



MEC PA08082 User Manual

M4 Sciences Embedded micro-Controller

MEC-PA08082 M4 Sciences Embedded Controller for Driving TriboMAM® Standard, TriboMAM®-mini, and TriboMAM®-micro drilling systems: Together the MEC controller and TriboMAM drilling system make up the TriboMAM drilling system.

Thank you for purchasing a MEC-PA08082 Controller. The TriboMAM drilling system uses Modulation-Assisted Machining (MAM®) to enable the improvement of drill speeds and feed rates for high-aspect ratio centerline drilling in CNC lathes. This manual provides information regarding safety precautions, installation procedures and operating protocols in the use of the MEC-PA08082 Controller.

This product is covered by United States and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specifications are subject to change without notice.

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1 Safety

Review the following precautions to maintain safety and prevent damage to the instrument or equipment connected to it. The safety features of this instrument may be ineffective if the equipment is not operated in the manner stated in this manual. Refer all maintenance procedures to qualified personnel.

1.1 Safety Precautions

- Use the Proper Power Cord. To avoid fire hazard, use only the power cord provided with this instrument.
- Avoid Electric Overload. To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.
- Avoid Electric Shock. To avoid electric shock, do not touch the metal surfaces of the HV connector while the instrument is on.
- Ground the Product. This product is grounded through the ground conductor of the power cord. To avoid electric shock, the ground conductor must be connected to earth ground. Before making connections to the input and output terminals of the product, ensure that the product is properly grounded.
- Do Not Operate Without Covers. To avoid electric shock or fire hazard, do not operate this instrument with the covers removed.
- Use Proper Fuses. To avoid fire hazard, use only the fuse type and rating specified for this instrument.
- Indoor Use Only. This instrument is intended for indoor use only.
- Do Not Operate in Wet or Damp Conditions. To avoid electric shock, do not operate this instrument in wet or damp conditions.
- Do Not Operate in an Explosive Environment. To avoid injury or fire hazard, do not operate this instrument in an explosive environment.

1.2 Product Protection Precautions

- Use the Proper Power Source. Do not operate this instrument with a power source that is different from the voltage specified on the serial number tag.
- Provide Proper Ventilation. To prevent the instrument from overheating, do not block air-cooling fins in back of unit.
- Do Not Operate with Suspected Failures. If you suspect there is damage to this instrument, contact M4 Sciences.

1.3 Safety Terms and Symbols

- These terms may appear in this manual:

Warning: Warning statements identify conditions or practices that could result in injury or loss of life.

Caution: Caution statements identify conditions or practices that could result in damage to this product or other equipments.

- These symbols may appear on the instrument:



Warning, risk of electric shock



Caution, refer to Operator's Manual

CAT I Installation category I (overvoltage category): Classification for the operation of a unit using voltage systems or circuits with required standardized limits for transient voltages. Category I pertains to voltages supplied at the peripheral level, with smaller tolerances for transient voltages as specified by the Low-Voltage Safety standard (EN 61010-1).

CAT II Installation category II (overvoltage category): Classification for the operation of a unit using voltage systems or circuits with required standardized limits for transient voltages. Category II pertains to using voltage supplied on the local level (example: local wall outlets) with smaller tolerances for transient voltages as specified by the Low-Voltage Safety standard (EN 61010-1).

Danger: High-voltage generating equipment, including this amplifier and related supplies are not designed, rated, or qualified to be operated in an environment or atmosphere which contains combustible or explosive materials or gases which may be ignited by electrical discharges.

2 Introduction

The M4 Sciences MEC-PA08082 is used to drive TriboMAM and TriboMAM-mini type piezo-based drilling system. The unit utilizes computer control interfaces for input, monitoring and control functions. The graphical front panel display with a keypad is used for local input and control.

2.1 *Receiving Inspection*

Visually inspect the instrument for physical damage such as dents, nicks, scratches, broken fittings, etc. External damage may indicate more serious damage has occurred within the instrument. In the event of damage, notify M4 Sciences and request instructions. Do not attempt to use a damaged instrument.

2.2 *Installation*

The MEC-PA08082 is designed for operation on a bench top. The MEC-PA08082 is air-cooled. Allow a minimum of 50 mm (2 in) of free space around the heat exchange fins on the rear panel. Refer to Figures on pages 10 and 11 for descriptions of front and rear panel features.

Caution: Do not operate the instrument with the covers removed. The covers must be installed completely to ensure proper cooling.

Power Connection

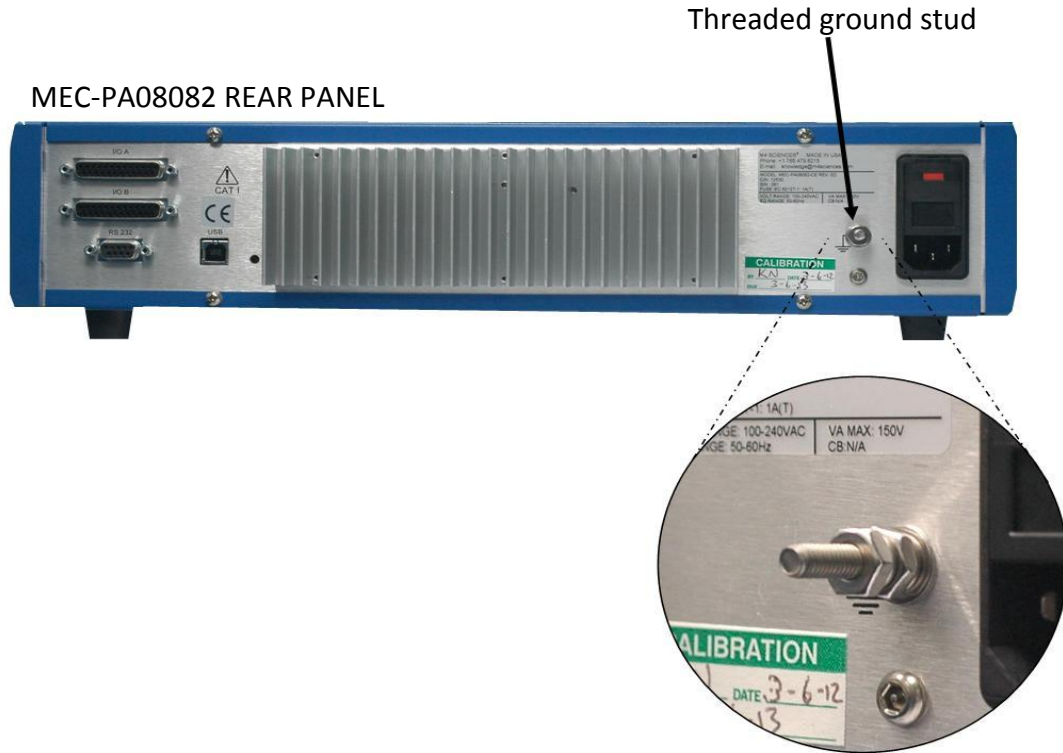
The MEC-PA08082 is designed for power sources of 100 to 240 V AC, at 48 to 63 Hz.

Caution: The MEC-PA08082 may be damaged if operated at an incorrect voltage. Check the voltage to ensure that configuration matches the line voltage in your area.

Warning: Make no attempt to bypass the ground prong in the power cord. This is a protective ground and any attempt to negate it could result in an electrical shock.

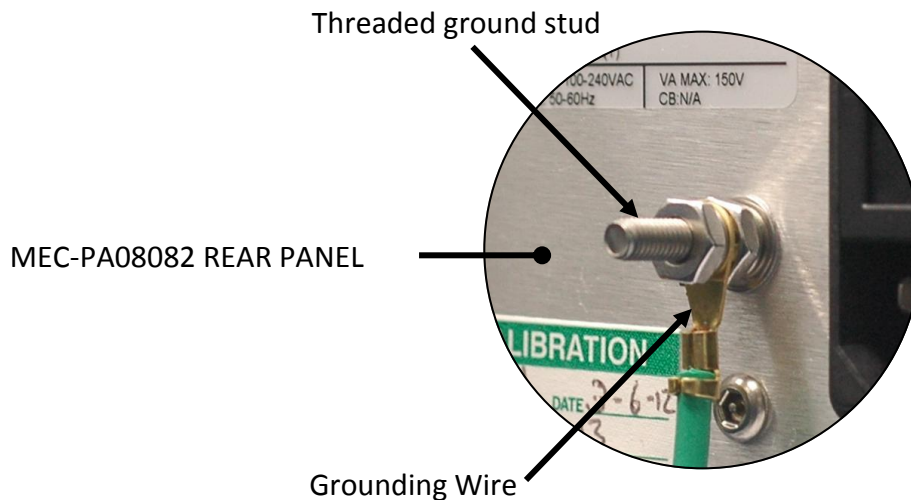
1. Verify that power source has ground to the power cord.

Caution: If the power source is not grounded, then ground the MEC-PA08082 using the rear panel threaded ground stud connection.



Ground connection example

Note: This ground connection is only required if the power source is not grounded.



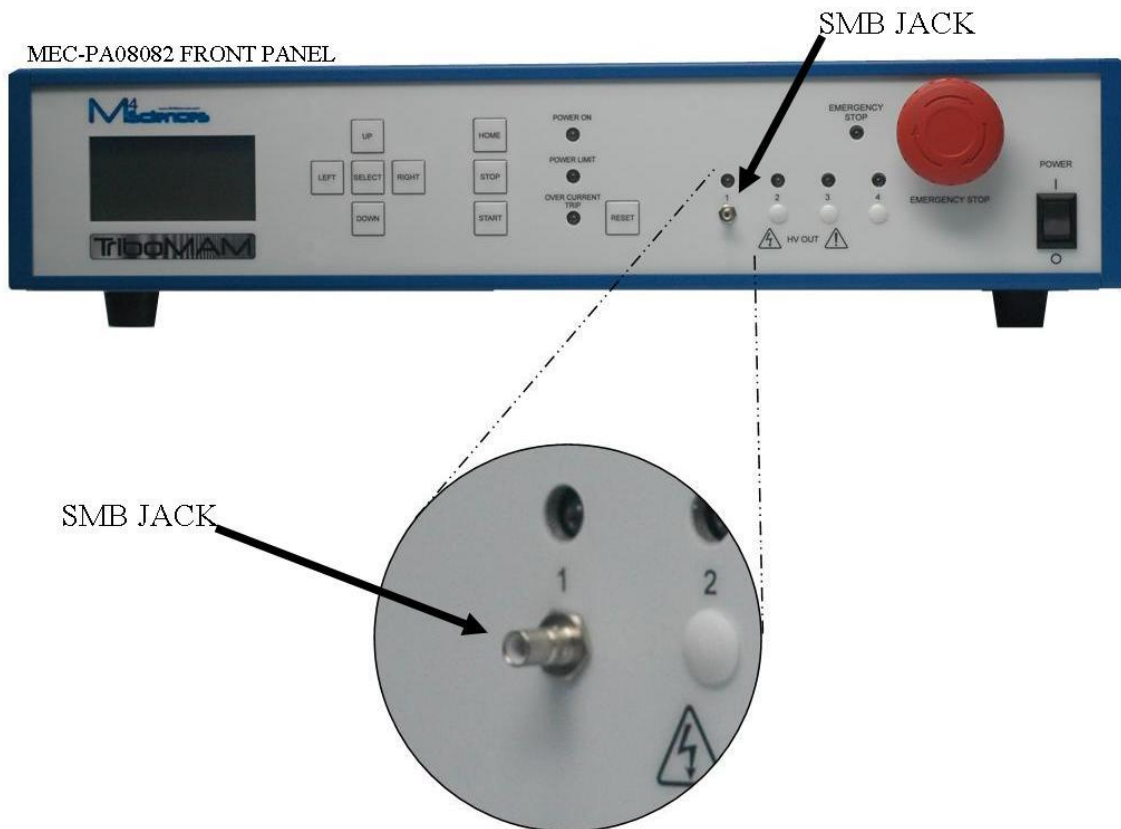
Warning: Make no attempt to operate the MEC-PA08082 without ground connection. A ground connection is required for proper operation.

2. Ensure that the power switch is off before connecting the power source.
3. Plug the power cord into the power connector on the rear panel.
4. Plug the free end of the power cord into the power source.

2.3 TribomAM Connection procedure

1. Connect the high-voltage cable to the SMB output jack (labeled HV OUT) on the MEC-PA08082 as shown below.

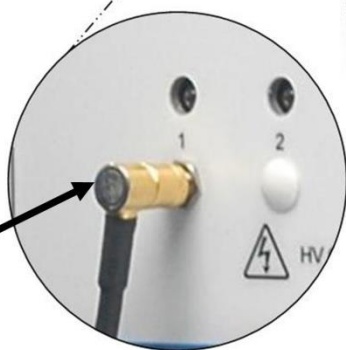
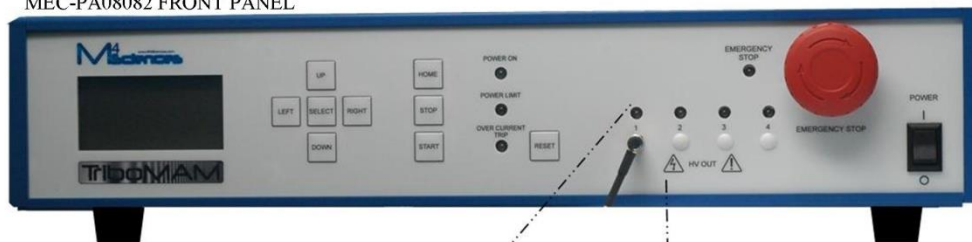
The high-voltage cable assembly for TribomAM to MEC-PA08082 connection is of the SMB type. **Only cables supplied by M4 Sciences may be used for connecting the TribomAM system to the MEC-PA08082 Controller.**



SMB COAXIAL PLUG
(For MEC-PA08082 coaxial jack)
SMB-RIGHT ANGLE



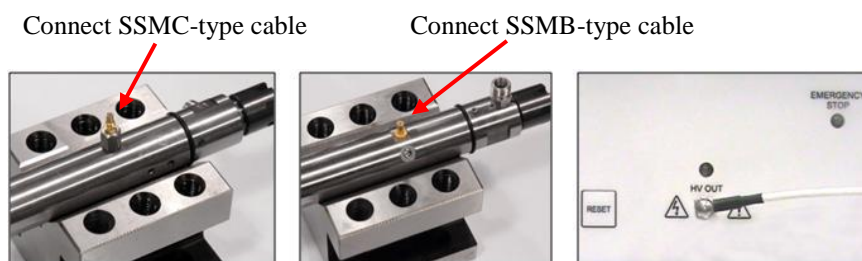
MEC-PA08082 FRONT PANEL



SMB coaxial plug connected to SMB Jack at front panel

2. Connect the high-voltage cable to the SSMB (or SSMC) jack located on the TriboMAM drilling system.

Route the high-voltage cable as directly as possible to the TriboMAM drilling system and away from grounded surfaces. This minimizes the effects of stray capacitance on the performance of the MEC-PA08082. It is desirable to keep the high-voltage output cable un-bundled from other cabling and away from grounded structures. These measures will minimize capacitive loading of the amplifier and reduce extraneous coupling to other devices.



SSMC-type (left) and SSMB-type (middle) connectors on TriboMAM-mini drilling system
Power cable attached to front panel of MEC-PA08082 Controller

The high-voltage cable assembly for TriboMAM connection may be configured with one of two types of coaxial cable connectors. These are SSMB and SSMC type plugs. The SSMC plug connector can be readily identified as it uses a threaded connection to the SSMC jack.

The SSMB connector is a small version of the standard *SubMiniature Version B* or SMB connector. The SSMB connector is a 'snap-on' coupling for ease connection.

The SSMB cable assembly connection may be configured with one of two types. These are *SSMB-STRAIGHT* and *SSMB-RIGHT ANGLE* as shown on the next pictures.

TriboMAM power cable connector configurations

SSMB-STRAIGHT



SSMB-RIGHT ANGLE

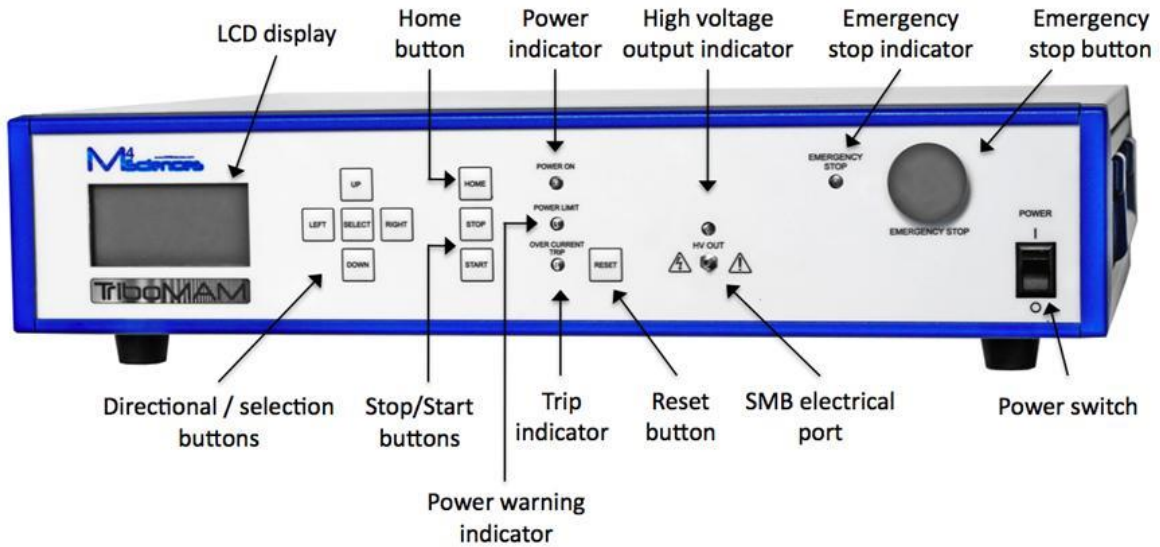


Warning: The high voltage output connector carries high voltage. DO NOT touch the high voltage output connector or the load circuit while the MEC-PA08082 is operating. An electrical shock could result. Always turn off the MEC-PA08082 before making changes to the load connections. The maximum voltage at the high voltage output connector is +150 V.

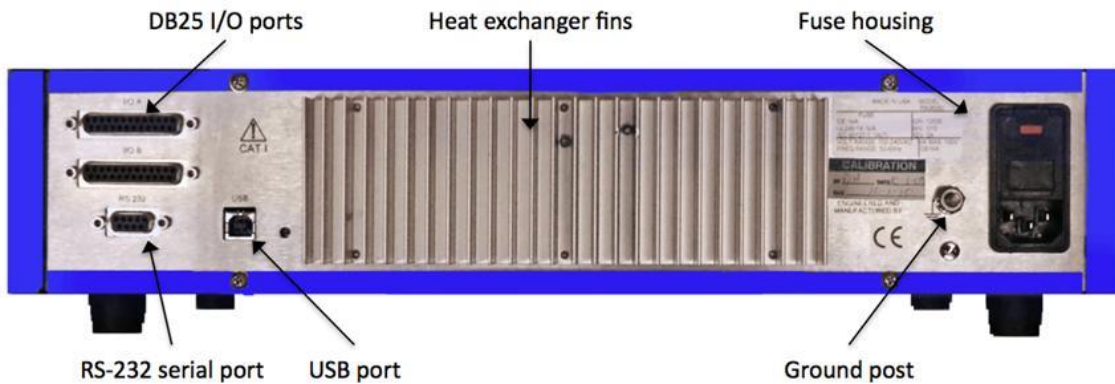
3 Operation

The following pictures show the location of various controls, displays, indicator lights and components on the Front and Rear Panels of the MEC-PA08082 Controller.

Front panel



Rear panel



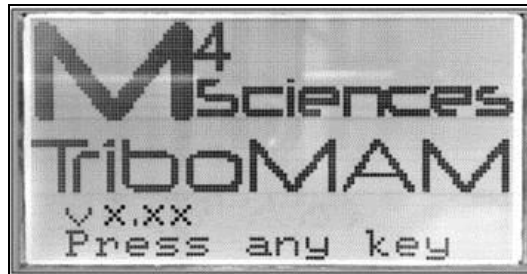
RS-232 serial port and USB port are for M4Sciences Engineering use only

- RS-232 9 pin female interface port with a 300-19.2 k baud rate (minimum) (115.2 k desired) with flow control hardware. This port is not currently used. Please contact M4 Sciences for additional information.
- USB 2.0 full speed compliant with a maximum transfer data rate of 12 Mbits/second. The USB port is used only for transfer of new software to the MEC-PA08082 by M4 Sciences personnel.

3.1 Programming Instructions

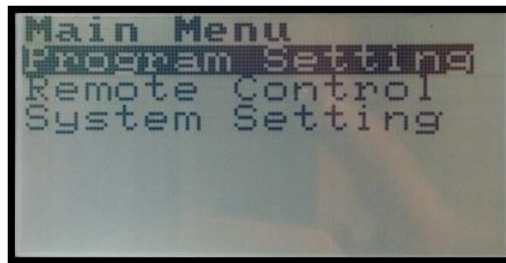
3.1.1 Startup

Power up the MEC-PA08082 by pushing the power switch to the ON position. A welcome screen will appear. The controller software version is indicated on the screen (v X.XX in the image below).



Press any key to enter the *Main Menu*. There are three options:

1. *Program Setting* – edit and run drilling programs, up to 5 programs can be stored
2. *Remote Control* – run program through I/O communications
3. *System Setting* – change English/SI units, display contrast/brightness, etc.



Press *UP* or *DOWN* button to change the highlighted line. Press *SELECT* button to enter the highlighted submenu. **Press the *HOME* button to return to the *Main Menu*.**

3.1.2 Program Menu

When *Program Setting* is selected, the screen below will appear on the LCD display. The first line shows the current program number (1 to 5 available) and program status. The following status are possible:

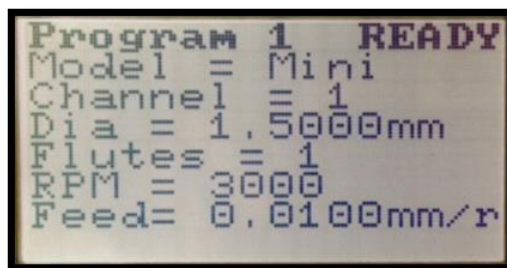
READY – program is ready for run; press *START* button to run the program

RUN – program is running; high voltage output is on

EDIT – program parameters can be edited; program cannot be run in this status

ERROR – indicate the input value is not allowed when editing the program

RESET – system is shut down unexpectedly; need to press *RESET* button to restore



Drilling program

3.1.2.1 Run/Stop Program

In the READY mode, press *UP* or *DOWN* button to change the current program.

In the READY mode, press *START* button to run the program (high voltage output on).

In the RUN mode, press *STOP* button to stop the program (high voltage output off).

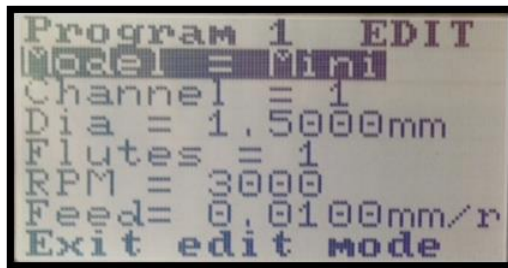
3.1.2.2 Edit Program

In the READY mode, press *SELECT* button to enter the EDIT mode for modifying the current program (The first line of the program will be highlighted). Press *UP* or *DOWN* button to choose the variable to be modified (The corresponding line will be highlighted).

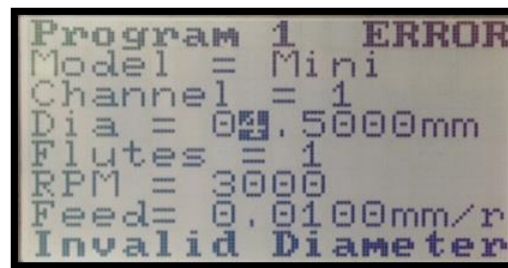
After highlighting the right variable, press *SELECT* button to start modifying the value of the variable; press *UP* or *DOWN* button to modify the value of the variable; press *LEFT* or *RIGHT* button to change the digit to be modified (for diameter and feed); press *SELECT* button to finish and save the value.

Select "Exit edit mode" to return back to the READY mode.

During editing the program, if ERROR status shows up on the top line, it indicates the combination of the input values are out of the processing envelope of the TriboMAM; an error message indicating "Invalid Diameter, Reduce Feed or Reduce RPM" will be shown at the bottom of the screen. Adjust the corresponding variables until the error is cleared. The error has to be cleared before returning back to the READY mode.



Program edit mode



Error in program edit

Note: Maximum values for spindle rotation RPM and drill feed depend on the other drilling parameters. The maximum values specified in the TriboMAM drilling system user manual are absolute maximums for the TriboMAM system. Actual drilling application limits are process dependent.

Note: The actual CNC program conditions must be set to the same conditions in the MEC controller in order to ensure proper operation of the TriboMAM.

Note: The maximum RPM and maximum feed cannot be reached at the same time, they depend on each other and also on other variables (flutes and diameter).

3.1.3 Remote Menu

After selecting the *Remote Control* from the main menu, the following screen appears. **For remote operation, the Remote Menu must be active on the controller (displayed on the screen).** If *Exit Remote Mode* is selected, then remote operation is disabled and the MEC must be controlled manually. **If the controller is powered off at the Remote Menu, it will automatically go back to the Remote Menu the next time it is powered on (skip the welcome screen).**

The Remote Menu lists the functions (some are optional) that can be controlled using the I/O communications. These functions can be turned on and off.

The bottom line indicates the status of the remotely controlled program. The first two letters indicates the model of the TriboMAM used (SD – Standard, MN – Mini, MC – Micro). The number after “PG” is the program number. The number after “CH” is the output channel number. Program status as described in section 3.1.2 appears at the end.



Note: The standard MEC Controller is configured for the Start option to be enabled on the remote menu. **All other functions require optional software [SOFTMEC] from M4 Sciences.**

3.1.3.1 Remote Menu Standard MEC Configuration

The *Start* option is used to enable/disable remote triggering of the high voltage output (HV Out) to the TriboMAM. This is used to turn the TriboMAM tool on and off.

3.1.3.2 Remote Menu Optional MEC Configuration: SOFTMEC

The *Program* option is used to enable/disable remote selection of a specific program (1-5) from the controller memory.

The *Channel* option is used to enable/disable remote selection of output channels (1-4). If the *Channel* is disabled (off), then the channel in the program will be active.

The *E-Stop* option is used to enable/disable remote input of the emergency stop from an external CNC control or output of a fault at the MEC controller.

The *Reset* option is used to enable/disable remote input of the reset.

Please note that while the *Start* option is standard for every controller, the *Output channel, Program, E-Stop, Reset* options are expandable options and require the special SOFTMEC upgrade from M4 Sciences.

Standard feature:

Start ON - Runs a program that is selected manually. For example, if program 2 needs to be operated remotely → Program menu → Select program 2 → Return to remote Menu. The status bar should show "PG2", indicating Program 2 has been selected.

Optional features:

- Channel ON
- Program ON
- E – Stop ON
- Reset ON

CAUTION

If the MEC is placed in the "Remote Menu" then inputs from an external device (such as relay inputs from a CNC machine control) will override manually selected output channels or program numbers

Refer Communications Protocol Section 8 for more information.

To exit the *Remote Menu*, select *Exit Remote Mode*. (HOME button does not work here!)

3.1.4 System Menu

After selecting the *System Setting* from the *Main Menu*, the following screen appears. Press *UP* or *DOWN* button to change the highlighted lines. Press the *SELECT* button to modify the highlighted parameters or start the highlighted function.



System Menu

The **Unit** option can be set to SI (denoted as *mm* for “millimeter”) or English units (denoted as *In* for “inches”). If *mm* is selected, drill diameter and feed per revolution will be in millimeters. If *In* is selected, drill diameter and feed per revolution will be in inches.

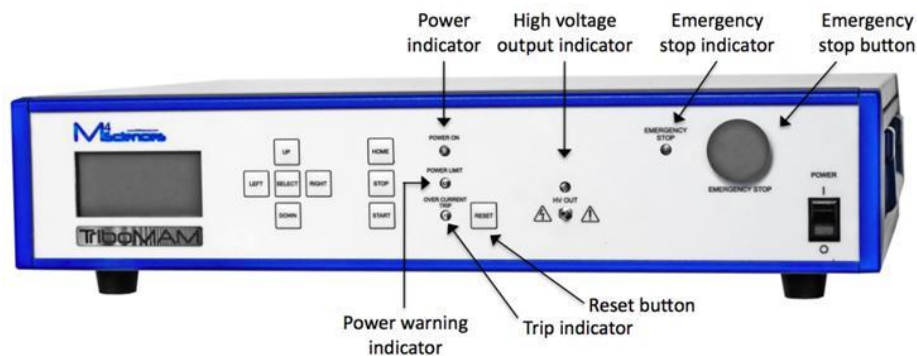
Contrast and Backlight are controlling the LCD display.

Function Test – HV output at preset low frequency and full amplitude for checking the displacement of connected TriboMAM.

Audible Check – HV output at audible frequency to check the connected TriboMAM.

3.1.5 Indicator Lights and Errors

Several indicator lights are provided on the controller. These are denoted on the front panel of the controller as *Power On* (Green), *Power Limit* (Yellow), *Overcurrent Trip* (Red), *HV Out* (Red) and *Emergency Stop* (Red).



The *Power On* indicator light indicates whether the device is on or off.

The *Power Limit* indicator light indicates if the MEC-PA08082 is near its power limit. The MEC-PA08082 will run and power the TribomAM with this indicator light on.

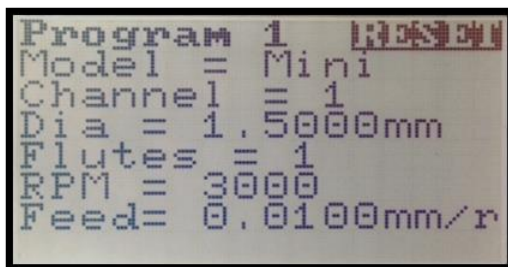
The *Overcurrent Trip* indicator light illuminates when the current capability of the MEC-PA08082 is exceeded or if output shorting occurs. The MEC-PA08082 will not run when this indicator light is on.

The *HV Out* indicator light indicates when the controller is running / sending a high-voltage signal to the *HV Out* port on the front panel.

The *Emergency Stop* indicator light is illuminated when the Emergency Stop button is depressed.

“Reset” appears on the status bar of LCD display when a) current limit exceeded on HV out, or b) e-stop engaged, or c) heat sink temperature limit exceeded or d) temperature limit exceeded inside housing of MEC controller, or e) the Emergency Stop button is depressed, or f) short circuit.

RESET Example on the status bar.



Program Menu screen example



Remote Menu screen example

3.1.6 Emergency Stop

In case of an emergency, the high voltage output and the TriboMAM drilling system can be turned off by depressing the Emergency Stop button on the front panel of the controller. The *Emergency Stop* indicator light is on until the button is returned to its initial state. To return back to normal operation, pull the Emergency Stop switch out and press the Reset key before pressing the Start key again.

Warning: The Emergency Stop does NOT disable the main power to the MEC-PA08082 controller. It disables the power to the *HV Out* connector on the front panel.

4 Specifications

4.1 *Output*

The standard configuration of the MEC-PA08082 has one output channel. Additional output channels are optional. **No more than one output channel can be active at a time.**

Output Voltage Range	-50 V to +150 V DC or peak AC.
Output Current Range	0 to 1 A peak [0.707 A rms]

4.2 *Features*

RS-232 Interface, USB Port and Programming Capability, USB 2.0 full speed compliant with a maximum transfer data rate of 12 Mbits/second, a RS-232 Interface with a 300-19.2 k baud rate (minimum) (115.2 k desired) with flow control hardware.

Internal programming capabilities allow control and monitoring of features, which include:

Frequency Control	0.01 Hz to 1000 Hz.
Offset Voltage	-50 V to +150 V
Amplitude Voltage	-50 V to +150 V
Output Channel Control	One channel (optional 4 channels)
Keypad	An eight-button keypad is provided for user programming of unit operation parameters.
Waveform Generation	14 bit, 0.01 Hz to 1.0 kHz resolution (minimum) 16 K to 64 K samples per cycle, with offset capability and control range of -50 V to +150 V HV output

LCD Interface	128 x 64 dot graphic LCD display with back-light and light intensity adjustments. Displays output information.
Over Current Trip	The high voltage will turn off and the error will be indicated on the display screen when current capability of the amplifier is exceeded or output shorting occurs. Maximum current capability is 1 Amp.
Trip Reset	After a Trip event occurs and the high voltage is turned off, depressing a series of keys on the keypad will turn off the Over Current Trip indicator and allow the high voltage to be turned back on, once the fault has been removed.
Limit Indicator	The display indicates when the MEC-PA08082 does not provide the required high-voltage. This can occur when the load exceeds the amplifier capacity.
High-Voltage	Front panel display indicates when the high-voltage is on.
Power On	Front panel display becomes active when the power is on.

4.3 Performance

DC Voltage Gain	20 V/V
DC Voltage Gain Accuracy (input to output)	Better than 2%.
Offset Voltage	Less than ± 1 V

4.4 General Specifications

Dimensions	19" rack mountable, 4" (2U high), 14" depth
Weight	6 kg (13 lb)
High-Voltage Output Connector	SMB coaxial bulkhead jack

High-Voltage Output Impedance	0.1 ohms
I/O Connectors	Two (2) 25-pin D type connector RS-232 Serial Port Connector USB Port 2.0
Power Requirements (Line Supply)	100 to 240 V AC at 48 to 63 Hz
Power Entry Module	A standard three-prong AC line connector with an integral fuse holder and an ON/OFF power switch
Operating Conditions	Temperature 0 °C to 35 °C Relative Humidity To 85%, noncondensing

5 Accessories

Line Cord (for 90 to 127 V AC operation)
Fuses, 5 mm x 20 mm, 1 A

6 Certification

M4 Sciences certifies that each Model MEC-PA08082 is tested and calibrated to specifications using measurement equipment traceable to the National Institute of Standards and Technology or traceable to consensus standards.

7 Maintenance

7.1 *Safety*

Observe the following safety precautions when performing maintenance procedures on the Model MEC-PA08082:

1. Do not open the panels to the MEC-PA08082. **Warranty will be void if the panels are opened.**

2. Always turn off the Model MEC-PA08082 and disconnect it from its power source before cleaning or inspecting it. Failure to observe this precaution could result in personnel injury or equipment damage.
3. Refer all maintenance procedures to qualified personnel.

7.2 Maintenance Assistance

Preventative Maintenance/Cleaning the Instrument

Preventative maintenance consists of inspecting and cleaning the instrument. Preventative maintenance performed on a regular basis may prevent instrument failure and improve reliability.

Inspection: Visually inspect the instrument for loose or damaged controls and connectors or other undesirable conditions.

Cleaning: Disconnect the unit from all external connections prior to cleaning. Clean the Model MEC-PA08082 as operating conditions require. Clean the exterior of the instrument with a soft cloth dampened with water. Use only water to dampen the cloth. The use of solvents may damage the finish or plastic components. A small brush is effective in removing dirt from the front and rear panel controls and connectors.

7.3 Servicing the Fuses

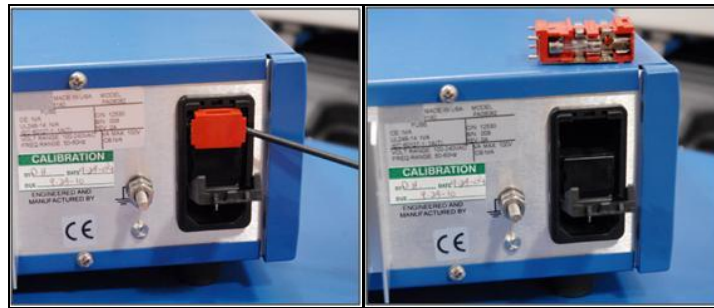
Refer servicing the fuses to qualified personnel. Always unplug the power cord from the power source before attempting to change the fuses. Always replace the fuses with fuses of the same rating.

Warning: Never attempt to service the fuses when the instrument is plugged into the power source. An electrical shock could result. The line fuses are contained in a fuse holder, which is an integral part of the power connector. These are the only user serviceable fuses.

1. On the rear panel of the controller, use a small flat head screwdriver to access the fuse door as shown below.



2. Use the screwdriver to guide existing fuse from controller.



3. Replace any blown fuses with same type and rating.

If the instrument has repetitive fuse failure, a more serious problem might exist within the instrument. Please contact M4 Sciences in this situation.

8 Communications Protocol

Please refer to the Programming Instructions section earlier in this manual for a description of the *Remote Menu* functions. The communications protocols described in this section correspond directly to these *Remote Menu* functions. The MEC-PA08082 can be interfaced directly to the CNC machine tool for limited basic relay logic interaction. The **standard** MEC-PA08082 is configured for on or off type control of the HV output signal to the TriboMAM-drilling system. Additional relay driven I/O features are available, including the ability to select individual programs stored within the MEC-PA08082 memory. **These I/O features currently do not enable direct transfer of numerical data such as G-code information between the MEC-PA08082 and the CNC controller of a particular machine tool.**

NOTE: Some communication features require optional software SOFTMEC

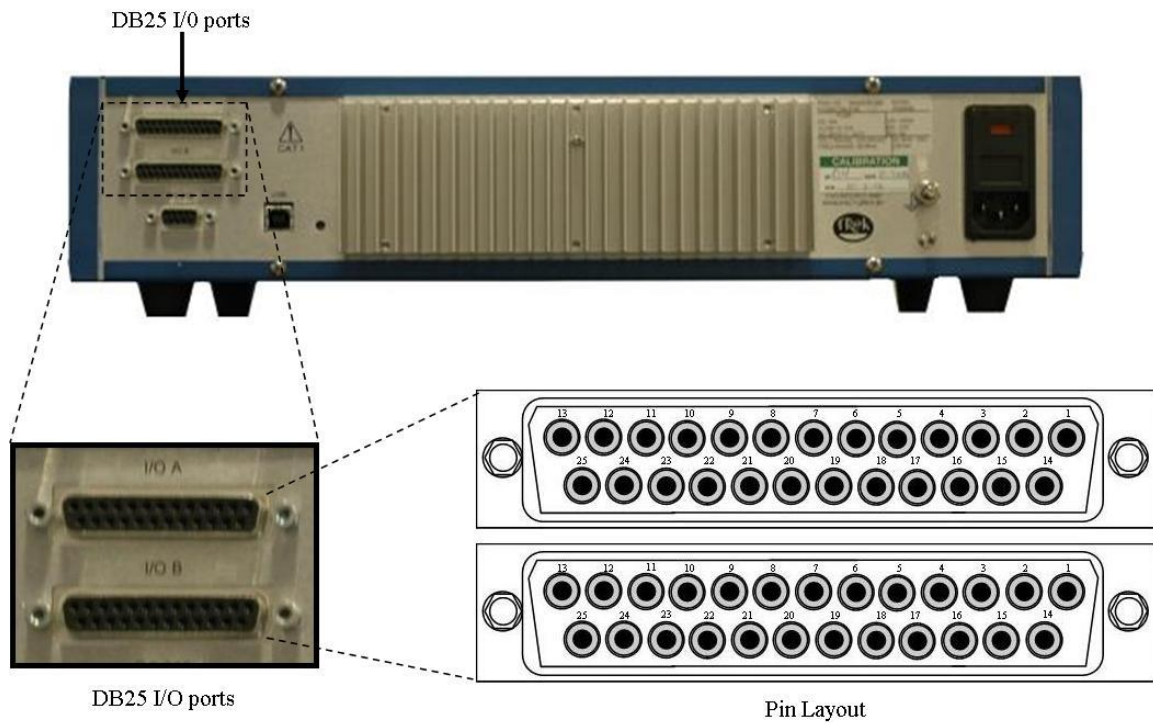
The MEC-PA08082 includes the following interface ports for relay control:

- Two (2) DB 25 parallel female connectors for programmable machine tool interface. These ports are used for active relay control with the CNC machine tool.

Note: A standard installation does not require interaction with the USB, RS232 or I/O A and I/O B ports. For further information please contact M4 Sciences.

8.1 DB25 Port Pin Layout

The interface ports are shown in the following image of the MEC-PA08082 Rear Panel. There are 2 DB 25 pin port connectors on the back panel of the MEC-PA08082 (I/O A and I/O B). These connectors may be linked to the CNC machine tool with the appropriate cables to allow operational interfacing to the controller directly from external relays (+12V to +24V DC).



The following tables provide a description of each pin of the I/O A and I/O B ports. For details regarding the communication protocol of each pin, consult the DB25 Pin Configuration immediately following this section.

I/O Port A

Pin#	Name	Input/ Output	Pin Description
1	IN1a	Input	Input 1a – used for program selection
2	IN2a	Input	Input 2a – used for program selection
3	IN3a	Input	Input 3a – used for program selection
4	IN4a	Input	Input 4a – used for output channel selection
5	IN5a	Input	Input 5a – used for output channel selection
6	IN6a	Input	Input 6a – start/stop operation command
7	+12 V	Output	+12V Current limited DC supply (100-200 mA, polyswitch or equiv.)
8	+12 V	Output	+12V Current limited DC supply (100-200 mA, polyswitch or equiv.)
9	K3no	Relay	Relay K3 normally open contact, ISOLATED (Main Power)
10	K3co	Relay	Relay K3 common contact, ISOLATED
11	K4no	Relay	Relay K4 normally open contact, ISOLATED (Run/Stop)
12	K4nc	Relay	Relay K4 normally closed contact, ISOLATED (Run/Stop)
13	Iout	Output	Current monitoring output (1V/100mA)
14	IN1b	Input	Input 1b – reference for IN1a, connected to 0V reference
15	IN2b	Input	Input 2b – reference for IN2a, connected to 0V reference
16	IN3b	Input	Input 3b – reference for IN3a, connected to 0V reference
17	IN4b	Input	Input 4b – reference for IN4a, connected to 0V reference
18	IN5b	Input	Input 5b – reference for IN5a, connected to 0V reference
19	IN6b	Input	Input 6b – reference for IN6a, connected to 0V reference
20	GND	-	Internal 0V reference for pin #7, 8
21	GND	-	Internal 0V reference for pin #7, 8
22	K3nc	Relay	Relay K3 normally closed contact, ISOLATED (Main Power)
23	K4co	Relay	Relay K4 common contact, ISOLATED
24	GND	-	Unit ground
25	Eout	Output	Voltage monitoring output (1V/20V)

I/O Port A includes 2 single pole double throw relays (K3 and K4) on the back panel DB25 female connector. The relay logic is as follows (0=relay off, 1= relay on)

Relay K3 – MEC Main power toggle switch on front panel: 0=off and 1=on

Relay K4 – MEC program running (started): 0= stopped, 1= run

3 terminals of each relay are accessible on the DB25 pin-outs according to table above

K3no/nc/co = pin 9/pin 22/pin 10 and K4no/nc/co = pin 11/pin 12/pin 23

no = normally open, nc = normally closed, co = common

These relays can be wired with several configurations, depending on the desired type of input to the external machine.

As shown in the table above pin 7 and pin 8 provide a local +12V source if needed.

****The K3 and K4 relays are completely isolated from the MEC controller. An external DC power source (e.g., an external +12V source) may be used to energize the relays.**

I/O Port B

Pin#	Name	Input/Output	Pin Description
1	IN7a	Input	Input 7a – emergency stop
2	IN8a	Input	Input 8a – unit reset
3	IN9a	-	Reserved
4	IN10a	-	Reserved
5	IN11a	-	Reserved
6	IN12a	-	Reserved
7	+12 V	Output	+12V Current limited DC supply (100-200 mA, polyswitch or equiv.)
8	+12 V	Output	+12V Current limited DC supply (100-200 mA, polyswitch or equiv.)
9	K1no	Relay	Relay K1 normally open contact, ISOLATED (Reset monitor)
10	K1co	Relay	Relay K1 common contact, ISOLATED
11	K2no	Relay	Relay K2 normally open contact, ISOLATED (software error status)
12	K2nc	Relay	Relay K2 normally closed contact, ISOLATED (software error status)
13	Iout	Output	Current monitoring output (1V/100mA)
14	IN7b	Input	Input 7b – reference for IN7a, connected to 0V reference
15	IN8b	Input	Input 8b – reference for IN8a, connected to 0V reference
16	IN9b	Input	Input 9b – reference for IN9a, connected to 0V reference
17	IN10b	Input	Input 10b – reference for IN10a, connected to 0V reference
18	IN11b	Input	Input 11b – reference for IN11a, connected to 0V reference
19	IN12b	Input	Input 12b – reference for IN12a, connected to 0V reference
20	GND	-	Internal 0V reference for pin #7, 8
21	GND	-	Internal 0V reference for pin #7, 8
22	K1nc	Relay	Relay K1 normally closed contact, ISOLATED (Reset monitor)
23	K2co	Relay	Relay K2 common contact, ISOLATED
24	GND	-	Unit ground
25	Eout	Output	Voltage monitoring output (1V/20V)

I/O Port B includes 2 single pole double throw relays (K1 and K2) on the back panel DB25 female connector. The relay logic is as follows (0=relay off, 1= relay on)

Relay K1 – reset monitor: 0=system ok, 1=reset required (system needs reset button pressed on the front panel)

Relay K2 – software error: 0=no errors ok, 1=software error (reset button needs pressed on the front panel)

*K1 relay controller reset can be due to the following: a) current limit exceeded , b) e-stop engaged, c) heat sink temperature limit exceeded or d) temperature limit exceeded inside housing of MEC controller, d) short circuit.

3 terminals of each relay accessible on the DB25 pin-outs according to the table above

K1no/nc/co = pin 9/pin 22/pin 10 and K2no/nc/co = pin 11/pin 12/pin 23

no = normally open, nc = normally closed, co = common

These relays can be wired with several configurations, depending on the desired type of input to the external machine.

As shown in the table above pin 7 and pin 8 provide a local +12V source if needed.

****The K1 and K2 relays are completely isolated from the MEC controller. An external DC power source (e.g., an external +12V source) may be used to energize the relays.**

8.1.1 Input Control of the MEC functions

The MEC can be controlled remotely using external low voltage relays (+12 to +24V)

Note: Input control of the MEC is only possible when the remote menu is selected and displayed at the LCD.

The input control is available with limited functionality in a standard MEC and additional capability with an optional configuration.

Standard Configuration: Start High Voltage (HV): ON option is available in the remote menu. In I/O Port A, pin 6 is connected to +12 to +24V input and pin 19 is connected to the 0V reference for the DC input. The Start engages the high voltage output to the TriboMAM drilling system. Refer to diagram "PORT A: PROGRAM SELECTION".

This function is the same as pressing Start/Stop key on front panel.



This is selectable

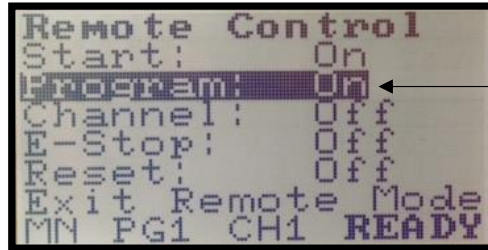
If "Strat" is turned on, the MEC HV output can be controlled from an external voltage input

Optional Configuration: SOFTMEC

Note: The MEC is available with additional output channels and software features. This option is referred to as SOFTMEC.

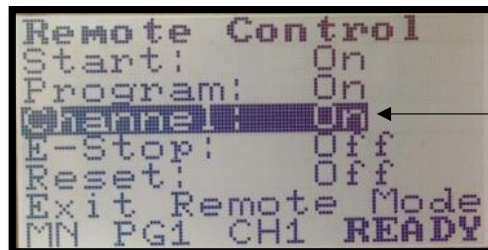
The SOFTMEC option enables functional control at the high voltage output, program selection, E-Stop, and Reset: These relay driven I/O features that can be accessed by directly linking the external I/O DB25 ports at the back of the MEC to the appropriate external relays at the machine tool.

Program. Scroll up or down by pressing the Up or Down directional/selection keys and select *Program*. Press the Select key to choose the desired option (On or Off). If Program “On” is enabled, then the MEC program selection (program 1, 2, 3, 4 and 5) can be controlled from an external DC signal. Refer to table on diagram “PORT A: PROGRAM SELECTION”.



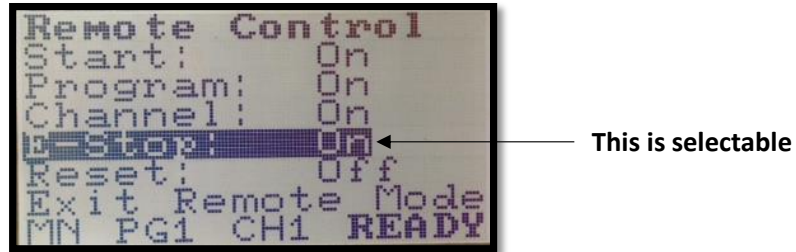
This is selectable

Output Channel. Scroll up or down by pressing the Up or Down directional/selection keys and select Channel. Press the Select key to choose the desired option (On or Off). If Channel “On” is enabled, then the MEC output (channel 1, 2, 3 or 4) can be controlled from an external DC signal. Refer to table on diagram “PORT A: CHANNEL SELECTION”.



This is selectable

E-Stop. Scroll up or down by pressing the Up or Down directional/selection keys and select *E-Stop*. Press the Select key to choose the desired option (On or Off). If E-Stop “On” is enabled, the MEC can be stopped remotely from an external DC signal. Refer to diagram “PORT B E-STOP EMERGENCY STOP”.



Note: If E-Stop ON, then “Reset” appears on the status bar of LCD display. The red LED on front panel does not illuminate if a remote E-Stop is present.

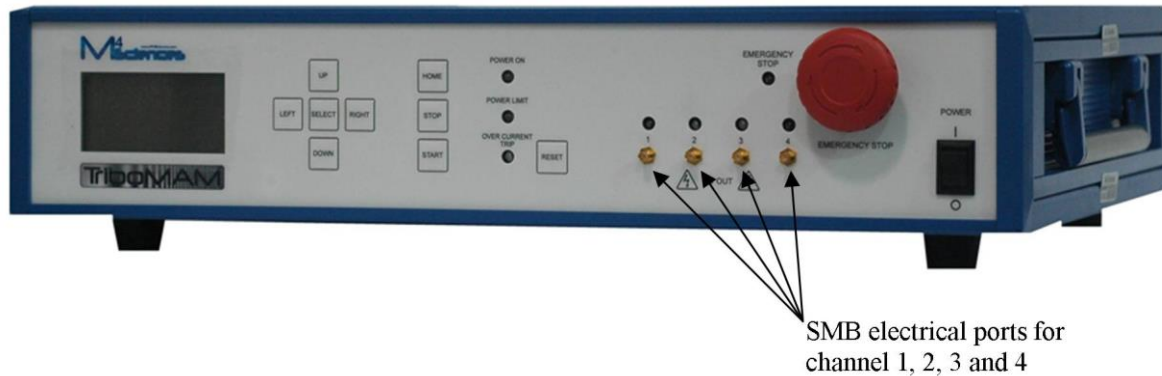
Warning: The Emergency Stop does NOT disable the main power to the MEC-PA08082 controller. It disables the power to the HV Out connector on the front panel.

Reset. Scroll up or down by pressing the Up or Down directional/selection keys and select *Reset*. Press the Select key to choose the desired option (On or Off). If Reset “On” is enabled, then the MEC can be reset from an external DC signal. Refer to diagram *PORT B RESET ON*. This function is the same as pressing the reset key located on the front panel.



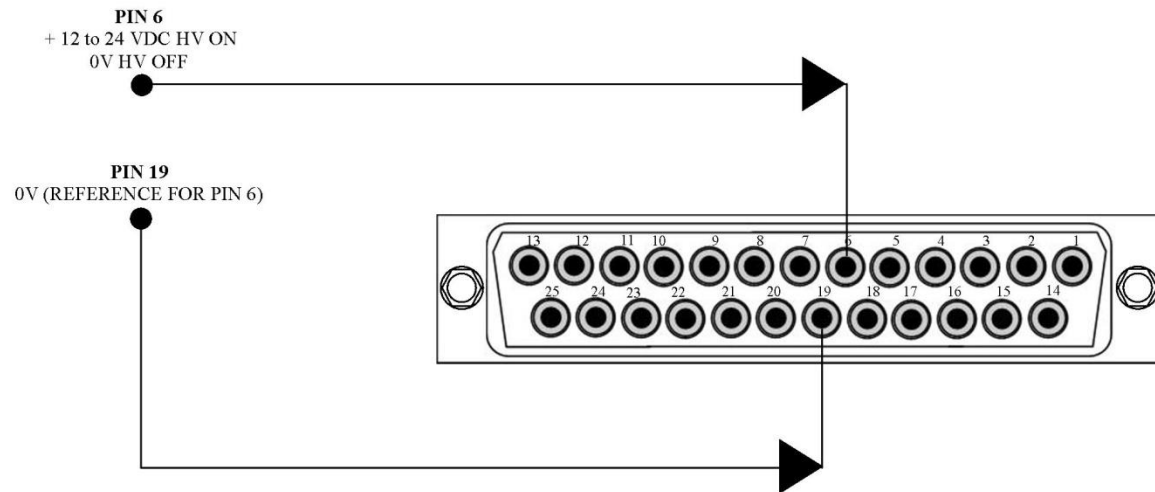
4 Channel Front Panel (optional)

The following picture show the front panel of the optional MEC-PA08082 Controller.



Note: The four channel output configuration is available as an upgrade [SOFTMEC] to the standard controller. The four channel output does not operate simultaneously, and only one output channel can be active at any given time. The output channels 1-4 can be selected in any order but never simultaneously. Please contact M4Sciences regarding optional software [SOFTMEC].

PORT A Start: High Voltage (HV) on

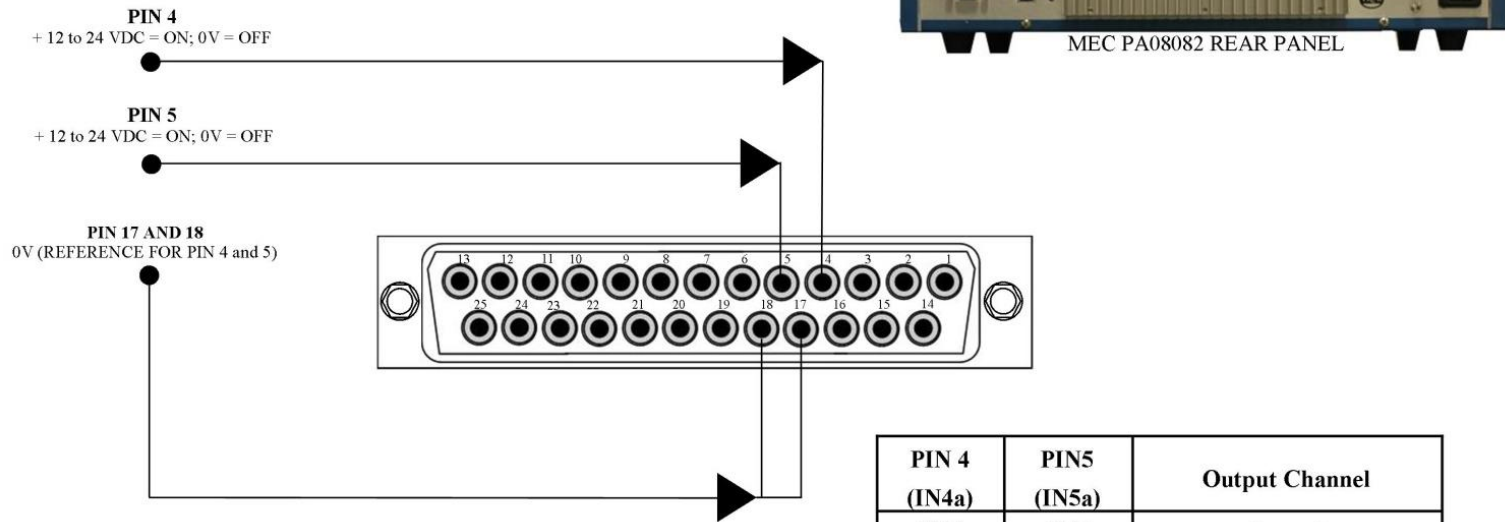


PORT A CHANNEL SELECTION

IN4a and IN5a select the HV output channel in remote mode

CAUTION

If the MEC is placed in the "Remote Menu" then inputs from an external device (such as relay inputs from a CNC machine control) will override manually selected output channels or program numbers.



*The individual output channels cannot be selected manually.
This configuration is only available through I/O.*

PIN 4 (IN4a)	PIN5 (IN5a)	Output Channel
OFF	OFF	Output 1
ON	OFF	*Optional Output 2
OFF	ON	*Optional Output 3
ON	ON	*Optional Output 4

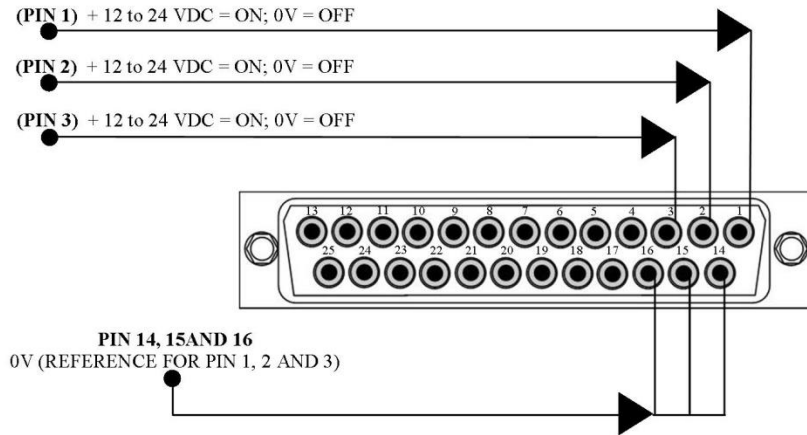
*Custom option. Contact M4 Sciences if needed.

PORT A PROGRAM SELECTION

IN1a through IN3a select the program when in remote mode

CAUTION

If the MEC is placed in the "Remote Menu" then inputs from an external device (such as relay inputs from a CNC machine control) will override manually selected output channels or program numbers



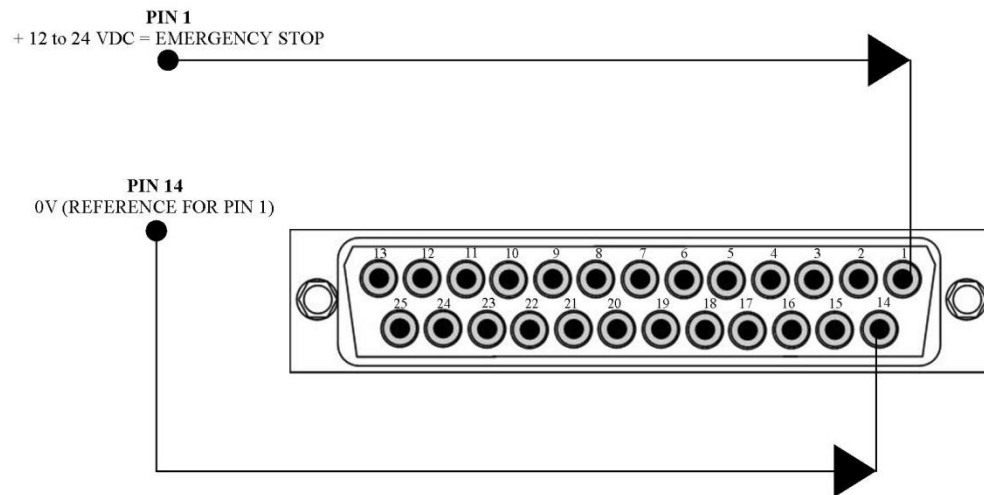
PIN 1 (IN1a)	PIN 2 (IN2a)	PIN 3 (IN3a)	Program Selected
OFF	OFF	OFF	Program 1
ON	OFF	OFF	Program 2
OFF	ON	OFF	Program 3
ON	ON	OFF	Program 4
OFF	OFF	ON	Program 5
ON	OFF	ON	*Optional Program 6
OFF	ON	ON	*Optional Program 7
ON	ON	ON	*Optional Program 8

*Custom option. Contact M4 Sciences if needed.

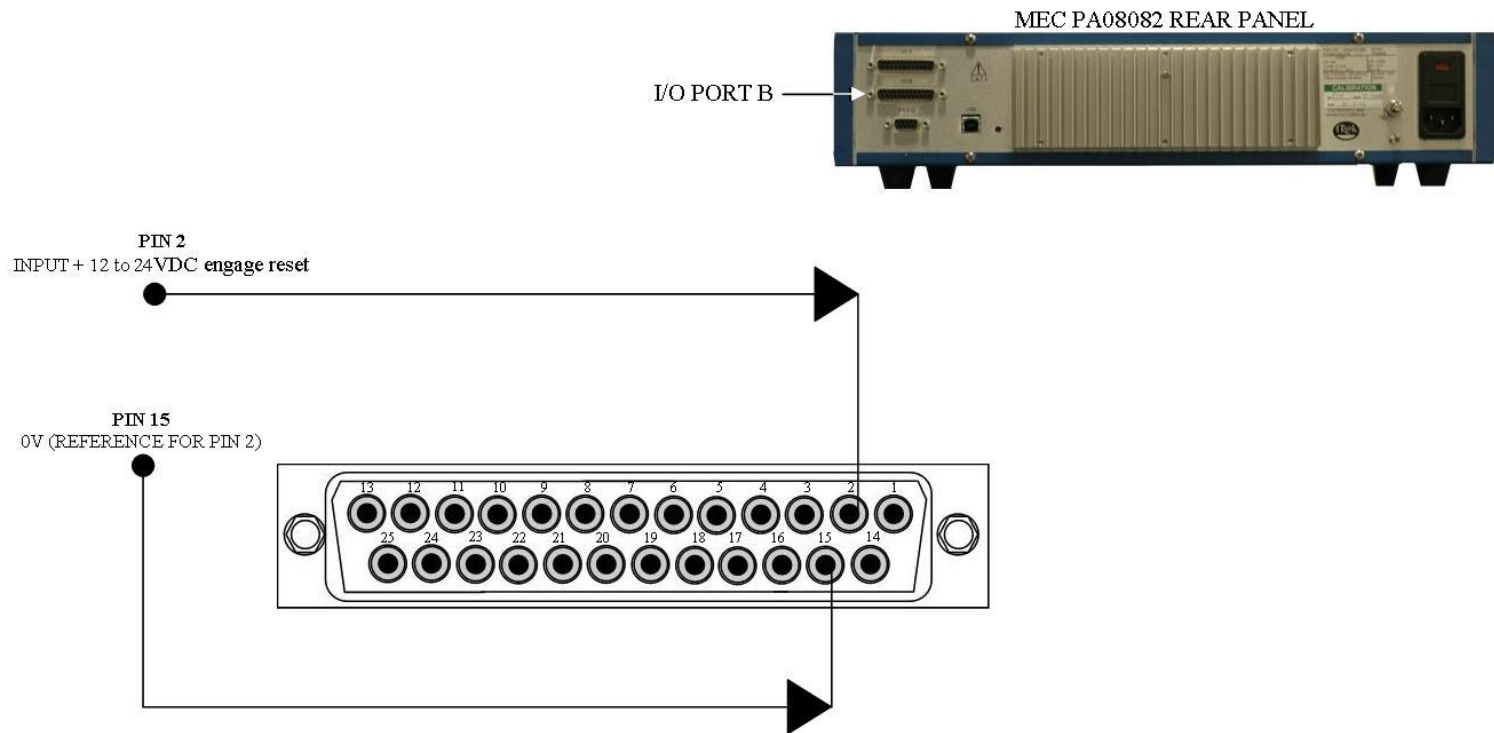
PORT B E-STOP – Emergency Stop

If E-Stop ON, then “Reset” appears on the status bar of LCD display. The red LED on front panel does not illuminate if a remote E-Stop is present.

Warning: The Emergency Stop does NOT disable the main power to the MEC-PA08082 controller. It disables the power to the HV Out connector on the front panel.



PORT B RESET ON



8.1.2 MEC Relay Logic Control I/O Functions

Two DB25 pin serial port connectors (Port A and Port B) are located on the back panel of the MEC controller. These connectors allow Input/Output (I/O) interfacing from an external control such as a CNC controller or other interface.

Each of the I/O Port A and Port B interface to 2 single pole double throw relays located internally on the MEC controller printed circuit board.

****These four internal relays are completely isolated from the MEC controller. An external DC power source (e.g., an external +12V - +24V source) may be used to energize the relays.**

A +12V source is available on the I/O Port DB 25 connector at pin 7 and pin 8 if needed.

These relays can be wired with several configurations, depending on the desired type of input to the external machine. The following pages outline typical configurations for the I/O port wiring typical of a machine installation and interface to a CNC controller with spare relays and M-codes already available on the CNC machine tool.

These relays are summarized as follows:

I/O Port A

Interface to 2 single pole double throw relays (K3 and K4) on the back panel DB25 female connector. The relay logic is as follows (0=relay off, 1= relay on)

Relay K3 – MEC Main power toggle switch on front panel: 0=off and 1=on

Relay K4 – MEC program running (started): 0= stopped, 1= run

3 terminals of each relay are accessible on the DB25 pin-outs

K3no/nc/co = pin 9/pin 22/pin 10 and K4no/nc/co = pin 11/pin 12/pin 23

no = normally open, nc = normally closed, co = common

I/O Port B

Interface to 2 single pole double throw relays (K1 and K2) on the back panel DB25 female connector. The relay logic is as follows (0=relay off, 1= relay on)

Relay K1 – reset monitor: 0=system ok, 1=reset required (system needs reset button pressed on the front panel)

A reset condition can occur when a) current limit exceeded, b) e-stop engaged, c) heat sink temperature limit exceeded, d) temperature limit exceeded inside housing of MEC controller, or d) short circuit.

Relay K2 – software error: 0=no errors ok, 1=software error (reset button needs pressed on the front panel)

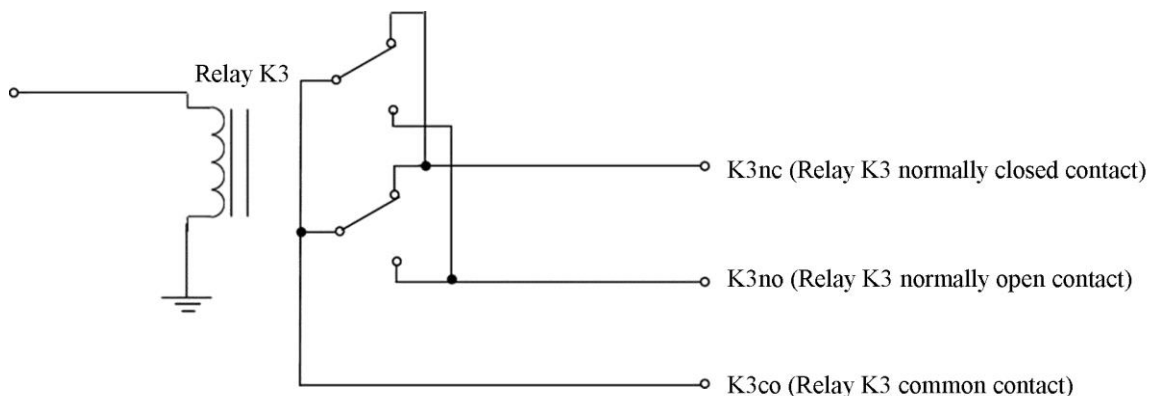
3 terminals of each relay accessible on the DB25 pin-outs

K1no/nc/co = pin 9/pin 22/pin 10 and K2no/nc/co = pin 11/pin 12/pin 23

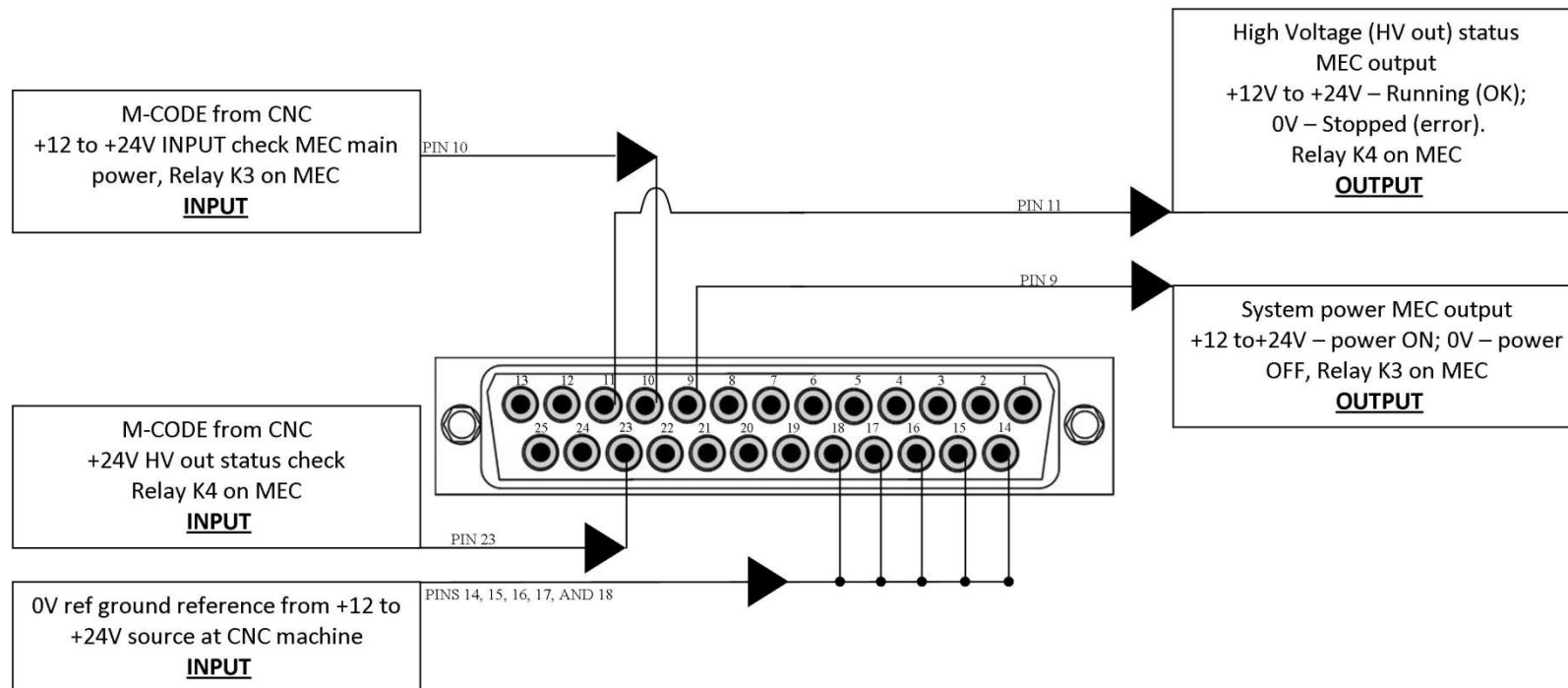
no = normally open, nc = normally closed, co = common

Relay Circuit

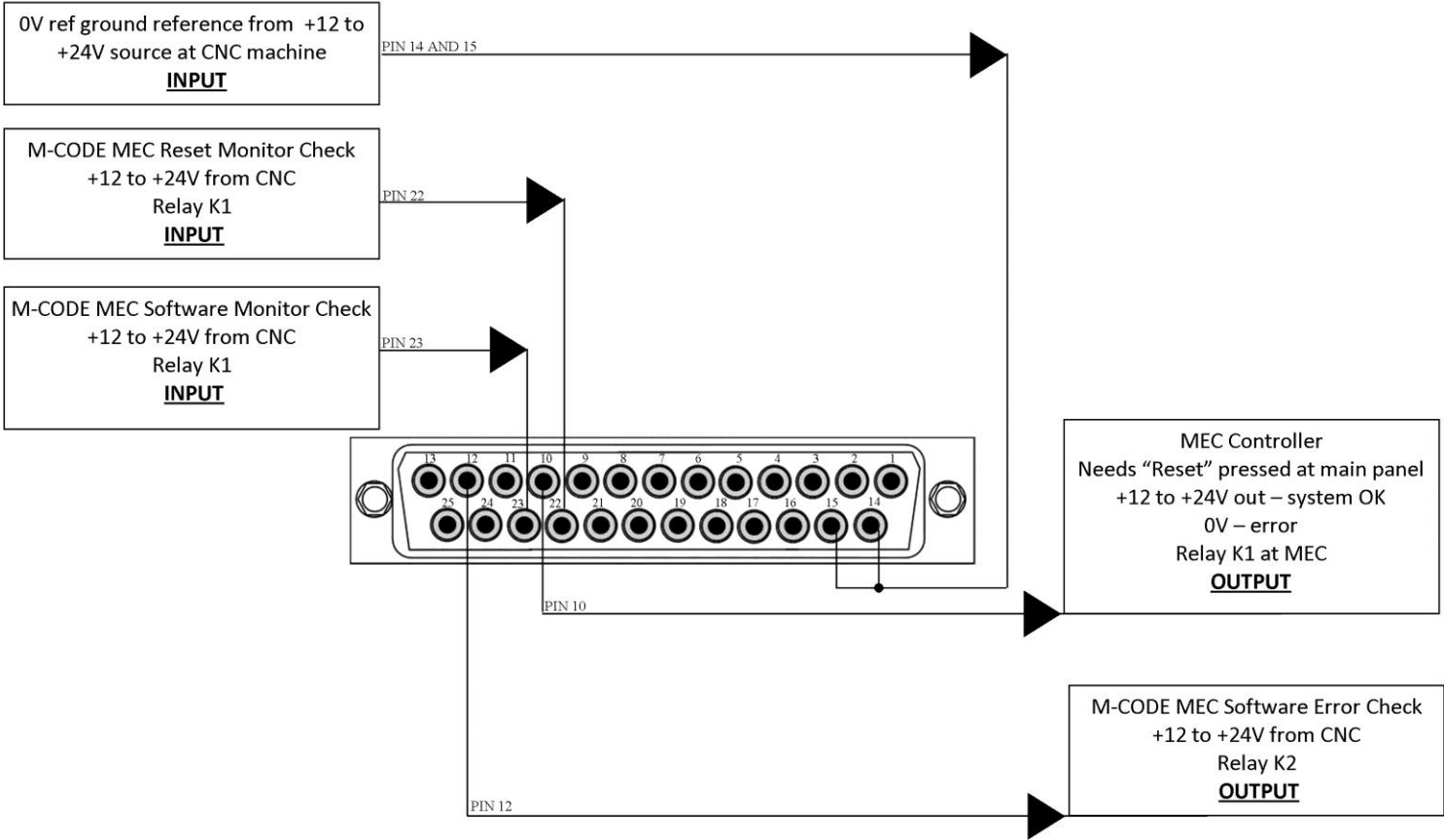
The following figure shows a basic representation of one of the internal relays on MEC-PA08082.



PORT A—RELAY K3 AND K4



PORT B—RELAY K1 AND K2



8.2 DB25 Port Pin Configuration

Voltage signals for input pins IN1a – IN8a

IN1b – IN8b are connected to 0 V reference for input voltage IN1a – IN8a
IN1a – IN8a input voltage V_{in} specification

Recommend setting:

ON: $|V_{in}|$ between 12V to 24V

OFF: V_{in} 0V

Program Selection - IN1a through IN3a select the program when in remote mode

IN1a	IN2a	IN3a	Program Selected
OFF	OFF	OFF	Program 1
ON	OFF	OFF	Program 2
OFF	ON	OFF	Program 3
ON	ON	OFF	Program 4
OFF	OFF	ON	Program 5
ON	OFF	ON	*Optional Program 6
OFF	ON	ON	*Optional Program 7
ON	ON	ON	*Optional Program 8

*Custom option. Contact M4 Sciences if needed.

Channel Selection - IN4a and IN5a select the HV output channel in remote mode

IN4a	IN5a	Output Channel
OFF	OFF	Output 1
ON	OFF	*Optional Output 2
OFF	ON	*Optional Output 3
ON	ON	*Optional Output 4

*Custom option. Contact M4 Sciences if needed.

Operation Control - IN6a controls the HV output on/off when in remote mode

IN6a	Operation on/off
ON	Start
OFF	Stop

Emergency Stop - IN7a monitors the emergency stop when in remote mode

IN7a	Emergency Stop
ON	e-stop on
OFF	e-stop off

Reset - IN8 monitors the reset when in remote mode

IN8a	Reset on/off
ON	Reset on
OFF	Reset off