



User Manual

version 2-9



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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
M-Ax-UM-EN-00-02-8	July 2019	02-8
UM--M-AX--ENG--02-9	October 2023	02-9

1.3 Warranty

For current warranty information please refer to the documents available from our website 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 preauthorization 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.

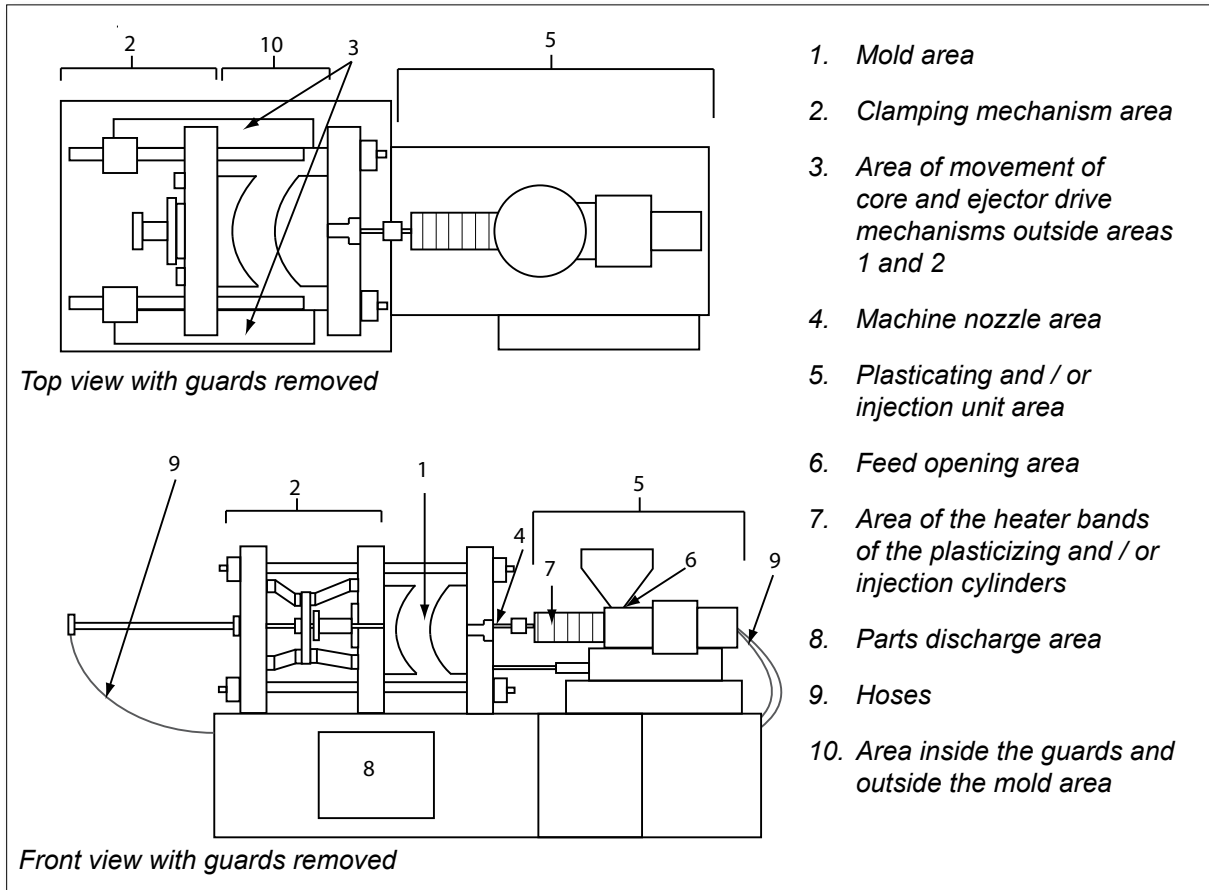


Figure 3-1 Injection molding machine hazard areas

Safety Hazards - continued

Table 3-1 Safety Hazards	
Hazard Area	Potential Hazards
<p>Mold Area Area between the platens. See Figure 3-1 area 1</p>	<p>Mechanical Hazards Crushing and/or shearing and / or impact hazards caused by:</p> <ul style="list-style-type: none"> • Movement of the platen • Movements of the injection barrel(s) into the mold area • Movements of cores and ejectors and their drive mechanisms • Tie bar motion <p>Thermal Hazards Burns and / or scalds due to operating temperature of: The mold heating elements Plasticized material released from / through the mold.</p>
<p>Clamping Mechanism Area See Figure 3-1 area 2</p>	<p>Mechanical Hazards Crushing and / or shearing and / or impact hazards caused by:</p> <ul style="list-style-type: none"> • Movement of the platen • Movement of the drive mechanism of the platen • Movement of the core and ejector drive mechanism
<p>Movement of Drive Mechanisms Outside the Mold Area and Outside the Clamping Mechanism Area See Figure 3-1 area 3</p>	<p>Mechanical Hazards Mechanical hazards of crushing, shearing and / or impact caused by the movements of:</p> <ul style="list-style-type: none"> • Core and ejector drive mechanisms
<p>Nozzle Area The nozzle area is the area between the barrel and the sprue bushing. See Figure 3-1 area 4</p>	<p>Mechanical Hazards Crushing, shearing hazards, and / or impact hazards caused by:</p> <ul style="list-style-type: none"> • Forward movement of the plasticizing and / or injection unit including nozzle • Movements of parts of-the power operated nozzle shutoff and their drives • Over pressurization in the nozzle <p>Thermal Hazards Burns and or scalds due to operating temperature of:</p> <ul style="list-style-type: none"> • The nozzle • Plasticized material discharging from the nozzle
<p>Plasticizing and / or Injection Unit Area Area from the adapter / barrel head / end cap to the extruder motor above the sled including the carriage cylinders. See Figure 3-1 area 5</p>	<p>Mechanical Hazards Crushing, shearing and / or drawn-into hazards caused by:</p> <ul style="list-style-type: none"> • Unintentional gravity movements e.g. for machines with plasticizing and / or injection unit positioned above the mold area • The movements of the screw and / or the injection plunger in the cylinder accessible through the feed opening • Movement of the carriage unit <p>Thermal Hazards Burns and or scalds due to operating temperature of:</p> <ul style="list-style-type: none"> • The plasticizing and / or injection unit • The heating elements e.g. heater bands • The plasticized material and / or vapors discharging from the vent opening, feed throat or hopper <p>Mechanical and / or Thermal Hazard Hazards due to reduction in mechanical strength of the plasticizing and / or injection cylinder due to overheating</p>
<p>Feed Opening See Figure 3-1 area 6</p>	<p>Pinching and crushing between injection screw movement and housing</p>

Safety Hazards - continued

Table 3-1 Safety Hazards	
Hazard Area	Potential Hazards
Area of the Heater Bands of the Plasticizing and / or Injection Cylinders See Figure 3-1 area 7	Burns and / or scalds due to operating temperature of: <ul style="list-style-type: none"> • The plasticizing and / or injection unit • The heating elements e.g. heater bands • The plasticized material and / or vapors discharging from the vent opening, feed throat or hopper
Parts Discharge Area See Figure 3-1 area 8	Mechanical Hazards Accessible Through the Discharge Area Crushing, shearing and / or impact hazards caused by: <ul style="list-style-type: none"> • Closing movement of the platen • Movements of cores and ejectors and their drive mechanisms Thermal Hazards Accessible Through the Discharge Area Burns and / or scalds due to operating temperature of: <ul style="list-style-type: none"> • The mold • Heating elements of the mold • Plasticized material released from/through the mold
Hoses See Figure 3-1 area 9	<ul style="list-style-type: none"> • Whipping action caused by hose assembly failure • Possible release of fluid under pressure that can cause injury • Thermal hazards associated with hot fluid
Area Inside the Guards and Outside the Mold Area See Figure 3-1 area 10	Crushing and / or shearing and / or impact hazards caused by: <ul style="list-style-type: none"> • Movement of the platen • Movement of the drive mechanism of the platen • Movement of the core and ejector drive mechanism • Clamp opening movement
Electrical Hazards	<ul style="list-style-type: none"> • Electrical or electromagnetic disturbance generated by the motor control unit • Electrical or electromagnetic disturbance that can cause failures in the machine control systems and adjacent machine controls • Electrical or electromagnetic disturbance generated by the motor control unit
Hydraulic Accumulators	High pressure discharge
Power Operated Gate	Crush or impact hazards caused by the movement of the power operated gates
Vapors and Gases	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.



Operational Hazards - continued**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
	General – Warning Indicates an immediate or potentially hazardous situation, which if not avoided, could result in a serious injury or death, and / or damage to equipment.
	Warning – Barrel Cover Grounding Strap 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.
	Warning – Crushing and / or Impact Points Contact with moving parts can cause serious crushing injury. Always keep guards in place.
	Warning – Crush Hazard Closing Mold
	Warning – Hazardous Voltage 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.
	Warning – High Pressure Overheated fluids may cause severe burns. Discharge pressure before disconnecting water lines.
	Warning – High Pressure Accumulator 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.
	Warning – Hot Surfaces Contact with exposed hot surfaces will cause serious burn injury. Wear protective gloves when working near these areas.
	Mandatory – Lockout / Tagout 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).
	Warning – Molten Material Splashing Hazard 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.
	Warning – Read Manual Before Operation Personnel should read and understand all instructions in the manuals before working on equipment. Only properly trained personnel should operate the equipment.
	Warning – Slip, Trip or Fall Hazard Do not climb on equipment surfaces. Serious slip, trip or fall injuries can result from personnel climbing on equipment surfaces.

General Safety Symbols - continued

Table 3-2 Typical Safety Symbols	
Symbol	General Description
	Caution Failure to follow instructions may damage equipment
	Important 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
Electrical Energy	<ul style="list-style-type: none"> • Power transmission lines • Machine power cords • Motors • Solenoids • Capacitors (stored electrical energy) 	<ul style="list-style-type: none"> • Turn off power at machine first (i.e., at point of operation switch), and then at the main disconnect switch for the machine. • Lock and tag the main disconnect switch. • Fully discharge all capacitive systems (e.g., cycle machine to drain power from capacitors) according to the manufacturer's instructions.
Hydraulic Energy	<ul style="list-style-type: none"> • Hydraulic systems (e.g., hydraulic presses, rams, cylinders, hammers) 	<ul style="list-style-type: none"> • Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves. • Bleed off and blank lines as necessary.
Pneumatic Energy	<ul style="list-style-type: none"> • Pneumatic systems (e.g., lines, pressure reservoirs, accumulators, air surge tanks, rams, cylinders) 	<ul style="list-style-type: none"> • Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves. • Bleed off excess air. • If pressure cannot be relieved, block any possible movement of machinery.
Kinetic Energy (Energy of a moving object or materials. Moving object may be powered or coasting)	<ul style="list-style-type: none"> • Blades • Flywheels • Materials in supply lines 	<ul style="list-style-type: none"> • 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. • Block material from moving into area of work. • Blank as required.
Potential Energy (Stored energy that an object has the potential to release due to its position)	<ul style="list-style-type: none"> • Springs (e.g., in air brake cylinders) • Actuators • Counterweights • Raised loads • Top or movable part of a press or lifting device 	<ul style="list-style-type: none"> • If possible, lower all suspended parts and loads to the lowest (rest) position. • Block parts that might be moved by gravity. • Release or block spring energy.
Thermal Energy	<ul style="list-style-type: none"> • Supply lines • Storage tanks and vessels 	<ul style="list-style-type: none"> • Shut off, lock (with chains, built-in lockout devices, or lockout attachments) and tag valves. • Bleed off excess liquids or gases. • Blank lines as necessary.

3.7 Grounded Earth Connections

Grounded earth connections are located on the M5 self clinching studs attached to the metallic panels of the controller cabinet. See Figure 3-2.

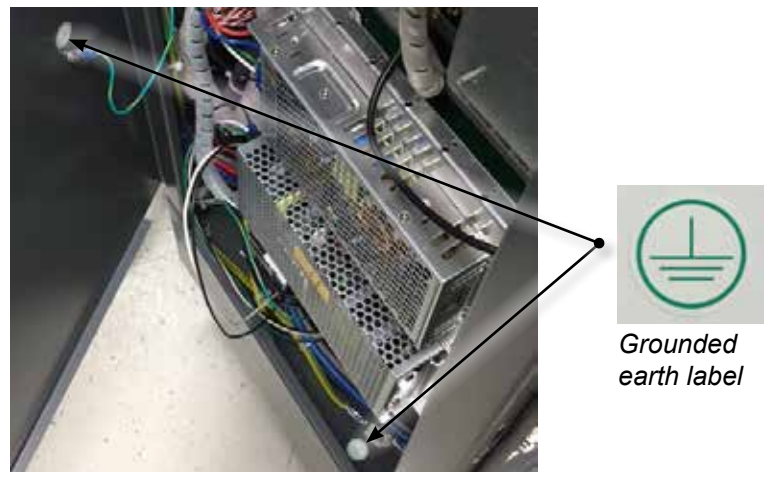


Figure 3-2 Example of grounded earth connections

3.8 Disposal



WARNING

Milacron *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 Milacron 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.

3.9.2 Cabinet Push / Tip Forces

Table 3-4 Cabinet Push / Tip Forces		
	Small Cabinet	Large Cabinet
Force required to move cabinet on castors	11 lbs (5KG F)	22 lbs (10KG F)
Force required to tip cabinet if one castor is missing	33 lbs (15KG F)	40lbs (18KG F)

3.10 M-Ax Controller Safety Features

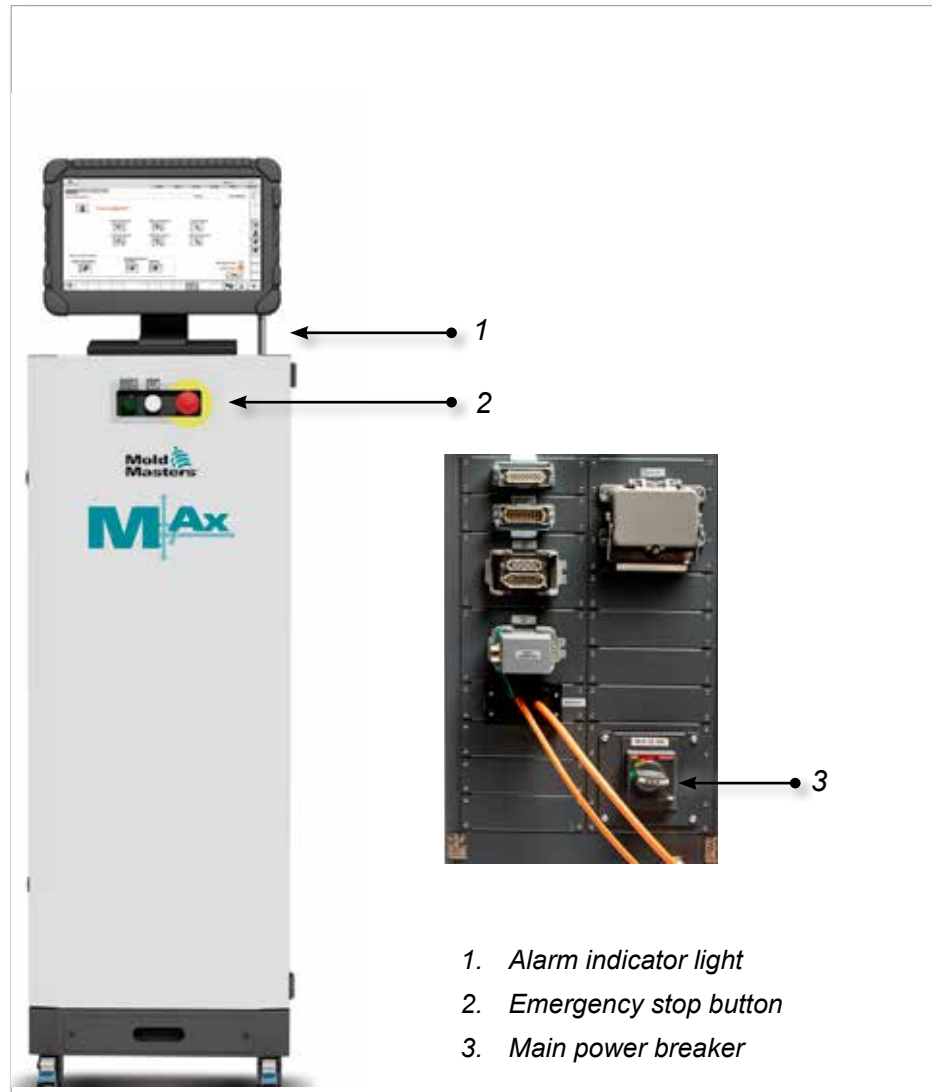


Figure 3-3 M-Ax controller safety features

Section 4 - 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.

Digital outputs can be programmed using the permission tables.

The motion permission tables prevent unwanted motions. Inputs and outputs can be added and removed by the Super User.

This controller includes:

1. 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.
6. Motion permission tables and programmable outputs.

4.2 Super User

Only a user with Supervisor level 12 authority can configure the auxiliary axis and its input / output. In this document, this user will be called the Super User.

4.3 Controller Front

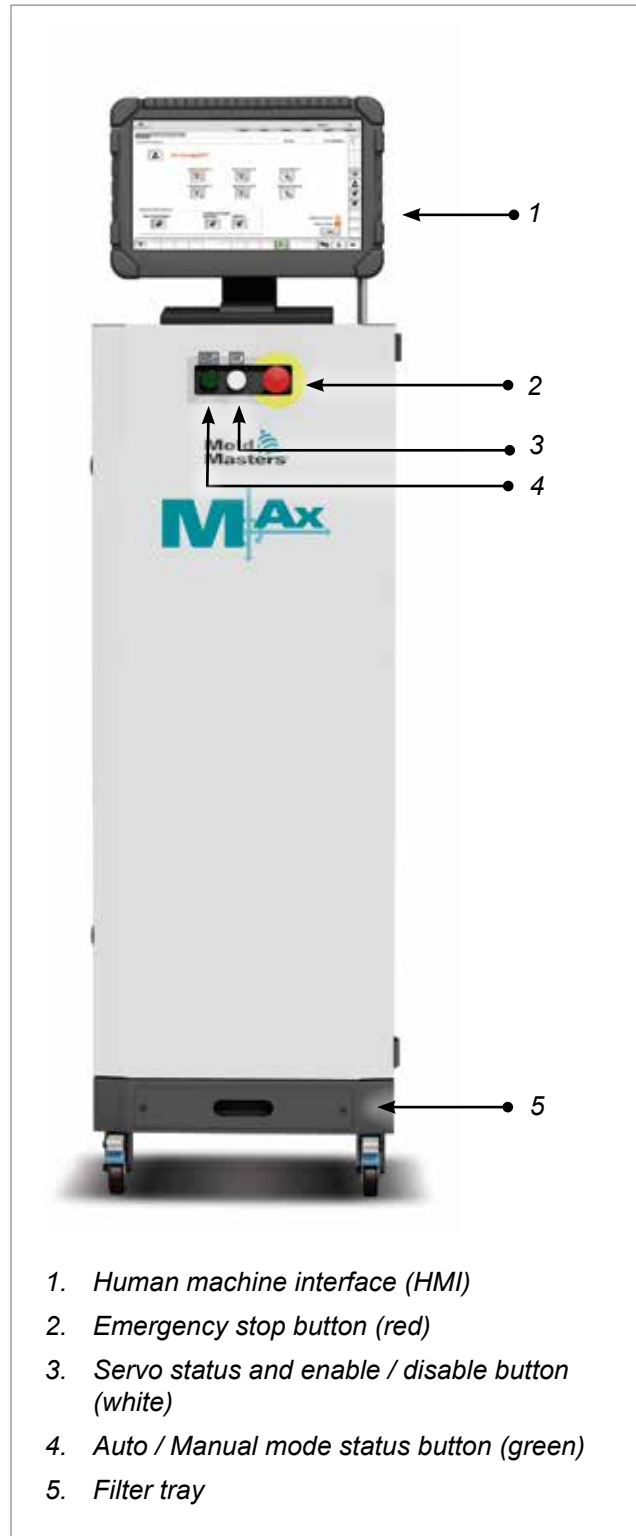


Figure 4-1 M-Ax controller front

4.4 Controller Back - Connections Side



Shown with standard wire connectors

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

Section 5 - System Setup

5.1 Installation



WARNING

Ensure that you have fully read “Section 3 - Safety” before connecting or operating the controller.

It is the responsibility of the integrator to understand and follow international and local standards for safety of machinery when integrating the controller with the molding system.

The M-Ax controller should be located in such a way that the main disconnect is easily accessible in case of emergency.

M-Ax controllers are shipped with a power cable, which is a correct size to run the system. When you install a connector on the cable, ensure that the connector can safely withstand the full system load.

The M-Ax controller supply should have a fused disconnect or main circuit breaker according to local safety codes. Refer to the serial plate on the controller cabinet for confirmation of the main supply requirements. If the local supply is outside the specified range, please contact *Mold-Masters* for advice.



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.
- Do not mix electrical power cables with thermocouple extension cables. They are not designed to carry the power load or list accurate temperature readings in each other's application.



WARNING - TRIP HAZARD

The integrator should ensure that the controller cables do not present a trip hazard on the floor between the controller and the mold machine.

5.2 Connecting the Controller to the M-Ax

There are 3 sets of cables that connect the controller to the M-Ax:

1. servo power cables
2. servo feedback cables
3. heater - I/O - IMM cables (optional)

The correct sequence must be followed when installing the cables. The servo power and feedback cables need to be routed through the cable track before being connected to the motors. The heater - I/O - IMM cables can be connected directly, and all the cables should be routed so they do not interfere with the mold or molding machine operation.

5.3 Connecting a Robot to the M-Ax

M-Ax units are compatible with both E67 and SPI robots. In all cases, the controller is shipped with a robot jumper plug.

If no robot is used, connect the robot jumper plug to the “ROBOT E67” connector on the controller.



Figure 5-1 Robot jumper plug

If an E67 robot is to be used, connect the robot's E67 cable to the “ROBOT E67” connector on the controller. If an SPI robot is to be used, attach the optional “ROBOT SPI ADAPTER” to the “ROBOT E67” connector on the controller, and connect the robot's SPI cable into the “ROBOT SPI ADAPTER.”

5.4 Connecting the M-Ax to the Molding Machine

M-Ax units are compatible with both E67 and SPI injection machines. All units ship with an IMM E67 cable. The cable connects to the IMM E67 connection on the controller. If used with an E67 IMM, the cable plugs into the IMM's E67 connection directly. If an SPI IMM is used, the cable plugs into the optional IMM SPI adapter, which then plugs into the IMM SPI connection.

Section 6 - 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.

6.1 Mode of Operation

1. Hot runner controller: Hot Runner Controller functionality is described in the M2 temperature controller manual.
2. Servo controller: Manual and Auto buttons are operated by pressing the yellow Auto/Manual button located beneath the HMI. See “Figure 4-1 M-Ax controller front” on page 4-2.

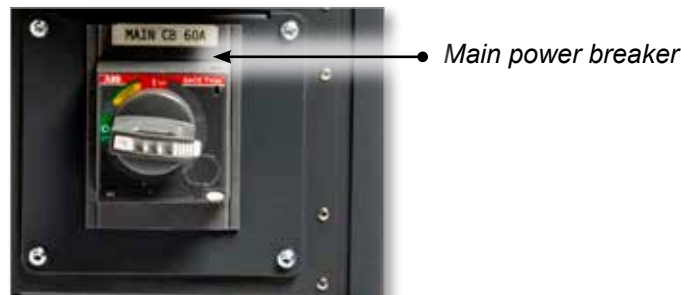
6.1.1 Controller Power Up



CAUTION

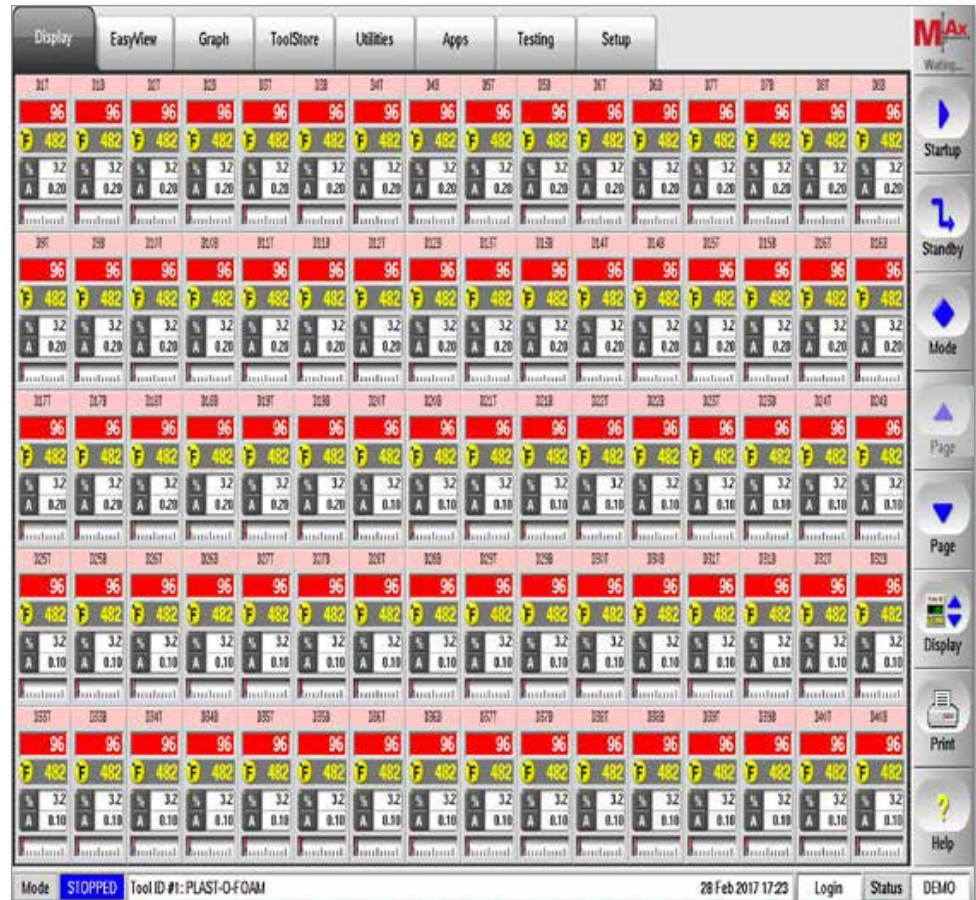
Although the main breaker has the capacity to switch the whole system “Off”, it is recommended that this is only done in an emergency. The controller uses computer technology and should be switched off in stages. A sequenced method for switching “On” and “Off” protects the console and keeps the switched load to a minimum to extend the life of the main isolator.

For all M-Ax controllers, the main power disconnect is a 3-pole breaker, located at the rear of the cabinet. This breaker is rated to safely disconnect the total load current when switched “Off”.



Controller Power Up - continued

When powered up, the controller starts up in HRC mode, as shown here:



After the controller unit has powered up, select servo control function with this button:



6.2 Movement Naming Conventions

There are four possible positions an axis can move to:

6.2.1 IN

IN means an axis position that is full stroke into the work area. Damage can occur to the axis when it is fully in the work area.

IN (In to trouble) can be described as forward, backward, advanced or retracted. It will still be fully in the work area.

Triggers and status I/O points can be selected to start movement and show status for the IN position.

6.2.2 OUT

OUT means an axis position that is full stroke out of the work area. No damage can occur to the axis when it is fully out of the work area.

OUT (Out of trouble) can be described as forward, backward, advanced or retracted. It will still be fully out of the work area.

Triggers and status I/O points can be selected to start movement and show status for the OUT position.

6.2.3 MidIN

MidIN means an axis position that is partially in to the work area. Damage can occur to the axis because it is in an intermediate position in the work area before full stroke IN.

Triggers and status I/O points can be selected to start movement and show status for the MidIN position.

6.2.4 MidOUT

MidOUT means an axis position that is partially in to the work area. Damage can occur to the axis because it is in an intermediate position in the work area before full stroke OUT.

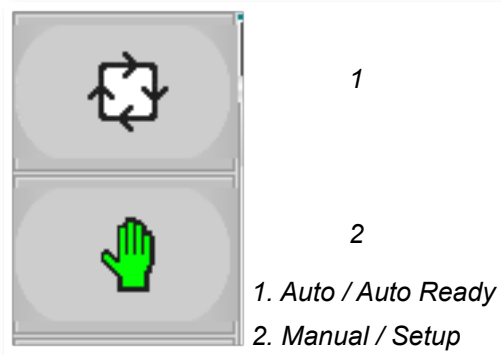
Triggers and status I/O points can be selected to start movement and show status for the MidOUT position.

6.2.5 Rotary Movements

When using a rotary axis, the four profile movements are shown as Index#1, Index#2, Index#3 and Index#4.

6.3 Manual Mode Indication

Manual mode without Calibration / Homing done.



6.3.1 Auto Ready Indication

Auto / Auto Ready is orange and Manual / Setup is green.

Auto Ready is achieved when there are no alarms present for the component and Calibration / Homing is done.



NOTE

Although the axis is in Auto Ready mode, it is still in Manual mode as well so the component can still be moved as if it were in Manual / Setup mode.



6.3.2 Auto Mode Indication

Auto / Auto Ready is green and Manual / Setup is off. To enter full Auto mode, tap "F1" on HMI panel with component in Auto Ready mode.



NOTE

The hand icon will turn green when the component is in Manual / Setup mode and orange when the component is ready for Auto mode.

6.3.3 Power Jog

Power jog allows a higher torque limit to be set on the Axis Configuration screen, found on the Jogging tab.



The Power jog icon will turn green when power jog is enabled.

6.3.4 Permission Table Override

Permission table override allows a Super User to get the component out of a locked condition. This action may be required if the permission table will not allow any movement of the component due to a fault condition.

Jog IN and jog OUT functions will be accessible to the Super User, although they will not be shown as available by the permission table.



The Permission Override icon will turn green when permission override is enabled.

Permission override will be turned off when the Super User taps this button again or by logging out or by leaving the screen.

**NOTE**

Power jog is only available when a Super User is logged in.

Section 7 - Quick View



WARNING

Ensure that you have fully read “Section 3 - Safety” before operating the M-Ax controller.

The Quick View screen was created to assist users in starting up the controller.



All the components operated by the controller can be quickly accessed by tapping the appropriate button shown below.



Each axis that has been configured by the Super User can be accessed by all users via the Quick View screen as shown below.



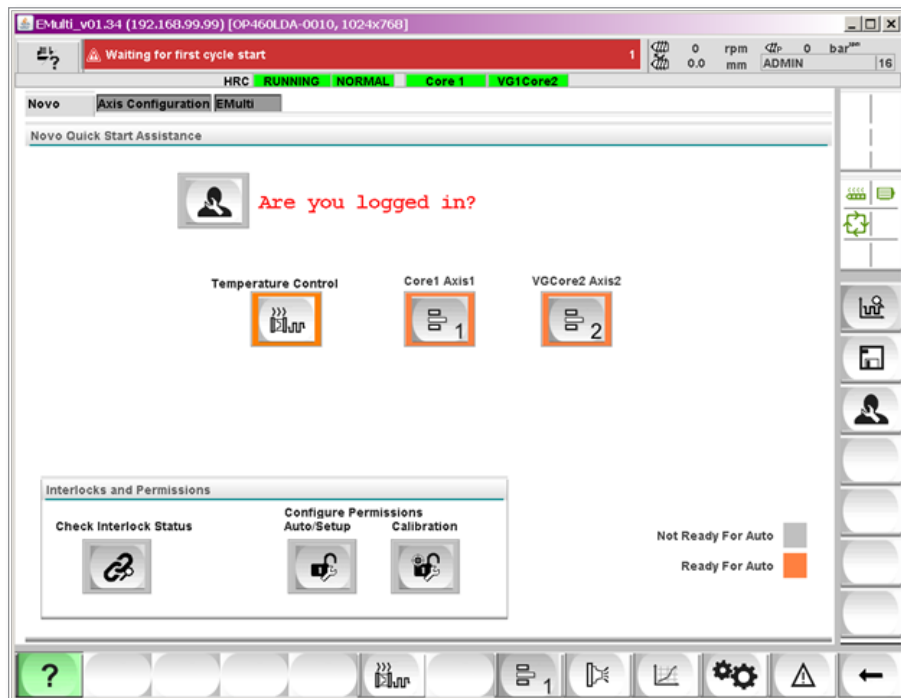
NOTE

All axes must be in Auto Ready mode before Auto mode can be activated.

The component is in Auto Ready mode when the corresponding button border on the Quick View screen turns orange in color.

See “7.1 Auto Ready Mode” on page 7-2 for further information.

Users can also access the component screen directly once they are familiar with the controller.





7.1 Auto Ready Mode

Auto Ready is the state where the axis is ready to be placed into Auto mode.

NOTE

All components must be in this state before the machine can be placed into Auto mode.

The axis must be homed and positioned at its OUT position within the At Home window.

See “13.7 Homing / Referencing Tab” on page 13-32 for more information on homing an axis.

7.2 Status Color Codes

The status bar as well as the quick buttons share a similar color code.

1. Servo off = gray
2. Manual mode with servo enabled = white
3. Auto Ready with servo homed and enabled = orange
4. Auto mode = green
5. Faulted = red
6. Stepping mode active = blue

Section 8 - Operator Level Axis Control Screen



WARNING

Ensure that you have fully read “Section 3 - Safety” before operating the M-Ax controller.

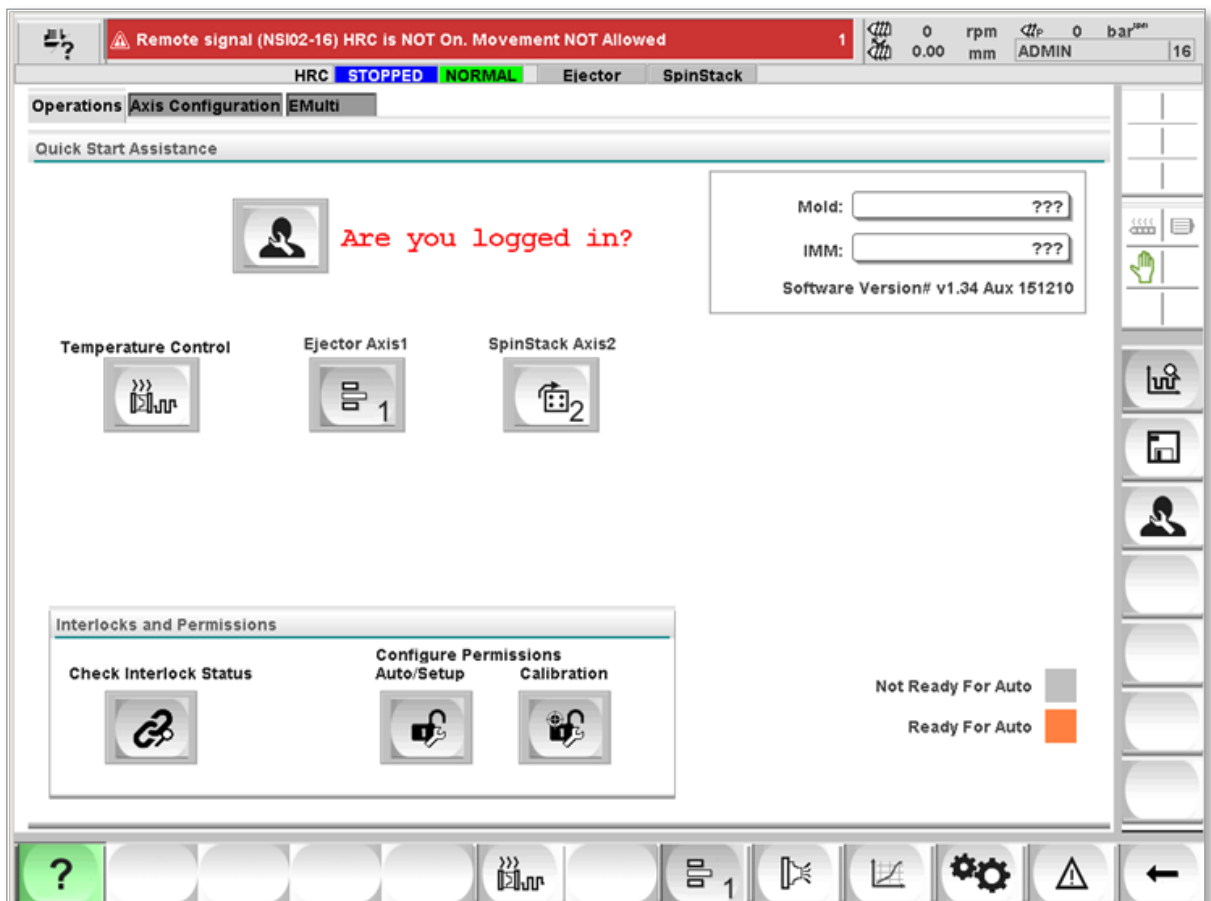
This screen is created for each axis defined by the Super User. The lower level users are able to operate the axis but only within the settings created by the Super User.

8.1 Accessing Operator Level Axis Control Screens

A button is created automatically each time the Super User configures an axis. There are two ways to access this screen.

8.1.1 Quick View Screen Access

To access the Quick View screen, tap the “?” button. The Operations tab will display the buttons for the components configured by the Super User.



8.1.2 Main Button Bar Access

The Operator Level Axis Control screens can be accessed from the main toolbar found at the bottom of the screen.



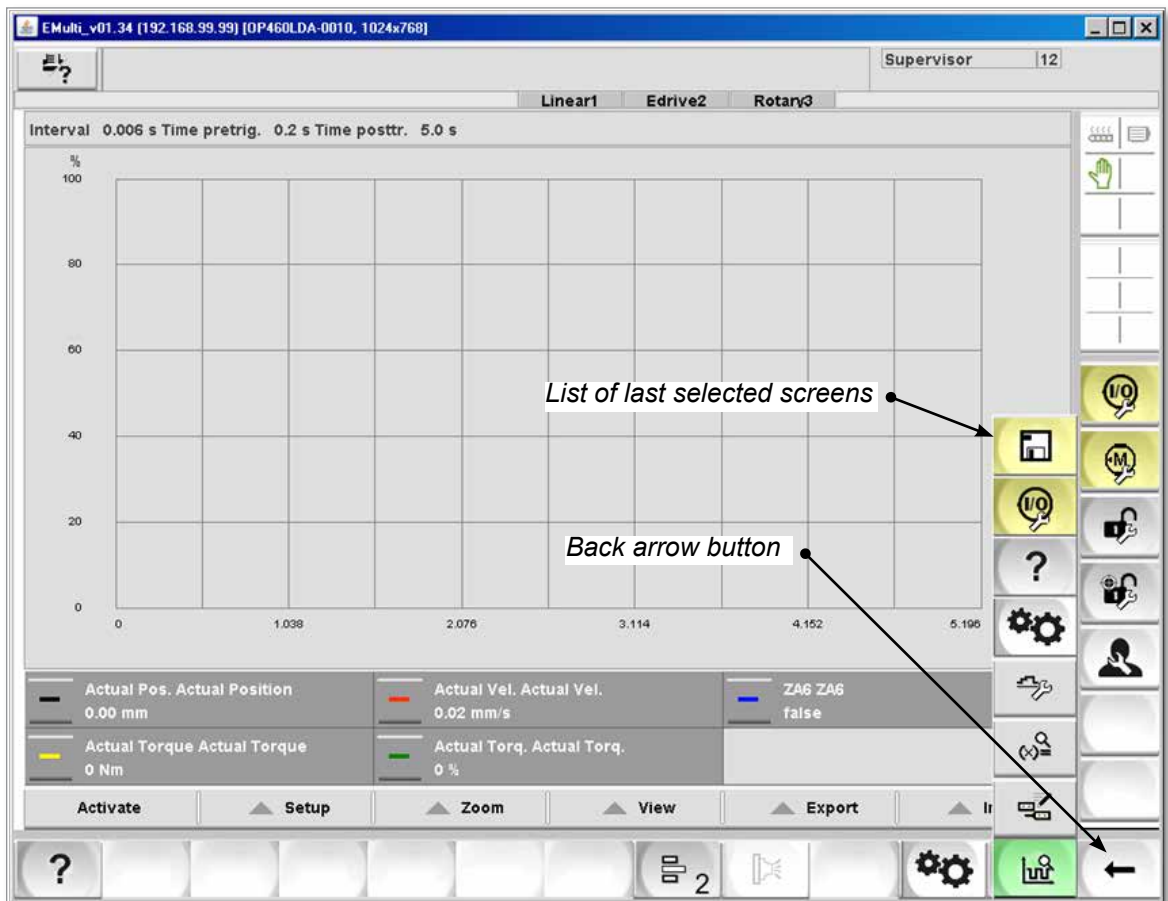
If the user taps on the “Axis” button found at the eighth button position, the corresponding Axis Control screen will be displayed.

Axis Screen buttons will stack on top of each other as they are created by the Super User.



8.1.2.1 Back Button

The user can tap on the back arrow button to display a list of recently accessed screens. Tapping on the back arrow button without selecting from the list takes the user back to the most recently accessed screen.



8.2 Axis Icons

The Axis Screen button and Jog button icons will be displayed based on the configuration by the Super User. The number on the icon is the auxiliary axis number.



8.2.1 Linear Axis

The icon for linear axis selected is:



The icon for linear axis not selected is:



8.2.2 Rotary Axis

The icon for rotary axis selected is:

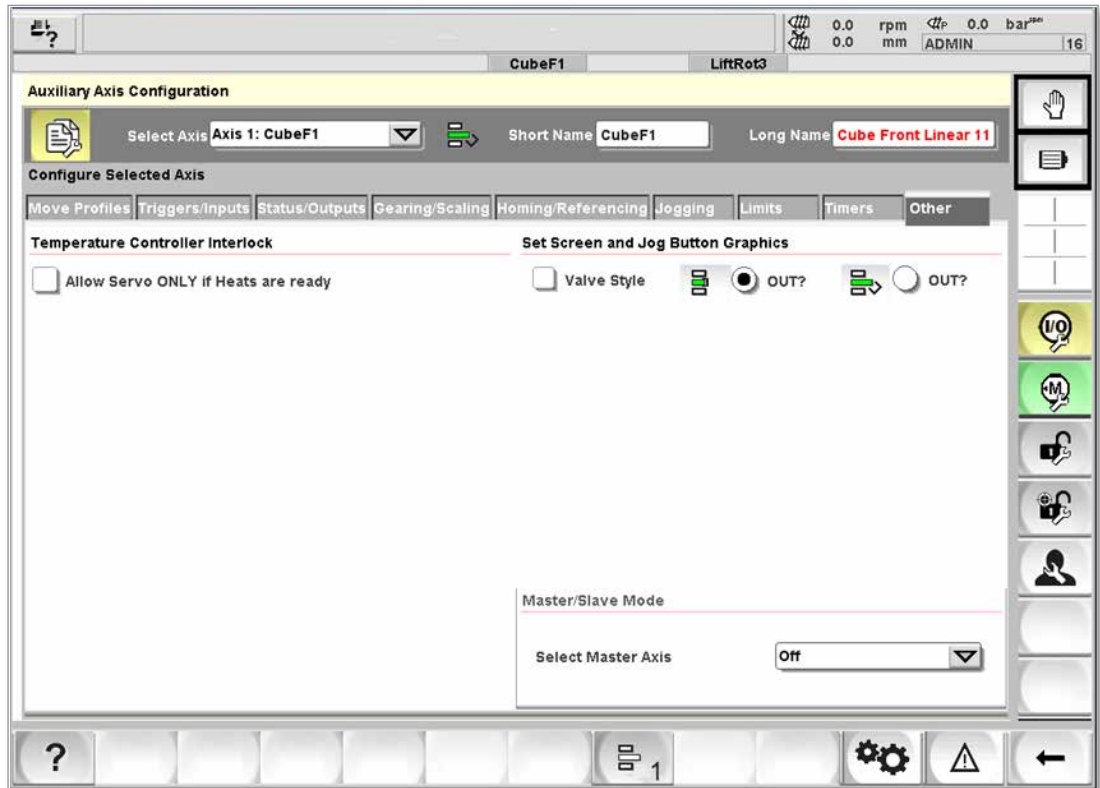


The icon for rotary axis not selected is:



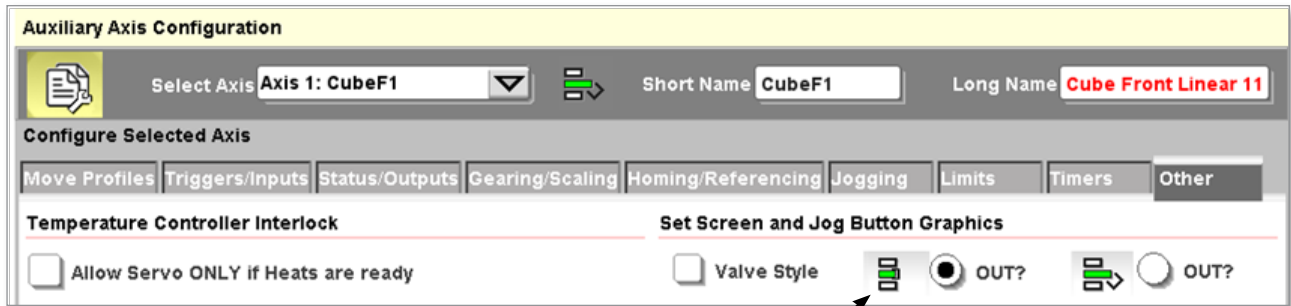
8.2.3 Jog Icon Selection

The Super User can change the jog icons to match the axis movements.



8.2.3.3 Linear

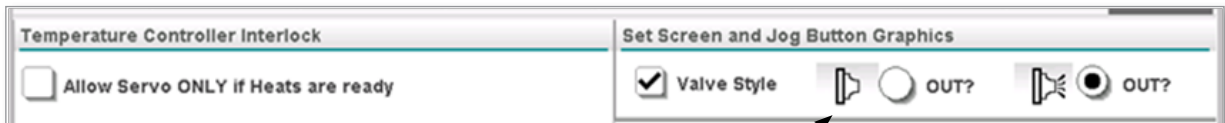
This is an example of a typical linear axis.



Select the icon that displays on the Jog buttons. The icon selected will appear on the OUT movement button so that means the other icon will display on the IN movement button.

8.2.3.1 Valve Gate

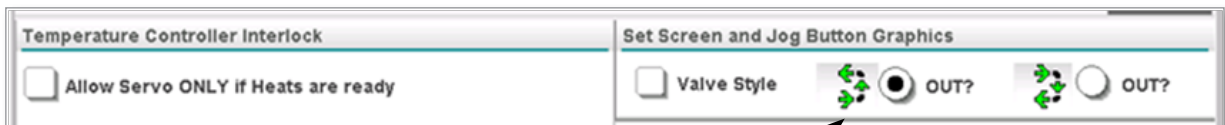
This is an example of a typical servo valve gate or E-Drive axis.



Select the icon that displays on the Jog buttons. The icon selected will appear on the OUT movement button so that means the other icon will display on the IN movement button.

8.2.3.2 Rotary

This is an example of a typical rotary axis.



Select the icon that displays on the Jog buttons. The icon selected will appear on the OUT movement button so that means the other icon will display on the IN movement button.

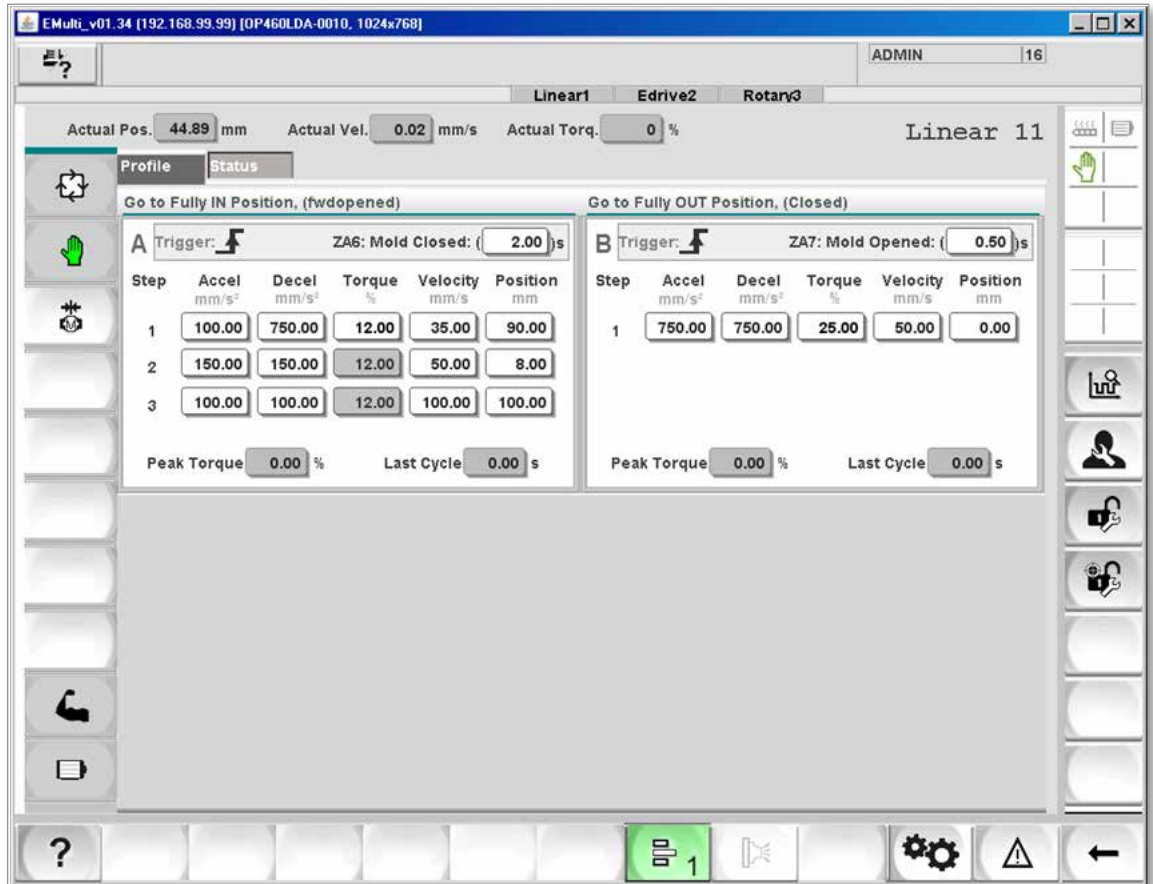
Section 9 - Axis Operation Screen



WARNING

Ensure that you have fully read “Section 3 - Safety” before operating your M-Ax controller.

These screens are created by the Super User to allow other users to operate and monitor each axis.



9.1 Axis Operation Screen Profile Tab

The main control of the axis is found on the Profile tab.

9.1.3.1 Actual Values

These values display the live current actual position, actual velocity and actual torque after the axis is homed.



9.1.1 Profiles

There are four possible profiles for each axis. Each profile is one complete nonstop movement.

A profile can be triggered by:

- an input preconfigured by the Super User.
- a set time delay from the end of the last profile
- a combination of a trigger and a set time delay



NOTE

The first profile cannot be started by a time delay only.

Profile order of operation indicator. (A,B,C and D) Profile A will be first to run followed by the others in sequence.

This profile is triggered by the falling edge of Core 3 go Eject and then a delay of five seconds occurs.

Go to Fully IN Position, (Eject Parts)

A Trigger: Core 3 go Eject: (Delay = 5.00 s)

Step	Accel mm/s ²	Decel mm/s ²	Torque kN	Velocity mm/s	Position mm
1	250.00	250.00	3.00	25.00	2.00
2	250.00	500.00	3.00	25.00	4.00
3	100.00	100.00	3.00	18.00	22.00

Peak Torque Kn Last Cycle s

9.1.1.1 Profile Order of Operation

The letter on the top left corner of each profile indicates the place in the sequence where the profile will be triggered.

See graphic above.

9.1.1.2 Trigger Edge

The trigger can be set by the Super User to happen on the leading or falling edge of the configured input.

Falling Edge



Leading Edge



9.1.1.3 Profile Steps

It is possible to have up to three steps in any profile, which is useful if a quick start to a movement and a change in ramps is required before the axis comes to its final set position.



NOTE

One torque limit value is set for all steps in the profile.

Below is an example of a rotary axis. The third step position is greyed out because this is the final position at which the axis is configured to stop. The steps before are used to adjust the motion to the final rotation position.

Step	Accel rad/s ²	Decel rad/s ²	Torque Nm	Velocity rpm	Position °
1	250.00	250.00	5.00	25.00	50.00
2	250.00	250.00	5.00	50.00	65.00
3	250.00	250.00	5.00	10.00	90.00

9.1.1.4 At Position Indicator

The green line behind step three indicates the current step of the profile.

Step	Accel rad/s ²	Decel rad/s ²	Torque Nm	Velocity rpm	Position °
1	250.00	250.00	5.00	25.00	50.00
2	250.00	250.00	5.00	50.00	65.00
3	250.00	250.00	5.00	10.00	90.00



NOTE

Rotary axis last step set position of last profile will be forced to the rotary full stroke set by the Super User in the Axis Configuration screen on the Gear Ratio tab.

9.1.1.5 Last Cycle Peak Torque

Indicates the peak torque applied during the last time the profile was run.

Peak Torque Kn

9.1.1.6 Last Cycle Time

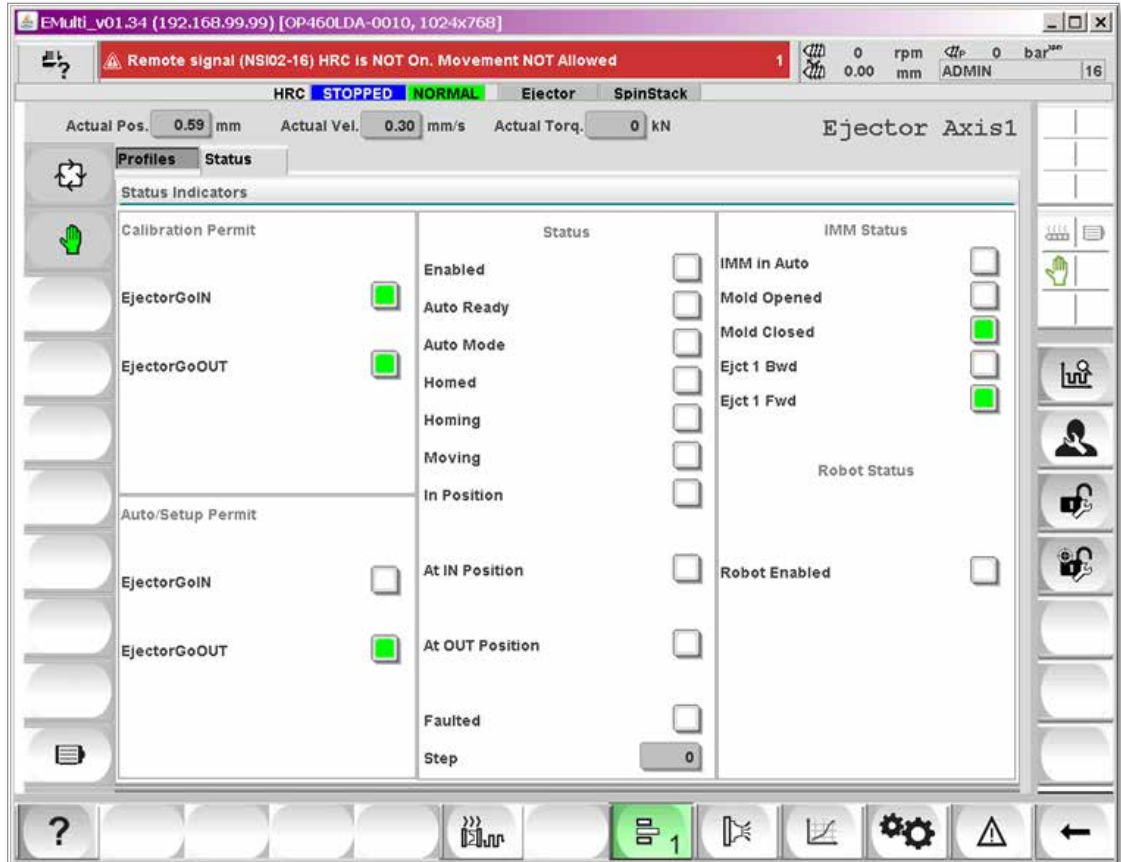
Indicates the time it took to run the profile last time it was triggered.

Last Cycle s

9.2 Screen Status Tab

This tab displays the information that follows:

- permission result for the axis profiles
- axis status indicators
- Euromap 67 status



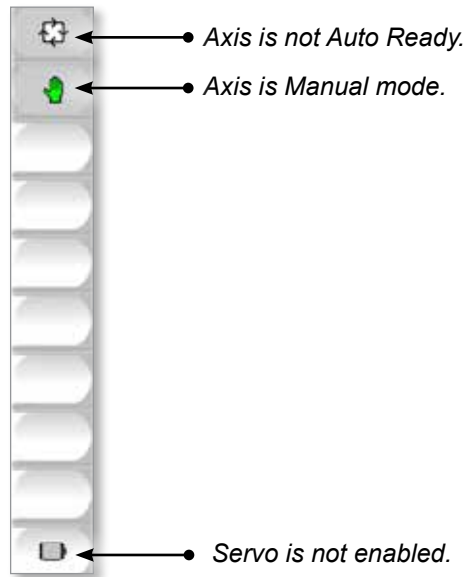
9.2.1 Control Buttons

The control buttons to operate the axis are found listed vertically on the left side of the Axis Control screen.

9.2.1.1 Servo Off

The axis is not operable when the servo is turned off. To turn the servo on:

1. Clear all existing error messages.
2. Tap the “F10” button located beneath the HMI display on the controller. The LED on the button will turn on.



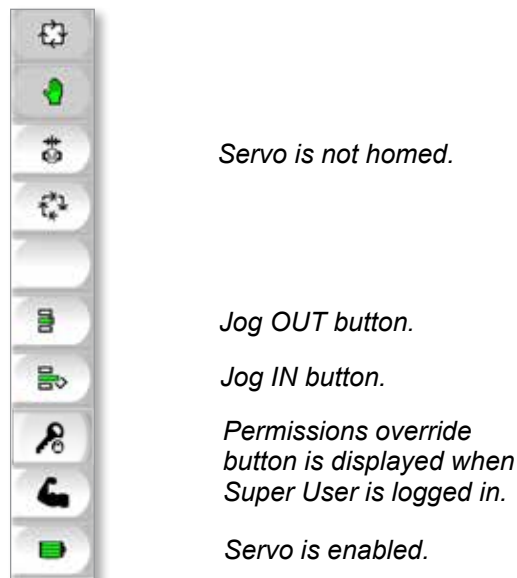
9.2.1.2 Servo On but Not Homed

The user will see this graphic if the servo is on but not homed:



NOTE

The actual display position is not correct until the axis is homed. Jogging the axis is allowed.



9.2.1.3 Permissions Override



CAUTION

Jogging axis in Permission Override mode can cause damage to equipment. Make sure to take great care because the axis can now be moved while ignoring set permissions.

When the Super User activates the Permissions Override function, the “Permission Override” button turns green and the Jog buttons turn light red. The servo must be enabled to activate this function.



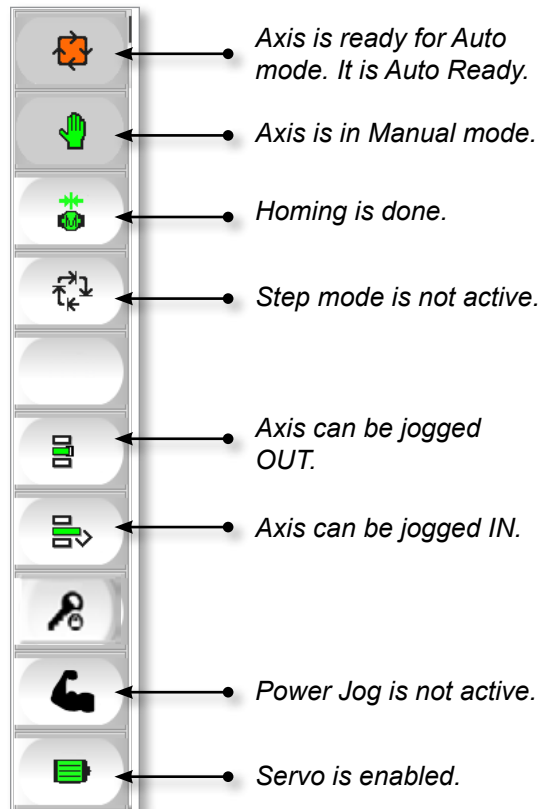
NOTE

Jogging is the only active function allowed during Permission Override mode.



9.2.1.4 Auto Ready

When homing has been completed without error, then the buttons will appear as below:



9.2.1.5 Step Mode

When the axis is homed and is Auto Ready, the stepping function can be used.

Stepping allows the user to step through the configured profiles of the axis without waiting for a trigger.

The axis moves like it is in Auto mode but waits for the Step button before each profile is run sequentially. This mode is very useful for testing the configuration of the profiles.



NOTE

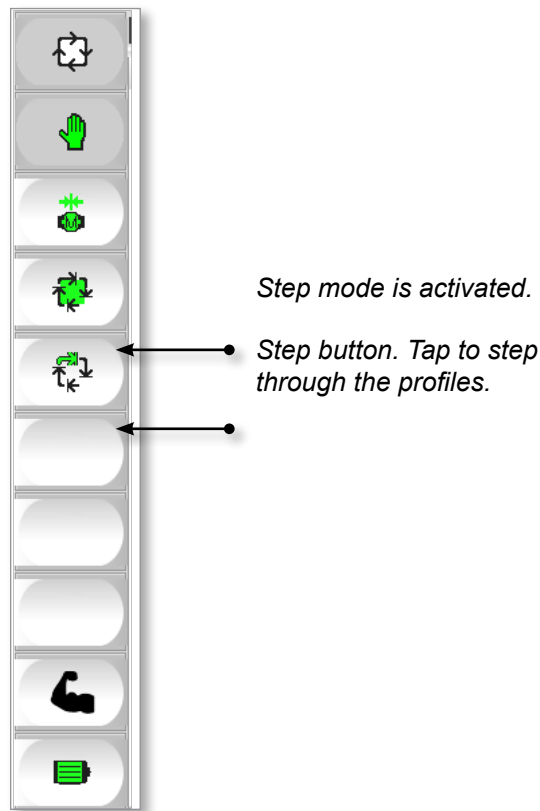
The triggers and time delays are ignored in Step mode. When the Step button is tapped the profiles will run sequentially. The profiles will run on a false to true transition of the step button.

To enable Step mode:

1. Tap the “Step mode” button.
2. Tap the “OK” button to confirm.

The Step mode button turns green, and the Step button appears.

3. Tap the “Step” button to step through the profiles.
4. Tap the “Step mode” button, and then tap “OK” to exit Step mode. The “Step” button disappears and the Step mode icon deactivates.



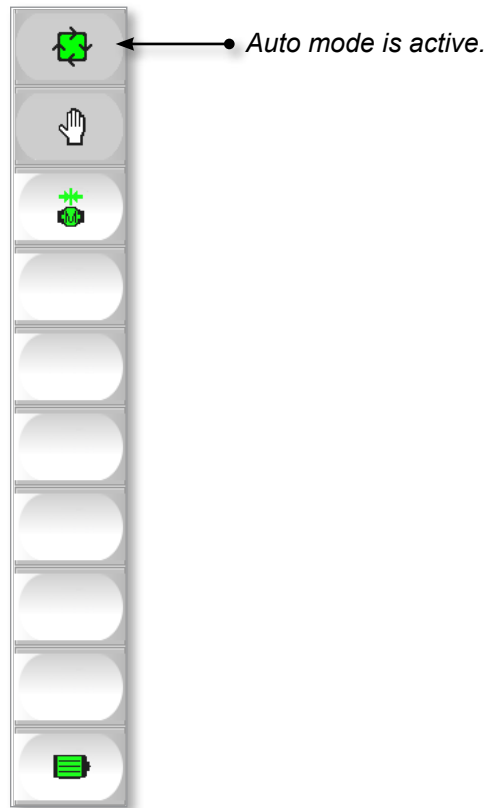
Step mode is activated.

Step button. Tap to step through the profiles.

9.2.1.6 Auto Mode

When the system is ready to go to Auto mode, tap the [F2] button located below the HMI on the controller.

The LED on the button will turn on and the control buttons will appear as shown below:



Section 10 - Status Bar



WARNING

Ensure that you have fully read “Section 3 - Safety” before operating your M-Ax controller.

The Status bar can be seen at the top of all screens.

As seen in the graphic here, the auxiliary access short names created by the Super User are displayed on the right hand side. The Status bar can hold up to six auxiliary axes.

A color coding system is used to indicate the status of the axes.



All of the status items for auxiliary axis follow a color code we have created.

10.1 Servo Off

If the servo is off, then the status item turns grey in color.



10.2 Manual Mode

If the servo is on but not homed (not Auto Ready), then the color code is white.



10.3 Auto Ready

If the axis has been homed and is Auto Ready, then the color is orange.



10.4 Step Mode

If the user has Stepping mode activated, then the color is blue.



10.5 Auto Mode

If the controller is in Auto mode, then the color is green.



Section 11 - I/O Configuration



WARNING

Ensure that you have fully read “Section 3 - Safety” before configuring the M-Ax controller.

This screen allows the Super User to configure physical inputs and outputs that are connected to the controller.

At bootup, the I/O point is checked to see if a connection exists. If the software determines the connection between the variable and the hardware is correct and exists, the I/O point will be displayed on this screen.

Wired In	Wired Out	E67 In	E67 Out	Axis Pos	Axis Motion	USED Triggers	USED Confirm Inputs	USED Status Outputs
State	Address	Connector Pin	Short Name	Long Name	Add to Lists		Add to Permission Tables	
<input type="checkbox"/> Yes	_di_0_2		? ?	? ?	<input type="checkbox"/> Triggers	<input type="checkbox"/> Status	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing
<input type="checkbox"/> Yes	_di_0_3	13	?13	?13	<input type="checkbox"/> Triggers	<input type="checkbox"/> Status	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing
<input type="checkbox"/> Yes	_di_0_4	14	?14	?14	<input type="checkbox"/> Triggers	<input type="checkbox"/> Status	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing
<input type="checkbox"/> Yes	_di_0_5	15	?15	?15	<input type="checkbox"/> Triggers	<input type="checkbox"/> Status	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing
<input type="checkbox"/> Yes	_di_0_6		? ?	? ?	<input type="checkbox"/> Triggers	<input type="checkbox"/> Status	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing
<input type="checkbox"/> Yes	_di_0_7		? ?	? ?	<input type="checkbox"/> Triggers	<input type="checkbox"/> Status	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing
<input type="checkbox"/> Yes	_di_1_1	EU13-IN-B10	StripINTrig	Strippers Go IN (strip 1)	<input type="checkbox"/> Triggers	<input type="checkbox"/> Status	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing
<input type="checkbox"/> Yes	_di_1_2	EU13-IN-B11	VGIMGoOpen	IM VG Go Open	<input type="checkbox"/> Triggers	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing	
<input type="checkbox"/> Yes	_di_1_3	EU13-IN-B12	VGIMGoClose	IM VG Go Close	<input type="checkbox"/> Triggers	<input type="checkbox"/> Auto	<input type="checkbox"/> Homing	

11.1 Navigation Buttons

Use these buttons to move up and down through the lists.



11.2 Triggers / Status Naming Conventions

To minimize confusion when naming the servos axes, Camel case notation is recommended.

In Camel case notation, all words run together, each word is capitalized and no spaces are left between words.

For example: an input that triggers Core 1 to go to the IN position would be named “Core1GoIN”.

11.2.1 Triggers

Use the word “Go” for inputs which act as triggers.

For example: an input that triggers Core 1 to go to the IN position would be named “Core1GoIN”.

11.2.2 Confirmation Input

Use the symbol “=” for inputs which act as confirmation that the axis is in position.

For example: an input that signals that Core 1 is at the IN position would be named “Core1=IN”.

11.2.3 Status Output

Use the symbol “@” for outputs which activate when the axis is in position.

For example: an output that is set when Core 1 is at the IN position would be named “Core1@IN”.

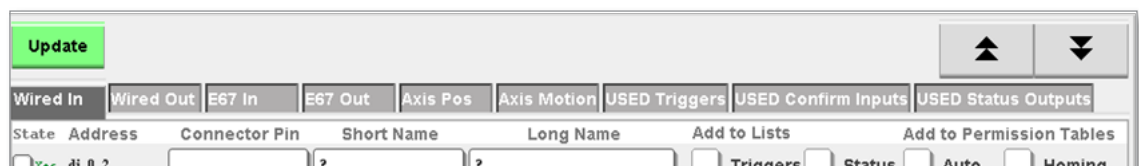
11.2.4 Axis at Set Position

Use the symbol “!” for inputs that are turned on when the axis encoder matches the required user set position.

For example: “Core1!OUT”.

11.3 Update Button

Tap the [Update] button after an I/O point is configured to assign this point its function and to update all drop down lists and permission tables.



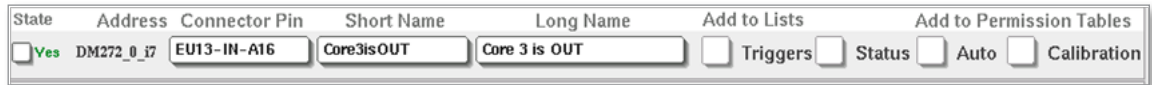
11.4 Types of I/O Fields



Only the Super User can edit the Connector Pin, Short Name and Long Name fields.

The state of the I/O point can be seen on the left side of the I/O strip. If a successful connection between the software and the physical I/O point exists, then Yes is displayed on the far left side of the I/O point.

The color green indicates that the state is active, and the color white indicates that the state is inactive.



11.4.1 State

The state indicator displays the true or false condition of the physical input or output.

The state of the I/O point can be seen on the left side of the I/O strip.

If a successful connection between the software and the physical I/O point exists, then Yes is displayed on the far left side of the I/O point. The word Yes will be green if the state is active, and it will be white if the state is inactive.



NOTE

If No is displayed then there is a problem with the I/O configuration. Contact *Mold-Masters* support. See “Section 2 - Global Support” on page 2-1.

11.4.2 Address

The address is the PLC I/O address.

The card numbering system and the I/O point system are 0 based, so the first card or point will be named 0, not 1. Inputs are shown by i and outputs are shown by o.

Example 1: For address DM272_0_i7 the PLC address would be I/O card 0 (the first card), input 7.

Example 2: For address DM272_1_o5 the PLC address would be I/O card 1, output 5.



11.4.3 Connector Pin

The Connector Pin field used to enter the pin-out of a connector. It cross-references the connector and the PLC I/O address, which helps with the setup of the cabling and wiring.



NOTE

This field is only used to display a link between the I/O point and the connector.



11.4.4 Short Name

Short text that describes the I/O point or axis where space is limited, such as permission tables.

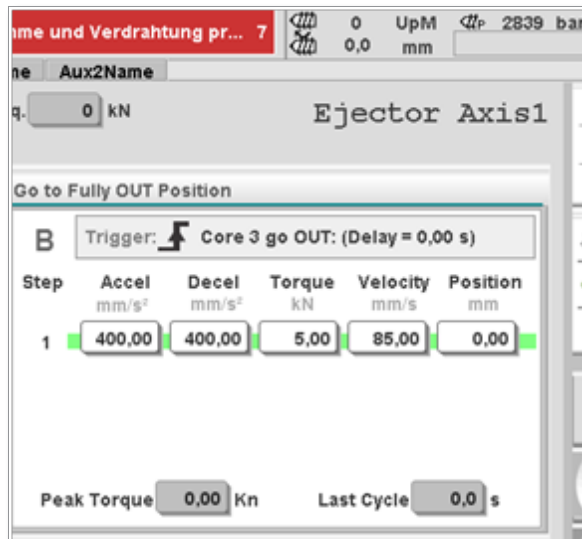
See “11.2 Triggers / Status Naming Conventions” on page 11-2 for recommended naming conventions.



11.4.5 Long Name

Long text that describes the I/O point or axis where space is not so limited, such as Axis screens.

See “11.2 Triggers / Status Naming Conventions” for recommended naming conventions.



11.4.6 Wired In (Inputs)

These physical inputs are attached to the controller. They can be configured to send “in position” confirmation signals from outside sensors to the auxiliary axis, or they can be used to trigger auxiliary axis movements. These inputs can be added to the permission tables to control the movement of permission outputs.

State	Address	Connector Pin	Short Name	Long Name	Add to Lists	Add to Permission Tables
<input checked="" type="checkbox"/> Yes	DM272_0_i7	EU13-IN-A16	Core3isOUT	Core 3 is OUT	<input type="checkbox"/> Triggers	<input type="checkbox"/> Status <input type="checkbox"/> Auto <input type="checkbox"/> Calibration

11.4.7 Wired Out (Outputs)

These are physical outputs attached to the computer, which can be configured to turn on when an auxiliary axis reaches a configured position. The output can be controlled from the permission tables.

State	Address	Connector Pin	Short Name	Long Name	Add to Lists	Add to Permission Tables
<input type="checkbox"/> Yes	DM272_3_o0	EU13-OUT-B9	Core3isOUT	Core3 Ejector is OUT1	<input type="checkbox"/> Status	<input type="checkbox"/> Auto <input type="checkbox"/> Calibration

11.4.8 E67 In (Inputs)

The Euromap 67 inputs are attached through a Euromap 67 connector to the controller, and they are used to send signals from outside equipment to the auxiliary axis to trigger movement. Euromap 67 inputs can be added to permission tables to control the movement of permission outputs.

State	Address	Short Name	Long Name	Add to Lists	Add to Permission Tables
<input type="checkbox"/> Yes	ZB5	ZB5	Core1Pos1	<input type="checkbox"/> Triggers	<input type="checkbox"/> Auto <input type="checkbox"/> Calibration

11.4.9 E67 Out (Outputs)

The Euromap 67 outputs are attached through a Euromap 67 connector to the controller, and they are used to send signals from outside equipment to the auxiliary axis to trigger movement. Euromap 67 outputs can be added to permission tables to control the movement of permission outputs.

State	Address	Short Name	Long Name	Add to Lists	Add to Permission Tables
<input type="checkbox"/> Yes	B8	B8	Enable Core2 Pos2	<input type="checkbox"/> Triggers	<input type="checkbox"/> Auto <input type="checkbox"/> Calibration

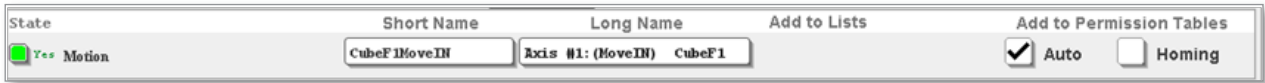
11.4.10 Axis Pos (Profile Positions)

These inputs are generated automatically when an axis is enabled and the profiles are selected. This allows the position of one auxiliary axis to trigger the movement of other auxiliary axes. This input will turn on when the axis is at the requested position and any configured status inputs are true. These inputs can be added to the permission tables to control the movement of permission outputs.

State	Short Name	Long Name	Add to Lists	Add to Permission Tables
<input checked="" type="checkbox"/> Yes	Soft Input	EjectorisOUT	Ejector Is OUT	<input type="checkbox"/> Triggers <input type="checkbox"/> Auto <input type="checkbox"/> Calibration

11.4.13 Axis Motion (Profile Motions)

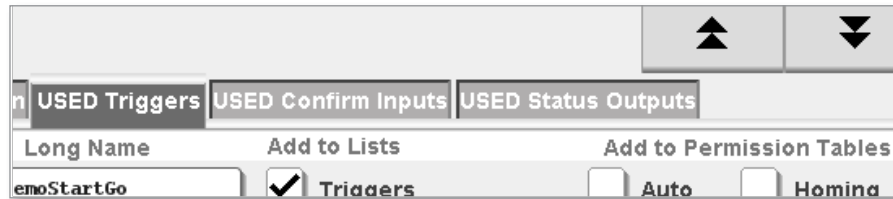
An axis pos output is created automatically when an axis is enabled and its profiles are selected. It lets the settings of the permission tables stop all movement of the profile movement if the result of the permission is false. This input will turn on when it is safe for the axis to move. This output can be added to the permission tables to control the movement of an axis based on the permission settings.



11.4.14 USED I/O

The tabs with the word USED in the title list the inputs and outputs which have been set as triggers, confirmation inputs or status outputs.

When the user selects I/O from any of the other tabs for use as a trigger, confirmation input or status output and taps the Update button, the selections will be moved to the corresponding USED tab.



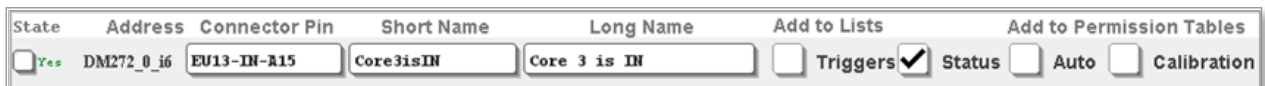
11.4.11 USED Triggers

After the user creates a trigger item and taps the Update button, the trigger item is removed from the I/O tab and added to the USED Triggers tab. All items in this tab will be added to all trigger selection lists for each auxiliary axis set up Input and Output tabs. These defined triggers will also populate the trigger selection lists for the M-Ax and valve gates, if used.



11.4.12 USED Confirmation Inputs

After the user checks the status checkbox and taps the Update button, the I/O point is removed from the I/O tab and added to the Set Confirmation Inputs tab. All items in this tab are added to all status input selection lists for each auxiliary axis. Status inputs are used to confirm that an axis is in the correct position. If the selected status input is not true, then a fault message is generated.



11.4.15 USED Status Outputs

After the user checks the Status checkbox and taps the Update button, the I/O point is removed from the I/O tab and added to the USED Status Outputs tab. All items in this tab are added to all status output selection lists for each auxiliary axis. Status outputs are used to confirm that an axis is in the correct position. If the selected status input is not true, then a fault message is generated.

State	Address	Connector Pin	Short Name	Long Name	Add to Lists	Add to Permission Tables
<input type="checkbox"/> Yes	DM272_0_00	EU13-OUT-R9	Core1atOUT	Core1 at OUT	<input checked="" type="checkbox"/> Status	<input type="checkbox"/> Auto <input type="checkbox"/> Calibration

11.4.16 Add to Permission Tables

When the Auto or Calibration checkboxes are selected, the I/O point is added to the chosen permission table.

If the I/O point is an input, it will be added as an input on the selected permission table.

If the I/O point is an output, it will be added as an output on the selected permission table.

State	Address	Short Name	Long Name	Add to Lists	Add to Permission Tables
<input type="checkbox"/> Yes	ZA6	ZA6	Mold Closed	<input checked="" type="checkbox"/> Triggers	<input checked="" type="checkbox"/> Auto <input checked="" type="checkbox"/> Calibration

Section 12 - Permission Tables



WARNING

Ensure that you have fully read “Section 3 - Safety” before setting up permission tables for your M-Ax controller.

The user sets up the conditions that must be met before the output is allowed to be true in the permission table.

- Outputs can be triggers for axis movements or hardwired outputs, such as valves or signals to external equipment.
- Inputs can be axis positions, hardwired inputs from other equipment or the status of internal temperature controller.

There are two types of permission table, which both allow and prevent the function of servo movements and digital outputs.

12.1 Auto and Manual Movements Permission Table

This permission table controls any automatic or manual movements of the axis, such as jogging or stepping.

Auto Mode Movement Permissions (Toggle Buttons for Desired Signal Condition)

	EjectorisIN	HRCatTEMP	HRCisFAULT	Laser2n3	Core1isIN	Core1isOUT	Core2isIN
EjectorGoOUT	Red	Green	Grey	Grey	Grey	Grey	Grey
EjectorGoIN	Green	Grey	Grey	Grey	Grey	Grey	Grey
SpinStackGoOUT	Grey	Red	Grey	Grey	Grey	Grey	Grey
SpinStackGoIN	Grey	Grey	Grey	Grey	Grey	Grey	Grey
Core1isIN	Grey	Grey	Grey	Grey	Green	Grey	Grey
Core2isOUT	Grey	Grey	Green	Grey	Grey	Grey	Grey
Core2isIN	Grey	Grey	Red	Grey	Grey	Grey	Green
Core4isOUT	Grey	Grey	Grey	Grey	Grey	Grey	Grey
Core4isIN	Grey	Grey	Grey	Grey	Grey	Grey	Grey
Core3isIN	Green	Grey	Grey	Grey	Grey	Grey	Grey

Signals: ■ MUST BE ON ■ MUST BE OFF ■ DOES NOT MATTER

12.2 Calibration and Homing Movements Permission Table

This permission table controls any calibration or homing movements of the axis.

Calibration Mode Movement Permissions (Toggle Buttons for Desired Signal Condition)								
Prev.	Next	HRCatTEMP	HRCisFAULT	Laser0	Core5isOUT	Laser6	Core4isIN	Core4is0
EjectorGoOUT		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EjectorGoIN		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SpinStackGoOUT		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SpinStackGoIN		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Signals: ■ MUST BE ON ■ MUST BE OFF ■ DOES NOT MATTER

12.3 Permissions Outputs and Inputs

The following descriptions apply to both types of permission tables, as they operate in the same way.

12.3.1 Permission Outputs

A permission output is set to true if the permission inputs match the pattern created by the Super User.

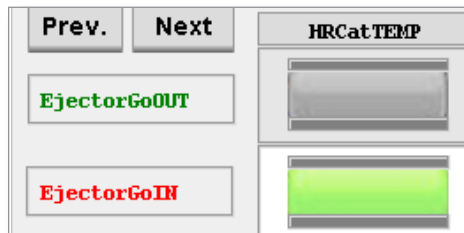
There are three ways an output gets added to the permission table as a permission output.

12.3.1.1 Trigger Generated by Axis Creation

A trigger permission output is automatically created for each axis profile selected by the Super User.

Trigger permission outputs are identified with a grey box around the short name.

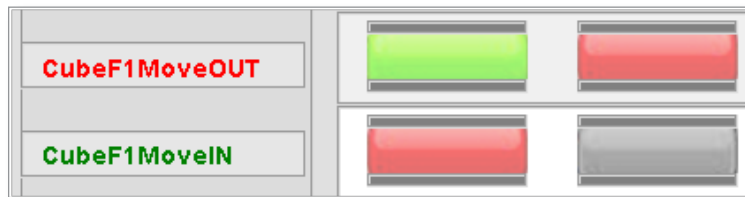
These outputs prevent the axis profile from being triggered if the sum of the set permission inputs is not true.



12.3.1.2 Move Generated by Axis Creation

A motion permission output is automatically created for each axis profile selected by the Super User.

Motion permission outputs are identified with a grey box around the short name. The motion profile for the axis will stop if the sum of the set permission inputs is not true. A fault message will then be displayed.



12.3.1.3 Added by the Super User

An output on the permission table is created when the Super User selects the Permission Table checkbox on the I/O screen.

NOTE

As this output is not automatically generated, there is no grey box around the text.



12.3.4.4 Output Text Colors

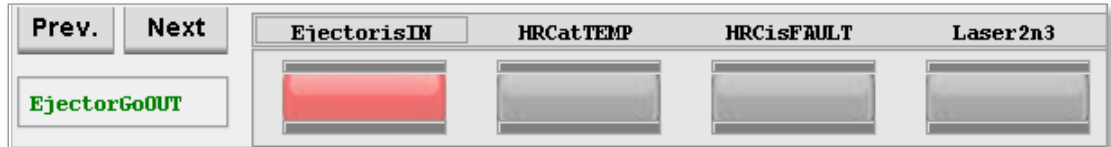
The permission output will turn green when the output is allowed to move and will turn red when it is not.

The color depends on the setup of the row of permission inputs.

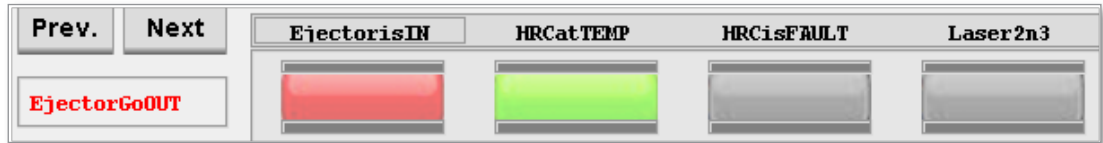
When the permission output text turns green permission is granted.

When the permission output text turns red permission is denied.

Permission Granted



Permission Denied



12.3.2 Permission Inputs

Only a Super User can add an input to the permission table as a permission input. There are two types of inputs:

12.3.2.1 Generated by Axis Creation

An I/O input is automatically created in the Axis Positions tab of the I/O Configuration screen. To add the input to the permission table, the Super User selects the corresponding checkboxes.

Selected axis positions are identified with a grey box around the short name.



12.3.2.2 Automatically Added Items

Some items are automatically added to the permission tables. If these items are not required, the Super User can select the [Does Not Matter] state.

12.3.3 Sensor Indicator

Two bars on the required state button indicated if the permission input is on or off:

- The bars will be green if the input is on.
- The bars will be grey if the input is off.

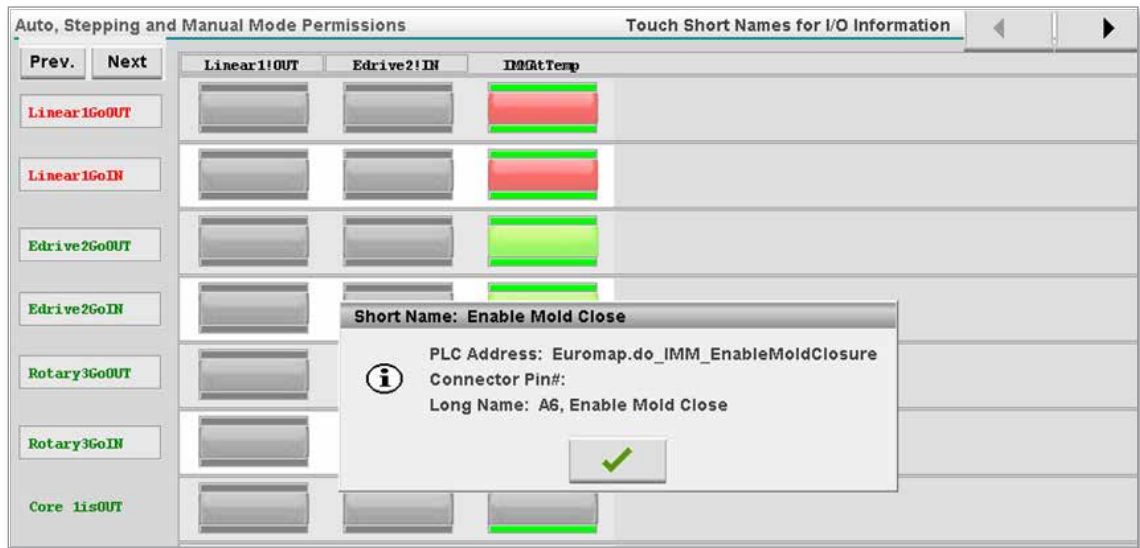


NOTE

These indicators update in real time.

12.3.4 Items More Information Dialog

The user can tap any item to see the full information set from the I/O Configuration screen.

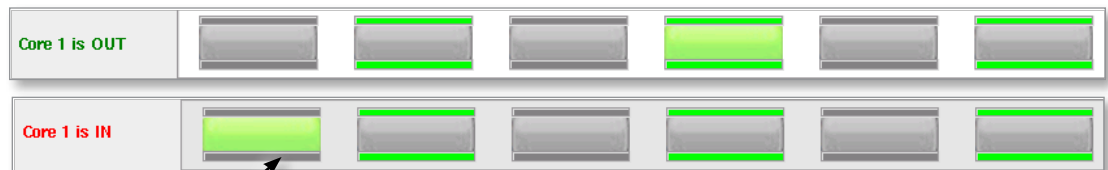


12.3.4.1 Input Must be On

In the first example below, permission is given because the required states match the selected required states.

In the second example, the arrow points at one Required State button.

The first permission input should be on but the indicators are grey.



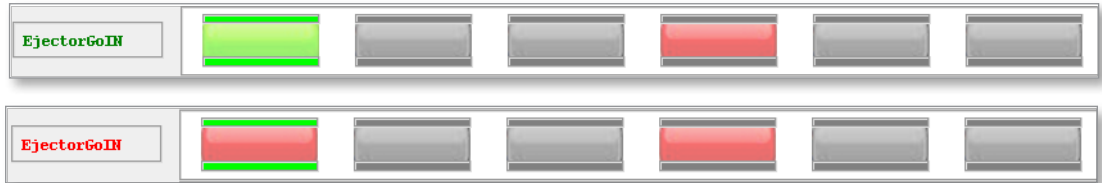
Note: indicators are grey

12.3.4.2 State #2 Signal (Input) Must be Off

In the first example below, the permission is given because the first indicator is on and its required state is "MUST BE ON".

The fourth indicator is off and its required state "MUST BE OFF".

Notice in the second example below, permission is not given because the first indicator is on but its required state is "MUST BE OFF".



12.3.4.3 State #3 Sensor State Does Not Matter

Notice below the permission is given because the first indicator is on and its required state is "DOES NOT MATTER". The rest of the indicators are off and their required states are "DOES NOT MATTER".



12.4 Edit the Permission Table



CAUTION

It is important that the Super User turns off Editing mode when the changes are complete to prevent errors.

Parameters in the permission tables can be changed if the Editing mode is enabled.

Access to the Edit mode is restricted to the Super User only.

If the Super User is logged in, the Permission edit button appears.

See Figure 12-5 below:



Figure 12-5 Permission edit button

Edit the Permission Table - continued

To access Editing mode:

1. Tap the Permission edit button.
A status bar appears as a sign that the permission tables can be edited.
See Figure 12-6 below:



Figure 12-6 Editing mode enabled

To leave Editing mode:

1. Tap the Edit button again.
The status bar will be hidden.

Section 13 - Auxiliary Axis Configuration



WARNING

Ensure that you have fully read “Section 3 - Safety” before configuring your M-Ax controller.

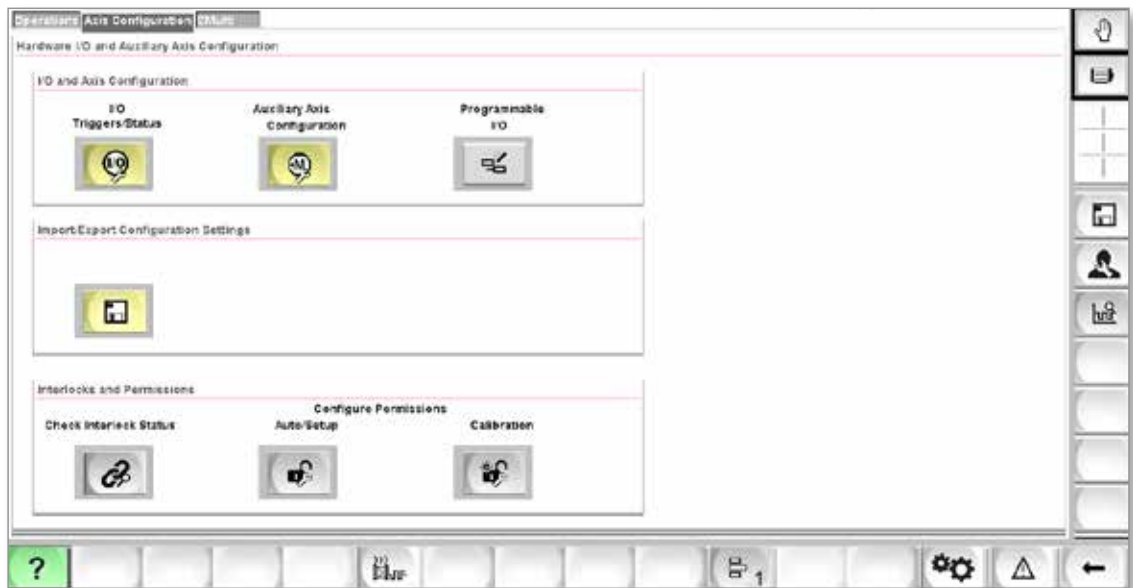
Authorized users can access the auxiliary axis configuration screen through the main menu to set parameters for what other users can see and can change.

The configuration process is the same for all axes.



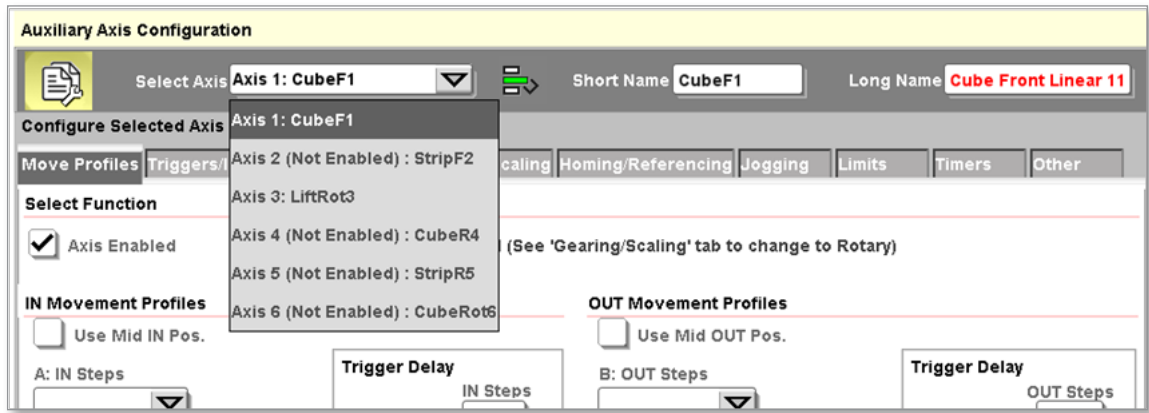
NOTE

Currently six axes are supported. There are future plans to expand this capacity.



13.1 Selecting an Axis

Tap on the dropdown list and select the axis to be configured.



13.1.1 Axis Short Name

To edit the short name of the axis:

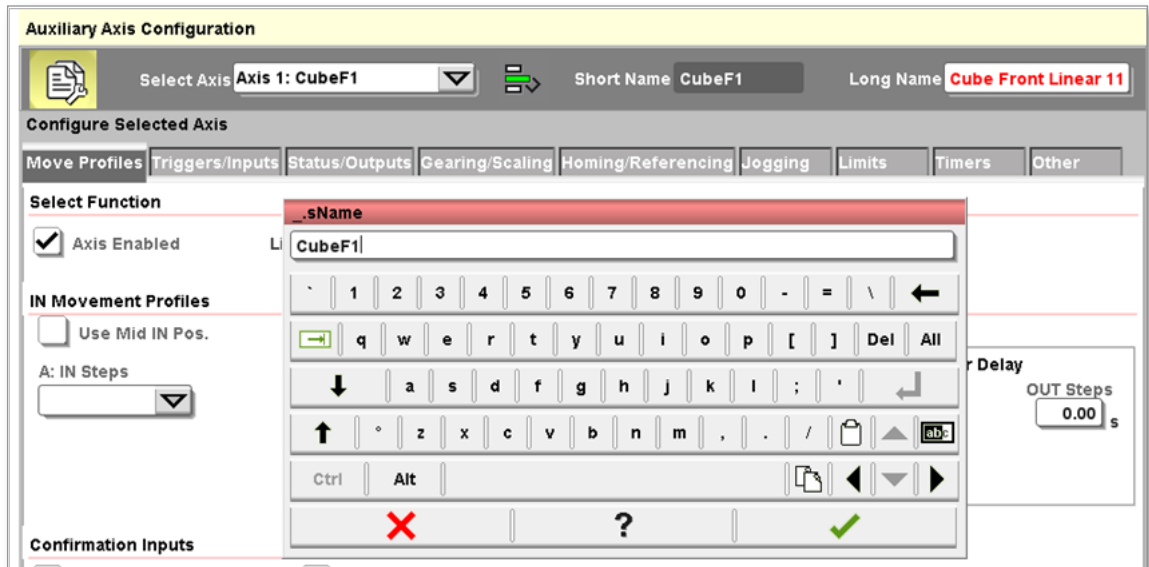
1. Tap the Short Name textbox to the right hand side of the dropdown list. A keypad will appear.
2. Edit the name of the axis.
3. Tap the green check mark on the keypad. The axis name appears in the dropdown list following the axis identifier.



NOTE

An axis can be named even if it is not enabled.

To enable an axis, see “13.2.2 Enabling an Axis”.



13.1.2 Axis Long Name

As the axis long name appears on any user screens related to the axis, it should be descriptive to help users.

To edit the long name of the axis:

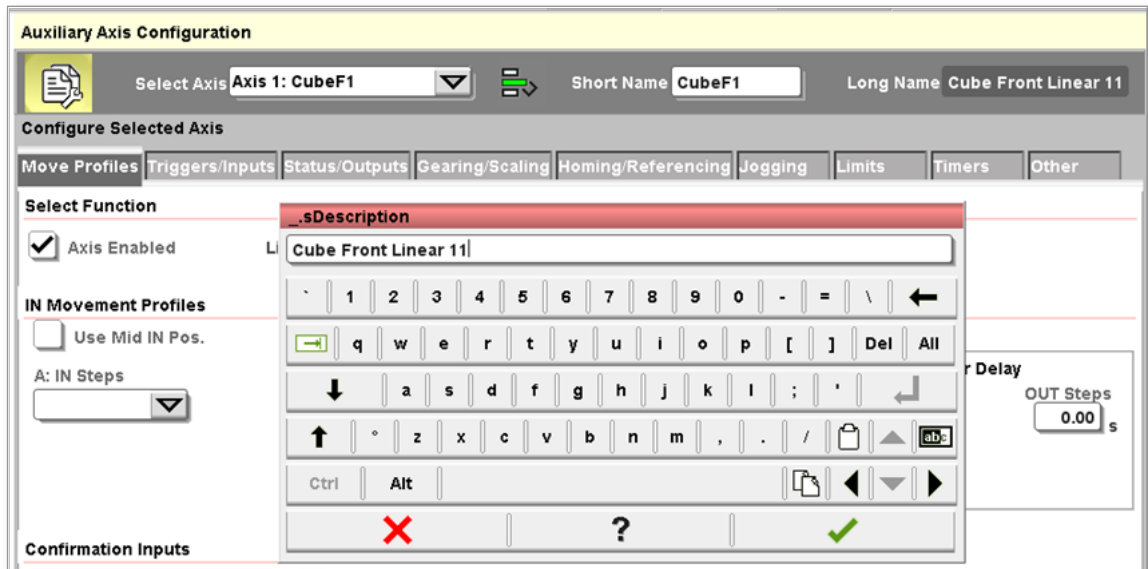
1. Tap the Long Name textbox to the right hand side of the dropdown list. A keypad will appear.
2. Edit the name of the axis. Any language can be used for the long name.
3. Tap the green check mark on the keypad.



NOTE

An axis can be named even if it is not enabled.

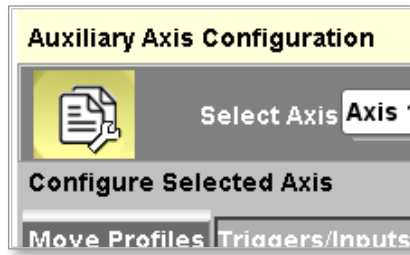
To enable an axis, see “13.2.2 Enabling an Axis”.



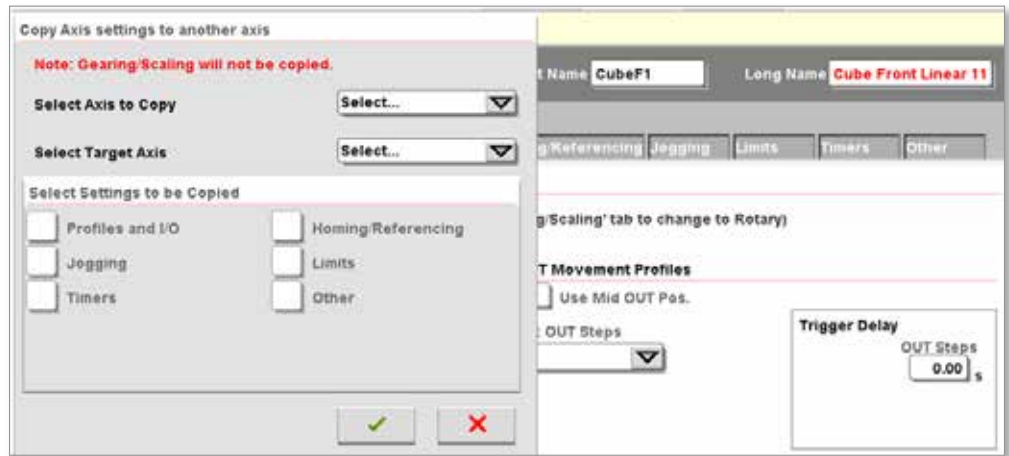
13.1.3 Copy / Paste Settings between Axes

The Super User can use the Copy / Paste button to duplicate settings from one axis to another.

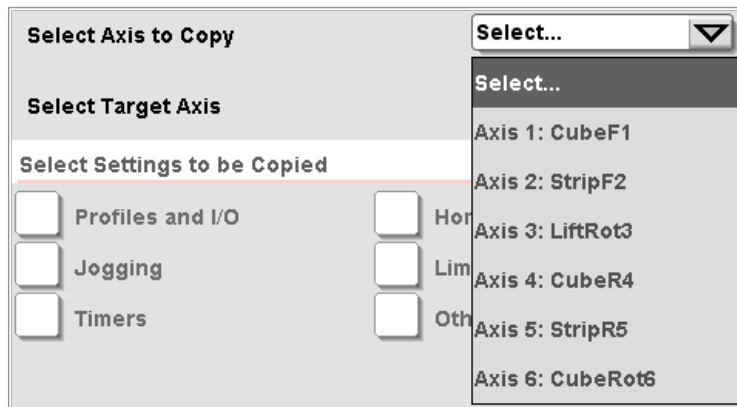
1. Tap on the Copy / Paste button as seen here:



This dialogue box will appear.

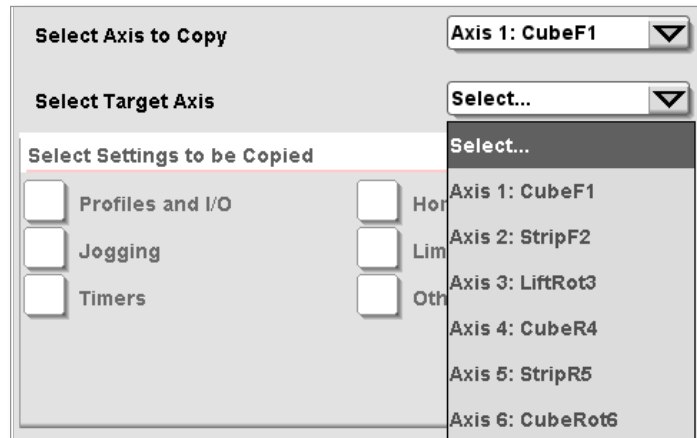


2. Select the axis to copy from the Select Axis to Copy dropdown list.

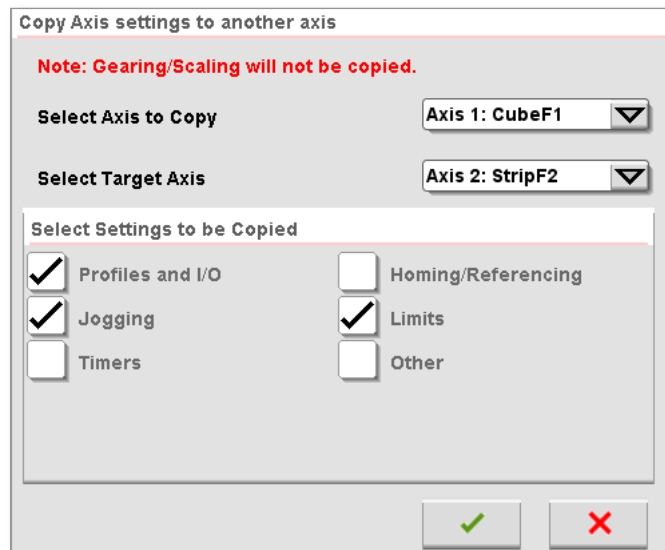


Copy / Paste Settings between Axes - continued

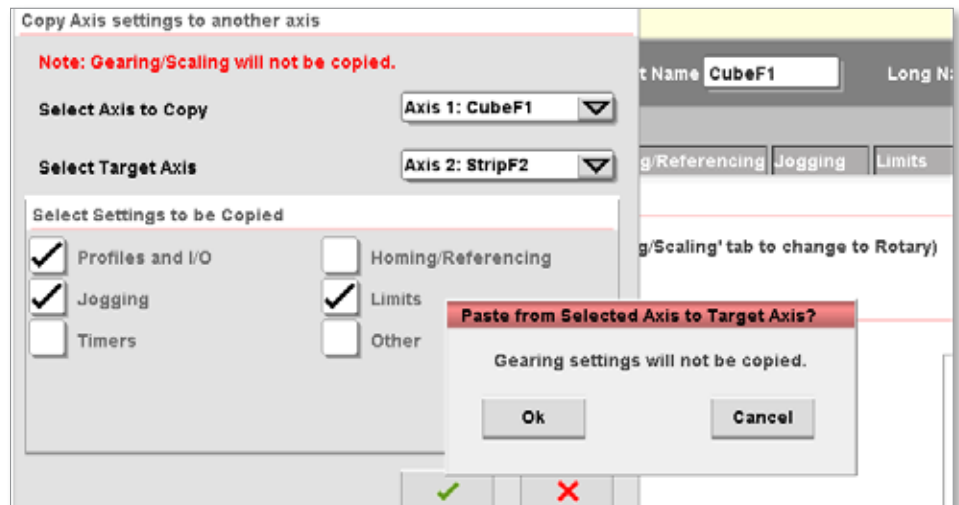
3. Select the axis to receive the settings from the Select Target Axis dropdown list.



4. Select the settings to copy.



5. Tap [Ok] to accept the copy request. Gearing settings will not be copied because each servo must be configured independently.



13.2 Setting Axis Configuration Parameters

The series of tabs located below the axis selection list are used to set up the selected axis.



13.2.1 Move Profiles Tab

The settings on this tab are the fundamental attributes of the axis.



13.2.2 Enabling an Axis



CAUTION

Only a qualified person should alter the servo drive settings.

To check if an axis is in use, tap on the Select Axis dropdown list. If the axis is to be used, this check box must be selected:



NOTE

When an axis is enabled for the first time, the power must be cycled. Set the Sercos III Slave address on the Bosch Rexroth drive in the cabinet. The addresses for the auxiliary axes start at 11 and go up to 16 to represent the six possible servo axes.

13.2.3 Profile Operation Order

The four possible profiles operate in a specific order. When triggers are activated, the profile is triggered only if the sequence is at the step that will run the profile.

The order of the profiles is:

1. If the MidIN profile is used, then the MidIN profile will be the first in the sequence to operate. If the MidIN trigger fires, the MidIN profile will function.
2. If the MidIN profile is not used, then the IN profile will be the first in the sequence.
3. If the MidOUT profile is used, then the MidOUT profile will be the first in the sequence to operate. If the MidOUT trigger fires, the MidOUT profile will function.
4. If the MidOUT profile is not used, then the OUT profile will be the first in the sequence.

13.2.4 IN and OUT Movement Profiles

The IN and OUT movement profiles are configured in the area shown below. Select the number and the type of steps from the dropdown menu.

Options include Triggered or Time Only:

- “Triggered” will start the profile when the set trigger is active.
- “Time Only” will start the profile after the timer is done.



NOTE

A linear axis automatically uses IN and OUT profiles. To use MidIN and MidOUT profiles, the Super User must check the Use Mid Pos. boxes.

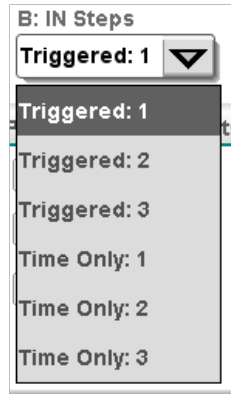
IN Movement Profiles		OUT Movement Profiles	
<input checked="" type="checkbox"/> Use Mid Pos.	Trigger Delay	<input type="checkbox"/> Use Mid Pos.	Trigger Delay
A: Mid Steps	Mid IN	IN	OUT
Triggered: 1	0.00 s	0.00 s	0.00 s
B: IN Steps			C: OUT Steps
Triggered: 1			Triggered: 1

13.2.4.1 Number of Steps

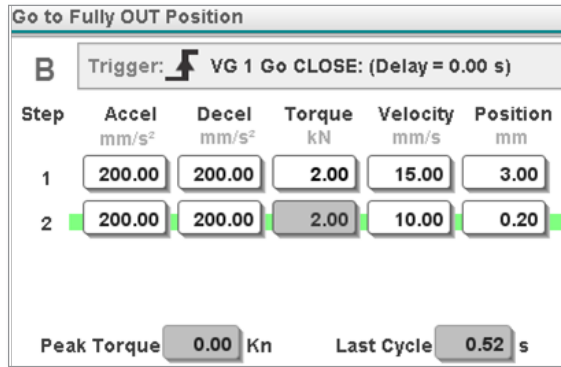
Up to three steps can be selected for each of the four possible movements. Select the number and the type of steps from the dropdown menu.

Options include Triggered or Time Only:

- “Triggered” will start the profile when the set trigger is active.
- “Time Only” will start the profile after the timer is done.



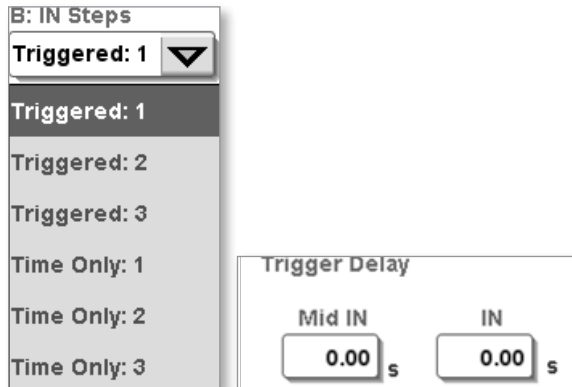
The example below shows a profile with the selection “Triggered: 2,” where the trigger is set with a rising edge and no time delay:



13.2.4.2 Time Only

This selection determines if a delay timer is used between the actual trigger event and the command to start the movement profile of the axis.

If the Super User selects Time Only with 1, 2 or 3 steps, the profile will be triggered after a time period rather than wait for a physical trigger. If the Super User leaves the time delay value at zero, the profile will trigger immediately when the software sequence gets to the point where the profile is to run.

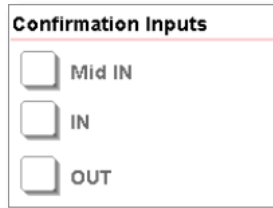


13.2.4.3 Status I/O

Read Section “11.2 Triggers / Status Naming Conventions” before you read the below instructions.

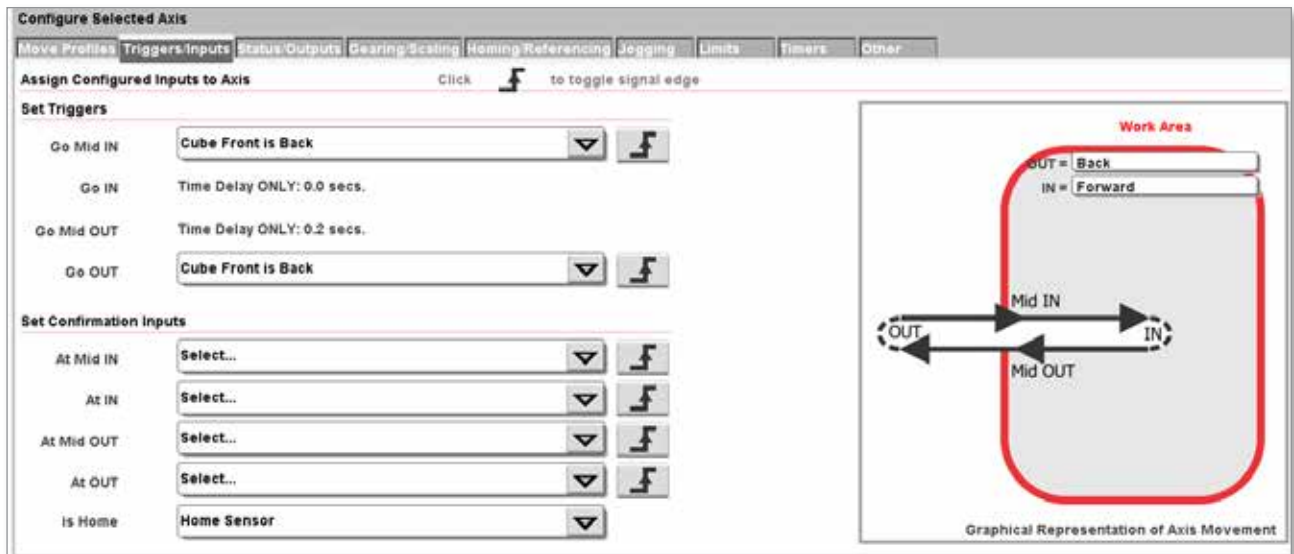
Position Status from Inputs:

The checked box means the status input configured in the I/O Configuration screen will be added to the selection lists on the Triggers / Inputs tab of the Axis Configuration screen.



If the boxed is checked by the user, then the axis must confirm its position with the sensor. Failure of this process will trigger an alarm message.

In the example below, the Use is In checkbox was selected, and the is IN selection list is displayed on the Triggers / Inputs tab.



Position Status to Outputs:

The checked box means the status outputs configured in the I/O Configuration screen will be added to the selection lists on the Status / Outputs tab of the Axis Configuration screen.

Position Status Outputs	
<input checked="" type="checkbox"/>	Mid IN
<input checked="" type="checkbox"/>	IN
<input checked="" type="checkbox"/>	Mid OUT
<input checked="" type="checkbox"/>	OUT

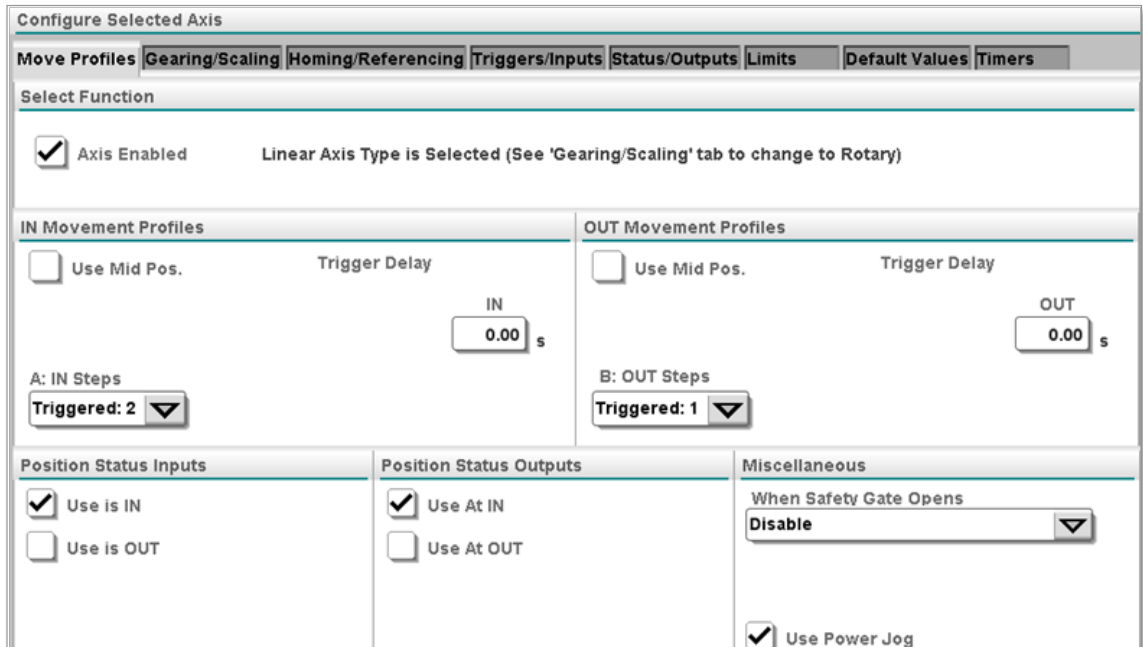
If the boxed is checked by the user, then the axis must turn on this output when the axis is at its position.

<input checked="" type="checkbox"/>	Use At IN
-------------------------------------	-----------

In the example below, the Use At In checkbox was selected, and the At IN selection list is displayed on the Triggers / Inputs tab.

13.3 Triggers / Inputs Tab

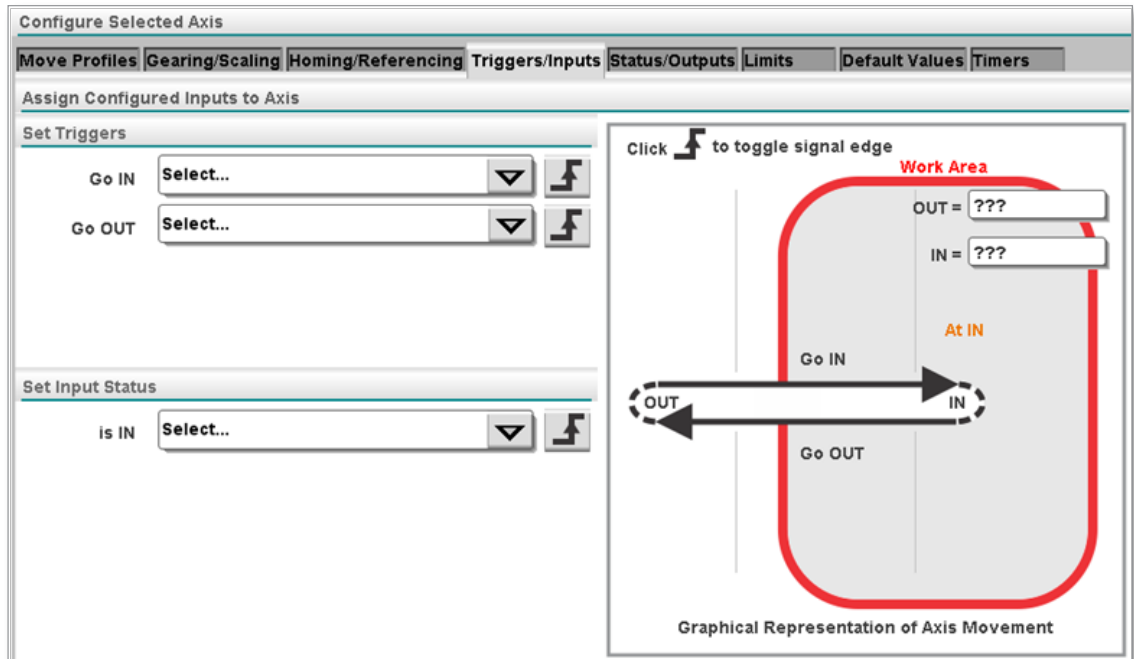
Refer to this screen shot for the profile setting used in the following sections.



13.3.1 Profile Triggers

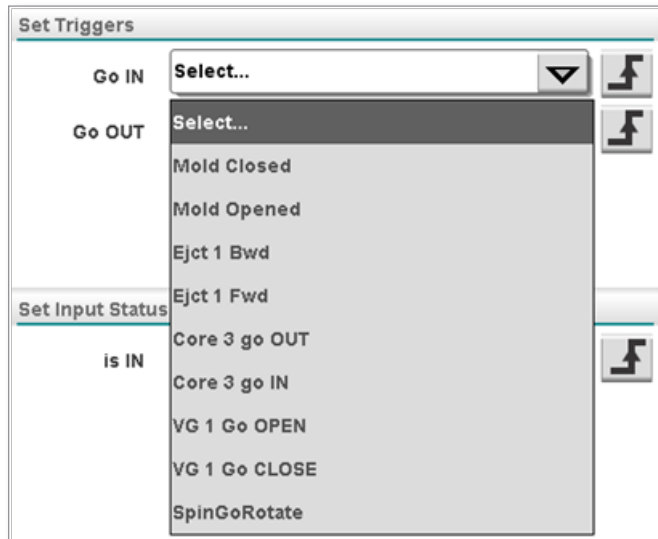
The Super User must assign the configured triggers to the axis.

See “11.2 Triggers / Status Naming Conventions” on page 11-2 for information about configuring I/O points.

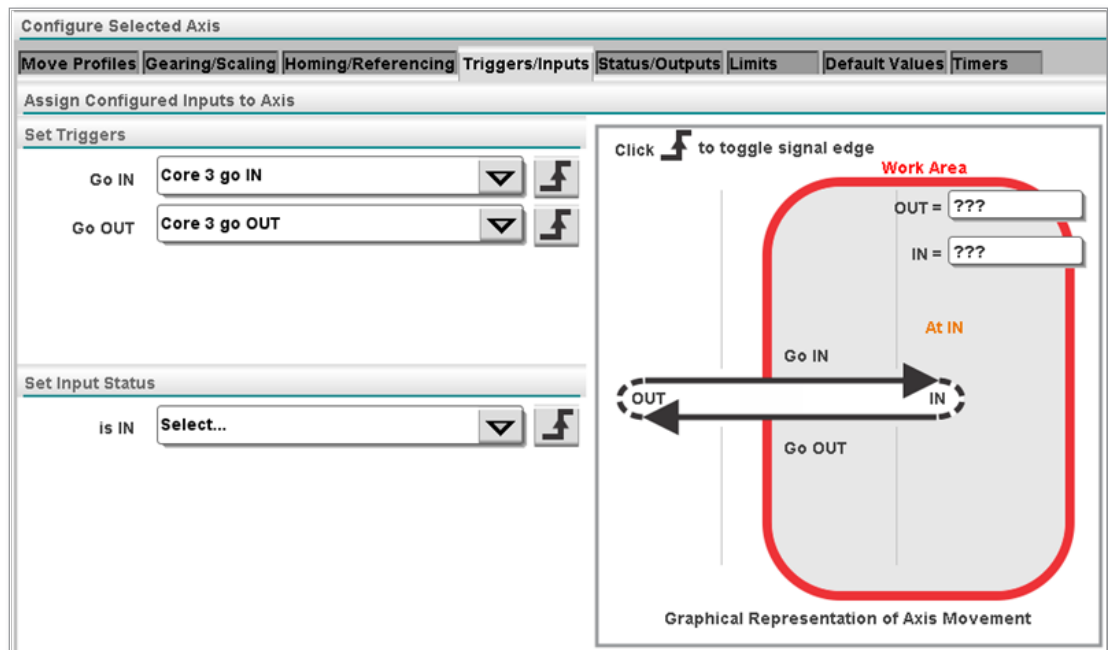


Profile Triggers - continued

The long names for the I/O points will be added to the dropdown lists as shown below:



When the controller is in Auto mode and the triggers shown below go from false to true, the profiles will be triggered.



13.3.1.1 Signal Edge

The Super User can tap on the Signal Edge icon to choose between a leading edge or a trailing edge.



NOTE

Status edges work the same as triggers. The selected status output will be true dependant on the choice of leading or trailing edge.

Leading Edge

The trigger is active on the leading edge of the selected input signal.



Trailing Edge

The trigger is active on the trailing edge of the selected input signal.



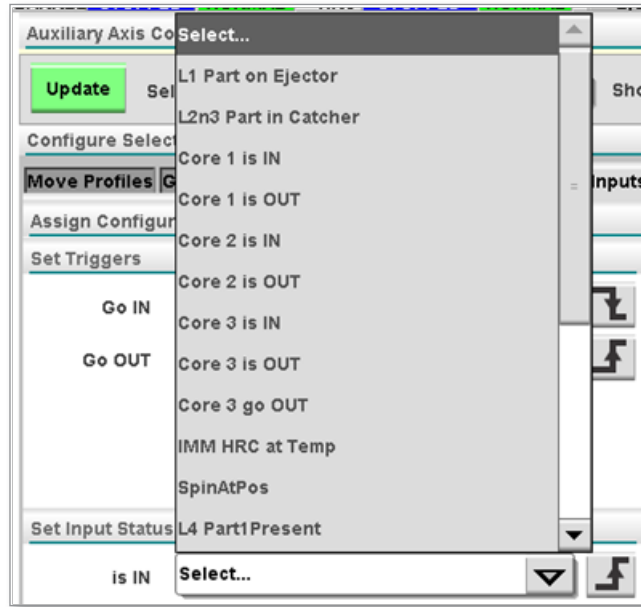
13.3.2 Set Input Status

The Super User must assign the configured status inputs to the axis. See Section 6 Configuring I/O for Triggers and Status for more information on how to configure I/O points.

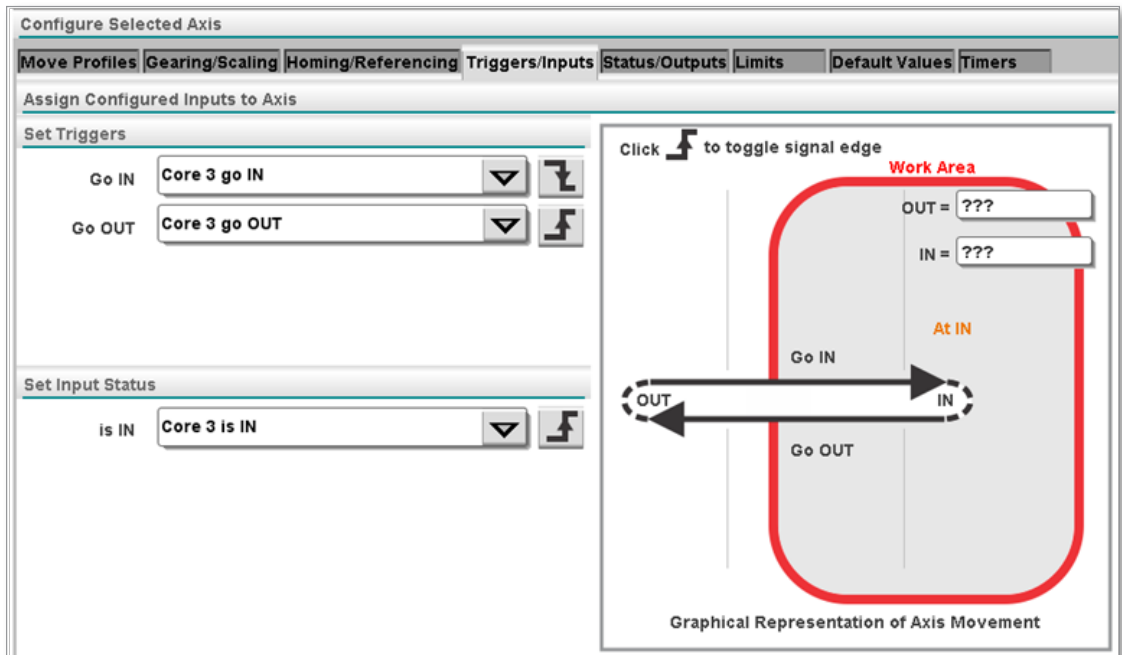
The status input is used to confirm the axis is in position. If the status input is used then the axis uses the input as well as the axis encoder position to state the axis is in position.

The long names for the I/O points will be added to the dropdown lists shown below.

Set Input Status - continued



13.3.2.1 Input Status after Selection



13.3.2.2 Signal Edge

The Super User can tap on the signal edge icon to choose between a leading edge or a trailing edge. When a signal is electrically high and the signal is set for leading edge, the trigger or status input will be true.



NOTE

Status edges work the same as triggers. The selected status output will be true dependant on the choice of leading or trailing edge.

Leading Edge

The status input is active on the leading edge of the selected input signal.



Trailing Edge

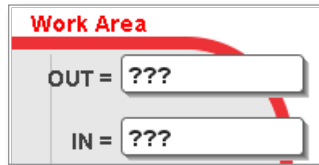
The status input is active on the trailing edge of the selected input signal.



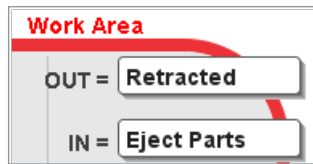
13.3.2.3 Define IN and OUT Positions

The two text boxes on this tab describe the IN and OUT function for the user. In this example, the machine is described as RETRACTED when it is out and as EJECT PARTS when it is in.

Before:



After:



Operator Screen:

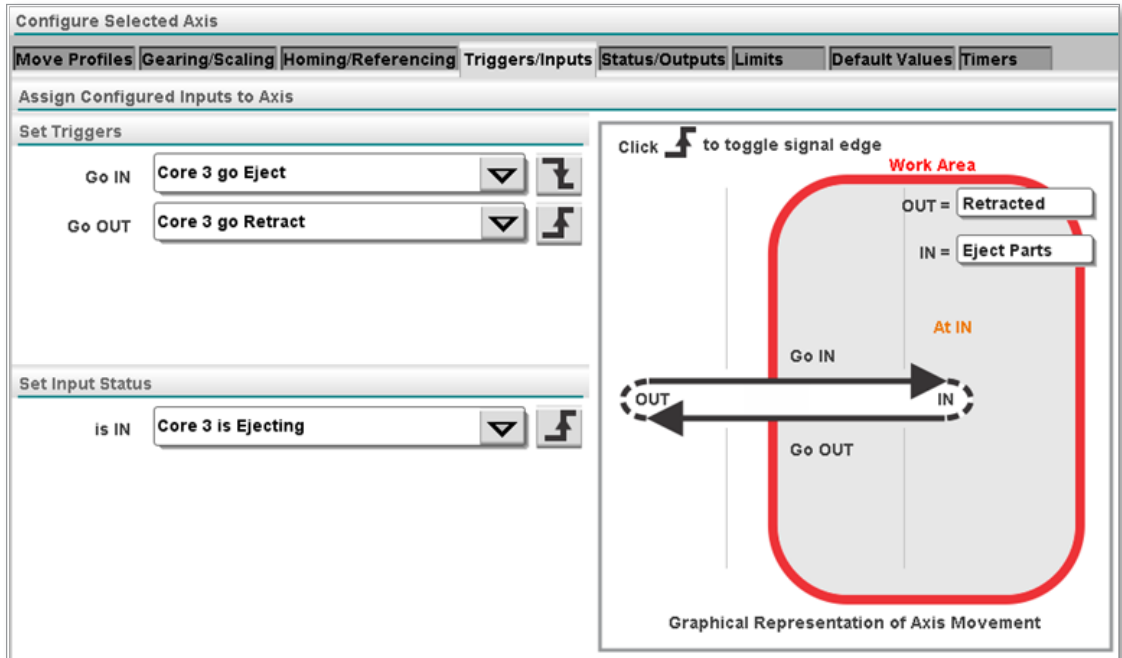
Profiles						Status									
Go to Fully IN Position, (Eject Parts)						Go to Fully OUT Position, (Retracted)									
A Trigger: Core 3 go Eject: (Delay = 0.00 s)						B Trigger: Core 3 go Retract: (Delay = 0.00 s)									
Step	Accel mm/s ²	Decel mm/s ²	Torque kN	Velocity mm/s	Position mm	Step	Accel mm/s ²	Decel mm/s ²	Torque kN	Velocity mm/s	Position mm				
1	250.00	250.00	10.00	50.00	20.00	1	400.00	400.00	5.00	85.00	0.00				
2	250.00	500.00	10.00	40.00	24.50										
Peak Torque			0.00 Kn	Last Cycle			0.00 s	Peak Torque			0.00 Kn	Last Cycle			0.00 s

Signal Edge - continued

It is possible to edit the trigger name to be more descriptive through the I/O screen on the Set Trigger tab.

See Section 10.4.5 Long Name for more information.

Tap the Update button and return to the Axis Configuration screen and the Triggers / Inputs tab.



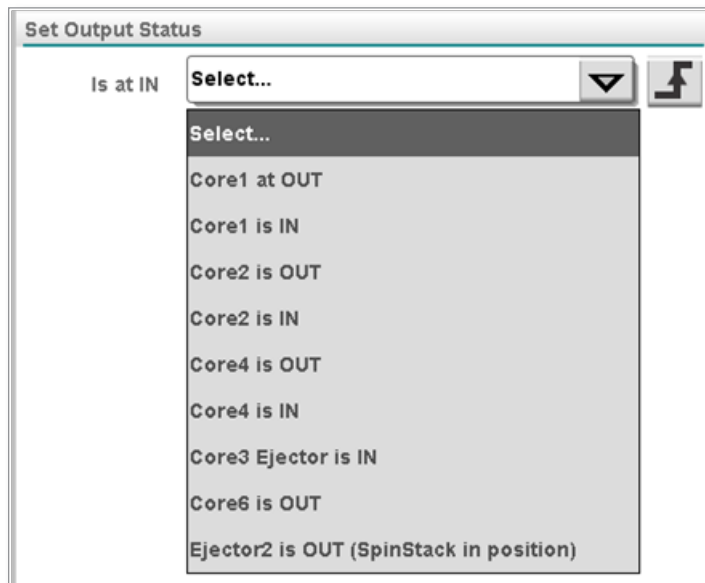
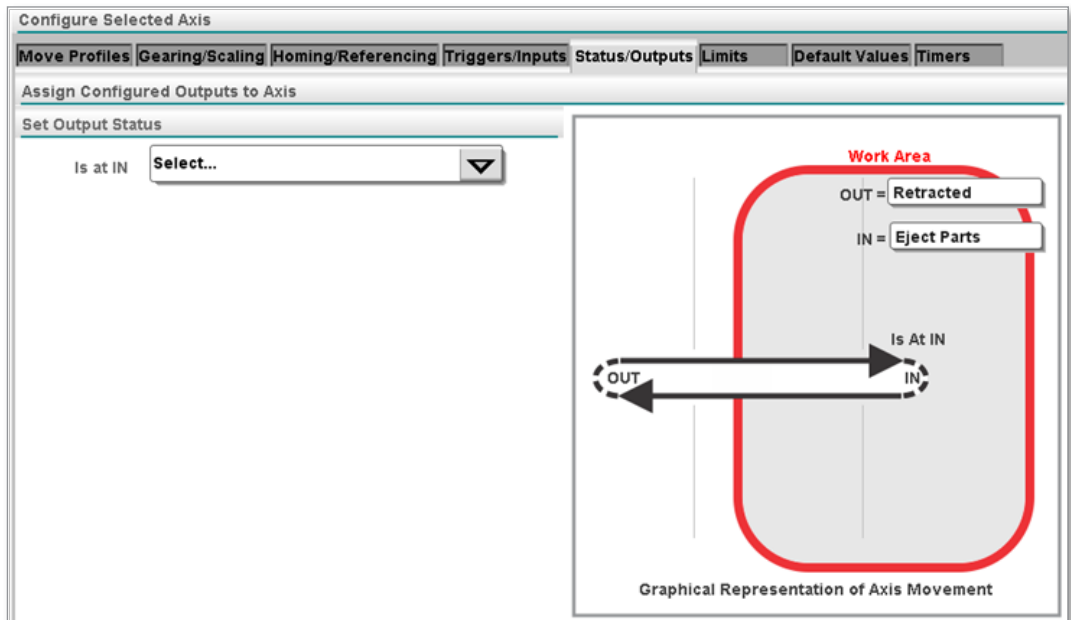
13.4 Status / Outputs Tab

13.4.1 Set Output Status

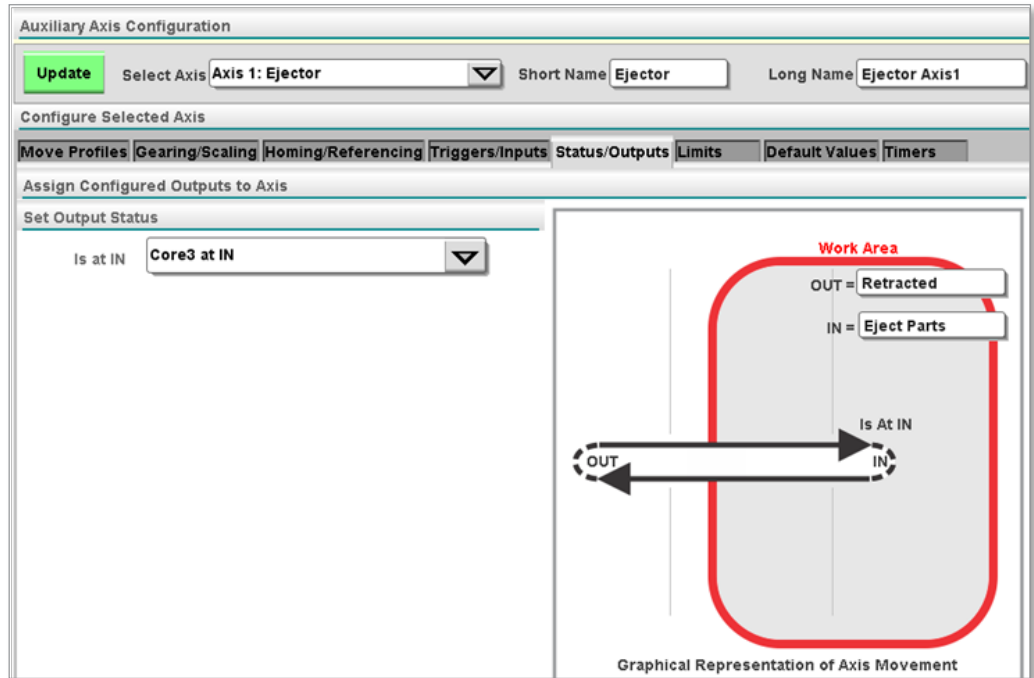
The Super User must assign the configured status outputs to the axis. See “Section 11 - I/O Configuration” on page 11-1 for more information on how to configure I/O points.

The status outputs are turned on when the axis is in position. The long names for the I/O points will be added to the dropdown lists shown below.

13.4.2 Before Selection



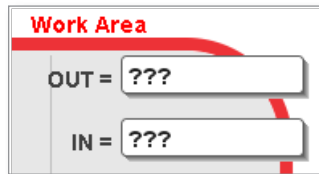
13.4.3 Output Status after Selection



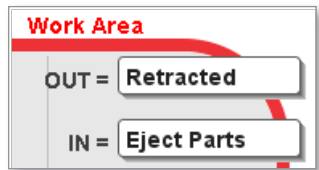
13.4.3.1 Define IN and OUT Positions

The two text boxes on this tab describe the IN and OUT function for the user. In this example, the machine is described as RETRACTED when it is out and as EJECT PARTS when it is in.

Before:



After:

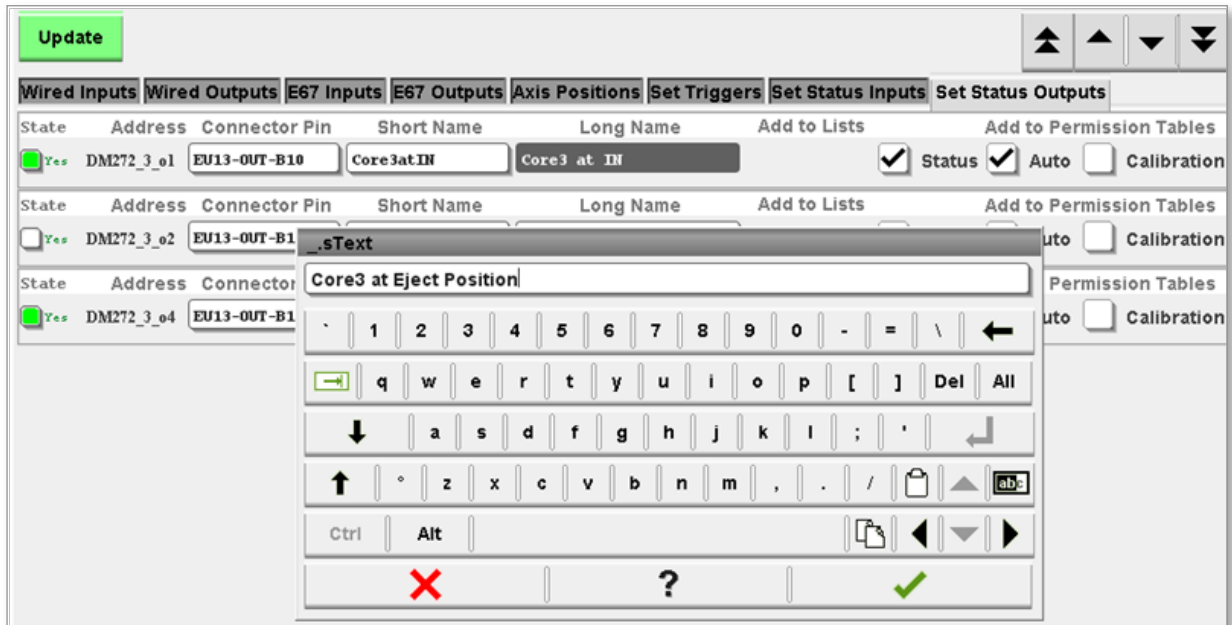


Profiles						Status					
Go to Fully IN Position, (Eject Parts)						Go to Fully OUT Position, (Retracted)					
A Trigger: Core 3 go Eject: (Delay = 0.00 s)						B Trigger: Core 3 go Retract: (Delay = 0.00 s)					
Step	Accel mm/s ²	Decel mm/s ²	Torque kN	Velocity mm/s	Position mm	Step	Accel mm/s ²	Decel mm/s ²	Torque kN	Velocity mm/s	Position mm
1	250.00	250.00	10.00	50.00	20.00	1	400.00	400.00	5.00	85.00	0.00
2	250.00	500.00	10.00	40.00	24.50						
Peak Torque			0.00	Kn		Last Cycle			0.00	s	
Peak Torque			0.00	Kn		Last Cycle			0.00	s	

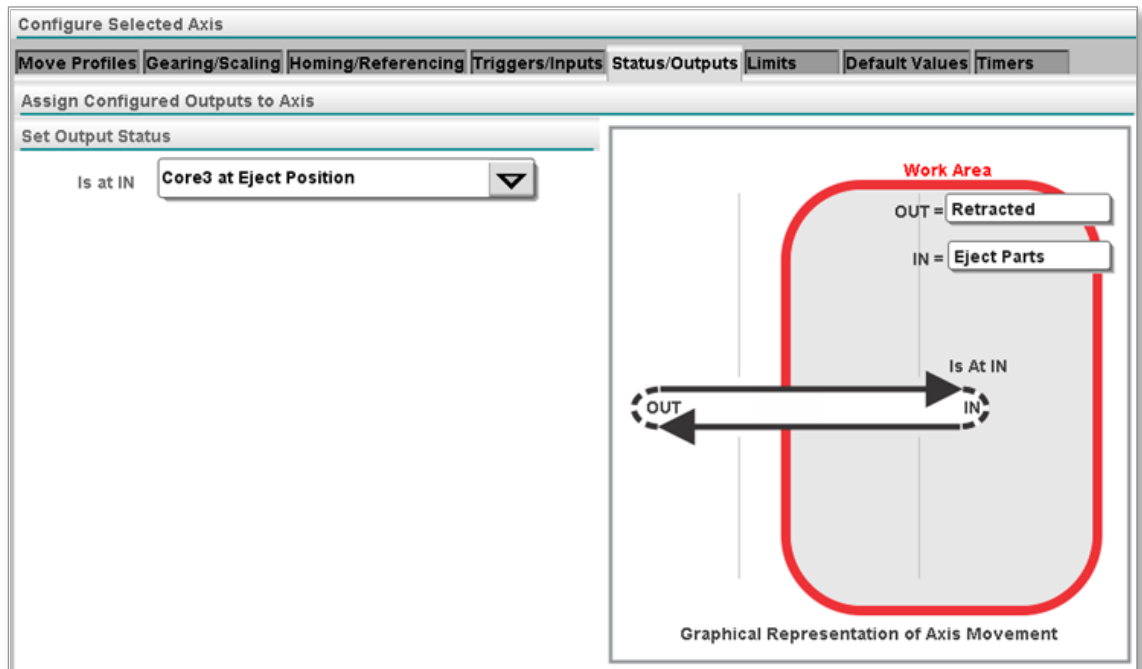
Define IN and OUT Positions - continued

The Super User can edit the trigger name to be more descriptive through the I/O screen on the Set Trigger tab.

See “11.4.5 Long Name” on page 11-4 for more information.



Tap the Update button and return to the Axis Configuration screen and the Triggers / Inputs tab.



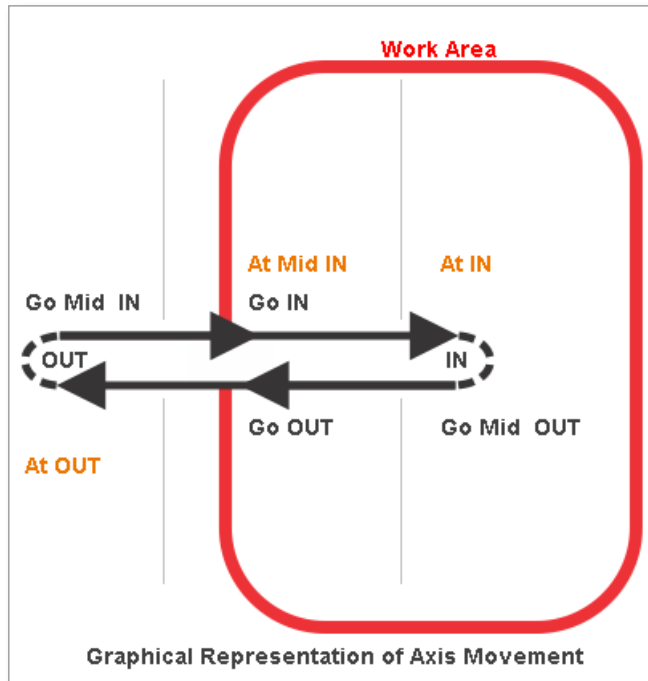
13.5 Graphical Display

The displayed graphic will change depending on the settings located on the Define tab.

The examples below show the configuration and its corresponding graphic.

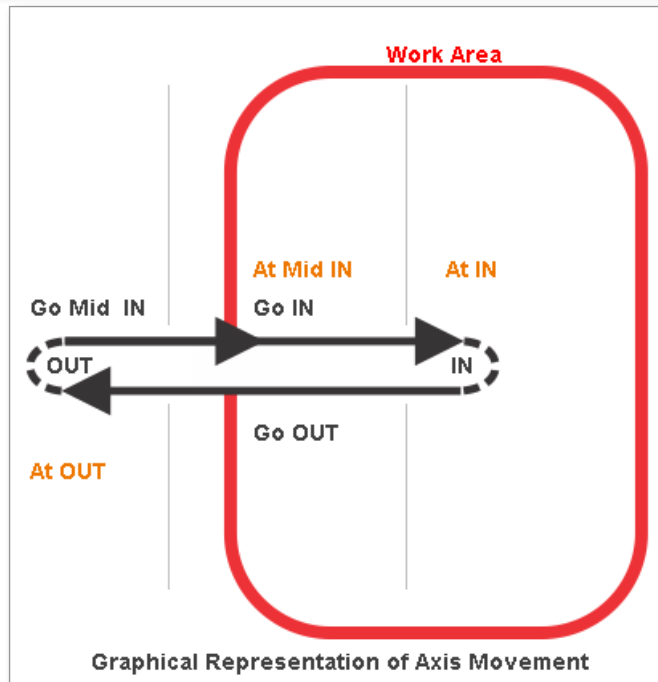
IN Movement Profiles		OUT Movement Profiles	
<input checked="" type="checkbox"/> Use Mid Pos.	Trigger Delay	<input checked="" type="checkbox"/> Use Mid Pos.	Trigger Delay
A: Mid Steps Triggered: 1	Mid IN: 0.00 s IN: 0.00 s	C: Mid Steps Triggered: 2	Mid OUT: 0.00 s OUT: 0.00 s
B: IN Steps Triggered: 2		D: OUT Steps Triggered: 1	

13.5.1 Four Positions



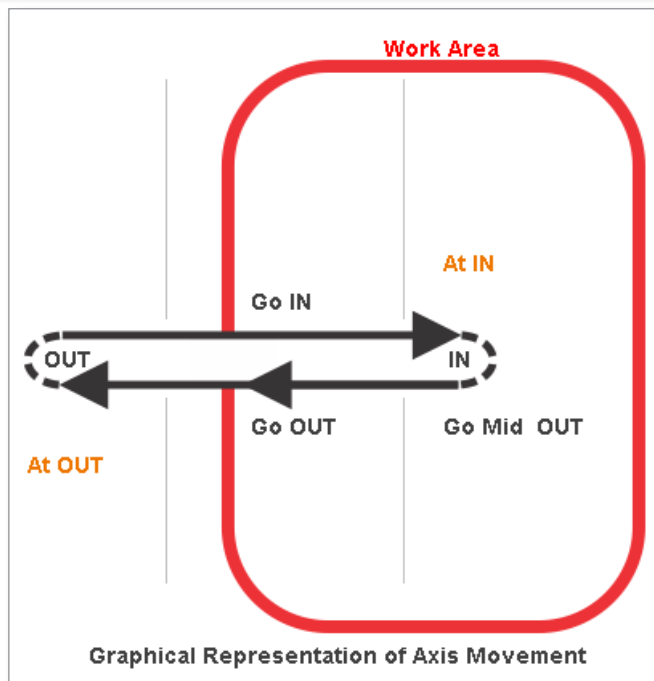
13.5.2 Three Positions MidIN

IN Movement Profiles		OUT Movement Profiles	
<input checked="" type="checkbox"/> Use Mid Pos.	Trigger Delay	<input type="checkbox"/> Use Mid Pos.	Trigger Delay
A: Mid Steps	Mid IN	IN	OUT
Triggered: 1	0.00 s	0.00 s	0.00 s
B: IN Steps			
Triggered: 2			
		C: OUT Steps	
		Triggered: 1	



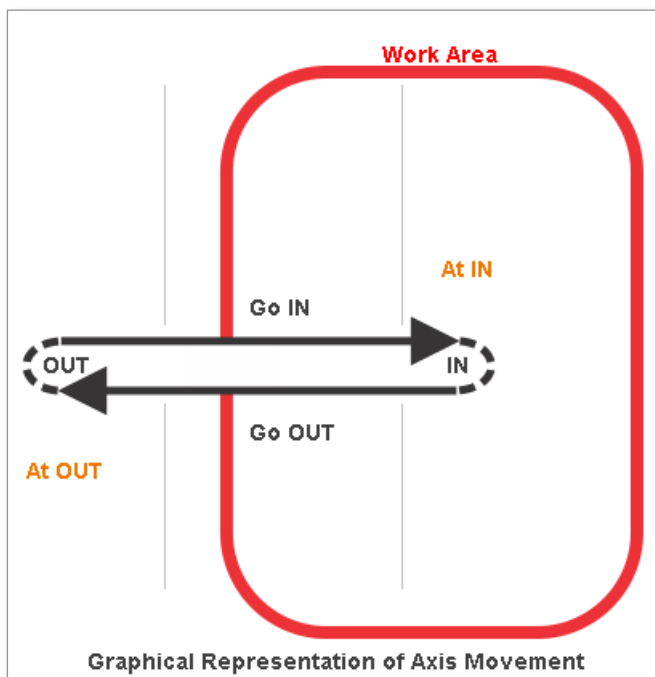
13.5.3 Three Positions MidOUT

IN Movement Profiles		OUT Movement Profiles	
<input type="checkbox"/> Use Mid Pos.	Trigger Delay	<input checked="" type="checkbox"/> Use Mid Pos.	Trigger Delay
	IN	B: Mid Steps	Mid OUT OUT
	0.00 s	Triggered: 2 ▼	0.00 s 0.00 s
A: IN Steps		C: OUT Steps	
Triggered: 2 ▼		Triggered: 1 ▼	



13.5.4 Two Positions

IN Movement Profiles		OUT Movement Profiles	
<input type="checkbox"/> Use Mid Pos.	Trigger Delay	<input type="checkbox"/> Use Mid Pos.	Trigger Delay
	IN		OUT
	0.00 s		0.00 s
A: IN Steps		B: OUT Steps	
Triggered: 2		Triggered: 1	



13.5.5 Rotary Continuous

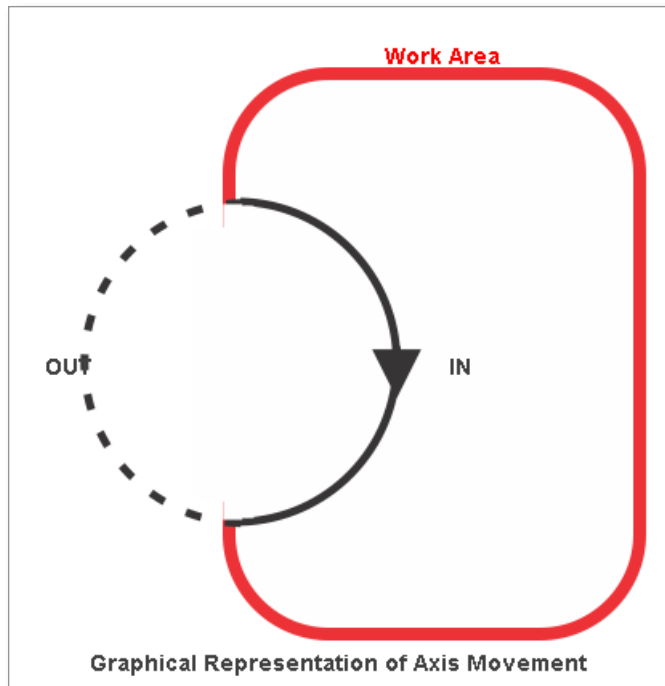
IN Movement Profiles

Use Mid Pos. Trigger Delay

IN
0.00 s

A: IN Steps

Triggered: 1 ▼



13.6 Gearing/Scaling Tab

The gearing ratios and axis stroke are set on this tab.

Configure Selected Axis

Move Profiles | Gearing/Scaling | Homing/Referencing | Triggers/Inputs | Status/Outputs | Limits | Default Values | Timers

Enter Scaling Values

Select Type of Movement

Linear ▼

Gear Ratio Input	1.00	1.00
Gear Ratio Output	1.00	1.00
Screw Pitch	6.73	6.73
Max Stroke/Rotate	25.29	25.29 mm

13.6.1 Drive Parameter Loading



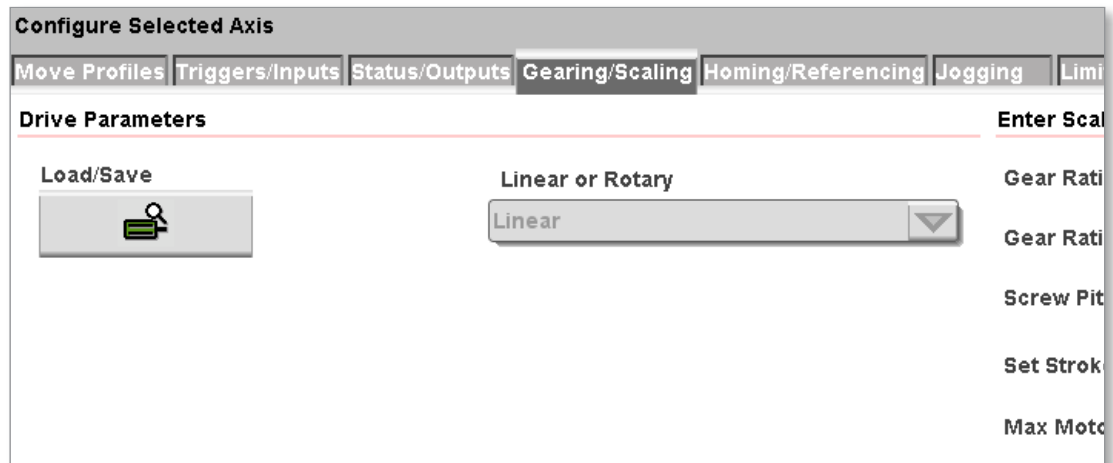
CAUTION

It is important to select the proper drive parameter file. If you are unsure, please contact *Mold-Masters* for help.

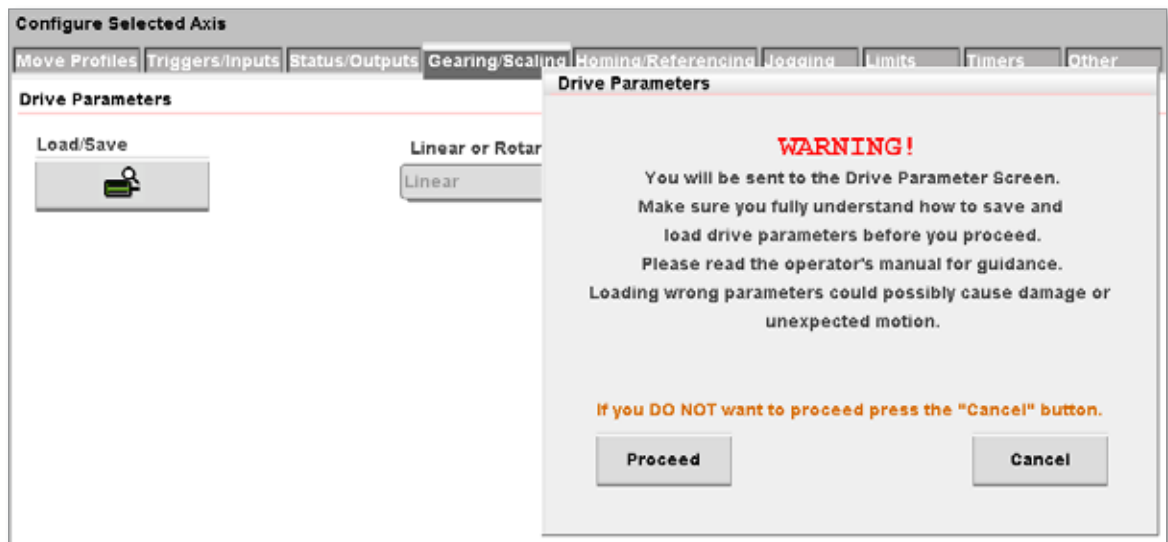
To create a linear or rotary axis you must first download drive parameters to the selected servo drive. To select the proper drive parameters you must contact a *Mold-Masters* representative to confirm the drive parameters are available for the motor you are using. If you need help with a new motor let us know.

Download new drive parameters for a new motor:

1. Tap the **[Load/Save]** button on the Gear/Scaling tab as shown below:



2. A Warning Dialog will appear. Read it and understand the risks. Tap the **[Proceed]** button or **[Cancel]** button.

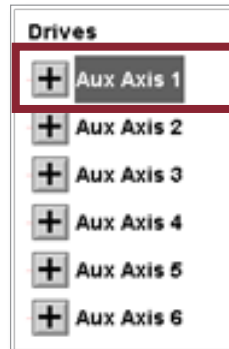


Drive Parameter Loading - continued

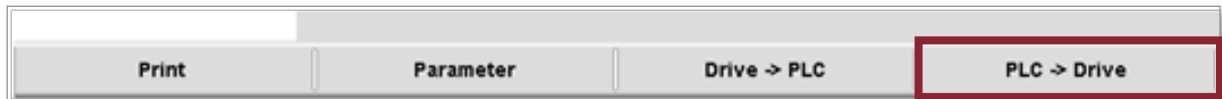
3. Tapping the **[Proceed]** button will cause the following screen to appear:



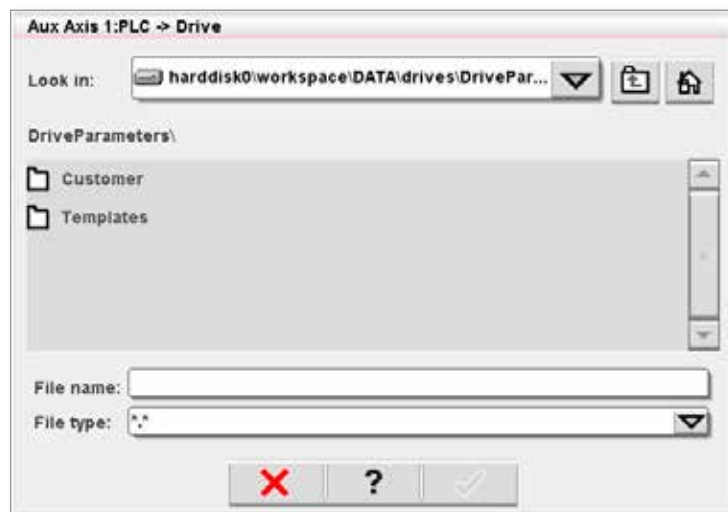
4. Select the axis you are configuring from the left as shown below.



5. Tap the **[PLC->Drive]** button at the bottom of the screen.

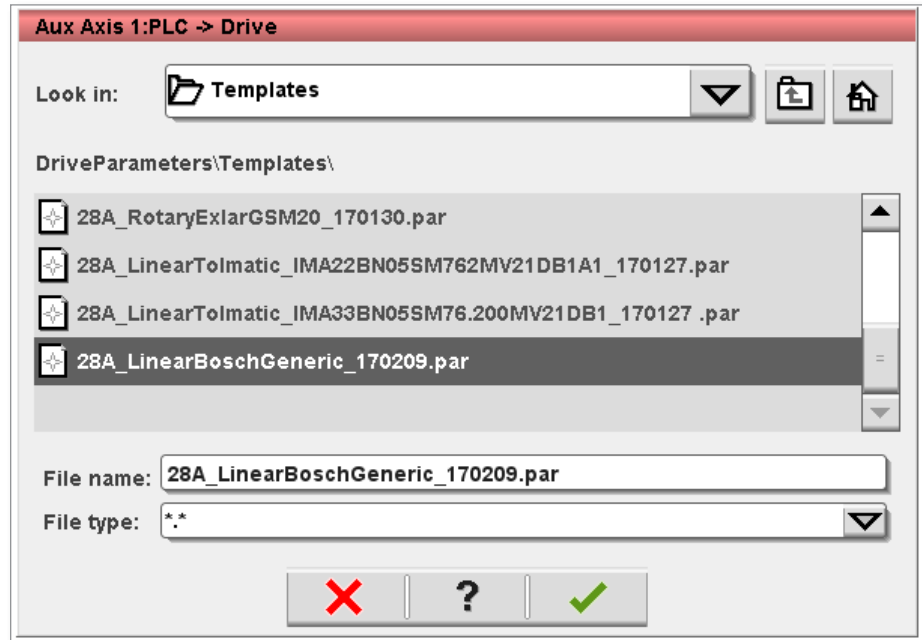


6. The following dialog box will appear.

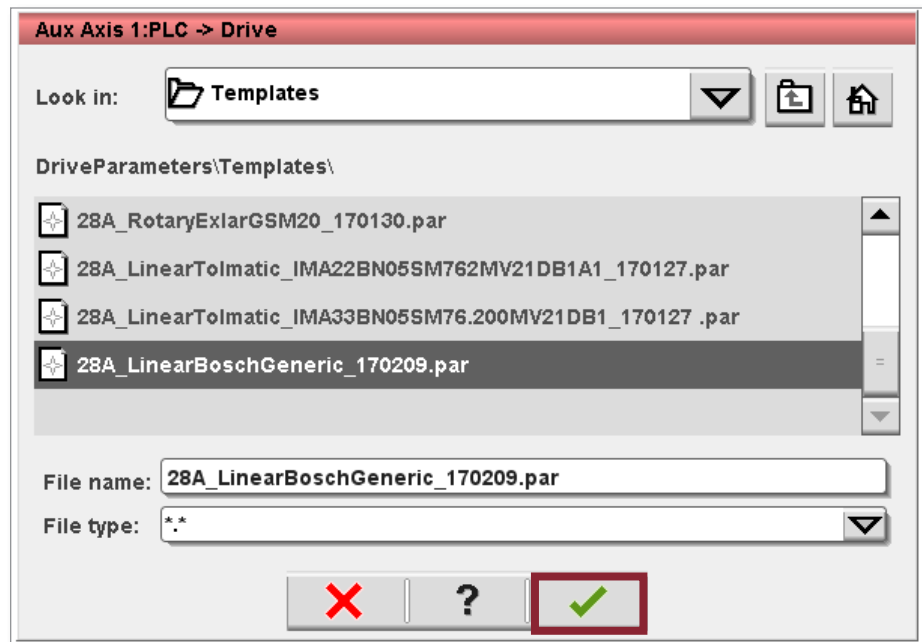


Drive Parameter Loading - continued

7. Select the Template folder as shown below:



8. Select the appropriate drive parameter file that matches the motor you are configuring.
9. Tap the green check mark button and the selected drive parameters will be downloaded to the servo drive.

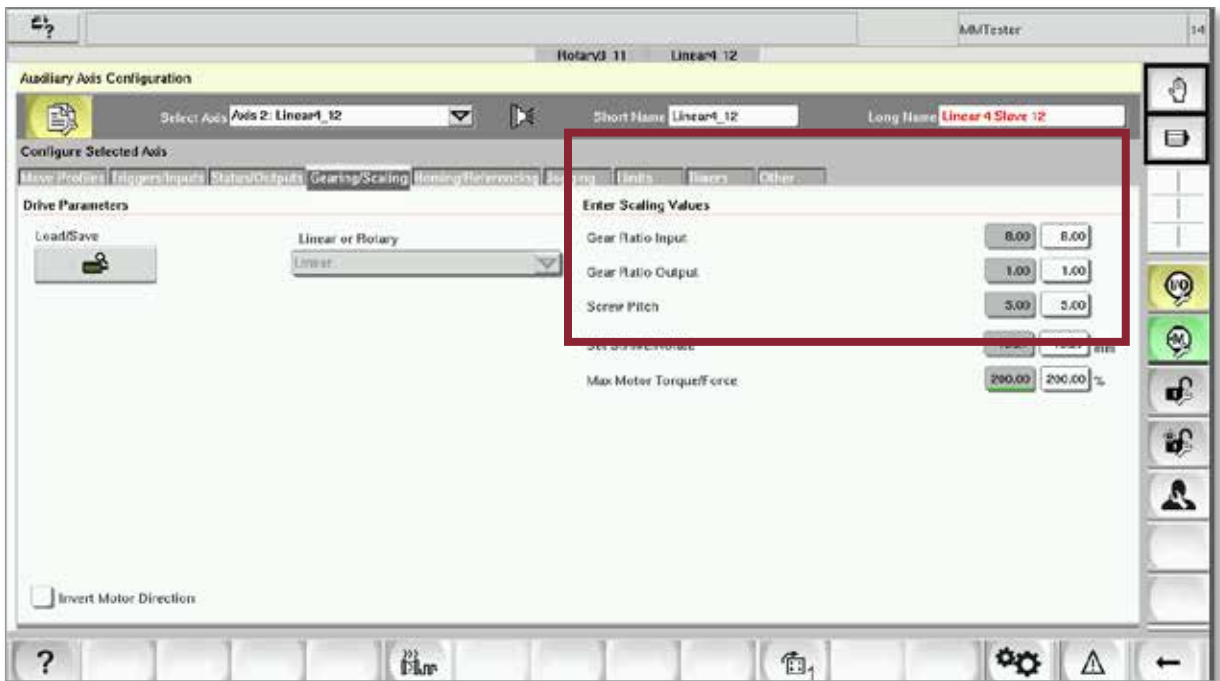


Drive Parameter Loading - continued

10. When the progress bar disappears, tap the axis configure button shown below to return to the Gearing/Scaling tab.

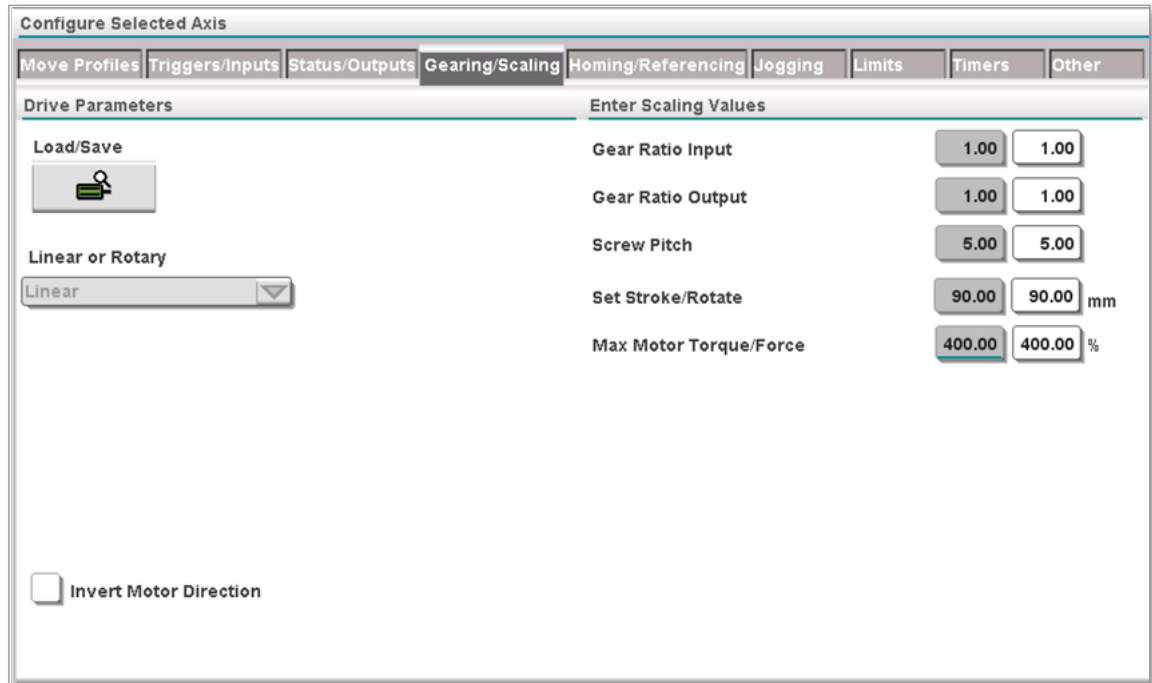


11. When you return to the Gearing/Scaling tab a message will be displayed that will prompt you to cycle power. Before you do, make sure the gear ratio, screw pitch, stroke and maximum torque is set properly.



13.6.1.1 Linear Settings

An example of an axis that has a linear setting would be an ejector.



Gear Ratio Input:

The gear ratio value from the input (driving) side of the gearbox.

Gear Ratio Output:

The gear ratio value from the output (driven) side of the gearbox.

Screw Pitch:

The linear distance travelled when the shaft is turned one rotation.

Max Stroke/Rotate:

The full physical linear movement.

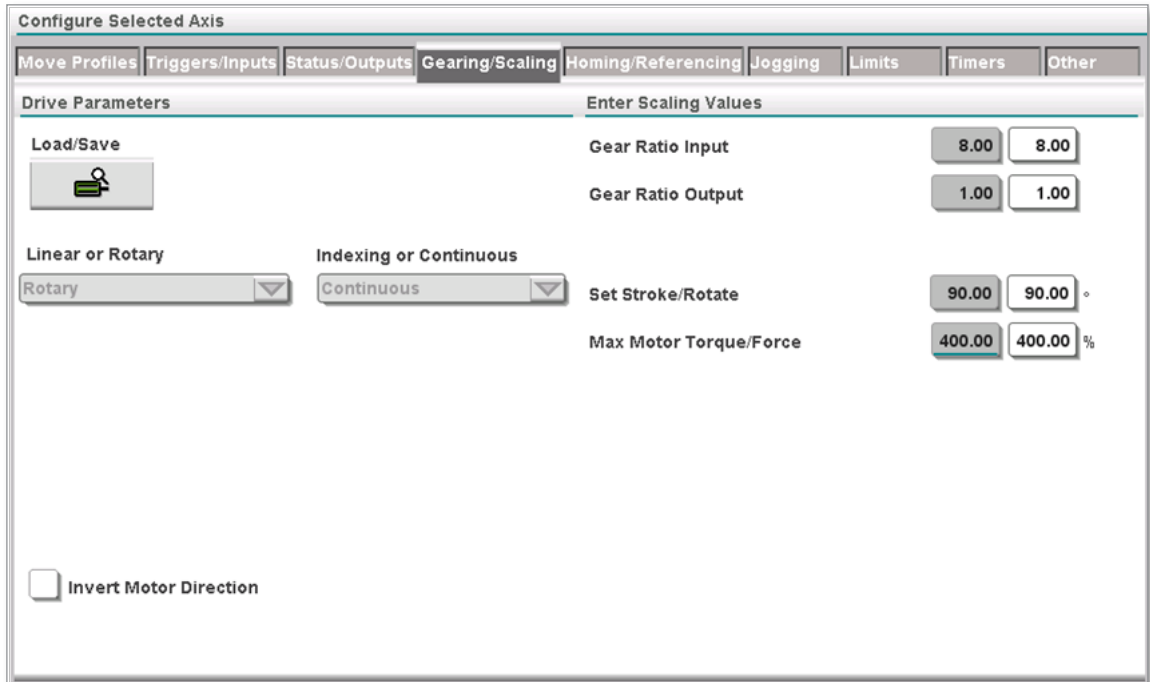
Invert Motor Direction:

Forces the servo drive to change the direction of the motor.

13.6.1.2 Rotary Settings

Define Indexing and Continuous Operation

- If the axis drives a rotating load back and forth, it is indexing. For example, a swing plate indexes.
- If the axis drives a rotating load in one direction only, it is continuous. For example, a spin stack is continuous.



Gear Ratio Input:

The gear ratio value from the input (driving) side of the gearbox.

Gear Ratio Output:

The gear ratio value from the output (driven) side of the gearbox.

Screw Pitch:

Screw Pitch is not used with a rotary axis.

Max Stroke/Rotate:

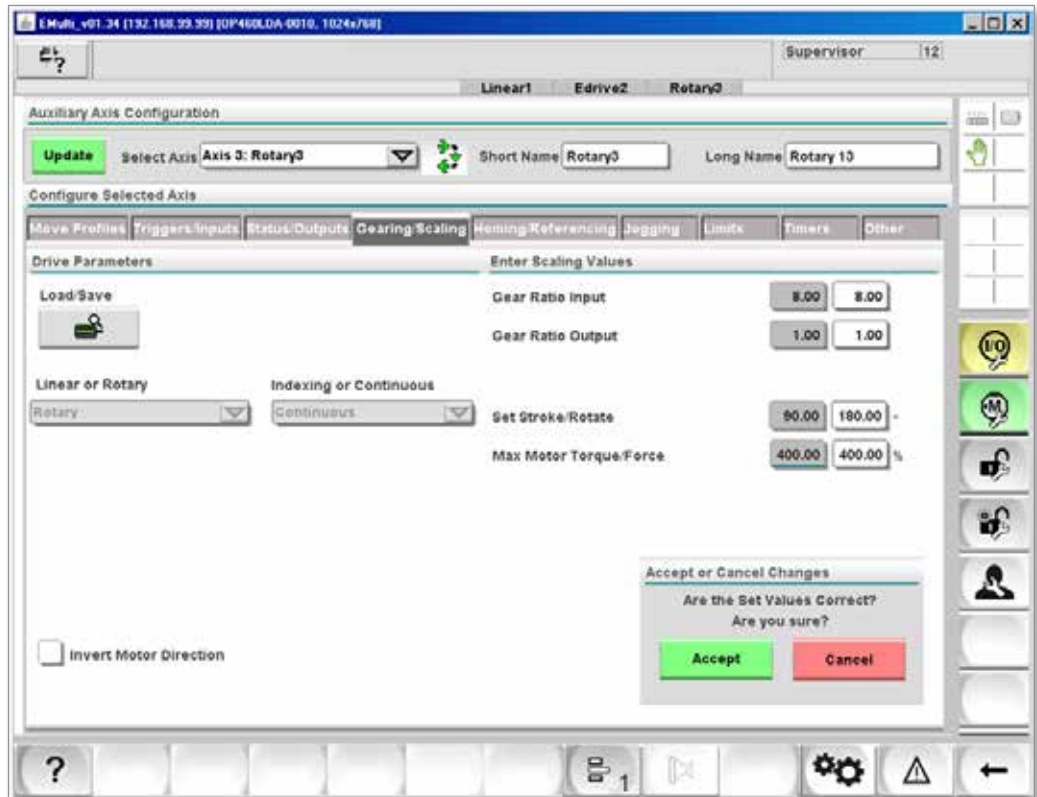
The full physical rotary movement each time the axis IN and OUT profiles are triggered.

Invert Motor Direction:

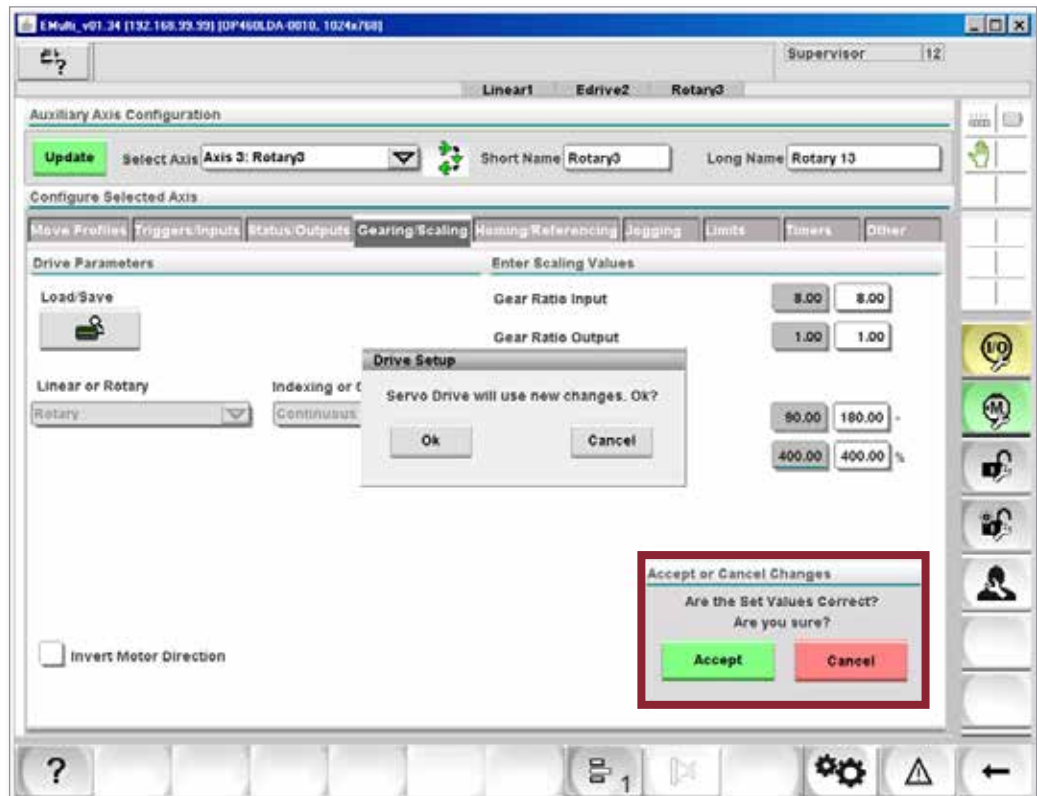
Forces the servo drive to change the direction of the motor.

13.6.2 Sending the Gear Ratio Settings to the Drive

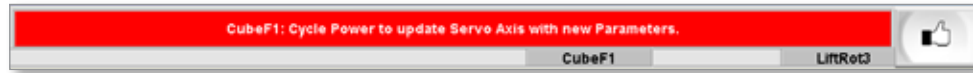
Tap the **[Accept]** button to send the entered gear ratios and stroke to the axis drive controller.



The dialogue box seen below will appear for confirmation:



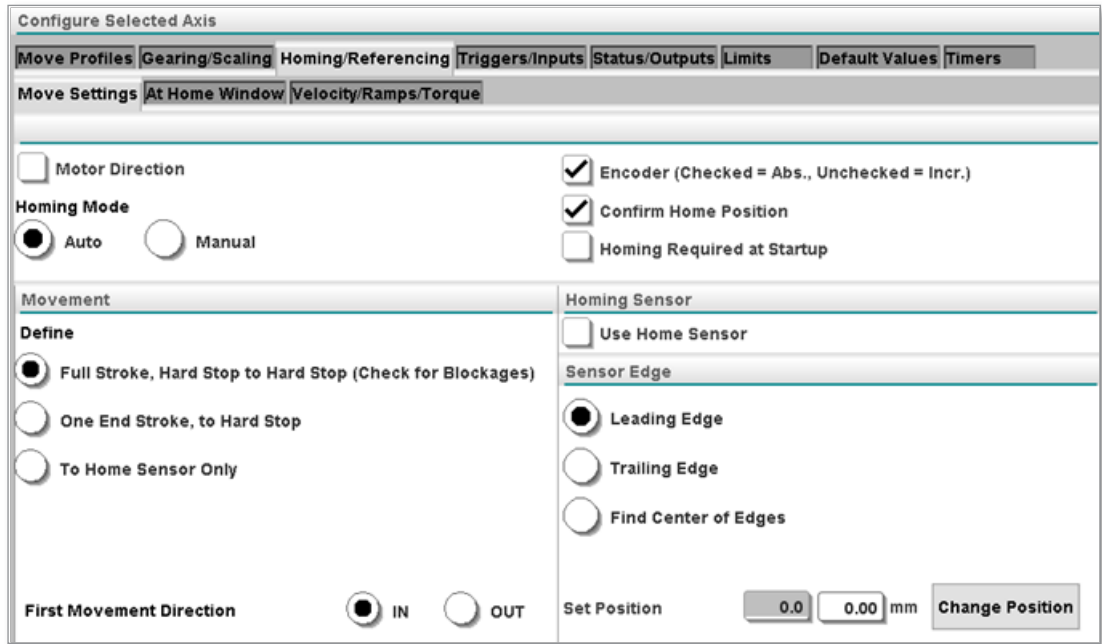
13.6.3 Cycle Power after Drive Parameters Setup



13.7 Homing / Referencing Tab

13.7.1 Move Settings Tab

This tab controls all of the methods and settings for the homing process.



13.7.1.1 Motor Direction

If this box is unchecked, the rotary direction will be clockwise.

If this box is checked, the rotary direction will be counterclockwise.

13.7.1.2 Homing Mode

Two modes for homing the motor are available:

1. Manual mode - the user jogs the motor to the required home position, then taps to define this position as home.
2. Auto mode - uses the configured homing procedure.

13.7.1.3 Encoder Type

The encoder type used, which can be either incremental or absolute.

13.7.1.4 Confirm Home Position

If this box is selected, then a dialogue box will appear the first time the auto homing procedure finishes.



NOTE

This dialogue box only appears again if the measured stroke does not match the expected stroke +/- window.

13.7.1.5 Homing Required at Start Up

If this box is selected, homing will be required each time the power is cycled.

13.7.1.6 Movement

This section allows the user to define the movement pattern followed during the homing procedure.

Full Stroke, Hard Stop to Hard Stop

The axis moves in one direction until it is prevented from moving by a hard stop, and this position is recorded.

The axis then moves in the opposite direction until it is prevented from moving by a hard stop, and this position is recorded.

The actual stroke is calculated from these two positions.

If the actual stroke does not fall within the pass / fail tolerance and the Confirm Home Position box is selected, a dialogue box will appear. This dialogue box will display the required stroke and the actual stroke. The user must decide to accept the actual stroke or reject it.

If the actual stroke is rejected, the homing procedure fails. The user must investigate the reason for the failure. If the procedure passes, the axis will move to the fully OUT position.

One End Stroke to Hard Stop

This option is used if it is not possible to move in both directions during the homing procedure.

The axis moves in one direction until it is prevented from moving by a hard stop, and this position is recorded.

As above, an actual stroke that falls outside the tolerance opens a dialogue box and the user will need to decide to pass or fail the homing procedure.

If the procedure passes, the axis will move to the fully OUT position.

To Home Sensor Only:

The axis moves in the selected direction until the home sensor is reached.

The user will define if the axis stops at the leading edge, trailing edge or center of the sensor using the Sensor Edge checkboxes.

When the home sensor is found, the axis will then move to the fully OUT position.

13.7.1.7 Homing Sensor

The user selects the Home Sensor box to force the axis to move to the home sensor after its configured movement is complete. The axis stops at the location defined by the user.

See Section 12.7.1.8 Sensor Edge for more information.

13.7.1.8 Sensor Edge

The user can select how the axis uses the home sensor during homing.

First Movement Direction

If the Full Stroke, Hard Stop to Hard Stop movement is used, the first movement can be changed by selecting this setting.

Set / Change Position

The user can manually set the absolute encoder position using this option.

The user jogs the axis to the required position and then taps the Change Position button.



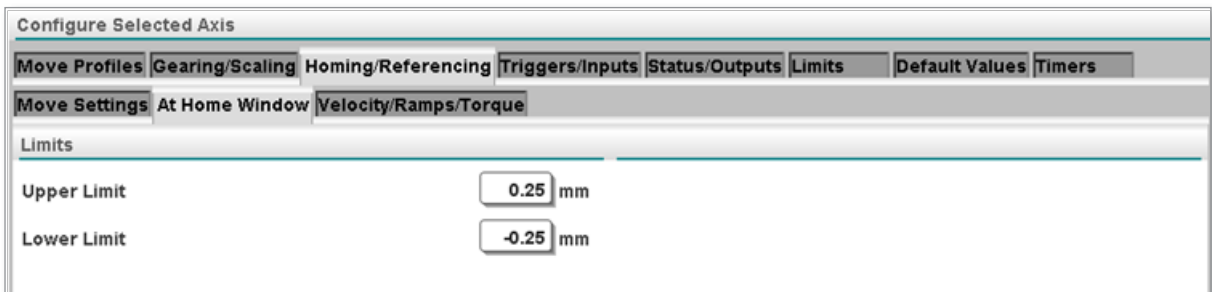
NOTE

This dialogue box only appears again if the measured stroke does not match the expected stroke +/- window.

13.7.2 At OUT Position Window Tab

These settings set a tolerance for the axis OUT position.

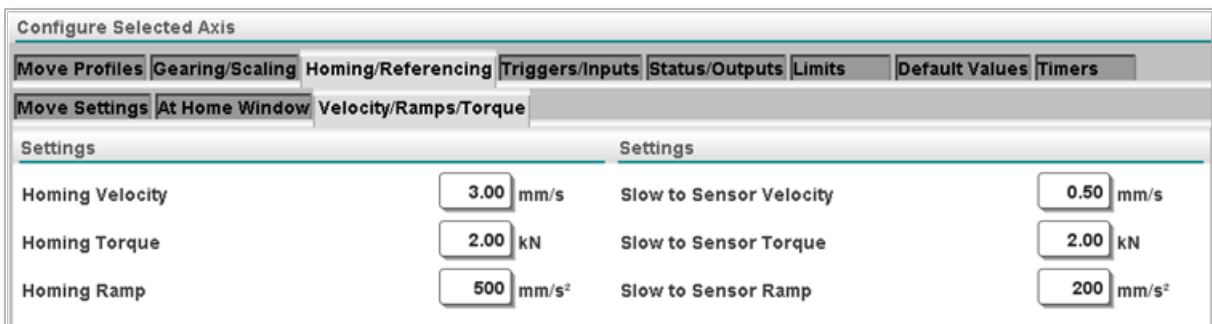
If the axis position is within this window, the axis is at the OUT position. The axis can be placed into Auto mode if the axis is at the OUT position.



13.7.3 Velocity / Ramps / Torque Tab

The Super User sets homing velocity, torque and ramp here.

The Super User defines fine adjustment values through the “Slow to Sensor” settings.



13.7.4 Jogging Tab

The Super User can set the velocity, torque limit and accel / decel ramps for all jog motion.

13.7.4.1 Power Jog

Power jog is active when the Super User is logged in and the power jog function has been enabled. The Super User can now set a greater torque limit to remove stuck parts using the jog buttons.

13.7.4.2 Settings

Configure Selected Axis

Move Profiles | Triggers/Inputs | Status/Outputs | Gearing/Scaling | Homing/Referencing | **Jogging** | Limits | Timers | Other

Jogging

Set Jog Vel. mm/s

Set Jog Torque/Force %

Set Jog Ramp mm/s²

Use Power Jog
(Logging in as Supervisor will override standard jog settings with Power Jog Settings)

Set Power Jog Torque/Force %

Set Power Jog Ramp mm/s²

13.8 Limits Tab

The Super User can limit the values the other users can input on the running screens.

The MIN and MAX values are the allowable limits that are used on each related value. When the other users try to change a value, the keypad input will be limited to these MIN and MAX values.

Configure Selected Axis

Move Profiles | Gearing/Scaling | Homing/Referencing | Triggers/Inputs | Status/Outputs | **Limits** | Default Values | Timers

Auto and Step Movements

Set Position MIN mm

Set Position MAX mm

Set Velocity MIN mm/s

Set Velocity MAX mm/s

Set Torque MIN kN

Set Torque MAX kN

Set Ramp MIN mm/s²

Set Ramp MAX mm/s²

Jog Movements

Set Jog Velocity MIN mm/s

Set Jog Velocity MAX mm/s

Set Jog Torque MIN kN

Set Jog Torque MAX kN

Set Jog Ramp MIN mm/s²

Set Jog Ramp MAX mm/s²

Trigger Delays and Dwells

Start Trigger Delay MIN s

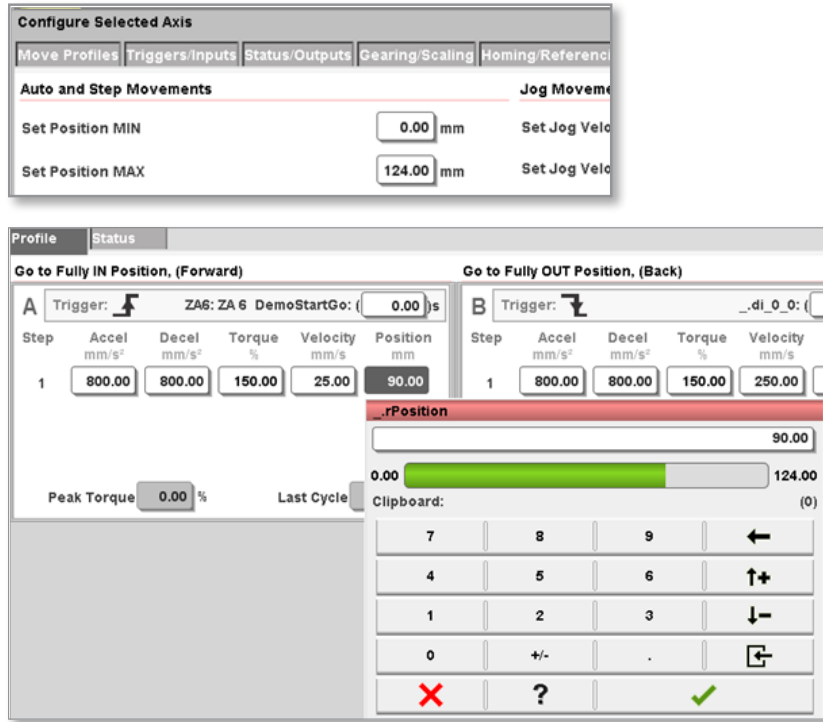
Start Trigger Delay MAX s

In Pos Dwell MIN s

In Pos Dwell MAX s

Limits Tab - continued

Note that the limiting values entered by the Super User are shown on the keypad:



13.9 Timers Tab

Two kinds of timers can be set on this tab.

13.9.1 Movement Timers

- The Move Timeout timer is used to set an alarm if the axis movement takes longer than the set time period.
- The In Position Dwell timer prevents the confirmation of the axis movement until the axis is in position and the set time period expires.

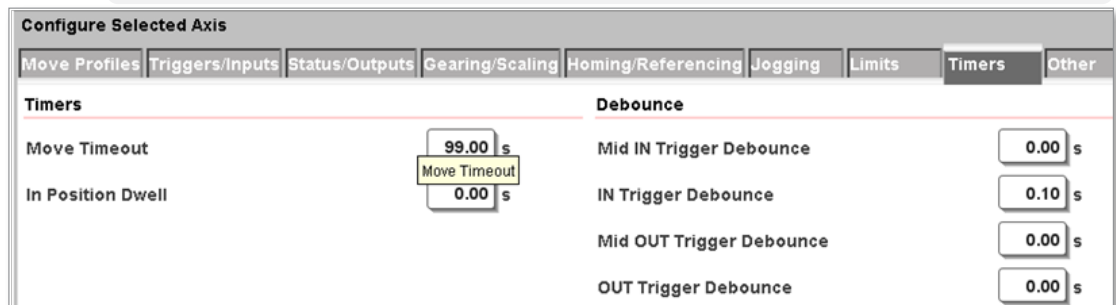
13.9.2 Debounce Timers

These timers can be used if the input trigger is bouncing. The input trigger will need to be correct for the debounce time period before the trigger is taken as set.

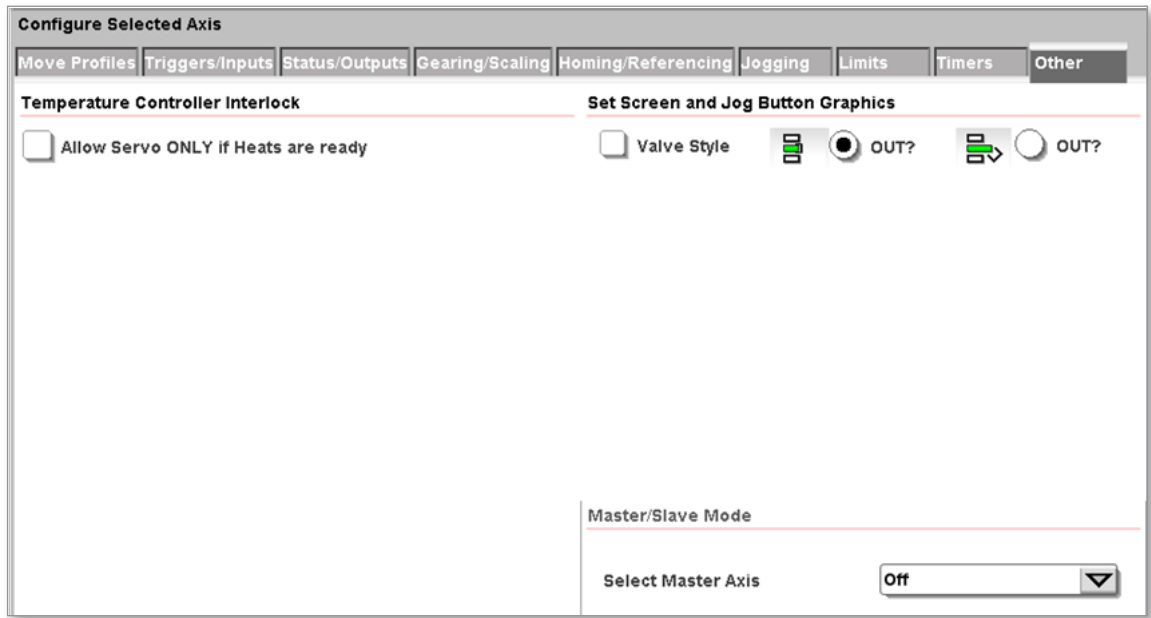


CAUTION

Using debounce timers will slow down the cycle time. It is preferable to fix to reason for the input bouncing.



13.10 Other



13.10.2.1 Allow Servo ONLY if Heats are Ready

The user selects this box to prevent the axis servo from turning on until the temperature controller is at operating temperature.



NOTE

Both the integrated and the remote temperature controllers must be at temperature.

13.11 Jog Icon Selection

The Super User can select or change the icons for jogging an axis.



13.11.1 Linear

This is an example of a typical linear axis and its jog button icons. The user selects the icon to appear on the OUT movement button. The other icon will then display on the IN movement button.



13.11.2 Valve Gate

This is an example of a typical servo valve gate or E-Drive axis and its jog button icons. The user selects the icon to appear on the OUT movement button. The other icon will then display on the IN movement button.



13.11.3 Rotary

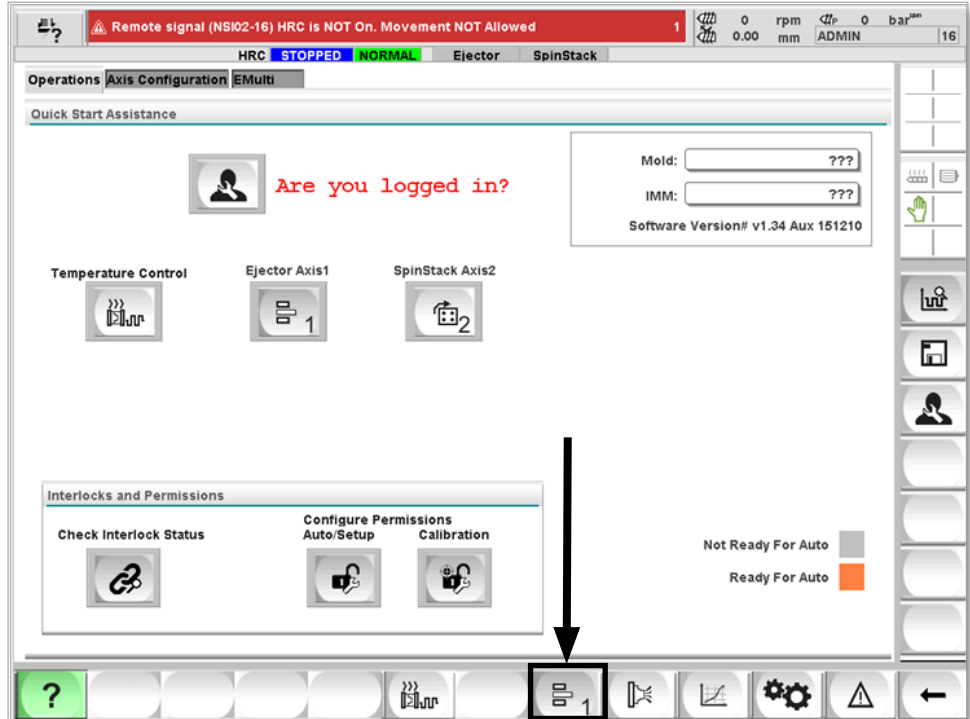
This is an example of a typical rotary axis and its jog button icons. The user selects the icon to appear on the OUT movement button. The other icon will then display on the IN movement button.



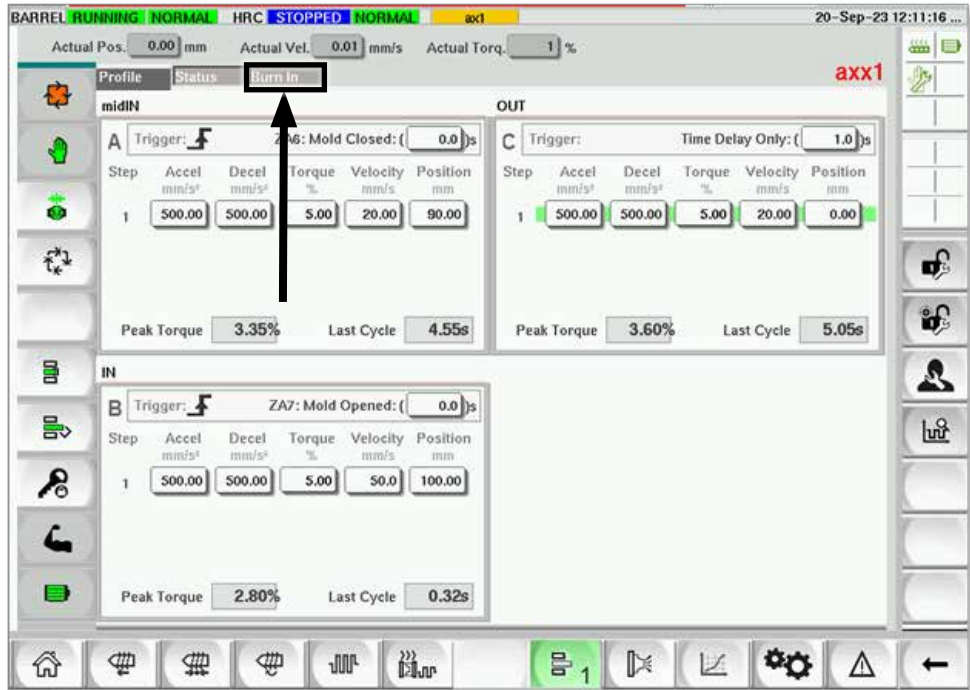
13.12 Burn-In Settings

13.12.1 Navigating to the Burn-In Settings

1. On the Quick View screen, tap the Axis button.



2. Tap the Burn In tab.



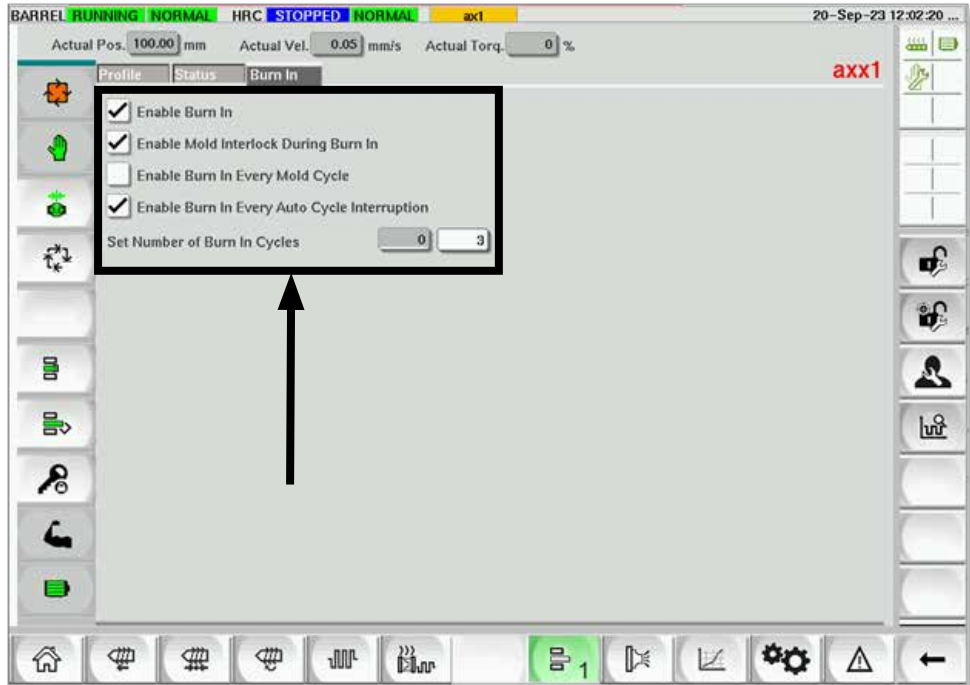


Figure 13-2 Burn-In settings highlighted

13.12.2 Description

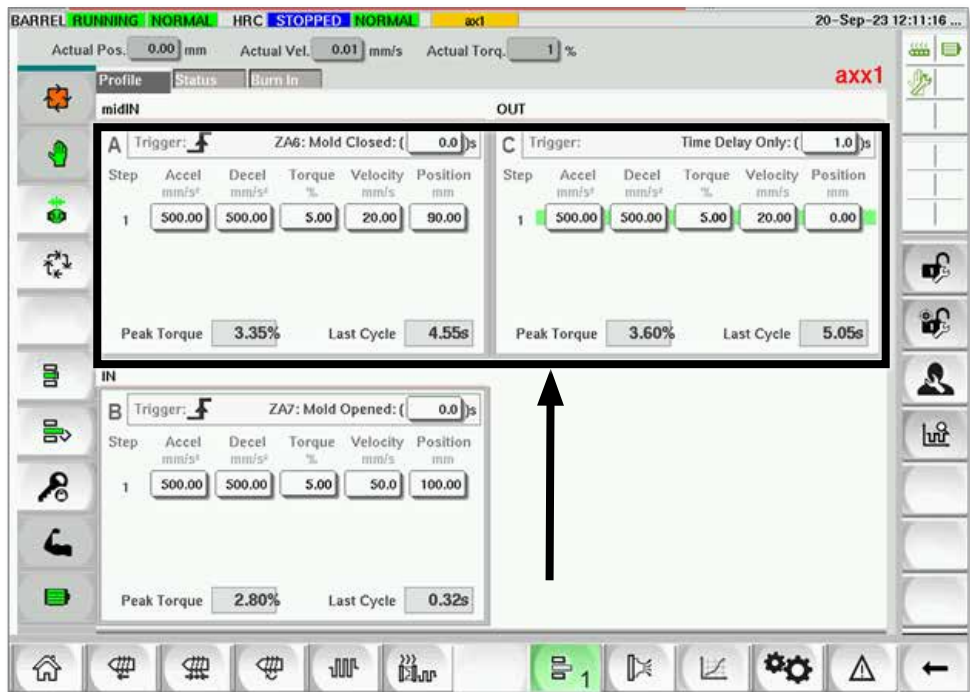


Figure 13-3 Motion profile with the burn-In cycle highlighted

The burn-In cycle is step C to step A repeated. The starting point for the burn-in cycle is always step C. The endpoint of the burn-in cycle is step A.

For information about setting up a motion profile, see section “Section 9 - Axis Operation Screen” on page 9-1.

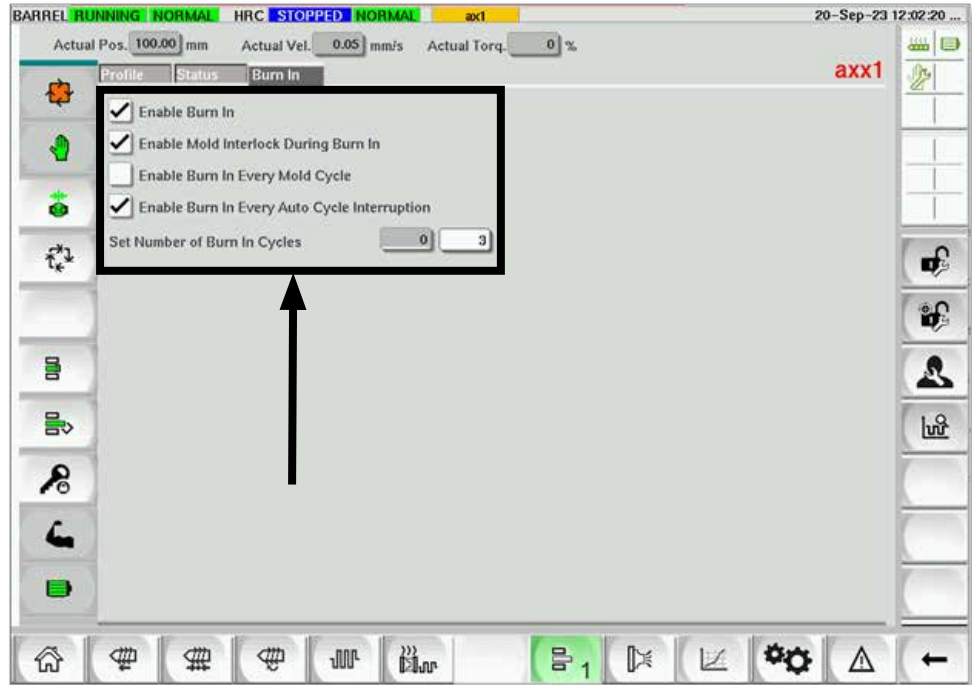


Figure 13-4 Burn-In settings highlighted

Table 13-1 Burn-In Settings	
Field	Description
Enable Burn In	Tap this check box to enable burn-in.
Enable Mold Interlock During Burn In	Tap this check box to have the Mold Area Free dropped during burn-in cycles.
Enable Burn In Every Mold Cycle	Tap this check box to do burn-in cycles each time the mold opens and closes.
Enable Burn In Every Auto Cycle	Tap this check box to do burn-in cycles each time the controller exits automatic mode.
Set Number of Burn In Cycles	Left box: Required number of burn-in cycles Right box: Number of elapsed burn-in cycles

Section 14 - Interlock Status




WARNING

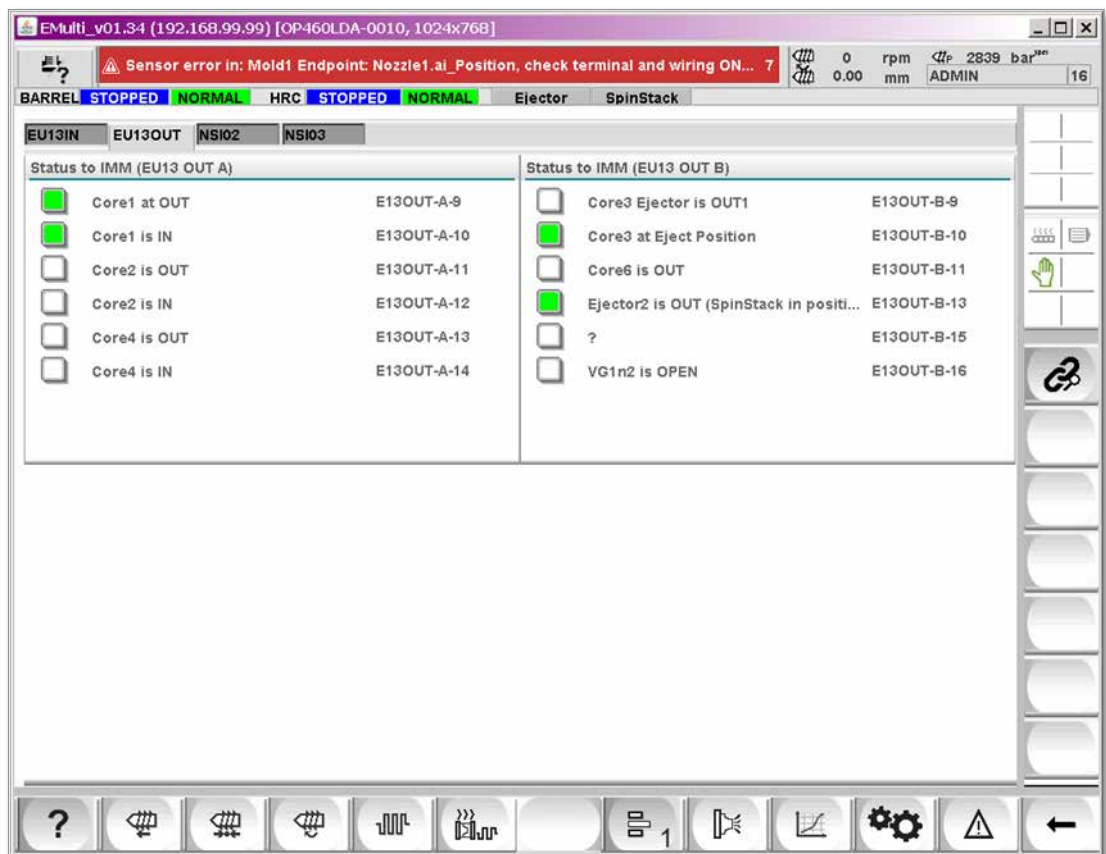
Ensure that you have fully read “Section 3 - Safety” before operating the M-Ax controller.

The interlocks are indicators that are directly linked to the Auxiliary I/O. This screen is used to monitor the status of the I/O.

Each tab represents a different I/O connector located on the back of the controller cabinet.

Toggle between the “Novo Standard I/O Layout” and the “PLC I/O Layout” by tapping the  button located on the right hand button strip.

14.1 Euromap Standard I/O Layout



14.2 PLC I/O Layout

EMulti_v01.34 (192.168.99.99) [OP460LDA-0010, 1024x768]

Sensor error in: Mold1 Endpoint: Nozzle1.ai_Position, check terminal and wiring ON... 7

0 rpm 2839 bar^{mm}
0.00 mm ADMIN 16

BARREL STOPPED NORMAL HRC STOPPED NORMAL Ejector SpinStack

Euromap I/O DM272/0 I/O DM272/1 I/O DM272/2 I/O DM272/3

Inputs			Outputs			
<input type="checkbox"/>	EU13-IN-A9	di_0_0	L1 Part on Ejector	<input checked="" type="checkbox"/>	EU13-OUT-A9 do_0_0	Core1 at OUT
<input type="checkbox"/>	EU13-IN-A10	di_0_1	L2n3 Part in Catcher	<input checked="" type="checkbox"/>	EU13-OUT-A10 do_0_1	Core1 is IN
<input type="checkbox"/>	EU13-IN-A11	di_0_2	Core 1 is IN	<input type="checkbox"/>	EU13-OUT-A11 do_0_2	Core2 is OUT
<input type="checkbox"/>	EU13-IN-A12	di_0_3	Core 1 is OUT	<input type="checkbox"/>	EU13-OUT-A12 do_0_3	Core2 is IN
<input type="checkbox"/>	EU13-IN-A13	di_0_4	Core 2 is IN	<input type="checkbox"/>	EU13-OUT-A13 do_0_4	Core4 is OUT
<input type="checkbox"/>	EU13-IN-A14	di_0_5	Core 2 is OUT	<input type="checkbox"/>	EU13-OUT-A14 do_0_5	Core4 is IN
<input type="checkbox"/>	EU13-IN-A15	di_0_6	Core 3 is Ejecting	<input type="checkbox"/>	SPARE do_0_6	?
<input type="checkbox"/>	EU13-IN-A16	di_0_7	Core 3 is OUT	<input type="checkbox"/>	SPARE do_0_7	?

Bottom toolbar: ? [Icons for various functions] [1] [Icons for various functions] [Settings] [Warning] [Back]

Section 15 - 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 source before you open the unit to inspect it or replace fuses.

15.1 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.

15.2 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. If the filters are clogged, they need to be replaced. Replacement filters can be obtained from *Mold-Masters*.

The filter is located in the fan tray, which is located on the front of the controller at the very bottom. To access the filter remove the two retaining screws and slide the tray out. See figure below:



Figure 15-1 M-Ax controller filter tray

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 you use an insulated screwdriver to check that no terminals have become loose.

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