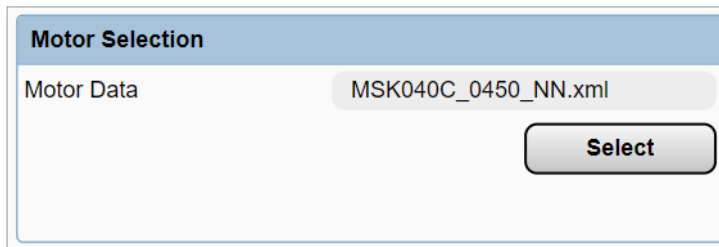
### 7.2.2.4 Configuring a motor



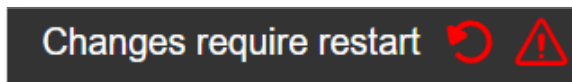
#### CAUTION

If you change a motor, the commutation offset must be determined again.  
For more information, see "7.2.2.5 Determining a commutation offset" on page 7-10.

1. Tap the Motor button in the Contextual panel.
2. Tap the Select button and select a motor from the Motor Data dialog box.



The message "Changes require restart" will be displayed in the top right of the Navigation panel.



3. Reset the controller.

You can confirm that the motor parameters are correct by going to the MAX1 axis motor page.

### 7.2.2.5 Determining a commutation offset

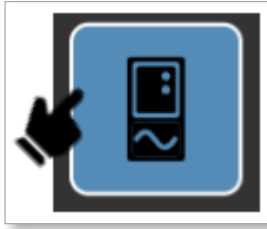
Requirements:

- The motors should not be powered on until the commutation offset has been determined. Before the commutation offset has been determined there can be unpredictable motion when powering the drive while the axis is enabled.

1. In the commutation-offset group box, tap the Autotune button.
2. Tap OK in the Start Auto-tuning dialog box.  
The Active LED will be green while auto-tuning is running.
3. Wait until the LED turns off.

### 7.2.2.6 Configuring a drive

1. Tap the Drive button in the Contextual panel.



2. Edit the Encoder Revolutions, Motor Revolutions, and the Reference Distance.
3. Save the Fixed data.

### 7.2.2.7 Auto-tuning a controller

1. Tap the Autotune button in the Controller group dialog box.
2. Tap OK in the Auto-tuning dialog box.

The Autotune active LED will turn green when auto-tuning starts. When the LED turns off, auto-tuning is complete.

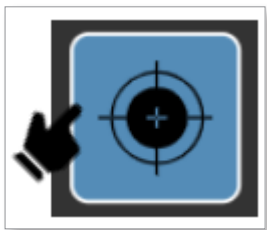
3. Optional: Save the Fixed or Recipe data values if they have been changed.
4. Optional: Reset the controller.

There are four methods of calibrating an axis:

1. Manual
2. Direct
3. Switch
4. Automatic

### 7.2.2.8 Manually calibrating an axis

1. Go to the Axis page.
2. Tap the Calibration button in the Contextual panel.



3. Turn the motors on
4. Tap the Enable Calibration Mode check box to enter calibration mode.
5. Tap the Jog negative or Jog positive button in the footer until contact is made with the end stop.
6. If the negative jog was used, the stroke should be set to 0 - Min Position Offset.
7. If the Positive jog was used, the stroke should be set to Maximum Position - Min Position Offset.
8. After the axis is calibrated to one of the end stops, jog to the other end stop and

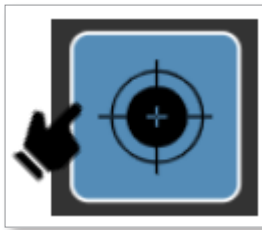
release the button once contact is made.

9. Confirm that the axis position is correct.
10. Switch to setup mode and negative jog the axis until the 0 position is reached.
11. Confirm that the hard stop is a distance of Min Position Offset away.
12. Positive jog the axis until the Maximum software position is reached,
13. Confirm that the hard stop is a distance of Max Position Offset away.

The axis position range is now from 0 to Maximum Position - Max Position Offset - Min Position Offset. You must go into Calibration mode to travel outside this range.

### 7.2.2.9 Using automatic calibration of an axis

1. Go to the Axis page.
2. Tap the Calibration button in the Contextual panel.



3. Turn on the motors.
4. Tap the Enable Calibration Mode check box to enter calibration mode.
5. Make sure that the axis is free to move its full stroke.
6. Select Switch, End Stop, or Automatic in the Homing-mode drop-down box.
7. Tap the Start button.

The axis will begin the automatic calibration based on the selected mode and parameters.

If automatic calibration finishes without errors, the Calibrated LED will turn green.

See section "5.3.8 Calibration" on page 5-46 for more information about calibration types.

### 7.2.2.10 Configuring the axis motion


1. Go to the Axis page.
2. Tap the M-Ax button in the Contextual panel.



3. Enter the number of motion steps required for this axis.

Steps

4. Enter the starting position for the motion steps. (The final motion step must return to this position.)

5. Select a start trigger.

 Start Trigger

6. Select the first motion step.
7. Tap the edit button.



8. In the motion detailed-dialog box, set the Direction, Position, Profile, and any additional parameters that are required.
9. Optional: If the motion step requires additional interlocks, press the New Interlock button to configure the new interlocks. (Up to nine interlocks can be configured for each motion step.)
10. Tap the Save button.
11. Repeat the previous steps for all motion steps.

## 7.2.3 Recipe/Fixed Data

### 7.2.3.1 Creating a recipe file

1. Tap the data button in the left panel to go to the Data page.



2. Tap in the text box and enter a name in the field using the pop-up keyboard.



3. Tap the create button.

The new recipe data file will be displayed in the file list and will be used as the active loaded recipe data file.

### 7.2.3.2 Saving recipe data

1. Tap the data button in the left panel to go to the Data page.



2. Tap a recipe file in the file list.
3. Tap the save button.

The saved data file will be used as the active loaded recipe data file.

### 7.2.3.3 Deleting a recipe file

1. Tap the data button in the left panel to go to the Data page.



2. Tap a recipe file in the file list.
3. Tap the delete button.

### 7.2.3.4 Creating a fixed data file

1. Tap the Fixed data page button in the Contextual panel.



2. Tap in the text box and enter a name in the field using the pop-up keyboard.



3. Tap the create button.

The new fixed data file will be displayed in the file list and will be used as the active loaded fixed data file.

### 7.2.3.5 Saving fixed data

1. Tap the Fixed data page button in the Contextual panel.



2. Tap a fixed data file in the file list.
3. Tap the save button.

The saved data file will be used as the active loaded fixed data file.

### 7.2.3.6 Deleting a fixed data file

1. Tap the Fixed data page button in the Contextual panel.



2. Tap a fixed data file in the file list.
3. Tap the delete button.

## 7.2.4 User Management

### 7.2.4.1 Navigating to the User Management Page

1. Tap the Directory button in the left panel.



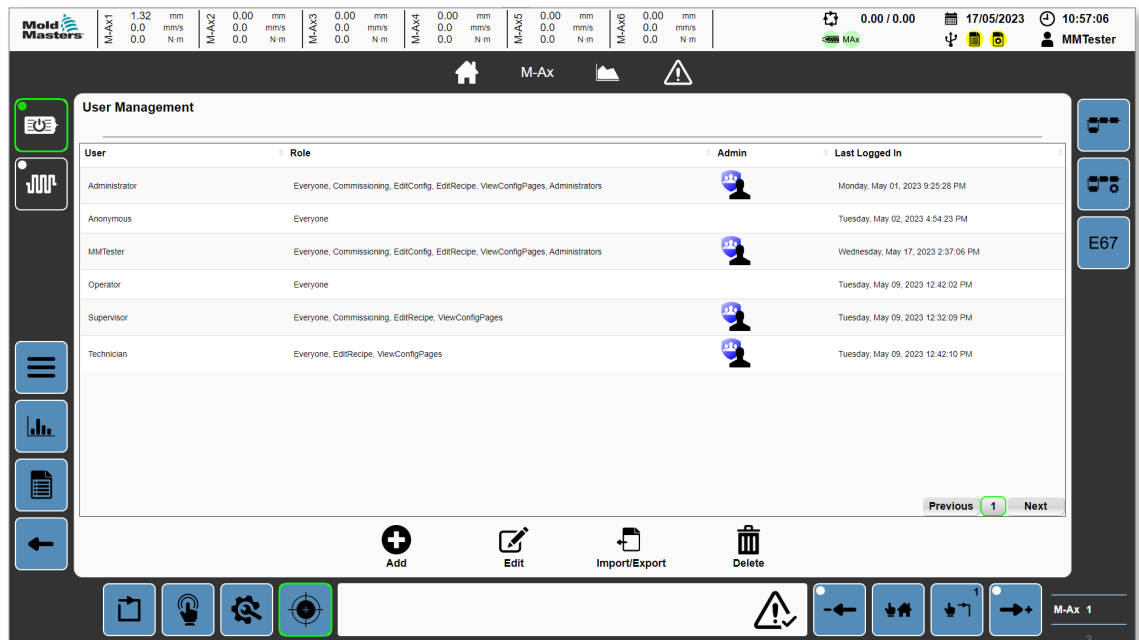
2. Tap the Machine button.



3. Tap the User button.



All users are displayed in the User Management panel.



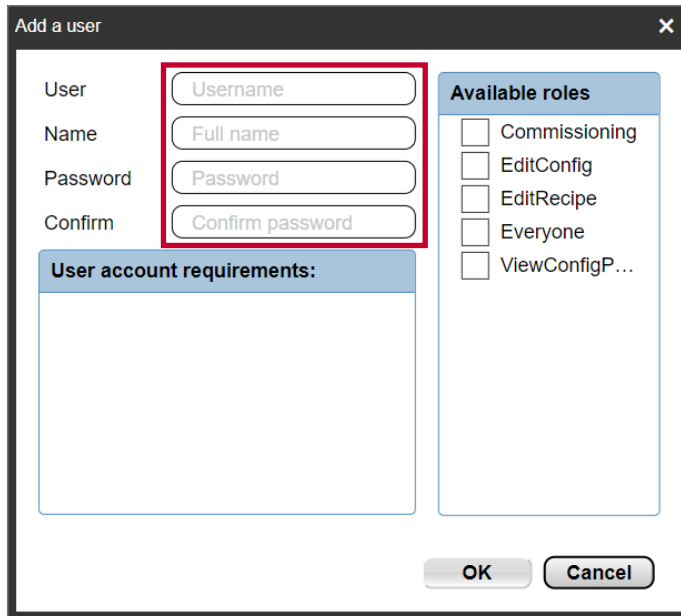
All users, except for Operator, can access this page, and can create, edit, or delete user profiles that have a lower level role than the currently logged-in user.

### 7.2.4.2 Creating a user

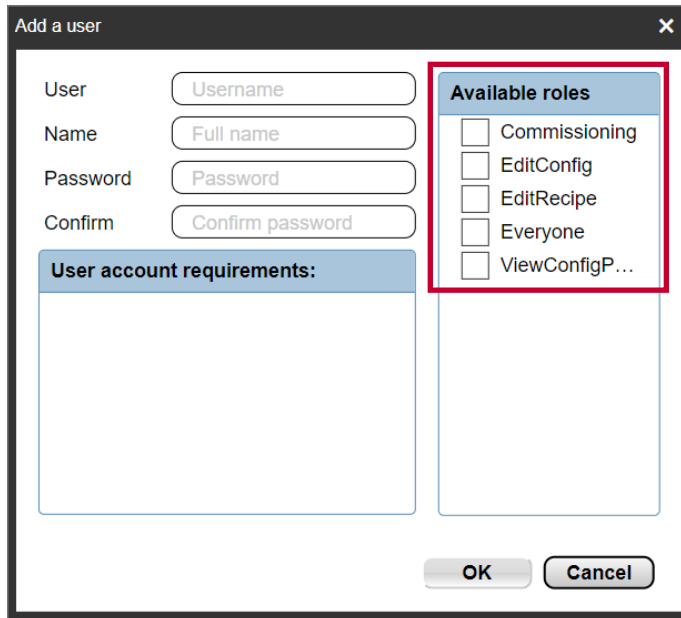
1. Tap the Add button.



2. Tap the fields of the Add a user dialog box and enter information,



3. Tap the appropriate check boxes of the Available Roles panel.





4. Press the OK button.  
The new user is added to the list of users.

New User	Commissioning, EditConfig, EditRecipe, Everyone		Wednesday, May 17, 2023 2:59:56 PM
Operator	Everyone		Tuesday, May 09, 2023 12:42:02 PM

### 7.2.4.3 Deleting a user

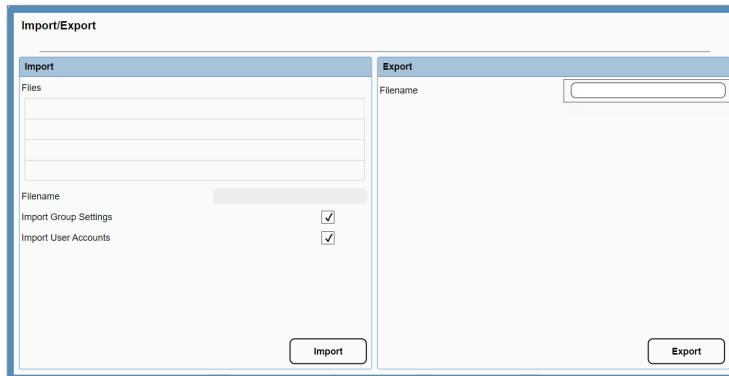
1. From the list of users, tap the user you want to delete.



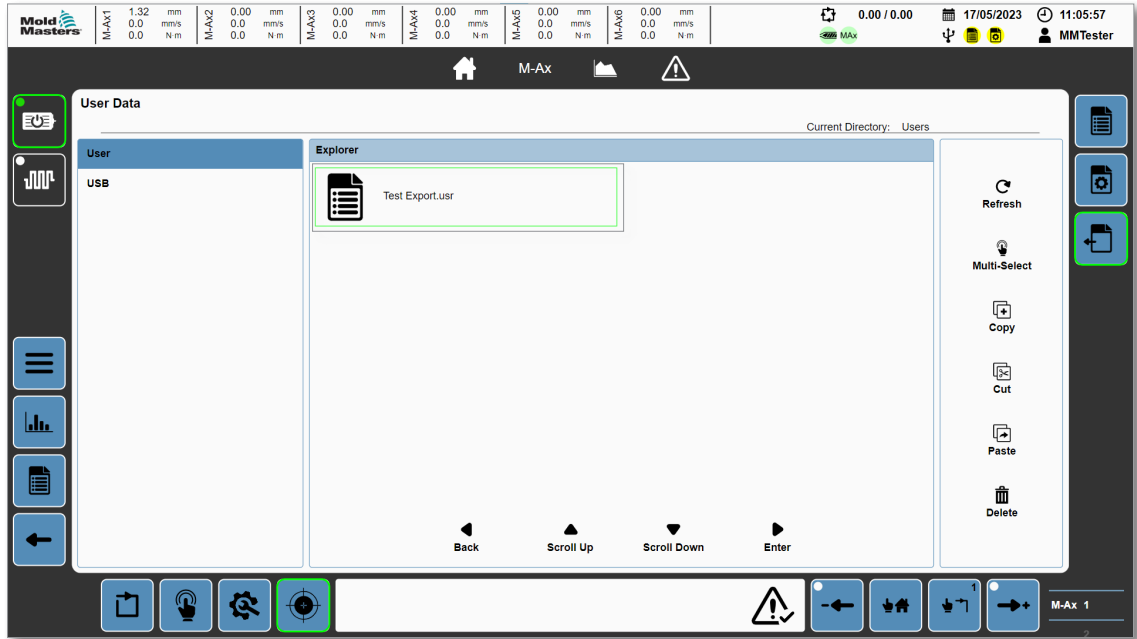
2. Tap the Delete button.
3. Tap the Yes button in the confirmation dialog box.

### 7.2.4.4 Exporting user management data

1. Tap the Import/Export button.
2. In the Export panel of the Import/Export dialog box, tap the Filename field and enter a filename.

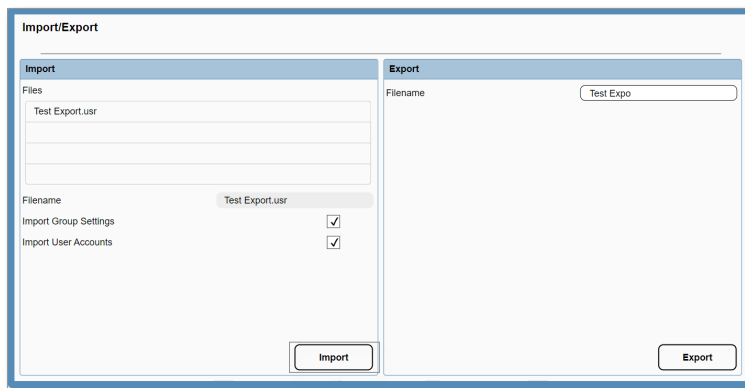


- The user data is exported to the User Data/Users folder.



### 7.2.4.5 Importing user management data

- Using the User Data page, move the .usr file to the User Data/Users folder. See section "5.9.3 User Data" on page 5-68 for more information about the User Data page.
- Go to the User Management page and tap the Import/Export button.
- From the list of files, tap the file that you want to import.
- Tap the Import button.



## 7.3 Using the controller

Forward motion is motion traveling towards 0. Backward motion is motion traveling away from 0.

### 7.3.1 Powering the motors

1. Tap the Motor button in the left panel.



If the motors are successfully powered, the LED and the border of the Motor button will turn green.



### 7.3.2 Turning off power to the motors

1. Tap the green Motor button in the left panel.



2. Tap OK in the dialog box.

If power is successfully turned off to the motors, the LED and the border of the Motor button will turn white.



Note: Some critical alarms will turn off the motors or restrict the motors from powering if they are active. If you cannot power the motors, check the active alarms.

### 7.3.3 Putting the controller into setup mode

Setup mode allows you to move the axes freely within the software position limits. Any configured interlocks will be ignored while jogging in setup mode.

Tap the Setup button in the Footer to put the controller into setup mode.



All moves in setup mode are executed with the velocity and torque set in Axis Configuration.

See section "5.1.5 Footer" on page 5-7 for more information on the Footer buttons.

### 7.3.4 Putting the controller into calibration mode

Calibration mode allows you to move the axes without restrictions. Any configured interlocks or software position limits will be ignored while jogging in calibration mode. Calibration mode should only be used to calibrate the axis, or in the event that something has moved the axes outside of the software's limited range and the axis is not able to move in another mode. All moves in calibration mode are executed with the velocity and torque set in Axis Configuration.

1. Tap the Setup mode button in the Footer.



2. Go to the M-Ax calibration page
3. Tap the Enable Calibration Mode checkbox.

The border of the Setup mode button will change from green to yellow when the controller is in calibration mode.



See "7.2.2 Configuring an axis" on page 7-7 for more information on calibrating an axis.

See "5.1.5 Footer" on page 5-7 for more information on the Footer buttons.

### 7.3.5 Putting the controller into manual mode

Manual mode allows you to move the axes within the predefined motion steps. All manual moves take into account the interlocks defined for the motion steps to be executed. Motion will be executed with the velocity and torque set up for each motion step.

Tap the Manual button in the Footer to put the controller into manual mode.



See section "5.1.5 Footer" on page 5-7 for more information on the Footer buttons.

### 7.3.6 Putting the controller into auto mode

Requirements for auto mode:

1. Motor power on
2. EM67—Safety gates must be closed
3. EM67/Machine—E-Stops must be OK
4. Enabled M-Ax axes must be in their start positions
5. No critical alarms active

Tap the Auto button in the Footer to put the controller into auto mode.



If the change to automatic mode is not possible, an alarm will be displayed in the footer.



Tap the alarm acknowledge icon in the Footer alarm display.



Once the machine is switched into auto mode, the M-Ax axes will monitor for the axis start

trigger to be OK. Once the axis start trigger is OK, the motion steps will check the steps interlocks and execute the motion steps until all the steps are completed. After all the steps are completed, the axis will again wait for the axis start trigger to begin motion again.

For more information on setting up the axes motion steps, see section "7.2.2 Configuring an axis" on page 7-7.

# Section 8 - Maintenance

**WARNING**

Ensure that you have fully read "Section 3 - Safety" before doing maintenance procedures on the M-Ax controller.

Always isolate your controller at the source before you open the unit to inspect it or replace fuses.

## 8.1 Replacement Parts

*Mold-Masters* does not expect that you will need to repair any controller parts at board level other than fuses. In the unlikely event of any board failure then we provide an excellent repair and exchange facility for all our customers.

## 8.2 Cleaning and Inspection

Every environment suffers some degree of contamination, and it is necessary to inspect the fan filters at regular intervals. Monthly inspection is recommended. Any excess dust that has entered into the cabinet may be removed with a light brush and vacuum cleaner.

If the equipment is subject to vibration, we recommend that you use an insulated screwdriver to check that no terminals have become loose.

# Index

## C

calibrating an axis 7-11

Connections

Connecting a Robot to the M-Ax 6-2

## H

Hard stop 5-35

Hazard Areas 3-2

## M

Maximum hard stop 5-35

Maximum position offset 5-35

Maximum SW position 5-35

Minimum Hard stop 5-35

Minimum position offset 5-35

Minimum software position 5-35

## S

Safety

Hazard Areas 3-2

Lockout 3-10

S.I. units 1-2

## T

trip hazard 6-1

## V

Valid stroke range 5-35





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