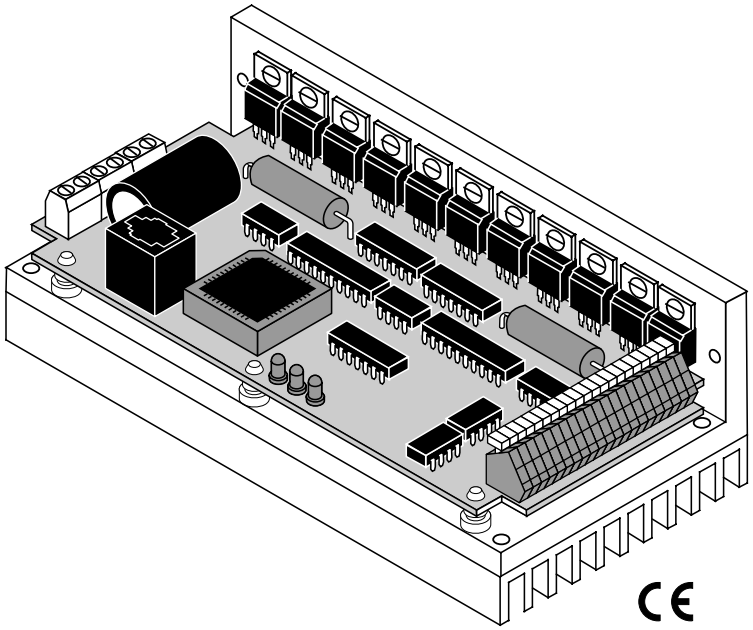
User's Manual

MS7080MI

Programmable
Step Motor Driver



MOONS'

motors • drives • controls• gear box • power supply

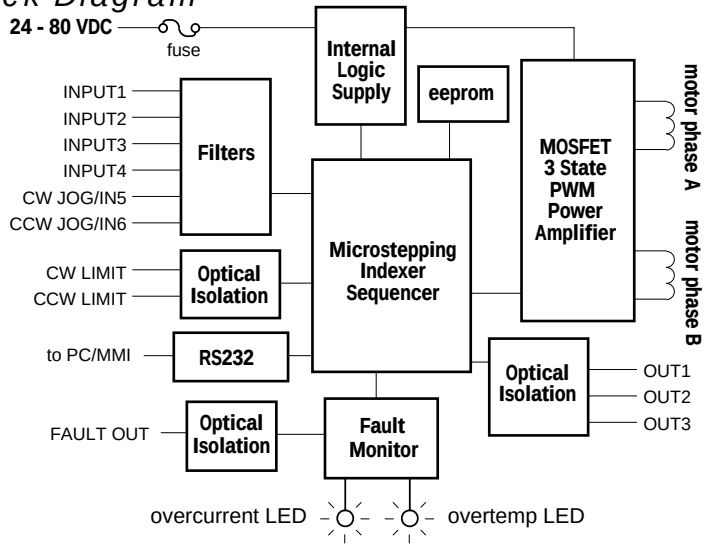
Introduction

Thank you for selecting a MOONS' motor control product. We hope our dedication to performance, quality and economy will make your motion control project successful. If there's anything we can do to improve our products or help you use them better, please call or fax. We'd like to hear from you.

Features

- Powerful, precise and efficient mosfet driver providing up to 7 amps per phase and microstepping to 50,800 steps per revolution.
- Accepts 24 - 80 VDC power supply.
- Powerful, flexible, easy to use indexer.
- Connects by a simple cable to your PC for programming (cable included).
- Microsoft Windows-based software for easy set up and programming.
- Eight inputs for interacting with the user and other equipment.
- Four outputs for coordinating external equipment.
- Sturdy 2 x 3 x 6 inch metal chassis with integral heat sink.
- Screw terminal connectors for motor and DC power. Cage clamp connector for I/O signals.
- Three LEDs indicating power, drive and indexer status.
- Overcurrent (short circuit) and over temperature protection.
- Optional man machine interface (MSMMI) allows operator to enter distances, speeds, loop counts and more.

Block Diagram

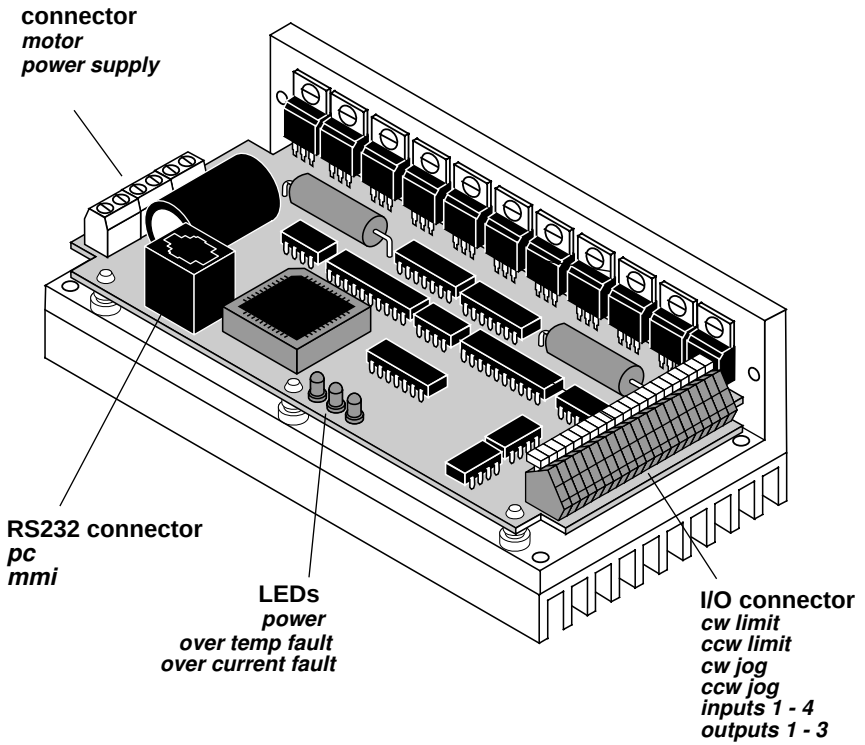


Getting Started

To use your MS7080MI motor control, you will need the following:

- ✔ a power supply (see page 5 for help in choosing one).
- ✔ a compatible step motor
- ✔ a small flat blade screwdriver for tightening the connectors - a MOONS' screwdriver suitable for this purpose is included with your drive.
- ✔ a personal computer running Windows 98,2000 or XP with a 9 pin serial port (486 or better with 8 MB ram recommended)
- ✔ the Mis Programmer software that came with your MS7080MI
- ✔ the programming cable that came with your MS7080MI
- ✔ Mis Programmer manual

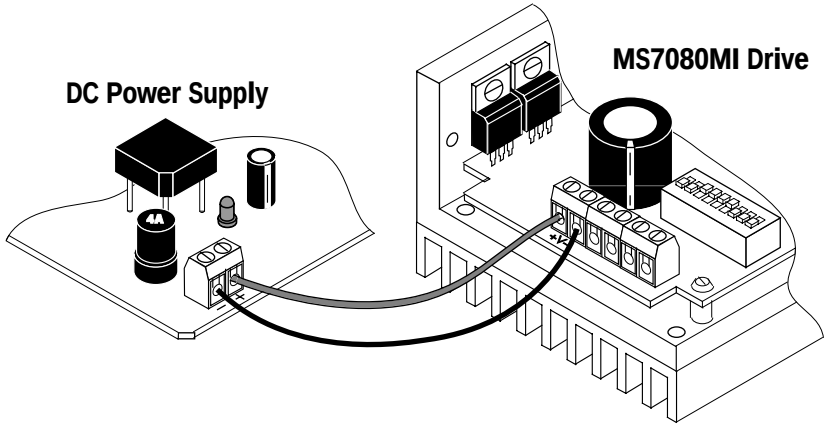
The sketch below shows where to find the important connection and adjustment points. Please examine it now.



Connecting the Power Supply

If you need information about choosing a power supply, please read *Choosing a Power Supply* below.

Connect the motor power supply **+** terminal to the driver terminal labeled "**+V**". Connect power supply **–** to the drive terminal labeled "**V–**." Use 18 gauge wire. **Be careful not to reverse the wires.**



Choosing a Power Supply

Voltage

Chopper drives like MS7080MI work by switching the voltage to the motor terminals on and off while monitoring current to achieve a precise level of phase current. To do this efficiently and silently, you'll want to have a power supply with a *voltage rating at least five times that of the motor*. Depending on how fast you want to run the motor, you may need even more voltage than that. If you choose an unregulated power supply, do not exceed 57 volts. This is because unregulated supplies are rated at full load current. At lesser loads, like when the motor's not moving, the actual voltage can be up to 1.4 times the rated voltage. For smooth, quiet operation, a lower voltage is better.

Current

The maximum supply current you could ever need is the sum of the two phase currents. However, you will generally need a lot less than that, depending on the motor type,voltage speed and load conditions. That's because MS7080MI uses switching amplifiers, converting a high voltage and low current into lower voltage and higher current. The more the power supply voltage exceeds the motor voltage, the less current you'll need from the power supply. A motor running from a 48 volt supply can be expected to draw only half the supply current that it would with a 24 volt supply.

We recommend the following selection procedure:

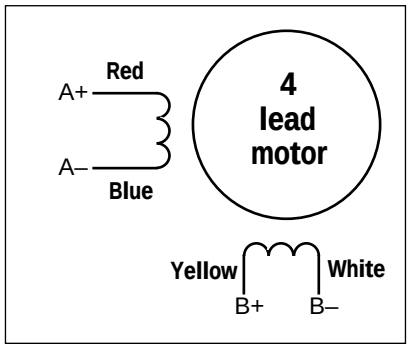
1. If you plan to use only a few drives, get a power supply with at least twice the rated phase current of the motor.
2. If you are designing for mass production and must minimize cost, get one power supply with more than twice the rated current of the motor. Install the motor in the application and monitor the current coming out of the power supply and into the drive at various motor loads. This will tell you how much current you really need so you can design in a lower cost power supply. If you plan to use a regulated power supply you may encounter a problem with current fold back. When you first power up your drive, the full current of both motor phases will be drawn for a few milliseconds while the stator field is being established. After that the amplifiers start chopping and much less current is drawn from the power supply. If your power supply thinks this initial surge is a short circuit it may "fold back" to a lower voltage. Because of that, unregulated power supplies are better. They are also less expensive.

Connecting the Motor

Never connect the motor to the driver when the power is on.
Secure any unused motor leads.
Never disconnect the motor while the power is on.
Never connect motor leads to ground or to a power supply.

You must now decide how to connect your motor to the drive.

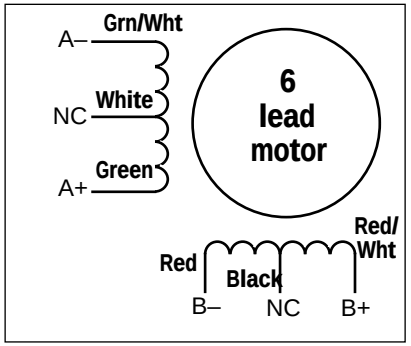
Four lead motors can only be connected one way. Please follow the sketch at the right.



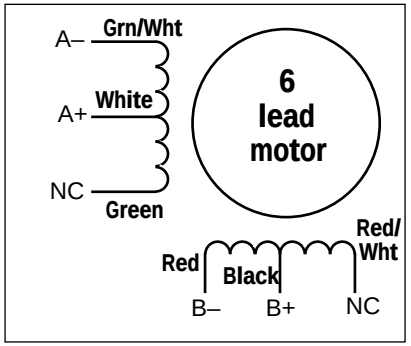
4 Leads

Six lead motors can be connected in series or center tap. In series mode, motors produce more torque at low speeds, but cannot run as fast as in the center tap configuration. In series operation, the motor should be operated at 30% less than the rated current to prevent overheating. Winding diagrams for both connection methods are shown below.

Note: NC means not connected to anything.

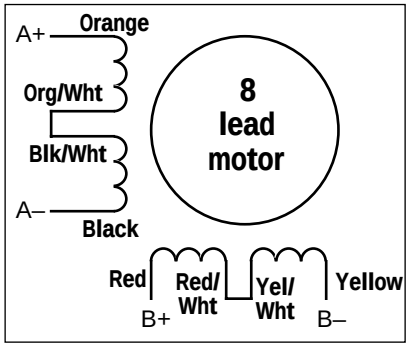


6 Leads Series Connected

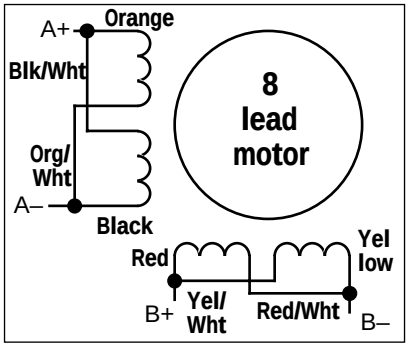


6 Leads Center Tap Connected

Eight lead motors can also be connected in two ways: series and parallel. As with six lead motors, series operation gives you more torque at low speeds and less torque at high speeds. In series operation, the motor should be operated at 30% less than the rated current to prevent overheating. The wiring diagrams for eight lead motors are shown below.



8 Leads Series Connected



8 Leads Parallel Connected

Connecting to the PC

• Locate your computer within 6 feet of the MS7080MI.

• Your MS7080MI was shipped with a black adapter plug. It has a telephone style jack at one end and a larger 9 pin connector at the other. Plug the large end into the COM1 serial port of your PC. Secure the adapter with the screws on the sides. If the COM1 port on your PC is already used by something else, you may use the COM2 port for the MS7080MI.On some PCs, COM2 will have a 25 pin connector that does not fit the black adapter plug. If this is the case, and you must use COM2, you will have to purchase a 25 to 9 pin serial adapter at your local computer store.

• Your MS7080MI was also shipped with a 7 foot telephone line cord.Plug one end into the adapter we just attached to your PC, and the other end into the RS232 jack on your MS7080MI.

Never connect the MS7080MI to a telephone circuit. It uses the same connectors and cords as telephones and modems, but the voltages are not compatible.

Programming Note: Always apply power to MS7080MI after the Mis Programmer software is running on your PC.

Jogging

Two of the MS7080MI input terminals are provided for jogging the motor. The inputs are labeled "JOG CW" and "JOG CCW". Connecting one of the inputs to ground commands the drive to move the motor at a pre-designated speed until the contact is opened. A relay or mechanical switch can be used to activate the jog inputs. 5 volt circuitry can also be used. The schematic diagram of the input circuit is shown below.

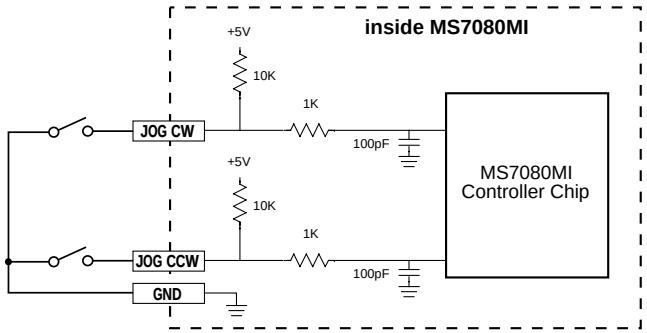
If you're using a switch or relay, wire one end to the JOG input and the other to one of the GND inputs. For active circuitry, connect the signal to JOG and the circuit ground to GND.

If the MS7080MI is connected to a PC with the programming software running, the jog inputs will function under two conditions:

1) if the program is not executing
2) if the program is executing a Wait Input command.

If the MS7080MI is operating in stand alone mode (i.e. without a computer attached) then the jog inputs work when the program is executing the Wait Input instruction.

To set the Jog Speed and Jog Accel/decel rate, adjust the scroll bars in the main programming window.

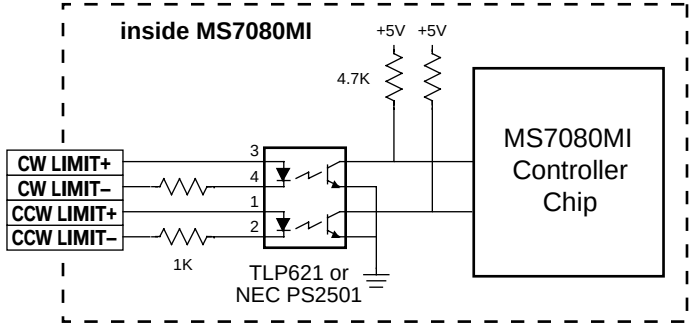


Limit Switches

The MS7080MI has two limit switch inputs,LIMIT CW and LIMIT CCW.By connecting switches or sensors that are triggered by the motion of the motor or load, you can force the MS7080MI to operate within certain limits. This is useful if a program error could cause damage to your system by traveling too far.

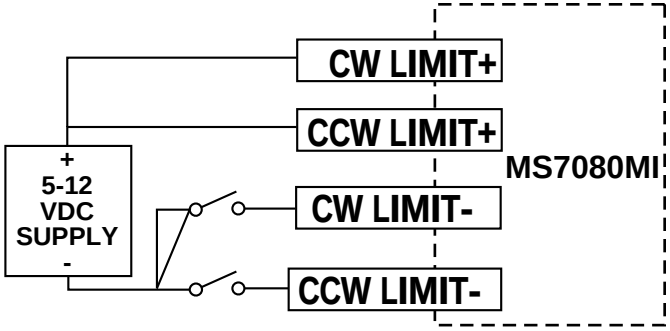
The limit inputs are optically isolated. This allows you to choose a voltage for your limit circuits of 5 to 24 volts DC. It also allows you to have long wires on limit sensors that may be far from the MS7080MI with less risk of introducing noise to the MS7080MI. The schematic diagram of the limit input circuit is shown below.

If you want to operate the limit switch circuits at 24 volts, you must add 1000 ohms in series with each limit switch. For 5 - 12V operation, no external resistance is required.



Wiring a Limit Switch

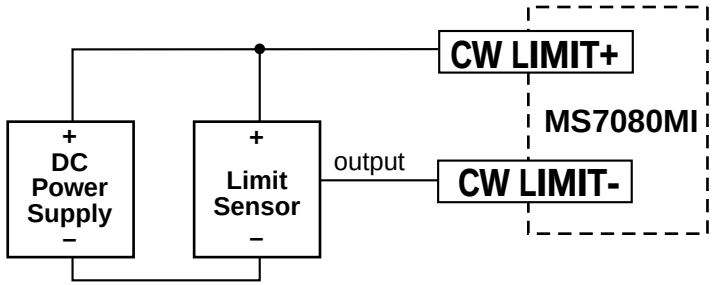
You can use normally open or normally closed limit switches. Either way, wire them as shown here.



Limit Sensors

Some systems use active limit sensors that produce a voltage output rather than a switch or relay closure. These devices must be wired differently than switches.

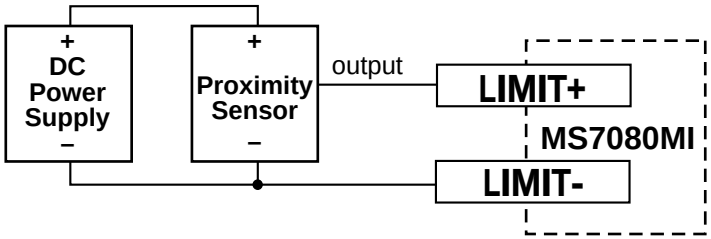
If your sensor has an open collector output or a sinking output, wire it like this:



Wiring for Sinking or Open Collector Output

If the sensor output goes low at the limit, select the option "closed." If the output is open, or high voltage, choose "open."

Other sensors have sourcing outputs. That means that current can flow out of the sensor output, but not into it. In that case, wire the sensor this way:



Wiring for Sourcing Output

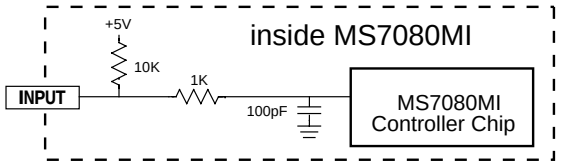
If the sensor output goes high at the limit, choose the program option "closed." If the output is low at the limit, select "open."

The current through the MS7080MI limit switch inputs must not exceed 20 mA. If your limit sensor power supply voltage is between 12 and 24 volts DC, add a 1000 ohm resistor in series with the sensor output. Do not use voltages higher than 24 VDC.

Wiring Inputs

Each input has a pull up resistor to the internal 5 volt power supply and an RC filter. Because of the pull up resistor, if nothing is connected to an input, it defaults to the "high" state. One way to control an input is by connecting a switch between the input and ground. When the switch is closed, the input state is "low." When the switch is open, it's "high." You can connect a relay the same way.

You can also connect an active signal to an MS7080MI input, as long as it's from a 0 - 5 VDC, or "TTL compatible" circuit. Open collector circuits are okay, too.



Schematic Diagram of Inputs 1 - 4, cw jog and ccw jog)

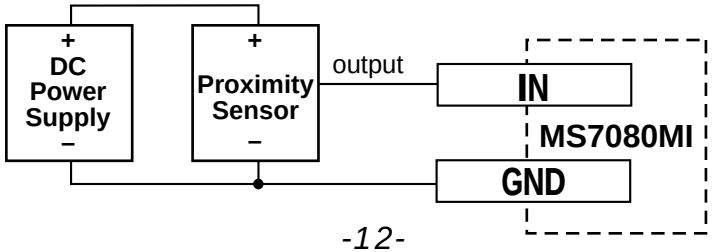
The maximum voltage that can be applied to an input terminal is 5 volts DC. Never apply AC voltage to an input terminal.

Connecting a Proximity Sensor to an Input

The best type of proximity switch to use is "NPN normally open." You will need an external power supply to operate the sensor. Connect the power supply and proximity switch terminals as shown in the diagram.

You may be concerned about wiring a proximity sensor to a 5 volt input when the sensor is powered by 12 or 24 volts. Fear not: even though the sensor is powered by a higher voltage, NPN type proximity sensors do not apply any voltage to the output. They either switch the output terminal to ground, or leave it open circuit. This is referred to as an "open collector" output. Thus, the MS7080MI input never sees more than 5 volts.

If you are uncertain about the output voltage of your sensor, hook it up to your power supply, but not the MS7080MI. Measure the voltage with a DC voltmeter at the output terminal in both sensor states and make sure it does not exceed 5 volts. If the sensor is truly open collector, the voltage will measure 0 in both states.

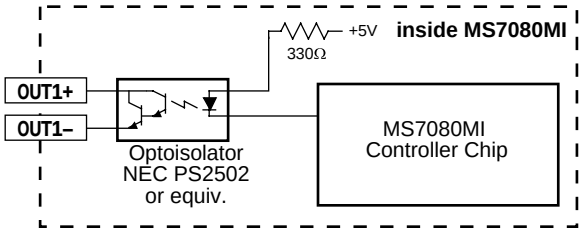


Wiring Outputs

Before we discuss the output conditions, we need to talk about the circuitry. All three MS7080MI outputs are optically isolated. That means that there is no electrical connection between the indexer-drive and the output terminals. The signal is transmitted to the output as light. What you "see" is a transistor (NPN type) that closes, or conducts current, when the output is "low". When the output is high, the transistor is open.

At power-up, the MS7080MI sets all three programmable outputs high (open circuit).

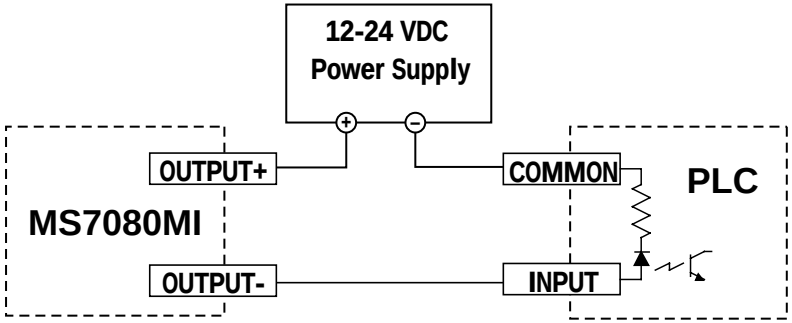
The maximum voltage between any pair of + and - output terminals is 24 volts DC. Never connect AC voltages to the MS7080MI output terminals. Maximum current is 100 mA per output.



Schematic Diagram of MS7080MI Output Circuit

Since there is no electrical connection to the MS7080MI, you must provide the source of current and voltage, typically from a power supply.You must also limit the current to less than 100 mA so that the output transistor is not damaged.You would normally use a resistor for this, but some loads (such as PLC inputs) limit the current automatically.

The diagram below shows how to connect an MS7080MI output to an optically isolated PLC input.



Microstepping

Most step motor drives offer a choice between full step and half step resolutions. In full step mode, both motor phases are used all the time. Half stepping divides each step into two smaller steps by alternating between both phases on and one phase on.

Microstepping drives like the MS7080MI precisely control the amount of current in each phase at each step position as a means of electronically subdividing the steps even further.The MS7080MI offers a choice of 13 step resolutions.The highest setting divides each full step into 254 microsteps, providing 50,800 steps per revolution when using a 1.8° motor.

In addition to providing precise positioning and smooth motion, microstep drives can be used for motion conversion between different units. The 25,400 step/rev setting is provided as a means of converting motion from metric to english. (There are 25.4 mm in an inch.) Other settings provide step angles that are decimal degrees (36,000 steps/rev makes the motor take 0.01° steps.) Some settings are used with lead screws. When the drive is set to 2000 steps/rev and used with a 5 pitch lead screw, you get .0001 inches/step.

The microstep resolution of the MS7080MI is set by the Mis Programmer software.

Fault Protection

The MS7080MI provides protection against motor short circuits and excessive drive temperature.

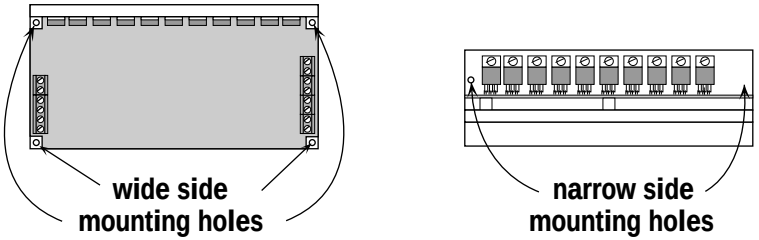
If the OVERTEMP light is on the MS7080MI has detected a thermal problem and shut down the amplifiers.The first thing you should do is to unplug the drive from the power source.Next,touch the heat sink with your fingers.If it is very hot, the drive has probably overheated. Usually this means you need more air flow around the drive.

If the OVERCURRENT light is on the MS7080MI has detected a short circuit and has shut down the amplifiers.Unplug the drive from the power source.Check the motor wiring carefully. Make sure that the connections to the drive are secure and that any unused motor leads are insulated from the drive and power supply and from each other. Check the motor leads for shorts between phases or to ground.

Mounting the Drive

You can mount your drive on the wide or the narrow side of the chassis. If you mount the drive on the wide side, use #6 screws through the four corner holes. For narrow side mounting applications, you can use #6 screws in the two side holes.

The MS7080MI drive will dissipate heat better if you mount it on the narrow side. Please use narrow side mounting whenever possible.



The amplifiers in MS7080MI generate heat. To operate the drive continuously at maximum power you may need additional heat sinking or forced air cooling. Never use your drive in a space where there is no air flow or where other devices cause the surrounding air to be more than 50 C. Never put the drive where it can get wet or where metal particles can get on it.

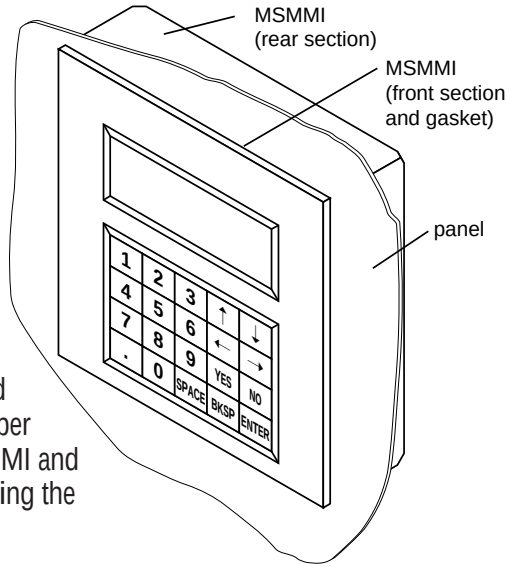
Mounting the Optional MSMMI

There are two ways to mount the MSMMI in your application. No matter which method you choose, you'll need to connect the MSMMI to your MS7080MI with the programming cable. You will not, however, need the adapter plug. The MSMMI has the same telephone style connector as the MS7080MI.

Depending on how you mount the MSMMI and cable in your application, you may find that it is difficult to remove the cable from the back of the MSMMI. If this is the case,and you need to reprogram the MS7080MI, you can use any telephone line cord as a programming cable.They are available at most supermarkets and discount stores. Please be careful not to lose the adapter plug that connects the telephone cord to the COM port of your PC. The adapter is a custom made part and is only available from MOONS'.

Flush Mounting

When you remove the MSMMI from the shipping carton, you will notice that it has two parts. The first is a fairly thin section that contains the keypad, display and some circuit boards. The other part is thicker and contains the telephone jack and a cable that connects to the thin part.



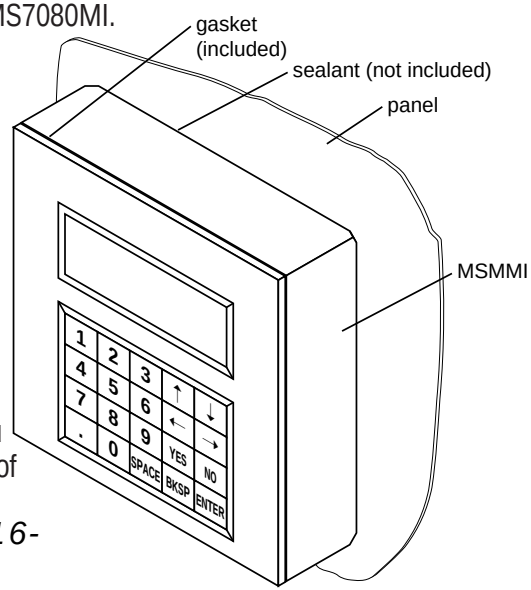
When you flush mount the MSMMI in a panel, only the thin section will stick out from your panel - the large portion mounts behind your panel. You'll need to cut a precise section from your panel. There is a cardboard template in your box for this purpose.

If you want the MMI to be dust proof and watertight, you must place the black rubber gasket between the thin part of the MSMMI and your panel. Assemble the two halves using the eight small screws.

Surface Mounting

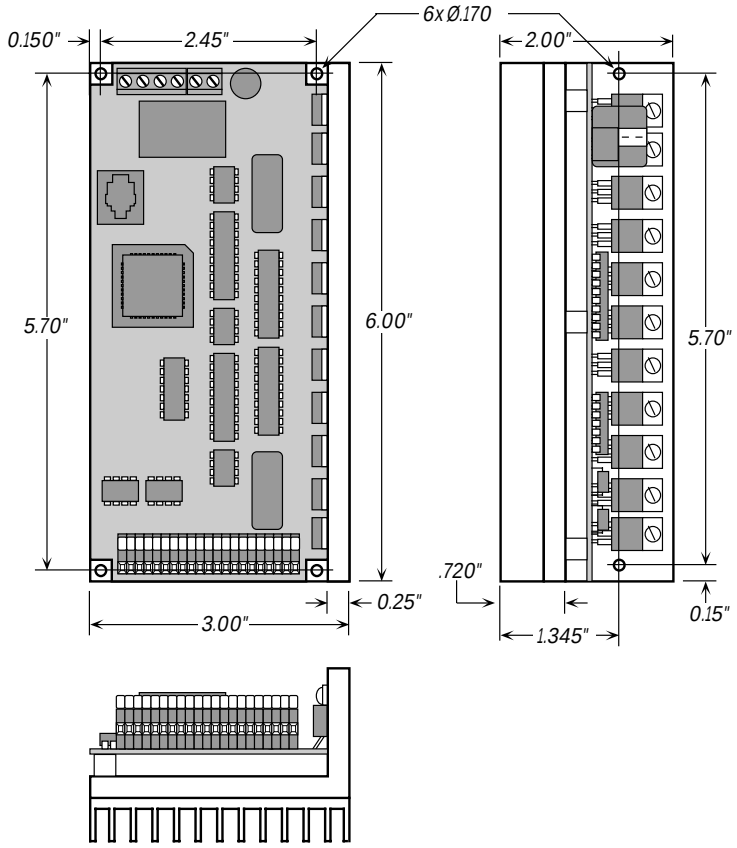
An easier way to mount the MSMMI is to bolt the two halves together ahead of time, using the eight small screws. If you want the MSMMI to be dust proof and watertight, put the black rubber gasket between the two halves before screwing them together.

Then cut a hole in your panel for the cable that runs between the MSMMI and the MS7080MI. The hole must be at least 5/8" in diameter for the connector to fit through. You will also need two holes that line up with the big mounting holes in the MSMMI. The mechanical outline on page 19 shows the location of the big mounting holes.



When you mount the MSMMI to your panel, you will need to use some kind of sealant to keep dust and liquid out. Silicone or latex caulking is okay, or you can make your own gasket from a sheet of compliant material like rubber or RTV.

Mechanical Outline - MS7080MI



Technical Specifications

Amplifiers Dual, MOSFET H-bridge, 3 state, pulse width modulated switching at 20 kHz. 0.8 - 7.0 amps/phase output current, software selectable. 560 watts maximum output power. Overcurrent and overtemperature protection. Automatic idle current reduction (software programmable), reduces current to motor when idle. Minimum motor inductance is 0.8 mH.

Power Supply Accepts 24 - 80 VDC power supply. 7 amps typical max load. 14A maximum power on surge.

Inputs IN 1-4, CW JOG, CCW JOG: 5V logic. Internally pulled up to +5V with 10k resistor. Filtered.
CW LIMIT, CCW LIMIT: 5 - 24V, optically isolated. 680 ohms internal resistance. No additional resistance is needed for 5 - 12 volts. For 24 volt logic, add 1000 ohms in series.

Outputs Optically isolated. 24V, 100 mA max.

Microstepping 13 software selectable resolutions. Steps per revolution with 1.8º motor: 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800. Waveform: pure sine.

Motion Update 12800 Hz.

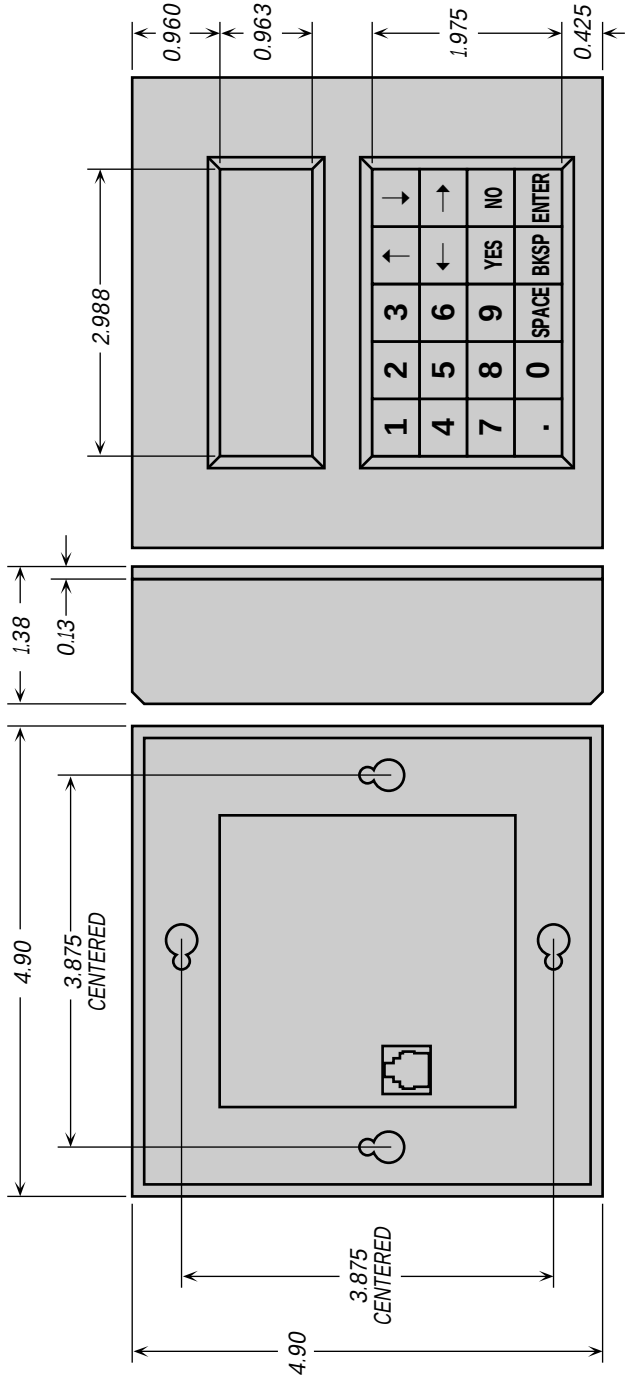
Physical Constructed on black anodized aluminum chassis/heat sink. 2 x 3 x 6 inches overall. 21 oz. 70ºC max. heat sink temperature. Power,overtemp and overcurrent LEDs. See page 17 for detailed drawing .

Connectors Power, motor: screw terminal block. Wire size: AWG 12 - 28. I/O Signals: Wago cage clamp block. Wire size: AWG 20 - 28.

Fuse Wickman TR-5 style, 6.3A fast acting. Order from Digikey (1-800-DIGIKEY), P/N WK3066.

CE Mark Complies with EN55011A and EN50082-1(1992).

Mechanical Outline - Optional MSMMI



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